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.

PEDIATRIC AND CONGENITAL IMAGING GUIDELINES
SPINE and PERIPHERAL NERVE DISORDERS (PND)
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MedSolutions, Inc. Clinical Decision Support Tool
for Advanced Diagnostic Imaging

Common symptoms and symptom complexes are addressed by this tool. Imaging requests for patients with atypical symptoms or clinical presentations that are not specifically addressed will require physician review. Consultation with the referring physician may provide additional insight.

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2011 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~IMAGING MODALITIES

- PACSP-2.1 Spinal Canal Ultrasound
  - Spinal canal ultrasound (CPT®76800) describes the ultrasonic evaluation of the spinal cord (canal and contents).
    - CPT®76800 describes evaluation of the entire spine and should not be reported multiple times for imaging of different areas of the spinal canal.
    - Do not use CPT®76800 for intraoperative spinal canal ultrasound.
      - CPT®76998, intraoperative ultrasonic guidance, is the appropriate code in this circumstance.
  - Spinal canal ultrasound (CPT®76800) is generally limited to infants less than one year old because of the bone mass surrounding the spinal cord.
    - Exception: the persisting acoustic window in children with posterior spinal defects of spinal dysraphism enables spinal canal ultrasound to be performed at any age (see PACSP-6 Spinal Dysraphism)
  - Indications for performing spinal canal ultrasound (CPT®76800) include:
    - Lack of complete ossification of the vertebral bodies
    - Tethered cord (see PACSP-7 Tethered Cord)
    - Evaluation of suspected occult and non-occult dysraphism (see PACSP-6 Spinal Dysraphism)
    - Evaluation of spinal cord tumors, vascular malformations, and cases of birth-related trauma
  - In general, additional imaging studies of the spine are not indicated in asymptomatic patients with normal spinal ultrasound findings.

PACSP-3~PEDIATRIC SPINE PAIN

- PACSP-3.1 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 reflects underlying serious disease when it occurs.
o 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-3.2 Back Pain in Children Age 5 and Under
  o A detailed physical examination and plain x-rays should be performed initially.
  o 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-3.3 Simple Back/Spine Pain in Children Age 6 and Over
  o A detailed physical/neurological examination should be performed initially.
  o Plain x-rays should be performed before advanced imaging is considered.
  o Advanced imaging is appropriate when the following 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
  o MRI without contrast of the symptomatic spinal region is usually the appropriate study.
  o 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.
  o CT without contrast may be appropriate when the request is based on abnormal plain x-ray results, especially spondylitic changes.
  o For diagnosis of pars defects, NM Tc-99m MDP is very sensitive and specific and is an appropriate alternative to CT or MRI.
  o 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.
     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.
     Preferences of such specialists to perform CT over MRI are generally acceptable.

• PACSP-3.4 Spondylolysis
  o 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.

- If imaging is needed because of radiological uncertainty or associated spondylolisthesis, noncontrast CT or MRI can be performed.
  - MRI must be performed at minimum on a 1.0 Tesla scanner with 3 mm cuts and at relatively high resolution.\(^1\)


### PACSP-3.5 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 age 17 and younger.
  - In adolescents, MRI without contrast is usually sufficient
  - MRI without and with contrast can be performed in children under age 12.

### PACSP-4~KYPHOSIS AND SCOLIOSIS

The term “kyphosis” refers to a curve convex posteriorly
- Kyphosis generally affects the thoracic spine

The term “lordosis” implies a curve convex anteriorly
- “Scoliosis” refers to lateral curvature

### PACSP-4.1 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 spine MRI (CPT®72146) can be performed.
  - Noncontrast lumbar spine 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.\(^1\)
This modality is not a diagnostic tool since the incidence of false positive vertebral changes in normal patients is high.\textsuperscript{2}


- **PACSP-4.2 Scoliosis**
  - Scoliosis an abnormal lateral curve of the thoracic or thoraco-lumbar spine in the frontal plane. A small lateral curve is not uncommon and generally does not require further investigation.
    - 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.
    - 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.
    - Developmental scoliosis (onset in childhood or adolescence) is the most common.
    - 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.
  - Standing anteroposterior (AP) and lateral x-ray of the spine are the initial imaging studies and standing x-rays are generally used for follow-up.
  - Spine specialists sometimes appropriately request MRI, CT, or both for preoperative planning of scoliosis surgery. Requests for both MRI and CT should be sent for Medical Director review.
  - **Congenital Scoliosis**
    - 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 (CPT®76800) is often useful as a second imaging procedure (following x-rays).
      - 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-2.2 MRI of the Spine in the adult Spine Imaging Guidelines).
        - By convention, sagittal/coronal screening studies of the entire spine are coded as one segment (cervical [CPT®72141], thoracic [CPT®72146], or lumbar [CPT®72148]), whichever is most appropriate.
      - Brain MRI, usually without contrast (CPT®70551), is appropriate if the clinical evaluation or preliminary imaging studies suggest an associated cerebral anomaly.
Renal ultrasound (CPT®76770 or CPT®76775) 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)

- Most cases are idiopathic, especially in adolescent girls.
- 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)

- 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**

- 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 or CT 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**

- 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.
- The appropriateness of advanced imaging will depend on the nature of the underlying disease.

**References:**

PACSP-5~OTHER CONGENITAL AND PEDIATRIC SPINE DISORDERS

- **PACSP-5.1 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-5.2 Ankylosing Spondylitis**
  - Also see SP-9.5 Ankylosing Spondylitis in the adult Spine Imaging 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, noncontrast MRI of the relevant spinal level is appropriate.

- **PACSP-5.3 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.
  - If surgery is being considered, noncontrast head and cervical spine CT scans (CPT® 70450 and CPT® 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.
  - Reference:

- **PACSP-5.4 Chiari Malformation**
  - Klippel-Feil anomaly (see PACSP-5.5 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.
    - Most patients have no or very vague symptoms, and diagnosis is usually made on head MRI done for other purposes.
    - A significant minority of these patients have an associated syringomyelia or hydromyelia.
    - 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 cervical spine (CPT®72141), with or without also performing MRI thoracic spine (CPT®72146) is recommended to exclude syrinx. Follow-up spinal MRI without and with contrast (CPT®72156, with or without CPT®72157) will be needed if hydro/syringomyelia is seen (see SP-15 Syringomyelia in the adult Spine Imaging Guidelines). Spinal CT is inferior to spinal MRI in the evaluation of syringomyelia. MRA and CTA of either head or neck are not generally indicated in the evaluation of syringomyelia unless ordered by the operating surgeon for preoperative planning.

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-34.5 CSF Flow Imaging in the adult Head Imaging Guidelines), but the coverage policy of the involved health plan regarding this study should be consulted. Chiari malformation is not itself familial, and family screening is not appropriate. Chiari II, III, and IV are very rare and involve much more extensive malformations at all levels of the neural axis which are not further discussed in these guidelines.

**PACSP-5.5 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-5.6 Marfan Syndrome**
- Spine MRI (contrast as requested) is an appropriate study for Marfan syndrome if dural ectasias are suspected.

**PACSP-5.7 Neurofibromatosis Type I**
- see PACHD-18.7 Inherited Syndromes that include Brain Tumor in the Pediatric Head Imaging Guidelines

**PACSP-5.8 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-5.9 Spine in von Hippel-Lindau (H-L) Syndrome**
  o H-L syndrome is associated with spinal hemangiomas and syrinx: level-appropriate spine MRI without and with contrast may be indicated.
  o 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.
  o Also see **PACHD-31 von Hippel-Lindau Disease** in the Pediatric Head Guidelines
  o von Hippel-Lindau syndrome does not usually become symptomatic until the early adult years.

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**PACSP-6~SPINAL DYSRAPHISM**

• **PACSP-6.1 Introduction**
  o 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.
  o Imaging of the most severe such lesions must be individualized to the case and is beyond the scope of this guideline.

• **PACSP-6.2 Cutaneous Lesions of the Back**
  o The spinal cord arises from an infolding of the skin of the back, 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.
  o **Not significantly associated with spinal dysraphism:**
    - **“Simple dimple”**
      - Defined as a soft tissue depression ≤25mm above the anus (regardless of size or depth)
    - Deviated gluteal fold
      - Defined as any abnormal gluteal fold (including bifid or split gluteal cleft) without an underlying mass.
    - 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 (such as dermal melanosis):
      - There is no increased incidence of spinal anomalies in these children, and advanced imaging is not appropriate unless there are associated midline cutaneous abnormalities.
  o **Sometimes associated with spinal dysraphism:**
    - Dermal sinuses overlying the lumbar, thoracic, or cervical spine.
• Initial spinal ultrasound (CPT®76800) is appropriate in neonates and infants.
  - Ultrasound has a sensitivity and specificity of 96%*  
    *J Pediatr 2009 Dec;155:864-869
• 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 (CPT®76800) 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 spine MRI without contrast (CPT® 72148) is appropriate when these are present.
• Café au lait spots are a marker for type 1 neurofibromatosis.
  - See PACHD-18.7 Inherited Syndromes that include Brain Tumor in the Pediatric Head Guidelines

**PACSP-6.3 Spina Bifida Occulta**
- Seen in 20%-30% of the normal population, usually at L5 or S1 and is commonly an incidental finding on spinal x-rays.
- These guidelines apply to adults as well as the pediatric population.
- Unless additional abnormalities are present, advanced imaging is not indicated.
  - Cutaneous lesions below the gluteal crease are often pilonidal sinuses and need no further evaluation. Tracts, pits, or lesions above the gluteal fold can be evaluated further for underlying spinal pathology.*(See PACSP-5.2)
- Clinically significant dysraphism includes findings ranging from complex vertebral anomalies to meningomyelecele.
  - 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
  - *Surg Neurol* 2005;63(S1):S8-S12

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**PACSP-7~TETHERED CORD**

• **Tethered Cord**
  - **Normal position of spinal cord:**
    - The conus medullaris in newborns should terminate at L2-3 or higher.
    - After 3 months of age, the conus should lie at or above the L2 level.
    - The spinal cord normally ends in the conus medullaris, which is positioned at L1-2 in normal infants and children.
  - **Tethered cord:**
    - If the conus terminates below L2-3, the cord may 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.
      - Tethering is certain when the cord terminates at or below L4 and there is other supporting evidence of tethering such as limited spinal cord pulsatility, posterior lie in the spinal canal, thick filum terminale, intraspinal mass, or lipoma.
  - **Imaging Studies to Evaluate Tethered Cord:**
    - In infants, if the conus terminates at L3, and there is uncertainty based upon previous imaging as to whether cord termination is low, repeat ultrasound (CPT®76800) of the spinal cord can be performed in 4 to 6 weeks. A normal cord will have “moved” higher within the spinal canal by this time.
    - Noncontrast lumbar MRI (CPT®72148) can be performed to evaluate tethered cord. 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-6 Spinal Dysraphism**
  - **References:**
    - AJR 1989;152:1029-1032
    - *Radiographics* 2000;20:923-938
EVIDENCE BASED CLINICAL SUPPORT

PACSP-6~SPINAL DYSRAPHISM

- Pilonidal cysts/Sacral dimpling/Dorsal dermal sinus
  - 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.
  - Dorsal dermal sinus frequently extends into the subarachnoid space and is associated with intraspinal pathology including spinal abscess, tethered cord, and epidermoid tumor.
  - 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.
  - In dimples/sinuses above the upper end of the intergluteal crease, spine MRI without contrast is indicated.
  - Ultrasound can be performed in infants under 12 months of age, but MRI should be done if ultrasound is positive.*
  - Other suggestive findings of dorsal dermal sinus are hair and capillary hemangioma around the opening.
  - MRI without contrast is also appropriate in any dimple with positive lower extremity neurological findings.
PEDIATRIC SPINE IMAGING GUIDELINE REFERENCES

PEDIATRIC AND CONGENITAL SPINE IMAGING GUIDELINE REFERENCES

PACSP-3~Pediatric Spine Pain


PACSP-4~Kyphosis and Scoliosis


PACSP-5~Other Congenital and Pediatric Spine Disorders


PACSP-6~Spinal Dysraphism


### PACSP-7~Tethered Cord


PEDIATRIC AND CONGENITAL PERIPHERAL NERVE DISORDERS
(PND) 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).
    - Occasionally, for upper trunk lesions, neck MRI (CPT®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.

- MRI studies should be without and with contrast (CPT®73220 or CPT®71552) when tumor is part of the differential diagnosis.
- Shoulder MRI, contrast as requested, can be performed in infants with birth brachial plexopathy for preoperative planning if ordered by the operating surgeon.
- These patients often have glenohumeral dysplasia and may require shoulder surgery.

**References:**
- Radiographics 2000;20:1023-1032
- ACR Appropriateness Criteria, Plexopathy, 2009
- Eur Radiol 2001;11:325-336

**Trauma:** The cause and extent are generally obvious, but noncontrast MRI of the brachial plexus (CPT®73218 or CPT®71550) is often useful, especially when surgical repair is being considered.

**Birth rauma:** 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 CPT®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.

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**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 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 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
• **Inflammatory Muscle Diseases**
  o Includes dermatomyositis, polymyositis, and sporadic inclusion body myositis.
  o 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)
  o **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.
  o **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) (CPT®76856 or CPT®76857 and/or CPT®76830 [transvaginal]) should be done initially.
    - CT abdomen and pelvis with contrast (CPT®74160 and CPT®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
- ACR Appropriateness Criteria, Plexopathy, 2009

PACPN-3~Gaucher’s Disease

PACPN-4~Muscle Disorders