



# CLINICAL GUIDELINES

## Pediatric Neck Imaging Guidelines

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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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| <b>Procedure Codes Associated with Neck Imaging</b>                                                                                                                                         |             |
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| <b>MRI</b>                                                                                                                                                                                  | <b>CPT®</b> |
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| PET Imaging: skull base to mid-thigh (this code not used in pediatrics)                                                                                                                     | 78812       |
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|                                                                                                                                                                              |             |
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**PEDNECK-1: General Guidelines**

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## **PEDNECK-1.0: General Guidelines**

- A pertinent clinical evaluation including a detailed history, physical examination, and appropriate laboratory studies should be performed prior to considering advanced imaging (CT, MRI, Nuclear Medicine), unless the patient is undergoing guideline-supported scheduled follow-up imaging evaluation. A meaningful technological contact (telehealth visit, telephone call, electronic mail or messaging) can serve as a pertinent clinical evaluation.
- Unless otherwise stated in a specific guideline section, the use of advanced imaging to screen asymptomatic patients for disorders involving the neck is not supported. Advanced imaging of the neck should only be approved in patients who have documented active clinical signs or symptoms of disease involving the neck.
- Unless otherwise stated in a specific guideline section, repeat imaging studies of the neck 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

## **PEDNECK-1.1: Age Considerations**

- Many conditions affecting the neck 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 Neck Imaging Guidelines if discussed. Any conditions not specifically discussed in the Pediatric Neck Imaging Guidelines should be imaged according to the General Neck Imaging Guidelines. Patients who are ≥18 years old should be imaged according to the General Neck Imaging Guidelines, except where directed otherwise by a specific guideline section.

## **PEDNECK-1.2: Appropriate Clinical Evaluation**

- See **PEDNECK-1.0: General Guidelines**

## **PEDNECK-1.3: Modality General Considerations**

- MRI
  - ◆ MRI Neck is generally performed without and with contrast (CPT® 70543) unless the patient has a documented contraindication to gadolinium or otherwise stated in a specific guideline section.
  - ◆ Due to the length of time required for MRI acquisition and the need to minimize patient movement, anesthesia is usually required for almost all infants (except neonates) and young children (age <7 years) as well as older children with delays in development or maturity. This anesthesia may be administered via oral or intravenous routes. In this patient population, MRI sessions should be planned with a goal of minimizing anesthesia exposure by adhering to the following considerations:

- MRI procedures can be performed without and/or with contrast use as supported by these condition based guidelines. If intravenous access will already be present for anesthesia administration and there is no contraindication for using contrast, imaging without and with contrast may avoid repetitive anesthesia administration to perform an MRI with contrast if the initial study without contrast is inconclusive.
    - 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 multiple body areas are supported by eviCore guidelines for the clinical condition being evaluated, MRI of all necessary body areas should be obtained concurrently in the same anesthesia session.
  - ◆ 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 Neck typically extends from the base of the skull to the upper thorax.
    - A separate CPT® code for head imaging in order to visualize the skull base is not necessary.
    - In some cases, especially in follow-up of a known finding, it may be appropriate to limit the exam to the region of concern to reduce radiation exposure.
  - ◆ CT Neck is generally performed with contrast (CPT® 70491) unless the patient has a documented contraindication to CT contrast or otherwise stated in a specific guideline section.
  - ◆ CT Neck may be indicated for further evaluation of abnormalities suggested on prior US or MRI Procedures.
  - ◆ In general, CT Neck is appropriate when evaluating trauma, malignancy, and for preoperative planning.
  - ◆ CTA Neck (CPT® 70498) is indicated for evaluation of the vessels of the neck, especially with concern for dissection.
  - ◆ 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 soft tissues of the neck (CPT® 76536) is indicated as an initial study for evaluating adenopathy, other palpable mass or swelling, thyroid, parathyroid, parotid and other salivary glands, and cysts.
- ◆ For those patients who do require additional advanced imaging after ultrasound, 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 of the neck in pediatric patients are most commonly used to evaluate neck masses, or thyroid and parathyroid disease following initial studies with anatomic imaging, such as ultrasound, CT, or MRI. See **PEDNECK-2: Neck Masses (Pediatric)** and **PEDNECK-6: Thyroid and Parathyroid** for imaging guidelines.
- ◆ Salivary Gland Nuclear Imaging (one of CPT® 78230, CPT® 78231, or CPT® 78232) is indicated for the following:
  - Evaluation of salivary gland function in patients with dry mouth (xerostomia) and ONE of the following:
    - Sjögren syndrome
    - Sialadenitis
    - History of head or neck radiation therapy

➤ 3D Rendering

- ◆ 3D Rendering indications in pediatric neck imaging are identical to those in the general imaging guidelines. See **Preface-4.1: 3D Rendering** in the Preface Imaging Guidelines.

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. Neck sonography. In: Pediatric sonography. 5<sup>th</sup> ed. Philadelphia. Wolters Kluwer 2018 pp112-155
2. Meier JD, and Grimmer JF. Evaluation and management of neck masses in children. *Am Fam Physician*. 2014; 89:353-358.
3. Biassoni L, Easty M. Paediatric nuclear medicine imaging. *British Medical Bulletin*. 2017;123(1):127-148. doi:10.1093/bmb/ldx025.
4. Bridges MD, Berland LL, Friedberg EB, et al. ACR Practice parameter for performing and interpreting magnetic resonance imaging (MRI). *American College of Radiology*. Revised 2017 (Resolution 10).
5. Karmazyn BK, John SD, Siegel MJ, et al. ACR–ASER–SCBT–MR–SPR Practice parameter for the performance of pediatric computed tomography (CT). *American College of Radiology*. Revised 2019 (Resolution 6).
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.
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.
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.
9. MacDonald A and S Burrell. Infrequently performed studies in nuclear medicine: part 2\*. *J Nucl Med Technol*. 2009 Mar; 37 (1): 1-13.
10. Fraum TJ, Ludwig DR, Bashir MR, et al. Gadolinium-based contrast agents: a comprehensive risk assessment. *J. Magn. Reson. Imaging*. 2017 Aug; 46 (2):338–353.
11. Update on FDA approach to safety issue of gadolinium retention after administration of gadolinium-based contrast agents available at <https://www.fda.gov/media/116492/download>
12. Blumfield, Einat, David W. Swenson, Ramesh S. Iyer, and A. Luana Stanescu. "Gadolinium-based Contrast Agents — Review of Recent Literature on Magnetic Resonance Imaging Signal Intensity Changes and Tissue Deposits, with Emphasis on Pediatric Patients." *Pediatric Radiology* 49, no. 4 (2019): 448-57. doi:10.1007/s00247-018-4304-8.

## PEDNECK-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 common lesions of the neck are very important in narrowing the differential diagnosis.

- Ultrasound Neck (CPT® 76536) is indicated as 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 (CPT® 93880 bilateral study or carotid arteries or CPT® 93882 unilateral study) can evaluate the vasculature.
- MRI Neck without contrast (CPT® 70540) or without and with contrast (CPT® 70543), or CT Neck with contrast (CPT® 70491) can be approved if ultrasound is inconclusive or to further characterize abnormalities seen on ultrasound.
- Cervical lymphadenitis is common in children and follows most viral or bacterial infections of the ears, nose, and throat. No advanced imaging is necessary with uncomplicated lymph node enlargement. When lymphadenopathy persists for more than 4 weeks of treatment or there is suspicion of complications, such as abscess formation, ultrasound is indicated, See **PEDNECK-3: Cervical Lymphadenopathy**.
- Congenital cervical cysts frequently 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%).
  - ◆ Barium swallow and MRI Neck without and with contrast (CPT® 70543) or CT Neck with contrast (CPT® 70491) are indicated for diagnosis of fourth branchial cleft cysts.
  - ◆ Ultrasound is indicated for initial evaluation of a suspected cystic neck mass.
  - ◆ MRI Neck without and with contrast (CPT® 70543) or CT Neck with contrast (CPT® 70491) may be indicated for preoperative planning.
- Salivary gland nuclear imaging (one of CPT® 78230, CPT® 78231, or CPT® 78232) is indicated for evaluation of parotid masses to allow preoperative diagnosis of Warthin's tumor.

### Practice Notes

The most common malignant ENT tumors in children are lymphoma and rhabdomyosarcoma.

**Differential Diagnosis of Neck Lesions by Anatomic Region:**

- Subcutaneous tissues:
  - ◆ Teratoma (includes dermoid cysts)
    - Cervical teratomas are typically large bulky masses discovered at birth or in the first year of life.
    - Large lesions may cause stridor, dyspnea, or dysphagia.
    - Most teratomas arise in the anterior suprahyoid neck and may be midline or off midline in location and adjacent to or within a thyroid lobe.
  - ◆ Vascular malformations
  - ◆ Lipoma
  - ◆ Cellulitis
  - ◆ Plexiform neurofibromas
  - ◆ Keloid
  - ◆ Scar
  - ◆ Pilomatrixoma
  - ◆ 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.
  - ◆ 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
    - Thyroglossal duct cyst is most common before the age of 20, 75% present as a midline mass and 43% of patients present with an infected mass.
    - Usually presents as an enlarging, painless midline mass.
    - Thyroid carcinoma occurs in 1% of thyroglossal duct cysts.
  - ◆ Goiter
  - ◆ Laryngocele
  - ◆ Lymphadenopathy
  - ◆ Teratoma
  - ◆ Abscess
  - ◆ Ectopic thymus or cervical extension of normal thymus
- 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:
  - ◆ Neurenteric cyst
  - ◆ Cellulitis
  - ◆ Abscess
  - ◆ Spondylodiskitis
  - ◆ Lymphadenopathy
  - ◆ Cellulitis
  - ◆ 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
  - ◆ Branchial cleft cyst
    - 90% of branchial abnormalities arise from the second branchial apparatus.
    - Second branchial cleft cysts are the most common branchial cleft cyst and usually present in patients between 10 and 40 years as painless fluctuant masses.
    - They typically present as slowly growing, nontender masses in the upper neck
    - Most second branchial cleft cysts are located in the submandibular space, at the anteromedial border of the sternocleidomastoid muscle, lateral to the carotid space, or posterior to the submandibular gland.
    - Ranula – typically cystic masses in the floor of the mouth.
- Masticator space (includes masseter and pterygoid muscles):
  - ◆ Venous or lymphatic malformation
  - ◆ Cellulitis
  - ◆ Abscess
  - ◆ Rhabdomyosarcoma
- Parapharyngeal space:
  - ◆ Cellulitis
  - ◆ Abscess
  - ◆ Rhabdomyosarcoma
  - ◆ Extension of lymphoma

- Paravertebral space:
  - ◆ Cervical dermal sinus (epithelium-lined dural tubes that connect the skin with the central nervous system or its covering)
  - ◆ Meningocele
  - ◆ Rhabdomyosarcoma
  - ◆ Lymphoma
  - ◆ Neuroblastoma
  - ◆ Neurofibroma
- Posterior cervical space:
  - ◆ Lymphadenopathy
  - ◆ Lymphatic malformation

### References

1. Siegel MJ. Neck sonography. In: Pediatric sonography. 5th ed. Philadelphia: Wolters Kluwer 112-155.
2. Geddes G, Butterly MM, Patel SM, et al. Pediatric Neck Masses. *Pediatr Rev.* 2013 Mar 1; 34(3):115-125.
3. Ludwig BJ, Wang J, Nadgir RN, et al. Imaging of cervical lymphadenopathy in children and young adults. *Am J Roentgenol.* 2012 Nov; 199 (5):1105-1113.
4. Rizzi MD, Wetmore RF, Potsic WP. Differential diagnosis of neck masses. In: Lesperance MM, Flint PW, eds. *Cummings Pediatric Otolaryngology*, Philadelphia: Saunders Company, 2015; 245-254.
5. Bansal AG, Oudsema R, Masseaux JA, Rosenberg HK. US of Pediatric Superficial Masses of the Head and Neck. *RadioGraphics.* 2018;38(4):1239-1263. doi:10.1148/rg.2018170165.
6. Kelly TG, Faulkes SV, Pierre SK, et al. Imaging submandibular pathology in the paediatric patient. *Clinical Radiol.* 2015 Jul;70(7):774-786.
7. Collins B, Stoner JA, and Digoy GP. Benefits of ultrasound vs. computed tomography in the diagnosis of pediatric lateral neck abscesses. *Int J Pediatr Otorhinolaryngol.* 2014 Mar; 78 (3): 423-426.
8. MacDonald A and S Burrell. Infrequently performed studies in nuclear medicine: part 2\*. *J Nucl Med Technol.* 2009 Mar; 37 (1): 1-13.
9. Stern JS, Ginat DT, Nicholas JL, Ryan ME. Imaging of Pediatric Head and Neck Masses. *Otolaryngologic Clinics of North America.* 2015;48(1):225-246.
10. ACR Appropriateness Criteria. Neck Mass/Adenopathy. Rev. 2018.
11. Brown, Ruth Elizabeth, and Srikrishna Harave. "Diagnostic Imaging of Benign and Malignant Neck Masses in Children—a Pictorial Review." *Quantitative Imaging in Medicine and Surgery* 6, no. 5 (2016): 591-604. doi:10.21037/qims.2016.10.10.
12. Riva G, Sensini M, Peradotto F, Scolfaro C, Rosa GD, Tavormina P. Pediatric neck masses: how clinical and radiological features can drive diagnosis. *European Journal of Pediatrics.* 2019;178(4):463-471. doi:10.1007/s00431-018-3305-9.

## **PEDNECK-3: Cervical Lymphadenopathy**

### **PEDNECK-3.1: Imaging**

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### **PEDNECK-3.1: Imaging**

- Painful acute lymphadenopathy and other painful neck masses (including neck “swelling”) should be treated with a trial of conservative therapy for at least 4 weeks, including antibiotics if appropriate.
  - ◆ If there is improvement with conservative treatment, advanced imaging is not indicated.
  - ◆ If there is unexplained fever with a temperature  $\geq 100.4^{\circ}\text{F}$  and there is clinical concern for suppurative lymphadenopathy or a neck abscess, ultrasound (CPT® 76536) is indicated without 4 weeks of treatment and observation.
- Ultrasound Neck (CPT® 76536) is indicated as an initial evaluation if lymphadenopathy persists following 4 weeks of treatment and/or observation.
- MRI Neck without contrast (CPT® 70540) or without and with contrast (CPT® 70543) or CT Neck with contrast (CPT® 70491) can be approved if ultrasound is inconclusive or to further characterize abnormalities seen on ultrasound. Both are superior to ultrasound for defining the relationship of an abscess to adjacent structures, particularly the airway; and detecting posterior cervical, mediastinal and intracranial extension.
- If systemic symptoms or other clinical findings suggest malignancy, See **PEDONC-5: Pediatric Lymphomas** in the Pediatric Oncology Imaging Guidelines.

#### ***Practice Notes***

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.

#### ***References***

1. Ludwig BJ, Wang J, Nadgir RN, et al. Imaging of cervical lymphadenopathy in children and young adults. Am J Roentgenol. 2012 Nov; 199 (5):1105-1113.
2. Nodler AR. Paediatric cervical lymphadenopathy: when to biopsy? Curr Opin Otolaryngol Head Neck Surg 2013; 21:567-570.
3. Ellika SK, Chadha M, and Yang Z. Imaging in nontraumatic pediatric head and neck emergencies. J Pediatr Neurol. 2017 Jul 27;15(5):263-293.
4. Rosenberg TL, Nodler AR. Pediatric Cervical Lymphadenopathy. Otolaryngologic Clinics of North America. 2014;47(5):721-731.
5. Weinstock MS, Patel NA, Smith LP. Pediatric Cervical Lymphadenopathy. Pediatrics in review. 2018 Sep;39(9):433-43.
6. ACR Appropriateness Criteria. Neck Mass/Adenopathy. Revised 2018.

## PEDNECK-4: Dystonia/Torticollis

### **Infants under 12 Months of Age (Congenital Muscular Torticollis)**

- Ultrasound Neck (CPT® 76536) is indicated as the initial study to evaluate suspected congenital muscular torticollis, also called fibromatosis coli.
  - ◆ Patients usually present by 2 weeks of life with an anterior neck mass, which is commonly right sided (75% of cases). A history of a traumatic breech or forceps delivery is common.
  - ◆ If Ultrasound is Positive → No further imaging is needed since diagnosis is defined.
  - ◆ If Ultrasound is Negative → CT Neck with contrast (CPT® 70491) or MRI Neck without contrast (CPT® 70540) or without and with contrast (CPT® 70543) can be approved to evaluate for other structural causes.

### **Children and Adults (Acquired Torticollis)**

- Injury or inflammation involving the sternocleidomastoid or trapezius muscles is the most common cause of acquired torticollis in children.
- If there has been recent trauma, plain radiographs of the cervical spine should be obtained as an initial evaluation when the suspicion of injury is low. CT Neck with contrast (CPT® 70491) and/or CT Cervical Spine without contrast (CPT® 72125) is indicated as the initial study to identify fracture or malalignment if plain radiographs are inconclusive or in patients with a high risk mechanism of cervical spine injury within the last 3 months (See below\*\*). MRI Cervical Spine without contrast (CPT® 72141) is also appropriate in the clinical setting of cervical spine trauma with an associated neurologic deficit.
- In the absence of trauma, CT Neck with contrast (CPT® 70491), CT Cervical Spine without contrast (CPT® 72125), MRI Cervical Spine without contrast (CPT® 72141), MRI Neck without and with contrast (CPT® 70543), or MRA Neck without and with contrast (CPT® 70549) can be approved to identify underlying abscess, bony, muscular, vascular, or neurologic causes.
  - ◆ Positive → Further advanced imaging is not required if a local cause has been identified.
  - ◆ Negative → MRI Brain without and with contrast (CPT® 70553) to exclude CNS cause.

\*\*High risk mechanisms of cervical spine injury may include:

- ◆ Head trauma and/or maxillofacial trauma
- ◆ Pedestrian in a motor vehicle accident
- ◆ Fall from above standing height
- ◆ Diving accident
- ◆ Head-on motor vehicle collision without/with airbag deployment
- ◆ Rollover motor vehicle collision
- ◆ Ejection from the vehicle in a motor vehicle collision
- ◆ High speed of the vehicle at the time of collision
- ◆ Not wearing a seatbelt/shoulder harness in a motor vehicle collision
- ◆ Patients with ankylosing spondylitis are at high risk of cervical spine fractures even with minor direct/indirect trauma to the cervical spine which can result in quadriparesis/quadriplegia

### ***Practice Note***

Torticollis or cervical dystonia is an abnormal twisting of the neck in which the head is rotated or twisted. Acute causes are most common. Other causes are variable and may be congenital, acquired (caused by trauma, juvenile idiopathic arthritis, or neoplasm), or idiopathic. Imaging approach is same as that for acute torticollis in children.

### ***References***

1. Dudkiewicz I, Ganel A, and Blankstein A. Congenital muscular torticollis in infants: ultrasound-assisted diagnosis and evaluation. J Pediatr Orthop. 2005 Nov-Dec; 25 (6):812-814.
2. Suhr MC and Oledzka M. Considerations and intervention in congenital muscular torticollis. Curr Opin Pediatr. 2015 Feb; 27 (1):75-81.
3. Haque S, Shafi BBB, and Kaleem M. Imaging of torticollis in children. RadioGraphics. 2012 Mar-Apr; 32 (2): 557-571. <http://pubs.rsna.org/doi/full/10.1148/rg.322105143>.
4. ACR APPROPRIATENESS CRITERIA Suspected Spine Trauma-Child. Revised 2018.

## PEDNECK-5: Dysphagia

- Dysphagia imaging indications in pediatric patients are very similar to those for adult patients. See **Neck-3: Dysphagia and Esophageal Disorders** in the Neck Imaging Guidelines.
- Pediatric-specific imaging considerations include the following:
  - ◆ X-rays neck and chest may be appropriate as the initial imaging study when concerned for foreign body ingestion as cause of dysphagia.
  - ◆ Esophageal motility study (CPT® 78258) is indicated for ANY of the following:
    - Dysphagia associated with chest pain and difficulty swallowing both solids and liquids.
    - Gastroesophageal reflux.
- CTA Chest (CPT® 71275) or MRA Chest (CPT® 71555) is indicated for a suspected vascular ring, which can be associated with dysphagia:
  - ◆ A right aortic arch or double arch noted on chest radiography is an indication for CTA or MRA.

### References

1. Kakodkar K and Schroeder Jr JW. Pediatric dysphagia. *Pediatr Clin N Am*. 2013 Aug; 60(4):969-977.
2. Stagnaro N, Rizzo F, Torre M, Cittadini G, Magnano G. Multimodality imaging of pediatric airways disease: indication and technique. *La radiologia medica*. 2017;122(6):419-429.
3. Dodrill P, Gosa MM. Pediatric Dysphagia: Physiology, Assessment, and Management. *Ann Nutr Metab* 2015; 66:24–31.
4. Sommburg O, Helling-Bakki A, Alrajab A, et al. Assessment of Suspected Vascular Rings and Slings and/or Airway Pathologies Using Magnetic Resonance Imaging Rather Than Computed Tomography. *Respiration*. 2018;97(2):108-118. doi:10.1159/000492080.

**PEDNECK-6: Thyroid and Parathyroid**

|                                               |           |
|-----------------------------------------------|-----------|
| <b>PEDNECK-6.1: Thyroid Masses or Nodules</b> | <b>20</b> |
| <b>PEDNECK-6.2: Hyperthyroidism</b>           | <b>21</b> |
| <b>PEDNECK-6.3: Hypothyroidism</b>            | <b>21</b> |
| <b>PEDNECK-6.4: Parathyroid Imaging</b>       | <b>21</b> |

## **PEDNECK-6.1: Thyroid Masses or Nodules**

- Ultrasound Neck (CPT® 76536) is the recommended initial study for evaluation of thyroid masses, diffuse thyroid enlargement, or nodules in pediatric patients.
  - ◆ If TSH normal or elevated, fine needle aspiration (FNA) under ultrasound guidance (CPT® 76942) is indicated for any solitary or suspicious thyroid nodule (s) detected by imaging or physical exam.
  - ◆ If TSH is low, nuclear thyroid scintigraphy (either CPT® 78013 or CPT® 78014), is indicated.
    - Hyperfunctioning nodules should be treated surgically but may also undergo FNA under ultrasound guidance (CPT® 76942) if suspicious in appearance and not being treated surgically.
    - Hypofunctioning nodules should undergo FNA under ultrasound guidance (CPT® 76942).
  - ◆ Repeat imaging with Ultrasound Neck (CPT® 76536) for lymph node assessment may be approved if cervical lymph node imaging was not performed at the time of the initial diagnostic thyroid ultrasound.
- CT Neck without contrast (CPT® 70490) or with contrast (CPT® 70491), or MRI Neck without contrast (CPT® 70540) or without and with contrast (CPT® 70543) is indicated for preoperative planning in patients with large or fixed masses, vocal cord paralysis, or bulky cervical or supraclavicular adenopathy.
  - ◆ CT Chest without contrast (CPT® 71250) or with contrast (CPT® 71260) is also indicated for patients with substernal extension of the thyroid, pulmonary symptoms, or abnormalities on recent chest x-ray.
- If any biopsy reveals thyroid carcinoma, See **ONC-6: Thyroid Cancer** in the Oncology Imaging Guidelines.
- If the initial biopsy shows inadequate, or non-diagnostic findings, repeat ultrasound (CPT® 76536) and/or FNA under ultrasound guidance (CPT® 76942) is indicated 3-6 months following initial biopsy.
  - ◆ If the nodule is stable and/or FNA is benign, repeat ultrasound (CPT® 76536) is indicated in 6-12 months.
  - ◆ If the nodule is growing or the FNA is not benign, the nodule should be treated surgically.
- If the initial biopsy shows benign findings, repeat ultrasound (CPT® 76536) is indicated 6-12 months following initial biopsy.
  - ◆ If the nodule is stable, repeat ultrasound (CPT® 76536) is indicated every 1-2 years.
  - ◆ If the nodule is growing or concerning new findings are present, the nodule should undergo repeat FNA under ultrasound guidance (CPT® 76942) or be treated surgically.
  - ◆ Benign nodules that have been surgically resected do not require routine imaging follow up in the absence of clinical or laboratory changes suggesting recurrence.
- If the initial biopsy shows indeterminate or suspicious findings, surgery is recommended.

### **PEDNECK-6.2: Hyperthyroidism**

- Ultrasound Neck (CPT® 76536) is the recommended initial study for evaluation of hyperthyroidism. Common causes are Graves' disease and autoimmune disorders (lupus, rheumatoid arthritis and Sjögren syndrome).
  - ◆ If a nodule or mass is discovered on ultrasound, the patient should be imaged according to **PEDNECK-6.1: Thyroid Masses or Nodules**.
- For all other patients with documented hyperthyroidism, thyroid uptake nuclear imaging (either CPT® 78012 or CPT® 78014) may be approved.

### **PEDNECK-6.3: Hypothyroidism**

- Causes include thyroid congenital dysgenesis, dysmorphogenesis autoimmune thyroiditis, Hashimoto thyroiditis, subacute thyroiditis, and abnormality in the pituitary gland or hypothalamus. Congenital hypothyroidism is usually diagnosed in the neonate on a routine perinatal screening examination.
- Ultrasound (CPT® 76536) is the recommended initial study for evaluation of hypothyroidism.
  - ◆ If a nodule or mass is discovered on ultrasound, the patient should be imaged according to **PEDNECK-6.1: Thyroid Masses or Nodules**.
- For patients with documented congenital hypothyroidism, thyroid uptake nuclear imaging (either CPT® 78012 or CPT® 78014) may be approved.

### **PEDNECK-6.4: Parathyroid Imaging**

- Parathyroid imaging indications in pediatric patients are the same as those for adult patients. See **Neck-8.3: Parathyroid Imaging** in the Neck Imaging Guidelines

## References

1. Waguespack SG, Huh WW, and Bauer AJ. Endocrine tumors. In: Pizzo PA, Poplack DG, eds. Principles and Practices of Pediatric Oncology. 7th ed. Wolters Kluwer. Philadelphia, PA. 2016;919-945.
2. Wassner AJ, Smith JR. Hypothyroidism. Nelson Textbook of Pediatrics, Chapter 581. eds Kliegman RM, St. Geme JW III, Blum NJ, Shah SS, Tasker RC, Wilson KM. 21st edition 2020. pp. 2914-2922.
3. Smith JR, Wassner AJ. Thyroid nodule. Nelson Textbook of Pediatrics, Chapter 585.1. eds Kliegman RM, St. Geme JW III, Blum NJ, Shah SS, Tasker RC, Wilson KM. 21st edition 2020. pp. 2936-2937.
4. Wassner AJ, Smith JR. Thyroiditis. Nelson Textbook of Pediatrics, Chapter 82. eds Kliegman RM, St. Geme JW III, Blum NJ, Shah SS, Tasker RC, Wilson KM. 21st edition 2020. pp. 2923-2925.
5. Smith JR, Wassner AJ. Thyrotoxicosis. Nelson Textbook of Pediatrics, Chapter 584. eds Kliegman RM, St. Geme JW III, Blum NJ, Shah SS, Tasker RC, Wilson KM. 21st edition 2020. pp. 2928-2934.
6. Doyle DA. Hypoparathyroidism. Nelson Textbook of Pediatrics, Chapter 589. eds Kliegman RM, St. Geme JW III, Blum NJ, Shah SS, Tasker RC, Wilson KM. 21st edition 2020. pp. 2945-2948.
7. Doyle DA. Hyperparathyroidism. Nelson Textbook of Pediatrics, Chapter 591. eds Kliegman RM, St. Geme JW III, Blum NJ, Shah SS, Tasker RC, Wilson KM. 21st edition 2020. pp. 2950-2953.
8. Francis GL, Waguespack SG, Bauer AJ, et al. Management guidelines for children with thyroid nodules and differentiated thyroid cancer. Thyroid. 2015 Jul; 25 (7): 716-759.
9. Essenmacher AC, Joyce PH, Kao SC, et al. Sonographic Evaluation of Pediatric Thyroid Nodules. RadioGraphics. 2017;37(6):1731-1752.
10. Williams JL, Paul DL, Bisset G. Thyroid disease in children: part 1. Pediatric Radiology. 2013;43(10):1244-1253.
11. Williams JL, Paul D, Bisset G. Thyroid disease in children: part 2. Pediatric Radiology. 2013;43(10):1254-1264.
12. Papendieck P, Gruñero-Papendieck L, Venara M, et al. Differentiated thyroid cancer in children: prevalence and predictors in a large cohort with thyroid nodules followed prospectively. J Pediatr. 2015 Jul; 167 (1):199-201.
13. Ross DS, Burch HB, Cooper DS, et al. 2016 American Thyroid Association Guidelines for Diagnosis and Management of Hyperthyroidism and Other Causes of Thyrotoxicosis. Thyroid. 2016;26(10):1343-1421. doi:10.1089/thy.2016.0229
14. Donangelo I, and Braunstein GD. Update on subclinical hyperthyroidism. Am Fam Physician. 2011; 83 (8):933-938.
15. Gharib H, Papini E, Garber JR, et al. American Association Of Clinical Endocrinologists, American College Of Endocrinology, And Associazione Medici Endocrinologi medical guidelines for clinical practice for the diagnosis and management of thyroid nodules-2016 update. Endocr Pract. 2016 May;22(Suppl 1):1-60.
16. Bilezikian JP, Brandi ML, Eastell R, et al. Guidelines for the Management of Asymptomatic Primary Hyperparathyroidism: Summary Statement from the Fourth International Workshop. The Journal of Clinical Endocrinology & Metabolism. 2014;99(10):3561-3569. doi:10.1210/jc.2014-1413.
17. Greenspan BS, Dillehay GL, and Intenzo C. SNM practice guideline for parathyroid scintigraphy 4.0\*. J Nucl Med Technol. 2012 Jun 1; 40 (2): 111-118.
18. Sung, Jin Yong. "Parathyroid Ultrasonography: The Evolving Role of the Radiologist." Ultrasonography 34, no. 4 (2015): 268-74. doi:10.14366/usg.14071.
19. ACR–SPR PRACTICE PARAMETER FOR THE PERFORMANCE OF PARATHYROID SCINTIGRAPHY—White paper, revised 2019. <https://www.acr.org/-/media/ACR/Files/Practice-Parameters/parathyroidscint.pdf>
20. ACR Appropriateness Criteria Parathyroid Adenoma, published April 2021. <https://acsearch.acr.org/docs/3158171/Narrative/>

## PEDNECK-7: Esophagus

- Esophagus imaging indications in pediatric patients are very similar to those for adult patients. See **Neck-3: Dysphagia and Esophageal Disorders** in the Neck Imaging Guidelines.
- Pediatric-specific imaging considerations include the following:
  - ◆ Esophagram is the study of choice for evaluating congenital atresia with associated tracheoesophageal fistula.
  - ◆ Plain radiographs alone usually suffice for the diagnosis of other types of esophageal atresia and a contrast examination of the esophagus is not warranted but may be indicated for post-operative evaluation.
  - ◆ CT Neck with contrast (CPT® 70491) and CT Chest with contrast (CPT® 71260) are indicated for evaluation of suspected congenital malformations if x-rays or esophagram are inconclusive.
    - 3D rendering may be approvable for preoperative planning in complex cases.
  - ◆ Ultrasound (CPT® 76536) can be approved for evaluation of upper esophageal foreign bodies.

### References

1. Hryhorczuk AL, Lee EY, Eisenberg RL. Esophageal Abnormalities in Pediatric Patients. AJR 2013; 201:W519-W532.
2. Seekins JM, et al. Esophagus congenital and neonatal abnormalities. Chapter 97. *Caffey's Pediatric Diagnostic Imaging*. eds. Coley B, Saunders E, Philadelphia PA, 2013. p 12.
3. Ellis WE Esophagus: Congenital and Neonatal Abnormalities. Chapter 96. *Caffey's Pediatric Diagnostic Imaging 13<sup>th</sup> Edition*. ed. Coley B Philadelphia PA, 2018. p 901-910.
4. Mori T, Nomura O, Hagiwara Y. Another Useful Application of Point-of-Care Ultrasound. *Pediatric Emergency Care*. 2019;35(2):154-156. doi:10.1097/pec.0000000000001729.

## PEDNECK-8: Trachea

- Trachea imaging indications in pediatric patients are very similar to those for adult patients. See **Neck-9: Trachea and Bronchus** in the Neck Imaging Guidelines.
- Pediatric-specific imaging considerations include the following:
  - ◆ CT Neck with contrast (CPT® 70491) and CT Chest with contrast (CPT® 71260) are indicated for evaluation of suspected congenital malformations if x-rays are inconclusive.
    - 3D rendering may be approvable for preoperative planning in complex cases.
    - CT is not routinely performed to evaluate foreign body aspiration, but it may be considered in complicated cases.

### References

1. Pugmire BS, Lim R, and Avery LL. Review of Ingested and aspirated foreign bodies in children and their clinical significance for radiologists. *RadioGraphics*. 2015; 35:1528-1538.
2. Lee EY, Restrepo R, Dillman JR, et al. Imaging evaluation of pediatric trachea and bronchi: systematic review and updates. *Semin Roentgenol*. 2012 Apr; 47 (2):182-196.
3. Lee EY. Lower large airway disease. Chapter 52. *Caffey's Pediatric Diagnostic Imaging*. eds. Coley B. Philadelphia PA, 2018. p486-494.
4. Semple T, Calder A, Owens C, Padley S. Current and future approaches to large airways imaging in adults and children. *Clinical Radiology*. 2017;72(5):356-374.
5. Stagnaro N, Rizzo F, Torre M, Cittadini G, Magnano G. Multimodality imaging of pediatric airways disease: indication and technique. *La radiologia medica*. 2017;122(6):419-429.