CLINICAL GUIDELINES

Pediatric Head Imaging Guidelines

Version 1.0

Effective February 1, 2021

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.

Pediatric Head Imaging

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924 www.eviCore.com

Procedure Codes Associated with Head Imaging	
MRI	**CPT®**
MRI Brain without contrast	70551
MRI Brain with contrast (rarely used)	70552
MRI Brain without and with contrast	70553
MRI Orbit, Face, Neck without contrast	70540
MRI Orbit, Face, Neck with contrast (rarely used)	70542
MRI Orbit, Face, Neck without and with contrast	70543
MRI Temporomandibular Joint (TMJ)	70336
Functional MRI Brain not requiring physician or psychologist	70554
Functional MRI Brain requiring physician or psychologist	70555
MR Spectroscopy	76390
Unlisted MRI procedure (for radiation planning or surgical software)	76498
MRA	**CPT®**
MRA Head without contrast	70544
MRA Head with contrast	70545
MRA Head without and with contrast	70546
MRA Neck without contrast	70547
MRA Neck with contrast	70548
MRA Neck without and with contrast	70549
CT	**CPT®**
CT Head without contrast	70450
CT Head with contrast	70460
CT Head without and with contrast	70470
CT Orbits without contrast (includes temporal bone and mastoid)	70480
CT Orbits with contrast (includes temporal bone and mastoid)	70481
CT Orbits without and with contrast (includes temporal bone and mastoid)	70482
CT Maxillofacial without contrast (includes sinuses, jaw, and mandible)	70486
CT Maxillofacial with contrast (includes sinuses, jaw, and mandible)	70487
CT Maxillofacial without and with contrast (includes sinuses, jaw, and mandible)	70488
CT Neck without contrast (includes jaw, and mandible)	70490
CT Neck with contrast (includes jaw, and mandible)	70491
CT Neck without and with contrast (includes jaw, and mandible)	70492
CT Guidance for Stereotactic Localization (used for sinus surgery planning)	77011
CT Guidance for Placement of Radiation Therapy Fields	77014
Unlisted CT procedure (for radiation planning or surgical software)	76497
CTA	**CPT®**
CTA Head	70496
CTA Neck	70498

Nuclear Medicine	CPT®
PET Brain Metabolic Evaluation	78608
PET Brain Perfusion Evaluation	78609
PET with concurrently acquired CT; limited area (this code rarely used in pediatrics)	78814
PET with concurrently acquired CT; whole body	78816
Brain Scintigraphy Static Limited	78600
Brain Scintigraphy Limited with Vascular Flow	78601
Brain Scintigraphy Complete Static	78605
Brain Scintigraphy Complete with Vascular Flow	78606
Brain Imaging Vascular Flow	78610
Cisternogram	78630
Cerebrospinal Ventriculography	78635
Shunt Evaluation	78645
CSF Leakage Detection	78650
Radiopharmaceutical Dacryocystography	78660
Ultrasound	**CPT®**
Echoencephalography (Head or Cranial Ultrasound)	76506
Ophthalmic ultrasound, diagnostic; B-scan & quantitative A-scan performed same encounter	76510
Ophthalmic ultrasound, diagnostic; quantitative A-scan only	76511
Ophthalmic ultrasound, diagnostic; B-scan	76512
Ophthalmic ultrasound, diagnostic; anterior segment ultrasound, immersion (water bath) B-scan	76513
Ophthalmic ultrasound, diagnostic; corneal pachymetry, unilateral or bilateral	76514
Ophthalmic biometry by ultrasound, A-scan	76516
Ophthalmic biometry by ultrasound, A-scan, with lens power calculation	76519
Ophthalmic ultrasonic foreign body localization	76529
Soft tissues of head and neck Ultrasound (thyroid, parathyroid, parotid, etc.)	76536
Transcranial Doppler study of the intracranial arteries; complete study	93886
Transcranial Doppler study of the intracranial arteries; limited study	93888
Transcranial Doppler study of the intracranial arteries; vasoreactive study	93890
Transcranial Doppler study of the intracranial arteries; emboli detection without intravenous microbubble injection	93892
Transcranial Doppler study of the intracranial arteries;; emboli detection with intravenous microbubble injection	93893
Duplex scan of extracranial arteries; complete bilateral study	93880
Duplex scan of extracranial arteries; unilateral or limited study	93882
Non-invasive physiologic studies of extracranial arteries, complete bilateral study	93875

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PEDHD-1: General Guidelines

PEDHD-1.0: General Guidelines

- A recent (within 60 days) face to face evaluation including a detailed history, physical examination with a thorough neurologic examination, and appropriate laboratory studies should be performed prior to considering the use of an advanced imaging (CT, MRI, Nuclear Medicine) procedure.
  - A detailed neurological exam is required prior to advanced imaging except in the following scenarios:
    - Patient is undergoing a guideline-supported scheduled follow-up imaging evaluation
    - Tinnitus, TMJ, Sinus or mastoid disease, ear pain, hearing loss, eye disease, and epistaxis. (A relevant physical exam is still required.)
    - The request is from or in consultation with a neurologist or neurosurgeon who has seen the patient since onset of symptoms.
- Unless otherwise stated in a specific guideline section, the use of advanced imaging to screen asymptomatic patients for disorders involving the head is not supported. Advanced imaging of the head is only indicated in patients who have documented active clinical signs or symptoms of disease involving the head.
- Unless otherwise stated in a specific guideline section, repeat imaging studies of the head 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.

PEDHD-1.1: Pediatric Head Imaging Age Considerations

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

PEDHD-1.2: Pediatric Head Imaging Appropriate Clinical Evaluation

- See **PEDHD-1.0: General Guidelines**

Requests for Studies with Overlapping Fields

- There are many CPT® codes for imaging the head that have significantly overlapping fields. In the majority of cases where multiple head CPT® codes are requested, only one CPT® code should be approved unless there is clear documentation of a need for the additional codes to cover all necessary body areas.
- See **HD-1.1: General Guidelines - Anatomic Issues** in the **Head Imaging Guidelines** for the correct coding of these studies.

PEDHD-1.3: Pediatric Head Imaging Modality General Considerations

- MRI
  - MRI is the preferred modality for imaging the pediatric head unless 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 be appropriate if requested. By doing so, the requesting provider 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.

- CT
  - CT is generally inferior to MRI for imaging the pediatric head, but has specific indications in which it is the preferred modality listed in specific sections of these guidelines.
    - 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.
- Ultrasound
  - Cranial ultrasound (CPT® 76506) is a non-invasive means of evaluating for intracranial abnormalities in infants with an open anterior fontanelle.
  - Transcranial Doppler ultrasonography has some utility in select populations of older children with known or suspected intracranial vascular disease.
- Nuclear Medicine
  - Nuclear medicine studies other than metabolic PET imaging on the pediatric brain or head are rarely performed in an elective outpatient setting, but the following studies can be approved when requested for the following indications:
    - Brain Scintigraphy with or without vascular flow (any one of CPT® codes: CPT® 78600, CPT® 78601, CPT® 78605, or CPT® 78606)
      - Establish brain death (rarely done in outpatient setting).
    - Radiopharmaceutical Localization Imaging SPECT (CPT® 78803)
      - Immunocompromised patients with mass lesion detected on CT or MRI for differentiation between lymphoma and infection.
    - Brain Imaging Vascular Flow (CPT® 78610)
      - Cerebral ischemia.
      - Establish brain death (rarely done in outpatient setting).
    - CSF Leakage Detection (CPT® 78650)
      - Evaluation of CSF rhinorrhea or otorrhea, or refractory post-lumbar puncture headache.
    - Radiopharmaceutical Dacryocystography (CPT® 78660)
      - Suspected obstruction of nasolacrimal duct due to excessive tearing.
- 3D Rendering
  - 3D Rendering indications in pediatric head 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.

PEDHD-1.4: General Guidelines-Other Imaging Situations

- CT Head without contrast (CPT® 70450) prior to lumbar puncture in patients with cranial complaints and in urgent situations.
- MRI Brain without contrast (CPT® 70551) or MRI Brain with and without contrast (CPT® 70553) can be performed for nausea and vomiting, persistent, unexplained and a negative GI evaluation
- MRI Brain without contrast (CPT® 70551) or MRI Brain without and with contrast (CPT® 70553) is approvable in the presence of neurological signs and/or symptoms, including headache, after COVID-19 infection
- Screening for metallic fragments before MRI should be done initially with Plain x-ray.
  - The use of CT Orbital to rule out orbital metallic fragments prior to MRI is rarely necessary
  - Plain x-rays are generally sufficient; x-ray detects fragments of 0.12 mm or more, and CT detects those of 0.07 mm or more
  - Plain x-ray is generally sufficient to screen for aneurysm clips
- CPT® 76377 (3D rendering requiring image post-processing on an independent workstation) or CPT® 76376 (3D) can be considered when performed in conjunction with conventional angiography (i.e.: conventional 4 vessel cerebral angiography).
- Imaging requests for MRI Brain with and without contrast (CPT® 70553) are approvable in consideration of neurosarcoidosis
- CT or MRI Perfusion (See **HD-24.5: CT or MRI Perfusion** in the **Head Imaging Guidelines**)
  - Performed as part of a CT Head or MRI Brain examination in the evaluation of patients with very new strokes or brain tumors.
  - Category III 0042T - “cerebral perfusion analysis using CT”. The study is generally limited to evaluation of acute stroke (<24 hours), to help identify patients with stroke-like symptoms most likely to benefit from thrombolysis or thrombectomy, to assist in planning and evaluating the effectiveness of therapy for cervical or intracranial arterial occlusive disease and/or chronic cerebral ischemia, identifying cerebral hyperperfusion syndrome following revascularization and following aneurysmal subarachnoid hemorrhage. Other indications are usually regarded as investigational and experimental. Individual health plan policies should be confirmed.
  - There is no specific CPT® code for MRI Perfusion. Perfusion weighted images are obtained with contrast and are not coded separately from a contrasted MRI Brain examination. If MRI Brain without and with contrast is approved, no additional CPT® codes are necessary or appropriate to perform MRI perfusion.

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PEDHD-2: Specialized Imaging Techniques

PEDHD-2.1: Magnetic Resonance Spectroscopy (MRS, CPT® 76390)

Magnetic Resonance Spectroscopy involves the analysis of the levels of certain chemicals in pre-selected voxels (small regions) on an MRI scan done at the same time.

**NOTE: ***Certain payers consider MRS investigational, and their coverage policies may take precedence over eviCore healthcare guidelines.

Uses in pediatric neuro-oncology: See **PEDONC-4: Pediatric CNS Tumors** in the **Pediatric Oncology Imaging Guidelines**.

Uses in Metabolic Disorders:

- These cases should be forwarded for Medical Director Review.
- MRS is indicated in patients with neonatal hypoxic ischemic encephalopathy to help estimate the age of the injury.
- MRS is associated with disease-specific characteristics findings and is indicated for diagnosis and disease monitoring in the following metabolic disorders:
  - Canavan disease
  - Creatine deficiency
  - Nonketotic hyperglycinemia
  - Maple Syrup Urine disease
- MRS has nonspecific abnormal patterns that can aid in the diagnosis of the following metabolic disorders, but is not routinely indicated for disease monitoring:
  - Metachromatic leukodystrophy (MCL)
  - Pelizaeus-Merzbacher disease (PMD)
  - Hypomyelination and Congenital Cataract
  - Globoid Cell Leukodystrophy (Krabbe disease)
  - X-linked adrenoleukodystrophy (X-ALD, CALD)
  - Mitochondrial disorders (e.g. Leigh's syndrome, Kearns-Sayre syndrome, MELAS, et al)
  - Alexander disease (ALX, AXD, demyelinogenic leukodystrophy)
  - Megalencephalic leukoencephalopathy with subcortical cysts
  - Vanishing White Matter disease (Leukoencephalopathy with vanishing white matter, CACH syndrome, CACH/VWM)
  - MRS can be approved for disease monitoring of these diagnoses when recent MRI findings are inconclusive and a change in therapy is being considered.
- MRS is considered investigational for all other pediatric indications at this time.

PEDHD-2.2: Functional Magnetic Resonance Imaging (fMRI, CPT® 70554 and CPT® 70555)

- These cases should be forwarded for Medical Director Review.
- MRI is indicated to define eloquent areas of the brain as part of preoperative planning for epilepsy surgery or removal of a mass lesion.
  - The documentation should be clear that brain surgery is planned.
  - Can be approved concurrently with MRI Brain (CPT® 70551 or CPT® 70553) and/or PET Brain Metabolic (CPT® 78608 or CPT® 78609).
- fMRI is considered investigational for all other pediatric indications at this time.

PEDHD-2.3: PET Brain Imaging (CPT® 78608 and CPT® 78609)

- These cases should be forwarded for Medical Director Review.
- Uses in pediatric neuro-oncology: See **PEDONC-4: Pediatric CNS Tumors** in the **Pediatric Oncology Imaging Guidelines**.
- PET Brain is indicated to define active areas of the brain as part of preoperative planning for epilepsy surgery.
  - The documentation should be clear that brain surgery is planned.
  - Can be approved concurrently with MRI Brain (CPT® 70551 or CPT® 70553) and/or fMRI (CPT® 70554 or CPT® 70555).
- PET Brain is considered investigational for all other pediatric indications at this time.

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PEDHD-3: Pediatric Headache

Headache is a very common complaint in school aged children and adolescents. Many of these children have a family history of one of the primary headache disorders, such as migraine or tension headache.

- A recent (within 60 days) evaluation including a detailed headache history, physical examination with a thorough neurologic examination, and appropriate laboratory studies should be performed prior to considering advanced imaging.
- Advanced imaging is not indicated for pediatric patients with headache in the absence of red flag symptoms. Sensitivity and specificity of MRI are greater than that of CT for intracranial lesions.
- MRI Brain without contrast (CPT® 70551) or without and with contrast (CPT® 70553) is indicated for children with headaches and at least ONE of the following red flags:
  - Age ≤5 years.
  - Headaches awakening from sleep or always present in the morning.
  - Focal findings, and/or symptoms on neurologic examination including diplopia.
  - Clumsiness (common description of gait or coordination problems in young children).
  - Headaches associated with morning nausea/vomiting.
  - New onset of seizure activity with focal features.
  - Papilledema on physical exam.
  - Headache precipitated by coughing, sneezing, or Valsalva.
  - Thunderclap headache.
  - Progressive worsening in headache frequency and severity without period of temporary improvement.
  - Systemic symptoms such as persistent fever, weight loss, rash, or joint pain.
  - Immunocompromised patient.
  - Patient with hypercoagulable state or bleeding disorder.
  - Known history of cancer of any type.
  - Known autoimmune or rheumatologic disease.
  - Known genetic disorder with predisposition to intracranial mass lesions.
  - History of stable chronic headaches with recent significant change in frequency or severity.
- MRI Brain without contrast (CPT® 70551) or MRI Brain without and with contrast (CPT® 70553) is approvable in the presence of neurological signs and/or symptoms, including headache, after COVID-19 infection
- Patients requiring sedation should generally have MRI studies without and with contrast. See **PEDHD-1.3: Pediatric Head Imaging Modality General Considerations**.
- CT Head poorly visualizes the posterior fossa in children and is generally insufficient to evaluate pediatric headaches with red flag symptoms. CT should not be approved in lieu of MRI solely to avoid sedation.

- CT Head without contrast (CPT® 70450) is indicated for pediatric headache with one or more of the following:
  - Sudden severe headache including thunderclap headache
  - Acute setting of suspected intracranial infection prior to lumbar puncture (CT Head with contrast CPT® 70460 if intracranial spread of disease is suspected to detect suppurative fluid collections) (See **PEDHD-1.4: General Guidelines-Other Imaging Situations**)
  - To exclude new hemorrhage, significant mass effect, or hydrocephalus in cases including rapid clinical deterioration.
  - Recent head trauma.
  - Suspected skull or other bony involvement.
  - If MRI is contraindicated
  - Ventriculoperitoneal shunt with suspected shunt malfunction. See **PEDHD-7: Macrocephaly, Microcephaly, and Hydrocephalus** for additional imaging.
- MRI Brain without contrast (CPT® 70551) or without and with contrast (CPT® 70553) can be approved if a recent CT is inconclusive.
- MRI Brain without and with contrast (CPT® 70553) may be approved if an abnormality is identified on a noncontrasted MRI performed greater than 2 weeks, otherwise a MRI Brain with contrast (CPT® 70552) is approvable
- MRA Head or CTA Head are not generally medically necessary in the evaluation of headache in children unless a vascular lesion has been seen or suspected on a prior MRI Brain or CT Head.
  - Concurrent approval of both MRI and MRA is generally not indicated.
- MRV Head (CPT® 70544, CPT® 70545, or CPT® 70546) is indicated in pediatric patients with papilledema and headache. See **HD-17: Papilledema/Pseudotumor Cerebri** in the **Head Imaging Guidelines**.

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PEDHD-4: Pediatric Head and Face Trauma

PEDHD-4.1: Head Trauma

In patients with recent head trauma, a history focused on the incident and careful examination of the head, neck, and neurological function should be performed prior to considering advanced imaging.

- Advanced imaging is indicated for children with head trauma with ANY of the following red flags:
  - Loss of consciousness
  - Altered mental status or abnormal behavior
  - Known or suspected skull fracture
  - Glasgow Coma Score <15
  - Age younger than 2 years
  - Vomiting
  - Severe mechanism of injury
  - Severe or worsening headache
  - Amnesia
  - Nonfrontal scalp hematoma
- CT Head without contrast (CPT® 70450) is the primary advanced imaging study in patients with acute head trauma.
  - CT Maxillofacial without contrast (CPT® 70486), CT Orbits/Temporal Bone without contrast (CPT® 70480), or CT Cervical Spine without contrast (CPT® 72125) is indicated if there has been associated injury to those structures.
- MRI Brain without contrast (CPT® 70551) is indicated for the following:
  - Children with an abnormal neurological exam that is not explained by the CT findings.
  - Subacute (8 days to one month after initial traumatic event) or chronic blunt head trauma with new or worsening neurological signs or cognitive symptoms
  - Children suspected of being the victims of physical abuse. See **PEDMS-7: Suspected Physical Child Abuse** in the **Pediatric Musculoskeletal Imaging Guidelines**.
- Following a head injury, a repeat CT Head without contrast (CPT® 70450) or MRI Brain without contrast (CPT® 70551) is indicated if the child develops fixed or fluctuating diminished mental acuity or alertness, or new abnormalities on neurological examination.
- Follow-up of known or treated parenchymal subdural or epidural hematoma may require frequent imaging during the initial 8 weeks following injury, and these requests should generally be approved.
  - These cases should be forwarded for Medical Director Review.

PEDHD-4.2: Facial Trauma

- CT Maxillofacial without contrast (CPT® 70486) is the preferred imaging study in facial trauma.

Coding of Facial Imaging

Both CT Orbital/Facial Bone (CPT® 70480) and CT Maxillofacial (CPT® 70486) cover the structures of the orbits, sinuses, and face. Unless there is a grounded suspicion of simultaneous involvement of more posterior lesions, especially of the region involving the middle or inner ear, one of these studies only should be sufficient.

CT Maxillofacial (CPT® 70486) is the usual study (except in obvious orbital or temporal bone trauma), but either study is appropriate.

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PEDHD-5: Sinusitis and Allergic Rhinitis

PEDHD-5.1: General Considerations

- Acute sinusitis is a clinical diagnosis, and imaging is not indicated to establish a diagnosis. Acute bacterial sinusitis can be presumptively diagnosed in a child with acute upper respiratory infection (URI) symptoms and any of the following:
  - Persistent symptoms lasting >10 days without improvement.
  - Worsening symptoms after initial period of improvement.
  - Severe symptoms including purulent nasal discharge and fever >102.2°F for at least 3 consecutive days.
  - Presumed bacterial infections should be treated empirically with appropriate antibiotics.
  - Imaging of any kind cannot distinguish bacterial from viral sinusitis.

PEDHD-5.2: Imaging Indications in Sinusitis

- Mild mucosal thickening in the paranasal sinuses or mastoids is an extremely common incidental finding noted on head imaging studies done for other indications. If there are no other abnormalities of facial structures noted, this finding is not an indication for advanced imaging of the sinuses or temporal bone.
- CT Maxillofacial without contrast (CPT® 70486) is indicated if ANY of the following is present:
  - No improvement after 10 days of appropriate antibiotic treatment
    - Generally this will be amoxicillin/clavulanate, amoxicillin, cefdinir, cefuroxime, cefpodoxime, or ceftriaxone
  - Recurrence of a treated infection within 8 weeks of effective treatment
  - Chronic sinusitis (persistent residual URI symptoms for >90 days)
  - Known or suspected fungal sinusitis (MRI Orbit, Face, and/or Neck without and with contrast (CPT® 70543) is approvable if requested instead of CT Maxillofacial)
  - Preoperative evaluation to assess surgical candidacy
- CT Maxillofacial with contrast (CPT® 70487) can be performed if ANY of the following is present:
  - Orbital or facial cellulitis
  - Proptosis.
  - Abnormal visual examination
  - Ophthalmoplegia
  - Cystic fibrosis
  - Immunocompromised patient
  - Fungal or vascular lesions visualized in nasal cavity
- CT Head with contrast (CPT® 70460) or MRI Brain without and with contrast (CPT® 70553) or MRI Orbit, Face and/or Neck with and without contrast (CPT® 70543) is indicated if ANY of the following are present:
  - Focal neurologic findings
  - Altered mental status
  - Seizures
  - Concern for orbital complications

- Concern for invasive fungal sinusitis
- MRA Head (CPT® 70544, CPT® 70545, or CPT® 70546) or CTA Head (CPT® 70496) can be approved with these findings as well if there is clinical concern for associated vascular complications including but not limited to mycotic aneurysm or venous sinus thrombosis.

- Repeat sinus imaging is generally not indicated for patients who have responded satisfactorily to treatment, but can be approved with clear documentation of the need for updated CT results to direct acute patient care decisions.
  - These cases should be forwarded for Medical Director Review

PEDHD-5.3: Stereotactic CT Localization (CPT® 77011)

Stereotactic CT localization is frequently obtained prior to sinus surgery. The dataset is then loaded into the navigational workstation in the operating room for use during the surgical procedure. The information provides exact positioning of surgical instruments with regard to the patient's 3D CT images. In most cases, the preoperative CT is a technical-only service that does not require interpretation by a radiologist.

- For treatment planning for sinus surgery CPT® 77011: A stereotactic CT localization scan is frequently obtained prior to sinus surgery. The dataset is then loaded into the navigational workstation in the operating room for use during the surgical procedure. The imaging facility should report CPT® 77011 when performing a scan not requiring interpretation by a radiologist.
- If a diagnostic scan is performed and interpreted by a radiologist, the appropriate diagnostic CT code (e.g. CPT® 70486) should be used.
- It is not appropriate to report both CPT® 70486 and CPT® 77011 for the same CT stereotactic localization imaging session.
- 3D Rendering (CPT® 76376 or CPT® 76377) should not be reported in conjunction with CPT® 77011 (or CPT® 70486 if used). The procedure inherently generates a 3D dataset.
- Such operative studies are indicated when ordered by the operating surgeon for this purpose.

PEDHD-5.4: Requests for both Head and Sinus Imaging

- CT Head does not visualize all of the sinuses.
- MRI Brain provides excellent visualization of the sinuses sufficient to recognize sinusitis, and addition of sinus CT for this purpose is unnecessary.
- In patients being evaluated for potential sinus surgery, separate CT Sinus is often appropriate even after a MRI Brain in order to visualize obstructions to spontaneous mucous flow. See **PEDHD-5.3: Stereotactic CT Localization (CPT® 77011)**.
- Separate head imaging is not generally indicated in patients with a normal neurological examination who have headaches associated with sinus symptoms.

- CT or MRI Sinus is not indicated for the evaluation of headaches or neurological complaints without a more specific indication pointing to a sinus etiology.

PEDHD-5.5: Allergic Rhinitis

- Advanced imaging is not indicated for diagnosis or management of patients with uncomplicated allergic rhinitis.

PEDHD-5.6: Other Indications for Sinus Imaging

- See **PEDHD-4.2: Facial Trauma** for imaging guidelines in trauma.
- Congenital anomalies of facial structures - CT Maxillofacial without contrast (CPT® 70486).
- 3D CT reconstructed images (CPT® 76377) in conjunction with routine CT should be an integral part of the examination in evaluating craniofacial abnormalities.
- Tumors or other disorders of facial structures - CT Maxillofacial without and with contrast (CPT® 70488) or MRI Orbits/Face/Neck without and with contrast (CPT® 70543).
- Obstructive sleep apnea See **PEDHD-24: Pediatric Sleep Disorders** for imaging guidelines.

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PEDHD-6: Epilepsy and Other Seizure Disorders

PEDHD-6: Epilepsy and Other Seizure Disorders

- A recent (within 60 days) face to face evaluation including a detailed history, physical examination with a thorough neurologic examination, and appropriate laboratory studies should be performed prior to considering the use of an advanced imaging (CT, MRI, Nuclear Medicine) procedure. An exception can be made if the patient is undergoing guideline-supported, scheduled follow-up imaging evaluation or request is from or in consultation with a neurologist or neurosurgeon who has seen the patient since onset of symptoms. This clinical evaluation should also include family history and (whenever possible) the accounts of eyewitnesses to the event(s).

PEDHD-6.1: Initial Imaging of Non-Febrile Seizures

- MRI Brain without contrast (CPT® 70551) or without and with contrast (CPT® 70553) is indicated for the following:
  - First-time seizure in child that has no known cause and is not associated with fever
  - Partial seizures
  - Generalized seizures in those who are neurologically abnormal, (e.g. developmental delay)
  - Focal neurologic deficits
  - Inconclusive findings on recent cranial ultrasound or CT Head
    - If patient meets criteria for MRI imaging for initial imaging of non-febrile seizure, MRI is approvable even with a recent negative CT.
  - Patients requiring sedation should generally not have non-contrast MRI studies. See **PEDHD-1.3: Pediatric Head Imaging Modality General Considerations**.
- CT Head without contrast (CPT® 70450) is indicated for the following:
  - First-time seizure in child associated with recent head trauma, barrier to obtaining a neuroimaging study in a timely manner and should not preclude MRI imaging when requested. **(**Late post traumatic seizures may be better evaluated by MRI Brain without contrast (CPT® 70551) See **PEDHD-4.1: Head Trauma**)
  - Patient cannot safely undergo MRI (avoidance of sedation is not an indication) or in urgent situations.
  - Identification of blood and calcifications
- Cranial ultrasound (CPT® 76506) can be approved for the following:
  - First-time seizure in child <12 months of age that has no known cause and is not associated with fever if the infant has an open fontanelle.
  - Cranial ultrasound is not required before MRI Brain without (CPT® 70551) for hypoxic ischemic encephalopathy (HIE) and congenital malformations.
- The following imaging tests do not generally add valuable information initially and are not indicated for the initial evaluation of seizures in children:
  - CTA Head or Neck
  - MRA Head or Neck
  - MRI Cervical, Thoracic, or Lumbar Spine

PEDHD-6.2: Repeat imaging indications

- Repeat MRI Brain without contrast (CPT® 70551) or without and with contrast (CPT® 70553) is indicated for the following:
  - Need to perform MRI using Epilepsy Protocol (typically 3T magnet with thin section angled slices through hippocampus and temporal lobes, either without or without and with contrast)
  - New or worsening focal neurologic deficits
  - Refractory or drug resistant seizures (See Practice Notes below)
  - Change in seizure type
  - Repeat imaging for persistent seizures as per specialist request or any provider in consultation with a specialist
  - MRI Brain with contrast (CPT® 70552) or without or with contrast (CPT® 70553) to clarify an abnormality on noncontrast MRI or if considering infection or inflammation
  - Patients requiring sedation should generally not have non-contrast MRI studies. See **PEDHD-1.3: Pediatric Head Imaging Modality General Considerations**

Practice Note

Drug Resistant synonyms may include “Refractory”, “Intractable” or “Pharmacoresistant”
Drug Resistant requires only 2 trials of antiepileptic medications

PEDHD-6.3: Special Imaging Studies in Evaluation for Epilepsy Surgery

- For patients with a previous MRI Brain and documentation of intractable epilepsy for which surgical treatment or another interventional modality is under active consideration, ANY of the following are indicated for preoperative planning:
  - These cases should be forwarded for Medical Director Review
  - PET Brain Metabolic (CPT® 78608 or CPT® 78609)
  - Functional MRI Brain (CPT® 70554 or CPT® 70555)
  - CTA Head (CPT® 70496) or MRA Head (CPT® 70544, CPT® 70545, or CPT® 70546)
  - MR Spectroscopy (CPT® 76390).
    - NOTE: Certain payers consider MR Spectroscopy investigational/experimental, and those coverage policies take precedence over eviCore Imaging Guidelines.

PEDHD-6.4: Febrile Seizures

A typical febrile seizure is a generalized seizure occurring in the presence of fever (>100.4°F/38°C) and no central nervous system infection in a child between the age of 6 months and 5 years.

- Neuroimaging should not be performed in the routine evaluation of children with simple febrile seizures.
- MRI Brain without contrast (CPT® 70551) or without and with contrast (CPT® 70553) is indicated for febrile seizures in the presence of one or more of the following:
  - Seizure lasting >15 minutes.
  - Partial seizures.
  - Focal neurologic deficits.
  - Multiple seizures within 24 hours.
  - Macrocephaly (Head circumference that is greater than the 95th percentile for age and sex, established by use of measurements and CDC growth charts. See **PEDHD-7.1: Macrocephaly**)
  - Signs and symptoms of increased intracranial pressure.

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PEDHD-7: Macrocephaly, Microcephaly, and Hydrocephalus

PEDHD-7.1: Macrocephaly

- Macrocephaly is defined as head circumference that is greater than the 95th percentile for age and sex, or head circumference increasing in percentiles over two visits established by use of measurements and CDC growth charts. An online calculator to determine head circumference percentile is available at: http://www.infantchart.com/cdc0to3headforage.php.
- Birth to age 6 months:
  - Ultrasound Head (CPT® 76506) is indicated initially in patients with an open fontanelle.
  - If hydrocephalus or hemorrhage is present on ultrasound, CT Head without contrast (CPT® 70450) is indicated.
  - For any abnormality seen on ultrasound, MRI Brain without contrast (CPT® 70551) or without and with contrast (CPT® 70553) is indicated.
- Age 7 months and older, or with closed fontanelle:
  - MRI Brain without contrast (CPT® 70551) or without and with contrast (CPT® 70553) is indicated.
  - CT is generally not indicated in this age group since uncomplicated hydrocephalus is less likely after early infancy.

PEDHD-7.2: Microcephaly

- Microcephaly is defined as head circumference that is less than the 5th percentile for age and sex, or head circumference decreasing in percentiles over two visits established by use of measurements and CDC growth charts. An online calculator to determine head circumference percentile is available at: http://www.infantchart.com/cdc0to3headforage.php.
- MRI Brain without and with contrast (CPT® 70553) is indicated for all patients.
  - CT is generally not recommended as that modality lacks the sensitivity to detect the relevant anatomical abnormalities.

PEDHD-7.3: Hydrocephalus

- This is the most common identifiable cause of macrocephaly. Almost all hydrocephalus is obstructive, except hydrocephalus due to choroid plexus papillomas. See **PEDONC-4.13: Choroid Plexus Tumors** in the **Pediatric Oncology Imaging Guidelines** for those lesions.
- Hydrocephalus is traditionally divided into non-communicating (the obstruction lies within the course of the brain's ventricular system) and communicating (the obstruction is distal to the ventricular system).
- Patients requiring sedation should generally not have non-contrast MRI studies. See **PEDHD-1.3: Pediatric Head Imaging Modality General Considerations**.
- For CSF flow imaging See **HD-24.4: CSF Flow Imaging** in the **Head Imaging Guidelines**

Initial Imaging Indications

Age 0-6 months:

- Screening head ultrasound examination (CPT® 76506)
- If ultrasound shows hydrocephalus, MRI Brain without and with contrast (CPT® 70553) is indicated.
- Serial US (CPT® 76506) can be used to monitor ventricular size to determine need and timing of placement of a ventricular catheter, or performance of an endoscopic third venticulostomy (ETV).

Greater than 6 months old:

- MRI Brain without and with contrast (CPT® 70553) is indicated.

Spine imaging:

- MRI Spine without and with contrast (CPT® 72156, CPT® 72157, and CPT® 72158) may be indicated in individuals with Chiari malformation (multiple spine segments), Dandy-Walker malformation (cervical spine only), or malignant infiltration of the meninges.

Repeat Imaging Indications including CSF flow shunting and Ventriculostomy

- Rapid MRI Brain without contrast (CPT® 70551) or CT Head without contrast (CPT® 70450) is indicated for any new signs or symptoms suggesting shunt malfunction (or ETV malfunction, including (but not limited to) sepsis, after shunt setting adjustments, decreased level of consciousness, protracted vomiting, visual or neurologic deterioration, decline of mentation after initial improvement, or new or changing pattern of seizures or as ordered by a specialist (neurologist or neurosurgeon) or any provider in consultation with a specialist.
- Rapid MRI Brain without contrast (CPT® 70551) or CT Head without contrast (CPT® 70450) is indicated in the postoperative period following shunt placement or ETV, with further follow-up imaging 6-12 months after the procedure and then every 12 months for patients with stable clinical findings.
  - Rapid MRI provides more anatomical detail and does not involve radiation exposure, but many providers use CT Head as rapid MRI is not universally available.
  - For routine follow up imaging with CT a low dose protocol should be used.
- Shunting into the peritoneum (VP shunts) can give rise to abdominal complications, but these are generally symptomatic, so surveillance imaging of the abdomen is not indicated.
  - Abdominal ultrasound (CPT® 76700) can be approved for suspicion of CSF pseudocyst formation or distal shunt outlet obstruction.
- Familial screening is not indicated for hydrocephalus except in siblings of individuals with aqueductal stenosis, for whom a one-time CT Head without contrast (CPT® 70450) or Rapid MRI Brain without contrast (CPT® 70551) is indicated.

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Additional Rarely Used Studies

- Cisternogram (CPT® 78630) is rarely done in children but can be approved for the following:
  - Known hydrocephalus with worsening symptoms.
  - Suspected obstructive hydrocephalus.
  - Suspected normal pressure hydrocephalus with gait disturbance and either dementia or urinary incontinence.
- Cerebrospinal Ventriculography (CPT® 78635) is rarely done in children but can be approved for the following:
  - Evaluation of internal shunt, porencephalic cyst, or posterior fossa cyst.
- Nuclear Medicine Shunt Evaluation (CPT® 78645) and CSF Flow SPECT (CPT® 78803) are rarely done in children but can be approved for the following:
  - Suspected malfunction of ventriculoperitoneal, ventriculopleural, or ventriculovenous shunts.

Practice Notes

Head ultrasound can be performed while the fontanelles are still open and has excellent spatial and anatomic resolution, particularly within the first 2 months of life. After 6 months, smaller acoustic windows due to closing sutures limit the sensitivity of the examination.

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PEDHD-8: Craniosynostosis

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PEDHD-8.1: Imaging

Craniosynostosis is the premature closure of one or more cranial sutures, usually during infancy. Abnormal head shape **is the common clinical feature**.

- Skull x-rays should be obtained prior to considering advanced imaging. In cases of very strong consideration of craniosynostosis with surgical planning in progress, an x-rays is not required.
- CT Head without contrast (CPT® 70450) is indicated in the diagnosis of craniosynostosis, with reported sensitivity near 100%. CT also detects associated intracranial pathology.
- 3D rendering (CPT® 76376 or CPT® 76377) is indicated with the initial diagnostic CT to evaluate the extent of synostosis and determine surgical candidacy or for preoperative planning.
- CT Maxillofacial (CPT® 70486) and CT Orbits (CPT® 70480) without contrast are generally not necessary to evaluate patients with craniosynostosis but are indicated if the craniosynostosis is part of a larger congenital defect which also involves the bones of the face or orbit.
- Ultrasound Head (CPT® 76506) can be approved as an alternative method of assessing sutural patency in neonates and infants when radiographs are indeterminate. If inconclusive or for pre-operative planning, CT with 3D rendering can be approved as discussed previously in this section.
- A postoperative CT Head without contrast (CPT® 70450) may be performed at the discretion of or in consultation with the specialist coordinating the patient's care.

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PEDHD-9: Chiari and Skull Base Malformations

PEDHD-9.1: Chiari I Malformations

This involves caudal displacement or herniation of the cerebellar tonsils. Chiari I may be associated with syringomyelia, and rarely with hydrocephalus. Most cases are asymptomatic and discovered incidentally on a head scan performed for another indication. When symptoms are present, they are usually nonspecific but can include headache, lower cranial nerve palsies, or sleep apnea.

- For initial evaluation, MRI Brain without contrast (CPT® 70551) or without and with contrast (CPT® 70553) and MRI of the entire spine without contrast (CPT® 72141, CPT® 72146, CPT® 72148) or without and with contrast (CPT® 72156, CPT® 72157, CPT® 72158) is indicated.
- For CSF flow imaging See **HD-24.4: CSF Flow Imaging** in the **Head Imaging Guidelines**
- Patients requiring sedation should generally not have non-contrast MRI studies. See **PEDHD-1.3: Pediatric Head Imaging Modality General Considerations**.
- Repeat imaging may be approved at the discretion of or in consultation with the specialist coordinating the patient's care for this condition.
  - These cases should be forwarded for Medical Director Review
- Repeat MRI Brain without contrast (CPT® 70551) or without and with contrast (CPT® 70553) is indicated for patients with a known Chiari I malformation when any of the following are present:
  - There are new or worsening signs or symptoms documented on a physical examination within 60 days of the imaging request.
  - A surgical procedure is actively being considered.
- Repeat MRI Spine imaging is not indicated for patients with normal initial spine imaging unless there are new or worsening signs or symptoms from baseline that suggest spinal cord pathology documented on a physical examination within 60 days of the imaging request.
- Repeat brain and spine imaging in individuals with Chiari I malformations and known syringomyelia or hydromyelia is highly individualized
- Familial screening is not indicated for Chiari I Malformations.

PEDHD-9.2: Chiari II Malformations (Arnold Chiari Malformation)

These malformations are more severe than Chiari I malformations. These patients usually present at birth. Myelomeningocele is always present, and syringomyelia and hydrocephalus are extremely common.

- Ultrasound is the initial examination in infants to determine ventricular size and associated anomalies and to provide a baseline for follow up evaluation.
- For initial advance imaging evaluation, MRI Brain without and with contrast (CPT® 70553) and MRI of the entire spine without and with contrast (CPT® 72156, CPT® 72157, CPT® 72158) is indicated.
- Repeat brain and spine imaging in individuals with Chiari II malformations is highly individualized and is indicated at the discretion of or in consultation with the specialist coordinating the patient's care for this condition.
  - These cases should be forwarded for Medical Director Review.
- Familial screening is not indicated for Chiari II Malformations.

PEDHD-9.3: Chiari III and IV Malformations

Chiari III malformation includes cerebellar herniation into a high cervical myelomeningocele. Chiari IV malformation refers to complete cerebellar agenesis. Both Chiari III and IV malformations are noted at birth, and are rarely compatible with life.

- Repeat brain and spine imaging in individuals with Chiari III and IV malformations is highly individualized and is indicated at the discretion of or in consultation with the specialist coordinating the patient's care for this condition.
  - These cases should be forwarded for Medical Director Review.
- Familial screening is not indicated for Chiari III or IV Malformations.

PEDHD-9.4: Basilar Impression

Basilar impression involves malformation of the occipital bone in relation to C1-2 (cervical vertebrae 1 and 2). The top of the spinal cord is inside the posterior fossa and the foramen magnum is undersized. Over time, this can lead to brain stem and upper spinal cord compression. Basilar impression can also be associated with the Chiari malformation, producing very complex anatomical abnormalities.

- MRI Brain (CPT® 70551) and Cervical Spine (CPT® 72141) without contrast are indicated.
- If surgery is being considered, CT Head (CPT® 70450) and Cervical Spine (CPT® 72125) without contrast are also indicated.
- Basilar impression appears to be genetic, and one-time screening of first-degree relatives with MRI Brain without contrast (CPT® 70551) can be approved.

PEDHD-9.5: Platybasia

Platybasia is a flattening malformation of the skull base, in which the clivus has a horizontal orientation.

- Patients are usually asymptomatic, but either MRI Brain without contrast (CPT® 70551) or CT Head without contrast (CPT® 70450) is indicated to establish a diagnosis when clinically suspected.

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PEDHD-10: Intracranial Aneurysms and AVM

PEDHD-10.1: Pediatric Intracranial Aneurysms

Unlike adults, the majority of pediatric aneurysms are caused by genetic or developmental defects rather than environmental or lifestyle factors.

Pediatric aneurysms most commonly present with subarachnoid hemorrhage, headache, increased intracranial pressure, seizure activity, or focal neurologic findings.

- A recent (within 60 days) evaluation including a detailed history, physical examination with a thorough neurologic examination, and appropriate laboratory studies should be performed prior to considering advanced imaging, unless the patient is undergoing guideline-supported scheduled follow-up imaging evaluation or request is from a neurologist or neurosurgeon who has seen the patient since onset of symptoms.
- For patients presenting with suspected subarachnoid hemorrhage, CT Head without contrast (CPT® 70450) or MRI Brain without contrast (CPT® 70551) is indicated as an initial study.
  - If subarachnoid hemorrhage is present on CT or MRI, or lumbar puncture findings suggest hemorrhage, additional imaging with CTA Head (CPT® 70496) or MRA Head (CPT® 70544, CPT® 70545, or CPT® 70546) is indicated.
  - CT or MRI Perfusion See **PEDHD-1.4: General Guidelines-Other Imaging Situations**
- For patients presenting with headache, increased intracranial pressure, seizures, or focal neurologic findings, MRI Brain without and with contrast (CPT® 70553) is indicated as an initial study.
  - If findings suspicious for intracranial aneurysm are present on MRI, additional imaging with CTA Head (CPT® 70496) or MRA Head (CPT® 70544, CPT® 70545, or CPT® 70546) is indicated.
- For patients with known unruptured aneurysm presenting with headache, increased intracranial pressure, seizures, or focal neurologic findings, MRI Brain without contrast (CPT® 70551) or without and with contrast (CPT® 70553) and MRA Head (CPT® 70544, CPT® 70545, or CPT® 70546) are indicated.
- For patients with treated aneurysms, CTA Head (CPT® 70496) is preferred.
- For patients with any of the following conditions and headache, increased intracranial pressure, seizures, or focal neurologic findings, MRI Brain without contrast (CPT® 70551) or without and with contrast (CPT® 70553) and MRA Head (CPT® 70544, CPT® 70545, or CPT® 70546) are indicated:
  - Polycystic kidney disease
  - Fibromuscular dysplasia
  - Ehlers-Danlos Syndrome
  - Klippel-Trenaunay-Weber Syndrome
  - Tuberous Sclerosis
  - Moyamoya Syndrome
  - Hereditary Hemorrhagic Telangiectasia (Osler-Weber-Rendu Syndrome)
  - Pseudoxanthoma elasticum
  - Neurofibromatosis type 1

- Kawasaki disease
- Coarctation of the aorta
- Patent ductus arteriosus
- Hyper-IgE syndrome
- 4 forms of Loeys-Dietz syndrome

- Patients requiring sedation should generally not have non-contrast MRI studies. See **PEDHD-1.3: Pediatric Head Imaging Modality General Considerations**.
- The timing of follow-up imaging for intracranial aneurysms in children is similar to that in adults. See **HD-12.1: Intracranial Aneurysms** in the **Head Imaging Guidelines**.
- Screening MRI Brain or MRA Head for aneurysms is not supported in asymptomatic patients under age 20 since only 0.6 % of ruptured aneurysms occur in the pediatric age range.
- Screening MRI Brain or MRA Head for aneurysms is not supported in patients with coarctation of the aorta repaired before age 3 since there is not an increased risk for intracranial aneurysm in this patient population.

PEDHD-10.2: Pediatric Intracranial Arteriovenous Malformations (AVM)

A recent (within 60 days) evaluation including a detailed history, physical examination with a thorough neurologic examination, and appropriate laboratory studies should be performed prior to considering advanced imaging, unless the patient is undergoing guideline-supported scheduled follow-up imaging evaluation or request is from or in consultation with a neurologist or neurosurgeon who has seen the patient since onset of symptoms.

Most intracranial AVMs are congenital, vary widely in their location and type, and are discovered at birth due to associated clinical findings or incidentally later in life. Certain hereditary conditions are associated with an increased risk for AVM development.

Vascular malformations include arteriovenous, venous, cavernous, and capillary malformations. The vein of Galen malformation is the most common arteriovenous malformation, presenting in neonates with signs of high output congestive heart failure or later in infancy of childhood with signs of hydrocephalus. Low flow venous, cavernous, and capillary malformations may be asymptomatic and discovered incidentally or they may present in childhood with seizures or neurologic findings secondary to intracranial hemorrhage.

Ultrasound Head (CPT® 76506) is the study of choice for evaluation of a suspected vein of Galen malformation in the neonate. Once confirmed, MRI or conventional angiography are required to precisely identify the feeding arteries and draining vein, especially if embolization is planned.

MRA or CTA are indicated for diagnosis of low flow malformations.

- MRI Brain without and with contrast (CPT® 70553) is the initial study of choice for evaluation of suspected AVM after the neonate period.
  - Patients requiring sedation should generally not have non-contrast MRI studies. See **PEDHD-1.3: Pediatric Head Imaging Modality General Considerations**.
  - MRA, CTA, or CT are generally not indicated prior to completion of initial MRI.
- For patients with known AVM, MRI Brain without contrast (CPT® 70551) or without and with contrast (CPT® 70553), and MRA Head (CPT® 70544, CPT® 70545, or CPT® 70546) or CTA Head (CPT® 70496) are indicated in the following circumstances:
  - Repeat advanced imaging with MRI Brain without and with contrast (CPT® 70553) or without contrast (CPT® 70551), AND/OR MRA Head (CPT® 70544, CPT® 70545, or CPT® 70546) or CTA Head (CPT® 70496) when requested by a specialist or any provider in consultation with a specialist .
- Head imaging for AVM screening is indicated for the following conditions:
  - Hereditary Hemorrhagic Telangiectasia (Osler-Weber-Rendu Syndrome).
    - MRI Brain without and with contrast (CPT® 70553) is indicated as an initial screening study for infants born to a parent with known HHT.
    - MRI Brain without and with contrast (CPT® 70553) at the time of diagnosis, and a single repeat study after the age of 20.
    - Ongoing surveillance imaging is not indicated for patients without new or worsening symptoms.
    - Repeat MRI alone or with MRA or CTA (as above) is indicated for clinical signs or symptoms concerning for progression in a patient with a known AVM.
    - CTA (as above) is indicated for clinical signs or symptoms concerning for progression in a patient with a clipped AVM
  - Capillary Malformation-Arteriovenous Malformation (CM-AVM)
    - Caused by *RASA1* mutations.
    - MRI Brain without and with contrast (CPT® 70553) at the time of diagnosis.
    - Ongoing surveillance imaging is not indicated for patients without new or worsening symptoms.
    - Repeat MRI alone or with MRA or CTA (as above) is indicated for clinical signs or symptoms concerning for progression in a patient with a known AVM.
    - See **PEDPVD-2: Vascular Anomalies** in the **Pediatric Peripheral Vascular Disease Imaging Guidelines**.
  - Sturge-Weber Syndrome:
    - MRI Brain without and with contrast (CPT® 70553) and MRI Face/Neck (CPT® 70543) at the time of diagnosis.
    - Ongoing surveillance imaging is not indicated for patients without new or worsening symptoms.
    - Repeat MRI alone or with MRA or CTA (as above) is indicated for clinical signs or symptoms concerning for progression in a patient with a known AVM.
  - Cerebral Cavernous Malformations:
    - Also known as cavernomas, cavernous angiomas, or cryptic vascular malformations.

- MRI Brain without and with contrast (CPT® 70553) and MRI Cervical (CPT® 72156) and Thoracic (CPT® 72157) Spine without and with contrast at the time of diagnosis.
- Ongoing surveillance imaging is not indicated for patients without new or worsening symptoms.
- Repeat MRI alone or with MRA or CTA (as above) is indicated for clinical signs or symptoms concerning for progression in a patient with a known AVM.

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PEDHD-11: Syncope

Syncope in children is almost always neurocardiogenic (vasovagal) in nature. Intracranial mass lesions do not cause isolated syncope. Syncope and seizure activity can often be challenging to distinguish for unwitnessed syncope.

- Advanced imaging of the brain is not indicated for patients with isolated syncope without focal neurologic findings. See **PEDCD-5: Syncope** in the **Pediatric Cardiac Imaging Guidelines** and **PEDHD-6: Epilepsy and Other Seizure Disorders** for additional imaging considerations.
- There is no role for advanced neuroimaging for Postural Tachycardia Syndrome (POTS).

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PEDHD-12: Pediatric Stroke

PEDHD-12.1: General Considerations

- Imaging indications are the same for neonates as for older children.

PEDHD-12.2: Pediatric Stroke Initial Imaging

- As pediatric strokes may be hemorrhagic, CT Head without contrast (CPT® 70450) is generally the initial study indicated.
  - MRI Brain without contrast (CPT® 70551) can be performed in lieu of initial CT if emergently available for evaluation of acute stroke symptoms.
- After the initial study, ANY of the following studies are indicated for further evaluation of pediatric stroke:
  - These cases should be forwarded for Medical Director Review.
  - MRI Brain without contrast (CPT® 70551) or without and with contrast (CPT® 70553)
  - MRA Head (CPT® 70544, CPT® 70545, or CPT® 70546) and MRA Neck (CPT® 70547, CPT® 70548 or CPT® 70549)
  - CTA Head (CPT® 70496) and Neck (CPT® 70498)
- MRI Brain without contrast (CPT® 70551) or MRI Brain without and with contrast (CPT® 70553) is approvable in the presence of neurological signs and/or symptoms, including headache, after COVID-19 infection

PEDHD-12.3: Pediatric Stroke Subsequent Imaging

- MRI Brain without contrast (CPT® 70551) or without and with contrast (CPT® 70553) is indicated for any new or worsening neurological findings or seizure activity.
- Most pediatric patients do not benefit from surveillance imaging after stroke, but specific surveillance imaging indications for specified conditions are listed in the disease-specific section.
  - These cases should be forwarded for Medical Director Review
  - MRI Brain without contrast (CPT® 70551) or without and with contrast (CPT® 70553)

PEDHD-12.4: Moyamoya Disease

Initial imaging

- MRI Brain without contrast (CPT® 70551) or without and with contrast (CPT® 70553), MRA Head (CPT® 70544, CPT® 70545, or CPT® 70546) and MRA Neck (CPT® 70547, CPT® 70548, or CPT® 70549) are indicated for all patients. CTA Head and Neck (CPT® 70496 and CPT® 70498) can be approved if MRI is contraindicated or not readily available.

Repeat imaging

- MRA Head (CPT® 70544, CPT® 70545, or CPT® 70546) every 12 months. CTA Head (CPT® 70496) can be approved if MRI is contraindicated or not readily available
- MRI Brain without contrast (CPT® 70551) every 12 months
- Radiopharmaceutical Localization Imaging SPECT (CPT® 78803) with vasodilating agent acetazolamide (Diamox) challenge can be approved when surgery or other vascular intervention is being considered.
- CT or MRI Perfusion See **PEDHD-1.4: General Guidelines-Other Imaging Situations**

PEDHD-12.5: Sickle Cell Disease

Patients with sickle cell disease are at significantly increased risk for stroke and silent infarction, beginning at a very young age. Recent advances allow physicians to identify patients at high risk for stroke and begin a primary stroke prevention program. Identification of silent cerebral infarction is important because treatment with prophylactic red cell transfusions to maintain hemoglobin S levels at <30% of total hemoglobin may reduce recurrent stroke and extent of neurologic damage.

- The following imaging is indicated for all sickle cell patients with a severe phenotype (Hgb SS or Hgb $S\beta^0$):
  - Transcranial Doppler (TCD) Ultrasound (CPT® 93886 or CPT® 93888) annually for all patients age 2 to 16. TCD is used to screen for overt and silent infarctions and monitor response to transfusion therapy.
    - A short interval repeat study is indicated for patients with conditional (170-199 cm/sec) flow results, or with patients undergoing transfusion therapy.
    - MRA Head (CPT® 70544, CPT® 70545, or CPT® 70546) or CTA Head (CPT® 70496) is approvable with 2 non-imaging TCD measurements of ≥200 cm/sec or a single measurement of >220 cm/sec or 2 assessment TCD measurements ≥185 cm/sec or a single measurement >205 cm/sec.
    - MRI Brain without contrast (CPT® 70551) or without and with contrast (CPT® 70553) and/or MRA Head (CPT® 70544, CPT® 70545, or CPT® 70546) is/are indicated in patients with persistent abnormal TCD velocities.
  - TCD is not indicated for patients with other phenotypes (Hgb SC, Hgb $S\beta^+$).
  - A 1-time MRI Brain (CPT® 70551 or CPT® 70553) screening without sedation to detect silent cerebral infarcts in early-school-age children, when MRI can commonly be performed without sedation. A second screening MRI can be considered if new symptoms or cognitive impairment occurs or a change in academic performance is noted.
  - After an infarct-like lesion is identified, MRI Brain (CPT® 70551 or CPT® 70553) surveillance every 12-24 months to assess for cerebral infarct progression.
  - Otherwise screening of asymptomatic sickle cell patients with MRI or MRA is no longer recommended.

- For children who had been receiving transfusion therapy for at least 1 year and are interested in stopping transfusion, according to the clinical trial risk stratification with an MRI Brain (CPT® 70551 or CPT® 70553) and MRA Head (CPT® 70544, CPT® 70545 or CPT® 70546) when considering hydroxyurea treatment as a substitution.

PEDHD-12.6: CNS Vasculitis and Stroke

- MRI Brain without and with contrast is the recommended initial study for all patients with vasculitis and suspected CNS involvement, whether primary or secondary.
  - A normal MRI Brain almost always completely excludes intracranial vasculitis
  - MRA Head (CPT® 70544, CPT® 70545, or CPT® 70546) is indicated for inconclusive MRI findings suggesting medium or large vessel vasculitis.
  - Patients with aggressive disease being treated with systemic therapy can have imaging approved for treatment response every 3 months during active treatment.
  - Annual surveillance imaging can be approved to detect progressive vascular damage that may require intervention

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PEDHD-13: Benign Brain Lesions

PEDHD-13.1: Arachnoid Cysts

Arachnoid cysts arise in the middle or posterior fossa, and the majority of lesions are discovered incidentally and do not require surgical intervention.

- MRI Brain without contrast (CPT® 70551) or without and with contrast (CPT® 70553) is indicated for initial evaluation of arachnoid cysts if not already completed.
- Repeat MRI Brain is not indicated for most patients with arachnoid cysts, but can be approved for the following:
  - Annual MRI Brain without contrast (CPT® 70551) or without and with contrast (CPT® 70553) until age 4 if diagnosed at a younger age
  - New or worsening headache or focal neurologic deficits suggesting progression of cyst
  - Preoperative planning
  - When requested by a specialist or any provider in consultation with a specialist

PEDHD-13.2: Pineal/Colloid Cysts

Pineal cysts are generally discovered incidentally and do not require surgical intervention.

- MRI Brain without contrast (CPT® 70551) or without and with contrast (CPT® 70553) is indicated for initial evaluation of pineal cysts if not already completed.
- Repeat MRI Brain is not indicated for most patients with pineal cysts, but MRI Brain without contrast (CPT® 70551) or without and with contrast (CPT® 70553) can be approved for the following:
  - New or worsening headache or focal neurologic deficits suggesting progression of cyst
  - Preoperative planning
- Repeat MRI Brain without contrast (CPT® 70551) or without and with contrast (CPT® 70553) can be approved for colloid cysts for the following:
  - In the presence of symptoms including syncope
  - Evaluation of CSF flow (CPT® 70551)
  - When requested by a specialist or any provider in consultation with a specialist

PEDHD-13.3: Acoustic Neuromas

- See **PEDPND-2.2: Neurofibromatosis 2** in the **Pediatric Peripheral Nerve Disorders Imaging Guidelines**

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PEDHD-14: Pediatric Demyelinating Diseases

PEDHD-14.1: General Considerations

- MRI Brain without and with contrast (CPT® 70553) is the preferred imaging study for evaluation of pediatric demyelinating disease.
  - MRI Spinal Cord without and with contrast (CPT® 72156 and CPT® 72157) is also indicated for evaluation of pediatric demyelinating disease.
  - MRI Lumbar Spine without and with contrast (CPT® 72158) is not indicated unless the patient has a tethered cord or other anatomic abnormality causing caudal displacement of the filum terminalis.
- CT imaging is generally not indicated in the evaluation of demyelinating disease.
- PET Brain (CPT® 78608 and CPT® 78609) and MR Spectroscopy (CPT® 76390) are considered investigational for evaluation of pediatric demyelinating diseases.

PEDHD-14.2: Multiple Sclerosis (MS)

Multiple sclerosis is less common in children. About 4% of MS cases are diagnosed before age 18, and only ~0.7% of all MS cases begin before age 10.

Ataxia, optic neuritis, diplopia, and transverse myelitis are common presentations. MS can present as an acute encephalitis-like illness, especially in childhood.

Among children with suspected demyelinating diseases, the principal differential diagnosis is often between MS and acute disseminated encephalomyelitis.

- MRI Brain (CPT® 70553) and Spinal Cord (CPT® 72156 and CPT® 72157) without and with contrast is indicated for initial diagnosis in patients with clinical signs and/or symptoms suggestive of MS.
  - MRI Brain (CPT® 70551) and Spinal Cord (CPT® 72141 and CPT® 72146) without contrast can be approved if there is a contraindication to gadolinium administration.
- MRI Brain (CPT® 70553) and Spinal Cord (CPT® 72156 and CPT® 72157) without and with contrast is indicated every 6 months for disease monitoring.
  - MRI Brain (CPT® 70551) and Spinal Cord (CPT® 72141 and CPT® 72146) without contrast can be approved if there is a contraindication to gadolinium.
  - MRI Orbit without and with contrast (CPT® 70543) may be considered if opticneuritis is suspected, in addition to the above scenario
  - Symptoms suggestive of Progressive Multifocal Leukoencephalopathy (PML) during Tysabri therapy (or other medications with similar risk).
    - Screening for patients on natalizumab (Tysabri) or other drugs with risk of PML (Progressive Multifocal Leukoencephalopathy)
      - MRI Brain every 6 months while on treatment
      - MRI Brain every 3-6 months for high risk patients positive for serum JC virus antibody and >18 months natalizumab exposure
- If a non-contrast study shows incidental evidence of possible demyelinating disease, repeat with MRI Brain with contrast (CPT® 70552) may be approved within 2 weeks of previous non-contrast study as the presence of enhancing lesions may be helpful in confirming the diagnosis. If non-contrast study was performed more than 2 weeks

prior to the request for repeat imaging, an MRI Brain with and without contrast (CPT® 70553) is appropriate.

Practice Notes

- Medications with similar risks of PML as Tysabri include: Dimethyl fumarate (Tecfidera), Fingolimod (Gilenya), Ocrelizumab (Ocrevus), Mavenclad (cladribine), Vumerity (diroximel fumarate), Soliris (eculizaumab), Zeposia (ozanimod), Lemtrada (alemtuzumab), Bafiertam (monomethyl fumarate), Rituxan (rituximab).
- 3D imaging in the evaluation of Multiple Sclerosis is not approvable as a separate code as most scanners are capable of 3D acquisitions or other imaging sequences may be done.

PEDHD-14.3: Acute Disseminated Encephalomyelitis (ADEM) and Other Pediatric Demyelinating Disorders

- ADEM has an acute onset, and is more common among younger children than MS, but the signs and symptoms overlap significantly, and distinguishing between MS and ADEM can be challenging based on clinical examination alone.
- MRI Brain (CPT® 70553) and Spinal Cord (CPT® 72156 and CPT® 72157) without and with contrast is indicated for initial diagnosis in patients with clinical signs and/or symptoms suggestive of ADEM.
  - MRI Brain (CPT® 70551) and Spinal Cord (CPT® 72141 and CPT® 72146) without contrast can be approved if there is a contraindication to gadolinium.
- MRI Brain (CPT® 70553) and Spinal Cord (CPT® 72156 and CPT® 72157) without and with contrast is indicated every 3 months for 1 year following diagnosis or if ordered out of sequence or beyond one year by a specialist or any provider in consultation with a specialist.
  - MRI Brain (CPT® 70551) and Spinal Cord (CPT® 72141 and CPT® 72146) without contrast can be approved if there is a contraindication to gadolinium.
  - Most patients will have complete clinical recovery by 12 months, while stable MRI abnormalities (gliosis) may persist. These findings do not require additional imaging unless the patient develops new neurologic symptoms. Prolonged symptoms or return of symptoms may represent a different demyelinating disorder.
- There are other pediatric demyelinating disorders that are less common but have clinical overlap with multiple sclerosis and ADEM such as (but not limited to):
  - Neuromyelitis optica (NMO) spectrum disorders
  - Anti-MOG syndromes (anti-myelin oligodendrocyte glycoprotein)
  - Demyelination secondary to infectious or inflammatory disorders (e.g. transverse myelitis)
- These conditions may require a different treatment regimen than multiple sclerosis and may require repeat imaging to monitor treatment response as the diagnosis becomes more clear. Repeat imaging with MRI Brain and/or MRI Cervical Spine and

MRI Thoracic Spine as requested by neurology or infectious disease may be approved.

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PEDHD-15: Pituitary Dysfunction

PEDHD-15.1: General Considerations

- The initial step in the evaluation of all potential pituitary masses is a detailed history, recent physical examination, and thorough neurological exam, including evaluation of the visual fields.
- Endocrine laboratory studies should be performed prior to considering initial advanced imaging.
- When pituitary imaging is indicated, MRI Brain without and with contrast (CPT® 70553) or MRI Brain without contrast (CPT® 70551) are approvable.
  - Pituitary Gland: one study (either MRI Brain [CPT® 70553] or MRI Orbit, Face, Neck [CPT® 70543]) is adequate to report the imaging of the pituitary. The reporting of two CPT® codes, to image the pituitary, is not indicated.
- If a previous MRI Brain was reported to show a possible pituitary tumor with supporting evidence of pituitary disease or is inconclusive, a repeat MRI with dedicated pituitary protocol may be performed. If a prior MRI Brain was without contrast a follow up scan either with contrast (CPT® 70552) or with and without contrast (CPT® 70553) may be approved
- For association between pituitary dysfunction and optic nerve issues See **HD- 32.1: Eye Disorders and Visual Loss** in the **Head Imaging Guidelines**
- Patients requiring sedation should generally not have non-contrast MRI studies. See **PEDHD-1.3: Pediatric Head Imaging Modality General Considerations**
- For repeat imaging, See **HD-19.1: Pituitary** in the **Head Imaging Guidelines**

PEDHD-15.2: Panhypopituitarism

Endocrine testing should be performed initially.

- MRI Brain without and with contrast (CPT® 70553) or MRI Brain without contrast (CPT® 70551) with special attention to the pituitary is indicated for newly diagnosed Panhypopituitarism.
- Patients with a normal pituitary on initial MRI do not need routine follow up imaging.
- Patients with mass lesions should have follow up imaging according to the guidelines for the specific diagnosis.

PEDHD-15.3: Isolated Growth Hormone Deficiency

- Clinical features include: height below the normal range (<3rd percentile), subnormal growth velocity or the child's height is below the range expected based on parental height.
- Risk factors include: a history of brain tumor, cranial irradiation or other congenital/organic hypothalamic-pituitary abnormality as well as an incidental finding of a hypothalamic-pituitary abnormality on MRI.
- Endocrine testing should be performed initially.
- MRI Brain without and with contrast (CPT® 70553) or MRI Brain without contrast (CPT® 70551) with special attention to the pituitary is indicated for any of the following:
  - Both IGF1 and IGFBP3 are below the laboratory reference range for age/sex.
  - 2 measurements of growth hormone stimulation with different stimulation agents (glucagon, clonidine, arginine, insulin, levodopa) performed on the same day or separate days produce maximal GH levels <10ng/mL See Practice Notes
- Patients with a normal pituitary on initial MRI do not need routine follow up imaging.
- Patients with mass lesions should have follow up imaging according to the guidelines for the specific diagnosis.

Practice Notes

- Growth hormone stimulation testing is limited by poor specificity and requires failure on 2 tests to diagnose growth hormone deficiency.
- Controversy exists as to the cutoff level which differentiates a normal response from a deficient response on provocative testing. Some experts support GH <7 ng/mL however many pediatric endocrinologists consider a peak GH level <10 ng/mL to be indicative of growth hormone deficiency and may identify children with partial GHD.

PEDHD-15.4: Diabetes Insipidus (DI) and Other Disorders of Anti-Diuretic Hormone

Laboratory testing should be performed initially. Diabetes insipidus is characterized by serum osmolality >300mOsm/kg and urine osmolality <300 mOsm/kg.

Central diabetes insipidus (CDI) is caused by diminished synthesis or secretion of vasopressin in the hypothalamus and nephrogenic diabetes insipidus (NDI) is caused by renal resistance to vasopressin.

Central Diabetes Insipidus (DI)

- MRI Brain without and with contrast (CPT® 70553) or MRI Brain without contrast (CPT® 70551) is indicated for newly diagnosed central DI
- Patients with a normal pituitary on initial MRI can have repeat MRI Brain without and with contrast (CPT® 70553) every 3-6 months for the first 2 years as germinomas may cause central DI while still too small to detect on imaging.

- Serial measurement of β -hCG is also indicated for these patients, and MRI should be repeated if a significant rise in β -hCG is detected on screening.

- Patients with mass lesions should have follow up imaging according to the guidelines for the specific diagnosis.

Nephrogenic DI

- Once this diagnosis is firmly established, further advanced imaging is usually not indicated.

Syndrome of Inappropriate Antidiuretic Hormone Secretion (SIADH)

Laboratory studies should be obtained prior to considering advanced imaging—urine osmolality should be high and serum osmolality low.

- MRI Brain without and with contrast (CPT® 70553) or MRI Brain without contrast (CPT® 70551) is approvable for initial evaluation of unexplained central (hypothalamic pituitary) SIADH.
- Patients with a normal pituitary on initial MRI do not need routine follow up imaging.
- Patients with mass lesions should have follow up imaging according to the guidelines for the specific diagnosis.

Practice Notes

- The most common association of SIADH is with tumors—specifically small cell carcinoma of the lung. Other non-chest cancers that have been associated with SIADH include but are not limited to head/neck cancers, extra-pulmonary small cell cancers and various GI/GU malignancies.
- See **ONC-7.1: Small Cell Lung Cancer-Suspected/Diagnosis** and **ONC-30.3: Paraneoplastic Syndromes** in the **Oncology Imaging Guidelines.**
- Pulmonary diseases including infection (tuberculosis, viral/bacterial pneumonia), acute respiratory infections, mechanical ventilation and others can cause SIADH although the mechanism is unclear. Individuals with lung disease should have chest imaging according to the guidelines for the specific diagnosis.

PEDHD-15.5: Precocious Puberty

Defined as the appearance of secondary sexual characteristics before age 8 in females and before age 9 in males. The diagnosis is made clinically using Tanner staging and often will include a bone age assessment (hand/wrist radiographs). See Practice Notes

Endocrine laboratory studies (baseline LH, FSH and either estradiol or testosterone) are used to determine if the etiology of precocious puberty is central (gonadotropin dependent) or peripheral (gonadotropin independent). Estradiol and testosterone levels will often be elevated to a pubertal range.

Central Precocious Puberty (CPP)

- An LH >0.3 U/L on a random blood sample is the most reliable screening test for central precocious puberty. If LH <0.3 U/L and CPP is suspected, a stimulation test with a GnRH analog is the gold standard.
- Neuroimaging should always follow hormonal studies that suggest a central origin of precocious puberty.
- MRI Brain without and with contrast (CPT® 70553, preferred study) or MRI Brain without contrast (CPT® 70551) is indicated for evaluation of any child with documented central precocious puberty.
- MRI is appropriate irrespective of age and gender in patients with precocious puberty and concurrent CNS symptoms of severe headache, visual changes or seizures.
- Patients with a normal pituitary on initial MRI do not need routine follow up imaging.
- Patients with mass lesions should have follow up imaging according to the guidelines for the specific diagnosis. (**PEDHD-15.6: Benign Pituitary Tumors** and **PEDHD-15.7: Pituitary Malignancies**)

Peripheral Precocious Puberty

The differential diagnosis of peripheral precocious puberty (LH suppressed or in the pre-pubertal range with elevated estradiol, testosterone and/or adrenal androgens) is broad and may include ovarian, testicular, adrenal and other sources of excessive hormonal production

- Initial imaging may include Ultrasound Abdomen (CPT® 76700) in both genders and Ultrasound Pelvis (CPT® 76856) in females and Scrotal ultrasound (CPT® 76870) in males depending on the suspected source of hormonal excess.
- See **PEDONC-4.7: CNS Germinomas and Non-Germinomatous Germ Cell Tumors** in the **Pediatric Oncology Imaging Guidelines** for evaluation of HCG secreting CNS tumors
- See **PEDONC-11.2: Hepatoblastoma** in the **Pediatric Oncology Imaging Guidelines** for evaluation of HCG secreting hepatic tumors .
- See **PEDONC-10: Pediatric Germ Cell Tumors** in the Pediatric Oncology Imaging Guidelines and **ONC-20: Testicular, Ovarian and Extragonadal Germ Cell Tumors** in the **Oncology Imaging Guidelines** for evaluation of Leydig Cell tumors.
- See **AB-16.1: Adrenal Cortical Lesions** in the **Abdomen Imaging Guidelines** for evaluation of adrenal virilizing tumors

PEDHD-15.6: Benign Pituitary Tumors

- Benign pituitary tumor indications in pediatric patients are identical to those for adult patients. See **HD-19: Pituitary** in the **Head Imaging Guidelines**.

PEDHD-15.7: Pituitary Malignancies

See **PEDONC-4.10: Craniopharyngioma and Other Hypothalamic/Pituitary Region Tumors** or **PEDONC-18: Histiocytic Disorders** in the **Pediatric Oncology Imaging Guidelines**

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PEDHD-16: Pediatric Ear Disorders

PEDHD-16.1: Hearing Loss

A recent (within 60 days) evaluation including a detailed history, physical examination (including otoscopic examination), and age-appropriate audiology testing should be performed on any child with known or suspected hearing loss prior to considering advanced imaging. The selection of imaging testing will depend on the age of the child and type of hearing loss.

- CT Temporal Bone without contrast (CPT® 70480) is indicated for the following:
  - Conductive hearing loss of any cause.
  - Preoperative planning for resection of mass lesion or cochlear implant placement.
  - Sensorineural hearing loss in patients who cannot safely undergo MRI.
  - Mixed conductive and sensorineural hearing loss.
  - Congenital hearing loss.
  - Total deafness.
- MRI Brain without and with contrast (CPT® 70553) with attention to internal auditory canals (included in CPT® 70553 and does not require a separate CPT code) is indicated for the following:
  - Conductive hearing loss secondary to known or suspected mass lesion.
  - Preoperative planning for resection of mass lesion or cochlear implant placement.
  - Sensorineural hearing loss of any cause.
  - Mixed conductive and sensorineural hearing loss.
  - Congenital hearing loss.
  - Total deafness.
  - Hearing loss associated with tinnitus See **PEDHD-16.5: Tinnitus**
- Both modalities (CT and MRI) may be approved simultaneously for evaluation and surgical planning if ordered by or in consultation with an ENT or Neurosurgical specialist
- Limited MRI Brain with attention to internal auditory canals (CPT® 70540, CPT® 70542, or CPT® 70543) can be approved when requested by the provider in place of a complete MRI Brain. Note: Limited MRI codes should not be used in addition to MRI Brain codes; IAC views are performed as additional sequences as part of the brain study. (See **HD-1.1: General Guidelines – Anatomic Issues** in the **Head Imaging Guidelines**)
- Patients requiring sedation should generally not have non-contrast MRI studies. See **PEDHD-1.3: Pediatric Head Imaging Modality General Considerations**.

PEDHD-16.2: Ear Pain

A recent (within 60 days) evaluation including a detailed history, physical examination (including otoscopic examination), should be performed on any child with ear pain prior to considering advanced imaging. Common causes of ear pain include external and middle ear infections, dental problems, sinus infection, neck problems, tonsillitis, and pharyngitis.

- Advanced imaging is not indicated in the overwhelming majority of pediatric patients with ear pain.
- CT Temporal Bone without contrast (CPT® 70480) or without and with contrast (CPT® 70482), OR, MRI Brain without and with contrast with attention to internal auditory canals (CPT® 70553), OR MRI Orbits/Face/Neck without and with contrast (CPT® 70543) is indicated for the following:
  - Persistent ear pain without obvious cause.
  - Clinical suspicion for complicated or invasive infection such as mastoiditis.
  - Clinical suspicion of mass lesion causing ear pain.
  - Significant trauma with concern for hematoma formation.
  - Preoperative planning.
- Patients requiring sedation should generally not have non-contrast MRI studies. See **PEDHD-1.3: Pediatric Head Imaging Modality General Considerations**.

PEDHD-16.3: Cholesteatoma

Cholesteatomas are expansive cysts of the middle ear filled with cellular debris. They can be congenital or arise from recurrent middle ear infections or trauma to the tympanic membrane. Hearing loss is usually conductive, although if the lesion is large enough combined conductive and sensorineural hearing loss may be present. Otoscopic exam findings and symptoms may include painless drainage from the ear or chronic/recurrent ear infections.

- CT Temporal Bone without contrast (CPT® 70480) or without and with contrast (CPT® 70482), OR MRI Brain without and with contrast with attention to internal auditory canals (CPT® 70553), OR MRI Orbits/Face/Neck without and with contrast (CPT® 70543) is indicated for preoperative evaluation in cholesteatoma patients.
- CT Temporal Bone without contrast (CPT® 70480) or without and with contrast (CPT® 70482), OR MRI Brain without and with contrast with attention to internal auditory canals (CPT® 70553), OR MRI Orbits/Face/Neck without and with contrast (CPT® 70543) is indicated one time post-operatively to exclude residual or regrown cholesteatoma to avoid the need for a second-look surgery.
- Patients requiring sedation should generally not have non-contrast MRI studies. See **PEDHD-1.3: Pediatric Head Imaging Modality General Considerations**.

PEDHD-16.4: Vertigo

Isolated vertigo is an uncommon complaint during childhood. Middle ear/Eustachian tube problems are the most common cause of isolated vertigo in children. A recent (within 60 days) face-to-face evaluation including a detailed history, physical examination (including otoscopic examination), should be performed on any child with vertigo prior to considering advanced imaging.

- If physical examination is otherwise normal and the vertigo responds to treatment, advanced imaging is not indicated.
- MRI Brain without and with contrast with attention to internal auditory canals (CPT® 70553) is indicated for the following:
  - Vertigo with associated headache or ataxia.
  - Vertigo associated with tinnitus.
  - Vertigo that does not respond to vestibular treatment.
- Patients requiring sedation should generally not have non-contrast MRI studies. See **PEDHD-1.3: Pediatric Head Imaging Modality General Considerations**.

PEDHD-16.5: Tinnitus

Tinnitus without hearing loss is a less common complaint during childhood. Children with hearing loss and tinnitus should be imaged according to **PEDHD-16.1: Hearing Loss**. A recent (within 60 days) face-to-face evaluation including a detailed history, physical examination (including otoscopic examination), and age-appropriate audiology testing should be performed on any child with known or suspected tinnitus prior to considering advanced imaging.

- Advanced imaging is not indicated in the overwhelming majority of pediatric patients with isolated tinnitus and normal hearing.
- CT Temporal Bone without contrast (CPT® 70480) or without and with contrast (CPT® 70482), OR MRI Brain without and with contrast with attention to internal auditory canals (CPT® 70553), OR MRI Orbits/Face/Neck without and with contrast (CPT® 70543) is indicated for the following:
  - Clinical suspicion of mass lesion causing tinnitus.
  - Persistent tinnitus after recent significant trauma.
- MRA Head (CPT® 70544, CPT® 70545 or CPT® 70546) or CTA Head (CPT® 70496) AND/OR MRA Neck (CPT® 70547, CPT® 70548 or CPT® 70549) or CTA Neck (CPT® 70498) for Pulsatile tinnitus or suspicion for vascular lesions
- Patients requiring sedation should generally not have non-contrast MRI studies. See **PEDHD-1.3: Pediatric Head Imaging Modality General Considerations**.

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PEDHD-17: Autism Spectrum Disorders

The group of diagnoses, including Asperger syndrome, are classified as pervasive development disorders (PDD). These diagnoses are established on clinical criteria, and no imaging study can confirm the diagnosis.

Comprehensive evaluation for autism might include history, physical exam, audiology evaluation, speech, language, and communication assessment, cognitive and behavioral assessments, and academic assessment.

- MRI Brain without and with contrast (CPT® 70553) is indicated for new or worsening focal neurologic findings documented on a physical examination within 60 days of the imaging request. Consider advanced imaging if there is loss of developmental milestones and/or regression in two or more areas of development.
- Patients requiring sedation should generally not have non-contrast MRI studies. See **PEDHD-1.3: Pediatric Head Imaging Modality General Considerations**.
- PET imaging is considered investigational in the evaluation of patients with autism spectrum disorders.

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PEDHD-18: Behavioral and Psychiatric Disorders

- Behavioral and psychiatric disorders of childhood or adolescence generally require no advanced imaging for diagnosis or management.
  - MRI Brain without and with contrast (CPT® 70553) is indicated for new or worsening focal neurologic findings documented on a physical examination within 60 days of the imaging request.
- Patients requiring sedation should generally not have non-contrast MRI studies. See **PEDHD-1.3: Pediatric Head Imaging Modality General Considerations**.
- For concerns of PANS (Pediatric acute-onset neuropsychiatric syndrome) and PANDAS (Pediatric autoimmune neuropsychiatric disorder associated with streptococcal infection) See **PEDHD-26: Movement Disorders including Tourette's Syndrome**)

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PEDHD-19: Intellectual Disability, Cerebral Palsy, and Developmental Motor Delay

PEDHD-19.1: Intellectual Disability

Intellectual disability was formerly known as mental retardation, and may be primary or secondary to a variety of heterogeneous disorders.

- MRI Brain without and with contrast (CPT® 70553) is indicated for new or worsening focal neurologic findings documented on a physical examination within 60 days of the imaging request.
- Patients requiring sedation should generally not have non-contrast MRI studies. See **PEDHD-1.3: Pediatric Head Imaging Modality General Considerations**.

PEDHD-19.2: Cerebral Palsy

Many patients with intellectual disability also have cerebral palsy, but not all patients with cerebral palsy have intellectual disability.

Cerebral palsy is a static motor encephalopathy caused by a variety of entities spanning developmental, metabolic, genetic, infectious, ischemic, and other acquired etiologies.

- MRI Brain without and with contrast (CPT® 70553) is indicated for:
  - Initial evaluation of newly diagnosed cerebral palsy.
  - New or worsening focal neurologic findings documented on a physical examination within 60 days of the imaging request, including the presence of developmental delay.
- Patients requiring sedation should generally not have non-contrast MRI studies. See **PEDHD-1.3: Pediatric Head Imaging Modality General Considerations.**
- For spinal imaging requests See **SP-7.1: Myelopathy** in the **Spine Imaging Guidelines**

PEDHD-19.3: Developmental Motor Delay

There are many causes for developmental motor delay. Patients with motor delay can have decreased, normal, or increased muscular tone. Patients with normal tone do not require imaging unless they have focal neurologic findings.

- MRI Brain without and with contrast (CPT® 70553) is indicated for:
  - Initial evaluation of newly diagnosed developmental motor delay with abnormal muscle tone.
  - Toe walking, when associated with upper motor neuron signs including hyperreflexia, abnormal tone (spasticity/hypotonia), or positive Babinski sign.
  - New or worsening focal neurologic findings documented on a physical examination within 60 days of the imaging request.
- Patients requiring sedation should generally not have non-contrast MRI studies. See **PEDHD-1.3: Pediatric Head Imaging Modality General Considerations**.

- For spinal imaging requests See **SP-7.1: Myelopathy** in the **Spine Imaging Guidelines** and **PEDSP-5: Tethered Cord** in the **Pediatric Spine Imaging Guidelines.**

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PEDHD-20: Ataxia

Ataxia refers to an abnormally ill-coordinated or unsteady gait for age. “Limb ataxia” refers to impaired coordination (for age) of limbs, especially arms. Developmental failure to acquire the ability to walk is a form of developmental delay, not ataxia.

(See **PEDHD-19: Intellectual Disability, Cerebral Palsy, and Developmental Motor Delay**)

- A recent (within 60 days) face-to-face evaluation including a detailed history, physical examination with a thorough neurologic examination, and appropriate laboratory studies should be performed prior to considering advanced imaging, unless the patient is undergoing guideline-supported scheduled follow-up imaging evaluation or request is from or in consultation with a neurologist or neurosurgeon who has seen the patient since onset of symptoms.
- MRI Brain without and with contrast (CPT® 70553) can be performed to evaluate ataxia, hereditary ataxia, and slowly progressive ataxia.
  - If spinal etiology is suspected the following may be indicated:
    - MRI Cervical Spine (CPT® 72141 or CPT® 72156) and/or
    - MRI Thoracic Spine (CPT® 72156 or CPT® 72157) and/or
    - MRI Lumbar Spine (CPT® 72148 or CPT® 72149)
- Patients requiring sedation should generally not have non-contrast MRI studies. See **PEDHD-1.3: Pediatric Head Imaging Modality General Considerations**.
- CT Head without and with contrast (CPT® 70470) or with contrast (CPT® 70460) is indicated for patients who have a contraindication to MRI.
  - CT should not be used in place of MRI solely to avoid sedation in young children because MRI is superior for imaging the posterior fossa.
  - If there is a contraindication to contrast and a spinal etiology is suspected the following may be indicated:
    - CT Cervical Spine (CPT® 72125 or CPT® 72127) and/or
    - CT Thoracic Spine (CPT® 72128 or CPT® 72130) and/or
    - CT Lumbar Spine (CPT® 72131 or CPT® 72133)
- CT Head without contrast (CPT® 70450) or without and with contrast (CPT® 70470) or MRI Brain without contrast (CPT® 70551) or without and with contrast (CPT® 70553) is indicated for patients with acute ataxia following significant head trauma.
- Repeat imaging may be appropriate no more frequently than every 12 months when requested by a specialist or any provider in consultation with a specialist unless there are new signs or symptoms.

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PEDHD-21: Epistaxis

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PEDHD-21.1: Imaging

Initial evaluation of epistaxis (nosebleed), including recurrent epistaxis that is refractory to medical management is by direct or endoscopic visualization of the relevant portions of the upper airway.

- If a mass lesion is detected on direct visualization, any ONE of the following imaging studies is indicated:
  - CT Maxillofacial without contrast (CPT® 70486) or without and with contrast (CPT® 70488).
  - MRI Orbits/Face/Neck without and with contrast (CPT® 70543).

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PEDHD-22: Pseudotumor Cerebri

- Pseudotumor cerebri indications in pediatric patients are identical to those for adult patients. See **HD-17: Papilledema/Pseudotumor Cerebri** in the **Head Imaging Guidelines**.

PEDHD-23: Cranial Neuropathies

- MRI Brain without and with contrast (CPT® 70553) is indicated for all patients with new or worsening specific cranial nerve abnormalities.
- MRI Neck without and with contrast (CPT® 70543) is also indicated for patients with abnormalities in cranial nerves IX, X, XI, or XII.

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PEDHD-24: Pediatric Sleep Disorders

- See **SL-3: Pediatric Sleep Guidelines** in the Sleep Apnea and Treatment Clinical Guidelines
- Advanced imaging is not indicated for the following:
  - Parasomnias.
  - Bed wetting (if child is otherwise neurologically normal).
  - Insomnia.
  - Narcolepsy.
  - Restless Leg Syndrome (polysomnography is useful).
- For Obstructive Sleep Apnea, endoscopic examination of the upper airway and lateral upper airway x-rays should be performed initially.
  - CT Maxillofacial without contrast (CPT® 70486) may be indicated for evaluation of obstructive anatomy if operative intervention is being considered.
- For Central Sleep Apnea, MRI Brain without contrast (CPT® 70551) or without and with contrast (CPT® 70553) is indicated if the clinical picture and/or polysomnography study suggests central sleep apnea.
- There is no indication for imaging prior to tonsillectomy for obstructive sleep apnea

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PEDHD-25: Temporomandibular Joint (TMJ) Imaging in Children

- Temporomandibular Joint (TMJ) Imaging in Children indications in pediatric patients are very similar to those for adult patients. See **HD-30.1: Temporomandibular Joint Disease (TMJ)** in the **Head Imaging Guidelines**.
- Pediatric-specific imaging considerations include the following:
  - There is a paucity of clinical symptoms and poor sensitivity of conventional x-rays in diagnosing TMJ arthritis in pediatric patients with arthritis
    - MRI TMJ (CPT® 70336) is indicated annually for detecting silent TMJ arthritis in children with juvenile idiopathic arthritis (JIA).

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PEDHD-26: Movement Disorders including Tourette's Syndrome

PEDHD-26.1: Tourette's Syndrome

The diagnosis of Tourette's syndrome is made clinically and advanced neuroimaging is not indicated for either diagnosis or management.

PEDHD-26.2: Movement Disorders

Movement disorders are hyperkinetic and hypokinetic movements that are involuntary. The majority are diagnosed based on a clinical diagnosis and do not require imaging.

- Typically Benign Movement disorders include:
  - Stereotypies, repetitive rhythmic movements
  - Tics that are vocal or motor with typical onset and course
  - Tourette Syndrome
  - Essential Tremor or tremors of anxiety or weakness
  - Restless Leg Syndrome
- MRI Brain without contrast (CPT® 70551), or without and with contrast (CPT® 70553) is considered in the following clinical scenarios:
  - Atypical clinical features for example, movements that persist in sleep, onset outside of typical age at onset (4-6 years for tics) , rapid progression, incomplete or uncertain medication responsiveness, or clinical diagnostic uncertainty, limbic encephalitis
  - Dystonia, intermittent involuntary muscle contractions
  - Chorea, continual irregular movements
  - Ballism, involuntary high amplitude movements
  - Athetosis, slow writhing continuous movements
  - Myoclonus, involuntary muscle jerks (not sleep myoclonus)
- For concerns of PANS (Pediatric acute-onset neuropsychiatric syndrome) and PANDAS (Pediatric autoimmune neuropsychiatric disorder associated with streptococcal infection), MRI Brain without contrast (CPT® 70551), or without and with contrast (CPT® 70553) may be considered only after a complete medical workup including labs, acute infection, and other comorbid psychiatric disorders (e.g. OCD, ADHD and ASD) have been investigated as routine brain imaging is not routinely recommended.
- These cases should be forwarded for Medical Director Review
  - Suspected Huntington Disease
  - Evaluation for surgical treatment of Essential Tremor or Parkinson's disease, including Deep Brain Stimulator (DBS) placement
- CT Head without contrast (CPT® 70450) may be performed in follow up after surgery for DBS placement.

Practice Notes

There is little evidence to support the use of MRA/CTA and PET in the evaluation of movement disorders.

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PEDHD-27: Tuberous Sclerosis

- See **PEDONC-2.9: Tuberous Sclerosis Complex (TSC)** in the **Pediatric Oncology Imaging Guidelines**.

PEDHD-28: Von Hippel-Lindau Syndrome (VHL)

- See **PEDONC-2.10: Von Hippel-Lindau Syndrome (VHL)** in the **Pediatric Oncology Imaging Guidelines**.

PEDHD-29: CNS Infection

- CNS infection imaging indications in pediatric patients are similar to those for adult patients. See **HD-14: CNS Infection** in the **Head Imaging Guidelines**.
- Pediatric-specific imaging considerations include suspected congenital brain infection and neonatal meningitis. The common causes of prenatal infections of the central nervous system are cytomegalovirus, *Toxoplasma gondii*, herpes simplex type 2 virus and most recently zika virus. The findings suggesting prenatal brain infection include microcephaly, microphthalmia, chorioretinitis, cataracts, hypotonia, and seizures. The following are performed for congenital brain infections:
  - The following imaging is considered for newborn infants with suspected prenatal brain infection regardless of inciting organism. (For additional information see CDC's Areas with risk of Zika site: https://wwwnc.cdc.gov/travel/page/zika-information)
    - Ultrasound Head (CPT© 76506) can be approved as an initial imaging study.
    - If the ultrasound is abnormal, MRI Brain without and with contrast (CPT® 70553) is indicated.
  - Newborn infants with microcephaly should be evaluated as discussed in **PEDHD-7: Macrocephaly, Microcephaly, and Hydrocephalus**.
- Neonatal meningitis is most often caused by bacterial pathogens and usually occurs as a complication of sepsis in the first week of life. In older infants and children, meningeal inoculation occurs secondary to hematogenous spread or penetrating trauma.
- The following imaging is considered for newborns or older infants with an open fontanelle and suspected meningitis.
  - Ultrasound Head (CPT© 76506) can be approved as an initial imaging study.
  - If the ultrasound is abnormal, MRI Brain without and with contrast (CPT® 70553) is indicated.
- Patients requiring sedation should generally not have only non-contrast MRI studies. See **PEDHD-1.3: Pediatric Head Imaging Modality General Consideration**.

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PEDHD-30: Scalp and Skull Lesions

- Scalp and skull lesion imaging indications in pediatric patients are identical to those for adult patients with the exception of neonates. See **HD-20: Scalp and Skull Lesions** in the **Head Imaging Guidelines**.
  - In neonates and young infants, scalp masses include:
    - Congenital lesions (cephalocele-discussed above, dermoid cysts, epidermoid cyst)
    - Vascular lesions (hemangioma, sinus pericranii)
    - Extracranial hemorrhage related to birth trauma (caput succedaneum, cephalohematoma, subgaleal hematoma)
    - After the first year of life, malignant tumors, such as Langerhans cell histiocytosis metastases from neuroblastoma and rhabdomyosarcoma are an additional cause of a scalp mass.
- The following imaging is considered for newborns with palpable scalp and skull lesions.
  - Ultrasound Head (CPT® 76506) can be approved as an initial imaging study.
  - If the ultrasound is abnormal and associated anomalies are suspected, MRI Brain without and with contrast (CPT® 70553) (preferred) or CT Head without and with contrast (CPT® 70470) is indicated.

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PEDHD-31: Eye Disorders

- Eye disorder imaging indications in pediatric patients are close to identical to those for adult patients. See **HD-32: Eye Disorders and Visual Loss** in the Head Imaging Guidelines.
- For specific pediatric conditions: MRI Brain without contrast (CPT® 70551) or MRI with and without contrast (CPT® 70553) can be performed for Optic Nerve Hypoplasia, Septo-Optic Dysplasia and/or Infantile Nystagmus Syndrome.
- For traumatic retinal hemorrhages as seen in suspected shaken baby syndrome (See **PEDHD-4.1: Head Trauma**)

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