

MedSolutions, Inc.
Clinical Decision Support Tool
Diagnostic Strategies

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
NECK and CHEST
©2009 MedSolutions, Inc

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.

This version incorporates MSI accepted revisions prior to 11/30/08

TABLE OF CONTENTS

2009 PEDIATRIC and CONGENITAL NECK GUIDELINES	PAGE
PACNECK- 1 GENERAL GUIDELINES	3
PACNECK- 2 NECK MASSES (Pediatric)	3
PACNECK- 3 CERVICAL LYMPHADENOPATHY	5
2009 PEDIATRIC and CONGENITAL CHEST GUIDELINES	PAGE
PACCH- 1 GENERAL GUIDELINES	8
PACCH- 2 SUPRACLAVICULAR REGION	8
PACCH- 3 HEMOPTYSIS	9
PACCH- 4 BRONCHIECTASIS	9
PACCH- 5 PNEUMONIA	10
PACCH- 6 POSITIVE PPD or TUBERCULOSIS (TB)	10
PACCH- 7 SARCOID	11
PACCH- 8 SOLITARY PULMONARY NODULE (SPN)	11
PACCH- 9 MEDIASTINAL LYMPHADENOPATHY	13
PACCH-10 MEDIASTINAL MASS	13
PACCH-11 BREAST MASS	14
PACCH-12 PECTUS EXCAVATUM and PECTUS CARINATUM	14
PACCH-13 PULMONARY ARTERIOVENOUS FISTULA (AVM)	15
PACCH-14 VASCULAR RING	15
EVIDENCE BASED CLINICAL SUPPORT	PAGE
PACNECK- 2 NECK MASSES (Pediatric)	6
PEDIATRIC and CONGENITAL NECK GUIDELINE REFERENCES	7
PEDIATRIC and CONGENITAL CHEST GUIDELINE REFERENCES	16

PEDIATRIC AND CONGENITAL NECK IMAGING GUIDELINES

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.
 - 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). 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 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
- **Retrovisceral space** (posterior to the cervical esophagus): Gastrointestinal duplication cysts (usually are diagnosed in first year of life)
- **Pretracheal space** (contains trachea, larynx, cervical esophagus, recurrent laryngeal nerves, and thyroid and parathyroid glands): thyroglossal duct cyst, goiter, laryngocele, lymphadenopathy, abscess
- **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.
- **Prevertebral space:** Neuroenteric cyst, cellulitis, abscess, spondylodiskitis lymphadenopathy, cellulitis, abscess, paraganglioma.
- **Carotid sheath space:** Jugular vein thrombosis or phlebitis, lymphadenopathy, cellulitis, abscess, paraganglioma.
- **Parotid gland space:** Parotid lymphadenopathy, retromandibular vein thrombosis, parotiditis, sialodochitis (inflammation of the salivary gland duct), salivary duct stone.
- **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.
- **Masticator space** (includes masseter and pterygoid muscles): Venous or lymphatic malformation, cellulitis, abscess, rhabdomyosarcoma.
- **Parapharyngeal space:** Cellulitis, abscess, rhabdomyosarcoma (second most common pediatric head and neck malignancy), extension of lymphoma.
- **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.
- **Posterior cervical space:** Lymphatic malformation, lymphadenopathy.

- **Reference:**
 - RadioGraphics 2005;25:931-948

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:**
 - Randolph GW. Anatomy of the neck, examination of the head and neck and evaluation of neck masses. In Wilson WR, Nadol JB, Randolph GW. The Clinical Handbook of Ear, Nose and Throat Disorders. New York, Parthenon Publishing Group, 2002, pp. 244-264
 - Am Fam Physician 1998 Oct;58:6

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.

PEDIATRIC AND CONGENITAL NECK IMAGING GUIDELINE REFERENCES

PACNECK-2~Neck Masses (Pediatrics)

- Meuwly JY, Lepori D, Theumann N, et. al. Multimodality imaging evaluation of the pediatric neck: techniques and spectrum of findings. *Radiographics* 2005;25:931-948.

PACNECK-3~Cervical Lymphadenopathy

- Randolph GW. *Anatomy of the neck, examination of the head and neck and evaluation of neck masses*. In Wilson WR, Nadol JB, Randolph GW. *The Clinical Handbook of Ear, Nose and Throat Disorders*. New York, Parthenon Publishing Group, 2002, pp. 244-264.
- Ferrer R. Lymphadenopathy: differential diagnosis and evaluation. *Am Fam Physician* 1998 Oct;58:6.

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.
- A recent complete history and physical examination should be performed prior to considering advanced imaging of the chest.
- 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:**
 - La Quaglia MP. *Congenital Anomalies*. In Pearson FG, Deslauriers J, Ginsberg RJ, et al. (Eds.). *Thoracic Surgery*. New York, Churchill Livingstone, Inc., 1995, pp.411-432

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.*
**Eliot Fishman. "Ask the Fish" e-mail communication. Johns Hopkins Medicine. <http://www.ctisus.com>. Accessed July 2, 2007*
- 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:**
 - *Am Fam Physician 2005;72(7):1253-1260*
- 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:**
 - Hassan I. *Bronchiectasis*. eMedicine, Dec 8, 2006. <http://www.emedicine.com>. Accessed October 31, 2007

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.*
**Rev Mal Respir 2003;20 (2 pt1):207-213*
- 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 nodule is any pulmonary or pleural lesion represented in a radiograph by a sharply defined, discrete, nearly circular opacity 2-30 mm in diameter.
 - 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*
- 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](#)
- No further imaging is necessary if a nodule has been stable for 2 years.
- Lesions that have a ground glass opacity component may require longer follow-up time than 2 years to exclude indolent adenocarcinoma.¹ These requests should be sent for Medical Director review.
 - Ground glass lesions that are greater than 2cm should be resected.²
 - Although most cancerous nodules are solid, partly solid nodules are most likely to be malignant (usually bronchioalveolar cancer).³
 - Likelihood of malignancy is 63% for partly solid nodule, 18% for nonsolid nodule, and 7% for solid nodule.⁴

¹[Radiology 2005;237:395-400](#)
²[Siegelman SS: Hot Topics in Chest CT; Presented at: 24th Annual Computed Body Tomography: The Cutting Edge, February 14-17, 2008 Orlando, FL](#)
³[Radiology 2006;239:34-49](#)
⁴[AJR 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 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.
 - **Reference:**
 - [J Nucl Med 2008;49:179-185](#)
- 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 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, one 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.
 - Lymph node biopsy should be considered in cases of persistent lymphadenopathy in order 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, ultrasound, 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.
- **Reference:**
 - Hebra A. *Pectus Excavatum*. eMedicine, August 8, 2007, <http://www.emedicine.com>. Accessed November 2, 2007

THORACIC VASCULAR DISORDERS

PACCH-13~PULMONARY ARTERIOVENOUS FISTULA (AVM)

- **Definition:** abnormal connection between pulmonary arteries and veins.
- **Etiology:**
 - Acquired: penetrating or blunt trauma to the chest; bronchiectasis
 - 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
 - *Current Pharmaceutical Design* 2006;12:1243-1248

PACCH-14 ~ VASCULAR RING

- 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

- La Quaglia MP. *Congenital Anomalies*. In Pearson FG, Deslauriers J, Ginsberg RJ, et al. (Eds.). *Thoracic Surgery*. New York, Churchill Livingstone, Inc., 1995, pp.411-432.

PACCH-2~Supraclavicular Region

- van Overhagen H, Brakel K, Heijenbrok MW, et al. Metastases in supraclavicular lymph nodes in lung cancer: assessment with palpation, US, and CT. *Radiology* 2004;232:75-80.
- Eliot Fishman. "Ask the Fish" e-mail communication. Johns Hopkins Medicine, <http://www.ctisus.com>. Accessed July 2, 2007.

PACCH-3~Hemoptysis

- Bidwell JL, Pachner RW. Hemoptysis: diagnosis and management. *Am Fam Physician* 2005;72:1253-1260.
- Revel MP, Fournier LS, Hennebicque AS, et al. Can CT replace bronchoscopy in the detection of the site and cause of bleeding in patients with large or massive hemoptysis? *AJR* 2002 Nov;179(5):1217-1224.

PACCH-4~Bronchiectasis

- Hassan I. *Bronchiectasis*. eMedicine, Dec 8, 2006, <http://www.emedicine.com>. Accessed October 31, 2007.

PACCH-6~Positive PPD or Tuberculosis (TB)

- Kim WS, Moon WK, Kim IO, et al. Pulmonary tuberculosis in children: evaluation with CT. *AJR* 1997 April;168(4):1005-1009.
- Uzum K, Karahan OI, Dogan S, et al. Chest radiography and thoracic computed tomography findings in children who have family members with active pulmonary tuberculosis. *Eur J Radiol* 2003 Dec;48(3):258-262.

PACCH-7~Sarcoid

- Hantous-Zannad S, Charrada L, Zidi A, et al. Value of CT scanning in the investigation of thoracic sarcoidosis. *Rev Mal Respir* 2003 April;20(2 pt 1):207-213.

PACCH-8~Solitary Pulmonary Nodule (SPN)

- MacMahon H, Austin JHM, Gamsu G, et al. Guidelines for management of small pulmonary nodules detected on CT scans: a statement from the Fleischner Society: *Radiology* 2005;237:395-400.
- Henschke CI, Yankelevitz DF, Naidich DP, et al. CT screening for lung cancer: suspiciousness of nodules according to size on baseline scans. *Radiology* 2004;231:164-168.
- *National Lung Screening Trial*
- *American College of Chest Physicians guidelines 2003*
- *International Symposium on Multidetector-Row CT, San Francisco, 2005.*
- McCarville MB, Lederman HM, Santana VM. Distinguishing benign from malignant pulmonary nodules with helical chest CT in children with malignant solid tumors. *Radiology* 2006 May;239(2):514-520.
- Siegelman SS: *Hot Topics in Chest CT*; Presented at: 24th Annual Computed Body Tomography: *The Cutting Edge*, February 14-17, 2008 Orlando, FL.
- Winer-Muram HT. The solitary pulmonary nodule. *Radiology* 2006 April;239(1):34-49.
- Henschke CI, Yankelevitz DF, Mirtcheva R, et al. CT screening for lung cancer: frequency and significance of part solid and nonsolid nodules. *AJR* 2002 May;178(5):1053-1057.

- Fletcher JW, Kymes SM, Gould M, et al. A comparison of the diagnostic accuracy of ¹⁸F-FDG PET and CT in the characterization of solitary pulmonary nodules. *J Nucl Med* 2008;49:179-185.

PACCH-9~Mediastinal Lymphadenopathy

- Bronson JG. Looking at the lungs: 2005. *Imaging Economics* 2005 Feb, p.37.

PACCH-12~Pectus Excavatum and Pectus Carinatum

- Hebra A. *Pectus Excavatum*. eMedicine, August 8, 2007, <http://www.emedicine.com>. Accessed November 2, 2007.

PACCH-13~Pulmonary Arteriovenous Fistula (AVM)

- Halefoglu AM. Rendu-Osler-Weber syndrome presenting with pulmonary arteriovenous fistula. *Australas Radiol* 2005 Jun;49(3):242-245.
- De Cillis E, Burdi N, Bortone AS, et al. Endovascular treatment of pulmonary and cerebral arteriovenous malformations in patients affected by hereditary haemorrhagic telangiectasia. *Current Pharmaceutical Design* 2006;12(10):1243-1248.