This tool addresses common symptoms and symptom complexes. Imaging requests for patients with atypical symptoms or clinical presentations that are not specifically addressed will require physician review. Consultation with the referring physician, specialist and/or patient’s Primary Care Physician (PCP) may provide additional insight.

MedSolutions, Inc. Clinical Decision Support Tool for Advanced Diagnostic Imaging

This version incorporates MSI accepted revisions prior to 11/30/07

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# PREFACE

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Preface-1 Guideline Development
MedSolutions, Inc. (MSI) has developed and maintains evidence-based, proprietary clinical guidelines to evaluate CT, CTA, MRI, MRA, PET, bone mineral densitometry, and cardiac imaging studies.

MedSolutions reserves the right to change and update the guidelines from time to time and conducts a formal review of the clinical guidelines once a year.

MedSolutions’ guidelines are based upon the American College of Radiology (ACR) Appropriateness Criteria®, the National Comprehensive Cancer Network (NCCN) Clinical Guidelines in Oncology™, evidence-based clinical data to the extent available, consensus statements from specialty societies such as the American College of Cardiology, the American Heart Association, the American Academy of Neurology, the Institute for Clinical Systems Improvement, and the American Academy of Orthopedic Surgeons, published literature in peer-reviewed journals, input from health plans, and input from practicing clinicians from academic institutions as well as community-based physicians.

Preface-2 Benefits, Coverage Policies, and Eligibility Issues
Benefits, coverage policies, and eligibility issues pertaining to each Health Plan take precedence over MedSolutions’ guidelines.

Certain imaging studies described in these guidelines are considered investigational by various payers, and their coverage policies will take precedence over MedSolutions’ guidelines. Prior authorization does not guarantee payment of the study.

Preface-3 Clinical Information
Preface-3.1
• The philosophy behind MSI guidelines is using an evidence-based approach to determine the most appropriate imaging procedure for each patient, at the most appropriate time in the diagnostic and treatment cycle. MSI guidelines are driven by the patient’s clinical presentation, not by the studies requested.
• Thus, advanced imaging studies should not be ordered prior to clinical evaluation of a patient, including a recent detailed history, physical examination, appropriate laboratory studies, and the use of non-advanced imaging modalities such as plain x-ray, ultrasound, bone scan, etc. if applicable.
• A current history and physical examination are necessary for determining the medical necessity of advanced imaging requests.
• The clinical information should describe how the requested imaging study(ies) will affect patient management or treatment decisions.
• MedSolutions maintains that a sequential approach to obtaining imaging studies, that is, awaiting the results of initial tests or radiologic studies to rule in or out an entity on the differential diagnosis prior to obtaining further tests or radiologic studies, is generally the most appropriate approach to managing patients in the elective, outpatient setting.
• The information provided to MedSolutions should have clinical relevance to the imaging study(ies) requested.
  o If the information provided makes no reference to a potential indication for the requested imaging study(ies), then the medical necessity of the imaging study(ies) cannot be supported.
• Advanced imaging of a particular body part is generally not indicated in the absence of recent clinical, laboratory, or imaging data suggesting an abnormality of that body part.
• Repeat advanced imaging study(ies) are generally not indicated in the absence of evidence of progression of disease, evidence of new onset of disease, or if there is insufficient information as to how repeat imaging will affect patient management or treatment decisions.

**Preface-3.2**

• The clinical guidelines for imaging are not intended to supersede or replace sound medical judgment, but instead, should facilitate the identification of the most appropriate imaging procedure given the patient's clinical condition.

• These guidelines are written to cover medical conditions as experienced by the majority of patients. However, these guidelines may not be applicable in certain clinical circumstances, and physician judgment can override the guidelines.

• Clinical decisions, including treatment decisions, are the responsibility of the patient and his/her provider. Clinicians are expected to use independent medical judgment which takes into account the clinical circumstances to determine patient management decisions.

**Preface-4 Coding Issues**

**Preface-4.1 3D Rendering**

CPT 76376 and 76377. Both of these CPT codes share the following text in their definitions: “3D rendering with interpretation and reporting of computed tomography, magnetic resonance imaging, ultrasound or other tomographic modality.” These two codes differ in the need for and use of an independent workstation for post-processing. CPT 76376 is for procedures not requiring image post-processing on an independent workstation, and CPT 76377 is for procedures that require image post-processing on an independent workstation.

These 3D rendering codes should not be used for 2D reformating. Two-dimensional reconstruction (e.g. reformatting an axial scan into the coronal plane) is now included in all cross-sectional imaging base codes and is not separately reimbursable.

Some payers do not reimburse for CPT 76376 or 76377. In addition, these CPT codes are not included in every MSI client's radiology management program.

CPT codes for 3D rendering should not be billed in conjunction with computer-aided detection (CAD) CPT codes, MRA, CTA, nuclear medicine SPECT studies, PET, PET/CT, CT colonoscopy (virtual colonoscopy), cardiac MRI, cardiac CT, or coronary CTA studies.

In general, MedSolutions maintains that CPT 76376 (3D rendering not requiring image post-processing on an independent workstation) should not be separately reimbursed, since this function is built into the imaging software and generally takes less than 15 minutes to perform.

CPT 76377 (3D rendering requiring image post-processing on an independent workstation) can be considered in the following clinical scenarios (Requests will be sent for Medical Director review):

1) Evaluation of congenital skull abnormalities in babies/toddlers (usually for preoperative planning).
2) Complex joint fractures or pelvis fractures
3) Spine fractures (usually for preoperative planning)
4) Complex facial fractures
5) Preoperative planning for other complex surgical cases
Preface-4.2 CT- or MR-Guided Procedures
Imaging studies performed as part of a CT- or MR-guided procedure (i.e. a separate diagnostic CT or MRI scan is not performed and dictated) should be coded using the following CPT codes:

- 75989 (radiological guidance (i.e. fluoroscopy, ultrasound, CT) for percutaneous drainage and catheter placement)
- 77011 (CT guidance for stereotactic localization)
- 77012 (CT guidance for needle placement [e.g. biopsy, aspiration, injection, or placement of localization device])
- 77013 (CT guidance for, and monitoring of parenchymal tissue ablation)
- 77021 (MR guidance for needle placement (e.g. biopsy, aspiration, injection, or placement of localization device)
- 77022 (MR guidance for, and monitoring of parenchymal tissue ablation)
- 76497 (unlisted CT procedure [e.g. diagnostic, interventional])
- 76498 (unlisted MR procedure [e.g. diagnostic, interventional])

For example, MR-guided breast biopsy should be coded as CPT 77021 and not as CPT 77058 or 77059 unless it is clear that a separate diagnostic breast MRI is being performed at the time of the biopsy, and there is a separate radiology report outlining the findings of the diagnostic study.

Preface-4.3 Unilateral versus Bilateral Breast MRI
Diagnostic MRI of both breasts should be coded as CPT 77059 regardless of whether both breasts are imaged simultaneously or whether unilateral breast MRI is performed in two separate imaging sessions.

Preface-5 Lifescan or Whole Body Scan
Life scan or whole body CT or MRI for screening of asymptomatic patients is not a covered benefit of any of the current health plans who have delegated utilization review to MedSolutions.

The performance of screening CT examinations in healthy patients does not meet any of the current validity criteria for screening studies and there is no clear documentation of benefit versus radiation risk.

Preface-6 References
References are embedded within the body of the guidelines. Complete reference citations for the journal articles can be found on the Reference page at the end of each guideline section.

The website addresses for certain references are included in the body of the guidelines but are not hyperlinked to the actual website.

The website address for the American College of Radiology (ACR) Appropriateness Criteria® is http://www.acr.org
Click on Quality and Patient Safety, then click on ACR Appropriateness Criteria®.

The website address for the National Comprehensive Cancer Network (NCCN) Clinical Guidelines in Oncology™ is http://www.nccn.org
Click on NCCN Clinical Practice Guidelines in Oncology™.
Preface- 7 Copyright Information
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Preface- 8 Trademarks
CPT® (Current Procedural Terminology) is a registered trademark of the American Medical Association (AMA).
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<tr>
<td>AD</td>
<td>Alzheimer’s Disease</td>
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<tr>
<td>AIDS</td>
<td>Acquired Immunodeficiency Syndrome</td>
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<tr>
<td>AION</td>
<td>arteritic ischemic optic neuritis</td>
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<td>AVM</td>
<td>arteriovenous malformation</td>
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<tr>
<td>CMV</td>
<td>cytomegalovirus</td>
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<td>CSF</td>
<td>cerebrospinal fluid</td>
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<td>DNA</td>
<td>deoxyribonucleic acid</td>
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<td>EEG</td>
<td>electroencephalogram</td>
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<tr>
<td>ENT</td>
<td>Ear, Nose, Throat</td>
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<tr>
<td>ESR</td>
<td>erythrocyte sedimentation rate</td>
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<td>FDG</td>
<td>fluorodeoxyglucose</td>
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<td>FSH</td>
<td>follicle-stimulating hormone</td>
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<td>FTD</td>
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<td>GCA</td>
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<td>GCS</td>
<td>Glasgow coma scale</td>
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<td>GH</td>
<td>growth hormone</td>
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<td>LH</td>
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<td>MMSE</td>
<td>mini mental status examination</td>
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<td>magnetic resonance neurography</td>
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<td>MS</td>
<td>multiple sclerosis</td>
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<td>NAION</td>
<td>non-arteritic ischemic optic neuritis</td>
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<td>NPH</td>
<td>normal pressure hydrocephalus</td>
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<tr>
<td>PET</td>
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<td>PML</td>
<td>progressive multifocal leukoencephalopathy</td>
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<tr>
<td>PNET</td>
<td>primitive neuro-ectodermal tumor</td>
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<td>SAH</td>
<td>subarachnoid hemorrhage</td>
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<td>SLE</td>
<td>systemic lupus erythematosus</td>
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<td>TIA</td>
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<td>VBI</td>
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<td>VP</td>
<td>ventriculoperitoneal</td>
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<td>XRT</td>
<td>radiation therapy</td>
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Advanced neuroimaging is only appropriate when there is either evidence of a cranial disorder or a clinically supported reason to search for cranial involvement in a systemic process.

### HD-1.1 Anatomic Issues
- If two studies using the same modality both cover the area of clinical interest, only one is generally needed. Certain exceptions are discussed as they arise.
- **Maxillofacial versus orbital/temporal bone CT:** both orbital CT and maxillofacial CT cover the structures of the orbits, sinuses, and face. Unless there is a grounded suspicion of simultaneous involvement of more posterior lesions, especially of the region involving the middle or inner ear, one of these studies only should be sufficient.
- **Pituitary Gland:** one study (either brain MRI [CPT 70553] or MRI Orbit, Face, Neck [CPT 70543]) is adequate to image the pituitary. The ordering physician should specify that the study is specifically to evaluate the pituitary gland. The use of two CPT codes to image the pituitary is not indicated.

### HD-1.2 Screening
- There are well-defined situations in which certain advanced neuroimaging studies may be useful in screening.
  - Screening noncontrast head MRI (CPT 70551) can be performed in first degree relatives (parents, siblings, children) of patients with known familial cerebral cavernous malformations (cavernomas).
  - Screening of asymptomatic individuals using advanced imaging is inappropriate in most circumstances, especially those in which the presence of clinical features is required to make the diagnosis (e.g. multiple sclerosis).

### HD-1.3 CT vs MRI
- MRI is usually preferable to CT for brain imaging. However in some situations the difference in value between the two is small.
  - **CT is the initial procedure of choice for the following:**
    - Urgent/emergent settings due to availability and speed of CT
    - Trauma
    - Evaluate for recent hemorrhage, whether traumatic or spontaneous
    - Evaluate the bony structures of the head
    - Evaluation and follow-up of hydrocephalus
    - Patients dependent on life support
  - CT is normally performed prior to lumbar puncture in patients with cranial complaints. On occasion MRI may be substituted. The contrast used for the MRI depends on the clinical setting.
  - In some low yield imaging settings such as dementia in the elderly and headache in patients with normal neurological examinations, CT continues to be useful despite the theoretical superiority of MRI.
  - CT has little role in epilepsy, multiple sclerosis, pituitary disorders, characterization of known tumors, or evaluation of the late effects of stroke or head trauma.

### HD-1.4 Coding Issues
- **Brain PET:** should be coded as metabolic brain PET (CPT 78608).
- References:
• **HD- 2.1 Contrast in CT:** Head CT is normally performed without contrast except in certain situations in which it is being used as a necessary alternative to MRI: e.g. evaluating tumor, abscess, or the pituitary gland in patients who cannot have MRI.
  - In these guidelines, head CT is without contrast (CPT 70450) unless otherwise specified.
  - Sinus CT (CPT 70486) and temporal bone CT (CPT 70480) are generally performed without using contrast. Exceptions are noted in the appropriate locations below.
  - The iodide contrast used in CT reveals breakdown of the blood brain barrier and shows vasculature.
  - Mass effect, blood or blood products, and abnormal tissue are shown on noncontrast CT.
  - In patients who can have MRI, any abnormality on noncontrast CT is almost always better evaluated by MRI rather than CT with contrast. MRI done in follow-up of an abnormal CT finding is usually done without and with contrast.
  - Contrast only head CT (CPT 70460) has almost no indications. Unless there has been a noncontrast CT done within a few days with abnormal results (but see the comments above), such requests are almost always made in error (i.e. the request for “CT with contrast” should be interpreted as without and with contrast [CPT 70470]).
  - Neurologists, neurosurgeons, ENT’s and ophthalmologists should be accorded the option of not using contrast when they believe it to be unnecessary.

• **HD- 2.2 Contrast in brain MRI:** MRI is done without contrast to find masses, simple infarcts, anatomical abnormalities, and blood or blood products. Otherwise, contrast is often useful.
  - MRI contrast (Gadolinium) also shows breakdown of the blood brain barrier (including inflammation), displays blood supply to advantage in certain setting, reveals contrast patterns which make a number of lesions easier to characterize, and can visualize the meninges when this is needed. It often helps to characterize posterior fossa lesions and to characterize known masses.
  - Contrast only MRI (CPT 70552) is “never” ordered in the head except to follow-up a very recent noncontrast study (within one to two weeks at most). Otherwise, requests for brain MRI with contrast only are almost always made in error and should be coded as without and with contrast (CPT 70553). Neurologists, neurosurgeons, ENT specialists and ophthalmologists should have the option of not using contrast when they believe it to be unnecessary.

**References:**

CT and MR angiography: (CTA and MRA): these have been regarded as equivalents, but for most uses, CTA seems to provide superior images (better resolution). For many purposes, but not all, CTA has replaced catheter angiography.

- CT angiography of head or neck is often ordered to resolve uncertainties identified on MRA of those regions, and this is acceptable.
- Head MRA in these guidelines means without contrast (CPT 70544).
  - Head MRA is generally done without contrast (CPT 70544). Some cerebrovascular experts prefer contrast MRA (CPT 70545) to evaluate certain strokes and AVM’s and to follow known aneurysms, but for technical reasons, the addition of contrast usually has little to offer.
    - Requests for head MRA with contrast (CPT 70545) from neuro specialists are acceptable.
    - In patients with documented marked reduction in cardiac output, head MRA with contrast (CPT 70545) may be useful to improve image quality.
- There are no indications for cranial MRA without and with contrast (CPT 70546).
- MRA of the neck vessels is usually done with contrast only (CPT 70548), and ‘Cervical MRA“ or neck MRA” in these guidelines refers to contrast only MRA (CPT 70548) unless otherwise indicated.
  - Some specialists use noncontrast MRA of the cervical vessels (CPT 70547) and this is acceptable when specifically requested.
  - A reasonable suspicion of carotid or vertebral dissection is the only indication for performing cervical MRA without and with contrast (CPT 70549).

References:

The use of orbital CT to rule out orbital metallic fragments prior to MRI is rarely necessary: Plain x-rays are generally sufficient. X-ray detects fragments of 0.12 mm or more; CT, those of 0.07 mm or more.*


Unilateral anosmia suggests the presence of a tumor of the olfactory groove (esp. meningioma). Brain MRI without and with contrast (CPT 70553) is appropriate.

Bilateral anosmia is generally a consequence of trauma or of olfactory damage from an otherwise banal viral infection.

However, because of the fear of anterior basal tumor, brain MRI without and with contrast (CPT 70553) is acceptable in patients in whom the history is uncertain.
• Dysgeusia (lost of taste without loss of smell) is uncommon and often reflects brain stem disease. Brain MRI without and with contrast (CPT 70553) is indicated unless the symptom is seen as a part of Bell’s palsy (see HD-9 Facial Palsy).

### HD- 6 ~ ATAXIA

#### Adults:
- Differential diagnosis of ataxia includes:
  - alcoholic cerebellar degeneration
  - drugs/toxins
  - Multiple sclerosis (MS)
  - stroke
  - posterior fossa mass
  - sporadic cerebellar degenerations
  - dominantly or recessively inherited cerebellar degenerations
  - “normal pressure hydrocephalus” (NPH) see also HD-13 Dementia
  - paramalignant subacute cerebellar degeneration.
- Cervical spinal disorders and sensory ataxia from large fiber polyneuropathy cause “sensory ataxia” and must at times be considered.
- Noncontrast brain MRI (CPT 70551) is most often the appropriate imaging study, but MRI without and with contrast (CPT 70553) is reasonable when tumor or MS is being considered.
- In patients with suspected paramalignant subacute cerebellar degeneration, chest x-ray and chest CT (CPT 71260) will also be appropriate because of the connection to small cell lung tumors.

• Detailed neurological history and recent clinical examination are indicated prior to selection of neuroimaging in the evaluation of ataxia.
• Neurological consultation is helpful in determining the appropriate imaging pathway.
• Cervical spine imaging: in both adults and children, noncontrast MRI of the cervical spine (CPT 72141) is appropriate when no etiology for the ataxia has been discovered after other evaluation.

#### Reference:
- ACR Appropriateness Criteria, Ataxia 2006

### HD- 7 ~ BEHAVIORAL DISORDERS IN ADULTS

• Panic attacks, anxiety states, and obsessive compulsive disorder:
  - Advanced neuroimaging is not generally indicated for the usual manifestations of these disorders.
• Characterologic disorders:
  - Advanced neuroimaging is not generally indicated in patients evaluated or treated for character disorders or sociopathic behavior unless there is a specific indication beyond that disorder or the range of behavior associated with it.
• Bipolar disorder, schizophrenia, and related disorders:
  - Advanced neuroimaging is not generally required in these disorders.
  - In patients who fail to respond to treatment in the expected manner or who manifest features suggestive of an organic brain disorder, noncontrast head MRI (CPT 70551) or CT (CPT 70450) may be appropriate.
  - Detailed psychiatric and neurological examinations are appropriate prior to considering advanced imaging.
- Neurology or Psychiatry consultation is helpful in determining the need for advanced imaging.

- Memory loss in young or middle aged adults:
  - This is most commonly a symptom of depression in the absence of other neurological abnormalities or head trauma.
  - Advanced imaging is not indicated unless the patient has failed to respond to an adequate trial of anti-depressant treatment or has other cognitive or neurological abnormalities discovered on detailed neurological examination.
  - Neurology or Psychiatry consultation is helpful in determining the need for advanced imaging.

- References

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### HD-8 ~ CHIARI AND SKULL-BASE MALFORMATION

- **HD- 8.1** Chiari malformation (properly Chiari I; formerly called Arnold-Chiari) is location of the cerebellar tonsils at least 5 mm below the foramen magnum. Most patients have no or very vague symptoms, and diagnosis is usually made unexpectedly on a head MRI done for other purposes. A significant minority of these patients have an associated syringomyelia or hydromyelia and a small number have hydrocephalus.
  - Noncontrast brain MRI (CPT 70551) is appropriate if not already performed. If the Chiari malformation has been identified, noncontrast MRI spine (CPT 72141 with or without also performing CPT 72146) is recommended to exclude syrinx. Follow-up cervical MRI without and with contrast (CPT 72156) will be needed if hydro/syringomyelia is seen (also see SP-15 Syringomyelia in the Spine guidelines).
  - Once the diagnosis has been established by MRI, repeat brain MRI is generally appropriate only in patients with increasing symptoms or signs, or as a preoperative study.
  - CSF flow studies may be appropriate in selected patients with evidence of hydrocephalus ([see HD-35.5 CSF flow imaging](#)), but the coverage policy of the involved health plan regarding this study should be consulted.

- Chiari II, III, and IV are very rare and involve much more extensive malformations which are not discussed in these guidelines.
- Chiari malformation is not itself familial, and family screening is not appropriate.

- **HD- 8.2 Skull-base Malformations**
  - **Platybasia** is a malformation of the skull base: the clivus is too horizontal.
    - Symptoms are not frequent, but noncontrast brain MRI (CPT 70551) or CT (CPT 70450) is appropriate if a case comes to notice.
  - **Basilar impression** involves malformation of the occipital bone in relation to C1/2.
    - The top of the spinal cord is inside the posterior fossa and the foramen magnum is undersized which can lead to brain stem and upper spinal cord compression over time.
    - Can be associated with the Chiari malformation, producing very complex anatomical abnormalities.
    - Noncontrast brain MRI (CPT 70551) and cervical spine MRI (CPT 72141) are appropriate.
• If surgery is being considered, noncontrast head and cervical spine CT scans (CPT 70450 and 72125) can be performed.
  ➢ Basilar impression appears to be partly genetic, and screening of first degree relatives with noncontrast brain MRI (CPT 70551) may be appropriate.

• HD- 8.3 Reference

CRANIAL NERVE (CN) PROBLEMS

HD- 9 ~ FACIAL PALSY (BELL’S PALSY)

• **Facial palsy**: acute facial weakness from peripheral lesions of the Facial nerve (CN VII) is common. Facial weakness can arise from stroke or other brain lesion (“central” weakness) but it very rarely involves the forehead muscles. In contrast, the hallmark of peripheral palsies is that they do include forehead weakness.
  o With only mild weakness, it may be hard to tell the two apart.
  o In peripheral palsies, taste and tearing on the side of weakness may be affected.
  o **Bell’s palsy**: Most cases of peripheral facial palsy are of unknown cause (Bell’s Palsy) and recurrences are not typical.
    ➢ Ear, temporal, and facial pain are commonly seen in Bell’s palsy. This helps to confirm the diagnosis and is not an indication for imaging.
    ➢ Patients often complain that the involved side of the face feels numb, but objective sensory loss, if reproducible and anatomical, suggests another diagnosis.
  o Imaging is generally unnecessary in a first episode of peripheral facial palsy in an otherwise healthy patient. Imaging may show either swelling or enhancement of the facial nerve in the canal, but neither finding will influence management.
  o The presence of a Complete vs partial facial paralysis in patients with Bell’s palsy affects prognosis for recovery, but does not affect the indications for advanced imaging.
  o **Brain MRI without and with contrast** (CPT 70553) is appropriate in the following:
    ➢ If the patient has failed to show improvement by six weeks from onset
    ➢ Patients who manifest visible hemifacial spasm at onset
    ➢ Recurrent cases
  o **Other facial palsies**
    ➢ Facial palsy can arise from HIV infection, Lyme disease, zoster infection of CN VII, parotid tumors, or the Guillain-Barre syndrome (usually bilateral in the last).
    ➢ Recurrent facial palsy can arise from sarcoidosis, the Melkerson-Rosenthal syndrome, or Sjogren’s syndrome.
    ➢ Such cases are not properly called Bell’s palsy, and their evaluation depends on the nature of the underlying disease.

• Reference:
**HD-10 ~ RECURRENT LARYNGEAL PALSY**

- **Recurrent laryngeal palsy** (unilateral vocal cord palsy):
  - Patient presents with a breathy hoarseness and the weakness is seen on laryngoscopy.
    - The term "vocal fold" is a synonym for "vocal cord."
    - The involved nerve is the recurrent laryngeal branch of the vagus (CN X).
  - **Etiology:**
    - Surgical injury to the nerve (e.g. thyroid surgery, carotid endarterectomy, anterior cervical spinal fusion, chest operations)
    - When no cause is apparent, many cases are idiopathic (post-viral), but it is necessary to exclude tumors (skull base, lungs, esophagus, metastatic disease).
      - Chest x-ray is appropriate initially since its findings may direct further evaluation.
      - If the chest x-ray is nondiagnostic, imaging of the entire course of the ipsilateral recurrent laryngeal nerve is appropriate, either by contrast only CT or (less often) by MRI without and with contrast. This course differs between the sides:
        - **Left:** skull base to mid-chest (neck and chest CT with contrast—CPT 70491 and 71260—not cervical-spine)
        - **Right:** skull base to clavicle (neck soft tissue CT with contrast CPT 70491).
  - Brain imaging is not usually required since central involvement of a vagus nerve can generally be clinically distinguished from pure recurrent laryngeal palsy, but there are situations when it is needed (upper vagus weakness).

- **References**
  - *Otolaryngol Clin N Am* 2004;37:45-58

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**HD-11 ~ DIPLOPIA**

- **HD-11.1 Diplopia:**
  - Double vision with both eyes open (binocular).
    - Monocular diplopia reflects ocular disorders (dislocated lens or retinal detachment). This guideline addresses binocular diplopia. Specialist consultation is helpful for the evaluation of diplopia.
  - Variable and inconsistent diplopia: neuromuscular diseases, esp. myasthenia gravis, should be considered before neuroimaging.
  - Cranial nerve disorders (III, IV, VI): see below.

- **HD-11.2 Internuclear ophthalmoplegia:** when looking to one side, the out-turning (abducting) eye turns as it should, but the other eye does not turn in (adduct).
  - In older patients, this usually indicates a pontine stroke (see HD-31.1 Vertebrobasilar ischemia).
  - In younger patients, it is a classic feature of MS.
  - About 25% of cases are from other causes (trauma, transtentorial herniation, tumor, infection, hemorrhage, vasculitis). Brain MRI (not CT) is appropriate. The need for
contrast depends on the clinical setting (mostly age), but MRI without and with contrast (CPT 70553) is acceptable.

- Reference:
  ➢ Arch Neurol 2005;62:714-717

- **HD-11.3 Abducens nerve (CN VI) palsy:** CN VI supplies the lateral rectus muscle which abducts the eye. VIth nerve palsies present with horizontal binocular diplopia worse when looking toward the involved side.
  - Ophthalmology or Neurology consultation is helpful in formulating the differential diagnosis, which affects choice of imaging studies.
  - Pure abducens palsies are common after trauma and as a so-called false localizing sign with increased intracranial pressure.
  - Abducens palsies can also occur with intracranial inflammatory disorders (sarcoidosis, MS, Lyme disease, non-viral meningitis) and from tumors in the region of the cavernous sinus.
  - Most abducens palsies, especially in the elderly, are “idiopathic,” probably from tiny infarcts of the CN VI itself. These tend to resolve over a few months.
  - There is no strong association with diabetes as there is with CN III nerve palsies although abducens palsies appear to be more common in diabetics.
  - MRI of the brain without and with contrast (CPT 70553) is the usual investigation. The tiny infarcts mentioned above are far too small for MRA or CTA to be useful. This is small vessel disease outside the brain.
    ➢ Lesions around the cavernous sinus may be difficult to see on routine head MRI and at least a 1.5T brain MRI without and with contrast (CPT 70553) with special attention to the area may be needed when such lesions are suspected.

- **HD-11.4 Trochlear nerve (CN IV) palsy:** CN IV supplies the superior oblique muscle which intorts the adducted depressed eye in near vision (reading, for example).
  - Most CN IV palsies are post-traumatic.
  - Patients have minimal vertical diplopia which they often correct by tilting the head.
  - Imaging is usually performed to evaluate associated brain or eye trauma or when the expected improvement fails to occur within a few months.

- **HD-11.5 Oculomotor nerve (III) palsy:** CN III innervates the pupil, the levator of the upper lid, and all of the extraocular muscles except the lateral rectus and superior oblique.
  - Painful extra-ocular palsies are discussed in HD 17.4 Painful CN III nerve palsy and their presence colors all CN III nerve evaluations.
  - In a full-blown CN III palsy, the upper lid is closed, the pupil is fully dilated and fixed (“blown”), and all motions but abduction are absent.
  - The pattern of a partial Oculomotor palsy may indicate an intra-orbital lesion. In this circumstance, orbital MRI or CT (contrast as requested) may be appropriate, rather than brain imaging.
  - Diabetics are prone to microvascular infarctions causing a third nerve palsy which typically spare the pupil. These generally resolve over about 4-6 months.
    ➢ Physicians who do not routinely image these “pupil sparing III palsies” will image those which fail to resolve using (brain MRI without and with contrast—(CPT 70553) and brain MRA—(CPT 70544).
  - The sympathetic innervation of the eye travels with CN III but is discussed separately (see HD-38 Horner’s Syndrome).
• Examination of the pupils may show abnormalities of no significance following iridectomy or other surgery involving the iris.
  
  **Mild isolated anisocoria**
  o Evaluation should start with old photographs, since up to about 1 mm of anisocoria is common in the normal population.
  o In patients with mild isolated anisocoria, it may be necessary to obtain full ophthalmologic or neurological evaluation to determine which is the abnormal side.

• **Adie’s (tonic) pupil:**
  o An apparently fixed and dilated pupil in an otherwise normal patient.
    ➢ Accommodation to near remains, and there is no pain.
  o Imaging is generally unnecessary.
  o In time these pupils become smaller than their mate.
  o Absent ankle jerks are common in these patients.

• **A dilated pupil with pain or neurological findings** must be assumed to reflect CN III nerve disease (see HD-11 Diplopia, HD-17 Hyperacute Headache, and HD-16 Headache, Adult under “Complex migraine.”)
  o Unless the cause is already known, brain MRI without and with contrast (CPT 70553), and brain MRA (CPT 70544) or CTA (CPT 70496) are appropriate.
  o If the dilatation is isolated, or if any accompanying IIIrd nerve palsy is partial, orbital MRI without and with contrast (CPT 70543) can also be performed.

• **Small pupil:** the differential diagnosis is Horner’s syndrome, “little old Adie’s”, and normal variation (if <1 mm difference).
  o Also see HD-38 Horner’s Syndrome

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**HD-13 ~ DEMENTIA**

• **HD-13.1 The diagnosis of dementia** is established clinically.
  o Neuropsychological evaluation is necessary, whether by mini mental status examination (MMSE or Folstein exam), by formal neuropsychological testing, or by less formal mental evaluation often performed by neurologists, psychiatrists, or gerontologists.
    ➢ Recent full neurological examination as part of the physical examination is also appropriate initially.
  o A raw MMSE (Folstein) cut-off score of <25 is a specific but insensitive measure of dementia (65% sensitivity), and scores should be adjusted for the patient’s background rather than looked at rigidly.
    ➢ A score ≥2 points below expected is significant (e.g. a score of 28 is very abnormal for a former college professor).
  o Advanced neuroimaging is used chiefly to exclude an unexpected brain tumor or subdural hematoma.
    ➢ Either noncontrast head CT (CPT 70450) or noncontrast brain MRI (CPT 70551) is generally sufficient.
    ➢ MRI has the advantage of superior evaluation for multi-infarct states and subcortical white matter diseases and is strongly preferable when those diagnoses are being considered.
• **HD-13.2 Normal pressure hydrocephalus:** the extremely rare syndrome called normal pressure hydrocephalus is really a differential diagnosis of gait ataxia. No controlled studies have shown intellectual benefit from shunting. Candidates for the diagnosis should undergo noncontrast brain MRI (CPT 70551), but there is no agreement on the need for further imaging.

• **HD-13.3 Dementia** In the elderly, depression can masquerade as dementia. Separate neuropsychological testing for depression may be necessary in some cases prior to consideration of neuroimaging, although a large minority of these patients have both diagnoses.

• **HD-13.4 Premature dementia:**
  o Dementia is rare before age 60, and brain MRI, contrast as requested (but not CT) can be obtained.

• **HD-13.5 Mild cognitive impairment, including isolated memory problems:**
  o The value of advanced imaging in such patients with an otherwise normal examination has not been established.
  o A detailed neurological and neuropsychological examination should precede neuroimaging.
  o Neurology consultation may identify findings which would support performing noncontrast brain CT (CPT 70450) or MRI (CPT 70551).

• **HD-13.6 Follow-up of known cases of dementia:**
  o Clinical and neuropsychological re-evaluation should be performed.
  o Repeat imaging studies are not appropriate

• **HD-13.7 Screening:**
  o The use of advanced neuroimaging to screen neurologically normal patients for dementia is inappropriate.

• **HD-13.8 Reference:**
  o Neurology 2001;56:1143-1153

• **HD-13.9 PET in dementia:** CPT code should be metabolic brain PET (CPT 78608).
  o The role of PET is limited to differentiating Alzheimer’s Disease (AD) from Frontotemporal Dementia (FTD).
  o Candidates for PET have:
    ➢ a clinical history of confirmed dementia involving more than one area of mental dysfunction present for at least six months
    ➢ a non-diagnostic head CT or brain MRI
    ➢ a neuropsychological profile which fulfills the diagnostic criteria for BOTH AD and FTD
  o The rare entity semantic dementia or progressive aphasia can be a manifestation of either FTD or AD, so such patients are candidates for PET.
  o Consultation with a neurologist or other dementia specialist is helpful in determining the need for PET and is required by CMS prior to PET.
  o Reference:
    ➢ Fed. Reg 70 (197) Oct 13, 2005
• Repeat PET (initial study positive): there is no indication to repeat PET when a prior study was diagnostic.
  ➢ PET cannot reliably be used to follow the progression of dementia. Clinical evaluation should be performed.
• Repeat PET (initial study nondiagnostic): may be of value when the patient has shown progressive dementia which has remained clinically uncharacterized for two years since the initial PET. This is a rare situation.
• PET in mild cognitive impairment: The term mild cognitive impairment refers to a loss of function limited to one area of mentation, most commonly memory loss in the elderly.
  ➢ PET is not indicated; a normal PET in that setting is 98% accurate in predicting the absence of underlying dementia, but the 15% rate of false positives with PET is unacceptably high.
  

### HD-14 ~ ADULT EPILEPSY/SEIZURE

- The diagnosis of epilepsy has immense medical, economic and social consequences to the patient.
  - In patients suspected of having seizures, a detailed history and neurological examination, including accounts of witnesses to the event when possible, is appropriate prior to consideration of imaging.
  - No imaging study can determine the presence or absence of seizures.
  - **Postictal paralysis or aphasia (Todd’s palsy):**
    - The clinical distinction between a TIA or minor stroke and a postictal palsy can be difficult.
    - Advanced imaging to rule out TIA/stroke may be necessary (see HD-30 General Stroke/TIA).
  - Neurological consultation can be helpful in determining the diagnosis and appropriate imaging pathway.
- Head CT is of limited use in establishing the source of epilepsy and it is not appropriate unless MRI is impossible.
  - Reference:
    - *Neurology* 2007;69:1772-1780
- MRI Head without and with contrast (CPT 70553) is generally the appropriate study in the initial evaluation of new onset seizures in adults.
  - Noncontrast brain MRI (CPT 70551) is sufficient when cerebral malformations are suspected.
- Brain MRI (contrast as requested) is also appropriate for many patients with recurrent intractable epilepsy.
- If an arteriovenous malformation is found on MRI, head and neck MRA (typically CPT 70544 and 70548) or head and neck CTA (CPT 70496 and 70498) are indicated unless catheter angiography is planned. If the initial MRI was done without contrast, MRI with contrast (CPT 70552 or 70553) can be performed.
- Cervical MRA and CTA will generally not be needed in the evaluation of epilepsy unless the seizures are thought to be due to a stroke (See HD-30 General stroke/TIA).
- Repeat brain MRI (contrast as requested) may be approved for surveillance after 1 to 2 years of treatment for epilepsy, especially if the seizures are not under complete
control. Further surveillance should be every 3-5 years unless there is a specific indication.

- Repeat MRI brain studies may also be indicated in the setting of an unexplained increase in seizure frequency, change in seizure type, or the appearance of new neurological findings.
  - Evaluation of medication changes and the possibility that anticonvulsant doses have become inadequate should be performed prior to considering repeat MRI.
  - The occurrence of one to a few breakthrough seizures in an established epileptic is not generally an indication for re-imaging.

- It is not necessary to repeat imaging before making the decision to withdraw anticonvulsant medications.*


- Epilepsy surgery and intractable epilepsy: PET (CPT 78608) may be useful in adult patients with intractable seizures in whom MRI/EEG have failed to establish a definite focus. Since this is done to aid in selection of potential epilepsy surgical procedures, such patients will be under the care of a neurologist or other epileptologist.
  - Reference:
    - Neurology 2003;60;538-547 Re-affirmed 10-15-2005

- Reference:

### HD-15 ~ FACIAL PAIN/TRIGEMINAL NEURALGIA

- Because of the complex differential diagnosis, difficulty with obtaining precise history which seems to be unique to this condition, and need for detailed examination, specialist consultation (ENT, neurology, or ophthalmology) is helpful prior to consideration of advanced imaging for facial pain.

- When the diagnosis of tic douloureux (or its IX or VII nerve variants) has been confirmed, brain MRI without and with contrast (CPT 70553) with special attention to the skull base, is appropriate.*


- In patients with tic douloureux, who have failed medical therapy and who are being considered for posterior fossa decompressive procedures, head MRA (CPT 70544) or CTA (CPT 70496) may be appropriate.
  - Specialist evaluation is helpful in determining the need for imaging (as these are essentially preoperative studies).

- In cases of trigeminal neuralgia which involve the ophthalmic nerve, (peri-orbital or forehead pain), once herpetic neuralgia has been excluded, orbital MRI without and with contrast (CPT 70543) may also be appropriate.

- The differential diagnosis of atypical facial pain is extensive, complex, and difficult, and there is considerable case-to-case variation in optimal imaging pathway.
  - Specialty consultation is helpful prior to selection of advanced imaging studies in these cases.
Thunderclap headaches are treated separately in HD-17 Hyperacute Headache.

**HD-16.1 New onset headaches:**
- The vast majority of headache patients do not benefit from advanced imaging.
- Diagnosis of the common headache syndromes such as migraine, tension headache, and headaches related to stress and depression is principally accomplished by a detailed history accompanied by a careful general physical and neurological examination.
- Headache is a common symptom of acute systemic infections and other non-cranial disorders. In the absence of either meningeal neck stiffness or abnormalities on neurological exam, advanced neuroimaging is rarely indicated.
- Patients whose headaches fit the clinical patterns typical of migraine, tension headache, or stress/depression related headache, do not generally require imaging **unless** any of the following applies:
  - Focal neurological signs found on physical exam, (includes papilledema see HD-25 Papilledema).
    - Note that Dizziness, subjective numbness of painful areas, blurry vision, etc. are **not** focal signs.
    - MRI brain without and with contrast (CPT 70553) is strongly preferred.
  - Decreased coordination on objective physical examination or mental status changes not due to medications.
    - Brain MRI without and with contrast (CPT 70553) is strongly preferred.
  - Thunderclap headache (see HD-17 Hyperacute Headache)
  - Headache that has persisted a month or more despite adequate physician-prescribed and monitored treatment, including both prophylactic and abortive treatment.
    - Noncontrast head CT (CPT 70450) or noncontrast head MRI (CPT 70551) are recommended.
  - Headache is accompanied by the following “red flags”:
    - Headaches can be produced (not merely worsened) by Valsalva maneuver (straining).
    - Headache frequently awakens the patient at night.
    - The headache is felt by the physician (usually Neurologist) to be atypical of any known benign pattern.
    - For these “red flag” indications, noncontrast head CT (CPT 70450) or brain MRI (CPT 70551) is appropriate.
- In patients over 60 years old with new onset unilateral headaches, temporal arteritis (Giant Cell Arteritis) should be ruled out by appropriate evaluation such as ESR (sed rate) prior to advanced imaging, unless there are also focal neurological signs or papilledema.
- Low pressure headaches (see HD-16.5)

**References:**
- Neurology 2000;55:754-763
• **HD 16-2 Migraine and tension headaches:**
  o Patients with an established diagnosis of headache, especially migraine or tension headache, do not generally require head MRA or CTA for those disorders.
  o Patients who experience a distinct change in the pattern of an established chronic headache disorder can have noncontrast head CT or MRI (CPT 70450 or 70551).
  o Patients who experience a marked increase in frequency or severity of an established headache disorder should receive a trial of treatment including prophylactic agents.
    ➢ If this is unsuccessful, noncontrast head CT or MRI (CPT 70450 or 70551) can be performed.
  o Patients with a normal neurologic examination and a new onset of headaches consistent with a diagnosis of migraine with or without aura, or of tension headache, should receive a 3 week trial of therapy extending beyond analgesics before consideration of advanced imaging.
  o Neck pain, giddiness, subjective numbness, nonspecific visual blurring, and mild vertigo with motion are all common accompaniments of migraine and tension headaches. Their presence is not of itself an indication for head or neck imaging.
    ➢ Separate cervical spine imaging is not generally indicated for neck pain when it is a part of a migraine or tension headache.
  o Migraine attacks usually worsen with straining, physical activity, and postural change. The presence of transient activity-related worsening is not of itself an indication for head imaging. In contrast, initiation headache by these activities is discussed under red flags.
    ➢ **Activity related migraine:** the tendency of otherwise typical migraine attacks to follow physical activities is well known.
      ▪ This may cause diagnostic confusion in a first ever attack, and noncontrast head CT (CPT 70450) or MRI (CPT 70551) may be appropriate in that setting.
      ▪ If the onset has a thunderclap quality, further evaluation may be appropriate (see HD-17.2 Hyperacute headache).
      ▪ Headaches provoked by sexual intercourse are a type of activity-related headache. A thunderclap onset is particularly common in these. See HD-17.5 Headache associated with sexual activity.
  o “**Complex migraine**” in patients with aphasic, hemiplegic, or ophthalmoplegic migraine (those with a prodrome including double vision), specialist evaluation is helpful in determining the need for advanced imaging and the appropriate imaging pathway.
    ➢ Consideration should be given to brain MRI without contrast (CPT 70551).
    ➢ Head and cervical MRA (CPT 70544 and 70548) (see HD-30 General Stroke/TIA) may also be appropriate.
    ➢ In those rare patients with ophthalmoplegic migraine resembling a painful CN III nerve palsy, brain MRA (CPT 70544) or CTA (CPT 70496) should be considered if not previously done (CTA is preferred).
      ▪ Repeat studies are generally not needed for subsequent attacks.
  o **References**
    ➢ *Cephalgia* 2004;24 (suppl 1):S1-S151
    ➢ *JAMA* 2006;296:1274-1283

• **HD-16.3 Cervicogenic headache** is not an established diagnosis, although there has been much speculation on this subject. Abnormalities seen on cervical spine advanced imaging have been shown to be no more common in those with headache than in the
population at large, and MRI/CT of the cervical spine is generally not indicated to evaluate headache.

- **References:**
  - Spine J 2001;1:31-46
  - Cephalgia 2003;3:85-92

- **HD-16.4 Cluster headache:**
  - This syndrome is distinct from migraine and is characterized by clusters of strictly unilateral severe headache usually associated with transient Horner’s syndrome and unilateral tearing and nasal congestion.
  - The clusters typically last several weeks and recur at varying intervals (more or less annually is common).
  - The diagnosis is made clinically, but since about 5%-10% of these patients harbor a pituitary tumor, brain MRI without and with contrast with attention to the pituitary (CPT 70553) may be appropriate once during the course of this illness.
  - Cluster headaches are not familial.
  - The term cluster migraine is nonstandard, and in most uses likely refers to migraine, not to cluster headaches.
  - Cluster headache is the only relatively common member of a family of headache disorders collectively called the trigeminal autonomic cephalgias.
    - Others include paroxysmal hemicrania, hemicrania continua, hypnic headaches, and SUNCT (an acronym for “short acting unilateral neuralgiform headaches attacks with unilateral conjunctival injection and tearing”). Trigeminal neuralgia within the ophthalmic division (V 1) can also be considered with this group, but only for diagnostic purposes.
    - All of these are diagnosed clinically, but head MRI (contrast as requested) is appropriate initially.
  - **References:**
    - Arch Neurol 2007;64:25-31
    - Brain 2005;128:1921-1930

- **HD-16.5 Low pressure headache:** headaches from intracranial hypotension are usually characterized by an impressive increase in severity in the upright posture and relief by lying flat (similar to the pattern of post-lumbar puncture headaches).
  - This is an unusual and difficult situation both to diagnose and to manage. Detailed clinical evaluation is needed, and neurological consultation (or ENT if there is CSF rhinorrhea) is very helpful.
  - Brain MRI without and with contrast (CPT 70553) is the appropriate initial imaging study. Contrast is helpful to visualize the typical basilar dural venous enhancement.
    - Requests for additional imaging beyond head MRI should be referred for Medical Director review.
  - One third of these cases have a spinal origin, so both spinal MRI and CT myelography are often needed, sometimes in combination.
  - **References:**
    - Practical Neurology 2002;2:192-197

- **HD-16.6 Chronic intractable headaches:**
  - Headache specialists at times see patients with a long history of more or less daily headaches of no specific type in whom extensive treatments have failed and diagnostic studies have been negative.
Guidelines are difficult to apply to this very individualized situation.
While there is generally no basis for repeating previously negative studies, there may be value in selected cases of obtaining brain MRI without and with contrast (CPT 70553) (e.g. atypical low pressure headaches, meningeal disorders), brain MRI without and with contrast (CPT 70553) dedicated to the parasellar region, or brain MRV (CPT 70544) (e.g. bilateral transverse sinus stenosis, occult venous sinus occlusion).

"Benign intracranial hypertension without papilledema": requests for MRV in a patient with intractable, very frequent headaches of no known cause commonly reflect a desire to exclude venous sinus occlusion as a cause.
- In patients who have had exhaustive prior clinical evaluation, prolonged unsuccessful attempts at treatment, and normal head MRI, this is acceptable.
- Reference: Neurology 2006;67:419-423
  o These cases should be sent for Medical Director review.

**HD-16.7 Sinus CT in evaluation of headaches:** see HD-44 Sinus, Adult

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**HD-17 ~ HYPERACUTE HEADACHE - BERRY ANEURYSM - SUBARACHNOID HEMORRHAGE**

**HD-17.1 General Information**
- Generally, the central issue in these cases is a search for intracranial bleeding and, when relevant, for a cause for such bleeding (usually aneurysm in adults and arteriovenous malformation in children).
- Berry aneurysms are intracranial. When it is appropriate to search for them, brain MRA or CTA are sufficient, and cervical studies are not indicated.
  - When there is a clinically grounded suspicion of a craniocervical vascular dissection, MRA or CTA neck or head and neck is appropriate.
- Arteriovenous malformations (AVM) can be recognized on noncontrast brain MRI (CPT 70551), but they are more readily seen and better evaluated on brain MRI without and with contrast (CPT 70553).
  - A reasonable approach is to proceed directly with brain MRI without and with contrast (CPT 70553) when the presence of an AVM is likely, but to perform noncontrast brain MRI (CPT 70551) initially when an AVM is merely possible.
  - When the presence of an AVM has been confirmed by imaging studies, CTA or MRA of both the head and neck are appropriate to outline the blood supply and venous drainage of the AVM.

**HD-17.2 Hyperacute headache** refers to a snap-of-the-fingers onset of immediately severe headache (thunderclap headache). Such headaches do not build after a mild onset: they are severe from the onset. They are investigated urgently because of the fear of non-traumatic (esp. aneurysmal) subarachnoid hemorrhage (or, less frequently, cervical arterial dissection). It is this single event, not a recurrent condition, that is being evaluated.
- Aneurysms do not cause chronic recurrent headaches. Imaging is not indicated in patients with established, recurrent thunderclap headaches (by convention, 4 or more such episodes) and patients whose thunderclap headaches have already been fully evaluated.
- Cervical arterial dissections can present with thunderclap pain radiating from neck to occiput (vertebral artery) or anterior neck to angle of jaw and temple (carotid artery).
  - See HD-31 Special Stroke/TIA
Noncontrast head CT (CPT 70450) should be performed in the first 12 hours after the onset of a thunderclap headache. If CT is negative, lumbar puncture should be done. Within the first 12 hours, MRI is “blind” to subarachnoid blood. MRI “sees”, not blood, but the products of hemoglobin breakdown.

Between 12 hours and about 7 days post onset, either noncontrast head CT (CPT 70450) or MRI (CPT 70551) can be used.

**HD-17.3 Subarachnoid hemorrhage (SAH):** CT is the primary procedure for identifying the presence of subarachnoid hemorrhage. The accuracy of CT falls with time: 98%+ within 12 hours, 90% at 24 hours, 80% at three days, 50% at one week. Blood products clear from spinal fluid more slowly than blood itself, so that MRI is positive for somewhat longer.

In practice, once a patient is more than 24 hours post onset, reliably excluding subarachnoid hemorrhage (SAH) becomes progressively more difficult.

In those in whom SAH is a reasonable concern despite negative CT or MRI, adding head CTA (CPT 70496) or MRA (CPT 70544) may be necessary.

Patients who were not adequately evaluated within 12 hours of onset may benefit from obtaining head CTA or MRA, even with negative head CT and LP.

Most of these patients have not, in fact, had a subarachnoid hemorrhage, and specialist consultation can be useful in identifying those cases in which evaluation beyond CT or noncontrast MRI is needed.

If head CT/lumbar puncture were done within the first 12 hours of the headache and were negative, further evaluation is not generally needed.

Once SAH has been confirmed by head imaging or lumbar puncture, catheter angiography or head CTA (CPT 70496) is indicated. MRA usually has little to add at this point, but there are exceptions.

Brain MRI without and with contrast (CPT 70533) is usually appropriate in patients with proven subarachnoid hemorrhage but negative angiographic studies.

**HD-17.4** Patients presenting with a painful CN III nerve palsy which includes pupillary dilatation are at substantial risk of harboring a posterior communicating artery aneurysm.

- Head CTA (CPT 70496) or catheter angiography should be performed urgently.
- Head MRA (CPT 70544) can be used, but is less definitive.
- No guideline can be given for pupil-sparing III nerve palsies. Many neuro-ophthalmologists perform no imaging at all if the patient is diabetic, while others feel the need to exclude aneurysms.
  - Also see HD-11.5 Oculomotor nerve (CN III) palsies

**HD-17.5 Headache associated with sexual activity:** the first episode raises concern for a hemorrhagic event, and should be evaluated as in **HD-17.2 Hyperacute headache.** Evaluation for cervical arterial dissection should be included if the clinical picture suggests (see **HD-31 Special Stroke/TIA**)

- Reference:
  - Practical Neurology 2005;5:350-355

**HD-17.6 Re-imaging in patients with known aneurysm (surveillance):** there are no clear standards regarding re-imaging (repeat brain MRA/CTA) of patients with a personal history of aneurysm, but the following can be offered for guidance at this time:

- Re-imaging after 10 years is reasonable in:
  - Patients taking oral contraceptives
Patients with hypertension

Smokers

- Evidence is insufficient at this time to make any general recommendation in those without these risk factors for aneurysm growth.
- Patients who have had aneurysm coiling are generally followed with annual re-imaging (usually head CTA—CPT 70496). In this setting, the established re-imaging protocol of the neuro-interventional facility following the patient should be honored.
- Re-imaging at 5 to 10 years can be considered (although evidence is weak) in patients who originally had multiple aneurysms, some of which were then thought to be too small to repair.

- References:
  - Brain 2005;128:2421-2429

- **HD-17.7 Re-imaging in patients with known aneurysm (on indication):** patients with known aneurysms, whether treated in the past or not, should be re-evaluated if there is onset of a new thunderclap headache or focal neurological deficit.
  - Either noncontrast head CT (CPT 70450) or noncontrast MRI (CPT 70551) and either head CTA (CPT 70496) or MRA (CPT 70544) are appropriate.

- **HD-17.8 Screening for aneurysm:**
  - Patients with a first degree relative with cerebral aneurysm may have head MRA (CPT 70544) or CTA (CPT 70496) performed, if they are less than 60 years old and their life expectancy is greater than 20 years.
    - Imaging of the cervical vessels is generally not indicated (but see Fibromuscular Dysplasia below).
  - Ideally, screening should be done when the subject enters the decade in which subarachnoid hemorrhage occurred in the family member(s)—there is usually an age cluster.
  - A second study after 10 years is reasonable when the first was negative.
  - The relative risk to second or higher degree relatives is slight, and screening is not generally appropriate.
  - Patients with familial polycystic kidney disease, Ehlers-Danlos syndrome, fibromuscular dysplasia, or a known aortic coarctation should be imaged at least once during adult life, preferably in their early 20’s.
    - Repeat imaging is not needed for at least 10 years (if the first study was negative).
    - In those with fibromuscular dysplasia, CTA (CPT 70498) or MRA (CPT 70548) of the cervical vessels should be included.
  - If the person being screened is asymptomatic, head CTA (CPT 70496) or noncontrast head MRA (CPT 70544) alone is sufficient.
  - In patients who also have headaches or neurological findings, head CT (CPT 70540) or MRI (CPT 70551) should be added.

- References:
  - Lancet 2003;362:103-110

- **References:**
Detailed medical history, recent general physical examination, and recent neurological examination are the initial phase in evaluating patients with potential neurological trauma.

CT is the primary imaging modality in patients with acute head trauma. MRI is used chiefly in severe acute head trauma when the clinical findings are not explained by the CT results (“the patient is much worse than the CT”) or to evaluate late effect of brain injury.

When more than evaluation for potential neurosurgical lesions is needed, MRI is superior to CT in recognizing non-hemorrhagic cortical contusions, diffuse axonal injury (“shears”), and brain stem injury.

**HD-18.1** Head CT is appropriate:
- after minor acute trauma in patients whose Canadian CT Head Rule inventory has any positive feature (see below)
- any head trauma patient who is:
  - taking one anticoagulant or two antiaggregants, (e.g. aspirin and Plavix)
  - has a known platelet or clotting disorder
  - has significant renal failure (creatinine>6)
- The modified Canadian CT Head Rule: **Positives include:**
  - Glasgow coma scale (GCS) score of 15 (perfect score) attained within 2 hours of injury
  - >30 minutes of amnesia
  - any “dangerous mechanism of injury”
  - a suspected open skull fracture
  - any signs of basilar skull fracture
  - two or more episodes of vomiting
  - patient > 64 years old
  - There must be no positives to omit scanning
- References:
  - *JAMA* 2005;294:1551-1553
  - *JAMA* 2005;294:1511-1518
  - *JAMA* 2005;294:1519-1525
  - *Lancet* 2001;357:1391-1396

In the six months following such injuries, whether or not there has been an initial scan, head CT or MRI is appropriate if the patient develops dementia, alteration of alertness, or focal neurological deficits (e.g. hemiparesis, diplopia). This includes fluctuating problems.

See [SP-13 Mechanical Neck Pain](#) in the Spine guidelines for guidelines pertaining to cervical spine trauma.

**HD-18.2** Brain MRI is not generally recommended as a first study, but noncontrast brain MRI (CPT 70551) is appropriate in:
- Patients (acute or chronic) who after head trauma have neurological features not explained by CT results.
- As part of a neurological or Pain Management evaluation following non-acute head trauma with documented neurological or neuropsychological deficits.
• HD-18.3 Head MRA (CPT 70544) or CTA (CPT 70496) and brain MRI without and with contrast (CPT 70553) can be performed:
  o If there is high suspicion for vascular injury.
  o To evaluate for post-traumatic aneurysm following penetrating trauma.

• HD-18.4 Follow-up of known subdural or epidural hematomas can be by either head CT or MRI (contrast as requested), and the preference of neurosurgeons and neurologists should be honored.
  o There is no precise schedule for follow-up imaging studies. These patients are usually under the care of a neuro specialist.

• HD-18.5 Patients with post-traumatic headache persistent past the acute phase (a week or two) but without specific findings are best evaluated with noncontrast brain MRI (CPT 70551) but noncontrast head CT—(CPT 70450) is acceptable.
  o Beyond 6 months past the injury, neurological consultation (Pain Management, Ophthalmology, or ENT if relevant) is helpful in determining the optimal imaging pathway, if any.

• Patients with head trauma are often at risk for associated facial and cervical trauma.
  o Consult the relevant guidelines when such cases are under review.

• HD-18.6 References:

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**HD-19 ~ CNS INFECTION**

• HD-19.1 Acquired Immune Deficiency Syndrome: neurological disorders are seen in most patients with AIDS. Etiologies include:
  o the HIV infection itself
  o opportunistic superinfection
  o tumor
  o effects of treatment
  o Meningeal syndromes: cryptococcal meningitis, tuberculous meningitis, and persistence of aseptic meningitis caused by HIV are often seen with initial infection.
    ➢ Diagnosis is by lumbar puncture.
    ➢ Brain MRI without and with contrast (CPT 70553) should be done initially to exclude other possibilities and visualize the meninges.
  o Nonfocal syndromes:
    ➢ AIDS associated dementia presents with psychiatric syndromes, dementia, and a scattering of motor findings.
      ▪ Diagnosis is by exclusion, and initial brain MRI without and with contrast (CPT 70553) is appropriate.
    ➢ Cytomegalovirus (CMV) infection in AIDS is a meningoencephalitis uncommon in the United States.
      ▪ Brain MRI without and with contrast (CPT 70553) to exclude other entities is indicated.
  o Focal syndromes:
    ➢ Differential diagnosis includes: toxoplasmosis, tuberculomas, and Epstein-Barr virus-associated lymphoma of the CNS.
Patients present with combinations of focal neurological deficit, altered mentation, and seizures.

Brain MRI without and with contrast (CPT 70553) is appropriate. Contrast is especially important to recognize the ring enhancing lesions typical of toxoplasmosis.

**Reference:**


**HD-19.2 Lyme Disease:**

- Serologic studies should be done initially.
- Meningitis or encephalitis can occur (headache, neck stiffness, mental changes, facial palsy)
  - If the diagnosis cannot be made clinically, lumbar puncture and brain MRI without and with contrast (CPT 70553) can be performed.

**Geographic range of Lyme disease:**

- Maryland to Massachusetts
- Minnesota to Wisconsin
- California to Oregon

**References:**


**HD-19.3 Cysticercosis:**

- May be the most common cause of seizures in non-industrialized countries and must be considered in immigrants to the United States from such countries who present with seizures or signs of a cerebral mass.
- The cysts are best seen on brain MRI without and with contrast (CPT 70553).
  - If there is marked calcification of the cysts, supplementary head CT (CPT 70450) may be useful.
- In the United States, cysts are usually found during evaluations for epilepsy.

**HD-19.4 Meningoencephalitis and Viral encephalitis:** Brain MRI without and with contrast (CPT 70553) is useful in diagnosis and, for severe illness, in management.

**HD-20 ~ MEDICATION INTOXICATION**

- Patients with mental confusion, ataxia, or diplopia who are taking medications known to cause those symptoms (especially sedatives and anticonvulsants) should be evaluated for drug intoxication before consideration of advanced imaging.
  - Noncontrast head CT (CPT 70450) may be appropriate in emergent/urgent situations.
- **Serotonin syndrome:**
  - Arises in patients taking pro-serotonergic agents, particularly antidepressants and antipsychotics.
  - Mental confusion, agitation, autonomic hyperactivity, and tremor or muscular rigidity can be present.
  - Discontinuation of relevant medications should be accomplished prior to considering advanced imaging.
The initial step and most important aid to the diagnosis of movement disorders is a careful history and recent neurological examination documenting the nature, frequency, and exacerbating factors of the abnormal movements.

**Typical Parkinson’s disease** is diagnosed clinically, and no imaging is needed in typical cases. Unilateral abnormalities early on are typical and are not an indication for imaging.

**Atypical Parkinsonism:**
- Noncontrast brain MRI (CPT 70551) may be useful in the differential diagnosis of certain “Parkinsonian syndromes” (multiple system atrophy, progressive supranuclear palsy, and corticobasal degeneration).
- CT is not sufficient for this purpose.
- A history of failure of response to dopaminergic treatment, prominent ataxia at presentation, parkinsonism without tremor, or severe postural hypotension early in the disease should be documented.
- Various cerebral vasculitides can present with a parkinsonian syndrome of premature onset (< age 45) or other movement disorder. When this is suspected, MRI of the head without and with contrast (CPT 70553) is appropriate.*
  - Also see HD-33.1 Vasculitis affecting small to medium sized arteries
    *Neurology 2007;69:644-653
- Detailed history and neurological examination is appropriate prior to advanced imaging, and neurological consultation is helpful to aid in differential diagnosis and selection of cases for imaging.
- References:
  - Neurology 2000;54:697-702
  - Radiology 2006;239:825-830
  - Neurology 2006;66:968-975

**Essential tremor:** imaging is not required for diagnosis.

**Tremors of anxiety and weakness:** advanced imaging is not generally required for diagnosis.

**Huntington’s chorea:**
- Diagnosis does not require imaging: a direct DNA study is more accurate.
- If DNA results are equivocal, noncontrast brain MRI (CPT 70551) or CT (CPT 70450) may be considered.

**Dystonia:** in adults and children with dystonia, brain MRI (contrast as requested) is indicated if there are other neurological features beside the dystonia itself.*

**PET:** at this time, there is no firmly established basis for the use of PET in the evaluation or management of movement disorders.

**HD-22 ~ SUSPECTED MULTIPLE SCLEROSIS (MS)**

- **HD-22.1 Introduction**
  - MS is notoriously variable in its presentation and course, but there are some useful generalizations.
    - The most common presentation is relapsing: the occurrence of multiple episodes of focal neurological deficit each of which at least partially resolves.
Over time, this tends to evolve into a course of either steady progression of deficits (chronic progressive) or of relapses without improvement (progressive relapsing).

- MS is correctly thought of as a disease of young adults, particularly young women. However, it can present in childhood or in middle age.
- When it presents in mid-life, a progressive form affecting the spinal cord in particular is not unusual.

- Symptoms from MS most often arise from involvement of the optic nerves, the brain stem, the cerebellum, and the spinal cord.
- Since the advent of treatments which appear to influence the course of MS, the use of brain and spinal cord imaging to speed confirmation of the diagnosis has become widespread.
  - Criteria to avoid over-diagnosis have also evolved.
  - These criteria require considerable specialty expertise in their application.

- **HD-22.2 Diagnosis:** MS is diagnosed by correlation between clinical, laboratory, and imaging data. The medical and social consequences of a misdiagnosis can be dire.
  - Extremely detailed history and recent neurological examination are indicated before selection of imaging studies.
  - Specialist consultation (neurology, neurosurgery, or, for visual syndromes, ophthalmology) is helpful in determining the appropriate imaging pathway and the significance of what are often difficult-to-interpret findings on imaging studies.
  - MS most commonly presents with apparently single episodes of demyelination involving specific areas of the nervous system.
  - However, many patients who experience a single episode do not go on to develop MS.
  - The criterion for firm diagnosis of MS is the presence of lesions dispersed in time and space (space=different locations in the nervous system).
  - Since treatments which somewhat affect the course of the disease have become available, the use of MRI to anticipate dispersion in either space or time has become widespread. This allows for earlier treatment.
    - Various MRI diagnostic criteria for this purpose, which include findings on both brain and spinal cord imaging, are discussed in [HD-22 Evidence Based Clinical Support section](#).
  - **General remarks on advanced imaging in MS:**
    - CT, CTA, MRA are not useful in the evaluation of either new onset or established MS unless there is documentation of a grounded concern regarding a concurrent and unrelated diagnosis for which any of these studies would be of value.
    - Orbital MRI is not generally indicated, except for atypical cases of optic neuritis.
    - At this time, the value of newer imaging techniques such as diffusion tensor imaging and magnetic resonance spectroscopy in patients with multiple sclerosis remains to be established.
    - Newer MRI diagnostic criteria lay greater stress on the results of spinal cord imaging, and inclusion of the spinal cord in the initial imaging battery is appropriate for most situations other than clinically pure optic neuritis.
    - **Spinal cord imaging in MS:**
      - Cervical and thoracic spine MRI scans visualize the entire spinal cord, and lumbar spine MRI is not needed.
      - Screening spinal MRI consisting only of sagittal views of the entire spinal cord using a phased array detector coil may occasionally be requested and is appropriate. Screening spinal MRI should be coded as one spine segment (CPT 72141 or 72146)
**HD-22.3 Isolated clinical syndromes:**

- **Optic neuritis:** MRI brain without and with contrast (CPT 70553) is indicated initially for patients with optic neuritis.
  - MRI of the spinal cord (cervical spine with or without imaging the thoracic spine), contrast as requested can be approved if the brain MRI is suggestive of MS but not firmly diagnostic.

- **Other cerebral isolated clinical syndromes:** MRI of the brain without and with contrast (CPT 70553) should be performed initially.
  - MRI of the spinal cord (cervical spine with or without imaging the thoracic spine), contrast as requested, can be approved if brain MRI is suggestive of MS but not firmly diagnostic.
  - In certain patients, neurological findings are such that the likelihood of a normal brain MRI is very low, and in such cases, on specialist request, spinal cord imaging may be done simultaneously with head imaging.

- **Transverse myelitis:**
  - Another “isolated clinical syndrome”
  - Spinal cord imaging (cervical and thoracic spine MRI (contrast as requested) are appropriate initially.
    - If the clinical presentation is typical of a demyelinating process, it is acceptable to include the brain MRI in the initial imaging battery.
  - If spinal imaging does not show a non-inflammatory origin (spinal tumor or compression), brain MRI without and with contrast (CPT 70553) is also appropriate to rule out Multiple sclerosis if that has not already been done.

- **References:**
  - *Neurology* 2003;61:602-611
  - *Ann Neurol* 2001;50:121-127
  - *AJNR* 2006;27:455-461

**HD-22.4 Migratory Paresthesias:** Patients with normal examinations who have either attacks of wandering paresthesias **lasting at least a full day** or a history of a recovered isolated clinical syndrome may be approved for imaging using the guidelines in HD-22.3 Isolated clinical syndromes.

- Also see HD-26 Paresthesia

**HD-22.5 Repeat of initial negative studies**

- In the settings covered by HD-22.3 and 22.4, if the initial imaging studies are diagnostic, repeat studies are not indicated.
- If the initial scans are not diagnostic, repeat studies at 3 months, and, if again negative, at one year can be approved.
- Some centers prefer a repeat at 6 months in patients not started on treatment after a single isolated clinical episode, and this is acceptable.
- Under the unusual circumstances detailed in the HD-22 Evidence Based Clinical Support section, repeat studies at one month may be appropriate.
- These cases should be sent for Medical Director review.

**HD-22.6 Familial MS and screening**

- The lifetime risk of MS in first degree relatives of MS patients is about 4% (higher for female relatives).
- Identical twins have a 35% concordance rate for MS.
Offspring of two MS patients have a 30% concordance rate for MS.

Screening based on family history in the absence of a clinical indication is not appropriate since the diagnosis cannot be made without a clinical component.

Reference: 

- **Also see** HD-36 Optic Neuritis

- **HD-22.7 Neuromyelitis optica (DeVic's disease):**
  - A demyelinating syndrome characterized by involvement of optic nerves and spinal cord without symptomatic cranial lesions.
  - Most patients have normal brain MRI but some have hypothalamic lesions or non-specific features.
  - While spinal cord lesions of MS involve two or fewer segments, those in Neuromyelitis optica involve three or more.
  - Recently, a specific serum immune marker for this disease has been discovered.
  - Initial evaluation includes brain and spine MRI.
  - Any needed follow up can be limited to spine MRI in typical cases.
  - Reference: 
    - *Neurology* 2006;66:1485-1489

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**HD-23 ~ ESTABLISHED MULTIPLE SCLEROSIS (MS)**

- Detailed interval history and recent neurological examination are the first steps in any re-evaluation of patients with MS.

- **HD-23.1 Baseline imaging** of the brain or brain and spinal cord (contrast as requested) before starting immunomodulating treatment of MS is appropriate.
  - Use of the agent natalizumab (Tysabri) requires initial brain MRI without and with contrast (CPT 70553).
  - Repeat brain MRI without and with contrast (CPT 70553) is appropriate if symptoms consistent with PML occur while on Tysabri (PML = progressive multifocal leukoencephalopathy).
  - Symptoms can include a rapidly progressive subacute dementia or a series of apparent strokes.
  - For all patients taking Tysabri, evaluation at 3 months of treatment and then semiannually are required.
  - Head MRI without and with contrast (CPT 70553) is acceptable at any of these re-evaluations if the treating physician requests it.

- **HD-23.2 Repeat imaging in established MS (MRI contrast as requested) is appropriate:**
  - If there is a new spinal episode (imaging should be limited to the spinal cord).
  - If the patient is being evaluated for the use of immunomodulating therapy. *(see HD-23.1 Baseline imaging of the brain or brain and spinal cord)*
    - Glatiramer = Copaxone
    - natalizumab = Tysabri
    - mitoxantrone = Novantrone  This agent may cause cardiotoxicity and MUGA scans may be useful *(see CD 3.7 MUGA study in the Cardiac guidelines)*
    - beta-interferons = Avonex, Betaseron, and Rebif are the “standard” ones at present.

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o If the patient develops what seems to be a new and unrelated disorder (imaging should be appropriate to the potential new disorder).

- **HD-23.3 Annual surveillance scans of established MS patients** require that the patient be on immunomodulating therapy or be a candidate for such therapy.
  o Imaging can include:
    ➢ Brain MRI (contrast as requested)
    ➢ Cervical and thoracic spine MRI (contrast as requested) if spinal cord findings are likely.
  o The value of surveillance scanning in established MS is uncertain at this time.
  o In the progressive spinal form of MS, if prior brain imaging has been negative, spinal MRI (contrast as requested) rather than brain MRI may be sufficient for surveillance.

- **HD-23.4 Other Issues**
  o Specialist evaluation (neurology, neurosurgery, or, for visual syndromes, ophthalmology) is helpful in determining the need for advanced imaging in established MS.
  o In patients with severe spinal cord disorders, including MS, clinical evaluation of abdominal disorders may be very difficult because impaired cord function affects expected signs and symptoms. Requests for abdominal and pelvic imaging studies should be evaluated in this light.
  o MS patients on immune therapy of any sort must be regarded as immuno-compromised, and this may be relevant to extra-neurologic imaging requests.
  o The practical difficulty of arranging imaging sessions in patients who are litter- or wheelchair-bound should be weighed before recommending a serial approach to imaging in those patients.

- **HD-23.5 References**
  o *AJNR* 2006;27:455-461
  o *Eur J Neuroradiol* 2006;13:313-325

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**HD-24 ~ NEURO-ONCOLOGY - BRAIN TUMORS**

- **HD-24.1 General remarks**
  o Brain MRI without and with contrast (CPT 70553) is indicated for both characterization and follow-up of brain tumors. However, occasionally neurologists, neurosurgeons, and oncologists treating such patients will find appropriate use for CT or noncontrast MRI.
  o Postoperative brain MRI is standard, usually 24 to 72 hours following brain tumor surgery.
  o Repeat imaging is appropriate when patients deteriorate or develop new features.
  o MRI of the entire neural axis without and with contrast includes CPT 70553, 72156, 72157, and 72158.

- **HD-24.2 Neurofibromatosis, type 1 (von Recklinghausen’s Disease)**
  o Autosomal dominant. Incidence 1 per 5000. Only half have family history.
  o Subcutaneous neurofibromas and multiple café au lait spots are typical.
  o Kyphoscoliosis is common and may cause cord compression. Spinal dural ectasias and meningoceles occur.
  o Intraspinal tumors are frequent.
    ➢ Screening those without symptoms or signs is usually not useful, since most
occult neurofibromas do not grow aggressively.

- Optic nerve and brain stem gliomas are common (brain MRI without and with contrast [CPT 70553] and also orbits [CPT 70543] for those with optic nerve lesions.)
  - These tumors require monitoring when present, but do not behave as malignantly as their names suggest. Growth can be heralded by precocious puberty.
- Headache is common, and because of elevated tumor risk and a high incidence of aqueductal stenosis (hydrocephalus), prompt brain MRI without and with contrast (CPT 70553) is appropriate.
- Neurofibromatosis I is a known cause of strokes and of Moya moya disease. Imaging should follow guidelines appropriate for pediatric stroke (see PACHD-17 Pediatric stroke).
- Imaging to screen family members without signs of the disease is generally inappropriate since the clinical picture is readily recognized.
- Imaging to screen children without symptoms is not generally appropriate.
- Neurofibromatosis, type II is a separate and extremely rare disease characterized by either bilateral acoustic neuromas or a combination of familial acoustic neuroma and another brain tumor. The tumors determine the imaging. It is mentioned only to avoid confusion with Neurofibromatosis I.
- Reference:

- **HD-24.3 Grade I-II astrocytoma and benign oligodendroglioma (low grade)**
  - After initial biopsy or other treatment, repeat MRI brain without and with contrast (CPT 70553) is appropriate.
  - Surveillance for posterior fossa tumors in this class is by brain MRI without and with contrast (CPT 70553) repeated every 3 to 6 months for 5 years and then annually.
  - Supratentorial (cerebral proper) tumors should be re-imaged at approximately 3 months, 6 months, and then annually.

- **HD-24.4 Glioblastoma and other malignant glial tumors (including grade III astrocytoma).**
  - Following surgery and radiation therapy (XRT) with or without adjuvant chemotherapy, brain MRI without and with contrast (CPT 70553) is usually performed 2 to 6 weeks following completion of treatment, and then every 2 to 3 months.
  - During chemotherapy treatments or a course of XRT, MRI brain without and with contrast (CPT 70553) every 8 to 10 weeks is usual.
  - PET: see HD-24.13 PET in brain tumor

- **HD-24.5 Ependymoma**
  - These tumors usually occur below the tentorium in children and above in adults. The more malignant ones can seed the entire neural axis.
  - Postoperatively, MRI of the entire neural axis is appropriate (brain and entire spine without and with contrast).
  - Surveillance scanning should be every 3 to 4 months the first year, every 6 months the next year, and then every 6 to 12 months depending on the malignancy of the tumor. For malignant ependymoma, entire neural axis scans are appropriate, but for benign ependymomas, imaging limited to the level of the tumor is appropriate. While the child remains under active treatment with radiation and/or chemotherapy, bimonthly imaging is acceptable. MRS may be useful to evaluate response to
therapy.

- **HD-24.6 CNS lymphoma** (also known as microglioma): often seen in the immunocompromised. This malignancy is so sensitive to corticosteroids that it is often necessary to take patients off those drugs to obtain a positive biopsy.
  - Initial staging usually requires total neural axis MRI without and with contrast to evaluate for meningeal seeding.
  - Extra-neural evaluation for the primary will be needed when the origin of the lymphoma is unclear, and this often includes body imaging (usually contrast only CT).
  - Follow-up neural axis imaging is appropriate every 3 months for at least a year following a positive biopsy because of meningeal spread.
  - Follow-up otherwise, esp. in the immunocompromised, is similar to that of glioblastoma if there is no meningeal seeding (see HD-24.4)
  - If meningeal seeding is present, follow-up is similar to that of malignant ependymoma or PNET (see HD-24.4)

- **HD-24.7 Metastatic brain tumors**
  - **Systemic cancer staging:** brain imaging is included in staging certain systemic cancers (see Oncology guidelines).
    - If the patient has no history of prior brain metastases and no current neurological complaints, either brain MRI without and with contrast (CPT 70553) or head CT without and with contrast (CPT 70470) is acceptable.
    - Otherwise, MRI rather than CT should be used.
  - **Pretreatment evaluation of known cerebral metastases:** Brain MRI without and with contrast (CPT 70553) is the appropriate study. MRI is much better than CT at finding multiple lesions, which is important in this situation.
  - **Metastatic brain deposits and no known primary:** patients with no known diagnosis of malignancy who are found on brain MRI to have cerebral metastases should have CT scan of the chest with contrast (CPT 71260) as the initial advanced imaging study to identify a source or a biopsy site. Women should also have mammography performed. CT scan of the chest and mammography will identify the most appropriate biopsy site in over 95% of cases.
    - Reference:  
      - *Neurology* 2005:65:908-911
  - **Carcinomatous meningitis:** most commonly arises in breast cancer but can be seen in lymphoma. Neural axis MRI without and with contrast is usually appropriate. If an Omaya reservoir is placed, CSF flow studies may be needed (see HD-35 Newer MRI Techniques).

- **HD-24.8 Meningiomas** are tumors of the dura and are usually benign.
  - Initial imaging should be a brain MRI without and with contrast (CPT 70553).
  - In selected cases, noncontrast head CT (CPT 70450) may also be required to evaluate bony involvement.
  - Following documented complete resection, repeat imaging at 6 months, 2 years, and 5 years is sufficient.
  - For skull base meningiomas or any meningioma subtotally resected, follow-up imaging every 6 months for 2 years and then annually for life is recommended.
  - Malignant meningiomas (by pathology): re-image at 3 and 6 months post resection and then annually for life.
• HD- 24.9 Acoustic neuroma and other cerebellopontine angle tumors:
  o MRI of the head without and with contrast with attention to the internal auditory canals (CPT 70553) is sufficient for initial diagnosis.
  o Adding separate temporal bone MRI without and with contrast (CPT 70543) is not generally required, but may be appropriate in patients with audiologic or clinical features of retrocochlear hearing loss and negative head MRI and in the rare patient in whom a detailed search is indicated for both a lesion of the cerebellopontine angle AND lesions of the cerebral hemispheres.
  o Reference:
    ➢ British Association of Otorhinolaryngologists Head and Neck Surgeons, Clinical Effectiveness Guidelines: acoustic neuroma

• HD-24.10 Pineal Cysts:
  o Apparently benign pineal cysts may be re-imaged 1 to 2 years after discovery to prove stability.
  o Further imaging of a stable benign cyst is not necessary.
  o If there is mass effect, yearly imaging to identify either increase in size or the appearance of hydrocephalus is appropriate.
  o For pineal region tumors other than cysts, appropriate imaging will depend on the nature and clinical effects of the tumor.

• HD-24.11 Arachnoid Cysts: these "cysts" generally reflect an underlying anomaly of brain development, and once identified as such, require no further imaging. If there is mass effect, yearly imaging to identify growth or the appearance of hydrocephalus is appropriate.

• Pituitary tumors: see HD-28 Pituitary guideline

• Orbital tumors: see Ophthalmology guidelines (HD-36, HD-37, HD-38, HD-39)

• HD-24.12 von Hippel Lindau Disease:
  o Autosomal dominant disorder
  o Principal features are retinal angiomas and hemangioblastoma of the cerebellum.
  o Pheochromocytomas (10%) and renal carcinoma are also relatively frequent.
  o The hemangioblastomas are benign cystic tumors and may be associated with secondary polycythemia.
  o Hemangiomas in other regions and benign renal and hepatic cysts occur.
  o DNA testing can identify family members not at risk.
    ➢ No screening imaging is needed for those members.
  o For those at risk, abdominal screening by ultrasound should be done during the teenage years.
    ➢ If the ultrasound is abnormal, CT of the abdomen with contrast (CPT 74160) can be performed.
    ➢ MRI of the brain and spine without and with contrast are recommended annually during the teenage years and then every two years.
    ➢ Temporal bone CT (CPT 70482) or MRI (CPT 70543) to rule out tumors of the endolymphatic sac is appropriate if hearing loss is present.
  o References:
• **HD-24.13 PET in brain tumor (metabolic brain PET—CPT 78608):**
  o Certain payers consider the use of brain PET in tumors to be investigational, and their coverage policies will take precedence over MedSolutions' guidelines. Prior authorization does not guarantee payment of the study in that situation.
  o The chief use of PET in the management of brain tumor is to aid in distinguishing recurrent tumor from radiation cerebritis in patients with known anaplastic tumors of glial origin (glioblastoma, anaplastic astrocytoma, and anaplastic oligodendroglioma) and prior XRT.
  o Candidates for PET will have had a very recent brain MRI showing enhancing new lesions compatible with either recurrent tumor or radiation necrosis.
  o On rare occasion, brain PET (or MRS) may be useful in resolving a diagnostic issue in a patient with a "tumefactive" MS plaque or infarct. Such cases require review by a medical director.
  o MR Spectroscopy is sometimes used to distinguish recurrent tumor from radiation cerebritis, and this is an acceptable alternative to PET (see HD-35.2 MR Spectroscopy).  
    ➢ Certain payers consider MR Spectroscopy investigational, and their coverage policies will take precedence over MedSolutions' guidelines. Prior authorization does not guarantee payment of the study.
  o Brain, especially gray matter, takes up FDG avidly, and only very metabolically active tumors are more "PET avid" than this.
    ➢ FDG-PET is therefore generally not useful in the evaluation of most metastatic deposits and well-differentiated brain tumors.

• **Reference:**
  o *Central Nervous System Cancers. NCCN Practice Guidelines in Oncology* v.2.2006

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HD-25 ~PAPILLEDEMA/PSEUDOTUMOR CEREBRI

- Pseudotumor cerebri is also called benign intracranial hypertension.
- The first step in evaluation is a detailed history and recent neurological examination.
- Papilledema indicates the presence of elevated intracranial pressure.
  o Brain MRI without and with contrast (CPT 70553) is indicated.
  o The vast majority of alert neurologically normal patients will have idiopathic intracranial hypertension (pseudotumor cerebri) and normal imaging studies.
  o Brain MRI is performed to exclude cerebral mass lesions, obstructive hydrocephalus, and occult meningeal disease.
  o Patients with papilledema will generally require lumbar puncture, but for reasons of patient safety, lumbar puncture is done after the initial brain imaging study.
- MRV (currently coded as CPT 70544) is appropriate to exclude venous sinus thrombosis in atypical cases of pseudotumor.
- Typical case of pseudotumor includes overweight women of childbearing years.
- Atypical cases include:
  ➢ male patients
  ➢ slender patients
  ➢ women > age 45
➢ children (< age16) unless there is an apparent cause
➢ patients with known intrinsic system clotting disorders
➢ patients who fail to respond to pharmacologic treatment

• Ophthalmology or Neurology consultation may be helpful to:
  o distinguish papilledema from papillitis
  o distinguish pseudopapilledema from genuine papilledema
  o establish the presence of mild papilledema

• Re-imaging is infrequently indicated unless done to evaluate possible shunt dysfunction in those patients who have had ventriculoperitoneal (VP) or lumboperitoneal (LP) shunts or because of distinct clinical deterioration.

• See HD-16.6 Chronic intractable headaches

• Reference:
  o Headache Currents 2005;2:1-10

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**HD-26 ~ PARESTHESIA**

• Paresthesia (localized numbness and tingling) can be a symptom of all but a few neurological disorders, so that no general guidance to the use of advanced imaging in its differential diagnosis or management can be of value. This guideline addresses some specific clinical problems but is not exhaustive.

• **HD-26.1 Circumoral paresthesia**, often with tingling of the distal limbs and a sense of breathlessness, is a common symptom of hyperventilation, and advanced imaging is not indicated.

• **HD-26.2 Paresthesia localized to the distribution of a particular somatic peripheral nerve** (with or without “objective” sensory loss)
  o Localization of such lesions is accomplished by detailed clinical examination and correlation with anatomical knowledge.
  o If the cause is clinically apparent, advanced imaging will infrequently be of value unless an interventional procedure is planned.
  o See PN-2 Focal Neuropathy in the Peripheral Nerve Disorders guidelines.

• **HD-26.3 Paresthesia in spinal radiculopathy**: this is a common symptom of these disorders and is not of itself an indication for advanced imaging. Consult the relevant sections of the Spine Guidelines.

• **Wandering paresthesia**: see HD-22 Suspected Multiple Sclerosis

• **HD-26.4 Facial paresthesia or sensory loss**
  o Isolated painless paresthesia of the cheek or upper lip, generally without objective sensory loss, is commonly seen with maxillary sinus disease since the maxillary nerve runs along the roof of the sinus. Maxillo-facial CT (CPT 70486) may be appropriate.
  o Paresthesias of the chin or lower gum on one side may follow mandibular trauma or surgery (including removal of lower wisdom teeth) since the inferior alveolar nerve lies in this area.
    ➢ Advanced imaging is infrequently necessary unless the cause is obscure or surgical intervention is planned.
  o Paresthesia, which may include sensory loss, can be seen following trauma to the supraorbital nerve. The supraorbital nerve also supplies the anterior scalp.
Orbital CT may be appropriate.
The need for brain imaging will depend upon the nature of the trauma.
Many patients with Bell's palsy complain of subjective paresthesia on the involved side but have no objective sensory loss.
The presence of this symptom is not relevant to the need for imaging.
Also see HD-9 Facial Palsy (Bell's Palsy)
Non-traumatic objective facial sensory loss is uncommon, and advanced imaging will usually be appropriate (brain MRI without and with contrast [CPT 70553] or facial CT depending on clinical details).
Unilateral: raises concern for benign or malignant tumor along the course of the trigeminal nerve or one of its branches.
Bilateral: raises concern for scleroderma or a related collagen vascular disease.
  Head MRI without and with contrast (CPT 70553) may be appropriate to evaluate for cerebral vasculitis or meningeal inflammation and to exclude bilateral trigeminal nerve lesions.

HD-27 ~ SLEEP DISORDERS

- HD-27.1 Narcolepsy is a relatively common disorder (prevalence ca 50/100,000) characterized by attacks of irresistible daytime sleepiness, usually accompanied by cataplexy, and often by phenomena called sleep paralysis and benign hypnagogic hallucinations. This combination of symptoms is called the narcolepsy tetrad.
  - Primary narcolepsy accounts for almost all cases: patients usually have HLA type DR2/DQ6 (DQB1*0602) and very low spinal fluid hypocretin levels. The vast majority of patients present by age 30.
  - Secondary narcolepsy is quite uncommon, but it may be clinically indistinguishable from the primary type and may include reduced spinal fluid hypocretin.
    - Cases arising from tumors (esp.of the hypothalamus or brain stem), head trauma, multiple sclerosis, and other brain disorders have been reported.
  - The diagnosis of narcolepsy should be confirmed by appropriate sleep studies or by consultation with a neurologist or sleep disorders specialist.
  - When imaging studies are requested in a patient with confirmed narcolepsy thought not to be primary, MRI head without and with contrast (CPT 70553) is appropriate.
    - In general these patients will be HLA negative, present later in life, or have associated neurological features.
  - Sleep paralysis can occur without narcolepsy in healthy individuals, and when it does, advanced imaging is not indicated.
    - Sleep paralysis is in effect a dream whose content consists of awakening and being paralyzed. There is no residual abnormality upon actual awakening.
  - Cataplexy is brief loss of postural tone usually provoked by startle or sudden emotion. It may be partial. Attacks last from seconds to 1-2 minutes.
    - Advanced imaging is usually not appropriate in patients with isolated cataplexy. However, drop attacks are similar in nature to cataplexy (see HD-32 Syncope).
  - Hypnagogic hallucinations occur as one falls asleep, and are common in otherwise normal individuals. When they occur without narcolepsy, imaging is not indicated.
  - References:
    - Sleep Med Rev. 2005;9:269-310

- HD-27.2 Sleep apnea: episodes of abnormal cessation of breathing with significant arterial oxygen desaturation which occur during sleep.
Sleep apnea is either central or obstructive.
- Sleep studies are necessary initially to distinguish these types.
- Central sleep apnea is a consequence of a variety of disorders involving the brain stem.
  - Brain MRI, usually without contrast (CPT 70551), is appropriate in confirmed cases.
  - The need for further advanced imaging depends on the results of the MRI and the clinical specifics of the case, but cervical spine MRI is appropriate in those cases which follow cervical spine surgery or trauma.
- Obstructive sleep apnea arises from dysfunction of the oropharynx during sleep and can be diagnosed via sleep studies. Lateral radiographs of the upper airway are useful in some patients.
  - Unless a mass lesion in the upper airway is identified clinically, the role of advanced imaging in the evaluation of these patients is unproven at this time.
- In selected adult and pediatric patients undergoing surgical correction of obstructive sleep apnea, preoperative maxillofacial CT may be of value.

Reference:

HD-27.3 Restless Legs Syndrome
- Advanced neuroimaging has no established value in this syndrome.

HD-28 ~ PITUITARY
- The initial step in the evaluation of all potential pituitary masses is a detailed history, recent physical examination, and thorough neurological exam, including evaluation of the visual fields.
- Endocrine laboratory studies should be performed prior to considering advanced imaging.
- Pituitary imaging is accomplished by brain MRI, generally done without and with contrast (CPT 70553). Noncontrast MRI (CPT 70551) or MRI Orbit, Face, Neck (CPT 70543) is used at times.
  - Head CT without and with contrast (CPT 70470) is occasionally used in addition to MRI to visualize perisellar bony structures in the preoperative evaluation of certain sellar tumors.
  - One study (either brain MRI [CPT 70553] or MRI Orbit, Face, Neck [CPT 70543]) is adequate to image the pituitary. The ordering physician should specify that the study is specifically to evaluate the pituitary gland. The use of two CPT codes to image the pituitary is not indicated.
- HD-28.1 Microadenomas are less than 1.0 cm in diameter. They may be either functioning (hormone secreting) or not. Hormone secreting microadenomas can be recognized by their hormonal effects.
  - Non-functional microadenomas are discovered incidentally since they have no hormonal effects and are generally too small to exert a mass effect. Microadenomas of the pituitary are found incidentally in about 7% of autopsies. Studies suggest that very few grow to significant size.
  - Non-functioning microadenomas: these lack hormonal effects, so endocrinological follow-up is impossible. About 25% of pituitary adenomas are nonfunctioning. About 10% secrete more than one hormone, the combination of prolactin and growth hormone being the most common.
Repeat brain MRI without and with contrast (CPT 70553) of non-functioning microadenomas can be performed after 1 to 2 years to ensure stability.

A repeat study can be performed again at 5 years.

Unexplained pituitary asymmetries or small low density regions: re-imaging is as for non-functioning adenomas.

Prolactinomas: the most common secreting microadenomas (>50%). These are generally identified in the work-up of elevated prolactin levels in women with galactorrhea or men with hypogonadism.

- Those that secrete only prolactin are commonly left in place and treated pharmacologically. This creates separate follow-up issues specific to them.

- Elevated prolactin levels:
  - Normal prolactin levels range up to 25 µg/l in non-lactating, non-pregnant women and up to 20 µg/l in males. Transient elevation up to 40 µg/l can occur with many activities, so a single elevated value of less than 40 µg/l requires repeating prior to consideration of advanced imaging.
  - Pregnancy, renal failure, and several medications—chiefly antipsychotics, metaclopramide (Reglan), and tricyclic antidepressants—can elevate prolactin, although not often above 100 µg/l. Therefore, before an elevated prolactin level of less than 100 µg/l can be regarded as requiring imaging, these other causes of hyper-prolactinemia should be ruled out. Prolactin levels should fall to normal within 7-10 days of withholding the relevant drug.

- Initial Imaging (CPT 70553) is appropriate when a significant, unexplained elevation of prolactin is identified.
  - Imaging is not necessary in women with galactorrhea and normal prolactin levels.

- Re-imaging is generally not indicated unless hormonal levels rise or visual or neurological findings appear. Only about 5% of prolactinomas exhibit significant growth after discovery. Dopamine agonists should be withdrawn for about a week before prolactin is checked to avoid false normals.

- Reference:

The next most common functioning microadenomas produce either ACTH (pituitary Cushing’s Disease/Nelson’s syndrome) or GH (acromegaly or gigantism).

- When found, these will generally be ablated because of the seriousness of their hormonal effects.
- Follow-up imaging is as for macroadenomas.

TSH, FSH, and LH producing microadenomas are uncommon. TSH producing tumors are appropriately sought via imaging in patients who have elevated TSH in the face of documented hyperthyroidism, and the others, on discovery of inappropriately elevated hormone levels.

- Reference:

**HD-28.2 Macroadenomas** are > 1 cm in diameter. They may present with hormonal abnormalities or visual/neurological effects. Bitemporal hemianopsia is the classic finding (see HD-37 Visual Field Deficits).

- Imaging (CPT 70553) is appropriate initially in patients with visual symptoms of a sellar mass regardless of endocrine status.
Post-treatment follow-up should include repeat brain MRI (CPT 70553) every six months for the first year and then annually for 5 years. Longer follow-up is required for craniopharyngiomas, which are tumors of Rathke’s pouch in the pituitary region. If treatment of a pituitary tumor must be deferred (e.g. during pregnancy), brain MRI (CPT 70553) should be repeated every six months during the period of observation.

Reference:  

**HD-28.3 Male hypogonadism** is occasionally caused by pituitary tumors. Other causes (depression, systemic illness, diabetes, and certain medications including psychoactive agents) should be excluded before advanced imaging is considered. If there are still borderline to low pituitary hormones (LH and FSH) and serum total testosterone of less than 80% of the lower limit of normal (i.e. <150 ng/l for most labs), brain MRI without and with contrast (CPT 70553) is appropriate. Mildly low testosterone levels (>60% of normal) should be repeated before advanced neuroimaging is considered. Repeat imaging is generally not appropriate in this setting.

Reference:  
- Endocr Pract 2002;8:440-456

**HD-28.4 Galactorrhea without elevated prolactin:** advanced neuroimaging is, in general, not appropriate.

**HD-28.5 Diabetes insipidus** (antidiuretic hormone deficiency): in most cases, the etiology (e.g. trauma, transphenoidal surgery) is known, but about 15% of cases arise from pituitary region neoplasms. Brain imaging (CPT 70553) is appropriate in confirmed cases which are of obscure origin.

**HD-28.6 Panhypopituitarism:** endocrinological confirmation is appropriate initially, but brain imaging (CPT 70553) is appropriate in confirmed cases (including hypothyroidism with low TSH).

**HD-28.7 Other pituitary region tumors**
- Craniopharyngiomas arise in the parasellar area, and are the most common tumor of that region in children. Over half of these tumors present by about age 20. Few general rules can be given for follow-up, especially for the adamantinomatous variety generally seen in children.
- Meningiomas: about 10% of meningiomas arise in this area. Evaluation may require CT in addition to MRI at times to evaluate for hyperostosis. Follow-up imaging is as for basal meningiomas in general (see HD-24.8 Meningiomas).

**HD-28.8 Enlarged (“empty”) sella turcica**
- An enlarged sella turcica without evident tumor is an occasional incidental finding on head MRI or CT. It can arise from a defect in the dural diaphragm of the sella (especially if there is elevated intracranial pressure from another cause), pituitary surgery, or as a result of a pituitary tumor which has expanded the sella and then infarcted (pituitary apoplexy).
- An “empty” sella causes no symptoms unless the optic chiasm herniates into the sella, causing Chiasmatic-type visual loss.
If the initial study was a CT, brain MRI without and with contrast (CPT 70553) is appropriate to exclude residual pituitary tumor and to assess the position of the chiasm.

If MRI has shown no abnormality other than the enlarged sella itself, further imaging is generally not necessary unless documented endocrine abnormalities occur.

However, to ensure stability and lack of residual pituitary tumor, a single repeat brain MRI without and with contrast (CPT 70553) 1-5 years after the initial study can be performed.

In patients whose sella is enlarged because of prior neurosurgery, the appropriate neuro-oncology guideline would apply.

**HD-29 ~ SCALP and SKULL LESIONS**

- **Scalp soft tissue masses:** These are almost always benign, especially if cystic. Advanced imaging is usually of limited value and surgical consultation is helpful prior to considering advanced imaging.

- **Skull bumps or irregularities:** Skull x-rays are recommended initially. Surgical consultation is helpful prior to considering advanced imaging if x-rays are normal or show only benign osteoma.
  
  - When advanced imaging is indicated, CT without and with contrast (CPT 70470) is recommended initially, although other choices by consulting neurosurgeons or oncologists are acceptable.

- Head CT (CPT 70450 or 70470) using bone windows is appropriate in patients with Langhans’ cell histiocytosis, myeloma, and metastatic cancer, when symptoms suggest bony lesions. Contrast may be useful.

**HD-30 ~ GENERAL STROKE/TIA**

**HD-30.1 INITIAL IMAGING**

- A stroke is a vascular event in the brain leading to death of neurons and manifested by creation of a fixed neurological deficit.
  
  - Hemiparesis, hemisensory loss, aphasia, and homonymous hemianopsia (see HD-37 Visual Field Deficits) are the typical deficits of stroke.
  
  - Small strokes which do not involve so-called eloquent areas of brain may be silent or have symptoms too ill-defined to permit clinical recognition.

- A TIA is a transient stroke-like episode lasting less than an hour and typically lasting 5 to 30 minutes.
  
  - Typical symptoms are hemiparesis, aphasia, and a sense of heaviness or weakness on one side of the body.
  
  - Amaurosis fugax is a TIA involving a retinal artery which presents with loss of vision in one eye lasting from 5 minutes to an hour.
  
  - Apparent TIA’s lasting over an hour or leaving minor fixed deficits are probably minor strokes.

- TIA’s can provide a warning of impending stroke, and the time window of the warning is brief. American guidelines support a maximum of one week to complete evaluation, and the briefer the delay, the better (See HD-30 Evidence Based Clinical Support section).

  - References:
    - *Neurology* 2004;62:569-573
    - *Neurology* 2005;64:817-820
Patients presenting within two weeks of the onset of typical TIA or minor stroke symptoms, as defined above, should have either noncontrast head CT (CPT 70450) or noncontrast brain MRI (CPT 70551) performed as soon as practical. Cervical MRA (CPT 70548) or CTA (CPT 70498) can also be approved initially. Head MRA (CPT 70544) or CTA (CPT 70496) can also be approved in this setting.

- Hyperacute stroke: the first few hours of stroke care are usually an issue in emergency or inpatient care.
  - Within three to six hours of stroke/TIA onset, centers which have diffusion weighted MRI capability may appropriately request both noncontrast head CT (CPT 70450) to exclude hemorrhage and brain MRI (contrast as requested) to evaluate for actual stroke and the presence of salvageable brain tissue.
  - CT perfusion studies (Procedure code 0042T) are a reasonable substitute for MRI diffusion/perfusion studies in most strokes which are evaluated within 9 hours of onset, but many health plans currently regard them as experimental (see HD-35.6 CT Perfusion).
  - These are usually issues in inpatient care, but some requests may be received on an outpatient basis, and they will require expeditious handling.

Patients who present more than two weeks after the onset of typical stroke or TIA as described above should have a detailed neurological examination documented before advanced imaging, but after that, noncontrast brain MRI (CPT 70551) and cervical MRA (CPT 70548) or CTA (CPT 70498) can be performed. Brain MRA (CPT 70544) or CTA (CPT 70496) can also be considered,

- If the picture is less clear (such as intermittent arm numbness only or pure facial weakness or numbness), neurological consultation is helpful in determining the most appropriate imaging pathway.

Vertebrobasilar TIA/stroke (VBI) presents both a more complex and, for the present, less urgent situation. A detailed neurological examination should precede selection of advanced imaging.

- Isolated syncope, “presyncope”, and vertigo are of themselves not often an indication of VBI. See HD-31 Special Stroke guideline.

HD-30.2 LATER IMAGING

- Brain MRI without contrast (CPT 70551) is appropriate in patients who have had a documented non remote stroke and no initial MRI was performed.
- Head and neck CTA (CPT 70496 and 70498) or MRA (CPT 70544 and 70548) are appropriate in patients with a documented stroke whose prior evaluation did not include this imaging.

Patients at increased risk of cerebral hemorrhage: CT head without contrast (CPT 70450) is appropriate in patients on either an anticoagulant (e.g. Coumadin, Plavix) or combined antiaggregant therapy (e.g. aspirin and Plavix together) who develop headache or new neurological findings or who sustain head trauma.

Surveillance imaging by MRI or CT is not routinely indicated for stroke, especially after the subacute period (several months).

Re-imaging is indicated if the patient develops features suggesting a new stroke or the appearance of seizures. Without imaging, it can be very difficult to distinguish a new stroke from partial seizures with prolonged Todd’s (postictal) palsy consequent to the original stroke. Neurological consultation is helpful in determining the appropriate imaging pathway in this complicated situation.

Asymptomatic Strokes
Small, clinically silent cerebral infarctions incidentally discovered on head imaging are commonly seen in otherwise healthy older adults. Unless there are multiple lesions confined to a single arterial territory or an abnormality seen in ultrasound of the carotid arteries, further advanced neuroimaging is not indicated.

- Incidentally noted on T-2 hyperintensities
  - The presence of white matter hyperintensities is an age-dependent entity and is especially common in diabetic patients and patients with migraines.
  - Unless there are an unusually high number of lesions or well-defined neurological signs or symptoms, further advanced neuroimaging is not indicated.

- Asymptomatic carotid stenosis
  - Also see PVD-3 Cerebrovascular and Carotid Disease in the Peripheral Vascular Disease guidelines

- General Stroke imaging references:
  - ACR Appropriateness Criteria, Focal neurologic deficit 2006

**HD-31 ~ SPECIAL STROKE/TIA**

- HD-31.1 Vertebrobasilar ischemia
  - The typical features of brain stem and cerebellar stroke are complex (see HD-31 Evidence Based Clinical Support section). Recognition of vertebrobasilar ischemia also requires detailed knowledge of brain stem vascular anatomy.
  - A recent detailed neurological examination should precede requests for advanced imaging, and neurologic consultation is helpful prior to considering advanced imaging.
  - Ultrasound is not adequate to image the vertebrobasilar system.
  - When neuroimaging is indicated, brain MRI without (contrast as requested) and head MRA without contrast (CPT 70544) or CTA (CPT 70496) are generally appropriate. Neck MRA (70548) or CTA (70498) are also acceptable.
  - Acute cerebellar infarcts can develop life-threatening mass effect. A repeat noncontrast brain MRI (CPT 70551) to ensure the stability of a known cerebellar infarction may be appropriate within a month of the stroke. Specialist input regarding the need for such re-imaging is helpful, but should not delay imaging in patients with worsening clinical signs.

- HD-31.2 Transient global amnesia: a syndrome very well defined by a striking clinical presentation. Neuroimaging is not generally required, but if there is uncertainty about the diagnosis, noncontrast CT or MRI of the brain (CPT 70450 or 70551) is reasonable. A small minority of patients will have a second episode, and in these patients, brain MRI without and with contrast (CPT 70553) and head MRA (CPT 70544) are appropriate.
  - Reference:

- HD-31.3 Venous infarcts
  - These are a small percentage of strokes (incidence ~3 per million per year vs ~2000 per million for all stroke), but most occur in children or young adults (75% of those
being in women). Half of puerperal strokes are venous (~12 per 100,000 confinements). They can arise either from cortical vein or venous sinus thrombosis. Those from sinus thrombosis typically cause elevated intracranial pressure.

- The most common outpatient presentation is intracranial hypertension with papilledema from venous sinus thrombosis.
- Brain MRI without and with contrast (CPT 70553) should be performed initially. MRV (CPT 70544) is appropriate when the typical pattern of venous infarction is seen on MRI.
- In women with postpartum stroke or postpartum papilledema, both brain MRI (CPT 70553) and MRV (CPT 70544) can be ordered initially.
- Children or young adults who present with a stroke in which headache and seizures are prominent, or who are known to have an intrinsic system clotting disorder, can have brain MRI (70553) and MRV (CPT 70544) initially.
- Head CT is often the first procedure done in stroke, and will usually indicate the presence of venous infarcts, but MRI/MRV will still be required if CT shows a venous infarct. Most of these cases are treated in hospital.
- Reference:

### HD-31.4 Carotid and Vertebral artery dissections:

- Account for about 20% of premature strokes and should be considered in patients under age 50. They probably occur more often in those with neck trauma, fibromuscular dysplasia, Ehlers-Danlos syndrome, Marfan’s syndrome, and very recent chiropractic neck manipulation.
- **Carotid dissection:** Classic presentation is the appearance of a painful Horner’s syndrome in a young adult, often followed by amaurosis fugax or stroke/TIA like symptoms. Sudden severe neck pain radiating to the angle of the jaw and temple is especially suggestive.
- **Vertebral dissection** causes more posterior neck to occiput pain, often with a thunderclap onset.
- Cervical CTA or MRA (without and with contrast--CPT 70549 is best) is reliable for diagnosis.
- Noncontrast brain MRI to rule out stroke should be done in all confirmed cases, and can be done at the same time as the neck MRA in patients with neurological features.
- Brain MRA without and with contrast (CPT 70546) is often useful, especially in patients in their 20’s to rule out intracranial dissection and in patients with vertebral/basilar dissection.
- Rarely, carotid or vertebral artery dissections may be seen on a neck MRI obtained for other reasons. Cervical MRA (CPT 70549) or CTA (70498) can be obtained for further evaluation in this situation.
- Dissections resolve over time, and re-imaging (MRA neck CPT 70548 or 70549) several months after onset is appropriate to document this.
- References:
  - Practical Neurology 2005;5:100-109

### Cerebral vasculitis:

- see HD-33 Cerebral Vasculitis

### HD-31.5 Premature stroke (patients under age 45, esp. those without marked conventional risk factors for atherosclerotic disease):
Accounts for 5%-10% of all strokes.

- The differential diagnosis should include cranio-cervical dissections, fibromuscular dysplasia, arteritis, venous infarction, cardioembolic stroke, MELAS, sickle cell disease, Moya moya disease, etc.
- Due to the more unusual etiologies, brain MRI without and with contrast (CPT 70553) is appropriate, even if an initial head CT to exclude hemorrhage was done.
- Brain and neck MRA, or CTA will generally be indicated as well. Neck MRA should be without and with contrast (CPT 70549) when dissection is suspected (see HD 31.4 above).
- Specialty consultation is strongly supported to aid in the best selection of imaging studies.
- Reference:

### HD-32~SYNCOPE

- **Also see CD-11 Syncope in the Cardiac guidelines**
- Complete medical history and recent physical/neurological examination, often supplemented by EKG, are the initial steps in the evaluation of syncope.
- Syncope and near syncope (lightheadedness) are infrequently of primary neurological origin. Neuroimaging is appropriate only when the history or physical examination points in that direction.
  - The preferred study will vary in those settings, but noncontrast brain CT or MRI (CPT 70450 or 70551) is most often recommended.
  - Neuroimaging is not indicated in patients with clinically typical isolated or recurrent syncope or near syncope and a normal neurological examination.
- **Near syncope:** the feeling that one is lightheaded, giddy, or about to faint.
  - Occasional, transient near syncope is very common and generally does not require extensive medical evaluation or advanced imaging.
  - The first step is a detailed history and careful physical examination, including a review of medications, evaluation of cardiac and autonomic function, and neurological examination.
  - Extensive evaluation of cardiac function may be appropriate in patients with frequent recurrent attacks.
  - In the absence of documented neurological abnormalities, advanced neuroimaging is generally not necessary.
- Syncope without other neurologic features can be an unusual presentation of vertebrobasilar TIA. Neurological consultation is helpful prior to considering advanced imaging in these patients.
- If there is uncertainty as to whether the correct diagnosis is syncope or seizure, neurology evaluation is helpful. Imaging studies will often not help make the correct diagnosis, and syncope is much more often misdiagnosed as epilepsy than the reverse. Note that postictal confusion does raise the issue of seizures.
  - References:
    - *Heart* 2003;89:353-358
    - *Eur Heart J* 2004;25:2054-2072
    - *Circulation* 2006;113:316-327 (section “neurological evaluation”)
- Neuroimaging is of little value in situational syncope (e.g. syncope associated with cough, postural syncope, exercise induced, volume depletion, post voiding syncope, fainting at the sight of blood, etc.). Postural syncope often occurs after about twenty
minutes in the upright posture unless the postural drop in blood pressure is unusually severe.

- **A drop attack** is a sudden loss of postural tone with a hard fall (cataplexy) rather than a true syncopal attack, but the two can be confused. Unless drop attacks present as a part of the narcolepsy syndrome, they can be a symptom of brain stem dysfunction, and brain MRI (contrast as requested) with brain MRA (CPT 70544) or CTA (CPT 70496) may be useful. Cardiac causes also need to be considered. Neurologic or cardiac consultation is helpful.

- **References:**

### HD-33 ~ CEREBRAL VASCULITIS

- **Definition:** Brain dysfunction caused by inflammation of cerebral arteries supplying either neural tissue or the meninges.

- There is a very rare primary cerebral vasculitis, but most cases of cerebral vasculitis are neurological complications in patients with a known systemic small vessel vasculitis.
  - Patients with normal spinal fluid examination and normal brain MRI (especially if FLAIR and DWI are normal) are extremely unlikely to suffer from a primary cerebral vasculitis.
  - Cerebral angiography: Catheter angiography is of established, but limited value in this condition.
    - The value of both CTA and MRA remains to be established.
  - Brain MRI without and with contrast (CPT 70553) is usually the most useful diagnostic study, and head CT is not often of value.

- **HD-33.1 Vasculitis involving small to medium sized arteries:** systemic lupus erythematosis (SLE) is the most common (>60%), and is a special case among them.
  - SLE can involve the nervous system at any level: brain, meninges, spinal cord, peripheral nerves, even muscles.
  - **Lupus cerebritis** is an ill-defined encephalopathy. Psychiatric symptoms and confusional states are the most common manifestation (75% of cases), followed by seizures (about 20%). Meningeal involvement can lead to cranial nerve syndromes, esp. optic neuritis (10%). The occurrence of the movement disorders in young adults is another fairly common presentation (see HD 21- Movement Disorders).
    - Brain MRI without and with contrast (CPT 70553) is appropriate
    - MRA is not often useful since the involved arteries are too small to be imaged well.
    - The value of CTA is being defined.
  - **Strokes in SLE:**
    - SLE causes hypercoagulability in many patients and can create sources of cardiogenic embolization (Libman-Sachs endocarditis). About 15% of patients with neurological involvement in SLE have strokes.
    - Brain MRI without and with contrast (CPT 70553) and head and neck MRA (CPT 70544 and 70548) or CTA (CPT 70496 and 70498) are appropriate for initial evaluation.
    - Venous infarcts can occur. If venous infarction is recognized on MRI or if there is papilledema, MRV (CPT 70544) is appropriate (see HD-31.3 Venous Infarcts).
- **Other collagen vascular diseases** involving small to middle size arteries can affect the brain. Brain MRI without and with contrast (CPT 70553) is indicated when this occurs, but MRA and CTA are generally not useful.
  - **Beçhets’ disease**: a third of patients have cerebral complications similar to those seen in SLE.
  - **Wegener's granulomatosis**: the usual neurological complication is peripheral neuropathy, but involvement of the meninges, skull base, or middle ear can lead to cranial nerve palsy or orbital pseudotumor. Temporal bone or orbital MRI without and with contrast (CPT 70543) is appropriate (see HD-39 Ophthalmology Conditions).
  - **Churg-Strauss**: (eosinophilia, atopy, asthma and a polyarteritis-like combination of glomerulonephritis and neuropathy) involves the CNS (encephalopathy) in 5% of cases. Brain MRI without and with contrast (CPT 70553) is appropriate in such cases.
  - **Seropositive rheumatoid arthritis, scleroderma, and Sjögren’s syndrome**: premature strokes occur (see HD-31.5 Premature stroke).

- **HD-33.2 Cocaine and methamphetamine** use are associated with premature vascular occlusive events, but whether this reflects spasm or arteritis is uncertain. Brain MRI without and with contrast (CPT 70553) is useful if neurological changes are present. Head CTA (CPT 70496) may be useful to demonstrate arterial abnormalities.

- **HD-33.3 Sarcoidosis** involves the nervous system in about 5% of cases, but neurosarcoidosis is rare in patients without established involvement elsewhere.
  - Meningeal involvement is common, leading to hydrocephalus or to cranial nerve palsies, esp. CN VII. Diffuse encephalopathy and spinal cord involvement can occur, but not commonly.
  - Brain MRI without and with contrast (CPT 70553) is generally the best study.
  - The use of head CT is largely limited to evaluation of shunt integrity in those with treated hydrocephalus.
  - Sarcoid involvement of the sinuses is common. Sinus CT (contrast as requested) is appropriate when this is suspected (see HD-44 Sinus, Adult).

- **HD-33.4 Large vessel arteritis** (Giant cell arteritis)
  - **Temporal arteritis**: a fairly common disorder in patients over age 50 (incidence of ~20/100,000 persons over age 50).
    - Marked elevation of ESR is almost always identified, and ESR is the initial test in evaluation for this diagnosis.
    - Monocular visual loss (arteritic ischemic optic neuritis—AION) is the only frequent vascular complication (see HD-39 Pure Ophthalmology Conditions), although there are reports of vertebrobasilar strokes.
    - Neuroimaging is indicated for evaluation of suspected vertebrobasilar stroke (see HD-30 General Stroke/TIA).
  - **Takayasu’s arteritis** (pulseless disease): is suspected in patients under age 40 with loss of at least one peripheral pulse, symptoms of limb claudication, and blood pressure asymmetries between limbs. About half of the patients have recurrent syncope.
    - Strokes, TIA’s, amaurosis fugax, and cardiovascular events are common.
    - The illness is seen in young children also.
The site of involvement is the aorta and its major branches, including the coronary arteries (see CD-8.7 Other Indications for Coronary CTA in the Cardiac guidelines).

MRA or CTA is useful for diagnosis and follow-up, and multiple studies (brain to lower limbs) are commonplace.

Brain MRI (CPT 70553) is appropriate if there are focal neurological complaints or substantial changes on head or cervical MRA or CTA.

Periodic re-evaluation with extensive MRA of the aorta and its primary branches is standard (annual studies are acceptable).

- **Reference:**
  - *Practical Neurology* 2002;2:80-93

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**HD-34 ~ VERTIGO**

- Also see HD-30.1 Vertebrobasilar Stroke
- A detailed history and description of the vertigo as well as a recent focused neurological/otological examination are the initial steps in the evaluation of patients with vertigo.

**Vertigo**, in contrast to lightheadedness (near syncope), is a false sense that either oneself or the world is rotating. It is fairly common, almost always episodic, quite distressing, and generally benign.
  - “Dizziness” is a term without defined medical meaning and is best avoided since it does not distinguish vertigo from lightheadedness.
  - Dizziness that is not vertigo is usually not a reflection of neurological disease and advanced imaging is not generally indicated.

**HD-34.1 Benign positional vertigo:** is characterized by vertigo lasting seconds, provoked by certain movements, and should be self-limited. It can be diagnosed at the bedside (Dix-Hallpike maneuvers), and imaging is not generally needed.
  - Patients with persistent attacks (continuing for >2 weeks) not resolved by Positional Maneuvers (including Epley’s maneuver) may require either brain MRI without and with contrast (CPT 70553) or temporal bone CT without contrast (CPT 70480) to visualize the superior labyrinth.
  - A detailed neuro-otological examination is critical to the evaluation of positional vertigo, and therefore ENT or neurological consultation is helpful in determining the appropriate imaging pathway.
  - References:

**HD-34.2 Vascular vertigo:** episodes of vertigo lasting 5 to 20 minutes, especially if associated with other neurological events, raise a suspicion of vertebrobasilar TIA’s (see HD-31.1 Vertebrobasilar Ischemia). Patients are generally ataxic during the episodes. Neurology or ENT evaluation may be helpful in determining both etiology and the need for advanced imaging.
  - Reference:
    - *Arch Neurol* 1989;46:281-284

**HD-34.3 Meniere’s Disease** (labyrinthine hydrops): episodes lasting several hours, often accompanied by tinnitus and, over time, documented unilateral hearing loss. Because of the extensive differential diagnosis and the importance of specialized
bedside testing, neurological or ENT consultation is helpful prior to consideration of advanced imaging.
  o Brain MRI without and with contrast (CPT 70553) can be performed for confirmation of the diagnosis.
  o Reference:  
    ➢ *Otolaryngol Head Neck Surg* 1995;113:181-185

- **HD-34.4 Acute labyrinthitis** (vestibular neuritis): acute usually severe vertigo, sometimes with hearing loss. An attack typically resolves over days.
  o Advanced imaging is not usually indicated.
  o Noncontrast brain MRI (CPT 70551) is recommended for the following:
    ➢ sudden onset in a patient with diabetes or hypertension
    ➢ onset includes severe headache
    ➢ neurological findings other than vertigo (inability to stand, incoordination of limbs, diplopia, dysarthria, hemiparesis, altered level of awareness) are also present
    ➢ If there is associated hearing loss with any of these features, brain MRI without and with contrast (CPT 70553) is appropriate.
  o Brain MRI (CPT 70553) is appropriate for patients with apparent acute labyrinthitis who fail to improve markedly within 2 weeks and in those who on careful examination fail to show abnormal head thrust bedside testing.
  o References:
    ➢ *Neurology* 2006;67:1178-1183

- **HD-34.5 Superior semicircular canal dehiscence:** syndrome characterized by dehiscence of bone overlying the superior canal. Diagnosis is by audiology followed by high resolution temporal bone CT (CPT 70480). The patients usually have vertigo and nystagmus provoked by loud noises and an increased sensitivity to bone conducted sounds.
  o Reference:  
    ➢ *Laryngoscope* 2005;115:1717-172

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**HD-35 ~ NEWER MRI TECHNIQUES**

- Continuing development of CT and MRI technology has led to potential new uses. Established clinical utility has been found for some of these newer techniques while others should still be regarded as experimental.

- **HD-35.1 Functional MRI (f-MRI):**
  o CPT codes for functional MRI:
    ➢ **70554** MRI Brain, functional MRI, including test selection and administration of repetitive body part movement and/or visual stimulation, not requiring physician or psychologist administration
    ➢ **70555** MRI Brain, functional MRI; requiring physician or psychologist administration of entire neurofunctional testing
  o Certain payers consider f-MRI investigational, and their coverage policies will take precedence over MedSolutions’ guidelines. Prior authorization does not guarantee payment of the study in this situation.
  o See HD-35 Evidence Based Clinical Support section for a detailed explanation of fMRI. Currently, fMRI is a technique used preoperatively to define “eloquent” areas of brain, esp. the sensorimotor strip and the regions involved in language use.
Avoidance of regions within 2 cm of eloquent cortex reduces postoperative neurological deficits.

- **f-MRI** is appropriate as a part of the preoperative evaluation of patients undergoing craniotomy for regions in which the presence of eloquent cortex is an issue (patients with appropriately located tumor, AVM, or epileptic focus).
  - Use of 3T MRI is appropriate when available.
  - Involvement of a neurologist or neurosurgeon is necessary since the test is preoperative.

- At this time, any use of f-MRI for diagnostic purposes, rather than for preoperative localization, is experimental.

- **References:**
  - Radiology 2005;236:247-253
  - Radiology 2006;240:793-802

- **HD-35.2 Magnetic resonance spectroscopy (MRS):** analysis of the levels of certain chemicals in a pre-selected voxels (small regions) on an MRI scan done at the same time (see discussion in HD-35 Evidence Based Clinical Support section).

  - Certain payers consider MRS investigational, and their coverage policies will take precedence over MedSolutions’ guidelines. Prior authorization does not guarantee payment of the study in this situation.

  - **Adult brain tumor:** MRS is generally regarded as experimental in the management or diagnosis of brain tumor in adults for most purposes. For instance, the results of MRS cannot reliably distinguish neoplasms from benign inflammatory lesions, or reliably distinguish malignant oligodendrogliomas likely to respond to chemotherapy from other malignant gliomatous tumors.

  - **Reference:**
    - CMS, Decision memo for magnetic resonance spectroscopy for brain tumors (CAG-00141N)  
      - Accessed November 30, 2006
    - Neurology 2005;64:2085-2089

  - After radiation treatment of brain tumors, it may be difficult to distinguish radiation necrosis from recurrent tumor without awaiting the results of serial MRI scans. In cases of glioblastoma or other highly anaplastic tumor, metabolic PET (CPT 78608) has been preferred to MRS to make this distinction. MRS is an acceptable alternative to PET for this purpose. Such cases should be referred for Medical Director review.

  - There may be a role for MRS in the follow-up of treated patients with less anaplastic tumors (in which FDG PET is not useful) esp. in the management of surgically inaccessible tumors.

  - MRS is clearly useful in the diagnosis and subsequent management of certain rare inborn errors of metabolism affecting the CNS, including adrenoleukodystrophy, creatinine pathway disorders, and others. Cases should be referred for Medical Director review.

- **References:**
knowledge regarding use of MRS in inborn errors, disease by disease.

- Neurology 2005;64:434-441

- MRS produces highly variable results in MS, varying with the pathological process. It does not appear to be useful in distinguishing multiple sclerosis plaques from tumors, since both can produce similar results.
  - The use of MRS in multiple sclerosis, especially in making the differential diagnosis of MS versus tumor, is experimental at this time.
- Use of MRS in patients with cerebral metastases of systemic cancers is currently regarded as experimental.

- **HD-35.3 Diffusion weighted imaging: (DWI):** diffusion weighted images are obtained without contrast and have in many centers become a routine or semi-routine part of the noncontrast MRI head examination. They are useful in a variety of situations, but especially in acute stroke evaluation. See Evidence Based Clinical Support section for HD-30 and HD-35.
  - Use of diffusion weighted imaging does not require separate CPT coding.

- **HD-35.4 Perfusion weighted imaging: (PWI):** performed with contrast and has become a common part of initial acute stroke evaluation. See HD-35 Evidence Based Clinical Support section.
  - Use of PWI does not require separate CPT coding.
  - CT perfusion imaging is an alternative to MRI DWI/PWI imaging. See HD-35.6 CT perfusion

- **HD-35.5 CSF flow imaging:** imaging of CSF flow is sometimes useful in preoperative evaluation of hydrocephalus and Chiari syndrome with either features of hydrocephalus or syrinx. There are various techniques for this.
  - Generally done as a part of a head MRI examination and is not often coded separately.
  - Certain payers consider CSF flow imaging investigational, and their coverage policies will take precedence over MedSolutions' guidelines. Prior authorization does not guarantee payment of the study in this situation.
  - Reference:

- **HD-35.6 CT perfusion.**
  - Use CPT 0042T - “cerebral perfusion analysis using CT”
  - Certain payers consider CT perfusion studies as investigational, and their coverage policies will take precedence over MedSolutions’ guidelines. Prior authorization does not guarantee payment of the study.
  - A contrasted CT technique that currently is used to measure regional cerebral blood flow (rCBF=mean transit time or r-MTT) and regional cerebral blood volume (rCBV).
  -Performed as part of a head CT examination and adds only a few minutes to the procedure.
  - Thus far, the only established use for CT perfusion studies is in the emergent evaluation of patients with very new strokes still within the window permitting thrombolytic use (probably about 6 to 9 hours).
    - Since this is emergent, preauthorization will rarely be requested.
CT perfusion studies have been shown to be similar in value for this purpose to MRI DWI/PWI imaging for strokes within the middle cerebral distribution, which is by far the most common location for stroke. (Stroke location can usually be determined clinically).

- CT perfusion studies are done on one or two axial cuts of the CT examination, so in strokes outside the middle cerebral territory, MRI DWI/PWI imaging will normally be preferred.
- Performance of both CT perfusion and MRI DWI/PWI will rarely be indicated.

Currently, the use of CT perfusion is experimental except for its use to evaluate new stroke patients as described above.

References:
- *Ann Neurol* 2006;60:508-517
- *Neurology* 2007;68:694-697
- *Stroke* 2001;32:2021-36
- *Neurology* 2007;68:730-736

**HD-35.7 Magnetic resonance neurography (MRN):**

- Also see PN-7 Newer Imaging Techniques
- These studies code as MRI of the relevant area, usually without contrast.
- MRN produces striking T2 weighted images of Wallerian degeneration in nerves involved in a variety of pathological processes. However, at this time there is no compelling evidence indicating that MRN adds significant information affecting patient management.
- MRN is considered experimental at this time.

References:
- *Neurology* 2002;58:1597-1602

**HD-35.8 Positional MRI:** currently, there is no body of evidence substantial enough to support the medical necessity of this procedure. The range of normal findings needs to be established, as does the clinical significance of those variations from that range that are not also identified on conventional MRI. It should be considered experimental at this time.

**HD-35.9 MRI using 3T and higher magnets:** A role for the use of 3T MRI scanners is known in functional MRI studies.

- Except for use in functional MRI studies, the usefulness of 3T and higher field strengths is yet undetermined, and they should be considered experimental at this time.
- See 35.1 Functional MRI
• **HD-35.10 Magnetic source imaging (MSI):**
  o Magnetic source imaging code: HCPCS code S8035.
  o Certain payers consider MEG and MSI investigational, and their coverage policies will take precedence over MedSolutions’ guidelines. Prior authorization does not guarantee payment of the study.
  o Magnetoencephalography (MEG) without MSI does not require preauthorization by MedSolutions at this time.
  o Magnetoencephalography (MEG) is an EEG-like technique which measures magnetic rather than electric fields created by living brain tissue. These signals can be averaged and those averages can be registered to brain MRI images to create a magnetic field brain map. This is called Magnetic Source Imaging (MSI).
    ➢ See discussion in HD-35 Evidence Based Clinical Support section.
  o MSI imaging can in theory be used to map the location of sensitive brain areas such as those involved in speech and sensorimotor function. Such maps can, in principle, be used to guide neurosurgical procedures which involve brain regions close to these sensitive functions and thereby make them safer.
    ➢ Similar results can be obtained using f-MRI (see HD-35.1 Functional MRI).
    ➢ Use of MEG/MSI in neurosurgical preoperative planning is still limited to a small number of centers worldwide and is widely regarded at this time as experimental.
  o MSI images have also been used to identify seizure foci in patients being considered for epilepsy surgery.
    ➢ The value of this technique and its eventual role are not yet established, and this indication is widely regarded as experimental.
  o At this time, there is no indication for using MEG/MSI in diagnostic testing.
  o References:
    ➢ *Radiology* 2006;241:213-222
    ➢ *Neurosurgery* 2006;59:493-511

**OPHTHALMOLOGY GUIDELINE**

**HD-36 ~ OPTIC NEURITIS**

• Also see HD-22 Suspected MS and HD-23 Established MS
• The diagnosis of optic neuritis can be made clinically—without imaging—with over 99% accuracy.
  o Imaging is done to find associated evidence of Multiple Sclerosis (MS); therefore, brain MRI without and with contrast (CPT 70553) is indicated on initial presentation.
  o Spinal cord imaging (cervical and thoracic spine) may be useful if brain imaging is neither normal nor firmly diagnostic of MS, but in apparently isolated optic neuritis, spinal cord imaging is not often useful.
  o Reference:
    ➢ *Neurology* 2004;62:226-233
• Dedicated orbital imaging will usually show demyelination/inflammation of the optic nerve. However, this information is rarely clinically useful and in patients with optic neuritis, it is not relevant to McDonald criteria scoring for MS. **Orbital MRI is appropriate only in atypical cases.**
  o MRI of the orbits without and with contrast (CPT 70543) is appropriate in the presence of at least one of the atypical features listed below:
    ➢ Visual loss progressing in severity for more than 10 days
    ➢ Patient age > 45

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Lack of any pain or soreness with the visual loss.

Severe disc edema on clinical examination. Mild disc edema is common in optic neuritis, but severe edema with hemorrhages and exudates is not.

Evidence of iritis or uveitis (eye disease not limited to the optic nerve)

Failure to manifest at least some improvement in visual acuity within a month of onset.

References:

- Lancet Neurology 2005;4:111-121

In adults, optic neuritis is generally unilateral.

References:

- Neurology 2006;67:258-262

### HD-37 ~ VISUAL FIELD DEFICITS

- Detailed history and recent physical examination, including testing of the visual fields, should be performed initially prior to considering advanced imaging.
- Neurology or Ophthalmology evaluation is helpful in determining the appropriate imaging pathway.
- Visual loss limited to a single eye generally reflects involvement of the optic nerve or the globe itself.
  - Imaging of the orbit should be performed and brain imaging is not indicated.
  - Exceptions:
    - Patients with typical optic neuritis should have brain imaging initially rather than orbital imaging (see HD-36 Optic Neuritis).
    - In certain ocular neoplasms, brain imaging may be needed also, since the lesion may extend into the cranial cavity.
- Chiasmatic field defects generally involve the temporal (lateral) visual fields of both eyes.
  - The cause of a chiasmic defect is near the pituitary.
  - Brain imaging is critical, but the orbits may need to be imaged as well, if the lesion is one prone to infiltrate “forward” to the orbits.
- Homonymous visual field defects (the kind common in strokes) are also called retrochiasmatic. The visual field loss is of the same side of the world in both eyes. The lesion is in the posterior half of the brain.
  - Brain imaging is needed, but orbital imaging is not.

### HD-38 ~ HORNER'S SYNDROME

- Patients with isolated anisocoria and presumed meiosis should have other causes (physiologic anisocoria, contracted Adie’s pupil) excluded by the examination of old photographs for evidence of previous abnormality prior to consideration of advanced imaging.
- Ptosis from Horner’s syndrome is mild (<2 mm). More severe ptosis suggests another diagnosis. Ptosis without anisocoria is very infrequently from Horner’s syndrome.
- Age and clinical setting determine the differential diagnosis and therefore the appropriate order of evaluation in patients with Horner’s syndrome.
  - In patients with Horner’s syndrome combined with other neurological features, the appropriate evaluation is determined by those other features, not the Horner’s syndrome, and the appropriate guideline should be consulted (e.g. noncontrast brain MRI [CPT 70551] if there are features of lateral brain stem infarction, etc.).
The coincidence of Horner’s syndrome with extraocular palsies suggests involvement in the region of the cavernous sinus.

- Brain MRI without and with contrast (CPT 70553) (earmarked for attention to the area) is indicated, along with head CTA (CPT 70496) or MRA (CPT 70544) if requested.

- When there are associated features suggesting sinus involvement, such as facial pain or bloody nasal discharge, sinus CT (contrast as requested) is appropriate.

- In patients between age 15 and 50 who present with pure Horner’s syndrome, carotid artery dissection is likely. Classically, there is pain radiating from neck to temple and facial sweating is noted to be spared.

- Brain MRI (70553) and cervical CTA (CPT 70498) or cervical MRA without and with contrast (CPT 70549) are indicated initially.

- Patients over age 50 with pure Horner’s syndrome should have chest CT (CPT 71260) as the initial imaging study to exclude apical lung masses. Chest x-ray is not reliable in the apical region.

- In patients with Horner’s syndrome and features of a cervical spinal lesion, imaging should begin with cervical spine MRI (contrast as requested).

- Horner’s syndrome during attacks is a typical feature of cluster headaches, and in some patients, a mild Horner’s syndrome is apparent between attacks: this is not an indication for imaging for the Horner’s syndrome, though head imaging for the cluster headaches themselves may be appropriate if not already done (see HD-16.4 Cluster headache).

- References:
  - Practical Neurology 2001;1:42-49
  - Horner’s syndrome associated with ophthalmic zoster does not generally require the use of advanced imaging.

### HD-39 ~ OPHTHALMOLOGY CONDITIONS

- **HD-39.1 Orbital imaging studies:**
  - Both orbital CT (CPT 70480 and 70482) and orbital MRI (70540 and 70543) are useful in certain orbital disorders, and in those disorders, the preferences of an ordering ophthalmologist for one modality or the other should be honored.
  - Orbital MRI or CT should not be added to head MRI or CT as a matter of routine: there must be documentation of a need to exclude an orbital disorder for which the head imaging study would not provide sufficient evaluation.
  - Head MRI or CT similarly should not be added to orbital MRI or CT as a matter of routine unless the ocular disorder is such that brain imaging is also warranted.
  - Except in the evaluation of potential aneurysm, TIA, or stroke, head CTA or MRA is not ordinarily useful in the evaluation of visual disorders.
  - Except in the evaluation of potential dissection, TIA, or stroke, cervical CTA or MRA is not ordinarily useful in the evaluation of visual disorders.

- **HD-39.2 Ill-defined visual symptoms:** Ophthalmology evaluation should be considered prior to advanced neuroimaging in patients with no objective abnormalities on general physical examination who also have nonspecific visual changes (blurry vision, seeing spots, floaters, etc.).

- **HD-39.3 Orbital trauma:** orbital CT without contrast (CPT 70480) is preferred.
• **HD-39.4 Orbital calcifications**: orbital CT without and with contrast (CPT 70482) is preferred.

• **HD-39.5 Bony erosion of orbit**: noncontrast orbital CT (CPT 70480) is useful to define the presence of erosions, but MRI (contrast as requested) may be needed to define their source.

• **HD-39.6 Evaluation of suspected retinoblastoma (including leukokoria)**: Orbital CT without and with contrast (CPT 70482) is preferred initially. Once a retinoblastoma has been confirmed, MRI scans without and with contrast of brain (CPT 70553) and orbits (CPT 70543) are indicated.

• **HD-39.7 Orbital cellulitis**: orbital or maxillofacial CT without and with contrast is indicated (CPT 70482 or 70488), but MRI may be substituted at the request of a consulting ophthalmologist or ENT specialist.
  o Brain imaging (CT or MRI without and with contrast—CPT 70470 or 70553) may also be useful if there is a suggestion of intracranial extension of the infection.

• **HD-39.8 Orbital pseudotumor and thyroid exophthalmos**: noncontrast orbital CT (CPT 70480) or MRI without and with contrast (CPT 70543) is indicated. CT is usually the preferred initial study.

• **HD-39.9 Proptosis**: noncontrast orbital CT (CPT 70480) is generally appropriate initially. Patients with tumors of the globe or orbit (other than retinoblastoma), MRI of orbit without and with contrast (CPT 70543) is indicated. For optic nerve glioma, brain MRI (contrast as requested) can also be performed.

• **HD-39.10 Optic neuropathy or “non-arteritic ischemic optic neuropathy (NAION)”**: generally, imaging is not required. If there is reason to believe this is part of more generalized cerebrovascular disease, stroke/TIA imaging guidelines apply (see HD-30 General Stroke/TIA and HD-31 Special Stroke/TIA).

• **HD-39.11 Arteritic ischemic optic neuropathy (AION)**: this is a complication of temporal arteritis (giant cell arteritis)
  o Requests for imaging in this complex situation should be referred to a Medical Director review.
  o Temporal arteritis usually does not significantly involve the cerebral circulation, but it can on occasion.

• **HD-39.12 Simple retinal detachment**: imaging is usually not required.

• **HD-39.13 Uveitis**: orbital MRI without and with contrast (CPT 70543) may be indicated. There are uveal-meningeal syndromes which may require the addition of brain MRI without and with contrast (CPT 70553) to visualize the meninges.

• **HD-39.14 References**:
  o Grossman RI, Yousem DM. *Neuroradiology, the requisites*. 2nd Ed. (Ch10). Philadelphia, Mosby, 2002
HD- 40 ~ EPISTAXIS

- Initial evaluation of epistaxis (nose bleed), including recurrent epistaxis, is by direct or endoscopic visualization of the relevant portions of the upper airway.
  - If the initial clinical evaluation is unrevealing, ENT consultation may be helpful.
  - Maxillofacial CT may be useful in individual cases, depending upon the findings during the initial clinical evaluation.

HD- 41 ~ MASTOID DISEASE

- Temporal bone CT without contrast (CPT 70480) is the usual initial imaging study for disease of the mastoid region, including mastoiditis.
- Minor degrees of mastoid cell mucosal thickening are often seen on head MRI or other cranial imaging studies, and do not, in general, require further imaging.

HD- 42 ~ FACIAL TRAUMA

- CT without contrast is the preferred imaging study in facial trauma.
- Coding of Facial imaging:
  - Maxillofacial versus orbital/temporal bone CT: both orbital/facial bone CT (CPT 70480, 70481, and 70482) and maxillofacial CT (CPT 70486, 70487, and 70488) cover the structures of the orbits, sinuses, and face. Unless there is a grounded suspicion of simultaneous involvement of more posterior lesions, especially of the region involving the middle or inner ear, one of these studies only should be sufficient.
  - Mild mucosal thickening in the paranasal sinuses or mastoids without other abnormalities is common in healthy individuals and not of itself an indication for imaging.
  - ENT, Plastic surgery, or other relevant specialist evaluation is helpful in determining the appropriate imaging pathway.
  - Maxillofacial CT (CPT 70486) is the usual study (except in orbital or temporal bone trauma), but the preference of a requesting ENT or neurologist/neurosurgeon should be honored.
  - Patients with facial trauma are often at risk for associated injury of both the cranial contents and the cervical spine.

HD- 43 ~ HEARING LOSS

- Otoscopic and audiological examinations are the initial steps in evaluating hearing loss of all types.
- Conductive hearing loss.
  - Advanced imaging is generally inappropriate in patients with hearing loss caused by benign impaction of one or both external auditory canals.
  - In patients with unilateral conductive hearing loss, especially those with abnormal otoscopic findings, temporal bone CT without contrast (CPT 70480) may be useful.
  - When advanced imaging is necessary in patients with bilateral conductive hearing loss, CT of the temporal bone (CPT 70480) is usually appropriate.
    - ENT physicians often use contrasted CT or MRI when malignancy is identified, and this is acceptable.
• **Cochlear hearing loss.**
  o ENT consultation is of benefit in patients with unexplained bilateral cochlear hearing loss.
  o In patients with unilateral cochlear loss, advanced imaging with either brain MRI without and with contrast (CPT 70553) or temporal bone CT (CPT 70480) may be appropriate.
    ➢ MRI is generally preferred when a retrocochlear lesion cannot be definitely excluded by other means.
• **Retrocochlear hearing loss:** MRI of the head with attention to the internal auditory canals and without and with contrast (CPT 70553) is helpful in both unilateral and bilateral cases.
• **Cochlear implants:** the surgeon’s choice among preoperative craniofacial studies should be honored

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<th>HD-44 ~ SINUS, ADULT</th>
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|• Acute sinusitis is normally treated on an empirical basis without the use of imaging studies. Some combination of antibiotics, corticosteroids, and antihistamines is usual. Current patterns of likely microbial sensitivity to antibiotics should be taken into account when those agents are used.
• Mild mucosal thickening in the paranasal sinuses or mastoids without other abnormalities is common in healthy individuals and not of itself an indication for advanced imaging.
• **HD-44.1 Imaging by noncontrast sinus CT (CPT 70486) is generally reserved for those with:**
  o Poor response to appropriate treatment for four or more weeks. A second antibiotic is appropriate when the first is unsuccessful.
  o Recurrence within two months of an apparently successful medical treatment. (Recurrence suggests obstruction).
  o Apparent sinusitis in an immunocompromised patient (including transplant patients).
    ➢ Sinus CT without and with contrast (CPT 70488) may be appropriate, since occult neoplasm and ill-contained infection are often issues.
  o Fungal sinusitis.
  o Sinusitis complicated by facial or orbital cellulitis.
• Sinus CT is also useful when there is a need to clarify a differential diagnosis (especially with concern about neoplasm), and in asthmatics when the physician suspects a sinus contribution to the asthmatic problems.
• Patients are usually not referred to ENT or Allergy specialists unless their sinus symptoms are recurrent. Therefore imaging is often appropriate at the time of initial specialist evaluation of chronic sinus disease.
  o Contrast may be appropriate in evaluation of possible malignancy and when there is extension of inflammation beyond the sinuses.
  o When sinus CT is used to direct surgical planning and is ordered by the operating surgeon, 3D rendering can be obtained.
• Sinus MRI without and with contrast (CPT70543) is superior to CT for evaluation of most aggressive or invasive processes (esp. tumor) and to reveal perineural spread.
• CT is the preferred study for evaluation of bony detail, for most fungal infections, for fibrousseous lesions, and for chondrosarcomas.
  o Mucosal thickening is seen well by both techniques, and CT is preferred for both convenience and expense.
• **HD-44.2 Combined head and sinus imaging**
  o Head CT does not visualize all of the sinuses.
  o Head MRI provides excellent visualization of the sinuses sufficient to recognize sinusitis, and addition of sinus CT for this purpose is unnecessary.
    ➢ In patients being evaluated for potential sinus surgery, separate sinus CT is often appropriate even after a head MRI in order to visualize obstructions to spontaneous mucous flow.
  o Separate head imaging is not generally indicated in patients with a nonfocal neurological examination who have headaches associated with sinus symptoms.
  o Sinus CT or MRI is not indicated for the evaluation of headaches without a more specific indication pointing to a sinus etiology.

• **HD-44.3 Mucous retention cysts**
  o Unless there is evidence of associated bony erosion or of uncertainty regarding the radiological diagnosis, repeat imaging is not indicated.

• **HD-44.4 References:**
  o *Otolaryngol Clin N Am* 2005;38:1137-1141

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**HD- 45 ~ TEMPOROMANDIBULAR JOINT DISEASE (TMJ)**

• Advanced imaging is not often required to diagnose or plan treatment for patients thought to have temporomandibular joint disease (TMJ).
• Patients with suspected TMJ should be evaluated and treated conservatively prior to considering advanced imaging.
• MRI should be reserved for those who fail non-surgical treatment and who are actively being considered for TMJ surgery.
• Since specific TMJ imaging is generally requested as a part of a preoperative evaluation, Evaluation by an oral surgeon, head and neck surgeon, or dentist experienced in the management of TMJ is helpful prior to imaging.

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**HD- 46 ~ TINNITUS**

• Tinnitus is called objective when the examiner can hear it and subjective when only the patient can.

• **Objective pulsatile tinnitus:**
  o Usually arises from a vascular lesion.
  o If there is an audible cardiac source (e.g. heart murmur), then cardiac evaluation is indicated prior to considering advanced imaging of the brain or neck.
  o If there is no cardiac abnormality on physical examination, brain MRI (contrast as requested) can be performed.
  o Cervical CTA (CPT 70498) or MRA (CPT 70548) is indicated if there is a cervical bruit.
  o Head CTA (CPT 70496) or MRA (CPT 70544) is indicated if there is a cranial bruit.

• **Subjective pulsatile tinnitus:** evaluation begins with an otoscopic examination.
  o If this is abnormal, temporal bone CT (usually without contrast-- CPT 70480) is indicated initially.
  o If the otoscopic examination is normal, brain MRI (contrast as requested)+/- head MRA/CTA is appropriate.
Some discretion is necessary in the evaluation of subjective pulsatile tinnitus: everyone has at one time or another briefly experienced tinnitus, and if not persistent or striking, it is unlikely to be significant.

- **For both objective and subjective pulsatile tinnitus:**
  - If a lesion involving bone is found on MRI, CT may be needed to further characterize the lesion.
  - If a vascular dissection is suspected, cranial and cervical MRA/CTA are appropriate (see HD-31.4 Carotid and vertebral artery dissections).

- **Non-pulsatile tinnitus:**
  - Audiologic evaluation, careful history, and recent physical examination, including otoscopic exam, should be performed initially.
    - If the audiologic exam is normal, no further evaluation is generally needed.
      - Medications, especially aspirin, can cause tinnitus without hearing loss.
  - Cochlear hearing loss in adults with normal otoscopic examination generally requires no imaging.
  - Retrocochlear hearing loss indicates the need for brain MRI without and with contrast (CPT 70553).
  - Conductive hearing loss: noncontrast temporal bone CT (CPT 70480) may be indicated.

- **References:**
  - *Radiology* 2000;216:342-349
A Brief Note on Clinical Neurology:

- Signs are what doctors find on examination. Symptoms are what patients experience. The terms are used with precision in these neurological guidelines: symptoms and signs should not be confused.
  - Examples can help make this clear. Numbness is a symptom. Loss of sensation in a specific body area on examination is a sign. A feeling of weakness is a symptom. Loss of strength in performing certain tasks during examination is a sign.
- The chief signs of brain lesions are Babinski’s sign (upgoing toes), spasticity, and marked hyperreflexia, all on one side of the body (and face). One-sided weakness and sensory loss are others. Aphasia is usually a sign of left cerebral disease. Certain kinds of visual field loss are cerebral signs. Cerebral lesions cause clinical pictures that all point to one side of the body.
- There are few signs of brain stem disease that come with a guarantee, and those few are infrequently seen.
  - Vertical nystagmus, palatal myoclonus, and internuclear ophthalmoplegia are the only reliable signs seen with any frequency in awake patients.
  - Deep Coma is the most common of the intrinsic brain stem signs, but has no application in outpatient medicine.
  - Most often, brain stem disease is recognized by complex patterns which share involvement of one side of the body and the other side of the head or face, often including balance disorders that cannot be explained by weakness. Those classic brain stem signs are infrequently present.
- The principal sign of spinal cord disease is the loss of functions on both sides below a certain level. This can take the form of sensory loss on one side and spastic weakness on the other, but there will still be a level.
- Loss of deep tendon reflexes, and stocking sensory loss are the traditional signs of peripheral neuropathy, but neither is always reliable either by its presence or absence.
- CNS infections generally cause fever with severe headache and a meningeal stiff neck (the neck resists flexion only—Brudzinski’s or Kernig’s sign). Confusion or delirium is frequent. In the immunocompromised, signs may be subtle.

EVIDENCE BASED CLINICAL SUPPORT
HD- 2 ~ CONTRAST USE IN HEAD IMAGING

- Any discrepancies between the criteria below and a specific guideline (HD-1 through HD-46) should be resolved in favor of the condition-specific guideline.
- Indications for Head CT without and with contrast (CPT 70470):
  - Patients in whom MRI without and with contrast is indicated but who cannot have an MRI (example: a patient with a pituitary tumor and a pacemaker).
  - Staging systemic cancer patients who have no overt neurological abnormality or only nonspecific symptoms such as headache. Note: MRI without and with contrast is desirable in a patient in whom there is every reason to expect metastases: they are being evaluated for neurosurgery, not being staged.
Remember that most neurologically asymptomatic cancer patients do not need any brain imaging for staging—there are only a few tumor types in which it is appropriate.

**Indications for Head CT without contrast (CPT 70450):**
- Acute or recent head trauma
- Nonacute but not remote head trauma (within 6 months) when the concern is to evaluate for chronic subdural hematoma.
- Recent hemorrhage or a concern about recent hemorrhage. CT is helpful within about a week of the event in identifying subarachnoid hemorrhage and 2-3 weeks for intracerebral hemorrhage.
- Headache evaluation in patients without neurological abnormalities, papilledema, or active cancer history.
  - In children and young adults (ages 6 to 30), noncontrast MRI should be considered to minimize radiation exposure, although noncontrast CT can be approved when it is strongly indicated.
- Recurrent syncope: a normal noncontrast CT is sufficient cerebral evaluation in most a case in which neuroimaging is indicated.
- Uncomplicated dementia in patients over age 70.
- Urgent exclusion of intracranial mass lesions. CT can generally be obtained readily 24/7. Contrast is not needed since any positive findings will likely require follow up by MRI.
- Most patients in whom noncontrast MRI is appropriate who cannot have MRI done.

**Indications for Noncontrast Brain MRI (CPT 70551):**
- Headache without papilledema or neurological signs (see exceptions in HD-16 Headache, Adult).
- Stroke in patients over 45 years old.
- Dementia in patients over 60 years old.
- Movement disorders, when any imaging at all is indicated.
- Some seizure patients.

**Indications for Brain MRI without and with Contrast (CPT 70553):**
- Evaluation or follow-up of known tumors.
- Evaluation of potential masses in the area of the pituitary or in the posterior fossa.
- Evaluation for spinal fluid leaks.
- CNS inflammatory disorders, including lupus cerebritis, encephalitis, and fungal, tuberculous, and carcinomatous meningitis.
- Epilepsy, esp. evaluation of new onset seizures in adults.
- Evaluation and follow-up of MS.
- Diagnosis of cerebral arteriovenous malformations.
- Evaluation of cerebral venous infarcts and premature strokes (patients < age 45).
- The usual study to follow up abnormalities seen on CT that require further characterization.

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**EVIDENCE BASED CLINICAL SUPPORT**

**HD-13 ~ DEMENTIA**

- Tests for B-12 deficiency and hypothyroidism rarely discover the cause of dementia, and it is generally not appropriate to delay imaging while awaiting their results.
- Neurology consultation is helpful in evaluating patients with suspected dementia (especially patients less than 60 years old). However, it may be impractical to expect this to be obtained in all elderly patients.
• Dementia is a disease of the elderly. The diagnosis should be scrutinized carefully in those below age 60.

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**EVIDENCE BASED CLINICAL SUPPORT**

**HD-14 ~ ADULT EPILEPSY/SEIZURE**

• Up to 1% of Americans will have a single seizure at some time in their life, and half that number will turn out to have epilepsy.
• Generalized epilepsies commonly begin in childhood and rarely do so after age 30.
• Adult onset epilepsy is generally from a focal brain disorder (partial epilepsy), but the actual source is more often than not never identified.
  o In rural Mexico, that focal disorder is usually cysticercosis. Immigration will make this more common in the United States.

---

**EVIDENCE BASED CLINICAL SUPPORT**

**HD-15 ~ FACIAL PAIN/TRIGEMINAL NEURALGIA**

• Facial pain is much less common than headache, but when it occurs, it is extremely severe and likelier than headache to arise from a serious underlying cause.
• The differential diagnosis includes: disorders of the teeth, sinuses or skull base, tumors or vascular abnormalities affecting the sensory nerves of the face, multiple sclerosis, and even migraine.
• The most notorious form is an especially severe recurrent lancinating facial pain called trigeminal neuralgia or tic douloureux. Tic causes extremely severe bouts of momentary pain often triggered by touching or moving a small region of the face or mouth. It is not a steady ache. The name tic comes from the brief facial contortion that often accompanies the pain. Tic douloureux is recognized by the very specific pattern of pain elicited on history, but it can take considerable skill and experience with the condition to obtain that history. As time goes by, patients with this disorder also tend to develop longer lasting facial pain which makes history taking even harder.
• Traditionally it has been believed that very careful neurological examination and response to treatment could separate the 10% or so of such cases caused by a compressive lesion affecting CN V, but the available evidence suggests that this is not so, and that MRI is indicated in these cases at the time of initial diagnosis.
• Only 5% of cases of tic douloureux involve the ophthalmic nerve, the first branch of the trigeminal (supplies the forehead and anterior scalp with feeling). The differential diagnosis is different from the usual case of tic, from other conditions of the cavernous sinus or orbit, and from post-herpetic neuralgia. This may require additional imaging studies.
• The glossopharyngeal nerve (CN IX) and the nervus intermedius, the small sensory branch of the facial nerve (CN VII), can be affected by a condition similar to trigeminal neuralgia, with the paroxysms arising from the throat (CN IX) or external ear canal (CN VII). Management is as for trigeminal neuralgia.
• Tic douloureux in patients under age 40 raises reasonable concerns about an underlying diagnosis of multiple sclerosis.
• Non-neuralgic facial pain is often called atypical facial pain. The use of advanced imaging in its evaluation varies depending on the specific clinical features, and no general rules can be given.
Known aneurysms and cases of subarachnoid hemorrhage (SAH) are currently evaluated by catheter angiography or by CTA. MRA and CTA are both used to follow known aneurysms, to discover either asymptomatic aneurysms in those with no personal history of aneurysm or to discover new aneurysms in those with such history.

Small (< 3-4 mm) unruptured aneurysms in those with no personal history of SAH have a very low rate of bleeding: 0.1% per year for those in the anterior circulation (carotid) and 0.5% a year for the much less common posterior circulation aneurysms. The risk of surgery (operative stroke or death) rises with age, but is never less than a few percent. Coiling is safer, but complication rates are not much below 1%-2%.

Risk and family history of aneurysm:
- The baseline risk of having an aneurysm is about 1%-2%
- The risk rises to 2%-4% with one first degree relative with history of aneurysm
- The risk rises to 6% with two such relatives.
- With an identical twin, the risk rises sharply to about 35%, and with two parents, to about 30%.

Intracranial hemorrhage on MRI and CT. For convenience, the table below summarizes the evolving appearances of blood on CT and MRI:

<table>
<thead>
<tr>
<th>Time</th>
<th>Pigment</th>
<th>CT</th>
<th>T1</th>
<th>T2</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;24 hrs</td>
<td>Oxy-Hb</td>
<td>↑</td>
<td>=, Slt ↓</td>
<td>↑</td>
</tr>
<tr>
<td>1-3 days (dy)</td>
<td>Desoxy-Hb</td>
<td>↑</td>
<td>=, Slt ↓</td>
<td>↓</td>
</tr>
<tr>
<td>Subacute 4-7 dy</td>
<td>Intracell Met-Hb</td>
<td>↑</td>
<td>↑</td>
<td>↓</td>
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<tr>
<td>Subacute 7-21 dy</td>
<td>Extracell Met-Hb</td>
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<td>↑↑</td>
<td>↓</td>
</tr>
<tr>
<td>Chronic &gt; 3 wks</td>
<td>Extracell Met-Hb</td>
<td>=</td>
<td>↑↑</td>
<td>↓</td>
</tr>
<tr>
<td></td>
<td>Hemosiderin</td>
<td>varies</td>
<td>↓</td>
<td>↓</td>
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<tr>
<td></td>
<td>Serous-resorbed</td>
<td>↓</td>
<td>↓</td>
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</tr>
</tbody>
</table>

The main issue of head trauma imaging concerns when to image alert, neurologically normal patients with apparently mild head trauma. This is especially important in the Emergency Department, but the problem arises in the office setting also. Fewer than 1% of these patients will have injuries requiring neurosurgical intervention, but it is imperative that the 1% be identified. Imaging all head trauma patients is impractical, and “the best clinical judgment of first providers” misses about 1/5 of the surgical lesions.

Two clinical algorithms have been widely used to deal with the problem, the Canadian CT Head Rule (CCHR, 2001) and the New Orleans Criteria (NOC, 2000). Both have been subjected to extensive practical testing. Both are reliable: no surgical lesions were missed in thousands of cases.
- The NOC identified a larger number of non-surgical lesions (99% vs 93% for CCHR and 98% for modified CCHR).
- Use of the NOC reduced Emergency Department head scanning by about 25% vs 70% for CCHR and 50% for modified CCHR.
The modified CCHR (see HD-18.1 Head Trauma, CT scan): the amnesia and dangerous mechanism rules are the modified part. Common sense identifies a dangerous mechanism of injury (e.g. high speed vehicular collisions).

The NOC: GCS of 15, absence of headache, no emesis, age < 60, not drug or alcohol intoxicated, no signs of trauma above the clavicles, no post-traumatic seizures, no short-term memory deficits (again, scan if any positive).

Glasgow coma scale: range of total score 3-15.
- Three sections:
  - Best motor response: obeys commands….6, localizes to pain….5, normal flexion….4, abnormal (reflex) flexion….3, extension….2, none….1.
- The Glasgow coma scale is now used universally for trauma and as "neuro vitals".

EVIDENCE BASED CLINICAL SUPPORT
HD- 22 ~ SUSPECTED MS

- MS typically presents with episodic neurological events lasting at least a full day and involving different areas of the CNS. It is diagnosed by recognizing events which indicate dispersion in space (different places in the CNS) and time (events separated by at least a month).
- MRI (but not CT) can be used to prove dispersion in space and time early. There must still be one documented clinical episode regardless of imaging results.
- Over the past several years, there have evolved a series of MRI criteria whose goal is to permit the accurate diagnosis of MS by means more rapid than waiting for subsequent clinical events. Findings on both brain and spinal cord imaging can be used to fulfill these criteria, but spinal cord findings are only useful with certain brain findings. The current incarnation of these diagnostic rules is the McDonald 2005 Criteria.
- The McDonald 2005 Criteria for use of MRI in diagnosis of suspected MS:
  - **Time:** the presence of one new contrast-enhancing lesion identified > 3 months following the initial event OR the presence of one new T2 weighted lesion clearly not related to the previous lesion > 3 months following the previous event. In those centers with neuroradiologic expertise sufficient to repeat the scan with precisely duplicate protocols, cuts, and positioning of the patient, a repeat at > 1 month is permissible, again if it can be known with certainty that the “new” lesion is separate from those seen previously.
  - **Space:** at least 3 of the following 4:
    - One contrast-enhancing lesion or 9 T2 hyperintense lesions.
    - At least one infratentorial lesion (Contrast-enhancing or T2 hyperintense).
    - At least one juxtacortical lesion.
    - At least 3 periventricular lesions.
  - **Spinal cord lesions (space and time)**
    - A cord lesion can count for the infratentorial lesion.
    - A contrast-enhancing cord lesion can count for both a contrast-enhancing brain lesion and an infratentorial lesion.
    - A cord lesion cannot count for a juxtacortical or periventricular lesion.
    - Individual separate cord lesions can each count toward the total of 9 T2 hyperintense lesions (in the 2001 McDonald criteria, only one cord lesion could be counted toward the total).
As a practical matter, this means that spinal cord imaging is more often appropriate under the McDonald 2005 criteria than previously and could always fulfill the time requirement. Still, if no reasonably expectable cord results would result in fulfilling the space requirement also, the diagnostic value of adding cord imaging to the non-diagnostic brain imaging approaches zero.

For instance, with either a fully normal brain MRI or one contrast-enhancing lesion which is not juxtacortical and no other findings, cord imaging is not going to permit the space requirement to be met whatever its results.

- In 2006, Swanton et. al.* proposed a simplified version of these criteria which seems to be as accurate:
  - Dispersion in space is satisfied by at least one T2 lesion (FLAIR included) in at least two of four MS typical regions (juxtacortical, periventricular, infratentorial, spinal cord).
  - Dispersion in time requires a new T2 lesion on a follow-up scan. It is early to evaluate the adequateness of this set of criteria. If they are confirmed, the use of contrast in evaluation for MS will become superfluous.

*J Neurol Neurosurg Psychiatry 2006;77:830-833

- Despite widespread acceptance of the McDonald criteria, there are serious questions regarding them, both because of reliance on short term cohort studies and because of insufficient attention to Bayesian issues concerning how sensitive and specific the criteria are in comparison to clinical diagnosis in these cases—for an experienced clinician, how much certainty do they add and how many errors do they permit or even encourage? The interested reader is referred to careful study of:

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EVIDENCE BASED CLINICAL SUPPORT
HD-23 ~ ESTABLISHED MS

- MRI is widely used to evaluate the effect of treatment on the course of known cases, although the validity of such use has never been established.
- Surveillance standards for established MS patients are uncertain, and sensitivity to the particular situation is needed. The only guidelines published for this have been directed at protocols for medical research, not clinical practice.

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EVIDENCE BASED CLINICAL SUPPORT
HD-28 ~ PITUITARY

- Pituitary microadenomas may be found in about 20% of the normal population and rarely cause visual or neurological symptoms. They are discovered either accidentally or, for the hormonally active ones, if their hormonal activities cause symptoms.

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EVIDENCE BASED CLINICAL SUPPORT
HD-30~GENERAL STROKE/TIA

- About 25% of strokes are preceded by TIA’s, and about 25% of TIA patients will experience a stroke within a year or so of the onset of TIA’s. Roughly ½ of the strokes to come will occur within a week of the warning TIA and ¼ will occur within two days. That means that one new TIA patient in 16 will have a stroke within two days and one in eight, within a week. There is simply not the time to mull over choices and obtain
consultations prior to imaging. This risk is greatest with those with significant large artery atherosclerosis (those who will have positive MRA or CTA of the neck).

- The Stroke Council of the American Heart Association states that evaluation should be completed in a week, and the British NHS has a two week rule (remember that their rule is a RULE not a guideline).
- The exceptions mentioned in the guideline are meant to avert extensive stroke work-ups for Bell’s palsy, post-ictal palsies, migraine, carpal tunnel syndrome, and radial nerve palsies.
- Brain MRI is appropriate in patients who have had a documented non remote stroke whose initial imaging did not include MRI. This aids in identifying stroke subtype, which is helpful for both prognosticating and direction of treatment. Neurological consultants may at times find this useful even in patients whose predicate stroke was more than several months ago, since, among other advantages, MRI’s ability to recognize border zone infarction and small, perhaps asymptomatic secondary infarcts often provides the strongest clue to a cardioembolic origin.
- Vertebralbasilar TIA/stroke is a less urgent situation only because, for now, there is not much we can do to intervene.
- In those of “a certain age” the differential diagnosis of stroke is about 30% each for small vessel cerebrovascular disease, large cervical vessel disease, and cardiogenic embolization. Other causes operate in fewer than 10%.
  - In the young, this is far from true, and therefore different pathways are appropriate.

**EVIDENCE BASED CLINICAL SUPPORT**

**HD-32 ~ SYNCOPE**

- There are few people who have never experienced lightheadedness (near syncope). About one third of adults have fainted once. Few require extensive evaluation. Generally, evaluation should be cardiovascular in nature.
- It is important to remember that syncopal episodes are brief (less than two minutes) and not followed by postictal confusion. Scattered twitching is common during faints and has no diagnostic significance.
- Syncope is misdiagnosed as epilepsy far more often than epilepsy is misdiagnosed as syncope. Generalized tonic-clonic seizures are hard to mistake for anything else.
- Patients are rarely hurt by being misdiagnosed as not having seizures. Their lives are almost always badly hurt by being told they have seizures when they don’t (jobs, insurance, driver's licenses, personal relationships).
- Drop attacks are usually seen in known narcoleptics or in patients above age 50. In men, they are usually from cardiac arrhythmias, but in women much less often so. When they occur as part of narcolepsy, the cause is known and imaging is not indicated.

**EVIDENCE BASED CLINICAL SUPPORT**

**HD-35 ~ NEWER MRI TECHNIQUES**

- **Functional MRI** depends on the BOLD effect (Blood Oxygenation Level Dependent) and on the paramagnetic properties of desoxy-hemoglobin, which enhances relaxation. Activation of an area of brain increases its oxygen consumption. But for about two seconds following activation, its increased oxygen consumption is not matched by increased blood flow and desoxy-Hb accumulates relative to oxy-Hb. An overcorrection follows in which the desoxy-Hb to oxy-Hb ratio falls below baseline, and then at about 5 seconds, baseline ratios are restored. The overall shifts of the ratio are
by about 15%. The equipment must include triggering devices which identify the time of activation, and it requires the patient to be an active participant. Localization of sensorimotor cortex (activities like repetitive finger tapping or having a hand repetitively stroked) and of speech (“say all the words all the words you can thing of that begin with L” or some such) are useful.

- f-MRI is used along with Wada testing to identify language bearing cortex. The Wada test in an invasive technique used to identify the hemisphere dominant for speech. At catheter angiography, amobarbital or another hypnotic is injected into a carotid artery and the patient’s speech is tested. Injection on the speech dominant side will produce a temporary aphasia, but injection on the non-speech related side will not. The Wada test is traditional, but f-MRI offers more precise localization. f-MRI can also be used to identify the primary sensorimotor cortex. Both uses provide for safer and at the same time more extensive neurosurgical procedures.
- F-MRI currently has no established diagnostic utility, but the technique's full usefulness has yet to be determined.
- BOLD signals are weak and more accurately detected in stronger magnetic fields. 3T magnets are clearly more useful for f-MRI.

- **CT perfusion imaging and MRI DWI/PWI:**
  - Immediate thrombolytic treatment of strokes improves outcomes but does have hazards. Without the use of perfusion imaging, it is necessary to limit its use to the first three hours after a stroke occurs, and the briefness of this window of opportunity has severely limited its use. Perfusion imaging permits us to extend that window to 9 hours in a large number of patients with new strokes, and this should greatly expand the usefulness of this treatment.
  - In the hours following a stroke, both CT and MR technology can be used to determine the presence of viable brain tissue at risk (the ischemic penumbra) and compare its extent to that of the infarct core (brain tissue no longer able to survive).
  - Thrombolysis appears to be useful as long as the ischemic penumbra makes up at least 20% of the total infarct size (core + penumbra). CT perfusion and MRI diffusion/perfusion weighted studies seem equally accurate for this in lesions within the middle cerebral territory, which is the most common location of strokes.
  - It is possible that other uses for perfusion imaging will emerge in time.

- **Positional MRI:** while most of the attention has been paid to spinal imaging, there may be a rare indication for this procedure to identify spinal fluid leaks in patients with CSF rhinorrhea in whom conventional imaging has been unsuccessful at identifying the leak site.

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**EVIDENCE BASED CLINICAL SUPPORT**

**HD- 38 ~ HORNER’S SYNDROME**

- Horner’s syndrome is caused by loss of sympathetic innervation of the eye and presents with meiosis (small pupil), mild ptosis, and (variably) loss of sweating on the involved side of the forehead.
- In order to understand the evaluation of this disorder, it is necessary to follow the course of that three neuron chain. The axons of the first neurons travel from hypothalamus through the lateral brain stem to synapse in Clarke’s column in the cervical to upper thoracic spinal cord. The axons of the second neurons travel from there over the lung apex to the stellate ganglion in the neck. The third neuron axons accompany the carotid artery to join the third cranial nerve near the cavernous sinus and enter the orbit through the superior orbital foramen. When the carotid artery bifurcates, the sympathetic fibers
• Mild pupillary asymmetries are very common in normal persons and often can be diagnosed by viewing old photographs. Testing with cocaine eye drops can identify Horner’s syndrome when simpler means fail. Cocaine dilates pupils which have NOT lost their sympathetic innervation, so in Horner’s it will fail to cause full pupillary dilatation (compared to the normal side). A positive cocaine test proves the presence of Horner’s syndrome but does not localize it.

• Involvement of the first neuron, usually by infarction, myelopathy, or a syrinx, will cause Horner’s syndrome associated with other neurological findings, and can be localized by those findings. The evaluation is that of the associated neurological abnormality (stroke, MS, syringomyelia, neurotrauma, etc) as described in the appropriate guideline.

• Lesions of the second neuron generally present with a pure Horner’s syndrome. Facial sweating is usually involved. Apical lung lesions, soft tissue cervical masses, and trauma are the usual causes, and contrast only CT of chest and/or soft tissues of the neck is useful. Since the sympathetic axons arise from multiple spinal segments, spinal disorders very infrequently cause second axon Horner’s syndrome.

• The most common cause of third axon Horner’s syndrome is dissection of the internal carotid artery. Facial sweating is spared. Conjunctival injection, pain radiating from the angle of the jaw to the temple, and contralateral neurological findings may be present. Carotid body tumors can present with a similar syndrome.

• Lesions in the region of the orbital apex or cavernous sinus can cause 3rd neuron Horner’s but they will usually cause other extra-ocular symptoms including ocular pain in addition to Horner’s syndrome.

• Additional clinical features will often identify third axon Horner’s syndrome.
HEAD GUIDELINE REFERENCES

HD- 1 ~ General Guidelines

HD- 2 ~ Contrast Use in Head Imaging

HD- 3 ~ CT and MR Angiography

HD- 4 ~ Screening for Metallic Fragments

HD- 6 ~ Ataxia

HD- 7 ~ Behavioral Disorders in Adults

HD- 8 ~ Chiari and Skull-base Malformation

HD- 9 ~ Facial Palsy (Bell’s Palsy)

HD- 10 ~ Recurrent Laryngeal Palsy
HD- 11 ~ Diplopia

HD- 13 ~ Dementia (including PET in dementia)

HD- 14 ~ Adult Epilepsy/Seizure

HD- 16 ~ Facial Pain/Trigeminal Neuralgia

HD- 16 ~ Headache, Adult
HD- 16.1 ~ New Onset Headaches
HD- 16.2 ~ Migraine and Tension Headaches
- The International Classification of Headache Disorders. 2nd Ed. Cephalgia 2004;24(suppl1):S1-S151.
- Detsky ME, McDonald DR, Baerlocher MO, et. al. Does this patient with a headache have a migraine or need neuroimaging? JAMA 2006;296:1274-1283.

HD- 16.3 ~ Cervicogenic Headache

HD- 16.4 ~ Cluster Headache

HD- 16.5 ~ Low Pressure Headache

HD- 16.6 ~ Chronic Intractable Headaches

HD- 17 ~ Hyperacute Headache, Berry Aneurysm, Subarachnoid Hemorrhage

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**HD- 24.2 Neurofibromatosis, type 1**

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**HD- 24.9 ~ Acoustic Neuroma and Other Cerebellopontine Angle Tumors**

**HD- 24.12 ~ von Hippel Lindau Disease**

**HD- 24.13 ~ PET in Brain Tumor**
- Central Nervous System Cancers. NCCN Practice Guidelines in Oncology v.2.2006.

**HD- 25 ~ Papilledema/Pseudotumor Cerebri**

**HD- 27 ~ Sleep Disorders**

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**HD- 27.2 ~ Sleep apnea**
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HD- 30.1 ~ Initial Imaging

HD- 30.2 ~ Later Imaging
  ➢ ACR Appropriateness Criteria, Focal neurologic deficit 2006

HD- 31 ~ Special Stroke/TIA
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**HD- 35.1 ~ Functional MRI (f-MRI)**

**HD- 35.2 ~ Magnetic Resonance Spectroscopy (MRS)**


**HD- 35.5 ~ CSF Flow Imaging**


**HD- 35.6 ~ CT Perfusion**


**HD- 35.7 ~ Magnetic Resonance Neurography (MRN)**


**HD- 35.10 ~ Magnetic Source Imaging (MSI)**


**HD-36 ~ Optic Neuritis**


**HD-38 ~ Horner’s Syndrome**


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### ABBREVIATIONS for NECK GUIDELINES

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<td>Amyotrophic lateral sclerosis</td>
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<tr>
<td>CT</td>
<td>computed tomography</td>
</tr>
<tr>
<td>ENT</td>
<td>Ear, Nose, Throat</td>
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<tr>
<td>FNA</td>
<td>fine needle aspiration</td>
</tr>
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<td>GERD</td>
<td>gastroesophageal reflux disease</td>
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<tr>
<td>GI</td>
<td>gastrointestinal</td>
</tr>
<tr>
<td>HIV</td>
<td>human immunodeficiency virus</td>
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<tr>
<td>MRI</td>
<td>magnetic resonance imaging</td>
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NECK-1 ~ GENERAL GUIDELINES

- Advanced imaging of the neck covers the area from the skull base, nasopharynx, and upper oral cavity to the head of the clavicle.
  - Neck imaging includes the parotid glands and the supraclavicular region.
  - Neck imaging includes the skull base; thus a separate CPT code for head imaging in order to visualize the skull base is not necessary.
- Neck CT is usually obtained with contrast only (CPT 70491). Little significant information is added by performing a neck CT without and with contrast (CPT 70492), and there is the risk of added radiation exposure, especially to the thyroid. Neck CT without contrast (CPT 70490) can be difficult to interpret due to difficulty identifying the blood vessels.
  - Exception: Contrast is not generally used when evaluating the thyroid gland with CT scan, since contrast may cause intense and prolonged enhancement of the gland which interferes with radioactive iodine nuclear medicine studies.
- Neck CT is indicated in the majority of cases to evaluate pathology in the neck when advanced imaging is appropriate. Indications for neck MRI are much less common.
  - MRI neck without and/or with contrast is also appropriate when there are concerns about CT contrast as in renal insufficiency or contrast allergy.

NECK-2 ~ CEREBROVASCULAR AND CAROTID DISEASE

- See in Head guidelines:
  - HD-3 CT and MR Angiography
  - HD-17 Hyperacute Headache/Berry Aneurysm/Subarachnoid Hemorrhage
  - HD-30 General Stroke/TIA
  - HD-31 Special Stroke/TIA
  - HD-32 Syncope
  - HD-33 Cerebral Vasculitis
  - HD-34 Vertigo
  - HD-38 Horner’s Syndrome
  - HD-46 Tinnitus
- See PVD-3 Cerebrovascular and Carotid Disease in Peripheral Vascular Disease guidelines

NECK-3 ~ DYSPHAGIA

- Dysphagia (difficulty swallowing) can be caused by anything that affects the body’s ability to move food, liquid, or saliva from the mouth to the pharynx and into the esophagus.
- A wide range of etiologies, including weak tongue or cheek muscles, neurological disability from stroke, ALS, neuromuscular disease, or Alzheimer's disease, medication side-effects, decreased function of the esophageal sphincter due to advanced age, esophageal spasm, benign strictures, or cancer, can cause dysphagia.
- Barium swallow, chest x-ray, and endoscopy should be the initial imaging studies obtained to evaluate dysphagia.
- Abnormalities seen on the above studies can be further evaluated with CT or less commonly, MRI.
• GI, ENT, Neurology or Thoracic surgery specialist consultation is helpful in determining the appropriate imaging pathway.
• Reference: British Journal of Nursing 2006;13(10):558-561

**NECK- 4 ~ ESOPHAGUS**

- Symptoms of dysphagia, odynophagia (painful swallowing), or regurgitation should be evaluated initially with barium swallow, chest x-ray, and endoscopy.
- Patients who present with hematemesis (including hematemesis from suspected Mallory-Weiss tear in the distal esophagus caused by severe vomiting) should be evaluated initially with endoscopy.
- Advanced imaging is not routinely indicated to evaluate patients with hiatal hernia.
  - **Exception:** chest CT with contrast (CPT 71260) and abdominal CT with contrast (CPT 74160) can be obtained for preoperative planning in patients with large hiatal hernias or paraesophageal hernias.
  - Postoperative advanced imaging is not routinely indicated unless the patient has signs/symptoms of a potential complication from surgery.
- Advanced imaging is not routinely indicated to evaluate patients with gastroesophageal reflux disease (GERD) unless requested as a preoperative study in patients undergoing Nissen fundoplication or other surgical treatment for the reflux.
  - Postoperative advanced imaging is not routinely indicated unless the patient has signs/symptoms of a potential complication from surgery.
  - Advanced imaging in patients with Barrett’s esophagus is not indicated unless biopsy shows frank malignancy.
- Suspected foreign body obstructing the esophagus should be evaluated with x-ray, contrast study such as barium or Gastrografin study, and endoscopy.
- Suspected esophageal stricture due to any cause (e.g. radiation, peptic stricture from reflux, lye stricture, neoplastic, postoperative, drug-induced, Crohn’s disease, Schatzki’s ring at the squamocolumnar junction, esophageal web) should be evaluated initially with barium swallow and endoscopy.
- Esophageal perforation
  - Associated with high morbidity and mortality
  - Esophageal endoscopy accounts for the vast majority of esophageal perforations.
  - Esophageal perforations occur most commonly at the distal esophagus and in the posterior wall of the cervical esophagus.
  - Chest x-ray should be obtained initially and can show subcutaneous emphysema, pneumomediastinum, or prevertebral air.
  - Contrast study using water-soluble contrast such as Gastrografin should be performed. If no perforation is seen, repeat contrast study using barium should be done.
  - Neck CT and/or chest CT with contrast (CPT 70491 and 71260) can be performed to evaluate for abscess.
- Motility Disorders:
  - Suspected motility disorders such as aperistalsis, achalasia, diffuse spasm, nutcracker esophagus, and scleroderma should be evaluated by barium swallow and manometry. Advanced imaging is not routinely indicated.
- Esophageal Diverticulum
  - Pulsion and traction diverticula can occur.
  - Midesophageal diverticula are usually traction in origin (contain both mucosal and muscular layer).
Zenker’s (pharyngoesophageal) and epiphrenic diverticula are usually pulsion (mucosa only).
- Initial evaluation includes barium swallow, endoscopy, and manometry studies.
- CT scan of the neck and/or chest (contrast as requested) can be performed for further evaluation if needed.

**Leiomyoma**
- Most common benign esophageal neoplasm.
- 60% of leiomyomas occur in the distal third of the esophagus, 30% in the middle third, 10% in the upper third.
- Usually solitary, but multiple leiomyomas can occur.
- Appears as a filling defect on barium swallow, but mucosa is normal on endoscopy since the leiomyoma is a submucosal lesion.
- Neck CT and/or chest CT with contrast (CPT 70491 and/or 71260) or MRI (CPT 70543 and/or 71552), and endoscopic ultrasound are helpful in evaluating this lesion and for preoperative planning.

- Other esophageal masses should undergo evaluation with barium swallow, endoscopy, and biopsy prior to considering advanced imaging.
- Esophageal Carcinoma—See ONC-8 Esophageal Cancer in the Oncology guidelines.
- Reference:

**NECK- 5 ~ CERVICAL LYMPHADENOPATHY**

- Causes of cervical lymphadenopathy can be divided into two categories:
  a) Inflammatory
  b) Neoplastic

  - **Inflammatory**
    - Inflammatory lymph nodes from acute lymphadenitis are usually painful, tender and mobile, frequently associated with upper respiratory infection, pharyngitis or dental infection.
    - Occasionally, sarcoidosis or toxoplasmosis and HIV can cause inflammatory lymphadenopathy.
    - Painful acute lymphadenopathy and other painful neck masses (including neck “swelling”) should be treated with a trial of conservative therapy, including antibiotics if appropriate.
      - If there is Improvement with conservative treatment, advanced imaging is not indicated.
    - Ultrasound can be helpful in determining whether a distinct mass/abnormality is present

  - **Neoplastic lymphadenopathy**
    - Most common causes are metastasis from head and neck tumors and lymphoma.
    - Neoplasm should be suspected in patients over age 40.
    - ENT evaluation and/or a thorough head and neck examination including laryngoscopy, if indicated, should be performed initially.
    - CT neck with contrast (CPT 70491) is helpful in determining an association with underlying structures, determining the full extent of the lesions, and to identify other pathologic lymph nodes.
    - Chest x-ray should be performed to identify primary lung disease, involvement of mediastinal lymph nodes or other metastases.
CT chest with (CPT 71260) or without (CPT 71250) contrast may be appropriate if x-ray findings are abnormal or unclear.

Left supraclavicular enlarged lymph nodes are worrisome for metastasis from a chest, abdominal, or pelvic primary. Biopsy is helpful to determine the primary source of a metastatic lymph node in this region.

- References:

**NECK- 6 ~ NECK MASSES**

- The age of a patient with a neck mass can narrow the diagnostic possibilities:
  - **Patients under age 20:** higher incidence of congenital lesions.
  - **Patients over age 40:** malignancy is a greater possibility, especially in heavy drinkers and smokers.

- Location of the neck mass is important.
  - Anterior portion of the neck is associated with thyroid and parathyroid disorders.
    - Neck masses that are located on the anterior neck should have ultrasound performed as the initial imaging study.
  - Lateral portions of the neck are associated with lymphadenopathy, branchial cleft cysts, and deep neck abscess.
    - If the neck mass is located on the lateral or posterior neck and is described as a definite, nontender, discrete mass on physical examination, neck CT with contrast (CPT 70491) can be performed.

- Reference:

- Patients who present with symptoms such as significant dyspnea, stridor, or dysphagia should be referred to the Emergency Department for immediate evaluation and treatment.

- Advanced imaging is not indicated in patients who present with uncomplicated pharyngitis or tonsillitis.
  - ENT evaluation can be helpful in determining the need for advanced imaging.

- Patients who present with suspected peritonsillar, retropharyngeal, or other head and neck abscesses should have neck CT with contrast (CPT 70491).

- For possible neck masses or fullness of the neck that is not well described on physical examination, ultrasound or ENT evaluation can be helpful in making decisions regarding the need for advanced imaging.

- Patients with a history of malignancy who present with a neck mass should have neck CT with contrast (CPT 70491) as the initial imaging study.

- CT of the neck without contrast (CPT 70490) is typically indicated in the setting of suspected salivary duct or gland stone.
  - CT of the neck with contrast (CPT 70491) may be useful if obstructing calculus and inflammatory disease is suspected.
  - Sialogram under fluoroscopy, CT sialogram (CPT 70486), or MR sialogram (CPT 70540), may be performed to rule out a stone.
In patients with a suspected parotid gland mass, ENT evaluation can be very helpful in determining the most appropriate diagnostic algorithm, including the use of advanced imaging.

- CT scan (usually CPT 70487 or 70488 if stone is also being ruled out; some ENT’s prefer CPT 70492) or MRI (CPT 70543) may be useful in determining a diagnosis.
- MRI of the neck without and with contrast (CPT 70543) is indicated when ultrasound or CT scan suggests neurogenic tumor (schwannoma, neurofibroma, glomus tumor, etc.), or if CT scan suggests the need for further imaging. MRI is also useful in evaluating vascular malformations and angiofibromas.
- Although CT and MRI scan can have characteristic appearances for certain entities, biopsy and histological diagnosis are the only way to obtain a definitive diagnosis.

### NECK- 7 ~ MALIGNANCIES INVOLVING THE NECK

- See in Oncology guidelines:
  - ONC-2 Squamous Cell Carcinomas of the Head and Neck
  - ONC-3 Salivary Gland Cancers
  - ONC-6 Thyroid Cancer
  - ONC-8 Esophageal Cancer
  - ONC-26 Lymphomas

### NECK- 8 ~ RECURRENT LARYNGEAL PALSY

- See HD- 10 Recurrent Laryngeal Palsy in the Head guidelines

### NECK- 9 ~ THYROID AND PARATHYROID

- All requests for advanced imaging in patients with thyroid or parathyroid disease should be sent for Medical Director review.
- Ultrasound and nuclear medicine scan are the preferred initial imaging studies for suspected thyroid masses. If ultrasound shows a dominant mass, fine needle aspiration (FNA) should be the next diagnostic study.
  - Repeat FNA with ultrasound guidance should be done for non-diagnostic results on initial biopsy, as there is up to a 10% false negative rate, especially for very small, very large (> 3 cm), and cystic masses.
- Neck CT (CPT 70490 or 70491) can be obtained as a preoperative study in patients in whom resection is planned.
  - Contrast is not generally used when evaluating the thyroid gland with CT scan since contrast may cause intense and prolonged enhancement of the gland which interferes with radioactive iodine nuclear medicine studies.
- Incidental thyroid nodules found on imaging (ultrasound, CT, or MRI) can be followed by ultrasound. FNA is indicated if there is concern for malignancy.
- Nuclear medicine Sestamibi study of the parathyroid gland is the preferred initial imaging study in patients with suspected parathyroid disease (high serum calcium and high serum parathyroid hormone level).
  - MRI has good sensitivity and positive predictive value for imaging non-ectopic and ectopic abnormal parathyroid glands and is generally used in patients with recurrent or persistent hyperparathyroidism following neck exploration.*
  
- CT or MRI is useful in patients with very high calcium (greater than or equal to 13) suggesting parathyroid carcinoma.
- Neck and chest CT without contrast (CPT 70490 and 71250) are sufficient to evaluate a suspected substernal goiter (i.e. a major portion of the goiter lies within the mediastinum). The vast majority of these goiters can be resected through a cervical incision.

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<td>• The initial imaging studies for evaluating patients with suspected tracheal pathology include plain x-ray and bronchoscopy.</td>
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<td>• Neck CT with contrast (CPT 70491) or without contrast (CPT 70490) and chest CT with contrast (CPT 71260) or without contrast (CPT 71250) can be performed to further evaluate abnormalities seen on other imaging studies.</td>
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<td>• CT is often not helpful in making the diagnosis of tracheomalacia, and cineradiography and bronchoscopy are the imaging studies of choice.*</td>
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Evidence Based Clinical Support
NECK- 6 ~ NECK MASSES

- Most lateral neck masses are enlarged lymph nodes.
- Other entities in the differential diagnosis include branchial cleft cyst, abscess, laryngocele, lipoma, neurinoma, glomus tumor, paraganglioma, and fibroma.
- Adults over age 40 presenting with a cystic neck mass can have cystic metastases from occult squamous cell primaries. Neck CT scan, FNA, and panendoscopy of the head and neck should be performed.
- 25%-45% of extracranial schwannomas occur in the head and neck and usually present as asymptomatic solitary neck lesions.
- The most common ENT manifestations of sarcoidosis are neck masses, parotid masses, and facial nerve palsy. Cervical adenopathy is usually bilateral with mobile, nontender lymph nodes. Neck CT scan and biopsy are needed for diagnosis.
REFERENCES
NECK GUIDELINE REFERENCES

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<td>abdominal aortic aneurysm</td>
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<td>ACE</td>
<td>angiotensin-converting enzyme</td>
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<td>AIDS</td>
<td>acquired immune deficiency syndrome</td>
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<td>AVM</td>
<td>arteriovenous malformation</td>
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<tr>
<td>BI-RADS</td>
<td>Breast Imaging Reporting and Database System</td>
</tr>
<tr>
<td>BP</td>
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<tr>
<td>BRCA</td>
<td>tumor suppressor gene</td>
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<td>deep venous thrombosis</td>
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<td>HRCT</td>
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<td>LCIS</td>
<td>lobular carcinoma in situ</td>
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<td>RODEO</td>
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<td>SPN</td>
<td>solitary pulmonary nodule</td>
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<td>SVC</td>
<td>superior vena cava</td>
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CH-1 ~ GENERAL GUIDELINES

- A recent complete history and physical examination should be performed prior to considering advanced imaging of the chest.
- Chest x-rays should be overread by a radiologist prior to request for advanced imaging.
- Intrathoracic abnormalities found on chest x-ray, fluoroscopy, abdominal CT scan, or other imaging modalities can be further evaluated with chest CT with contrast (CPT 71260).
- Non-contrast chest CT (CPT 71250) can be used for the following:
  - Patient has contraindication to contrast
  - Follow-up of pulmonary nodule(s)
  - High Resolution CT (HRCT)
  - Noncontrast CT is specifically requested by pulmonary specialist
  - Other circumstances as specified in the guidelines
- Chest CT without and with contrast (CPT 71270) does not add significant diagnostic information above and beyond that provided by chest CT with contrast, unless a question regarding calcification needs to be resolved.

CH-2 ~ SUPRACLAVICULAR REGION

- Also see NECK-1 General Guidelines in the Neck guidelines
- A complete history and physical examination, including palpation of the supraclavicular region, should be performed initially in the evaluation of a suspected supraclavicular mass or abnormality.
  - The sensitivity of palpation, CT, and ultrasound for detecting supraclavicular metastases were 33%, 83%, and 100%, respectively.\(^1\)
  - In one study, lymph nodes had to have a diameter of 22.3 mm or greater to be palpated in 50% of cases.\(^1\)
\(^1\) Radiology 2004;232:75-80
- Given the high false positive and false negative results of palpation alone, ultrasound should be performed in order to confirm the presence of enlarged lymph nodes or other mass prior to considering advanced imaging.
  - Ultrasound has the added advantage of allowing ultrasound-guided fine needle aspiration (FNA) for histologic diagnosis of a suspicious lymph node or mass.*
\(^*\) Radiology 2004;232:75-80
- If ultrasound is indeterminate, soft tissue neck CT with contrast (CPT 70491) or chest CT with contrast (CPT 71260) can be performed. Either study images the supraclavicular region equally well if done correctly.*
- Definitive diagnosis of a supraclavicular abnormality requires biopsy (FNA or open biopsy).
CH- 3 ~ CHRONIC COUGH

- Chronic cough is defined as a cough that lasts at least eight weeks.
- Information provided for patients with chronic cough should include a complete list of current medications, smoking history, history of recent upper respiratory infection, and history of cancer.
- All patients must first be evaluated with a recent chest x-ray (overread by a radiologist).
- Current or past cigarette smokers with a history of chronic smoker's cough should be asked if the cough has changed. If no change in cough and chest x-ray is unremarkable, no further imaging is indicated.
- Chest CT with contrast (CPT 71260) is indicated in a current or past smoker with a change in cough (other than improvement) or a new onset cough lasting greater than 4 weeks.
- Patients taking medications known to cause coughing (e.g. ACE inhibitors) should have medication discontinued. If cough persists > 4 weeks, chest CT with contrast (CPT 71260) or without contrast (CPT 71250) is indicated.
- Patients with no history of smoking and clear chest x-ray should undergo the following algorithm.1,2
  o A 3 week trial of antihistamine and decongestant treatment should be performed initially.
  o If chronic cough persists after treatment of upper airway cough syndrome, asthma should be ruled out with bronchoprovocation challenge (e.g. methacholine challenge, exhaled nitric oxide test) and spirometry should be performed.
  o If bronchoprovocation challenge is not available, an empiric trial of corticosteroids should be performed.
  o If cough persists, treatment of gastroesophageal reflux disease should be started and referral to a cough specialist is helpful.
  o If cough persists, chest CT (either with contrast [CPT 71260] or without contrast [CPT 71250] can be performed.

1Can Fam Physician 2002 Aug;48:1311-1316
2Chest 2006;129:1S-23S

CH- 4 ~ CHRONIC NON-CARDIAC CHEST PAIN

- Defined as recurrent episodes of unexplained retrosternal pain in patients lacking a cardiac abnormality after a reasonable evaluation.*
  *Chiropractic and Osteopathy 2005;13:18
- This guideline addresses all types of chronic non-cardiac chest pain (chest wall pain, pleuritic pain, retrosternal pain, etc.).
- Chronic pain generally persists for 6 months or more.
- More than half of patients with no organic cause for chest pain continue to experience chest pain one year after discharge from the hospital. European J of Emergency Medicine 1997;4:72-80
- Common etiologies include musculoskeletal, esophageal (e.g. reflux disease), and panic disorder.
  o Esophageal angina: Approximately 10%-20% of patients with GERD present with symptoms that are clinically indistinguishable from angina pectoris.
Clinical features that may suggest the esophagus as the source of the atypical pain include: posturally aggravated symptoms, history of dysphagia, substernal pain limited to the midline and radiating to the interscapular area.


- 25%-50% of chest pain presentations in ambulatory settings may be musculoskeletal.
  - Musculoskeletal pain is a diagnosis of exclusion.
  - Some patients with Thoracic Outlet Syndrome can present with anterior chest wall or parascapular pain. *
  - *Also see CH-32 Thoracic Outlet Syndrome*

- Chest x-ray should be performed initially and overread by a radiologist.
- Abnormalities present on chest x-ray that were not present on previous imaging studies (if available) can be further evaluated with chest CT with contrast (CPT 71260).
- If chest x-ray is unremarkable, a thorough cardiac (EKG, echocardiogram, stress test), GI (trial of anti-reflux medication, possible upper endoscopy, pH probe, esophageal manometry), and pulmonary (PFT’s) evaluation should be performed at least once.
- If the above evaluations have not yielded an explanation for the chest pain, the chest pain has been present for greater than 6 months, and the patient has had a recent chest x-ray (within 2 to 4 weeks), then chest CT with contrast (CPT 71260) can be performed.
- Repeat advanced imaging of the chest in patients with unchanged symptoms is not appropriate.

---

**CH-5 ~ HEMOPTYSIS**

- The patient’s history should help determine the amount of blood and differentiate between hemoptysis, pseudohemoptysis, and hematemesis.
- Most common etiologies for hemoptysis:
  - Adults: Bronchitis, bronchogenic carcinoma, pneumonia
- Work up:
  - Careful history and physical examination and chest x-ray.
  - Low risk patient with normal chest x-ray: treat on an outpatient basis with close monitoring and antibiotics if indicated.
  - Patients with risk factors for malignancy (e.g. male sex, age >40, smoking, duration of hemoptysis >1 week): chest CT with contrast (CPT 71260) should be performed even if chest x-ray is normal.
- Reference:
- In the non-trauma patient with a history of clinically documented hemoptysis, chest CT (either with contrast [CPT 71260] or without contrast [CPT 71250] depending on physician preference) is indicated prior to bronchoscopy.* *AJR 2002;179:1217-1224

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**BRONCHIAL TREE**

**CH-6 ~ BRONCHIECTASIS**

- Bronchiectasis is defined as localized, irreversible dilatation of bronchi >2 mm in diameter. Patients have excessive mucus production.
- Bronchiectasis is associated with a wide range of disorders, including cystic fibrosis,
AIDS, alpha 1-antitrypsin deficiency, rheumatoid arthritis, obstruction of the bronchi, and necrotizing bacterial infections.

- Chest x-ray and PFT’s should be performed initially in patients with known or suspected bronchiectasis, but may be normal.
- High resolution chest CT scan (HRCT) without contrast (CPT 71250) is the advanced imaging study of choice to confirm the diagnosis of bronchiectasis and/or evaluate patients with known bronchiectasis who have worsening symptoms or worsening PFT’s.
- There is no published data to support performing routine follow-up advanced imaging of the chest in the absence of new or worsening symptoms or worsening lung function studies in patients with known bronchiectasis.
- MRI is not used to evaluate patients with bronchiectasis.
- Patients with bronchiectasis who present with hemoptysis should undergo chest CTA (CPT 71275).
- Reference:

LUNG PARENCHYMA (ALPHABETICAL ORDER)

CH- 7 ~ ASBESTOS EXPOSURE

- Chest x-ray must be performed initially in patients with suspected asbestos-related lung disease.
- In patients with stable calcified pleural plaques seen on chest x-ray, no advanced imaging of the chest is indicated.
- If a change is seen on chest x-ray, high resolution chest CT (HRCT) (CPT 71250) can be performed.
- Patients with progressive pleural and parenchymal changes are at particularly high risk of developing malignant mesothelioma and should have HRCT (CPT 71250) every 3 to 6 months.

CH- 8 ~ CHRONIC OBSTRUCTIVE PULMONARY DISEASE (COPD)

- COPD includes a spectrum of diseases: asthmatic bronchitis, chronic bronchitis, and emphysema.
- Typical presenting symptoms include cough, excess mucus, dyspnea on exertion, and/or wheezing.
- Diagnosis is best made by performing spirometry (PFT’s).¹
  - In addition, chest x-ray and arterial blood gas measurement should be performed.¹
  - Chest CT without contrast (CPT 71250), high resolution chest CT without contrast (CPT 71250), or chest CT with contrast (CPT 71260) can be performed if emphysema is suspected and the above initial studies are indeterminate.
  - Chest MRI is generally not indicated in the evaluation of COPD.
  - Patients with a family history of emphysema or chronic bronchitis should have a spirometry test as part of their initial evaluation.*
- There is no published data to support performing routine follow-up advanced imaging of...
the chest in patients with COPD in the absence of new or worsening symptoms or worsening lung function studies.

**CH- 9 ~ INTERSTITIAL DISEASE**

- High resolution chest CT scan (HRCT) without contrast (CPT code 71250) is the diagnostic modality of choice to evaluate for interstitial changes in patients with pulmonary symptoms and abnormal pulmonary function studies (PFT’S). Chest x-ray may be normal in some cases of interstitial lung disease and PFT’s are the best indicator of the need for HRCT.
- Evaluation by a Pulmonologist is helpful in determining the need for advanced imaging.
- HRCT can be performed in patients with known interstitial pneumonia, idiopathic pulmonary fibrosis, or other interstitial lung disease if there are new or worsening pulmonary symptoms or worsening PFT’s.
- HRCT can be performed once a year in patients with known idiopathic pulmonary fibrosis (IPF) who are asymptomatic or have stable symptoms and PFT’s, if imaging results showing progression or regression of disease will change patient management.*

**CH- 10 ~ MULTIPLE PULMONARY NODULES**

- More than 6 nodules usually indicates inflammatory lung disease, and this has been confirmed after years of follow-up.*
  *Chest 2004;125:1522-1529
- Clustering of multiple nodules in a single location in the lung tends to favor an infectious process, although a dominant nodule with adjacent small satellite nodules can be seen in primary lung cancer.*
- In patients with multiple pulmonary nodules, the largest nodule should be imaged based on Ch-14 Solitary Pulmonary Nodule guidelines listed below.
- If infection is highly suspected in a patient with multiple pulmonary nodules, the first follow-up chest CT (CPT 71250 or 71260) can be performed sooner than 3 months.

**CH- 11 ~ PNEUMONIA**

- Chest x-ray (overread by a radiologist) must be performed initially in all patients with suspected pneumonia prior to considering advanced imaging.
- Chest CT with contrast (CPT 71260) may be helpful in evaluating a patient with pneumonia that has shown no improvement by chest x-ray after two weeks or has not cleared by chest x-ray after four weeks.
- Chest CT with contrast (CPT 71260) is indicated when chest x-ray shows a possible complication of pneumonia (e.g. abscess, effusion) or possible lung mass associated with the infiltrate.

**CH- 12 ~ POSITIVE PPD or TUBERCULOSIS (TB)**

- Chest CT with contrast (CPT 71260) can be performed in patients with positive PPD skin test or other positive tuberculin skin tests and normal chest x-ray who have not had a previous normal chest CT.
- Chest CT can show evidence of tuberculosis (e.g. primary complexes, mediastinal or hilar lymphadenopathy) in up to 20% of patients with unremarkable chest x-rays.*
Evidence of tuberculosis on chest CT will alter clinical management and result in full multi-drug treatment for these patients rather than single drug treatment for positive PPD.

- If chest CT is unremarkable, there is insufficient data to support performing subsequent chest CT scans unless symptoms develop or chest x-ray shows a new abnormality.
- Follow-up chest CT with contrast (CPT 71260) can be used to re-evaluate patients undergoing active treatment for tuberculosis who had abnormalities seen only on chest CT.
  - The frequency of the follow-up chest CT scans should be at the discretion of the pulmonary specialist following the patient, as there are no published guidelines or evidence-based data addressing this issue.
- Patients with suspected complications or progression of tuberculosis (e.g. pleural tuberculosis, empyema, mediastinitis) can be evaluated with chest CT with contrast (CPT 71260).

### CH-13 ~ SARCOID

- Also see ONC-28.5 Sarcoidosis in the Oncology guidelines and HD-33.3 Sarcoidosis in the Head guidelines.
- CT of the chest either with contrast (CPT 71260) or without contrast (CPT 71250) is superior to chest x-ray in establishing the diagnosis of sarcoid. CT scan helps differentiate sarcoid from other granulomatous disorders, especially tuberculosis, and allows follow-up for the detection of complications, especially fibrosis.*
- Patients with suspected sarcoid should have chest CT either with contrast (CPT 71260) or without contrast (CPT 71250) to establish or rule out the diagnosis.
- Chest CT (either with or without contrast) is indicated in patients with worsening symptoms, new symptoms after a period of being asymptomatic, or if a treatment change is being considered.
- There is currently insufficient evidence-based data to support the routine use of PET in evaluating sarcoidosis.

### CH-14 ~ SOLITARY PULMONARY NODULE (SPN)

- A pulmonary nodule seen on an imaging study other than a dedicated chest CT (e.g. nodule seen on abdominal CT, spine MRI, chest or coronary artery CTA, etc.) can be further evaluated with one chest CT without contrast (CPT 71250) or with contrast (CPT 71260).
  - Follow-up imaging should proceed based upon the following guidelines in CH-14 Solitary pulmonary nodule.
- A solitary pulmonary nodule (SPN) can be imaged by chest CT without contrast (CPT 71250) or with contrast (CPT 71260) (depending on physician preference) if there has been an increase in size on chest x-ray, if there are no old films for comparison, or if the lesion does not have classically benign characteristics by chest x-ray or previous CT (e.g. benign calcification pattern typical for a granuloma or hamartoma).
- If the SPN was identified on a prior CT, then CT without contrast (CPT 71250) or with contrast (CPT 71260) (with thin cuts through the nodule) can be performed as follows:1-5
  - Nodules less than 5 mm (0.5 cm): repeat CT scan at 1 year.
• Nodules 5 to 6 mm (0.5 to 0.6 cm): repeat CT scan at 6, 12, 24 months
• Nodules >7 mm (0.7 cm): repeat CT scan at 3, 6, 12, 24 months

1Radiology 2004;231:164-168
2Radiology 2005;237:395-400
3National Lung Screening Trial
4American College of Chest Physicians guidelines 2003
5International Symposium on Multidetector-Row CT, San Francisco, 2005

• Patients with a personal history of malignancy that would reasonably metastasize to the lungs or mediastinum who are found to have pulmonary nodules of any size can have repeat chest imaging at 3, 6, 12, and 24 months.
• A nodule that grows at a rate consistent with cancer (doubling time 30 to 360 days) should be sampled for biopsy or resected.*
  *Chest 2004;125:1522-1529
• No further imaging is necessary if a nodule has been stable for 2 years.
• A linear or essentially two-dimensional opacity that does not have an approximately spherical component is not a nodule.
• Purely linear or sheet like lung opacities are unlikely to represent neoplasms and do not require follow up, even when the maximum dimension exceeds 8 mm (0.8 cm).*
  *Radiology 2005;237:395-400
• Nodular opacities and/or thickening that are typical of scarring do not require follow-up advanced imaging and do not require imaging with contrast for further delineation.*
  *Radiology 2005;237:395-400
• Lesions that have a ground glass opacity component may require longer follow-up time than 2 years to exclude indolent adenocarcinoma.1 These cases should be sent for Medical Director review.
  • Approximately 34% of nonsolid nodules are due to malignancy.2
  • Although most cancerous nodules are solid, partly solid nodules are most likely to be malignant.2
    ➢ Likelihood of malignancy is 63% for partly solid nodule, 18% for nonsolid nodule, and 7% for solid nodule.3
      1Radiology 2005;237:395-400
      2Radiology 2006;239:34-49
      3AJR 2002 May;178(5):1053-1057
• PET scan (CPT 78812 or 78815) is appropriate for the characterization of an SPN if the lesion is a distinct parenchymal lung nodule (not an infiltrate, ground glass opacity, or hilar enlargement) measuring greater than or equal to 7 mm (0.7 cm) on chest CT scan.
  • NOTE: Certain payers consider PET scan investigational for evaluating pulmonary nodules ≤1 cm or lung masses >4 cm. Their coverage policies will take precedence over MedSolutions’ guidelines. Prior authorization does not guarantee payment of the study.
  • If PET scan is negative, chest CT should be performed at 3, 6, 12, and 24 months.*
    *Radiology 2006; 239:34-49
• Serial PET scans to evaluate lung nodules are not appropriate: if the original PET is positive, biopsy should be performed. If the original PET is negative but subsequent chest CT shows increase in size of the nodule, biopsy should be performed. *
    *Radiology 2006; 239:34-49
PLEURA (ALPHABETICAL ORDER)

CH-15 ~ PLEURAL-BASED NODULES and OTHER ABNORMALITIES

- A pleural-based nodule or lesion seen on an imaging study other than a dedicated chest CT (e.g. nodule or lesion seen on chest x-ray overread by a radiologist, abdominal CT, spine MRI, chest or coronary artery CTA, etc.) can be further evaluated with one chest CT without contrast (CPT 71250) or with contrast (CPT 71260).
  - If CT scan shows findings consistent with a benign process (round atelectasis, scarring, apical thickening, etc.), no follow-up advanced imaging is indicated.
  - “Round atelectasis”: twisting or folding of the lung which becomes adherent to the adjacent pleura.
  - If the abnormality cannot be read as benign, repeat chest CT (CPT 71250 or 71260) can be performed using the guidelines for SPN:
    - Nodules less than 5 mm (0.5 cm): repeat CT scan at 1 year
    - Nodules 5 to 6 mm (0.5 to 0.6 cm): repeat CT scan at 6, 12, 24 months
    - Nodules >7 mm (0.7 cm): repeat CT scan at 3, 6, 12, 24 months
- Nodular opacities and/or thickening that are typical of scarring do not require follow-up advanced imaging and do not require imaging with contrast for further delineation.*
- There is no evidence-based data to support performing PET scan in patients with pleural-based nodules or lesions.

CH-16 ~ PLEURAL THICKENING

- Pleural thickening may be the residual effect of inflammatory processes, including pneumonia with parapneumonic effusion, empyema, hemothorax, asbestos exposure, talc exposure, rheumatoid lung disease, radiation therapy, and drugs.
- May occur due to infiltration of the pleura by malignant tumors such as mesothelioma or metastatic adenocarcinoma.
- May occur due to localized fibrous tumor of the pleura (LFTP)
  - LFTP’s exist in benign and malignant forms with the benign form occurring seven times more frequently than the malignant form.
  - Etiology of LFTP’s is unknown.
  - If LFTP is suspected due to a chest x-ray abnormality, chest CT with contrast (CPT 71260) or chest MRI without and with contrast (CPT 71552) can be performed.
  - Histologic examination is needed for a definitive diagnosis.
  - Treatment is resection.
  - Reference:
- Localized pleural thickening often occurs at the lung apices with increasing age, forming a pleural cap. Unless the patient is at high risk for malignancy or tuberculosis, no advanced imaging is indicated.
- Patients with suspected pleural thickening seen on chest x-ray (overread by a radiologist) can have chest CT with contrast (CPT 71260) or high resolution chest CT without contrast (CPT 71250) for further evaluation.
  - If the chest CT shows pleural plaques or findings consistent with asbestosis, follow-up imaging guidelines described in CH-7 Asbestos exposure should be followed.
  - If CT scan shows findings consistent with a benign process (round atelectasis, scarring, apical thickening, etc.), no follow-up advanced imaging is indicated.
  - If there is concern for malignancy or a definitive diagnosis is desired, then pleural
biopsy should be performed by thoracoscopy or open biopsy.

- Serial advanced imaging of pleural thickening is not indicated unless patients have a known diagnosis such as asbestos-related disease, silicosis, or tuberculosis that is causing progressive pleural changes.

**DISORDERS INVOLVING THE PLEURAL SPACE (ALPHABETICAL ORDER)**

### CH- 17 ~ PLEURAL EFFUSION

- Chest x-ray (including lateral decubitus films) should be performed initially in patients with suspected pleural effusion.
- In patients with large pleural effusions, thoracentesis and analysis of the pleural effusion (cytology, culture, cell count, biochemical studies) to distinguish transudative vs exudative should be performed prior to considering advanced imaging.
- The most common causes of pleural effusions in the United States are congestive heart failure, bacterial pneumonia, malignancy (esp. lung cancer, breast cancer, and lymphoma), and pulmonary emboli.
- If the pleural effusion is transudative and the etiology has been established (e.g. congestive heart failure, cirrhosis, nephrotic syndrome, peritoneal dialysis), advanced imaging of the chest is rarely indicated.
- If the pleural effusion is exudative, chest CT with contrast (CPT 71260) can be performed after as much fluid as possible has been removed by thoracentesis.
  - There is little utility to obtaining chest CT in a patient with a large effusion prior to thoracentesis, since the fluid will obscure the underlying lung parenchyma.
  - Pleural biopsy is indicated for unexplained exudative effusions, most of which are found to result from malignancy or tuberculosis.
- Reference:

### CH- 18 ~ PNEUMOTHORAX/HEMOTHORAX

- Advanced imaging of the chest is rarely indicated in the diagnosis or management of pneumothorax.
- If the diagnosis of a small pneumothorax is in doubt, and the presence of a pneumothorax will affect patient treatment decisions, then noncontrast chest CT (CPT 71250) can be performed.
- Patients with trauma significant enough to raise suspicion for hemothorax should be evaluated in the Emergency Department.
- Chest CT with contrast (CPT 71260) can be performed as a preoperative study in patients undergoing pleurodesis or other invasive procedure for pneumothorax.
- There is no data supporting the use of serial chest CT scans to follow patients with known hemothorax who are asymptomatic or have stable symptoms.
- Chest CT with contrast (CPT 71260) can be performed in patients with suspected complications from hemothorax (e.g. empyema).
- Chest CT with contrast (CPT 71260) can be performed as a preoperative study in patients undergoing surgical evacuation for hemothorax.
MEDIASTINUM

CH-19 ~ MEDIASTINAL LYMPHADENOPATHY

- See PET-17.3 Generalized Lymphadenopathy and Mediastinal Abnormalities in the PET guidelines.
- Mediastinal abnormalities detected on chest x-ray (overread by a radiologist) can be further evaluated by chest CT with contrast (CPT 71260).
- Mediastinal masses identified on screening chest CT scans should be approached conservatively.
  - In the I-ELCAP study which involved almost 30,000 individuals who received screening chest CT scans, 123 (1%) had a mediastinal lesion, but only 4 were cancers.*
    *Imaging Economics 2005 Feb, p.37
- If chest CT shows one or two enlarged lymph nodes in the mediastinum with no other abnormalities in a patient at low risk for malignancy and with no clinical suspicion for malignancy, follow up chest CT (CPT 71260) at 4 to 8 weeks can be performed.
  - Requests for additional CT scans or for PET should be sent for Medical Director review.
- If chest CT shows multiple enlarged lymph nodes in the mediastinum, then either follow up chest CT (CPT 71260) can be performed at 4 to 8 weeks, or lymph node biopsy should be considered to obtain a histologic diagnosis.
- Lymphadenopathy from neoplasms as well as from benign sources of inflammation can result in a positive PET scan. Therefore, the use of PET may not be helpful prior to histologic diagnosis.
- If biopsy can only be accomplished by mediastinoscopy or thoracoscopy/thoracotomy (i.e. percutaneous biopsy, transbronchial biopsy, transbronchial biopsy using endobronchial ultrasound, and endoscopic ultrasound-guided FNA cannot be performed), and a negative PET scan will allow the patient to be observed, then PET can be considered to confirm the likelihood of yielding a pathologic diagnosis and to determine if a more favorable site for biopsy exists.
- PET may be helpful in characterizing anterior mediastinal abnormalities, especially since the thymus gland has a characteristic uptake pattern on most PET scans, and the study may differentiate normal or benign hypertrophic thymus tissue from pathologic mediastinal lesions.

CH-20 ~ MEDIASTINAL MASS

- Chest CT with contrast (CPT 71260) is the imaging study of choice to evaluate mediastinal abnormalities.
- Chest CT with contrast (CPT 71260) is indicated to evaluate a widened mediastinum on a chest x-ray (overread by a radiologist).
- Chest CT (either with contrast [CPT 71260] or without contrast [CPT 71250]) is indicated in patients diagnosed with myasthenia gravis in order to rule out a thymoma. Note: iodinated contrast has been reported to provoke myasthenia crisis.
  - Also see PN-6.1 Neuromuscular Disease in Peripheral Nerve Disorders guidelines and Thymoma in ONC-9 Other Thoracic Tumors in the Oncology guidelines
- Patients with a suspected substernal goiter should have a neck ultrasound or radionuclide study first to confirm extension of the thyroid to the sternum.
• In patients who present with dysphagia and no history of prior malignancy, barium swallow should be performed initially (see NECK-3 Dysphagia in the Neck guidelines).

CHEST WALL AND RIBS (ALPHABETICAL ORDER)

CH-21 ~ CHEST TRAUMA

• Rib Fracture
  o A complete history and physical examination, including palpation of the chest, should be performed initially in patients with chest trauma and suspected rib fracture.
  o A recent chest x-ray, including erect posteroanterior (PA) and oblique views should be performed prior to considering advanced imaging.
  o Suspicion of an occult rib fracture is not an indication for chest CT.
  o If the patient remains symptomatic, repeat plain x-rays of the ribs should be obtained. These may show signs of early healing of a rib fracture.
  o If the diagnosis is still uncertain, bone scan is indicated. A delay of several days should be allowed after an acute trauma to increase the sensitivity of bone scan to detect rib fracture(s).
  o Patients with multiple new rib fractures can undergo chest CT without contrast (CPT 71250) or with contrast (CPT 71260) to rule out any associated intrathoracic pathology.
  o Routine follow-up advanced imaging of rib fractures is not indicated.

• Fracture of the Sternum
  o Injury to the sternum or suspected fracture of the sternum should be evaluated initially with lateral and oblique x-rays centered on the sternum.
  o If the diagnosis is still uncertain, chest CT without (CPT 71250) or with contrast (CPT 71260) can be performed.
  o If a new sternal fracture is found, cardiac evaluation with ECG, cardiac enzymes, and rhythm monitoring should be performed to rule out significant arrhythmia due to blunt cardiac trauma.
  o Routine follow-up advanced imaging of sternal fractures is not indicated.

• Reference:

• Imaging of the Abdomen and Pelvis in Patients with Chest Trauma
  o If there was no significant trauma involving the abdomen or pelvis, and a careful physical examination, laboratory studies, and urinalysis do not raise suspicion for abdominal or pelvic pathology, no advanced imaging of the abdomen or pelvis is indicated.

CH-22 ~ COSTOCHONDritis

• Inflammatory process of the costochondral or costosternal joints that causes localized pain and tenderness. More than one site is affected in 90% of cases.
• The 2nd to 5th costochondral junctions are most commonly involved.
• Pain is usually described as follows:
  o Worse with movement of the trunk, deep breath, and/or exertion
  o Decreases with change of position
  o Sharp, nagging, aching, or pressure-like
  o Usually localized but may radiate extensively
May wax and wane

- Physical examination with palpation of the chest should be performed initially.
  - Pain with palpation of the affected costochondral joints is a constant finding in costochondritis.
  - The diagnosis should be reconsidered if there is absence of local tenderness to palpation.
- Chest x-ray should be the initial imaging study to rule out other pathology.
- Bone scan is sometimes performed to confirm the diagnosis of costochondritis or if infection of the costochondral joint is suspected.
- If signs, symptoms, and physical examination are consistent with costochondritis, advanced imaging is not indicated.
- If pain persists despite treatment with rest and anti-inflammatory medication, work-up should proceed as described in CH-4 Chronic Non-cardiac Chest Pain.

**Reference:**


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**CH-23 ~ CHEST WALL MASS**

- Chest x-ray should be performed initially to rule out intrathoracic pathology, evaluate the presence of calcification in the mass and rule out bony destruction of the chest wall.
- If chest x-ray shows a suspicious intrathoracic abnormality, chest CT with contrast (CPT 71260) can be performed.
- If chest x-ray does not show a suspicious intrathoracic abnormality, but there is a palpable chest lesion that is not clinically consistent with a lipoma or simple skin lesion, then chest MRI without and with contrast (CPT 71552) is the advanced imaging modality of choice. Chest CT with contrast (CPT 71260) is acceptable if MRI cannot be performed.
- If lipoma or simple skin lesion is high on the differential diagnosis list, then evaluation by a surgeon or dermatologist is helpful in determining the need for advanced imaging.
  - Lipomas are one of the most common chest wall lesions.
  - The preferred imaging technique for evaluating lipomas depends on the clinical question.
    - If the study is being performed to diagnose a mass as a lipoma, noncontrast chest CT (CPT 71250) is sufficient and enables specific recognition of fat and is faster than MRI.
    - If surgical removal of the lesion is planned and the lesion is large, infiltrating, or near important neurovascular structures, chest MRI (contrast as requested) can be performed.
  - Reference

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**CH-24 ~ PECTUS EXCAVATUM and PECTUS CARINATUM**

- See also PACCH-10 in the Pediatric Chest guidelines
- Initial evaluation of patients with suspected or known pectus excavatum (ribs and sternum grow abnormally producing a concave or caved-in appearance in the anterior chest wall), pectus carinatum (anterior protrusion of the chest wall), or other deformities of the chest wall or sternum should include a complete history and physical examination and plain chest x-rays.
- Chest CT without contrast (CPT 71250) can be performed in selected cases of
asymmetric pectus excavatum if significant cardiac displacement and rotation is suspected, or for preoperative planning.

- ECG and echocardiography should be performed initially in patients with cardiac symptoms or evidence of abnormalities of cardiac function.
- Recent chest x-ray and PFT's should be performed initially in patients with known pectus who present with increasing shortness of breath.

**Reference:**

## BREAST

### CH-25 ~ BREAST ABNORMALITIES

- Mammography, ultrasound, and percutaneous biopsy should be used to screen for breast cancer in the general population.
- Ultrasound should be used to differentiate cysts from solid lesions.

#### CH-25.1 Breast MRI

- **Computer-aided detection (CAD) for breast MRI:**
  - The Category III code 0159T went into effect July 2006 and covers CAD. It is to be used in conjunction with 77058 (unilateral breast MRI) or 77059 (bilateral breast MRI).
    - It is not appropriate to use the 3D rendering codes (CPT 76376 or CPT 76377) when requesting breast MRI with CAD, since 3D rendering is included in the CPT code for CAD (CPT 0159T).
  - CAD is intended to improve the specificity of MRI in detecting or measuring malignant tissue and in reducing the time needed to interpret breast MRI images.
  - Although preliminary studies appear promising, there have been no large, prospective studies showing that CAD definitively improves the sensitivity, specificity, and recall rates of breast MRI.
  - Therefore, the use of CAD with breast MRI should be considered investigational at this time.

- **Indications for MRI of the breast** (can be unilateral [CPT 77058] or bilateral [CPT 77059] per physician request):
  - Evaluate or confirm breast implant rupture
    - Patients with silicone breast implants can have a surveillance breast MRI at 1, 2, 4, 6, 8, and 10 years after the silicone implant(s) were placed to rule out leakage per the current FDA recommendations.
    - If leakage is detected on MRI, the implant(s) should be removed.
    - Once the implant(s) have been removed, no further surveillance MRI of the affected breast(s) is indicated.
    - **NOTE:** Certain payers do not include breast implants in their coverage policies if the breast implants were placed as part of purely cosmetic surgery. Thus, surveillance MRI scans in these patients would also not be included in the coverage policy. Their coverage policies will take precedence over MedSolutions’ guidelines. Prior authorization does not guarantee payment of the study.
  - Screening study for patients with BRCA 1 or BRCA 2 mutation or patients with a first degree relative with BRCA mutation (if patient has not been tested).
  - Screening study beginning at age 30 for high risk patients, defined as 20%-25% or
greater lifetime risk of developing breast cancer:

- Two or more first degree relatives (parent, sibling, child) with breast or ovarian cancer
- One first degree relative with breast cancer or ovarian cancer diagnosed before age 50
- One first degree relative with bilateral breast cancer or both breast and ovarian cancer
- History of breast cancer in a male relative
- Ashkenazi Jewish women from families with onset of breast cancer before age 40
- Li-Fraumeni Syndrome and first degree relatives
- Cowdan and Bannayan-Riley-Ruvalcoabe Syndromes and first degree relatives
- Women with history of radiation to the chest between ages 10 and 30.
- The American Cancer Society recommends that screening with breast MRI be performed in facilities that have the capability to perform MRI-guided breast biopsies.

References:

- CA Cancer J Clin 2007;57:75-89

- Patients in whom mammography, ultrasound, and clinical findings are inconclusive and no focal finding is apparent (e.g. spontaneous single duct nipple discharge, diffuse microcalcifications, extensive cysts or fibroadenomas, silicone injections, subtle architectural distortions, etc.)*
  

- Preoperative staging in patients with newly-diagnosed, biopsy-proven breast cancer (including DCIS and LCIS), particularly infiltrating lobular cancer and tumors with extensive intraductal component
  
  A recent study found that breast MRI detected cancers in the contralateral breast that were not detected by clinical exam or mammogram in 30 of 969 women*
  

- Assess response to neoadjuvant chemotherapy for locally advanced breast cancer
  
  If no pre-chemotherapy breast MRI was performed, then a post-chemotherapy MRI should not be performed, as the findings will be too confusing.*
  
  *Huff JG. Clinical Applications of Breast MRI: Current Indications and Examples. Presented at: Identification and Management of Breast Cancer, October 6, 2007; Nashville, TN

- Assessment of residual tumor load in patients who have undergone lumpectomy and have close or positive margins for residual disease

- Detect tumor recurrence in the lumpectomy site to differentiate post-operative scar versus tumor recurrence

  **NOTE:**
  
  - Breast MRI in the first 12 months after surgery has poor sensitivity and specificity due to post surgical edema, hemorrhage, inflammation, scarring, and fat necrosis.*
  
  It is advisable to wait 6 to 12 months after chemotherapy before performing breast MRI. MRI prior to this time may give misleading results, as cancers may exhibit benign appearing kinetics.*

  - It is advisable to wait 6 to 12 months after radiation before performing breast
MRI. MRI prior to this time may give misleading results due to edema, architectural distortion, and cancers may exhibit benign appearing kinetics.*

- Hormonal replacement (other than low dose) may have a significant effect on breast MRI enhancement patterns and specificity. If there is an unacceptable amount of physiologic enhancement on MRI, it may be necessary to stop hormone replacement for several months and repeat the MRI.*
- It is unknown how hormonal therapy for breast cancer affects breast MRI.*

*Huff JG. Clinical Applications of Breast MRI: Current Indications and Examples. Presented at: Identification and Management of Breast Cancer, October 6, 2007; Nashville, TN

1. Evaluate suspected cancer recurrence in reconstructed breast tissue
   - See NOTE in previous bullet point.
2. Rule out chest wall recurrence
   - See NOTE in previous bullet point
3. Guide biopsy of lesions seen only on MRI
   - A diagnostic breast MRI (CPT 77058 or 77059) often needs to be performed prior to MRI-guided breast biopsy, especially if the biopsy is being performed at a different facility than the original breast MRI.
   - However, if breast MRI is being performed solely to guide a breast biopsy (i.e. a diagnostic breast MRI is not being performed), then the breast MRI portion of the procedure is included in the CPT code for the MRI-guided procedure (CPT 77021) and requests for CPT 77058 or 77059 are inappropriate.
4. Evaluate patients who present with axillary metastases suspicious for primary breast cancer with negative physical exam and negative mammogram (MRI detects breast cancer in 90%-100% of cases if tumor is indeed present)
5. Breast MRI should not be used for routine surveillance in patients with a history of breast cancer, including DCIS, unless the patient has dense breasts or extensive scar tissue that causes the mammogram to be uninterpretable.
   - Breast MRI may be indicated when there is suspicion of recurrence and clinical and/or mammographic and ultrasound findings are inconclusive.
6. Currently, there is insufficient data to support the use of breast MRI for breast cancer screening in women with breast implants, lobular carcinoma in situ, atypical hyperplasia, or mutations other than BRCA.*

References:

- CA Cancer J Clin 2007;57:75-89

There is insufficient data to support using serial MRI studies to follow patients with mammographic abnormalities. The first MRI should be able to characterize a lesion as probably benign or as suspicious. The probably benign lesion (MRI BI-RADS 3) should undergo repeat mammography and repeat MRI in 6 months. The suspicious lesion should be biopsied.

A solid lesion found on mammogram/ultrasound can be observed and followed with repeat mammogram/ultrasound in 6 months if the lesion is a low-risk, probably benign lesion (includes the following: <15 mm, three or fewer lobulations, more than 50% of the lesion margin appears well-circumscribed in any view).

- Lesions not fitting all of the above criteria should be considered indeterminate and the patient should be referred for surgical evaluation for biopsy.*

• In the evaluation of BI-RADS category 3 lesions, MRI did not provide additional information (low positive predictive value [33.3%]) and was similar to that of short interval (6-month) mammography follow-up.*
  *Eur J Radiol 2006 Mar;57(3):436-444

• Bilateral total breast ultrasound and bilateral axillary ultrasound are recommended for patients who have BI-RADS 4 or 5 abnormalities. If additional suspicious breast lesions or more extensive malignant breast disease is detected by ultrasound, the extent of disease can be mapped with ultrasound-guided biopsies.*

• A breast mass categorized as BI-RADS 4 or 5 should be biopsied.*
  *ACR Appropriateness Criteria, Nonpalpable Breast Mass, Updated 2005

• The sensitivity of MRI in evaluating mammographically detected suspicious microcalcifications was only 87% with specificity 68%. The sensitivity of MRI for DCIS was 79%.* Therefore, biopsy of these lesions is warranted rather than MRI.
  o Some DCIS is only seen on MRI, therefore MRI-guided biopsy is appropriate in these cases.
  *AJR 2006 Jun;186(6):1723-1732

• A report from The Agency for Healthcare Research and Quality (AHRQ) Effective Health Care Program concluded that none of the four commonly used noninvasive tests for breast abnormalities (MRI, ultrasound, PET, scintimammography) are sufficiently accurate to preclude breast biopsy in average risk women with nonpalpable breast lesions. The data were insufficient to estimate the accuracy of these tests in women with only palpable lesions.*

• Also see ONC-10 Breast Cancer in the Oncology guidelines

• RODEO MRI: Rotating Delivery of Excitation Off-resonance MRI
  o High resolution 1.5T MRI system designed specifically for the breast. Utilizes a unique fat suppression technology which provides greater detail about a lesion including distance, length/width, area, surface area, and volume without the distraction of fat tissue in the image. This reduces signal from normal ductal tissue and avoids false positive enhancement from benign lesions and dense fibroglandular tissue.
  o With current MRI techniques on a non-RODEO MRI, multiple MRI sequences give similar results to those obtained on a RODEO MRI
  o There is no unique CPT code or different reimbursement for breast MRI scans performed using the RODEO system, and the indications for breast MRI are no different (see Indications for MRI of the Breast above).

CH-25.2 Nipple Discharge/Galactorrhea

• Mammogram should be obtained. Ultrasound may be helpful to locate a duct papilloma, an intraductal nodule, or dilated duct.

• The appearance of the fluid generally correlates with the etiology:
  o Yellow, brown, green, or gray fluid is associated with fibrocystic change in most patients.
  o Purulent discharge can result from duct ectasia or partial duct obstruction.
  o Pathologic discharges are usually bloody, blood-containing, or sometimes watery and usually are unilateral and involve a single duct.
  ➢ Patients with bloody or unilateral watery discharge should have a mammogram,
with or without an ultrasound and referral to a surgeon is recommended.*


- Physiologic discharges are usually bilateral, involve multiple ducts, are multicolored or milky, sticky, and are stimulated rather than occurring spontaneously.

- Prolactin and TSH levels should be obtained. A prolactinoma typically causes a milky or clear discharge bilaterally.
  - Imaging of the pituitary is not necessary in patients with galactorrhea and normal prolactin levels.
  - See HD-28.1 Prolactinomas in the Head guidelines

- Bloody or, less commonly, watery discharge raises the possibility of cancer (cancer accounts for 8%-15% of bloody nipple discharges), although most hemoccult-positive discharges are due to a benign etiology such as intraductal papilloma (45%), duct ectasia (36%), and infection and other causes (5%-10%).
  - Ductogram and duct excision can be considered. A papilloma should be resected by lumpectomy or vacuum-assisted lumpectomy.
  - Ductogram and duct excision can be considered. A papilloma should be resected by lumpectomy or vacuum-assisted lumpectomy.
  - Breast MRI is not indicated*

*Lawson LL. State of the Art Diagnosis of Breast Abnormalities: From Clinical Exam to MRI. Presented at: Identification and Management of Breast Cancer, October 6, 2007; Nashville, TN

- If mammography and endocrine studies are normal, observation and clinical re-evaluation should be performed. If clinical evaluation at the time of follow-up does not reveal any palpable or visible abnormalities, the patient should return to routine screening interval studies with mammogram or clinical exam.

- Reference:

**CH-25.3 Breast Pain**

- Three classifications:
  - Cyclic mastalgia: occurs in premenopausal women and is clearly related to the menstrual cycle.
  - Non-cyclic mastalgia: intermittent or continuous pain that is not related to the menstrual cycle. Usually occurs in older women.
  - Non-mammary pain: may present with the symptom of breast pain. History and physical exam should help differentiate breast pain from pain radiating from the chest wall or another site.

- Evaluation of breast pain:
  - Careful history and physical exam
  - Pregnancy test is generally the only laboratory study that is needed
  - Mammogram/ultrasound

- Advanced imaging is not routinely indicated in patients with breast pain and negative evaluation as outlined above.
  - The risk of malignancy following a negative examination has been estimated to be only 0.5%.

- Reference:
CH-25.4 Newer breast imaging techniques

- **Positron-Emission Mammography (PEM) or Naviscan**: See CH-35
- **Breast MR Spectroscopy**: See CH-36
- **Breast Tomosynthesis**
  - Uses conventional mammographic x-ray tubes, but the x-ray source is movable and swings over the breast in a 50-degree arc, creating 11 discrete images that can be combined or analyzed in many different ways to provide a three-dimensional data set or to create cross-sectional images.
  - There is insufficient data currently to generate appropriateness criteria for the use of breast tomosynthesis, and this procedure should be considered investigational at this time.

- **Scintimammography**
  - Nuclear medicine study that uses a radioisotope such as Tc-99 tetrofosmin to image the breast. Breast cancer typically shows increased uptake of the radioisotope compared to benign lesions.
  - Acts as a “poor man’s MRI” and the indications for scintimammography are the same as for breast MRI.

**THORACIC VASCULAR DISORDERS (ALPHABETICAL ORDER)**

**CH-26 ~ PULMONARY ARTERIOVENOUS FISTULA (AVM)**

- **Definition**: abnormal connection between pulmonary arteries and veins.
- **Etiology**:
  - **Acquired**: penetrating or blunt trauma to the chest; bronchiectasis
  - Pulmonary AVM’s are most commonly found in the lower lobes.
  - Chest x-rays are abnormal in approximately 98% of patients with pulmonary AVM.
    - Chest x-ray usually shows a peripheral, circumscribed, non-calcified lesion connected by blood vessels to the hilum of the lung.
  - Chest CT (contrast as requested) and chest MRA (CPT 71555) or chest CTA (CPT 71275) can be obtained for evaluation of possible pulmonary AVM.
  - First degree relatives of a patient with a pulmonary AVM (not due to trauma or bronchiectasis) can undergo screening with chest CT (CPT 71260).
  - Treatment of pulmonary AVM is by surgery (usually lobectomy) or embolization of the feeding artery using platinum coils or detachable balloons.
- **References**:

**CH-27 ~ PULMONARY EMBOLISM (PE)**

- Patients who present with severe findings and dyspnea (including heart rate >100 beats/minute along with systolic BP<90, syncope, new onset right heart failure) should be referred to the Emergency Department for immediate evaluation and treatment.
- The clinical probability of PE is important in making an accurate diagnosis. An often cited point system (Wells criteria) includes the following:*
  
  *Thromb Haemost 2000;83:416-420
  - Clinical signs/symptoms of DVT (at minimum: leg swelling and pain with palpation of the deep veins) (3 points)
  - No alternate diagnosis likely or more likely than pulmonary emboli (3 points)
  - Heart rate >100 beats/minute (1.5 points)
Immobilization (>3 days) or surgery in last 4 weeks (1.5 points)
- Previous history of DVT or PE (1.5 points)
- Hemoptysis (1 point)
- Cancer actively treated in last 6 months or receiving palliative treatment (1 point)
- Low probability <2 points; moderate 2 to 6 points; high>6 points
- Using the above criteria, only 3% of patients with a low pretest probability had PE versus 63% of those with a high pretest probability.
- Patients with a score higher than 4 points can undergo chest CT (CPT 71260) or chest CTA (CPT 71275)*

*JAMA 2006; 295:172-179

- Pleuritic chest pain can also be a symptom of PE.
- PE is found in 5%-20% of patients who present to the Emergency Department with pleuritic pain.*
  *Am Fam Physician 2007 May;75(9):1357-1364

- Recent history of a long airplane flight or use of birth control pills also increases the risk for PE.
- Evaluation of outpatients with suspected pulmonary embolism should include a consideration for clinical probability of PE using the point chart above as well as the urgent nature of the request, and results of a quantitative D-dimer study. If the clinical score is ≤4 and D-dimer is negative, imaging for PE is generally not indicated.*
  *JAMA 2006; 295:172-179

- Patients with an abnormal D-dimer test should have chest CT with contrast (PE protocol) (CPT 71260) or chest CTA (CPT 71275).
  - NOTE: recent surgery, injury, malignancy, sepsis, diabetes, pregnancy, or other conditions where fibrin products are likely to be present can give a false positive D-dimer result.
- Patients with a normal D-dimer test and low or moderate clinical probability of PE require no advanced imaging, since the negative predictive value approaches 100%.
- In patients with a high clinical probability of PE, chest CT with contrast (PE protocol) (CPT 71260) or chest CTA (CPT 71275) is appropriate.
- Pregnant patients with suspected PE should have D-dimer performed.
  - If there is low clinical pre-test probability for PE and D-dimer is negative, no further work-up is needed.
  - If D-dimer is positive (D-dimer is normally increased in pregnancy and the levels tend to increase as pregnancy goes to term), or if clinical pre-test probability is intermediate or high, lower extremity Doppler study should be performed.
    - If Doppler study is positive, the patient should be treated for PE.
    - If Doppler study is negative, chest CTA (CPT 71275) or chest MRA (CPT 71555) can be performed.
    - If CTA is performed, neonates need to have thyroid functions tested in the first week of life to rule out contrast-induced hypothyroidism.
- Although the use of CTA combined with venous phase imaging (CTA-CTV) for diagnosing PE was found to have a higher sensitivity (90%) than CTA alone (sensitivity 83%),* there is insufficient data at this time to justify routinely performing CTA-CTV in patients with suspected PE.
  - If routine diagnostic testing (including CTA) is inconclusive, and clinical suspicion remains high, then CTA-CTV can be considered.
- Follow-up imaging in patients with known PE:
  - The duration of treatment with anticoagulation in patients with known DVT or PE is
based upon the patient’s history and risk factors and is **NOT** based upon advanced imaging studies (see CH-27 Pulmonary Embolism Evidence Based Clinical Support section).*

*Am Fam Physician 2004 June;69(12):2841-2848

- There is no evidence-based data to support routine follow-up advanced imaging in asymptomatic patients or patients with stable symptoms who have known DVT or PE, including advanced imaging prior to discontinuing anticoagulation therapy.

**PULMONARY HYPERTENSION:**

See PVD- 5 Pulmonary Artery Hypertension Peripheral Vascular Disease guidelines

### CH- 28 ~ SUBCLAVIAN STEAL SYNDROME

- **Definition:** reversal of flow in the ipsilateral vertebral artery distal to a stenosis or occlusion of the proximal subclavian or innominate artery. Blood flows up the contralateral vertebral artery to the basilar artery and retrograde down the ipsilateral vertebral artery to supply collateral circulation to the arm on the side of the subclavian lesion.
- **Symptoms** include vertebral basilar artery insufficiency, vertigo, limb paresis, and paresthesias. Bilateral cortical visual disturbances, ataxia, syncope, and dysarthria occur less frequently.
  - Also see HD-31.1 Vertebrobasilar Ischemia in the Head guidelines.
- **Patients** have a difference in the brachial systolic blood pressure of at least 30 mmHg between the two arms associated with a bruit in the supraclavicular area on the affected side.
- **Symptoms** of cerebral ischemia may be produced by exercise of the affected arm.
- Carotid duplex study should be the initial imaging study in patients with suspected Subclavian Steal Syndrome.
  - Duplex study will show reversal of flow in the ipsilateral vertebral artery.
- **Neck and chest MRA** (CPT 70548 and 71555) or CTA (CPT 70498 and 71275) can be performed for diagnosis if the clinical exam and duplex study are indeterminate, or as preoperative studies if they will substitute for invasive angiography.
- **Upper extremity MRA** (CPT 73225) or CTA (CPT 73206) can be performed if needed to exclude pathology distal to the subclavian artery and if they will substitute for invasive angiography.
- **Treatment options** include ligation of the ipsilateral vertebral artery, aorta-subclavian artery bypass graft, or subclavian endarterectomy.

### CH-29 ~ SUPERIOR VENA CAVA (SVC) SYNDROME

- Chest x-ray and CT of the chest with contrast (CPT 71260) are the initial imaging studies of choice for the evaluation of suspected SVC syndrome.
- MRV (CPT 71555) or CTV (CPT 71275) of the chest may be indicated when stenting of the SVC is being considered.

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• **Aortic Dissection**
  o Suspicion of acute dissection should be handled as a medical emergency. Patients typically present with sharp, severe retrosternal or interscapular chest pain with subsequent migration down the back (ripping or tearing sensation). This occurs in 90% of patients with aortic dissections and usually causes patients to seek medical attention within minutes or hours of onset.
  o In patients with aortic dissection, CTA or MRA of the entire aorta (including arch branches) and extending through the femoral arteries is indicated.
  o Patients with Type A dissection (involving the ascending aorta) require urgent surgical intervention with placement of an aortic graft or endovascular stent graft.
    ➢ **Follow-up imaging after repair of Type A dissection:**
      ▪ In the small number of patients with pure, truly isolated ascending aortic dissection that has been completely repaired, there is no evidence-based data to support routine follow-up imaging.
      ▪ Many patients with Type A dissection also have an aortic arch and descending aortic component to the dissection. In these patients, follow-up imaging should proceed as in patients with Type B dissection.
  o Patients with Type B dissection (involves the descending aorta; usually originates distal to the origin of the left subclavian artery) can usually be treated medically with careful blood pressure control. Surgery is reserved for distal dissections that are leaking, ruptured, or compromising blood flow to a vital organ, or if there is inability to control the blood pressure.
    ➢ **Follow-up imaging in patients with Type B dissection who are being treated medically:**
      ▪ If false lumen is <4.5 cm, routine imaging can be performed every 12 months.
      ▪ If false lumen is ≥4.5 cm, routine imaging can be performed every 6 months.
    ➢ **Follow-up imaging in patients with Type B dissection who underwent surgical procedure:**
      ▪ Routine imaging can be performed at 1 month, 6 months, 12 months, and then every 12 months for patients who have had stent grafts placed or other types of surgical procedures for dissection.
      ▪ The preferred imaging is CTA of chest, abdomen and pelvis (CPT 71275, 74175, and 72191). Alternative advanced imaging studies can be considered based on the thoracic or vascular specialist’s preference.
      ▪ The purpose of routine follow-up imaging is due to the fact that 30%-40% of chronic dissections will become aneurysmal in 5 years and will require intervention. Patency of the false lumen is an independent risk-factor for secondary dilatation of the aorta.*

• **Thoracic Aortic Aneurysm**
  o The normal size of the aortic arch and descending thoracic aorta is 3 cm. The aortic root is normally 3.5 cm.
  o Thoracic aortic aneurysms (TAA) greater than 3 cm can be followed every year by chest CT (contrast as requested), chest MRA (CPT 71555), or chest CTA (CPT 71275).
  o TAA greater than 4 cm can be followed every 6 months by chest CT (contrast as requested), chest MRA (CPT 71555), or chest CTA (CPT 71275). Consultation with a thoracic surgeon is helpful in determining the frequency of imaging.
Consultation with a thoracic surgeon is helpful in determining the frequency of imaging.

Patients with TAA should be screened for AAA using the Abdominal Guidelines (see AB-22 Abdominal Aortic Aneurysm).

Patients with known TAA who present with chest pain or back pain should have chest CT (contrast as requested), chest MRA (CPT 71555), or chest CTA (CPT 71275).

Follow-up imaging in patients who have had open repair or endovascular stent graft repair of TAA:

- If open repair was performed, routine chest imaging can be performed every 3 to 5 years.
- If endovascular graft was placed, routine chest imaging can be performed at 1 month, 6 months, 12 months, and then every 12 months. An additional study can be performed at 3 months if there was evidence of endoleak on the 1 month study.
- Chest imaging can be chest CT (contrast as requested), chest MRA (CPT 71555), or chest CTA (CPT 71275).

Screening guidelines for familial thoracic aortic aneurysm:

- In one study of 520 patients with TAA, an inherited pattern for TAA was present in 21.5% of non-Marfan syndrome patients. The predominant inheritance pattern was autosomal dominant (76.9%) with varying degrees of penetrance and expressivity. Familial TAA's have a relatively early age of onset. Aortic growth rate was highest for the familial group (0.21 cm/year).\(^1\)
- There is no general consensus statement regarding screening of relatives of patients with TAA. The Thoracic Aortic Center at Massachusetts General Hospital recommends that whenever a patient less than 70 years old has an ascending thoracic aortic aneurysm that is otherwise unexplained, all first-degree relatives (parents, siblings, children) should be screened for TAA.\(^2\)
  - Screening studies should include echocardiogram and chest x-ray initially. If these studies are equivocal or do not visualize the ascending aorta adequately, chest CT with contrast (CPT 71260) can be performed.


MISCELLANEOUS

CH-31 ~ ELEVATED HEMIDIAPHRAGM

- The right hemidiaphragm usually sits 1-2.5 cm higher than the left.
- The most common cause of a significant discrepancy between the two hemidiaphragms is focal or diffuse eventration of the higher diaphragm, which occurs more commonly on the left.
- Eventration occurs when the muscular sheet of the diaphragm is replaced by a thin membranous sheet causing elevation of the diaphragm due to upward pressure from the adjacent abdominal viscera.
- Work-up of an elevated hemidiaphragm includes the following:
  - Comparison with previous chest x-rays should be performed initially.
    - If the elevation is an old finding, further evaluation is not indicated.
    - If the elevation is a new finding, work-up to rule out phrenic nerve pathology is indicated.
- Work-up to rule out phrenic nerve pathology:
Interruption of the phrenic nerve anywhere between the neck and the diaphragm results in paralysis of the ipsilateral hemidiaphragm.

Fluoroscopic examination (“sniff test”) should be performed initially to evaluate whether there is true diaphragmatic paralysis versus diaphragmatic weakness.

Common causes of diaphragmatic paralysis include:
- Phrenic nerve injury
- Malignancy involving the phrenic nerve such as lung carcinoma (usually involving the mediastinum or mediastinal lymph nodes) or other mediastinal tumors such as thymoma, lymphoma, or germ cell tumors.

Other thoracic causes of elevated hemidiaphragm include lobar pneumonia, tuberculosis, empyema, substernal thyroid, pulmonary infarction, rib fracture, atelectasis, aortic aneurysm, and radiation treatment.

Elevated hemidiaphragm can also be idiopathic.

Chest CT with contrast (CPT 71260) can be performed in patients with new diaphragmatic paralysis.

If chest CT does not reveal the etiology of the elevated hemidiaphragm, CT abdomen with contrast (CPT 74160) can be performed to rule out liver pathology, subphrenic abscess, or intraabdominal mass.

Repeat advanced imaging studies in the absence of new signs or symptoms are not indicated.

- Reference:

### CH-32 ~ THORACIC OUTLET SYNDROME (TOS)

- Refers to compression of the subclavian vessels and/or brachial plexus at the thoracic outlet of the chest (the area bounded by the two scalene muscles and the first rib).
- Three types of TOS:
  - **Neurogenic TOS** (80% of TOS):
    - Etiologies include an injury causing tearing and spasm in the scalene muscles which then irritate the adjacent nerves.
    - Symptoms include pain and paresthesias (95% of patients) as well as motor weakness and sometimes atrophy of the hypothenar and interosseous muscles (10% of patients).
    - Generally occurs in patients < age 45.
    - Almost never occurs bilaterally.
    - EMG/NCV studies should be performed initially in the evaluation of patients with suspected neurogenic TOS in order to exclude carpal tunnel syndrome.
    - Also see PN-4 Brachial Plexus in the Peripheral Nerve Disorders guideline.
  - **Arterial TOS** (5% of TOS cases):
    - Symptoms include coldness, weakness, easy fatigability of the arm and hand.
    - Emboli from thrombosis in the proximal subclavian artery may travel to the hand, causing distal ischemia.
    - Generally occurs in patients < age 25.
  - **Venous TOS** (also called “effort thrombosis”) (15% of TOS cases):
    - Due to compression of the subclavian vein between the rib and clavicle.
    - Symptoms include arm edema, discoloration of the arm, distention of the superficial veins of the limb and shoulder, and arm pain.
    - Competitive athletes and individuals who repeatedly use their arms overhead are susceptible.
Generally occurs in patients < age 25.

- Neck and chest MRA (CPT 70548 and 71555) or CTA (CPT 70498 and 71275) can be performed to evaluate for arterial or venous TOS.
- Since true TOS is a rare entity and diagnosis is difficult, specialist evaluation by a Vascular surgeon or Thoracic surgeon is helpful in determining the appropriate imaging pathway.
- Reference:

### NEWER IMAGING TECHNIQUES

#### CH-33 ~ VIRTUAL BRONCHOSCOPY

- Virtual bronchoscopy uses multidetector CT with 3D rendering (CPT 71260 and 76377) to generate an image of the tracheobronchial tree down to the level of the sixth- to seventh-generation bronchi, and can visualize areas inaccessible to the flexible bronchoscope.
- There is insufficient data currently to generate appropriateness criteria for the use of virtual bronchoscopy, and this procedure should be considered investigational at this time.

#### CH-34 ~ EM-GUIDED PERIPHERAL BRONCHOSCOPY

- Peripheral bronchoscopy using electromagnetic (EM) guidance on a CT road map is a technology for performing biopsies of peripheral lesions of the lungs. A 3D image of the lungs is generated using CT and transferred to the peripheral bronchoscopy system. The target nodule position is marked by the physician. The next day, the patient is placed on a location board in the procedure room. The location board detects an EM sensor inserted through the working channel of the bronchoscope. When the bronchoscope reaches the target, the working channel is locked in place and the location sensors removed, allowing the physician to biopsy the suspect tissue using the system’s steerable flexible catheter.
- EM-guided bronchoscopy enables biopsies to be performed on regions of the lungs that were formerly very difficult or dangerous to reach.
- Clinical trials are currently underway to evaluate this technique for mediastinal lymph node biopsies.
- Currently this procedure should fall under the classification of CT-guided biopsy (CPT 77012).

#### CH-35 ~ POSITRON-EMISSION MAMMOGRAPHY (PEM) OR NAVISCAN

- High-resolution positron-emission mammography (PEM) by Naviscan PET Systems, also referred to as Naviscan or PET mammography, performs high-resolution metabolic imaging of breast cancer using FDG tracer. The PEM detectors are integrated into a conventional mammography system, allowing acquisition of the emission images immediately after the mammogram.
- Requesting providers often code requests for PEM as CPT 78811 or “PET scan of the breast.”
• The spatial resolution of this technique is at the individual duct level (1.5 mm) and allows visualization of intraductal as well as invasive breast cancers. This technique is especially adept at detecting ductal carcinoma in situ.
• Early clinical trials have shown high clinical accuracy in characterizing lesions identified as suspicious on conventional imaging or physical examination, as well as detecting incidental breast cancers not seen on other imaging modalities.
• There is an ongoing prospective multi-center clinical trial for women with newly diagnosed breast cancer anticipating breast-conservation surgery. These women will undergo both high-resolutions PEM imaging and breast MRI to determine changes in surgical management resulting from PEM or MRI imaging as compared to conventional imaging. The expected completion date of the study is December 2008.*

• There is currently insufficient data to generate appropriateness criteria for this modality, and this procedure should be considered investigational at this time.

References:

CH-36 ~ BREAST MR SPECTROSCOPY

• Breast MR Spectroscopy identifies the presence of choline, which is a strong indicator of malignancy.
• Preliminary studies show that breast MR Spectroscopy can help reduce breast MRI false positives.
• A clinical study from Memorial Sloan-Kettering Cancer Center in New York showed that imaging suspicious breast lesions with both MRI and MR spectroscopy reduced the need for biopsy by 58% without missing any of the resultant cancers. However, only 56 patients were included in the study.*

*Radiology 2006 June;239(3):686-692
• There is currently insufficient data to generate appropriateness criteria for breast MR Spectroscopy, and this procedure should be considered investigational at this time.
Evidence Based Clinical Support
CH-3 ~ CHRONIC COUGH

- The American College of Chest Physicians has updated their evidence-based guidelines on cough. *Chest 2006;129:1-25*
- Chronic cough is defined as a cough that lasts at least eight weeks. One percent of the population is affected by chronic cough, and it is the fifth most common reason for consultation with a primary care physician.
- The most common cause of chronic cough is upper airway cough syndrome which usually follows a viral infection of the upper respiratory tract and usually resolves by 8 weeks.
- In 95% of immunocompetent persons, chronic cough is caused by one of the following: cough variant asthma, upper airway cough syndrome, eosinophilic bronchitis, reflux disease, chronic bronchitis from cigarette smoking, bronchiectasis, or medication side effect (especially ACE inhibitors).
- In the remaining 5%, cough is caused by lung cancer, carcinomatosis, sarcoidosis, left ventricular failure, or aspiration.
- A normal chest x-ray in an immunocompetent patient rules out carcinoma, tuberculosis, sarcoidosis, or bronchiectasis in the majority of patients.
- The cause of chronic cough can be determined in 88%-100% of cases with treatment for specific causes yielding a success rate from 84%-98%.*
  * *New Eng J Med 2000 Dec;343(23):1715-1721*
- Cough variant asthma occurs in almost 50% of all asthma cases, and chronic cough is the only symptom. Methacholine challenge test has a positive predictive value of 88% and negative predictive value of 100%. Cough resolves in 6 to 8 weeks after treatment with beta agonists and steroids.
- Resolution of cough after smoking cessation or stopping medications with cough as a known side effect may take 4 weeks.
- The character of the cough (productive vs dry), timing (night, with meals, etc.) has not been shown to be diagnostically useful.

Evidence Based Clinical Support
CH-7 ~ ASBESTOS EXPOSURE

- The risk of developing pleural disease (mesothelioma) increases with increasing intensity and duration of exposure.
- Rales and low diffusion capacity on PFT’s support the diagnosis of asbestosis.
- The sensitivity and specificity of chest x-ray and high resolution chest CT (HRCT) in detecting pleural lesions are 64.9% and 98.5%, respectively.* However, out of 2,080 patients exposed to asbestos without chest x-ray signs of asbestosis or pleural changes, 13 (0.6%) developed malignant mesothelioma.*
  * *Croat Med J 2003;44(5):618-625*
  * *Scand J Work Environ Health 2003;29(5):388-395*
Sarcoidosis is a systemic disease of unknown etiology that commonly affects young and middle-aged patients with a higher prevalence in women, African Americans, Swedes and Danes.

Symptoms commonly include dyspnea and dry cough. Half of patients are asymptomatic.

Clinical signs include fatigue, weight loss, general malaise, and fever. Treatment can include steroids, Methotrexate, and/or cyclophosphamide.

Ninety percent of patients with sarcoidosis have pulmonary involvement (usually asymptomatic mediastinal lymphadenopathy). 50% of patients present with lymphadenopathy only.

Bilateral hilar lymphadenopathy is the most common radiologic finding and there is frequently an associated pulmonary infiltrate. Mediastinal adenopathy without hilar involvement is rare and sometimes seen in older patients.

Lung involvement occurs in 20% of patients and can include multiple small perivascular nodules, miliary nodules, bronchial wall thickening, or ground glass attenuation.

Sarcoidosis can have spontaneous resolution or progress to fibrosis of lung or other organs.

Sarcoid can involve the heart, eyes (uveitis or lacrimal glands), parotid glands, liver, spleen, kidney and paraaortic lymph nodes (rare).

A solitary pulmonary nodule (SPN) is a lesion less than 3 cm in diameter that is completely surrounded by pulmonary parenchyma. Lesions larger than 3 cm are called lung masses and are often malignant.

An estimated 150,000 SPN’s are identified on chest imaging each year.

The malignancy rate in nodules 1 cm or smaller in the Early Lung Cancer Action Project study was 8%. This study did not include patients with known primary malignancies.

*Lancet 1999;354:99-105

In a Mayo Clinic study, three year follow-up detected lung cancer in 1.4% of all lung nodules found. In nodules less than 7 mm in size, less than 1% were malignant.

*Radiology 2005;235:259-265

In ELCAP II which screened 2,897 subjects, there were zero cancers among 378 subjects whose largest detected nodule was <5mm at baseline. There were 14 cancers among 238 subjects (5.9%) whose largest nodule was 5 mm to 9 mm

*Radiology 2004;231:164-168

Patients with known primary malignancies have a higher rate of malignancy of SPN’s (between 12% and 58% depending on the study).

New nodules discovered on a 1 year repeat CT more frequently contain cancer and at smaller size than on the baseline CT scan.

Infectious granulomas constitute about 80% of the benign lesions, and hamartomas 10%.

A lung nodule that doubles in volume in less than 1 month is uncharacteristic of lung cancer.
• Nodules are considered benign if they resolve, decrease in size, or demonstrate no perceptible growth over 2 years. However, only biopsy with pathological diagnosis can give a definitive diagnosis.

• If a nodule does not grow in volume in 6 months, the risk of malignancy is <10%.*
  *Chest 2004;125:1522-1529

• Malignant nodules have a doubling time of 40 to 360 days. Therefore, CT scan will detect nodule growth in virtually all patients with malignant lesions within 12 months.*
  *Radiology 2003;226:489-493

• The National Lung Screening Trial is an ongoing trial to determine whether there is a mortality benefit from x-ray or CT lung screening.
  o Protocol: If lung nodule <4 mm, annual screening; Lung nodules 4-10 mm, follow up scan at 6, 12, 24 months.

• A false-negative PET scan occurred in 27% of cancers that were 1cm or smaller, in 10% of cancers between 1 to 2 cm, and in 12% of cancers >2cm. AJR 2005;185:126-131

• Current PET technology is likely inaccurate in discriminating nodules smaller than 7 mm. AJR 2005;185:126-131

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**Evidence Based Clinical Support**

**CH-20 ~ MEDIASTINAL MASS**

- The most common primary mediastinal tumors are lymphoma, thymus gland neoplasia, thymus cysts/hyperplasia, and endocrine tumors (mainly goiters).
- Other tumors include germ cell tumors such as mature teratomas, seminomas, and nonseminomatous germ cell tumors. Overall, 43% of mediastinal tumors are malignant and 57% benign.

---

**Evidence Based Clinical Support**

**CH-25 ~ BREAST ABNORMALITIES**

- MRI has an 80%-100% sensitivity for detecting breast cancers, but positive predictive value is only 26%-75%. Therefore, MRI has a high false-positive rate (i.e. low specificity).
- This makes MRI a poor screening device for the general population.
- Dense breasts lower the sensitivity of mammography to detect breast cancer because the cancers are obscured. There is also an independent increased risk (1.8 to 6 times higher) of malignancy in dense breasts.
- In a study of 11,130 women undergoing 27,825 screening exams for breast cancer, mammography was shown to have 98% sensitivity in detecting breast cancer in patients with fatty breasts. The sensitivity decreased to 48% in grade 4 breasts (defined as having tissue that can obscure cancer in >75% of the breast).*
  *Radiology 2002;224:165-175
- In the same study cited above, the sensitivity of ultrasound in detecting breast cancer was 75% in patients with dense breasts. The combined sensitivity of mammography and ultrasound in patients with minimally (grade 2) to extremely dense breasts (grade 4) was 97%. (grade 2: having at least one area of tissue that could obscure cancer; grade 3: having tissue that can obscure cancer in 50% to 75% of the breast).
- In several studies, MRI showed no additional lesions in patients with fatty breasts, but showed additional true positive lesions in 28% of grade 2, 57% of grade 3, and 14% of grade 4 breasts.
Numerous studies have shown the usefulness of breast MRI in the preoperative staging of breast cancer:
- MRI detects intraductal spread more accurately than mammography or ultrasound. Intraductal spread is a principal risk factor for local recurrence.
- In women with biopsy-proven unilateral breast cancer who were considered candidates for breast conservation surgery and had MRI of the ipsilateral breast preoperatively, MRI identified mammographically and clinically occult cancer other than the index lesion in 27% of women.*
  *AJR 2003 April;180(4):901-910
- Screening MRI of both breasts in patients with newly diagnosed breast cancer demonstrated that 15 out of 182 patients (8.2%) had suspicious lesions in the contralateral breast. 7 patients (3.8%) had malignant results on biopsy (7 true positives, 8 false positives).*
  *Radiology 2003 March;226(3):773-778
- Another study found that breast MRI detected cancers in the contralateral breast that were not detected by clinical exam or mammogram in 30 of 969 women with newly diagnosed breast cancer.*
- In 26%-30% of cases, preoperative breast MRI resulted in a change from the planned surgical procedure (e.g. re-excision of the lumpectomy site or planned conservation therapy) to mastectomy, neoadjuvant chemotherapy, biopsy of an additional lesion in the ipsilateral breast or contralateral breast.*
  *AJR 2004 Feb;182:473-480
  *Cancer 2003 Aug;98(3):468-473
- MRI is especially useful in predicting the extent of disease in patients with invasive lobular cancer (ILC) which accounts for 15% of all breast cancers and is more likely to occur in multiple sites and in both breasts.
- MRI is more sensitive in detecting residual cancer in patients who have undergone lumpectomy. Sensitivity 61.2%, specificity 69.7%, positive predictive value 75%, negative predictive value 54.8%.*
  *AJR 2004 Feb;182:473-480
- Tumor recurrence in the lumpectomy site occurs at a rate of 1%-2% per year. In one study, MRI had 100% sensitivity and 88.8% specificity in detecting recurrent breast cancer in patients who had undergone breast conservation surgery and had completed at least one year of radiation therapy. Dynamic MRI is accurate in differentiating post-treatment changes from recurrent carcinoma.*
  *J Am Coll Surg 2004 Feb;198(2):190-197
- MRI can assess the response to neoadjuvant chemotherapy better than physical exam and mammography.
- There is growing consensus regarding which patients should be screened with breast MRI. Experts agree that MRI should be used as an adjunct to mammography and ultrasound rather than replacing these studies.
- The American Society of Breast Disease statement June 2004 (found at http://www.guideline.gov): “At this time there are no data on the use of MRI for breast cancer screening of women at high risk based on personal history of breast cancer, previous chest irradiation, lobular carcinoma in situ, atypical hyperplasia, or mutations other than BRCA”. However, the latest recommendations from the American Cancer Society do recommend screening breast MRI in women who have had chest radiation between the ages of 10 and 30 years old.*
  *CA Cancer J Clin 2007;57:75-89
• It is estimated that 600,000 episodes of pulmonary embolism (PE) occur each year in
  the U.S. resulting in 100,000 to 200,000 deaths.
• The most common signs/symptoms of PE include unexplained dyspnea (>80% of
  patients with PE), unexplained tachycardia, and pleuritic chest pain either with or
  without dyspnea. Also, SaO2 <95% in a nonsmoker with no asthma or COPD.
• 25%-65% of patients with suspected PE have a low clinical probability of embolism.
• In patients with a low pretest probability and a negative D-dimer study, the 3 month
  follow-up rate of PE was 0%.*
  *Arch Intern Med 2002;162:1631-1635
• D-dimer level has a high sensitivity and low specificity for diagnosing PE.
• A number of conditions in which fibrin products are likely to be present often lead to
  false positive D-dimer exams including: patients with recent surgery or trauma,
  malignancy, sepsis, diabetes, GI problems, certain liver and blood disorders,
  pregnancy, and Alzheimer care givers. The exam specificity in these situations is
  approx. 50%.
• Highly sensitive D-dimer assays based on ELISA safely rule out PE in outpatients
  presenting with low clinical probability. However, low sensitivity assays based on latex
  agglutination or whole blood agglutination cannot be used in isolation to rule out PE.
  There is a lack of standardization among assays, which makes them less useful.
  However, newer automated ELISA assays and quantitative latex-agglutination assays
  compare favorably with the manual ELISA. The whole blood agglutination assay is a
  qualitative study.
• 90% of CT angiograms obtained in one hospital were negative for PE. A study was then
  performed with 419 patients evaluated by both quantitative D-dimer and pulmonary
  CTA.
  Conclusion: If the D-dimer was <1.0 micrograms/ml, no CTA should be performed
  unless there is a high clinical suspicion. A 3 month follow up of all patients with D-dimer
  <1.0 micrograms/ml showed that none of the 247 patients had a subsequent acute PE.
  Therefore, if a D-dimer <1.0 micrograms/ml had been used, 60% of the CTA’s could
  have been avoided. If a positive D-dimer threshold is defined as ≥1.0 micrograms/ml,
  the sensitivity and negative predictive value are 100%, specificity is 62% and positive
  predictive value is 17%.*
  *AJR 2004;182:1377-1381
• CT pulmonary angiography (which is largely equivalent to contrasted chest CT scan
  with PE protocol—120cc of i.v. contrast and slice thicknesses of 1.25 mm) has a
  sensitivity of 60%-100% and specificity of 78%-100% in diagnosing PE.*
  *AJR 2004;182:499-504
• CT scan also showed additional potentially significant findings in 30%-78% of patients
  that provided alternative diagnoses to PE. 47% of these findings were not suspected on
  chest x-ray.*
  *AJR 2004;182:499-504
• Most clinical studies predict patients with a high probability of PE based on physical
  exam, chest x-ray, EKG, and ABG. However, these studies are not readily available in
  physicians’ offices.
• The most cost-effective strategies for PE diagnosis are D-dimer level (provided there
  are no risk factors for a false positive exam) followed by spiral CT if the D-dimer is
  positive, or leg ultrasound followed by spiral CT if the ultrasound is negative.* However,
this study estimated that as the sensitivity of CT scan approached 100% and the specificity approached 96%, the most cost-effective strategy became the spiral CT alone. With the advent of multidetector CT scanners, these high sensitivity and specificity levels are being realized.

*Chest 2001;119:1791-1800

- Although V/Q scan is an accurate study in patients in whom there is a clinical suspicion for PE, a normal chest x-ray, and no known chronic pulmonary disease, this study is difficult to obtain quickly, does not provide a substantial cost savings, and does not diagnose other pulmonary pathology if the diagnosis of PE is negative. Thus, many of the patients with low probability V/Q scan would potentially go on to have a chest CT to rule out other pathology.

- The Prospective Investigation of Pulmonary Embolism Diagnosis II trial (PIOPED II) was a prospective, multicenter investigation of the accuracy of CTA alone combined with venous-phase imaging (CTA-CTV) for the diagnosis of acute PE.
  - **Results**: Among 824 patients, sensitivity of CTA was 83%, specificity was 96%. Positive predictive values were 96% with a concordantly high or low probability on clinical assessment, and 92% with an intermediate probability on clinical assessment. Sensitivity of CTA-CTV for PE was 90%, specificity 95%. Both CTA and CTA-CTV were nondiagnostic with a discordant clinical probability.*

- American College of Chest Physicians Recommendations for Long-Term Anticoagulation in Patients with DVT or PE:

<table>
<thead>
<tr>
<th>Thromboembolism</th>
<th>Duration of anticoagulation</th>
<th>Strength of recommendation*</th>
<th>Reference</th>
</tr>
</thead>
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<tr>
<td>First event with a reversible or time-limited risk factor</td>
<td>At least 3 months</td>
<td>A</td>
<td>4</td>
</tr>
<tr>
<td>for venous disease (e.g. trauma, surgery)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>First episode of idiopathic venous thromboembolic disease</td>
<td>At least 6 months</td>
<td>A</td>
<td>4</td>
</tr>
<tr>
<td>Recurrent idiopathic venous thromboembolic disease</td>
<td>At least 12 months</td>
<td>B</td>
<td>4</td>
</tr>
<tr>
<td>or continuing risk factor (e.g. trombophilia)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Symptomatic isolated calf-vein thrombosis</td>
<td>6-12 weeks †</td>
<td>A</td>
<td>17</td>
</tr>
</tbody>
</table>

ACCP= American College of Chest Physicians; DVT = deep venous thrombosis; PE = pulmonary embolism; INR = International Normalized Ratio.

*-ACCP ratings have been converted to American Family Physician’s strength-of-recommendation taxonomy.

†-Serial noninvasive studies of the lower extremities to assess for extension are an option.

Evidence Based Clinical Support
CH-29 ~ SUPERIOR VENA CAVA (SVC) SYNDROME

- SVC syndrome is caused by intrinsic or extrinsic obstruction of the SVC and can be acute or subacute.
- Symptoms of SVC syndrome include head fullness, dyspnea/orthopnea, headache, and dizziness.
- Signs include head swelling, enlarged collateral vessels on the chest wall, facial cyanosis, and arm swelling.
- Malignancies are the etiology in 80%-85% of cases, and lung cancer is the most common cause.
- 15%-20% of cases are due to nonmalignant causes such as mediastinal fibrosis, sclerosing mediastinitis, indwelling central venous catheter, or transvenous pacemaker electrodes.

Evidence Based Clinical Support
CH-30 ~ THORACIC AORTIC DISSECTION OR ANEURYSM

- For confirming or ruling out thoracic aortic dissection, transesophageal echo (TEE), CT, and MRI have equally reliable diagnostic values.*
  *Arch Intern Med 2006;166(13):1350-1356
- Thoracic aortic aneurysms (TAA) occur in the ascending aorta (25%), aortic arch (25%) or descending aorta (50%).
- Risk factors include connective tissue disorders (e.g. Marfan’s or Ehlers-Danlos), atherosclerosis, previous aortic dissection, prolonged hypertension, and trauma.
- Mean age is 65 years old.
- Most patients are asymptomatic until the aneurysm begins to leak or expand. Chest or back pain may indicate acute expansion or leakage.
- 25% of patients with TAA also have AAA.
- The normal diameter of the aorta is 2.5 cm to 3 cm.
- The normal diameter of the aortic root is 3.5 cm.
- The usual size of a TAA is 4 to 5 cm.
- Risk of rupture at 5 years is 0% for TAA less than 4 cm, 16% for diameter 4-5.9 cm, and 31% for aneurysms greater than 6 cm.
- The critical point for rupture or dissection of an ascending TAA is 6 cm (31% risk) and for a descending TAA, 7 cm (43% risk).
- Surgery is usually recommended if the aneurysm is 5.5 cm in the ascending aorta or 6.5 cm in the descending aorta. Ann Thorac Surg 2002;74:S1877-S1880
- Surgery is recommended earlier (when aneurysm is 5 cm) in Marfan’s patients.
- The median size of an ascending aortic or arch aneurysm at rupture or dissection is 5.9 cm.
- All symptomatic TAA’s require surgery or intervention regardless of size.
CHEST GUIDELINE REFERENCES

CH-2~Supraclavicular Region

CH- 3~Chronic Cough

CH- 4~Chronic Non-Cardiac Chest Pain

CH- 5~Hemoptysis

CH- 6~Bronchiectasis

CH- 8~Chronic Obstructive Pulmonary Disease

CH- 9~Interstitial Disease

CH-10~Multiple Pulmonary Nodules

CH-12~Positive PPD or Tuberculosis (TB)

**CH-13~Sarcoid**

**CH-14~Solitary Pulmonary Nodule (SPN)**
- *National Lung Screening Trial*
- *American College of Chest Physicians guidelines 2003*
- *International Symposium on Multidetector-Row CT, San Francisco, 2005*

**CH-15~Pleural-Based Nodules and Other Abnormalities**

**CH-16~Pleural Thickening**

**CH-17~Pleural Effusion**

**CH-19~Mediastinal Lymphadenopathy**

**CH- 21~Chest Trauma**

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CH- 31~Elevated Hemidiaphragm

CH- 32~Thoracic Outlet Syndrome (TOS)

CH- 35~Positron-Emission Mammography (PEM) or Naviscan

CH- 36~Breast MR Spectroscopy

CHEST EVIDENCE BASED CLINICAL SUPPORT REFERENCES

CH- 3~Chronic Cough, Evidence Based Clinical Support

CH- 7~Asbestos Exposure, Evidence Based Clinical Support

CH-14~Solitary Pulmonary Nodule, Evidence Based Clinical Support

**CH-25~Breast Abnormalities, Evidence Based Clinical Support**

**CH-27~Pulmonary Embolism, Evidence Based Clinical Support**
- Abcarian PW, Sweet JD, Watabe JT, Yoon HC. Role of a quantitative D-dimer assay in determining the need for CT angiography of acute pulmonary embolism. *AJR* 2004;182:1377-1381.

**CH-30~Thoracic Aortic Dissection or Aneurysm, Evidence Based Clinical Support**
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<td>ACC</td>
<td>American College of Cardiology</td>
</tr>
<tr>
<td>ACS</td>
<td>acute coronary syndrome</td>
</tr>
<tr>
<td>AHA</td>
<td>American heart Association</td>
</tr>
<tr>
<td>ASCOT</td>
<td>Anglo-Scandinavian Cardiac Outcomes trial</td>
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<tr>
<td>ASD</td>
<td>atrial septal defect</td>
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<tr>
<td>BMI</td>
<td>body mass index</td>
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<tr>
<td>CABG</td>
<td>coronary artery bypass grafting</td>
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<tr>
<td>CAD</td>
<td>coronary artery disease</td>
</tr>
<tr>
<td>CHF</td>
<td>congestive heart failure</td>
</tr>
<tr>
<td>COPD</td>
<td>chronic obstructive pulmonary disease</td>
</tr>
<tr>
<td>CT</td>
<td>computed tomography</td>
</tr>
<tr>
<td>CTCA</td>
<td>computed tomography of coronary arteries</td>
</tr>
<tr>
<td>CTA</td>
<td>computed tomography angiography</td>
</tr>
<tr>
<td>EBCT</td>
<td>electron beam computed tomography</td>
</tr>
<tr>
<td>ECP</td>
<td>external counterpulsation (also known as EECP)</td>
</tr>
<tr>
<td>ECG</td>
<td>electrocardiogram</td>
</tr>
<tr>
<td>ETT</td>
<td>exercise treadmill stress test</td>
</tr>
<tr>
<td>FDG</td>
<td>fluorodeoxyglucose</td>
</tr>
<tr>
<td>LAD</td>
<td>left anterior descending coronary artery</td>
</tr>
<tr>
<td>LDL-C</td>
<td>low density lipoprotein cholesterol</td>
</tr>
<tr>
<td>LV</td>
<td>left ventricle</td>
</tr>
<tr>
<td>LVEF</td>
<td>left ventricular ejection fraction</td>
</tr>
<tr>
<td>MI</td>
<td>myocardial infarction</td>
</tr>
<tr>
<td>MPI</td>
<td>myocardial perfusion imaging (SPECT study, nuclear cardiac study)</td>
</tr>
<tr>
<td>MRA</td>
<td>magnetic resonance angiography</td>
</tr>
<tr>
<td>MRI</td>
<td>magnetic resonance imaging</td>
</tr>
<tr>
<td>mSv</td>
<td>millisievert (a unit of radiation exposure)</td>
</tr>
<tr>
<td>MUGA</td>
<td>multi gated acquisition scan</td>
</tr>
<tr>
<td>PCI</td>
<td>percutaneous coronary intervention (includes percutaneous coronary angioplasty (PTCA) and coronary artery stenting)</td>
</tr>
<tr>
<td>PET</td>
<td>positron emission tomography</td>
</tr>
<tr>
<td>PTCA</td>
<td>percutaneous coronary angioplasty</td>
</tr>
<tr>
<td>SPECT</td>
<td>single photon emission computed tomography</td>
</tr>
<tr>
<td>TEE</td>
<td>transesophageal echocardiogram</td>
</tr>
<tr>
<td>VSD</td>
<td>ventricular septal defect</td>
</tr>
<tr>
<td><strong>Agatston Score</strong>:</td>
<td>a calcium score for the coronary arteries; the only calcium score accepted by MedSolutions</td>
</tr>
<tr>
<td>---------------------</td>
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</tr>
<tr>
<td><strong>Angina</strong>:</td>
<td>principally chest discomfort, exertional (or with emotional stress) and relieved by rest or nitroglycerine (see CD-3.3 Table B1 and definitions)</td>
</tr>
<tr>
<td><strong>Anginal variants or equivalents</strong>:</td>
<td>a manifestation of myocardial ischemia which is perceived by patients to be (otherwise unexplained) dyspnea, unusual fatigue, more often seen in women and may be unassociated with chest pain</td>
</tr>
<tr>
<td><strong>ARVD/ARVC – Arrhythmogenic Right Ventricular Dysplasia/Cardiomyopathy</strong>:</td>
<td>a potentially lethal inherited disease with syncope and rhythm disturbances, including sudden death, as presenting manifestations</td>
</tr>
<tr>
<td><strong>BNP</strong>:</td>
<td>B-type natriuretic peptide, blood test used to diagnose and track heart failure (n-T-pro-BNP is a variant of this test)</td>
</tr>
<tr>
<td><strong>Double product</strong>:</td>
<td>systolic blood pressure times heart rate, generally calculated at peak exercise; over 25000 means an adequate stress load was performed</td>
</tr>
<tr>
<td><strong>Fabry’s Disease</strong>:</td>
<td>an infiltrative cardiomyopathy, can cause heart failure and arrhythmias</td>
</tr>
<tr>
<td><strong>Hibernating myocardium</strong>:</td>
<td>viable but poorly functioning or non-functioning myocardium which likely could benefit from intervention to improve myocardial blood supply</td>
</tr>
<tr>
<td><strong>Moderate exercise</strong>:</td>
<td>the ability of a patient to perform the equivalent of a trot</td>
</tr>
<tr>
<td><strong>Optimized Medical Therapy</strong>: should include (where tolerated):</td>
<td>antiplatelet agents, calcium channel antagonists, partial fatty acid oxidase inhibitors (e.g., ranolazine), statins, short-acting nitrates as needed, long-acting nitrates up to 6 months after an acute coronary syndrome episode, beta blocker drugs (optional), angiotensin-converting enzyme (ACE) inhibitors/angiotensin receptor blocking (ARB) agents (optional)</td>
</tr>
<tr>
<td><strong>Platypnea</strong>:</td>
<td>shortness of breath when upright or seated (the opposite of orthopnea) and can indicate cardiac malformations, shunt or tumor</td>
</tr>
<tr>
<td><strong>Silent ischemia</strong>:</td>
<td>cardiac ischemia discovered by testing only and not presenting as a syndrome or symptoms</td>
</tr>
<tr>
<td><strong>Syncope</strong>:</td>
<td>loss of consciousness; near-syncope is not syncope</td>
</tr>
<tr>
<td><strong>Troponin</strong>:</td>
<td>a marker for ischemic injury, primarily cardiac</td>
</tr>
</tbody>
</table>
| **Uninterpretable electrocardiogram (ECG)**: | (for stress test purposes, this is very often NOT the same as ABNORMAL ECG), a baseline ECG that renders exercise interpretation invalid due to:  
  1. complete LEFT bundle branch block  
  2. ventricular paced rhythm  
  3. pre-excitation patterns such as Wolff-Parkinson-White  
  4. left ventricular hypertrophy with ST segment depression >1mm or any resting ST segment pattern with that change  
  5. patient on a digitalis preparation  
  6. resting heart rate <55 in patients on beta blocker and/or calcium blocker drug  
 Multiple other patterns may be noted (e.g. right bundle branch block, nonspecific ST or T changes, ST elevations), but other than the ECG patterns mentioned above, are considered interpretable. |
| **Volume Score**:   | another type of calcium score under consideration for acceptance |
CD-1.1 General Issues

- Cardiovascular disease imaging is rapidly changing.
- Prior to considering cardiac imaging, there should be recent (within 30 days) clinical evaluation or documented meaningful contact with the patient (preferably with a recent ECG and chest x-ray, if clinically relevant to the evaluation process).
- No test is considered a “gold standard” in cardiac testing, especially in the area of risk stratification.
- Cardiac imaging is used for diagnostic (e.g. surveillance or risk-stratification), or treatment (e.g. in patients with known coronary disease) purposes.
- These guidelines are based upon appropriate imaging in the context of a patient willing to proceed with further imaging, invasive evaluation, or procedures.
  - If the patient has no desire for these, advanced imaging may be curtailed or quite limited.
- These guidelines are based upon using cardiac imaging to answer a specific clinical question that will affect patient management.
  - If the clinical question (e.g. does the patient have coronary artery disease?) has already been answered based upon previous patient evaluation or imaging, then additional cardiac imaging is not indicated.
  - Cardiac imaging is not indicated if the results will not affect patient management decisions.
- Cardiac imaging appropriateness criteria published by professional specialty organizations are not precisely concordant with these guidelines, as there is a large area of “uncertain” benefit for many imaging modalities in the specialty society criteria (i.e. the evidence is substantially incomplete, particularly as it relates to CT coronary angiography and cardiac MRI).
  - Even some of the “appropriate” criteria are open to interpretation, since these criteria are largely consensus-based and not evidence-based.
  - “Appropriateness does not necessarily imply that the test being rated is the initial clinical approach to be taken”*

*J Am Coll Cardiol 2005;46(8):1587-1605

CD-1.2 Risk assessment is an inexact process and always requires judgment as to overall cardiovascular risk.

- Pretest probability of coronary artery disease (CAD) should be assessed initially (see Table B1 in CD-3.3 Patients with No Known CAD Who are Asymptomatic or have Stable Symptoms).
- In general, diseases such as diabetes are considered an equivalent for coronary disease risk and equate to high risk.
- Evidence of peripheral vascular disease such as erectile dysfunction or claudication can be considered as a risk factor.
- Metabolic syndrome is considered a risk factor.
- Patients who have undergone organ transplant are at increased risk for ischemic heart disease secondary to their medication.
- Advanced cardiac imaging is generally not indicated for patients who are considered low or very low risk for CAD.
• **CD-1.3 Chest pain**
  o “Chest pain” is a rather generic term describing any constellation of symptoms that may (or may not) represent coronary disease.
    - Examples include chest pain, chest tightness, burning, dyspnea, shoulder or arm pain, and jaw pain.
  o Using the concept of “chest pain syndrome” rather than chest pain, and initially applying Table B1 in CD-3.3 and the definitions of typical angina, atypical angina, and non-anginal chest pain in CD-3.3 will facilitate evaluation of most cases of “chest pain.”

• **CD-1.4 Exercise Treadmill Stress Test**
  o Positive exercise treadmill stress test (for ischemia) is defined as:
    - ECG ST depression of >1 mm
    - Exception: women over age 45 may have false-positive ST depression
    - exercise-induced angina
    - drop in systolic blood pressure >10 mm Hg with exercise
    - development of ventricular tachycardia with exercise
  o If the exercise treadmill stress test is equivocal, inconclusive, or inadequate (e.g. double product < 25,000), stress testing with imaging such as stress echocardiography or MPI is appropriate.
  o Patients at high coronary risk are the most likely to have diagnostic exercise treadmill stress test results.

• **CD-1.5 Stress Testing with Imaging**
  - Stress testing with stress echocardiography, MPI or cardiac MRI can be performed with maximal exercise or chemical stress (dipyridamole, adenosine or dobutamine).
  - Cardiac PET is performed using chemical stress.
  - The use of exercise versus chemical stress does not alter the CPT codes used for these studies.

• **CD-1.6 Women**
  - Women are known to have unique presenting characteristics of coronary artery disease.
  - In some instances, this leads to gender-based variations in guidelines/diagnostic criteria which are reflected in these guidelines.*
    *J Am Coll Cardiol 2006 Feb;47(3):4S-20S

• **CD-1.7 Hybrid imaging**
  - SPECT/CT which involves SPECT (MPI) imaging and CT for optimizing location, accuracy, and attenuation correction combines functional and anatomic information.
  - There is currently no evidence-based data to formulate appropriateness criteria for these hybrid scans.

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**CD- 2 ~ ECHOCARDIOGRAPHY (ECHO)**

**CD-2.1 Transthoracic Echocardiography (TTE)**
- A careful recent physical examination and relevant laboratory tests such as BNP elevations and worsening elevated BNP in the setting of heart failure should be performed prior to considering imaging.
- The need for repeat transthoracic echocardiography (TTE) is based upon findings in the original study and documentation of the way in which repeat studies will affect patient management.
• The following are indications for which transthoracic echocardiography (TTE) can be performed at least once:
  o Valve function and structure including:
    ➢ Mitral valve prolapse
    ➢ Mitral regurgitation
    ➢ Mitral stenosis
    ➢ Aortic regurgitation
    ➢ Aortic stenosis
    ➢ Bicuspid aortic valve
    ➢ Tricuspid valve regurgitation
    ➢ Pulmonary valve regurgitation
      ▪ Once the valve pathology is identified, repeated studies for surveillance only are not indicated.
      ▪ If valve surgery is being considered, TTE to assess aortic, pulmonary or mitral stenosis or regurgitation can be performed once or twice a year.
      ▪ TTE can accurately assess the severity of valve stenosis but is sometimes less accurate in assessing valve regurgitation.
  o Ventricular function including global and segmental wall motion for evaluating ejection fraction (EF) and coronary artery disease.
    ➢ Echo can be performed to evaluate cardiomyopathy due to etiologies such as ischemia, alcohol, viral myocarditis, or idiopathic.
    ➢ Echo can be performed before and after chemotherapy known to affect heart function.
  o Ventricular structure including:
    ➢ Infiltrative diseases (e.g. sarcoid, amyloid)
    ➢ Aneurysm with/without thrombus
    ➢ Ventricular septal defect (VSD)
    ➢ Papillary muscle rupture/dysfunction
    ➢ Hypertrophy (including asymmetric septal hypertrophy, spade heart, hypertensive concentric hypertrophy, infiltrative hypertrophy)
  o Evaluate atrial or ventricular chamber size (e.g. patients with atrial fibrillation, tachyarrhythmias, or left ventricular dilatation).
    ➢ Yearly TTE may be indicated depending on the clinical circumstance.
  o Detection of embolic source in patients with recent Transient Ischemic Attack (TIA), stroke, or peripheral vascular emboli.
    ➢ Although transesophageal Echo (TEE) is more accurate in visualizing thrombus in the cardiac chambers and in visualizing the cardiac valves for vegetations (or classic mitral valve fibrinous excrescences), TTE is non-invasive and is indicated as the initial study.
    ➢ Intravenous injected sterile saline contrast can be performed for shunt detection in cases of known or suspected atrial and/or ventricular septal defect and/or patent foramen ovale.
      ▪ This is best assessed using TEE, especially in patients with decompression illness, although TTE is still useful in this setting.
  o Evaluation of ASD repair or other cardiac surgeries (e.g. valve surgery)
  o Tumor evaluation including myxomas
  o Clot detection
  o Evaluation of right ventricular systolic pressure and pulmonary hypertension
  o Evaluation of pericardial effusion/pericardial disease, particularly suspected cardiac tamponade
  o Evaluation of congenital heart disease
o Evaluation of endocarditis
  ➢ Note: lack of visible vegetations does not eliminate the diagnosis.
  ➢ TEE remains a more sensitive technique for identification of small vegetations.
  o Complications of pacemaker insertion should be monitored by TTE

**CD-2.2 Transesophageal Echocardiography (TEE)**

- The need for repeat TEE studies is based upon findings in the original study and documentation of the way in which repeat studies will affect patient management:
- The following are indications for which transesophageal echocardiography (TEE) can be performed at least once.
  - Limited transthoracic echo window
  - Detection of embolic source or intracardiac shunting when TTE is inconclusive
    ➢ Examples: atrial septal defect, ventricular septal defect, patent foramen ovale, aortic cholesterol plaques, thrombus in cardiac chambers, valve vegetations, tumor
  - Evaluation of cardiac valve dysfunction
    ➢ Differentiation of tricuspid from bicuspid aortic valve
    ➢ Congenital abnormalities
  - TEE is not particularly sensitive for left ventricular assessment since this chamber lies farther from the TEE probe than in transthoracic echo
    ➢ Exceptions: the base of the heart in evaluating asymmetric septal hypertrophy or membranous ventricular septal defect

**CD-2.3 Frequency of Echocardiography testing**

- Annual testing can be performed for the following:
  - Assessment of left ventricular hypertrophy progression or regression
  - Assessment of valve dysfunction
  - Assessment of cardiac chamber size in cardiomyopathy and atrial dysrhythmias
  - Assessment of chronic pericardial effusions
  - Assessment of left ventricular contractility/diastolic function prior to planned medical therapy for heart failure or to evaluate the effectiveness of on-going therapy
    ➢ BNP levels are useful and may alone be sufficient for monitoring in many cases
  - Assessment of aortic dissection
  - Assessment of aortic root dilatation
- Testing twice a year can be performed for the following:
  - New (not chronic stable) pericardial effusions
  - Assessment of new/changed medical therapy for congestive heart failure
    ➢ BNP levels are useful and may alone be sufficient for monitoring in many cases
  - Assessment of new/changed medical therapy for hypertension if left ventricular hypertrophy was present
- New Echo can be performed for the following regardless of number of previous Echo studies:
  - New cardiac murmurs
  - New myocardial infarction or acute coronary syndrome
  - New congestive heart failure (or new symptoms of dyspnea, orthopnea, paroxysmal nocturnal dyspnea, edema, elevated BNP)
  - New pericardial disease
  - New stroke/transient ischemic attack
  - New aortic dissection (TEE is preferred)
  - New decompression illness
CD-2.4 Stress Echocardiography (Stress Echo)

- Also see CD-3 Nuclear Cardiac Imaging (MPI)
- Stress Echo is the preferred modality in evaluating the following if pretest CAD probability (see CD-3.3b Table B1) or risk factor assessment per CD-3 Nuclear Cardiac Imaging guidelines supports such testing:
  - Arrhythmias and palpitations (where there is Holter monitor or ECG data confirming significant dysrrhythmia)
  - Any chronic (not rate-related) complete bundle branch block (right or left) on ECG, or presence of ST depression >1 mm on pre-exercise ECG
  - Dyspnea on exertion
  - Syncope or pre-syncope
  - Edema
  - Positional chest pain (e.g. pain when lying back but not when bending forward)
  - Pericardial disease (where there is no evidence of hemodynamic compromise)
  - Heart murmur with no known moderate or severe valvular disease
  - Valvular heart disease, if mild
  - Right heart dysfunction
  - Pulmonary hypertension
  - Diastolic dysfunction (not systolic dysfunction)
  - Cardiac chamber abnormalities
  - Chest pain syndrome with any of the above
  - Women over age 45 with ST depression on exercise treadmill stress testing

CD-2.5 Newer Echocardiography Modalities

- There is insufficient data currently to generate appropriateness criteria for the use of the following Echo modalities:
  - 3D, 4D, and higher Echo
  - Tissue perfusion Echo
  - Requests for these studies should be referred for Medical Director review

CD-3.1 General

- Prior to considering cardiac imaging, there should be recent (within 30 days) clinical evaluation or documented meaningful contact with the patient (preferably with a recent ECG and chest x-ray, if clinically relevant to the evaluation process).
- MPI studies should include perfusion, left ventricular ejection fraction, and wall motion (CPT 78465, 78478, 78480). Other coding requests should be sent for Medical Director review.
  - CPT 78465 includes exercise or “chemical stress” testing.
  - Effort should be made to obtain copies of reported “abnormal” ECG studies in order to determine whether the ECG is uninterpretable.
  - The most recent stress testing and its findings should be documented.
- If a decision to perform cardiac catheterization or other angiography has already been made, there is often no need for MPI. These requests should be sent for Medical Director review.
- Stress echocardiography (where feasible) is in many instances at least competitive if not superior to MPI for evaluation of ischemic heart disease (see CD-2.4 Stress Echocardiography) and avoids radiation.*

*J Am Coll Cardiol 2007;49:227-237
CD-3.2 Patients with known CAD

- Includes patients with prior cardiac imaging showing CAD and/or patients who have had MI or coronary procedures such as PCI, stenting, or CABG.
- Symptoms and/or evidence of worsening cardiac function should be the prime reason for further cardiac testing.
  - There should be clear documentation of the reason(s) why stress testing with imaging (i.e. all cardiac modalities other than maximal exercise treadmill stress test) is needed and how the results of the study will affect patient management.
- Routine follow-up imaging is not indicated in the majority of patients with known CAD.
  - **Exception:** routine MPI or stress echo can be performed every 2 years if there is documentation of previous “silent ischemia” (poor or absent anginal warning system) and prior maximal exercise treadmill stress test that did not show ischemia.
    - If previous exercise treadmill stress test was positive, then follow-up studies should consist of exercise treadmill stress tests if patient can exercise.
  - Patients with worsening symptoms or significantly deteriorated exercise treadmill stress test performance and parameters should be considered for cardiac catheterization rather than MPI.
- If there is documentation of uncertainty that current symptoms are ischemic (e.g. symptoms are not similar to the patient’s prior ischemic pattern), or there are cardiac enzyme abnormalities or documented suspicious ECG changes, then stress imaging can be performed once.
- MPI is not indicated in stable patients with CAD if there is insufficient evidence that these patients are on optimized medical therapy (to the extent tolerated) for both coronary risk factors and symptoms.¹ ²
  - **Optimized Medical Therapy** should include (where tolerated): antiplatelet agents, calcium channel antagonists, partial fatty acid oxidase inhibitors (e.g. ranolazine), statins, short-acting nitrates as needed, long-acting nitrates up to 6 months after an acute coronary syndrome episode, beta blocker drugs (optional), angiotensin converting enzyme (ACE) inhibitors/angiotensin receptor blocking (ARB) agents (optional)³
  - External counterpulsation (ECP), where feasible, is a treatment that is considered part of optimal medical therapy for refractory angina.
  ¹*Cleveland Clinic Journal of Medicine* 2007 Feb;74(2):123-126
  ³*Am J Cardiol* 2007 Dec; 100(11):1635-1643
- MPI can be performed in patients with documented new or clinically worsening heart failure (e.g. recent elevated BNP or troponin levels, documented ventricular tachycardia, or symptomatic ventricular ectopy)
  - These patients can then undergo MPI every 2 years.
  - Cardiac MRI or PET can also be considered to follow these patients
- Patients with known CAD do not need extensive listings of risk factors since they have known disease, although documentation of major risk factors such as diabetes, continued smoking, or confirmed arterial disease elsewhere is useful information.
- Patients with prior imaging demonstrating coronary stenosis of uncertain significance can have one stress test with imaging (i.e. all cardiac modalities other than exercise treadmill stress test).
  - The choice of stress testing (stress echo, MPI, MRI, or PET) will depend on the individual circumstances (see [CD- 2.4](#), [CD- 3.4](#), [CD- 6](#), and [CD- 7](#)).
CD-3.3 Patients with no known CAD who are asymptomatic or have stable symptoms

- **CD-3.3a** The U.S. Preventive Services Task Force (USPSTF) recommends against routine screening with resting ECG, exercise treadmill test, nuclear cardiac imaging, or EBCT in asymptomatic adults at low risk for coronary heart disease (defined as men <50 years old and women <60 years old with no other risk factors for coronary artery disease (CAD) such as high blood pressure, smoking, abnormal lipid levels, parental or sibling history of cardiovascular disease before age 55, vascular disease, diabetes or obesity).
  - In these patients, the harm of false-positive tests, including unnecessary invasive procedures, over-treatment, and patient labeling, outweigh the potential benefits.

- **CD-3.3b** Table B1. Pre-Test Probability of CAD by Age, Gender, and Symptoms

<table>
<thead>
<tr>
<th>Age (yrs)</th>
<th>Gender</th>
<th>Typical/Definite Angina Pectoris</th>
<th>Atypical/Probable Angina Pectoris</th>
<th>Nonanginal Chest Pain</th>
<th>Asymptomatic</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 - 39</td>
<td>Men</td>
<td>Intermediate</td>
<td>Intermediate</td>
<td>Low</td>
<td>Very low</td>
</tr>
<tr>
<td></td>
<td>Women</td>
<td>Intermediate</td>
<td>Very low</td>
<td>Very low</td>
<td>Very low</td>
</tr>
<tr>
<td>40 - 49</td>
<td>Men</td>
<td>High</td>
<td>Intermediate</td>
<td>Intermediate</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>Women</td>
<td>Intermediate</td>
<td>Low</td>
<td>Very low</td>
<td>Very low</td>
</tr>
<tr>
<td>50 - 59</td>
<td>Men</td>
<td>High</td>
<td>Intermediate</td>
<td>Intermediate</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>Women</td>
<td>Intermediate</td>
<td>Intermediate</td>
<td>Low</td>
<td>Very low</td>
</tr>
<tr>
<td>60 - 69</td>
<td>Men</td>
<td>High</td>
<td>Intermediate</td>
<td>Intermediate</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>Women</td>
<td>High</td>
<td>Intermediate</td>
<td>Intermediate</td>
<td>Low</td>
</tr>
</tbody>
</table>

**High**: Greater than 90% pre-test probability; **Intermediate**: Between 10% and 90% pre-test probability; **Low**: Between 5% and 10% pre-test probability; **Very Low**: Less than 5% pre-test probability.

ACCF/ASNC 2005 Appropriateness Criteria*

*J Am Coll Cardiol 2005;46(8):1587-1605

- Angina as defined by the ACC/AHA 2002 Guideline Update for Exercise Testing:*
  - **Typical angina (definite)**: 1) Substernal chest pain or discomfort that is 2) provoked by exertion or emotional stress and 3) relieved by rest and/or nitroglycerin.
  - **Atypical angina (probable)**: Chest pain or discomfort that lacks one of the characteristics of definite or typical angina.
  - **Non-anginal chest pain**: Chest pain or discomfort that meets one or none of the typical angina characteristics.

*J Am Coll Cardiol 2002;40:1531-1540

- MPI requests for patients outside the above age ranges should be sent for Medical Director review.

- **CD-3.3c** Pretest probability of CAD is determined using Table B1 above.
  - If a patient has a high pretest probability of CAD based upon the table, then no further risk assessment is necessary and cardiac testing should proceed as in CD-3.3g.
  - If a patient has very low, low, or intermediate pretest probability of CAD based upon the Table B1, then Risk factor assessment is performed as follows to see whether
the patient can be classified as higher risk (patients are never classified as lower risk than their pretest probability classification in Table B1):

- **Risk factors for CAD:**
  - Males over age 50
  - Females over age 60
  - High blood pressure
  - Congestive heart failure
  - Renal failure
  - Documented peripheral artery disease
  - History of smoking
  - High lipid levels
  - Diabetes or metabolic syndrome
  - Sleep apnea
  - Family history of MI, acute coronary syndrome, or sudden cardiac death in a first degree relative less than 60 years old

- **CD-3.3d Patients with low or very low risk of coronary artery disease:**
  - Advanced cardiac imaging is generally not indicated for patients who are considered low or very low risk for CAD.

- **CD-3.3e Patients with intermediate risk of coronary artery disease are defined per Table B1 or by having at least two of the above risk factors for CAD.**

  - **Patients with intermediate risk of coronary artery disease** who are not taking digoxin, have an interpretable resting ECG, and are able to do moderate exercise, can undergo maximal treadmill exercise stress test as the initial study.
  - Patients with three or more of the above risk factors can be considered for MPI, stress echo, cardiac MRI, or PET (see CD- 2.4, CD- 3.4, CD- 6, and CD- 7).
  - **Borderline cases** (e.g. a 51 year old male with only hypertension and mild hyperlipidemia or a 50 year old female smoker with hypertension and hyperlipidemia) should be sent for Medical Director review.
  - Stress testing with imaging is appropriate in asymptomatic individuals with at least 2 risk factors (as defined above) who have high risk occupations (e.g. airline pilots and bus drivers).

- **CD-3.3f If diabetes is the only risk factor in the asymptomatic or stable patient, imaging requests should be sent for Medical Director review.**
  - The emerging evidence recommends MPI in diabetics, especially those with evidence of peripheral or carotid atherosclerosis, symptoms of dyspnea, or 2 or more additional coronary disease risk factors. Easy fatigability can be an anginal equivalent.
    - See CD- 2.4 since stress echo or other testing (such as PET or MRI in morbidly obese patients) can also be authorized, if feasible.
  - Reference: J Am Coll Cardiol 2005;46(8):1587-1605

- **CD-3.3g Patients with a high pretest probability of coronary artery disease** as defined by Table B1 or who are high clinical risk as defined in the bullet point below and have an interpretable ECG should be considered for exercise treadmill stress test as the initial stress study.
  - If exercise treadmill stress test is clearly positive, then the diagnosis of CAD is likely
and the patient should have optimal medical treatment accordingly.

- **Patients with low or intermediate Duke Treadmill scores but high pretest probability or high clinical risk** (defined by one point each for: typical angina or suspicion of anginal variants, a history of acute coronary syndrome, mild MI, diabetes, insulin use, male gender, documented vascular disease, metabolic syndrome, renal failure and one point for each decade for age over 40 years; high risk is greater than or equal to 5 of these points) benefit from further noninvasive testing with stress imaging.
  - This is especially true of women with diabetes, who have the worst outcome for any given extent of reversible myocardial defect on imaging.

- **CD-3.3h Routine follow-up MPI** is not indicated in the majority of stable patients
  - Repeat testing for coronary disease before 2 years from any normal coronary disease testing (if done) should be reviewed by a Medical Director. If the previous testing was a normal coronary angiogram or coronary CTA, repeat studies for CAD are not indicated prior to 5 years.
  - **Exceptions:**
    - If there is documented evidence for atherosclerosis progression in the non-coronary vasculature, then follow-up imaging for CAD can be performed.
    - Patients who are candidates for any type of organ or bone marrow transplant can undergo imaging stress testing every year (usually stress echo or MPI) prior to transplant.
    - The frequency of stress echo or MPI studies in the asymptomatic post-transplant patient should be at the discretion of the transplant physician following the patient, and depends on the risk of cardiac ischemia imposed by the transplant medications.

**CD-3.4 INDICATIONS FOR MPI OVER OTHER STRESS TESTING**

- **If stress testing with imaging is appropriate, MPI can be performed as the initial stress test if one or more of the following applies:**
  - Evidence of ventricular tachycardia.
  - Paced rhythm (pacemakers create altered contraction pattern)
  - Rate related complete left bundle branch block (not right bundle branch block) (if chronic LBBB [see CD-2.4]
  - Resting heart rate <50 due to beta- or calcium channel-blocker medications
  - Moderate or severe valvular heart disease
  - Limited echo window due to chest wall deformity, COPD, obesity or other body habitus limitations.
    - If a recent previous echo has been performed without problems, then arguments for limited echo window do not apply.
  - Poorly controlled hypertension (both physical stress and dobutamine stress may exacerbate hypertension during stress echo)
  - Poorly controlled atrial fibrillation (resting heart rate >100 bpm) or uncontrolled paroxysmal atrial fibrillation (exercise-induced atrial fibrillation).
  - Inability to perform stress echo due to lack of availability of this modality or lack of expertise on the part of the technician and/or physician
- **MPI is appropriate to assess myocardial viability in patients with ischemic ventricular dysfunction (suspected hibernating myocardium).**
  - MRI or PET is more accurate in that assessment, but MPI testing is also appropriate
- **If a prior echo shows normal wall motion, stress echo can be performed rather than MPI.**
• Where there is decreased ejection fraction/abnormal wall motion (systolic dysfunction) already known (e.g. prior MI) and patient is a candidate for revascularization, MPI is generally preferred.

**CD-3.5 Patients with no known CAD who have new (≤ 2 weeks) symptoms or worsening symptoms**

• Proper description of symptoms and diagnostic coding are important, since general chest pain, atypical symptoms, or "likely noncardiac" descriptions of symptoms decrease the indication for cardiac imaging
  o See definitions of angina, atypical angina and nonanginal chest pain in CD-3.3b
• Patients with new angina or anginal equivalent symptoms or who have other chest pain syndrome and intermediate or high risk (see CD-3.3b, 3.3c, 3.3g) of CAD can undergo stress imaging testing initially.
  o The appropriate imaging study in this context is highly case-specific, and no single guideline can consistently dictate appropriateness.
  o See CD-2.4 and CD-3.4 to help determine the appropriate imaging study.
• **Acute Angina (or anginal equivalent):** Patients with intermediate risk of coronary disease (defined under CD-[3.3b, 3.3c, 3.3e] above) with normal cardiac enzymes and no evidence of ST elevation on ECG can undergo stress echo or MPI.
  o This would likely be a patient recently seen in an emergency center for chest pain and seen shortly thereafter as an outpatient.
• **Symptomatic patients in the low or very low pretest probability and risk category (see Table B1 in CD-3.3b) should initially undergo stress echo or, if ECG is interpretable and patient can adequately exercise, exercise treadmill stress test.**
  *Circulation 2006;113:316-327
• **Syncope:** patients who are intermediate to high risk for coronary artery disease (see CD-3.3 for risk factors) can undergo stress echo (preferred) or one MPI (see CD-11 Syncope).
  o Stress echo should be done if indications (see CD-3.4) for MPI are not met.
• Patients with new onset/diagnosed heart failure or evidence of LV dysfunction with or without chest pain syndrome who have intermediate or high pre-test likelihood or risk profile for coronary disease can undergo MPI unless cardiac catheterization is planned.
• Patients with moderate or severe valvular heart disease with or without chest pain syndrome with intermediate or high CAD pretest probability or risk profile benefit from MPI, PET, or MRI over stress echo to help guide decisions for invasive testing.
• Repeat testing within 2 years from any prior normal coronary disease testing (if any) can be done once at any time if there is documented worsening anginal syndrome
  o Otherwise, these requests should be sent for Medical Director review.

**CD-3.6 Preoperative evaluation**

• If preoperative imaging criteria are not fulfilled, CD-2 and CD-3 guidelines should be used to assess whether cardiac imaging is indicated irrespective of the preoperative assessment.
• **Patients with known CAD undergoing non-cardiac surgery**
  o The type of planned surgery or procedure must be documented
  o See CD-3.2 Patients with Known CAD
  o Noninvasive preoperative testing is best directed at patients considered to be at intermediate or high pretest likelihood of disease, or intermediate or high clinical risk (diabetes, stable coronary artery disease, compensated heart failure, peripheral vascular disease, chronic renal failure) who are scheduled to undergo intermediate,
or especially vascular surgery, and who are considered candidates for PCI or coronary bypass if the test will change management.

- Low risk surgeries (endoscopy, superficial surgeries, cataract, breast and ambulatory surgery) do not require testing for purely preoperative purposes.
- Exercise treadmill stress test is preferred in patients capable of achieving adequate exercise workloads who have an interpretable ECG.
- Stress echo, MPI, MRI, or PET should be reserved for patients whose baseline ECG is uninterpretable.
  - Stress echocardiogram, if feasible, should be considered prior to MPI (see CD-2.4 and CD-3.4)

- Reference:
  - J Am Coll Cardiol 2007;5(17):195-241

- Asymptomatic patients who have had normal coronary angiogram, normal stress test, or previous revascularization within a year, do not need MPI for preoperative cardiac evaluation.*
  - J Am Coll Cardiol 2005;46(8):1587-1605

**CD-3.7 MUGA study**

- For a quantitative determination of ejection fraction, patients may be studied with an echocardiogram (preferred), nuclear ventriculogram or MUGA study (CPT 78472 [default code] or 78494)
  - Echocardiography is more likely to detect early diastolic changes with chemotherapy but MUGA may be used for pre- and post-chemotherapy evaluation as well as in patients who have had chest radiation treatment or a non-diagnostic echocardiogram.
  - MUGA may not be accurate in patients with cardiac arrhythmias or left bundle branch block.
  - Also see Cardiomyopathy in CD-6 Cardiac MRI

- Agents such as Adriamycin, Herceptin, mitoxantrone (Novantrone) and others are considered cardiotoxic and can result in myocardial dysfunction and cardiomyopathy. Patients treated with these agents can be assessed by MUGA scan (CPT 78472 or 78494) or echocardiography.*
  - J Clinical Oncology 2006;24:4107-4115
  - Cancer Drugs Can Cause Heart Damage. Cancer and Chemotherapy. MD Anderson Cancer Center

- Patients on active Herceptin treatment can undergo MUGA (CPT 78472 or 78494) at 3, 6, and 9 months.*
  - Invasive Breast Cancer. NCCN Practice Guidelines in Oncology v.2.2006

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**CD-4~ ULTRAFAST CT, EBCT, OR MULTIDETECTOR CT FOR CORONARY CALCIUM SCORING**

- Certain payers consider coronary calcium scoring investigational, and their coverage policies will take precedence over MedSolutions’ guidelines. Prior authorization does not guarantee payment of the study.
- Coronary calcium scoring is not a covered benefit for any of the current health plans who have delegated utilization review to MedSolutions.
- Currently, there is insufficient evidence-based data to support performing coronary calcium scoring in symptomatic or asymptomatic patients with any degree of CAD risk.*
  - J Am Coll Cardiol 2006;48(7):1475-1497
It is currently unclear whether coronary calcium scoring contributes significantly to management decisions, including achieving certain optimal lipid levels.

- Recommendations based on the ASCOT trial are that patients with a 10% to 20% 10-year risk of CAD should have an optimal LDL-C target of less than 100, regardless of coronary calcium score.*
  
  *Lancet 2003 April;361:1149-1158

- The optimal interval for obtaining repeat coronary calcium scoring has not yet been determined.

### CD-5~ CARDIAC IMAGING BASED ON CORONARY CALCIUM SCORE

- One imaging study can be performed in non-diabetic symptomatic or asymptomatic patients who have a recent Agatston coronary calcium score greater than or equal to 400.
- Diabetics with recent Agatston score over 100 can undergo one MPI.
- MPI guidelines for asymptomatic patients with Agatston score less than 100 should follow those under CD- 3 Nuclear Cardiac Imaging (MPI).
- The Agatston score is the only accepted coronary calcium score for these guidelines.

### CD- 6 ~ CARDIAC MRI

- All requests for cardiac MRI should be sent for Medical Director review.
- MRA of the coronary arteries is not yet adequately sophisticated to replace coronary angiography in evaluating coronary disease and should not be authorized.
  - EXCEPTIONS: coronary artery anomalies (refer to CD-8.7) and Kawasaki disease are conditions where coronary MRA is considered useful.

- **CD-6.1 Cardiac MRI Coding**
  - The 2007 cardiac MRI CPT codes (CPT 75552-75556) were deleted and replaced with restructured codes that combine function and morphology.
  - **Cardiac MRI CPT codes, effective January 1, 2008:**
    - 75557 Cardiac MRI for morphology and function without contrast
    - 75558 Cardiac MRI for morphology and function without contrast; with flow/velocity quantification
    - 75559 Cardiac MRI for morphology and function without contrast materials; with stress imaging
    - 75560 Cardiac MRI for morphology and function without contrast materials; with flow/velocity quantification and stress
    - 75561 Cardiac MRI for morphology and function without contrast materials, followed by contrast material(s) and further sequences
    - 75562 Cardiac MRI for morphology and function without contrast materials, followed by contrast material(s) and further sequences; with flow/velocity quantification
    - 75563 Cardiac MRI for morphology and function without contrast materials, followed by contrast material(s) and further sequences; with stress imaging
    - 75564 Cardiac MRI for morphology and function without contrast materials, followed by contrast material(s) and further sequences; with flow/velocity quantification and stress
  - Per the AMA: Only one procedure in the series 75557-75564 is appropriately reported per session.*

Medicare Coverage: CMS (National Coverage Determination 220.2) states that the use of MRI for blood flow measurement is "not considered reasonable and necessary."
➢ Therefore, the cardiac MRI codes that include flow/velocity quantification (CPT 75558, 75560, 75562, 75564) are non-covered in Medicare patients.

• CD-6.2 Indications for cardiac MRI include:
  o Myocardial viability study. Use CPT 75561.
  o Stress perfusion study (see CD-3 Nuclear Cardiac Imaging (MPI) for guidelines regarding use of the appropriate stress imaging testing)
    ➢ Use CPT 75559 (or 75563 if viability study is done as part of the procedure)
    ➢ Use 75560 (or 75564 if there is a documented indication to clarify or precisely quantitate a valve or shunt flow abnormality seen on a recent echo).
  o Assessment of global ventricular function and mass (especially with poor or difficult echocardiogram visualization).
    ➢ Cardiac MRI is particularly useful in evaluating cardiomyopathy (ischemic, diabetic/ hypertrophic/muscular dystrophy), noncompaction, amyloid heart disease, post cardiac transplant, hemochromatosis, hypertrophic heart disease, myocarditis, cardiac aneurysm, trauma and contusions, and in monitoring cancer chemotherapy effect on the heart.
    ➢ Use CPT 75557 or 75561.
  o Pre- and postoperative congenital heart disease assessment (e.g. Tetralogy of Fallot, patent ductus arteriosus, platypnea, coarctation of the aorta, atrial septal defects, restrictive VSD, anomalous pulmonary arteries or veins or anomalous coronary arteries).
    ➢ Use CPT 75557 or 75561.
    ➢ CPT 71555 (chest MRA) may be added if the aorta or pulmonary artery need to be visualized beyond the root.
    ➢ Use 75558 or 75562 only if there is a need to clarify findings on a recent echocardiogram.
    ➢ Chest MRA alone (CPT 71555) can be performed in certain situations (e.g.; suspected dissection), especially if requested by the cardiovascular specialist.
  o Clinical suspicion of arrhythmogenic right ventricular dysplasia or arrhythmogenic cardiomyopathy (ARVD/ARVC) especially if patient has presyncope or syncope. MRI (CPT 75557) is considered the optimal test for this disorder.*
    * Circulation 2006;113:316-327
    * Eur Heart J 1989;10:127-132
    * Circulation 2005;112(25):3823-3832
  o Pericardial disease (constrictive pericarditis versus restrictive and perimyocarditis). Use CPT 75561.
  o Evaluate cardiac tumor or mass (e.g. in sarcoidosis or tuberous sclerosis ). Use CPT 75561.
  o Anomalous coronary arteries: Cardiac MRI (CPT 75561) or CTA (CPT 0146T) (which is still favored) is much better at detecting this than conventional angiography.
  o Fabry’s disease: late enhancement MRI may predict the effect of enzyme replacement therapy on myocardial changes that occur with this disease. Use CPT 75561.
  o Aortic dissection. CPT 71555 (MRA chest) can be used and add 74185 (MRA abdomen) if dissection extends beyond ascending aorta.
Valvular disease including Libman-Sachs endocarditis, other endocarditis, and assessing valve abnormalities associated with ankylosing spondylitis. Transthoracic echo or transesophageal echo is supported initially.

- For cardiac MRI use CPT 75562.
- Alternatively, cardiac CTA (CPT 0145T) can be used.

- Diagnosing paravascular abscess in patients with endocarditis. Use CPT 75561.
- Pulmonary vein anatomy for planned ablation procedures in patients with supraventricular tachycardia or atrial fibrillation. (see CD-10 Pulmonary Artery and vein imaging). Use CPT 75562
- Rule out cardiac thrombus. Use CPT 75557.*

- CD-6.3 The aortic root and proximal ascending aorta can be adequately evaluated during a cardiac MRI.
  - For screening due to family history of aortic aneurysm or dissection see CH-30 Thoracic Aortic Dissection or Aneurysm in the Chest guidelines.
  - If a patient (e.g. Marfan’s or Loeys-Dietz syndrome) with known ascending aortic aneurysm needs a cardiac MRI to evaluate another problem and the physician wishes to evaluate the ascending aorta, this evaluation should be included with the cardiac MRI interpretation. If the ascending aortic aneurysm is quite distal, near the arch, it is appropriate to include the chest MRI code (CPT 71551) or thoracic MRA code (CPT 71555).

- CD-6.4 Echocardiogram is the initial imaging study of choice to evaluate pericardial effusions or diagnose pericardial tamponade.
  - However, contrast enhanced cardiac MRI is useful for evaluating pericarditis, neoplastic effusion, tamponade or myocardial infiltration.
  - Cancers that can metastasize to the pericardium or myocardium and can cause a malignant effusion include lung, breast, renal cell, lymphoma and melanoma.

CD-6.5 There are a few institutions that will perform cardiac MRI in patients with pacemakers or defibrillators.

CD- 7 ~ CARDIAC PET SCAN

- All requests for cardiac PET scan should be sent for Medical Director review.
- CPT 78492 should be used for stress cardiac PET scans used to determine ischemia (i.e. coronary artery disease).
  - This study uses rubidium tracer most often and is similar to, but more sensitive than, MPI.
  - In most circumstances, cardiac PET does not need to replace MPI for determining coronary artery disease, and CD-3 Nuclear Cardiac Imaging (MPI) guidelines should be followed.
  - There are circumstances in which cardiac PET can be useful:
    - Cardiac PET is more accurate than MPI in obese patients or those with large breasts or implants in differentiating ischemia from attenuation artifact.
    - Cardiac PET can be useful in patients who have an equivocal nuclear perfusion (MPI) stress test.
      - PET demonstrated unequivocal normal perfusion in as many as 77% of a
subset of women with equivocal nuclear perfusion studies.*
*J Am Coll Cardiol 2006;48:1029-1039

- CPT 78459 should be used for cardiac PET scans used to determine myocardial viability (i.e. identification of jeopardized but viable “hibernating” myocardium that can be salvaged with revascularization).
  - This study uses FDG tracer and is used to determine metabolically active myocardium. A reduction of FDG uptake indicates nonviable tissue.
  - With the excellent results given by cardiac MRI in viability studies, this application for PET is diminishing.
- Radiation exposure from cardiac PET is slightly lower than from SPECT MPI exposure although data is limited.
  - Radiation exposure from cardiac PET/CTCA (CTCA=CT coronary angiogram) is high enough to raise concerns.
  - PET/CT in which CT is used only for attenuation correction has a much lower radiation exposure. The radiation exposure is slightly over that of PET alone.
  - Reference:
    ➢ Circulation 2007;116:1290-1305

### CD- 8 ~ CT OF THE HEART and CTA of the CORONARY ARTERIES

#### CD- 8.1 General

- Certain payers consider coronary calcium scoring and/or cardiac CT and coronary CTA investigational, and their coverage policies will take precedence over MedSolutions’ guidelines. Prior authorization does not guarantee payment of the study.
- Certain payers require cardiac CT studies to be performed on a 64-slice CT scanner.
- Metallic interference including surgical clips, pacemaker devices, defibrillator devices and tissue expanders can also cause interference with CTA imaging.
- Contraindications for CT angiography of the heart include:
  - Irregular heart rhythms (e.g. atrial fibrillation/flutter, frequent irregular premature ventricular contractions or premature atrial contractions, and high grade heart block)
  - Very obese patients (body mass index >40 kg/m²)
  - Elevated calcium score
    ➢ CTA of the coronaries should not be performed if there is extensive coronary calcification (calcium score >1000).
  - Renal insufficiency with creatinine greater than 1.8 mg/dl
  - Inability to follow breath holding instructions (e.g. patients with serious valve disease with marked dyspnea, patients with COPD)
  - Heart rate over 75 beats per minute
  - Allergy to iodine contrast material

#### CD- 8.2 CT Used For Coronary Calcium Scoring

- Also see CD-4 Ultrafast, EBCT, or Multidetector CT for Coronary Calcium Scoring.
- Coronary Calcium Scoring: Currently, there is insufficient evidence-based data to support performing coronary calcium scoring in symptomatic or asymptomatic patients with any degree of CAD risk.
  - Reference:
    ➢ J Am Coll Cardiol 2006;48(7):1475-1497
- The optimal interval for obtaining repeat coronary calcium scoring has not yet been determined.
CD- 8.3 Coronary CTA in the Asymptomatic Patient

- CTA should not be used in asymptomatic patients.
  - “Use of CT angiography in asymptomatic persons as a screening test for atherosclerosis (noncalcific plaque) is not recommended.”
    - *Circulation* 2006;114:1761-1791
    - [http://circ.ahajournals.org/cgi/content/full/114/16/1761](http://circ.ahajournals.org/cgi/content/full/114/16/1761)
    - Accessed November 29, 2006
  - “Future trials are needed to evaluate whether multidetector CT is useful as a screening method in a selected patient population, as an alternative to exercise testing, myocardial perfusion, or dobutamine stress testing, or as an alternative to conventional angiography in patients with favorable characteristics.”
    - *J Am Coll Cardiol* 2004;44:1224-1229

CD- 8.4 Coronary CTA in the Symptomatic Patient

- Coronary CTA using a 64-slice or greater CT scanner can be used to evaluate chest pain in patients with low or very low pretest probability of CAD (see Table B1 in CD-3.3) when the patient cannot perform or has contraindications to exercise and chemical stress testing (i.e. exercise treadmill stress test, stress echo, and MPI).
- Coronary CTA using a 64-slice or greater CT scanner can be used to evaluate patients with intermediate risk (see Table B1 in CD-3.3) when:
  - recent exercise treadmill stress test or stress echo are un-interpretable or equivocal and CTA will replace performance of MPI, cardiac PET, or coronary angiogram.
  - recent MPI is un-interpretable or equivocal and CTA will replace performance of cardiac PET or coronary angiogram.
- Abnormal results on exercise treadmill stress test, stress echo or MPI are not necessarily an indication for coronary CTA, especially with stable patients and good performance parameters (e.g. patients going over 6 minutes on Bruce protocol).
- Patients with high risk of coronary artery disease should undergo conventional coronary angiography rather than coronary CTA, especially if an interventional procedure (e.g. PCI) is anticipated.
  - Any scenario where a coronary intervention is likely to be necessary is one in which coronary CTA should be avoided, since the patient runs the risk of undergoing two studies that require contrast and radiation exposure.
- There is insufficient data to support performing “triple rule out” studies to exclude coronary artery disease, aortic dissection and pulmonary embolism in a patient with chest pain.
  - Requests for “triple rule out” should be sent for Medical Director review.
  - Also see CH-27 Pulmonary Embolism and CH-30 Thoracic Aortic Dissection or Aneurysm in the Chest guidelines.
- If coronary artery disease is present on CTA and no functional stress test has been performed, exercise stress test, stress echocardiogram, or MPI is needed to determine whether the coronary artery stenosis seen on CTA is causing functional ischemia.
  - See CD-2 Echocardiography and CD-3 Nuclear Cardiac Imaging (MPI) for guidelines regarding which functional stress test would be appropriate.

CD- 8.5 Coronary CTA and Other Cardiac Imaging Studies

- The high negative predictive value (98%-99%) of CTA of the coronaries in ruling out significant coronary artery disease has been found on multiple studies.
  - Coronary CTA (CPT 0148T) using a 64-slice or greater CT scanner can be useful in ruling out coronary artery disease in patients with low or very low pretest probability of CAD (see Table B1 in CD-3.3) if stress test results (e.g. exercise treadmill, stress
Coronary CTA (CPT 0148T) using a 64-slice or greater CT scanner can be used to evaluate patients with intermediate risk (see Table B1 in CD-3.3) when:

- recent exercise treadmill stress test or stress echo are un-interpretable or equivocal and CTA will replace performance of MPI, cardiac PET, or coronary angiogram.
- recent MPI is un-interpretable or equivocal and CTA will replace performance of cardiac PET or coronary angiogram.

- If CTA shows no significant coronary artery disease, then no further cardiac imaging is necessary.
- If coronary artery disease is present on CTA and no functional stress test has been performed, exercise stress test, stress echocardiogram or MPI is needed to determine whether the coronary artery stenosis seen on CTA is causing functional ischemia.
- See CD-2 Echocardiography and CD-3 Nuclear Cardiac Imaging (MPI) for guidelines regarding which functional stress test would be appropriate.

- Patients with dilated cardiomyopathy who have at least intermediate coronary risk can undergo coronary CTA.*

*JACC 2007 May;49:2044-2050

- There is no data to support performing serial follow-up coronary CTA studies in symptomatic or asymptomatic patients.

- Serial imaging studies to evaluate for coronary artery disease should follow the guidelines in CD-3 Nuclear Cardiac Imaging (MPI).

### CD-8.6 Coronary CTA in Patients with Previous Coronary Artery Procedures

- Detection of coronary artery disease post-revascularization (PCI and/or CABG):
  - Evaluation of bypass grafts and coronary anatomy, especially in symptomatic patients, for preoperative planning (re-operation) if there is no planned conventional angiography is generally an appropriate indication for coronary CTA (CPT 0148T or 0146T).
  - Coronary CTA can be helpful in post-bypass patients who are going to undergo re-do bypass surgery in order to identify whether bypass grafts such as the mammary are located directly beneath the sternum, so that alternative ways to enter the chest can be planned. Additionally, the precise course of the LAD (including an intramyocardial route) and the relationship of target vessels to intercostal spaces can be accurately determined by CTA. However, not every patient who is scheduled for re-do surgery needs a CTA, and there are no evidence-based data that performing CTA in these patients improves health outcome.
    - Because accurately imaging both the native coronary arteries and bypass grafts at the same time is challenging, this application of coronary CTA has not yet been proven.
    - Requests for coronary CTA in post-bypass patients should be sent for Medical Director review.
  - Evaluation of coronary stents is difficult due to metal artifact and the clinical value of coronary CTA after stent placement is currently limited to detection of stent occlusion. Other degrees of in-stent re-stenosis cannot be accurately determined. Therefore, based on current data, coronary CTA to follow-up stent placement cannot be recommended.*

* Circulation 2006;114:1761-1791
http://circ.ahajournals.org/cgi/content/full/114/16/1761
Accessed November 29, 2006
**CD- 8.7 Other Indications for Coronary CTA**

- Evaluating coronary artery anomalies and other complex congenital heart disease of cardiac chambers or great vessels is an appropriate indication for coronary CTA.
  - Use CPT 0146T for evaluating coronary artery anomalies
  - CPT 0150T for congenital heart disease
    - can add CPT 71275 (chest CTA) to evaluate great vessels
    - In cases of anomalous pulmonary venous return, can add CT abdomen and pelvis
  - The use of coronary CTA to rule out anomalous coronary artery(ies) should be limited to patients less than age 40 with a history that includes one or more of the following:
    - angina or myocardial infarction without high atherosclerosis risk
    - full sibling(s) with history of sudden death syndrome before age 30 or with documented anomalous coronary artery
    - resuscitated sudden death
    - unexplained syncope (not presyncope)
    - Patients should have had a thorough negative evaluation for syncope as outlined in HD-32 Syncope in the Head Guidelines and CD-11 Syncope (e.g. echocardiogram, cardiac evaluation for postural blood pressure changes, resting low blood pressure, or low heart rate, MPI study, exercise treadmill test, or stress echocardiogram, consideration for situational syncope) prior to considering coronary CTA.
    - unexplained new onset of heart failure (e.g. without atherosclerotic coronary disease or other causes for cardiomyopathy)
    - documented ventricular tachycardia (6 beat runs or greater)
    - equivocal coronary artery anatomy on conventional cardiac catheterization
  - The presence of other congenital heart disease is not a separate indication for coronary CTA to rule out anomalous coronary artery(ies).
- Evaluation of coronary artery status in patients with new onset heart failure is an appropriate indication for coronary CTA (CPT 0148T).
- Coronary CTA (CPT 0148T) for preoperative assessment of the coronary arteries in patients who are going to undergo surgery for aortic dissection, aortic aneurysm, or valvular surgery can be performed if CTA will replace invasive coronary angiography.
- Vasculitis/Takayasu’s/ Kawasaki’s disease can be imaged with coronary CTA (CPT 0148T).
- Cardiac/coronary CTA (CPT 0148T) can help determine the age of a myocardial infarction as can cardiac MRI.* Requests for this application should be sent for Medical Director review.
  
  *Am J Cardiol 2006;98:303-308
- Cardiac trauma: chest CTA (CPT 71275) and coronary CTA (CPT 0148T) are useful in detecting aortic and coronary injury and can help in the evaluation of myocardial and pericardial injury.*
  
  o Also see CD-13 Cardiac Trauma
  
  *Am J Cardiol 2006;98:402-406

**CD-8.8 Indications for Cardiac CT**

- Cardiac CT (CPT 0145T) is a useful study to accurately identify coronary veins for lead placement in patients needing biventricular pacemaker devices.
- Congenital heart disease assessment using CPT 0150T or CPT 71275 is supported in adults.
• Cardiac CT (CPT 0145T) can be performed for preoperative evaluation of pulmonary veins in patients in whom pulmonary vein isolation procedure (ablation) for tachycardia or atrial fibrillation is planned and for follow-up studies (See CD-10 Pulmonary Artery and Vein Imaging).

• Cardiac CT (CPT 0145T) can be used to assess cardiac tumor or mass, pericardial mass, pericarditis/constrictive pericarditis, complications of cardiac surgery, etc.

• Cardiac CT (CPT 0145T) can be used to evaluate cardiac thrombus in patients with technically limited echocardiogram, MRI, or TEE.

• Cardiac CT (CPT 0145T) can be used to evaluate clinical suspicion of arrhythmogenic right ventricular dysplasia or arrhythmogenic cardiomyopathy (ARVD/ARVC), especially if patient has presyncope or syncope

• Native aortic abnormalities can be investigated with cardiac CT (CPT 0145T) if echocardiogram is indeterminate.

• Cardiac CT may be helpful in the evaluation of recurrent laryngeal nerve palsy due to cardiac chamber enlargement.

**CD- 8.9 Unproven Uses of Cardiac CT and Coronary CTA**

• There is insufficient data to support the routine use of cardiac CT and/or coronary CTA for the following:
  o As the first test in evaluating symptomatic patients (e.g. chest pain)
    ➢ see CD- 8.4 for exception in patients with low or very low pretest probability of CAD.
  o To evaluate chest pain in an intermediate or high risk patient when a stress test (exercise treadmill, stress echo, MPI, cardiac MRI, cardiac PET) is clearly positive or negative.
  o Preoperative assessment for non-cardiac, nonvascular surgery (see CD- 3.6 Preoperative evaluation)
  o Patients at high coronary disease risk with coronary calcium score greater than or equal to 400 should undergo MPI rather than coronary CTA (see CD- 5 Cardiac Imaging Based on Coronary Calcium Score)
  o There is no data to support performing serial follow-up coronary CTA studies in symptomatic or asymptomatic patients.
    ➢ Serial imaging studies to evaluate for coronary artery disease should follow the guidelines in CD- 3 Nuclear Cardiac Imaging (MPI).
  o Identification of plaque composition and morphology is possible with CTA, especially using 64-slice scanners. However, this technique currently has limited sensitivity, and the reproducibility of the measure has not been reported.
    ➢ Therefore, the use of coronary CTA for determining plaque morphology or for quantification of coronary atherosclerotic plaque burden is not recommended at this time.*
      *Circulation 2006;114:1761-1791
      http://circ.ahajournals.org/cgi/content/full/114/16/1761
      Accessed November 29, 2006
  o Evaluation of left ventricular function following myocardial infarction or in chronic heart failure.
  o Myocardial perfusion and viability studies.
  o Evaluation of patients with postoperative native or prosthetic cardiac valves who have technically limited echocardiograms, MRI or TEE.
    ➢ Patients with indeterminate echocardiogram should undergo MUGA (CPT 78472 or 78494) or cardiac MRI (see CD-3.7 MUGA study and CD- 6 Cardiac MRI).
Considerable question remains as to whether CTA improves net health outcomes as well as any established imaging alternatives.*

*Blue Cross Blue Shield Association, Technology Evaluation Assessment Program Volume 20, No.4 May 2005

**CD- 8.10 Radiation Dose and Coronary CTA**

- Radiation dosage for CTA of the coronaries varies by facility and the particular protocol used. The American College of Radiology Clinical Statement on Noninvasive Cardiac Imaging states that “as a general rule a multi-detector CT scan encompassing the heart should not result in an effective dose of greater than 12 mSv”.*
  - Current 16-slice CT scanners usually keep the radiation dose <13 mSv.
  - 64-slice CT scanners can deliver a radiation dose from 15-25 mSv (especially in women due to needing to penetrate breast tissue).
  - Using dose modulation, in which much less radiation is delivered during the portion of the cardiac cycle not normally used for reconstruction, the radiation dose can be reduced to <13 mSv, but not all facilities have this capability.
  - Dual source scanners decrease radiation exposure by approximately one third.

**CD- 8.11 CPT Coding**

- 3D rendering (CPT 76376 or 76377) and nuclear medicine codes for ventricular function or ejection fraction should not be used in conjunction with coding for CTA of the coronaries with left ventricular function assessment.
- Coronary imaging is not included in the code definition for CPT 71275.
  - The description for CPT 71275 in the 2007 AMA CPT code book reads: “CTA Chest (non-coronary), without contrast, followed by contrast and further sections, including image postprocessing.”
- The American College of Cardiology (ACC) has indicated that unless specific payers have instructed otherwise, the Category III (“T codes”) should be used to report coronary CTA studies since they most accurately describe the procedures performed.*
  *ACC Advocacy Weekly, July 11, 2005
- The Category III codes are as follows:
  - **0144T** CT, heart without contrast material, including image post processing and quantitative evaluation of coronary calcium.
    - Used if only calcium scoring is being performed.
    - This code should be used as a stand-alone code and **never** should be used in conjunction with 0145T-0151T.
  - **0145T** CT, heart without and with contrast, including cardiac gating and 3D image post processing; cardiac structure and morphology.
    - Used for cardiac CT (does not include the coronary arteries), pulmonary vein imaging, and imaging of the cardiac veins.
  - **0146T** CTA of coronary arteries without quantitative evaluation of coronary calcium
    - Used to image the coronary arteries (e.g. for evaluating anomalous coronary arteries).
  - **0147T** CTA of coronary arteries with quantitative evaluation of coronary calcium
    - Used to evaluate coronary artery disease and perform calcium scoring.
  - **0148T** Cardiac structure and morphology and CTA of the of the coronaries without quantitative evaluation of coronary calcium
    - Used to evaluate cardiac morphology as well as coronary artery disease; calcium scoring is not included.
    - This code is a combination of 0145T and 0146T.
o **0149T** Cardiac structure and morphology and CTA of the coronaries with quantitative evaluation of coronary calcium
  - Used to evaluate cardiac morphology as well as coronary artery disease; calcium scoring is included.
  - This code is a combination of 0145T and 0147T.

o **0150T** Cardiac structure and morphology in congenital heart disease.
  - Used to evaluate congenital heart disease.

o **0151T** CT, heart, without and with contrast including cardiac gating and 3D image post processing; function evaluation (left and right ventricular function, ejection fraction, and segmental wall motion).
  - Used to evaluate wall motion and ventricular function
  - This is an add-on code and should **never** be used as a stand-alone procedure. It should be used in conjunction with 0145T-0150T. However, it **can** be entered alone on a separate case in the instance of a RETRO review.

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**CD-9 ~ DIAGNOSTIC LEFT HEART CATHETERIZATION**

- Diagnostic left heart catheterization (cath) is an invasive procedure with morbidity of 1.5% and mortality of 0.15%.
- These guidelines apply to patients with chronic stable conditions or new but stable conditions.
  - These guidelines **do not** apply to patients in the acute setting (acute coronary syndrome) or patients with unstable angina. These patients should be handled as a medical emergency.
- **Indications for diagnostic left heart catheterization:**
  - Identifying disease for which invasive procedures have been shown to prolong survival:
    - Left main coronary artery disease plus right coronary artery disease plus left ventricular dysfunction.
    - Triple vessel coronary artery disease plus left ventricular dysfunction.
  - Identifying disease that is unresponsive to optimized medical therapy and for which invasive procedures are needed to provide pain relief.
    - **Optimized Medical Therapy** should include (where tolerated): antiplatelet agents, calcium channel antagonists, partial fatty acid oxidase inhibitors (e.g. ranolazine), statins, short-acting nitrates as needed, long-acting nitrates up to 6 months after an acute coronary syndrome episode, beta blocker drugs (optional), angiotensin converting enzyme (ACE) inhibitors/angiotensin receptor blocking (ARB) agents (optional)*
      *Am J Cardiol 2007 Dec;100(11):1635-1643
  - Evaluating the presence and/or extent of coronary artery disease suggested by noninvasive imaging studies if the results of catheterization will change patient management.
  - Evaluating the cause of left ventricular dysfunction (congestive heart failure) in patients suspected of having coronary artery disease that is treatable using invasive procedures.
  - Ruling out coronary artery disease prior to planned non-coronary cardiac or great vessel surgery (cardiac valve surgery, aortic dissection, aortic aneurysm, congenital disease repair such as atrial septal defect, etc.)
• Diagnostic left heart catheterization is NOT indicated for the following where pump function has already been determined by other means:
  o Prior to initiation of medical therapy in patients with coronary artery disease diagnosed by other means.
  o Prior to a reasonable trial of optimized medical therapy in stable patients with coronary artery disease diagnosed by other means.
  o Patients in whom catheterization will not change management decisions (e.g. patients who are unwilling or unable to proceed with invasive procedures such as angioplasty, stenting, or surgery).
  o Surveillance imaging
  o Screening for coronary artery disease
    ➢ There must be objective evidence of coronary artery disease/cardiac ischemia by elevated cardiac enzymes, ECG, and/or noninvasive cardiac imaging.
  o NOTE: A positive stress test should not automatically lead to cardiac catheterization, since angioplasty/stenting should no longer be considered first-line therapy for stable coronary artery disease.
  o The printed report of the left heart catheterization should describe hemodynamics, coronary calcifications, coronary artery stenosis, aortic and mitral valve function/dysfunction, and segmental and global left ventricular wall motion.
  o In appropriate cases, post left ventriculogram renal fluoroscopy may be used to assess for evidence of renovascular hypertension (see AB-41 Renovascular Hypertension in the Abdominal guidelines).

### CD- 10 ~ PULMONARY ARTERY and VEIN IMAGING

| Pulmonary artery hypertension (PAH): CT or CTA or MRA of the pulmonary arteries (CPT 71260 or 71275 or 71555) is useful in the assessment of PAH, especially if there is suspicion for recurrent pulmonary emboli |
| Also see PVD- 5 Pulmonary Artery Hypertension in the Peripheral Vascular Disease guidelines and CH- 27 Pulmonary Embolism in the Chest guidelines. |
| Reference: |
| ➢ Radiology 2007;243:70-79 |
| **Pulmonary vein imaging:** A preoperative cardiac MRI (CPT 75562) or CTA (CPT 0145T) can be performed to evaluate anatomy of the pulmonary veins prior to an ablation procedure performed for atrial fibrillation. |
| o A routine post-procedure MRI or CTA can be performed 3 months after ablation. |
| ➢ If no pulmonary vein stenosis is present, no further follow-up imaging is required. |
| ➢ The routine follow-up study is due to a 1%-2% incidence of asymptomatic pulmonary vein stenosis following ablation procedures. These patients may benefit from treatment (anti-inflammatory medication, angioplasty or stenting), although there are no large, prospective studies to help establish guidelines in this area. |
| o Patients who have symptoms (usually shortness of breath) following ablation should be imaged at 1, 3, 6, and 12 months post-ablation. |
| ➢ The majority (81%) of pulmonary vein stenosis remain stable over 1 year. Progression occurs in 8.8% and regression occurs in a small percentage.
CD-11 ~ SYNCOPE

- Also see HD-32 Syncope in the Head guidelines.
- **Evaluation of syncope:**
  - Echocardiogram should be performed initially to look for valvular or cardiomyopathic dysfunction.
  - Cardiac evaluation for postural blood pressure changes, resting low blood pressure, or low heart rate should be performed.
- Stress echo (preferred) or one MPI can be performed in patients with syncope who are intermediate to high risk for coronary artery disease (see CD-3.3 for risk factors). *Circulation 2006;113:316-327*
- Patients at low risk for CAD should undergo exercise treadmill test or stress echocardiogram initially.
- Cardiac MRI (CPT 75561) or coronary CTA (see CD- 8.11 for CPT codes) can be considered if there is concern for anomalous coronary arteries, infiltrative heart disease or certain types of cardiomyopathy (see CD-6 Cardiac MRI and CD-8.7 Other indications for coronary CTA).
- **Duchenne muscular dystrophy:** usually imaged by echocardiogram but evaluation for ischemic or cardiomyopathic changes using MPI or (typically) cardiac MRI (CPT 75557 or 75561) can be performed (see CD- 6 Cardiac MRI).
- Cardiac MRI (CPT 75557) can be performed to evaluate pre-syncope or syncope in patients with suspected ARVD/ARVC (see CD- 6 Cardiac MRI).

CD-12 ~ CONGESTIVE HEART FAILURE (CHF)

- Cardiac CTA should not be used for evaluation of left ventricular function following myocardial infarction or in chronic heart failure mostly out of concern for radiation exposure.
  - Patients with indeterminate echocardiogram should undergo MUGA (CPT 78472 or 78494) or cardiac MRI (CPT 75557).
  - In patients with CHF undergoing coronary CTA for an appropriate indication (see CD-8 CT of the Heart and CTA of the Coronary Arteries), additional CT imaging for ventricular function (CPT 0151T) will not add significant radiation.
- MPI imaging, echocardiogram, and/or ideally cardiac MRI (which is the most accurate in assessing cardiac pump function) (CPT 75557) can be used to assess patients with CHF.
  - Where there is evidence of arteriovenous fistula with “high output” heart failure, CT scans of the chest, abdomen and pelvis with contrast (CPT 71260, 74160, 72193) can be performed. Chest and/or abdominal MRA (CPT 71555 and/or 74185) may also be useful.
- Right-sided congestive heart failure can be a manifestation of pulmonary hypertension or serious lung disease.
  - Chest CT (CPT 71260) or chest CTA (CPT 71275) to evaluate for recurrent pulmonary embolism can be considered in patients with right-sided CHF.
- Post-cardiac transplant heart failure should be assessed by echocardiogram or cardiac MRI (CPT 75557 or 75561).
Echocardiographic modalities (TTE, TEE) are the fastest modalities to assess cardiac trauma.

Cardiac MRI (CPT 75557, 75561, 75558, or 75562 depending on physician request) can be performed in stable patients.
  - CPT 71555 (chest MRA) can be added if there is suspicion of vascular trauma distal to the root of the great vessels.

Chest CTA (CPT 71275) and coronary CTA (CPT 0148T) are useful in detecting aortic and coronary injury and can help in the evaluation of myocardial and pericardial injury.*

*Am J Cardiol 2006;98:402-406
The major goal of performing noninvasive cardiac imaging is the identification of subsets of patients at high risk for subsequent cardiac death or nonfatal infarction who may benefit from prompt referral for cardiac catheterization and possible revascularization. Conversely, patients deemed to be at low risk for subsequent cardiac events based on imaging studies are treated medically. Medical therapy in most stable patients is a competitive product.

Risk factors associated with a higher risk of coronary heart disease events such as a nonfatal myocardial infarction and coronary death include:

- Older age
- Male gender
- High blood pressure
- Smoking
- Abnormal lipid levels (increased total serum cholesterol and LDL; low serum HDL; increased serum triglycerides)
- Diabetes
- Known vascular disease
- Renal failure
- Obesity
- Family history of premature coronary artery disease
- Metabolic syndrome
- Sleep apnea

The U.S. Preventive Services Task Force (USPSTF) found insufficient evidence to recommend for or against screening with ECG, exercise treadmill testing or EBCT for coronary artery stenosis in asymptomatic adults at increased risk for coronary heart disease events.

The SHAPE task force has published a paper supporting noninvasive imaging as an additional mass screening tool. Due to a clear lack of outcomes data this is considered too controversial for widespread application.

Men <50 years old and women < 60 years old who have no other risk factors for coronary heart disease (less than 5% -10% 10 year risk) are considered to be at low risk.

In a study of 1,461 symptomatic patients with low risk exercise treadmill scores who underwent myocardial perfusion imaging (MPI), patients with low risk treadmill scores and a low clinical risk score (clinical risk derived by assigning one point to each of the following: typical angina, history of MI, diabetes, insulin use, male gender, and one point for each decade of age over 40 years; high risk is >=5 points), MPI was limited was of limited prognostic value. This is because patients with a low treadmill score and a low clinical score had an excellent 7-year survival (99%) regardless of whether the subsequent MPI was normal, mildly abnormal, or severely abnormal. In patients with low-risk treadmill score and a high clinical risk score, MPI had an independent prognostic value. In this population of patients, survival rate was 94% for patients with normal MPI scans, 94% for patients with mildly abnormal scans, and 84% for patients with severely abnormal scan.*

*J Am Coll Cardiol 2004;43:194-199

The sensitivity of stress ECHO is 79% and negative predictive value (NPV) is 83.7%. The sensitivity of exercise treadmill testing is 43% and specificity is 66%.*

*Am Heart J 2005;149:527-533
• The American College of Cardiology/American Heart Association (ACC/AHA) gives a class IIb (usefulness/efficacy is less well established by evidence/opinion) recommendation for screening higher-risk patients for coronary artery stenosis, and does recommend screening for asymptomatic patients with diabetes. High risk patients are defined as patients with a >20% 10-year-risk of developing coronary artery disease. *

    *Circulation 1999;100:1481-1492

• From a study of 7,456 patients with normal MPI study followed for 665 +/- 200 days:
  o The predicted rate of cardiac death or nonfatal myocardial infarction (MI) in patients with no history or previous coronary artery disease (i.e. no previous MI or revascularization) was <1% per year in the two years following normal MPI in nondiabetic males and females age 80 and older, in diabetic males age 80 and older and in diabetic females age 60 and older.
  o The predicted rate of cardiac death or nonfatal MI in patients with a history of CAD (i.e. previous MI or revascularization) was <1% per year in males (nondiabetic and diabetic) age 50 or greater, in females with diabetes age 50 or greater and in nondiabetic females age 80 or greater. *

    *J Am Coll Cardiol 2003;41:1329-1340
  o Historically, a normal MPI study is considered to indicate low risk if the event rate (cardiac death or nonfatal MI) is below 1% per year.

• The ACC/AHA 2003 Guidelines for Clinical Use of Cardiac Radionuclide Imaging state:
  o Resting left ventricular ejection fraction (LVEF) is universally recognized as one of the most important determinants of long-term prognosis in patients with chronic stable coronary artery disease. LV function during exercise reflects disease severity and provides prognostic information.
  o Studies estimating the extent of LV dysfunction are excellent predictors of cardiac mortality.
  o Markers of provicable ischemia (exertional symptoms, ECG changes, extent of reversible perfusion defects, and stress-induced ventricular dyssynergy) are better predictors of the subsequent development of acute ischemic syndromes.

• “A stress imaging technique (MPI) should be used for patients with widespread resting ST depression (>1 mm), complete left bundle branch block, digoxin use, ventricular paced rhythm, pre-excitation syndrome (Wolff-Parkinson-White), or left ventricular hypertrophy (LVH) with repolarization changes” (in patients with LVH, ST depression during exercise is frequently present in the absence of significant coronary artery disease).

• Cardiovascular disease in women is often times substantially different in its presentation and symptoms than it is in men. Substantial discomfort and morbidity can be experienced by women who have normal or at worst, equivocal cardiac imaging results and who have persisting chest pain syndrome. Oftentimes this is considered due to the presence of microvascular disease which does not lend itself to surgical or mechanical intervention such as PCI and all too frequently does not respond ideally to current medication therapy.

• Women first develop anginal symptoms an average of 10 years later than men and have their first myocardial infarction (MI) an average of 20 years later than men. Women with typical angina have a high prevalence of coronary artery disease (CAD): 60% – 72%. Women with atypical symptoms have a very low prevalence of CAD: 2% – 7%. There is an extremely low risk of CAD in premenopausal women with atypical chest pain. Women with persisting chest pain syndrome despite normal cardiac imaging are thought to have a poor prognosis with higher risk of subsequent cardiac events.
Cardiac disease in women is thought by some to be quite a different disease relative to that seen in men. *

*Am J Cardiol 1995;75:52D-60D

- In women with typical angina, 50% of premenopausal versus 90% of older women will have significant coronary artery disease. There is a sharp rise in coronary heart disease morbidity and mortality in women after age 70.

- One study examined 158 women who presented with chest pain and had at least 2 cardiac risk factors. Women were followed for 26.2 months. Only 2.5% had hard cardiac events (2 MI’s, 2 unstable angina). 81% had experienced chest pain unrelated to a cardiac event. The remaining 19% continued to have chest pain during the follow up period but experienced no adverse events. Only a history of diabetes was significantly associated with a cardiac event.*

*J Women’s Health 2005;14:240-247

- There is a lower sensitivity and specificity for ECG stress treadmill testing in women compared with men. This is thought to be due to women being more likely to have low or inadequate duration of exercise stress test and estrogen having a digitalis-like effect on the ECG (giving false ST segment change) thus, there is a high false positive rate. However, in women with a normal baseline ECG, an adequate duration of exercise, and no ischemic changes, risk of significant CAD is very low.*

*Am J Cardiol 1995;75:52D-60D

- 22% – 58% of asymptomatic patients with Type 2 diabetes show evidence of ischemia on stress myocardial perfusion imaging (MPI). A number of studies have confirmed that stress MPI provides incremental prognostic value and achieves adequate risk stratification in diabetic cohorts.*

*J Am Coll Cardiol 2005;45:50-53

- Diabetics with abnormal resting ECG, evidence of peripheral or carotid occlusive arterial disease, or symptoms suspicious for CAD (chest pain, dyspnea) have a high yield of positive MPI studies. MPI is low yield in lower risk asymptomatic diabetic patients. Further investigation of sequential testing strategies is needed in order to identify an efficient means for screening this population of patients. *

*J Am Coll Cardiol 2005;45:50-53

### Evidence Based Clinical Support

**CD- 4~ ULTRAFAST CT, EBCT, OR MULTIDETECTOR CT FOR CORONARY CALCIUM SCORING**

- Among 1743 unselected asymptomatic men and women who were screened for coronary artery calcium and followed for a mean of 2.5 years, 30.3% subsequently reported chest pain. Coronary artery calcium was seen in 340 patients (19.5%). The proportion of patients who had coronary artery calcium were similar among those who had no chest pain, noncardiac pain, atypical pain, or cardiac chest pain.*

*Am J Cardiol 2005;96:61-63

- A study evaluating coronary calcium scores from electron beam tomography scanning (EBCT) in 1,795 asymptomatic subjects from 1997 – 2000 (age range 62-85 years old) showed that the risk of coronary artery disease increased with increasing calcium score. The mean follow up was 3.3 years. The multivariate-adjusted relative risk of coronary events was 3.1 for calcium scores 101 – 400, 4.6 for calcium scores 401 to 1000 and 8.0 for calcium scores >1000 compared with calcium scores of 0 – 100. Risk prediction based on the cardiovascular risk factors improved when coronary calcification was added. The author concluded that coronary calcification is strong and independent predictor of coronary heart disease.*
• Publications such as the SHAPE task force advocate using imaging such as coronary calcium scoring for general population screening, since current risk assessment tools are imperfect. There is no current outcome data to confirm the cost-effectiveness of this approach.
  o The task force also recommends carotid intimal-media thickness measurement which is performed with ultrasound, does not require radiation, and is much less expensive to perform.
  o It is currently unclear whether either of these modalities adds to screening effectiveness for vascular disease or coronary disease. However, with lower radiation exposure and cost of coronary calcium scoring, calcium scoring or carotid intimal-media thickness measurement may become more acceptable for screening purposes.

Evidence Based Clinical Support
CD- 6~CARDIAC MRI

• Contrast-enhanced cardiac MRI is an excellent imaging study to determine the extent of cardiac damage following a myocardial infarction (MI). Hyper enhancement on T1-weighted delayed contrast-enhanced MRI only occurs in necrotic, irreversibly injured myocardium, irrespective of the age of the infarct. The regional extent of hyper enhancement across the left ventricular wall has been shown to predict functional improvement of stunned or hibernating myocardium, with the likelihood of functional improvement decreasing with increasing segmental extent of hyper enhancement.

• Viability study: In instances in which segments of LV demonstrated decreased wall motion (i.e. stunned or hibernating myocardium), but are shown to have viable myocardium that involves at least 50% of wall thickness, studies have demonstrated that these segments are likely to benefit from revascularization with full recovery of cardiac function.* Thus, MRI is very good at determining whether there has been a subendocardial MI versus a transmural MI. In this respect, MRI is being used to replace both nuclear cardiac stress testing and PET scan for myocardial viability imaging.  

  *J Am Coll Cardiol 2003;42:895-901

• SSFP cine MRI provides an excellent assessment of valvular morphology and motion. Semi-quantitative assessment of gradients and regurgitation is increasingly being assessed by cine CMR.

• Cardiac MRI can reveal myocarditis in specific ways and can help differentiate this from other processes such as MI.

• The degree of valvular calcification is not easily evaluated with MRI.

• Transesophageal echocardiography (TEE) is best for demonstrating valve vegetations in endocarditis.

• MRI is useful in diagnosing paravalvular abscesses associated with endocarditis. These paravalvular abscesses are difficult to demonstrate by echocardiogram.

• Patients with prosthetic valves can be imaged safely in high-field magnets.

• Patients with coronary stents can safely undergo MRI.

• MRI can quantify many aspects of cardiac function, including ventricular volumes, ejection fraction, cardiac output, shunt ratio, valvular pressure gradients, and regurgitation fractions. However, measuring valve function with velocity studies by MRI can be complex. Conventional Echo gives accurate information regarding the valves and is easier to perform.
• Tuberous sclerosis involves benign tumors of the heart and other organs. Usually these are best assessed using cardiac MRI although cardiac CT can also be used.

### Evidence Based Clinical Support

**CD-8~CT OF THE HEART and CTA of the CORONARY ARTERIES**

- Coronary artery disease remains the leading cause of death in Western nations. One-third of all conventional coronary angiograms in the U.S. are performed in conjunction with an interventional procedure, while the rest are performed only for verification of the presence and degree of coronary artery disease. Therefore, development of a reliable noninvasive imaging study of the coronary arteries for detection of coronary artery disease is a high priority.
- In reality, there still is no "gold standard" for the evaluation of coronary disease.
- CT coronary angiography is emerging as a potentially useful imaging study with a variety of applications. However, the standard of reference for diagnosis of coronary artery disease remains conventional coronary angiography.* Conventional coronary angiography gives high spatial resolution and the option of direct performance of interventions such as balloon dilatation or coronary stent placement.
  *Radiology 2004;232:18-37

- Noninvasive imaging of the coronary arteries is complex due to their small size, tortuosity, and cardiac motion. The overall diagnostic quality of noninvasive CT coronary angiography is largely dependent on spatial resolution, the patient’s heart rate during the exam, the choice of appropriate reconstruction time points in the cardiac cycle, calcium interference, and contrast enhancement.
- Heart rate greater than 70-75 bpm, or variation of heart rate during scanning, consistently induces motion artifact and produces less consistent and reproducible imaging results. It is recommended that the heart rate of patients with persistently irregular heart rates (such as atrial fibrillation) result in interscan discontinuities that prohibit evaluation of CT angiographic images for coronary artery stenosis.*
  *Radiology 2004;232:18-37
- Heart rates greater than 70 bpm that do not respond to heart rate slowing medicines limit the accuracy of CTA. In this setting, CTA may need to be reconsidered for another imaging modality.
- Other considerations for obtaining a high quality cardiac CTA:
  - Patients must be able to hold still for a number of minutes and follow breathing instructions closely.
  - Patients should be able to take Nitroglycerin and have no medications that would contraindicate their taking Nitroglycerin
    - Erectile dysfunction drugs are a contraindication to taking Nitroglycerin
  - Patients should not have an iodine allergy or should be prepped for possible allergy reaction to contrast
  - Patients should be able to lift both arms above their shoulders.
  - Any of the above considerations place an obvious limitation on CTA imaging and should be considered a potential contraindication for CTA.
- Currently there is a lack of standardization of the protocols in use for coronary CTA. The consistent and reproducible visualization of the right coronary artery, the circumflex coronary artery, and the small side branches is difficult because of these vessels’ complex motion during the cardiac cycle. For optimal visualization retrospective reconstruction (rendering) data of different coronary arteries is recommended.*
  *Radiology 2004;232:7-17
  *J Am Coll Radiol 2006;3(9):677-685
• Knowledge of imaging techniques regarding multiplanar reformation (MPR), oblique MPR, maximum-intensity projection, shaded surface display, and direct volume rendering is necessary. Different clinical examinations such as stent evaluation, stenosis evaluation and bypass evaluation, require different visualization techniques. Errors such as findings of false stenoses can be avoided by means of accurate and appropriate use of software features. Training regarding the capabilities of the software and the background of the different techniques and their possible pitfalls is necessary.*

*Cardiol Clin 2003;21(4):549-559

• Careful custom tailoring of the contrast bolus for achieving adequate, consistent, and homogeneous contrast attenuation over the entire course of the coronary arteries in order to facilitate imaging is needed. Optimal contrast attenuation within the vessel is high enough to allow lesion detection but not so high that it obscures calcified coronary artery wall lesions.*

*Radiology 2004;232:18-37

• High risk patients, if they receive CTA, may be running an unacceptably high risk of having to have angiography which results in double contrast and essentially double radiation dose which is a major reason to avoid this test in those patients.

• A prospective, single center study evaluating 1,384 coronary artery segments in 103 patients showed that, compared with invasive coronary angiography for detection of significant lesions (>50% stenosis), segment-based sensitivity, specificity, and positive and negative predictive values of 16-slice CTA were 95%, 98% 87% and 99%, respectively. *

*JAMA 2005;293:2471-2478

• A study of 72 patients scheduled for invasive coronary angiography because of suspected CAD who also underwent CTA on a 16-slice CT scanner showed sensitivity, specificity, and positive and negative predictive values of 82%, 98%, 87% and 97%, respectively for CTA. *

*J Am Coll Cardiol 2005;45:123-127
CARDIAC GUIDELINE REFERENCES

CD- 1~ General Guidelines

CD- 3~ Nuclear Cardiac Imaging (MPI)

CD- 3.1~ General

CD- 3.2~ Patients with Known CAD

CD- 3.3~ Patients with no known CAD who are asymptomatic or have stable symptoms

CD- 3.5~ Patients with no known CAD who have new symptoms or worsening symptoms

CD- 3.6 ~ Preoperative Evaluation

CD- 3.7~ MUGA Study
- Invasive Breast Cancer. NCCN Practice Guidelines in Oncology v.2.2006

CD- 4~ Ultrafast CT, EBCT, or Multidetector CT for Coronary Calcium Scoring
- Sever PS, Dehlof B, Poulter NR, et al. Prevention of coronary and stroke events with atorvastatin in hypertensive patients who have average or lower-than-average cholesterol concentrations, in the Anglo-Scandinavian Cardiac Outcomes Trial--lipid lowering arm (ASCOT-LLA): a multicentre randomised controlled trial. *Lancet* 2003 April;361:1149-1158
CD- 6 ~ Cardiac MRI

CD- 7~ Cardiac PET Scan

CD- 8~ CT of the Heart and CTA of the Coronary Arteries
CD- 8.2~ CT Used For Coronary Calcium Scoring

CD- 8.3~ Coronary CTA in the Asymptomatic Patient

CD- 8.5~ Coronary CTA in Patients with Previous Coronary Artery Procedures

CD- 8.7~ Other Indications for Coronary CTA
CD- 8.9~ Unproven Uses of Cardiac CT and Coronary CTA
  [http://circ.ahajournals.org/cgi/content/full/114/16/1761](http://circ.ahajournals.org/cgi/content/full/114/16/1761). Accessed November 29, 2006.
- Blue Cross Blue Shield Association, Technology Evaluation Assessment Program Volume 20, No. 4 May 2005.

CD- 8.10~ Radiation Dose and Coronary CTA

CD- 8.11~ CPT Coding

CD- 9~Diagnostic Left Heart Catheterization

CD- 11~ Syncope

CD- 13~ Cardiac Trauma

EVIDENCE BASED CLINICAL SUPPORT REFERENCES

CD- 3 ~ Nuclear Cardiac Imaging (MPI), Evidence Based Clinical Support
- Cerqueira MD. Diagnostic testing strategies for coronary artery disease: special issues related to gender. *Am J Cardiol* 1995;75:52D-60D.

CD- 4~ Ultrafast CT, EBCT, or Multidetector CT for Coronary Calcium Scoring, Evidence Based Clinical Support

CD- 6~ Cardiac MRI, Evidence Based Clinical Support
CD- 8~ CT of the Heart and CTA of the Coronary Arteries, Evidence Based Clinical Support

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**ABBREVIATIONS and GLOSSARY for PERIPHERAL VASCULAR DISEASE GUIDELINES**  
(see Cardiac Guidelines Glossary)

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<td>AAA</td>
<td>abdominal aortic aneurysm</td>
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<td>ABI</td>
<td>ankle brachial index: a noninvasive, non-imaging test for arterial insufficiency – see toe-brachial index below. This testing can also be done after exercise if resting results are normal.</td>
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<td>Claudication or Intermittent claudication</td>
<td>usually a painful cramping sensation of the legs with walking or severe leg fatigue</td>
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<td>CTA</td>
<td>computed tomography angiography</td>
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<tr>
<td>CTV</td>
<td>computed tomography venography</td>
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<td>DLCO</td>
<td>diffusion capacity: defined as the volume of carbon monoxide transferred into the blood per minute per mmHg of carbon monoxide partial pressure</td>
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<td>DVT</td>
<td>deep venous thrombosis</td>
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<tr>
<td>ECG</td>
<td>electrocardiogram</td>
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<tr>
<td>ENT</td>
<td>Ears, Nose, Throat</td>
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<tr>
<td>HbA1C</td>
<td>hemoglobin A1C: test used to determine blood sugar control for patients with diabetes</td>
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<tr>
<td>MRA</td>
<td>magnetic resonance angiography</td>
</tr>
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<td>MRV</td>
<td>magnetic resonance venography</td>
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<td>PAD</td>
<td>peripheral artery disease</td>
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<td>transient ischemic attack</td>
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<td>TTE</td>
<td>transthoracic echocardiogram</td>
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**Toe-Brachial Index**: useful in patients with ABI above the normal range due to noncompressible posterior tibial or dorsalis pedis arteries

**V/Q Scan**: ventilation and perfusion scan
PERIPHERAL VASCULAR DISEASE IMAGING GUIDELINES

PVD-1 ~ GENERAL GUIDELINES

- The same general risk factors apply for coronary disease as for vascular disease in the non-coronary bed (see CD-3 Nuclear Cardiac Imaging Evidence Based Clinical Support section in the Cardiac guidelines).
- Diabetes is a particularly high risk factor for the development of vascular disease.
- The presence of vascular disease implies a substantially heightened risk for coronary artery disease and confirmed vascular disease may prompt cardiac imaging. (see CD-3 Nuclear Cardiac Imaging in the Cardiac guidelines).
- Even patients less than age 50 with at least one risk factor are considered “at risk” for vascular disease.
- The presence of erectile dysfunction can be associated with vascular disease* (see PV-13 Impotence/Erectile Dysfunction in the Pelvic guidelines). If this is the only indication listed for advanced imaging, Medical Director review is needed.
  *Arch Int Med 2006;166:201-206
- Post angioplasty/reconstruction: Follow-up imaging is principally guided by symptoms
  - Also see
    - AB-22 Abdominal Aortic Aneurysm in the Abdominal guidelines,
    - AB-23 Endovascular Abdominal Aortic Aneurysm Repair in the Abdomen guidelines
    - CH-30 Thoracic Aortic Dissection or Aneurysm in the Chest guidelines.
- Imaging Studies:
  - Carotid studies (neck MRA or CTA) capture the area from the top of the aortic arch (includes the origin of the innominate artery, common carotid artery, and subclavian artery, which gives off the vertebral artery) to the base of the skull.
  - CTA/ MRA abdomen (CPT 74175/74185) images from the diaphragm to the umbilicus or iliac crest.
  - CTA/MRA chest (CPT 71275/71555) images from the base of the neck to the dome of the liver.
  - Runoff studies (CPT 75635 for CTA or 74185, 73725, and 73725 for MRA) image from the umbilicus to the feet.
- CPT Coding:
  - CTA of the abdomen and lower extremities should be coded as CPT 75635 rather than using the individual CPT codes for the abdomen, pelvis, and legs.
  - MRA of the abdomen and lower extremities should be coded as CPT 74185, 73725, and 73725. The CPT code for MRA pelvis should not be included in this circumstance.

PVD-2 ~ SCREENING ASYMPTOMATIC PATIENTS

- Over 50% of individuals with peripheral artery disease (PAD) are asymptomatic or have atypical symptoms. One third of patients with PAD have claudication.*
  *N Engl J Med 2001 May;344:1608-1621
- U.S. Preventive Services Task Force (USPSTF) recommends against routine screening for peripheral vascular disease because screening for PAD among asymptomatic adults in the general population would have few or no benefits due to the low prevalence of PAD.
There is little evidence that treatment of PAD at this asymptomatic stage, beyond treatment based on standard cardiovascular risk assessment, improves health outcomes.

Furthermore, USPSTF found fair evidence that screening asymptomatic adults with the ankle brachial index (ABI) could lead to some small degree of harm, including false-positive results and unnecessary workups.

Thus, the USPSTF concludes that, for asymptomatic adults, the harms of routine screening for PAD exceed benefits.

**Individuals with diabetes:**

- PAD is more than twice as common among diabetics compared with non-diabetic individuals and is a strong predictor of subsequent cardiovascular morbidity and mortality.*
- Elevated HbA1C levels are associated with an increased risk of PAD independently of known risk factors.*
  - *Diabetes Care 2006;29:877-882*
- Many diabetics with PAD are asymptomatic.
- Thus, screening for PAD in diabetic individuals should be performed.
- Screening should be done initially with clinical assessment followed by ABI and/or duplex ultrasound.
  - ABI <0.90 has been shown to have 79% sensitivity and 90% specificity for detecting angiogram-positive PAD (stenosis of >50%).*
  - *Diabetes Care 2006;29:877-892*

**PVD-3 ~ CEREBROVASCULAR AND CAROTID DISEASE**

- See also (in Head guidelines):
  - HD-17 Hyperacute Headache/Berry Aneurysm/Subarachnoid Hemorrhage
  - HD-30 General Stroke/TIA
  - HD-31 Special Stroke/TIA
  - HD-33 Cerebral Vasculitis
  - HD-46 Tinnitus

- Carotid intima-media thickness using duplex ultrasound imaging is being advocated as a screening test for vascular disease. This does not involve advanced imaging.
  - Outcomes data are currently lacking.

- **PVD-3.1 Duplex ultrasound** should be performed initially to evaluate possible carotid artery disease, including carotid bruit, prior to considering advanced imaging.
  - If the bruit originates from the external carotid artery, further imaging is not necessary.
  - If ultrasound shows > 50% occlusion/stenosis of the internal carotid artery, then neck MRA with contrast (CPT 70548) or CTA (CPT 70498) can be performed.
  - The presence or absence of a carotid bruit is not particularly useful in estimating the presence or severity of carotid occlusive disease.

- **PVD-3.2 Patients with typical symptoms of TIA/stroke or carotid dissection:**
  - Carotid imaging with MRA (CPT 70548 for TIA/Stroke, or CPT 70549 for carotid dissection) or CTA (CPT 70498) can be performed initially.
  - Also see HD-30 General Stroke/TIA and HD-31 Special Stroke/TIA in the Head guidelines.
• **PVD-3.3 Patients with suspected vertebrobasilar pathology:**
  o Brain MRI (CPT 70553) and brain MRA (CPT 70544) are generally appropriate.
    ➢ Also see [HD-31 Special Stroke/TIA](#) and [HD-30 Evidence Based Clinical Support](#) section in the Head guidelines.
  o Evaluation by a neurologist is helpful in determining the appropriate imaging pathway.
  o **Surveillance of individuals who are asymptomatic or have unchanged symptoms and known vertebrobasilar disease:**
    ➢ There is no evidence of-based data supporting serial follow-up advanced imaging in these patients.
  o **Surveillance of individuals who are asymptomatic or have unchanged symptoms who are status post vertebrobasilar stenting:**
    ➢ Follow-up imaging studies should be at the discretion of the specialist who performed the stenting or the vascular specialist who is following the patient.

• **PVD-3.4 Surveillance after intracranial hemorrhage:**
  o The preference of the neurosurgeon or neurologist following the patient should be honored. There is no precise schedule for follow-up imaging in these patients.

• **PVD-3.5 Surveillance of individuals with known carotid disease who are asymptomatic or have unchanged symptoms and who have not undergone carotid endarterectomy or carotid angioplasty/stenting:**
  o **In non-diabetics**, follow-up of a known cervical internal carotid stenosis of >50% by ultrasound, neck MRA (CPT 70548), or neck CTA (CPT 70498) can be performed every year for two years.
    ➢ If there is no change in stenosis category after two years, the imaging interval should be increased to every other year.
      ▪ There is no evidence-based data to support continued yearly imaging in these individuals in the absence of disease progression.
    ➢ If there is a change in stenosis category, imaging can remain on a yearly basis until there is no change in stenosis category for two years.
    ➢ Example of a stenosis categories:
      ▪ Mild stenosis (<30%)
      ▪ Moderate stenosis (30-68%)
      ▪ Severe stenosis (70-99%)
  o **In diabetics**, follow-up of a known cervical internal carotid stenosis of >50% by ultrasound, neck MRA (CPT 70548), or neck CTA (CPT 70498) can be performed every year for three years.
    ➢ If there is no change in stenosis category after three years, the imaging interval should be increased to every other year.
      ▪ There is no evidence-based data to support continued yearly imaging in these individuals in the absence of disease progression.
    ➢ If there is a change in stenosis category, imaging can remain on a yearly basis until there is no change in stenosis category for three years.

• **PVD-3.6 Surveillance of individuals who are asymptomatic or have unchanged symptoms who are status post carotid angioplasty or endarterectomy:**
  o Surveillance imaging of asymptomatic patients who have undergone prior endarterectomy has not been proven to reduce neurologic events.*
    
There is insufficient evidence-based data to support serial follow-up MRA, CTA, or other advanced imaging in patients who have undergone prior endarterectomy who are asymptomatic or have unchanged symptoms.

- **PVD-3.7 Surveillance of individuals who are asymptomatic or have unchanged symptoms who are status post carotid stenting:**
  - There are currently no published recommendations regarding the type or frequency of imaging studies for patients who have undergone carotid stenting.
  - Ultrasound should be the initial study unless the vascular specialist has a documented reason why advanced imaging is needed.
  - The preference of the vascular specialist should be honored in terms of frequency of follow-up imaging studies.

- **PVD-3.8 New signs and symptoms** consistent with progressive carotid artery disease are an indication to re-image the neck vessels using ultrasound, neck MRA (CPT 70548) or neck CTA (CPT 70498).

### PVD- 4 ~ UPPER EXTREMITY PERIPHERAL VASCULAR DISEASE

- **MRA (or MRV) of the chest (CPT 71555) and/or upper extremities (CPT 73225) may be required when clinical evidence points to arterial or venous insufficiency.**
  - Symptoms can include muscular limb pain, particularly with exertion, or otherwise unexplained swelling of the upper extremities.
- **Superior vena cava syndrome:** Chest MRV (CPT 71555) may be indicated when this syndrome is suspected. This syndrome is frequently associated with aggressive thoracic cancers or metastases.*
  - Also see CH-29 Superior Vena Cava Syndrome in the Chest guidelines.

- **Upper extremity DVT**
  - Evaluation should begin with chest x-ray (especially if prior intravenous catheter was placed) and duplex ultrasound.
  - Request for advanced imaging should be sent for Medical Director review.
    - MRI of the upper extremity (CPT 73218) and chest (CPT 71550) and/or MRV (CPT 73225 and 71555) are useful for evaluating suspected or known central venous obstruction.
    - CT of the upper extremity (CPT 73201) and chest (CPT 71260) with contrast and/or CTA (CPT 73206 and 71275) can occasionally be helpful.
  - Reference:
    - *ACR Appropriateness Criteria, Suspected upper extremity deep vein thrombosis, 2005

- **MRA (or MRV) of the chest (CPT 71555) and/or upper extremities (CPT 73225) may be required when clinical evidence points to arterial or venous insufficiency.**
  - Symptoms can include muscular limb pain, particularly with exertion, or otherwise unexplained swelling of the upper extremities.
- **Superior vena cava syndrome:** Chest MRV (CPT 71555) may be indicated when this syndrome is suspected. This syndrome is frequently associated with aggressive thoracic cancers or metastases.*
  - Also see CH-29 Superior Vena Cava Syndrome in the Chest guidelines.

- **Upper extremity DVT**
  - Evaluation should begin with chest x-ray (especially if prior intravenous catheter was placed) and duplex ultrasound.
  - Request for advanced imaging should be sent for Medical Director review.
MRI with contrast of the upper extremity (CPT 73219) and chest (CPT 71551) and/or MRV (CPT 73225 and 71555) are useful for evaluating suspected or known central venous obstruction.

CT of the upper extremity (CPT 73201) and chest (CPT 71260) with contrast and/or CTA (CPT 73206 and 71275) can occasionally be helpful.

Reference:

ACR Appropriateness Criteria, Suspected upper extremity deep vein thrombosis, 2005

PVD- 5 ~PULMONARY ARTERY HYPERTENSION

- Pulmonary artery hypertension (PAH) comprises a spectrum of diseases characterized by elevated pulmonary artery pressure with a mean above 25 mmHg at rest or 30 mmHg with exercise, or systolic pulmonary artery pressure at rest > 39 mmHg.
- Confirmatory tests include ECG (right ventricular hypertrophy with/ without strain, right atrial dilatation); chest x-ray; transthoracic echocardiogram (TTE).*
- Identifying the clinical class can be accomplished by arterial blood gas, PFT’s, V/Q scan, TTE.*
  *Eur Heart J 2004 Dec;25(24):2243-2278

- Types of pulmonary hypertension:
  - **Pulmonary arterial hypertension**
    - Includes idiopathic and PAH from e.g. collagen vascular disease, portal hypertension from cirrhosis, etc.
  - **Pulmonary venous hypertension**
    - Due to cardiac disease
    - Stress echocardiogram or left heart catheterization is indicated.
  - **Pulmonary hypertension associated with hypoxemia**
    - PAH secondary to lung disorders
    - PFT’s should be obtained: if restrictive disease is present and DLCO is decreased, high resolution chest CT (CPT 71250) should be obtained to rule out restrictive lung disorders such as idiopathic pulmonary fibrosis.
  - **PAH secondary to chronic thromboembolic disease**
    - Only form of PAH that has potentially curative treatment.
  - Reference:

- **Chest CTA** (CPT 71275) for evaluation of pulmonary hypertension is appropriate if the etiology is felt to be pulmonary embolism. Otherwise, requests should be sent for Medical Director review.

- Obstructive sleep apnea is associated with pulmonary hypertension and can be associated with right heart failure (cor pulmonale).
  - Cardiovascular advanced imaging is generally not indicated in the evaluation of obstructive sleep apnea.
  - ENT imaging in certain settings of nasopharyngeal abnormalities or deformities may be indicated for sleep apnea evaluation.
    - Also see HD-27.2 Sleep Apnea in the Head guidelines.
PVD- 6 ~ AORTIC DISORDERS AND RENAL VASCULAR DISORDERS and VISCERAL ARTERY ANEURYSMS

- See also (in Abdomen guidelines):
  - AB- 22 Abdominal Aortic Aneurysm and Iliac Artery Aneurysm
  - AB- 23 Endovascular Abdominal Aortic Aneurysm Repair
  - AB- 41 Renovascular Hypertension

- See also CH-30 Thoracic Aortic Dissection or Aneurysm in the Chest guidelines

**Thoracic Aortic Disease**

- Chest CT (CPT 71260 or 71270), chest CTA (CPT 71275), or chest MRA (CPT 71555) can be used for surveillance or follow-up of thoracic aortic abnormalities in patients with Loeys-Deitz syndrome, Marfan syndrome, Takayasu arteritis, or Kawasaki syndrome.*

- Less lethal disorders such as Turner syndrome and tuberous sclerosis have also been associated with aortic dissection.*
  *Clin.Cardiol 2006;29:383-386

**Renal Artery disease:**

- See AB- 41 Renovascular Hypertension in the Abdomen guidelines.

**Abdominal aortic abnormality:**

- Also see AB- 22.1 Abdominal Aortic Aneurysm and AB-23 Endovascular Abdominal Aortic Aneurysm Repair in the Abdomen guidelines.

  - Ultrasound should be performed initially in any patient with a pulsatile or expansible abdominal mass.

  ➢ **Exception:** In circumstances in which ultrasound is technically difficult (e.g. obese body habitus), CTA (CPT 74175) [preferred] or MRA (CPT 74185) can be performed initially.

    - If suspicion of lower extremity vascular insufficiency is warranted (see PVD- 7 Lower Extremity Peripheral Vascular Disease), aortoiliofemoral run-off studies from the abdomen to the extremities (CTA--CPT 75635, or MRA—CPT 74185, 73725, and 73725) can be performed.*

- Certain forms of bacterial endocarditis/vasculitis, such as seen in *salmonella* infections, can result in both pseudoaneurysms and true aneurysms of the aorta and require advanced imaging to confirm their presence.

  ➢ Outpatient assessment can be done in settings of suspected salmonellosis, but patients usually undergo inpatient assessment.

**Mesenteric ischemia:**

- Also see AB-9 Mesenteric/Colonic Ischemia in the Abdomen guidelines.

- CTA of the abdomen (CPT 74175), unless contraindicated, is preferred over MRA (CPT 74185) for evaluation of mesenteric ischemia.

- Conventional angiography is still is favored by many specialists.

**Visceral artery aneurysms**

- These include arteries to the spleen, kidney, liver and intestines.

- Aneurysm of these arteries is defined by an increase of more than 50% of the original arterial diameter.

- Risk for rupture is high when the aneurysm is greater than 2 cm or is increasing rapidly*  
Vascular specialist consultation is beneficial in order to determine the time-frame to intervention.

Monitoring by ultrasound or CT with contrast is appropriate, although ultrasound should be attempted first.

Celiac artery aneurysm can be evaluated by CT abdomen with contrast (CPT 74160) and ultrasound.\(^*\)

Arch Surg 2002;137:670-674

No definitive time period for serial studies has been established.

- Initial evaluation with six month follow-up is reasonable.
- Yearly follow-up in conjunction with vascular specialist consultation should be performed if no significant enlargement is seen.

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### PVD- 7 ~ LOWER EXTREMITY PERIPHERAL VASCULAR DISEASE

**Individuals at Risk for Lower Extremity Peripheral Arterial Disease**

- Age less than 50 years, with diabetes and one other atherosclerosis risk factor (smoking, dyslipidemia, hypertension, or hyperhomocysteinemia)
- Age 50 to 69 years and history of smoking or diabetes
- Age 70 years and older
- Leg symptoms with exertion (suggestive of claudication) or ischemic rest pain
- Abnormal lower extremity pulse examination
- Known atherosclerotic coronary, carotid, or renal artery disease

*J Am Coll Cardiol 2006;47:1-192

**PVD-7.1 Claudication**

- ABI is the preferred initial test\(^*\)
  - If ankle brachial index (ABI) and post-exercise ABI are normal, no advanced imaging is indicated.
  - Normal ABI range is 0.9 to 1.3.
  - If ABI is greater than 1.3, this suggests severe peripheral vascular disease and arteries that are inelastic or “stiff.”
    - A toe-brachial index may be used as further screening in patients with ABI’s greater than 1.3
    - Advanced imaging may be indicated in these patients, including CTA with run off (CPT 75635) or MRA of the aortoiliofemoral system (CPT 74185, 73725, and 73725).

ACR Appropriateness Criteria, Claudication, 2005

- ABI may not be needed if a vascular specialist documents classic signs and symptoms of extremity vascular insufficiency and worsening symptoms and indicates why ABI documentation is not necessary (since it may prove useful for comparison to post procedure evaluation)

- ABI is the preferred initial test, but lower extremity duplex ultrasound and Doppler studies are adjuncts.* and should be performed prior to considering advanced imaging.


Radiology 2005;236:1083-1093 and 1094-1103

- Duplex ultrasound with Doppler is useful for identifying location and extent of disease.

- Evaluation by a vascular surgeon or other vascular specialist is helpful in determining the need for advanced imaging.
Advanced imaging is not medically indicated in patients who have claudication symptoms that are improving with medical therapy (walking exercise, rehabilitation and medications).

If advanced imaging is indicated, MRA of the aorta and lower extremities (CPT 74185, 73725 and 73725) or CTA (CPT 75636) can be performed to further evaluate the lower extremity arteries.

- Although MRA may be preferred for infrapopliteal and foot vessels either MRA or CTA may be chosen to visualize these vessels*

  *J Am Coll Cardiol 2006;47:1-192

- Patients with evidence of potentially limb-threatening vascular disease, such as skin breakdown, ulceration, resting leg pain, or gangrene, can undergo advanced imaging (CTA—CPT 75635 or MRA—CPT 74185, 73725, and 73725).

Pseudoclaudication:

- See SP- 4 Lumbar Spinal Stenosis in the Spine guidelines.
- Post-exercise ABI is often one of the first tests ordered for suspected pseudoclaudication in order to delineate vascular vs nonvascular causes.

### PVD-7.2 Lower extremity artery aneurysms

- **Iliac artery aneurysm:**
  - See AB-22 Abdominal Aortic Aneurysm and Iliac Artery Aneurysm in the Abdominal guidelines

- **Femoral artery aneurysm**
  - Patients present with local pressure symptoms, thrombosis, or distal embolization.
  - A pulsatile mass can be felt in the groin.
  - Ultrasound should be performed initially.
  - Vascular specialist consultation is helpful in determining the need for advanced imaging and the time-line to intervention.
  - Advanced imaging (CTA [CPT 73706] or MRA [CPT 73725]) is generally reserved as a preoperative study for patients with no plans for invasive angiography and/or who have technically limited or abnormal ultrasound results.

- **Popliteal artery aneurysm:**
  - Account for 80% of all peripheral aneurysms.
  - Patients with this aneurysm are at risk for other types of aneurysm (e.g. aortic aneurysm).
  - Ultrasound should be the initial imaging study to assess for other aneurysms (especially aortic aneurysm).
  - Vascular specialist consultation is helpful in determining the need for advanced imaging and the time-line to intervention.
  - Advanced imaging (CTA—CPT 73706 or MRA—CPT 73725) is generally reserved as a preoperative study for patients with no plans for invasive angiography and/or who have technically limited or abnormal ultrasound results.
  - Post procedure surveillance imaging is unnecessary and has not been shown to alter patient management. Post interventional functional testing (ABI) may be useful as establishing a new baseline for the patient.

- **Reference:**
• **PVD-7.3 Lower extremity edema**
  o Also see **AB-19 Lower Extremity Edema** in the Abdomen guidelines.
  o Patients presenting with lower extremity edema should have venous duplex study as the initial imaging study to rule out deep venous thrombosis (DVT)
    ➢ In patients with negative venous duplex study and unilateral calf edema, a dedicated ultrasound of the popliteal fossa to rule out popliteal (Baker’s) cyst should be performed initially.
      ▪ If negative, CT or MRI of the lower extremity without contrast (CPT 73700 or 73718) can be performed.
    ➢ In patients with negative venous duplex study and persistent unexplained unilateral or bilateral lower extremity edema, abdominal and pelvic ultrasound should be performed prior to CT of the abdomen and pelvis with contrast (CPT 74160 and 72193), or CT scan of the pelvis (CPT 72193) alone.
  o Although uncommon, diabetic muscle necrosis can present with acute painful swelling in the lower extremity. MRI of the extremity (contrast as requested) is the diagnostic method of choice.
  o The documented presence of chronic lower extremity edema due to chronic venous insufficiency generally will not respond to intervention, and advanced imaging is not routinely indicated.
    ➢ If there is documented need to exclude other more treatable causes such as thigh or abdominal/pelvic clot(s) or masses, MRV (or CTV) can be helpful (CPT 74185 and 72198 or 74175 and 72191). These cases should be sent for Medical Director review.
      ▪ CT venography of the abdomen and pelvis (CPT 74175 and 72191) or MRV (CPT 74185 and 72198) may be appropriate if venous thrombosis is suggested but is indeterminant on other imaging tests, or if the extent of thrombosis needs more detailed assessment.
      ▪ Phlegmasia cerulea dolens can be evaluated by MRV, CTV or CTA with run off to assess the arterial system. MRA (CPT 74185, 73725, and 73725) may also be required for this problem, which can reflect both arterial and venous compromise and produce substantial lower extremity edema.
Evidence Based Clinical Support
PVD- 4 ~ UPPER EXTREMITY PERIPHERAL VASCULAR DISEASE

- Upper extremity claudication is rare and can be manifested as fatigue and cramping pain along with muscle weakness. Positional tests such as Adson’s maneuver can be done on physical examination and demonstrate pulse deficit in certain positions, which may suggest extracellular compromise (e.g. vascular thoracic outlet syndrome). Not all patients with a positive Adson test have thoracic outlet syndrome. Surgery or stenting of the arterial or venous segments is sometimes performed.
- Superior vena cava syndrome is usually manifested as facial and upper truncal and neck swelling, usually in the presence of a malignancy or blood clotting disorder, or in patients with central venous catheters which can cause clotting or scarring of veins.

Evidence Based Clinical Support
PVD- 5 ~PULMONARY ARTERY HYPERTENSION

- Primary pulmonary artery hypertension is more frequent in young females than males and can be manifested as dyspnea on exertion, chest pain, and less commonly, hemoptysis.
- Secondary pulmonary hypertension can be due to multiple or single large pulmonary emboli or obstructive sleep apnea.

Evidence Based Clinical Support
PVD-7~LOWER EXTREMITY PERIPHERAL VASCULAR DISEASE

- PVD-7.1 Claudication
  - ABI measurements:
    - 0.9-1.3 is probably within normal limits
    - ABI 0.5-0.89 represents moderate disease
    - ABI < 0.5 represents severe disease
    - ABI > 1.3 represents “stiff” arterial vessels and may be due to atherosclerotic obstruction, but further testing is justified
    - There is a 5% false negative rate due to calcification of the lower extremity arteries
  - CTA versus MRA of the infrapopliteal vessels:
    - In patients with critical limb ischemia, CT imaging is limited by adequate contrast delivery and the adjacent bone which limits volumetric analysis of the dataset.
    - MRA is an excellent imaging study, but requires expertise by the technologist performing the study to avoid mistaking the paratibial veins for arteries.
PERIPHERAL VASCULAR DISEASE GUIDELINE REFERENCES

PVD- 1~General Guidelines

PVD- 2~Screening Asymptomatic Patients

PVD- 3~Cerebrovascular and Carotid Disease

PVD- 4 ~Upper Extremity Peripheral Vascular Disease

PVD- 5 ~Pulmonary Artery Hypertension

PVD- 6 ~Aortic Disorders, Renal Vascular Disorders, and Visceral Artery Aneurysms

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<td>angiotensin-converting enzyme</td>
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<tr>
<td>ACTH</td>
<td>adrenocorticotropic hormone</td>
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<td>AFP</td>
<td>alpha-fetoprotein</td>
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<tr>
<td>ALT</td>
<td>alanine aminotransferase</td>
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<tr>
<td>AST</td>
<td>aspartate aminotransferase</td>
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<tr>
<td>BEIR</td>
<td>Biological Effects of Ionizing Radiation</td>
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<tr>
<td>BUN</td>
<td>blood urea nitrogen</td>
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<tr>
<td>GFR</td>
<td>glomerular filtration rate</td>
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<tr>
<td>GGT</td>
<td>gamma glutamyl transferase</td>
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<td>gastrointestinal</td>
</tr>
<tr>
<td>HCC</td>
<td>hepatocellular carcinoma</td>
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<td>Hounsfield units</td>
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<td>iliac artery aneurysm</td>
</tr>
<tr>
<td>IV</td>
<td>intravenous</td>
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<tr>
<td>KUB</td>
<td>Kidneys, ureters, bladder (plain frontal supine abdominal radiograph)</td>
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<td>liver function tests</td>
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<td>magnetic resonance cholangiopancreatography</td>
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<td>millisievert</td>
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<tr>
<td>ZES</td>
<td>Zollinger-Ellison Syndrome</td>
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AB-1 ~ GENERAL GUIDELINES

- Abdominal imaging begins at the diaphragm and extends to the umbilicus or iliac crest.
- Pelvic imaging begins at the iliac crest and extends to the pubis.
- CT imaging is a more generalized modality
  - Abdominal CT is usually performed with contrast (CPT 74160). Exceptions are noted in the individual guidelines.
  - Abdominal CT without and with contrast (CPT 74170) can be considered in patients with fatty liver who have suspicion of a liver lesion.
- MRI imaging is preferred as a more targeted study, in cases of renal failure, and in patients allergic to contrast.
  - MRI of the abdomen with contrast only is essentially never performed. If contrast is indicated, MRI abdomen without and with contrast (CPT 74183) should be performed.
  - Pregnant women should be evaluated by ultrasound or MRI where it is a clinical option to avoid radiation exposure.
- Abdominal CT or MRI can be considered to further evaluate abnormalities seen on other imaging modalities such as plain x-ray, ultrasound, etc.
- Prior to considering advanced imaging, patients should undergo a recent detailed history, physical examination, appropriate laboratory studies, and the use of non advanced imaging modalities such as plain x-ray and ultrasound.
- Fever of unknown origin; Unexplained weight loss—Refer to ONC-28 ~Medical Conditions with Cancer in the Differential Diagnosis in the Oncology guidelines.

GENERAL ABDOMINAL SIGNS/SYMPTOMS (ALPHABETICAL ORDER)

AB-2 ~ ABDOMINAL PAIN

- Ultrasound should be the initial imaging study in patients who present with right upper quadrant pain, left upper quadrant pain or epigastric pain, since ultrasound is useful in detecting gallbladder and other hepatobiliary pathology, renal lesions, ascites, splenic pathology, and sometimes adrenal lesions. If an abnormality is found that warrants further imaging, the information provided by ultrasound can help determine the most appropriate advanced imaging modality (CT vs MRI vs MRCP, etc.).*
  *ACR Practice Guidelines for the Performance of an Ultrasound examination of the abdomen or retroperitoneum 1/1/02
- Ultrasound should be the initial imaging study in women with ovaries or uterus intact who present with generalized abdominal or lower abdominal pain, in order to rule out gynecological pathology.
- In general, if advanced imaging is indicated, MRI should be used in pregnant women with acute abdominal pain and equivocal ultrasound.*
  *AJR 2005 Feb;184:452-458
- In other adult patients, MRI is usually not indicated for evaluation of abdominal pain, unless guidelines under Specific Abdominal Organs are met (see AB-21 through AB-43).
- Patients without prior inguinal hernia surgery who present with lower abdominal or groin pain and suspected inguinal hernia may benefit from evaluation by a surgeon. Imaging (ultrasound, CT, MRI) can be helpful when physical exam is inconclusive. Ultrasound
has a very high sensitivity and specificity (88%-100%) for evaluating inguinal and femoral hernias.* Ultrasound identified the pathology in a groin (either hernia or lipoma) without a palpable bulge at an accuracy of 75%.*

*Ann Ital Chir. 2002 Jan-Feb;73(1):65-68

- In all other patients who present with persistent abdominal pain (greater than 4 weeks with no improvement) with unremarkable endoscopy results, CT scans of the abdomen and pelvis with contrast (CPT 74160 and 72193) can be performed.
  - GI specialist evaluation can be helpful in determining the appropriate imaging pathway
  - Repeat imaging in patients with unchanged symptoms is not appropriate.
  - Patients with severe abdominal pain disproportionate to clinical findings should undergo mesenteric CTA or MRA (CPT 74175 or 74185) if plain x-rays and/or abdominal CT is negative (see AB-9 Mesenteric/Colonic Ischemia).
- CT of abdomen and/or pelvis may be performed to evaluate abnormalities detected on plain abdominal x-rays that require further clarification.

**AB- 3 ~ ABDOMINAL SEPSIS (Suspected Abdominal Abscess)**

- CT abdomen and/or pelvis with contrast (CPT 74160 and/or 72193) is indicated when the patient has a palpable mass or suspicious abdominal symptoms with fever and/or elevated white count.*
  *ACR Appropriateness Criteria, Acute Abdominal Pain, 2006
- Ultrasound may be useful in follow-up of known fluid collections, especially with catheter drainage, provided the patient is stable or improving. Serial CT scans with contrast (CPT 74160 and/or 72193) are also appropriate.

**DIARRHEA/CONSTIPATION/BLOATING—SEE AB-26**

**AB- 4 ~ EPIGASTRIC PAIN/DYSPEPSIA/GASTRITIS/POSTPRANDIAL FULLNESS**

- Ultrasound should be the initial imaging study in patients who present with epigastric pain, since ultrasound is useful in detecting gallbladder and other hepatobiliary pathology, renal lesions, ascites, splenic pathology, and sometimes adrenal lesions. If an abnormality is found that warrants further imaging, the information provided by ultrasound can help determine the most appropriate advanced imaging modality (CT vs MRI vs MRCP, etc.).*
  *ACR Practice Guidelines for the Performance of an ultrasound examination of the abdomen or retroperitoneum,1/1/02
- Patients <55 with epigastric pain/dyspepsia should initially have 4 to 8 weeks of conservative treatment with antisecretory medication and/or H. Pylori treatment.
  - Patients who fail conservative treatment benefit from GI consultation, and upper endoscopy should be considered.
  - Non-invasive imaging is of low yield.*
  *Am J Gastro 2005;100:2324-2337
- Patients ≥ 55 with epigastric pain/dyspepsia who present with anemia, weight loss, progressive dysphagia, bleeding, family history of GI cancer, abnormal labs, or history of GI disease should undergo initial endoscopy.
  - Evaluation by a GI specialist should be strongly considered.
  - Advanced imaging usually proceeds based upon the GI consultation.*
  *Am J Gastro 2005;100:2324-2337
• Symptoms that fail to respond to conservative treatment with antisecretory and/or *H. pylori* medications should be evaluated by upper GI series or endoscopy.
  o GI consultation is helpful, and advanced imaging should not be used as the initial study unless there is clinical evidence for tumor.*
  
  *South Med J 2001;94(2):184-189

• In patients with suspicion for **pancreatic disease** (especially those with chronic alcohol abuse or chronic pancreatitis) and symptoms of persistent midepigastric pain (greater than 3 to 4 weeks with no improvement) or weight loss, CT of the abdomen with contrast (CPT 74160) is appropriate.
  o However, patients with nonspecific abdominal pain and less than three times the upper limit of normal elevation of amylase (normal range: 53-123 units/L) and lipase (normal range: 10-150 units/L) rarely have detectable pancreatic pathology* and should have a trial of conservative treatment (e.g. clear liquid diet) prior to considering advanced imaging of the pancreas.
  
  *Can J Gastroenterol 2002 Dec;16(12):849-854
  o Lipase levels are more specific for acute pancreatitis, as increased amylase may be present in a variety of conditions.
  o GI or surgical consultation is useful in determining the need for advanced imaging.

• CT of abdomen and/or pelvis may be performed to evaluate abnormalities detected on plain abdominal x-rays that require further clarification.

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**AB- 5 ~ FLANK PAIN, RULE OUT RENAL STONE**

• If renal stone is not at the top of the differential diagnosis, ultrasound should be performed as the initial imaging study.

• If renal stone is at the top of the differential diagnosis, CT scans of the abdomen and pelvis without contrast (CPT 74150 and 72192) are the best imaging studies in the non-pregnant patient to evaluate kidney stone.

• In pregnant patients and children, ultrasound or MR urography (MRI abdomen and pelvis, contrast as requested) is the best initial study to avoid radiation exposure.*
  
  *ACR Appropriateness Criteria, Acute Onset Flank Pain, 2005

• CT urogram (CT abdomen and pelvis without and with contrast—CPT 74170 and 72194) should be performed, if requested, in patients over 40 years old with flank pain and documented hematuria on 2 of 3 urinalysis specimens.

• Serial CT scans to determine the passage or dissolution (of uric acid stones) of kidney stones are acceptable if they do not exceed three scans in a six week period. If the stone has been seen on the pelvic CT portion of the CT scan, the subsequent CT scan(s) should only include the pelvis. Urology evaluation can be helpful in determining the need for serial CT scans.

• Post-procedure follow-up should be performed with x-rays of the abdomen every 6 to 12 months in asymptomatic patients unless the patient had uric acid stones.*
  o Noncontrast CT abdomen and/or pelvis (CPT 74150 and/or 72192) can be used to follow-up patients with uric acid stones.
  o CT abdomen and pelvis without and with contrast (CPT 74170 and 72194) can be performed if there were surgical complications or the patient develops unusual symptoms.*

Gastroenteritis is generally defined as diarrhea with nausea and vomiting and usually with a viral or bacterial etiology.

Imaging is only necessary if laboratory studies and physical examination reveal an acute abdomen (e.g. evidence of bowel obstruction, toxic megacolon [abdominal swelling, fever, tachycardia, elevated white blood cell count], or perforation).

GI consultation is helpful in evaluating diarrhea lasting more than 1 to 2 weeks, failure of conservative management, GI bleeding, or abnormal labs including stool analysis and/or culture.

Reference:

Patients with known diverticulosis and/or suspected diverticulitis who present with any one of the following clinical findings: severe abdominal pain, palpable mass on examination, nausea/vomiting, fever, significant abdominal tenderness to palpation, or elevated white blood cell count, should proceed to CT of the abdomen and pelvis with contrast (CPT 74160 and 72193) in order to rule out significant inflammation or complications of diverticulitis such as abscess or perforation, prior to invasive diagnostic procedures such as colonoscopy.

Patients with diabetes, renal failure, or the very elderly should be evaluated initially with CT abdomen and pelvis with contrast (CPT 74160 and 72193), or without contrast (CPT 74150 and 72192) for those with renal failure.

Patients who present with mild to moderate abdominal pain, but without significant clinical findings may benefit from a 5 to 7 day trial of antibiotic therapy and close observation prior to considering advanced imaging.

Pelvic ultrasound is the initial imaging study of choice for women of child bearing age (<45 years old) who still have ovaries or uterus intact, for detecting gynecologic abnormalities that may cause left lower quadrant pain.

CT abdomen and pelvis with contrast (CPT 74160 and 72193) are the preferred imaging tests for the evaluation of suspected complicated diverticulitis to identify extracolonic disease that might warrant an interventional procedure.

Patients with mild pain and heme positive stools or rectal bleeding should proceed to colonoscopy first, since advanced imaging with CT is rarely helpful in the initial evaluation of these patients.

References:
- Am Fam Physician 2005;72:1229-1234 and 1241-1242
- ACR Appropriateness Criteria, Left Lower Quadrant Pain, 2005

Ultrasound should be the initial imaging study in patients who present with, left upper quadrant pain, since ultrasound is useful in detecting gallbladder and other hepatobiliary pathology, renal lesions, ascites, splenic pathology, and sometimes adrenal lesions.
an abnormality is found that warrants further imaging, the information provided by ultrasound can help determine the most appropriate advanced imaging modality (CT vs MRI vs MRCP, etc.).*

*ACR Practice Guidelines for the Performance of an Ultrasound examination of the Abdomen and Retroperitoneum, 1/1/02

**AB- 9 ~ MESENTERIC/COLONIC ISCHEMIA**

- Also see Mesenteric Ischemia under PVD- 6 Aortic Disorders and Renal Vascular Disorders, and Visceral Artery Aneurysms in the Peripheral Vascular Disease guidelines.
- GI evaluation may be helpful in determining this diagnosis.
- Chronic mesenteric ischemia is associated with postprandial pain and marked weight loss.
- In patients with chronic postprandial abdominal pain and weight loss with a negative abdominal/pelvic CT, abdominal CTA (CPT 74175) or MRA (CPT 74185) can be obtained.*

  *World J Gastroenterol 2006 May;12(20):3243-3247

- Patients with minimal abdominal tenderness on physical examination and mild to moderate abdominal pain, diarrhea or lower intestinal bleeding suggesting colonic ischemia should be evaluated by barium enema or colonoscopy initially.
  - MRA/CTA are not helpful unless symptomatology is localized to the right colon and pain more severe than clinical findings.*

  *Gastroenterology 2000 May;118(5):951-953

**AB- 10 ~ POST OPERATIVE PAIN WITHIN 60 DAYS FOLLOWING ABDOMINAL SURGERY**

- CT abdomen and pelvis with contrast (CPT 74160 and 72193) can be performed in patients with suspected postoperative complications (e.g. bowel obstruction, abscess, anastomotic leak, etc.).
- Pregnant women should be evaluated with MRI (contrast as requested).*
- Beyond 60 days postoperatively, see AB-2 Abdominal Pain.

  *ACR Appropriateness Criteria, Suspect Small Bowel Obstruction, 2005
  *ACR Appropriateness Criteria, Acute Abdominal Pain and Fever or Suspected Abdominal Abscess, 2006

**AB- 11 ~ RIGHT LOWER QUADRANT PAIN, RULE OUT APPENDICITIS**

- Women of childbearing age and pregnant patients may be evaluated first with ultrasound if local expertise exists. If positive, no further diagnostic imaging is necessary. If negative or equivocal, CT with contrast (CPT 74160 and 72193) or without contrast (CPT 74150 and 72192) can be performed.
  - MRI without and with contrast (CPT 74183 and 72197) or without contrast (CPT 74181 and 72195)* can be performed for pregnant patients if ultrasound is equivocal.
  - References:
    - AJR 2004 Sept;183:671-675
    - Radiology 2006 Mar;238(3):891-899
• If appendicitis is strongly suspected, CT of the abdomen and pelvis either with contrast (CPT 74160 and 72193) or without contrast (CPT 74150 and 72192) should be performed in all patients except pregnant patients (see above).*
  *ACR Appropriateness for Acute Abdominal Pain, 2006
• If appendicitis is not at the top of the differential diagnosis, then women less than 45 years old who have ovaries or uterus intact and present with right lower quadrant pain should have ultrasound of the pelvis performed initially to rule out gynecological pathology.

AB-12 ~ RIGHT UPPER QUADRANT PAIN, RULE OUT CHOLECYSTITIS

• Right upper quadrant ultrasound is generally the imaging study of choice in the patient with acute right upper quadrant pain, with or without fever, if the gallbladder has not been removed.*
  *ACR Appropriateness Criteria: Right Upper Quadrant Pain, 2005
  Accessed November 20, 2006
• In patients who have had cholecystectomy, or in patients with normal ultrasound, CT of the abdomen with contrast (CPT 74160) can be performed.

MISCELLANEOUS ABDOMINAL ENTITIES (ALPHABETICAL ORDER)

AB-13 ~ ABDOMINAL LYMPHADENOPATHY

• Patients with lymphadenopathy localized to the abdomen and found incidentally on previous imaging without associated fever, weight loss, pain, GI bleeding, or other intraabdominal findings to raise the suspicion of malignancy, can have one follow-up CT abdomen with contrast (CPT 74160) or CT abdomen and pelvis with contrast (CPT 74160 and 72193) two months following the original imaging study.
  o If enlarged lymph node(s) persist, biopsy should be considered to establish a histological diagnosis.*
  *Am Fam Physician 2001 Jan;63(1)
  Accessed September 20, 2007
  Accessed September 20, 2007

AB-14 ~ BARIATRIC SURGERY

• Patients who have had obesity surgery and present with fever, abdominal pain, abdominal distention, frequent vomiting, or suspected incisional hernia should undergo CT of the abdomen and pelvis with contrast (CPT 74160 and 72193).
• Patients who have had obesity surgery within the past six months and present with acute or progressive shortness or breath and suspicion of pulmonary embolus should have CT of the chest with contrast (CPT 71260) or chest CTA (CPT 71275).

AB-15 ~ BLUNT ABDOMINAL TRAUMA

• Significant trauma should be evaluated in the Emergency Department.
• Trauma with low probability of intra-abdominal injury should have ultrasound initially and any positive findings can be further evaluated with CT abdomen and/or pelvis without and with contrast (CPT 74170 and/or 72194).
• For more significant trauma or blunt renal trauma associated with hematuria,¹ ² CT abdomen and pelvis without and with contrast (CPT 74170 and 72194) may be used initially to determine patients who need hospitalization for observation.³

³ ACR Appropriateness Criteria, Blunt Abdominal Trauma, 2005

### AB-16 ~ GAUCHER’S DISEASE

• See also PN-6.3 Gaucher’s Disease in the Peripheral Nerve Disorders guidelines

**Imaging for follow-up:**
- **Patients not on enzyme therapy:** MRI abdomen without contrast (CPT 74181) and MRI lower extremity without contrast (CPT 73718) every 12 to 24 months
- **Patients on enzyme therapy:**
  - **Not achieved therapeutic goals:** MRI abdomen without contrast (CPT 74181) and MRI lower extremity without contrast (CPT 73718) every 12 months
  - **Achieved therapeutic goals:** MRI abdomen without contrast (CPT 74181) and MRI lower extremity without contrast (CPT 73718) every 12 to 24 months
  - **Change in dose of medication or clinical complication:** MRI abdomen without contrast (CPT 74181) and MRI lower extremity without contrast (CPT 73718)
- Patients with active bone disease may require more frequent monitoring than once a year.

**References:**
- Current Medical Research and Opinion 2006;22(6):1045-1064

### AB-17 ~ HERNIAS

• Patients without prior inguinal hernia surgery who present with lower abdominal or groin pain and suspected inguinal hernia may benefit from evaluation by a surgeon. Imaging (ultrasound, CT, MRI) can be helpful when physical exam is inconclusive. Ultrasound has a very high sensitivity and specificity (88%-100%) for evaluating inguinal and femoral hernias.* Ultrasound identified the pathology in a groin (either hernia or lipoma) without a palpable bulge at an accuracy of 75%.*

*Ann Ital Chir. 2002 Jan-Feb;73(1):65-68

• Patients with known or suspected Spigelian hernia (anterior abdominal wall hernia through the semilunar line), ventral hernia, or incisional hernia can be evaluated by ultrasound initially, but CT of the abdomen (and pelvis if below the umbilicus) with contrast (CPT 74160 ± 72193) or without contrast (CPT 74150 ± CPT 72192) may be necessary for definitive evaluation.

• Patients with known or suspected incisional hernia can be evaluated with CT abdomen (and pelvis where applicable) either with contrast (CPT 74160 ± 72193) or without contrast (CPT 74150 ± CPT 72192) (whichever the physician prefers).
• Patients with suspected recurrent inguinal hernia after inguinal hernia surgery can have CT of the pelvis with contrast (CPT 72193) or without contrast (CPT 72192) (whichever the physician prefers).

• **Sportsman’s Hernia**
  o A controversial clinical entity thought to account for up to 5% of all groin injuries, especially among athletes involved in kicking sports.
  o Probably a chronic overuse injury involving posterior inguinal wall weakness, tearing of the transversus abdominis aponeurosis, and neuralgia.
  o Conservative management is performed initially. Some elite athletes require surgical intervention.
  o Ultrasound may show posterior inguinal wall bulging, but this is also seen in asymptomatic athletes.
  o Advanced imaging is not indicated.
  o The microtears described at surgery cannot be reliably diagnosed on imaging and therefore, **this condition remains a clinical diagnosis**.

  o Reference:

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**AB-18 ~ LIPOMA**

• **Subcutaneous lipoma** does not require imaging for diagnosis
  o Evaluation by a dermatologist or surgeon is helpful in determining the need for advanced imaging.
  o If the clinical exam is equivocal, ultrasound should be performed initially.
  o Noncontrast MRI can be performed if surgery is planned.

• Lipomas in other locations (not subcutaneous) should be evaluated by ultrasound or CT without and with contrast.
  o Lesions with Hounsfield units less than -50 HU do not require additional imaging except for surgical planning.*
  o Noncontrast MRI can be considered if ultrasound and/or CT are equivocal, or for preoperative planning. MRI shows a discrete, homogeneous fatty mass with few or no thin septa and minimal or no areas of high T2 signal. *
    > *AJR 2004;182:733-739*

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**AB-19 ~ LOWER EXTREMITY EDEMA**

• Also see [PVD- 7.3 Lower Extremity Edema](#) in the Peripheral Vascular Disease guidelines.
AB-20 ~ ZOLLINGER-ELLISON SYNDROME (ZES)

- The initial imaging for evaluation of elevated serum gastrin (normal value is <100 pg/ml) and/or abnormal gastric acid secretory test should be Somatostatin Receptor Scintigraphy (sensitivity of >95%).
  - If the serum gastrin is not elevated and there is no abnormal gastric acid secretory test, then no advanced imaging is needed.
- Surgical consultation is helpful in determining the appropriate imaging pathway.
- CT abdomen with contrast (CPT 74160) or MRI abdomen without and with contrast (CPT 74183) have a specificity approaching 100%, but sensitivity of only 20%-59% in detecting gastrinoma.
- References:

SPECIFIC ABDOMINAL ORGANS

AB-21 ~ ADRENAL CORTICAL LESIONS

- AB-21.1 Adrenal Cortical Lesions
  - CT of the abdomen without contrast (CPT 74150) is the imaging study of choice in patients with no history of malignancy, no symptoms, and a lesion less than 3 cm.
    - If the Hounsfield number is less than 10 HU, malignancy is unlikely and no follow-up is required.*
  - J Clin Endocrinol Metab 2005 Feb;90(2):871-877
  - Noncontrast CT (CPT 74150) and chemical shift MRI (CPT 74181) have comparable performances in the evaluation of lipid content.
  - Mass lesions larger than 6 cm or hormone-secreting tumors should be resected.*
    *ACR Appropriateness Criteria, Incidental Discovery of Adrenal Mass, 2005
    *AJR 2005;185:684-688
  - If the lesion cannot definitely be characterized as a benign adenoma on noncontrast CT, CT of the abdomen with contrast (CPT 74160) with washout calculated can be performed to help distinguish benign adenoma from other lesions such as metastases.
    - Over 50% washout of contrast material on a 10-minute delayed CT scan is diagnostic of an adenoma. This is the most sensitive and specific study because it can detect both lipid rich (70% of adenomas) and lipid poor (30% of adenomas) adenomas.
    - If CT is contraindicated, chemical shift MRI (CPT 74181) can be performed.
    - MRI can only reliably detect lipid rich adenomas.
  - If CT of the abdomen with washout is indeterminate, MRI will not add significant information.
    - Therefore, follow-up CT of the abdomen without contrast (CPT 74150) in 3 to 6 months and again at 12 months and at 24 months can be performed.
    - Endocrine re-evaluation should be performed at one year.¹ ²
    - There is no good evidence supporting continued radiologic surveillance if the follow-up at 24 months shows no change in adrenal tumor size.²
      ¹J Clin Endocrinol Metab 2005;90(2):871-877
      ²Ann Intern Med 2003;138:424-429
If CT with washout or MRI defines the lesion as a probable adenoma, follow-up imaging is not indicated.

If CT is contraindicated and MRI is indeterminate, follow-up noncontrast abdominal MRI (CPT 74181) at 3 to 6 months and at 12 months and at 24 months can be performed.*


CT of the abdomen without contrast (CPT 74150) is adequate to evaluate a possible myelolipoma.

In the oncology patient, CT without and with contrast (CPT 74170) (malignant lesions show slow enhancement with delayed washout after IV contrast) or MRI of the abdomen (contrast as requested; default CPT code 74183) is appropriate for evaluation of an adrenal lesion.

Biopsy may be considered if pheochromocytoma is excluded.

**AB-21.2 Adrenal Endocrine Tumors**

In patients with signs/symptoms of an adrenal cortical endocrine syndrome (e.g. Cushing’s syndrome, Conn’s syndrome), evaluation may include dexamethasone suppression, serum ACTH level, serum aldosterone/renin, and/or virulizing hormone levels, and 24 hour urine for adrenal hormones.*

Normal Values:

- Aldosterone: 3-10 ng/dl (supine); 5-30 ng/dl (upright)
- Cortisol: at 8am: 250-850 nmol/L
  at 4pm: 110-390 nmol/L
  at 10pm: 50% of 8am value


CT with bolus arterial phase (CPT 74160) can detect or exclude an adrenal mass in a high percentage of cases and should be the initial imaging study.

**Pheochromocytoma**

Signs/symptoms include flushing spells and/or poorly controlled hypertension.

Elevated plasma metanephrines support the diagnosis of pheochromocytoma.

If plasma metanephrines are not elevated, a 24-hour urine for catecholamine and metanephrine levels should be obtained prior to considering advanced imaging.

If catecholamine and metanephrine levels are not elevated in a 24-hour urine, then no advanced imaging is indicated unless unexplained symptoms suggestive of pheochromocytoma persist.¹²

If possible, 24-hour urine for catecholamines and metanephrines should be obtained after an episode of sign/symptoms (e.g. following a hypertensive crisis).

Sensitivity for diagnosing pheochromocytoma is 99.7% with this approach.¹²


Chemical shift MRI (CPT 74181) is the preferred imaging study for possible pheochromocytoma, since the tumor lights up brightly on T2 weighted images; however MRI abdomen (contrast as requested) can be performed.

In patients with elevated catecholamines/metanephrines, great care should be exercised when considering IV contrast administration. These patients are known to have hypertensive crises with the bolus injection of IV contrast.
AORTA

AB-22 ~ ABDOMINAL AORTIC ANEURYSM (AAA) and ILIAC ARTERY ANEURYSM (IAA)

• AB-22.1 Abdominal Aortic Aneurysm (AAA)
  o Also see PVD-5 Aortic Disorders and Renal Vascular Disorders, and Visceral Artery Aneurysms in the Peripheral Vascular Disease guidelines.
  o Ultrasound is the preferred initial imaging study in the non-obese patient to screen for AAA or to evaluate a pulsatile abdominal mass.
  o Serial ultrasounds are used to follow aneurysm size in non-surgical, non-obese candidates who are asymptomatic and have aneurysms less than 5 cm in males and less than 4.5 cm in females.*
    *Circulation 2006;113:463-654
  o Patients with AAA’s smaller than 4 cm in diameter should be followed by ultrasound every 2 to 3 years.*
    *Cardiosource Review Journal November 2006, pp.73-77
  o CT of the abdomen with contrast (CPT 74160) is indicated to follow asymptomatic obese patients using the same imaging timeline used for ultrasound in non-obese patients.
  o CT of the abdomen and pelvis with contrast (CPT 74160 and 72193), without and with contrast (CPT 74170 and 72194), or CTA (CPT 74175 and 72191) is indicated for surgical candidates, or to evaluate suspected rupture or dissection.
  o MRA (CPT 74185 and 72198) or CTA (CPT 74175 and 72191) of the abdomen and pelvis can be used for surgical planning if the vascular surgeon will substitute the study for aortography.
  o Surveillance CT of the abdomen and pelvis with contrast (CPT 74160 and 72193) should be performed every 3 to 5 years after open repair of a AAA to screen for aneurysms in the remaining aorta.*
    *Am Fam Physician 2006;73:1198-1204 and 1205-1206

• AB-22.2 Iliac Artery Aneurysm (IAA)
  o Iliac artery aneurysms are most commonly associated with aortic aneurysms.
  o Isolated IAA’s are rare.
    ➢ The incidence is estimated to be 6.58/100,000 for men and 0.26/100,000 for women in the U.S.¹
  o Isolated IAA’s are frequently bilateral at time of presentation.
  o The majority of patients are male and between 50 and 70 years old.²
  o The normal size of the iliac artery is <1cm. IAA’s rarely rupture when <2cm.²
  o The average size of an IAA is 4 to 5 cm, and the average size of a ruptured aneurysm is estimated at 6 cm.¹
  o Surgical intervention should be considered when an IAA exceeds 3 to 4 cm.²
  o Evaluation of a suspected IAA should begin with ultrasound.
    ➢ If ultrasound is equivocal, CT pelvis with contrast (CPT 72193) can be performed.
  o If IAA is found, referral to a Vascular surgeon is appropriate.
    ➢ Follow-up imaging studies can be performed at the discretion of the Vascular specialist.
  o In patients who are status post endovascular repair of an isolated IAA, ultrasound, CT pelvis (CPT 72193 or 72194), or CTA pelvis (CPT 72191) can be performed every 6 months.²

AB-23 ~ ENDOVASCULAR ABDOMINAL AORTIC ANEURYSM (AAA) REPAIR

- Preoperative imaging in patients with AAA being considered for endovascular repair can include CT of the abdomen and pelvis without and with contrast (CPT 74170 and 72194) or CTA (CPT 74175 and 72191). The without contrast portion can help evaluate thrombus and calcification in the aneurysm.
- MRA of the abdomen and pelvis (CPT 74185 and 72198) are also acceptable preoperative studies if there is a contraindication to CT or per the surgeon’s preference.
- Postoperative imaging of patients who have undergone endovascular repair can include CT of the abdomen and pelvis (contrast as requested, although without and with contrast—CPT 74170 and 72194 is the usual), CTA of the abdomen and pelvis (CPT 74175 and 72191), or MRA of the abdomen and pelvis (CPT 74185 and 72198), although MRA is not the preferred study.
  - Routine imaging studies are obtained at 1 month, 6 months, and 12 months following repair, then every year.*
  - An additional study at 3 months can be performed if there was evidence of endoleak on the 1 month study.

AB-24 ~ AORTIC DISSECTION

- See CH-30 Thoracic Aortic Dissection or Aneurysm in the Chest guidelines
- Suspicion for acute dissection should be handled as a medical emergency.

BOWEL (ALPHABETICAL ORDER)

DIVERTICULITIS – SEE AB-7
MESENTERIC/COLOnic ISCHEMIA – SEE AB-9

AB-25 ~ BOWEL OBSTRUCTION

- Plain x-rays of the abdomen (obstructive series) should be obtained as the initial study in patients with suspected bowel obstruction.
- CT of the abdomen and pelvis with contrast (CPT 74160 and 72193) may be used to confirm the presence and site of an obstruction if plain x-rays are abnormal or equivocal.
- CT with contrast (CPT 74160 and 72193) may also be indicated if there is a high index of suspicion for bowel obstruction (abdominal pain, vomiting, constipation, abdominal distention, failure to pass flatus), especially in patients with prior history of abdominal surgery, history of malignancy, or patients with current hernias.*
  *ACR Appropriateness Criteria, Suspected Small Bowel Obstruction, 2005

AB-26 ~ DIARRHEA/CONSTIPATION AND IRRITABLE BOWEL

- Diarrhea in the absence of fever, weight loss, abnormal physical examination findings, fecal incontinence, GI bleeding, or abnormal labs including stool analysis, should be treated conservatively initially or endoscopy should be performed.
  - Diarrhea associated with any of the above signs/symptoms may require imaging depending on the highest probable concern.
GI consultation is helpful in determining the appropriate imaging pathway.

- If advanced imaging is indicated, CT scans of abdomen and pelvis with contrast (CPT 74160 and 72193) are appropriate.

**References:**
- *Gastroenterol* 1999;116:1461-1463
- *Gastroenterol* 2004;127:287-293

**Constipation** in the absence of GI bleeding, fever, substantial pain, vomiting, weight loss, rectal pain, abnormal lab studies, or abnormal physical examination findings should be treated conservatively.

- Patients who fail to respond to treatment or have any of the above abnormal findings should undergo barium enema or endoscopy.
- GI consultation is helpful in determining the appropriate imaging pathway.
- Reference:
  - *Am Fam Physician* 2002 June;65(11):2283-2290
- MRI Defecography for constipation should be considered investigational. It may be appropriate if ordered for preoperative evaluation for the planning of complex pelvic reconstruction.*
  - *Obstet Gynecol* 2004;103:41-46
  - *Radiographics* 2002;22:817-832

**Bloating and/or Irritable bowel syndrome**

Irritable bowel syndrome is frequently a diagnosis of exclusion and is often associated with bloating or abdominal fullness.

- The criteria for making the clinical diagnosis includes the following:
  - Abdominal pain
  - Onset of symptoms associated with a change in frequency of stool (diarrhea, constipation or both)
  - Onset of symptoms with an associated change in the form of stool.
  - Relief of symptoms with defecation
- If the above symptoms occur in a patient under age 50 and are associated with alarm symptoms such as fever, anemia, weight loss, GI bleeding, frequent nocturnal symptoms, or failure of a 6-8 week trial of conservative therapy, work-up should include laboratory studies and flexible sigmoidoscopy prior to considering advanced imaging.
- Patients ≥ age 50 with or without alarm symptoms should be evaluated with endoscopy initially.
- GI consultation is helpful in determining the appropriate imaging pathway, since advanced imaging is often not indicated in these patients.
- References:
  - Holten K. *Diagnosing the Patient with Abdominal Pain and Altered Bowel Habits: Is It Irritable Bowel Syndrome?* AFP 2003 May;67(10)
  - *Gastroenterol* 2000;119:1761-1778
AB-27 ~ GI BLEEDING

- GI bleeding should be evaluated initially by endoscopy or barium studies unless endoscopy is contraindicated.*
  
  *Gastroenterol 2000;118:197-200

AB-28 ~ INFLAMMATORY BOWEL DISEASE RULE OUT CROHN’S DISEASE or ULCERATIVE COLITIS

- Colonoscopy or barium studies are the preferred imaging studies for the initial evaluation of suspected early Crohn’s disease or ulcerative colitis when pathology is limited to the mucosa.
- CT of the abdomen and pelvis with contrast (CPT 74160 and 72193) are the best studies for assessing mesenteric and extra-intestinal extent of disease.
- CT of the abdomen and pelvis with contrast (CPT 74160 and 72193) are the best studies for evaluation of possible abscess, bowel perforation, fistula formation, or acute inflammation in the patient with known Crohn’s disease or ulcerative colitis and an acute exacerbation (abdominal pain).
- Endoscopic ultrasound, rectal ultrasound or MRI (CPT 72197) may be considered in the setting of rectal pathology (either inflammatory or neoplastic) to evaluate for peri-rectal involvement.
- Suspected Small Bowel Crohn’s should be initially evaluated with small bowel follow through (SBFT), barium study, and/or ileoscopy. If these are inconclusive or if obstructive disease is expected, CT enterography may be considered (CPT 74160 and 76377).¹
  
  o Capsule Endoscopy (CPT 91110) may be considered if SBFT and/or ileoscopy are inconclusive, and NON-obstructive small bowel Crohn’s is present. Capsule endoscopy is particularly effective for detecting proximal and early mucosal disease.²

  ¹Radiology 2006 Jan;238(1):128-134
  ²Cigna HealthCare Coverage Position. Subject: Capsule Endoscopy, Revised February 15, 2007

- SPECT and PET are considered investigational.*

  *ACR Appropriateness Criteria, Crohn’s Disease, 2005

AB-29 ~ VIRTUAL COLONOSCOPY (VC)

- Certain payers consider VC investigational and their coverage policies will take precedence over MedSolutions’ guidelines. Prior authorization does not guarantee payment of the study.
- Virtual colonoscopy (CT colonography) can be used in:
  
  o Patients who have failed conventional colonoscopy
  o Patients on anticoagulants who cannot have the anticoagulation withheld
  o Patients with severe medical conditions that preclude conventional colonoscopy.
- The correct CPT code for virtual colonoscopy is either 0066T (for screening) or 0067T (for diagnostic virtual colonoscopy).
- Reference:
  
• A large comparative study has shown that virtual colonoscopy produced similar rates of
detection for advanced neoplasia as conventional colonoscopy and is an effective
method for colorectal screening.
  o Although these results support the efficacy and safety of VC for colorectal cancer
  screening, there are only limited follow-up data available so far for patients who
  underwent VC and opted to have follow-up surveillance screening for polyps 6 to 9
  mm in size.
  o In addition, specific criteria need to be developed to ensure that physicians are
  adequately trained and quality metrics for programs are in place.
  o Reference:

LIVER

AB- 30 ~ CIRRHOSIS AND LIVER SCREENING FOR HEPATOCELLULAR CARCINOMA
(HCC)

• Hepatitis B carriers with or without cirrhosis, non-hepatitis B patients with cirrhosis, and
  any patient with high risk for hepatocellular carcinoma (HCC) should undergo liver
  screening with ultrasound every 6 to 12 months.
  o Any liver lesion less than 1 cm should be followed with ultrasound every 3 to 6
    months for 2 years and, if stable, ultrasound should be performed every 6 to 12
    months.
  o Liver lesions over 1 cm should be evaluated per AB-32 Liver Lesion Characterization
• A liver lesion that is negative on biopsy should be followed with ultrasound or CT
  abdomen without and with contrast (CPT 74170) every 3 to 6 months until the lesion
  resolves, displays diagnostic characteristics of HCC, or repeat biopsy is positive for
  HCC.
• Reference:
  o Hepatology 2005 Nov;42(5):1208-1236
• If the criteria outlined above are fulfilled, and the provider is requesting a CTA abdomen
  (CPT 74175), rather than (and not in addition to) the conventional CT abdomen (CPT
  74170), CTA abdomen (CPT 74175) may be authorized.
• Any suspicious findings on CT scan should be evaluated with MRI of the
  abdomen without and with contrast (CPT 74183).
• CTA (74175) or MRA (74185) abdomen may be done for preoperative evaluation of the
  liver for the removal of tumors or for liver transplant surgery.
  o Also see ONC~13 Upper GI Cancers in the Oncology guidelines.
  o Reference:
    ➢ RadioGraphics 2004;24:1367-1380

AB- 31 ~ JAUNDICE

• Ultrasound is the preferred initial imaging study for patients with obstructive jaundice
  (i.e. high direct or conjugated bilirubin level) to visualize the biliary ductal system, and
  often demonstrates the level and cause of any obstruction.
  o Normal Values:
    ➢ Bilirubin (total) 0.2-1.0 mg/dl
    ➢ Bilirubin (conjugated) 0-0.2 mg/dl
• CT of the abdomen with contrast (CPT 74160) is preferred in obese patients, patients
  with large amounts of intestinal gas, patients who present with painless jaundice, or
patients who present with acute abdominal pain and one of following: fever, previous biliary surgery, or known cholelithiasis.

- MR cholangiopancreatography (MRCP CPT 74181 or S8037) may be used to assess the extent and cause of intrahepatic bile duct obstruction suggested by either ultrasound or CT if further characterization is warranted. MRCP can help identify the course and drainage pattern of the pancreatic duct and is useful in diagnosing congenital anomalies such as pancreas divisum, and annular pancreas, and in detection of strictures, fistulas, and intraductal calculi prior to surgery.

- MRCP is also useful when there are contraindications to the use of IV contrast for CT imaging. Specialist evaluation is helpful in determining the need for MRCP.

- Abdominal CT with contrast (CPT 74160) or abdominal MRI (CPT 74183) with MRCP (CPT 74181) for patients with contraindications to CT* can be used to evaluate jaundice with high likelihood of malignancy (insidious onset, weight loss, fatigue).

*ACR Appropriateness Criteria, Jaundice, 2005

### AB-32 ~ LIVER LESION CHARACTERIZATION

- A liver lesion with typical ultrasound and/or contrast enhanced CT features of a simple cyst or hemangioma may be classified as benign and does not require follow-up imaging.  
  

- A liver lesion with typical CT features of a malignant mass does not require additional imaging. Confirmation with biopsy under ultrasound or CT guidance is indicated.

- PET scan is not indicated to evaluate a liver lesion in a patient with no prior history of confirmed malignancy.

#### AB-32.1 Hemangioma

- If a lesion >1cm is found as an incidental finding on ultrasound or other imaging, triple phase CT (CPT 74170) is preferred to confirm a suspected hepatic hemangioma.
- Most hemangiomas are easily diagnosed with CT scan.
- MRI of the abdomen without and with contrast (CPT 74183) should be reserved for equivocal lesions.
  
  In one study, the diagnosis of hemangioma was established by ultrasound in 57% of patients, by CT scan in 73%, and by MRI in 84%.*

  *J Am Coll Surg 2003 Sep;197(3):392-402

- CT angiography of the abdomen (CPT 74175) is useful as a preoperative study in patients with large hemangiomas considered for resection.

#### AB-32.2 Hepatic Adenoma or Focal Nodular Hyperplasia

- MRI of the abdomen without and with contrast (CPT 74183) is the imaging study of choice to evaluate a possible hepatic adenoma or focal nodular hyperplasia (FNH).
- For FNH lesions being followed by serial imaging, MRI of the abdomen without and with contrast (CPT 74183) can be performed annually for 3 years. If no changes occur, imaging is discontinued.
  
  Lesions greater than 3 cm should be biopsied for definitive diagnosis.*

  *AJR 2004;182:1227-1231

#### AB-32.3 Cirrhotic Liver

- An indeterminate liver lesion in a cirrhotic liver is best evaluated with MRI of the abdomen without and with contrast (CPT 74183).
AB-32.4 Nonalcoholic fatty liver disease (NAFLD):
   o Ultrasound is the preferred imaging study to evaluate for biliary disease or isolated liver lesion.
   o Distinguishing between fatty liver and steatohepatitis is made via biopsy rather than advanced imaging.*
     *Gastroenterology 2002 Nov;123(5):1705-1725
     *Internal Medicine Journal 2004;34:187-191
     *CMAJ 2005 March;172(7):899-905

AB-32.5 Liver Lesion <1 cm
   o Any Liver lesion less than 1 cm should be followed with ultrasound every 3 to 6 months for 2 years, if stable, ultrasound should be performed every 6 to 12 months.

AB-32.6 Liver Lesion ≥1 cm
   o Liver lesions ≥1 cm may be evaluated by CT abdomen without and with contrast (CPT 74170) or MRI abdomen without and with contrast (CPT 74183).
   o If the lesion appearance is typical of hepatocellular carcinoma (HCC), the lesion should be treated as HCC.
   o If further characterization of a one centimeter or larger liver lesion found on CT is needed, MRI of the abdomen without and with contrast (CPT 74183) can be performed.
   o Lesions that are unable to be characterized as either benign or typical of malignancy on CT or MRI should be biopsied.
   o Lesions ≥1 cm with a negative biopsy can have repeat ultrasound or CT abdomen without and with contrast (CPT 74170) every 3 to 6 months until the lesion resolves, displays diagnostic characteristics of HCC, or repeat biopsy is positive.
   o Reference:
     ➢ Hepatology 2005 Nov;42(5):1208-1236

AB- 33 ~ ELEVATED LIVER FUNCTION (LFT) LEVELS

- The enzymes included in this category are AST, ALT, alkaline phosphatase, GGT, and bilirubin.
- Normal Values:
  - AST 7-40 U/L
  - ALT 0-40 U/L
  - GGT 0-50 U/L
  - Bilirubin (total) 0.2-1.0 mg/dl
  - Bilirubin (conjugated) 0-0.2 mg/dl
  - Alkaline phosphatase 5-150 U/L
- Patients with elevation of AST and/or ALT less than two times normal should have repeat levels performed in three to four weeks prior to considering advanced imaging.
- Patients on lipid lowering medications (statins) or other medications known to cause elevated LFT’s should have those medications stopped for at least 4 weeks and the LFT levels repeated prior to considering advanced imaging.
- Patients with persistently elevated LFT’s or LFT’s less than three times normal should have ultrasound as the initial imaging study.
  - If a liver or pancreatic mass is seen, CT of the abdomen without and with contrast (CPT 74170) is appropriate.
If biliary dilatation or other nonspecific abnormality is seen, CT of the abdomen with contrast (CPT 74160) is appropriate.

- If biliary dilatation is seen on ultrasound or CT, MRCP (CPT 74181) may be appropriate.
  - Specialist evaluation can be helpful in determining the need for MRCP because ERCP is both diagnostic and therapeutic if biliary stone is a high probability.

- Patients with known cancer and suspected liver metastases should have CT of the abdomen without and with contrast (CPT 74170) or CT of the abdomen with contrast (CPT 74160) (whichever the physician prefers). Default CPT code should be 74160.

- Patients with elevated alpha-fetoprotein (AFP) levels should have MRI of the abdomen without and with contrast (CPT 74183).

- CT of the abdomen with contrast (CPT 74160) is appropriate in patients who present with painless jaundice. MRI/MRCP are accurate but should be reserved for patients with contraindications to CT.

  *ACR Appropriateness Criteria, Jaundice, 2005

- Hemochromatosis:
  - The diagnosis is made by biopsy.
  - Specialist (GI or Hematologist) evaluation is helpful.
  - MRI without contrast (CPT 74181) is used to confirm liver iron stores and for following treatment.

  *Hepatology 2001;33(5):1321-1328
  *Joffe S. Hemochromatosis. Updated March11, 2005

### AB-34 ~ RULE OUT LIVER METASTASIS

- CT of the abdomen with contrast (CPT 74160) is a sensitive modality that is preferred to MRI to screen for liver metastasis and/or metastases in the adrenal glands, retroperitoneum, and other abdominal organs.

- MRI of the abdomen without and with contrast (CPT 74183) can be used to image lesions that are indeterminate on CT scan or if CT is contraindicated.

- MRI of the abdomen without and with contrast (CPT 74183) should be considered as the initial imaging study in the setting of elevated AFP with a suspected liver lesion. CT of the abdomen without and with contrast (CPT 74170) can be approved if requested by the physician’s office.

### PANCREAS

#### AB-35 ~ PANCREATIC LESION

- CT of the abdomen with contrast with triphasic imaging (CPT code 74170), or CT of the abdomen without and with contrast (CPT 74170) is indicated to evaluate a pancreatic mass, since the majority of primary pancreatic tumors and other tumors metastatic to the pancreas will enhance following IV contrast.
  - The most common tumors to metastasize to the pancreas are renal cell carcinoma and lung carcinoma. Melanoma, breast, ovarian, colon, and thyroid carcinoma can also metastasize to the pancreas.


- CT abdomen without and with contrast (CPT 74170) is used to evaluate cystic pancreatic lesions.

- For pancreatic necrosis following pancreatitis, CT abdomen with contrast (CPT 74160) or without contrast (CPT 74150) can be performed.
• MRI of the abdomen without and with contrast (CPT 74183) may be useful in cases where CT scan is indeterminate.
• MRI and CT scan demonstrate similar accuracy in differentiating malignant from benign cystic pancreatic lesions.
  o Suspected malignant lesions must be biopsied or resected to make a definitive diagnosis.

**AB- 36 ~ PANCREATIC PSEUDOCYSTS**

- There are no established guidelines for the serial imaging of pancreatic pseudocysts.
  - CT of the abdomen with contrast (CPT 74160) should be obtained initially.*
  - In patients with minimal symptoms, CT of the abdomen with contrast (CPT 74160) or without and with contrast (CPT 74170) every two weeks or so up to six weeks total can be obtained.
  - After six weeks, CT scan should be every four weeks.
  - Abdominal CT without and with contrast (CPT 74170) can be obtained earlier if symptoms worsen, if ascites or pleural effusion develops, if serum amylase increases, or if drainage of the cyst is planned.
  - Endoscopic ultrasound has increasingly become an important imaging modality in evaluating pseudocysts.
    *Federle MP and Anne VS. Pancreatic pseudocyst. In Federle MP, Jeffrey RB, Desser TS, et. al. (Eds.). Diagnostic Imaging Abdomen, 1st Ed. Salt Lake City, Amirsys and Elsevier Publishers, 2004, pp. II:3;24-25
- MR cholangiopancreatography (MRCP—CPT 74181) may be obtained for preoperative planning if cyst drainage is being considered.
- MRCP is useful in detecting or excluding pancreatic duct trauma and pseudocysts in patients with pancreatic trauma.

**AB- 37 ~ PANCREATITIS**

- Ultrasound should be performed in every patient with acute pancreatitis.*
  *ACR Appropriateness Criteria, Acute Pancreatitis, 2006
- Patients with mild, uncomplicated acute pancreatitis usually require no imaging other than ultrasound evaluation for gallstones.
- CT of the abdomen with contrast (CPT 74160) or without contrast (CPT 74150) is useful to assess intraabdominal complications in patients with severe, acute pancreatitis. These complications include peripancreatic effusions, pseudocysts, abscess, and pancreatic necrosis.
  - MRI without and with contrast (CPT 74183) can be obtained if CT is contraindicated or equivocal.*
    *ACR Appropriateness Criteria, Acute Pancreatitis, 2006
- Patients with an elevated amylase (normal range 0-99 U/L) or lipase level (≥ 3 times normal is diagnostic [normal range 0-59 U/L]) who have any of the following: fever, elevated WBC, palpable mass, or who do not improve with medical therapy should have a CT abdomen with contrast (CPT 74160).*
  *ACR Appropriateness Criteria, Acute Pancreatitis, 2006
- MR cholangiopancreatography (MRCP—CPT 74181) should be considered for:
  - Patients with known or suspected gallstone pancreatitis to screen for those patients who would benefit from ERCP.
  - Patients with recurrent, acute pancreatitis with no known cause.
MRCP can help identify the course and drainage pattern of the pancreatic duct and is useful in diagnosing congenital anomalies such as pancreas divisum, and annular pancreas, and in the detection of strictures, fistulas, and intraductal calculi prior to surgery. MRCP is also useful when there are contraindications to the use of IV contrast for CT imaging.

Specialist evaluation may be helpful in determining the need for MRCP.

- **Chronic pancreatitis** should be evaluated with amylase/lipase levels and upper abdominal ultrasound to rule out other causes for pain.

  - If these studies are inconclusive, CT abdomen without and with contrast (CPT 74170) can be performed.

References:


**SPLEEN**

**AB- 38 ~ SPLEEN**

- **Splenomegaly** is usually the result of systemic disease, and diagnostic studies are directed toward identifying the causative disease.
  
  - Complete blood count with differential, LFT’s, and peripheral blood smear examination should be performed prior to considering advanced imaging.
  
  - Suspected splenomegaly should be evaluated by ultrasound initially.*
    
    * ACR Practice Guidelines for the Performance of an Ultrasound examination of the abdomen or retroperitoneum, Oct. 2006

  - If ultrasound is indeterminate or shows an abnormality, CT abdomen without and with contrast (CPT 74170) can be performed.*
    

  - If ultrasound is indeterminate, MRI can be used in pregnant women for further evaluation.
  
  - If CT is indeterminate or contraindicated, MRI abdomen without and with contrast (CPT 74183) can be performed.

- **Incidental Finding of Splenic Lesion(s):**
  
  - If an incidental splenic lesion is seen on a non-abdominal imaging study (e.g. chest CT, thoracic MRI, etc.), abdominal ultrasound should be performed if the lesion has cystic qualities.
  
  - CT abdomen (either with contrast [CPT 74160] or without and with contrast [CPT 74170]) can be performed if ultrasound is non-diagnostic or the lesion does not have cystic qualities.

  - If CT is indeterminate or contraindicated, MRI abdomen without and with contrast (CPT 74183) can be performed.
  
  - There is no evidence-based data to support performing serial CT or MRI scans to follow patients with incidental splenic lesions.

- **Trauma:**
  
  - CT scans of the abdomen and pelvis without and with contrast (CPT 74170 and 72194) are indicated in patients with blunt abdominal trauma with suspected splenic rupture or in patients with penetrating trauma to the left upper quadrant.
AB- 39 ~ INDETERMINATE RENAL LESION

- A newly discovered renal mass (indeterminate by the initial test) should be evaluated by ultrasound in order to rule out a simple cyst. Simple cysts (spherical or ovoid shape, absence of internal echoes, presence of a thin smooth wall, enhancement of the posterior wall) that meet these criteria do not need further imaging.*
  *Am Fam Physician 2001;63:288-294 and 299
- CT of the abdomen without and with contrast (CPT 74170) is recommended for the indeterminate renal lesion that cannot be adequately classified as benign by ultrasound. If the patient cannot tolerate IV contrast, then MRI of the abdomen without and with contrast (CPT 74183) is appropriate.
- If CT or MRI is still indeterminate, follow-up imaging should be performed in 3 to 6 months, then annually for 5 years in older patients. In younger patients, longer annual follow-up is needed.*
  *Radiographics 2004; 24:5101-5115
- If a lesion has been characterized as a hyperdense renal cyst, follow-up CT scan should be performed in 3 to 6 months.

AB- 40 ~ RENAL FAILURE

- Ultrasound is the preferred initial imaging study for patients with acute or chronic renal failure.
- Nephrology or Urology evaluation is helpful in evaluating patients with GFR <30 ml/min/1.73m² to determine the need for advanced imaging.*
  *ACR Appropriateness Criteria, Renal Failure, 2005

AB- 41 ~ RENOVASCULAR HYPERTENSION

- The clinical information provided should include a list of the current blood pressure medications and at least two or three serial blood pressure measurements. It is suggested that home blood pressure should be considered to rule out “white coat syndrome” and other secondary causes of resistant hypertension.*
- No imaging is required for patients with hypertension that is easily controlled with one or two blood pressure medications with the exceptions listed in “Other considerations for imaging evaluation”-see below in this section.
- In patients with uncontrolled or resistant hypertension (>140/90 without history of diabetes or renal disease or >130/80 with diabetes or renal disease on three or more blood pressure medications-including diuretics), MRA (CPT 74185) or CTA (CPT 74175) of the abdomen is indicated. It is suggested that home blood pressure should be considered to rule out “white coat syndrome” and other secondary causes of resistant hypertension. N Engl J Med 2006 July;355:385-392
- Doppler ultrasound is the most cost-effective exam for screening renovascular hypertension and can be used as the initial screening tool for medically controlled patients with clinical suspicion of renovascular disease. However, ultrasound results are highly dependant on the expertise of the local facility/radiologist.* AJR 2005;184:931-937
• **Other considerations for imaging evaluation:**

Abdominal MRA (CPT 74185) or CTA (CPT 74175) may be indicated for the following:

- Patients under 40 years old with hypertension, controlled or uncontrolled, to exclude fibromuscular dysplasia of the renal arteries.
- Patients > age 55 with sudden onset of significant hypertension (not specifically defined but >160/100 is considered severe).
- Patients with previously stable hypertension who experience progressively worsening hypertension, increase in creatinine, or worsening renal function (especially after the administration of an ACE inhibitor or with angiotensin receptor blocking agent). These are the patients that benefit most from renal artery stenting, since renal parenchyma is preserved and eventual kidney dialysis can hopefully be avoided.
- Unexplained atrophic kidney or discrepancy in size between kidneys of greater than 1.5 cm.
- Recurrent (flash) pulmonary edema.
- Co-existing diffuse atherosclerotic vascular disease, especially in heavy smokers.
- Women who develop hypertension (≥140/90) within the first 20 weeks of pregnancy should have renal artery imaging following delivery, if the hypertension persists >12 weeks post partum.


*Current Cardiology Reports 2005;7:405-411

*Gibson P. Hypertension and Pregnancy. Updated June 8, 2006


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### URINARY TRACT

#### AB- 42 ~ HEMATURIA

- The distinction between microhematuria and gross hematuria is no longer used as a criterion for guidelines to determine which patients need imaging evaluation.
- If a dipstick test is positive for blood, a blood creatinine level and complete urinalysis with microscopic exam should be performed prior to imaging studies.
  - The American Urological Association defines microscopic hematuria as 3 or more RBC’s per high power field from 2 of 3 urinalysis specimens.
- Women <40 years of age with evidence of urinary tract infection (urinary frequency, burning on urination, fever, elevated WBC >10,000) should receive at least a 3 day regimen of antibiotics followed by repeat complete urinalysis with microscopic exam. If the hematuria resolves, advanced imaging is not indicated.
- Patients with evidence of primary generalized renal disease (elevated creatinine or urinalysis showing red cell casts, greater than 2+ protein on dipstick, dysmorphic red blood cells, or 24 hour urine protein >500 mg per 24 hrs) should have renal ultrasound in order to determine renal volume and morphology prior to considering advanced imaging.
  - Nephrology or Urology evaluation can be helpful in determining the need for advanced imaging.
• In all remaining patients with hematuria verified by complete urinalysis with microscopic exam, and absence of acute flank pain, CT urogram (CPT 74170 and 72194) is indicated.

• The American Urological Association recommends imaging of the upper urinary tract (CT urogram [CPT 74170 and 72194]), urine cytology, and cystoscopy for patients over 40 years old with documented hematuria on 2 of 3 urinalysis specimens.
  - This applies to all patients over 40 years old whether there is painless hematuria or flank pain with hematuria.
  - CT studies ordered by Urology should be contrast as requested.

• Patients who have had a thorough work up for hematuria with no etiology found should have repeat urinalysis, urine cytology, and blood pressure measurements at 6, 12, 24 and 36 months. Repeat imaging is not necessary, as studies have found no cancer on repeat imaging.*

  *ACR Appropriateness Criteria, Radiologic Investigation of Patients with Hematuria, 2006
  *Am Fam Physician 2006;73:1748-1754 and 1759

AB- 43 ~ URINARY TRACT INFECTION (UTI)

• Urology evaluation can be helpful in determining the need for advanced imaging in patients with recurrent urinary tract infections.

• Thorough diagnostic work up includes CT urogram (CPT 74170 and 72194), cystoscopy, and voiding cytourethrography.

• Males with first time urinary tract infection may benefit from Urology evaluation and CT urogram.

• Pregnant women should be evaluated initially by ultrasound and if further imaging is necessary, MRI abdomen and pelvis (contrast as requested).

Upper urinary tract

• Uncomplicated acute pyelonephritis does not require imaging prior to antibiotic treatment unless the patient has a history of kidney stones, prior renal surgery, or repeated pyelonephritis.

• No advanced imaging is indicated in patients with uncomplicated pyelonephritis.

• If there is no response to medication after 72 hours, ultrasound should be performed initially. CT without and with contrast (CPT 74170 and 72194) may be indicated.

• Diabetics and immunocompromised patients should be evaluated with CT abdomen and pelvis without and with contrast (CPT 74170 and 72194) within 24 hours of initiating antibiotics if there is no clinical improvement.*

  *ACR Appropriateness Criteria, Imaging in Acute Pyelonephritis, 2005

Lower urinary tract

• Urology evaluation is helpful in women with recurrent lower urinary tract infections (2 or more infections occurring in the preceding 12 months and confirmed by cultures).

• Plain x-rays can detect bladder calculi, which can be a cause of recurrent lower tract infection, and should be the initial study.

• Complicated recurrent UTI can be evaluated with CT abdomen and pelvis without and with contrast (CPT 74170 and 72194). The combination of ultrasound and plain x-rays can be as good as CT, but ultrasound quality is not as consistent and is operator dependent.
• Unexplained dysuria (failure of conservative treatment and/or presence of normal urinalysis) and/or increased urinary frequency may benefit from Urology evaluation and cystoscopy prior to considering advanced imaging.

• Suspected urethral diverticulum should be evaluated by voiding cystourethography, retrograde urethography, or ultrasound.
  o Pelvic MRI without and with contrast (CPT 72197) can be performed in equivocal cases.
  *ACR Appropriateness Criteria, Recurrent Lower Urinary Tract Infection in Women, 2005
  o Also see PV-9 Periurethral Cysts and Urethral Diverticula in the Pelvis guidelines.

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<th>AB-44 ~ PATENT URACHUS</th>
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• **Patent urachus** which is suspected due to umbilical discharge should initially be evaluated by ultrasound.
  o The urachus is a “tube” connecting the fetal bladder to the umbilical cord. It is usually obliterated during fetal growth, but if it remains patent, there can be a connection between the bladder and the umbilicus.

• CT Pelvis with contrast (CPT 72193) can be performed if ultrasound is equivocal or if needed for surgical planning.
Evidence Based Clinical Support
AB- 2 ~ ABDOMINAL PAIN

- After low back, headache, and musculoskeletal pain, abdominal pain is the fourth most frequent chronic pain syndrome. In many patients, even an extensive work up does not reveal the cause of pain.
- A review of over 10,000 patients with acute abdominal pain found that 28% had appendicitis, 9.7% had cholecystitis, 4.1% had small bowel obstruction, 4% had a gynecological disorder, 2.9% had pancreatitis, 2.9% had renal colic, 2.5% had peptic ulcer disease, 1.5% had cancer, 1.5% had diverticular disease, and 9% had other conditions. A specific diagnosis was not established in 34% of cases.*
  *de Dombal FT. Diagnosis of acute abdominal pain. 2nd Ed. New York, Churchill Livingstone, 1991
- A review of 70 patients with chronic abdominal pain for greater than 12 weeks who underwent laparoscopy showed adhesions in 39 patients, hernia in 13, adhesions from adjacent structures in 6, appendix pathology in 5, endometriosis in 3, gallbladder pathology in 2, and 10 patients with no obvious pathology.
- After 12 weeks postoperatively, 71% of patients had long term relief of pain.*
  *Surgery 2003 Oct;134(4):549-554
- Questions such as “Does taking a deep breath aggravate your symptoms?” and “Does twisting your back aggravate your symptoms?” are a positive indication of abdominal symptoms of musculoskeletal origin.

Evidence Based Clinical Support
AB- 5 ~ FLANK PAIN, RULE OUT RENAL STONE

- The classic presentation of renal stone disease involves acute onset of flank pain sometimes with radiation to the groin, hematuria, and possible nausea/vomiting.
- Calcium stones comprise 85% of all kidney stones and are composed of calcium oxalate and phosphate. The majority of calcium stones are radiopaque (i.e. they would show up on a plain x-ray), but not all.
- Uric acid stones and cystine stones comprise 9% of all kidney stones and are radiolucent and thus cannot be seen on plain x-ray.
- Most patients who form one calcium stone will eventually form another, with the average rate of new stone formation about one stone every 2 or 3 years. Calcium stone disease is strongly familial.
- The absence of hematuria does not rule out a kidney stone.
- Unenhanced CT has a very high, >95% sensitivity and specificity for urinary tract calculi and allows for delineation of other potential causes of the patient’s symptoms. In addition, CT scan accurately determines the presence of hydronephrosis caused by urethral obstruction due to kidney stones.

Evidence Based Clinical Support
AB- 11 ~ RIGHT LOWER QUADRANT PAIN, RULE OUT APPENDICITIS

- The differential diagnosis of acute right lower quadrant pain includes appendicitis, Crohn’s disease, epiploic appendagitis, infectious ileitis, mesenteric adenitis, omental infarction, right-sided diverticulitis, Meckel’s diverticulitis, and intestinal ischemia.
• The diagnosis of appendicitis is generally made by patient history, physical exam findings, and lab results (including urinalysis in all patients and pregnancy test for women of childbearing age).
• The classic presentation of appendicitis includes sudden onset of epigastric/periumbilical pain which then moves to the right lower quadrant, possible nausea/vomiting, low grade fever (100-101 degrees), leukocytosis (11,000-15,000), and localized tenderness/guarding/rebound in the right lower quadrant at McBurney’s point. However, low grade fever is present in only 67%-69% of patients.
• Patients with atypical clinical findings or an unclear diagnosis may require imaging with CT or ultrasound.
• CT can decrease the false-negative rate for appendectomy. In a study of 146 patients with clinically suspected appendicitis who also underwent CT scanning, the false-negative appendectomy rate was only 4%* compared to the historical false negative rate of 20% in patients taken to surgery on clinical suspicion alone.
  *Am J Gastroenterol 1998;93:768-771
• The highest clinical misdiagnosis of appendicitis occurs in young women in whom acute gynecologic conditions are common and may mimic appendicitis.
• The sensitivity of CT and US for diagnosing acute appendicitis is 93% and 77%, respectively.*
  *Radiology 2002;225:131-136
• CT scan without contrast has a sensitivity of 86%, specificity of 98%, positive predictive value of 97%, and negative predictive value of 98% in diagnosing appendicitis.*
  *Br J Radiol 2002;75:721-725

**Evidence Based Clinical Support**

**AB-14 ~ BARIATRIC SURGERY**

• There are a variety of methods used in bariatric, or obesity, surgery. Restrictive surgery includes vertical banded gastroplasty (using bands and staples to create a small stomach pouch), gastric banding, and laparoscopic gastric banding. Combined restrictive and malabsptive surgery includes Roux-en-Y bypass (the jejunum or ileum is directly connected to the small stomach pouch thereby bypassing a portion of the small intestine) or biliopancreatic diversion.
• There is a relatively high (>10%) complication rate for obesity surgery.
• Complications include pulmonary embolus, infection, and leakage from the GI tract, bleeding, bowel obstruction, incisional hernias and gallstones.

**Evidence Based Clinical Support**

**AB-19 ~ LOWER EXTREMITY EDEMA**

• Lower extremity edema is caused by venous or lymphatic obstruction.
• Unilateral lower leg swelling can be caused by deep venous thrombosis (DVT), thrombophlebitis, or even a popliteal cyst.
• Bilateral lower extremity edema can be caused by deep venous thrombosis (DVT), thrombophlebitis, chronic lymphangitis, and external compression of the iliac veins from a mass or even from a large bladder caused by prostate hypertrophy. Abdominal lesions such as a large pancreatic pseudocyst compressing the inferior vena cava can also cause lower extremity edema.
• Systemic medical conditions such as congestive heart failure, nephrotic syndrome (marked proteinuria >3.5 g/Day and severe hypoalbuminemia <2g/dL), hypothyroidism...
(myxedema usually manifested by pretibial edema), and even lesions in the CNS affecting the vasomotor fibers on one side of the body can cause lower extremity edema.

- There is an association between bilateral leg edema in obese primary care patients and obstructive sleep apnea and modest pulmonary hypertension.* The etiology of the leg edema is largely unknown.


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**Evidence Based Clinical Support**

**AB-21 ~ ADRENAL CORTICAL LESIONS**

- Most incidentally discovered adrenal nodules (incidentalomas) are benign if there is no underlying malignancy, the lesion is less than 3 cm in diameter, and there are no symptoms.
- The incidence of these lesions in the general population is 2%.
- One in 4000 adrenal masses is malignant. Masses <3cm are rarely functional tumors. 25% of adrenal masses >6cm are adrenal cortical cancer.
- The mean attenuation value of adrenal adenomas is 8 HU ± 18. 29% of adenomas have attenuation values higher than 10 HU.
- Tumors found incidentally in the adrenal glands on CT are likely to represent adenomas or hyperplasia if they are <4 cm in diameter and have HU values <20.*

  *J Clin Endocrinol Metab 2005;90:871-877

- Mean attenuation value of metastases to the adrenal gland is 34 HU ± 11.*


- Plasma free metanephrines are the most sensitive biochemical test for pheochromocytoma.

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**Evidence Based Clinical Support**

**AB-23 ~ ENDOVASCULAR ABDOMINAL AORTIC ANEURYSM (AAA) REPAIR**

- Patient selection for endovascular AAA repair is based on the anatomy of the aneurysm. Precise measurements of the aorta and iliac arteries must be obtained.
- Women with smaller diameter AAA tend to rupture earlier.
- A commonly used preoperative protocol involves CT scan of the abdomen and pelvis or CTA, followed by aortography.
- Another protocol uses ultrasound and MRA of the abdomen and pelvis with contrast.
- Endoleak, in which there is persistent bleeding into the original aneurysm sac, is the most common complication of endovascular AAA repair and occurs in 2.4%-45% of patients. The presence of an endoleak can cause progressive enlargement of the AAA and eventual rupture. Therefore, early detection and monitoring of endoleaks is important.
- Postoperative imaging protocols generally involve CT scan of the abdomen and pelvis within the first 30 days postoperatively, at 3 months, 6 months, 12 months, and every year thereafter.
- Since the durability of endovascular grafts is not yet known, surveillance CT scans should continue every year indefinitely, since some grafts have developed fractures, suture disruption, and wear holes over time.
- Several studies comparing duplex ultrasound to CT scan in the surveillance of endovascular aneurysm repair have shown poor sensitivity of ultrasound (42.9%) compared with CT scan in detecting endoleaks.
Evidence Based Clinical Support
AB-28 ~ INFLAMMATORY BOWEL DISEASE RULE OUT CROHN’S DISEASE

- MRI is preferable in patients expected to need repeated follow-up exams.
- Small bowel Crohn’s disease may benefit from capsule endoscopy and/or CT enterography. Capsule endoscopy should be avoided in known or suspected obstructive disease. With either test barium study and ileoscopy should precede their use.

Evidence Based Clinical Support
AB-29~VIRTUAL COLONOSCOPY (VC)

- Out of the 3120 patients who underwent primary VC screening, 87% of the results were negative, 13% were positive, and 8% of patients underwent therapeutic conventional colonoscopy. Patients were referred for polypectomy if VC showed a polyp at least 6mm in size. Patients with smaller polyps (6-9mm) were offered the option of continued surveillance with VC or polypectomy.*

Evidence Based Clinical Support
AB-30 ~ CIRRHOSIS AND LIVER SCREENING FOR HEPATOCELLULAR CARCINOMA (HCC)

- Worldwide, 90% of cases of hepatocellular carcinoma (HCC) occur in patients with cirrhosis, with an annual incidence in cirrhotics of 2%-6%. In the U.S., 56% of cases of hepatocellular carcinoma occur in patients with cirrhosis.
- Risk factors for HCC in cirrhotics are male gender, age >50, macronodular cirrhosis, and large cell dysplasia.
- Hemochromatosis is associated with a substantial risk of hepatocellular carcinoma once cirrhosis has developed. Patients with alcoholic cirrhosis, alpha antitrypsin deficiency, or tyrosinemia are also at increased risk of hepatocellular carcinoma.
- HCC is most prevalent in patients with cirrhosis due to hepatitis B and especially hepatitis C. (Hepatitis C was the etiology of cirrhosis in 63% of patients with HCC in one study).
- A study comparing screening alpha-fetoprotein (AFP), ultrasound, and CT scan in patients with established cirrhosis found that the sensitivity of CT scan (88%) was significantly higher than AFP >20 ng/ml (62%) and ultrasound (59%) for detecting HCC.*
  *Am J Gastroenterol 1999 Oct;94(10):2988-2993
- HCC is best detected by triple phase CT scanning.
- Clinically unsuspected HCC was found in 14% of 430 patients with cirrhosis referred for liver transplantation.* In this study, the sensitivity of triphasic CT was only 59%.
  *Radiology 2000 Dec;217(3):743-749
- Serum AFP levels higher than 300-500 micrograms/L are very specific for HCC, but serum AFP values are not sensitive for detection of most small tumors. In one study, 55% of patients with cirrhosis and HCC had normal serum AFP levels.
Evidence Based Clinical Support
AB- 32 ~ LIVER LESION CHARACTERIZATION

- Liver lesions can be categorized as cystic or solid. Cystic lesions are usually benign. The most common benign lesions are hemangioma, focal nodular hyperplasia, and hepatic adenoma.
- Malignant lesions can be primary hepatocellular carcinoma or metastases from other primary tumors.
- Hemangiomas are congenital vascular malformations and are the most common solid benign hepatic tumors.

Evidence Based Clinical Support
AB- 36 ~ PANCREATIC PSEUDOCYSTS

- Pseudocysts are collections of tissue, fluid, debris, pancreatic enzymes, and blood which develop one to four weeks after the onset of acute pancreatitis. They form in approximately 15% of patients with acute pancreatitis. Pseudocysts are preceded by pancreatitis in 90% of cases and by trauma in 10%. Pseudocysts resolve spontaneously in 40%-50% of patients. Therefore, up to 50% of pseudocysts can be managed nonoperatively.
- Pancreatic pseudocysts larger than 5 cm or present for longer than six weeks should be considered for drainage.

Evidence Based Clinical Support
AB- 39 ~ INDETERMINATE RENAL LESION

- A retrospective study of 102 sonographically indeterminate renal masses which were then evaluated by CT scan showed that 13% were malignant, 85% were benign, and 2% remained indeterminate.*
- CT remains the major method of imaging and characterizing cystic renal lesions. A change of <10 HU from pre to post contrast images is usually considered typical of a benign cyst.*
  *Radiographics 2004;24:5101-5115

Evidence Based Clinical Support
AB- 41 ~ RENOVASCULAR HYPERTENSION

- In the general hypertensive population, the prevalence of renovascular disease varies between 1% and 5%. However, the prevalence of renal artery stenosis (RAS) increases to 20%-40% with specific clinical characteristics.
- Patients with the following clinical features associated with renal artery stenosis (RAS) are often considered for further evaluation:*  
  o Abrupt onset of hypertension before age 40 (suggestive of fibromuscular dysplasia).
  o Abrupt onset of hypertension or progressive worsening of hypertension at or after age 50 (suggestive of atherosclerotic RAS).
  o Accelerated or malignant hypertension (defined as very high blood pressure with end organ damage such as papilledema, retinal hemorrhage, heart failure, renal failure, or hypertensive encephalopathy).
  o Refractory hypertension (diastolic blood pressure consistently >100 but the JNC-7* has defined refractory as BP >140/90 for patients without diabetes or renal disease.
and >130/80 for patients with diabetes or renal disease on three or more blood pressure medications).

*The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of HBP.
NIH Publication No. 04-5230  August 2004

- Unexplained azotemia (abnormally high BUN), or azotemia induced by treatment with ACE inhibitors is suggestive of atherosclerotic RAS.
- Unilateral small kidney.
- Abdominal bruit, flank bruit, or both.
- Carotid, coronary, or peripheral vascular disease.
- Unexplained congestive heart failure with normal left ventricular function, or acute pulmonary edema.


- Atherosclerotic renal artery disease is present in 7% of the general population over age 65, and in 20%-45% of patients with coronary artery disease or aortoiliac disease.

- JNC-7* has defined severe hypertension to include the importance of systolic blood pressure (BP). Based on their recommendations, the definition of uncontrolled BP has been redefined as >140/90 for patients without diabetes or renal disease, and >130/80 for patients with diabetes or renal disease. Systolic hypertension is associated with the prediction of hypertension complications.


- Medication-resistant hypertension in one study is defined as no decrease in blood pressure after institution of two-drug therapy, and uncontrolled hypertension is defined as diastolic blood pressure >110. The prevalence of renal artery stenosis in the medication-resistant hypertension population is 20%.*

*AJR 2003 Dec;181:1653-1661

- The clinical success rate of renal angioplasty of atherosclerotic stenosis is 40%-70%.
- The positive predictive value of MRA for predicting clinical success after angioplasty is very low. The advantage of MRA is the high negative predictive value (i.e. absence of false-negative exams).*

*AJR 2005;184:931-937

- Captopril renography has 92% sensitivity in detecting renal artery stenosis, but has decreased accuracy in patients with bilateral disease or renal impairment. In addition, interference from concurrent antihypertensive medication, especially ACE inhibitors, and the lack of facilities equipped to perform this study, have limited the availability of this imaging study.*


- Ultrasound has a sensitivity of 56%-95% in detecting renal artery stenosis, but is highly operator dependent.
- There is no statistically significant difference between MR angiogram and multidetector row CT angiogram in the detection of hemodynamically significant RAS. (MRA sensitivity 98%, specificity 94%; CTA sensitivity 96%, specificity 96%).*

*Radiology 2003 March;226(3):798-811

- Patients with significant renal artery stenosis on MRA or CTA still need to have conventional arteriography performed if stents are placed.
Evidence Based Clinical Support
AB-42 ~ HEMATURIA

- Urologic cancers (mainly of bladder and prostate) account for approximately 5% of cases of microscopic hematuria.
- In a referral-based study of 100 men less than 40 years old with microscopic hematuria, no bladder cancers were identified by cystoscopy.*

ABDOMEN GUIDELINE REFERENCES

AB-2~Abdominal Pain
➢ ACR Practice Guidelines for the performance of an ultrasound examination of the abdomen or retroperitoneum 1/1/02

AB-3~Abdominal Sepsis (Suspected Abdominal Abscess)
➢ ACR Appropriateness Criteria, Acute Abdominal Pain 2006

AB-4~Epigastric Pain/Dyspepsia/Gastritis/Postprandial Fullness
➢ ACR Practice Guidelines for the Performance of an ultrasound examination of the abdomen or retroperitoneum, 1/1/02.

AB- 5~ Flank Pain, Rule Out Renal Stone
➢ ACR Appropriateness Criteria, Acute Onset Flank Pain 2005

AB- 6~Gastroenteritis

AB- 7~Left Lower Quadrant Pain, Rule Out Diverticulitis
➢ ACR Appropriateness Criteria, Left Lower Quadrant Pain 2005

AB- 8 ~ Left Upper Quadrant Pain
➢ ACR Practice Guidelines for the performance of an ultrasound examination of the abdomen or retroperitoneum 1/1/02

AB- 9 ~ Mesenteric/Colonic Ischemia

AB- 10 ~ Post Operative Pain Within 60 Days Following Abdominal Surgery
➢ ACR Appropriateness Criteria, Suspect small bowel obstruction 2005
➢ ACR Appropriateness Criteria, Acute abdominal pain and fever or suspected abdominal abscess 2006
AB- 11 ~ Right Lower Quadrant Pain, Rule Out Appendicitis
- ACR Appropriateness Criteria, Acute Abdominal Pain 2006

AB- 12 ~ Right Upper Quadrant Pain, Rule Out Cholecystitis
- ACR Appropriateness Criteria, Right upper quadrant pain 2005

AB-13 ~ Abdominal Lymphadenopathy

AB- 15 ~ Blunt Abdominal Trauma
- ACR Appropriateness Criteria, Blunt abdominal trauma 2005

AB-16~Gaucher's Disease

AB- 17 ~ Hernias

AB- 18~ Lipoma

AB-20~Zollinger-Ellison Syndrome (ZES)

AB-21 ~ Adrenal Cortical Lesions


ACR Appropriateness Criteria, Incidental discovery of adrenal mass 2005


AB-22 ~ Abdominal Aortic Aneurysm (AAA) and Iliac Artery Aneurysm


AB-23 ~ Endovascular Abdominal Aortic Aneurysm (AAA) Repair


AB-25 ~ Bowel Obstruction

ACR Appropriateness Criteria, Suspected Small Bowel Obstruction 2005

AB-26 ~ Diarrhea/Constipation and Irritable Bowel


**AB-27 ~GI Bleeding**


**AB-28 ~Inflammatory Bowel Disease, Rule Out Crohn’s Disease or Ulcerative Colitis**

- ACR Appropriateness Criteria, Crohn’s disease 2005

**AB-29 ~ Virtual Colonoscopy (VC)**


**AB- 30 ~Cirrhosis and Liver Screening for Hepatocellular Carcinoma**


**AB- 31 ~Jaundice**

- ACR Appropriateness Criteria, Jaundice 2005

**AB- 32 ~ Liver Lesion Characterization**


**AB-33 ~Elevated Liver Function Test (LFT) Levels**

- ACR Appropriateness Criteria, Jaundice 2005
AB-35 ~ Pancreatic Lesion
- ACR Appropriateness Criteria, Acute pancreatitis 2006

AB-37 ~ Pancreatitis
- ACR Appropriateness Criteria, Acute pancreatitis 2006

AB-38 ~ Spleen
- ACR Practice Guidelines for the performance of an ultrasound examination of the abdomen or retroperitoneum Oct. 2006

AB-39 ~ Indeterminate Renal Lesion

AB-40 ~ Renal Failure
- ACR Appropriateness Criteria, Renal failure 2005

AB-41 ~ Renovascular Hypertension

AB-42 ~ Hematuria
- ACR Appropriateness Criteria, Radiologic investigation of patients with hematuria 2006

AB-43 ~ Urinary Tract Infection (UTI)
- ACR Appropriateness Criteria, Imaging in acute pyelonephritis 2005
- ACR Appropriateness Criteria, Recurrent lower urinary tract infection in women 2005

EVIDENCE BASED CLINICAL SUPPORT REFERENCES
AB-2 ~ Abdominal Pain, Evidence Based Clinical Support
AB-11 ~ Right Lower Quadrant Pain, Rule Out Appendicitis, Evidence Based Clinical Support


AB-19 ~ Lower Extremity Edema, Evidence Based Clinical Support


AB-21 ~ Adrenal Cortical Lesions, Evidence Based Clinical Support


AB-29 ~ Virtual Colonoscopy (VC), Evidence Based Clinical Support


AB-30 ~ Cirrhosis and Liver Screening, Evidence Based Clinical Support


AB-39 ~ Indeterminate Renal Lesion, Evidence Based Clinical Support


AB-41 ~ Renovascular Hypertension, Evidence Based Clinical Support


AB-42 ~ Hematuria, Evidence Based Clinical Support

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<td>cancer antigen 125 test</td>
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<tr>
<td>CT</td>
<td>computed tomography</td>
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<td>GTN</td>
<td>gestational trophoblastic neoplasia</td>
</tr>
<tr>
<td>HCG</td>
<td>human chorionic gonadotropin</td>
</tr>
<tr>
<td>KUB</td>
<td>kidneys, ureters, bladder (frontal supine abdomen radiograph)</td>
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<tr>
<td>MRA</td>
<td>magnetic resonance angiography</td>
</tr>
<tr>
<td>MRI</td>
<td>magnetic resonance imaging</td>
</tr>
<tr>
<td>MSv</td>
<td>millisievert</td>
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<tr>
<td>PA</td>
<td>posteroanterior projection</td>
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<tr>
<td>PID</td>
<td>pelvic inflammatory disease</td>
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<tr>
<td>TA</td>
<td>transabdominal</td>
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<tr>
<td>TV</td>
<td>transvaginal</td>
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<tr>
<td>WBC</td>
<td>white blood cell count</td>
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PV-1 ~ GENERAL GUIDELINES

- Abdominal imaging begins at the diaphragm and extends to the umbilicus or iliac crest.
- Pelvic imaging begins at the umbilicus and extends to the pubis.
- CT imaging is a more generalized modality.
  - CT pelvis with contrast (CPT 72193) is the usual modality unless there is a contrast allergy or the study is to look for a renal stone in the lower pelvis.
- MRI imaging is preferred as a more targeted study, in cases of renal failure, or for patients allergic to iodinated contrast.
  - MRI without contrast (CPT 72195) is the usual modality to view the pelvis.
  - Pelvic MRI without and with contrast (CPT 72197) is appropriate for evaluating the ovary or retroperitoneum.
  - MRI of the pelvis with contrast only is essentially never performed. If contrast is indicated, MRI pelvis without and with contrast (CPT 72197) should be performed.
- Prior to considering advanced imaging, patients should undergo a recent detailed history, careful gynecological and/or urological exam (including appropriate laboratory studies such as blood count, tumor markers, and gonadotropins if indicated), and the use of non advanced imaging modalities such as plain x-ray and ultrasound.
- Pelvic CT or MRI may be indicated if conservative treatment (hormones) has failed.
- Pelvic CT or MRI may be indicated to further evaluate abnormalities seen on other imaging modalities such as plain x-rays, ultrasound, etc.
- To avoid radiation exposure, pregnant women should be evaluated by ultrasound or MRI where it is a clinical option.
- Gynecology consultation is helpful in determining the appropriate diagnostic and imaging pathway in patients presenting with suspected pelvic pathology.

PELVIC SIGNS AND SYMPTOMS – FEMALE

PV-2 ~ ABNORMAL UTERINE BLEEDING

- Initial evaluation includes ultrasound, saline infusion sonography,* hysteroscopy and possible biopsy. MRI pelvis without contrast (CPT 72195) is indicated only if other tests are equivocal and the MRI results will affect treatment.
  *Obstet Gynecol 2003;102:659-662
- Gynecology specialist evaluation is helpful for women with abnormal uterine bleeding.*
  *Management of Abnormal Uterine Bleeding. Slide presentation modified from: APGO Educational Series on Women’s Health Issues

PV-3 ~ ADENOMYOSIS

- Adenomyosis is a histologic diagnosis and imaging has limitations.
- Adenomyosis is suspected by history and physical examination.
- Pelvic ultrasound is the primary screening modality for imaging the female pelvis.
  - Transvaginal ultrasonography (along with color Doppler ultrasound) is the diagnostic procedure of choice for the initial evaluation of suspected adenomyosis and is useful to evaluate other potential etiologies of the patient’s symptoms.
If transvaginal ultrasound is inconclusive and a more definitive diagnosis is necessary because invasive treatment is being considered, MRI pelvis without contrast (CPT 72195) can be useful.

If hormonal therapy is going to be tried first, then MRI is not indicated in patients with suspected adenomyosis.

---

**PV- 4~ SUSPECTED ADNEXAL MASS**

- The adnexa include the ovaries, Fallopian tubes, and ligaments that hold the uterus in place.
- Adnexal masses have a long list of diagnostic possibilities and ultrasound results must be correlated with history and laboratory testing.
- Transabdominal (TA) and transvaginal (TV) ultrasound imaging techniques should be combined for the evaluation of adnexal masses.
  - Color Doppler ultrasound may be helpful in selected situations.

**PV-4.1 Simple adnexal cysts**

- Ultrasound identification of a simple cystic mass (ovarian or paraovarian) establishes a benign process in almost 100% of premenopausal women and 95% of postmenopausal women.
  - Adnexal cysts 5 cm or smaller in postmenopausal women are not considered malignant, although a 3 cm to 5 cm cyst may need correlation with CA-125 and color Doppler findings.

**PV-4.2 Complex adnexal masses**

- Complex adnexal masses are usually ovarian in origin, and in premenopausal women, most commonly represent hemorrhagic cysts or endometriomas.
- Ultrasound characteristics usually suggest the diagnosis, and in premenopausal women, a follow up ultrasound can be done in six weeks or following a menstrual cycle to evaluate for resolution.
  - A pregnancy test is important to narrow the differential diagnosis.
- In postmenopausal women with a complex adnexal mass by ultrasound, MRI pelvis without and with contrast (CPT 72197) may be indicated for further characterization.*

*ACR Appropriateness Criteria for Women’s Imaging, 2002

- MRI pelvis without and with contrast (CPT 72197) is superior to CT scan in evaluating whether a complex adnexal mass is ovarian cancer when ultrasound is indeterminate.
  - CT is useful only when the identification of fat and calcifications is important, such as in benign teratoma.
  - The probability that a lesion is ovarian cancer in a premenopausal woman with an indeterminate ovarian mass on ultrasound decreases to less than 2% with a negative MRI.  *Radiology 2005;236:85-94

- Complex or solid ovarian masses may require surgical removal.
  - With complex or solid ovarian masses, preoperative evaluation of the abdomen and pelvis without and with contrast using CT (CPT 74170 and 72194) or MRI (CPT 74183 and 72197) can be performed.

**PV-4.3 Screening for Ovarian Cancer**

- See ONC-20 Ovarian Cancer in the Oncology guidelines
PV- 5 ~ ENDOMETRIOSIS

- Endometriosis is a surgical diagnosis and imaging is of little value unless the pelvic clinical exam is abnormal.
- Pelvic ultrasound is the first line diagnostic exam for suspected endometriosis.
  - Although ultrasound is able to diagnose endometriosis in most locations, it has limited sensitivity for posterior locations such as utero-sacral ligaments, cul-de-sac of Douglas, torus uterinus, vagina, recta sigmoid, and occasionally the bladder.
- In most patients, ultrasound followed by medical treatment or laparoscopy should be considered prior to advanced imaging.
  - Laparoscopy remains the definitive test for diagnosis and evaluation of endometriosis in most patients.*
    *Eur Radiol 2006 Feb; 16(2):285-298
    *ACOG Committee Opinion, Number 310, April 2005
- MRI has shown high accuracy for both anterior and posterior endometriosis and can enable complete lesion mapping prior to surgery.*
  - MRI pelvis without and with contrast (CPT 72197) can be considered for preoperative planning. This is the minority of patients and MRI should not, in general, be used for diagnosing endometriosis in women with pelvic pain.
    *Eur Radiol 2006 Feb; 16(2):285-298
    *Aeby TC, Hiraoka MKY. Endometriosis Updated May 15 2006

PV- 6 ~ PELVIC INFLAMMATORY DISEASE (PID)

- Ultrasound is the initial study for imaging of pelvic inflammatory disease (PID) that does not respond well to antibiotic therapy or for complicated PID.
- In rare cases where there is extensive abscess formation or a percutaneous drainage procedure is planned, CT of the abdomen and pelvis with contrast (CPT 74160 and CPT 72193) may be helpful.

PV-7~ PELVIC PAIN/DYSPARUNIA, FEMALE

- Complete clinical pelvic examination and pelvic ultrasound are indicated for the initial evaluation of pelvic pain.,
  - Pelvic ultrasound with color Doppler should be performed if ovarian torsion is a consideration.
- Advanced imaging is generally not indicated for pelvic pain unless accompanied by fever, elevated WBC, failure of conservative treatment (including the use of hormones or antibiotics when appropriate), palpable mass, the pelvic ultrasound is nondiagnostic or equivocal, or there is a suspicious pelvic exam. In this setting, CT pelvis with contrast (CPT 72193) can be performed.
  - Gynecology consultation is helpful in determining the appropriate imaging pathway since most pelvic pain complaints do not require advanced imaging.
- Suprapubic pain: If pain is frequently recurrent or chronic and is associated with urgency and pressure with negative urine cultures, no response to conservative treatment, and normal ultrasound and laboratory studies, then Gynecology and/or Urology consultation is helpful to rule out interstitial cystitis.
• Pelvic pain/Hip pain—rule out Piriformis Syndrome
  o See PN-2.4 Sciatic Neuropathy in the Peripheral Nerve Disorders guidelines and MS-24.8 Piriformis Syndrome in the Musculoskeletal guidelines.

PV- 8 ~ LEIOMYOMATA

• Transabdominal and transvaginal ultrasound are the preferred screening procedures for leiomyomata.
• Abnormal uterine bleeding from suspected submucus leiomyoma should be evaluated by saline sonohysterography or panoramic hysteroscopy initially.
  o If these studies are equivocal, or if imaging for surgical planning is needed, MRI pelvis without contrast (CPT 72195) can be performed.
• Preoperative ultrasound should be performed prior to myomectomy.
  o If ultrasound is indeterminate, MRI pelvis without contrast (CPT 72195) may be considered.
  o MRI pelvis without and with contrast (CPT 72197) can be performed if leiomyoma necrosis is suspected.
• MRI pelvis without and with contrast (CPT 72197) can be performed in those cases in which arterial embolization is being considered. MRI accurately assesses the number, location, and size of leiomyomata for pretreatment planning and post treatment response.
    *AJR 2003; 181:851-856
  o For uterine artery embolization, size of the dominant fibroid must be considered.
  Some studies have reported treatment failure to be more likely with fibroids >8 cm.
    *Obstet Gynecol Surv 2002;57:810-815
• There is no literature support for the addition of MRA pelvis (CPT 72198) to the preoperative evaluation.
• There are currently no published guidelines regarding follow up MRI in patients who have undergone uterine artery embolization.
  o Although there are no compelling data to support the need for follow up MRI in asymptomatic patients who are status post uterine artery embolization, consensus opinion suggests that one follow up pelvic MRI (CPT 72197) post embolization will be allowed 3 to 6 months after the procedure.
    ➢ MRI results are used for prediction, and for some practitioners, any gadolinium accumulation is followed by another embolization.
  o In patients with persistent or recurrent symptoms, pelvic MRI without and with contrast (CPT 72197) should be performed.
  o In patients with fever, pain, or other acute symptoms status post embolization, pelvic MRI without and with contrast (CPT 72197) should be performed.
    *J Vasc Interv Radiol 2004;15:115-120

PV- 9 ~ PERIURETHRAL CYSTS AND URETHRAL DIVERTICULA

• Also see AB-43 Urinary Tract Infection (last solid bullet).
• Symptomatic infection of congenital periurethral glands can result in urethral diverticula. Symptoms include pain, urinary urgency, frequency of urination, recurrent urinary tract infection, dribbling after urination, or incontinence.
  o MRI pelvis without and with contrast (CPT 72197) is superior to transvaginal ultrasound for evaluating these entities but should be reserved for patients in
whom ultrasound, voiding cytourethrography, or retrograde urethography are equivocal.*

*ACR Appropriateness Criteria, Recurrent Lower Urinary Tract Infections in Women, 2005

PV-10 ~ UTERINE ANOMALIES

- In the detection of uterine anomalies, particularly during infertility evaluation, transabdominal and transvaginal ultrasound are the initial imaging modalities of choice.
- If ultrasound defines a complex anomaly or is not definitive, then pelvic MRI without contrast (CPT 72195) is recommended.*
  *Radiographics 2003; 23:1401-1421 and 1423-1439

PV-11 ~ MOLAR PREGNANCY AND GESTATIONAL TROPHOBLASTIC NEOPLASIA (GTN)

- A recurrent molar pregnancy is called gestational trophoblastic neoplasia (GTN). These cells can metastasize to other organs such as lungs, brain, bone, and vagina.
- Treatment is usually methotrexate.
- Patients should have head CT without and with contrast (CPT 70470), CT abdomen and pelvis with contrast (CPT 74160 and 72193), and chest x-ray as a metastatic work up.
- Weekly HCG tests are performed until they fall to zero.

PV-12 ~ PELVIMETRY

- Pelvimetry for cephalic dystocia (failure to progress in active labor because of a disproportion between the fetal head and the size of the bony pelvis) is investigational.
- Pelvimetry may be done for breech presentations in which vaginal delivery is anticipated.
- Pelvimetry is usually done with plain x-ray, low dose CT pelvis without contrast (CPT 72192), or MRI pelvis without contrast (CPT 72195).
  - Low dose CT is institution specific and if protocol is not followed, the fetus will receive full ionizing radiation dose.
- References:
  - Obstet Gynecol 2004;104:647-651

PELVIC SIGNS AND SYMPTOMS – MALE

PV-13 ~ IMPOTENCE/ERECTILE DYSFUNCTION

- Brain MRI without and with contrast (CPT 70553) should be restricted to hypogonadism as documented by low bio-available/free testosterone of <20 ng/dl
or total serum testosterone of less than 80% of the lower limit of normal (i.e. <150 ng/dl is lower limits for most labs), or patients with elevated prolactin.
  - Also see HD-28.3 Male Hypogonadism in the Head guidelines

- Erectile dysfunction is frequently an early symptom of peripheral vascular disease.
  - Also see PVD-1 General Guidelines (Bullet 5) in the Peripheral Vascular Disease guidelines.
- Functional MRI or PET studies are considered investigational.
- Reference:

PV-14 ~ PROSTATITIS/PUDENAL NEURALGIA/CHRONIC PELVIC PAIN

- Chronic prostatitis is a clinical diagnosis and advanced imaging is not indicated.
  - Physical examination, including digital rectal examination, should be performed.
- Urology consultation is helpful in patients with Pudendal Neuralgia/ Chronic Pelvic Pain.
  - Confirmatory tests include Pudendal Nerve Terminal Motor Latency Test and Quantitative Sensory Threshold Test.
  - MRI of the lumbar spine without contrast (CPT 72148) and/or sacral plexus MRI without contrast (CPT 72195) may be requested but are rarely abnormal.
  

PV-15 ~ SCROTAL PATHOLOGY

- Acute scrotal pain, masses, trauma, inguinal hernia, varicocele, or inflammation should be evaluated by ultrasound. MRI in these patients is not supported by evidence-based data.*

  *ACR Appropriateness Criteria, Acute Onset Scrotal Pain, 2005

UNDESCENDED TESTIS-SEE PEDIATRIC GUIDELINES

MISCELLANEOUS

PV-16 ~ FISTULA IN ANO

- MRI pelvis without and with contrast (CPT 72197) is indicated for the assessment of complex or recurrent fistulas. Preoperative MRI frequently alters the surgical approach and MRI guided surgery can significantly decrease postoperative recurrence in complex cases by 75%.*

  * AJR 2004;183:135-140

PV-17 ~ FECAL INCONTINENCE

- MRI pelvis without and with contrast (CPT 72197) or MRI colpocystography may be useful for surgical planning prior to anal sphincter surgery when external sphincter atrophy is suspected due to negative or equivocal Pudendal Nerve Terminal Latency. The need for MRI should be determined by the operating surgeon.*

  *Am J Gastroenterol 2004;99(8):1585-1604
• **Patent urachus** which is suspected due to umbilical discharge should initially be evaluated by ultrasound.
  o The urachus is a “tube” connecting the fetal bladder to the umbilical cord. It is usually obliterated during fetal growth, but if it remains patent, there can be a connection between the bladder and the umbilicus.
• CT pelvis with contrast (CPT 72193) can be performed if ultrasound is equivocal or if needed for surgical planning.
Evidence Based Clinical Support

PV- 3 ~ ADENOMYOSIS

- Adenomyosis is characterized by benign invasion of ectopic endometrium into the myometrium with hyperplasia of adjacent smooth muscle.
- Common symptoms include dysmenorrhea, menorrhagia, and abnormal uterine bleeding, and enlarged uterus.
- Differentiation of adenomyosis from leiomyoma is important because treatment will differ. Hysterectomy is the only definitive treatment for symptomatic adenomyosis. Embolization of adenomyosis has poor long term results with only 55% of treated patients showing clinical improvement after 2 years. *
  
  *Radiology 2005;234:948-953
- The only way to accurately diagnose adenomyosis is pathologically after hysterectomy.
- Transvaginal ultrasound has a reported sensitivity of 53%-89% in diagnosing adenomyosis, and a specificity of 67% *
  
  *Radiographics 2005;25:21-40
- MRI has a sensitivity of 78%-88% and specificity of 67%-93% in diagnosing adenomyosis. *
  
  *Radiographics 2005;25:21-40

Evidence Based Clinical Support

PV- 4 ~ SUSPECTED ADNEXAL MASS

- A study of 505 consecutive resected adnexal masses over 3.5 years showed that 457 (90%) were benign. Lesions smaller than 4 cm were benign in 211 of 218 cases (97%). 246 of 287 lesions (86%) larger than 4 cm were benign. Every lesion that did not have a solid component was benign. Every non-benign lesion had some solid component. 244 of 250 (98%) of lesions without Doppler flow were benign, while lesions with flow were benign in 76 of 106 (72%) cases. *
  
  *RSNA meeting 2003

Evidence Based Clinical Support

PV-12 PELVIMETRY

- Low Dose CT utilizes a single view with 0.25 mSv radiation exposure, but most facilities will do multiple views with total exposure of 10 mSv (same as a normal CT pelvis).
PV-2 ~Abnormal Uterine Bleeding

PV-4 ~Suspected Adnexal Mass
- ACR Appropriateness Criteria for Women's Imaging, 2002

PV-5 ~Endometriosis

PV-8 ~Leiomyomata

PV-9 ~Periurethral Cysts and Urethral Diverticula
- ACR Appropriateness Criteria, Recurrent Lower Urinary Tract Infections in Women, 2005

PV-10 ~Uterine Anomalies

PV-12 ~Pelvimetry

PV-13 ~Impotence/Erectile Dysfunction
PV-14 ~Prostatitis/Pudendal Neuralgia/Chronic Pelvic Pain

PV-15 ~Scrotal Pathology
- ACR Appropriateness Criteria, Acute Onset of Scrotal Pain, 2005

PV-16 ~Fistula in Ano

PV-17 ~Fecal Incontinence

EVIDENCE BASED CLINICAL SUPPORT REFERENCES
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PV-4 ~Suspected Adnexal Mass, Evidence Based Clinical Support
- RSNA meeting 2003
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### ABBREVIATIONS for MUSCULOSKELETAL GUIDELINES

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<td>AP</td>
<td>anteroposterior view</td>
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<tr>
<td>AVN</td>
<td>avascular necrosis</td>
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<td>CMS</td>
<td>Centers for Medicare and Medicaid Services</td>
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<td>CPK</td>
<td>creatinine phosphokinase</td>
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<tr>
<td>CT</td>
<td>computed tomography</td>
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<tr>
<td>DEXA (DXA)</td>
<td>dual energy x-ray absorptiometry</td>
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<tr>
<td>DMARDs</td>
<td>disease modifying anti-rheumatic drugs</td>
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<tr>
<td>EMG</td>
<td>electromyogram</td>
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<td>ESR</td>
<td>erythrocyte sedimentation rate</td>
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<td>MRI</td>
<td>magnetic resonance imaging</td>
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<td>nerve conduction velocity</td>
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<td>NSAIDS</td>
<td>non steroidal anti-inflammatory drugs</td>
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<td>RA</td>
<td>rheumatoid arthritis</td>
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<tr>
<td>RICE</td>
<td>rest, ice, compression, elevation</td>
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<tr>
<td>SI</td>
<td>sacro-iliac</td>
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<tr>
<td>WBC</td>
<td>white blood cell count</td>
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• Advanced imaging can be ordered in almost any musculoskeletal condition and does show abnormality in most musculoskeletal conditions, however, that does not mean that it is indicated in these situations.

• These guidelines will attempt to guide the clinician in the most appropriate use of musculoskeletal imaging.

• The guidelines are divided into two basic sections:
  o 1) Disease/Injury Category and 2) Anatomical Area Category
  o Some conditions, e.g. tumors can occur in any area and some, e.g. torn meniscus are specific to certain anatomical areas.

• These guidelines are diagnosis oriented so it is imperative that the reviewer have a working/tentative diagnosis prior to review.
  o Prior to considering advanced imaging, patients should undergo a recent detailed history, physical examination, appropriate laboratory studies, and the use of non advanced imaging modalities such as plain x-ray.
  o Advanced imaging should serve as an adjunct in arriving at a more definitive diagnosis.
  o Orthopedic specialist evaluation can be helpful in determining the need for advanced imaging.

• Standard medical practice would dictate continuing conservative therapy prior to advanced imaging in patients who are improving on current treatment programs.

MS-2 ~ IMAGING TECHNIQUES

• Plain X-Ray
  o Should be done prior to advanced imaging in most musculoskeletal conditions* to rule out those situations that do not require advanced imaging, such as osteoarthritis, acute/healing fracture, osteomyelitis, and tumors of bone amenable to biopsy or radiation therapy (in known metastatic disease), etc.
  
  *ACR Appropriateness Criteria, Musculoskeletal Imaging, 2005
  o Even in soft tissue masses, plain x-rays are helpful in evaluating for calcium/bony deposits, e.g. myositis ossificans and invasion of bone.

• MRI vs CT
  o In general MRI is the preferred imaging modality in musculoskeletal conditions because it is superior in imaging the soft tissues and can also define physiological processes in some instances, e.g. edema, loss of circulation (AVN), and increased vascularity (tumors).
  o CT is better at imaging bone and joint anatomy; thus it is useful for studying complex fractures (particularly of the joints) and dislocations.

• Contrast Issues
  o Most musculoskeletal imaging (MRI or CT) is without contrast.
  o Exceptions:
    ➢ Tumors and osteomyelitis (without and with contrast)
    ➢ MR arthograms, CT myelogram, CT for discogram (with contrast only)
    ➢ MRI for rheumatoid arthritis (contrast as requested)
    ➢ In postoperative joint studies, MRI with contrast (direct or indirect arthrogram) can be approved if requested.
MS-3 ~ 3-D RENDERING

- CMS approves 3-D rendering both on an independent workstation (CPT 76377) and on a non-independent workstation (CPT 76376) if they are medically necessary.
  - However, certain health plans do not reimburse these 3-D CPT codes and their coverage policies will take precedence over MedSolutions' guidelines. Prior authorization does not guarantee payment of the study.
- Musculoskeletal indications for 3-D imaging are as follows:
  - Complex fractures of any joint or the pelvis
  - Spine fractures
  - Preoperative planning in complex surgical cases*
    - These requests should be sent for Medical Director review.
  -- ACR 2006 Coding Update Sept/Oct 2005

DISEASE/INJURY CATEGORY (ALPHABETICAL ORDER)

MS-4 ~ AVASCULAR NECROSIS (AVN)

- If AVN is suspected, plain x-rays should be performed initially.¹
- If plain x-rays are positive, no further imaging is necessary, as follow-up can be performed with plain x-rays.²
- MRI without contrast is the modality of choice to evaluate suspected AVN with negative X-rays.¹
- Either unilateral hip MRI (CPT 73721) can be performed to visualize one hip, or pelvis MRI (CPT 72195) can be performed if bilateral hips need to be imaged.
- If the differential diagnosis is AVN vs labral tear, then MRI (CPT 73721) of the more symptomatic hip should be performed initially. If that hip is positive for AVN, then MRI (CPT 73721) of the other hip can be imaged if requested.

  ¹ ACR Appropriateness Criteria, Chronic Hip Pain 2003
  ² Major N. Pitfalls in Musculoskeletal Imaging—the Hip. Presented at: 33rd Annual Radiology Refresher Course of the International Skeletal Society, September 13-16, 2006; Vancouver, British Columbia, Canada

MS-5 ~ FRACTURE AND DISLOCATION

- MS-5.1 Acute
  - Plain x-rays should be performed initially in any obvious or suspected acute fracture or dislocation.
  - If plain x-rays are positive, no further imaging is generally indicated except in complex joint fractures where noncontrast CT is helpful.¹,²
  - If plain x-rays are equivocal for fracture, CT or MRI without contrast can be performed.
  - Orthopedic evaluation is helpful in determining the appropriate imaging pathway.
  - If x-rays are negative and a fracture is clinically suspected, a several week trial of conservative therapy with periodic re-evaluation and repeat x-rays are indicated prior to considering advanced imaging.

  ¹ ACR Appropriateness Criteria, Acute hand and wrist trauma 2005
  ² Greene WB (Ed.). Essentials of Musculoskeletal Care. 2nd Ed. Rosemont,IL, American Academy of Orthopaedic Surgeons, 2001, p.36
• **MS-5.2 Joint**
  o CT can be approved in complex fractures involving a joint for preoperative planning.*
  *Greene WB (Ed.), *Essentials of Musculoskeletal Care, 2nd Ed.*
  Rosemont, IL, American Academy of Orthopaedic Surgeons, 2001, p.41
  *ACR Appropriateness Criteria, Acute hand and wrist trauma 2005
  o Orthopedic evaluation is helpful in determining the need for advanced imaging.

• **MS-5.3 Metaphysis (end of bone)/Diaphysis (shaft of bone)**
  o These fractures can generally be managed adequately with plain x-ray.
  o If there is concern for delayed union or non-union of the bone, CT without contrast is appropriate.

• **MS-5.4 Osteochondral/Chondral**
  o These fractures are joint fractures essentially of the joint surface (a piece of bone with attached cartilage, or a piece of cartilage alone).
  o If x-rays are negative and an osteochondral fracture is suspected, MRI without contrast is the appropriate imaging study.
  o CT without contrast can be approved if MRI is contraindicated.*
  *ACR Appropriateness Criteria, Chronic Ankle Pain, 2005

• **MS-5.5 Stress/Occult Fracture**
  o These fractures, almost always in weight bearing bones, can be evaluated adequately by history, physical exam, plain x-ray and bone scan.
  o Plain x-rays should be performed initially.
  o A history of increased physical activity is often elicited and swelling and tenderness are present on exam.
  o Plain x-rays are usually negative initially and become positive at 3-4 weeks. Bone scan will be positive within 72 hours of onset.
  o Treatment includes protected weight bearing with or without casting. Occasionally surgery is necessary, particularly for 5th metatarsal fractures.
  o Periodic follow-up plain x-rays will usually show progressive healing.
  o Except in situations where there is concern for non-union, advanced imaging is not routinely performed.
  ➢ **Exceptions** are hip and tibial stress fractures--MRI without contrast or CT without contrast can be approved if stress fracture is suspected because prolonged healing with a poor outcome can occur with delayed diagnosis.
  *Greene WB (Ed.), *Essentials of Musculoskeletal Care, 2nd Ed.*
  Rosemont, IL, American Academy of Orthopaedic Surgeons, 2001, p.356
  o References:
  ➢ *ACR Appropriateness Criteria, Stress/Insufficiency fractures, 2005
  ➢ Greene WB (Ed.), *Essentials of Musculoskeletal Care, 2nd Ed.*
  Rosemont, IL, American Academy of Orthopaedic Surgeons, 2001, p.508

• **MS-5.6 Compartment Syndrome**
  o Caused by swelling in the closed compartments of the extremities
  o Advanced imaging is not indicated
  o Diagnosis is made clinically and by direct measurement of compartment pressure and is a surgical emergency*
  *Greene WB (Ed.), *Essentials of Musculoskeletal Care, 2nd Ed.*
  Rosemont, IL, American Academy of Orthopaedic Surgeons, 2001, pp 18-19
MS- 6 ~ FOREIGN BODY

- MRI (contrast as requested) can be approved after plain x-rays rule out the presence of radiopaque foreign bodies.*
  
  *Am Fam Physician 2003 June;67(12):2557-2562

MS- 7 ~ GANGLION CYSTS

- Ganglions are small sacs (cysts) filled with clear, jellylike fluid.
- A ganglion can usually be diagnosed by its appearance and location.
- Some of the fluid found in the ganglion may be removed and examined.
- X-ray may be done if osteoarthritis or injury is suspected, but will not be done only to diagnose the ganglion.
- In rare cases (usually in suspected occult ganglia), noncontrast MRI or ultrasound is used to evaluate unusual ganglions.
- Ganglions usually do not need treatment and often resolve on their own.
- Reference:

MS- 8 ~ GOUT/PSEUDOGOUT/CRYSTAL DEPOSITION DISEASE

- The diagnosis of crystal deposition disease (e.g. gout, pseudogout) is confirmed by the presence of polymorphonuclear leukocytes and intracellular monosodium urate crystals or calcium pyrophosphate crystals in synovial fluid aspirated from an inflamed joint.
- Imaging studies are not very useful in diagnosing initial attacks of acute gouty arthritis.
- Radiographic findings are generally nonspecific.
  - Advanced imaging is not used routinely in the evaluation of crystal deposition disease.
  - Rarely, a gouty tophus may mimic an infectious or neoplastic process. In this instance, MRI evaluation is indicated.
- Reference:
  - Am Fam Physician 1999 April;59(7):1799-1806,1810

MS- 9 ~ INFECTION

- MS-9.1 General Considerations
  - History and Physical exam—information should include location, open/closed, systemic signs, cultures performed?
  - Plain x-ray initially to rule out extension either into or out of bone and to look for gas in soft tissues which is seen in *Clostridium perfringens* and other gas forming infections.*
  
  
  - CT scan shows anatomy (e.g. bony destruction) better than plain x-rays, but its use should be discouraged in favor of the more definitive MRI.
  - CT can be approved in the setting of negative plain x-rays and contraindication to MRI.
• **MS-9.2 Soft Tissue Infections**
  o MRI without and with contrast can be performed if plain x-rays are negative, patient is not responding to therapy, and abscess is suspected.

• **MS-9.3 Bone (Osteomyelitis)**
  o MRI without and with contrast if plain x-rays are negative.*
    *Greene WB (Ed.). *Essentials of Musculoskeletal Care. 2nd Ed.*
    Rosemont,IL, American Academy of Orthopaedic Surgeons, 2001,
    p.687
  o If plain x-rays are positive, there is generally no need for advanced imaging unless the physician (usually Orthopedic or Infectious Disease specialist) is looking for necrotic bone.

• **MS-9.4 Joint Infections**
  o Septic arthritis can almost always be diagnosed by history, physical examination, and joint aspiration with cell count and culture.*
    ➢ Acute septic arthritis is an urgent/emergent surgical problem and should almost never be evaluated in an outpatient setting.
    *Am Fam Physician 2000 April;61(8):2391-2400

• **MS-9.5 Evaluation of Painful Total Joint Prostheses**
  o Imaging in painful total joint prostheses is complicated.
  o Standard technetium bone scan has good sensitivity, but poor specificity* being positive in any condition causing inflammatory response including aseptic loosening.
  o PET is under investigation, but also has decreased specificity because it is positive in most cases of aseptic loosening.**
    ➢ “18F-FDG imaging is less accurate than, and is not a suitable replacement for, leukocyte/marrow imaging [bone scan with Indium labeled WBC’s] for diagnosing infection of the failed joint replacement.” **
  o Prosthetic artifact limits the usefulness of CT and MRI.**
    **JNM 2004;45(11):1864-1871
  o Therefore, leukocyte/marrow imaging (bone scan with Indium labeled WBC’s) should be the initial imaging study in evaluating possible infection versus aseptic loosening of a joint prosthesis.
  o Orthopedic specialist evaluation is helpful in determining the appropriate imaging pathway in these patients.

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**MS-10 ~ MASS**

• **MS-10.1 General Considerations**
  o History and Physical exam--information should include location, size, duration, solid/cystic, fixed/not fixed to bone
  o Plain x-rays should be performed initially (see MS-2 Imaging Techniques).
  o Most discrete masses warrant imaging (usually MRI without and with contrast).
  o **Exceptions**- advanced imaging is generally **not** indicated for these entities:
    ➢ Ganglia
    ➢ Sebaceous cyst
    ➢ Subcutaneous lipoma does not require imaging for diagnosis
    • Evaluation by a dermatologist or surgeon is helpful in determining the need for advanced imaging.
• If the clinical exam is equivocal, ultrasound should be performed initially.
• Noncontrast MRI can be performed if surgery is planned.
  ▶ Lipomas in other locations (not subcutaneous) should be evaluated by ultrasound or CT without and with contrast.
  ▶ Lesions with Hounsfield units less than -50 HU do not require additional imaging except for surgical planning.*
• Noncontrast MRI can be performed if ultrasound and/or CT are equivocal, or for preoperative planning.
  ▶ Ill-defined mass/swelling: ultrasound should be performed as the initial study
  ▶ Mass that has been present and stable for 1 year
  ▶ Most hematomas can be adequately imaged by ultrasound.*
  o Orthopedic or Surgical evaluation is helpful in determining the need for advanced imaging.

• MS-10.2 Soft tissue mass with negative x-ray
  o MRI (contrast as requested) can be performed (Ultrasound or CT with contrast if MRI contraindicated)*
    *ACR Appropriateness Criteria, Soft tissue masses, 2005
• MS-10.3 Soft tissue mass with calcification on x-ray
  o CT without contrast if Myositis Ossificans (bone formation in muscle tissue after trauma) is suspected.*
    *ACR Appropriateness Criteria,Soft tissue masses, 2005
  o MRI without and with contrast if not demonstrated to be Myositis Ossificans by CT*
    *ACR Appropriateness Criteria, Soft tissue masses, 2005
• MS-10.4 Bone or Attached to Bone (including lytic and blastic metastatic disease)
  o MRI (contrast as requested) can be performed; (CT without and with contrast if MRI is contraindicated)*
    *ACR Appropriateness Criteria, Bone Tumors 2005

MS- 11 ~ MUSCLE/TENDON UNIT INJURIES/DISEASES

• Almost all complete tendon ruptures can be diagnosed by physical exam showing loss of function of the affected joint and/or palpable disruption of the involved tendon.
• If history and physical exam point to a suspected partial tendon rupture of a specific tendon named in the clinical information, then MRI without contrast is appropriate.¹
• Muscle belly strains/muscle tears can be diagnosed clinically by history and physical exam. Although MRI is positive, it is not needed for diagnosis.²
• For acute strains, treatment initially consists of rest, application of ice, compression, and avoidance of painful activity. Surgical treatment is generally not recommended, even for complete tears. Muscle tissue is not amenable to surgical repair.*
  *Am Fam Physician1999 Oct;60(6):1687-1696
• Inflammatory myopathies (polymyositis, dermatomyositis, inclusion body myositis, myositis of malignancy)
Plain x-rays should be performed initially,\textsuperscript{1,2} which will most often reveal “characteristic joint space narrowing and osteophytic spurring.”

Treatment is conservative with weight reduction if necessary, acetaminophen, NSAIDS, exercise, intraarticular steroid injection, and in severe cases, joint replacement.\textsuperscript{3,4}

Advanced imaging is usually not necessary\textsuperscript{3,4,5} except in special circumstances—e.g. suspected concomitant internal derangement in the knee (MRI without contrast) and preoperative planning in joint replacement (CT without contrast).

MRI or CT without contrast after 8-12 weeks to evaluate healing can be approved if follow-up plain x-rays are equivocal.

Plain x-rays should be performed initially.*

MRI or CT without contrast after 8-12 weeks to evaluate healing can be approved if follow-up plain x-rays are equivocal.

Patients at risk include postmenopausal women over age 65, patients on bedrest, patients on steroids, and alcoholics.

At particularly high risk is the female with early surgical menopause post hysterectomy.

DEXA scan is the modality of choice for screening and therapeutic follow-up in patients with suspected/known osteoporosis.\textsuperscript{1,2}

CMS allows imaging every two years for the following:

- Estrogen deficient female
- Patients with osteopenia or fracture on spine films
- Patients on long term steroid therapy
- Patients with primary hyperparathyroidism
- Patients under treatment for osteoporosis\textsuperscript{3}

Quantitative CT scan (CPT 77078 which replaces CPT 76070 for CT bone mineral density study, axial skeleton) can be approved in the following special circumstances where DEXA scan is known to be inaccurate:

\textsuperscript{1} ACR Appropriateness Criteria, Chronic ankle pain, 2005
\textsuperscript{2} Greene WB (Ed.), Essentials of Musculoskeletal Care, 2nd Ed. Rosemont,IL, Academy of Orthopaedic Surgeons, 2001, p.330
\textsuperscript{3} Greene WB (Ed.). Essentials of Musculoskeletal Care. 2nd Ed. Rosemont,IL, Academy of Orthopaedic Surgeons, 2001, pp 320-321
\textsuperscript{5} Am Fam Physician 2000 March;61(6):1795-1804
\textsuperscript{6} Am Fam Physician 2000 April;61(8):2391-2400
Multiple healed compression fractures
- Significant scoliosis
- Severe degenerative disk disease due to increased cortical sclerosis with large marginal osteophytes
- Follow-up in cases where Quantitative CT was the original study
- Morbidly obese patients

1 Greene WB (Ed.). Essentials of Musculoskeletal Care. 2nd Ed. Rosemont, IL, American Academy of Orthopaedic Surgeons, 2001, p.58

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**MS-15 ~ PAGET’S DISEASE**

- Paget’s Disease is asymptomatic in the majority of cases, but pain can sometimes be severe.
- Diagnosis is by laboratory results (marked elevation of alkaline phosphatase) and findings on plain x-ray.
- MRI without contrast can be performed if the diagnosis is in doubt or if malignant degeneration is suspected (occurs in up to 10% of the cases).
- **Reference:**

**MS-16~POST-OPERATIVE EVALUATION**

- Diagnosing the etiology of pain or other symptoms after surgery can be a difficult diagnostic problem.
- Knowledge of the complications of the specific orthopedic procedure performed and of the usual post-operative course of that procedure is important.
- The imaging choices in evaluating symptomatic post-operative patients can be complicated.
- Orthopedic evaluation is extremely helpful in determining the appropriate imaging pathway and to interpret the significance of imaging findings in the postoperative setting.

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**MS-17 ~ RHEUMATOID ARTHRITIS (RA) and INFLAMMATORY ARTHRITIS**

- The rheumatological disorders are usually recognized by clinical patterns supplemented by laboratory tests of immune reactions.
- MRI is increasingly being used in clinical trials to study the effects of treatment with DMARDS and in clinical practice to identify seronegative RA patients that might benefit from early DMARD therapy.*


- Prior to advanced imaging, physical exam, laboratory studies and plain x-rays should be performed.
If a diagnosis of RA is still uncertain, then MRI (contrast as requested) of the most symptomatic joint, or of the dominant hand or wrist* can be considered to establish the diagnosis prior to institution of therapy with potent therapeutic agents.

*J Rheumtol 2001;28(5):1158-1161

Advanced imaging is not indicated to routinely follow the results of treatment.

Neither evidence-based nor consensus guidelines for the use of serial follow up MRI scans in RA patients have been established due to multiple factors including:

- Lack of a good reproducible scoring system for erosions, bone edema, and synovitis (the primary lesion in Rheumatoid Arthritis)
- Disagreement on the relationship between synovitis and erosions
- Differences of opinion on use of contrast
- Low versus high field magnet discussion

There are no well-controlled large cohort studies relating MRI use to improved clinical outcomes.1

1 J Rheumtol 2005;32(12):2462-2464
2 J Rheumtol 2005;32(12):2465-2469
3 J Rheumtol 2003;30(4):671-679
4 Joint Bone Spine 2005;72:229-234

MRI without contrast can be approved in special situations in RA, such as suspected internal derangement in the knee (see MS-25 Knee) or rotator cuff tear in the shoulder (see MS-19 Shoulder).

**MS-18 ~ TENDONITIS/ BURSITIS**

Plain x-rays first to rule out entities such as calcific tendonitis/bursitis.*

*Am Fam Physician 1998 Feb;57(4):667-674

A trial of at least 6 to 8 weeks of conservative therapy with NSAIDS/cortisone dosepack/cortisone injection/physical therapy is warranted prior to considering advanced imaging.

MRI without contrast is the appropriate study if advanced imaging is indicated.

Orthopedic evaluation is helpful in determining the need for advanced imaging.

**ANATOMICAL AREAS**

**General Considerations**

- Areas are organized from head to toe. Plain x-ray should almost always be performed prior to advance imaging (see MS-2 Imaging Techniques).

**MS-19 ~ SHOULDER**

**MS-19.1 See Disease/Injury Categories (MS-4 through MS-18)**

- Studies can be approved if applicable to the shoulder.

**MS- 19.2 Shoulder Pain**

- A thorough history, recent physical exam, and plain x-rays should be performed initially.
- “When imaging studies are indicated during the initial evaluation and treatment of a patient with shoulder pain, appropriate plain x-rays should be obtained. More sophisticated imaging studies (such as shoulder MRI, ultrasound, or arthrography) are not indicated.”*
• **MS-19.3 Impingement**
  - Definition: Pressure-induced tendonitis of the rotator cuff (chiefly the supraspinatus) caused by the acromion process during shoulder abduction.
  - Diagnosis is generally by history and physical exam with the “impingement sign” (abduction and internal rotation of the shoulder) being positive.
  - Suspected impingement should be managed with a conservative program (NSAIDS, physical therapy, steroid dosepack, and/or steroid injection) for 6 to 8 weeks prior to considering advanced imaging.\(^1\)\(^,\)\(^2\)\(^,\)\(^3\)\(^,\)\(^4\)
  - Orthopedic consultation is helpful in determining when to proceed with imaging.\(^5\)
  - Variants of the acromion process such as down-turned acromion, can contribute to impingement syndrome.
    - Noncontrast MRI of the shoulder (CPT 73221) can be performed to identify these variants if surgery is being considered.


• **MS-19.4 Tendinitis**
  - Definition: Inflammation of tendons, generally the rotator cuff (subscapularis, supraspinatus, and infraspinatus), but also of the tendon of the long head of the biceps which traverses the shoulder joint.
  - As with impingement, tendonitis should be managed conservatively (NSAIDS, physical therapy, steroid dosepack, and/or steroid injection) for 6 to 8 weeks prior to considering advanced imaging.\(^1\)\(^,\)\(^2\)\(^,\)\(^3\)\(^,\)\(^4\)
  - Although tendonitis can be diagnosed by noncontrast MRI, MRI is rarely indicated except to rule out other more serious problems.
  - Noncontrast MRI (CPT 73221) should be approved only after a protracted (at least 6 to 8 weeks) trial of conservative measures has failed or the physician expresses concern for malignancy.

• **MS-19.5 Tendon (Biceps Long Head) Rupture**
  o Common shoulder injury which can also occur spontaneously.
  o Usually diagnosed clinically.
  o Diagnosis can be difficult in obese patients.
    ➢ Noncontrast MRI (CPT 73218) can be performed in obese patients with suspected biceps long head rupture.
  o Conservative treatment is performed in the vast majority of patients since the biceps has two tendons of origin and remains quite functional.*
    ➢ MRI rarely affects treatment.
  o Surgical repair is more likely to be performed in patients under age 35.
    *Greene WB (Ed.). *Essentials of Musculoskeletal Care. 2nd Ed.* Rosemont,IL, American Academy of Orthopaedic Surgeons, 2001, p.146

**MS-19.6 Rotator Cuff Tear**
  o The rotator cuff is composed of three musculotendinous units: subscapularis (anteriorly), supraspinatus (superiorly), and the infraspinatus (posteriorly) which function to assist in rotating and stabilizing the humeral head.
  o Other muscles such as the deltoid and pectoralis major can also affect shoulder rotation, so there is no good clinical test to evaluate rotator cuff function.
  o Pain on abduction, a positive drop test, Speed’s test, and limited shoulder rotation are not reliable signs of rotator cuff tear and can be positive in other pain-producing shoulder conditions.
  o Rotator cuff tear is not a surgical emergency, and suspected rotator cuff tear should be treated conservatively for 4 to 6 weeks¹ with NSAIDS, steroid dosepack, steroid injection and physical therapy in most cases prior to advanced imaging.
    ➢ This is particularly true in the older patient with impingement.²
    ➢ The exception is the acute injury in the patient under age 40.
      ▪ Surgical repair should be done in these patients within 3 weeks, and noncontrast shoulder MRI (CPT 73221) is appropriate.³
        ¹American Academy of Orthopedic Surgeons-Shoulder Pain Guideline 2001
        ²Am Fam Physician 1998 Feb;57(4):667-674
        ³Am Fam Physician 2000 June;61(11):3291-3300
  o Noncontrast shoulder MRI (CPT 73221) is the study of choice for the chronic rotator cuff tear, but should be reserved as a preoperative study for patients who have failed conservative therapy.
  o Orthopedic consultation is useful in determining the need for imaging and operative treatment.

• **MS-19.7 Dislocation/Subluxation/Labral Tear**
  o The glenoid (shoulder socket) labrum is a fibrocartilagenous ring/rim that deepens the glenoid cavity.
  o The labrum is torn in acute twisting injuries of the shoulder joint that also can cause dislocation. Chronic tears occur in throwing athletes.
  o Symptoms/signs can be pain, a popping or clicking with shoulder motion, and a positive apprehension sign (anxiety and pain with shoulder abduction and external rotation).
Labral tear, if symptomatic, is generally treated surgically and Orthopedic input is helpful.

Shoulder MRI with contrast (MR arthrogram CPT 73222) is the appropriate study and can be approved when labral tear is suspected as documented on an appropriate physical examination.

Frank shoulder dislocation is reduced emergently in the Emergency Department/office and should be imaged by plain x-ray including axillary view if necessary.

Shoulder MRI with contrast (MR arthrogram CPT 73222) is the appropriate study and can be approved when labral tear is suspected as documented on an appropriate physical examination.

Advanced imaging in patients with shoulder dislocation is rarely needed. Exception: noncontrast shoulder CT (CPT 73200) to evaluate large Hill-Sachs lesions (impaction/indentation fractures of the humeral head caused by the edge of the glenoid in a dislocation) can be performed prior to surgery.

Some subtle dislocations/subluxations (e.g. posterior dislocations) are difficult to see on plain x-ray.

Noncontrast shoulder CT (CPT 73200) can be approved if the treating physician suspects this condition.

Advanced imaging in patients with shoulder dislocation is rarely needed. Exception: noncontrast shoulder CT (CPT 73200) to evaluate large Hill-Sachs lesions (impaction/indentation fractures of the humeral head caused by the edge of the glenoid in a dislocation) can be performed prior to surgery.

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Advanced imaging in patients with shoulder dislocation is rarely needed. Exception: noncontrast shoulder CT (CPT 73200) to evaluate large Hill-Sachs lesions (impaction/indentation fractures of the humeral head caused by the edge of the glenoid in a dislocation) can be performed prior to surgery.

Some subtle dislocations/subluxations (e.g. posterior dislocations) are difficult to see on plain x-ray.

Noncontrast shoulder CT (CPT 73200) can be approved if the treating physician suspects this condition.
Exception: noncontrast shoulder CT or MRI (CPT 73200 or 73221) as ordered by the operating surgeon for preoperative planning.

- **MS-19.10 Acromioclavicular (AC) Separation**
  - Plain x-rays should be performed initially to rule out fracture.
  - If an unstable AC joint injury is suspected but not confirmed on routine AP and lateral views on plain x-ray, stress views are indicated.*
  - MRI is not ordered routinely in the management of straightforward AC disruptions. Detailed knowledge of AC and coracoclavicular ligamentous injury is not needed for conservative or surgical care.
    - In middle-aged and older patients who continue to have disabling shoulder pain after the acute pain of an AC disruption abates, MRI may be indicated to evaluate for possible rotator cuff tear.*
  - Treatment is conservative initially with surgery being reserved for grade III separations that fail conservative therapy.*


- **MS-19.11 Post-operative Shoulder**
  - Diagnosing the etiology of pain or other symptoms after shoulder surgery can be a difficult diagnostic problem.
  - Knowledge of the complications of the specific orthopedic procedure performed and of the usual post-operative course of that procedure is important.
  - The imaging choices in evaluating symptomatic post-operative patients are complicated.*


  - Orthopedic evaluation is extremely helpful in determining the appropriate imaging pathway and to interpret the significance of imaging findings in the postoperative setting.
  - **Painful total joint prosthesis**
    - See MS-9.5 Evaluation of Painful Total Joint Prostheses.

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**MS-20 ~ ELBOW**

- See Disease/Injury Categories (MS-4 through MS-18)
  - Studies can be approved if applicable to the elbow.

- **Epicondylitis /Tendonitis (Tennis Elbow)**
  - Diagnosis is made clinically.
  - Treatment is conservative with NSAIDS, steroid injection, steroid dosepack, and physical therapy for 8-12 weeks.¹
  - Specialty referral is beneficial for failures of conservative therapy.¹
  - Surgery is reserved for conservative treatment failures.²

    ¹Am Fam Physician 2007 Sept;76(6):843-848
    Accessed November 28, 2006

  - Advanced imaging should rarely be needed.
Ruptured Biceps Insertion (at elbow)
- Complete rupture can often be diagnosed clinically by palpation, but patients will still have active elbow flexion with complete rupture due to the brachialis muscle.
- Often treated operatively, and noncontrast elbow MRI (CPT 73221) is appropriate if requested.*


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### MS-21 ~ WRIST

- See Disease/Injury Categories (MS-4 through MS-18)
  - Studies can be approved as above if applicable to the wrist.
- **Rheumatoid Arthritis**
  - See MS-17 Rheumatoid arthritis and Inflammatory Arthritis
- **Carpal Tunnel Syndrome**
  - Also see SP-11.5 Cervical Radiculopathy, Differential Diagnosis in the Spine guidelines and PN-2.1 Carpal Tunnel Syndrome in the Peripheral Nerve Disorders guidelines.
  - Diagnosis is made clinically and with NCV/EMG.
  - Imaging studies are rarely indicated.
  - MRI can show wrist anatomy but has not been shown to be useful in diagnosing carpal tunnel.*
  - However, if a mass is being considered as the etiology, noncontrast wrist MRI (CPT 73221) can be performed preoperatively.

  *National Institute of Neurological Disorders and Stroke. Carpal Tunnel Fact Sheet. Updated August 2, 2006

- **Ligament Injuries**
  - Plain x-rays should be performed initially.
  - Imaging procedures are appropriate for wrist pain/sprain that has been treated for 6 weeks with little or no improvement.
  - Repeat x-rays with scaphoid views are indicated.
  - Additionally, arthrogram may be of value to evaluate carpal ligament tears, but should only be done after consultation with an orthopedic surgeon.*

  *Forearm, wrist, & hand (acute & chronic), not including carpal tunnel syndrome. May 16, 2007.

  o Since ligament injuries of the wrist are generally difficult to diagnose, a noncontrast wrist MRI (CPT 73221) can be performed.
  o Surgery is indicated for most complete ligament injuries,* therefore the request will often be from an orthopedic or hand surgeon and their input is helpful prior to advanced imaging.


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### MS-22 ~ HAND

- See Disease/Injury Categories (MS-4 through MS-18)
  - Studies can be approved as above if applicable to the hand
• A thorough history, recent physical exam, and plain x-rays should be performed initially.
  ➢ If plain x-rays are positive for fracture, no further imaging is generally indicated except in complex joint fractures where noncontrast CT is helpful.
  ➢ If plain x-rays are equivocal, CT or MRI without contrast (CPT 73200 or 73218) can be performed.
• Orthopedic specialist, Hand surgeon, or Plastic surgery evaluation is helpful in determining the appropriate imaging pathway.
• Ganglion cyst
  o See MS-7 Ganglion Cysts

MS-23 ~ PELVIS

• See Disease/Injury Categories (MS-4 through MS-18)
  o Studies can be approved as above if applicable to the pelvis.
• Complex Fracture
  o Orthopedic evaluation is helpful in determining the need for advanced imaging.
  o Pelvic CT without contrast (CPT 72192) can be performed to evaluate complex pelvic ring/acetabular fractures.*
• Sacro-iliac Joints (SI Joints)
  o Also see SP-9.5 Ankylosing Spondylitis in the Spine guidelines.
  o Rheumatology evaluation is helpful in assessing the need for advanced imaging.

MS-24 ~ HIP

• MS-24.1 See Disease/Injury Categories (MS-4 through MS-18)
  o Studies can be approved as above if applicable to the hip.
• MS-24.2 Hip Pain
  o A thorough history, recent physical exam, and plain x-rays should be performed initially.
  o True hip pain is almost always anterior and often accompanied by a painful and/or limited range of motion of the hip.
  o Plain films should be done initially.¹
    ➢ “In the typical patient presenting with hip pain, there have been no studies to indicate that MRI should be used routinely to detect occult AVN. Because of the large number of patients who have bursitis or osteoarthritis, it would not be cost effective to obtain an MRI on every patient presenting with hip pain.”²
      ¹ACR Appropriateness Criteria, Chronic hip pain, 2003
      ²ACR Appropriateness Criteria, Avascular necrosis of the hip, 2005
  ➢ If plain x-rays are negative, a 6 to 8 week trial of conservative therapy (NSAIDS, physician supervised exercise program, steroid dosepack, and/or steroid injection) is warranted prior to considering advanced imaging.
  o Hip pathology as the cause of hip pain can be evaluated by examination of hip range of motion (particularly rotation), which will be limited and/or painful in patients with hip disease.*
o Hip pain is frequently a feature of vertebral disc disease.
  - The presence of hip pain in the setting of low back pain is not in and of itself an
description for hip imaging in addition to spine imaging.

  o Degenerative disc disease can cause hip pain (usually posteriorly).
    - These patients do not have anterior thigh pain and do not have pain and/or
limited motion on hip range of motion exam.
    - Advanced hip imaging is not indicated in this situation.*
      *Greene WB (Ed.). Essentials of Musculoskeletal Care. 2nd Ed.
      Rosemont,IL, American Academy of Orthopaedic Surgeons, 2001, p. 295

o Orthopedic specialist evaluation is helpful in determining the appropriate imaging
pathway.

- **MS-24.3 Suspected Occult Hip Fracture**
  o A thorough history, recent physical exam, and plain x-rays should be performed
initially.
  o If plain x-ray is negative for fracture, but occult hip fracture is suspected, noncontrast
hip CT (CPT 73700) or hip MRI (CPT 73721) depending on physician preference,
can be performed.

- **MS-24.4 Osteoarthritis**
  o The diagnosis is based on history and physical exam and confirmed by x-ray.*
    - X-ray also helps to rule out other significant causes of hip pain such as AVN and
tumor.
      *ACR Appropriateness Criteria, Chronic hip pain 2003
      *Lower Extremity Musculoskeletal Disorders-A Guide to Diagnosis and
Treatment 2003.
      Brigham and Women’s Hospital. http://www.brighamandwomens.org
      Accessed November 28, 2006

  o Treatment is conservative with weight reduction if necessary, acetaminophen,
NSAIDS, exercise, intraarticular steroid injection, and in severe cases, joint
replacement.  
  1,2
  o Advanced imaging is rarely needed in osteoarthritis.  1,2,3
    - **Exception:** noncontrast hip CT (CPT 73700) or MRI (73721) as requested by the
operating surgeon for preoperative planning in patients undergoing total hip
replacement.
  o Referral to an orthopedic surgeon should be considered in patients who fail medical
management.4
    1 Am Fam Physician 2000 March;61(6):1795-1804
    2 Greene WB (Ed.). Essentials of Musculoskeletal Care. 2nd Ed.
    Rosemont,IL, American Academy of Orthopaedic Surgeons, 2001, pp. 320-321
    3 Stacy GS and Basu PA. Osteoarthritis, Primary. eMedicine,
    4 Arthritis & Rheumatism 2000 Sept;43(9):1905-1915

- **MS-24.5 Avascular Necrosis (AVN)**
  o Also see **MS-4 Avascular Necrosis (AVN)**
  o Occurs when the femoral head loses its blood supply.
  o Common causes include femoral neck fracture, cortisone therapy (usually long
term), alcoholism, collagen disease, sickle cell disease, and gout.
  o Less common causes include deep sea diving and Gaucher’s disease.
  o Pain is generally severe and there is significant pain with hip motion.
Plain x-rays should be done initially in all cases. If positive, no further imaging is necessary since treatment is symptomatic only until total hip replacement becomes necessary for severe cases.*

*Major N. *Pitfalls in Musculoskeletal Imaging—the Hip.*
Presented at: 33rd Annual Radiology Refresher Course of the International Skeletal Society,
September 13-16, 2006; Vancouver, British Columbia, Canada

Noncontrast hip MRI (CPT 73721) if unilateral imaging is requested, or noncontrast MRI pelvis (CPT 72195) if bilateral hip imaging is requested, is the modality of choice to evaluate suspected AVN with negative or equivocal x-rays.* If the differential diagnosis is AVN vs labral tear, then MRI (CPT 73721) of the more symptomatic hip should be performed initially. If that hip is positive for AVN, then MRI (CPT 73721) of the other hip can be imaged if requested.

*ACR Appropriateness Criteria, Chronic hip pain, 2003
*Greene WB (Ed.). *Essentials of Musculoskeletal Care.* 2nd Ed.
Rosemont, IL, American Academy of Orthopaedic Surgeons, 2001, pp.322-333

Treatment is symptomatic (NSAIDS and partial weight bearing) in mild cases, but often total hip replacement is necessary.

**MS-24.6 Labral Tear**
- The acetabular (hip socket) labrum is similar to the glenoid labrum, but is less frequently torn. Often, no history of trauma can be elicited.
- Symptoms include hip pain and mechanical signs such as clicking/popping and painful catching.
- MRI with contrast (MR arthrogram CPT 73722) is the appropriate imaging study.*


**MS-24.7 Impingement**
- There are two types of femoral/acetabular impingement:
  - **cam type**: caused by the loss of the normal “waist” (indentation) at the head/neck junction (usually superior) causing incongruity with abduction.
  - **pincer type**: caused by an overcoverage/protrusion of the acetabulum causing incongruity with motion.
- The diagnosis in both types is by plain x-ray.
- Hip MRI without contrast (CPT 73721) can be approved as a preoperative study.

**MS-24.8 Piriformis Syndrome**
- Also see PN-2.4 Sciatic Neuropathy in the Peripheral Nerve Disorders guidelines
- Piriformis Syndrome is characterized by buttock, thigh, and sometimes calf pain due to entrapment of the sciatic nerve at the sciatic notch in the pelvis by a tight piriformis muscle band.
- Pain is often exacerbated with prolonged sitting.
- On physical examination, there is tenderness in the sciatic notch and pain with flexion, adduction, and internal rotation of the hip (FAIR test).*
- Imaging is rarely helpful, but EMG/NCV should confirm the diagnosis.*
- Evaluation by a Neurology, Orthopedic, or Pain Management specialist is helpful in determining the need for advanced imaging.
  - MRI pelvis without contrast (CPT 72195) or CT pelvis without contrast (CPT 72192) can be approved as a preoperative study or to evaluate severe cases.
MS-24.9 Painful Total Joint Prosthesis
  o See MS-9.5 Evaluation of Painful Total Joint Prostheses

MS-25 ~ KNEE

MS-25.1 See Disease/Injury Categories (MS-4 through MS-18)
  o Studies can be approved as above if applicable to the knee.

MS-25.2 General (History, Physical exam, Mechanism of injury)
  o A recent careful history, physical examination, and plain x-rays should be performed prior to considering advanced imaging.
  o **History of mechanism of injury** is very important.
    ➢ Most meniscal and ligament tears are sustained due to twisting type injuries.
  o **Physical exam** is very important.
    ➢ Almost all significant meniscal injuries will be associated with swelling.
    ➢ **Signs of ligamentous disruption:**
      ▪ Valgus (medial) instability
      ▪ Varus (lateral) instability
      ▪ Anterior drawer (pulling tibia forward with knee flexed 90 degrees)
      ▪ Posterior drawer (pushing tibia backward with the knee flexed 90 degrees)
      ▪ **Lachman** (modified anterior drawer with knee at 20 degrees of flexion).
    ➢ **McMurray’s test** (rotating the foot while flexing/extendng the knee).
      ▪ When positive (a deep clunk or shift, not a snap or click), McMurray’s test is **strong evidence** of a meniscal tear.
    ➢ **Crepitus** is usually caused by chondromalacia (softening of the articular cartilage) which causes a momentary catch or failure of the joint surfaces to slide smoothly. Usually generates a high pitched sound—snap or crackle (as opposed to McMurray’s which is low pitched).
    ➢ Particular attention to knee extension is important, as displaced meniscal tears and other causes of internal derangement, (e.g. loose body, etc.) will often cause a limitation of full extension-- the so called “locked knee.”
    ➢ **Soft signs/symptoms of meniscal tear include:**
      ▪ Giving way (which can also be due to pain or weakness).
      ▪ Joint line tenderness.
      ▪ Inability to bear weight.

MS-25.3 Nontraumatic Knee Pain
  o Plain x-rays should be performed initially if there is severe pain, or after 1 to 4 weeks of treatment with analgesics/NSAID’s prior to considering advanced imaging if pain is not severe.1,2
  o If plain x-rays are negative, the knee is stable and extends fully, and there is no evidence of internal derangement on physical exam, a 6 to 8 week period of conservative care, 3 including NSAIDS, a physician-supervised exercise program, steroid dosepack, and/or steroid injection is appropriate prior to considering advanced imaging.
    ➢ If x-rays are negative, specialist evaluation is helpful.2
  o If x-rays show arthritis, further treatment with analgesics/NSAIDS, patient education, walking aids, and physical therapy should be performed prior to considering advanced imaging.2

1 ACR Appropriateness Criteria, Non traumatic knee pain, 2005
MS-25.4 Meniscus Tear
- Plain x-rays should be performed initially\(^1, 2\) to rule out other problems such as osteochondral fractures or joint mice (loose bodies) that can mimic meniscus tear.
  - If these are present, Orthopedic evaluation is helpful to determine further treatment and need for advanced imaging.
- If plain x-rays are negative, the knee is stable and extends fully, and McMurray’s test is negative, a 6 to 8 week period of conservative care,\(^3\) including NSAIDS and a physician-supervised exercise program such as aggressive quadriceps strengthening exercises is appropriate prior to considering advanced imaging.
- If conservative therapy fails, Orthopedic evaluation is helpful in deciding the need for further advanced imaging and treatment.\(^3\)
- Knee MRI without contrast (CPT 73721) is the study of choice when advanced imaging is indicated.
  \(^1\)American Academy of Orthopedic Surgeons Knee Injury Guideline 2001
  \(^3\)New Zealand Guidelines Group, The Diagnosis and Management of Soft Tissue Knee Injuries, 2003

MS-25.5 Ligament Tear
- Complete ligament tears are usually diagnosed clinically; however, the exam can be quite difficult in a large person who has pain and guarding. This is not an indication for immediate advanced imaging, since surgical repair of a torn knee ligament is rarely an emergent procedure.
- If physical exam indicates a torn ligament (e.g. positive anterior drawer, posterior drawer, Lachman, medial (valgus) or lateral (varus) stress test), Orthopedic consultation is helpful in delineating further treatment and/or need for advanced imaging.\(^1\)
- If the physical exam is negative or equivocal, a period of conservative therapy, including brief splinting with protected weight bearing followed by aggressive physical therapy for at least four weeks, is indicated prior to advanced imaging.\(^1\)
- Noncontrast knee MRI (CPT 73721) is the study of choice if conservative therapy fails.\(^2\)
  \(^1\)American Academy of Orthopedic Surgeons Knee Injury Guideline 2001
  \(^2\)ACR Appropriateness Criteria, Nontraumatic knee pain, 2005

MS-25.6 Osteoarthritis
- Advanced imaging is not recommended in known arthritis of the knee.\(^1\)
  - **Exception:**
    - If signs of internal derangement are present or there is concern for malignancy, noncontrast knee MRI (CPT 73721) can be performed.
    - MRI knee without contrast (CPT 73721) can be approved for patients being considered for unicompartmental knee replacement (medial or lateral) if plain x-rays do not show significant arthritis in the other side of the joint.
- Referral to an orthopedic surgeon should be considered in patients who fail medical management.\(^2\)
- Noncontrast knee CT (CPT 73700) with 3-D rendering (CPT 76377) can be approved for preoperative planning of total knee replacement if requested by the operating surgeon. 
  2Arthritis & Rheumatism 2000 Sept;43(9):1905-1915
  3AJR 2006 June;186(6):1778-1782

- MS-25.7 Patellar Dislocation/Subluxation
  - Dislocation/subluxation of the patella is largely a clinical diagnosis.
  - Plain x-rays should be performed initially to rule out resulting osteochondral fractures.
  - Treatment is conservative with splinting followed by aggressive quadriceps exercises.
  - Most patients respond to this regimen, but if continued dislocation/subluxation occurs, surgery (lateral release or formal extensor realignment) may be indicated. 
    - Some studies have shown that most common surgical procedures for patellar tracking problems result in medial displacement of the patella.
  - Currently, some centers (mainly academic) are doing dynamic MRI and CT imaging for assessment of patellar tracking, which is abnormal in patellar subluxation.
  - Insufficient information is available at this time to routinely approve these studies and requests should be sent for Medical Director review.
    2Radiology 1989 Sept:172;799-804

- MS-25.8 Chondromalacia Patella
  - Degeneration of hyaline cartilage on the articular surface of the patella, femur or tibia.
  - Diagnosis is made clinically based upon the patient’s symptoms and clinical examination of the knee.
  - Plain x-rays are helpful in demonstrating anatomic variations associated with chondromalacia.
  - MRI does show abnormalities of the joint surface cartilage, but is rarely necessary for diagnosis.
  - The role of MRI in this condition is currently being investigated.
    - Also see MS-24.7 Patellar Dislocation/Subluxation

- MS-25.9 Baker’s Cyst
  - See also PVD-7.3 Lower Extremity Edema in the Peripheral Vascular Disease guidelines
  - Definition: Cyst posterior to the knee which is almost always associated, in adults, with intra-articular knee pathology.
  - Ultrasound is the indicated initial imaging study. 
  - It is generally accepted that Baker’s cysts in adults are not amenable to surgical excision because they will almost always recur.
  - Noncontrast knee MRI (CPT 73721) is only indicated if surgical excision is being considered.
• **MS-25.10 Post-operative Knee**
  o Diagnosing the etiology of pain or other symptoms after knee surgery can be a difficult diagnostic problem.
  o Knowledge of the complications of the specific orthopedic procedure performed and of the usual post-operative course of that procedure is important.
  o The imaging choices in evaluating symptomatic post-operative patients are complicated.*
    
    *Radiology 2003;229:159
  o Orthopedic evaluation is extremely helpful in determining the appropriate imaging pathway and to interpret the significance of imaging findings in the postoperative setting.
  o **Painful total joint prosthesis**
    
    ➢ See MS-9.5 Evaluation of Painful Total Joint Prostheses

• **MS-25.11 Plica (Symptomatic Synovial Plica/Medical Synovial Shelf)**
  o Symptomatic Synovial Plica is a clinical diagnosis with symptoms of anterior knee pain, a painful snap or pop with knee flexion, and a palpable and tender cord (usually medially but occasionally laterally or above the patella).¹²
  o MRI is of limited value in the diagnosis.²


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**MS-26 ~ LEG LENGTH DISCREPANCY**

• Prediction of ultimate limb length discrepancy is an inexact science.
  o A small limb length discrepancy (e.g.1.5 cm) has no known deleterious effects.
  o The goal in epiphysiodesis, when done, should be near and not necessarily perfect limb length equality.*
    
  • Radiographic scanogram remains the gold standard for leg length measurement.*
    
  • Advanced imaging is generally not indicated.

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**MS-27 ~ANKLE**

• **MS-27.1 See Disease/Injury Categories (MS-4 through MS-18)**
  o Studies can be approved as above if applicable to the ankle.

• **MS-27.2 One study/area only**
  o In foot and ankle imaging, studies are frequently ordered of both areas. This is unnecessary since ankle MRI will image from above the ankle to the mid- metatarsal area. **Only one CPT code should be approved.**

• **MS-27.3 Sprain (including Avulsion Fracture)**
  o Plain x-rays should be performed initially to rule out fracture.¹
If plain x-rays are negative, a 6 to 8 week trial of conservative therapy is warranted prior to considering advanced imaging.²

If conservative therapy fails, Noncontrast ankle MRI (CPT 73721) can diagnose pathology, including osteochondral fracture of the talar dome, occult fracture, peroneal tendon rupture and “high ankle sprain,” and is the study of choice.¹,²

Alternatively, noncontrast ankle CT (CPT 73700) can be approved, especially if requested by the Orthopedic or Podiatry specialist.

High ankle sprain refers to injury to the ligaments of the tibiofibular syndesmosis (the ligaments that attach the distal ends of the tibia and fibula to each other).

- Examination reveals tenderness and swelling in the syndesmosis, positive squeeze test (squeezing the tibia and fibula together at mid calf), and external rotation (of the foot) test.

- Treatment is conservative (RICE, partial weight bearing and range of motion exercises).²,³

¹ ACR Appropriateness Criteria, Chronic ankle pain, 2005
² Am Fam Physician 2001 Jan;63(1):93-104

• MS-27.4 Impingement
- Impingement can be anterior. Diagnosis is by plain x-ray with the ankle in maximum dorsiflexion. It is a bony impingement characterized by anterior tibial and talar neck spurs.

- In anterior-lateral impingement, which often occurs after sprains, a scar tissue mass in the area of the anterior talofibular ligament (one of the three lateral ankle ligaments) is usually the cause of the impingement.¹

  - If anterior-lateral impingement is suspected, MR or CT arthrography (CPT 73722 or 73701) can be approved.²

- Posterior impingement often involves an os trigonum (accessory foot bone). Ankle MRI without contrast (CPT 73721) can be approved.

  ² ACR Appropriateness Criteria, Chronic ankle pain, 2005

• MS-27.5 Tendonitis
- Plain x-rays should be performed initially to rule out entities such as calcific tendonitis/bursitis.*

  * Am Fam Physician 1998 Feb;57(4):667-674

- A trial of at least 6 to 8 weeks of conservative therapy with NSAIDS/cortisone dosepack, and physical therapy is warranted prior to considering advanced imaging.

- MRI ankle without contrast (CPT 73721) is the appropriate study if advanced imaging is indicated.

- Orthopedic evaluation is helpful in determining the need for advanced imaging.

• MS-27.6 Ruptured Achilles Tendon (Partial/Complete)
  - Complete rupture of the Achilles tendon
    - Complete rupture is most often a clinical diagnosis.¹

    - Patients present with swelling, point tenderness, and often a palpable defect.

    - Not all plantar flexion is lost because of the intact toe flexors, but the Thompson’s test is positive for rupture.
- Thompson’s test is done by having the patient kneel in a chair then squeezing the calf muscle. If the Achilles is ruptured, the foot will not plantar flex.¹ *
- In complete rupture of the Achilles’ tendon, surgery is the usual treatment and prompt referral to Orthopedics is helpful.¹ *


- Advanced imaging is rarely indicated as a preoperative test.
- MRI without contrast (CPT 73721) can be approved if requested by the operating surgeon.

**Partial rupture of the Achilles tendon**
- Orthopedic/podiatry evaluation is helpful in differentiating partial Achilles tendon rupture from plantaris tendon or gastrocnemius muscle rupture.
- Chronic partial tendon ruptures are characterized by intermittent soreness and often by a knot/mass palpable or visible in the tendon.
- Imaging is usually not necessary unless surgery is planned.

**References:**
- ACR Appropriateness Criteria, Chronic ankle pain, 2005

**MS-27.7 Lateral Instability**
- Chronic lateral instability can occur after single or multiple ankle sprains. It is manifested by recurrent ankle sprains sometimes with minimal trauma.
- "This is a dynamic problem which is not generally amenable to identifying with a static test."¹
- Conservative treatment is generally done first with physical therapy.²
- A lateral heel/sole wedge may be prescribed.
- Ankle MRI without contrast (CPT 73721) or MR arthrography (CPT 73722)³ can be approved if surgery to reconstruct the lateral ankle ligament complex is planned.

¹ Personal communication, C. DiGiovanni, Chief, Foot and Ankle Service, Brown Medical School
³ ACR Appropriateness Criteria, Chronic ankle pain, 2005

**MS-28 ~FOOT**

**MS-28.1 See Disease/Injury Categories (MS-4 through MS-18)**
- Studies can be approved as above if applicable to the foot.

**MS-28.2 Sprain/Fracture/Dislocation/Subluxation (Lisfranc tarsometatarsal fracture)**
- Injuries to the mid foot should have plain x-rays performed initially to rule out fracture or frank dislocation.
  - Subtle tarsometatarsal dislocation of the foot (Lisfranc fracture) can be difficult to see on plain x-ray, and noncontrast CT (CPT 73700) or MRI (CPT 73718) is indicated when this injury is suspected even though plain x-rays are negative.*
Orthopedic evaluation is helpful if a tarsometatarsal dislocation/subluxation is suspected since treatment is usually operative.*

All other sprains with negative x-rays should be treated conservatively for a 4 to 6 week period prior to considering advanced imaging.

If stress fracture is suspected, bone scan should be performed prior to considering advanced imaging.

**MS-28.3 Tendonitis**

Plain x-rays should be performed initially to rule out entities such as calcific tendonitis/bursitis.*
*Am Fam Physician 1998 Feb;57(4):667-674

A trial of at least 6 to 8 weeks of conservative therapy with NSAIDS/cortisone dosepack, and physical therapy is warranted prior to considering advanced imaging.

MRI without contrast (CPT 73718) is the appropriate study if advanced imaging is indicated.

Orthopedic evaluation is helpful in determining the need for advanced imaging.

**MS-28.4 Tendon Rupture**

Posterior tibial and peroneal tendon ruptures are the most commonly ruptured foot/ankle tendons after the Achilles tendon.

With posterior tibial tendon rupture, there is usually flattening of the longitudinal arch and often valgus of the heel.

With this scenario, particularly if unilateral and accompanied by medial foot and/or ankle pain, noncontrast ankle MRI (CPT 73721) can be approved. MRI can differentiate between tendonitis and rupture of the posterior tibial tendon.

Peroneal tendon rupture/subluxation can occur, particularly with lateral ankle sprains.

Noncontrast ankle MRI (CPT 73721) is indicated * after a 4 week period of conservative therapy if disability and lateral pain persist.
*Greene WB (Ed.). Essentials of Musculoskeletal Care. 2nd Ed.
Rosemont,IL, American Academy of Orthopaedic Surgeons, 2001, pp.436, 497-498

Orthopedic or Podiatry evaluation is helpful in determining the need for advanced imaging.

**MS-28.5 Morton’s Neuroma**

Usually a clinical diagnosis,¹ but if surgery is being planned, foot MRI without and with contrast (CPT 73720)² can be approved as a preoperative test for diagnosis confirmation.

¹Lower Extremity Musculoskeletal Disorders-A Guide to Diagnosis and Treatment. 2003
Brigham and Women’s Hospital. http://www.brighamandwomens.org
Accessed November 28, 2006
²ACR Appropriateness Criteria, Chronic foot pain, 2005

**MS-28.6 Plantar Fasciitis**

Definition: Inflammation of plantar fascia at its insertion into the calcaneus (at bottom of heel). Often, but not always, associated with heel spur.

Diagnosis is made clinically and no advanced imaging is necessary.

Treatment is conservative with heel pads, stretching, NSAIDS, and steroid injections.

Surgery is considered only in longstanding cases that have been unresponsive to conservative therapy.
The surgery involves release of the plantar fascia at its attachment to the calcaneus.

Reference:
- Greene WB (Ed.). Essentials of Musculoskeletal Care. 2nd Ed.
- Orthopedic or Podiatry evaluation is helpful in determining the need for advanced imaging.

**MS-28.7 Diabetic Foot Infection**
- Foot infections are quite common in diabetes and range from mild cellulitis to osteomyelitis and usually involve multiple organisms.
- Treatment ranges from oral antibiotics in mild cases to intravenous antibiotics and even amputation in severe cases of osteomyelitis with gangrene.
- Plain x-rays should be performed initially. ¹
  - If positive for osteomyelitis, no further advanced imaging is necessary.
  - If negative, foot MRI without and with contrast (CPT 73720) can be approved.²

¹ Greene WB (Ed.). Essentials of Musculoskeletal Care. 2nd Ed.
  Rosemont, IL, American Academy of Orthopaedic Surgeons, 2001, p.211
² Greene WB (Ed.). Essentials of Musculoskeletal Care. 2nd Ed.
  Rosemont, IL, American Academy of Orthopaedic Surgeons, 2001, p.687

**MS-28.8 Tarsal Tunnel Syndrome**
- Definition: Nerve entrapment of the posterior tibial nerve in the area of the medial malleolus analogous to carpal tunnel syndrome in the wrist.
- Diagnosis is usually made clinically but can be difficult.
- Nerve conduction studies and clinical evaluation are indicated initially.
- Ankle MRI without contrast (CPT 73721) can be approved as a preoperative study if mass/lesion is suspected as etiology of the entrapment.¹* or to evaluate for associated coalition.

¹ Greene WB (Ed.). Essentials of Musculoskeletal Care. 2nd Ed.
  Rosemont, IL, American Academy of Orthopaedic Surgeons, 2001, pp.511-512

*Greene WB (Ed.). Essentials of Musculoskeletal Care. 2nd Ed.
  Rosemont, IL, American Academy of Orthopaedic Surgeons, 2001, pp.511-512
- If the concern is for a tarsal coalition, noncontrast CT (CPT 73700) is an acceptable alternative.

- Reference:
  - Persich G and Touliopoulos S. Tarsal tunnel syndrome. eMedicine, Sept 6, 2007.
  - Bergquist IH (Ed.). Radiology of the Foot and Ankle. 2nd Ed. Philadelphia, Lippincott,
    2000, pp.155-156

**MS-28.9 Sinus Tarsi Syndrome**
- Characterized by chronic lateral ankle pain after lateral ankle sprain.
- Etiology is strain/sprain of the intertarsal ligaments of the subtalar joint.
- Diagnosis is made clinically and confirmed by injection of lidocaine into the sinus tarsi.
- Treatment is conservative.
  - Surgery (excision of sinus tarsi contents or even subtalar fusion in severe cases) is reserved for conservative treatment failures.*
- Ankle MRI without contrast (CPT 73721) is the most appropriate imaging study, but should be reserved for patients in whom the diagnosis is unclear or for patients in whom surgery is being considered.*

* The Physician and Sportsmedicine 2000 May;28(5)
Orthopedic or Podiatry evaluation is helpful in determining the need for advanced imaging.

- **MS-28.10 Chronic Lateral Ankle/Foot Pain**
  - See MS-27.4 Ankle Impingement, MS-27.7 Lateral Instability in the Ankle guidelines, and MS-28.9 Sinus Tarsi Syndrome in the Foot guidelines.
  - Another less common entity seen as a cause of chronic ankle pain is a split tear of the peroneus brevis tendon after lateral ankle sprain. *
    
  
  - Treatment of chronic lateral ankle/foot pain initially is conservative, but ankle MRI without contrast (CPT 73721) can be approved after 6 to 8 weeks of failed conservative therapy.
  - Orthopedic or Podiatry evaluation is helpful in determining the need for advanced imaging.
MUSCULOSKELETAL GUIDELINE REFERENCES

MS- 2 ~Imaging Techniques
- ACR Appropriateness Criteria, Musculoskeletal Imaging, 2005

MS- 3 ~3-D Rendering
- ACR 2006 Coding Update Sept/Oct 2005

MS- 4 ~Avascular Necrosis (AVN)
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  Presented at: 33rd Annual Radiology Refresher Course of the International Skeletal Society,
  September 13-16, 2006; Vancouver, British Columbia, Canada.

MS- 5 ~Fracture and Dislocation
- ACR Appropriateness Criteria, Acute hand and wrist trauma 2005
- Greene WB (Ed.). Essentials of Musculoskeletal Care. 2nd Ed.
- ACR Appropriateness Criteria, Chronic ankle pain 2005
- ACR Appropriateness Criteria, Stress/insufficiency fractures 2005

MS- 6 ~Foreign Body

MS- 7 ~Ganglion Cysts

MS- 8 ~Gout/Pseudogout/Crystal Deposition Disease
- Pittman JR and Bross MH, Diagnosis and management of gout. AM Fam Physician 1999
  April;59(7); 1799-1806, 1810

MS- 9 ~Infection
- Toms AD, Davidson D, Masri BA, Duncan CP.
  Management of peri-prosthetic infection in total joint arthroplasty.

MS- 10 ~Mass
- ACR Appropriateness Criteria, Soft tissue masses 2005
- ACR Appropriateness Criteria, Bone tumors 2005

MS- 11 ~Muscle/Tendon Unit Injuries/Diseases
- ACR Appropriateness Criteria, Chronic ankle pain 2005
- Greene WB (Ed.). Essentials of Musculoskeletal Care. 2nd Ed.
MS-12 ~Osteoarthritis

MS-13 ~Osteochondritis Dissecans
- ACR Appropriateness Criteria, Non traumatic knee pain 2005

MS-14 ~Osteoporosis

MS-15 ~Paget’s Disease

MS-17 ~Rheumatoid Arthritis (RA) and Inflammatory Arthritis

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- ACR Appropriateness Criteria, Non traumatic knee pain 2005

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- ACR Appropriateness Criteria, Non traumatic knee pain 2005

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- *University of Michigan Health System Knee Pain Guideline- 2005*.

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- *ACR Appropriateness Criteria, Chronic ankle pain* 2005

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- *ACR Appropriateness Criteria, Chronic ankle pain* 2005

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- *ACR Appropriateness Criteria, Chronic ankle pain* 2005

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MS-27.7 ~Lateral Instability
- Personal communication, C. DiGiovanni, Chief, Foot and Ankle Service, Brown Medical School.
- ACR Appropriateness Criteria, Chronic ankle pain 2005

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<td>ANA</td>
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<td>CNS</td>
<td>central nervous system</td>
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<td>electromyogram</td>
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<td>erythrocyte sedimentation rate</td>
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<td>FUO</td>
<td>fever of unknown origin</td>
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**Von H-L Syndrome:** von Hippel Lindau Syndrome
SPINE IMAGING GUIDELINES

SP-1 ~ GENERAL GUIDELINES

- Spinal pain is an immensely common problem affecting most adults at one time or another. Few cases indicate serious disease, and well over 90% of episodes will clear up on their own with the aid of minor analgesics, continued activity, and time (typically 8 weeks or less). The low back is the most common location.
- Certain syndromes other than simple back pain—radiculopathy, lumbar spinal stenosis, and myelopathy—can generally be identified clinically and approached separately.
- In some cases, a serious cause for the pain is rendered likely (or at least less unlikely) by so-called “red or yellow flags.”
- These guidelines will take the approach of dealing first with the identifiable syndromes (radiculopathy, lumbar stenosis, and myelopathy), and then with the much more common plain spinal pain (often called mechanical pain).

SP-2 ~ IMAGING TECHNIQUES

- Detailed history and physical examination are the first step in the evaluation of spinal disorders and should precede advanced imaging.
- Advanced imaging studies of the spine should be limited to clinically appropriate spinal regions which are involved or could reasonably be suspected to be involved in the patient’s clinical syndrome, and documentation should reflect this.

- **SP-2.1 Anatomic guidelines:**
  - CT cervical spine covers from the skull base/foramen magnum through T1.
  - MRI cervical spine covers from skull base through T1 on the sagittal images and from C2 through T1 on the axial images.
  - CT or MRI thoracic spine covers from C7 through L1.
  - CT lumbar spine covers from T12 through mid sacrum.
  - MRI lumbar spine covers from T12 through mid sacrum on the sagittal images and from L1 through S1 on the axial images.
  - CT or MRI of the cervical and thoracic spine will image the entire spinal cord. Therefore, lumbar spine imaging is not needed when imaging the spinal cord.
  - Exception: if tethered cord is present, lumbar spine imaging will be necessary to image the entire spinal cord.
    - Also see **SP-12.1 Myelopathy**

- **SP-2.2 MRI of the spine**
  - Procedure of choice to evaluate disc disease, spinal cord and nerve root disorders, and most other spinal conditions.
  - Performed without contrast for disc and nerve root disorder, fractures, and degenerative disease.
  - Contrast is optional in looking for metastatic cancer in vertebrae.
  - Contrast is appropriate in evaluating spinal infections, tumors inside the spinal canal, multiple sclerosis or other causes of myelitis, syringes, (except post-traumatic syrinx), and in the postoperative lumbar spine.
  - As with the brain, spine MRI is performed either without contrast or without and with contrast.
  - A “with contrast” study alone is appropriate only to complete a study begun without contrast if the without study was done within one to two weeks prior.
NOTE: see SP-16 Procedure Related Guidelines, Open MRI Scanners regarding repeat of inadequate studies performed in open scanners.

Screening studies of the entire spine
- The recent development of the phased-array surface coil has solved the problem of limited longitudinal field-of-view. This allows screening studies of the entire spine to be made in one acquisition, rather than treating the spine as three separate units (cervical, thoracic, and lumbar).
- Selected axial images (T1 or fast spin-echo T2) should be obtained only through the levels of abnormality, rather than through the entire spine. *
- By convention, sagittal/coronal screening studies of the entire spine are coded as one segment (cervical [CPT 72141], thoracic [CPT 72146], or lumbar [72148]), whichever is most appropriate.

SP- 2.3 CT of the spine
- Indications:
  - To look specifically at detail within bony structures.
  - As a part of myelography or discography.
  - In patients who cannot have MRI.
- CT myelograms and discograms are coded as “with contrast” studies only.
  - Indications for CT myelogram:
    - When ordered by a specialist in a patient who is unable to have an MRI, or has had an MRI which is neither completely normal nor diagnostic of a single level problem, or has recently had spine surgery and meets criteria for MRI (but has not had an MRI)
- Otherwise the use of contrast in CT parallels that for MRI.

SP- 2.4 The value of spinal imaging
- In patients with radiculopathy or lumbar canal stenosis, the diagnosis is infrequently in doubt, and imaging is done in essence as a part of pre-procedural evaluation.
- Earlier imaging may be useful in the very occasional patient in whom the diagnosis is unclear despite a complete medical history and neurological examination.
- In low back pain without neurological features, imaging is done to establish a diagnosis. It is chiefly to exclude occult metastatic disease and infection in those who are very likely to harbor such a cause or who have failed to respond to conservative treatment.
- In longstanding pain, imaging may be useful to aid in the selection of pain management procedures.
- In intrinsic spinal cord disorders, imaging is done to confirm a diagnosis, reveal the extent of a disease process, or monitor results of treatment.

SP- 2.5 Limitations of spinal imaging in degenerative spinal disorders: as the years pass, fewer and fewer healthy adults have “normal” CT or MRI of the spine. Even frank disc protrusions are seen in about 30% of individuals with no symptoms.
- In patients with poorly defined clinical findings, “abnormal” spinal imaging results are likely not to be significant and may even lead to inappropriate treatment.*
- Consequently, advanced spinal imaging based only on the presence of spinal degenerative disease identified on x-rays is not generally indicated in patients who are either asymptomatic or who present with non-specific spinal region pain.
• **SP- 2.6 Miscellaneous spinal lesions**
  o **Hemangiomas**: spinal hemangiomas are benign lesions usually incidentally encountered on spinal imaging studies.
    - If the MRI appearance of a hemangioma is typical, further imaging is not normally needed.
    - Occasionally, MRI may be indeterminate, and noncontrast CT of the area is indicated.
    - No follow-up is necessary once the diagnosis is established.
  o **Tarlov cysts**: cystic dilatation of a sacral root sleeve. It is unclear whether these cause symptoms of sciatica or not, but they can cause local bone erosion.
    - Further evaluation of a known or suspected Tarlov cyst can be performed with a post-contrast MRI or with CT lumbar myelography (CPT 72132).
  o Reference:

• **SP- 2.7 “Specialist”** means neurosurgeon, orthopedist, neurologist, or physiatrist (PM&R) and also, in their areas of expertise, pain specialist, oncologist, rheumatologist, and cardiovascular specialist.

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**SP- 3 ~ PAINFUL LUMBOSACRAL RADICULOPATHY**

• **SP- 3.1 Uncomplicated radiculopathy** (pain radiating in a radicular pattern): in the lumbar spine, that pattern is generally from back to thigh and **into the leg**.
  o **Note**: musculo-ligamentous back pain frequently radiates into the gluteal region and hamstrings. This feature is not sufficient to validate the diagnosis of radiculopathy.
  o Symptoms of trochanteric bursitis (lateral hip pain usually with local tenderness) can be confused with radiation of pain from lumbar disc disease, and if present alone without other symptoms or signs are not an indication for spine imaging.

• Recent detailed history and relevant physical examination should be performed initially.

• Symptomatic treatment is appropriate before consideration of advanced imaging. Physician-directed clinical care with clinical re-evaluation should be attempted for 6 to 8 weeks before imaging (generally noncontrast lumbar MRI [CPT 72148]) is considered.
  o Advanced imaging of the hip or pelvis is not generally appropriate in the evaluation of apparent lumbar radiculopathy unless a separate recognized indication for such studies is documented. (see **MS-24.2, Hip Pain** in the Musculoskeletal guidelines).

• The approximate date of onset must be documented by survey or notes, and this is an absolute requirement in patients age 18 to 50.

• **Advanced imaging** (MRI lumbar spine without contrast [CPT 72148]) is appropriate in the following situations:
  o **Failure of symptomatic therapy**: patients who fail to recover after a full course of physician-directed therapy.
  o **Specific objective weakness**: must be documented and should be myotomal:
    - ankle dorsiflexion for L5 (trouble walking on heels) on the involved side
    - Plantar flexion for S1 (trouble walking on toes) on the involved side
  o **Intractable pain** despite a reasonable attempt at conservative therapy must be documented.
  o **Cauda Equina Syndrome**: the very rare patient, usually a late adolescent or young adult, who develops acute bilateral sciatica complicated by urinary retention (or incontinence if there is an incompetent sphincter), perineal sensory loss ("saddle
anesthesia”), or decreased anal sphincter tone, requires urgent noncontrast lumbar MRI (CPT 72148).

- **Societal convenience**: imaging may be necessary to permit the return of police and fire fighters to their jobs, and this is acceptable as a reason.
- **Specialist consultation**: patients are not often referred to spine specialists unless symptomatic therapy has failed. Requests for imaging after the initial consultation are usually appropriate.
- **Recurrent radiculopathy**: patients having ≥3 episodes within two years without prior imaging or surgery.

**NOTE**: In patients between age 18 and 50 who have not completed at least 4 weeks of conservative care, the reasons for earlier scanning must be documented in the case notes.

- **Resolved or improving radiculopathy**: advanced imaging is generally unnecessary in patients with lumbar radiculopathy that has resolved or is improving.

- **SP-3.2 Trauma**: Noncontrast lumbar CT (CPT 72131) or MRI (CPT 72148) may be appropriate in patients with lumbar radiculopathy after moderate to severe trauma.
  - Specialist consultation is helpful in determining the need for advanced imaging.
  - Also see SP-9 Mechanical Back Pain, Trauma

- **SP-3.3 Other issues**
  - **Contrast in Lumbar MRI**: patients with prior lumbar surgery should have MRI without and with contrast (CPT 72158), but noncontrast MRI (CPT 72148) is acceptable during pregnancy and upon specialist request.
  - **CT**: as an alternative to MRI, noncontrast lumbar spine CT (CPT 72131) or CT myelogram (CPT 72132) may be appropriate for patients who cannot have MRI for the evaluation of spondylolisthesis, and/or upon specialist request.
  - **Recurrent postoperative radicular symptoms within a year of back surgery**: specialist evaluation is helpful in determining the need for advanced imaging and the appropriate imaging pathway (plain x-ray, CT, CT myelogram, MRI, discography).
  - **Routine post-fusion imaging**: following a clinically successful spinal fusion procedure or laminectomy, advanced imaging is not indicated after the immediate postoperative interval unless plain x-rays show failure of fusion or the patient develops worsening symptoms (see bullet above).
  - **Repeat studies**: requests by orthopedists and neurosurgeons for repeat MRI or CT studies more than six months old are acceptable for preoperative evaluation or if the patient’s clinical condition has changed since the time of the prior study.

- **SP-3.4 Meralgia paresthetica**: numbness of the outside of the thigh is infrequently due to radiculopathy.
  - Also see PN-2.6 Meralgia Paresthetica in the Peripheral Nerve Disorders guidelines.

- **SP-3.5 References**
  - [ACR Appropriateness Criteria, Low back pain, Rev 2005](http://www.guideline.gov)  
  - [American Academy of Neurology](http://www.guideline.gov)  
  - Also supported by the North American Spine Society Accessed November 20, 2006  
**SP- 4 ~ LUMBAR SPINAL STENOSIS**

- Lumbar canal stenosis generally occurs in patients over 60 years old and presents with chronic backache typically associated with pseudo-claudication—the patient has pain radiating into the legs on walking which is relieved by bending forward or sitting down.
- Lumbar canal stenosis can readily be confused with either painful polyneuropathy or arterial insufficiency.
  - Detailed examination including neurological and peripheral vascular examination is appropriate initially.
  - Diabetics and alcoholics especially should have EMG to exclude peripheral neuropathy unless there is very clear cut pseudoclaudication.
  - In those with pseudoclaudication, vascular insufficiency must be excluded by physical exam or by arterial Doppler prior to consideration of advanced imaging.
- Patients with mild to moderate symptoms (see next bullet) should be treated with an extended trial of conservative therapy, including analgesics and a regimen of regular activity. Conservative treatment is successful 70% of the time in these patients.*
  - Noncontrast lumbar spine MRI CPT 72148) or CT (CPT 72131) is appropriate for those who fail to reach a level of symptoms they find acceptable.
  Sg2 Web Seminar, November 8, 2007
- Noncontrast lumbar MRI (CPT 72148) is indicated in patients with more severe symptoms restricting normal activity or requiring narcotic analgesics, once other confounding diagnoses have been excluded.
  - When there are diagnostic uncertainties unresolved by MRI, a lumbar CT myelogram (CPT 72132) may be appropriate to resolve them.
  - In patients with severe spinal stenosis, decompression is effective 80% of the time.*
  Sg2 Web Seminar, November 8, 2007
- In patients with previous lumbar surgery, MRI without and with contrast (CPT 72158) is appropriate.
  - Specialist evaluation is helpful in determining the appropriate imaging pathway in patients with prior lumbar surgery.
  - The value of CT in this post-operative setting is limited.

**References:**
- ACR Appropriateness Criteria, Low Back Pain, Rev 2005 Variant 6

**SP- 5 ~ FIBROMYALGIA**

- Pain syndrome characterized by chronic, diffuse musculoskeletal pain, fatigue, abnormal sleep, headaches, morning stiffness, and abnormal soft tissue tenderness to palpation.
  - Most frequently seen in females between the ages of 20 to 50 years old.
  - The diagnosis is based on clinical findings established by the American College of Rheumatologists. (See SP- 5 Evidence Based Clinical Support section)
  - These clinical findings have 88% sensitivity and 81% specificity.
- Advanced imaging studies in patients with fibromyalgia are not indicated without specific clinical features appropriate to the region for which the request is made.
SP- 6 ~SACRO-ILIAC (SI) JOINT PAIN

- SI joints are located in the pelvis and join the sacrum to the hips.
  - Pain may be referred to SI joint, lumbosacral spine, or ipsilateral leg.
  - Onset usually follows rotation coupled with axial load (lift and turn, push and turn).
  - Pain tends to be worse in the morning, with bending, and with prolonged standing/sitting.
  - SI joint pain causes no neurological features.
  - Patrick’s sign is typically present.
  - Diagnosis is made by SI joint injection of local anesthetic and this should be performed prior to advanced imaging in non-rheumatoid cases.
  - **Ankylosing Spondylitis**: see SP-9.5 Ankylosing Spondylitis

- Patrick’s sign is typically present.

- Diagnosis is made by SI joint injection of local anesthetic and this should be performed prior to advanced imaging in non-rheumatoid cases.

- Plain x-rays of the SI joints (pelvis) are the initial study.

- **Rheumatology** 2004;43:234-237

- Reference:

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SP- 7 ~VERTEBRAL COMPRESSION FRACTURES

- Sudden localized back pain is the typical feature, but compression fractures may be subclinical (painless). They are associated with age and osteoporosis. Incidence in the US is > 700,000 per year.

- Detailed neurological examination and review of plain x-rays are indicated initially.
  - If the x-rays reveal a compression fracture, noncontrast MRI or CT of the affected spinal level may be appropriate.
  - Orthopedic or neurosurgical consultation is helpful in determining the need for advanced imaging.
  - If the x-rays are non-diagnostic and pain persists over a week in an elderly patient or a patient with known osteoporosis, noncontrast MRI of the painful spinal level is appropriate.

- Reference:
  - J Fam Practice 2005 Sept (Supplement):781-788

- In a patient < 55 years old with atraumatic compression fracture, malignancy should be considered and MRI (contrast as requested) is recommended.

- MRI or CT is appropriate preoperatively in patients ≥2 weeks following known compression fracture, who are going to undergo kyphoplasty or vertebroplasty.

- Compression fractures are a frequent incidental finding on spinal x-rays. If the patient has appropriately located back pain, bone scan may be needed to determine the fracture’s age (new vs old).

- Reference:
  - ACR Appropriateness Criteria, Low Back Pain, Rev 2005
This guideline applies to patients with known cancers of types which metastasize to bone and who develop new back pain which has either persisted over two weeks or is progressively severe. It does not apply to longstanding (>4 months) pain in such patients.

- Breast, lung, prostate, renal cell and colon cancers, along with myeloma, are the most likely to metastasize to bone.

See ONC-27.4 Metastatic Cancer Bone (and Spine) for guideline regarding imaging pathways in cancer patients with back pain.

**Additional MRI scans in patients with known spinal metastasis:** one third of patients with a known spinal metastasis have further metastases, so imaging of any spinal regions that have not already been imaged is appropriate (MRI contrast as requested)

- Inclusion of the cervical spine is at the discretion of the treating physician (cervical metastases are much less common than lumbar and thoracic metastases).

**Spinal pain with neurological findings:** urgent spinal MRI (contrast as requested) is indicated. Selection of levels to be scanned depends on the spinal level of the findings, but areas above that may be included at the discretion of the treating physician.

**Reference:**

- ACR Appropriateness Criteria, Low Back Pain, Rev 2005

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**SP- 9 ~ MECHANICAL BACK PAIN**

**BACK PAIN WITHOUT NEUROLOGICAL FEATURES**

Mechanical back pain of benign causes accounts for over 90% of cases in the general backache group.

**SP- 9.1 Red flag settings** are situations in which localized back pain is likely to reflect serious underlying disease. If the pain is severe and persists for more than a week, advanced imaging (generally noncontrast MRI; MRI contrast as requested if there is a high suspicion for tumor) of the symptomatic level (lumbar or thoracic) is appropriate. This group as a whole represents about 1% to 2% of all back pain cases.

**MRI of the relevant spinal level (contrast as requested) is appropriate in the following circumstances:**

- Patients with known recent or metastatic malignancies, (the meaning of recent varies with the tumor type).
- Patients with persistent septicemia (FUO>3 weeks) or known endocarditis. This includes fever and severe localized backache in intravenous drug users.
- Immunocompromised hosts (AIDS, transplant patients, those on immunosuppressant therapy or chronic dialysis).
- Clinical suspicion of disc space infection, epidural abscess, or spinal osteomyelitis.
- Hematuria is often added to this list, but generally requires evaluation for its cause first (see AB- 42 Hematuria in the Abdomen guidelines).

**SP- 9.2 Yellow flag settings** are situations where there is some increased likelihood that a backache is a sign of serious underlying disease, but much less strongly so than in a red flag setting.

- Patients with two or more yellow flags should have consideration of level-appropriate spine MRI without contrast.
With one yellow flag, a four week trial of conservative therapy is indicated prior to consideration of advanced imaging in most cases.

**Yellow Flags:**
- Coincident systemic symptoms, adenopathy, or unintentional weight loss >10 pounds.
- History of remote “internal” cancer or non-melanoma skin cancer. E.g. a history of lung cancer two years ago would be a red flag; a history of bowel cancer 15 years ago would be a yellow flag (because people who have formed one cancer are likelier to form another one).
- History of intravenous drug use without other medical complications of drug use.
- Back pain worse at night or unrelieved with position change.
- Age > 60.
- Elevated ESR (>24).

**Reference:**

**SP- 9.3 Uncomplicated backache:** patients with lumbar or thoracic pain uncomplicated by neurological features or red/yellow flags (as described above) rarely have a serious underlying cause.

- Analgesics, supportive care and continued physical activity under the direction of a physician are appropriate for 4 to 8 weeks.
- Patients improving by 4 weeks should continue with conservative treatment.
- Patients with no improvement at 4 weeks should receive careful clinical re-evaluation and continued therapy.
- At six weeks, re-evaluation, perhaps including lumbar x-rays, is appropriate. If the x-rays show abnormalities other than simple degenerative disease, noncontrast MRI of the relevant area of the spine can be performed.
- Lumbar spine x-rays can be important in identifying spondylolisthesis, lumbar scoliosis, spondyloysis, and transitional spinal segments.
- After 12 weeks duration without improvement (including 4 to 8 weeks of those 12 weeks being under the care of a physician), noncontrast MRI is appropriate regardless of prior treatment or not.*


**SP- 9.4 Spondylolysis**
- Thought to be caused by repeated microtrauma resulting in stress fracture of the pars interarticularis. Heredity is also believed to be a factor.¹
- Immobilization with various corsets or braces and activity restriction are the principles of treatment of symptomatic patients.²
- Surgical treatment is only recommended for very symptomatic patients whose symptoms have not responded to non-surgical care and whose symptoms are disabling.²
- Is best recognized on plain x-rays, and advanced imaging is generally not indicated. If imaging is needed because of radiological uncertainty or associated spondylolisthesis, noncontrast CT or MRI is acceptable. (MRI must be performed on 1.0 Tesla [minimum] machine with 3 mm cuts and at relatively high resolution).¹
- Specialist evaluation is helpful in determining the need for advanced imaging.

• **SP- 9.5 Ankylosing Spondylitis**
  o 97% of patients are HLA B-27 positive
  o Recent clinical examination, positive HLA test result, and plain x-rays should precede consideration of advanced imaging.
    ➢ There is no evidence-based data demonstrating that advanced imaging changes patient management decisions in patients with proven SI disease on plain x-rays.
    ➢ MRI has shown inflammatory changes in the SI joints prior to visible x-ray changes in several small studies.
      ▪ However, further data is needed to establish the ability of MRI to characterize inflammation in early ankylosing spondylitis, the ability of MRI to predict destructive changes, and the value of monitoring treatment effects.*
        *Rheumatology 2004;43:234-237
  o If there are specific neurological problems, noncontrast MRI of the relevant spinal level is appropriate
  o Pelvic MRI without and with contrast (CPT 72197) may be indicated in difficult diagnostic situations such as rheumatoid arthritis.
  o Rheumatology evaluation is helpful in assessing the need for advanced imaging.

• **SP- 9.6 Trauma**: patients with trauma affecting the lumbar or thoracic spine should have lumbar or thoracic spine x-rays and a thorough neurological examination. If both are normal, further imaging is generally unnecessary.
  o If there is concern about an occult fracture, nuclear bone scan or noncontrast CT (CPT 72131 or 72128) is indicated.
  o In patients with uncomplicated clear-cut radicular features after spinal trauma, noncontrast MRI (CPT 72148 or 72146) is appropriate.
  o Spinal cord trauma: see **SP-12 Myelopathy**.

• **SP- 9.7 Advanced pelvic or hip imaging is not generally appropriate in evaluation of low back pain with pelvic radiation.**
  o Such requests should be approved only when there is documentation of a separate pelvic problem
  o Also see **PN-2.5 Femoral Neuropathy** in the Peripheral Nerve Disorders guidelines.

• **SP- 9.8 Thoracic spine advanced imaging** is generally not appropriate in evaluation of low back pain with radiation toward the thoracic region unless there are documented features indicating thoracic spine disease.

• **SP- 9.9 References**:
  o **Ann Intern Med 2000;137:586-597**
  o **Radiol 2001;220:393-395**
  o **N Engl J Med 2001;344:363-370**
• **SP-10.1 Thoracic pain**
  o Careful physical examination and detailed history are the first step in the evaluation of thoracic regional pain.
  o Upper back pain is generally from musculo-tendinous causes and responds to time and conservative management. Pain management consultation is often useful when the problem is prolonged.
  o Plain x-rays of the thoracic spine are the appropriate initial imaging study in patients with thoracic pain without radiculopathy, a history of cancer, immunocompromised status, or sepsis.
  o Interscapular pain usually reflects either non-neurological disease or a cervical etiology.
  o Thoracic pain which consistently awakens the patient from sleep raises the possibility of a spinal tumor (esp. meningioma or nerve sheath tumor).

• **SP-10.2 Thoracic radiculopathy**
  o Thoracic radicular-pattern pain is not common, but can be seen with diabetic intercostal neuropathy and zoster (shingles).
    ➢ In most cases of shingles, pain is the initial symptom, but the cause becomes evident with the appearance of the typical rash. Imaging is rarely required for either.
  o Thoracic radiculopathy from disc disease is quite uncommon (0.1%-0.5% of disc disease).
    ➢ It presents with thoracic level dermatomal pain on one side.
      ➢ The thoracic dermatomes essentially include the entire ventral trunk.
    ➢ In clinically typical thoracic radiculopathy, noncontrast thoracic MRI (CPT 72146) is appropriate if significant symptoms persists for >8 weeks.
    ➢ Specialist consultation is helpful to clarify diagnosis and aid in selection of imaging choices.
    ➢ Reference:

• **SP-10.3 Metastatic disease to the thoracic spine**
  o Spinal metastases from systemic cancer occur most often in the thoracic spine.
    ➢ See [SP 8 Spinal Pain in Cancer Patients](#)

• **SP-10.4 Thoracic spine trauma**
  o See [SP-9.6 Trauma](#)

• **SP-10.5 Myelopathy**
  o See also [SP-12 Myelopathy](#)
SP-11 ~ CERVICAL RADICULOPATHY

- Detailed history and physical examination are appropriate initially.
- Cervical radiculopathy is distinctly less common than the lumbar syndrome, but its management is similar.
  - Most cases resolve over 6-12 weeks and will start to show improvement within 2-4 weeks.
  - Conservative therapy for 4 weeks, continuing longer if improvement begins, is appropriate prior to consideration of advanced imaging.
  - **Note:** patients are generally referred to spinal specialists in this condition after a failed trial of symptomatic treatment. Requests for cervical spine MRI without contrast (CPT 72141) after specialty consultation are generally appropriate.
  - Approximate date of onset of the symptoms should be documented. Date of the first office visit is of limited relevance if the patient has previously seen other physicians for the problem.
  - Reference:

- **SP-11.1** Escalation of advanced imaging (CPT 72141) is appropriate in certain circumstances:
  - Extremely severe or worsening pain despite a two week plus trial of symptomatic treatment.
  - Objective weakness in the relevant myotome (includes grip strength, biceps strength [C6] and triceps strength [C7]). This must be documented.
  - Recurrent radiculopathy: patients having their third or greater episode within two years without prior imaging should be approved for noncontrast cervical spine MRI (CPT 72141).

- **SP-11.2** Special clinical features of painful cervical radiculopathy
  - Pain radiation patterns often include the interscapular area, and the addition of thoracic spine advanced imaging on that basis alone is generally inappropriate.
  - Radiation of pain into the limb (arm and forearm) is less clear cut than the analogous radiation in lumbar radiculopathy.
  - Sensory radiation (subjective paresthesia), however, is better defined: C6 into the thumb and C7 into the middle finger.
  - 90% of cases involve either the C6 or C7 root.
  - C5 radiculopathy is not common, but it is often very hard to tell clinically from shoulder pain, even after careful clinical evaluation. MRI of the shoulder without contrast (CPT 73221) may be appropriate in this setting, but only when the nature of the clinical issue is documented.
    - Patients with C5 radiculopathy with objective weakness benefit from prompt surgical evaluation, since early nerve root decompression may be needed to prevent permanent loss of strength.
  - Ulnar neuropathy must be considered in patients suspected of C8/T1 radiculopathy (radiation to pinkie finger). Generally, nerve conduction studies (EMG/NCV) should precede advanced spinal imaging.
    - Also see PN-2.2 Ulnar Neuropathy in the Peripheral Nerve Disorders guidelines.
• **SP-11.3 Advanced imaging modalities:** patients who fail conservative management as outlined above and are surgical candidates should be imaged by noncontrast cervical spine MRI (CPT 72141).
  o Noncontrast cervical spine CT (CPT 72125) can be useful in patients greater than 60 years old to evaluate for bony spurs, but is of little value in visualizing cervical disc disease.
  o Specialist evaluation is helpful in determining the most appropriate imaging study for those patients who cannot have MRI performed.
    ➢ CT myelogram (CPT 72126) and cervical spine CT without contrast (CPT 72125) can be useful in this setting.

• **SP-11.4 Patients with prior cervical spine surgery:** Contrast is not often useful in this setting in the cervical spine (in contrast to the lumbar spine).
  o Noncontrast cervical spine MRI (CPT 72141) and cervical CT myelogram (CPT 72126) can both be useful.
  o Specialist input is helpful in evaluating patients with recurrent symptoms within a year of cervical spinal surgery, and is useful in all recurrent problems.
  o **Postoperative MRI:**
    ➢ Not indicated if patient is doing well.
    ➢ If there are continued postoperative symptoms with new neurological findings postoperatively, noncontrast cervical spine MRI (CPT 72141) is appropriate.
    ➢ Continued symptoms postoperatively without neurological findings should be treated for 6 to 8 weeks before consideration of follow-up MRI.

• **SP-11.5 Differential diagnosis:** cervical spondylosis is often confused with other entities, most commonly:
  o **Shoulder-arm symptoms:** non-localized aching or numbness in the entire arm is a symptom of muscle spasm in the neck or shoulder, not cervical radicular disease.
    ➢ Orthopedic evaluation is helpful in determining the need for advanced imaging for this symptom complex.
  o **Carpal tunnel syndrome:** distal paresthesia of a hand (rather than one or two fingers), especially if worse at night, is typical of carpal tunnel syndrome.
    ➢ Advanced imaging is not usually required for the diagnosis and treatment of carpal tunnel syndrome.
    ➢ Carpal tunnel syndrome is usually diagnosed by clinical features supplemented by nerve conduction studies (EMG/NCV).
    ➢ See also [PN-2.1 Carpal Tunnel Syndrome](#) in the Peripheral Nerve Disorders guidelines and [MS-21 Carpal Tunnel under Wrist](#) in the Musculoskeletal guidelines.
  o **Brachial “plexitis” (Parsonage-Turner syndrome):** this is a clinical diagnosis assisted initially by EMG. Neurological consultation is helpful, and at times, brachial plexus imaging may be appropriate.
    ➢ Also see [PN-4 Brachial Plexus](#) in the Peripheral Nerve Disorders guidelines.
• **See also** [HD-22.3 Isolated Clinical Syndromes, Transverse Myelitis](#) located in the Head guidelines

• **SP-12.1** Myelopathy refers to abnormal spinal cord function
  o Detailed history and neurological examination focused on the spinal cord should be performed initially.
  o Classic signs are spastic legs with hyperreflexia and upgoing toes (positive Babinski). Sensory level and urinary incontinence are also seen.
  o Advanced imaging is generally appropriate in the initial evaluation of documented or reasonably suspected myelopathy.
  o MRI is the procedure of choice for initial evaluation of the spinal cord.
    ➢ Cervical and thoracic spine MRI scans are sufficient since the spinal cord normally ends at L1-2, which is seen on thoracic MRI.
      ▪ Specialist evaluation is helpful in determining the appropriate imaging pathway in spinal cord disease.
    ➢ If the conus medullaris is known to end at L2/3 or below, it is tethered, and lumbar MRI (contrast as requested) is appropriate.
      ▪ If the conus is not seen on the thoracic spine MRI, the spinal cord must be presumed to be tethered, and lumbar MRI (contrast as requested) is appropriate.
  o CT myelography also has a role at times in diagnosis of spinal cord compression.

• **SP-12.2** Acute myelopathy, except after obvious trauma, is generally either inflammatory or neoplastic.
  o MRI without and with contrast is appropriate, but specialists’ requests for noncontrast MRI should be honored.
  o When inflammation is suspected (MS included), cervical and thoracic MRI is appropriate.

• **SP-12.3** Traumatic myelopathy: noncontrast MRI is generally sufficient, but noncontrast CT for fracture definition or to detect occult fractures may also be indicated. Patients with acute traumatic myelopathy are rarely evaluated in an outpatient setting.
  o **Post-traumatic syrinx:** the use of MRI to evaluate a post-traumatic syrinx in a patient with an established spinal cord injury is usually appropriate only in patients with increased spinal pain or a worsening neurological picture. Contrast is usually not indicated.
    ➢ Post-traumatic syrinx in spinal cord injury patients does not require re-imaging unless there is a change in the neurological picture at or below the syrinx.

• **SP-12.4** Chronic cervical myelopathy is usually spondylitic (from disc or degenerative disease). Noncontrast cervical spine MRI (CPT 72141) is often sufficient, but MRI of the spinal cord without and with contrast is acceptable when other sources of myelopathy require exclusion.
  o Because of the pattern of blood supply to the spinal cord, chronic cervical myelopathy may simulate a high thoracic pattern (esp. T4). Requests for cervical imaging are appropriate in that setting.

• **SP-12.5** Progressive thoracic myelopathy is unusual except in cancer patients and in intrinsic cord disorders, including MS.
  o In such cases, MRI without and with contrast is appropriate.
• **SP-12.6 Cancer patients**: see [SP-8 Spinal Pain in Cancer Patients](#).
  - Evaluation is on a very urgent basis if there are signs of myelopathy.
• **Use of the term spinal stenosis outside the lumbar spine is best avoided. A narrowed cervical or thoracic canal is only significant when it affects spinal cord function. Therefore, myelopathy is the important issue.**

• **SP-12.7 Lhermitte’s sign**:
  - The presence of a more or less reproducible electric sensation that shoots down the entire spine and sometimes into the limbs with sudden neck flexion.
    - This is a common occasional event in normal individuals, but it is significant when it is sustained and prominent.
  - When sustained and prominent, this is a sign of cervical myelopathy, and cervical spine MRI is appropriate.
    - The need for contrast will depend on the clinical setting and the choice is best left to the treating physician.

• **SP-12.8 Babinski’s sign** (“upgoing toe”):
  - A reliable sign of a lesion somewhere in the central nervous system (CNS) above the lumbar spine.
  - In a patient with a prior appropriately located CNS lesion, a Babinski’s sign per se requires no imaging.
  - Patients with an unexplained Babinski’s sign should undergo neuroimaging
    - The most appropriate imaging pathway will depend on other findings, so history and detailed neurological examination are essential.
    - If there are no other known findings, noncontrast brain MRI (CPT 70551) is generally the best initial study.
    - Neurological consultation is helpful in determining the most appropriate imaging pathway.

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**SP-13 ~ MECHANICAL NECK PAIN**

**NECK PAIN WITHOUT NEUROLOGICAL FEATURES**

• **Uncomplicated neck pain**: conservative management for 6 to 8 weeks is appropriate. By far, most neck pain is musculo-tendinous in origin.

• **Complicated neck pain**:
  - Patients with red or yellow flags are managed as for lumbar pain (see [SP-9 Mechanical Back Pain](#)), but both red and yellow flag situations are much less common in the neck than in the lower spine.

• **Trauma**: patients with a history of trauma affecting the neck should have a thorough history and neurological examination. Subsequent cervical imaging pathway depends upon the clinical situation. Either noncontrast cervical spine CT (CPT 72125) or plain x-rays are the appropriate initial imaging study, depending on the mechanism of injury (patients with significant head or facial trauma must be presumed to be at risk for cervical spine trauma).
  - If x-rays or CT shows fracture or dislocation: urgent spinal surgical consultation is appropriate.
    - Noncontrast CT (CPT 72125) and/or MRI (CPT 72141) will likely be the next step.
  - If x-rays do not show fracture or dislocation:
    - If the patient is asymptomatic with normal clinical examination: further imaging is not generally required.
Patients with persistent neck pain and a normal clinical examination: noncontrast CT (CPT 72125) to exclude occult fracture is appropriate if it was not the initial study.

MRI of the cervical spine without contrast (CPT 72141) is appropriate if there are neurological symptoms or examination findings (arm or below).

- If x-rays were performed and are equivocal for fracture: noncontrast CT (CPT 72125) can be performed.

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**SP-14 ~ FAILED BACK SYNDROME**

- The term designates prolonged intractable pain following or despite spinal surgery. It is not used in reference to cancer patients.
  - Specialist involvement (neurologists, spine surgeons, physiatrists and pain specialists) is especially helpful in determining the need for advanced imaging and the appropriate imaging pathway in these very complex patients.
- MRI of a spinal region can be difficult to interpret if the MRI is obtained within three months of surgery in that region.
  - A patient with new or recurrent symptoms related to the surgical area should have either MRI or CT myelography if imaging is needed (usually at the discretion of the spine specialist).
    - At times, both MRI and CT myelography will be needed. These should be requested by a spine specialist who has clear documentation of the indications for both studies.
- When the patient is more than six months past surgical intervention, MRI is again preferred (without and with contrast in the lumbar—CPT 72158 and thoracic spine—CPT 72157, noncontrast in the cervical spine—CPT 72141).
  - However, a trial of conservative therapy may be beneficial prior to considering advanced imaging.
- If there has been the placement of orthopedic hardware or a prior fusion whose status is being checked, noncontrast CT or CT myelography is generally preferred.
- **Reference:**

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**SP-15 ~ SYRINGOMYELIA**

- Syringomyelia may begin to form in childhood but rarely becomes symptomatic before the adult years.
  - See **HD-8 Chiari Malformation** in the Head guidelines for imaging choices in that setting.
- The evaluation of potential syringomyelia begins with a detailed history and neurological examination, including the spine.
- Noncontrast MRI of the cervical spine (CPT 72141) is indicated for evaluation of a possible syrinx. If a syrinx or hydromyelia is found, contrast will be needed.
  - Except for routine imaging in Chiari patients, specialist evaluation is helpful in determining the need for advanced imaging.
  - The study should be performed without and with contrast initially if syrinx is the expected diagnosis (high clinical suspicion based on prior clinical information or imaging studies) in order to enable distinction of a primary syrinx from one secondary to a cord tumor.
• **Initial imaging pathway:** following initial recognition of a syrinx, MRI of the brain (generally noncontrast—CPT 70551) is recommended to evaluate for syringobulbia.
  o MRI of the thoracic spine is also appropriate to define the lower extent or to identify a skip lesion.
  o Separate lumbar spine imaging is useful if there is concern for tethered cord.
• **Follow-up imaging:** repeat noncontrast cervical spine MRI (CPT 72141), and, when involved, head or other spinal regions will be appropriate following surgical treatment of a syrinx (including posterior fossa decompression).
  o Annual follow-up is appropriate until stability is established, then imaging every few years for life can be performed.
  o Re-imaging is appropriate whenever there is clinical deterioration.
• **Post-traumatic syrinx in spinal cord injury patients** does not require re-imaging unless there is a change in the neurological picture at or below the syrinx.
• **Reference:**

### SP-16 ~ PROCEDURE RELATED GUIDELINES

• **Positional or weight-bearing MRI:** See [HD-35 Newer MRI Techniques](#) in the Head Guidelines
  o Currently regarded as experimental.
• **Open MRI Scanners:** spinal images produced by some of these scanners are inferior to those obtained in closed 1.5 Tesla MRI units and sometimes repeat imaging in a closed unit MRI scanner is necessary.
  o The use of open scanner spinal imaging should be discouraged but is sometimes unavoidable.
  o Adequate studies can generally be obtained from one of the newer open MRI 0.7 Tesla units.
  o Requests from neuro specialists and spinal orthopedists for repeat of an inadequate spinal MRI done on an open unit are acceptable.
• **CT myelography** is generally unnecessary when a good quality and diagnostic MRI has been obtained. However, MedSolutions will attempt to honor established practice patterns of spine surgeons.
  o CT myelography may be useful to clarify equivocal MRI findings or to further evaluate the significance of multiple abnormal levels.
  o Other exceptions are noted throughout the guidelines.
  o CT myelography may also be useful with calcified lesions, since MRI shows calcification poorly.
• **Epidural steroid injection:** a treatment used by many pain specialists to treat radicular or mechanical spine pain which has not responded to an adequate trial of non-invasive conservative measures, especially when it is desired to avoid spine surgery.
  o Noncontrast MRI may be appropriate to select the level of injection, but without substantial change in the clinical picture or intervening surgery, repeat studies are not necessary with each injection or series of injections.

### SP-17 ~ DISCOGRAPHY

• **Lumbar Discography:**
  o **Indications:**
    ➢ To identify a symptomatic pseudo-arthrosis in a failed back fusion.
To identify which of two herniated discs seen on MRI is symptomatic when that cannot be determined clinically.
To confirm the discogenic nature of pain in a patient with an abnormal disc seen on MRI and to rule out pain from an adjacent level.
To confirm a diagnosis of the presumed entity “symptomatic internal disc disruption.”

- **Preconditions of approval:**
  - The patient must have had an MRI and a CT myelogram which were not completely normal but failed to establish a clear diagnosis.
  - Current specialist involvement is helpful.
  - There must be an absence of defined objective neurological findings except for those with multiple level disc protrusions in whom prior imaging has not resolved uncertainty about the symptomatic level.
  - Since lumbar discography is essentially a pre-procedural study, the patient must be a candidate for spinal fusion surgery or percutaneous disk procedure.
  - Patients with failed back surgery are generally not candidates except for those being evaluated for pseudo-arthritis as above.
  - Psychological testing prior to discography is prudent, since those with high symptom fixation scores are unreliable subjects.
  - Those unable to provide meaningful responses during this interactive test are not candidates for it.

- **Cervical and thoracic discography** are even more controversial than lumbar discography, and are used infrequently by a small number of spine specialists.
  - Given the uncertainty of benefit and the very real risk of complications (>1%), these procedures should not be approved for coverage except in exceptional circumstances.
  - Requests should be sent for Medical Director review.
  - The caveats mentioned in lumbar discography apply.

- **References:**
  - *Spine* 2001;1:364-372
  - *Spine* 1995;20:2048-2059
  - *Pain Physician* 2003;6:3-81 pp.18-22
  - *Spine* 1993;18:2035-2038
  - *Pain Physician* 2007;10:147-164
Evidence Based Clinical Support
SP- 3 ~ PAINFUL LUMBOSACRAL RADICULOPATHY

- About 4% of those in the back pain group, mostly patients between 20 and 50 years old, have sciatica or lumbar radiculopathy.
- Radiculopathy in the lumbar region involves L5 or S1 in 95% of cases and causes sciatica—these nerve roots are the major contributors to the sciatic nerve. Pain radiates through the thigh to well below the knee. Back pain is usual but not invariable. There is generally a positive straight leg raising sign. An absent or very depressed ankle jerk (S1) and radicular sensory subjective complaints are common.
- Occasional cases involve L3 or L4: the pain will radiate to the anterior thigh from the back; the knee jerk may be lost, and sensory complaints, if present, usually refer to the medial leg.
- Lumbar radicular pain is usually worse while sitting.
- Weakness most typically involves ankle dorsiflexion for L5 (patient has foot drop or trouble walking on the involved heel) and ankle plantar flexion for S1 (patient has weakness trying to walk on toe on the involved side).
- It is important to remember that asymptomatic disc bulges and herniations are immensely common in healthy people (about 35%). Without a clear-cut radicular syndrome, their significance is doubtful, so careful clinical evaluation must precede imaging.
- The same warning applies even more strongly to disc “degeneration” (dehydration): such changes are all but inevitable with age, and bear, at most, a tenuous connection to symptoms.
- Consequently, a cervical or lumbar MRI performed on a patient with nonspecific clinical features is much likelier to lead the practitioner astray than to clarify the situation.
- In the cervical spine, where radiculopathy is less frequent and other causes of pain more frequent, this is especially so.

Evidence Based Clinical Support
SP- 4 ~ LUMBAR SPINAL STENOSIS

- About 3% of low back cases, usually in the elderly, are a manifestation of lumbar canal stenosis. This is a degenerative disease infrequent below age 60.
- The characteristic symptoms are back, and, especially, leg pain relieved by sitting or bending forward (in contrast to the worsening of radicular pain that way). The pain is often brought on by walking (pseudoclaudication).

Evidence Based Clinical Support
SP- 5 ~ FIBROMYALGIA

- The diagnosis is based on clinical findings established by the American College of Rheumatologists:
  o Greater than 3 month’s duration of widespread pain bilaterally above and below the diaphragm
  o 11 out of 18 tender, painful points in characteristic locations
- No special diagnostic studies but fibromyalgia can co-exist with other diseases.
• CBC, ESR, Thyroid panel, ANA, RF, and Creatinine Kinase should be obtained to rule out Rheumatoid diseases, anemia, malignancy, etc.

**Evidence Based Clinical Support**

**SP-11 ~ CERVICAL RADICULOPATHY**

• Cervical radiculopathy is much less common than lumbar. 90% of cases involve C6 or C7 roots. Pain radiates from the neck to the forearm or hand (thumb/index finger for C6 and middle finger/index finger for C7). Lost or depressed reflexes (triceps for C7 and biceps/brachioradialis for C6) and dermatomal subjective sensory complaints can be seen. Pain radiates somewhat diffusely into the arm and forearm and often includes inter-scapular pain.
• C5 radiculopathy (10% of cases) is hard to tell from a shoulder problem, which often results in requests from neuro specialists and orthopedists for both cervical spine and shoulder imaging. The likelier diagnosis should generally be pursued first.

**Evidence Based Clinical Support**

**SP-13 ~ MECHANICAL NECK PAIN**

• Metastatic cancer and infection involve the cervical spine much less commonly than they do the lumbar or thoracic spine (about 90% of metasteses to spine are thoracic, lumbar, or sacral).
• Neck pain generally originates from soft tissues.
• Degenerative changes of the cervical spine are all but universal with age, but their relation to actual symptoms is unclear.

**Evidence Based Clinical Support**

**SP-15~ SYRINGOMYELIA**

• Syringomyelia is an illness usually involving the cervical spinal cord which generally evolves over decades. It can present subacutely, although this is not common. Many cases are associated with Chiari I malformations. The thoracic cord and even the brain stem can be involved. Syrinxes may be associated with tumor, trauma, or infection.
SPINE GUIDELINE REFERENCES

SP- 2 ~Imaging Techniques


SP-3 ~Painful Lumbosacral Radiculopathy


SP-4 ~Lumbar Spinal Stenosis


SP- 6 ~Sacro-iliac (SI) Joint Pain


SP-7 ~Vertebral Compression Fractures


SP- 8 ~Spinal Pain in Cancer Patients


SP- 9 ~Mechanical Back Pain/Back Pain without Neurological Features


**SP- 10 ~ Suspected Thoracic Spine Pathology**


**SP- 11 ~ Cervical Radiculopathy**


**SP- 14 ~ Failed Back Syndrome**


**SP- 15 ~ Syringomyelia**


**SP- 17 ~ Discography**


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### Abbreviations for Peripheral Nerve Disorders Imaging Guidelines

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PERIPHERAL NERVE DISORDERS IMAGING GUIDELINES

PN-1~ GENERAL GUIDELINES

- The peripheral nerves can be damaged by a multitude of causes, including trauma, infection, tumors, and metabolic disorders such as diabetes.
- The initial work-up of a suspected peripheral nerve disorder should include a detailed neurological history and examination followed by electromyography and nerve conduction (EMG/NCV) studies.
- Advanced imaging plays a limited role in the diagnosis and management of disorders of peripheral nerves and muscles. The extent of that role is currently being defined.
  - **NOTE:** many disorders of these structures are associated with systemic diseases in which there are well-established indications for advanced imaging.
- When imaging of peripheral nervous tissue or muscles is indicated, MRI is used. In general, CT is not an acceptable alternative (occasional exceptions will be mentioned below).
- MRI is sometimes useful as a preoperative procedure since surgical decisions often depend on the presence or absence of **anatomic** integrity of the nerves (EMG tests functional integrity).
- Reference:

PN- 2~ FOCAL NEUROPATHY

- **PN- 2.1 Carpal tunnel syndrome:**
  - Also see MS-21 Wrist in the Musculoskeletal guidelines and SP-11.5 Carpal Tunnel Syndrome under Cervical Radiculopathy in the Spine guidelines.
  - Common clinical syndrome causing intermittent hand numbness usually worse at night and with some aching.
  - Diagnosis is by clinical evaluation and electro-diagnostic studies (EMG/NCV).
  - Noncontrast wrist MRI (CPT 73221) reveals median nerve compression fairly well, but is less sensitive than nerve conduction measurements.
  - At this time, advanced imaging has no established role in the evaluation of carpal tunnel syndrome.
  - References:
    - Neurology 2002;58:1583-1584
    - Neurology 2002;58:1597-1602

- **PN- 2.2 Ulnar neuropathy:**
  - The diagnosis of ulnar neuropathy should be made based upon symptoms, clinical examination, and NCV/EMG results.
  - Advanced imaging is not generally indicated.
• PN- 2.3 Radial neuropathy:
  o An infrequent upper extremity neuropathy causing wrist drop. Common sites of entrapment include the inferior aspect of the humerus (Saturday night palsy) or the forearm (Posterior Interosseus Syndrome).
  o Trauma or fractures of the humerus, radius, or ulna can damage the radial nerve.
  o NCV/EMG should be performed initially.
  o Noncontrast MRI of the upper arm or forearm (CPT 73218) is indicated only in severe cases where surgery is considered.
  o Reference:
    ➢ Radiographics 2006;26:1267-1287

• PN- 2.4 Sciatic neuropathy
  o Although the term sciatica is common, at least 98% of cases are due to lumbar radiculopathy.
  o Rarely, trauma to the gluteal area with hematoma, injection palsy, hip or pelvic fractures, or hip replacement (arthroplasty) can damage the proximal sciatic nerve.
  o A controversial disorder called Piriformis Syndrome involves entrapment of the sciatic nerve at the sciatic notch in the pelvis by a tight piriformis muscle band.
  o EMG/NCV should be performed initially to localize the problem.
  o Evaluation by a Neurology, Orthopedic, or Pain Management specialist is helpful in determining the need for advanced imaging.
    ➢ Rarely, CT pelvis without contrast (CPT 72192) or MRI pelvis without contrast (CPT 72195) may be performed in severe cases to evaluate sciatic neuropathy.
  o Reference:
    ➢ Neurologic Clinics 1999 August;17(3):617-631

• PN- 2.5 Femoral neuropathy:
  o Can arise as a complication of pelvic surgery in women or, in patients on anticoagulants, as a complication of retroperitoneal bleeding.
  o Pelvic CT can be performed either with (CPT 72193) or without (CPT 72192) contrast for evaluation in either setting.

• PN- 2.6 Meralgia paresthetica:
  o A common sensory neuropathy involving the lateral femoral cutaneous nerve as it exits the pelvis under the inguinal ligament.
  o Patients have objective sensory loss in the region supplied by the nerve (lateral thigh and buttocks).
  o Spinal imaging is not indicated.
  o In cases recalcitrant to medical management, studies to exclude a pelvic mass may be appropriate (see Pelvis Guidelines).
  o In women, pelvic ultrasound is recommended initially.
  o In men (and in women with nondiagnostic ultrasound), either pelvic CT with contrast (CPT 72193) or pelvic MRI without contrast (CPT 72195) is acceptable.
  o Abdominal imaging may be useful if the clinical picture suggests involvement in the upper lumbar plexus.
  o If imaging is being done as a preoperative study to evaluate for decompression of the nerve, MRI is preferred.
• PN-2.7 Peroneal neuropathy:
  o A common neuropathy in the lower leg causing foot drop.
  o The most common site of entrapment is on the lateral aspect of the knee as the nerve wraps around the neck of the fibula.
  o Peroneal neuropathy usually resolves over time with no specific treatment.
  o Neurology, Orthopedic, or Pain Management consultation is helpful in distinguishing this disorder from an L5 radiculopathy causing foot drop.
  o EMG/NCV should be performed initially.
  o Rarely, noncontrast knee MRI (CPT 73721) or noncontrast MRI lower extremity other than joint (CPT 73718) may be performed in severe cases when surgery is considered.
  o Reference: Neurology 2005;65:1829-1831

• PN-2.8 Tarsal tunnel syndrome:
  o Also see MS-28.8 Tarsal Tunnel Syndrome in the Musculoskeletal guidelines.

• PN-2.9 Other peripheral mononeuropathies: Advanced imaging is generally not useful in other peripheral mononeuropathies and should be regarded as largely investigational in those settings.
  o However, following major trauma, MRI (not CT) may have some role as a preoperative study to evaluate an injured peripheral nerve for anatomical integrity.
  o Only nerves greater than 2 mm in diameter can be visualized.
  o Note: For indications other than preoperative imaging of traumatized nerves, imaging without and with contrast is preferred, if imaging is indicated.
  o Advanced imaging is generally not useful in other peripheral mononeuropathies and should be regarded as largely investigational in those settings.
    ➢ These cases should be sent for Medical Director review.

PN-3 ~ POLYNEUROPATHY

• MRI (not CT) has very uncommon but distinct usefulness in a variety of peripheral neuropathies. Neurological consultation is helpful to clarify the diagnostic pathway in these unusual settings.

• PNS/CNS Crossover syndromes:
  o Occasional cases of Guillain-Barré syndrome and CIDP (Chronic Inflammatory Demyelinating Polyneuropathy) manifest signs of central nervous system involvement.
  o Advanced neuroimaging (MRI without and with contrast) of brain or spinal cord may be appropriate if the clinical findings point to abnormalities in those areas.

• AIDS related cytomegaloviral neuropathy/radiculopathy:
  o This is a rapidly progressive but treatable disorder which may present with urinary retention and a clinically confusing picture in the legs.
  o Lumbar spine MRI without and with contrast (CPT 72158) may be useful in suspected cases to identify swelling and enhancement of lumbar roots.

• Chronic Inflammatory Demyelinating Polyneuropathy (CIDP)
  o Treatable neuropathy usually diagnosed by clinical features, EMG, and nerve biopsy.
• Multifocal motor neuropathy:
  o Treatable neuropathy which can generally be diagnosed based upon the clinical examination and EMG.
  o If the diagnosis remains uncertain after full evaluation, MRI of the brachial plexus (CPT 71552) may be useful. This is an uncommon situation in a very uncommon disorder.
  o Reference: *Muscle & Nerve* 2001;24:311-324

• POEMS (Polyneuropathy, Organomegaly, Endocrinopathy, M-protein, Skin changes):
  o Also see ONC-24 Multiple Myeloma and Plasmacytomas in the Oncology guidelines.
  o Advanced imaging is appropriate for the non-neurological entities of this rare osteosclerotic plasmacytoma syndrome.

• Subacute sensory neuronopathy and other paraneoplastic demyelinating neuropathies:
  o Also see ONC-28.3 Paraneoplastic Syndromes in the Oncology guidelines.
  o Subacute sensory neuronopathy is a paraneoplastic syndrome associated most strongly with small cell lung cancer, but at times seen with lymphomas, adenocarcinoma of the lung, or tumors of breast or ovary.
  o Advanced imaging should be performed as indicated for the associated malignancy or to search for malignancy (see Oncology guidelines).
  o Most of the syndromes have antibodies associated with different groups of tumor type, and evaluation should be guided by such titers when positive.

  References:
  - PET in occult tumor evaluation:
    - Scattered case reports and small studies suggest that PET may be of value in detecting occult neoplasms in patients with paraneoplastic syndromes in whom other diagnostic studies have failed to diagnose a tumor.
    - Currently, there is insufficient data to support the use of PET to find an occult malignancy in patients with paraneoplastic syndromes.
  - Several collagen vascular diseases may present with a progressive polyneuropathy.
    - Systemic lupus, Sjogren’s syndrome, Beçet’s disease, polyarteritis nodosa, Churg-Strauss syndrome, and Wegener’s granulomatosis can all present in this manner. (See HD-33 Cerebral Vasculitis in the Head guidelines).
  o Imaging studies will be those relevant to the diagnosis and treatment of the underlying disorder or to any central nervous features which may also be identified clinically.

**PN- 4~ BRACHIAL PLEXUS**

• Disorders of the brachial plexus can generally be identified and distinguished from lesions in other locations by clinical and EMG examination. If the diagnosis remains unclear, advanced imaging can be useful.

• Advanced imaging can be helpful as a preoperative study to evaluate the anatomy of brachial plexus lesions which should have already been defined by clinical examination.
• MRI is the preferred modality. CT is not often useful and should generally not be used as a substitute for MRI to image the brachial plexus.
  o Brachial plexus studies can be coded either as upper extremity other than joint MRI (CPT 73218) or as chest MRI (CPT 71550).
    ➢ Occasionally, for upper trunk lesions, neck MRI (70540) may be requested.
    ➢ Chest MRI will image both brachial plexi and is useful for comparing one plexus with the other.
    ➢ Rarely, more than one CPT code may be necessary to adequately image the brachial plexus area of interest.
  o MRI studies should be without and with contrast (CPT 73220 or 71552) when tumor is part of the differential diagnosis.
  o Reference:
    ➢ Radiographics 2000;20:1023-1032
    ➢ ACR Appropriateness Criteria, Plexopathy Variant: Brachial, 2006
    ➢ Eur Radiol 2001;11:325-336
• The principal brachial plexus disorders include: malignant infiltration, radiation plexitis, Parsonage-Turner syndrome (so-called brachial plexitis), trauma, birth trauma, and the “neurogenic thoracic outlet syndrome.”

• Malignant infiltration:
  o Most often involves the lower plexus and may include Horner’s syndrome.
  o Most cases arise in patients with lung or breast cancer.
  o Pain is an early and very prominent symptom. Sensory loss and weakness follow.
  o EMG will aid in localization, but will not reveal etiology.
  o MRI without and with contrast (CPT 73220 or 71552) is appropriate to aid in the differential diagnosis and localization of the tumor mass, although in cases with perineural spread, MRI may fail to show a mass.
  o Reference: Neurology 1981;31:45-50
• Radiation plexitis:
  o Occurs several months to 1-2 years following radiation therapy.
  o The upper plexus is usually most involved and pain is infrequent.
  o EMG may show changes specific to radiation plexitis.
  o MRI without and with contrast (CPT 73220 or 71552) is often done for reassurance that there is no malignant infiltration, especially in the infrequent painful cases.
  o An acute form of transient plexitis resembling the Parsonage-Turner syndrome (see Brachial Plexitis bullet below) can occur during radiation treatment. It clears with time even if radiation treatment is continued.
  o MRI without and with contrast (CPT 73220 or 71552) can be performed.
  o References:
    ➢ Neurology 1989;39:502-506
    ➢ Radiology 2000;214:837-842
• “Brachial plexitis” (Parsonage-Turner syndrome or painful brachial amyotrophy).
  o A benign and largely self-limited syndrome characterized by initial shoulder region pain followed by weakness of specific muscles in a pattern which does not conform to involvement of a single root or distal peripheral nerve.
  o Careful clinical examination should distinguish brachial plexitis from radiculopathy (see SP-11 Cervical Radiculopathy in the Spine guidelines) and its temporal profile does not resemble that of radiation plexitis or malignant infiltration.
  o The value of imaging is very limited in these cases.
    ➢ MRI of the plexus is generally normal and MRI should be performed only in clinically confusing cases.
MRI of the cervical spine is often requested in these cases. However, unless the clinical picture truly resembles radiculopathy, the results often lead to misdiagnosis, since asymptomatic findings are commonly seen on the cervical spine MRI scans of normal individuals.

MRI of overtly weak muscles may show increased T2 signal, but this adds no important information.


- **Trauma:** the cause and extent are generally obvious, but noncontrast MRI of the brachial plexus (CPT 73218 or 71550) is often useful, especially when surgical repair is being considered.

- **Thoracic outlet syndrome (TOS):**
  - Also see *CH-32 Thoracic Outlet Syndrome* in the Chest guidelines
  - This is a contentious diagnosis, and the much more common carpal tunnel syndrome should be excluded prior to considering a diagnosis of thoracic outlet syndrome. (See *PN-2.1 Carpal Tunnel Syndrome, MS-21 Wrist* in the Musculoskeletal guidelines, and *SP-11 Carpal Tunnel Syndrome* under Cervical Radiculopathy in the Spine guidelines).
  - Diagnosis of neurogenic TOS is most reliably made by the electro-diagnostic studies (EMG/NCV) which will be done to exclude carpal tunnel syndrome.
  - Brachial plexus imaging is appropriate only in patients in whom the diagnosis has been confirmed by EMG and who have failed a 2 to 3 month trial of conservative management and are being considered for surgical treatment.
  - **Note:** “Adson’s sign” (transient radial pulse extinction by abduction and external rotation of the arm) is common in normal individuals and is not itself an indication for advanced imaging.

**PN- 5~ LUMBAR AND LUMBOSACRAL PLEXUS**

- **Anatomy:**
  - The upper lumbar plexus is located in the abdominal retroperitoneal space and gives rise to, among others, the femoral, lateral femoral cutaneous, and obturator nerves.
  - The lumbosacral plexus lies in the pelvis and gives rise to the sciatic and gluteal nerves.
- **Radiation plexopathy, malignant infiltration, and trauma can involve these structures.**
- **Malignant infiltration:**
  - As with brachial plexus infiltration, pain is early and severe, and the sensorimotor findings follow the onset of pain.
  - Colon cancer, gynecological cancers, and genitourinary cancers are the most common primaries.
  - MRI of the abdomen (CPT 74183) or pelvis (CPT 72197) without and with contrast with fat suppression imaging is appropriate, and the imaging study chosen (abdomen vs pelvis) will depend on which plexus is involved.
  - Tumors usually appear as soft tissue masses compressing the plexus.
  - CT scan with contrast (CPT 74160 or 72193) is inferior to MRI but can be performed if MRI is unavailable or contraindicated.
- **Radiation plexopathy:**
  - Less common in the lumbar and lumbosacral plexi than in the brachial plexus.
  - Imaging is similar to that performed for radiation plexitis of the brachial plexus (see PN-4 Brachial plexus).
• **Trauma:**
  - These cases will involve either major abdominal trauma or local surgical procedures and initial management will be in an inpatient setting.
  - If later surgical repair of a plexus injury is contemplated, noncontrast MRI of the relevant region with fat suppression may be appropriate. These cases should be sent for Medical Director review.

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**PN- 6~ MUSCLE DISORDERS**

- There are no established indications for advanced imaging in the muscular dystrophies. However, in neuromuscular disorders, the inflammatory myopathies, and Gaucher’s Disease, noncontrast MRI has its roles. CT is not useful for visualizing muscle disease.

- **PN- 6.1 Neuromuscular Disease:** both myasthenia gravis (MG) and the less common Lambert-Eaton myasthenic syndrome (LEMS) are associated with chest neoplasms (thymoma and small cell lung cancer, respectively).
  - **Myasthenia Gravis (MG):**
    - Initial diagnosis of MG is by clinical presentation, electro-diagnostic studies, and antibody titers.
    - 15% of patients (mostly elderly) harbor a thymoma, but most others have thymic hypertrophy.
    - Thymectomy is widely used as a treatment of MG with or without thymoma.
    - Chest CT with contrast (CPT 71260) is part of the initial evaluation of confirmed myasthenia gravis.
    - In patients with initial chest CT scans that are negative and who have not undergone thymectomy, repeat chest CT is not appropriate without a specific indication (e.g. symptoms of chest mass, rising anti-striated muscle antibody titers, or need for preoperative evaluation).
  - **Lambert –Eaton myasthenic syndrome (LEMS):**
    - Oat cell lung tumors (small cell lung cancer) are found in about half of cases. The cancer often cannot be found initially but will surface a month to 1-2 years after diagnosis of the neuromuscular syndrome.
    - Initial diagnosis of LEMS is by clinical presentation, electro-diagnostic studies, and antibody titers (anti-voltage gated calcium channel).
    - Chest x-ray and chest CT with contrast (CPT 71260) are appropriate in confirmed cases.
    - If the initial tumor evaluation is negative, chest imaging can be repeated in 3 months or when symptoms of a chest mass are present.
    - Although no published consensus has been established regarding further follow-up imaging, if the second chest CT is negative, repeat chest imaging at 6, 12, and 24 months seems appropriate.
    - See PN-3 Polyneuropathy for use of PET in paraneoplastic syndromes.
    - Reference: *N Engl J Med* 2003;349:1543-1554 (Includes useful lists of the various syndromes and the antibodies associated with them)
  - **Stiff man syndrome:**
    - A rare presynaptic disorder which can be associated with small cell lung cancer and breast cancer in those with anti-amphiphysin antibodies.
    - Chest CT with contrast (CPT 71260) and, in women, mammography, are appropriate.
• **PN-6.2 Inflammatory muscle diseases:**
  
  - Includes dermatomyositis, polymyositis, and sporadic inclusion body myositis.
  - Advanced imaging is used in these disorders for three purposes:
    
    1. Selection of biopsy site
    2. Treatment monitoring
    3. Detection of occult malignancy (for patients with dermatomyositis and polymyositis)

  - **Initial evaluation:**
    
    - Involvement of muscles is patchy, and noncontrast MRI can be useful to select biopsy sites.
    - Noncontrast MRI of one or both thighs is usual (CPT 73718).
    - Studies have shown both the diagnostic value and cost effectiveness of this approach.

    - References:
      - *AJR* 1995;165:1469-1471

  - **Sporadic inclusion body myositis** is seen in older adults. Involvement of the deep finger flexors is early and striking, and noncontrast MRI of the forearm (CPT 73218) can be useful to establish the diagnosis early in the course. *Neurology* 1997;48:863-866

  - **Management of Inflammatory Muscle Diseases:**
    
    - Clinical evaluation of muscle strength and endurance along with assay of muscle enzyme levels (especially CPK) is the principal method of monitoring the results of therapy in all three disorders.
    - Noncontrast MRI, including fat suppression techniques, can be useful, especially when enzyme and clinical function assessments differ.
    - When available, P-31 MRS has also shown value.
    - No data has emerged to support surveillance imaging in these patients.

    - References:
      - *Rheumatology* 2000;39:7-17

  - **Search for occult neoplasm in adults with dermatomyositis and in all patients with polymyositis:**
    
    - Lung and ovarian tumors are the most common, but lymphomas and other carcinomas can also be found.
    - Chest CT with contrast (CPT 71260) and pelvic ultrasound (in women) should be done initially.
    - CT abdomen and pelvis with contrast (CPT 74160 and 72193) are indicated if the above fail to make a diagnosis.
    - Tumors may remain occult for months to several years after the onset of the myositis.

    - Reference: *Lancet* 2001;357:96-100

• **PN-6.3 Gaucher Disease (storage disorders):**
  
  - See also [AB-16 Gaucher's Disease](#) in the Abdominal guidelines.
  - Gaucher's disease is group of autosomal recessive inborn errors of metabolism characterized by lack of the enzyme acid β-glucuronidase with destructive ceramide storage in various tissues.
  - Gaucher's disease is a treatable disorder (enzyme replacement) in which the liver, spleen, and bone marrow/bones are the most affected organs.
This guideline addresses Type I Gaucher’s disease, which is by far the most common type in North America.

MRI is used to follow progression of disease in order to make treatment decisions, to monitor response to treatment, and to evaluate complications as they occur.

Liver and spleen size are followed by annual noncontrast abdominal MRI (CPT 74181).

Annual noncontrast thigh MRI (CPT 73718) is used to follow marrow replacement by the disease and to monitor response to treatment. MRI of a single thigh should be sufficient.

These patients often develop avascular necrosis of the hips and compression fractures of the spine, and relevant noncontrast MRI scans are appropriate when the clinical setting suggests these complications.

In addition, many experts routinely perform MRI of the hips in untreated patients.

References:
- *BJR* 2002;75 suppl 1:A13-A24
- *Haematologica* 2000;85:792-799
- McGovern M. *Gaucher Disease.* Updated October 15, 2003

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**PN- 7 ~ NEWER IMAGING TECHNIQUES**

- **PN-7.1 Magnetic resonance neurography (MRN):**
  - MRI using a phased array of coils can be used to produce striking T2 weighted images of Wallerian degeneration in larger peripheral nerves (>2 mm diameter) involved in a variety of pathological processes.
  - At this time there is no compelling evidence indicating that the results of such studies add significant information to the knowledge that can be obtained by traditional clinical and electro-diagnostic studies.
  - MRN must be regarded as experimental at this time.
  - Current studies of the value of MRN are plagued by small sample size, limited clinical definition of the cases, and lack of longer term follow-up.

References:
- *Neurology* 2002;58:1597-1602
- *Cigna Healthcare coverage position 0316, Magnetic resonance neurography.* March 15, 2007
PN-1~ General Guidelines

PN-2~ Focal Neuropathy
- Fleckenstein JL, Wolfe GI. MRI vs EMG Which has the upper hand in carpal tunnel syndrome? *Neurology* 2002;58:1583-1584.

PN-~ Polyneuropathy

PN-4~ Brachial Plexus

PN- 5~ Lumbar and Lumbosacral Plexus
PN- 6~ Muscle Disorders


PN- 7~ Newer Imaging Techniques

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<td>AP</td>
<td>anteroposterior</td>
</tr>
<tr>
<td>BCC</td>
<td>basal cell carcinoma</td>
</tr>
<tr>
<td>beta-HCG</td>
<td>beta human chorionic gonadotropin</td>
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<tr>
<td>CA 19-9</td>
<td>cancer antigen 19-9</td>
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<tr>
<td>CA 125</td>
<td>cancer antigen 125 test</td>
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<tr>
<td>CBC</td>
<td>complete blood count</td>
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<tr>
<td>CEA</td>
<td>carcinoembryonic antigen</td>
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<tr>
<td>CNS</td>
<td>central nervous system</td>
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<tr>
<td>CT</td>
<td>computed tomography</td>
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<tr>
<td>CTA</td>
<td>computed tomography angiography</td>
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<tr>
<td>CR</td>
<td>complete response</td>
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<tr>
<td>DCIS</td>
<td>ductal carcinoma in situ</td>
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<tr>
<td>DLBCL</td>
<td>Diffuse Large B Cell Lymphomas</td>
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<tr>
<td>DRE</td>
<td>digital rectal exam</td>
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<tr>
<td>EGD</td>
<td>esophagastroduodenoscopy</td>
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<tr>
<td>ENT</td>
<td>Ear, Nose, Throat</td>
</tr>
<tr>
<td>ERCP</td>
<td>endoscopic retrograde cholangiopancreatography</td>
</tr>
<tr>
<td>ESR</td>
<td>erythrocyte sedimentation rate</td>
</tr>
<tr>
<td>EUA</td>
<td>exam under anesthesia</td>
</tr>
<tr>
<td>EUS</td>
<td>endoscopic ultrasound</td>
</tr>
<tr>
<td>FDG</td>
<td>fluorodeoxyglucose</td>
</tr>
<tr>
<td>FNA</td>
<td>fine needle aspiration</td>
</tr>
<tr>
<td>FUO</td>
<td>fever of unknown origin</td>
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<tr>
<td>GE</td>
<td>gastroesophageal</td>
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</table>

ABBREVIATIONS CONTINUED ON NEXT PAGE . . .
### ABBREVIATIONS for ONCOLOGY GUIDELINES

Continued from previous page . . .

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>GI</td>
<td>gastrointestinal</td>
</tr>
<tr>
<td>GU</td>
<td>genitourinary</td>
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<tr>
<td>HIV</td>
<td>human immunodeficiency disease</td>
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<tr>
<td>HRPC</td>
<td>Hormone Refractory Prostate Cancer</td>
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<tr>
<td>LCIS</td>
<td>lobular carcinoma in situ</td>
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<tr>
<td>LDH</td>
<td>lactate dehydrogenase</td>
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<tr>
<td>LFT</td>
<td>liver function tests</td>
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<tr>
<td>MALT</td>
<td>Mucosa Associated Lymphoid Tissue</td>
</tr>
<tr>
<td>MEN</td>
<td>Multiple Endocrine Neoplasia</td>
</tr>
<tr>
<td>MG</td>
<td>myasthenia gravis</td>
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<tr>
<td>MGUS</td>
<td>Monoclonal Gammopathy of Unknown Significance</td>
</tr>
<tr>
<td>MIBG</td>
<td>I-123 metaiodobenzylguanidine scintigraphy</td>
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<tr>
<td>MRA</td>
<td>magnetic resonance angiography</td>
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<tr>
<td>MRI</td>
<td>magnetic resonance imaging</td>
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<tr>
<td>MUGA</td>
<td>multiple gated acquisition scan</td>
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<tr>
<td>NCCN</td>
<td>National Comprehensive Cancer Network</td>
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<tr>
<td>NHL</td>
<td>Non-Hodgkin’s Lymphoma</td>
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<tr>
<td>NPC</td>
<td>nasopharyngeal carcinoma</td>
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<tr>
<td>NSABP</td>
<td>National Surgical Adjuvant Breast and Bowel Project</td>
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<tr>
<td>NSAIDS</td>
<td>nonsteroidal anti-inflammatory drugs</td>
</tr>
<tr>
<td>NSCLC</td>
<td>Non-Small Cell Lung Cancer</td>
</tr>
<tr>
<td>NSGCT</td>
<td>Non-Seminomatous Germ Cell Tumor</td>
</tr>
<tr>
<td>PA</td>
<td>posteroanterior</td>
</tr>
<tr>
<td>PCI</td>
<td>prophylactic cranial irradiation</td>
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<tr>
<td>PET</td>
<td>positron emission tomography</td>
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<tr>
<td>POG</td>
<td>Pediatric Oncology Group</td>
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<tr>
<td>PSA</td>
<td>prostate specific antigen</td>
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<tr>
<td>RFA</td>
<td>radiofrequency ablation</td>
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<tr>
<td>RPLND</td>
<td>retroperitoneal lymph node dissection</td>
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<tr>
<td>SCC</td>
<td>squamous cell carcinoma</td>
</tr>
<tr>
<td>SIADH</td>
<td>syndrome of inappropriate secretion of antidiuretic hormone</td>
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<tr>
<td>TCC</td>
<td>transitional cell carcinoma</td>
</tr>
<tr>
<td>TNM</td>
<td>Tumor Node Metastasis staging system</td>
</tr>
<tr>
<td>TSH</td>
<td>thyroid-stimulating hormone</td>
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<tr>
<td>TURBT</td>
<td>trans-urethral resection of bladder tumor</td>
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<tr>
<td>VIPoma</td>
<td>vasoactive intestinal polypeptide</td>
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<tr>
<td>WM</td>
<td>Waldenstrom’s macroglobulinemia</td>
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</table>
ONCOLOGY IMAGING GUIDELINES

ONC-1~ GENERAL GUIDELINES

- A recent careful history and physical examination, and appropriate laboratory studies should be performed prior to considering advanced imaging.
- In many clinical situations, an invasive tissue biopsy is the diagnostic procedure of last resort, only considered after all radiographic and lab testing options and specialist consultations have been exhausted.
  - Not so in oncology; once neoplastic disease is suspected, biopsy should proceed as soon as feasible.
  - To delay tissue confirmation of disease while awaiting scheduling of advanced imaging or specialty consultation is inappropriate.
- These oncology guidelines are based on the National Comprehensive Cancer Network (NCCN) Practice Guidelines in Oncology (http://www.nccn.org) and also reflect consensus opinion concerning the diagnostic procedures to be employed in the majority of cancers for most patients.
  - Clinical judgment remains paramount, however, and variance from these guidelines may be appropriate and warranted for unusual situations.
- The Oncology guidelines should be applied in conjunction with the corresponding PET guidelines (PET-4 through PET-17).
- All indications for PET also apply to PET/CT fusion scans.
- In the Guidelines that follow, the following terms are used:
  - SUSPECTED – Diagnostic procedures to consider prior to tissue confirmation, when the clinical picture is typical for a particular cancer.
  - INITIAL WORKUP, DIAGNOSIS – (Also known as “Staging”) Diagnostic procedures to be followed concurrently with and immediately after biopsy confirmation of disease; usually, but not always, prior to consideration of definitive surgery or other oncologic therapies.
  - RE-STAGING/RECURRENCE – Procedures to be used when tumor progression is suspected.
    - An exception to this is when high dose chemotherapy, with or without radiation, has a high probability of “down-staging” a cancer, such as in lymphoma.
      - Re-staging studies following such therapies are appropriate.
    - Re-staging a patient following adjuvant chemotherapy whose primary modality of definitive local therapy was surgery, is inappropriate.*
    - Re-staging a patient with obvious multi-system metastatic disease following palliative therapy may not be necessary when a response to therapy can be clearly assessed by change of symptoms, rather than radiographic response.
  - SURVEILLANCE – Procedures to be used in the follow-up of patients following standard therapies, when the patient is assumed to have either no known disease, or stable or clinically insignificant disease.
- A patient who refuses standard oncologic therapies in lieu of alternative therapies should not be frequently imaged, but rather, should only have limited re-staging studies one time upon consenting to standard therapy.
ONC- 2~ SQUAMOUS CELL CARCINOMAS OF THE HEAD & NECK

- Also see PET- 4 Cancers of the Head and Neck in the PET guidelines.
- These guidelines apply to invasive squamous cell carcinomas (except skin cancer), including:
  - Nasopharyngeal carcinomas, (NPC) which sometimes are referred to as Lymphoepitheliomas
- Carcinoma-in-situ does not require advanced imaging.
- Most, but not all, of these cancers are related to heavy tobacco and alcohol abuse.
- Early stage disease can be treated equally well by surgery only or radiotherapy only.
- Stages III and IV (non-metastatic) cancers and all NPCs are usually initially treated with combined chemoradiotherapy, possibly with planned radical neck dissection.
  - Surgery is reserved for salvage in the event of local failure.
- Less than 10% of patients have metastatic spread to lung.
  - Given the tobacco abuse history of most patients, differentiating a metastatic lung lesion from a primary lung cancer is very difficult, and these patients should be evaluated by a multidisciplinary team.

SUSPECTED
- Any heavy smoker who presents with hoarseness, dysphagia, unexplained ear pain, voice changes, or lymphadenopathy needs to have cancer ruled out.
  - Any smoker with the above should be assessed with chest x-ray.
- Patients who present with lymphadenopathy should be evaluated by a clinician skilled in thorough head and neck examination, including laryngoscopy and endoscopy, to assess for a possible primary site of malignancy. Approximately 5% of such cancers will not have a discoverable primary site.
- CT neck with contrast (CPT 70491) is appropriate only after a thorough Head and Neck examination, including laryngoscopy and endoscopy.*

*Head and Neck Cancers. NCCN Practice Guidelines in Oncology v.1.2006

- PET is not indicated until histologic diagnosis is confirmed, except for evaluation of pulmonary nodules. See PET-8 Lung Cancer and Pulmonary Nodules in the PET guidelines, CH-10 Multiple Pulmonary Nodules, and, CH-14 Solitary Pulmonary Nodule in the Chest guidelines).
- NPCs usually present with lymphadenopathy and occasionally, with cranial nerve palsies.

INITIAL WORKUP, DIAGNOSIS
- All patients with these tumors should be evaluated by pan-endoscopy of their upper aero-digestive system under general anesthesia.
- Upon histologic confirmation, dental evaluation is immediately indicated unless the patient is edentulous.
- Staging is primarily by physical examination in these tumors. Imaging of the neck for possible nodal metastasis may be omitted at the clinician’s discretion in the presence of a clinically negative neck.
  - Imaging of the neck for possible nodal metastasis may be omitted at the clinician’s discretion in the presence of a clinically negative neck.
  - “T” stage by physical exam must be stated in all imaging requests prior to approval.
• Chest x-ray and neck CT with contrast (CPT 70491) or MRI neck (contrast as requested) are all that are routinely necessary to complete staging.
  o Neck MRI (contrast as requested) may also be required to further evaluate unusual findings noted on CT.
  o Chest CT with contrast (CPT 71260) is not required, but can be performed if requested.
• Abdominal CT is only indicated when LFT’s are elevated, when signs and symptoms of metastatic disease are present, or in the setting of obviously abnormal intrathoracic findings.
  o Liver lesions incidentally found during imaging do not require follow-up advanced imaging unless LFT’s are elevated.
• Pelvic CT is not indicated for the initial work-up of any head and neck malignancy.
• Imaging of the CNS (head, spine) is only indicated to evaluate specific signs or symptoms suggesting such spread.
• PET is indicated per the criteria listed in PET-4 Cancers of the Head and Neck in the PET guidelines.
• Nasal cavity and paranasal sinuses may, in some cases, need both CT of maxillofacial area (CPT 70486) and facial MRI (CPT 70543) to assess extent of bony erosion, as well as skull base and intracranial involvement.
• For NPC’s initial staging is as above with the addition of the following:
  o Chest CT with contrast (CPT 71260)
  o Head MRI without and with contrast (CPT 70553) is indicated for neurological findings or if there is suspicion of base of skull invasion based on the above studies.
  o CT abdomen with contrast (CPT 74160) for lymph node positive NPC’s may be done, but this is optional.

RE-STAGING/RECURRENCE
• Following radiation, patient should be followed clinically for 90 days, unless progression is suspected, as some tumors are slow to regress completely.
• PET is contraindicated for 120 days following combined chemoradiotherapy, unless a new lesion outside of the radiation portal is suspected.
  o PET is contraindicated for re-staging when surgery only was the primary treatment modality.
  o PET is optional after 120 days following completion of radiotherapy, and is particularly helpful in differentiating residual tumor from scarring, which can be extensive.
• Chest x-ray and LFTs are adequate for re-staging. However, chest CT with contrast (CPT 71260) can be performed if clinically indicated.
• If recurrence is suspected, PET may be appropriate for apparent recurrent lymphadenopathy, or for glottic tumors which cannot be adequately visualized by a clinician capable of performing adequate examination with indirect laryngoscopy.
  o PET scan requests in this context must be accompanied by documentation of such an examination.
  o Otherwise, recurrence must be confirmed by biopsy prior to consideration of advanced imaging.
SURVEILLANCE/FOLLOW UP

- Primarily clinical with repeated complete physical examination of all head and neck structures.
- Neck CT with contrast (CPT 70491), as well as any imaging found to be abnormal during initial work-up, can be performed every 4 months for the first year, then every year after that for the next four years. Specific abnormalities may require more frequent follow up.
- PET is not appropriate for surveillance
  - PET scan may be repeated one time in patients with previous positive or equivocal findings to rule out persistent disease.
- Annual chest x-ray for life.
- Chest CT (CPT 71260) is not routinely indicated for follow up, unless a suspicious abnormality arises on chest x-ray, or when suspicion of recurrence is detected elsewhere.

ONC-3~ SALIVARY GLAND CANCERS

- Over a dozen histologic types of salivary gland tumors are described; most common are adenoid cystic carcinomas, acinic cell carcinomas and mucoepidermoid carcinomas.
- Parotid tumors:
  - 83% are benign—the most common benign tumor is pleomorphic adenoma, followed by Warthin’s tumor.
  - 17% are malignant—the most common malignant lesion is adenocystic cancer.
  - A bilateral parotid mass is more likely to be a Warthin’s tumor.
  - Pleomorphic adenoma is a benign tumor but should be treated like a malignant tumor if, and when, it recurs.
  - Parotid glands may also give rise to lymphomas;
    - Differentiating lymphomas from other histologies may be difficult on FNA.
  - In parotid tumors requiring surgery, MRI is better than CT in assessing the position of the facial nerve in relationship to the parotid tumor.
    - MRI gives a good assessment of the tumor mass and its anatomical relationships in order to plan what operation will be required.
- Local recurrence and/or metastatic spread to lungs can occur.
- Lymph node spread is uncommon, therefore, repeated imaging of the neck and elective therapy of neck (e.g. dissection, radiotherapy) are not indicated.
- **Primary Squamous Cell Carcinoma of the Parotid Gland** has been described but is rare
  - If this histology is found in the parotid gland, metastatic spread from another site should be aggressively ruled out.

SUSPECTED:

- Mass on palpation.
- Palsies of cranial nerves VII, IX, or X.
- Rarely, tumors in hypopharynx, larynx, or trachea may cause stridor.
- Hoarseness and vocal cord paralysis are uncommon with salivary gland tumors.
INITIAL WORKUP/DIAGNOSIS

- Biopsy by oral surgeon or ENT physician should proceed without delay.
- MRI neck without and with contrast (CPT 70543) is preferred. Neck CT (contrast as requested) can be performed, especially if requested by the ENT surgeon planning resection
  - CT of base of skull (CPT 70450) is indicated if skull invasion is suggested on MRI.
  - Brain imaging is usually not indicated unless neurologic signs or symptoms are present.
- Chest x-ray
- Chest CT (CPT 71260) is indicated only if there are abnormalities on chest x-ray or if unusual lymphadenopathy is noted in the neck.
- The role of PET in salivary gland tumors has yet to be established
  - PET may be considered to evaluate suspicious abnormalities in the lungs if the guidelines for pulmonary nodules (CH-10 Multiple Pulmonary Nodules and CH-14 Solitary Pulmonary Nodule in the Chest guidelines) can be applied.

RE-STAGING/RECURRENCE

- Imaging for re-staging is usually not indicated.
- A single neck CT (CPT 70491) or neck MRI (CPT 70543) may be performed 3 months after radiation therapy of an unresectable lesion.
- If recurrence is suspected, neck MRI without and with contrast (CPT 70543 is indicated.
- Chest CT with contrast (CPT 72160) can be performed upon confirmation of recurrence.

SURVEILLANCE/FOLLOW UP

- Primarily by physical exam and chest x-ray only.
- Neck CT with contrast (CPT 70491) every six months can be performed if original tumor was unresectable.
- PET is not indicated for routine surveillance.

ONC- 4~ CENTRAL NERVOUS SYSTEM CANCERS

- See HD-24 Neuro-Oncology/Brain Tumors in the Head guidelines and PET-5 Primary Brain Tumors in the PET guidelines.
  - PET can be considered if findings of a brain biopsy or resection suggest that a lesion is a metastasis from an unknown primary (see PET-17.1 Carcinomas of Unknown Primary Site in the PET guidelines and ONC 27.7 Carcinoma of Unknown Primary).
- Primary brain tumors presenting only with headache are very uncommon; most primary brain tumors present with a specific CNS finding, (e.g. seizures and/or symptoms of stroke).
- Histologic confirmation is critical. Therapeutic decisions should not be made on radiographic findings alone.

Exceptions:
  - Patients so medically fragile that attempted biopsy carries excess medical risk, as stated in writing by both the attending physician and surgeon.
  - Brain stem tumors or other sites where the risk of permanent neurological damage, even of a limited biopsy attempt, is excessive.
Normally, brain MRI without and with contrast (CPT 70553) is all that is necessary prior to biopsy; however, some surgeons may appropriately desire both brain MRI and CT (contrast as requested). These may be approved when specifically requested by the responsible surgeon.
  o For posterior fossa tumors, tumors with evidence of leptomeningeal spread, and multi-focal tumors, diagnosis by cytology via lumbar puncture should be considered, although this is not required

**ONC- 5~ MELANOMAS AND SKIN CANCERS**

- Also see **PET-6 Melanoma** in the PET guidelines.
- **Desmoid Tumors and Dermatofibroma Protuberans (DFST):**
  - See **ONC-11 Soft Tissue Sarcomas**
- **Melanoma:**
  - Typically arises in patients age 45 and older.
  - Some melanomas arise in nonpigmented musocal surfaces; such melanomas usually have lymphatic spread in a fashion similar to squamous cell carcinomas of that respective site.
  - Incidence is increasing more rapidly than any other cancer, except lung cancer in women.
- Melanomas can metastasize in an unpredictable fashion; any patient with suspected metastatic cancer should be examined with a careful visual inspection for any suspicious skin or mucosal lesions.
- Advanced imaging is not indicated in **Squamous Cell Carcinomas (SCC) of the skin and Basal Cell Carcinomas (BCC);** rare exceptions are noted below.
- **Merkel Cell Carcinoma** is an unusual skin cancer with neuroendocrine-like histologic features, which has a high propensity (25%-33%) for regional lymph node spread and occasionally, metastatic spread to lungs.
  - Advanced imaging has not been shown to significantly alter outcomes in this disease.

**SUSPECTED**

- Patients presenting with a suspicious pigmented lesion should undergo a biopsy.
- Lesions are rarely symptomatic until very advanced.
- Imaging is not helpful until histologic diagnosis is confirmed. If biopsy is negative, consider re-biopsy.

**DIAGNOSIS/INITIAL WORK-UP**

**Melanoma**

- Stage 0, Ia (in situ disease or disease less than 1mm thick): no imaging
- Stage Ib or Iia (Lesions 1 to 2 mm thick or any with ulceration):
  - Chest CT with contrast (CPT 71260) or CT of regional lymphatic bed area, with contrast, can be performed to evaluate abnormalities on chest x-ray, physical exam, or if unusual factors preclude adequate physical exam of the regional lymphatic area.
- Stage IIb, IIC or Stage III (lesions greater than 2mm thick, obvious clinical lymphadenopathy or lymphatic disease confirmed histologically)
  - Chest CT with contrast (CPT 71260) for abnormalities noted on chest x-ray.
Abdominal CT with contrast (CPT 74160) if elevated LDH or abdominal abnormalities noted on other imaging modalities.

CT with contrast of body area containing regional lymphatics nearest to the original site of disease.

PET (CPT 78813 or 78816) is optional and may be considered to address specific signs and symptoms not explained by conventional imaging.*

*Melanoma. NCCN Practice Guidelines in Oncology, v.2.2007

Brain MRI without and with contrast (CPT 70553), can be performed for any CNS symptoms, or preoperatively if the proposed procedure involves significant risk of morbidity.

- Stage IV (metastatic)
  - Brain MRI (CPT 70553) and CT of body areas not previously imaged, may be considered if clinically relevant.
  - PET (CPT 78813 or 78816) and/or abdominal MRI without and with contrast (CPT 74183), may be considered when the results will change management decisions, but these studies are usually inappropriate in the setting of obvious multi-organ metastatic spread.

Other skin cancers
- Advanced imaging is not usually indicated, except to further define abnormalities found on chest x-ray or physical examination.
  - Squamous cell carcinoma of the skin of the head or neck presenting with regional lymphadenopathy should be evaluated with chest and neck CT with contrast (CPT 71260 and 70491).
  - Merkel Cell Carcinoma under consideration for adjuvant chemotherapy or radiotherapy: an additional CT or MRI of the affected region, at the oncologist’s discretion, may be performed to define appropriate therapy.
  - Merkel Cell Carcinoma, lymph node positive, may be evaluated with chest CT (CPT 71260) and abdominal CT (contrast as requested).
  - Any non-melanoma skin cancer of the head and neck area showing significant evidence of perineural involvement should be evaluated with imaging, MRI or CT, (clinician’s preference), contrast as requested, of the base of skull to evaluate for neural ganglion involvement.

RE-STAGING/RECURRENCE
- All recurrences should be confirmed histologically, except when excessive morbidity from a biopsy may occur, such as a biopsy requiring craniotomy.

Melanoma
- Re-staging in melanoma is not appropriate after adequate aggressive local therapy, because all patients are then followed according to the surveillance strategy detailed below.
  - Upon confirmation of local recurrence:
    - re-stage with chest x-ray, LDH, CT scans of body areas judged to be clinically relevant.
  - If melanoma recurs in regional lymph nodes, or for metastatic recurrence:
    - CT chest (CPT 71260), abdomen (CPT 74160 or 74170), +/-pelvis (CPT 72193), head MRI without and with contrast (CPT 70553), and PET (CPT 78813 or 78816) are appropriate.
• PET is not appropriate when CT scans demonstrate multi-organ metastasis.
• Cranial Imaging (CT or MRI) is indicated only for clear clinical progression of disease or new onset of neurological signs or symptoms; not for surveillance.

Other skin cancers
• Recurrence of Merkel Cell Carcinoma:
  o Chest CT (CPT 71260), abdominal CT with contrast (CPT 74160), and CT of the affected regional site.
• If non-melanomatous skin cancer recurs, and therapy is planned that is more extensive than simple wide local excision, then CT with contrast of the primary site is indicated.
• The role of PET in non-melanomatous skin cancer is not yet defined.

SURVEILLANCE/FOLLOW UP
• Primarily with physical exam.
• Chest x-ray and LFTs are performed in patients clinically judged to have risk of metastatic spread.
• For melanomas, CT with contrast, (MRI only on a case-by-case basis) may be approved on an annual basis for body areas with previously documented radiographic findings or pathologically involved lymph nodes.
• PET and head imaging for routine surveillance in all skin cancers, including melanoma, for asymptomatic patients, is not indicated.

ONC-6~ THYROID CANCER
• Also see PET-7 Thyroid Cancer in the PET guidelines.
• It can be very difficult to distinguish malignant thyroid nodules from benign nodules.
• Thyroid cancer is three to four times more prevalent in women than men.
• One of the few cancers where a clear relationship between carcinogenesis and radiation exposure is established.
• While most thyroid cancers occur randomly, a strong familial pre-disposition is known to occur.
• Imaging decisions for the management of Hurthle Cell, Follicular, and Papillary carcinomas are essentially identical.
• Medullary and Anaplastic Thyroid Carcinomas have significantly different diagnostic and therapeutic algorithms.

SUSPECTED
• Palpable nodules in patients with one or more of the following risk factors:
  o Age <15 or > 45 with new onset nodule
  o Male sex
  o Size greater than 4 cm or any size with rapid growth
  o Vocal cord paralysis
  o Regional lymphadenopathy
  o Symptoms suggestive of tumor invasion into the neck structures
  o Very firm or fixed nodule
  o History of radiation exposure, particularly as a young person
  o Family history of thyroid cancer
  o Ultrasound appearance described by radiologist as suspicious
Suspicious lesions having the above risk factors should be assessed by neck ultrasound, TSH, and FNA of the nodule and/or any suspicious lymph nodes.*
  - CT with contrast is relatively contraindicated because of iodine load — consider neck MRI without contrast (CPT 70540)*
  - Nondiagnostic FNA is not an indication for advanced imaging. Consider repeat FNA under ultrasound guidance or surgery.
  *Cancer Control 2006 April;13(2):89-98, 99-105
Thyroid nodules with suspicious criteria but <1 cm without adenopathy or suspicious findings on ultrasound, or nodules <4 cm with no suspicious criteria are followed clinically.
  - No advanced imaging is indicated.
An incidentally identified thyroid lesion that is positive on PET scan should be evaluated by ultrasound per the above guidelines.

INITIAL DIAGNOSIS/WORK-UP
- Chest x-ray, laboratory studies
- Surgery is the primary therapy for disease, may be required to confirm diagnosis, and may proceed even in setting of known metastatic disease.
- Noncontrast Neck CT (CPT 70490) or MRI (CPT 70540) is indicated if fixation is suggested by ultrasound or clinical exam, or if substernal disease precludes full ultrasound examination
  - Otherwise, pre-operative advanced imaging is not indicated.
- Chest CT without contrast (CPT 71250) can be performed if any suspicious lesions are found on chest x-ray or ultrasound only if results of the imaging will be used to change management decisions.
  - Use of iodinated contrast is discouraged as its use complicates the utility of post-operative radioactive iodine.
  - MRI may be considered in selected cases if clinically warranted.
  - Chest CT with contrast (CPT 71260), neck CT with contrast (CPT 70491) or neck MRI without and with contrast (CPT 70543) can be performed preoperatively for medullary and anaplastic carcinomas.
  - CT scans of abdomen, pelvis, and head, contrast as requested, can be performed for Anaplastic Carcinomas.
- Skeletal pain should be assessed with bone scan initially.
- Head imaging is not routinely indicated in the absence of neurological signs or symptoms, except for anaplastic carcinomas.
- PET is not indicated in the initial diagnosis or staging of thyroid cancer (see PET-7 Thyroid Cancer in the PET guidelines).

RE-STAGING/RECURRENCE
- Most thyroid cancers are assessed postoperatively by thyroid function tests and I-131 whole body scan with the patient off thyroid replacement medications.
- When recurrent or persistent disease is detected on 1-131 scan, proceed directly to considering radiiodine therapy. Advanced imaging is not relevant as it will not change therapeutic decisions.
  - Imaging studies may take up to 6 months to normalize after radiiodine; imaging during such time will not be expected to yield clinically significant information unless there is a change in the patient’s clinical status.
- Advanced imaging (CT, MRI) is usually unnecessary in the setting of low thyroglobulin levels and negative I-131 scan, except for medullary and anaplastic carcinomas.
• Recurrence suggested by elevated thyroglobulin level, I-131 scan, neck ultrasound or physical exam:
  o CT or MRI with contrast of the suspicious body area can be performed.
• CT or MRI (contrast as requested) can be performed of any site of suspected recurrence, if new symptoms develop.
• If elevated calcitonin or CEA levels in patients with medullary carcinoma:
  o CT with contrast of Neck (CPT 70491), Chest (CPT 71260), and Abdomen (CPT 74160) (but not pelvis) can be performed.
• PET is not indicated for routine use in re-staging.
  o Exceptions:
    ➢ When medical or technical factors preclude full thyroidectomy
    ➢ When 1-131 scan is negative, but repeated serum thyroglobulin tests remain >10 ng/ml
    ➢ Anaplastic thyroid cancers
    ➢ When abnormalities are found on other imaging studies that cannot be explained.

SURVEILLANCE/FOLLOW UP
• Predominantly by neck ultrasound, chest x-ray, and laboratory studies every three months for the first two years, then annually.
  o Annual I-131 scan if above are suspicious, or if patient had prior requirement for radioiodine.
  o CEA and calcitonin levels are required for Medullary Carcinomas
    ➢ CT with contrast of neck and chest (CPT 70491 and 71260) if CEA and/or calcitonin are elevated.
• Routine advanced imaging is not indicated.
  o Exception: in anaplastic carcinomas, neck CT with contrast (CPT 70491), and either chest x-ray or chest CT (CPT 71260) every 3 to 6 months for 3 years, then annually are indicated.
• PET is only indicated when the above imaging shows an abnormality that cannot be explained by other imaging modalities.
• Routine PET in asymptomatic patients without radiographic abnormalities is not indicated.
survival advantage when the metastatic focus, along with the primary tumor, is aggressively treated with local modalities.

- **Small Cell Carcinomas**
  - Not staged by a TNM system.
  - Most small cell carcinomas present as “extensive stage” tumors, defined as either metastatic disease or an extent of disease which cannot be encompassed by a single radiotherapy portal.
    - These are treated with chemotherapy alone, except for palliative radiotherapy directed at symptomatic sites.
  - Small cell carcinomas that are non-metastatic, and that also can be encompassed by a single radiotherapy portal, are termed “limited-stage,” and are treated with combined chemoradiotherapy and sometimes with elective cranial irradiation.
  - Surgical resection of a primary small cell carcinoma is appropriate in certain situations.

**SUSPECTED**

- **Screening for Lung Cancer:**
  - There is currently insufficient data to recommend routine screening for lung cancer. The American Cancer Society recommends that CT screening not be performed in asymptomatic at risk persons.*
    
    *
    *JNCCN 2006;4:591-594
  - Given the weaknesses in the I-ELCAP study (see ONC-7 Evidence Based Clinical Support section), MedSolutions supports awaiting the results of the National Lung Screening Trial prior to changing its current guidelines on chest CT screening for lung cancer.

- **Suspected Lung Cancer:**
  - Chest x-ray, (PA/Lateral), possibly with AP lordotic view, should be performed whenever lung cancer is suspected.
    
    ➢ When clinical suspicion remains high in spite of a normal chest x-ray, chest CT with contrast (CPT 71260) or without contrast (CPT 71250) can be approved.
  - Lung cancers can cause paraneoplastic syndromes (see ONC-28.3 Paraneoplastic syndromes) such as Lambert-Eaton (proximal leg weakness), encephalomyelitis, and sensory neuropathy. Small cell lung cancer can produce ACTH (Cushing’s syndrome) or vasopressin.

**INITIAL WORKUP, DIAGNOSIS:**

- Biopsy is performed by bronchoscopy or CT-directed biopsy. If these fail or are not feasible, video-assisted thorascopy or thoracotomy should be considered.
- All patients should have chest x-ray, CT chest/abdomen with contrast (CPT 71260/74160), PET (except for bronchioalveolar cancer) if histologic diagnosis is confirmed.
- PET for small cell carcinoma only for staging of apparently limited stage disease after standard imaging.
- Bone scan for all Small Cell Lung Cancers and for evaluation of bone pain in NSCLC (unless previously performed PET scan is negative)
Advanced imaging of skeletal sites prior to bone scan is inappropriate (See ONC-27.4 Metastatic Cancer Bone (and Spine))

- **Brain Imaging:**
  - Brain MRI (contrast as requested) (preferred) or head CT (contrast as requested) can be performed in patients with small cell lung cancer (any stage) or in patients with non-small cell lung cancer stage II (T1-2, N1) or above.
  - Brain MRI (CPT 70553) should be performed in patients with lung cancer of any type or stage who have neurologic signs or symptoms.

- **Superior sulcus tumor (Pancoast tumor):**
  - MRI chest without and with contrast (CPT 71552) if surgery is a therapeutic possibility.
  - MRI of cervical (CPT 72156) and/or thoracic spine (CPT 72157), if other imaging modalities or signs/symptoms suggest a possibility of neural foraminal encroachment by the tumor.

- **CT of neck or pelvis, MRI of suspected bone metastases, MRI abdomen, and duplicative imaging of head (MR or CT) are usually unnecessary, unless the clinical rationale is fully explained.**

**RE-STAGING/RECURRENTCE**

- Re-staging studies are appropriate if chemoradiotherapy was the initial treatment modality.
- Re-staging studies are not indicated if definitive resection was the initial treatment and all known disease was completely resected.
  - For non-metastatic unresectable, inoperative, or inadequately resected disease, re-staging with CT chest and abdomen with contrast (CPT 71260 and 74160).
    - CT or MRI scans of other areas can be performed if symptoms strongly suggest possible metastatic disease
    - MRI chest can be performed if an MRI was required pre-operatively
    - PET is not indicated for re-staging
- There are no evidence-based data addressing the frequency of re-staging imaging studies. Treatment protocols dictate that patients with responsive or stable disease can continue to receive a total of 4 to 6 cycles of chemotherapy or until disease progresses.

- **Brain MRI (CPT 70553) (preferred) or head CT (CPT 70470):**
  - For Limited stage small cell lung cancers, if prophylactic cranial irradiation (PCI) is planned.
  - Following pre-operative chemoradiation therapy, if an adequate response to therapy is demonstrated, and if evidence of intracranial disease will preclude surgery
  - Upon evidence of recurrence of any lung cancer
- If recurrence is suspected, the same imaging studies as initial work-up protocols plus head imaging (mentioned above) can be performed. Therapies for recurrence are rarely curative.

**SURVEILLANCE/FOLLOW UP**

- All patients: Chest x-ray or chest CT with contrast (CPT 71260) every 4 to 6 months for first two years, then, annually for an additional three years.
- Bone scan should be the initial study for bone pain or suspicion of skeletal disease, unless neurologic compromise is evident; see ONC-27.4 Metastatic Cancer Bone (and Spine).
- Imaging of CNS is appropriate for any CNS related symptoms.
Also see PET-10 Esophageal Cancer in the PET guidelines.

Clinicians must describe esophageal cancer by cell type and in which third of the esophagus they occur.
- Cancers of the upper and middle third are usually squamous cell and are highly associated with tobacco and alcohol abuse.
- Cancers of the gastroesophageal (GE) junction are treated as lower third cancers.
  - Lower third cancers are usually adenocarcinomas; 62% of these arise in the setting of Barrett's esophagus, a condition associated with high body mass index.

**SUSPECTED**

- In smokers, or former smokers, chest x-ray should promptly be done for all cases of weight loss and dysphagia.
- Esophagram (Barium swallow) and/or upper GI endoscopy (EGD) are the initial procedures of choice.
- CT chest, contrast as requested, can be performed
- PET prior to histologic diagnosis is only indicated when the above studies yield conflicting information or when an attempted biopsy is non-diagnostic or technically not feasible.

**INITIAL WORKUP, DIAGNOSIS**

- Transesophageal ultrasound is performed if no metastases are suspected and patient is considered a surgical candidate.
- CT chest/abdomen with contrast (CPT 71260/74160) for all patients with biopsy-proven esophageal cancer.
  - Abdominal CT may be without and with contrast (CPT 74170) if clinically justified.
  - Pelvic imaging is not indicated
- CT neck with contrast (CPT 70491) may be appropriate for tumors of the upper third and/or patients with possible neck mass.
- PET may be indicated to confirm M0 disease if conventional imaging does not find evidence of metastatic disease.
- Head imaging (MRI or CT) without and with contrast (CPT 70553 or 70470) should be performed only if neurological signs/symptoms are present.
- Chest MRI is not routinely indicated.

**RE-STAGING**

- PET to evaluate apparent partial response for marginally resectable disease can be performed following chemoradiation for patients who may be able to undergo esophagectomy.
  - Upper endoscopy or endoscopic ultrasound (EUS) should be performed prior to PET, since evidence of obvious progression or complete response negates the need for PET
  - PET should be delayed as much as feasible to allow time for tumor response to be assessed but not so late as to unduly delay required surgery.
- For patients not undergoing surgery, CT chest (CPT 71260) and abdomen (CPT 74160) or PET is indicated for re-staging.
  - PET should be delayed until 120 days after completion of radiotherapy due to risk of false positive FDG uptake in lethally irradiated cells, unless the clinical situation requires evaluation of disease outside the irradiated volume.
SURVEILLANCE/FOLLOW UP

- Advanced imaging not routinely indicated.
- Primarily with endoscopy, chest x-ray, clinical follow-up, laboratory studies.
- CT chest (CPT 71260) and/or abdomen (CPT 74160) are indicated when patient has progression of symptoms, abnormalities of above tests, or continued weight loss.
- MRI is not routinely indicated unless specifically recommended by radiologist to address an abnormality not adequately described by CT.
- PET is not indicated for patients being managed with best supportive care.
- PET for surveillance is not indicated.

Mesothelioma:

Suspected

- Especially prevalent in patients with asbestos and smoking history.
- Presenting Signs/Symptoms:
  - Dyspnea, chest pain, cough, night sweats, palpitations (from arrhythmias secondary to pericardial involvement), fatigue, dysphasia, pleural effusions, ascites.
- Frequently causes paraneoplastic syndromes, especially thrombocytosis.

Diagnosis

- Chest x-ray and CT chest with contrast (CPT 71260) are appropriate prior to biopsy.*
  *Cancer Control 2006;13:255-263

Staging

- Tumors are usually locally extensive prior to becoming metastatic and can extend locally or metastasize into the peritoneal cavity, contralateral pleura, and/or lung.
  - Staging with CT chest and abdomen with contrast (CPT 71260 and 74160) is indicated.
  - Imaging of other sites is indicated only for symptoms or clinical suspicion.
- Chest MRI (CPT 71552) may be considered for surgical planning when requested by the operating surgeon.
- There is insufficient data to support the routine use of PET.*
  *Comm Onc 2006 May;3:215-224

Surveillance

- Chest CT (CPT 71260) every 3 months for 2 years, then every year for life.
  - Other imaging may be done of previously positive sites or of newly symptomatic areas.
  - Chest MRI (CPT 71552) may be done if chest CT is questionable.

Thymoma:

Suspected

- Also see PN-6.1 Neuromuscular Disease in the Peripheral Nerve Disorders guidelines.
- Chest CT (CPT 71260) is indicated for any patient with suspicion of myasthenia gravis, since thymus resection may cure or at least improve symptoms.
• Thymomas cause anterior mediastinal densities seen on lateral chest x-rays.
  o Chest CT with contrast (CPT 71260) can be performed for any symptomatic patient with a mediastinal finding on plain chest x-ray.

INITIAL DIAGNOSIS/STAGING
• Thymomas are difficult to categorize clearly as malignant or benign. They are broadly characterized as encapsulated thymoma, invasive thymoma, and thymic carcinoma.
  o Encapsulated thymomas do not need to be staged.
  o Invasive thymomas usually are sufficiently staged with chest CT, as mentioned above, but abdominal CT (CPT 74160) and/or neck CT (CPT 70491) may be indicated if mediastinal involvement is extensive.
  o PET is usually not indicated, but can be considered on a case-by-case basis to explain specific questions not well addressed by other modalities
  o Radiolabeled Octreotide Scan may be helpful in some situations
  o Reference:
    ➢ Non-Small Cell Lung Cancer, NCCN Practice Guidelines in Oncology, v.v 2008
• Chest MRI without and with contrast (CPT 71552) may be indicated as a preoperative study if requested by the operating surgeon.
• Thymic Carcinomas should be staged in a similar fashion to non-small cell lung cancer (see ONC-7 Lung Cancer), except that there is no current literature supporting the use of PET for thymic carcinomas.

SURVEILLANCE
• Chest CT (CPT 71260) should be performed twice a year for the first two years following treatment, and then annually for the next 20 years.
• Thymomas respond to radiation therapy, but are slowly responding tumors. Therefore, CT scans to assess response are contraindicated for the first 90 days after completion of radiation therapy unless there is a sudden change in the patient’s symptoms.

ONC-10 ~ BREAST CANCER
• Also see PET-9 Breast Cancer in the PET guidelines and CH-25.1 Breast MRI in the Chest guidelines.
• While family history is relevant, clinicians should remember that the majority of breast cancers diagnosed in the United States appear to be random events and are not associated with a familial disposition.
• NSABP clinical trials have shown that in patients who were initially treated with breast conservation surgery and radiation therapy, then were found to have a local recurrence, a prompt salvage mastectomy confers the same survival advantage as an initial mastectomy would have originally.
  o This finding has led the National Cancer Institute (NCI) to recommend breast conservation therapy as the first choice of therapy for breast cancer.
• Male Breast Cancer: Although many forms of male breast cancer are considered to be more virulent, on a stage-by-stage basis, the diagnostic and therapeutic decisions for breast cancer in males are identical to breast cancer in females.
  o Therefore, the guidelines below apply equally to breast cancer in males and females unless specific clinical information justifies deviation from these guidelines.
SUSPECTED

- Breast cancer should be considered in patients with a breast mass, axillary or supraclavicular mass, suspicious findings on mammogram, ultrasound, or suspicious findings on chest CT or MRI performed for other indications.
- Any change to skin or areola color, nipple or areola size or shape, symmetry of breasts, or change in ptosis of breast should be carefully evaluated.
- Breast cancer in a postmenopausal woman needs to be ruled out anytime an adenocarcinoma that may represent metastatic disease is found in another site.
- Diagnostic mammography, supplemented with ultrasound if needed, remains the mainstay test of choice for any suspected breast abnormality.
- Breast MRI: See CH-25.1 Breast MRI in the Chest guidelines for MRI indications.

INITIAL WORKUP, DIAGNOSIS

- Prior negative screening mammograms do not obviate the need for diagnostic mammography, as 5%-10% of mammographically detectable breast abnormalities are missed during screening mammograms.
- MRI Breast (CPT 77058 or 77059 whichever is requested) See CH 25.1 Breast MRI in the Chest guidelines for MRI indications
- Noninvasive breast cancer: Lobular or ductal carcinoma in situ (LCIS, DCIS):
  - An initial bilateral breast MRI (CPT 77059) should be performed in all patients with newly diagnosed, biopsy-proven LCIS or DCIS
- Invasive breast cancer:
  - There must be a histologic diagnosis of invasive cancer prior to advanced imaging.
  - An initial bilateral breast MRI (CPT 77059) should be performed in patients with a newly diagnosed, biopsy-proven breast cancer, particularly infiltrating lobular cancer and tumors with extensive intraductal component.
  - Initial staging with PET is indicated for:
    - T4 (inflammatory) breast cancer.
    - Lymph node positive disease.
    - When needed to clarify positive findings on other studies.
    - PET is not indicated for clinical Stage I or IIa disease prior to axillary sampling.
  - Chest x-ray, mammograms, ultrasound if necessary, and laboratory studies are all that is required for Stage I disease.
  - Bone scan should be the initial study for bone pain or suspicion of skeletal disease, unless neurologic compromise is evident; see ONC-27.4 Metastatic Cancer Bone (and Spine).
  - Chest CT (CPT 71260) can be performed for:
    - Suspicious findings on other studies.
    - Patients with clinically palpable lymph nodes.
    - Patients with >4 positive lymph nodes found during dissection.
  - CT abdomen (CPT 74160) and CT pelvis (CPT 72193) can be performed in patients with Stage II or higher breast cancer if patient has abnormal alkaline phosphatase, liver function studies, signs or symptoms suggesting abdominal disease, or for patients undergoing neo-adjuvant therapy for locally advanced disease.
  - Brain MRI (CPT 70553) (preferable) or head CT (CPT 70470) (if MRI is contraindicated) are only indicated in patients with neurological signs/symptoms.
    - Routine CNS imaging in asymptomatic patients is not indicated.
  - Body or Spinal MRI can be considered to evaluate abnormalities noted on other imaging modalities.
RE-STAGING/RECURRENCE

- PET is not indicated for re-staging if all known disease has been surgically removed.
- Breast MRI may be performed as a preoperative study following neoadjuvant chemotherapy in patients with locally advanced disease, if physical examination fails to document adequate response.
- PET can be performed in Stage IV disease to document response to therapy.
- CT chest (CPT 71260)/abdomen (CPT 74160)/pelvis (CPT 72193) can be performed one time for re-staging when the patient finishes Tamoxifen, Femara, Arimidex, or other similar hormonal therapy.
- Obtaining both CT scans and PET for re-staging is discouraged and considered redundant unless a specific clinical question needs the improved resolution of a diagnostic CT.
- If a palpable abnormality suggests a possible recurrence, diagnostic mammogram and ultrasound with possible biopsy should proceed at once.
  - Breast MRI (CPT 77058 or 77059) is indicated if mammography with ultrasound findings is inconclusive.
- CT chest (CPT 71260) for any new findings on chest x-ray.
- CT chest (CPT 71260) or neck (CPT 70491) to evaluate lymphadenopathy of those sites.
- CT chest (CPT 71260) (not Neck) is indicated for suspicion of a supraclavicular node, unless other pathology of head and neck region is suspected.
- Bone scan should be the initial study for bone pain or suspicion of skeletal disease, unless neurologic compromise is evident; see ONC-27.4 Metastatic Cancer Bone (and Spine).
- Cranial Imaging when patient has documented CNS findings or symptoms.
- Elevated LFTs or tumor markers should be verified with repeat laboratory measurements.
  - If LFT abnormalities are persistent, abdominal CT with contrast (CPT 74160) is preferred.
    - Ultrasound and/or MRI abdomen (CPT 74183) are also appropriate choices.
    - If tumor markers are elevated, a thorough gynecologic examination should be performed prior to considering advanced imaging.
      - Clinical re-evaluation, chest x-ray, and mammography are indicated, and if non-contributory, then either CT of chest/abdomen/pelvis or PET can be performed.
- Routine use of pelvic imaging is discouraged, except when symptoms indicate a need for that region, or in the setting of new abnormalities found on abdominal CT.

SURVEILLANCE/FOLLOW UP

- Advanced imaging is not indicated for asymptomatic patients, regardless of prior stage or adverse histologic features.
  - Routine CNS imaging without neurological signs or symptoms is not indicated.
  - PET for surveillance is not indicated.
  - Reference:
    - Invasive Breast Cancer. NCCN Practice Guidelines in Oncology v.2.2007
- Breast MRI (CPT 77058 or 77059) is indicated only if criteria in Initial Work-up section is met, or for new palpable breast masses not easily visualized on other imaging modalities.
Also see CH-25.1 Breast MRI in the Chest guidelines
Patients on active Herceptin treatment can undergo MUGA (CPT 78472 or 78494) at 3, 6, and 9 months.

**ONC-11~SOFT TISSUE SARCOMAS**

- Also see PET-17.2 Soft Tissue Sarcomas in the PET guidelines.
- Rare tumors of mesenchymal origin, usually presenting as an asymptomatic mass.
- It may be difficult to distinguish sarcomas from lymphomas, metastases, or lipomas and other benign masses.
- Ideally, sarcomas should be managed by a multidisciplinary team including an oncologic orthopedist or surgical oncologist.
- Histologic grade of the sarcoma is very important for determining type of therapy needed.
  - Sarcomas are generally classified as high-, intermediate-, and low-grade tumors. (Some centers only use high- and low-grade classifications).

**SUSPECTED**

- Asymptomatic mass; frequently brought to medical attention after trauma, although there is no association between development of this tumor and trauma.
- Pre-biopsy CT or MRI (without and with contrast) of area containing the suspicious mass.
  - Both CT and MRI may be appropriate, prior to biopsy, if clinical information justifies both studies.
- Chest x-ray
- Plain x-rays and/or ultrasound of the mass may be helpful but are not required.

**INITIAL WORKUP, DIAGNOSIS**

- Biopsy should be by a carefully planned core-needle or open biopsy; FNA is inappropriate.
- CT with contrast of the next contiguous body region where first echelon lymph nodes are found (e.g., pelvis if sarcoma involves lower extremity) may be indicated after histologic diagnosis is established for high-grade tumors, tumors greater than 5 cm, or certain unusual histologies known to have propensity for lymphatic spread.
- CT chest with contrast (CPT 71260) or without contrast (CPT 71250) can be performed for staging only after histologic diagnosis is established.
- Additional CT or MRI scans (contrast as requested) of the affected body part are appropriate if felt necessary for surgical and adjuvant therapeutic planning.

**Desmoid Tumors and Dermatofibroma Protuberans (DFST)**

- CT or MRI, contrast as requested, of the affected body part is appropriate.
- Imaging of lung and lymph node areas for these tumors is inappropriate.
- PET, abdominal CT, and MRI of a region distant from the primary tumor are usually not indicated, except in cases of suspected unusual metastatic spread.

**RE-STAGING/ RECURRENCE**

- Many centers use a plan of preoperative radiotherapy, followed by surgical resection, followed by additional radiation.
  - MRI (contrast as requested) of affected part can be performed following each of these modalities.
- Re-staging:
MRI without and with contrast (preferable) or CT with contrast of primary site following all local therapies can be performed as a baseline.

- PET may be considered if needed to differentiate tumor from radiation or surgical fibrosis.
- Chest CT is not indicated for re-staging if the pre-operative chest CT was negative and post-therapy chest x-ray is normal.
- Body imaging to re-stage lymph nodes is not indicated unless abnormalities are suggested by physical exam or other imaging.

- If local recurrence is suspected, repeating all steps of initial work-up is appropriate.
- If lung metastasis is suspected, limited metastasectomy, with or without adjuvant chemotherapy and radiation therapy, may offer significant survival advantage.
- Imaging of a suspected metastasis may include PET, CT, and/or MRI, if needed to determine eligibility for metastasectomy, extent of resection needed, and/or other therapies.

SURVEILLANCE/FOLLOW UP

- Chest Imaging:
  - Chest x-ray only for patients with completely resected low- and intermediate-grade sarcomas every 6 to 12 months for 10 years.
  - Chest CT (either with contrast [CPT 71260] or without [CPT 71250]) or chest x-ray every 3 to 4 months for 2 years, then every 6 months for next 2 years, then annually in patients with high-grade and/or unresectable sarcomas.
  - References:
    > Cancer 2001:92:863-868
    > Cancer 2002:94:197-204
  - Intra-abdominal and retroperitoneal sarcomas may undergo CT chest/abdomen/pelvis with contrast (CPT 71260, 74160, 72193) every 3 to 4 months for 2 years, then every 6 months for next 2 years, then annually.
  - Periodic imaging of primary site with MRI (preferable) or CT, contrast as requested, according to the clinician’s judgment of risk of local recurrence.
  - Routine body imaging for lymph nodes is NOT appropriate, unless clearly clinically indicated in unusual situations.
  - There is insufficient data to support the use of PET for surveillance.

ONC-12 ~ PANCREATIC CANCER

- Also see PET-11 Gastrointestinal Tumors in the PET guidelines.
- This guideline refers only to adenocarcinoma of the exocrine pancreas, which accounts for over 90% of pancreatic malignancies.
- Endocrine and carcinoid tumors of the pancreas are not included in this guideline.
- These guidelines or Onc-13 Upper GI Cancer guidelines may be used for cancer of the Ampulla of Vater, duodenum, or common bile duct.
- Pancreatic cancer is an infrequently diagnosed but very virulent tumor. Long term survival is rare.
  - Fifth leading cause of cancer death in adults; fourth leading cause of cancer death in males. Peak Incidence in 7th and 8th decade of life.
  - Strongly associated with smoking and increased body mass index.
  - Less strongly associated with alcohol intake and family history.
SUSPECTED

- There is no “classic” symptom of pancreatic cancer.
- Symptoms may include: jaundice, weight loss, floating stools, dyspepsia, depression, pain, nausea, anorexia, inexplicable desire to quit smoking, sudden exacerbation of previously well-controlled chronic disease.
- Should be considered in any adult over age 50 with sudden onset of adult type 2 diabetes.
- Liver enzymes, amylase, and CA 19-9 are usually, but not consistently, elevated.
- Ultrasound should be performed initially if patient presents with symptoms only.
- Abdominal CT with contrast (CPT 74160) can be performed when symptoms are accompanied by abnormal lab or physical exam findings, or if abnormality is noted on ultrasound or ERCP.
- Chest x-ray initially.
- CT chest (CPT 71260) can be performed if abdominal CT or chest x-ray is abnormal.
- Pelvic CT is not indicated.
- References:
  - Radiology 2006;238;405-422

INITIAL WORKUP, DIAGNOSIS

- Full history and physical examination, liver enzymes, amylase, CA 19-9, and chest CT (CPT 71260) and abdominal CT (CPT 74160 or 74170) are appropriate in all cases.
- Because of high risk of false negative biopsies and risk of peritoneal seeding from biopsies, patients may proceed with all staging studies and initial attempt at surgical resection without histologic confirmation of cancer.
- Biopsy with histologic confirmation of cancer is required for preoperative chemotherapy or for any administration of radiation therapy.
- Abdominal MRI (CPT 74183) can be performed as a preoperative study or to further clarify clinical questions remaining from CT and ultrasound.
- Abdominal CTA (CPT 74175) to assess for vascular invasion by tumor can be performed if resection is being considered.
- Possible lymphadenopathy seen on CT may or may not contraindicate attempt at resection on a case-by-case basis. Surgical evaluation should not be delayed for additional imaging in the absence of metastasis.
- The role of PET in the initial staging of pancreatic cancer is limited to the following:
  - Pancreatic cancers under consideration for resection by Whipple procedure, or subtotal pancreatectomy of pancreatic tail tumors.*
  - PET can be performed if there is reasonable clinical suspicion that a pancreatic malignancy is a possible metastasis from an unknown primary.
- Pelvic CT is not indicated in the initial work up of pancreatic cancer.

RE-STAGING/RECURRENCE

- CT of abdomen (CPT 74160 or 74170) and any other area initially suspected of having disease can be performed for re-staging.
- Recurrence may be assumed clinically if there is enlargement of the original mass; biopsy is not required.
- PET may be helpful post-radiotherapy if residual mass persists on CT or if unusual
pattern of metastatic spread suggests a second primary cancer.

- PET following radiotherapy should be delayed a minimum of 120 days due to risk of false positive FDG uptake in lethally irradiated cells, unless the clinical situation requires evaluation of disease outside the irradiated volume.

**SURVEILLANCE/FOLLOW UP**

- History and physical exam, laboratory studies, abdominal CT with contrast (CPT 74160), and chest x-ray every 3 to 6 months for 2 years, then annually.
- Chest CT with contrast (CPT 71260) should be performed only to address abnormalities noted on chest x-ray or other imaging, or if pulmonary symptoms appear.
- Abdominal MRI (CPT 74183) for unexplained elevation of liver enzymes or if an abnormality is seen on CT.
- PET and Pelvic CT for routine surveillance are not indicated.

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**ONC-13~ UPPER GI CANCERS**

- Also see PET-11 Gastrointestinal Tumors in the PET guidelines.
- This guideline applies to Gastric, Duodenal, Gall Bladder, Hepatocellular and Hepatobiliary Tree Cancers: It does not apply to pancreas or esophageal cancers.
- Gastric cancer is a major health problem in other parts of the world; incidence of these cancers within the U.S. has actually decreased over the last 50 years.

**SUSPECTED**

- Endoscopy, upper GI barium study, chest x-ray, and/or ultrasound are preferred as the initial imaging studies.
- Abdominal CT (CPT 74160) is warranted if the above studies are equivocal or abnormal, if multiple symptoms occur, or if the above symptoms are present and liver enzymes worsen on repeat evaluation.
  - Liver lesions less than 1 cm found on ultrasound only require repeat ultrasound every 3 to 6 months for two years. If no growth is documented in 2 years then ultrasound should be performed every 6 to 12 months.*
  *Hepatology 2005 Nov;42(5):1208-1236
- MR cholangiopancreatography (MRCP [CPT 74181]):
  - See AB-31 Jaundice in the Abdominal guidelines
- CT chest with contrast (CPT 71260) can be performed if abdominal CT or chest x-ray is abnormal.
- Pelvic CT is not routinely indicated.

**INITIAL WORKUP, DIAGNOSIS**

- Full history and physical exam, chest x-ray, liver enzymes, and abdominal CT with contrast (CPT 74160) are appropriate in all cases.
  - Ultrasound is indicated if not already previously done to establish baseline for follow-up examinations.
  - Pelvic CT with contrast (CPT 72193) can be performed in females.
  - Pelvic CT for males is not indicated unless liver metastasis or unusual lymphadenopathy is noted on abdominal CT.
  - Chest CT (CPT 71260) should be performed only if needed to confirm absence of metastatic disease in an otherwise apparently localized case, when surgical resection is contemplated.
- Alpha fetoprotein (AFP), CEA, hepatic panel should be performed.
- PET is indicated for gastric cancer and GIST tumors, not for other types.*

*AJR 2004 Dec;183:1619-1628
*Gastric Cancer, NCCN Practice Guidelines in Oncology, v.2.2007

- PET is not indicated for T1 gastric cancers
- PET is not indicated if metastatic disease is already confirmed
- Abdominal MRI without and with contrast (CPT 74183) can be performed to further evaluate liver lesions if clinical questions remain after CT.
- Abdominal CTA (CPT 74175) or MRA (CPT 74185) can be performed if requested by the surgeon considering resection.
  - CTA/MRA is not indicated if the patient is not a candidate for resection (e.g. patients with metastatic disease, cases where the lesion is clearly unresectable, or cases where the patient is medically inoperable).*

RE-STAGING/RECURRENCE
- CT of abdomen (74160 or 74170) and any other area involved with disease can be performed for re-staging.
- Pelvic CT is not indicated except for significant changes on abdominal CT or for pelvic symptoms.
- Recurrence may be assumed clinically if the patient has an enlarging mass at the original site
  - Biopsy is desirable, if feasible, but not required.
- If the original local site seems to be under control and a new liver lesion appears, CT abdomen without and with contrast (CPT 74170) and pelvis with contrast (CPT 72193) or MRI abdomen and pelvis without and with contrast (CPT 74183 and 72197) can be performed, and biopsy confirmation should be considered.
- PET can be performed only for gastric cancer or if needed to clarify other possible sites of metastatic disease that are equivocal on CT or chest x-ray.
  - If radiation therapy is employed, PET is contraindicated up to 120 days from completion of therapy.
- Treatment of liver lesions with Radio-Frequency Ablation (RFA) for palliation is frequently done.
  - Repeat CT (CPT 74160 or 74170) NOT PET, is indicated after this procedure.

SURVEILLANCE/FOLLOW UP
- **Hepatocellular Carcinomas:** abdominal CT (CPT 74160) every 3 to 6 months for two years, then annually.
- **Biliary Tract and Gastric Cancers:** abdominal CT (CPT 74160) every six months for two years.
- Chest x-ray and laboratory studies every 3 to 6 months per clinician’s judgment.
- Routine chest and pelvic CT are not indicated unless an abnormality arises on chest x-ray or other studies.
- Abdominal MRI (CPT 74183) can be performed only if CT scan is contraindicated or if previous imaging findings suggest a certain abnormality is best followed by MRI in lieu of CT.
- PET is not indicated for surveillance
ONC-14 ~ OTHER GI NEUROENDOCRINE CANCERS

- Also see PET-11 Gastrointestinal Tumors in the PET guidelines.
- Includes carcinoid, pheochromocytoma, and endocrine tumors of the pancreas.
- Many are associated with Multiple Endocrine Neoplasia (MEN) familial syndromes.

**SUSPECTED**

- **Carcinoid** is suspected with symptoms of episodic cutaneous flushing, abdominal cramps, cyanosis, and diarrhea.
- **Pheochromocytoma** is suspected in the setting of episodic, symptomatic hypertension in young people, especially when exacerbated by a maneuver that puts pressure on the tumor.
  - Also see AB-21 Adrenal Cortical Lesions in the Abdominal guidelines.
- **Pancreatic endocrine tumors (islet cell tumors):**
  - Can be non-secreting and cause symptoms similar to typical pancreatic cancer.
  - Can be secretory, causing a wide variety of endocrine abnormalities including atypical diabetes, hyperglycemia, carcinoid syndrome, diarrhea, and atypical peptic ulcers.
  - Include insulinomas, glucagonomas, VIPomas, gastrinomas, and others.
    - See also AB-20 Zollinger-Ellison Syndrome in the Abdomen guidelines.

**INITIAL WORKUP, DIAGNOSIS**

- **For Carcinoid:**
  - Octreoscan, chest x-ray, abdominal CT without and with contrast (CPT 74170) and pelvic CT with contrast (CPT 72193). *
    - *Current Opin Gastroenterology 2007;23(1):74-78
  - MRI only when the above studies are negative or clinically contraindicated, and clinical suspicion remains high.
  - Chest CT (CPT 71260) if an abnormality is suspected on chest x-ray or on the upper slices of the abdominal CT.
  - If carcinoid symptoms are also associated with dysphagia, consider upper GI exam prior to chest CT.
  - Endoscopic ultrasound may also be useful.
- **For pheochromocytoma:**
  - MIBG (preferred) or Octreoscan are useful.
  - CT of chest (CPT 71260) and abdomen with contrast (CPT 74160) are indicated.
    - In patients with elevated catecholamines/metanephrines, great care should be exercised when considering IV contrast administration. These patients are known to have hypertensive crises with the bolus injection of IV contrast
  - Abdominal MRI without and with contrast (CPT 74183) may be helpful to evaluate equivocal findings, especially in the adrenal glands.
  - Spine MRI without and with contrast of the affected area may be indicated when paraspinal sympathetic chain tumors are suspected.
  - PET may be useful in situations clinically judged to be at high risk for metastatic disease.
    - Use of radiotracers other than FDG have been shown to be more sensitive but should be considered investigational at this time.
- **For Pancreatic Endocrine tumors:**
  - Abdominal CT (CPT 74160 or 74170) or MRI (CPT 74183) and chest x-ray for all suspected tumors.
Octreoscan may be helpful.
CT chest (CPT 71260) if tumor is clearly malignant, or when abnormality is suspected on chest x-ray.

- **For tumors that are judged to be poorly differentiated or undifferentiated, or have features of small cell carcinoma:**
  - Brain MRI without and with contrast (CPT 70553) may be performed even in the absence of symptoms.
- For all other neuroendocrine tumors, imaging of the brain should be reserved for patients with neurologic signs/symptoms.
- For bone pain, nuclear bone scan is the imaging modality of choice.

**RE-STAGING/RECURRENCE**
- Surgical resection is usually therapy of choice.
- Following resection, proceed directly to surveillance.
- Re-stage only after aggressive chemotherapy of any unresectable disease.

**SURVEILLANCE**
- Repeat CT with contrast of any CT that was positive preoperatively at 3 months and 1 year postoperatively, then as clinically indicated.
- Frequent assessment of tumor markers, as clinically indicated.
- Repeat MIBG or Octreoscan studies that were previously positive annually if risk of recurrence is high.

**ONC-15 ~ COLORECTAL CANCER**
- Also see PET-11 Gastrointestinal Tumors in the PET guidelines.
- Symptoms include obstructive symptoms, rectal pain, constipation, bleeding or heme-positive stools, anemia, change in stool caliber.
- Rectal cancer is defined as an adenocarcinoma <12 cm from the anal verge (as determined by imaging or colonoscopy) OR tumor below peritoneal reflection (as stated by surgeon at time of laparotomy).
  - Distal tumors found to be squamous cell or basaloid carcinomas are considered anal carcinomas and are managed according to ONC-23 below.
- A survival advantage has been demonstrated in carefully selected colorectal cancer patients when metastatic disease involves a single organ and all known disease can be removed or treated with interventional techniques.
- Pelvic recurrence from a colorectal cancer is an extremely painful and difficult condition; therefore, prevention of, prompt detection, and treatment of pelvic recurrence are high priorities.

**SUSPECTED**
- There is currently no consensus regarding recommended imaging studies for routine screening in asymptomatic patients.
  - See also AB-29 Virtual Colonoscopy in the Abdominal guidelines.
- Colorectal cancer is reasonably suspected in any adult over age 50 with unexplained anemia, change in bowel habits, or elevated CEA or LFTs.
- Chest x-ray, routine labs, and CEA should be obtained in any patient with suspected colorectal cancer.
Symptomatic patients should be evaluated with full colonoscopy and/or barium enema. Abnormal findings on these studies should be further evaluated by CT abdomen and pelvis with contrast (CPT 74160 and 72193).

CT chest (CPT 71260) should be performed only in the setting of an obviously abnormal abdominal CT or abnormal chest x-ray.

**DIAGNOSIS/INITIAL WORK-UP**

- No advanced imaging is indicated when a carcinoma within a polyp is completely removed by endoscopy.
  - Full panel of liver function studies and CEA should be obtained as a baseline prior to resection.
- CT chest/abdomen/pelvis with contrast (CPT 74160/71260/72193) should be performed in all patients with invasive cancers.
  - MRI is acceptable if clinically justified.
  - Abdominal MRI without and with contrast (CPT 74183) can be performed to further evaluate a liver lesion seen on CT which requires further characterization prior to making a therapeutic decision.
- Head imaging should be performed only if there are neurologic signs/symptoms.
- PET is appropriate for initial staging of lymph node positive colorectal cancers or when an abnormality suggests a possible solitary metastatic lesion that might be amenable to resection.
  - PET is not indicated when all imaging studies are negative and LFTs, CEA, and symptoms/signs are consistent with localized disease.

**RE-STAGING/RECURRENCE**

- Many rectal cancers and some colon cancers judged to be unresectable or marginally resectable are treated with preoperative chemotherapy and/or radiation therapy, followed by PLANNED resection. Because the resection is planned, resection may proceed without routine imaging.
  - CT or MRI of primary cancer site, contrast as requested, can be considered when requested by the operating surgeon to address a specific surgical issue.
  - Re-staging is NOT routinely appropriate following preoperative therapy, except if metastatic disease was suspected on initial staging.
- Re-staging following resection is not routinely indicated, except in cases of unusual symptoms, unexpected intra-operative findings, unresectable disease, or persistently elevated LFTs or CEA.
- PET may be considered in re-staging for the following:
  - To evaluate potentially resectable disease.
  - If postoperative CEA or LFTs remains elevated and other attempts at imaging are negative.
  - To assess response to therapy at sites of unresectable disease.
  - If recurrence is clinically suspected and conventional imaging is negative or equivocal.
  - In differentiating local tumor recurrence from postoperative and/or post- radiation scarring;
    - PET should be delayed until at least 120 days following completion of radiation therapy.
- CT chest/abdomen/pelvis with contrast (CPT 71260, 74160, and 72193) can be performed upon histologic confirmation of any recurrence.
Abdominal MRI (CPT 74183) can be performed to evaluate a liver lesion seen on CT that requires further characterization prior to making a therapeutic decision.

SURVEILLANCE/FOLLOW UP

- PET is not indicated for routine surveillance.
- PET may be considered if imaging stated below is equivocal; however, obviously suspicious radiographic abnormalities should be considered for biopsy in most cases prior to PET.
- All patients should undergo clinical examination, CEA, and LFTs every 3 months for 2 years, then every 6 months until the 5 year point is reached, with annual colonoscopies.
- Lymph node positive colon cancer, and locally advanced rectal cancer, and any other indication judged to be at high risk for recurrence:
  - Annual CT scans, with contrast, of chest/abdomen/pelvis (CPT 71260, 74160, and 72193).
- Patients with metastatic disease, adequately treated, can undergo CT scans of chest/abdomen/pelvis with contrast (CPT 71260, 74160, and 72193) every 3 months for first year, then every six months until 5 years out, then annually for an additional 5 years.
- Head imaging is indicated only if neurological signs/symptoms are present.
  - If indicated, brain MRI without and with contrast (CPT 70553) is preferred.
- Abdominal MRI (CPT 74183) can be performed to evaluate the liver for any unexplained elevation of CEA.
- MRI pelvis without and with contrast (CPT 72197) is indicated at any time for unexplained onset or worsening pelvic pain for a colorectal patient who is judged by the clinician to be at risk for a pelvic failure.

**ONC-16 ~ RENAL CELL CANCER (RCC)**

- Also see PET-12.3 Kidney in the PET guidelines.
- This guideline pertains to Renal Cell Carcinoma (RCC) of the kidney.
- Transitional Cell Carcinomas of the renal pelvis are considered below in ONC-17 Bladder Cancer.
- Many renal cell carcinomas are asymptomatic and incidentally discovered on CT or ultrasound while evaluating other conditions.
- Frequent presenting symptoms include hematuria, flank pain, mass, or symptoms related to metastatic spread.
- Metastatic spread is highly variable and may involve any organ, but common sites are brain, bone, liver, and lung.

**SUSPECTED**

- CT abdomen and pelvis without and with contrast (CPT 74170 and 72194) for flank pain or hematuria without signs of infection.
- Ultrasound and/or CT without contrast (CPT 74150 and 72192) are appropriate substitutes for initial imaging, if contrast is contraindicated.
- MRI is not appropriate as the initial imaging modality unless CT is contraindicated or findings on the above studies are equivocal.
INITIAL WORKUP, DIAGNOSIS

- 85% to 90% of renal masses that are radiographically solid are RCCs. Workup may proceed presumptively on this basis.*
  - CT chest/abdomen/pelvis, contrast as requested, can be performed.
  *Cancer Control 2006;13:199-210
- MRI abdomen and pelvis without and with contrast (CPT 74183 and 72197) can be performed for lesions seen on ultrasound, if contrast is contraindicated (e.g. renal insufficiency), or if CT suggests extension of tumor into the vena cava.
- MRI abdomen (CPT 74183) as well as CTA (CPT 74175) or MRA (CPT 74185) abdomen, can be performed as preoperative studies (especially if partial nephrectomy is planned).
- PET is not routinely indicated for initial diagnosis or staging of RCC.
  - Exception: If there is suspicion of a metastatic lesion and biopsy of the lesion is considered potentially less invasive than biopsy of the kidney or nephrectomy, then PET can be performed.
- CNS imaging is not indicated except for specific signs or symptoms of neurological pathology.
- Bone Scan should be the initial study for bone pain or suspicion of skeletal disease, unless neurologic compromise is evident; see ONC-27.4 Metastatic Cancer Bone (and Spine).

RE-STAGING/RECURRENCE

- PET is usually not appropriate, except in selected patients who meet the criteria listed in PET-12.3 Kidney in the PET guidelines.
- Any suspicion of recurrence should undergo repeat initial work-up as above.
- Bone Scan is the initial imaging test of choice for unexplained bone pain. MRI can be performed for unexplained findings or if patient has neurological compromise.
- Brain MRI (CPT 70553) can be performed for development of symptoms suggestive of CNS metastasis. CT, contrast as requested, is acceptable if MRI is not feasible.

SURVEILLANCE

- Surveillance is primarily performed with chest x-ray, laboratory studies, and urinalysis.
- All patients who are post nephrectomy should be evaluated with baseline CT chest and abdomen with contrast (CPT 71260, 74160) at 4 to 6 months.
  - Repeat abdominal CT 3 months from the baseline CT for any suspicious abnormalities found on the baseline CT to document stability, if patient is asymptomatic.
  - Repeat annually for any Stage III or non-metastatic Stage IV (T3 or higher or lymph node positive) for 5 years.
  - Pelvic imaging is not indicated after nephrectomy except for specific pelvic symptoms
  - Repeat as indicated for any clinical abnormalities or change in symptoms.
- PET is not indicated for routine surveillance.
• Also see PET-12.4 Bladder and other Urinary Tract Transitional Cell Carcinomas in the PET guidelines.
• Includes tumors of the bladder, renal pelvis, ureters, and urethra, as well as transitional cell carcinoma of the prostate.
• Strongly associated with tobacco use.
• Usually presents with painless hematuria and less commonly, increased urinary frequency.
• Most superficial tumors do not require advanced imaging and are assessed by cystoscopy with cytology.

SUSPECTED
• Urology consultation for cystoscopy is preferred; however, CT abdomen and pelvis without and with contrast (CPT 74170 and 72194) can be performed prior to Urology consultation for suspicious clinical situations in accordance with AB-42 Hematuria in the Abdomen guidelines.

INITIAL WORKUP, DIAGNOSIS
• For many lesions, cystoscopy with transurethral resection (TURBT), along with bimanual exam under anesthesia (EUA), is both diagnostic and therapeutic. EUA should be documented in the clinical record.
• CT abdomen and pelvis (CPT 74170 and 72194) for any muscle invasive bladder cancer, for sites other than bladder, and/or anytime all gross disease cannot be resected for technical reasons.
  o MRI abdomen and pelvis (CPT 74183 and 72197) if contrast is medically contraindicated or to answer specific surgical questions.
• CT chest (CPT 71260) only to address abnormalities seen on other imaging studies, or if metastatic disease to other organs is suspected, or for histologies other than transitional cell carcinoma.
• Bone Scan should be the initial study for bone pain or suspicion of skeletal disease, unless neurologic compromise is evident; see ONC-27.4 Metastatic Cancer Bone (and Spine).

RE-STAGING/RECURRENCE
• Superficial Transitional Cell Carcinomas do not require advanced imaging for re-staging.
• CT abdomen and pelvis (74160 or 74170 and 72193 or 72194) as baseline and for re-staging, for the following:
  o Following cystectomy for any indication
  o Muscle invasive bladder cancer
  o Ureter or renal pelvis tumor
  o Histologies other than transitional cell carcinoma (TCC)
  o Symptoms suggesting recurrence
• MRI (CPT 74183 and 72197) may be performed instead of CT for tumors of the upper GU tract or prostate.
• CT chest, MRI, or CNS imaging is only indicated for symptoms or if other modalities suggest metastatic disease.
SURVEILLANCE

- For superficial and minimally invasive (Tis and T1) transitional cell carcinoma of the bladder with no additional risk factors:
  - Clinical follow up with cystoscopy only – no advanced imaging is needed.
- CT abdomen and pelvis (CPT 74160 and 72193) every 3 to 6 months for two years, then as clinically indicated for Muscle Invasive Bladder Cancer, for histologies other than transitional cell carcinoma, or for Upper GU tumors.
- If cystectomy shows less than muscle invasive (t3) disease, then surveillance CT scans are not indicated other than one set of baseline postoperative imaging studies.
- MRI (CPT 74183 and 72197) may be substituted for CT for tumors of the upper GU tract or prostate.
- Chest x-ray annually.
- CT chest (CPT 71260) only for abnormalities on chest x-ray or if metastatic disease is suggested on other modalities.
- Bone Scan for development of unexplained skeletal pain.
- MRI of bone or spine only for documented neurological compromise, for unexplained bone scan or plain x-ray findings, or when clinical suspicion remains high in spite of a negative bone scan.
- PET is not indicated in these urothelial (transitional cell) tumors for any indication.

ONC-18 ~ PROSTATE CANCER

- Also see PET-12.2 Prostate Cancer in the PET guidelines.
- A very common cancer of older men, yet the optimal therapy for this disease is poorly defined due to the lack of prospective, randomized studies and because the natural history of prostate cancer is highly variable.
  - Recent updates of the American Urologic Association's Prostate Cancer guidelines continue to offer observation only as a reasonable therapeutic option, along with surgery and radiation therapy.
- Metastatic spread is usually to the skeleton, and is almost always evaluated sufficiently by nuclear bone scan supplemented by plain x-rays.
  - If skeletal metastatic disease is suspected, clinicians should have any prior CT scans reviewed with bone windows.

SUSPECTED

- Currently, most men diagnosed with prostate cancer are asymptomatic with normal physical examinations.
- All men over age 40 with new onset back pain, urinary symptoms, and/or neurologic signs below the diaphragm should be evaluated by PSA and digital rectal exam (DRE).
- Trans-rectal ultrasound (TRUS), PSA, and Digital Rectal Examination (DRE) are critical evaluations for any man with suspected prostate cancer.
- CT and/or MRI are contraindicated prior to biopsy.

INITIAL WORKUP, DIAGNOSIS

- Chest x-ray, routine labs
- Most decisions concerning therapy are driven by pre-diagnostic PSA, Gleason score and DRE findings.
• Pelvic CT (CPT 72193) (preferred) or pelvic MRI without and with contrast (CPT 72197) can be performed to evaluate the following:
  o Palpable disease possibly extending outside of the prostate (T3,4)
  o Tumor with Gleason grade \( \geq 7 \)
  o Patients with PSA greater than 20
  o Other suspicious physical exam findings or specific factors indicating a higher than 20% risk of nodal disease.
  o References:
    - *J Urol* 2004;171:2122-2127
    - *Urology* 1999;54:490-494
    - *Radiology* 2006 Feb;238(2):597-603
• MRI pelvis can be considered in addition to CT pelvis for high risk patients prior to prostatectomy, but only if ordered by the attending urologic surgeon.*
  *J Urology* 2005;174:2158-2162
• A decision to choose expectant management (watchful waiting) does not indicate a need for any imaging.*
  *AUA and NCCN Guidelines
• CT abdomen with contrast (CPT 74160) can be performed for any suggestion of abnormal lymphadenopathy or GU pathology on pelvic CT, elevated creatinine, hematuria, or heme-occult positive stools.
• Bone scan should be the initial study for high risk patients, for bone pain, or suspicion of skeletal disease, unless neurologic compromise is evident; see ONC-27.4 Metastatic Cancer Bone (and Spine).
  o Skeletal MRI is indicated only after bone scan has been performed and clinical suspicion remains high for metastatic disease, or for neurologic compromise.
  o If cord compression is suspected, and neurologic findings are well documented, MRI of the entire spine without and with contrast (cervical—CPT 72156, thoracic—CPT 72157, lumbar—CPT 72158) is appropriate.
  o If skeletal metastatic disease is suspected, clinicians should have any prior CT scans reviewed with bone windows.
• PET for diagnosis and initial staging is not indicated.

**RE-STAGING/RECURRENCE**

• All patients should be followed with PSA and digital rectal exam.
• Chest imaging is rarely helpful.
  o Chest CT (contrast as requested) only if chest x-ray is abnormal
• No advanced imaging is indicated routinely following local therapy unless the patient is first evaluated by at least two PSAs which suggest a risk of recurrence.
• CT abdomen and pelvis with contrast (CPT 74160 and 72193) for PSA above 0.2 postoperatively, or for three consecutive rising PSAs above 2.0 following radiotherapy.
  o MRI is not appropriate for PSA-only relapse. However, MRI can be considered to explain palpable abnormalities or radiographic findings, if its use will impact subsequent therapeutic decisions.
• Men with high risk factors may choose to receive adjuvant radiotherapy immediately following prostatectomy, or may choose to be observed.
  o Imaging does not add to this clinical decision*
• CT abdomen and pelvis with contrast (CPT 74160 and 72193) prior to adjuvant or salvage radiotherapy, only if not previously done.
- Bone scan for suspicion of bone metastasis, as discussed above.
- PET is rarely indicated; see PET-12.2 Prostate Cancer in the PET guidelines for specific exceptions.
- In patients requiring salvage local therapy for recurrence, some centers advocate use of ProstaScint scan, a nuclear medicine study.
  - ProstaScint (CPT 78803) does not require preauthorization by MedSolutions at this time.
  - The results of outcomes from ProstaScint are inconsistent; therefore, no recommendations concerning use of this study can be made at this time.
  - Combined use of ProstaScint along with diagnostic CT (fused SPECT/CT) is considered investigational.

SURVEILLANCE/FOLLOW UP
- Primarily done with physical exam and PSA every 6 months, even in patients with advanced stage disease.
- Routine advanced imaging for surveillance is not indicated.
- Advanced imaging can be performed to assess response of chemotherapy in Hormone Refractory Prostate Cancer (HRPC).
  - CT with contrast of the body area previously found to have soft tissue disease is appropriate.
  - Bone scan is the study of choice for assessing response to therapy for skeletal metastasis, since MRI will remain falsely positive.

ONC-19~ TESTICULAR and NONEPITHELIAL OVARIAN (GERM CELL) CANCER
- Also see PET-12.5 Testicular Cancer (Germ Cell Tumors) in the PET guidelines.
- These guidelines are for germ cell tumors of the testicle and any extragonadal site.
  - Ovarian germ cell tumors are managed similarly to testicular cancer, except as noted below.
- Requests for imaging must state the histologic type of the cancer being evaluated.
- Classified as pure seminomas (dysgerminomas) (40%) or Non-seminomatous germ cell tumors (NSGCT)
  - Mixed tumors are treated as NSGCTs, as they tend to be more aggressive.
  - The NSGCT histologies include:
    - Yolk-Sac tumors
    - Immature (malignant) teratomas
    - Choriocarcinomas (<1%)
    - Embryonal cell carcinomas (15%-20%)
    - Endodermal Sinus Tumors (ovarian)

SUSPECTED
- Hard painless mass in the testicle or as stated in ONC-20 Ovarian Cancer.
- Symptoms similar to “morning sickness” of pregnancy.
- Anterior mediastinal mass on chest x-ray in a young adult male.
- Prior to resection, the patient should be evaluated by thorough physical exam, alpha fetoprotein (AFP), beta-HCG, chest x-ray, and chemistry profile including LDH, and CBC.
  - Ultrasound (pelvic or testicular) is suggested but is not required if physical exam is unequivocal.
• Advanced imaging is not indicated prior to resection, unless an extragonadal site is suspected from the above studies.

INITIAL WORKUP, DIAGNOSIS
• For males, Orchiectomy is both diagnostic and therapeutic, and should be accomplished promptly prior to advanced imaging.
• Following orchiectomy/oophorectomy:
  o CT chest, abdomen and pelvis with contrast (CPT 71260, 74160 and 72193).
  o Brain MRI without and with contrast (CPT 70553) if neurologic signs/symptoms are present.
    ➢ Rarely, head MRI without and with contrast is indicated for NSGCT with very high tumor markers.
  o Bone scan if suggested by clinical symptoms.
• PET is not indicated for initial work-up.
• Body MRI is not considered a substitute for CT in testicular cancers and should only be considered in unusual cases.

RE-STAGING/RECURRENCE
• Re-staging is not indicated unless abnormalities were detected during initial post-orchiectomy work-up; otherwise, patients should proceed to surveillance.
• If extragonadal masses were confirmed during initial work-up:
  o Repeat all laboratory studies and chest x-ray.
  o CT with contrast of that body area only is indicated for re-staging of seminomas.
  o PET for seminomas, not NSGCT, if residual mass is persistent.
  o CT chest/abdomen/pelvis with contrast (CPT 71260, 74160, 72193) for re-staging NSGCT following full course of planned chemotherapy or after retroperitoneal lymph node dissection (RPLND).
• Suspected recurrences should be worked-up according to initial work-up guidelines, including ultrasound of the remaining gonad. Re-biopsy should be considered but is not mandatory.
  o Re-biopsy is strongly suggested if the clinical picture suggests development of non-seminomatous histology in a patient previously diagnosed with pure seminoma.
  o PET can be performed to characterize residual pure seminoma mass following chemotherapy.
  o PET is not considered reliable for non-seminomatous histologies.
  o CT chest/abdomen/pelvis with contrast (CPT 71260, 74160, 72193) if there is elevation of tumor markers which had previously normalized.

SURVEILLANCE
• Frequent clinical follow-up with laboratory work and chest x-ray are the hallmark of surveillance.
• PET scan is not appropriate for surveillance.
• For Stage I Ovarian Dysgerminomas or low grade immature Teratomas:
  o No imaging necessary, assess with periodic physical examination and laboratory studies
• For Stage I seminoma treated with radiotherapy or chemotherapy:
  o CT abdomen and pelvis with contrast (CPT 74160 and 72193) annually for three years.
• For Stage I seminoma not treated with radiotherapy or chemotherapy:
  o CT abdomen and pelvis with contrast (CPT 74160 and 72193) every 3 to 4 months for years 1 through 3, then every 6 months up to year seven, then annually thereafter.

• For higher stage seminomas or dysgerminaomas, and for any recurrent seminomas,
  o CT abdomen and pelvis with contrast (CPT 74160 and 72193) at 4 months post-therapy, then:
    ➢ annually for 3 years if previous nodal burden was less than 5 cm (Stages IIA, IIB) or
    ➢ every 3 months until stable, then annually for metastatic or bulky nodal (Stage IC or higher) disease.

• For Non-seminomatous germ cell tumors, Stage I, not treated by additional surgery or chemotherapy:
  o CT abdomen and pelvis with contrast (CPT 74160 and 72193) every 2 to 4 months for first two years, then every 4 to 6 months for next two years, then annually until year 7, then every two years thereafter.

• For Non-seminomatous germ cell tumors, Stage II and higher, all other female germ cell tumors not listed above, treated with chemotherapy or RPLND, or for recurrent tumors:
  o CT abdomen and pelvis with contrast (CPT 74160 and 72193) every 6 months for first two years, then annually until year 7, then every two years thereafter.

• Chest CT with contrast (CPT 71260) may be added to above surveillance plans if previous thoracic disease was detected, or for abnormal chest x-ray.

• Brain MRI without and with contrast (CPT 70553) or bone scan if suggested by clinical symptoms.

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**ONC-20~ OVARIAN CANCER**

- Also see PET-13.1 Ovarian Cancer in the PET guidelines.
- Commonly occurs in advanced age (median age at time of diagnosis is 63 years old).
- Referral to and management by a gynecologic oncologist is helpful in determining the appropriate imaging pathway for these patients.
- Most ovarian cancers are epithelial cancers.
  - Less common histologies include borderline epithelial cancers (or epithelial ovarian cancer of low malignant potential), germ cell tumors, mixed Mullerian tumors, and stromal tumors.
  - Germ Cell Tumors may be managed according to ONC-19 Testicular and Nonepithelial Ovarian (Germ Cell) Cancer.

**Screening for Ovarian Cancer**
- Premenopausal patients at high risk (defined as low parity, decreased fertility, delayed childbearing, family history of ovarian cancer, hereditary ovarian cancer syndrome that includes ovarian, breast, and/or endometrial and gastrointestinal cancers [Lynch II syndrome] in multiple members of two to four generations) should undergo transvaginal ultrasound with Doppler.
  - Screening ultrasounds should be performed every 12 months if there is no mass on physical examination.
  - CA125 is less helpful
Post menopausal patients at high risk (see above definition) should be screened for ovarian cancer every year with CA 125 level and transvaginal ultrasound with Doppler.

Reference:
- ACR Appropriateness Criteria, Ovarian Cancer Screening, 2005

SUSPECTED
- Malignancy may be suggested by cytology from pelvic examination.
- Ovarian cancer should be considered in any elderly woman with lower extremity edema, abdominal distention, pelvic mass, or ascites.
- Chest x-ray and ultrasound are preferred as the initial imaging studies.

INITIAL WORKUP, DIAGNOSIS
- Laboratory tests including LFTs and CA-125
  - Serum beta-HCG, and alpha-fetoprotein (AFP) levels should be obtained if germ cell tumor is suspected.
- Chest x-ray
- CT abdomen and pelvis with contrast (CPT 74160 and 72193) only for specific clinical indications following ultrasound.
- Consider GI and GU evaluations.
- Timely histologic confirmation of neoplastic disease is extremely important. Most tumors are diagnosed and staged by laparotomy.
  - Patients who are not surgical candidates or who are felt to need neoadjuvant chemotherapy must have a histological diagnosis with FNA, core needle biopsy, open biopsy, or by paracentesis cytology.
  - Chest CT with contrast (CPT 71260) if chest x-ray is abnormal or for symptoms suggestive of thoracic metastasis.
  - PET scan is not indicated for the initial diagnosis or staging.

RE-STAGING/RECURRENCE
- For completely resected disease with elevated preoperative markers:
  - If markers have normalized, no further imaging is indicated.
- For completely resected disease and unknown preoperative labs, or for incompletely resected disease:
  - CT abdomen and pelvis with contrast (CPT 74160 and 72193) as baseline
  - Following chemotherapy, repeat of all labs which were elevated preoperatively.
- For elevated CA-125 or other tumor markers (confirmed by repeat labs) or for physical examination abnormalities:
  - CT chest/abdomen/pelvis with contrast (CPT 71260, 74160, 72193).
  - PET if CT scans are negative and CA-125 continues to rise
    - If PET is not obtained, repeat CT scans (chest, abdomen, pelvis) can be obtained after a minimum of 60 days
- For elevation of LFTs in the absence of other clinical abnormalities:
  - CT abdomen and pelvis with contrast (CPT 74160 and 72193).
- MRI scans (contrast as requested) may be substituted for CT if CT scan is contraindicated or equivocal.
• Repeat PET scan to document response to therapy can be considered if prior conventional imaging failed to demonstrate tumor or if persistent radiographic mass is seen.

SURVEILLANCE
• Clinical exams and CA-125, chemistry profiles, and other indicated tumor markers every 2 to 4 months for first 2 years, then every six months for 3 years, then annually.
• Chest x-ray, CT abdomen and pelvis with contrast (CPT 74160 and 72193) every six months for three years, for high risk patients, according to clinician’s judgment of risk for recurrence, or for elevated tumor markers or labs.
  o CT chest (CPT 71260) if other studies suggest a possible thoracic finding.
  o PET for elevation of CA-125 and negative conventional imaging.

ONC-21 ~ UTERINE CANCER
• Also see PET-13.3 Uterine/Vaginal/Vulvar in the PET guidelines.
• The most common female genital tract cancer.
• Although curable in most cases, this disease can occasionally be very aggressive.
• Overall death rate from this cancer is increasing.

SUSPECTED
• Must be suspected in any post-menopausal female with new onset unexplained vaginal bleeding.
• No imaging is required; patient should be evaluated with endometrial biopsy.
• Transvaginal ultrasound can be helpful in most cases.

INITIAL WORKUP, DIAGNOSIS
• Chest x-ray, routine labs only.
• No advanced imaging is routinely required.
  o Pelvic MRI without and with contrast (CPT 72197) is appropriate if cervical or extrauterine disease is suspected.

RE-STAGING/RECURRENCE
• Re-staging is indicated in unresectable, medically inoperable, or incompletely surgically staged patients.
  o Abdomen/Pelvis CT with contrast (CPT 74160 and 72193) or MRI without and with contrast (CPT 74183 and 72197).
  o Chest x-ray
  o CT chest (CPT 71260) if extensive intra-abdominal disease is found on abdominal imaging, for abnormalities found on chest x-ray, or for patients with uterine sarcomas.
  o CA-125 if extra-uterine pathology is suspected.
  o CT chest/abdomen/pelvis with contrast (CPT 71260, 74160, 72193) for any suspected recurrence.
SURVEILLANCE

- Physical examination every three months for two years, then annually.
- Chest x-ray annually, more frequently for aggressive histologies.
- Advanced imaging is not indicated routinely for asymptomatic patients with unchanged physical exams.
- CT abdomen and pelvis with contrast (CPT 74160 and 72193) for change in symptoms or examination, or as clinically indicated for at-risk sarcomas.

ONC-22—CERVIX CANCER

- Also see PET-13.2 Cervical Cancer in the PET guidelines.
- The third most common cancer in women worldwide, although the incidence in developed countries is decreasing.
- Strongly associated with Human Papilloma Virus infection.
- Other risk factors include smoking, multiple sexual partners, and early age of coitus.

SUSPECTED

- Most cases in the United States are asymptomatic and found with screening cytology (Pap smear).
- Symptoms for early stage tumors include watery discharge and abnormal vaginal bleeding, especially post-coital.
- Symptoms for advanced tumors may be pelvic pain, edema, and/or bowel and bladder habit changes.
- Diagnosis must be confirmed by biopsy following full pelvic examination.

INITIAL WORKUP, DIAGNOSIS

- Staging is primarily by physical examination.
- For any tumor less than 4 cm confined to the cervix (Stage IB1 or less):
  - CT abdomen and pelvis with contrast, (CPT 74160 and 72193) and chest x-ray are appropriate, but optional.
- For Stage IB2 or higher stages:
  - CT chest/abdomen/pelvis with contrast (CPT 71260, 74160, 72193) or PET scan.
  - MRI abdomen and pelvis without and with contrast (CPT 74183 and 72197) may be substituted for CT.
  - Abdomen/Pelvis CT (CPT 74160 and 72193) or MRI (CPT 74183 and 72197) and chest x-ray should be performed for incidental cervical cancer found in a hysterectomy specimen.

RE-STAGING/RECURRENCE

- Re-staging is indicated for:
  - Advanced disease (defined as distant metastases or nodal disease present initially).
  - Locally advanced disease requiring chemotherapy and/or radiotherapy.
- CT chest/abdomen/pelvis with contrast (CPT 71260, 74160, 72193) or PET can be performed for re-staging or to evaluate suspected recurrence.
- PET is contraindicated until 120 days post-radiotherapy.
SURVEILLANCE

- Predominantly with physical examination. Requests for imaging for surveillance will not be considered without documentation of a recent pelvic examination.
- For Stages less than 1B1, no advanced imaging is indicated.
- For higher stages, CT abdomen and pelvis with contrast (CPT 74160 and 72193) and chest x-ray annually.
- CT chest (CPT 71260), PET, and shorter intervals between the above studies if indicated by changes in symptoms, physical examination, or to follow previously questionable imaging findings.
- Routine use of PET for surveillance is not indicated.

ONC-23 ~ ANAL CANCER, VAGINAL CANCER AND CANCERS OF THE EXTERNAL GENITALIA

- Also see PET-13.3 Uterine/Vaginal/Vulvar and PET-11 Gastrointestinal Tumors (for anal carcinomas) in the PET guidelines.
- Most are squamous cell carcinomas, although some transitional and cloacogenic carcinomas are seen.
- Tumors reported as adenocarcinomas of the anal canal should be treated as rectal cancers.
- Tend to occur in the elderly and can be associated with exposure to Human Papilloma Virus and/or HIV.
- Geographic location of the primary site should be carefully defined.
- Squamous cell carcinomas of the perianal and perigenital areas are essentially skin cancers.

SUSPECTED

- Sensation of mass, itching, or any bleeding lesion.
- Tumors are usually visually seen and/or palpated. Biopsy should proceed without delay.
- Consider evaluation of HIV status.
- Females should have full gynecologic evaluation, as some tumors may actually represent local extension of cancers arising in other gynecologic organs.
- Advanced imaging prior to biopsy is not indicated.

INITIAL WORKUP, DIAGNOSIS

- Abdominal/Pelvic CT with contrast (CPT 74160, 72193) or MRI without and with contrast (CPT 74183, 72197).
- CBC and full chemistry panel, including LFTs.
- Anoscopy or flexible sigmoidoscopy, if indicated.
- Careful evaluation of inguinal lymph nodes.
  - Consider FNA or biopsy of suspicious lymph nodes.
  - Repeat advanced imaging of suspicious lymph nodes in lieu of biopsy is not appropriate.
- Chest x-ray
- Chest CT with contrast (CPT 71260) if lymph nodes are positive, if symptoms raise clinical suspicion, or for elevated LFTs.
- PET scan may be approved for any Squamous Cell Carcinoma of the Anal Canal (not Anal Margin).
RE-STAGING/RECURRENCE

- Re-staging is not indicated if primary disease has been surgically managed.
- Many of these cancers are treated by radiation therapy, with or without chemotherapy.
  - Response is assessed by direct palpation.
  - Biopsy only after serial examinations.
- Advanced imaging for re-staging is not generally indicated.
- Abdomen/Pelvis CT with contrast (CPT 74160 and 72193) or MRI without and with contrast (CPT 74183 and 72197) can be performed for re-staging the following patients:
  - Lymph nodes initially positive
  - Recurrent disease
  - Metastatic disease
- For any biopsy proven recurrence, CT chest/abdomen/pelvis with contrast (CPT 71260, 74160, 72193) can be obtained.
- Bone scan, brain MRI without and with contrast (CPT 70553) if symptoms indicate.
- PET may be approved for Anal Canal Carcinoma, if the initial staging study was PET avid and not easily evaluated on other imaging tests or by physical examination.

SURVEILLANCE

- Primarily by direct palpation, careful examination of the inguinal lymph node areas, and annual chest x-ray.
- Anal cancers should be followed with serial anoscopy.
- For tumors initially 5 cm or greater, or for tumor previously found to have lymphadenopathy, abdominal/pelvic CT with contrast (CPT 74160 and 72193) or MRI without and with contrast (CPT 74183 and 72197) can be performed every six months for five years.
- PET is not indicated for routine surveillance of these cancers.

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ONC-24 ~ MULTIPLE MYELOMA AND PLASMACYTOMAS

- Also see PET-16 Multiple Myeloma and Plasmacytomas in the PET guidelines.
- Multiple myeloma is a plasma cell neoplasm and is essentially a disease of the bone marrow, manifesting either as diffuse involvement of the marrow throughout the skeleton, or as plasmacytomas in multiple sites.
- Solitary plasmacytoma is a diagnosis, usually of bone, where malignant plasma cells are present in a single site, but the systemic blood tests to establish the diagnosis of multiple myeloma are negative or equivocal. Extramedulary plasmacytomas are rare.
- Waldenstrom’s macroglobulinemia (WM) is a rare myeloma-like disease which can diffusely involve multiple visceral organs.

SUSPECTED

- Bone pain, especially in an elderly patient, with proteinuria is a classic presentation for myeloma. Many cases are minimally symptomatic when first discovered.
  - Plain x-rays of any area having pain or tenderness should be obtained without delay, along with urinalysis and CBC.
- Advanced imaging is not indicated for Monoclonal Gammopathy of Unknown Significance (MGUS) until previously stable labs begin to worsen.
INITIAL WORKUP, DIAGNOSIS

- The establishment of myeloma requires (with certain exceptions) all three of the following:
  - The presence of a monoclonal plasma protein (M-protein) in the urine or serum.
  - Monoclonal cells in the bone marrow and/or presence of a biopsy proven plasmacytoma.
  - Myeloma related organ dysfunction, including radiographic abnormalities, as well as hypercalcemia, elevated creatinine, anemia, etc.

- Imaging may include the following:
  - Skeletal x-ray survey
  - CT can be performed for areas of skeleton if required for decisions concerning radiotherapy and/or surgery, or if extraosseous plasmacytoma is suspected.
  - MRI, without and with contrast, of the cervical, thoracic, and lumbar spine and pelvis (CPT 72156, 72157, 72158, 72197) or MRI Bone Marrow Survey (CPT 77084).
  - PET, if solitary plasmacytoma or "smoldering" myeloma is suspected, can be performed to confirm early stage disease.
  - Bone scan is usually not contributory, but can be helpful in certain cases.

RE-STAGING/RECURRENCE

- Re-staging is done primarily by repeating serum blood tests.
- Imaging is not usually required for re-staging, except to define response to therapy.
  - CT, with or without contrast, of any area previously known to have plasmacytoma.
  - CT chest, abdomen, pelvis (contrast as requested) to re-stage Waldenstrom’s macroglobulinemia.
  - CT or MRI of symptomatic areas, if laboratory tests obtained for re-staging fail to normalize.

- MRI without and with contrast of the cervical, thoracic, and lumbar spine (CPT 72156, 72157, 72158) in patients with known lesions of the spine who develop new neurological signs/symptoms, or if response to therapy is in doubt because routine labs are equivocal.
  - CT with contrast, of any body area, if extra-osseous plasmacytoma is suspected.
  - PET is appropriate if a patient with previously diagnosed early stage disease has symptoms suggesting progression.
  - Neither PET nor skeletal MRI is appropriate for routine monitoring of therapy.
  - PET can be approved if a negative PET will allow the oncologist to change a patient’s management plan from active treatment to surveillance.
  - MRI, entire spine and pelvis, without and with contrast (CPT 72156, 72157, 72158, 72197) if patient is under consideration for bone marrow transplant.
    - One series of MRI scans be obtained before and after transplant.
    - Further follow-up imaging is not routinely indicated.

SURVEILLANCE

- Laboratory studies every month to every three months, as clinically indicated
- Plain skeletal x-rays for symptoms or annually.
- CT or MRI, contrast as requested, for areas that are symptomatic and have changes on plain films.
- For plasmacytomas, CT or MRI, contrast as requested, every six months for two years, then annually.
• For Waldenstrom’s macroglobulinemia, CT, contrast as requested, every 3 to 6 months, only for areas with previously documented abnormalities.
• Routine PET scan for surveillance is not indicated.

**ONC- 25 ~ LEUKEMIA**

• While most leukemia patients do not require advanced imaging, brain MRI without and with contrast (CPT 70553) can be performed in high risk patients, patients exhibiting CNS symptoms, and in patients found to have obvious positive CNS cytology.

**ONC-26~ LYMPHOMAS**

• Also See [PET-15 Lymphomas](#) in the PET guidelines.
• This guideline covers both Hodgkin’s and Non-Hodgkin’s (NHL) lymphomas. While the natural history and treatment of these are significantly different, the decision rationale for advanced imaging is frequently similar.
• Classic “B” symptoms (weight loss >10%, fever, drenching night sweats) were first described for Hodgkin’s, but can occur with either disease.
• Both diseases can occur at any age with the greatest risk of developing either Hodgkin’s or Non-Hodgkin’s lymphoma is in the 6th and greater decades of life.
• Non-Hodgkin’s lymphoma can present as a solid appearing tumor in organs known to be at risk for carcinomas, such as the breast, pancreas, salivary glands, etc., and histologic differentiation of lymphoma versus a benign lymphocytosis can be difficult.
  o This is an important reason why biopsy and histologic confirmation of cell type is emphasized early in the work-up of any such mass.
• CT scans are recommended to be performed with contrast only; however, other contrast regimens are allowable, if clinically justified.
• MRI in lymphomas is usually inappropriate, except to confirm skeletal and/or neurological involvement.

**SUSPECTED**

• Classic “B” symptoms, fatigue, elevated LDH.
• Unexplained persistent painless lymphadenopathy after a trial of antibiotics (7-10 days), should lead to consideration of biopsy.
• Chest x-ray, CT (contrast as requested) of affected area.
  o CT chest/abdomen/pelvis with contrast (CPT 71260/74160/72193) can be performed for a patient with “B” symptoms and elevated labs, following detailed physical examination.
  o Usually CT scans of chest/abdomen/pelvis are inappropriate in the setting of palpable lymphadenopathy prior to biopsy
• PET is inappropriate prior to attempt at histologic confirmation of disease, except as discussed under [PET-17.3 Generalized Lymphadenopathy](#) in the PET guidelines.

**INITIAL WORKUP, DIAGNOSIS**

• Following histologic confirmation, work-up includes standard lab tests, including ESR, LDH, albumin, and bone marrow biopsy.
• CT chest/abdomen/pelvis with contrast (CPT 71260, 74160, 72193) if not already done.
  o CT scans for Chronic Lymphocytic Leukemia/Small Lymphocytic Lymphoma (CLL/SLL) are unnecessary, unless lymphadenopathy is suspected.
CT neck with contrast (CPT 70491) is usually unnecessary, but can be performed if clinically justified.

PET can be obtained if needed to confirm lower stage disease or to clarify findings on CT scan.
  - PET is only recommended for Hodgkin’s, Follicular, Mantle Cell, Mycosis Fungoides, and all aggressive sub-types of lymphoma.
  - If PET is unavailable Gallium-67 nuclear scan is an acceptable alternative.
  - For the purposes of this guideline, aggressive subtypes include Diffuse Large B-Cell (DLBCL), DLBCL mixed with other histologies, anaplastic large-cell, peripheral T-cell lymphomas, and AIDS-related lymphomas.

**RE-STAGING/RECURRENT**

- All imaging requests must clearly document the diagnosis with cell subtype of lymphoma which is being evaluated.
- Chest x-rays, labs, including ESR, LDH.

**For re-staging following 3 to 4 cycles of chemotherapy (minimum 8 weeks):**
  - Repeat CT scans, with contrast, of body areas previously positive.
  - Additional re-staging is warranted, minimum 8 weeks, if less than complete response was noted on first re-staging.
  - Repeat all CT scans when chemotherapy is completed.

**For Hodgkin’s and aggressive non-Hodgkin’s lymphomas, PET is appropriate after 4 cycles to assess response to therapy.**
  - One additional repeat PET is indicated after an additional 4 cycles of chemotherapy or following radiotherapy.
  - Once PET becomes negative, additional PET scanning is discouraged.
  - PET should not be performed for at least 3 weeks following conclusion of chemotherapy or 8 to 12 weeks after conclusion of radiation therapy.

- For other Non-Hodgkin’s lymphomas and for mycosis fungoides, a single PET for re-staging can be performed for less than complete response, when pre-treatment PET demonstrates FDG-avid disease.
- If complete response (CR) is documented on CT scans and labs, no additional imaging is necessary for re-staging; patient goes on to surveillance.
- For indolent and intermediate grade lymphomas, conventional imaging of previously involved areas is usually sufficient.
- Patients with evidence of recurrence or progression of disease may undergo staging work-up as stated in the “Initial Diagnosis” section above.

**SURVEILLANCE**

- Annual CT scans with contrast for 5 years of areas not previously involved.
- CT scans with contrast of areas previously involved, along with chest x-ray, labs, clinical follow-up, every 3 to 6 months for first 2 to 3 years, then annually for additional 5 years.
- PET is not indicated for routine surveillance, with the following exceptions:
  - To confirm absence of lymphoma in a radiographically persistent CT abnormality.
  - When repeated lab tests such as LFTs or ESR become elevated after previously being normalized, and CT scans are negative.
ONC-27 ~ METASTATIC CANCER and CARCINOMAS OF UNKNOWN PRIMARY SITE

The following site specific discussions concern patients who have a history of malignancy known to place the patient at risk for metastatic disease.

ONC-27.1 Lung
- Lung and/or mediastinl metastases are can arise from nearly any site and malignancy type and should be suspected in a patient with a history of cancer and worsening fatigue, cough, hemoptysis, dysphagia, pneumonia, vocal cord paralysis or pleural effusion
  - Vocal cord paralysis frequently indicates lymphadenopathy near the “aorto-pulmonary window” of the mediastinum.
  - Intrathoracic disease frequently causes dysphagia from growth of paraesophageal and subcarinal lymph nodes.
- Cytology from thoracentesis or sputum may be helpful.
- CT chest with contrast (CPT 71260) if symptoms and history are highly suggestive, or if chest x-ray shows abnormality.
  - MRI is rarely indicated unless needed to define chest wall or brachial plexus pathology.
  - CT chest without contrast (CPT 71250) is appropriate for history of sarcoma or if contrast is contraindicated.
- PET scan is inappropriate if chest is normal. If chest CT demonstrates pathology of greater than 7 mm, then PET may be considered.
  - NOTE: Certain payers consider PET scan investigational for evaluating pulmonary nodules ≤1 cm or lung masses >4 cm. Their coverage policies will take precedence over MedSolutions’ guidelines. Prior authorization does not guarantee payment of the study.
- PET is especially indicated to confirm that an isolated appearing metastatic lesion is, in fact, a solitary metastasis.

ONC-27.2 Liver
- Liver metastases tend to come from any GI malignancy, lung, breast, gynecologic cancers, lymphoma, and melanoma.
- Liver metastases should be suspected in any patient with the above high risk malignancies who develop jaundice, unexplained weight loss, ascites, persistent (over 7 days) bowel changes, or increased abdominal girth.
- Liver metastases in the setting of completely normal LFTs and other tumor markers are extremely rare.
- CT abdomen with contrast (CPT 74160) is indicated for elevated labs, or if clinically justified with above signs and symptoms.
- MRI abdomen without and with contrast (CPT 74183) can be performed for the following:
  - If limited resection is assumed to confer a possible survival advantage.
  - To confirm first site of metastatic failure.
  - To clarify clinical questions remaining after CT.
- PET is indicated to confirm that an isolated appearing metastatic lesion, amenable to surgical resection is, in fact, a solitary metastasis.
  - PET is also indicated if LFTs and/or tumor markers continue to rise and above studies are negative.
  - PET is not indicated if CT scans and MRI scans demonstrate multi-system disease.
o PET is not indicated for those histologies known to have poor uptake of FDG, such as transitional cell carcinoma.

ONC-27.3 Brain

- Also see HD-24 Neuro-Oncology/Brain Tumors in the Head guidelines.
- Headache without other neurological signs is rarely caused by metastatic disease.
- Lung cancer, any small (oat) cell carcinoma, and melanoma very commonly give rise to CNS disease, even if the primary tumors are in early stages.
  - For these diseases, patients without neurologic signs/symptoms can undergo either head CT without and with contrast (CPT 70470) or brain MRI without and with contrast (CPT 70553) for staging when aggressive local therapy is being contemplated.
  - Brain imaging is not appropriate if the patient is asymptomatic and Stage IV disease is demonstrated elsewhere.
- Esophaphageal, Breast, and Renal Cell Cancers, and less frequently, other GI malignancies can cause metastatic disease to brain.
  - Advanced imaging is not indicated for these malignancies if the patient is asymptomatic.
  - Symptoms may be vague; frequently the earliest sign is a family member reporting change in moods in the patient.
  - For symptomatic patients, brain MRI without and with contrast (CPT 70553) is the study of choice, although alternative head imaging studies and contrast options requests by oncologists should be honored.
  - When a solitary metastasis is detected and if cancer elsewhere in the body appears to be stable or eliminated, then aggressive surgical resection or stereotactic radiosurgery can confer a survival advantage.
    - Both head CT and brain MRI, contrast as requested, can be considered appropriate for this limited indication if requested by the neurosurgeon or radiation oncologist considering such aggressive local therapy.
- PET is a poor study to evaluate the CNS, but a skull base to mid-thigh PET (CPT 78812 or 78815) is indicated in the setting of an apparently isolated brain lesion, to confirm the absence of other metastatic disease.

ONC-27.4 Bone (and Spine)

- Backache, osteoporosis, and arthritis are very common in the population at large; therefore, they are also common in oncology patients.
- Clinicians are strongly encouraged to perform careful clinical evaluations, including focused history and physical examination, in any oncology patient presenting with bone pain, prior to considering advanced imaging modalities.
- Lung, breast, prostate, renal cell and other urogenital cancers give frequent rise to bone metastases.

Bone scan, supplemented by plain x-rays, is the initial diagnostic imaging study of choice for suspicion of bone metastases, as geographic location of disease may not always correlate with subjective complaint of pain.*

*AJR 2005;184:1266-1273
  - Noncontrast CT can be useful to further clarify abnormalities seen on bone scan, plain x-ray, or other body imaging modalities.
  - Skeletal metastatic disease noted on bone scan in a weight bearing bone, or in the humerus, should periodically be evaluated by plain film to assess structural integrity.
- Orthopedic or Radiation Oncology evaluation can be helpful for the prevention of pathologic fracture.
- MRI, without and with contrast, is useful for diagnosing skeletal metastases in the following situations:
  - When clinical suspicion remains high in spite of negative bone scan or in light of equivocal findings on other imaging modalities.
  - When neurological compromise is evident.
  - When soft tissue component is suggested on other imaging modalities or physical examination.
  - To help differentiate neoplastic disease from Paget’s disease of Bone.
- PET is inappropriate if the above modalities have confirmed skeletal disease.

**ONC-27.5 Adrenal Gland**
- Adrenal metastases are frequently seen in lung and renal cell cancers.
- See [ABD-21 Adrenal Cortical Lesions](#) in the Abdominal guidelines:
  - CT abdomen with washout (CPT 74160 or 74170) should be performed to differentiate between benign adrenal adenoma and metastatic disease.
  - If more than two repeat CT scans are being considered to evaluate an adrenal lesion, then a more definitive method of diagnosis such as biopsy should be considered.
- Normally, no further work-up is necessary unless a solitary adrenal metastasis appears to be the only site of metastatic disease.
  - If local control of the primary tumor site is achievable, definitive surgical resection or radiotherapy of an adrenal metastasis is potentially curative.
  - CT-directed needle biopsy is the diagnostic procedure of choice.
  - MRI abdomen (contrast as requested) can be performed if CT is inadequate or contraindicated.

**ONC-27.6 Spinal cord compression**
- Spinal cord compression is suspected when there is clearly documented neurological compromise in a patient who has, or is suspected to have, a malignancy at risk for skeletal metastases (e.g. lung, breast, prostate, renal, cell, or other urogenital cancers).
  - Complete spinal cord compression is considered to be a therapeutic emergency since initiation of radiotherapy or surgical decompression within 24 hours of onset of symptoms has been shown to favorably restore neurological function in many cases.
  - If neoplastic disease has not been confirmed, immediate Neurosurgical, Orthopedic, or Interventional Radiology consultation for biopsy with immediate pathological evaluation is indicated.
  - Biopsy and initiation of therapy should never be delayed in order to perform additional work-up or radiographic search for a primary site.
- Classically, spinal cord compression presents with unexpected, sudden loss of bowel or bladder control, sudden loss of ability to ambulate, or complete loss of pinprick sensation corresponding to a specific vertebral level.
- Less often, a sign of spinal cord compression is loss of pain at a site that had previously been refractory to pain management.
- MRI of the entire spine (cervical, thoracic, and lumbar) without and with contrast (CPT 72156, 72157, and 72158) is indicated to evaluate for cord compression if the neurological signs described above are documented.
  - If MRI is unavailable or contraindicated, CT myelogram of the entire spine (CPT 72126, 72129, and 72132) can be performed.
• Pain, unilateral weakness, extremity tremors, unilateral change in reflexes and radicular symptoms may be signs of nerve root involvement, but probably not cord compression.
  o MRI without and with contrast of the appropriate spinal segment is appropriate in this setting.

**ONC-27.7 Carcinoma of Unknown Primary Site**

• Also see [PET-17.1 Carcinomas of Unknown Primary Site](#) in the PET guidelines.
• Defined as carcinoma found in a lymph node or in an organ known not to be the primary for that cell type, (e.g. adenocarcinoma arising in the brain or in a neck lymph node).
• Detailed history and physical examination, to include pelvic and rectal exams, labs, and chest x-ray should be performed initially.
• Clinicians should alert the pathologist that a search for an unknown primary site is underway, to ensure that any possible clues from the pathology specimen can be obtained.
• Patients presenting with a thoracic squamous cell carcinoma described as metastatic appearing on chest imaging, or in lymph nodes above the clavicle, should undergo a detailed head and neck examination by a clinician skilled in laryngeal and pharyngeal examinations, especially in smokers.
• Females found to have adenocarcinoma should undergo diagnostic mammography, regardless of how recent the previous mammogram was obtained, and full pelvic examination.
• CT scans of chest/abdomen/pelvis with contrast (CPT 71260, 74160, 72193) are indicated.
• CT or MRI of additional sites only if symptomatic.
• Bone scan is the initial imaging modality of choice for skeletal pain.
• PET is appropriate if the above studies have failed to clearly demonstrate site of primary.
  o If PET demonstrates primary site, then subsequent imaging decisions should be made according to guidelines for that site.
• Brain imaging (CT or MRI contrast as requested) may be obtained in patients without neurologic signs/symptoms if the results will change the therapeutic plan.
  o If neurologic signs/symptoms exist, brain MRI without and with contrast (CPT 70553) is appropriate and is the preferred imaging.

**ONC 27.8 Extrathoracic Small Cell Carcinomas**

• These can arise in virtually any site. The imaging decision pathways should be similar to those of Small Cell Carcinoma of the Lung ([see ONC-7 Lung Cancer](#)).

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**ONC-28 MEDICAL CONDITIONS WITH CANCER IN THE DIFFERENTIAL DIAGNOSIS**

**ONC-28.1 Fever of unknown origin (FUO):**

• While fever is a classic “B” symptom of advanced lymphoma, a cancer-related fever presenting in isolation without any other signs or symptoms of neoplastic disease is exceedingly rare.
• FUO is defined as a persistent body temperature of greater than or equal to 101°F (38.3 °C) for 3 weeks or longer without discovering the cause despite extensive investigation for at least one week.
• Careful head and neck and pelvic examination, to include digital rectal exam, must be performed, as these areas can harbor occult sources of fever and are frequently overlooked when multiple specialists become involved in a patient’s care.
• Chest x-ray and repeated battery of lab tests listed in most medical textbooks are the initial diagnostic procedures of choice. Any abnormalities found on these studies may focus appropriate imaging decisions.
• Echocardiogram may reveal cardiac valve vegetations.
• Abdominal ultrasound should be performed to evaluate pancreas, liver, spleen, and gallbladder.
• Any CNS signs/symptoms can be evaluated by brain MRI without and with contrast (CPT 70553).
• If all tests listed above remain non-contributory, CT scans of chest/abdomen/pelvis with contrast (CPT 71260, 74160, 72193) can be performed.
  o No other imaging is appropriate for FUO.
  o PET is not indicated in the work-up of patients with FUO.

O NC-28.2 Unexplained Weight Loss:
• Unexplained weight loss from neoplastic disease is very common in end-stage cancer; however, cancer-related weight loss presenting as the sole symptom without any other signs or symptoms related to the cancer is exceedingly rare.
• Careful attention to symptoms related to dysphagia, early satiety, and food intake may indicate a problem with the upper GI system.
  o Endoscopy and/or barium swallow, and a detailed examination of the oral cavity, pharynx and upper esophagus should be performed.
• Panhypopituitarism or hyperthyroidism may give rise to weight loss.
  o A thorough endocrine evaluation, including tests for TSH and ACTH, is indicated.
  o Any abnormality of pituitary hormones may indicate a need for MRI of the sella turcica (CPT 70553).
  o Elevated thyroglobulin level may indicate a need for nuclear thyroid scan or thyroid ultrasound.
• Renal, hepatic, and cardiac pathologies must be carefully ruled out using lab tests and imaging studies such as echocardiogram and abdominal ultrasound.
• Weight loss associated with anemia may suggest occult GI bleeding and/or hypogonadism.
  o Serial tests for heme in stools and endocrine evaluations for gonadal function may be helpful.
• Depression and early dementia may be causes of weight loss.
  o Detailed neurological examination should be performed.
  o When considering such etiologies, care must be taken to consider that the weight loss may be intentional but not disclosed for reasons of secondary gain.
• Unintentional weight loss may be an infrequent side effect of commonly prescribed medications and over-the-counter medications. Careful history taking is recommended.
• Chest x-ray should be performed.
• If all of the above considerations fail to suggest an obvious abnormality, CT of abdomen and pelvis with contrast (CPT 74160 and 72193) can be performed.
• PET is not appropriate in the work-up of patients with unexplained weight loss.

O NC-28.3 Paraneoplastic Syndromes
• Also see PN-6 Muscle Disorders in the Peripheral Nerve Disorders guidelines.
• Paraneoplastic syndromes are metabolic and neuromuscular disturbances not directly related to a tumor or to metastatic disease.
• Almost any tumor can give rise to these syndromes, but they are most commonly associated with lung cancer (especially Small Cell Lung Cancer).
• The following are the most common symptoms of paraneoplastic syndromes known to arise from various malignancies, but especially found in patients with lung cancer:
  o Hypertrophic Pulmonary Osteoarthropathy.
    ➢ Usually presents as a constellation of rheumatoid-like polyarthritis, periostitis of long bones, and clubbing of fingers and toes.
  o Amyloidosis
  o Hypercalcemia
  o Hypophosphatemia
  o Cushing’s Syndrome
  o Somatostatinoma syndrome (vomiting, abdominal pain, diarrhea, cholelithiasis)
  o Syndrome of inappropriate antidiuretic hormone secretion (SIADH)
  o Polymyositis/dermatomyositis
  o Opsoclonus
  o Paraneoplastic sensory neuropathy
  o Subacute cerebellar degeneration
  o Eaton-Lambert syndrome (a myasthenia-like syndrome)
  o Disseminated Intravascular Coagulation
  o Migratory thrombophlebitis
• Patients with a paraneoplastic syndrome should be evaluated initially with chest x-ray and complete metabolic panel.
• Chest CT with contrast (CPT 71260) can be performed in a patient who is a past or present smoker if other causes of paraneoplastic syndrome have been ruled out. Specialist consultation may be helpful.*
  *Chest 2003;123:97S-104S
• In younger patients or non-smokers, abdominal ultrasound, labs with tumor markers, and careful urogenital physical examination is indicated.
• CT abdomen and pelvis with contrast (CPT 74160 and 72193) can be performed if all other tests are negative.
• PET is not appropriate for this indication, except to characterize an abnormality seen on other imaging in a location difficult to biopsy.

**ONC-28.4 Monoclonal Gammopathy of Unknown Significance (MGUS)**
• Defined as the presence of serum or urine M-protein in asymptomatic, apparently healthy persons, with no other signs of multiple myeloma.
• A condition that may precede multiple myeloma and may be occasionally associated with other malignancies, but more frequently remains clinically insignificant.
• If the patient has progression of symptoms, abnormalities on CT scan, or if other labs become abnormal, See **ONC-24 Multiple Myeloma and Plasmacytomas** for evaluation of possible multiple myeloma.
• Bone pain is best evaluated with plain x-rays and a trial of conservative treatment with NSAIDs. CT or MRI of bone without and with contrast can be performed if clinical suspicion remains high in spite of normal plain x-rays.
• If bone marrow biopsy shows increasing plasmacytosis, routine labs worsen, or for equivocal x-ray findings, MRI Bone Marrow (or MRI spine and Pelvis) is appropriate if negative imaging will allow the patient to continue to be observed.

**ONC-28.5 Sarcoidosis**
• Also see **CH-13 Sarcoid** in the Chest guidelines.
• A multisystem granulomatous disorder of unknown etiology.
• Occurs in African Americans and in Caucasians of Northern European lineage.
• Chest x-ray findings include bilateral hilar and right para-tracheal adenopathy, frequently with small granulomas and/or ground glass infiltration.
• Bronchoscopy with biopsy is indicated; if positive for sarcoidosis, no further imaging is necessary.
• If the above findings are equivocal and clinical suspicion of adenopathy is concerning, chest CT with contrast, (CPT 71260) is appropriate.
• There is insufficient data to support the routine use of PET in this disease.
Evidence Based Clinical Support
ONC- 2 ~SQUAMOUS CELL CARCINOMAS OF THE HEAD AND NECK

- Surveillance in patients with history of head and neck cancer: Out of 3645 visits over an 18-month period: recurrence or new primary tumor was documented in 180 (5%). 79% of patients in these 180 recurrences or new primaries had new symptoms or physical findings prior to the physician’s exam—usually a neck mass (38%), progressive pain (27%), or visible lesion or ulcer (14%). Recurrence was rare in the absence of reported symptoms or findings (1.2%).

Evidence Based Clinical Support
ONC- 5 ~ MELANOMAS AND SKIN CANCERS

- No investigations are necessary in patients with Stage I disease. Stage I and IIA disease should not be staged by imaging, as the true positive pick-up rate is low and false positive rate is high. Patients at intermediate or high risk of recurrence (stage IIB or over) should have chest x-ray, CT scans of chest, abdomen, pelvis.*

*British Association of Dermatologists
Br. J Dermatol 2002;146(1):7-17

- Most patients who are going to have recurrent disease will present in the first five years after treatment.

  o Recurrences occurred in 6.6% of patients. 62% of recurrences were detected by the patients themselves.
  o 2.6% of patients developed subsequent primary melanoma.
  o Of the various follow-up investigations requested by physicians, only medical history and physical exam seem to be cost-effective.

Evidence Based Clinical Support
ONC- 7 ~ LUNG CANCER

- Screening for lung cancer:
  o Although the recent results of the International Early Lung Action Program Investigators (I-ELCAP)* showed that 85% of patients diagnosed with lung cancer by chest CT screening had stage I lung cancer and the five-year survival rate was 92%, there are a number of caveats to consider regarding this study:
    1) This was a case-controlled study, not a randomized clinical trial.
    2) The true cost-effectiveness of chest CT screening is still an unanswered question. The cost of low-dose CT in the study was below $200—this does not hold true in all centers across the country.
    3) The longer survival shown in the study is exaggerated by lead time and length biases and does not necessarily mean that CT screening will reduce the number of lung cancer deaths (i.e. lung cancer mortality).
    4) Even in the “at risk” population that was screened in the study, the number of cancers was low (484 cancers were diagnosed out of 31,567 individuals scanned).
      a) If screening is started on a large-scale, the definition of who is at high risk and who should be screened needs to be clarified.
b) Inevitably, the general population, including low risk individuals, will start being screened. This will result in an even lower prevalence of disease, so that the benefits of screening are at risk of being outweighed by the problems produced by false-positive findings.

c) There will be many, many lung nodules found on these screening tests, and the costs of following these lesions either with serial CT scans or with biopsy or PET scan, will potentially negate the benefits of detecting the early lung cancers. Individuals who are eager to be screened need to realize the spiral of further testing or procedures that this may generate.


o The National Lung Screening Trial (NLST) sponsored by the National Cancer Institute has been ongoing since 2002 and is a randomized controlled trial of over 53,000 individuals receiving three sequential screenings with either chest x-ray or low-dose CT.
  ➢ This study has been designed to eliminate biases present in other studies such as the I-ELCAP study and to definitively determine whether CT can improve on chest x-ray in decreasing the lung cancer mortality rate. Results from the NLST are expected in 2009.

o Given the above weaknesses in the I-ELCAP study, MedSolutions supports awaiting the results of the National Lung Screening Trial prior to changing its current guidelines on chest CT screening for lung cancer.
  • PET scan has a sensitivity of 84% and specificity of 89% in evaluating mediastinal lymph nodes in patients with non small cell lung cancer.
  • A negative PET scan provides 90% certainty of the absence of mediastinal lymph node metastases.
  • Positive PET scan findings in the mediastinum need pathologic confirmation.
  • Greater than 60% of patients have a change in their clinical stage when using PET versus CT scan for staging.*

  *Chest 2003;123:137S-146S

Evidence Based Clinical Support
ONC-10 ~ BREAST CANCER

• Next to obstetrical complications, the most commonly claimed allegation in malpractice suits is “failure to diagnose breast cancer.” Fear of cancer by patients and fear of lawsuits colors much of clinical practice for this disease.
• Women with ≥4 positive axillary lymph nodes are at substantially increased risk for local recurrence.
• Features of node negative tumors that predict a high rate of local recurrence include tumors >5 cm, positive pathologic margins, and close (<1 mm) margins.
• Routine radiologic (other than mammogram) and lab studies have not been proven to be beneficial in patients with stage 0, I, II, III breast cancer or in post-surgical patients.*
  *Institute for Clinical Systems Improvement (ICSI), Breast Cancer Treatment. Sept 2005

• For invasive breast cancer and DCIS post-resection: “The routine use of more sophisticated means to detect tumor recurrence such as tumor markers, imaging for metastases, and LFT’s has not been shown to be useful or cost-effective and is discouraged”*

  *Singapore Ministry of Health, National Committee on Cancer Care.
The incidence of intrathoracic metastases in patients with Stage I breast cancer is <0.5% in asymptomatic women.

The yield of all tests (bone scan, liver ultrasound, chest x-ray) in Stage I patients is <1%.


Evidence Based Clinical Support
ONC-15 ~ COLORECTAL CANCER

A follow up study of 530 patients with resected Stage II or III colorectal cancer followed with CT scans at 12 and 24 months following commencement of adjuvant chemotherapy showed that 155 patients (29%) had relapse. Recurrence was detected first by CT scan in 49 patients and by increased serum CEA in 45 patients. Nearly eight times as many asymptomatic patients with relapses detected by CT (23.8%) underwent curative resection of liver or lung metastases as did patients with symptomatic recurrence (3.1%). The median overall survival from time of relapse was longer in patients with CT detection of recurrence (26.4 months) than in patients with symptomatic presentation (12.6 months).*

*J Clin Oncol 2004;22:1363-1365 and 1420-1429

Evidence Based Clinical Support
ONC-16 ~ RENAL CELL CANCER (RCC)

The most common sites for metastases are lung, bone, skin, liver, and brain

For small lesions (<3 cm) the risk of metastases is so small as to eliminate the need for chest CT.*

*ACR Appropriateness Criteria, Renal Cell Carcinoma Staging 2005.

Following definitive resection, renal cell carcinoma will recur in up to 40% of patients.

Solitary metastases can occasionally be treated by resection.

The incidence of recurrence in the resection site is similar or only slightly higher in patients who had partial nephrectomy compared with those who had radical nephrectomy.

Most recurrences appear within 2 years after the initial resection and the lung is the most common site of recurrence.

Evidence Based Clinical Support
ONC-17~BLADDER CANCER

The average age at diagnosis of bladder cancer is 65. Bladder cancer is unusual prior to age 50.

80% of patients present with hematuria, either gross or microscopic. The hematuria is usually painless and intermittent.

Over 90% of urothelial tumors originate in the bladder; 8% originate in the renal pelvis, and 2% originate in the ureter and urethra.

Most common sites of distant spread for transitional cell carcinoma of the bladder (TCCB) are lung, bone, liver, and brain.

70%-85% of TCCB is superficial at presentation, without muscle invasion.
• MRI may have an advantage over CT in differentiating between superficial and deep invasion of the bladder wall.
• CT and MRI are considered similar in their ability to detect lymph node enlargement.
• There is insufficient data to support the routine use of PET scan in patients with transitional cell carcinoma.

**Evidence Based Clinical Support**  
**ONC-18~PROSTATE CANCER**

- Multiple studies have indicated a poor accuracy for CT in staging prostate cancer. Overall accuracy in staging is 65%. For staging extra-capsular penetration, accuracy is as low as 24%.
- Of 4,264 patients who underwent CT scan and pelvic dissection, 654 (15.8%) had pathologically proven lymph node metastases, while CT scan detected disease in only 105 (2.5%). CT detected lymph node metastases in 1.2% and 12.5% of prostate cancer cases with Gleason scores of 1-7 and ≥8, respectively.*  
  *J Urol 2004;171:2122-2127
- Often patients in whom lymph nodes are identified on CT scan also have clinical evidence of bone metastases.
- MRI using endorectal coil is the most useful imaging test available, providing both loco-regional and nodal evaluation.*  
  *ACR Appropriateness Criteria, Pretreatment Staging Prostate Cancer 2005

**Evidence Based Clinical Support**  
**ONC-19~TESTICULAR and NONEPITHELIAL OVARIAN (GERM CELL) CANCER**

- Most testicular tumors spread along the regional lymphatic chain alongside the spermatic vessels. Left sided tumors spread to the renal hilar region and periaortic nodes. Right sided tumors spread to the paracaval region below the renal vessels and the nodes between the vena cava and aorta, precaval, and periaortic nodes.*  
- 90% of patients with advanced nonseminomatous tumors will have elevated levels of alpha-fetoprotein (AFP), beta human chorionic gonadotropin (beta-HCG) or both.
- 10%-25% of patients with seminoma will have elevated levels of beta-HCG.
- Tumor markers can be used to follow patients to determine recurrence and response to therapy.
- Patients with nonseminomatous germ cell tumors are at higher risk of relapse if there is lymphatic or vascular invasion, or if there is embryonal cell cancer in the primary specimen. Risk of occult retroperitoneal disease can be >50%.*  
  *Can J Urol 2001;8(1):1184-1192

**Evidence Based Clinical Support**  
**ONC-20 ~ OVARIAN CANCER**

- 70% of patients present with advanced disease.
- Patients with ≥ 2 first degree relatives with ovarian cancer are at risk for early onset disease.
- Patients with ovarian cancer are more likely to have target symptoms, especially abdominal swelling and pain, >6 months before diagnosis.
- The risk of recurrence is highest in the first 2 years following first line therapy.
The majority of patients will suffer from intra-abdominal relapse within the first 5 years after surgery.

CA-125 has high sensitivity in ovarian cancer patients. The median time to clinical relapse in women with rising CA-125 level is 2 to 6 months.

In a retrospective study of 58 patients with recurrent ovarian cancer, 45 out of 54 (83%) had elevated CA-125 at time of recurrence. Ultrasound showed tumor recurrence in 33 out of 47 patients (70%) and tumor was detected by physical exam in 45 out of 58 (78%) of patients. 98% of patients with recurrences were identified by physical exam and CA-125 alone.

- In patients with pelvic recurrence, vaginal exam had the highest sensitivity compared with vaginal ultrasound or CT scan.
- The conclusion was that: “Imaging techniques did not add clinically relevant information during follow up and should only be performed prior to surgical or therapeutic intervention.”


Brain metastases are rare in ovarian cancer. A retrospective study of all patients diagnosed with brain metastases from epithelial ovarian cancer over the last 20 years showed a 1.17% incidence of brain mets.


Lung metastases in ovarian cancer are rare. In a study of 127 women with metastatic ovarian cancer, the rate of lung mets was 6%. In all of these patients, abdominal or pelvic disease had appeared on imaging studies before spreading to the chest, or pulmonary mets were preceded by a rise in tumor markers.

- CT chest can be eliminated in routine follow up but should be performed in patients with increased serum tumor markers and no evidence of abdomen or pelvic disease.

*AJR 2001;177(4):857-859

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**Evidence Based Clinical Support**

**ONC-21 ~ UTERINE CANCER**

- Papillary serous endometrial cancer is an uncommon but particularly aggressive uterine malignancy with high propensity to spread. Treatment is surgery plus adjuvant chemoradiation.
- Clear cell carcinoma is a more aggressive histology with higher incidence of extra-uterine disease at presentation.
- In 75% of patients with adenocarcinoma of the endometrium, the tumor is confined to the uterus at diagnosis. Patients usually present with vaginal bleeding (90% of patients) in the postmenopausal period.

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**Evidence Based Clinical Support**

**ONC-22 ~ CERVIX CANCER**

- Cervical cancer spreads contiguously to adjacent organs via lymphatics.
- Common sites of distant metastases include lung, supraclavicular lymph nodes, liver and bone. Metastases to brain are rare.
- MRI in early cervical cancer may overestimate the stage. Staging is more accurate if vaginal opacification is used.

*Eur Radiol 2005;15(8):1727-1733*
• The accuracy of MRI in staging lymph node involvement is 67% versus 78% for PET. Therefore, PET is more useful in the evaluation of pelvic lymph nodes.*

• The positive predictive value of PET in the pelvis and para-aortic region is sufficient to obviate lymph node sampling, but sampling is still required to exclude small volume disease cranial to the sites of abnormality on PET.*
  *Int J Gynecol Cancer 2001;11(4):263-271

• In the follow up of patients with recurrent cervical cancer treated with intracavitary radiotherapy and brachytherapy, MRI is superior to CT.*
  *Rays 2004;29(2):201-208

• In patients who have undergone curative radiation therapy for cervical cancer, the cumulative risk of developing a second primary cancer is 10.9% at 15 years and 19.8% at 25 years.
  o Outside of the irradiated field, the most common malignancies are uterine cancer, leukemia, and lung cancer.
ONCOLOGY GUIDELINE REFERENCES

ONC-1~General Guidelines

ONC-2~Squamous Cell Carcinomas of the Head & Neck
- *Head and Neck Cancers. NCCN Practice Guidelines in Oncology.* v.1.2006

ONC-5~Melanomas and Skin Cancers

ONC-6~Thyroid Cancer

ONC-7~Lung Cancer

ONC-9~Other Thoracic Tumors

ONC-10~Breast Cancer

ONC-11~Soft Tissue Sarcomas

ONC-12~Pancreatic Cancer

ONC-13~Upper GI Cancers
- *Gastric Cancer, NCCN Practice Guidelines in Oncology.* v.2.2007.

ONC-14~Other GI Neuroendocrine Cancers
ONC-16~Renal Cell Cancer (RCC)

ONC-18~Prostate Cancer

ONC-20~Ovarian Cancer
- ACR Appropriateness Criteria, Ovarian Cancer Screening, 2005.

ONC-27~Metastatic Cancer and Carcinomas of Unknown Primary Site

ONC-28~Medical Conditions with Cancer in the Differential Diagnosis

ONCOLOGY EVIDENCE BASED CLINICAL SUPPORT REFERENCES

ONC-5~Melanomas and Skin Cancers, Evidence Based Clinical Support

ONC-7~Lung Cancer, Evidence Based Clinical Support

ONC-10~Breast Cancer, Evidence Based Clinical Support

ONC-15~Colorectal Cancer, Evidence Based Clinical Support


ONC-16 - Renal Cell Cancer (RCC), Evidence Based Clinical Support

- ACR Appropriateness Criteria, Renal cell carcinoma staging, 2005.

ONC-18 - Prostate Cancer, Evidence Based Clinical Support

- ACR Appropriateness Criteria, Pretreatment staging prostate cancer 2005

ONC-19 - Testicular (Germ Cell) Cancer, Evidence Based Clinical Support


ONC-20 - Ovarian Cancer, Evidence Based Clinical Support


ONC-22 - Cervix Cancer, Evidence Based Clinical Support

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ABBREVIATIONS for PET GUIDELINES

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<tr>
<th>Abbreviation</th>
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<tr>
<td>CA-125</td>
<td>cancer antigen 125 test</td>
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<td>CEA</td>
<td>carcinoembryonic antigen</td>
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<td>CNS</td>
<td>central nervous system</td>
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<tr>
<td>CT</td>
<td>computed tomography</td>
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<tr>
<td>ESR</td>
<td>erythrocyte sedimentation rate</td>
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<tr>
<td>FDG</td>
<td>fluorodeoxyglucose</td>
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<tr>
<td>GI</td>
<td>gastrointestinal</td>
</tr>
<tr>
<td>GIST</td>
<td>gastrointestinal stromal tumor</td>
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<tr>
<td>LFT</td>
<td>liver function tests</td>
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<tr>
<td>MALT</td>
<td>Mucosa-Associated Lymphoid Tissue (rare form of Non-Hodgkin’s lymphoma)</td>
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<tr>
<td>MGUS</td>
<td>Monoclonal Gammopathy of Unknown Significance</td>
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<tr>
<td>MIBG</td>
<td>I-123 metaiodobenzylguanidine scintigraphy</td>
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<td>MM</td>
<td>multiple myeloma</td>
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<td>NHL</td>
<td>Non-Hodgkin’s lymphoma</td>
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<td>NSCLC</td>
<td>Non-Small Cell Lung Cancer</td>
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<td>NSGCT</td>
<td>Non Seminomatous Germ Cell Tumor</td>
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<td>PET</td>
<td>positron emission tomography</td>
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<td>PSA</td>
<td>prostate specific antigen</td>
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<td>renal cell carcinoma</td>
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PET IMAGING GUIDELINES

PET-1 ~ GENERAL GUIDELINES

- The usefulness of PET is now well established in many cardiac, neurological, and oncologic situations.
- All of the indications for PET also apply to PET/CT fusion scan
  - In general, the anatomic detail acquired in PET/CT is reasonable for the evaluation of many oncologic conditions; however, the diagnostic quality may be inconsistent.
  - For initial diagnosis or staging, a diagnostic CT may be appropriate in addition to a PET/CT.
  - For restaging, therapy monitoring, and evaluation of recurrence, either PET/CT or diagnostic CT, but not both, should be chosen by the clinician as the initial imaging modality.
- For Oncologic applications, the skull base to mid-femur (“eyes-to thighs”) procedure code for PET (CPT 78812 or 78815) is usually the most appropriate procedure to order.
  - **Exceptions** (use CPT 78813 or 78816). include the following:
    - Malignant melanoma
    - Some unusual presentations of sarcomas and lymphomas
- PET is a poor choice for imaging metastatic disease in the central nervous system (CNS).
- PET is unreliable for imaging lesions less than 7 mm in size.
- PET is inappropriate for use as a surveillance test in monitoring patients in whom recurrence is not suspected.
- PET guidelines for cancers should be applied in conjunction with the corresponding Oncology guidelines (ONC-1 through ONC-28).
PET- 2 ~ CARDIAC PET SCAN

- See CD-7 Cardiac PET Scan in the Cardiac guidelines.

PET- 3 ~ PET IN NEUROLOGY

- See in the Head Guidelines:
  - HD-1 General Guidelines
  - HD-13 Dementia
  - HD-14 Adult Epilepsy/Seizure
  - PACHD-5 Pediatric Epilepsy/Seizure
  - HD-21 Movement Disorders
  - HD-24.13 PET in brain tumor

PET- 4 ~ CANCERS OF THE HEAD & NECK

- See ONC-2 Squamous Cell Carcinomas of the Head and Neck and ONC-3 Salivary Gland Cancers in the Oncology Guidelines.
- PET is not indicated for suspected cancers of the head and neck prior to biopsy, except if needed to guide direction of decisions concerning biopsy in diagnostically challenging cases.
  - PET is not intended to be a substitute for panendoscopy
- PET may be indicated for the following:
  - To explain radiographic findings suggestive of disease outside the head and neck area and if a positive PET demonstrating metastatic disease will change management.
  - To define the extent of lymphadenopathy if such information is needed to determine extent of therapy.*
  - To identify the primary site when a carcinoma is found in the lymph nodes of the neck and panendoscopy fails to find a primary site.
- PET is helpful in assessing response to chemoradiotherapy, if clinical examination remains abnormal or equivocal.
  - Requests for PET should be accompanied by description of recent clinical examination of previously involved sites.
  - PET should be delayed a minimum of 120 days following radiotherapy due to risk of false positive FDG uptake in lethally irradiated cells, unless the clinical situation requires evaluation of disease outside the irradiated volume.
  - **Exception:** PET may be performed sooner in patients with clinically apparent lymph nodes if the result of the PET will determine the need for radical neck dissection. In these patients, PET should be performed 10 to 12 weeks following therapy, to avoid excess radiation-induced fibrosis.*
    - *Head & Neck 2006;28:166-175
    - Laryngoscope 2005;115:2206-2208
  - PET is contraindicated for re-staging when surgery only was the primary treatment modality.
  - PET is not appropriate for surveillance; however, PET scans with previous positive or equivocal findings may be repeated once to rule out recurrence or persistent disease.
• Suspected recurrence:
  o PET may be appropriate for apparent recurrent lymphadenopathy, or for glottic
tumors which cannot be adequately visualized by a clinician capable of performing
adequate examination with indirect laryngoscopy.
  ➢ PET requests in this context must be accompanied by documentation of such an
examination.
  ➢ Otherwise, recurrence must be confirmed by biopsy prior to consideration of
advanced imaging
• The role of PET in the management of salivary gland tumors has not yet been
determined.

PET- 5 ~ PRIMARY BRAIN TUMORS

• PET is not indicated in the detection or initial work-up of primary brain tumors.
  o A rare exception to this is in distinguishing high-grade from low-grade gliomas,
either due to indeterminate histology by biopsy, or because the lesion is in a
surgically inaccessible location of the brain, such as the brain stem.
• PET may be helpful in distinguishing tumor from radiation necrosis when recurrent
disease is suspected and other imaging modalities are indeterminate (see [HD-24.13
PET in brain tumor in the Head guidelines). These cases should be sent for Medical
Director review.
• PET can be considered if findings of a brain biopsy or resection suggest a lesion is a
metastasis from an unknown primary.
  o See [ONC-4 Central Nervous System Cancers] and [ONC-27.7 Carcinoma of
Unknown Primary Site] in the Oncology guidelines

PET- 6 ~ MELANOMA

• See [ONC-5 Melanomas and Skin Cancers] in the Oncology guidelines.
• PET is indicated in the initial evaluation of Stage IIb, IIc, III, and IV disease, (lesions
greater than 2 mm thick, obvious clinical lymphadenopathy, or lymphatic disease
confirmed histologically) and in patients with recurrent disease, except when
widespread metastatic disease has already been documented on other imaging
modalities.
• In patients with known Stage IV (metastatic) disease, PET is appropriate only when
needed to rule in or rule out involvement of a specific organ, if information from the
study will change clinical management decisions.
  o PET is not indicated for Stage I and IIa disease (lesions less than 2 mm thick without
lymphadenopathy).*
    *Current Op in Oncol 2005;17:154-159
    *Clin Nuc Med 2003;28:961-965
  o PET in melanoma is not appropriate in the setting of obvious multiple brain
metastases.*
    *Melanoma, NCCN Practice Guidelines in Oncology v.2,2006

PET- 7 ~ THYROID CANCER

• See [ONC-6 Thyroid Cancer] in the Oncology guidelines.
• Since the vast majority of thyroid cancers are treated with total thyroidectomy, even in
the setting of metastatic disease, use of PET prior to thyroidectomy is not indicated.
• Following thyroidectomy for follicular and papillary cancers, evaluation of the patient may involve therapeutic radioactive iodine both before and/or following evaluation with I-131 whole body scan and thyroid function tests. Scans may take up to 6 months to normalize after radiiodine therapy. During this process, use of PET prior to full evaluation of the effect of the radioactive iodine is inappropriate.
  o **Exceptions:**
    ➢ When medical or technical factors preclude full thyroidectomy.
    ➢ When I-131 scan is negative, and serum thyroglobulin level remains greater than 10 ng/ml.
    ➢ For anaplastic thyroid cancers.*
    ➢ When abnormalities are found on other imaging studies that cannot be explained.

• PET for routine follow-up is inappropriate, except for the following:
  o Exceptions listed in bullet 3 above.
  o If highly morbid surgery or radiotherapy is contemplated for salvage or recurrence.*
        *Cancer Control 2006;13(2):89-105

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**PET- 8 ~ LUNG CANCER AND PULMONARY NODULES**

• See **ONC-7 Lung Cancer** in the Oncology guidelines.
• See **CH-10 Multiple Pulmonary Nodules** and **CH-14 Solitary Pulmonary Nodule** in the Chest guidelines.
• PET is appropriate for the evaluation of one or more newly discovered, distinct pulmonary nodules, confirmed on CT and/or MRI and at least 7 mm in size.*
        *Applied Radiology 2002;31(6):9-17
  o **NOTE:** Certain payers consider PET scan investigational for evaluating pulmonary nodules ≤1 cm or lung masses >4 cm. Their coverage policies will take precedence over MedSolutions’ guidelines. Prior authorization does not guarantee payment of the study.

• PET can be obtained for the initial staging of patients with histologically proven lung cancer in the absence of evidence for Stage IV disease.
  o **Exceptions** are bronchioalveolar carcinoma, bronchial carcinoid, and mucinous carcinoma, as these histologies may not take up sufficient FDG to warrant the use of PET.
  o PET for small cell carcinoma is not recommended, but can be performed for staging of apparently limited stage disease after standard imaging.

• PET is especially helpful in determining mediastinal lymph node staging in Non-Small Cell Lung Cancer (NSCLC)
  o In the absence of metastatic disease, PET positive mediastinal or hilar lymph nodes need histologic confirmation by either surgery or mediastinoscopy.

• PET is not indicated for re-staging of lung cancer, except as noted below.
  o PET following radiotherapy should be delayed a minimum of 120 days, due to risk of false positive FDG uptake in lethally irradiated cells and in radiation pneumonitis, unless the clinical situation requires evaluation of disease outside the irradiated volume.
  o PET can differentiate persistent tumor from necrotic tissue following chemotherapy or radiotherapy.
  o PET is useful for evaluation of abnormalities seen on CT or other imaging modalities.
PET may help differentiate persistent or recurrent tumor from radiation-induced fibrosis or pleural thickening.

- PET is inappropriate if surgery was the primary treatment modality and all known tumor was resected.
- PET may be considered if LFTs or tumor markers become elevated and CT scans are negative or equivocal.
- PET is inappropriate for routine surveillance.

### PET- 9 ~ BREAST CANCER

- See Onc-10 Breast Cancer in the Oncology guidelines.
- PET is not appropriate for patients with non-invasive cancers, or when obvious multi-organ metastatic disease is demonstrated.
- PET is indicated for evaluation of all Stage IIb, III, and IV disease (lymph node-positive, locally advanced, or limited metastatic disease). This includes patients with inflammatory breast cancer and patients with breast cancers greater than 5 cm.
  - PET is inappropriate prior to lymph node sampling in a patient with clinical Stage I and II disease.*
  
  *Breast Cancer. NCCN Practice Guidelines in Oncology. v.2.2006

- PET is appropriate preoperatively if neoadjuvant chemotherapy or radiotherapy is planned due to size of tumor, dermal involvement, or clinically palpable lymph nodes.
- PET is not appropriate for preoperative assessment of response after neoadjuvant chemotherapy.
- PET may be used for monitoring therapy after two chemotherapy cycles in patients with metastatic disease, when identification of responders vs non-responders will influence future therapy decisions.
  - Repeated use of PET in Stage IV disease is of unproven benefit.
- PET is appropriate in the evaluation of a patient with recurrence documented by other imaging, elevations of laboratory tests, or histologic confirmation.
- PET following radiotherapy should be delayed a minimum of 120 days due to risk of false positive FDG uptake in lethally irradiated cells, unless the clinical situation requires evaluation of disease outside the irradiated volume.
- Bone scan is the initial study of choice for breast cancer patients with bone pain.
  - In some circumstances, PET may be indicated if additional information about organ systems other than skeletal is clinically relevant.*
  
  *AJR 2005;184:1266-1273

### PET-10 ~ ESOPHAGEAL CANCER

- See ONC-8 Esophageal Cancer in the Oncology guidelines.
- PET is usually contraindicated prior to biopsy; however, when other imaging modalities yield conflicting information, PET may be considered to evaluate the feasibility of an approach to biopsy.
- PET may be indicated to confirm M0 disease if conventional imaging does not find evidence of metastatic disease.
- PET is appropriate for the evaluation of response to radiation or chemotherapy:
  - Upper endoscopy or endoscopic ultrasound (EUS) should be performed prior to PET, since evidence of obvious progression or complete response negates the need for PET.
o PET to evaluate apparent partial response for marginally resectable disease can be performed following chemoradiation for patients who may be able to undergo esophagectomy
o PET should be delayed as much as feasible to allow time for tumor response to be assessed but not so late as to unduly delay required surgery.
o If surgery is not an option, PET following radiotherapy should be delayed a minimum of 120 days, due to risk of false positive FDG uptake in lethally irradiated cells, unless the clinical situation requires evaluation of disease outside the irradiated volume.

**PET-11 ~ GASTROINTESTINAL TUMORS**

- See [ONC-13 Upper GI Cancers](#), [ONC-14 Other GI Neuroendocrine Cancers](#), and [ONC-15 Colorectal Cancer](#) in the Oncology guidelines.
- Histologic confirmation of malignancy should be obtained prior to considering PET scan.
- PET is inappropriate for non-invasive carcinomas, carcinomas contained within a polyp, or for any completely resected, lymph node negative colon cancer.
- **PET is indicated for the initial staging of:**
  - Lymph node positive colorectal cancers
  - Adenocarcinoma of the stomach*
    - *Gastric Cancer, NCCN Practice Guidelines in Oncology v.1.2006*
  - Gastrointestinal stromal tumors GIST tumors*
    - *AJR 2004;183:1619-1628*
  - Pancreatic cancers under consideration for resection by Whipple procedure, or subtotal pancreatectomy of pancreatic tail tumors*
  - Any GI tumor where a solitary metastatic lesion is detected in a site where aggressive local therapy of the primary site and of the solitary metastasis can confer a survival advantage.
  - Any GI tumor with an elevated CEA preoperatively, and the CEA fails to normalize after apparently curative resection.
  - Any GI tumor where pathologic diagnosis suggests a primary site other than the GI system, and a search for a second primary site is reasonable.
  - Malignant and non-adrenal pheochromocytomas, and any symptomatic neuroendocrine tumor when an apparently complete resection fails to resolve secretion of pathologic levels of hormones or neurotransmitter compounds, if functional nuclear imaging (MIBG or Octreoscan) is negative.*
    - *Ann NY Acad Sci 2004;1018:495-504*
    - *Current Opinions Gastroenterology 2007;23(1):74-78*
  - Rectal Cancers, when limited sphincter sparing procedures are being contemplated and a negative PET can allow avoidance of laparotomy.
  - Initial staging of Anal Canal Squamous Cell Carcinomas
  - Restaging of Anal Canal Carcinomas, if the initial staging study was PET avid and not easily evaluated on other imaging tests or by physical examination.
  - PET is not indicated for Anal Margin Carcinomas.
- The role of PET for cancers of the Liver, Gallbladder, and Hepatobiliary Tree (including Klatskin’s tumors) has not been established.
  - Liver lesions less than 1 cm in patients without a prior history of confirmed malignancy should be evaluated with ultrasound only.
  - See [ONC-13 Upper GI Cancers, Suspected](#).
PET is not appropriate for use following postoperative adjuvant chemotherapy when resection has removed all known gross disease and markers are not elevated.

PET may be indicated, in certain select cases, for evaluation of any unresectable or inoperable GI tumor following chemotherapy or radiotherapy.

- **NOTE:** PET should be delayed until 120 days following radiotherapy due to risk of false positive FDG uptake in lethally irradiated cells, unless the clinical situation requires evaluation of disease outside the irradiated volume.
- PET is inappropriate in the setting of obvious multi-organ metastatic disease.
- PET may be considered for any suspicious appearing lesion that cannot be characterized by CT or MRI.

PET is not indicated for routine surveillance.

PET for restaging can be considered to evaluate abnormalities detected on other routine follow-up imaging modalities, or in patients with rising LFTs or CEA when resection or other local treatment modalities are feasible.*


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### PET-12 ~ UROLOGIC and TESTICULAR CANCERS

#### PET-12.1 GENERAL GUIDELINES

- Also see in the Oncology guidelines:
  - ONC-16 Renal Cell Cancer
  - ONC-17 Bladder Cancer
  - ONC-18 Prostate Cancer
  - ONC-19 Testicular and Nonepithelial Ovarian (Germ Cell) Cancer

- For all urologic malignancies, a histologically confirmed diagnosis of malignancy must be obtained prior to considering PET scan.
- PET should be used with great caution in all urologic malignancies, due to the inconsistent nature of FDG uptake in these tumor cells.
- Clinical situations where PET is useful are discussed below

#### PET-12.2 PROSTATE CANCER:

- See ONC-18 Prostate Cancer in the Oncology guidelines
- PET has not been found to be helpful in prostate cancer except in patients with Hormone Refractory disease, a rising PSA or a suspicious finding on another imaging modality following initially successful local therapy.
- Bone Scan is the imaging modality of choice for detecting osseous metastases.*
- PET is unable to differentiate neoplastic disease from benign prostatic hypertrophy.
- Radiopharmaceuticals other than FDG seem to offer exciting potential in clinical trials, but their use is considered investigational at this time.*
  *J. Urology 2006;176:954-960

#### PET-12.3 KIDNEY (Renal Cell Carcinoma):

- See ONC-16 Renal Cell Cancer in the Oncology guidelines
- This guideline excludes Transitional Cell Carcinomas and Oncocytomas of the kidney.
- In general, PET is of limited value because of inconsistent uptake of FDG.
- PET is not indicated for initial diagnosis or staging of renal cell carcinoma.
- **Exception:** if there is suspicion of a metastatic lesion and biopsy of that lesion is considered potentially less invasive than biopsy of the kidney or performing nephrectomy, then PET may be appropriate.
• PET is helpful for clarifying findings on other imaging modalities that are suspicious for, but not diagnostic of, metastatic disease, bilateral disease, or recurrence, particularly in settings where a positive PET will avoid an invasive biopsy.
  o PET, in conjunction with conventional imaging, is helpful in differentiating possible osseous metastasis from benign bone lesions.
  o PET is helpful in differentiating local tumor recurrence from postoperative and/or post-radiation changes in patients who have undergone complete nephrectomy.
• PET is not appropriate for routine surveillance in renal cell carcinoma.*
  *J Urol 2004;171:1806-1809

PET-12.4 BLADDER AND OTHER URINARY TRACT TRANSITIONAL CELL CARCINOMAS:
• See ONC-17 Bladder Cancer in the Oncology guidelines
• There is currently insufficient evidence to support the routine use of PET in evaluating patients with transitional cell carcinomas of the bladder or other urinary tract sites.

PET-12.5 TESTICULAR AND NONEPITHELIAL OVARIAN CANCER (GERM CELL TUMORS):
• See ONC-19 Testicular and Nonepithelial Ovarian (Germ Cell) Cancer in the Oncology guidelines
• The following comments apply to testicular cancers, extragonadal germ cell tumors, and germ cell tumors of the ovary.
• There is insufficient data to support the use of PET in the diagnosis, initial staging, or routine surveillance of Testicular Cancers.
• PET may be considered in the evaluation of a germ cell tumor found in a retroperitoneal and/or mediastinal mass, when testicular examination is negative.
• PET has been shown to be non-contributory for routine use in Non Seminomatous Germ Cell Tumors (NSGCT)*
  *Proc Am Soc Clin Oncol 2006;24:222s Abstract 4521
  *Proc Am Soc Clin Oncol 2006;24:222s Abstract 4520
• PET is indicated in a patient with advanced seminoma and a CT-documented residual mass after chemotherapy, to differentiate viable tumor from fibrosis or necrosis.*
  o PET is not appropriate for re-staging if CT is negative.
  o If used following radiation therapy, PET should be delayed until 120 days after completion of therapy due to risk of false positive FDG uptake in lethally irradiated cells, unless the clinical situation requires evaluation of disease outside the irradiated volume.
• Most testicular cancers are very chemo-and radio-sensitive, therefore conventional CT is sufficient for evaluating response to therapy.
• PET can be helpful, in conjunction with conventional imaging, in evaluating patients with germ cell tumors who are found to have rising tumor markers following potentially curative therapies.

PET-12.6 PENILE CANCER
• See ONC-23 Cancers of the External Genitalia in the Oncology guidelines.
• PET is not indicated in this disease.
PET-13.1 OVARIAN CANCER:

- See [ONC-20 Ovarian Cancer](#) in the Oncology guidelines
- PET is not indicated for initial work-up of Ovarian Cancers.
- PET is not indicated for surveillance of Ovarian Cancers.
- **Following complete resection, PET may be considered for the following:**
  - Patients with elevated CA-125 or other relevant tumor markers, and/or changes in physical examination, with normal conventional imaging.
  - Evaluation of radiographic abnormalities suspicious for recurrence, or for elevation of LFTs when abdominal imaging is negative.
- Repeat PET scans can be considered if prior conventional imaging failed to demonstrate tumor, or if a persistent radiographic mass is seen, in order to document response to therapy.

PET-13.2 CERVICAL CANCER:

- See [ONC-22 Cervix Cancer](#) in the Oncology guidelines
- PET is indicated for the evaluation of newly diagnosed cervical cancers that are clinical Stage IB2 or higher (>4 cm or invasion beyond uterus, positive lymph nodes, or distant metastasis).*
  
  *[Radiology](http://radiology.ovid.com/) 2006;238(1):272-279
- PET is not indicated in patients with non-invasive cervical cancer.
- PET can be considered to evaluate abnormalities seen on other imaging modalities in lower stage invasive cancers, and for cancers incidentally discovered during hysterectomy.
- PET is indicated following radiation therapy for advanced disease, but should be delayed until 120 days from the end of completion of therapy, due to risk of false positive FDG uptake in lethally irradiated cells, unless the clinical situation requires evaluation of disease outside the irradiated volume.
  - **Exceptions to delay of PET following radiotherapy include:**
    - If distant metastases are suspected clinically.
    - If progression is suspected on examination or by symptoms, and surgical salvage is being contemplated.
- PET is indicated for defining and staging recurrent disease when suspected by physical examination or other imaging.

PET-13.3 UTERINE (Endometrial)/VAGINAL/VULVAR:

- See [ONC-21 Uterine Cancer](#) and [ONC-23 Anal Cancer, Vaginal Cancer, and Cancers of the External Genitalia](#) in the Oncology guidelines
- PET is currently not indicated for these cancers, except in detecting suspected recurrence following therapy in endometrial carcinoma when recurrence cannot be confirmed histologically or by other imaging modalities.

PET-14 ~ LEUKEMIA

- See [ONC-25 Leukemia](#) in the Oncology guidelines
- There is currently no indication for PET in the evaluation of leukemia.
PET-15 ~ LYMPHOMAS

- See ONC-26 Lymphomas in the Oncology guidelines
- All imaging requests must clearly document the diagnosis with the cell subtype of lymphoma which is being evaluated.
- PET is inappropriate prior to histologic confirmation of cell type, except as discussed under Generalized Lymphadenopathy in PET-17 Miscellaneous.
- PET is helpful in the setting of most Lymphomas for initial staging.
- For the initial chemotherapy regimens for Hodgkin’s and many Non-Hodgkin’s Lymphomas (NHL), an “interim” re-staging PET study is suggested to evaluate response after 4 cycles, and a “final” re-staging PET is suggested when all therapies are complete.
  - Most patients will not require any more than these two restaging studies.
  - Interim PET is not indicated when there is no stated change in management that will be impacted by the results of the scans
  - Interim PET is not indicated if complete response is apparent by other imaging modalities or clinical information.
- Patients who achieve complete response to the above regimens should be followed by labs and CT only, reserving PET for suspected recurrence.
- PET is useful for detection of recurrence:
  - when recurrence is suspected on physical examination, laboratory studies, or conventional imaging in a patient with a history of Hodgkin’s lymphoma or history of an aggressive or intermediate lymphoma.
  - to confirm absence of lymphoma in a radiographically persistent CT abnormality.
  - when repeated lab tests such as LFT’s or ESR become elevated after previously being normalized, and CT scans are negative.
- PET is only recommended for Hodgkin’s, Follicular, Mantle Cell, Mycosis Fungoides, and all aggressive sub-types of lymphoma, see ONC-26 Lymphomas, Initial Workup, Diagnosis and Re-Staging/Recurrence in the Oncology guidelines.
  - However, for other sub-types, a single PET for re-staging can be performed for less than a complete response, if a previously obtained pretreatment PET demonstrates FDG-avid disease.
- PET is not indicated for routine surveillance.

PET-16 ~ MULTIPLE MYELOMA and PLASMACYTOMAS

- See ONC-24 Multiple Myeloma and Plasmacytomas in the Oncology guidelines
- As a rule, PET is not indicated in patients who clearly have MGUS or clearly have Stage III Myeloma.
- PET may be used to ensure that an apparently solitary plasmacytoma is truly solitary.
- PET may be indicated if lab studies suggest that an MGUS patient has possible progression to a more malignant form of disease, or for unusual signs, symptoms, or unexplained radiographic abnormalities.
- PET is useful to ensure that a patient with less than “full-blown” MM, (Stage I or II, or so-called “smoldering” myeloma) may be safely observed.
- PET is useful to evaluate for extraosseous plasmacytomas, if clinically suspected.
- PET may be helpful in certain cases of refractory disease, to aid in determining additional therapies.
- PET is not indicated for Full Stage (Stage III) multiple myeloma, when standard imaging and lab tests can define extent of disease and response to therapy.*
PET-17 ~ MISCELLANEOUS

PET-17.1 Carcinomas of Unknown Primary Site
- See ONC-27.7 Carcinoma of Unknown Primary Site in the Oncology guidelines
- PET is indicated for finding a probable primary site in carcinomas of unknown primary site.*

*ACR Practice Guidelines, FDG-PET/CT 2006

PET-17.2 Soft Tissue Sarcomas
- See ONC-11 Soft Tissue Sarcomas in the Oncology guidelines
- PET is generally not indicated for most soft tissue sarcomas.
  - **Exceptions:**
    - For patients with high grade sarcomas who have abnormalities found on other imaging studies or on physical examination, PET can be used to solve specific clinical questions or problems.*
    *ACR Appropriateness Criteria: Follow-up MusculoSkeletal Tumors, 2006
    *Clinical Nuclear Medicine 2006 Dec;31(12):754-760
    - To assist in determining the grade of an unresectable lesion, such as in the retroperitoneum, when the grade of the pathologic specimen is in doubt.
    - Prior to resection of an apparent solitary metastasis.

PET-17.3 Generalized Lymphadenopathy and Mediastinal Abnormalities:
- Also see CH-19 Mediastinal Lymphadenopathy in the Chest guidelines
- Lymphadenopathy from neoplasms as well as benign sources of inflammation can result in a positive PET scan. Therefore, the use of PET may not be helpful prior to histologic diagnosis.
  - Delaying biopsy of an accessible pathologic lymph node while awaiting the results of imaging tests is usually ill-advised. Biopsy should proceed as quickly as feasible.
- PET may be helpful when biopsy of a relatively inaccessible body region is contemplated, to confirm the likelihood of yielding a pathologic diagnosis and to determine if a more favorable site for biopsy exists.
- PET may be helpful in characterizing anterior mediastinal abnormalities, especially since the thymus gland has a characteristic uptake pattern on most PET scans, and the study may differentiate normal or benign hypertrophic thymus tissue from pathologic mediastinal lesions.

PET-17.4 Liver Lesions
- PET is indicated when a patient with a history of extrahepatic malignancy, with a cell type known to be FDG-avid, has a new finding of a liver lesion greater than 1 cm, judged to be suspicious for malignancy.*

*ACR Appropriateness Criteria: Suspected Liver Metastasis, 2005
PET GUIDELINE REFERENCES

PET-1~General Guidelines

PET-4~Cancers of the Head & Neck

PET-6~Melanoma
- Melanoma. NCCN Practice Guidelines in Oncology v.2.2006

PET-7~Thyroid Cancer

PET-8~Lung Cancer and Pulmonary Nodules

PET-9~Breast Cancer
- Breast Cancer. NCCN Practice Guidelines in Oncology. v.2.2006

PET-11~Gastrointestinal Tumors
- Gastric Cancer. NCCN Practice Guidelines in Oncology v.1.2006

PET-12~Urologic and Testicular Cancers


**PET-13~Gynecologic Cancers**


**PET-15~Lymphomas**


**PET-16~Multiple Myeloma and Plasmacytomas**

Multiple Myeloma. *NCCN Practice Guidelines in Oncology*. v.1.2006


**PET-17~Miscellaneous**

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2008 PEDIATRIC AND CONGENITAL HEAD IMAGING GUIDELINES

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The Head Imaging Guidelines are the same for both the pediatric population and the adult population, unless there are specific guidelines listed here in the Pediatric and Congenital Head Imaging Guidelines.

Advanced neuroimaging is only appropriate when there is either evidence of a cranial disorder or a clinically supported reason to search for cranial involvement in a systemic process.

**PACHD-1.1 Congenital anomalies:** Children and adults with one congenital anomaly are likely to have others. Imaging requests should be considered in this light. Anomalies are too various to permit general rules.

**PACHD-1.2 Overlapping studies:** If two studies using the same modality both cover the area of clinical interest, only one is generally needed. Certain exceptions are discussed as they arise.

- **Maxillofacial versus orbital/temporal bone CT:**
  - There is overlap in anatomy between maxillofacial and orbital CT.
  - A temporal bone CT exam requires a separate protocol and should be considered a separate entity.
    - The exception is that the temporomandibular joint (TMJ) may be seen on both temporal bone and maxillofacial CT studies.
  - Unless there is a grounded suspicion of simultaneous involvement of more posterior lesions, especially of the region involving the middle or inner ear, only one of these studies should be approved in a single case.
  - Mild mucosal thickening in the paranasal sinuses or mastoids without other abnormalities is common in healthy individuals and not of itself an indication for advanced imaging.
    - Head MRI provides sufficient visualization of the paranasal sinuses to evaluate for the presence or absence of sinusitis.
    - See PACHD-24 Sinus, Child guideline.

- **PACHD-1.3 Screening**
  - There are well-defined situations in which certain advanced neuroimaging studies may be useful in screening.
    - Screening noncontrast head MRI (CPT 70551) can be performed in first degree relatives (parents, siblings, children) of patients with known familial cerebral cavernous malformations (cavernomas).
    - Screening of asymptomatic individuals using advanced imaging is inappropriate in most circumstances, especially those in which the presence of clinical features is required to make the diagnosis (e.g. multiple sclerosis).

- **PACHD-1.4 CT versus MRI:**
  - MRI is usually preferable to CT for brain imaging. However, in some situations, the difference in value between the two is small.
    - When the advantage of MRI is slight, CT is often used in infants and toddlers to avoid anesthesia/heavy sedation.
    - **CT is the initial procedure of choice for the following:**
      - Urgent/emergent settings due to availability and speed of CT
      - Trauma
Evaluate for recent hemorrhage, whether traumatic or spontaneous
Evaluate the bony structures of the head
Evaluation and follow-up of hydrocephalus
Patients dependent on life support
- CT is normally performed prior to lumbar puncture in patients with cranial complaints.
  - On occasion MRI may be substituted.
  - The contrast used for the MRI depends on the clinical setting.
- In some low yield imaging settings such as dementia in the elderly and headache in patients with normal neurological examinations, CT continues to be useful despite the theoretical superiority of MRI.
- CT has little role in epilepsy, multiple sclerosis, pituitary disorders, characterization of known tumors, or evaluation of the late effects of stroke or head trauma.

- **PACHD-1.5 Brain PET:** Should be coded as metabolic brain PET (CPT 78608).

- **PACHD-1.6 References:**

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**PACHD- 2 ~ CONTRAST USE IN HEAD IMAGING**

- **PACHD- 2.1 Contrast in CT**
  - Head CT is normally performed without contrast except in certain situations in which it is being used as a necessary alternative to MRI: e.g. evaluating tumor, abscess, or the pituitary gland in patients who cannot have MRI.
  - **In these guidelines, head CT is without contrast (CPT 70450) unless otherwise specified.**
  - Sinus CT (CPT 70486) and temporal bone CT (CPT 70480) are generally performed without using contrast. Exceptions are noted in the appropriate locations below.
  - The iodide contrast used in CT reveals breakdown of the blood brain barrier and shows vasculature.
  - Mass effect, blood or blood products, and abnormal tissue are shown on noncontrast CT.
  - In patients who can have MRI, any abnormality on noncontrast CT is almost always better evaluated by MRI rather than CT with contrast.
  - MRI done in follow-up of an abnormal CT finding is usually done without and with contrast.
  - Contrast only head CT (CPT 70460) has almost no indications.
  - Unless there has been a noncontrast CT done within a few days with abnormal results (but see the comments in the bullet point above), such requests are almost always made in error (i.e. the request for “CT with contrast” should be interpreted as without and with contrast [CPT 70470]).
  - Neurologists, neurosurgeons, ENT specialists, and ophthalmologists should have the option of not using contrast when they believe it to be unnecessary.
• **PACHD- 2.2 Contrast in brain MRI**
  o MRI is done without contrast to find masses, simple infarcts, anatomical abnormalities, and blood or blood products. Otherwise, contrast is often useful.
  o MRI contrast (Gadolinium) also shows breakdown of the blood brain barrier (including inflammation), displays blood supply to advantage in certain settings, reveals contrast patterns which make a number of lesions easier to characterize, and can visualize the meninges when this is needed. It often helps to characterize posterior fossa lesions and to characterize known masses.
  o Contrast only MRI (CPT 70552) is never ordered in the head except to follow-up a very recent noncontrast study (within one to two weeks at most). Otherwise, requests for brain MRI with contrast only are almost always made in error and should be coded as without and with contrast (CPT 70553).
  o Neurologists, neurosurgeons, ENT specialists, and ophthalmologists should have the option of not using contrast when they believe it to be unnecessary.

• **References:**

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### PACHD- 3 ~ CT and MR ANGIOGRAPHY

• Except for stroke, arteriovenous malformation (AVM), sickle cell disease, pre-operative planning, and certain very rare disorders, these procedures are not often useful in childhood, and should be ordered only if there is both an appropriate presumptive diagnosis and an abnormal MRI, CT, or transcranial Doppler ultrasound. The exceptions are separately covered in the guidelines.
  o Review by a medical director is necessary for indications other than stroke, AVM, and sickle cell disease.
  o Reference:
    ➢ *Pediatr Neurol* 2000;23:307-311

• **CT and MR angiography (CTA and MRA):** These have been regarded as equivalents, but for most uses, CTA seems to provide superior images (better resolution). For many purposes, but not all, CTA has replaced catheter angiography.
  o CT angiography of head or neck is often ordered to resolve uncertainties identified on MRA of those regions, and this is acceptable.
  o **Head MRA is these guidelines means without contrast (CPT 70544).**
    ➢ Head MRA is generally done without contrast (CPT 70544). Some cerebrovascular experts prefer contrast MRA (CPT 70545) to evaluate certain strokes and AVM’s and to follow known aneurysms, but for technical reasons, the addition of contrast usually has little to offer.
      ▪ Requests for head MRA with contrast (CPT 70545) from neuro specialists are acceptable.
      ▪ In patients with documented marked reduction in cardiac output, head MRA with contrast (CPT 70545) may be useful to improve image quality.
  o **There are no generally recognized indications for head MRA without and with contrast (CPT 70546).**
MRA of the neck vessels is usually done with contrast only (CPT 70548), and “Cervical MRA” or “neck MRA” in these guidelines refers to contrast only MRA (CPT 70548) unless otherwise indicated.

- Some specialists use noncontrast MRA of the cervical vessels (CPT 70547) and this is acceptable when specifically requested.
- A reasonable suspicion of carotid or vertebral dissection is the only clear indication for performing cervical MRA without and with contrast (CPT 70549).

References:

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**PACHD- 4 ~ ATAXIA**

- Detailed neurological history and recent clinical examination are indicated prior to selection of neuroimaging in the evaluation of ataxia.
- Neurological consultation is helpful in determining the appropriate imaging pathway in these cases.

**PACHD- 4.1 Differential diagnosis of ataxia in children includes:**

- Tumor
- ataxia telangiectasia
- Friedreich’s ataxia
- juvenile lipofuscinoses
- Refsum’s disease
- Abetalipoproteinemia
- Post viral ataxia of childhood

- Noncontrast brain MRI (CPT 70551) is most often the appropriate imaging study, but MRI without and with contrast (CPT 70553) is reasonable when tumor or multiple sclerosis is being considered.
- Neurological consultation is helpful in determining the appropriate imaging pathway.
- **Cervical spine imaging:** In both adults and children, noncontrast MRI of the cervical spine (CPT 72141) is appropriate when no etiology for the ataxia has been discovered after other evaluation.

- Reference:
  - *ACR Appropriateness Criteria, Ataxia*, 2006

**PACHD- 4.2 Hereditary ataxias and sporadic slowly progressive ataxias** are an indication for MRI of the brain (contrast as requested) in both adults and children. If brain MRI is nondiagnostic, noncontrast cervical spine MRI (CPT 72141) is appropriate.

- Huntington’s disease and their use does not change the need for imaging

**PACHD- 4.3 Ataxia telangiectasia:**

- The most common cause of ataxia after tumor in children under age 10. In essence, inherited via autosomal recessive mechanisms.
- The most common cause of ataxia after tumor in children under age 10. In essence, inherited via autosomal recessive mechanisms.
Cerebellar abnormalities appear by early childhood and progress slowly. Cutaneous and conjunctival telangiectasias appear later.

Immune (IgA) deficiencies are usual, and sinopulmonary infections are prominent.

Lymphomas and related disorders occur with 50-100 times the expected frequency.

*Formes frustes* of Ataxia telangiectasis exist, with milder features occurring later in life.

Brain MRI shows cerebellar atrophy. A variety of medical tests and genetic tests are relevant.

Sinus and body imaging may be necessary for complications.

These children are immunocompromised.

Brain MRI, including upper cervical spine is appropriate when the diagnosis is unclear. Contrast is appropriate only when tumor is under consideration.

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**PACHD- 5 ~ PEDIATRIC EPILEPSY/SEIZURE**

- Detailed neurological examination and case history, including family history and the accounts of witnesses to seizures, should precede imaging.
- Neurological consultation is helpful in determining the need for advanced imaging in potential pediatric seizure patients.
- When imaging is indicated, brain MRI should be done if at all possible, rather than CT. Contrast should be added to the protocol if there is a progressing neurological deficit, if a noncontrast scan was abnormal, or at the discretion of an evaluating consultant.
- In contemporary American practice, noncontrast brain MRI (CPT 70551) will generally be performed in any child with documented new onset of non-febrile epileptic seizures.
- Repeat imaging for surveillance is not often indicated.
  - The specific indications for repeat imaging are those of adults:  
    - (see HD-14 Adult Epilepsy/Seizure in the adult Head guidelines).
- Imaging of children with typical febrile seizures is not medically necessary. These occur in children from ages 6 months to age five during fevers of >101°F (>38.4°C) and are brief generalized seizures. There is very often a family history of febrile seizures.
  - Neurological consultation may be helpful in confirming the diagnosis.
  - Important: not all seizures which occur in the presence of fever are febrile seizures.
- Evaluation for epilepsy surgery and intractable epilepsy: As in adults, PET (CPT 78608) may be useful in the evaluation of intractable epilepsy in children.
  - In certain rare pediatric syndromes, use of PET tracers other than FDG is growing at academic pediatric epilepsy centers.
- References:
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HEADACHE, CHILD

PACHD-6 ~ HEADACHE, CHILD

- Brain MRI without and with contrast (CPT 70553) is indicated in children with headache accompanied by an abnormal neurological examination, papilledema, or seizures.
- Advanced imaging without contrast is appropriate in children without neurological abnormalities if the headaches:
  - awaken the child from sleep
  - are associated with morning vomiting
  - are associated with diplopia.
    ▶ Brain MRI contrast as requested is preferred to evaluate diplopia
  - become severe and progressive within a month of onset
- MRI (CPT 70551) is preferred to CT (CPT 70450) to avoid exposure to ionizing radiation in a low benefit situation. However, in some of these children it may be difficult to obtain the cooperation needed for MRI.
- Thunderclap headaches in children without a family history of migraine:
  - Noncontrast head CT (CPT 70450) is the procedure of choice within 12 hours of onset.
  - If more than 12 hours, noncontrast head CT (CPT 70540) or head MRI, contrast as requested, can be performed.
  - If bleeding is seen, brain MRI without and with contrast (CPT 70553) will usually be appropriate, since in children, arteriovenous malformation (AVM), not aneurysm, is the most common non-traumatic source.
  - Head CTA (CPT 70496) or brain MRA without contrast (CPT 70544) should be performed if the initial imaging study shows intracranial bleeding.
    ▶ If AVM is identified, cervical CTA (CPT 70498) or MRA (CPT 70548) is also appropriate.
- Pediatric migraine, tension headaches, and school headaches are not an indication for advanced imaging.
- See HD 17.2 Thunderclap Headaches
- References:
  - Radiology 1997;202:819-824
  - ACR Appropriateness Criteria, Headache—Child, Revised 2005

PACHD-7 ~ SUBARACHNOID HEMORRHAGE

- Children and adolescents: Arteriovenous malformation (AVM), not aneurysm, is the leading cause of non-traumatic subarachnoid hemorrhage.
  - Even if CT has already been done (to establish the presence of subarachnoid blood), MRI (usually without and with contrast [CPT 70553]) is appropriate along with head and neck CTA (CPT 70496 and 70498) or MRA (CPT 70544 and 70548). Some centers use contrast enhanced MRA of the head for AVM, while others do not.
  - Reference:
Detailed medical history, recent general physical examination, and recent neurological examination are the initial phase in evaluating patients with potential neurological trauma.

CT is the primary imaging modality in patients with acute head trauma.
- MRI is used chiefly in severe acute head trauma when the clinical findings are not explained by the CT results (“the patient is much worse than the CT”) or to evaluate late effect of brain injury.
- When more than evaluation for potential neurosurgical lesions is needed, MRI is superior to CT in recognizing non-hemorrhagic cortical contusions, diffuse axonal injury (“shears”), and brain stem injury.

PACHD-8.1 Head CT is appropriate:
- After minor acute trauma in patients whose modified Canadian CT Head Rule inventory has any positive feature (see below)
- Any head trauma patient who is:
  - taking one anticoagulant or two antiaggregants, (e.g. aspirin and Plavix)
  - has a known platelet or clotting disorder
  - has significant renal failure (creatinine>6)
- The modified Canadian CT Head Rule:
  **Positives include:**
  - Glasgow coma scale (GCS) score of <15 within 2 hours of injury
  - >30 minutes of amnesia
  - any “dangerous mechanism of injury”
  - a suspected open skull fracture
  - any signs of basilar skull fracture
  - two or more episodes of vomiting
  - patient >64 years old
  - There must be no positives to omit scanning
- References:
  - *JAMA* 2005;294:1551-1553
  - *JAMA* 2005;294:1511-1518
  - *JAMA* 2005;294:1519-1525
  - *Lancet* 2001;357:1391-1396

In the six months following such injuries, whether or not there has been an initial scan, head CT or MRI is appropriate if the patient develops dementia, alteration of alertness, or focal neurological deficits (e.g. hemiparesis, diplopia). This includes fluctuating problems.

See SP-13 Mechanical Neck Pain, Trauma in the adult Spine guidelines for guidelines pertaining to cervical spine trauma.

PACHD-8.2 Brain MRI is not generally recommended as a first study, but noncontrast brain MRI (CPT 70551) is appropriate in:
- Patients (acute or chronic) who after head trauma have neurological features not explained by CT results.
- As part of a neurological or Pain Management evaluation following non-acute head trauma with documented neurological or neuropsychological deficits.
- Infants and children suspected of battered child syndrome (see below). These children have multiple non synchronous lesions which are best seen on MRI.
• PACHD- 8.3 Head MRA (CPT 70544) or CTA (CPT 70496) and brain MRI without and with contrast (CPT 70553) can be performed:
  o If there is high suspicion for vascular injury.
  o To evaluate for post-traumatic aneurysm following penetrating trauma.

• PACHD- 8.4 Battered child syndrome:
  o In children under age 2 with no neurological abnormalities in whom this situation is suspected, noncontrast brain MRI (CPT 70551) is recommended for evidentiary reasons to identify clinically silent non-synchronous lesions.
  o If there is a history of head trauma, noncontrast head MRI (CPT 70551) is preferred.
  o After age 5, history can be obtained and the situation more nearly resembles adult head trauma.
  o Reference:
    ➢ ACR Appropriateness Criteria, Suspected physical abuse--child, Updated 2005

• PACHD- 8.5 Follow-up of known subdural or epidural hematomas can be by either head CT or MRI (contrast as requested), and the preference of neurosurgeons and neurologists should be honored.
  o There is no precise schedule for follow-up imaging studies. These patients are usually under the care of a neuro specialist.

• PACHD- 8.6 Patients with post-traumatic headache persistent past the acute phase (a week or two) but without specific findings are best evaluated with noncontrast brain MRI (CPT 70551), but noncontrast head CT (CPT 70450) is acceptable.
  o Beyond 6 months past the injury, neurological consultation (Pain Management, Ophthalmology, or ENT (if relevant) is helpful in determining the optimal imaging pathway, if any.

• PACHD- 8.7 References:

PACHD- 9 ~ DYSTONIA

• Dystonia: In adults and children with dystonia, brain MRI (contrast as requested) is indicated if there are other neurological features beside the dystonia itself.*
  o PET: At this time, there is no firmly established basis for the use of PET in the evaluation or management of dystonia or other movement disorders

PACHD-10 ~ SUSPECTED MULTIPLE SCLEROSIS (MS)

• PACHD-10.1 Introduction
  o MS is notoriously variable in its presentation and course, but there are some useful generalizations.
    ➢ The most common presentation is relapsing: the occurrence of multiple episodes of focal neurological deficit each of which at least partially resolves.
Over time, this tends to evolve into a course of either steady progression of deficits (chronic progressive) or of relapses without improvement (progressive relapsing).

- MS is correctly thought of as a disease of young adults, particularly young women. However, it can present in childhood or in middle age.
- When it presents in mid-life, a progressive form affecting the spinal cord in particular is not unusual.

- Symptoms from MS most often arise from involvement of the optic nerves, the brain stem, the cerebellum, and the spinal cord.
- Since the advent of treatments which appear to influence the course of MS, the use of brain and spinal cord imaging to speed confirmation of the diagnosis has become widespread.
  - Criteria to avoid over-diagnosis have also evolved.
  - These criteria require considerable specialty expertise in their application.

**PACHD-10.2 Diagnosis:**
- MS is diagnosed by correlation between clinical, laboratory, and imaging data. The medical and social consequences of a misdiagnosis can be dire.
- Extremely detailed history and recent neurological examination are indicated before selection of imaging studies.
- Specialist consultation (neurology, neurosurgery, or, for visual syndromes, ophthalmology) is helpful in determining the appropriate imaging pathway and the significance of what are often difficult-to-interpret findings on imaging studies.
- MS most commonly presents with apparently single episodes of demyelination involving specific areas of the nervous system.
  - However, many patients who experience such a single episode do not go on to develop MS.
- The criterion for a firm diagnosis of MS is the presence of lesions dispersed in time and space (space=different locations in the nervous system).
- Since treatments which somewhat affect the course of the disease have become available, the use of MRI to anticipate dispersion in either space or time has become widespread. This allows for earlier treatment.
  - Various MRI diagnostic criteria for this purpose, which include findings on both brain and spinal cord imaging, are discussed in HD-22 Evidence Based Clinical Support section in the adult Head guidelines.
- General remarks on advanced imaging in MS:
  - CT, CTA, MRA are not useful in the evaluation of either new onset or established MS unless there is documentation of a grounded concern regarding a concurrent and unrelated diagnosis for which any of these studies would be of value.
  - Orbital MRI is not generally indicated, except for atypical cases of optic neuritis.
  - At this time, the value of newer imaging techniques such as diffusion tensor imaging and magnetic resonance spectroscopy in patients with multiple sclerosis remains to be established.
  - Newer MRI diagnostic criteria lay greater stress on the results of spinal cord imaging, and inclusion of the spinal cord in the initial imaging battery is appropriate for most situations other than clinically pure optic neuritis.
  - **Spinal cord imaging in MS:**
    - Cervical and thoracic spine MRI scans visualize the entire spinal cord, and lumbar spine MRI is not needed.
    - Screening spinal MRI consisting only of sagittal views of the entire spinal cord using a phased array detector coil may occasionally be requested and is
appropriate. Screening spinal MRI should be coded as one spine segment (CPT 72141 or 72146)

- **PACHD-10.3 Isolated clinical syndromes:**
  - **Optic neuritis:** MRI brain without and with contrast (CPT 70553) is indicated initially for patients with optic neuritis
  - MRI of the spinal cord (cervical spine with or without imaging the thoracic spine), contrast as requested, can be approved if brain MRI is suggestive of MS but not firmly diagnostic.
  - **Other cerebral isolated clinical syndromes:** MRI of the brain without and with contrast (CPT 70553) should be performed initially.
    - MRI of the spinal cord (cervical spine with or without imaging the thoracic spine), contrast as requested, and can be approved if brain MRI is suggestive of MS but not firmly diagnostic.
    - In certain patients, neurological findings are such that the likelihood of a normal brain MRI is very low, and in such cases, on specialist request, spinal cord imaging may be done simultaneously with head imaging.
  - **Transverse myelitis:**
    - Another “isolated clinical syndrome”
    - Spinal cord imaging (cervical and thoracic spine MRI [contrast as requested]) is appropriate initially.
      - If the clinical presentation is typical of a demyelinating process, it is acceptable to include the brain MRI in the initial imaging battery.
      - If spinal imaging does not show a non-inflammatory origin (spinal tumor or compression), brain MRI without and with contrast (CPT 70553) is also appropriate to rule out Multiple sclerosis if that has not already been done.
  - **References:**
    - *Neurology* 2003;61:602-611
    - *Ann Neurol* 2001;50:121-127
    - *AJNR* 2006;27:455-461

- **PACHD-10.4 Migratory Paresthesias:**
  - Patients with normal examinations who have either attacks of wandering paresthesias *lasting at least a full day* or a history of a recovered isolated clinical syndrome may be recommended for imaging using the guidelines in PACHD-10.3 Isolated clinical syndromes.
  - Also see **HD-26 Paresthesia** in the adult Head guidelines

- **PACHD-10.5 Repeat of initial negative studies:**
  - In the settings covered by PACHD-10.3 and 10.4, if the initial imaging studies are diagnostic, repeat studies are not indicated.
  - If the initial scans are not diagnostic, repeat studies at 3 months, and, if again negative, at one year can be approved.
  - Some centers prefer a repeat at 6 months in patients not started on treatment after a single isolated clinical episode, and this is acceptable.
  - Under the unusual circumstances detailed in the **HD-22 Suspected MS Evidence Based Clinical Support section in the adult Head guidelines**, repeat studies at one month may be appropriate.
    - These cases should be sent for Medical Director review.
• **PACHD-10.6 Familial MS and screening**
  o The lifetime risk of MS in first degree relatives of MS patients is about 4% (higher for female relatives).
  o Identical twins have a 35% concordance rate for MS.
  o Offspring of two MS patients have a 30% concordance rate for MS.
  o Screening based on family history in the absence of a clinical indication is not appropriate since the diagnosis cannot be made without a clinical component.
  o Reference:

• **Also see PACHD-20 Optic Neuritis**

• **PACHD-10.7 Neuromyelitis optica (DeVic's disease):**
  o A demyelinating syndrome characterized by involvement of optic nerves and spinal cord without symptomatic cranial lesions.
  o Most patients have normal brain MRI but some have hypothalamic lesions or non-specific features.
  o While spinal cord lesions of MS involve two or fewer segments, those in Neuromyelitis optica involve three or more.
  o Recently, a specific putative serum immune marker for this disease has been discovered.
  o Initial imaging includes brain and spine MRI.
  o Any needed follow-up can be limited to spine MRI in typical cases.
  o Reference:
    ➢ *Neurology* 2006;66:1485-1489

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**PACHD-11 ~ ESTABLISHED MULTIPLE SCLEROSIS (MS)**

• Detailed interval history and recent neurological examination are the first steps in any re-evaluation of patients with MS.

• **PACHD-11.1 Baseline imaging of the brain or brain and spinal cord** (contrast as requested) before starting immunomodulating treatment of MS is appropriate.
  o Use of the agent natalizumab (Tysabri) requires baseline brain MRI without and with contrast (CPT 70553).
    ➢ Repeat brain MRI without and with contrast (CPT 70553) is appropriate if symptoms consistent with PML occur while on Tysabri (PML = progressive multifocal leukoencephalopathy). Symptoms can include a rapidly progressive subacute dementia or a series of apparent strokes.
  o For all patients taking Tysabri, clinical evaluation at 3 months of treatment and then semiannually is required.
    ➢ Head MRI without and with contrast (CPT 70553) is acceptable at any of these re-evaluations if the treating physician requests it.

• **PACHD-11.2 Repeat imaging in established MS (MRI contrast as requested) is appropriate:**
  o If there is a new spinal episode (imaging should be limited to the spinal cord).
  o If the patient is being evaluated for the use of immunomodulating therapy. (see PACHD-11.1 Baseline imaging of the brain or brain and spinal cord)
    ➢ glatiramer = Copaxone
    ➢ natalizumab = Tysabri
    ➢ mitoxantrone = Novantrone This agent may cause cardiotoxicity and MUGA scans may be useful (see CD-3.7 MUGA study in the adult Cardiac guidelines)
- Beta-interferons = Avonex, Betaseron, and Rebif are the “standard” ones at present.
  - If the patient develops what seems to be a new and unrelated disorder.
  - Imaging should be appropriate to the potential new disorder.

- **PACHD-11.3 Annual surveillance scans of established MS patients** require that the patient be on immunomodulating therapy or be a candidate for such therapy.
  - Imaging can include:
    - Brain MRI (contrast as requested)
    - Cervical and thoracic spine MRI (contrast as requested) if spinal cord findings are likely.
  - The value of surveillance scanning in established MS is uncertain at this time.
  - In the progressive spinal form of MS, if prior brain imaging has been negative, spinal MRI (contrast as requested) rather than brain MRI may be sufficient for surveillance.

- **PACHD-11.4 Other Issues**
  - Specialist evaluation (neurology, neurosurgery, or, for visual syndromes, ophthalmology) is helpful in determining the need for advanced imaging in established MS.
  - In patients with severe spinal cord disorders, including MS, clinical evaluation of abdominal disorders may be very difficult because impaired cord function affects expected signs and symptoms. Requests for abdominal and pelvic imaging studies should be evaluated in this light.
  - MS patients on immune therapy of any sort must be regarded as immunocompromised, and this may be relevant to extra-neurologic imaging requests.
  - The practical difficulty of arranging imaging sessions in patients who are litter- or wheelchair-bound should be weighed carefully before recommending a serial approach to imaging in those patients.

- **PACHD-11.5 References**
  - AJNR 2006;27:455-461

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**PACHD-12 ~ NEURO-ONCOLOGY**

**BRAIN TUMORS**

- **PACHD-12.1 General remarks**
  - Brain MRI without and with contrast (CPT 70553) is indicated for both characterization and follow-up of brain tumors. However, occasionally neurologist, neurosurgeons, and oncologists treating such patients will find appropriate use for CT or noncontrast MRI.
  - Postoperative brain MRI is standard, usually 24 to 72 hours following brain tumor surgery.
  - Repeat imaging is appropriate when patients deteriorate or develop new features.
  - The management of pediatric brain tumors presents issues not readily addressed by general guidelines.
    - Reasonable imaging protocols in use by dedicated pediatric neuro-oncology centers should be considered acceptable.
  - MRI of the entire neural axis without and with contrast includes CPT 70553, 72156, 72157, and 72158.
**PACHD-12.2 Neurofibromatosis**

- **Neurofibromatosis, type 1 (von Recklinghausen’s Disease)**
  - Autosomal dominant. Incidence 1 per 5000. Only half have family history.
  - Imaging to screen children without symptoms is not generally appropriate.
  - Subcutaneous neurofibromas and multiple café au lait spots are typical.
  - Kyphoscoliosis is common and may cause cord compression. Spinal dural ectasias and meningoceles occur.
  - Intraspinal tumors are frequent.
  - Screening those without symptoms or signs is usually not useful, since most occult neurofibromas do not grow aggressively.
  - Optic nerve and brain stem gliomas are common (brain MRI without and with contrast [CPT 70553] and also orbits [CPT 70543] for those with optic nerve lesions).
  - These tumors require monitoring when present, but do not behave as malignantly as their names suggest.
  - Growth can be heralded by precocious puberty.
  - Headache is common, and because of elevated tumor risk and a high incidence of aqueductal stenosis (hydrocephalus), prompt brain MRI without and with contrast (CPT 70553) is appropriate.
  - Neurofibromatosis I is a known cause of strokes and of Moya moya disease.
  - Imaging should follow guidelines appropriate for pediatric stroke (see PACHD-17 Pediatric Stroke).
  - Imaging to screen family members without signs of the disease is generally inappropriate since the clinical picture is readily recognized.

- **Neurofibromatosis, type II** is a separate and extremely rare disease characterized by either bilateral acoustic neuromas or a combination of familial acoustic neuroma and another brain tumor. The tumors determine the imaging. It is mentioned only to avoid confusion with Neurofibromatosis I.

- Reference:

**PACHD-12.3 Grade I-II astrocytoma and benign oligodendroglialoma (low grade)**

- After initial biopsy or other treatment, repeat MRI brain without and with contrast (CPT 70553) is appropriate.
- Surveillance for posterior fossa tumors in this class is by brain MRI without and with contrast (CPT 70553) repeated every 3 to 6 months for 5 years and then annually.
- Supratentorial (cerebral proper) tumors should be re-imaged at approximately 3 months, 6 months, and then annually.
- Frequent imaging is used in the follow-up of low grade astrocytomas of childhood, with imaging in the range of every 3-4 months in the first two years, every 6 months in the third year, and every 6 to 12 months thereafter. Further imaging may be appropriate upon specific indication.
- Magnetic Resonance Spectroscopy (MRS) can be useful in following the course of pediatric low-grade astrocytomas, especially in regions such as the cerebellum, brain stem, and diencephalon.
  - Certain payers consider the use of MRS to be investigational, and their coverage policies will take precedence over MedSolutions’ guidelines. Prior authorization does not guarantee payment of the study.
• **PACHD-12.4 Glioblastoma and other malignant glial tumors (including grade III astrocytoma).**
  o Following surgery and radiation therapy (XRT) with or without adjuvant chemotherapy, brain MRI without and with contrast (CPT 70553) is usually performed 2 to 6 weeks following completion of treatment, and then every 2 to 3 months.
  o During chemotherapy treatments or a course of XRT, MRI brain without and with contrast (CPT 70553) every 8 to 10 weeks is usual.
  o PET: see PACHD-12.8 PET in brain tumor

• **PACHD-12.5 Ependymoma**
  o These tumors usually occur below the tentorium in children and above in adults.
    - The more malignant ones can seed the entire neural axis.
  o Postoperatively, MRI of the entire neural axis is appropriate (brain and entire spine without and with contrast).
  o Surveillance scanning should be every 3 to 4 months the first year, every 6 months the next year, and then every 6 to 12 months depending on the malignancy of the tumor.
    - For malignant ependymoma, entire neural axis scans are appropriate, but for benign ependymomas, imaging limited to the level of the tumor is appropriate.
    - While the child remains under active treatment with radiation and/or chemotherapy, bimonthly imaging is acceptable.
    - Magnetic Resonance Spectroscopy MRS may be useful to evaluate response to therapy.
    - Certain payers consider the use of MRS to be investigational, and their coverage policies will take precedence over MedSolutions’ guidelines. Prior authorization does not guarantee payment of the study.

• **PACHD-12.6 Medulloblastoma**
  o This tumor of childhood (also referred to as PNET--primitive neuro-ectodermal tumor) also seeds the entire neural axis, and imaging guidelines are similar to those for malignant Ependymoma (see PACHD-12.5 Ependymoma).
  o As long as the child remains under treatment with chemotherapy and/or radiation, imaging at bimonthly intervals is acceptable.

• **PACHD-12.7 Meningiomas** are tumors of the dura and are usually benign.
  o Initial imaging should be a brain MRI without and with contrast (CPT 70553).
  o In selected cases, noncontrast head CT (CPT 70450) may also be required to evaluate bony involvement.
  o Following documented complete resection, repeat imaging at 6 months, 2 years, and 5 years is sufficient.
    - For skull base meningiomas or any meningioma subtotally resected, follow-up imaging every 3 to 6 months for 2 years and then annually for life is recommended.
  o Malignant meningiomas (by pathology): re-image at 3 and 6 months post resection and then annually for life.
  o Meningiomas in children are unusual, but very aggressive, and more frequent MRI imaging is appropriate, especially during the two years following diagnosis.
• **PACHD-12.8 PET in brain tumor (metabolic brain PET – CPT 78608)**
  o Certain payers consider the use of brain PET in tumors to be investigational, and their coverage policies will take precedence over MedSolutions’ guidelines. Prior authorization does not guarantee payment of the study in that situation.
  o The chief use of PET in the management of brain tumor is to aid in distinguishing recurrent tumor from radiation cerebritis in patients with known anaplastic tumors of glial origin (glioblastoma, anaplastic astrocytoma, and anaplastic oligodendroglioma) and prior XRT.
  o Candidates for PET will have had a very recent brain MRI showing enhancing new lesions compatible with either recurrent tumor or radiation necrosis.
  o On rare occasion, brain PET (or Magnetic Resonance Spectroscopy) may be useful in resolving a diagnostic issue in a patient with a “tumefactive” MS plaque or infarct. Such cases require review by a medical director.
  o Magnetic Resonance Spectroscopy (MRS) is sometimes used to distinguish recurrent tumor from radiation cerebritis, and this is an acceptable alternative to PET
    ➢ Certain payers consider MRS investigational, and their coverage policies will take precedence over MedSolutions’ guidelines. Prior authorization does not guarantee payment of the study.
  o Brain, especially gray matter, takes up FDG avidly, and only very metabolically active tumors are more “PET avid” than this.
    ➢ FDG-PET is therefore generally not useful in the evaluation of most metastatic deposits and well-differentiated brain tumors.
  o Reference:
    ➢ *Central Nervous System Cancers. NCCN Practice Guidelines in Oncology v.2.2006*

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**PACHD-13 ~ PAPILLEDEMA – PSEUDOTUMOR CEREBRI**

• Pseudotumor cerebri is also called benign intracranial hypertension.
• The first step in evaluation is a detailed history and recent neurological examination.
• Papilledema indicates the presence of elevated intracranial pressure.
  o Brain MRI without and with contrast (CPT 70553) is indicated.
  o The vast majority of alert neurologically normal patients will have idiopathic intracranial hypertension (pseudotumor cerebri) and normal imaging studies.
  o Brain MRI is performed in these cases to exclude cerebral mass lesions, obstructive hydrocephalus, and occult meningeal disease.
  o Patients with papilledema will generally require lumbar puncture, but for reasons of patient safety, lumbar puncture is done after the initial brain imaging study.
• MRV (CPT 70544) is appropriate to exclude venous sinus thrombosis in atypical cases of pseudotumor.
  o Typically, pseudotumor occurs in overweight women of childbearing years and responds to medical treatment.
  o Atypical cases include:
    ➢ male patients.
    ➢ slender patients
    ➢ women > age 45
    ➢ children (< age 16) unless there is an apparent cause
    ➢ patients with known intrinsic system clotting disorders
    ➢ patients who fail to respond to pharmacologic treatment
• Ophthalmology or Neurology consultation may be helpful to:
  o distinguish papilledema from papillitis
  o distinguish pseudopapilledema from genuine papilledema

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establish the presence of mild papilledema
Re-imaging is infrequently indicated unless done to evaluate possible shunt dysfunction in those patients who have had ventriculoperitoneal (VP) or lumboperitoneal (LP) shunts or because of distinct clinical deterioration.
Also see HD-16.6 Chronic intractable headaches in the adult Head guidelines
Reference:
- Headache Currents 2005;2:1-10

### PACHD-14 ~ HYDROCEPHALUS

**Hydrocephalus:**
- Head ultrasound to screen for hydrocephalus is appropriate in infants less than six months of age (important for radiation exposure considerations).
- Head CT (CPT 70450) or MRI (CPT 70551) without contrast is appropriate to screen for hydrocephalus in children with accelerated head growth.
  - A positive study will usually require follow-up with brain MRI without and with contrast (CPT 70553).
- Head CT without contrast (CPT 70450) is appropriate to check shunt integrity in patients with ventricular shunts in whom shunt obstruction is suspected (children and adults).
  - Occasionally, there may be a role for abdominal CT to evaluate distal ventriculoperitoneal (VP) shunt problems.
- In some patients with obstructive hydrocephalus, CSF flow studies may be helpful in making treatment decisions (see HD-35.5 CSF flow imaging in the adult Head guidelines). These studies are generally part of a preoperative evaluation of the patient, and therefore, evaluation by a neurological or neurosurgical specialist is appropriate.

### PACHD-15 ~ OTHER PEDIATRIC HEAD GUIDELINES

(NOT ELSEWHERE COVERED)

**PACHD-15.1 Behavioral disorders**
- Behavioral disorders of childhood or adolescence generally require no imaging.
  - **Exception:**
    - Requests from neurologists and psychiatrists for MRI (contrast as requested) in children who show features of major psychoses and intellectual decline, and who have not responded to treatment, are often appropriate, since schizophrenia is uncommon before mid-adolescence.

**PACHD-15.2 Cerebral palsy**
- A non-progressive motor impairment dating from infancy and usually antenatal in origin.
- MRI or CT can identify a treatable problem in about 5% of those cases in which the cause was not determined in the newborn period (usually by ultrasound). In addition, it can prove the timing of the insult in most of the remaining cases.
- MRI is superior, but generally requires sedation or anesthesia.
- Brain MRI without and with contrast (CPT 70553) or head CT (CPT 70470) is appropriate for cases of cerebral palsy of undetermined origin or if a fixed deficit worsens.
  - **Reference:**
    - Neurology 2004; 62:851-863
• **PACHD-15.3 Craniostenosis**
  - Noncontrast head CT (CPT 70450) is indicated in the diagnosis of craniostenosis (craniosynostosis), and 3-D rendering (CPT 76376 or 76377) may be needed for surgical planning.

• **PACHD-15.4 Developmental delay/mental retardation**
  - Brain MRI without contrast (CPT 70551) is appropriate to evaluate for congenital abnormalities whether cerebral palsy is noted or not. If necessary, noncontrast head CT (CPT 70450) may be substituted.
  - Reference:

• **PACHD-15.5 Macrocephaly**
  - Defined as head circumference over two standard deviations above the mean for age and sex (as measured by standard growth charts).
  - Accelerated head growth of more than a standard deviation from prior measurements is also significant.
  - MRI scans should be approved contrast as requested to minimize the need for re-imaging.
  - Age less than 6 months: ultrasound is preferred initially. If ultrasound is abnormal (or unsuccessful), head CT to evaluate for hydrocephalus and calcifications is preferred, but MRI will also often be indicated after CT images are reviewed and, at times, will be done first.
  - Age 6 months to 2 years: MRI is recommended initially, since in this age group, uncomplicated hydrocephalus is less likely than in early infancy. CT is sometimes appropriate because of difficulty obtaining MRI in patients of this age.
  - Over two years of age: MRI is recommended initially.

• **PACHD-15.6 Megalencephaly**
  - This term refers to excessive size of brain constituents rather than just head size. MRI is appropriate when further imaging is required (the use of the term suggests there has been prior imaging).
  - Reference:

• **PACHD-15.7 Microcephaly**
  - The definition is similar to that for macrocephaly in reverse. MRI is recommended initially since CT may not detect the relevant anatomical abnormalities.
  - Reference:

• **PACHD-15.8 Sturge-Weber syndrome**
  - Port-wine nevus of the upper face (forehead or upper eyelid typical) combined with a meningeal vascular anomaly, usually with developmental delay, premature glaucoma, seizures, and stroke-like events. Only 5% of patients with the nevus have the cerebral disorder.
    - This condition is not familial and familial screening is not indicated.
  - Imaging: Brain MRI without and with contrast (CPT 70553). Head CT without and with contrast (CPT 70470) can be useful at times.
Cortical resections can be used to treat intractable seizures, and brain PET (CPT 78606) can be useful for preoperative mapping.

Reference:

### PACHD-15.9 Tuberous sclerosis
- Transmitted as an autosomal dominant with prevalence of ~1 per 7500
- Nervous system manifestations include cortical tumors, gliotic areas which resemble astrocytomas in appearance but not in behavior (tubers), and subependymal nodules. Seizures and mental retardation are typical.
  - Calcification of tubers is seen in about half of the cases.
- A peculiar tumor (giant cell astrocytoma) occurs in about 15% of patients.
- Multiple small angiofibromas of the face usually enable visual recognition of the syndrome.
- Extra-cranial neoplasms are also common, esp. cardiac rhabdomyomas, renal cysts, and benign tumors.
- **Imaging:** Brain MRI without and with contrast (CPT 70553) is sufficient for confirmation of the diagnosis and to follow giant cell astrocytomas.
- Cardiac echocardiogram and abdominal CT without and with contrast (CPT 74170) are appropriate when there is concern for tumors in those regions.
- Female patients often develop lymphangiomatosis of the lungs, and high resolution chest CT (CPT 71250) for screening is appropriate in adult female patients with tuberous sclerosis.
- **Familial screening:** Careful clinical evaluation without imaging is generally sufficient.
- Reference:

### PACHD-15.10 von Hippel Lindau Disease
- Autosomal dominant disorder
- Principal features are retinal angiomas and hemangioblastoma of the cerebellum.
- Pheochromocytomas (10%) and renal carcinoma are also relatively frequent.
- The hemangioblastomas are benign cystic tumors and may be associated with secondary polycythemia.
- Hemangiomas in other regions and benign renal and hepatic cysts occur.
- DNA testing can identify family members not at risk.
  - No screening imaging is needed for those members.
- For those at risk, abdominal screening by ultrasound should be done during the teenage years.
  - If the ultrasound is abnormal, CT of the abdomen with contrast (CPT 74160) can be performed.
- MRI of the brain and spine without and with contrast are recommended annually during the teenage years and then every two years.
- Temporal bone CT (CPT 70482) or MRI (CPT 70543) to rule out tumors of the endolymphatic sac is appropriate if hearing loss is present.
- References:
**PACHD-16 ~ SICKLE CELL DISEASE**

- Stroke is common and is an indication for active treatment. Half of these strokes are asymptomatic.
- Many centers follow the cerebral circulation of children with sickle cell disease (SS) with transcranial Doppler. Positive findings are further evaluated with brain MRI/MRA.
  - Transcranial Doppler is not reliable in those over age 20.
- At the preference of the treating physicians, brain MRI without and with contrast (CPT 70553) and noncontrast brain MRA (CPT 70544) can be used to follow these children even when neurologically normal.
  - Annual repeat studies are acceptable.
- A Moya-moya disease effect may arise. Noncontrast brain MRA (CPT 70544) is indicated, since CTA is unsafe (iodide based contrast is contraindicated in these patients).
- Sickle cell carriers (SA) are not at risk for these complications and do not require imaging.
- Many patients with S-Thalassemia and some patients with S-C disease require the same management as SS patients.

**PACHD-17 ~ PEDIATRIC STROKE**

**PACHD-17.1 General Considerations**

- The differential diagnosis is similar to that discussed for young adults (see HD-31.5 Premature Stroke in the adult Head guidelines), although large vessel atherosclerosis is less likely.
- The differential diagnosis includes cranio-cervical dissections, fibromuscular dysplasia, arteritis, venous infarction, cardioembolic stroke, MELAS, Moya moya disease, congenital heart disease, and arteriopathy related to a variety of congenital malformation syndromes, etc.
- Specialty consultation is strongly supported.
- Brain MRI without and with contrast (CPT 70553) is appropriate even if an initial head CT to exclude hemorrhage was performed.
- Brain and neck MRA, or CTA will generally be indicated as well.
  - Neck MRA should be without and with contrast (CPT 70549) when dissection is suspected.
- Sickle cell anemia is a major cause of strokes in children (see PACHD-16 Sickle Cell Disease).
- References:
  - J Child Neurol 2005;20:194-197

**PACHD-17.2 Venous infarcts**

- These are a small percentage of strokes (incidence ~3 per million per year vs ~2000 per million for all stroke), but most occur in children or young adults (75% of those being in women).
- Venous infarcts can arise either from cortical vein or venous sinus thrombosis. Those from sinus thrombosis typically cause elevated intracranial pressure.
The most common outpatient presentation is intracranial hypertension with papilledema from venous sinus thrombosis.

Brain MRI without and with contrast (CPT 70553) should be performed initially. MRV (CPT 70544) is appropriate when the typical pattern of venous infarction is seen on MRI.

Children or young adults who present with a stroke in which headache and seizures are prominent, or who are known to have an intrinsic system clotting disorder, can have brain MRI (70553) and MRV (CPT 70544) initially.

Head CT is often the first procedure done in stroke, and will usually indicate the presence of venous infarcts, but MRI/MRV will still be required if CT shows a venous infarct. Most of these cases are treated in hospital.

PACHD-17.3 Kawasaki syndrome

- Kawasaki syndrome (mucocutaneous lymph node syndrome) can cause aseptic meningitis and occasionally pediatric strokes
- Most patients with this disease are under age 12
- Coronary aneurysms are the most feared complications (see CD-8.7 Other Indications for Coronary CTA in the adult Cardiac guidelines)

PACHD-17.4 Takayasu’s arteritis (“pulseless disease”)

- Suspected in patients under age 40 with loss of at least one peripheral pulse, symptoms of limb claudication, and blood pressure asymmetries between limbs
- About half of patients have recurrent syncope.
- Strokes, transient ischemic attacks (TIA’s), amaurosis fugax, and cardiovascular events are common.
- The illness is seen in young children also.
- The site of involvement is the aorta and its major branches, including the coronary arteries (see CD-8.7 Other Indications for Coronary CTA in the adult Cardiac guidelines).
- MRA or CTA is useful for diagnosis and follow-up, and multiple studies (brain to lower limbs) are commonplace.
- Brain MRI (CPT 70553) is appropriate if there are focal neurological complaints or substantial changes on head or cervical MRA or CTA.
- Periodic re-evaluation with extensive MRA of the aorta and its primary branches is standard (annual studies are acceptable).

Reference:  

PACHD-18 ~ PITUITARY

PACHD-18.1 General Considerations

- The initial step in the evaluation of all potential pituitary masses is a detailed history, recent physical examination, and thorough neurological exam, including evaluation of the visual fields.
- Endocrine laboratory studies should be performed prior to considering advanced imaging.
- Pituitary imaging is accomplished by brain MRI, generally done without and with contrast (CPT 70553). Noncontrast MRI (CPT 70551) or MRI Orbit, Face, Neck
(CPT 70543) is used at times. CT head without and with contrast (CPT 70470) is acceptable in patients who cannot have MRI.

- Head CT without and with contrast (CPT 70470) is also occasionally used in addition to MRI to visualize parasellar bony structures in the preoperative evaluation of certain sellar tumors.
- One study (either brain MRI [CPT 70553] or MRI Orbit, Face, Neck [CPT 70543]) is adequate to image the pituitary. The ordering physician should specify that the study is specifically to evaluate the pituitary gland. The use of two CPT codes to image the pituitary is not indicated.
  - Pituitary adenomas are uncommonly found in children.

- **PACHD-18.2 Growth hormone (GH) deficiency** (pituitary short stature)
  - In patients suspected of growth hormone deficiency who have failed at least two standard growth hormone stimulation tests, imaging to evaluate the pituitary-hypothalamic area is recommended.
  - One abnormal GH test is sufficient for patients with defined central nervous system pathology, history of irradiation, multiple pituitary hormone deficiency or genetic defect affecting the growth hormone axis.
  - Reference:

- **PACHD-18.3 Pediatric diabetes insipidus**
  - The most common assigned causes are intracranial tumor, Langhans’ cell histiocytosis, and “idiopathic.”
  - Brain MRI without and with contrast (CPT 70553) is appropriate initially in pediatric diabetic insipidus.
  - Reference:

- **PACHD-18.4 Other pituitary region tumors**
  - Craniopharyngiomas arise in the parasellar area, and are the most common tumor of that region in children. Over half of these tumors present by about age 20. Few general rules can be given for follow-up, especially for the adamantinomatous variety generally seen in children.
  - **Meningiomas:** About 10% of meningiomas arise in this area. Evaluation may require CT in addition to MRI at times to evaluate for hyperostosis. Follow-up imaging is as for basal meningiomas in general (see PACHD-12.7 Meningiomas).

- **PACHD-18.5 Precocious puberty**
  - More common in girls than in boys. Defined as the appearance of secondary sexual characteristics before age 8 in girls and before age 9 in boys.
  - Most cases, especially in girls, are of no known cause. However, brain tumors, especially those of the diencephalon, need to be excluded. The most common tumor is a hypothalamic hamartoma.
    - Brain MRI without and with contrast (CPT 70553) is appropriate and usually sufficient.
PACHD-19 ~ MAGNETIC RESONANCE SPECTROSCOPY--PEDIATRIC

- **Magnetic resonance spectroscopy (MRS)**
  - Analysis of the levels of certain chemicals in pre-selected voxels (small regions) on an MRI scan done at the same time (see discussion in HD-35 Newer Imaging Techniques, Evidence Based Clinical Support section in the adult Head guidelines).
  - Certain payers consider MRS investigational, and their coverage policies will take precedence over MedSolutions' guidelines. Prior authorization does not guarantee payment of the study in this situation.
  - **Pediatric uses in neuro-oncology**: MRS is often useful in the management of pediatric brain tumors to determine the need for further therapy. Such cases require referral to a Medical Director.
    - Reference:
  - MRS is clearly useful in the diagnosis and subsequent management of certain rare inborn errors of metabolism affecting the central nervous system, including adrenoleukodystrophy, creatinine pathway disorders, and others. Cases should be referred for Medical Director review.
    - References:
      - *Neurology* 2005;64:434-441
  - MRS produces highly variable results in MS, varying with the pathological process. It does not appear to be useful in distinguishing multiple sclerosis plaques from tumors, since both can produce similar results.
    - The use of MRS in multiple sclerosis, especially in making the differential diagnosis of MS versus tumor, is experimental at this time.
  - Use of MRS in patients with cerebral metastases of systemic cancers is currently regarded as experimental.

PACHD-20 ~ OPTIC NEURITIS

- Also see [PACHD-10 Suspected MS](#) and [PACHD-11 Established MS](#)
- The diagnosis of optic neuritis can be made clinically - without imaging - with over 99% accuracy.
  - Imaging is done to find associated evidence of Multiple Sclerosis (MS); therefore, brain MRI without and with contrast (CPT 70553) is indicated on initial presentation.
  - Spinal cord imaging (cervical and thoracic spine) may be useful if brain imaging is neither normal nor firmly diagnostic of MS, but in apparently isolated optic neuritis, spinal cord imaging is not often useful.
  - Reference:
- Dedicated orbital imaging will usually show demyelination/inflammation of the optic nerve. However, this information is rarely clinically useful and in patients with optic neuritis, it is not relevant to McDonald criteria scoring for MS. **Orbital MRI is appropriate only in atypical cases.**
  - MRI of the orbits without and with contrast (CPT 70543) is appropriate in the presence of at least one of the atypical features listed below:
    - Visual loss progressing in severity for more than 10 days.
    - Patient age >45.
- Lack of any pain or soreness with the visual loss.
- Severe disc edema on clinical examination. Mild disc edema is common in optic neuritis, but severe edema with hemorrhages and exudates is not.
- Evidence of iritis or uveitis (eye disease not limited to the optic nerve).
- Failure to manifest at least some improvement in visual acuity within a month of onset.

References:
- Lancet Neurology 2005;4:111-121

- In adults, optic neuritis is generally unilateral. In children bilateral involvement is seen in about 40% of cases.

Reference:
- Neurology 2006;67:258-262

PACHD-21 ~ EPISTAXIS

- Initial evaluation of epistaxis (nose bleed), including recurrent epistaxis, is by direct or endoscopic visualization of the relevant portions of the upper airway.
  - If the initial clinical evaluation is unrevealing, Ear, Nose, and Throat (ENT) specialist consultation is helpful.
  - Maxillofacial CT may be useful in individual cases, depending upon the findings during the initial clinical evaluation.

PACHD-22 ~ FACIAL TRAUMA

- CT without contrast is the preferred imaging study in facial trauma.
- Coding of Facial imaging:
  - Maxillofacial versus orbital/temporal bone CT: both orbital/facial bone CT (CPT 70480, 70481, and 70482) and maxillofacial CT (CPT 70486, 70487, and 70488) cover the structures of the orbits, sinuses, and face. Unless there is a grounded suspicion of simultaneous involvement of more posterior lesions, especially of the region involving the middle or inner ear, one of these studies only should be sufficient.
  - Mild mucosal thickening in the paranasal sinuses or mastoids without other abnormalities is common in healthy individuals and not of itself an indication for imaging.
  - Ear, Nose, and Throat (ENT), Plastic surgery, or other relevant specialist evaluation is helpful in determining the appropriate imaging pathway.
  - Maxillofacial CT (CPT 70486) is the usual study (except in orbital or temporal bone trauma), but the preference of a requesting ENT or neurologist/neurosurgeon should be honored.
  - Patients with facial trauma are often at risk for associated injury of both the cranial contents and the cervical spine.

PACHD-23 ~ HEARING LOSS

- Otoscopic and audiological examinations are the initial steps in evaluating hearing loss of all types.
- Conductive hearing loss:
  - Advanced imaging is generally inappropriate in patients with hearing loss caused by benign impaction of one or both external auditory canals.
In patients with unilateral conductive hearing loss, especially those with abnormal otoscopic findings, temporal bone CT without contrast (CPT 70480) may be useful. When advanced imaging is necessary in patients with bilateral conductive hearing loss, CT of the temporal bone (70480) is usually appropriate.

- **ENT physicians often use contrasted CT or MRI when malignancy is identified, and this is acceptable.**

- **Cochlear hearing loss:**
  - ENT consultation is of benefit in patients with unexplained bilateral cochlear hearing loss.
  - In patients with unilateral cochlear loss, imaging with either brain MRI without and with contrast (CPT 70553) or temporal bone CT (CPT 70480) may be appropriate.
    - MRI (CPT 70553) is generally preferred when a retrocochlear lesion cannot be definitely excluded by other means.

- **Retrocochlear hearing loss:**
  - Brain MRI with attention to the internal auditory canals and without and with contrast (CPT 70553) is helpful in both unilateral and bilateral case.

- **Cochlear implants:**
  - The surgeon’s choice among preoperative craniofacial studies should be honored.

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**PACHD-24 ~ SINUS, CHILD**

- **PACHD-24.1 Indications for advanced imaging of the sinuses**
  - Maxillofacial or sinus CT is performed without contrast (CPT 70486) unless specifically indicated otherwise.
    - **Apparent sinusitis in an immunocompromised patient:** in this setting, sinus CT without and with contrast (CPT 70488) may be appropriate, since occult neoplasm and ill-contained infection are often issues.
    - Sinus CT without and with contrast (CPT 70488) is appropriate for sinusitis complicated by local spread of the infection into orbital or facial cellulitis or for other complications of sinusitis.
  - Suspected sinus infections should be treated empirically, generally with some combination of antihistamines, steroids, and antibiotics. If there has been no clear cut response within 10 days, especially if fever persists, sinus CT is indicated.
  - Sinus CT is also indicated if there is recurrence of a treated infection within 8 weeks of treatment.
  - Asthma with upper respiratory symptoms which responds poorly to empirical treatment for at least a week is a potential indication for sinus CT.
  - Sinus CT is indicated in the initial evaluation of fungal sinusitis.
  - Sinus CT may be indicated prior to upper respiratory endoscopy and as part of a specialty evaluation (ENT or Allergist) of either a persistent sinus problem or pediatric obstructive sleep apnea (see PACHD-24.3 Sleep apnea).
    - Children are not often referred to see ENT and Allergy consultants unless the problem is persistent, so sinus imaging is often a reasonable part of the consultant's initial evaluation.
  - CT stereotactic localization (CPT 77011) is sometimes used to direct surgical planning in patients undergoing surgery in this body region. When ordered by the operating surgeon for this purpose, such an operative study is appropriate.
  - If there is orbital or intracranial involvement, brain MRI (contrast as requested) may also be useful, typically following maxillofacial CT.
• **PACHD-24.2 Combined head and sinus imaging.**
  o Head CT does not visualize all of the sinuses.
  o Head MRI provides excellent visualization of the sinuses sufficient to recognize sinusitis, and addition of sinus CT for this purpose is unnecessary.
    ➢ In patients being evaluated for potential sinus surgery, separate sinus CT is often appropriate even after a head MRI in order to visualize obstructions to spontaneous mucous flow.
  o Separate head imaging is not generally indicated in patients with a nonfocal neurological examination who have headaches associated with sinus symptoms.
  o Sinus CT or MRI is not indicated for the evaluation of headaches without a more specific indication pointing to a sinus etiology.

• **PACHD-24.3 Sleep apnea:** At times either maxillofacial or neck (soft tissue) CT may be useful to evaluate for structures compressing the nasopharynx. Lateral radiographs should be done initially.

• **PACHD-24.4 References:**
  o *Pediatrics* 2001;108:798-808
  o *ACR Appropriateness Criteria, Sinusitis – child*, Updated 2006
  o *Otolaryngol Clin N Am* 2005;38:1137-1141
PEDIATRIC AND CONGENITAL HEAD IMAGING GUIDELINE REFERENCES

PACHD-1~General Guidelines

PACHD-2~Contrast Use in Head Imaging

PACHD- 3~CT and MR Angiography

PACHD- 4~Ataxia

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PACHD-7~Subarachnoid Hemorrhage
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PACHD-10~Suspected Multiple Sclerosis (MS)

PACHD-11~Established Multiple Sclerosis

PACHD-12~Neuro-Oncology, Brain Tumors
- Central Nervous System Cancers. NCCN Practice Guidelines in Oncology v.2.2006.

PACHD-13~Papilledema/Pseudotumor Cerebri
PACHD-15~Pediatric Head Guidelines (not elsewhere covered)

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PACNECK-1 ~ GENERAL GUIDELINES

- The Neck Imaging Guidelines are the same for both the pediatric population and the adult population, unless there are specific guidelines listed here in the Pediatric and Congenital Neck Imaging Guidelines.
- Advanced imaging of the neck covers the area from the skull base, nasopharynx, and upper oral cavity to the head of the clavicle. Thus, it includes the parotid gland and the supraclavicular region.
- Neck CT is usually obtained with contrast only (CPT 70491). Little significant information is added by performing a neck CT without and with contrast (CPT 70492). Neck CT without contrast (CPT 70490) can be difficult to interpret due to difficulty identifying the blood vessels.
- Neck CT is usually indicated to evaluate pathology in the neck when advanced imaging is appropriate. Indications for neck MRI are much less common.
  - However, in the pediatric population, neck MRI can be considered when advanced imaging of the neck is appropriate, due to concerns for radiation exposure with CT scans.

PACNECK-2 ~ NECK MASSES (PEDIATRIC)

- Evaluation of neck masses in pediatric patients involves careful consideration of clinical history and accurate physical examination. The patient’s age and knowledge of the anatomy and embryology of the neck are very important in narrowing the differential diagnosis.
- Imaging is helpful in making an accurate diagnosis if there is a well-defined differential diagnosis (see below).
- Ultrasound is the initial imaging study of choice. Ultrasound helps define the size and extent of localized superficial masses and helps confirm whether they are cystic or solid. Color Doppler ultrasound can evaluate the vasculature.
- Neck CT (usually with contrast [CPT 70491]) or MRI (contrast as requested) can be used to further characterize abnormalities seen on ultrasound.
- MRI usually requires sedation in patients under age 6.
- Cervical lymphadenitis is common in children and follows most viral or bacterial infections of the ears, nose, and throat. No advanced imaging is necessary in the absence of persistent lymph node enlargement.
- Differential diagnosis of neck lesions by anatomic region:
  - Subcutaneous tissues: Teratoma (includes dermoid cysts), vascular malformations, lipoma, cellulitis, plexiform neurofibroma, keloid, scar, subcutaneous fat fibrosis (in neonates).
  - Retropharyngeal space:
    - Abscess, cellulitis, adenitis
    - Usually involves children under age 6.
    - Patients have history of upper respiratory tract infection followed by high fever, dysphagia, and neck pain.
    - Soft tissue neck CT (CPT 70491) or MRI (contrast as requested) can be used to rule out abscess.
    - Lymphadenopathy
    - Extension of goiter
    - Extension of pharyngeal tumor
o Retrovisceral space (posterior to the cervical esophagus): Gastrointestinal duplication cysts (usually are diagnosed in first year of life)

o Pretracheal space (contains trachea, larynx, cervical esophagus, recurrent laryngeal nerves, and thyroid and parathyroid glands): thyroglossal duct cyst, goiter, laryngocele, lymphadenopathy, abscess

o Danger space (closed space lying between the skull base and the posterior mediastinum and between the alar and prevertebral fasciae in a sagittal plane): Cellulitis, abscess.

o Prevertebral space: Neuroenteric cyst, cellulitis, abscess, spondylodiskitis lymphadenopathy, cellulitis, abscess, paraganglioma.

o Carotid sheath space: Jugular vein thrombosis or phlebitis, lymphadenopathy, cellulitis, abscess, paraganglioma.

o Parotid gland space: Parotid lymphadenopathy, retromandibular vein thrombosis, parotiditis, sialodochitis (inflammation of the salivary gland duct), salivary duct stone.

o Submandibular and sublingual spaces:
  - Thyroglossal duct cyst
    - Usually presents as an enlarging, painless midline mass in a child or young adult.
    - 50% of patients present before age 20 and 50% present during young adulthood.
  - Branchial cyst
    - 90% of branchial abnormalities arise from the second branchial apparatus
    - Most second branchial cleft cysts are located in the submandibular space, at the antero-medial border of the sternocleidomastoid muscle, lateral to the carotid space, or posterior to the submandibular gland.

o Masticator space (includes masseter and pterygoid muscles): Venous or lymphatic malformation, cellulitis, abscess, rhabdomyosarcoma.

o Parapharyngeal space: Cellulitis, abscess, rhabdomyosarcoma (second most common pediatric head and neck malignancy), extension of lymphoma.

o Perivertebral space (includes the prevertebral and paravertebral spaces): Cervical dermal sinus (epithelium-lines dural tubes that connect the skin with the central nervous system or its covering), meningocele, rhabdomyosarcoma, extension of lymphoma, cervical neuroblastoma.

o Posterior cervical space: Lymphatic malformation, lymphadenopathy.

- **Reference**:

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**PACNECK- 3 ~ CERVICAL LYMPHADENOPATHY**

- Causes of cervical lymphadenopathy can be divided into two categories:
  1) Inflammatory
  2) Neoplastic

- **Inflammatory**
  - Inflammatory lymph nodes from acute lymphadenitis are usually painful, tender and mobile, frequently associated with upper respiratory infection, pharyngitis or dental infection.
  - Occasionally, sarcoidosis or toxoplasmosis and Human immunodeficiency virus (HIV) can cause inflammatory lymphadenopathy as well.
  - Painful acute lymphadenopathy and other painful neck masses (including neck “swelling”) should be treated with a trial of conservative therapy, including antibiotics if appropriate.
  - If there is Improvement with conservative treatment, advanced imaging is not indicated.
Ultrasound can also be helpful in determining whether a distinct mass/abnormality is present

- **References:**

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**Evidence Based Clinical Support**

**PACNECK- 2 ~ NECK MASSES (PEDIATRIC)**

- Congenital cervical cysts usually present in children and include thyroglossal duct cyst (55% of cases), cystic hygroma (25%), branchial cleft cysts (16%), bronchogenic cyst (0.91%), and thymic cyst (0.3%).
- Thyroglossal duct cyst is the most common congenital neck mass and is usually detected before the age of 20. 75% present as a midline mass. 43% of patients present with an infected mass. Thyroid carcinoma occurs in 1% of thyroglossal duct cysts.
- Second branchial cleft cysts are the most common branchial cleft cyst and usually present in young adults as painless fluctuant masses. A history of repeated infections in the region of the mandible suggests the diagnosis.
- Fourth branchial pouch cysts are rare and present as a recurring abscess in the left side of the neck. Barium swallow and neck CT scan are needed for diagnosis.
- The most common malignant ENT tumors in children are lymphoma and rhabdomyosarcoma.
PACNECK-2~Neck Masses (Pediatrics)

PACNECK-3~Cervical Lymphadenopathy
PEDIATRIC AND CONGENITAL CHEST IMAGING GUIDELINES

PACCH-1 ~ GENERAL GUIDELINES

- The Chest Imaging Guidelines are the same for both the pediatric population and the adult population, unless there are specific guidelines listed here in the Pediatric and Congenital Chest Imaging Guidelines.
- Although there are a number of congenital disorders that affect the thorax (e.g. congenital lobar emphysema (CLE), bronchogenic cyst, congenital cystic adenomatoid malformation (CCAM), pulmonary sequestration, lung aplasia and hypoplasia, congenital diaphragmatic hernia (CDH), pericardial cyst, vascular rings), imaging guidelines for the chest in the pediatric population are the same as for adults.
  - Chest x-ray should be performed as the initial imaging study, and results of the chest x-ray will then dictate the need for subsequent diagnostic studies such as CT, MRI, ultrasound, or bronchoscopy.
  - Chest x-rays should be overread by a radiologist prior to request for advanced imaging.
  - Intrathoracic abnormalities found on chest x-ray, fluoroscopy, abdominal CT scan, or other imaging modalities can be further evaluated with chest CT with contrast (CPT 71260).
  - Chest CT without and with contrast (CPT 71270) does not add significant diagnostic information above and beyond that provided by chest CT with contrast, unless a question regarding calcification needs to be resolved.
  - MRI, if requested, can be considered rather than CT due to concerns regarding radiation exposure.
  - Chest MRA (CPT 71555) or CTA (CPT 71275) can be performed to evaluate possible vascular anomalies or to evaluate the blood supply to certain anomalies such as pulmonary sequestration.
- Reference:

ANATOMIC GUIDELINES

PACCH-2 ~ SUPRACLAVICULAR REGION

- A complete history and physical examination, including palpation of the supraclavicular region, should be performed initially in the evaluation of a suspected supraclavicular mass or abnormality.
  - The sensitivity of palpation, CT and ultrasound for detecting supraclavicular metastases were 33%, 83%, and 100%, respectively.\(^1\)
  - In one study, lymph nodes had to have a diameter of 22.3 mm or greater to be palpated in 50% of cases.\(^1\)
    \(^1\) Radiology 2004;232:75-80
  - Given the high false positive and false negative results of palpation alone, ultrasound should be performed in order to confirm the presence of enlarged lymph nodes or other mass prior to considering advanced imaging.
    - Ultrasound has the added advantage of allowing ultrasound-guided fine needle aspiration (FNA) for histologic diagnosis of a suspicious lymph node or mass.*
    \(*\) Radiology 2004;232:75-80
  - If ultrasound is indeterminate, soft tissue neck CT with contrast (CPT 70491) or chest CT with contrast (CPT 71260) can be performed. Either study images the supraclavicular region equally well if done correctly.*
Definitive diagnosis of a supraclavicular abnormality requires biopsy (fine needle aspiration biopsy or open biopsy).

**SYMPTOM-BASED GUIDELINES**

### PACCH- 3 ~ HEMOPTYSIS

- The patient’s history should help determine the amount of blood and differentiate between hemoptysis, pseudohemoptysis, and hematemesis.
- Most common etiologies for hemoptysis:
  - **Children:** Lower respiratory tract infections, foreign body aspiration, bronchiectasis secondary to cystic fibrosis.
    - In addition, bleeding caused by suffocation, deliberate or accidental, should be considered.
- **Work up:**
  - Careful history and physical examination and chest x-ray.
  - **Low risk patient with normal chest x-ray:** treat on an outpatient basis with close monitoring and antibiotics if indicated.
  - **Patients with recurrent or unexplained hemoptysis:** chest CT with contrast (CPT 71260) should be performed even if chest x-ray is normal.
- **Reference:**
  - In the non-trauma patient with a history of clinically documented hemoptysis, chest CT (either with contrast [CPT 71260] or without contrast [CPT 71250] depending on physician preference) is indicated prior to bronchoscopy.*
    *AJR 2002;179:1217-1224

### BRONCHIAL TREE

### PACCH- 4 ~ BRONCHIECTASIS

- Bronchiectasis is defined as localized, irreversible dilatation of bronchi >2 mm in diameter. Patients have excessive mucus production.
- Bronchiectasis is associated with a wide range of disorders, including cystic fibrosis, AIDS, alpha1-antitrypsin deficiency, rheumatoid arthritis, obstruction of the bronchi, and necrotizing bacterial infections.
- Chest x-ray and pulmonary function tests (PFT’s) should be performed initially in patients with known or suspected bronchiectasis, but may be normal.
- High resolution chest CT scan (HRCT) without contrast (CPT 71250) is the advanced imaging study of choice to confirm the diagnosis of bronchiectasis and/or evaluate patients with known bronchiectasis who have worsening symptoms or worsening PFT’s.
- MRI is not used to evaluate patients with bronchiectasis.
- There are no published data to support performing routine follow-up advanced imaging of the chest in the absence of new or worsening symptoms or worsening lung function studies in patients with known bronchiectasis.
- Patients with bronchiectasis who present with hemoptysis should undergo chest CTA (CPT 71275).
- **Reference:**
LUNG PARENCHYMA (ALPHABETICAL ORDER)

PACCH- 5 ~ PNEUMONIA

- Chest x-ray (overread by a radiologist) should be performed initially in all patients with suspected pneumonia prior to considering advanced imaging.
- Chest CT with contrast (CPT 71260) may be helpful in evaluating a patient with pneumonia that has shown no improvement by chest x-ray after two weeks or has not cleared by chest x-ray after four weeks.
- Chest CT with contrast (CPT 71260) is indicated when chest x-ray shows a possible complication of pneumonia (e.g. abscess, effusion) or possible lung mass associated with the infiltrate.

PACCH- 6 ~ POSITIVE PPD or TUBERCULOSIS (TB)

- Chest CT with contrast (CPT 71260) can be performed in patients with positive PPD skin test or other positive tuberculin skin tests and normal chest x-ray who have not had a previous normal chest CT.
- Chest CT can show evidence of tuberculosis (e.g. primary complexes, mediastinal or hilar lymphadenopathy) in up to 20% of patients with unremarkable chest x-rays.*
  *AJR 1997 April;168(4):1005-1009
  *Eur J Radiol 2003 Dec;48(3):258-262
- Evidence of tuberculosis on chest CT will alter clinical management and result in full multi-drug treatment for these patients rather than single drug treatment for positive PPD.
- If chest CT is unremarkable, there is sufficient data to support performing subsequent chest CT scans unless symptoms develop or chest x-ray shows a new abnormality.
- Follow-up chest CT with contrast (CPT 71260) can be used to re-evaluate patients undergoing active treatment for tuberculosis who had abnormalities seen only on chest CT.
  - The frequency of the follow-up chest CT scans should be at the discretion of the pulmonary specialist following the patient, as there are no published guidelines or evidence-based data addressing this issue.
- Patients with suspected complications or progression of tuberculosis (e.g. pleural tuberculosis, empyema, mediastinitis) can be evaluated with chest CT with contrast (CPT 71260).

PACCH- 7 ~ SARCOID

- Also see ONC-28.5 Sarcoidosis in the Adult Oncology guidelines and HD-33.3 Sarcoidosis in the Adult Head guidelines.
- CT of the chest either with contrast (CPT 71260) or without contrast (CPT 71250) is superior to chest x-ray in establishing the diagnosis of sarcoid. CT helps differentiate sarcoid from other granulomatous disorders, especially tuberculosis, and allows follow-up for the detection of complications, especially fibrosis.*
- Patients with suspected sarcoid should have chest CT either with contrast (CPT 71260) or without contrast (CPT 71250) to establish or rule out the diagnosis.
- Chest CT (either with [CPT 71260] or without [CPT 71250] contrast) is indicated in patients with worsening symptoms, new symptoms after a period of being asymptomatic, or if a treatment change is being considered.
- There is currently insufficient evidence-based data to support the routine use of PET in evaluating sarcoidosis.
PACCH- 8 ~ SOLITARY PULMONARY NODULE (SPN)

- A pulmonary nodule seen on an imaging study other than a dedicated chest CT (e.g. nodule seen on abdominal CT, spine MRI, chest or coronary artery CTA, etc.) can be further evaluated with one chest CT without contrast (CPT 71250) or with contrast (CPT 71260).
- A solitary pulmonary nodule (SPN) can be imaged by chest CT without contrast (CPT 71250) or with contrast (CPT 71260) (depending on physician preference) if there has been an increase in size on chest x-ray, if there are no old films for comparison, or if the lesion does not have classically benign characteristics by chest x-ray or previous CT (e.g. benign calcification pattern typical for a granuloma or hamartoma).
- If the SPN was identified on a prior CT, then CT without contrast (CPT 71250) or with contrast (CPT 71260) (with thin cuts through the nodule) can be performed as follows: 1-5
  - Nodules less than 5 mm (0.5 cm): repeat CT scan at 1 year
  - Nodules 5 to 6 mm (0.5 to 0.6 cm): repeat CT scan at 6, 12, 24 months
  - Nodules ≥7 mm (0.7 cm): repeat CT scan at 3, 6, 12, 24 months
  
  1 Radiology 2004;231:164-168
  2 Radiology 2005;237:395-400
  3 National Lung Screening Trial
  4 American College of Chest Physicians guidelines 2003
  5 International Symposium on Multidetector-Row CT, San Francisco, 2005

- Children with a malignant solid tumor of other sites who are found to have pulmonary nodules of any size can have repeat chest imaging at 3, 6, 12 and 24 months, since in this population, pulmonary nodules ≤5 mm were as likely to be malignant as larger nodules.*
  
  *Radiology 2006; 239:514-520

- PET scan (CPT 78812 or 78815) is appropriate for the characterization of an SPN if the lesion is a distinct parenchymal lung nodule (not an infiltrate, ground glass opacity, or hilar enlargement) measuring greater than or equal to 7 mm on chest CT scan.
  - **NOTE:** Certain payers consider PET scan investigational for evaluating pulmonary nodules ≤1 cm or lung masses >4 cm. Their coverage policies will take precedence over MedSolutions’ guidelines. Prior authorization does not guarantee payment of the study.

  - If PET scan is negative, chest CT should be performed at 3, 6, 12, and 24 months.*
    
    *Radiology 2006; 239:34-49

- Serial PET scans to evaluate lung nodules are not appropriate: if the original PET is positive, biopsy should be performed. If the original PET is negative but subsequent chest CT shows increase in size of the nodule, biopsy should be performed.*
  
  *Radiology 2006; 239:34-49

MEDIASTINUM

PACCH- 9 ~ MEDIASTINAL LYMPHADENOPATHY

- See PET-17.3 Generalized Lymphadenopathy and Mediastinal Abnormalities in the Adult PET guidelines.
- Mediastinal abnormalities detected on chest x-ray (overread by a radiologist) can be further evaluated by chest CT with contrast (CPT 71260).
- Mediastinal masses identified on screening chest CT scans should be approached conservatively.
  - In the I-ELCAP study which involved almost 30,000 individuals who received screening chest CT scans, 123 (1%) had a mediastinal lesion, but only 4 were cancers.*
    
    *Imaging Economics 2005 Feb, p.37
• If chest CT shows one or two enlarged lymph nodes in the mediastinum with no suspicion for malignancy, follow up chest CT (CPT 71260) at 4 to 8 weeks can be performed.
  o Requests for additional CT scans or for PET should be sent for Medical Director review.
• If chest CT shows multiple enlarged lymph nodes in the mediastinum, then either follow up chest CT (CPT 71260) can be performed at 4 to 8 weeks, or lymph node biopsy should be considered to obtain a histologic diagnosis.
• Lymphadenopathy from neoplasms as well as from benign sources of inflammation can result in a positive PET scan. Therefore, the use of PET may not be helpful prior to histologic diagnosis.
• If biopsy can only be accomplished by mediastinoscopy or thoracoscopy/thoracotomy (i.e. percutaneous biopsy, transbronchial biopsy, transbronchial biopsy using endobronchial ultrasound, and endoscopic ultrasound-guided FNA cannot be performed), and a negative PET scan will allow the patient to be observed, then PET can be considered to confirm the likelihood of yielding a pathologic diagnosis and to determine if a more favorable site for biopsy exists.
• PET may be helpful in characterizing anterior mediastinal abnormalities, especially since the thymus gland has a characteristic uptake pattern on most PET scans, and the study may differentiate normal or benign hypertrophic thymus tissue from pathologic mediastinal lesions.

### PACCH-10 ~ MEDIASTINAL MASS

- The most common primary mediastinal tumors are lymphoma, thymus gland neoplasia, thymus cysts/hyperplasia, and endocrine tumors (mainly goiters).
  - Other tumors include germ cell tumors such as mature teratomas, seminomas, and nonseminomatous germ cell tumors.
  - Overall, 43% of mediastinal tumors are malignant and 57% are benign.
- Chest CT with contrast (CPT 71260) is the imaging study of choice to evaluate mediastinal abnormalities.
- Chest CT with contrast (CPT 71260) is indicated to evaluate a widened mediastinum on a chest x-ray (overread by a radiologist).
- Chest CT (either with contrast [CPT 71260] or without contrast [CPT 71250]) is indicated in patients diagnosed with myasthenia gravis in order to rule out a thymoma. Note: iodinated contrast has been reported to provoke myasthenia crisis.
- Patients with a suspected substernal goiter should have a neck ultrasound or radionuclide study first to confirm extension of the thyroid to the sternum.
- In patients who present with dysphagia and no history of prior malignancy, barium swallow should be performed initially.

### BREAST

### PACCH-11 ~ BREAST MASS

- Chest x-ray and chest CT (either CPT 71250 or 71260) can be performed to evaluate a breast mass in the pediatric population, since malignancies such as lymphoma or rhabdomyosarcoma will need to be ruled out.
CHEST WALL AND RIBS

PACCH-12 ~ PECTUS EXCAVATUM and PECTUS CARINATUM

• Initial evaluation of patients with suspected or known pectus excavatum (ribs and sternum grow abnormally producing a concave or caved-in appearance in the anterior chest wall), pectus carinatum (anterior protrusion of the chest wall), or other deformities of the chest wall or sternum should include a complete history and physical examination and plain chest x-rays.
• Chest CT without contrast (CPT 71250) can be performed in selected cases of asymmetric pectus excavatum, if significant cardiac displacement and rotation is suspected, or for preoperative planning.
• ECG and echocardiography should be performed initially in patients with cardiac symptoms or evidence of abnormalities of cardiac function.
• Recent chest x-ray and pulmonary function tests (PFT’s) should be performed initially in patients with known pectus who present with increasing shortness of breath.

THORACIC VASCULAR DISORDERS

PACCH-13 ~ PULMONARY ARTERIOVENOUS FISTULA (AVM)

• Definition: abnormal connection between pulmonary arteries and veins.
• Etiology:
  o Acquired: penetrating or blunt trauma to the chest; bronchiectasis
  o Congenital:
    ➢ Most congenital AVM’s are associated with hereditary hemorrhagic telangiectasia (Rendu-Osler-Weber syndrome).
    ➢ 50%-60% of patients with pulmonary AVM are affected by Rendu-Osler-Weber syndrome.
    ➢ Pulmonary AVM’s are usually discovered in the third or fourth decade of life.
    ➢ Patients present with dyspnea, hemoptysis, cyanosis (due to left to right shunting), extra-cardiac bruits, and rarely with epistaxis and hematemesis.
    ➢ Multiple AVM’s occur in 30% of cases, and bilateral AVM’s occur in 10% of cases.
    ➢ Patients at risk for Rendu-Osler-Weber syndrome should also have brain imaging to rule out cerebral AVM (present in 10%-20% of patients with Rendu-Osler-Weber).
• Pulmonary AVM’s are most commonly found in the lower lobes.
• Chest x-rays are abnormal in approximately 98% of patients with pulmonary AVM.
• Chest x-ray usually shows a peripheral, circumscribed, non-calcified lesion connected by blood vessels to the hilum of the lung.
• Chest CT (contrast as requested) and chest MRA (CPT 71555) or chest CTA (CPT 71275) can be obtained for evaluation of possible pulmonary AVM.
• First degree relatives of a patient with a pulmonary AVM (not due to trauma or bronchiectasis) can undergo screening with chest CT (CPT 71260).
• Treatment of pulmonary AVM is by surgery (usually lobectomy) or embolization of the feeding artery using platinum coils or detachable balloons.
• References: Australasian Radiology 2005;49:242-245
• Chest CTA (CPT 71275) or MRA (CPT 71555) can be performed in patients with known or suspected vascular ring.
• Patients may present with stridor or dysphagia if the vascular ring is compressing the esophagus.
• A vascular ring is often suggested initially on barium swallow obtained to evaluate dysphagia.
PEDIATRIC AND CONGENITAL CHEST IMAGING GUIDELINE REFERENCES

PACCH-1~General Guidelines

PACCH-2~Supraclavicular Region

PACCH-3~Hemoptysis

PACCH-4~Bronchiectasis

PACCH-6~Positive PPD or Tuberculosis (TB)

PACCH-7~Sarcoid

PACCH-8~Solitary Pulmonary Nodule (SPN)
- National Lung Screening Trial
- American College of Chest Physicians guidelines 2003
PACCH-9~ Mediastinal Lymphadenopathy

PACCH-12~ Pectus Excavatum and Pectus Carinatum

PACCH-13~ Pulmonary Arteriovenous Fistula (AVM)
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PEDIATRIC AND CONGENITAL CARDIAC IMAGING GUIDELINES

PACCD-1 ~ GENERAL GUIDELINES

- The Cardiac Imaging Guidelines are the same for both the pediatric population and the adult population unless there are specific guidelines listed here in the Pediatric and Congenital Cardiac Imaging Guidelines.
- Hybrid imaging (e.g. SPECT/CT) which involves SPECT (MPI) imaging and CT for optimizing location, accuracy, and attenuation correction combines functional and anatomic information.
  - There is currently no evidence-based data to formulate appropriateness criteria for these hybrid scans.

PACCD-2 ~ CARDIAC MRI

- All requests for cardiac MRI should be sent for Medical Director review.
- See CD-6.1 Cardiac MRI, CPT Codes in the adult Cardiac guidelines for guidelines regarding the new cardiac MRI CPT codes for 2008.
- MRA of the coronary arteries is not yet adequately sophisticated to replace coronary angiography in evaluating coronary disease and should not be authorized.
  - EXCEPTIONS: coronary artery anomalies and Kawasaki disease are conditions where MRA is considered useful.

- PACCD-2.1 Indications for cardiac MRI in the pediatric population include:
  - Pre- and postoperative congenital heart disease assessment (e.g. Tetralogy of Fallot, patent ductus arteriosus, platypnea, coarctation of the aorta, atrial septal defects, restrictive ventricular septal defect, anomalous pulmonary arteries or veins or anomalous coronary arteries).
    - Use CPT 75557 or 75561.
    - CPT 71555 (chest MRA) may be added if the aorta or pulmonary artery need to be visualized beyond the root.
    - Use CPT 75558 or 75562 only if there is a need to clarify findings on a recent echocardiogram.
    - Chest MRA alone (CPT 71555) can be performed in certain situations, especially if requested by the cardiovascular specialist.
  - Clinical suspicion of arrhythmogenic right ventricular dysplasia or arrhythmogenic cardiomyopathy (ARVD/ARVC), especially if patient has presyncope or syncope. MRI (CPT 75557) is considered the optimal test for this disorder.*
    - * Circulation 2006;113:316-327
    - *Circulation 2005;112(25):3823-3832
  - Pericardial disease (constrictive versus restrictive pericarditis; perimyocarditis).
    - Use CPT 75561.
  - Evaluate cardiac tumor or mass (e.g. in sarcoidosis or tuberous sclerosis).
    - Use CPT 75561.
  - Anomalous coronary arteries: Cardiac MRI (CPT 75561) or CTA (CPT 0146T) (which is still favored) is much better at detecting this than conventional angiography.
  - Fabry's disease: late enhancement MRI may predict the effect of enzyme replacement therapy on myocardial changes that occur with this disease. Use CPT 75561.
• PACCD-2.2 The aortic root and proximal ascending aorta can be adequately evaluated during a cardiac MRI.
  o For screening due to family history of aortic aneurysm or dissection see CH-30 Thoracic Aortic Dissection or Aneurysm in the adult Chest guidelines.
  o If a patient (e.g. Marfan’s or Loey-Dietz syndrome) with known ascending aortic aneurysm needs a cardiac MRI to evaluate another problem and the physician wishes to evaluate the ascending aorta, this evaluation should be included with the cardiac MRI interpretation. If the ascending aortic aneurysm is quite distal, near the arch, it is appropriate to include the chest MRI code (CPT 71551) or chest MRA code (CPT 71555).

• PACCD-2.3 Echocardiogram is the initial imaging study of choice to evaluate pericardial effusions or diagnose pericardial tamponade.
  o However, contrast enhanced cardiac MRI is useful for evaluating pericarditis, neoplastic effusion, tamponade or myocardial infiltration.
  o Cancers that can metastasize to the pericardium or myocardium and can cause a malignant effusion include lung, breast, renal cell, lymphoma and melanoma.

**PACCD-3~CT OF THE HEART and CTA of the CORONARY ARTERIES**

• PACCD-3.1 General
  • Certain payers consider coronary calcium scoring and/or cardiac CT and coronary CTA investigational, and their coverage policies will take precedence over MedSolutions’ guidelines. Prior authorization does not guarantee payment of the study.
  • Certain payers require cardiac CT studies to be performed on a 64-slice CT scanner.

• PACCD-3.2 Anomalous Coronary Artery(ies)
  • Evaluating coronary artery anomalies and other complex congenital heart disease of cardiac chambers or great vessels is an appropriate indication for coronary CTA.
  o Use CPT 0146T for evaluating coronary artery anomalies
  o Use CPT 0150T for congenital heart disease
    ➢ Can add CPT 71275 (chest CTA) to evaluate great vessels
    ➢ In cases of anomalous pulmonary venous return, can add CT abdomen and pelvis
  o The use of coronary CTA to rule out anomalous coronary artery(ies) should be limited to patients less than age 40 with a history that includes one or more of the following:
    ➢ angina or myocardial infarction without high atherosclerosis risk
    ➢ full sibling(s) with history of sudden death syndrome before age 30 or with documented anomalous coronary artery
    ➢ resuscitated sudden death
    ➢ unexplained syncope (not presyncope)
    ➢ Patients should have had a thorough negative evaluation for syncope as outlined in HD-32 Syncope in the adult Head Guidelines and CD-11 Syncope in the adult Cardiac guidelines (e.g. echocardiogram, cardiac evaluation for postural blood pressure changes, resting low blood pressure, or low heart rate, myocardial perfusion imaging study, exercise treadmill test, or stress echocardiogram, consideration for situational syncope) prior to considering coronary CTA.
    ➢ unexplained new onset of heart failure (e.g. without known coronary artery disease or other causes for cardiomyopathy)
    ➢ documented ventricular tachycardia (6 beat runs or greater)
    ➢ equivocal coronary artery anatomy on conventional cardiac catheterization
The presence of other congenital heart disease is not a separate indication for coronary CTA to rule out anomalous coronary artery(ies).

**PACCD-3.3 Other Indications for Cardiac CT/Coronary CTA:**
- Congenital heart disease assessment using CPT 0150T or 71275 is indicated in both children and adults for the following:
  - Determination of extra-cardiac anatomy in patients with complex congenital heart disease
    - For example: great vessel relationships, bronchial collateral vessels, abdominal situs, etc.
  - Pulmonary artery (PA) and Pulmonary vein assessment:
    - Pulmonary artery evaluation in children who need preoperative or postoperative evaluation for PA stenosis or PA atresia
    - PA caliber evaluation in children with pulmonary hypoplasia
    - PA evaluation to look for another anatomic structure impinging on the PA, or to look for airway/bronchial compromise by an enlarged PA or other mediastinal vessel.
    - Assessment of the course of drainage of pulmonary veins when chest x-ray suggests anomalous pulmonary venous drainage.
  - Coarctation of the aorta or interruption of the aortic arch suspected on echocardiography.
  - Evaluation of the arterial supply and venous drainage in children with bronchopulmonary sequestration.
- Vasculitis/Takayasu's/Kawasaki's disease can be imaged with coronary CTA (CPT 0148T).
- Cardiac CT (CPT 0145T) can be used to assess cardiac tumor or mass, pericardial mass, pericarditis/ constrictive pericarditis, complications of cardiac surgery, evaluation of postoperative anatomy and surgically corrected systemic-to-pulmonary artery shunts and intra-cardiac baffles, etc.
- Cardiac CT (CPT 0145T) can be used to evaluate cardiac thrombus in patients with technically limited echocardiogram, MRI, or transesophageal echocardiogram.
- Cardiac CT (CPT 0145T) can be used to evaluate clinical suspicion of arrhythmogenic right ventricular dysplasia or arrhythmogenic cardiomyopathy (ARVD/ARVC), especially if patient has presyncope or syncope.
- Native aortic abnormalities can be investigated with cardiac CT (CPT 0145T) if echocardiogram is indeterminate.

**PACCD-3.4 Radiation Dose**
- Radiation dosage for CTA of the coronaries varies by facility and the particular protocol used. The American College of Radiology Clinical Statement on Noninvasive Cardiac Imaging states that "as a general rule a multi-detector CT scan encompassing the heart should not result in an effective dose of greater than 12 mSv.”*
  - Current 16-slice CT scanners usually keep the radiation dose <13 mSv.
  - 64-slice CT scanners can deliver a radiation does from 15-25 mSv (especially in women due to needing to penetrate breast tissue).
  - Dual source scanners decrease radiation exposure by approximately one third.
  - Using dose modulation, in which much less radiation is delivered during the portion of the cardiac cycle not normally used for reconstruction, the radiation dose on non-dual source CT scanners can be reduced to <13 mSv, but not all facilities have this capability.

*J Am Coll Radiol 2005;2:471-477*
PACCD-4~SYNCOPE

- Also see HD-32 Syncope in the adult Head guidelines
- **Evaluation of syncope:**
  - Echocardiogram should be performed initially to look for valvular or cardiomyopathy dysfunction.
  - Cardiac evaluation for postural blood pressure changes, resting low blood pressure, or low heart rate should be performed.
- Stress echo (preferred) or one myocardial perfusion imaging (MPI) study can be performed in patients with syncope who are intermediate to high risk for coronary artery disease (see CD-3.3b and CD-3.3c in the adult Cardiac guidelines for risk assessment).
  - *Circulation* 2006;113:316-327
- Patients at low risk for coronary artery disease should undergo exercise treadmill test or stress echocardiogram initially.
- Cardiac MRI (CPT 75561) or coronary CTA (see CD-8.11 CPT Coding in the adult Cardiac guidelines for CPT codes) can be considered if there is concern for anomalous coronary arteries, infiltrative heart disease or certain types of cardiomyopathy.
- **Duchenne muscular dystrophy:** usually imaged by echocardiogram but evaluation for ischemic or cardiomyopathic changes using MPI or (typically) cardiac MRI (CPT 75557 or 75561) can be performed
- Cardiac MRI (CPT 75557) can be performed to evaluate pre-syncope or syncope in patients with suspected ARVD/ARVC (see PACCD-2 Cardiac MRI).
PACCD-2~Cardiac MRI

PACCD-3~CT of the Heart and CTA of the Coronary Arteries

PACCD-4~Syncope
PEDIATRIC AND CONGENITAL PERIPHERAL VASCULAR DISEASE (PVD) IMAGING GUIDELINES

PACPVD-1~GENERAL GUIDELINES

• The Peripheral Vascular Disease Imaging Guidelines are the same for both the pediatric population and the adult population, unless there are specific guidelines listed here in the Pediatric and Congenital Peripheral Vascular Disease Imaging Guidelines.

PACPVD-2~AORTIC DISORDERS, RENAL VASCULAR DISORDERS, and VISCERAL ARTERY ANEURYSMS

• Thoracic Aortic Disease
  o Chest CT (CPT 71260 or 71270), chest CTA (CPT 71275), or chest MRA (CPT 71555) can be used for surveillance or follow-up of thoracic aortic abnormalities in patients with Loeys-Dietz syndrome, Marfan syndrome, Takayasu disease, or Kawasaki syndrome.*
  o Less lethal disorders such as Turner syndrome and tuberous sclerosis have also been associated with aortic dissection.*
    *Clin Cardiol 2006;29:383-386

• Aortic congenital vascular malformations can be seen with chromosomal abnormalities such as Turner syndrome.
  o Malformations can include aortic coarctation and aortic valve abnormalities.
  o Cardiac MRI (CPT 75557 or 75561), chest MRA (CPT 71555), chest CT (CPT 71260), or chest CTA (CPT 71275) may be needed for evaluation. Specialist input is helpful in determining the appropriate imaging pathway.
  o Coarctation is usually detected at younger ages with blood pressure substantially elevated in one or both upper extremities relative to lower extremity blood pressures. Plain chest x-ray in this syndrome may also demonstrate characteristic “rib notching.”

• Visceral artery aneurysms
  o These include arteries to the spleen, kidney, liver and intestines
  o Aneurysm of these arteries is defined by an increase of more than 50% of the original arterial diameter
  o Risk for rupture is high when the aneurysm is greater than 2 cm or is increasing rapidly*
  o Vascular specialist consultation is beneficial in order to determine the time-frame to intervention.
  o Monitoring by ultrasound or CT with contrast is appropriate, although ultrasound should be attempted first
  o Celiac artery aneurysm can be evaluated by CT abdomen with contrast (CPT 74160) and ultrasound.*
    * Arch Surg 2002;137:670-674
  o No definitive time period for serial studies has been established.
    ➢ Initial evaluation with six month follow-up is reasonable.
    ➢ Yearly follow-up in conjunction with vascular specialist consultation should be performed if no significant enlargement is seen.
PACPVD-2~Aortic Disorders, Renal Vascular Disorders, and Visceral Artery Aneurysms

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PACAB-1 ~ GENERAL GUIDELINES

• The Abdominal Imaging Guidelines are the same for both the pediatric population and the adult population, unless there are specific guidelines listed here in the Pediatric and Congenital Abdominal Imaging Guidelines.
• Abdominal imaging begins at the diaphragm and extends to the umbilicus or iliac crest.
• Prior to considering advanced imaging, patients should undergo a recent detailed history, physical examination, appropriate laboratory studies, and the use of non advanced imaging modalities such as plain x-ray and ultrasound.
• To avoid radiation exposure, pediatric imaging should consider the use of ultrasound or MRI where it is a clinical option.
  o MRI of the abdomen with contrast only is essentially never performed. If contrast is indicated, MRI abdomen without and with contrast (CPT 74183) should be performed.
• CT imaging:
  o Abdominal CT is usually performed with contrast (CPT 74160). Exceptions are noted in the individual guidelines.
  o Abdominal CT performed for evaluation of renal stones is performed without intravenous contrast (CPT 74150).
  o Abdominal CT for the evaluation of a pediatric abdominal mass can be performed without and with intravenous contrast (CPT 74170), to detect calcification in the mass.
• Abdominal CT or MRI can be considered to further evaluate abnormalities seen on other imaging modalities such as plain x-ray, ultrasound, etc.
• Fever of Unknown Origin: Refer to ONC-28~Medical Conditions with Cancer in the Differential Diagnosis in the Adult Oncology guidelines.

GENERAL ABDOMINAL SIGNS/SYMPTOMS (ALPHABETICAL ORDER)

PACAB-2 ~ ABDOMINAL PAIN

• Ultrasound should be the initial imaging study in patients who present with right upper quadrant pain, left upper quadrant pain or epigastric pain, since ultrasound is useful in detecting gallbladder and other hepatobiliary pathology, renal lesions, ascites, splenic pathology, and sometimes adrenal lesions. If an abnormality is found that warrants further imaging, the information provided by ultrasound can help determine the most appropriate advanced imaging modality (CT vs MRI vs MRCP, etc.).*
  *ACR Practice Guidelines for the Performance of an ultrasound examination of the abdomen or retroperitoneum, 1/1/02
• Ultrasound should be the initial imaging study in females with ovaries or uterus intact who present with generalized abdominal or lower abdominal pain, in order to rule out gynecological pathology.
• Children with generalized abdominal pain and normal physical examination and laboratory studies, including stool for blood (and stool culture if diarrhea), should initially be evaluated by ultrasound and treated conservatively.
  o Gastroenterology (GI) specialist evaluation is helpful in determining the need for advanced imaging.
• Children with abdominal pain and signs of failure to thrive, anemia, bleeding, and/or abnormal laboratory studies should be initially evaluated with ultrasound to determine the need for further imaging.*
• Patients without prior inguinal hernia surgery who present with lower abdominal or groin pain and suspected inguinal hernia may benefit from evaluation by a surgeon.
  o Ultrasound is the initial modality for inguinal hernia screening in children.
  o CT is not appropriate unless the child is morbidly obese.
  o Ultrasound has a very high sensitivity and specificity (88%-100%) for evaluating inguinal and femoral hernias.* Ultrasound identified the pathology in a groin (either hernia or lipoma) without a palpable bulge at an accuracy of 75%.*
  *Ann Ital Chir. 2002 Jan-Feb;73(1):65-68
• Children presenting with abdominal pain may have an intussusception.
  o Plain x-rays (supine and left lateral decubitus views) should be performed initially to exclude mass or bowel obstruction from other causes.
  o Ultrasound is appropriate as the initial study if there is a strong suspicion for intussusception, but if negative, plain x-rays of the abdomen should follow.
• In all other patients who present with persistent abdominal pain (greater than 4 weeks with no improvement) with unremarkable endoscopy and/or barium enema results, CT scans of the abdomen and pelvis with contrast (CPT 74160 and 72193) can be performed.
  o GI specialist evaluation can be helpful in determining the appropriate imaging pathway.
  o Repeat imaging in patients with unchanged or improving symptoms is not appropriate.

**PACAB- 3 ~ ABDOMINAL SEPSIS (SUSPECTED ABDOMINAL ABSCESS)**

• CT abdomen and/or pelvis with contrast (CPT 74160 and/or 72193) is indicated when the patient has a palpable mass or suspicious abdominal symptoms with fever and/or elevated white blood cell count.*
  *ACR Appropriateness Criteria, Acute abdominal pain, 2006
• Ultrasound may be useful in follow-up of known fluid collections, especially with catheter drainage, provided the patient is stable or improving. Serial CT scans with contrast (CPT 74160 and/or 72193) are also appropriate.

**PACAB- 4 ~ FLANK PAIN, RULE OUT RENAL STONE**

• In pregnant patients and children, ultrasound or MR urography (MRI abdomen and pelvis, contrast as requested) is the best initial study to avoid radiation exposure.*
  *ACR Appropriateness Criteria, Acute onset flank pain, 2005
• CT of the abdomen and pelvis without contrast (CPT 74150 and 72192) are the best imaging studies in the non-pregnant patient to rule out kidney stone.
• Serial CT scans to determine the passage or dissolution (of uric acid stones) of kidney stones are acceptable if they do not exceed three scans in a six week period.
  o If the stone has been seen on the pelvic CT portion of the CT scan, the subsequent CT scan(s) should only include the pelvis.
  o Urology evaluation can be helpful in determining the need for serial CT scans.
• Post-procedure follow-up should be performed with x-rays of the abdomen every 6 to 12 months in asymptomatic patients unless the patient had uric acid stones.¹
• CT abdomen and pelvis without and with contrast (CPT 74170 and 72194) can be performed if there were surgical complications or the patient develops unusual symptoms.¹


PACAB-5 ~ ACUTE GASTROENTERITIS (PEDIATRIC)

• Imaging is not indicated in pediatric acute gastroenteritis unless there is a concern for other causes of symptoms.
• Pediatric imaging in suspected gastroenteritis should begin with plain x-rays of the abdomen, including supine and left lateral decubitus views. The left lateral decubitus view is useful for the detection of air-fluid levels and for detection of gas in the rectum—to exclude obstruction.
• Ultrasound should be performed if there is suspicion for intussusception or organomegaly.
• Ultrasound may detect findings of gastroenteritis, but is not indicated for the diagnosis of gastroenteritis.
• Gastroenterology (GI) specialist evaluation is helpful, especially in evaluating patients with persistent symptoms or with gross bleeding.

References:
  o CDC, Managing Acute Gastroenteritis Among Children, November 21, 2003, Vol.52, No. RR-16

PACAB-6 ~ LEFT LOWER QUADRANT PAIN

• Pelvic ultrasound is the initial imaging study of choice for children and for females <45 years old who still have ovaries or uterus intact, for detecting gynecologic abnormalities that may cause left lower quadrant pain.
• A 5 to 7 day trial of conservative therapy and close observation should be performed prior to considering advanced imaging in patients who present with mild localized abdominal pain, but without significant clinical or laboratory findings.
• CT abdomen and pelvis with contrast (CPT 74160 and 72193) can be performed if pain persists or if any one of the following significant clinical findings is present:
  o severe abdominal pain
  o palpable mass on examination
  o nausea/vomiting
  o fever
  o significant abdominal tenderness to palpation
  o elevated white blood cell count
• Gastroenterology (GI) specialist evaluation is helpful in determining the appropriate diagnostic pathway in patients with mild pain and heme positive stools or rectal bleeding, since advanced imaging with CT is rarely helpful in the initial evaluation of these patients.
  o References:
    o Am Fam Physician 2005;72:1229-1234 and 1241-1242
    o ACR Appropriateness Criteria, Left Lower Quadrant Pain, 2005
PACAB- 7 ~ LEFT UPPER QUADRANT PAIN

- Ultrasound should be the initial imaging study in patients who present with left upper quadrant pain or epigastric pain, since ultrasound is useful in detecting gallbladder and other hepatobiliary pathology, renal lesions, ascites, splenic pathology, and sometimes adrenal lesions. If an abnormality is found that warrants further imaging, the information provided by ultrasound can help determine the most appropriate advanced imaging modality (CT vs MRI vs MRCP, etc.)*

*ACR Practice Guidelines for the Performance of an ultrasound examination of the abdomen and retroperitoneum, 1/1/02

PACAB- 8 ~ POSTOPERATIVE PAIN WITHIN 60 DAYS FOLLOWING ABDOMINAL SURGERY

- CT abdomen and pelvis with contrast (CPT 74160 and 72193) can be performed in patients with suspected postoperative complications (e.g. bowel obstruction, abscess, anastomotic leak, etc.)*
- Children should be evaluated with ultrasound initially (especially in small children or in thin older children) or with MRI abdomen and pelvis without and with contrast (CPT 74183 and 72197).*
  - Although MRI theoretically would be desirable to reduce radiation exposure, MRI is not practical for the timely evaluation of post-operative abscesses.
  - MRI often requires sedation, is a lengthy study, and may take several days to be performed, thus causing a significant time delay in diagnosis.
- Beyond 60 days postoperatively, see PACAB-2 Abdominal Pain.
  *ACR Appropriateness Criteria, Suspected small bowel obstruction, 2005
  *ACR Appropriateness Criteria, Acute abdominal pain and fever or suspected abdominal abscess, 2006

PACAB-9 ~ RIGHT LOWER QUADRANT PAIN, RULE OUT APPENDICITIS

- Children, females of childbearing age, and pregnant patients may be evaluated first with ultrasound if local expertise exists. If positive, no further diagnostic imaging is necessary. If negative or equivocal, CT abdomen and pelvis with contrast (CPT 74160 and 72193) or without contrast (CPT 74150 and 72192) can be performed.
  - MRI abdomen and pelvis without and with contrast (CPT 74183 and 72197) or without contrast (CPT 74181 and 72195) can be performed for pregnant patients or if ultrasound or CT is equivocal.
  - References:
    ➢ AJR 2004 Sept;183:671-675
    ➢ Radiology 2006 March;238(3):891-899
- If appendicitis is strongly suspected, CT of the abdomen and pelvis either with contrast (CPT 74160 and 72193) or without contrast (CPT 74150 and 72192) should be performed in all patients except pregnant patients (see above).*
  *ACR Appropriateness Criteria, Acute abdominal pain, 2006
- If appendicitis is not at the top of the differential diagnosis, then females less than 45 years old who have ovaries or uterus intact and present with right lower quadrant pain should have ultrasound of the pelvis performed initially to rule out gynecological pathology.
PACAB-10 ~ RIGHT UPPER QUADRANT PAIN, RULE OUT CHOLECYSTITIS

- Right upper quadrant ultrasound is generally the imaging study of choice in the patient with acute right upper quadrant pain, with or without fever, if the gallbladder has not been removed.*
  *ACR Appropriateness Criteria, Right upper quadrant pain, 2005
  Accessed November 20, 2006

- In patients who have had cholecystectomy, or in patients with normal ultrasound, CT of the abdomen with contrast (CPT 74160) can be performed.

MISCELLANEOUS ABDOMINAL ENTITIES (ALPHABETICAL ORDER)

PACAB-11 ~ ABDOMINAL LYMPHADENOPATHY

- Patients with lymphadenopathy localized to the abdomen and found incidentally on previous imaging without associated fever, weight loss, pain, GI bleeding, or other intraabdominal findings to raise the suspicion of malignancy, can have one follow-up CT abdomen with contrast (CPT 74160) or CT abdomen and pelvis with contrast (CPT 74160 and 72193) two months following the original imaging study.
  - If enlarged lymph node(s) persist, biopsy should be considered to establish a histological diagnosis.*
  - PET scan is not generally appropriate prior to biopsy.
    *Kanwar V. Lymphadenopathy. eMedicine, June 28, 2006, http://www.emedicine.com
    Accessed September 20, 2007
    Accessed September 20, 2007

PACAB-12 ~ BLUNT ABDOMINAL TRAUMA

- Significant trauma should be evaluated in the Emergency Department.
- Trauma with low probability of intra-abdominal injury should have ultrasound initially and any positive findings can be further evaluated with CT abdomen and/or pelvis without and with contrast (CPT 74170 and/or 72194).
- For more significant trauma or blunt renal trauma associated with hematuria¹,² CT abdomen and pelvis without and with contrast (CPT 74170 and 72194) may be used initially to determine patients who need hospitalization for observation.³
  ¹ Geehan DM and Santucci RA. Renal Trauma. eMedicine, June 12, 2006, http://www.emedicine.com
  Accessed September 11, 2007
  ² Smith J. Kidney, Trauma. eMedicine, Feb 21, 2007, http://www.emedicine.com
  Accessed September 11, 2007
  ³ ACR Appropriateness Criteria, Blunt abdominal trauma, 2005

PACAB-13 ~ GAUCHER’S DISEASE

- See also PACPN-3 Gaucher’s Disease in the Pediatric and Congenital Peripheral Nerve Disorders guidelines
- Imaging for follow-up:
  - Patients not on enzyme therapy: MRI abdomen without contrast (CPT 74181) and MRI lower extremity without contrast (CPT 73718) every 12 to 24 months
Patients on enzyme therapy:
- **Not achieved therapeutic goals:** MRI abdomen without contrast (CPT 74181) and MRI lower extremity without contrast (CPT 73718) every 12 months
- **Achieved therapeutic goals:** MRI abdomen without contrast (CPT 74181) and MRI lower extremity without contrast (CPT 73718) every 12 to 24 months
- **Change in dose of medication or clinical complication:** MRI abdomen without contrast (CPT 74181) and MRI lower extremity without contrast (CPT 73718)

Patients with active bone disease may require more frequent monitoring than once a year.

**References:**
- Current Medical Research and Opinion 2006;22(6):1045-1064

**PACAB-14 ~ HERNIAS**

Patients without prior inguinal hernia surgery who present with lower abdominal or groin pain and suspected inguinal hernia may benefit from evaluation by a surgeon.
- Imaging (ultrasound, CT, MRI) can be helpful when physical exam is inconclusive.
- Ultrasound has a very high sensitivity and specificity (88%-100%) for evaluating inguinal and femoral hernias.* Ultrasound identified the pathology in a groin (either hernia or lipoma) without a palpable bulge at an accuracy of 75%.*
  *Ann Ital Chir. 2002 Jan-Feb;73(1):65-68

Patients with known or suspected Spigelian hernia (anterior abdominal wall hernia through the semilunar line) or ventral hernia can be evaluated by ultrasound initially, but CT of the abdomen (and pelvis if below the umbilicus) either with contrast (CPT 74160 ± 72193) or without contrast (CPT 74150 ± CPT 72192) may be necessary for definitive evaluation.

Patients with known or suspected incisional hernia can be evaluated with CT abdomen (and pelvis where applicable) either with contrast (CPT 74160 ± 72193) or without contrast (CPT 74150 ± CPT 72192) (whichever the physician prefers).

Patients with suspected recurrent inguinal hernia after inguinal hernia surgery can have CT of the pelvis with contrast (CPT 72193) or without contrast (CPT 72192) (whichever the physician prefers).

**Sportsman’s Hernia**
- A controversial clinical entity thought to account for up to 5% of all groin injuries, especially among athletes involved in kicking sports.
- Probably a chronic overuse injury involving posterior inguinal wall weakness, tearing of the transversus abdominis aponeurosis, and neuralgia.
- Conservative management is performed initially. Some elite athletes require surgical intervention.
- Ultrasound may show posterior inguinal wall bulging, but this is also seen in asymptomatic athletes.
- Advanced imaging is not indicated.
- The microtears described at surgery cannot be reliably diagnosed on imaging and therefore, this condition remains a clinical diagnosis.

**References:**
PACAB-15 ~ LIPOMA

- **Subcutaneous lipoma** does not require imaging for diagnosis
  - Evaluation by a dermatologist or surgeon is helpful in determining the need for advanced imaging.
  - If the clinical exam is equivocal, ultrasound should be performed initially.
  - Noncontrast MRI can be performed if surgery is planned.
- Lipomas in other locations (not subcutaneous) should be evaluated by ultrasound or CT without and with contrast.
  - Lesions with Hounsfield units (HU) less than -50 HU do not require additional imaging except for surgical planning.*
- Noncontrast MRI can be considered if ultrasound and/or CT are equivocal, or for preoperative planning.
  - MRI shows a discrete, homogenous fatty mass with few or no thin septa and minimal or no areas of high T2 signal.*
    *AJR 2004;182:733-739

**SPECIFIC ABDOMINAL ORGANS**

PACAB-16 ~ ADRENAL CORTICAL LESIONS

- **PACAB-16.1 Adrenal Cortical Lesions**
  - CT abdomen without contrast (CPT 74150) is the imaging study of choice in patients with no history of malignancy, no symptoms, and a lesion less than 3 cm.
  - If the Hounsfield number is less than 10 HU, malignancy is unlikely and no follow-up imaging is required.*
    *J Clin Endocrinol Metab 2005 Feb;90(2):871-877
  - Noncontrast CT (CPT 74150) and chemical shift MRI (CPT 74181) have comparable performances in the evaluation of lipid content.
  - Mass lesions larger than 6 cm or hormone-secreting tumors should be resected.*
    *ACR Appropriateness Criteria, Incidental discovery of adrenal mass, 2005
    *AJR 2005;185:684-688
  - If the lesion cannot definitely be characterized as a benign adenoma on noncontrast CT, CT abdomen with contrast (CPT 74160) with washout calculated can be performed to help distinguish benign adenoma from other lesions such as metastases.
    - Over 50% washout of contrast material on a 10-minute delayed CT scan is diagnostic of an adenoma. This is the most sensitive and specific study because it can detect both lipid rich (70% of adenomas) and lipid poor (30% of adenomas) adenomas.
    - If CT is contraindicated, chemical shift MRI (CPT 74181) can be performed.
    - MRI can only reliably detect lipid rich adenomas.
  - If CT of the abdomen with washout is indeterminate, MRI will not add significant information.
    - Therefore, follow-up CT of the abdomen without contrast (CPT 74150) in 3 to 6 months, at 12 months, and at 24 months can be performed.
    - Endocrine re-evaluation should be performed at one year.1,2
    - There is no good evidence supporting continued radiologic surveillance if the follow-up at 24 months shows no change in adrenal tumor size.2
    1J Clin Endocrinol Metab 2005 Feb;90(2):871-877
    2Ann Intern Medication 2003;138:424-429

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o If CT with washout or MRI defines the lesion as a probable adenoma, follow-up imaging is not indicated.
o If CT is contraindicated and MRI is indeterminate, follow-up noncontrast abdominal MRI (CPT 74181) at 3 to 6 months, at 12 months, and at 24 months can be performed.*
o CT of the abdomen without contrast (CPT 74150) is adequate to evaluate a possible myelolipoma.
o In the oncology patient, CT abdomen without and with contrast (CPT 74170) (malignant lesions show slow enhancement with delayed washout after intravenous contrast) or MRI abdomen (contrast as requested; default CPT code 74183) is appropriate for evaluation of an adrenal lesion.
  ▶ Biopsy may be considered if pheochromocytoma is excluded.

- **PACAB-16.2 Adrenal Endocrine Tumors**
o In patients with signs/symptoms of an adrenal cortical endocrine syndrome (e.g. Cushing’s syndrome, Conn’s syndrome), evaluation may include dexamethasone suppression, serum ACTH level, serum aldosterone/renin, and/or virulizing hormone levels, and 24 hour urine for adrenal hormones.*
  ▶ Normal Values:
    - Aldosterone: 3-10 ng/dl (supine); 5-30 ng/dl (upright)
    - Cortisol:  at 8am: 250-850 nmol/L
      at 4pm: 110-390 nmol/L
      at 10pm: 50% of 8am value
o CT with bolus arterial phase (CPT 74160) can detect or exclude an adrenal mass in a high percentage of cases and should be the initial imaging study.
o **Pheochromocytoma**
  ▶ Signs/symptoms include flushing spells and/or poorly controlled hypertension.
  ▶ Elevated plasma metanephrines support the diagnosis of pheochromocytoma.
  ▶ If plasma metanephrines are not elevated, a 24-hour urine for catecholamine and metanephrine levels should be obtained prior to considering advanced imaging.
  ▶ If catecholamine and metanephrine levels are not elevated in a 24- hour urine, then no advanced imaging is indicated unless unexplained symptoms suggestive of pheochromocytoma persist.1,2
  ▶ If possible, 24-hour urine for catecholamines and metanephrines should be obtained after an episode of signs/symptoms (e.g. following a hypertensive crisis).
    ▶ Sensitivity for diagnosing pheochromocytoma is 99.7% with this approach.1,2
  ▶ Chemical shift MRI (CPT 74181) is the preferred imaging study for possible pheochromocytoma, since the tumor lights up brightly on T2 weighted images; however MRI abdomen, contrast as requested, can be performed.
  ▶ In patients with elevated catecholamines/metanephrines, great care should be exercised when considering intravenous contrast administration. These patients are known to have hypertensive crises with the bolus injection of intravenous contrast.
BOWEL (ALPHABETICAL ORDER)

PACAB-17 ~ BOWEL OBSTRUCTION

- Plain x-rays of the abdomen (obstructive series) should be obtained as the initial study in patients with suspected bowel obstruction.
- CT of the abdomen and pelvis with contrast (CPT 74160 and 72193) may be used to confirm the presence and site of an obstruction if plain x-rays are abnormal or equivocal.
- CT with contrast (CPT 74160 and 72193) may also be indicated if there is a high index of suspicion for bowel obstruction (abdominal pain, vomiting, constipation, abdominal distention, failure to pass flatus), especially in patients with prior history of abdominal surgery, history of malignancy, or patients with current hernias.*
  *ACR Appropriateness Criteria, Suspected small bowel obstruction, 2005

PACAB-18 ~ DIARRHEA/CONSTIPATION AND BLOATING/IRRITABLE BOWEL

- **Diarrhea** in the absence of fever, weight loss, abnormal physical examination findings, fecal incontinence, gastrointestinal (GI) bleeding, or abnormal labs including stool analysis, should be treated conservatively initially or endoscopy should be performed.
  - Diarrhea associated with any of the above signs/symptoms may require imaging depending on the highest probable concern.
  - GI specialist consultation is helpful in determining the appropriate imaging pathway.
  - If advanced imaging is indicated, CT scans of abdomen and pelvis with contrast (CPT 74160 and 72193) are appropriate.
  - References:
    - Gastroenterol 1999;116:1461-1463
    - Gastroenterol 2004;127:287-293

- **Constipation** in the absence of GI bleeding, fever, substantial pain, vomiting, weight loss, rectal pain, abnormal lab studies, or abnormal physical examination findings should be treated conservatively.
  - Patients who fail to respond to treatment or have any of the above abnormal findings should undergo barium enema or endoscopy.
  - GI specialist consultation is helpful in determining the appropriate imaging pathway.
  - Reference:
    - Am Fam Physician 2002 June;65(11):2283-2290
  - MRI Defecography for constipation should be considered investigational. It may be appropriate if ordered for preoperative evaluation for the planning of complex pelvic reconstruction.*
    *Obstet & Gynecol 2004;103:41-46
    *Radiographics 2002;22:817-832

- **Constipation in children** that is not associated with abnormal physical examination including rectal exam, abnormal laboratory studies, GI bleeding, and/or failure to thrive does not require imaging.
  - With any of the above mentioned findings, the child should be evaluated with plain x-rays, ultrasound, or barium enema.
  - GI specialist consultation is helpful in determining the appropriate imaging pathway.*
    *Am Fam Physician 2002 June;65(11):2283-2290

- **Bloating and/or Irritable bowel syndrome**
  - Irritable bowel syndrome is frequently a diagnosis of exclusion and is often associated with bloating or abdominal fullness.
The criteria for making the clinical diagnosis include the following:

- Abdominal pain
- Onset of symptoms associated with a change in frequency of stool (diarrhea, constipation, or both)
- Onset of symptoms with an associated change in the form of stool.
- Relief of symptoms with defecation

If the above symptoms occur in a patient under age 50 and are associated with alarm symptoms such as fever, anemia, weight loss, GI bleeding, frequent nocturnal symptoms, or failure of a 6-8 week trial of conservative therapy, workup should include laboratory studies and flexible sigmoidoscopy prior to considering advanced imaging.

- Children should be evaluated with plain x-rays, ultrasound, or barium enema prior to considering advanced imaging.

GI specialist consultation is helpful in determining the appropriate imaging pathway, since advanced imaging is often not indicated in these patients.

References:

- *Am Fam Physician* 2003 May;67(10):2157-2162
- *Gastroenterol* 2000;119:1761-1778

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**PACAB-19 ~ INFLAMMATORY BOWEL DISEASE, RULE OUT CROHN’S DISEASE or ULCERATIVE COLITIS**

- Colonoscopy or barium studies are the preferred imaging studies for the initial evaluation of suspected early Crohn's disease or ulcerative colitis when pathology is limited to the mucosa.
- CT scans of the abdomen and pelvis with contrast (CPT 74160 and 72193) are the best studies for assessing mesenteric and extra-intestinal extent of disease.
- CT scans of the abdomen and pelvis with contrast (CPT 74160 and 72193) are the best studies for evaluation of possible abscess, bowel perforation, fistula formation, or acute inflammation in the patient with known Crohn's disease or ulcerative colitis and an acute exacerbation (abdominal pain).
- Children <age14 should be initially evaluated with ultrasound or MRI abdomen and pelvis without and with contrast (CPT 74183 and 72197).
- Endoscopic ultrasound, rectal ultrasound or pelvic MRI (CPT 72197) may be considered in the setting of rectal pathology (either inflammatory or neoplastic) to evaluate for peri-rectal involvement.
- Suspected small bowel Crohn’s should be initially evaluated with small bowel follow through (SBFT), barium study, and/or ileoscopy. If these are inconclusive or if obstructive disease is expected, CT enterography may be considered (CPT 74160 and 76377).1
  - Capsule Endoscopy (CPT 91110) may be considered if SBFT and/or ileoscopy are inconclusive, and NON-obstructive small bowel Crohn's is present. Capsule endoscopy is particularly effective for detecting proximal and early mucosal disease.2
  1*Radiology* 2006 Jan;238(1):128-134
- SPECT and PET are considered investigational.*
  *ACR Appropriateness Criteria, Crohn’s Disease, 2005*
A liver lesion with typical ultrasound and/or contrast enhanced CT features of a simple cyst or hemangioma may be classified as benign and does not require follow-up imaging.*


A liver lesion with typical CT features of a malignant mass does not require additional imaging. Confirmation with biopsy under ultrasound or CT guidance is indicated.

PET scan is not indicated to evaluate a liver lesion in a patient with no prior history of confirmed malignancy.

**PACAB-20.1 Hemangioma**
- If a lesion >1cm is found as an incidental finding on ultrasound or other imaging, triple phase CT (CPT 74170) is preferred to confirm a suspected hepatic hemangioma.*
  *Hepatology 2005 Nov;42(5):1208-1236
- Most hemangiomas are easily diagnosed with CT scan.
- MRI of the abdomen without and with contrast (CPT 74183) should be reserved for equivocal lesions.
  - In one study, the diagnosis of hemangioma was established by ultrasound in 57% of patients, by CT scan in 73%, and by MRI in 84%.*
    *J Am Coll Surg 2003 Sep;197(3):392-402
- CT angiography of the abdomen (CPT 74175) is useful as a preoperative study in patients with large hemangiomas considered for resection.

**PACAB-20.2 Hepatic Adenoma or Focal Nodular Hyperplasia**
- MRI of the abdomen without and with contrast (CPT 74183) is the imaging study of choice to evaluate a possible hepatic adenoma or focal nodular hyperplasia (FNH).
- For FNH lesions being followed by serial imaging, MRI of the abdomen without and with contrast (CPT 74183) can be performed annually for 3 years. If no changes occur, imaging is discontinued.
  - Lesions greater than 3 cm should be biopsied for definitive diagnosis.*
    *AJR 2004;182:1227-1231

**PACAB-20.3 Cirrhotic Liver**
- An indeterminate liver lesion in a cirrhotic liver is best evaluated with MRI of the abdomen without and with contrast (CPT 74183).

**PACAB-20.4 Nonalcoholic fatty liver disease (NAFLD):**
- Ultrasound is the preferred imaging study to evaluate for biliary disease or isolated liver lesion.
- Distinguishing between fatty liver and steatohepatitis is made via biopsy rather than advanced imaging.*
  *Gastroenterology 2002 Nov;123(5):1705-1725
  *Internal Medicine Journal 2004;34:187-191
  *CMAJ 2005 March;172(7):899-905

**PACAB-20.5 Liver Lesion <1 cm**
- Any liver lesion less than 1 cm should be followed with ultrasound every 3 to 6 months for 2 years and, if stable, ultrasound should be performed every 6 to 12 months.
• **PACAB-20.6 Liver Lesion ≥1cm**
  - Liver lesions ≥1cm may be evaluated by CT abdomen without and with contrast (CPT 74170) or MRI abdomen without and with contrast (CPT 74183).
  - If the lesion appearance is typical of hepatocellular carcinoma (HCC), the lesion should be treated as HCC.
  - If further characterization of a one centimeter or larger liver lesion found on CT is needed, MRI of the abdomen without and with contrast (CPT 74183) can be performed.
  - Lesions that are unable to be characterized as either benign or typical of malignancy on CT or MRI should be biopsied.
  - Lesions ≥1cm with a negative biopsy can have repeat ultrasound or CT abdomen without and with contrast (CPT 74170) every 3 to 6 months until the lesion resolves, displays diagnostic characteristics of HCC, or repeat biopsy is positive.
  - Reference:
    ➢ *Hepatology* 2005 Nov;42(5):1208-1236

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**PACAB-21 ~ ELEVATED LIVER FUNCTION TEST (LFT) LEVELS**

- The enzymes included in this category are AST, ALT, alkaline phosphatase, GGT, and bilirubin.
- **Normal Values:**
  - AST 7-40 U/L
  - ALT 0-40 U/L
  - GGT 0-50 U/L
  - Bilirubin (total) 0.2-1.0 mg/dl
  - Bilirubin (conjugated) 0-0.2 mg/dl
  - Alkaline phosphatase 5-150 U/L
- Patients with elevation of AST and/or ALT less than two times normal should have repeat levels performed in three to four weeks prior to considering advanced imaging.
- Patients on lipid lowering medications (statins) or other medications known to cause elevated LFT’s should have those medications stopped for at least 4 weeks and the LFT levels repeated prior to considering advanced imaging.
- Patients with persistently elevated LFT’s or LFT’s less than three times normal should have ultrasound as the initial imaging study.
  - If a liver or pancreatic mass is seen, CT of the abdomen without and with contrast (CPT 74170) is appropriate.
  - If biliary dilatation or other nonspecific abnormality is seen, CT of the abdomen with contrast (CPT 74160) is appropriate.
- MRCP (CPT 74181) is appropriate in patients who are status post cholecystectomy and have a possible common bile duct stone.
- If biliary dilatation is seen on ultrasound or CT, MRCP (CPT 74181) may be appropriate.
  - Specialist evaluation can be helpful in determining the need for MRCP because ERCP is both diagnostic and therapeutic if biliary stone is a high probability.
- Patients with known cancer and suspected liver metastases should have CT of the abdomen without and with contrast (CPT 74170) or CT of the abdomen with contrast (CPT 74160) (whichever the physician prefers). Default CPT code should be 74160.
- Patients with elevated alpha-fetoprotein (AFP) levels should have MRI of the abdomen without and with contrast (CPT 74183).
- CT of the abdomen with contrast (CPT 74160) is appropriate in patients who present with painless jaundice. MRI/MRCP are accurate but should be reserved for patients with contraindications to CT.*

*ACR Appropriateness Criteria, Jaundice, 2005*
• **Hemochromatosis:**
  o The diagnosis is made by biopsy.
  o Specialist (GI or Hematologist) evaluation is helpful.
  o MRI abdomen without contrast (CPT 74181) is used to confirm liver iron stores and for following treatment.*
    *Joffe S. Hemochromatosis. eMedicine, March 11, 2005. 

**SPLEEN**

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- **Splenomegaly** is usually the result of systemic disease, and diagnostic studies are directed toward identifying the causative disease.
  o Complete blood count with differential, LFT’s, and peripheral blood smear examination should be performed prior to considering advanced imaging.
  o Suspected splenomegaly should be evaluated by ultrasound initially.*
    * ACR Practice Guidelines for the Performance of an ultrasound examination of the abdomen or retroperitoneum. Oct. 2006
  o If ultrasound is indeterminate or shows an abnormality, CT abdomen without and with contrast (CPT 74170) can be performed.*
  ➢ In children, if ultrasound is indeterminate, MRI abdomen without and with contrast (CPT 74183) can be performed.
  o If CT is indeterminate or contraindicated, MRI abdomen without and with contrast (CPT 74183) can be performed.

- **Incidental Finding of Splenic Lesion(s):**
  o If an incidental splenic lesion is seen on a non-abdominal imaging study (e.g. chest CT, thoracic MRI, etc.), abdominal ultrasound should be performed if the lesion has cystic qualities.
  o CT abdomen (either with contrast [CPT 74160] or without and with contrast [CPT 74170]) can be performed if ultrasound is non-diagnostic or the lesion does not have cystic qualities.
  o If CT is indeterminate or contraindicated, MRI abdomen without and with contrast (CPT 74183) can be performed.
  o There is no evidence-based data to support performing serial CT or MRI scans to follow patients with incidental splenic lesions.

- **Trauma:**
  o CT scans of the abdomen and pelvis without and with contrast (CPT 74170 and 72194) are indicated in patients with blunt abdominal trauma with suspected splenic rupture or in patients with penetrating trauma to the left upper quadrant.

**RENAL**

FLANK PAIN, RULE OUT RENAL STONE- SEE **PACAB- 4**
PACAB-23 ~ INDETERMINATE RENAL LESION

- A newly discovered renal mass (indeterminate by the initial test) should be evaluated by ultrasound in order to rule out a simple cyst.
  - Simple cysts (spherical or ovoid shape, absence of internal echoes, presence of a thin smooth wall, enhancement of the posterior wall) that meet these criteria do not require further imaging.*
    *Am Fam Physician 2001;63:288-294 and 299
- CT abdomen without and with contrast (CPT 74170) is recommended for the indeterminate renal lesion that cannot be adequately classified as benign by ultrasound.
  - If the patient cannot tolerate intravenous contrast, then MRI of the abdomen without and with contrast (CPT 74183) is appropriate.
- If CT or MRI is still indeterminate, follow-up imaging should be performed in 3 to 6 months, then annually for 5 years in older patients. In younger patients, longer annual follow-up is needed.*
  *Radiographics 2004;24:5101-5115
- If a lesion has been characterized as a hyperdense renal cyst, follow-up CT scan should be performed in 3 to 6 months.

PACAB-24 ~ RENOVASCULAR HYPERTENSION

- Doppler ultrasound is the most cost-effective exam for screening renovascular hypertension and can be used as the initial screening tool for medically controlled patients with clinical suspicion of renovascular disease. However, ultrasound results are highly dependant on the expertise of the local facility/radiologist.*
  *AJR 2005;184:931-937
- Other considerations for imaging evaluation:*Abdominal MRA (CPT 74185) or CTA (CPT 74175) may be indicated for the following:
  - Patients under 40 years old with hypertension, controlled or uncontrolled, to exclude fibromuscular dysplasia of the renal arteries.

PACAB-25 ~ URINARY TRACT INFECTION (UTI)

- Urology evaluation is helpful in determining the need for advanced imaging in patients with recurrent urinary tract infections.
- Thorough diagnostic work-up includes ultrasound, voiding cystourethrography (VCUG), diuretic renography, and MR urography (MRI abdomen and pelvis, contrast as requested).
- Males with first time urinary tract infection may benefit from Urology evaluation and CT urogram (CPT 74170 and 72194).
- Children should be evaluated initially by ultrasound and if further imaging is indicated, MRI abdomen and pelvis (contrast as requested) can be performed.

**PACAB-25.1 Upper Urinary Tract**

- Males with first time UTI (and females with first or second UTI) should undergo ultrasound evaluation as the initial imaging modality to diagnose hydronephrosis, pyonephrosis or congenital renal anomaly.
  - If hydronephrosis is present, this should be further evaluated with voiding cystourethography (VCUG), to evaluate for vesicoureteral reflux.
  - If the ultrasound findings are compatible with a multicystic dysplastic kidney, diuretic renography should be confirmed to evaluate function of the affected kidney or a ureteral-pelvic junction (UPJ) obstruction of the contralateral kidney.
If VCUG is negative, diuretic renography (using Tc-99m MAG 3) should be performed for diagnostic evaluation of upper tract dilatation.

- Diuretic renography is also appropriate for follow-up of some children with hydronephrosis.
- Diuretic renography is the study of choice for differentiating a dilated non-obstructed urinary system from a true stenosis (e.g., UPJ obstruction; ureteral-vesical junction [UVJ] obstruction), and for quantifying renal parenchymal function.
- Magnetic resonance urography (MRU) is appropriate (where available) for investigation of a dilated upper urinary tract.

  **NOTE:** MRU requires sedation in young children

- Where available, MRU can also quantitate renal function.

- Children aged 5 years or younger with febrile UTI may undergo nuclear medicine DMSA imaging (Technetium-99m-dimercaptosuccinic acid [DMSA] scintigraphy) for the diagnosis of acute pyelonephritis.

- Sensitivity of DMSA scintigraphy is much higher than ultrasound and is equivalent to CT, but at a lower radiation dose.

- Tc-99m DMSA scintigraphy is highly sensitive for detection of acute pyelonephritis and is the reference standard for detection of post-pyelonephritic renal scarring.

- For detection of renal scarring, DMSA scintigraphy should be performed at least 6 months after the documented upper tract UTI.

- Power Doppler ultrasound is significantly less accurate than Tc-99m DMSA or CT for the diagnosis of acute pyelonephritis.

- MRI is very sensitive for the detection of acute pyelonephritis, and where available, should be used in place of CT

  **NOTE:** MRI requires sedation in young children

**PACAB-25.2 Lower Urinary Tract**

- Ultrasound studies in neonates or young children revealing hydronephrosis should undergo voiding cystourethrography (VCUG) for detection of possible vesico-ureteral reflux (VUR).

- Fluoroscopic VCUG is typically performed for diagnosis and grading of VUR, and should be the first modality used for diagnosis.

- Radionuclide cystography, because of its lower radiation burden and higher sensitivity for reflux > Grade I, is recommended for follow-up imaging of VU reflux, and investigation of VU reflux in siblings of refluxing children.

  - First time male UTI’s should be evaluated with fluoroscopic VCUG studies rather than radionuclide cystography, to visualize the male urethra for possible posterior urethral valves.

  - Radionuclide cystography may replace fluoroscopic VCUG in girls as the first time study, since urethral anatomy is rarely abnormal except in complex malformations.

- MR urography may be used for evaluation of ectopic distal ureteral insertion, or other complex lower urinary tract anatomy.

  **NOTE:** MR urography requires sedation in young children

**References:**

- *J Urol* 2003;169:2308-2311
- *AJR* 1991;157:539-543
- **Patent urachus** which is suspected due to umbilical discharge should initially be evaluated by ultrasound.
  - The urachus is a “tube” connecting the fetal bladder to the umbilical cord. It is usually obliterated during fetal growth, but if it remains patent, there can be a connection between the bladder and the umbilicus.
- CT pelvis with contrast (CPT 72193) can be performed if ultrasound is equivocal or if needed for surgical planning.
PACAB- 2~Abdominal Pain

- ACR Practice Guidelines for the performance of an ultrasound examination of the abdomen or retroperitoneum, 1/1/02.

PACAB- 3~Abdominal Sepsis (Suspected Abdominal Abscess)


PACAB- 4~Flank Pain, Rule Out Renal Stone


PACAB- 5~Acute Gastroenteritis (Pediatric)


PACAB- 6~Left Lower Quadrant Pain


PACAB- 7~Left Upper Quadrant Pain

- ACR Practice Guidelines for the Performance of an ultrasound examination of the abdomen or retroperitoneum, 1/1/02.

PACAB- 8~Postoperative Pain Within 60 Days Following Abdominal Surgery


PACAB- 9~Right Lower Quadrant Pain, Rule Out Appendicitis

PACAB-10~Right Upper Quadrant Pain, Rule Out Cholecystitis

PACAB-11~Abdominal Lymphadenopathy

PACAB-12~Blunt Abdominal Trauma

PACAB-13~Gaucher’s Disease

PACAB-14~Hernias

PACAB-15~Lipoma
- Gaskin CM and Helms CA. Lipomas, lipoma variants, and well-differentiated liposarcomas (atypical lipomas): results of MRI evaluations of 126 consecutive fatty masses. AJR 2004;182:733-739.

PACAB-16~Adrenal Cortical Lesions

PACAB-17~Bowel Obstruction

PACAB-18~ Diarrhea/Constipation and Bloating/Irritable Bowel

PACAB-19~ Inflammatory Bowel Disease, Rule Out Crohn’s Disease or Ulcerative Colitis

PACAB-20~ Liver Lesion Characterization
Clouston AD, Powell BE. Nonalcoholic fatty liver disease: is all the fat bad? Internal Medicine Journal 2004;34:187-191.


PACAB-21~ Elevated Liver Function Test (LFT) Levels


PACAB-22~Spleen


PACAB-23~ Indeterminate Renal Lesion


PACAB-24~Renovascular Hypertension


PACAB-25~Urinary Tract Infection (UTI)

PACPV-1 ~ GENERAL GUIDELINES

- The Pelvis Imaging Guidelines are the same for both the pediatric population and the adult population, unless there are specific guidelines listed here in the Pediatric and Congenital Pelvis Imaging Guidelines.
- Pelvic imaging begins at the umbilicus and extends to the pubis.
- Prior to considering advanced imaging, patients should undergo a recent detailed history, careful gynecological and/or urological exam (including appropriate laboratory studies such as blood count, tumor markers, and gonadotropins if indicated), and the use of non-advanced imaging modalities such as plain x-ray and ultrasound.
- To avoid radiation exposure, pediatric imaging should consider the use of ultrasound or MRI where it is a clinical option.
  - MRI without contrast (CPT 72195) is the usual modality to view the pelvis.
  - MRI without and with contrast (CPT 72197) is appropriate for evaluating the ovary or retroperitoneum.
  - MRI of the pelvis with contrast only is essentially never performed. If contrast is indicated, MRI pelvis without and with contrast (CPT 72197) should be performed.
- If CT is performed, CT with contrast (CPT 72193) is the usual modality unless there is a contrast allergy or the study is looking for a renal stone in the lower pelvis.
- Pelvic CT or MRI may be indicated to further evaluate abnormalities seen on other imaging modalities such as plain x-rays, ultrasound, etc.
- Gynecology consultation is helpful in determining the appropriate diagnostic and imaging pathway in patients presenting with suspected pelvic pathology.

PACPV-2 ~ PELVIC INFLAMMATORY DISEASE (PID)

- Ultrasound is the initial study for imaging of pelvic inflammatory disease (PID) that does not respond well to antibiotic therapy, or for complicated PID.
- In rare cases where there is extensive abscess formation or a percutaneous drainage procedure is planned, CT of the abdomen and pelvis with contrast (CPT 74160 and CPT 72193) may be helpful.

PACPV-3 ~ PERIURETHRAL CYSTS AND URETHRAL DIVERTICULA

- Symptomatic infection of congenital periurethral glands can result in urethral diverticula. Symptoms include pain, urinary urgency, frequency of urination, recurrent urinary tract infection, dribbling after urination, or incontinence.
  - MRI pelvis without and with contrast (CPT 72197) is superior to transvaginal ultrasound for evaluating these entities but should be reserved for patients in whom ultrasound, voiding cystourethrography, or retrograde urethography are equivocal.*

*ACR Appropriateness Criteria, Recurrent Lower Urinary Tract Infections in Women, 2005
PACPV- 4 ~ FETAL MRI

- Ultrasound (ideally performed at a tertiary care center) remains the predominant modality for evaluating disorders related to the fetus and pregnancy overall. MRI is used as an adjunct to ultrasound in evaluating fetal abnormalities.
- Most fetal MRI imaging occurs after 18 weeks gestation.
- Studies should be coded as MRI scan, unspecified (CPT 76498).
- Fetal MRI is helpful for obstetrical planning, prenatal care, parental counseling, and planning for fetal interventions/surgery and/or immediate postnatal surgical planning in fetuses with significant congenital malformations and neoplasms.\(^1,2\)
- The most common use of fetal MRI is to evaluate central nervous system abnormalities. Neural tube defects are usually well evaluated by ultrasound\(^1\), although some defects are difficult to visualize by this modality.
- **Fetal MRI can also be helpful in evaluating the following:**
  - Masses distorting the airway in the neck and chest.\(^1,2\)
  - Abnormalities in the fetal thorax, such as congenital diaphragmatic hernia and fetal lung development.\(^2\)
  - Paraspinal masses.\(^1,2\)
  - Fetal genitourinary abnormalities in pregnancies complicated by oligohydramnios.
  - Antenatal evaluation of conjoined twins in whom postnatal separation is being anticipated.
- The added utility of fetal MRI in the evaluation of organ systems other than central nervous system, thorax, and urogenital system has not yet been demonstrated.\(^3\)


PACPV- 5 ~ SCROTAL PATHOLOGY

- Acute scrotal pain, masses, trauma, inguinal hernia, varicocele, or inflammation should be evaluated by ultrasound initially.*
  - MRI pelvis without and with contrast (CPT 72197) can be used to evaluate abnormalities of the scrotum if ultrasound is inconclusive.

*ACR Appropriateness Criteria, Acute Onset Scrotal Pain, 2005

PACPV- 6 ~ UNDESCENDED TESTIS

- Boys with a history of cryptorchid (undescended) testes have a several fold risk increase of testicular cancer.
  - It is important to diagnose and treat this condition either by bringing the undescended testis into the scrotum, or resecting the testis.
  - MRI abdomen and pelvis without and with contrast (CPT 74183 and 72197) can be performed.
  - MRI pelvis without and with contrast (CPT 72197) can be used to evaluate abnormalities of the scrotum if ultrasound is inconclusive.
- The pediatric population should be evaluated initially with ultrasound, and if inconclusive, MRI pelvis (CPT 72197) can be performed.* CT and MRI have a high false negative rate and in general are not reliable as diagnostic tools.
  - Urology evaluation is helpful in determining the most appropriate imaging pathway.

PACPV- 3~Periurethral Cysts and Urethral Diverticula

PACPV- 4~Fetal MRI

PACPV- 5~Scrotal Pathology

PACPV- 6~Undescended Testis
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PEDIATRIC AND CONGENITAL MUSCULOSKELETAL IMAGING GUIDELINES

PACMS-1 ~ GENERAL GUIDELINES

• The Musculoskeletal Imaging Guidelines are the same for both the pediatric population and the adult population, unless there are specific guidelines listed here in the Pediatric and Congenital Musculoskeletal Imaging Guidelines.

• Advanced imaging can be ordered in almost any musculoskeletal condition and does show abnormality in most musculoskeletal conditions, however, that does not mean that it is indicated in these situations.

• The guidelines are divided into two basic sections:
  o Disease/Injury Category and 2) Anatomical Area Category
  o Some conditions, e.g. tumors can occur in any area and some, e.g. torn meniscus are specific to certain anatomical areas.

• These guidelines are diagnosis oriented so it is imperative that the reviewer have a working/tentative diagnosis prior to review.
  o Prior to considering advanced imaging, patients should undergo a recent detailed history, physical examination, appropriate laboratory studies, and the use of non advanced imaging modalities such as plain x-ray.
  o Advanced imaging should serve as an adjunct in arriving at a more definitive diagnosis.
  o Orthopedic specialist evaluation can be helpful in determining the need for advanced imaging.

• Standard medical practice would dictate continuing conservative therapy prior to advanced imaging in patients who are improving on current treatment programs.

PACMS- 2 ~ IMAGING TECHNIQUES

• Plain x-ray
  o Should be done prior to advanced imaging in most musculoskeletal conditions* to rule out those situations that do not require advanced imaging, such as osteoarthritis, acute/healing fracture, osteomyelitis, and tumors of bone amenable to biopsy or radiation therapy (in known metastatic disease), etc.
  *ACR Appropriateness Criteria, Musculoskeletal Imaging, 2005
  o Even in soft tissue masses, plain x-rays are helpful in evaluating for calcium/bony deposits, e.g. myositis ossificans and invasion of bone.

• MRI versus CT
  o In general MRI is the preferred imaging modality in musculoskeletal conditions because it is superior in imaging the soft tissues and can also define physiological processes in some instances, e.g. edema, loss of circulation (AVN), and increased vascularity (tumors).
  o CT is better at imaging bone and joint anatomy; thus it is useful for studying complex fractures (particularly of the joints) and dislocations.

• Contrast Issues
  o Most musculoskeletal imaging (MRI or CT) is without contrast.
  o Exceptions:
    ➢ Tumors and osteomyelitis (without and with contrast)
    ➢ MR arthrograms, CT myelogram, CT for discogram (with contrast only)
    ➢ MRI for rheumatoid arthritis (generally with contrast only)
    ➢ In postoperative joint studies, MRI with contrast (direct or indirect arthrogram) can be approved if requested.
Certain health plans do not reimburse the 3-D rendering CPT codes (CPT 76376 and 76377) and their coverage policies will take precedence over MedSolutions’ guidelines. Prior authorization does not guarantee payment of the study.

**Musculoskeletal indications for 3-D imaging are as follows:**
- Complex fractures of any joint or the pelvis
- Spine fractures
- Preoperative planning in complex surgical cases*
  - These requests should be sent for Medical Director review.

  *ACR 2006 Coding Update Sept/Oct 2005

**DISEASE/INJURY CATEGORY (ALPHABETICAL ORDER)**

**Legg-Perthe’s Disease Avascular Necrosis (AVN) – Legg-Perthe’s Disease**
- Occurs when the femoral head loses its blood supply.
- Affects children between the ages of 4 and 8 (occasionally younger and older).
- Clinically is quite different than adult AVN since there is good healing potential of the femoral head (especially in younger children).
- Plain x-ray is the initial imaging study and may be all that is necessary for follow-up.
- If the diagnosis is uncertain on plain x-ray, hip MRI without contrast (either unilateral CPT 73721 or pelvis CPT 72195) can be approved.
- Treatment is observation in mild cases and containment of the head within the acetabulum by abduction bracing in more severe cases.*


**FRACTURE AND DISLOCATION**

- **PACMS-5.1 Acute**
  - Plain x-rays should be performed initially in any obvious or suspected acute fracture or dislocation.
  - If plain x-rays are positive, no further imaging is generally indicated except in complex joint fractures where noncontrast CT is helpful.¹ ²
  - If plain x-rays are equivocal for fracture, CT or MRI without contrast can be performed.
  - Orthopedic evaluation is helpful in determining the appropriate imaging pathway.
  - If x-rays are negative and a fracture is clinically suspected, a several week trial of conservative therapy with periodic re-evaluation and repeat x-rays are indicated prior to considering advanced imaging.

  ¹ACR Appropriateness Criteria, Acute hand and wrist trauma, 2005

- **PACMS-5.2 Joint**
  - CT can be approved in complex fractures involving a joint for preoperative planning.*


  *ACR Appropriateness Criteria, Acute hand and wrist trauma, 2005

  - Orthopedic evaluation is helpful in determining the need for advanced imaging.
• PACMS-5.3 Metaphysis (end of bone)/Diaphysis (shaft of bone)
  o These fractures can generally be diagnosed and managed adequately with plain x-ray.
  o If there is concern for delayed union or non-union of the bone, CT without contrast is appropriate.

• PACMS-5.4 Osteochondral/Chondral
  o These fractures are joint fractures essentially of the joint surface (a piece of bone with attached cartilage, or a piece of cartilage alone).
  o If x-rays are negative and an osteochondral fracture is suspected, MRI without contrast is the appropriate imaging study.
  o CT without contrast can be approved if MRI is contraindicated.*

*ACR Appropriateness Criteria, Chronic ankle pain, 2005

• PACMS-5.5 Stress/Occult Fracture
  o These fractures, almost always in weight bearing bones, can be evaluated adequately by history, physical exam, plain x-ray, and bone scan.
  o Plain x-rays should be performed initially.
  o A history of increased physical activity is often elicited and swelling and tenderness are present on exam.
  o Plain x-rays are usually negative initially and become positive at 3 to 4 weeks. Bone scan will be positive within 72 hours of onset.
  o Treatment includes protected weight bearing with or without casting.
    ➢ Occasionally surgery is necessary, particularly for 5th metatarsal fractures.
  o Periodic follow-up plain x-rays will usually show progressive healing.
  o Except in situations where there is concern for non-union, advanced imaging is not routinely performed.
    ➢ Exceptions are hip and tibial stress fractures--MRI without contrast or CT without contrast can be approved if stress fracture is suspected because prolonged healing with a poor outcome can occur with delayed diagnosis.*


  o References:
    ➢ ACR Appropriateness Criteria, Stress/Insufficiency fractures, 2005

• PACMS-5.6 Compartment Syndrome
  o Caused by swelling in the closed compartments of the extremities
  o Advanced imaging is not indicated
  o Diagnosis is made clinically and by direct measurement of compartment pressure and is a surgical emergency*


[PACMS- 6 ~ FOREIGN BODY]

  o MRI (contrast as requested) can be approved after plain x-rays rule out the presence of radiopaque foreign bodies.*

  *Am Fam Physician 2003 June;67(12):2557-2562
**PACMS-7.1 General Considerations**
- History and Physical exam--information should include location, size, duration, solid/cystic, fixed/not fixed to bone
- Plain x-rays should be performed initially (see PACMS-2 Imaging Techniques).
- Most discrete masses warrant imaging (usually MRI without and with contrast).
- **Exceptions**- advanced imaging is generally not indicated for the following entities:
  - Ganglia
  - Sebaceous cyst
  - Subcutaneous lipoma does not require imaging for diagnosis
    - Evaluation by a dermatologist or surgeon is helpful in determining the need for advanced imaging.
    - If the clinical exam is equivocal, ultrasound should be performed initially.
    - Noncontrast MRI can be performed if surgery is planned.
  - Lipomas in other locations (not subcutaneous) should be evaluated by ultrasound or CT without and with contrast.
    - Lesions with Hounsfield units less than -50 HU do not require additional imaging except for surgical planning.*
    - Noncontrast MRI can be considered if ultrasound and/or CT are equivocal, or for preoperative planning.
      - Ill-defined mass/swelling: ultrasound should be performed as the initial study
      - Mass that has been present and stable for 1 year
      - Most hematomas can be adequately imaged by ultrasound.*
  - Orthopedic or Surgical evaluation is helpful in determining the need for advanced imaging.

**PACMS-7.2 Soft tissue mass with negative x-ray**
- MRI (contrast as requested) can be performed (ultrasound or CT with contrast if MRI is contraindicated)*
  *ACR Appropriateness Criteria, Soft tissue masses, 2005

**PACMS-7.3 Soft tissue mass with calcification on x-ray**
- CT without contrast if Myositis Ossificans (bone formation in muscle tissue after trauma) is suspected.*
  *ACR Appropriateness Criteria, Soft tissue masses, 2005
- MRI without and with contrast if not demonstrated to be Myositis Ossificans by CT*
  *ACR Appropriateness Criteria, Soft tissue masses, 2005

**PACMS-7.4 Bone or Attached to Bone (including lytic and blastic metastatic disease)**
- MRI (contrast as requested) can be performed (CT without and with contrast if MRI is contraindicated)*
  *ACR Appropriateness Criteria, Bone tumors, 2005
Almost all complete tendon ruptures can be diagnosed by physical exam showing loss of function of the affected joint and/or palpable disruption of the involved tendon.

If history and physical exam point to a suspected partial tendon rupture of a specific tendon named in the clinical information, then MRI without contrast is appropriate.¹

Muscle belly strains/muscle tears can be diagnosed clinically by history and physical exam. Although MRI is positive, it is not needed for diagnosis.²

For acute strains, treatment initially consists of rest, application of ice, compression and avoidance of painful activity. Surgical treatment is generally not recommended, even for complete tears. Muscle tissue is not amenable to surgical repair.*

¹Am Fam Physician 1999 Oct;60(6):1687-1696

Inflammatory myopathies (polymyositis, dermatomyositis, inclusion body myositis, myositis of malignancy)

Also see PACPN-4 Inflammatory Muscle Diseases in the Pediatric and Congenital Peripheral Nerve Disorders guidelines.

¹ACR Appropriateness Criteria, Chronic ankle pain. 2005

Traction apophysitis of the tibial tubercle in skeletally immature individuals

Diagnosis is by clinical examination and x-ray¹,²

Treatment is conservative.¹,²

Advanced imaging is not generally indicated in this disorder.


Baker’s cyst in children is a different clinical situation than in adults and is almost never due to intra-articular pathology.

Usually treated conservatively and rarely requires surgery.

Ultrasound is the appropriate imaging study.*


Prediction of ultimate limb length discrepancy is an inexact science.

A small limb length discrepancy (e.g.1.5 cm) has no known deleterious effects.

The goal in epiphysiodesis, when done, should be near and not necessarily perfect limb length equality.*


Radiographic scanogram remains the gold standard for leg length measurement.*


Advanced imaging is generally not indicated.
• **Tarsal Coalition** (Calcaneonavicular Bar/Rigid Flat Foot)
  o Plain x-rays should be performed initially since the calcaneonavicular bar is readily visible in older children and adults.
  o Talocalcaneal coalition is more difficult to evaluate on plain x-rays.
  o If tarsal coalition is suspected (because of restricted hindfoot motion on physical exam), and plain x-rays are negative, CT or MRI without contrast (CPT 73700 or 73718) can be approved.*
    *ACR Appropriateness Criteria, Chronic foot pain, 2005

• **Club Foot**
  o **Definition:** Congenital foot contracture with foot in equinus (plantar flexion) and heel and forefoot in varus/adduction (turned in).
  o Immediate diagnosis and specialty evaluation in the first week of life provide the best chance for successful correction.
  o Treatment consists of serial casting; surgery is reserved for the difficult cases.*
  o MRI or CT without contrast (CPT 73700 or 73718) can be approved if requested by the treating specialist, usually as a preoperative evaluation.
    *Greene WB (Ed.). *Essentials of Musculoskeletal Care. 2nd Ed.* Rosemont,IL, American Academy of Orthopaedic Surgeons, 2001, pp.613-615
PACMS-2~Imaging Techniques
   ➢ ACR Appropriateness Criteria, Musculoskeletal Imaging, 2005.

PACMS-3~3-D Rendering

PACMS-4~Avascular Necrosis (AVN)—Legg-Perthe’s Disease

PACMS-5~Fracture and Dislocation
   ➢ ACR Appropriateness Criteria, Chronic ankle pain, 2005.

PACMS-6~Foreign Body

PACMS-7~Mass
   ➢ ACR Appropriateness Criteria, Bone tumors, 2005.

PACMS-8~Muscle/Tendon Unit Injuries/Diseases
   ➢ ACR Appropriateness Criteria, Chronic ankle pain, 2005.

PACMS-9~Osgood-Schlatter’s Disease

PACMS-10~Knee—Baker’s Cyst

PACMS-11~Leg Length Discrepancy


PACMS-12~Foot—Congenital Anomalies

ACR Appropriateness Criteria, Chronic foot pain, 2005.

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PEDIATRIC AND CONGENITAL SPINE IMAGING GUIDELINES

PACSP-1 ~ GENERAL GUIDELINES

- The Spine Imaging Guidelines are the same for both the pediatric population and the adult population, unless there are specific guidelines listed here in the Pediatric and Congenital Spine Imaging Guidelines.

PACSP-2 ~ PEDIATRIC BACK PAIN

- **PACSP-2.1 Introduction**
  - Traditionally, it has been thought that back pain in children and adolescents, especially in those under age 10, was both very uncommon and usually a sign of serious disease. In the past twenty years, back pain in this population has become more common, and at the same time the incidence of benign back pain of no discoverable cause has risen sharply, though not yet to adult levels.
  - Currently, about 40% of back pain in children over age 5 is from a discoverable cause. Scoliosis, spondylitic disorders, Scheuermann disease, tumor, and trauma are the most common causes.
  - Back pain in children under age 5 appears to remain quite uncommon and often to reflect underlying serious disease when it occurs.
  - Disc herniations are rare in children, but become less infrequent during adolescence.

- **References**:
  - Southern Med J 1997;90:789-792
  - Arch Dis Child 2005;90:312-316
  - Spine 2005;30:798-806

- **PACSP-2.2 Back pain in children age 5 and under**
  - A detailed physical examination and plain x-rays should be performed initially.
  - Advanced imaging is appropriate in all patients in this age group except those with mild and transient back pain
    - MRI (contrast as requested) of the symptomatic spinal region is usually appropriate, but noncontrast CT may be preferred based on the x-ray findings.
    - At times, CT is performed because the child cannot cooperate for MRI.

- **PACSP-2.3 Simple back pain in children age 6 or over**
  - A detailed physical/neurological examination should be performed initially.
  - Plain x-rays should be performed before advanced imaging is considered.
  - **Advanced imaging is appropriate when certain pediatric “red flags” are present:**
    - Accompanying systemic symptoms (fever, weight loss, etc.)
    - Pain which is extremely severe or worse at night.
    - Pain which worsens despite an attempt at symptomatic treatment.
    - Neurological symptoms or abnormal neurological examination findings.
    - The known presence of systemic cancer.
    - Abnormal x-rays.
  - MRI without contrast of the symptomatic spinal region is usually the appropriate study.
  - MRI without and with contrast should be performed in the setting of fever, clinical suspicion of infection (discitis, osteomyelitis, paraspinous abscess), or in patients with cancer.
  - CT without contrast may be appropriate when the request is based on abnormal plain x-ray results, especially spondylitic changes.
For diagnosis of pars defects, NM Tc-99m MDP is very sensitive and specific and is an appropriate alternative to CT or MRI.

In the absence of any “red flags” (see above), a 4 week trial of physician-directed conservative treatment should be attempted before considering advanced imaging.
  o It can be assumed that children who are being evaluated by a pediatric spine specialist have failed a reasonable trial of conservative treatment. This is by far the most common reason for such referrals.
  o Preferences of such specialists to perform CT over MRI are generally acceptable.

**PACSP-2.4 Spondylolysis**

Spondylolysis is believed to be caused by repeated microtrauma, resulting in stress fracture of the pars interarticularis. Heredity is also believed to be a factor.\(^1\)

Immobilization with various corsets or braces and activity restriction are the initial treatment for symptomatic patients.\(^2\)

Surgical treatment is only recommended for very symptomatic patients in whom symptoms are disabling and have not responded to non-surgical care.\(^2\)

Spondylolysis is best recognized on plain x-rays, and advanced imaging is generally not indicated.
  o If imaging is needed because of radiological uncertainty or associated spondylolisthesis, noncontrast CT or MRI can be performed.
  o MRI must be performed at minimum on a 1.0 Tesla scanner with 3 mm cuts and at relatively high resolution.\(^1\)


**PACSP-2.5 Spinal Radiculopathy (cervical, thoracic, or lumbar)**

This is uncommon in adolescents under age 18 and rare in children.

Documentation of specific radicular features by detailed history and neurological examination should be performed initially.

Specialty consultation is very useful.

Since this is an unusual diagnosis in children and younger adolescents, establishing the cause from the onset is important.

Once the diagnosis is clinically confirmed, spinal MRI of the involved level is appropriate in patients ages 17 and younger.
  o In adolescents, MRI without contrast is usually sufficient
  o MRI without and with contrast is acceptable in children under age 12.

**PACSP- 3 ~ KYPHOSIS AND SCOLIOSIS**

The term “kyphosis” refers to a curve convex posteriorly
  o Kyphosis generally affects the thoracic spine

The term “lordosis” implies a curve convex anteriorly

“Scoliosis” refers to lateral curvature
• **PACSP- 3.1 Thoracic Kyphosis and Scheuermann Disease**
  • These patients generally present with chronic and recurrent back pain.
  • Careful physical/neurological examination and x-rays should be performed initially.
  • Lower thoracic kyphosis from developmental vertebral wedging with thoracic kyphosis totaling over 15°-20° should be identified by plain x-rays before considering advanced imaging.
  • If advanced imaging is indicated, noncontrast thoracic MRI (CPT 72146) can be performed.
    o Noncontrast lumbar MRI (CPT 72148) can be added when there are low back complaints as well.
  • MRI of the thoracic spine is carried out preoperatively to rule out any associated spinal cord problems.\(^1\)
    o This modality is not a diagnostic tool since the incidence of false positive vertebral changes in normal patients is high.\(^2\)


• **PACSP- 3.2 Scoliosis**
  • Scoliosis an abnormal lateral curve of the thoracic or thoraco-lumbar spine in the frontal plane. A small lateral curve is not uncommon.
    o Using the Cobb technique for measuring these curves, a curve of under 10° is clearly normal, a curve over 20° is significantly abnormal, and a curve >40° is severely abnormal.
    o Most patients with significant scoliosis have some element of kyphosis as well.
  • There are many ways of classifying scoliosis. These guidelines will classify scoliosis as congenital, developmental, and neuromuscular scoliosis.
    o Developmental scoliosis (onset in childhood or adolescence) is the most common.
    o Most developmental scoliosis, especially in adolescents, is idiopathic (no known cause).
  • The initial step in the evaluation of all patients with scoliosis is a careful neurological examination, including detailed examination of the spine in different body positions.
  • Spinal anteroposterior (AP) and lateral x-rays are the initial imaging study.
  • **Congenital scoliosis**
    o Cases are recognized in infancy or early childhood.
      - Most cases arise from anomalies of vertebral development, and many are associated with anomalies of the genitourinary system or of other organs.
      - In infants, spinal ultrasound is often useful as a second imaging procedure (following x-rays).
    o MRI of the entire spine, generally without contrast, can be performed to search for anomalies.
      - Sagittal/coronal screening of the spine may be appropriate for this, if available (see SP-2 Imaging Techniques in the adult Spine guidelines).
      - By convention, sagittal/coronal screening studies of the entire spine are coded as one segment (cervical [CPT 72141], thoracic [CPT 72146], or lumbar [72148]), whichever is most appropriate.
    o Brain MRI, usually without contrast (CPT 70551), is appropriate if the clinical evaluation or preliminary imaging studies suggest an associated cerebral anomaly.
    o Renal ultrasound should be performed, since about a third of patients also have genitourinary anomalies.
      - Advanced imaging of the genitourinary tract will be appropriate in many cases, especially if the ultrasound is abnormal.
• Developmental scoliosis (especially adolescent and late childhood scoliosis)
  o Most cases are idiopathic, especially in adolescent girls.
  o The following clinical features have been identified which make the presence of an underlying spinal or spinal cord abnormality more likely:
    ➢ Associated prominent back pain
    ➢ Neurological abnormalities on examination or striking neurological symptoms.
    ➢ Left sided curve (concave to right)
    ➢ Double curves or high thoracic curves
    ➢ Spinal x-ray abnormalities other than the curve itself (widened spinal canal, dysplastic changes in spine or ribs, etc.)
    ➢ Midline spinal cutaneous markers (esp. sacral) such as dermal tracts, tufts of hair, skin tags, etc.
    ➢ Abnormal number or size of café au lait spots (neurofibromatosis)
  o Spinal MRI, generally without contrast, should be performed when any of the above clinical features is present.
    ➢ Imaging of the cervical spine may or may not be included depending on spine specialist preference.

• Typical idiopathic scoliosis
  o There is uncertainty regarding the value of MRI in the evaluation or preoperative work-up of patients with typical idiopathic scoliosis (with none of the above clinical features present).
    ➢ Noncontrast MRI of the entire spine or thoracic/lumbar spine can be performed in these patients when they are actively being evaluated for corrective surgery.

• Neuromuscular scoliosis
  o Scoliosis can result from many disorders of the nervous system. In some, the presence of scoliosis suggests local disease in the spine or spinal cord, but not in others.
  o The appropriateness of advanced imaging will depend on the nature of the underlying disease.

• References:
  o Nelson, pp.1843-4, 28511-18
  o J Bone Joint Surg Am 2001;83:577-579
  o J Bone Joint Surg Am 2002;84:2230-2234

PACSP- 4 ~OTHER CONGENITAL AND PEDIATRIC SPINE DISORDERS

PACSP- 4.1 Achondroplasia
• The diagnosis of achondroplasia is made clinically.
• Achondroplastic patients are at risk for hydrocephalus, and with age, myelopathy from spinal stenosis.
• Noncontrast spine MRI directed at the appropriate clinical level can be performed.
• Brain MRI without contrast (CPT 70551) is appropriate if hydrocephalus is reasonably suspected.
• This guideline also applies to adults.

PACSP- 4.2 Ankylosing spondylitis
• Also see SP-9.5 Ankylosing Spondylitis in the adult Spine guidelines
• 97% of patients are HLA B-27 positive
• Both a positive HLA test result and plain x-rays should precede consideration of advanced imaging.
• Advanced imaging is not generally useful in this condition.
• If there are specific neurological problems, imaging by noncontrast MRI of the relevant spinal level is appropriate to the problem.

**PACSP- 4.3 Basilar impression**

• Basilar impression involves malformation of the occipital bone in relation to C1/2 (cervical vertebrae 1 and 2). The top of the spinal cord is inside the posterior fossa and the foramen magnum is undersized. Over time this can lead to brain stem and upper spinal cord compression.

• Basilar impression can also be associated with the Chiari malformation, producing very complex anatomical abnormalities.

• Noncontrast MRI of the brain (CPT 70551) and cervical spine (CPT 72141) are appropriate, and if surgery is contemplated, noncontrast CT of both may also be appropriate.

• Basilar impression appears to be partly genetic, and familial screening using noncontrast head MRI (CPT 70551) may be appropriate.

• Reference:

**PACSP- 4.4 Chiari malformation**

• Klippel-Feil anomaly (see PACSP-4.5 below) is often also seen

• **Chiari malformation (Chiari I; formerly called Arnold-Chiari)** is location of the cerebellar tonsils at least 5 mm below the foramen magnum.
  o Most patients have no or very vague symptoms, and diagnosis is usually made on head MRI done for other purposes.
  o A significant minority of these patients have an associated syringomyelia or hydromyelia.
  o A small number have hydrocephalus.

• Noncontrast brain MRI (CPT 70551) is appropriate if not already performed.
  o If the Chiari malformation has been identified, noncontrast MRI spine (CPT 72141 with or without also performing CPT 72146) is recommended to exclude syrinx.
    ➢ Follow-up cervical MRI without and with contrast (CPT 72156) will be needed if hydro/syringomyelia is seen (see **SP-15 Syringomyelia in the adult Spine guidelines**).

• Once the diagnosis has been established by MRI, repeat brain MRI is generally appropriate only in patients with increasing symptoms or signs, or as a preoperative study.

• CSF flow studies may be appropriate in selected patients with evidence of hydrocephalus (see **HD-35.5 CSF Flow Imaging in the adult Head guidelines**), but the coverage policy of the involved health plan regarding this study should be consulted.

• Chiari II, III, and IV are very rare and involve much more extensive malformations which are not discussed in these guidelines.

• Chiari malformation is not itself familial, and family screening is not appropriate.

**PACSP- 4.5 Klippel-Feil anomaly** (congenital fusion of cervical vertebrae)

• Generally an incidental finding.

• A detailed neurological examination should be performed initially in both adults and children.

• Plain x-rays of the cervical spine should have been performed initially to make the diagnosis.

• Advanced imaging is indicated if there are symptoms, or if multiple levels are involved.
Noncontrast cervical spine MRI (CPT 72141) is appropriate, and sometimes cervical spine CT (CPT 72125) may be of value.

**PACSP- 4.6 Marfan syndrome**
- Spine MRI (contrast as requested) is an appropriate study for Marfan syndrome if dural ectasias are suspected.

**PACSP- 4.7 Neurofibromatosis type I**
- see [PACHD-12.2 Neurofibromatosis](#) in the Pediatric Head guidelines

**PACSP- 4.8 Platybasia**
- Malformation of the skull base: the clivus is too horizontal.
- Symptoms are not frequent, but noncontrast brain MRI (CPT 70551) or head CT (CPT 70450) can be performed for further evaluation.

**PACSP- 4.9 Spine in von Hippel-Lindau (H-L) syndrome**
- H-L syndrome is associated with spinal hemangiomas and syrinx: level-appropriate MRI without and with contrast may be indicated.
- Many authorities perform MRI of the entire neural axis every other year in these patients.
- The value of this is currently unclear since the risk of bleeding from the hemangiomas of von H-L syndrome is low.
- Also see [PACHD-15.10 von Hippel-Lindau Disease](#) in the Pediatric Head guidelines
- von Hippel-Lindau syndrome does not usually become symptomatic until the early adult years.

**PACSP- 5 ~ SPINAL DYSRAPHISM**

**PACSP- 5.1 Introduction:** Embryological abnormalities of the structures which create the spinal cord and vertebrae can be either trivial or catastrophic. Such anomalies can be either obvious or clinically occult.
- Imaging of the most severe such lesions must be individualized to the case and is beyond the scope of this guideline.

- **PACSP- 5.2 Cutaneous lesions of the back:** the spinal cord arises from an infolding of the skin of the back, and so certain lesions of the overlying skin raise questions about an associated spinal deformity. Others are not associated with a meaningful risk of hidden spinal disorders.
  - Not significantly associated with spinal dysraphism:
    - Coccygeal pits and pilonidal cysts:
      - There is strong and extensive evidence that these lesions at or below the level of the intergluteal fold carry no increased risk of associated spinal abnormalities.
      - Advanced imaging is not generally indicated.*
      *HK J Paediatr 2007;12(2):93-95
    - Strawberry nevi are benign in significance and advanced imaging is not generally appropriate.
    - Non-specific darkened areas of skin over the sacrum:
      - There is no increased incidence of spinal anomalies in these children, and advanced imaging is not appropriate unless there are associated midline cutaneous abnormalities.
Sometimes associated with spinal dysraphism:

- Dermal sinuses overlying the lumbar, thoracic, or cervical spine.
- Initial spinal ultrasound is appropriate in neonates and infants.
- MRI of the relevant spinal level without and with contrast should be done if the ultrasound shows abnormalities other than a cutaneous dermal cleft.
- MRI of the appropriate spinal level (contrast as requested) is appropriate initially in children or young adults (< age 30).
- Sacral dermal sinuses which point cephalad (up) should be imaged as above.
- Subcutaneous midline masses at any level, caudal extensions, deviation of the gluteal fold, midline skin tags, abnormal patches of hair over the spine, and complex midline birthmarks above the upper sacral region:
  - MRI of the relevant spinal level (contrast as requested) is appropriate in children.
  - In infants, ultrasound is appropriate initially, but with masses, it is acceptable to proceed directly to MRI of the appropriate spinal level (contrast as requested).
- Congenital ano-rectal abnormalities are often associated with dysraphism.
- Lumbar MRI without contrast (CPT 72148) is appropriate when these are present.
- Café au lait spots are a marker for type 1 neurofibromatosis.

See PACHD-12.2 Neurofibromatosis in the Pediatric Head guidelines

- **PACSP- 5.3 Spina bifida occulta** is seen in 20%-30% of the normal population, usually at L5 or S1 and is commonly an incidental finding on spinal x-rays.
  - Unless additional abnormalities are present, advanced imaging is not indicated.*
- Clinically significant dysraphism includes findings ranging from complex vertebral anomalies to meningomyelocele.
  - MRI of the involved spinal level is appropriate, and in many cases, MRI of the entire spine will be indicated, often with sagittal and coronal reformatted images. The use of contrast is sometimes necessary.
- Spinal dysraphism does not usually include the brain.
  - Advanced imaging of the brain is not indicated in cases without hydrocephalus, affirmative signs of cerebral involvement, or the presence of multiple hydromyelia (which suggests hydrocephalus).
- Advanced imaging of the pelvis is not commonly necessary in these cases unless there are clinical signs of pelvic or rectal involvement.

- **References:**
  - *Pediatrics* 2001;108: e101
  - *Pediatrics* 2000;105:e69
  - *Pediatrics* 2003;112:641-647
  - *Pediatr Neurosurg* 2002;37:137-147
  - *Surgical Neurology* 2005;63(S1):S8-S12
  - *J Neurosurg* 2003;98(3 Suppl):247-250
Tethered cord:
- The conus medullaris in newborns should terminate at L2-3 or higher. If the conus is below L2-3, it may be considered tethered.
- The spinal cord normally ends in the conus medullaris, which is positioned at L1-2 in normal infants and children.
  - If the conus is as low as L2-3, the cord can be presumed to be tethered by an abnormal structure.

Abnormalities can be found in both lumbosacral and thoracic regions and are often associated with spinal lipomas in either region.
- Noncontrast lumbar MRI (CPT 72148) is usually performed, but thoracic spine MRI, cervical spine MRI, and the use of contrast may be appropriate when a tethered cord has been found.
- These cases should be sent for Medical Director review, especially if the patients have already had recent spine imaging.

Also see PACSP-5 Spinal Dysraphism

References:
- AJR 1989;152:1029-1032
- Radiographics 2000;20:923-938
• Pilonidal cysts/Sacral dimpling/Dorsal dermal sinus
  o Skin indentations at the base of the spine, which in the case of pilonidal cysts and sacral dimpling are always benign and never communicate with the subarachnoid space.
  o Dorsal dermal sinus frequently extends into the subarachnoid space and is associated with intraspinal pathology including spinal abscess, tethered cord, and epidermoid tumor.
  o The important finding is the location of the dimple/sinus. If it is below the upper end of the intergluteal crease, the tract never communicates with the spinal canal.
  o In dimples/sinuses above the upper end of the intergluteal crease, spine MRI without contrast is indicated.
  o Ultrasound can be performed in infants under 12 months of age, but MRI should be done if ultrasound is positive.*
    Accessed November 20, 2006
  o Other suggestive findings of dorsal dermal sinus are hair and capillary hemangioma around the opening.
  o MRI without contrast is also appropriate in any dimple with positive lower extremity neurological findings.
PACSP- 2~Pediatric Back Pain


PACSP- 3~Kyphosis and Scoliosis

- Nelson, pp.1843-4, 28511-18,

PACSP- 4~Other Congenital and Pediatric Spine Disorders


PACSP- 5~Spinal Dysraphism

PACSP- 6~Tethered Cord

PACSP- 5~Spinal Dysrphism, Evidence Based Clinical Support
PEDIATRIC and CONGENITAL PERIPHERAL NERVE DISORDERS IMAGING GUIDELINES

PACPN-1 ~ GENERAL GUIDELINES

- The Peripheral Nerve Disorders Imaging Guidelines are the same for both the pediatric population and the adult population, unless there are specific guidelines listed here in the Pediatric and Congenital Peripheral Nerve Disorders Imaging Guidelines.
- The peripheral nerves can be damaged by a multitude of causes, including trauma, infection, tumors, and metabolic disorders such as diabetes.
- The initial work up of a suspected peripheral nerve disorder should include a detailed neurological history and examination followed by electromyography and nerve conduction (EMG/NCV) studies.
- Advanced imaging plays a limited role in the diagnosis and management of disorders of peripheral nerves and muscles. The extent of that role is currently being defined.
  - **NOTE:** many disorders of these structures are associated with systemic diseases in which there are well-established indications for advanced imaging.
- When imaging of peripheral nervous tissue or muscles is indicated, MRI is used. In general, CT is not an acceptable alternative (occasional exceptions will be mentioned below).
- MRI is sometimes useful as a preoperative procedure since surgical decisions often depend on the presence or absence of **anatomic** integrity of the nerves (EMG evaluates functional integrity).

**Reference:**

PACPN-2 ~ BRACHIAL PLEXUS

- Disorders of the brachial plexus can generally be identified and distinguished from lesions in other locations by clinical and electromyography and nerve conduction (EMG/NCV) examination. If the diagnosis remains unclear, advanced imaging can be helpful.
- Advanced imaging can be helpful as a preoperative study to evaluate the anatomy of brachial plexus lesions which should have already been defined by clinical examination.
- MRI is the preferred modality. CT is not often useful and should generally not be used as a substitute for MRI to image the brachial plexus.
  - Brachial plexus studies can be coded either as upper extremity other than joint MRI (CPT 73218) or as chest MRI (CPT 71550). Chest MRI will image both brachial plexi and is useful for comparing one plexus with the other.
  - MRI studies should be without and with contrast (CPT 73220 or 71552) when tumor is part of the differential diagnosis.
  - **Reference:**
    - *Radiographics* 2000;20:1023-1032
    - *Eur Radiol* 2001;11:325-336
- **Trauma:** the cause and extent are generally obvious, but noncontrast MRI of the brachial plexus (CPT 73218 or 71550) is often useful, especially when surgical repair is being considered.
- **Birth trauma:** injury to the baby’s upper (Erb’s palsy) or lower (Klempke’s palsy) plexus can occur during birth.
  - Noncontrast MRI of the brachial plexus (CPT 73218 or 71550) can be useful to define the defect.
If there is clinical suspicion for cervical nerve root avulsion, noncontrast cervical spine MRI (CPT 72141) may be useful.

**PACPN-3 ~ GAUCHER's DISEASE**

- Gaucher's disease is a group of autosomal recessive inborn errors of metabolism characterized by lack of the enzyme acid 3-glucuronidase with destructive ceramide storage in various tissues.
- Gaucher’s disease is a treatable disorder (enzyme replacement) in which the liver, spleen, and bone marrow/bones are the most affected organs.
- This guideline addresses Type I Gaucher’s disease, which is by far the most common type in North America.
- MRI is used to follow progression of disease in order to make treatment decisions, to monitor the results of treatment, and to evaluate complications as they occur.
- Liver and spleen size are followed by annual noncontrast abdominal MRI (CPT 74181).
- Annual noncontrast thigh MRI (CPT 73718) is used to follow marrow replacement by the disease and to monitor response to treatment.
  - MRI of a single thigh should be sufficient.
- These patients often develop avascular necrosis of the hips and compression fractures of the spine, and relevant noncontrast MRI scans are appropriate when the clinical setting suggests these complications. In addition, many experts routinely perform MRI of the hips in untreated patients.
- References:
  - *BJR* 2002;75 suppl 1:A13-A24
  - *Haematologica* 2000;85:792-799

**PACPN-4 ~ MUSCLE DISORDERS**

- **Inflammatory muscle diseases**
  - Includes dermatomyositis, polymyositis, and sporadic inclusion body myositis.
  - Advanced imaging is used in these disorders for three purposes:
    1. Selection of biopsy site
    2. Treatment monitoring
    3. Detection of occult malignancy (for patients with dermatomyositis and polymyositis)
  - **Dermatomyositis in children:**
    - In children with dermatomyositis, MRI is often used to confirm a clinical diagnosis and thus avoid a biopsy.
    - An issue specific to this disorder is the presence of progressive calcification in muscles.
      - Noncontrast CT of the thighs (CPT 73700) is the procedure of choice to follow this condition, but MRI (CPT 73718) is often used since it permits assessment of the primary muscle disease as well.
  - **Search for occult neoplasm in patients with polymyositis:**
    - Lung and ovarian tumors are the most common, but lymphomas and other carcinomas can also be found
    - Chest CT with contrast (CPT 71260) and pelvic ultrasound (in females) should be done initially.
    - CT abdomen and pelvis with contrast (CPT 74160 and 72193) are indicated if the above fail to make a diagnosis.
Tumors may remain occult for months to several years after the onset of the myositis.

Reference:
- Lancet 2001;357:96-100

**PEDiatric AND CONGENITAL PERIPHERAL NERVE DISORDERS**

**IMAGING GUIDELINE REFERENCES**

**PACPN-1~General Guidelines**

**PACPN-2~Brachial Plexus**

**PACPN-3~Gaucher’s Disease**

**PACPN-4~Muscle Disorders**
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PACONC-1~GENERAL GUIDELINES

- The Oncology Imaging Guidelines are the same for both the pediatric population and the adult population, unless there are specific guidelines listed here in the Pediatric and Congenital Oncology Imaging Guidelines.
- For many pediatric tumors, adherence to adult guidelines, if applicable, is suggested.
- For pediatric patients suspected or confirmed to have a malignancy, Pediatric Oncology consultation without delay is strongly supported.
  - As with adult tumors, confirmation of malignancy via biopsy should proceed promptly. Excess delay in obtaining tissue confirmation of disease while awaiting imaging is frequently inappropriate.
  - Pediatric oncology patients enrolled or treated according to current Pediatric Oncology Group (POG) protocols should have imaging obtained in accordance with POG protocols.
    - Imaging obtained in accordance with such protocols should not be denied as being investigational, unless a specific investigational imaging technology is part of the protocol.

- PET Imaging: For Oncologic applications, the skull base to mid-femur ("eyes-to thighs") procedure code for PET (CPT 78812 or 78815) is usually the most appropriate procedure to order.
  - Exceptions for the use of CPT 78813 or 78816 (whole-body protocol) include the following:
    - Pediatric malignancies, when requested by a pediatric oncology referral center
    - Malignant melanoma
    - Some unusual presentations of sarcomas and lymphomas

- The guidelines listed in this section for certain specific indications are not intended to be inclusive; broad clinical discretion is advised.

PACONC-2~PEDIATRIC MALIGNANCIES

PACONC-2.1 Leukemia

- While most leukemia patients do not require advanced imaging, brain MRI without and with contrast (CPT 70553) can be performed in high risk patients, patients exhibiting central nervous system (CNS) symptoms, and in patients found to have obvious positive CNS cytology.

PACONC-2.2 Lymphomas

- Imaging pathways for pediatric lymphomas are similar to adults (see ONC-26 Lymphomas in the adult Oncology guidelines), except imaging after each 2 cycles of chemotherapy is generally allowed, as per protocol guidance.
  - After the initial staging imaging studies, repeat imaging studies (such as after chemotherapy cycles) should be either CT scans, with contrast, of body areas previously positive or PET/CT but not both—this is especially important in the pediatric population due to radiation issues.
PACONC-2.3 Neuroblastoma
• Abdominal and pelvic CT or MRI, contrast as requested, with chest x-ray is indicated for the initial evaluation of any child less than age 5 with a palpable abdominal mass. Neuroblastoma should be in the differential diagnosis for young children who present with adrenal tumors.
  o Follow-up chest CT or MRI, contrast as requested, can be performed for any abnormality seen on the above studies.
  o Both CT and MRI may be necessary to fully evaluate patients with neuroblastoma.
  o MIBG and/or bone scan is the standard staging study to assess the possibility of skeletal disease.
  o MRI of skeleton or central nervous system (CNS) is not routinely indicated in the absence of signs or symptoms or strong clinical suspicion of disease in those systems.
• Re-staging studies can be repeated every 3 to 6 months post-therapy for the interval of time calculated to be (age at diagnosis in months) plus 9 months.

PACONC-2.4 Wilm’s Tumor
• Abdominal and pelvic CT or MRI, contrast as requested, with chest x-ray is indicated for the initial evaluation of any child less than age 5 with a palpable abdominal mass.
  o CT chest can be performed upon verification of Wilm’s tumor.
  o Brain MRI without and with contrast (CPT 70553) can be performed if the patient has the unusual variants of rhabdoid histology and clear cell sarcoma.
• Re-staging studies may be repeated every 3 to 6 months post-therapy for the interval of time calculated to be (age at diagnosis in months) plus 9 months.
  o Pelvic imaging is unnecessary for patients who have had no previous pelvic involvement.

PACONC-2.5 Pediatric Rhabdomyosarcoma
• Pediatric rhabdomyosarcomas: should be imaged according to current national protocol guidance.
  o Ultrasound is generally performed initially, followed by CT.
• Adult Guidelines, ONC-11~Soft Tissue Sarcomas and ONC-17~Bladder Cancer do not apply.

PACONC-2.6 Germ Cell Tumors
• See ONC-19 Testicular and Nonepithelial Ovarian (Germ Cell) Cancer in the adult Oncology guidelines and PET-12.5 Testicular Cancer (Germ Cell Tumors) in the adult PET guidelines.

PACONC-2.7 Pediatric Central Nervous System Tumors
• See PACHD-12 Neuro-Oncology Brain Tumors in the Pediatric and Congenital Head guidelines.

PACONC-2.8 Parotid tumors
• Parotid tumors: In children, 75% of parotid masses are benign
  o Pleomorphic adenoma and mucoepidermoid cancer are the most common tumors.

PACONC-2.9 Chest Wall Tumors
• Ewing’s sarcoma is high on the differential diagnosis.
• Chest MRI (CPT 71552) and chest CT (CPT 71260) may both be indicated to evaluate the chest wall and rule out lung metastases.
PACONC-2.10 Breast Mass
• Chest x-ray and chest CT (either CPT 71250 or 71260) can be performed to evaluate a breast mass in the pediatric population, since malignancies such as lymphoma or rhabdomyosarcoma will need to be ruled out.