



CLINICAL GUIDELINES

Pediatric Chest Imaging Policy

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eviCore healthcare Clinical Decision Support Tool Diagnostic Strategies: This tool addresses common symptoms and symptom complexes. Imaging requests for individuals with atypical symptoms or clinical presentations that are not specifically addressed will require physician review. Consultation with the referring physician, specialist and/or individual's Primary Care Physician (PCP) may provide additional insight.

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Pediatric Chest Imaging Guidelines

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Procedure Codes Associated with Chest Imaging	
MRI	CPT®
Chest MRI without contrast	71550
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Unlisted MRI procedure (for radiation planning or surgical software)	76498
MRA	CPT®
Chest MRA (non-cardiac)	71555
CT	CPT®
Chest CT without contrast	71250
Chest CT with contrast	71260
Chest CT without and with contrast (rarely used)	71270
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Quantitative Differential Pulmonary Perfusion, Including Imaging When Performed	78597
Quantitative Differential Pulmonary Perfusion and Ventilation (e.g., Aerosol or Gas), Including Imaging When Performed	78598
Ultrasound	CPT®
Ultrasound, chest (includes mediastinum, chest wall, and upper back)	76604
Ultrasound, axilla	76882
Ultrasound, breast; <i>unilateral</i> , including axilla when performed; complete	76641
Ultrasound, breast; <i>unilateral</i> , including axilla when performed; limited	76642

PEDCH-1: General Guidelines

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PEDCH-1.1: Pediatric Chest Imaging Age Considerations

Many conditions affecting the chest in the pediatric population are different diagnoses than those occurring in the adult population. For those diseases which occur in both pediatric and adult populations, minor differences may exist in management due to patient age, comorbidities, and differences in disease natural history between children and adults.

- Patients who are < 18 years old should be imaged according to the Pediatric Chest Imaging Guidelines, and patients who are ≥ 18 years old should be imaged according to the Adult Chest Imaging Guidelines, except where directed otherwise by a specific guideline section.

PEDCH-1.2: Pediatric Chest Imaging Appropriate Clinical Evaluation

- A recent (within 60 days) face to face evaluation including a detailed history, physical examination, and appropriate laboratory studies should be performed prior to considering advanced imaging (CT, MR, Nuclear Medicine), unless the patient is undergoing guideline-supported scheduled imaging evaluation.
- Unless otherwise stated in a specific guideline section, the use of advanced imaging to screen asymptomatic patients for disorders involving the chest is not supported. Advanced imaging of the chest should only be approved in patients who have documented active clinical signs or symptoms of disease involving the chest.
- Unless otherwise stated in a specific guideline section, repeat imaging studies of the chest are not necessary unless there is evidence for progression of disease, new onset of disease, and/or documentation of how repeat imaging will affect patient management or treatment decisions.

PEDCH-1.3: Pediatric Chest Imaging Modality General Considerations

- MRI
 - ◆ MRI Chest is generally performed without and with contrast (CPT® 71552) unless the patient has a documented contraindication to gadolinium or otherwise stated in a specific guideline section.
 - ◆ Due to the length of time for image acquisition and the need for the patient to lie still, anesthesia is required for almost all infants and young children (age < 7 years), as well as older children with delays in development or maturity. In this patient population, MRI imaging sessions should be planned with a goal of minimizing anesthesia exposure adhering to the following considerations:
 - ◆ MRI should be performed without and with contrast unless there is a specific contraindication to gadolinium use and strict criteria for contrast agent use should be applied in all cases.
 - ◆ Recent evidence-based literature demonstrates the potential for gadolinium deposition in various organs including the brain, after the use of MRI contrast.

- The U.S. Food and Drug Administration (FDA) has noted that there is currently no evidence to suggest that gadolinium retention in the brain is harmful and restricting gadolinium-based contrast agents (GBCAs) use is not warranted at this time. It has been recommended that GBCA use should be limited to circumstances in which additional information provided by the contrast agent is necessary and the necessity of repetitive MRIs with GBCAs should be assessed.
- If requesting clinicians indicate that a non-contrast study is being requested due to concerns regarding the use of gadolinium, the exam can be approved.
- ◆ If multiple body areas are supported by eviCore guidelines for the clinical condition being evaluated, MRI of all necessary body areas should be obtained concurrently.
- ◆ The presence of surgical hardware or implanted devices may preclude MRI.
- ◆ The selection of best examination may require coordination between the provider and the imaging service.
- CT
 - ◆ CT Chest is generally performed either with contrast (CPT® 71260) or without contrast (CPT® 71250).
 - There are no generally accepted pediatric indications for CT Chest without and with contrast (CPT® 71270).
 - ◆ CT should not be used to replace MRI in an attempt to avoid sedation unless listed as a recommended study in a specific guideline section.
 - ◆ The selection of best examination may require coordination between the provider and the imaging service.
- Ultrasound
 - ◆ Ultrasound of the chest (CPT® 76604) or axilla (CPT® 76882) is indicated as an initial study for evaluating adenopathy, palpable chest wall lesions, pleural effusion or thickening, and patency of thoracic vasculature.
 - ◆ For those patients who do require advanced imaging, ultrasound can be very beneficial in selecting the proper modality, body area, image sequences, and contrast level that will provide the most definitive information for the patient.
- Nuclear Medicine
 - ◆ Nuclear medicine studies other than PET/CT are very rarely used in evaluation of the pediatric chest.
 - ◆ Pulmonary Ventilation-Perfusion Imaging (CPT® 78582) has been replaced by CTA (CPT® 71275) or CT (CPT® 71260) Chest with contrast, but can be approved for evaluation of suspected pulmonary embolism if CT is unavailable.
 - See also **CH-25: Pulmonary Embolism (PE)** for additional imaging guidelines.
 - ◆ Pulmonary Perfusion Imaging (CPT® 78580) should generally not be approved in lieu of CPT® 78582 for initial evaluation of suspected pulmonary embolism, but

can be approved for follow up of an equivocal or positive recent ventilation-perfusion lung scan (CPT® 78582) to evaluate for interval change.

- ◆ Pulmonary Ventilation Imaging (CPT® 78579) should not be approved in lieu of CPT® 78582 for evaluation of suspected pulmonary embolism, but can be approved for additional evaluation of an abnormal perfusion-only scan (CPT® 78580).
- ◆ Pulmonary split crystal function study (CPT® 78597 or CPT® 78598), also known as Quantitative Differential Pulmonary Perfusion, is indicated for preoperative planning of segmental, lobar, or lung resection.
- ◆ Radiopharmaceutical nuclear medicine imaging of an inflammatory process (CPT® 78805, CPT® 78806, or CPT® 78807) is rarely performed, but is indicated for evaluation of sarcoidosis or toxicity from drug toxicity (cyclophosphamide, busulfan, bleomycin, amiodarone, or nitrofurantoin).

The guidelines listed in this section for certain specific indications are not intended to be all-inclusive; clinical judgment remains paramount and variance from these guidelines may be appropriate and warranted for specific clinical situations.

References

1. Siegel MJ. Chest. In: *Pediatric Sonography*. Philadelphia. Wolters Kluwer, 2018.
2. ACR Practice parameter for performing and interpreting of magnetic resonance imaging (MRI) Revised 2017 (Resolution 10). Accessed January 16, 2018. <https://www.acr.org/-/media/ACR/Files/Practice-Parameters/mr-perf-interpret.pdf?la=en>.
3. ACR–ASER–SCBT–MR–SPR Practice parameter for the performance of pediatric computed tomography (CT) Revised 2014 (Resolution 3). Accessed October 26, 2017. <https://www.acr.org/-/media/ACR/Files/Practice-Parameters/ct-ped.pdf?la=en>.
4. Trinavarat P and Riccabonna M. Potential of ultrasound in the pediatric chest. *Eur J Radiol*. 2014 Sep; 83 (9):1507-1518. Accessed October 26, 2017. [http://www.ejradiology.com/article/S0720-048X\(14\)00211-3/fulltext](http://www.ejradiology.com/article/S0720-048X(14)00211-3/fulltext).
5. Goh Y, Kapur J. Sonography of the pediatric chest. *J Ultrasound Med*. 2016 May; 35 (5):1067-1080. Accessed October 26, 2017. <http://onlinelibrary.wiley.com/doi/10.7863/ultra.15.06006/epdf>.
6. Ing C, DiMaggio C, Whitehouse A, et al. Long-term differences in language and cognitive function after childhood exposure to anesthesia. *Pediatrics*. 2012 Sep; 130 (3): e476-e485. Accessed October 26, 2017. <http://pediatrics.aappublications.org/content/pediatrics/130/3/e476.full.pdf>.
7. Monteleone M, Khandji A, Cappell J, et al. Anesthesia in children: perspectives from nonsurgical pediatric specialists. *J Neurosurg Anesthesiol*. 2014 Oct; 26 (4):396-398. Accessed October 26, 2017. <https://www.medscape.com/medline/abstract/25191959>.
8. DiMaggio C, Sun LS, and Li G. Early childhood exposure to anesthesia and risk of developmental and behavioral disorders in a sibling birth cohort. *Anesth Analg*. 2011 Nov; 113 (5):1143-1151. Accessed October 26, 2017. <https://stacks.cdc.gov/view/cdc/33236>.
9. Nevin MA. Pulmonary embolism, infarction, and hemorrhage. *Nelson Textbook of Pediatrics, Chapter 407*. eds Kliegman RM, Stanton BF, St. Geme JW III, et al. 20th edition. 2016, pp 2123-2128.
10. Kirsch J, Brown KJ, Henry TS, et al. Suspected pulmonary embolism. *ACR Appropriateness Criteria®*. Revised 2016. Accessed January 16, 2018. <https://acsearch.acr.org/docs/69404/Narrative/>.
11. Fesmire FM, Kline JA, Wolf SJ, et al. Clinical policy: critical issues in the evaluation and management of adult patients presenting with suspected pulmonary embolism. *Ann Emerg Med* 2003 Feb; 41 (2):257-270. Accessed October 26, 2017. <https://mayoclinic.pure.elsevier.com/en/publications/clinical-policy-critical-issues-in-the-evaluation-and-management--8>.

12. Parker JA, Coleman RE, Grady E, et al. Society of Nuclear Medicine practice guideline for lung scintigraphy. *J Nuc Med Tech*. 2012 Mar; 40 (1):57-65. Accessed October 26, 2017. http://interactive.snm.org/DOCS/LUNG_SCINTIGRAPHY_V4_FINAL.PDF.
13. Wells PS, Anderson DR, Rodger M, et al. Derivation of a simple clinical model to categorize patient's probability of pulmonary embolism: Increasing the models utility with the SimpliRED D-dimer. *Thromb Haemost*. 2000 Mar; 83 (3):416-420. Accessed January 16, 2018. <https://th.schattauer.de/en/contents/archive/issue/882/issue/special/manuscript/2372/show.html>.
14. Drescher FS, Chandrika S, Weir ID, et al. Effectiveness and acceptability of a computerized decision support system using modified wells criteria for evaluation of suspected pulmonary embolism. *Ann Emerg Med*. 2011 Jun; 57 (6):613-621. Accessed October 26, 2017. [http://www.annemergmed.com/article/S0196-0644\(10\)01557-X/fulltexttr](http://www.annemergmed.com/article/S0196-0644(10)01557-X/fulltexttr).
15. Morton KA, Clark PB, et al. Diagnostic imaging: nuclear medicine. *Amirsys*. 2013; (4) 2-15.
16. Thrall JH and Zeissman HA. Nuclear medicine: the requisites. *Mosby*. 2001, 145-165.
17. Palestro CJ, Brown ML, Forstrom LA, et al. Society of Nuclear Medicine procedure guideline for ¹¹¹in-leukocyte scintigraphy for suspected infection /inflammation, Version 3.0, approved June 2, 2004. Accessed October 26, 2017. http://interactive.snm.org/docs/Leukocyte_v3.pdf.
18. De Vries EFJ, Roca M, Jamar F et al. Guidelines for the labelling of leucocytes with ^{99m}Tc-HMPAO. *Eur J Nucl Med Mol Imaging*. 2010 Apr; 37 (4):842-848. Accessed October 26, 2017. <https://link.springer.com/article/10.1007/s00259-010-1394-4>.

PEDCH-2: Lymphadenopathy

- Axillary lymphadenopathy imaging indications in pediatric patients are identical to those for adult patients. See also **CH-2.2: Axillary Lymphadenopathy** for imaging guidelines.
- Supraclavicular adenopathy in pediatric patients is almost always pathologic, and advanced imaging is indicated prior to excisional biopsy. Fine needle aspiration, while common in adults prior to advanced imaging, is inappropriate for evaluating lymphadenopathy in pediatric patients. Any of the following studies may be approved for evaluation of supraclavicular adenopathy in children:
 - ◆ CT Chest with contrast (CPT® 71260).
 - ◆ MRI Chest without and with contrast (CPT® 71552).
 - ◆ Ultrasound of the chest (CPT® 76604).
- If malignancy is suspected, see the appropriate imaging guidelines as below:
 - ◆ Lymphoma: **PEDONC-5: Pediatric Lymphomas**.
 - ◆ Soft tissue sarcoma: **PEDONC-8: Pediatric Soft Tissue Sarcomas**.
 - ◆ Neuroblastoma: **PEDONC-6: Neuroblastoma**.

Reference

1. Allen-Rhoades W and Steuber CP. Clinical assessment and differential diagnosis of the child with suspected cancer. *Principles and Practice of Pediatric Oncology*. eds Pizzo PA and Poplack DG. 7th edition. 2015, pp 101-111.

PEDCH-3: Mediastinal Mass

The causes of mediastinal masses in children are generally different than those in adults, and the imaging considerations are different.

- Chest x-ray is indicated as an initial study for all patients with suspected mediastinal mass.
- CT Chest with contrast (CPT® 71260) is indicated for any pediatric patient with a mediastinal mass.
 - ◆ Masses can be very large and anterior masses frequently cause compression of the trachea and/or mediastinal blood vessels.
- MRI Chest without and with contrast (CPT® 71552) is indicated for any pediatric patient with:
 - ◆ A posterior (paravertebral) mediastinal mass.
 - ◆ CT findings are inconclusive regarding specific anatomy.
 - ◆ MRI should not be used for patients with large anterior mediastinal masses if anesthesia is necessary to complete the study.
- If lymphoma is strongly suspected or there is evidence of tracheal compression on CT imaging, PET/CT (CPT® 78815) is indicated prior to biopsy in pediatric patients. See **PEDONC-5: Pediatric Lymphoma** for imaging guidelines.
- If neuroblastoma is strongly suspected, MIBG (CPT® 78804) is indicated and can be approved prior to biopsy in pediatric patients. See **PEDONC-6: Neuroblastoma** for imaging guidelines.
- Ultrasound can be approved in children younger than 5 years old to distinguish prominent but otherwise normal thymus from true mediastinal mass.
- A single repeat CT Chest with contrast (CPT® 71260) can be approved to confirm stability and avoid biopsy for patients with NONE of the following features:
 - ◆ Anterior mediastinal mass.
 - ◆ Enlarged lymph nodes anywhere in the imaging field.
 - ◆ Lymphopenia.
 - ◆ Pleural effusion.

References

1. Thacker PG, Mahani MG, Heider A, et al. Imaging evaluation of mediastinal masses in children and adults. *J Thorac Imaging*, 2015 Jul; 30(4):247-264. Accessed October 26, 2017. <https://www.medscape.com/medline/abstract/26086589>.
2. Mullen EA and Gratias EJ. Oncologic emergencies, *Nathan and Oski's Hematology and Oncology of Infancy and Childhood*. eds Orkin SH, Fisher DE, Ginsburg D, et al. 8th edition. 2015, pp 2267-2291.
3. Trinavarat P and Riccabonna M. Potential of ultrasound in the pediatric chest. *Eur J Radiol*. 2014 Sep; 83(9):1507-1518. Accessed October 26, 2017. [http://www.ejradiology.com/article/S0720-048X\(14\)00211-3/fulltext](http://www.ejradiology.com/article/S0720-048X(14)00211-3/fulltext).
4. Naeem F, Metzger ML, Arnold SR, et al. Distinguishing benign mediastinal masses from malignancy in a histoplasmosis-endemic region. *J Pediatr*. 2015 Aug; 167(2):409-415. Accessed October 26, 2017. <https://www.medscape.com/medline/abstract/26009018>.
5. Manson DE. Magnetic resonance imaging of the mediastinum, chest wall and pleura in children. *Pediatr Radiol*. 2016 May; 46 (6):902-915. Accessed October 26, 2017. <https://link.springer.com/article/10.1007%2Fs00247-016-3598-7>.

PEDCH-4: Hemoptysis

PEDCH-4.1: Imaging

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PEDCH-4.1: Imaging

- True hemoptysis is rare in pediatric patients, and a detailed history, physical examination, and appropriate laboratory studies should be performed prior to considering advanced imaging.
 - ◆ Aspirated blood from epistaxis or emesis frequently presents as hemoptysis, and history and physical examination will aid in this assessment.
- Chest x-ray is indicated as an initial study for stable patients.
 - Advanced imaging is not indicated for patients with epistaxis and a normal chest radiograph and no personal or family history of underlying lung disease or bleeding disorder.
- Chest CT with contrast (CPT® 71260) is indicated for all other pediatric patients with hemoptysis.
 - ◆ Chest CT without contrast (CPT® 71250) can be approved for patients with a documented allergy to CT contrast or significant renal dysfunction.
- MRI is not indicated in the evaluation of pediatric hemoptysis.

References

1. Singh D, Bhalla AS, Veedu PT, et al. Imaging evaluation of hemoptysis in children. *World J. Clin Pediatr.* 2013 Nov 8; 2 (4):54-64. Accessed October 26, 2017. <https://www.ncbi.nlm.nih.gov/pubmed/25254175>.
2. Nevin MA. Pulmonary embolism, infarction, and hemorrhage, *Nelson Textbook of Pediatrics Chapter 407*. eds Kliegman RM, Stanton BF, St. Geme JW III, et al. 20th edition. 2016, pp 2123-2128.

PEDCH-5: Cystic Fibrosis and Bronchiectasis

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PEDCH-5.1: Cystic Fibrosis

- Chest x-ray is the primary study for initial evaluation of acute clinical symptoms in patients with cystic fibrosis.
- CT Chest without contrast (CPT® 71250) or with contrast (CPT® 71260) is indicated for the following (without initial chest x-ray):
 - ◆ Hemoptysis.
 - ◆ Pneumonia worsening despite antibiotic therapy.
 - ◆ Pleural effusion or empyema.
 - ◆ Suspected fungal pneumonia.
 - ◆ Monitoring treatment changes on bronchiectasis.
 - ◆ Expiratory CT for evaluating small airways disease.
 - ◆ Pre- and post-lung transplant evaluation.
- Low dose CT Chest without contrast (CPT® 71250) is indicated **every 2 years** for monitoring of bronchiectasis and small airways disease.

PEDCH-5.2: Bronchiectasis Not Associated with Cystic Fibrosis

- Bronchiectasis not associated with cystic fibrosis is rare in pediatric patients, and imaging indications are identical to those for adult patients. See **CH-7: Bronchiectasis** for imaging guidelines.

References

1. Egan M., Green DM, Voynow JA. Cystic fibrosis. *Nelson Textbook of Pediatrics, Chapter 403.* eds Kliegman RM, Stanton BF, St. Geme JW III, et al. 20th edition. 2016, pp 2098-2113.
2. Paranjape SM and Mogayzel Jr PJ. Cystic fibrosis. *Pediatr Rev.* 2014 May; 35 (5):194-205. Accessed October 26, 2017. http://pedsinreview.aappublications.org/content/35/5/194?sso=1&sso_redirect_count=2&nfstatus=401&nftoken=00000000-0000-0000-0000-000000000000&nfstatusdescription=ERROR%3A%20No%20local%20token&nfstatus=401&nftoken=00000000-0000-0000-0000-000000000000&nfstatusdescription=ERROR%3a+No+local+token
3. Tiddens HAM, Stick SM, and Davis S. Multi-modality monitoring of cystic fibrosis lung disease: the role of chest computed tomography. *Paediatr Resp Rev.* 2014 Mar; 15(1):92-97. Accessed October 26, 2017. [http://www.prrjournal.com/article/S1526-0542\(13\)00076-6/fulltext](http://www.prrjournal.com/article/S1526-0542(13)00076-6/fulltext)

PEDCH-6: Bronchiolitis

Bronchiolitis is a self-limiting viral infection causing lower respiratory tract illness, most common in infants under 12 months of age.

- Advanced imaging is not indicated for routine evaluation or monitoring of bronchiolitis, but can be approved for the following:
 - ◆ Pleural effusion or empyema on recent chest x-ray.
 - ◆ Immunocompromised patient with acute pulmonary symptoms.
 - ◆ Abnormality on recent chest x-ray suggesting condition other than bronchiolitis.

Reference

1. Coates BM, Carmada LE, and Goodman DM. Wheezing in infants: bronchiolitis. *Nelson Textbook of Pediatrics Chapter 391.1*. eds Kliegman RM, Stanton BF, St. Geme JW III, et al. 20th edition. 2016, pp 2044-2048.

PEDCH-7: Pneumonia

- Pneumonia imaging indications in pediatric patients are very similar to those for adult patients. See **CH-13: Pneumonia** for imaging guidelines.
- Pediatric-specific imaging considerations include the following:
 - ◆ Immunocompromised patients with acute pulmonary symptoms should be imaged using CT Chest with contrast (CPT® 71260).
 - ◆ Patients with recurrent lower respiratory tract infections should undergo CT Chest without contrast (CPT® 71250) or with contrast (CPT® 71260).
 - ◆ Ultrasound of the chest (CPT® 76604) can be approved for evaluation of childhood pneumonia.

References

1. Kelly MS and Sandora TJ. Community-acquired pneumonia. *Nelson Textbook of Pediatrics, Chapter 400*. eds Kliegman RM, Stanton BF, St. Geme JW III, et al. 20th edition. 2016, pp 2088-2094.
2. Patria MF and Esposito S. Recurrent lower respiratory tract infections in children: a practical approach to diagnosis. *Paediatr Resp Rev*. 2013 Mar; 14(1):53-60. Accessed October 26, 2017. [http://www.prrjournal.com/article/S1526-0542\(11\)00092-3/fulltext](http://www.prrjournal.com/article/S1526-0542(11)00092-3/fulltext).
3. Pereda MA, Chavez MA, Hooper-Miele CC, et al. Lung ultrasound for the diagnosis of pneumonia in children: a meta-analysis. *Pediatrics*. 2015 Apr; 135 (4):714-722. Accessed October 26, 2017. <http://pediatrics.aappublications.org/content/135/4/714>.
4. Goh Y and Kapur J. Sonography of the pediatric chest. *J Ultrasound Med*. 2016 May; 35 (5):1067-1080. Accessed October 26, 2017. <http://onlinelibrary.wiley.com/doi/10.7863/ultra.15.06006/epdf>.

PEDCH-8: Solitary Pulmonary Nodule

The Fleischner Society guidelines for solitary pulmonary nodule management do not apply to pediatric patients. An incidental solitary pulmonary nodule in a child representing a primary lung carcinoma has never been reported in the literature. Similarly, an extrathoracic malignancy presenting with an incidental solitary pulmonary nodule in an otherwise healthy child is very rare.

- All children with a pulmonary nodule incidentally discovered on other imaging should have CT Chest with contrast (CPT® 71260) as a one-time evaluation.
- Follow up imaging of incidental solitary pulmonary nodules in asymptomatic healthy children is not necessary.
 - ◆ Follow up imaging is indicated for the following:
 - Immunocompromised patients.
 - Malignancy (see below).
 - Invasive infection.
 - New or worsening pulmonary symptoms.
- Children with a malignant solid tumor who have pulmonary nodules of any size should have imaging according to the guideline section for the specific cancer type. See **Pediatric Oncology Imaging Guidelines** for specific imaging indications.
- This guideline section does not apply to multiple pulmonary nodules, which are imaged according to the underlying disorder in pediatric patients.

References

1. Assefa D and Atlas A. Natural history of incidental pulmonary nodules in children. *Pediatr Pulmonol*. 2015 May; 50 (5):456-459. Accessed October 26, 2017. <http://onlinelibrary.wiley.com/doi/10.1002/ppul.23141/abstract>.
2. Westra SJ, Broday AS, Mahani MG, et al. The incidental pulmonary nodule in a child, Part 1; recommendations from the SPR Thoracic Imaging Committee regarding characterization, significance, and follow up. *Pediatr Radiol*. 2015 May 45 (5): 628-633. Accessed October 26, 2017. <https://link.springer.com/article/10.1007/s00247-014-3267-7>.
3. Westra SJ, Thacker PG, Podberesky DJ, et al. The incidental pulmonary nodule in a child, Part 2; commentary and suggestions for clinical management, risk communication and prevention. *Pediatr Radiol*. 2015 May; 45 (5): 634-639. Accessed October 26, 2017. https://www.aamr.org.ar/secciones/neumonologia_pediatica/2015-09_nodulo_pulmonar_incidental_2da_parte.pdf.
4. Strouse PJ. The incidental pulmonary nodule in a child: a conundrum. *Pediatr Radiol*. 2015 May; 45 (5): 627. Accessed October 26, 2017. <https://link.springer.com/article/10.1007/s00247-014-3251-2>.

PEDCH-9: Positive PPD or Tuberculosis

- Positive PPD and tuberculosis imaging indications in pediatric patients are identical to those for adult patients. See **CH-14.1: PPD or TB** for imaging guidelines.
- Radiopharmaceutical nuclear medicine imaging of an inflammatory process (CPT® 78805, CPT® 78806, or CPT® 78807) is rarely performed, but is indicated for evaluation of tuberculosis.

References

1. Liu AH, Covar RA, Spahn JD, et al. Childhood asthma, *Nelson Textbook of Pediatrics, Chapter 144*. eds Kliegman RM, Stanton BF, St. Geme JW III, Schor NF, 20th edition 2016, pp 1095-1115.
2. Palestro CJ, Brown ML, Forstrom LA, et al. Society of Nuclear Medicine procedure guideline for ¹¹¹In-leukocyte scintigraphy for suspected infection /inflammation, Version 3.0, approved June 2, 2004. Accessed October 26, 2017. http://interactive.snm.org/docs/Leukocyte_v3.pdf.
3. De Vries EFJ, Roca M, Jamar F, et al. Guidelines for the labelling of leucocytes with ^{99m}Tc-HMPAO. *Eur J Nucl Med Mol Imaging*. 2010 Apr; 37 (4): 842-848. Accessed October 26, 2017. <https://link.springer.com/article/10.1007/s00259-010-1394-4>.

PEDCH-10: Asthma

- Advanced imaging is not indicated for routine evaluation or monitoring of asthma, but CT Chest without (CPT® 71250) or with (CPT® 71260) contrast can be approved for the following:
 - ◆ Pleural effusion or empyema on recent chest x-ray.
 - ◆ Immunocompromised patient with acute pulmonary symptoms.
 - ◆ Abnormality on recent chest x-ray suggesting condition other than asthma, including suspected foreign body.
 - ◆ Asthma and poor response to bronchodilators or conventional inhaled corticosteroid therapy in whom associated conditions, such as allergic bronchopulmonary aspergillosis and eosinophilic pneumonia can mimic asthma.

Reference

1. Liu AH, Covar RA, Spahn JD, and Sicherer SH. Childhood asthma. *Nelson Textbook of Pediatrics Chapter 144*. eds Kliegman RM, Stanton BF, St. Geme JW III, et al. 20th edition. 2016, pp 1095-1115.
2. Weiss LN. The diagnosis of wheezing in children. *Am Fam Physician*. 2008 Apr 15; 77 (8): 1109-1114. Accessed January 16, 2018. <https://www.aafp.org/afp/2008/0415/p1109.html>.

PEDCH-11: Pectus Deformities

- CT Chest without contrast (CPT® 71250) is indicated in patients with a pectus deformity for:
 - ◆ Preoperative planning.
 - ◆ Significant cardiac displacement after chest x-ray and echocardiography (CPT® 93306).
 - ◆ Evidence of pulmonary impingement after chest x-ray and pulmonary function tests (PFTs) if there is increasing shortness of breath. **Note:** It may not be possible to obtain PFTs in children younger than 9 years old.
 - ◆ CT Chest with contrast (CPT® 71260) or MRI of the chest without and with contrast (CPT® 71552) is indicated when congenital heart disease or Marfan's syndrome is suspected in those with pectus deformities.

References

1. Shaul D, Phillips JD, Gilbert J, et al. Pectus carinatum guidelines. *American Pediatric Surgical Association*. August 8, 2012 – Approved by the APSA Board of Governors. https://www.eapsa.org/apso/media/Documents/Pectus_Carinatum_Guideline_080812.pdf.
2. Frantz FW. Indications and guidelines for pectus excavatum repair. *Curr Opin Pediatr*. 2011 Aug; 23 (4):486-491. Accessed October 26, 2017. <https://www.ncbi.nlm.nih.gov/pubmed/21670676?dopt=Abstract>.
3. Koumbourlis AC. Chest wall abnormalities and their clinical significance in childhood. *Paediatr Resp Rev*. 2014 Sep; 15 (3):246-255. Accessed October 26, 2017. <https://www.ncbi.nlm.nih.gov/pubmed/24462760?dopt=Abstract>. Dore M, Junco PT, Bret M, et al. Advantages of cardiac magnetic resonance imaging for severe pectus excavatum assessment in children. *European J Pediatr Surg*. 2017 Jul 31. Accessed October 26, 2017. <https://www.thieme-connect.de/DOI/DOI?10.1055/s-0037-1604427>.

PEDCH-12: Breast Masses

- See PEDONC-17: Pediatric Breast Masses for imaging guidelines.

PEDCH-13: Vascular Malformations

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PEDCH-13.1: Vascular Ring

Vascular rings generally present with either respiratory symptoms (stridor, wheezing, tachypnea, cough) or feeding difficulties (dysphagia, slow feeding, hyperextension of the head while feeding, weight loss, failure to thrive) but can also be discovered incidentally on imaging obtained for other purposes.

- Chest x-ray is the recommended initial study in patients with respiratory symptoms.
- Barium esophagram is the recommended initial study in patients with feeding difficulties.
- Either Chest CTA (CPT® 71275) or Chest MRA (CPT® 71555) can be approved in patients with known or suspected vascular ring after chest x-ray or barium esophagram.
- Echocardiogram can be approved to rule out associated congenital heart disease.
 - ◆ CPT® 93303, CPT® 93306, CPT® 93320, and CPT® 93325 can be approved for initial evaluation of patients with vascular ring and no prior echocardiograms.

PEDCH-13.2: Other Vascular Malformations

See **PEDPVD-2: Vascular Anomalies** for imaging guidelines.

References

1. Licari A, Manca E, Rispoli GA, et al. Congenital vascular rings: a clinical challenge for the pediatrician. *Pediatr Pulmonol*. 2015 May; 50 (5): 511-524. Accessed October 26, 2017. <http://onlinelibrary.wiley.com/doi/10.1002/ppul.23152/abstract>.
2. Poletto E, Mallon MG, Stevens RM, et al. Imaging review of aortic vascular rings and pulmonary sling. *J Am Osteopath Coll Radiol*. 2017; 6 (2): 5-14. Accessed October 26, 2017. http://cdn.agilitycms.com/jaoacr/PDFs/Issues/Vol6Iss2RA1_Poletto.pdf.