

CIGNA MEDICAL COVERAGE POLICIES – RADIOLOGY

Pediatric Head Imaging Guidelines

Effective Date: February 1, 2025



Instructions for use

The following coverage policy applies to health benefit plans administered by Cigna. Coverage policies are intended to provide guidance in interpreting certain standard Cigna benefit plans and are used by medical directors and other health care professionals in making medical necessity and other coverage determinations. Please note the terms of a customer's particular benefit plan document may differ significantly from the standard benefit plans upon which these coverage policies are based. For example, a customer's benefit plan document may contain a specific exclusion related to a topic addressed in a coverage policy.

In the event of a conflict, a customer's benefit plan document always supersedes the information in the coverage policy. In the absence of federal or state coverage mandates, benefits are ultimately determined by the terms of the applicable benefit plan document. Coverage determinations in each specific instance require consideration of:

1. The terms of the applicable benefit plan document in effect on the date of service
2. Any applicable laws and regulations
3. Any relevant collateral source materials including coverage policies
4. The specific facts of the particular situation

Coverage policies relate exclusively to the administration of health benefit plans. Coverage policies are not recommendations for treatment and should never be used as treatment guidelines.

This evidence-based medical coverage policy has been developed by EviCore, Inc. Some information in this coverage policy may not apply to all benefit plans administered by Cigna.

These guidelines include procedures EviCore does not review for Cigna. Please refer to the **Cigna CPT code list** for the current list of high-tech imaging procedures that EviCore reviews for Cigna.

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Procedure Codes Associated with Head Imaging

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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

Procedure Codes Associated with Head Imaging	
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

Procedure Codes Associated with Head Imaging	
Unlisted CT procedure (for radiation planning or surgical software)	76497
CTA	CPT®
CTA Head	70496
CTA Neck	70498
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

General Guidelines (PEDHD-1.0)

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- A pertinent clinical evaluation including a detailed history, physical examination with a thorough neurologic examination since the onset or change in signs and/or symptoms²⁸, appropriate laboratory studies and basic imaging such as plain radiography or ultrasound should be performed prior to considering advanced imaging (CT, MR, Nuclear Medicine), unless the individual is undergoing guideline-supported scheduled imaging evaluation. A meaningful technological contact (telehealth visit, telephone call, electronic mail or messaging) since the onset or change in signs and/or symptoms²⁸, can serve as a pertinent clinical evaluation.
 - A detailed neurological exam is required prior to advanced imaging except in the following scenarios:
 - Individual is undergoing a guideline-supported scheduled follow-up imaging evaluation
 - Tinnitus, TMJ, Sinus or mastoid disease, ear pain, hearing loss, eye disease, papilledema²⁸, dental requests and epistaxis. (A relevant physical exam is still required.)
 - The request is from a neurologist, neurosurgeon, endocrinologist, otolaryngologist, or ophthalmologist who has evaluated the individual since onset of symptoms.
- Unless otherwise stated in a specific guideline section, the use of advanced imaging to screen asymptomatic individuals for disorders involving the head is not supported. Advanced imaging of the head is only indicated in individuals 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 individual management or treatment decisions.

Pediatric Head Imaging Age Considerations (PEDHD-1.1)

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- 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 individual age, comorbidities, and differences in disease natural history between children and adults.
- Individuals who are 18 years old or younger³⁰ and any conditions not specifically discussed in the General Head Imaging Guidelines should be imaged according to the Pediatric Head Imaging Guidelines. Any conditions not specifically discussed in the Pediatric Head Imaging Guidelines should be imaged according to the General Head Imaging Guidelines. Individuals who are >18 years old should be imaged according to the General Head Imaging Guidelines, except where directed otherwise by a specific guideline section.

Pediatric Head Imaging Appropriate Clinical Evaluation (PEDHD-1.2)

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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 is appropriate unless there is clear documentation of a need for the additional codes to cover all necessary body areas.
- See **General Guidelines - Anatomic Issues (HD-1.1)** in the Head Imaging Guidelines for the correct coding of these studies.

Pediatric Head Imaging Modality General Considerations (PEDHD-1.3)

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- 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 individual 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 individual 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 the guidelines for the clinical condition being evaluated, MRI/MRA 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.
- CT Head without contrast (CPT[®] 70450) may be indicated for:
 - Mass effect
 - Blood/blood products
 - Urgent/emergent settings due to availability and speed of CT
 - Trauma
 - Recent hemorrhage, whether traumatic or spontaneous
 - Bony structures of the head evaluations including dystrophic calcifications
 - Hydrocephalus evaluation and follow-up
 - Some centers use limited non-contrast “fast or rapid MRI” (CPT[®] 70551) to minimize radiation exposure in children - these requests are appropriate.
 - Prior to lumbar puncture in individuals with cranial complaints
 - Scenarios in which MRI is contraindicated (i.e. pacemakers, ICDs, cochlear implants, aneurysm clips, orbital metallic fragments, etc.)
- CT and MR Angiography (CTA and MRA) Head and Neck
 - MRA Head may be performed without contrast (CPT[®] 70544), with contrast (CPT[®] 70545), or without and with contrast (CPT[®] 70546).
 - CTA Head is performed without and with contrast (CPT[®] 70496).
 - MRA Neck may be done either without contrast (CPT[®] 70547), with contrast (CPT[®] 70548), or without and with contrast (CPT[®] 70549), depending on facility preference and protocols and type of scanner.
 - CTA Neck is done with and without contrast (CPT[®] 70496)
- Indications for CTA and MRA Head and Neck vessels include, but are not limited to the following:
 - MRA is the preferred study in children unless contraindicated:
 - Pulsatile tinnitus
 - Hemifacial spasm if consideration for surgical decompression
 - Evaluation of stroke or TIA (See **Pediatric Stroke Initial Imaging (PEDHD-12.2)**, **Pediatric Stroke Subsequent Imaging (PEDHD-12.3)**, **Moyamoya Disease (PEDHD-12.4)**, **Sickle Cell Disease (PEDHD-12.5)** and **CNS Vasculitis and Stroke (PEDHD-12.6)** including collateral assessment)
 - Follow up of known cerebral artery stenosis
 - Trigeminal neuralgia that has failed medical therapy
 - Cerebral sinus thrombosis suspected with increased intracranial pressure (refractory headaches, papilledema, diagnosis of pseudotumor cerebri)
 - Aneurysm suspected with acute “thunderclap” headache syndrome and appropriate screening or evaluation of known subarachnoid hemorrhage and pseudoaneurysms (may be appropriate to limit CTA to include only the head

to avoid unnecessary radiation to the individual) (See **Pediatric Intracranial Aneurysms (PEDHD-10.1)**)

- Noninflammatory vasculopathy, including radiation vasculopathy (See Long Term **Pediatric Cancer Survivors (PEDONC-19)** in the Pediatric and Special Populations Oncology Imaging Guidelines)
- Traumatic vascular injuries
- Vascular malformations, vascular anatomic variants and fistulas (See **Pediatric Intracranial Arteriovenous Malformations (AVM) (PEDHD-10.2)**)
- Arterial, including carotid dissections
- Tumors of vascular origin or involving vascular structures
- Surgical and radiation therapy localization, planning and neuronavigation
- Evaluation for vascular intervention and follow-up including postsurgical/posttreatment vascular complications
- Intra-cranial pre-operative planning if there is concern of possible vascular involvement or risk for vascular complication from procedure
- Vasculitis and collagen vascular disease (See **CNS Vasculitis and Stroke (PEDHD-12.6)**)
- Sickle cell disease (See **Sickle Cell Disease (PEDHD-12.5)**)
- Moyamoya disease (See **Moyamoya Disease (PEDHD-12.4)**)
- MRA Head without contrast (CPT[®] 70544), MRA head with contrast (CPT[®] 70545) **OR** MRA head without and with contrast (CPT[®] 70546) **OR** CTA Head (CPT[®] 70496) for follow up of aneurysm clipping or coiling procedures (See Intracranial Aneurysms (HD-12.1) in the Head Imaging Guidelines)
- CT and MR Venography (CTV and MRV) are reported with the same codes as the CTA/MRA counterpart (there is no specific code for CT/MR venography):
 - If arterial and venous CT or MR studies are both performed in the same session, only one CPT[®] code should be used to report both procedures
- MRA without and with contrast with venous sinus thrombosis to differentiate total from subtotal occlusion
- NOTE: Evaluation of posterior circulation disease requires both neck and head MRA/CTA to visualize the entire vertebral-basilar system.
- 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.
- 3D Rendering
 - CPT[®] 76377 (3D rendering requiring image post-processing on an independent workstation) or CPT[®] 76376 (3D rendering not requiring image post-processing on an independent workstation) can be considered in the following clinical scenarios:

- Bony conditions:
 - Evaluation of congenital skull abnormalities in newborns, infants, and toddler (usually for preoperative planning)
 - Complex joint fractures or pelvis fractures
 - Spine fractures (usually for preoperative planning)
 - Complex facial fractures
- Preoperative planning for other complex surgical cases
- Cerebral angiography
- 3D Rendering (CPT® 76377 or CPT® 76376) may be used for surgical planning and surgical follow up after craniotomy when ordered by surgical specialist.
- 3D Rendering indications in pediatric head imaging are identical to those in the general imaging guidelines. See 3D Rendering (Preface-4.1) 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.

Background and Supporting Information

- “The U.S. Food and Drug Administration (FDA) is warning that repeated or lengthy use of general anesthetic and sedation drugs during surgeries or procedures in children younger than 3 years or in pregnant women during their third trimester may affect the development of children’s brains. ...Published studies in pregnant animals and young animals have shown the use of general anesthetic and sedation drugs for more than 3 hours caused widespread loss of nerve cells in the brain. ...All the studies in children had limitations, and it is unclear whether any negative effects seen in children’s learning or behavior were due to the drugs or to other factors, such as the underlying medical condition that led to the need for the surgery or procedure.”²⁸

General Guidelines-Other Imaging Situations (PEDHD-1.4)

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- 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
- 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).
- MRI Brain with and without contrast (CPT[®] 70553) is appropriate in consideration of neurosarcoidosis
- CT or MRI Perfusion (See **CT or MRI Perfusion (HD-24.5)** in the Head Imaging Guidelines)
 - Performed as part of a CT Head or MRI Brain examination in the evaluation of individuals 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 individuals 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 not medically necessary. (See **Moyamoya Disease (PEDHD-12.4)**)
 - There is no specific CPT[®] code for MRI Perfusion. Perfusion weighted images are not coded separately from a MRI Brain examination. If MRI Brain is planned, no additional CPT[®] codes are necessary or appropriate to perform MRI perfusion.
- MRI Perfusion may be obtained with MRI Brain (CPT[®] 70551 **OR** CPT[®] 70552 **OR** CPT[®] 70553), no additional CPT[®] codes are necessary or appropriate to perform MRI perfusion.³¹

References (HDP-1)

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1. Siegel MJ. Brain. In: Pediatric sonography. 5th ed. Philadelphia, Wolters Kluwer. 2018. 40-111
2. Prabhu SP, Young-Poussaint T. Pediatric central nervous system emergencies. *Neuroimaging Clin N Am*. 2010;20(4):663-683. doi:10.1016/j.nic.2010.07.008
3. Patra KP, Lancaster JD, Hogg J, et al. Pediatric MRI of the Brain: a primer. *Pediatr Rev*. 2014 Mar; 35(3):106-113
4. Reighard C, Junaid S, Jackson WM, et al. Anesthetic Exposure During Childhood and Neurodevelopmental Outcomes. *JAMA Netw Open*. 2022;5(6):e2217427. doi:10.1001/jamanetworkopen.2022.174
5. Nakagawa TA, Ashwal S, Mathur M, Mysore M. the Committee for Determination of. Guidelines for the determination of brain death in infants and children: An Update of the 1987 Task Force Recommendations- Executive Summary. *Annals of Neurology*. 2012;71(4):573-585. doi:10.1002/ana.23552
6. Donohoe KJ, Agrawal G, Frey KA, et al. SNMPPractice Guideline for Brain Death Scintigraphy 2.0 *Journal of Nuclear Medicine Technology*. 2012;40(3):198-203. doi:10.2967/jnmt.112.105130
7. MacDonald A, and Burrell S. Infrequently performed studies in nuclear medicine: Part 2. *J Nucl Med Technol*. 2009 Mar; 37: 1-13
8. Fraum TJ, Ludwig DR, Bashir MR, et al. Gadolinium-based contrast agents: a comprehensive risk assessment. *J Magn Reson Imaging*. 2017; 46:338–353
9. FDA Drug Safety Communication: FDA warns that gadolinium-based contrast agents (GBCAs) are retained in the body; requires new class warnings. 5-16-2018 Update <https://www.fda.gov/drugs/drug-safety-and-availability/fda-drug-safety-communication-fda-warns-gadolinium-based-contrast-agents-gbcas-are-retained-body>
10. AIUM Practice Parameter for the Performance of Neurosonography in Neonates and Infants. *J Ultrasound Med*. 2020;39(5):E57-E61. doi:10.1002/jum.15264
11. Sodhi K, Gupta P, Saxena A, Khandelwal N, Singhi P. Neonatal cranial sonography: A concise review for clinicians. *Journal of Pediatric Neurosciences*. 2016;11(1):7. doi:10.4103/1817-1745.181261
12. Gupta P, Sodhi KS, Saxena AK, Khandelwal N, Singhi P. Neonatal cranial sonography: A concise review for clinicians[AGM1]. *J Pediatr Neurosci*. 2016;11(1):7-13. doi:10.4103/1817-1745.181261
13. ACR-ASNR-SPR Practice Parameter for the Performance of Computed Tomography (CT) of the Extracranial Head and Neck Revised 2021. (Resolution 5). <https://www.acr.org/-/media/ACR/Files/Practice-Parameters/CT-Head-Neck>
14. Stern BJ, Royal W, Gelfand JM, et al. Definition and Consensus Diagnostic Criteria for Neurosarcoidosis. *JAMA Neurology*. 2018;75(12):1546. doi:10.1001/jamaneurol.2018.2295
15. Shosha E, Dubey D, Palace J, et al. Area postrema syndrome. *Neurology*. 2018;91(17). doi:10.1212/wnl.0000000000006392
16. Hornby PJ. Central neurocircuitry associated with emesis. *The American Journal of Medicine*. 2001;111(8):106-112. doi:10.1016/s0002-9343(01)00849-x
17. ACR-ASNR- SPR Practice Parameters for the performance of Computed Tomography (CT) perfusion in neuroradiologic imaging. Revised 2017. (Resolution 18). <https://www.acr.org/-/media/ACR/Files/Practice-Parameters/CT-Perfusion.pdf>
18. Blumfield E, Swenson DW, Iyer RS, Stanescu AL. Gadolinium-based contrast agents — review of recent literature on magnetic resonance imaging signal intensity changes and tissue deposits, with emphasis on pediatric patients. *Pediatric Radiology*. 2019;49(4):448-457. doi:10.1007/s00247-018-4304-8
19. ACR ASNR SPR Practice Parameter for the Performance and Interpretation of Cervicocerebral Computed Tomography Angiography (CTA) Revised 2020. <https://www.acr.org/-/media/ACR/Files/Practice-Parameters/CervicoCerebralCTA.pdf?la=en>
20. ACR ASNR SPR Practice Parameter for the Performance and Interpretation of Magnetic Resonance Imaging (MRI) of the Brain. Revised 2019. <https://www.acr.org/-/media/ACR/Files/Practice-Parameters/MR-Brain.pdf>
21. ACR-ASNR-SNIS-SPR Practice Parameter for the Performance of Cervicocerebral Magnetic Resonance Angiography (MRA) Revised 2020 <https://www.acr.org/-/media/ACR/Files/Practice-Parameters/cervicocerebralmra.pdf?la=en>

22. Drug Safety Communication: FDA review results in new warnings about using general anesthetics and sedation drugs in young children and pregnant women. 12/14/2016. https://www.fda.gov/drugs/drug-safety-and-availability/fda-drug-safety-communication-fda-review-results-new-warnings-about-using-general-anesthetics-and?source=govdelivery&utm_medium=email&utm_source=govdelivery
23. Drug Safety Communication: FDA approves label changes for use of general anesthetic and sedation drugs in young children. 4-27-2017 Update. <https://www.fda.gov/drugs/drug-safety-and-availability/fda-drug-safety-communication-fda-approves-label-changes-use-general-anesthetic-and-sedation-drugs>
24. Response to the FDA Med Watch December 16, 2016. American Academy of Pediatrics. https://www.aap.org/en-us/_layouts/15/WopiFrame.aspx?sourcedoc=/en-us/Documents/Response_FDA_12-16_Statement.docx&action=default
25. Artunduaga M, Liu CA, Morin CE, et al. Safety challenges related to the use of sedation and general anesthesia in pediatric patients undergoing magnetic resonance imaging examinations. *Pediatr Radiol*. 2021;51(5):724-735. doi:10.1007/s00247-021-05044-5
26. ACR–AIUM–SPR–SRU PRACTICE PARAMETER FOR THE PERFORMANCE OF NEUROSONOGRAPHY IN NEONATES AND INFANTS. Revised 2019. <https://www.acr.org/-/media/ACR/Files/Practice-Parameters/Neurosonog.pdf>
27. ACR–ASNR–SPR PRACTICE PARAMETER FOR THE PERFORMANCE OF COMPUTED TOMOGRAPHY (CT) OF THE HEAD. Revised 2019. <https://www.acr.org/-/media/ACR/Files/Practice-Parameters/CT-Head.pdf>
28. History and Physicals - Understanding the Requirements at <https://www.jointcommission.org/standards/standard-faqs/critical-access-hospital/medical-staff-ms/000002272/?p=1>
29. Aylward SC, Reem RE. Pediatric Intracranial Hypertension. *Pediatr Neurol*. 2017 Jan;66:32-43. doi: 10.1016/j.pediatrneurol.2016.08.010
30. Implementation Guide: Medicaid State Plan Eligibility Eligibility Groups Mandatory Coverage Infants and Children under Age 19 Guidance Portal. <https://www.hhs.gov/guidance/document/implementation-guide-medicaid-state-plan-eligibility-eligibility-groups-aeu-mandatory-2>
31. ACR–ASNR–SPR PRACTICE PARAMETER FOR THE PERFORMANCE OF INTRACRANIAL MAGNETIC RESONANCE PERFUSION IMAGING. Revised 2022 (Resolution 24). PRACTICE PARAMETER MR_Perfusion.[https:// la=en](https://la=en).

Specialized Imaging Techniques (PEDHD-2)

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

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- 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.
- Uses in pediatric neuro-oncology: See **Pediatric CNS Tumors (PEDONC-4)** in the Pediatric and Special Populations Oncology Imaging Guidelines.
- MRS is indicated in individuals with neonatal hypoxic ischemic encephalopathy to help estimate the age of the injury.
- Uses in Metabolic Disorders:
 - See **Neurometabolic and Neurogenetic Disorders (PEDHD-19.4)**
- MRS is considered not medically necessary for all other pediatric indications at this time.

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

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- 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 performed concurrently with MRI Brain (CPT[®] 70551 or CPT[®] 70553) and/or PET Brain Metabolic (CPT[®] 78608 or CPT[®] 78609).
- fMRI is considered not medically necessary for all other pediatric indications at this time.

PET Brain Imaging (CPT[®] 78608) (PEDHD-2.3)

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- Uses in pediatric neuro-oncology: See **Pediatric CNS Tumors (PEDONC-4)** in the Pediatric and Special Populations Oncology Imaging Guidelines.
- Metabolic (FDG) 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 appropriate concurrently with MRI Brain (CPT[®] 70551 or CPT[®] 70553) and/or fMRI (CPT[®] 70554 or CPT[®] 70555).
- Metabolic (FDG) PET Brain/MRI is generally not supported for neurologic conditions due to lack of standardization in imaging technique and interpretation. However, it can be appropriate in certain pediatric individuals when ALL of the following criteria are met:
 - The individual meets guideline criteria for Metabolic (FDG) PET/CT Brain AND
 - Metabolic (FDG) PET/CT Brain is not available at the treating institution AND
 - The provider requests Metabolic (FDG) PET Brain/MRI in lieu of Metabolic (FDG) PET/CT Brain
- Metabolic (FDG) PET Brain/MRI, when the above criteria are met, are reported using the code combination of Metabolic (FDG) PET Brain (CPT[®] 78608) and MRI Brain (CPT[®] 70551 or CPT[®] 70553). All other methods of reporting Metabolic (FDG) PET Brain/MRI are inappropriate
 - When clinically appropriate, diagnostic MRI codes can be appropriate at the same time as the Metabolic (FDG) PET Brain/MRI code combination.
- Metabolic (FDG) PET Brain is considered not medically necessary for all other pediatric indications at this time.

References (HDP-2)

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1. Hertz-Pannier L, Noulhaine M, Rodrigo S, et al. Pretherapeutic functional magnetic resonance imaging in children. *Neuroimag Clin N Am*. 2014 Nov; 24 (4): 639-653
2. Patra KP, Lancaster JD, Hogg J, et al. Pediatric MRI of the brain: a primer. *Pediatr Rev*. 2014 Mar; 35 (3):106-111
3. Schneider JF. MR Spectroscopy in children: protocols and pitfalls in non-tumorous brain pathology. *Pediatr Radiol*. 2016 Jun; 46 (7): 963-982
4. Expert Panel on Pediatric Imaging, Trofimova A, Milla SS, et al. ACR Appropriateness Criteria® Seizures-Child. *J Am Coll Radiol*. 2021;18(5S):S199-S211. doi:10.1016/j.jacr.2021.02.020
5. Ramey WL, Martirosyan NL, Lieu CM, et al. Current management and surgical outcomes of medically intractable epilepsy. *Clin Neurol Neurosurg*. 2013 Dec; 115 (12): 2411-2418
6. Ghei SK, Zan E, Nathan JE, et al. MR Imaging of Hypoxic-Ischemic Injury in Term Neonates: Pearls and Pitfalls. *RadioGraphics*. 2014;34(4):1047-1061. doi:10.1148/rg.344130080
7. Schwartz ES, Barkovich AJ. Brain and spine injuries in infancy and childhood. In: Barkovich AJ, Raybaud C, eds. *Pediatric Neuroimaging*, 6th ed. Philadelphia PA. Wolters Kluwer. 2019; 263-404
8. Boerwinkle VL, Cediel EG, Mirea L, et al. Network-targeted approach and postoperative resting-state functional magnetic resonance imaging are associated with seizure outcome. *Annals of Neurology*. 2019;86(3):344-356. doi:10.1002/ana.25547
9. Yahyavi-Firouz-Abadi N, Pillai J, Lindquist M, et al. Presurgical Brain Mapping of the Ventral Somatomotor Network in Patients with Brain Tumors Using Resting-State fMRI. *American Journal of Neuroradiology*. 2017;38(5):1006-1012. doi:10.3174/ajnr.a5132
10. Szaflarski JP, Gloss D, Binder JR, et al. Practice guideline summary: Use of fMRI in the presurgical evaluation of patients with epilepsy. *Neurology*. 2017;88(4):395-402. doi:10.1212/wnl.0000000000003532

Pediatric Headache (PEDHD-3)

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Pediatric Headache (PEDHD-3.1)

HDP.PH.0003.1.A

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- A pertinent clinical evaluation including a detailed history, physical examination with a thorough neurologic examination, since the onset or change in signs and/or symptoms, and appropriate laboratory studies should be performed prior to considering advanced imaging.
- Advanced imaging is not indicated for pediatric individuals with headache in the absence of supported indications.

Indications	Supported Imaging
<ul style="list-style-type: none"> ◦ Age ≤5 years ◦ Focal neurological complaints including acute hypertension or altered mental status ◦ Clumsiness (common description of gait or coordination problems in young children) ◦ Headaches awakening from sleep or always present in the morning ◦ Headaches associated with morning nausea/vomiting ◦ Seizures ◦ 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 individual ◦ 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 ◦ Neurological signs and/or symptoms, including headache, after COVID-19 infection ◦ If a recent Head CT is inconclusive 	<ul style="list-style-type: none"> ◦ MRI Brain without contrast (CPT[®] 70551) OR ◦ MRI Brain without and with contrast (CPT[®] 70553)
<ul style="list-style-type: none"> ◦ Abnormality identified on MRI Brain without contrast (CPT[®] 70551) performed less than 2 weeks prior to request 	<ul style="list-style-type: none"> ◦ MRI Brain with contrast (CPT[®] 70552)

Indications	Supported Imaging
<ul style="list-style-type: none"> ◦ Abnormality identified on MRI Brain without contrast (CPT[®] 70551) performed greater than 2 weeks prior to request 	<ul style="list-style-type: none"> ◦ MRI Brain without and with contrast (CPT[®] 70553)
<ul style="list-style-type: none"> ◦ Headache precipitated by coughing, sneezing, physical exertion or Valsalva¹¹ ◦ Thunderclap headache¹¹ ◦ Individual with hypercoagulable state or bleeding disorder¹¹ 	<ul style="list-style-type: none"> ◦ MRI Brain without contrast (CPT[®] 70551) OR ◦ MRI Brain without and with contrast (CPT[®] 70553) AND/OR ◦ MRA Head (CPT[®] 70544, CPT[®] 70545, or CPT[®] 70546) OR ◦ CTA Head (CPT[®] 70496)
<ul style="list-style-type: none"> ◦ Papilledema on physical exam¹¹ ◦ Focal signs and/or symptoms of bruit, dissection, vertebrobasilar insufficiency and/or positional changes^{9,11} 	<ul style="list-style-type: none"> ◦ MRI Brain without contrast (CPT[®] 70551) OR ◦ MRI Brain without and with contrast (CPT[®] 70553) AND/OR ◦ MRA Head (CPT[®] 70544, CPT[®] 70545, or CPT[®] 70546) OR ◦ CTA Head (CPT[®] 70496) OR ◦ MRV Head (CPT[®] 70544, CPT[®] 70545, or CPT[®] 70546) <p>For requests of MRA OR CTA AND MRV: See Pediatric Head Imaging Modality General Considerations (PEDHD-1.3)</p>

Indications	Supported Imaging
<ul style="list-style-type: none"> ◦ Urgent/Emergent settings ◦ 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 General Guidelines-Other Imaging Situations (PEDHD-1.4)) ◦ 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 Macrocephaly, Microcephaly, and Hydrocephalus (PEDHD-7) for additional imaging 	<ul style="list-style-type: none"> ◦ CT Head without contrast (CPT[®] 70450)

- If concern for CNS infection – See **CNS Infection (PEDHD-29)**
- CT Head poorly visualizes the posterior fossa in children and is generally insufficient to evaluate pediatric headaches in the absence of supported indications. CT is not supported in lieu of MRI solely to avoid sedation.

Background and Supporting Information

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.

References (HDP-3)

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1. Expert Panel on Pediatric Imaging, Hayes LL, Palasis S, et al. ACR Appropriateness Criteria® Headache-Child. *J Am Coll Radiol*. 2018;15(5S):S78-S90. doi:10.1016/j.jacr.2018.03.017
2. Expert Panel on Pediatric Imaging, Ryan ME, Pruthi S, et al. ACR Appropriateness Criteria® Head Trauma-Child. *J Am Coll Radiol*. 2020;17(5S):S125-S137. doi:10.1016/j.jacr.2020.01.026
3. De Vries A, Young PC, Wall E, et al. CT scan utilization patterns in pediatric patients with recurrent headache. *Pediatrics*. 2013;132(1);e1-e8. doi:10.1542/peds.digest1321
4. Trofimova A, Vey BL, Mullins ME, Wolf DS, Kadom N. Imaging of Children With Nontraumatic Headaches. *AJR Am J Roentgenol*. 2018;210(1):8-17. doi:10.2214/AJR.17.18561
5. Dao JM, Qubty W. Headache Diagnosis in Children and Adolescents. *Curr Pain Headache Rep*. 2018;22(3). doi:10.1007/s11916-018-0675-7
6. Bear JJ, Gelfand AA, Goadsby PJ, Bass N. Occipital headaches and neuroimaging in children. *Neurology*. 2017;89(5):469-474. doi:10.1212/WNL.0000000000004186
7. Loder E, Weizenbaum E, Frishberg B, Silberstein S. Choosing Wisely in Headache Medicine: The American Headache Society's List of Five Things Physicians and Patients Should Question. *Headache*. 2013;53(10):1651-1659. doi:10.1111/head.12233
8. Gofshteyn JS, Stephenson DJ. Diagnosis and Management of Childhood Headache. *Curr Probl in Pediatr and Adolesc Health Care*. 2016;46(2):36-51. doi:10.1016/j.cppeds.2015.11.003
9. Dalvi N, Sivaswamy L. Life-Threatening Headaches in Children: Clinical Approach and Therapeutic Options. *Pediatric Annals*. 2018;47(2). doi:10.3928/19382359-20180129-04
10. Klein J, Koch T. Headache in Children. *Pediatr Rev*. 2020;41(4):159-171. doi:10.1542/pir.2017-0012.
11. Sarma A, Poussaint TY. Indications and Imaging Modality of Choice in Pediatric Headache. *Neuroimaging Clin N Am*. 2019;29(2):271-289. doi:10.1016/j.nic.2019.01.007
12. Kadom N. Imaging of Headaches: Appropriateness and Differential Diagnosis. *Pediatr Ann*. 2020;49(9):e389-e394. doi:10.3928/19382359-20200819-01

Pediatric Head and Face Trauma (PEDHD-4)

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Head Trauma (PEDHD-4.1)

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- In individuals with recent head trauma, a history focused on the incident and careful examination of the head, neck, and neurological function should be performed since the onset or change in signs and/or symptoms 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 injury¹⁰
 - Including, but not limited to:
 - Motor vehicle crash with patient ejection
 - Motor vehicle crash with death of another passenger
 - Motor vehicle crash with rollover
 - Pedestrian or bicyclist without helmet struck by a motorized vehicle
 - Head struck by a high-impact object
 - Falls of more than 1.5 m (5 feet) for children aged 2 years and older and more than 0.9 m (3 feet) for those younger than 2 years
 - Severe or worsening headache
 - Amnesia
 - Nonfrontal scalp hematoma
- CT Head without contrast (CPT[®] 70450) is the primary advanced imaging study in individuals 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) **OR** MRI Brain without and with contrast (CPT[®] 70553) 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 **Suspected Physical Child Abuse (PEDMS-7)** 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 repeat neuroimaging during the initial 8 weeks following injury with:
 - MRI Brain without contrast (CPT[®] 70551) **OR**
 - MRI Brain without and with contrast (CPT[®] 70553) **OR**
 - CT Head without contrast (CPT[®] 70450)

Facial Trauma (PEDHD-4.2)

HDP.PS.0004.2.A

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

Coding of Facial Imaging

- Both CT Orbital/Facial/Temporal Bone without contrast (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 without contrast (CPT[®] 70486) is the usual study (except in obvious orbital or temporal bone trauma), but either study is appropriate.

References (HDP-4)

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1. Expert Panel on Pediatric Imaging, Ryan ME, Pruthi S, et al. ACR Appropriateness Criteria® Head Trauma-Child. *J Am Coll Radiol*. 2020;17(5S):S125-S137. doi:10.1016/j.jacr.2020.01.026
2. Osmond MH, Klassen TP, Wells GA, et al. CATCH: a clinical decision rule for the use of computed tomography in children with minor head injury. *CMAJ*. 2010 Mar 9; 182 (4): 341-348. doi:10.1503/cmaj.091421
3. Nigrovic LE, Stack AM, Mannix RC, et al. Quality improvement effort to reduce Cranial CTs for children with minor blunt head trauma. *Pediatrics*. 2015; 136 (1): e227-e233
4. Homme J(JL. Pediatric Minor Head Injury 2.0. *Emergency Medicine Clinics of North America*. 2018;36(2):287-304. doi:10.1542/peds.2014-3588
5. Lumba-Brown A, Yeates KO, Sarmiento K, et al. Centers for Disease Control and Prevention Guideline on the Diagnosis and Management of Mild Traumatic Brain Injury Among Children. *JAMA Pediatr*. 2018;172(11):e182853. doi:10.1001/jamapediatrics.2018.2853
6. Babl FE, Borland ML, Phillips N, et al. Accuracy of PECARN, CATCH, and CHALICE head injury decision rules in children: a prospective cohort study. *Lancet*. 2017;389(10087):2393-2402.doi:10.1016/S0140-6763(17)30555-X
7. O'Brien WT, Caré MM, Leach JL. Pediatric Emergencies: Imaging of Pediatric Head Trauma. *Semin Ultrasound CT MR*. 2018;39(5):495-514. doi:10.1053/j.sult.2018.01.007
8. Schachar JL, Zampolin RL, Miller TS, Farinhas JM, Freeman K, Taragin BH. External validation of the New Orleans Criteria (NOC), the Canadian CT Head Rule (CCHR) and the National Emergency X-Radiography Utilization Study II (NEXUS II) for CT scanning in pediatric patients with minor head injury in a non-trauma center. *Pediatr Radiol*. 2011;41(8):971-979. doi:10.1007/s00247-011-2032-4
9. Taylor CA, Bell JM, Breiding MJ, Xu L. Traumatic Brain Injury–Related Emergency Department Visits, Hospitalizations, and Deaths — United States, 2007 and 2013. *MMWR Surveill Summ*. 2017;66(9):1-16. doi:10.15585/mmwr.ss6609a1
10. Kuppermann N, Holmes JF, Dayan PS, et al. Identification of children at very low risk of clinically-important brain injuries after head trauma: a prospective cohort study. *Lancet*. 2009;374(9696):1160-1170. doi:10.1016/S0140-6736(09)61558-0
11. Easter JS, Bakes K, Dhaliwal J, Miller M, Caruso E, Haukoos JS. Comparison of PECARN, CATCH, and CHALICE Rules for Children With Minor Head Injury: A Prospective Cohort Study. *Ann Emerg Med*. 2014;64(2). doi:10.1016/j.annemergmed.2014.01.030
12. Harmon KG, Clugston JR, Dec K, et al. American Medical Society for Sports Medicine position statement on concussion in sport. *Br J of Sports Med*. 2019;53(4):213-225. doi:10.1136/bjsports-2018-100338.
13. ACR-ASNR-SPR Practice Parameter for the Performance of Computed Tomography (CT) of the Extracranial Head and Neck Revised 2021. (Resolution 5). <https://www.acr.org/-/media/ACR/Files/Practice-Parameters/CT-Head-Neck>
14. Gelineau-Morel RN, Zinkus TP, Le Pichon JB. Pediatric Head Trauma: A Review and Update. *Pediatr Rev*. 2019;40(9):468-481. doi:10.1542/pir.2018-0257

Sinusitis and Allergic Rhinitis (PEDHD-5)

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Sinus And Facial Imaging General Considerations (PEDHD-5.1)

HDP.AR.0005.1.A

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- 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.

Imaging Indications in Sinusitis (PEDHD-5.2)

HDP.AR.0005.2.A

v1.0.2025

- 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, including nasal obstruction, facial pressure/pain or cough¹⁰ for >90 days)
 - Known or suspected fungal sinusitis
 - MRI Orbit/Face/Neck without and with contrast (CPT[®] 70543) is appropriate 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
 - Immunocompromised individual
 - 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/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) is appropriate 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 individuals who have responded satisfactorily to treatment, but is appropriate with clear documentation of the need for updated CT results to direct acute patient care decisions.

Stereotactic CT Localization (CPT[®] 77011) (PEDHD-5.3)

HDP.AR.0005.3.A

v1.0.2025

- 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 individual'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.

Requests for both Head and Sinus Imaging (PEDHD-5.4)

HDP.AR.0005.4.A

v1.0.2025

- 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 individuals being evaluated for potential sinus surgery, separate CT Sinus is often appropriate even after a MRI Brain in order to visualize obstructions to spontaneous mucus flow. See **Stereotactic CT Localization (CPT[®] 77011) (PEDHD-5.3)**.
- Separate head imaging is not generally indicated in individuals 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

Allergic Rhinitis (PEDHD-5.5)

HDP.AR.0005.5.A

v1.0.2025

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

Other Indications for Sinus Imaging (PEDHD-5.6)

HDP.AR.0005.6.A

v1.0.2025

- See **Facial Trauma (PEDHD-4.2)** for imaging guidelines in trauma.
- CT Maxillofacial without contrast (CPT[®] 70486) - Congenital anomalies of facial structures.
- Cleft lip and palate can be associated with brain malformations and abnormal brain development.
 - MRI Brain (CPT[®] 70551) is appropriate in cases of cleft lip and/or palate.
 - MRI Orbits/Face/Neck without contrast (CPT[®] 70540) or MRI Orbits/Face/Neck with and without contrast (CPT[®] 70543)⁸ is appropriate if requested by surgeon or any provider in consultation with the surgeon. See **Facial Anomalies (PEDHD-8.2)**
- 3D CT reconstructed images (CPT[®] 76377) **OR** CPT[®] 76376) in conjunction with routine CT should be an integral part of the examination in evaluating craniofacial abnormalities.
- CT Maxillofacial without and with contrast (CPT[®] 70488) **OR** MRI Orbits/Face/Neck without and with contrast (CPT[®] 70543) - Tumors or other disorders of facial structures.
- Obstructive sleep apnea See **Pediatric Sleep Disorders (PEDHD-24.1)** for imaging guidelines.
- See **Sinus and Facial Imaging (HD-29)** for conditions not addressed in **Sinus and Facial Imaging (PEDHD-5)**

References (HDP-5)

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1. Wald ER, Applegate KE, Bordley C, et al. Clinical Practice Guideline for the Diagnosis and Management of Acute Bacterial Sinusitis in Children Aged 1 to 18 Years. *PEDIATRICS*. 2013;132(1):e262-e280. doi:10.1542/peds.2013-1071
2. Expert Panel on Pediatric Imaging; Tekes A, Palasis S, et al. ACR Appropriateness Criteria® Sinusitis-Child. *J Am Coll Radiol*. 2018;15(11S):S403-S412. doi:10.1016/j.jacr.2018.09.029
3. Magit A. Pediatric Rhinosinusitis. *Otolaryngol Clin of North Am*. 2014;47(5):733-746. doi:10.1016/j.otc.2014.06.003
4. Siedman MD, Gurgel RK, Lin SY, et al. Clinical Practice Guideline.allergic rhinitis executive summary *Otolaryngol Head Neck Surg*. 2015;152(2):197-206. doi:10.1177/0194599814562166
5. AAP Releases Guideline on Diagnosis and Management of Acute Bacterial Sinusitis in Children One to 18 Years of Age. *Am Fam Physician*. 2014 Apr 15;89:676-681
6. ACR-ASNR-SPR Practice Parameter for the Performance of Computed Tomography (CT) of the Extracranial Head and Neck Revised 2021. (Resolution 5). <https://www.acr.org/-/media/ACR/Files/Practice-Parameters/CT-Head-Neck>
7. Gallagher ER, Collett BR. Neurodevelopmental and Academic Outcomes in Children With Orofacial Clefts: A Systematic Review. *Pediatrics*. 2019;144(1):e20184027. doi:10.1542/peds.2018-4027
8. Ornoy, A. Craniofacial malformations and their association with brain development: the importance of a multidisciplinary approach for treatment. *Odontology*. 2019;108(1):1-15. doi:10.1007/s10266-019-00433-7
9. Kucukguven A, Calis M, Topaloglu H, Ozgur F. Assessment of Neurologic Disorders and Rare Intracranial Anomalies Associated With Cleft Lip and Palate. *J of Craniofac Surg*. 2018;29(8):2195-2197. doi:10.1097/scs.0000000000004848
10. Brietzke SE, Shin JJ, Choi S, et al. Clinical consensus statement: pediatric chronic rhinosinusitis. *Otolaryngol Head Neck Surg*. 2014;151(4):542-553. doi:10.1177/0194599814549302

Epilepsy and Other Seizure Disorders (PEDHD-6)

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Epilepsy and Other Seizure Disorders (PEDHD-6.0)

HDP.EP.0006.0.A

v1.0.2025

- A pertinent evaluation including a detailed history, physical examination with a thorough neurologic examination, since the onset or change in signs and/or symptoms, 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 individual 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 individual since onset of symptoms. This clinical evaluation should also include family history and (whenever possible) the accounts of eyewitnesses to the event(s).

Initial Imaging of Non-Febrile Seizures (PEDHD-6.1)

HDP.EP.0006.1.A

v1.0.2025

- MRI Brain without contrast (CPT[®] 70551) **OR** MRI Brain 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
 - New onset primary generalized epilepsy (e.g., absence epilepsy or juvenile myoclonic epilepsy)¹ in those who are neurologically abnormal (e.g. developmental delay)
 - Focal neurologic deficits
 - Inconclusive findings on recent cranial ultrasound or CT Head
 - If individual meets criteria for MRI imaging for initial imaging of non-febrile seizure, MRI is appropriate even with a recent negative CT.
 - MRI Brain with and without contrast (CPT[®] 70553) is appropriate if there are history or examination findings concerning for a mass lesion or demyelinating disease.
- 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 **Head Trauma (PEDHD-4.1)**)
 - Individual cannot safely undergo MRI (avoidance of sedation is not an indication) or in urgent situations.
 - Identification of blood and calcifications
- Cranial ultrasound (CPT[®] 76506) for the following:
 - First-time seizure in child <30 days 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

Repeat imaging indications (PEDHD-6.2)

HDP.EP.0006.2.A

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- Repeat MRI Brain without contrast (CPT[®] 70551) **OR** MRI Brain 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 **Background and Supporting Information** 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** MRI Brain without and with contrast (CPT[®] 70553) to clarify an abnormality on noncontrast MRI or if considering infection or inflammation

Background and Supporting Information

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

Special Imaging Studies in Evaluation for Epilepsy Surgery (PEDHD-6.3)

HDP.EP.0006.3.A

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- Individuals with a previous MRI Brain and documentation of intractable epilepsy for which surgical treatment or another interventional modality is under active consideration, below are examples of, but not all inclusive, include:
 - Focal Resection
 - Temporal Lobe Resection
 - Extratemporal Resection
 - Lesionectomy
 - Multiple Subpial Transections
 - Laser Interstitial Thermal Therapy
 - Anatomical or Functional Hemispherectomy and Hemispherotomy
 - Corpus Callosotomy
 - Stereotactic Radiosurgery
 - Neurostimulation Device Implantations including,
 - Vagus Nerve Stimulation (VNS)
 - Responsive Neurostimulation
 - Deep Brain Stimulation
- **ALL** of the following requests are appropriate for pre-surgical evaluation:
 - MRI Brain without contrast (CPT[®] 70551) **OR** MRI Brain with and without contrast 3T/7T (CPT[®] 70553)
 - Ictal SPECT (CPT[®] 78803)
 - Functional MRI (f-MRI) (CPT[®] 70555 or CPT[®] 70554) See **Functional MRI (fMRI) (HD-24.2)** in the Head Imaging Guidelines
 - Metabolic (FDG) PET/CT Brain (CPT[®] 78608)
- Metabolic (FDG) PET Brain/MRI is generally not supported in place of Metabolic (FDG) PET/CT Brain for neurologic conditions due to lack of standardization in imaging technique and interpretation. However, it may be appropriate in certain pediatric individuals when ALL of the following criteria are met:
 - The individual meets guideline criteria for Metabolic (FDG) PET/CT Brain (pre-surgical evaluation) **AND**
 - Metabolic (FDG) PET/CT Brain is not available at the treating institution **AND**
 - The provider requests Metabolic (FDG) PET Brain/MRI in lieu of Metabolic (FDG) PET/CT Brain.

- Metabolic (FDG) PET Brain/MRI, when the above criteria are met, is reported using the code combination of:
 - Metabolic (FDG) PET Brain (CPT[®] 78608) **AND**
 - MRI Brain without contrast (CPT[®] 70551) **OR** MRI Brain without and with contrast (CPT[®] 70553).
- All other methods of reporting Metabolic (FDG) PET Brain/MRI are inappropriate.
 - When clinically appropriate, diagnostic MRI codes may be appropriate at the same time as the Metabolic (FDG) PET Brain/MRI code combination.
- MR Spectroscopy (CPT[®] 76390)
- See **Primary Central Nervous System Tumors-General Considerations (ONC-2.1)** in the Oncology Imaging Guidelines for additional imaging requests for surgery and/or **Neurosurgical Imaging (HD-28)** in the Head Imaging Guidelines
- When noninvasive EEG monitoring is insufficient, intracranial monitoring with stereo-EEG or grids/strips and electrodes may be required with appropriate additional imaging for neuronavigation with one of each of the following after consulting the health plan direction for unlisted codes:
 - MRI Brain with and without (CPT[®] 70553) **OR** MRI Brain without contrast (CPT[®] 70551)
 - CT Head, contrast as requested CPT
 - If previous head imaging is considered inadequate or additional sequences/protocols are required **OR** is greater than 6 months old, diagnostic head imaging may be appropriate.
- Due to variances with techniques currently available for neuronavigation, the following are appropriate:
 - CTA Head (CPT[®] 70496) **OR** MRA Head (CPT[®] 70544, CPT[®] 70545 or CPT[®] 70546)
 - Post-operative imaging including after intracranial (EEG) monitoring is appropriate per neurosurgeon's request.

Febrile Seizures (PEDHD-6.4)

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- A typical febrile seizure is a generalized seizure occurring in the presence of fever ($T > 100.4^{\circ}\text{F}/38^{\circ}\text{C}$) 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** MRI Brain 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 **Macrocephaly (PEDHD-7.1)**)
 - Signs and symptoms of increased intracranial pressure
 - Developmental delay
 - If CT Head without contrast (CPT[®] 70450) was performed for an initial evaluation for new onset seizure, MRI (as described above) is indicated for additional evaluation
- CT of head without contrast (CPT[®] 70450) is indicated for:
 - Evaluation of structural findings in seizure etiologies that contain dystrophic calcifications, such as with oligodendrogliomas and tuberous sclerosis.
 - Acute setting of seizure evaluation.

References (HDP-6)

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1. Expert Panel on Pediatric Imaging, Trofimova A, Milla SS, et al. ACR Appropriateness Criteria® Seizures-Child. *J Am Coll Radiol*. 2021;18(5S):S199-S211. doi:10.1016/j.jacr.2021.02.020
2. Gogou M, Cross JH. Seizures and Epilepsy in Childhood. *Continuum (Minneap Minn)*. 2022;28(2):428-456. doi:10.1212/CON.0000000000001087
3. Culler GW 4th, Jobst BC. Surgical Treatments for Epilepsy. *Continuum (Minneap Minn)*. 2022;28(2):536-558. doi:10.1212/CON.0000000000001106
4. Myers KA. Genetic Epilepsy Syndromes. *Continuum (Minneap Minn)*. 2022;28(2):339-362. doi:10.1212/CON.0000000000001077
5. Duffner PK, Berman PH, Baumann RJ, et al. Clinical practice guideline—febrile seizures: guideline for the neurodiagnostic evaluation of the child with a simple febrile seizure. *Pediatrics*. 2011 Feb; 127 (2): 389-394
6. Lapalme-Remis S, Nguyen DK. Neuroimaging of Epilepsy. *Continuum (Minneap Minn)*. 2022;28(2):306-338. doi:10.1212/CON.0000000000001080
7. Biassoni L, Easty M. Paediatric nuclear medicine imaging. *British Medical Bulletin*. 2017;123(1):127-148. doi:10.1093/bmb/ldx025
8. Coryell J, Gaillard WD, Shellhaas RA, et al. Neuroimaging of Early Life Epilepsy. *Pediatrics*. 2018;142(3). doi:10.1542/peds.2018-0672
9. Kwan P, Arzimanoglou A, Berg AT, et al. Definition of drug resistant epilepsy: consensus proposal by the ad hoc Task Force of the ILAE Commission on Therapeutic Strategies [published correction appears in *Epilepsia*. 2010 Sep;51(9):1922]. *Epilepsia*. 2010;51(6):1069-1077. doi:10.1111/j.1528-1167.2009.02397.x
10. Gaillard WD, Chiron C, Cross JH, et al. Guidelines for imaging infants and children with recent-onset epilepsy. *Epilepsia*. 2009;50(9):2147-2153. doi:10.1111/j.1528-1167.2009.02075.x
11. Szaflarski JP, Gloss D, Binder JR, et al. Practice guideline summary: Use of fMRI in the presurgical evaluation of patients with epilepsy: Report of the Guideline Development, Dissemination, and Implementation Subcommittee of the American Academy of Neurology. *Neurology*. 2017;88(4):395-402. doi:10.1212/wnl.0000000000003532
12. Duez L, Tankisi H, Hansen PO, et al. Electromagnetic source imaging in presurgical workup of patients with epilepsy. *Neurology*. 2019;92(6). doi:10.1212/wnl.0000000000006877
13. Qiu J, Cui Y, Qi B, Sun L, Zhu Z. The application of preoperative computed tomography angiogram for hemispherectomy. *Clinics and Practice*. 2017;7(4). doi:10.4081/cp.2017.992
14. Youngerman BE, Khan FA, Mckhann GM. Stereoelectroencephalography in epilepsy, cognitive neurophysiology, and psychiatric disease: safety, efficacy, and place in therapy. *Neuropsychiatric Disease and Treatment*. 2019;Volume 15:1701-1716. doi:10.2147/ndt.s177804/
15. Iida K, Otsubo H. Stereoelectroencephalography: Indication and Efficacy. *Neurol Med Chir (Tokyo). Neurologia medico-chirurgica*. 2017;57(8):375-385. doi:10.2176/nmc.ra.2017-0008
16. Brigo F, Marson A. Approach to the Medical Treatment of Epilepsy. *Continuum (Minneap Minn)*. 2022;28(2):483-499. doi:10.1212/CON.0000000000001081
17. Orringer DA, Golby A, Jolesz F. Neuronavigation in the surgical management of brain tumors: current and future trends. *Expert review of medical devices*. 2012 Sep 1;9(5):491-500

Macrocephaly, Microcephaly, and Hydrocephalus (PEDHD-7)

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Macrocephaly (PEDHD-7.1)

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Indications	Age or Condition	Supported Imaging
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. See: https://www.infantchart.com/cdc0to3headforage.php	Birth to age 6 months or open fontanelle	<ul style="list-style-type: none"> ◦ Ultrasound Head (CPT[®] 76506)
	Hydrocephalus or hemorrhage is present on ultrasound	<ul style="list-style-type: none"> ◦ CT Head without contrast (CPT[®] 70450)
	Any abnormality seen on ultrasound	<ul style="list-style-type: none"> ◦ MRI Brain without contrast (CPT[®] 70551) OR ◦ MRI Brain without and with contrast (CPT[®] 70553)
	Age 7 months and older or with closed fontanelle	<ul style="list-style-type: none"> ◦ MRI Brain without contrast (CPT[®] 70551) OR ◦ MRI Brain without and with contrast (CPT[®] 70553) <p>CT is generally not indicated in this age group since uncomplicated hydrocephalus is less likely after early infancy</p>

Background and Supporting Information

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: <https://www.infantchart.com/cdc0to3headforage.php>.

Microcephaly (PEDHD-7.2)

HDP.MC.0007.2.A

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- MRI Brain without and with contrast (CPT[®] 70553) is indicated for all individuals with 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.
 - CT is generally not recommended as that modality lacks the sensitivity to detect the relevant anatomical abnormalities

Background and Supporting Information

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: <https://www.infantchart.com/cdc0to3headforage.php>.

Hydrocephalus (PEDHD-7.3)

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Initial Imaging Indications

- Age 0-6 months:
 - Screening head ultrasound examination (CPT[®] 76506)
 - MRI Brain without and with contrast (CPT[®] 70553) is indicated if ultrasound shows hydrocephalus.
 - 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 ventriculostomy (ETV).
- Greater than 6 months old:
 - MRI Brain without and with contrast (CPT[®] 70553) is indicated.

Spine Imaging Indication	Imaging Study
Including, but not limited to: <ul style="list-style-type: none"> • Chiari Malformation • Malignant infiltration of meninges 	MRI Cervical Spine without and with contrast (CPT [®] 72156) OR MRI Cervical Spine without contrast (CPT [®] 72141) AND/OR MRI Thoracic Spine without contrast (CPT [®] 72146) OR MRI Thoracic Spine without and with contrast (CPT [®] 72157) AND/OR MRI Lumbar Spine without and with contrast (CPT [®] 72158) OR MRI Lumbar Spine without contrast (CPT [®] 72148)
Dandy-Walker malformation	MRI Cervical Spine without and with contrast (CPT [®] 72156) OR MRI Cervical Spine without contrast (CPT [®] 72141)

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, decreased level of consciousness, protracted vomiting, visual or neurologic deterioration, decline of mentation after initial improvement, or new or changing pattern of seizures.
- Rapid MRI Brain without contrast (CPT[®] 70551) **OR** CT Head without contrast (CPT[®] 70450) is indicated after shunt setting adjustments or as ordered by a neurologist or neurosurgeon or any provider in consultation with a neurologist or neurosurgeon.
- 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 individuals 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) is appropriate 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.

Additional Rarely Used Studies

- Cisternogram (CPT[®] 78630) is rarely done in children but can be appropriate 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 appropriate 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 appropriate for the following:
 - Suspected malfunction of ventriculoperitoneal, ventriculopleural, or ventriculovenous shunts.

Background and Supporting Information

- 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.
- Rapid MRI Brain without contrast (CPT[®] 70551) provides more anatomical detail and does not involve radiation exposure, but many providers use CT Head as rapid MRI is not universally available.
- Hydrocephalus is the most common identifiable cause of macrocephaly. Almost all hydrocephalus is obstructive, except hydrocephalus due to choroid plexus papillomas. See **Choroid Plexus Tumors (PEDONC-4.13)** in the Pediatric and Special Populations 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).
- Ventriculomegaly refers to enlarged ventricular spaces. It is often initially found on fetal ultrasound. It can be from an obstructive cause or can be relative secondary to small brain volume. It can remain stable and may be monitored with serial ultrasound (CPT[®] 76506) to assess stability or MRI Brain with and without contrast (CPT[®] 70553) if over age 6 months. If ventriculomegaly progresses to hydrocephalus, follow imaging timelines listed below for hydrocephalus.
- Benign external hydrocephalus (aka benign extra-axial fluid collection among other names) is defined as a rapid increase in head circumference in an infant with enlarged frontal subarachnoid spaces. It is a common cause of macrocephalus and is commonly secondary to a familial large head size. See **Macrocephaly (PEDHD-7.1)** for initial imaging guidelines. It typically requires no intervention. Once diagnosed and confirmed with MRI Brain with and without contrast (CPT[®] 70553) no additional imaging is required unless new neurological symptoms appear, worsen or persist beyond age 4 years. If developmental motor delay See **Developmental Motor Delay (PEDHD 19.3)**.
- For CSF flow imaging See **CSF Flow Imaging (HD-24.4)** in the Head Imaging Guidelines.

References (HDP-7)

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1. Ashwal S, Michelson D, Plawner L, et al. Practice parameter: evaluation of the child with microcephaly (an evidence-based review). *Neurology*. 2009 Sep; 73: 887-897
2. Boyle TP, Paldino MJ, Kimia AA, et al. Comparison of Rapid Cranial MRI to CT for Ventricular Shunt Malfunction. *Pediatrics*. 2014 July; 134 (1): e47-e54
3. Orrù E, Calloni SF, Tekes A, Huisman TAGM, Soares BP. The Child With Macrocephaly: Differential Diagnosis and Neuroimaging Findings. *American Journal of Roentgenology*. 2018;210(4):848-859
4. Raybaud A. Hydrocephalus. In: Barkovich AJ, ed. *Pediatric Neuroimaging*, 6th ed. Philadelphia PA. Wolters Kluwer. 2019; 907-972
5. Feng Z, Li Q, Gu J, Shen W. Update on Endoscopic Third Ventriculostomy in Children. *Pediatric Neurosurgery*. 2018;53(6):367-370. doi:10.1159/000491638
6. Wright Z, Larrew TW, Eskandari R. Pediatric Hydrocephalus: Current State of Diagnosis and Treatment. *Pediatrics in Review*. 2016;37(11):478-490. doi:10.1542/pir.2015-0134
7. Sanyal S, Duraisamy S, Garga UC. Magnetic Resonance Imaging of Brain in Evaluation of Floppy Children: A Case Series. *Iran J Child Neurol*. 2015 Fall;9(4):65-74
8. Ali AS. Magnetic Resonance Imaging (MRI) Evaluation of Developmental Delay in Pediatric Patients. *Journal Of Clinical And Diagnostic Research*. 2015. doi:10.7860/jcdr/2015/11921.5478
9. Khalatbari H, Parisi MT. Complications of CSF Shunts in Pediatrics: Functional Assessment With CSF Shunt Scintigraphy—Performance and Interpretation. *American Journal of Roentgenology*. 2020;215(6):1474-1489. doi:10.2214/ajr.20.22899
10. Zahl SM, Egge A, Helseth E, Wester K. Benign external hydrocephalus: a review, with emphasis on management. *Neurosurgical Review*. 2011;34(4):417-432. doi:10.1007/s10143-011-0327-4
11. Zahl SM, Egge A, Helseth E, Wester K. Clinical, Radiological, and Demographic Details of Benign External Hydrocephalus: A Population-Based Study. *Pediatr Neurol*. 2019;96:53-57. doi:10.1016/j.pediatrneurol.2019.01.015
12. Kestle JRW, Riva-Cambrin J. Prospective multicenter studies in pediatric hydrocephalus. *Journal of Neurosurgery: Pediatrics*. 2019;23(2):135-141. doi:10.3171/2018.10.peds18328
13. Patel SK, Zamorano-Fernandez J, Nagaraj U, Bierbrauer KS, Mangano FT. Not all ventriculomegaly is created equal: diagnostic overview of fetal, neonatal and pediatric ventriculomegaly. *Child's Nervous System*. 2019;36(8):1681-1696. doi:10.1007/s00381-019-04384-w

Craniofacial Anomalies (PEDHD-8)

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Craniosynostosis Imaging (PEDHD-8.1)

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- Skull x-rays and/or ultrasound should be obtained prior to considering advanced imaging. In cases of very strong consideration of craniosynostosis with surgical planning in progress, x-rays and/or ultrasound are 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 without contrast (CPT[®] 70486) **AND** CT Orbits/Temporal Bone without contrast (CPT[®] 70480) are generally not necessary to evaluate individuals 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.
- CT Maxillofacial without contrast (CPT[®] 70486) **AND/OR** CT Orbits/Temporal Bone without contrast (CPT[®] 70480) is/are supported in certain types of craniosynostosis and is/are supported when ordered by surgical specialties or in consultation with surgical specialties during surgical evaluation and planning.
- Ultrasound Head (CPT[®] 76506) is supported 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 is supported as discussed previously in this section.
- CT Head without contrast (CPT[®] 70450) is supported postoperatively at the discretion of or in consultation with the surgical specialist coordinating the individual's care.
- Positional plagiocephaly typically does NOT require advanced imaging.^{11,13,14}

Background and Supporting Information

Craniosynostosis is the premature closure of one or more cranial sutures, usually during infancy. Craniosynostosis may be caused by a genetic condition, such as Apert, Pfeiffer or Crouzon syndrome to name a few.¹⁶ Abnormal head shape is the common clinical feature.

Facial Anomalies (PEDHD-8.2)

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- Congenital anomalies of facial structures
 - CT Maxillofacial without contrast (CPT[®] 70486) **OR** MRI Orbits/Face/Neck without contrast (CPT[®] 70540) **OR** MRI Orbits/Face/Neck with and without CPT[®] 70543¹⁹.
- Facial Anomalies (such as, cleft lip and palate) can be associated with brain malformations and abnormal brain development.
 - MRI Brain without contrast (CPT[®] 70551) is supported in individuals with cleft lip and/or palate.
 - MRI Orbits/Face/Neck without contrast (CPT[®] 70540) **OR** MRI Orbits/Face/Neck with and without contrast (CPT[®] 70543)¹⁷ is supported if requested by surgeon or any provider in consultation with the surgeon.

References (HDP-8)

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1. Hall KM, Besachio DA, Moore MD, et al. Effectiveness of screening for craniosynostosis with ultrasound: a retrospective review. *Pediatr Radiol*. 2017;47: 606-612
2. Rozovsky K, Udjus K, Wilson N, Barrowman NJ, Simanovsky N, Miller E. Cranial Ultrasound as a First-Line Imaging Examination for Craniosynostosis. *Pediatrics*. 2016;137(2):e20152230. doi:10.1542/peds.2015-2230
3. Fearon JA. Evidence-based medicine: craniosynostosis. *Plast Reconstr Surg*. 2014 May; 133 (5): 1261-1275
4. Khanna P, Thapa M, Iyer R, Prasad S. Pictorial essay: The many faces of craniosynostosis. *Indian Journal of Radiology and Imaging*. 2011;21(1):49. doi:10.4103/0971-3026.76055
5. Mathijssen IM. Guideline for Care of Patients With the Diagnoses of Craniosynostosis. *Journal of Craniofacial Surgery*. 2015;26(6):1735-1807. doi:10.1097/scs.0000000000002016
6. Kim HJ, Roh HG, Lee IW. Craniosynostosis : Updates in Radiologic Diagnosis. *Journal of Korean Neurosurgical Society*. 2016;59(3):219. doi:10.3340/jkns.2016.59.3.219
7. ACR-ASNR-SPR Practice Parameter for the Performance of Computed Tomography (CT) of the Extracranial Head and Neck Revised 2021. (Resolution 5). <https://www.acr.org/-/media/ACR/Files/Practice-Parameters/CT-Head-Neck.pdf>
8. AIUM Practice Parameter for the Performance of Neurosonography in Neonates and Infants. *J Ultrasound Med*. 2020;39(5):E57-E61. doi:10.1002/jum.15264
9. Gallagher ER and Collett BR. Neurodevelopmental and Academic Outcomes in Children With Orofacial Clefts: A Systematic Review. *Pediatrics*. 2019;144(1)
10. Massimi L, Bianchi F, Frassanito P, Calandrelli R, Tamburrini G, Caldarelli M. Imaging in craniosynostosis: when and what?. *Childs Nerv Syst*. 2019;35(11):2055-2069. doi:10.1007/s00381-019-04278-x
11. Flannery AM, Tamber MS, Mazzola C, et al. Congress of Neurological Surgeons Systematic Review and Evidence-Based Guidelines for the Management of Patients With Positional Plagiocephaly: Executive Summary. *Neurosurgery*. 2016;79(5):623-624. doi:10.1227/NEU.0000000000001426
12. Linz C, Collmann H, Meyer-Marcotty P, et al. Occipital plagiocephaly: unilateral lambdoid synostosis versus positional plagiocephaly. *Arch Dis Child*. 2015;100(2):152-157. doi:10.1136/archdischild-2014-305944
13. Linz C, Kunz F, Böhm H, Schweitzer T. Positional Skull Deformities. *Dtsch Arztebl Int*. 2017;114(31-32):535-542. doi:10.3238/arztebl.2017.0535
14. Mazzola C, Baird LC, Bauer DF, et al. Congress of Neurological Surgeons Systematic Review and Evidence-Based Guideline for the Diagnosis of Patients With Positional Plagiocephaly: The Role of Imaging. *Neurosurgery*. 2016;79(5):E625-E626. doi:10.1227/NEU.0000000000001427
15. Schweitzer T, Böhm H, Meyer-Marcotty P, Collmann H, Ernestus RI, Krauß J. Avoiding CT scans in children with single-suture craniosynostosis. *Childs Nerv Syst*. 2012;28(7):1077-1082. doi:10.1007/s00381-012-1721-0
16. Wenger T, Miller D, Evans K. FGFR Craniosynostosis Syndromes Overview. 1998 Oct 20 [Updated 2020 Apr 30]. In: Adam MP, Ardinger HH, Pagon RA, et al., editors. GeneReviews® [Internet]. Seattle (WA): University of Washington, Seattle; 1993-2022. https://www.ncbi.nlm.nih.gov/books/NBK1455/pdf/Bookshelf_NBK1455.pdf
17. Abramson ZR, Peacock ZS, Cohen HL, Choudhri AF. Radiology of Cleft Lip and Palate: Imaging for the Prenatal Period and throughout Life. *Radiographics*. 2015;35(7):2053-2063. doi:10.1148/rg.2015150050

Chiari and Skull Base Malformations (PEDHD-9)

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Chiari Malformations (PEDHD-9.1)

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- Ultrasound can be utilized for initial examination in infants to determine ventricular size and associated anomalies and to provide a baseline for follow up evaluation but is not required prior to MRI.

Indication	Imaging Study
<ul style="list-style-type: none"> ◦ Initial evaluation for suspected or known Chiari malformations 	<p>Any of the following sets of imaging:</p> <p>MRI Brain without contrast (CPT[®] 70551) OR MRI Brain without and with contrast (CPT[®] 70553) AND/OR</p> <p>MRI Cervical Spine without contrast (CPT[®] 72141) OR MRI Cervical Spine without and with contrast (CPT[®] 72156) AND/OR</p> <p>MRI Thoracic Spine without contrast (CPT[®] 72146) OR MRI Thoracic Spine without and with contrast (CPT[®] 72157) AND/OR</p> <p>MRI Lumbar Spine without contrast (CPT[®] 72148) OR MRI Lumbar Spine without and with contrast (CPT[®] 72158)</p>

Indication	Imaging Study
<ul style="list-style-type: none"> ◦ Repeat imaging for any of the following: <ul style="list-style-type: none"> ▪ At the discretion of or in consultation with the neurologist and/or neurosurgeon coordinating the individual's care ▪ New or worsening signs or symptoms ▪ Surgical procedure is actively being considered 	<p>Any of the following sets of imaging:</p> <p>MRI Brain without contrast (CPT[®] 70551) OR MRI Brain without and with contrast (CPT[®] 70553) AND/OR</p> <p>MRI Cervical Spine without contrast (CPT[®] 72141) OR MRI Cervical Spine without and with contrast (CPT[®] 72156) AND/OR</p> <p>MRI Thoracic Spine without contrast (CPT[®] 72146) OR MRI Thoracic Spine without and with contrast (CPT[®] 72157) AND/OR</p> <p>MRI Lumbar Spine without contrast (CPT[®] 72148) OR MRI Lumbar Spine without and with contrast (CPT[®] 72158)</p>

- Familial screening is not indicated for Chiari I Malformations
- For CSF flow imaging, see **CSF Flow Imaging (HD-24.4)** in the Head Imaging Guidelines

Background and Supporting Information

- Chiari I malformations involve 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.
- Chiari II malformations are more severe than Chiari I malformations. These individuals usually present at birth. Myelomeningocele is always present, and syringomyelia and hydrocephalus are extremely common.
- Chiari III malformations include cerebellar herniation into a high cervical myelomeningocele. Chiari IV malformations refer 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 I malformations and known syringomyelia or hydromyelia is highly individualized.

Basilar Impression/Basilar Invagination (PEDHD-9.4)

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

Platybasia (PEDHD-9.5)

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- Platybasia is a flattening malformation of the skull base, in which the clivus has a horizontal orientation.
- MRI Brain without contrast (CPT[®] 70551) **OR** CT Head without contrast (CPT[®] 70450) is indicated to establish a diagnosis when clinically suspected, individuals are usually asymptomatic

References (HDP-9)

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1. Siegel MJ. Brain. In: pediatric sonography. 5th ed. Philadelphia. Wolters Kluwer. 2018 40-111
2. Strahle J, Muraszko KM, Kapurch J, et al. Chiari malformation Type I and syrinx in children undergoing magnetic resonance imaging. *J Neurosurg Pediatr.* 2011 Aug; 8 (2): 205-213
3. Strahle J, Muraszko KM, Kapurch J, et al. Natural history of Chiari malformation Type I following decision for conservative treatment. *J Neurosurg Pediatr.* 2011 Aug; 8 (2): 214-221
4. Strahle J, Muraszko KM, Garton HJL, et al. Syrinx location and size according to etiology: identification of Chiari-associated syrinx. *J Neurosurg Pediatr.* 2015 July; 16 (1): 21-9 Epub 2015 Apr 3
5. Strahle J, Smith BW, Martinez M, et al. The association between Chiari malformation Type I, spinal syrinx, and scoliosis. *J Neurosurg Pediatr.* 2015 Jun; 15 (6): 607-611
6. Victorio MC, Khoury CK. Headache and Chiari I Malformation in Children and Adolescents. *Seminars in Pediatric Neurology.* 2016;23(1):35-39
7. Radic JAE, Cochrane DD. Choosing Wisely Canada: Pediatric Neurosurgery Recommendations. *Paediatrics & Child Health.* 2018;23(6):383-387. doi:10.1093/pch/pxy012
8. Smoker WRK and Khanna G. Imaging the craniocervical junction. *Childs Nerv Syst.* 2008 Oct; 24 (10): 1123-1145
9. D'Arco F, Ganau M. Which neuroimaging techniques are really needed in Chiari I? A short guide for radiologists and clinicians. *Childs Nerv Syst.* 2019 Oct;35(10):1801-1808. doi: 10.1007/s00381-019-04210-3

Intracranial Aneurysms and AVM (PEDHD-10)

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Pediatric Intracranial Aneurysms (PEDHD-10.1)

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- A pertinent 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 individual is undergoing guideline-supported scheduled follow-up imaging evaluation or request is from a neurologist or neurosurgeon who has seen the individual since onset of symptoms
- Initial study for suspected subarachnoid hemorrhage:
 - CT Head without contrast (CPT[®] 70450) **AND/OR**
 - MRI Brain without contrast (CPT[®] 70551) **OR**
 - MRI Brain without and with contrast (CPT[®] 70553)
- If subarachnoid hemorrhage is present on CT or MRI, or lumbar puncture findings suggest hemorrhage, then the following is/are supported
 - MRA Head (CPT[®] 70544, CPT[®] 70545, **OR** CPT[®] 70546) **OR**
 - CTA Head (CPT[®] 70496) **AND/OR**
 - CT Brain Perfusion (CPT[®] 0042T) or MRI Brain Perfusion (CPT[®] 70553)
 - See also: **Background and Supporting Information**
- If findings suspicious for intracranial aneurysm on MRI, then the following is supported
 - MRA Head (CPT[®] 70544, CPT[®] 70545, **OR** CPT[®] 70546) **OR**
 - CTA Head (CPT[®] 70496)
- Initial study for individuals presenting with headache, increased intracranial pressure, seizures, or focal neurologic findings:
 - CT Head without contrast (CPT[®] 70450) **AND/OR**
 - MRI Brain without contrast (CPT[®] 70551) **OR**
 - MRI Brain without and with contrast (CPT[®] 70553)
 - If findings suspicious for intracranial aneurysm on prior imaging, then the following is supported:
 - MRA head (CPT[®] 70544, CPT[®] 70545, **OR** CPT[®] 70546) **OR**
 - CTA Head (CPT[®] 70496)
- Imaging for individuals with known aneurysm presenting with headache, increased intracranial pressure, seizures, or focal neurologic findings:
 - MRI Brain without contrast (CPT[®] 70551) **OR**
 - MRI Brain without and with contrast (CPT[®] 70553) **AND/OR**
 - MRA Head (CPT[®] 70544, CPT[®] 70545 **OR** CPT[®] 70546) **OR**

- CTA Head (CPT[®] 70496)
 - CTA Head (CPT[®] 70496) for individuals with treated aneurysms is preferred.
- MRI Brain without contrast (CPT[®] 70551) **OR** MRI Brain without and with contrast (CPT[®] 70553) **AND/OR** MRA Head (CPT[®] 70544, CPT[®] 70545, **OR** CPT[®] 70546) is/are indicated for individuals with any of the following conditions (including but not limited to the conditions below) and headache, increased intracranial pressure, seizures, or focal neurologic findings:
 - Aicardi–Goutières syndrome²¹
 - Alpha-1-antitrypsin deficiency
 - Alpha-glucosidase deficiency
 - Azygos Anterior Cerebral Artery
 - Bicuspid aortic valve
 - Coarctation of the aorta
 - Ehlers-Danlos Syndrome
 - Fibromuscular dysplasia
 - Hereditary Hemorrhagic Telangiectasia (Osler-Weber-Rendu Syndrome)
 - Hyper-IgE syndrome
 - Kawasaki disease
 - Klinefelter syndrome
 - Klippel-Trenaunay-Weber Syndrome
 - Loews-Dietz syndrome (There are 4 forms)
 - Marfan Syndrome
 - Microcephalic osteodysplastic primordial dwarfism Type II
 - Moyamoya Syndrome
 - Multisystemic Smooth Muscle Syndrome (MSMS)/Smooth Muscle Dysfunction Syndrome (SMDS)/ACTA2 Mutations (See **HD-21.7**)
 - Neurofibromatosis type 1
 - Noonan syndrome
 - Patent ductus arteriosus
 - Pheochromocytoma
 - Pseudoxanthoma elasticum
 - Polycystic kidney disease
 - Tuberous Sclerosis
- MRI Perfusion may be obtained with MRI Brain (CPT[®] 70551 **OR** CPT[®] 70552 **OR** CPT[®] 70553)
 - No additional CPT[®] codes are necessary or appropriate to perform MRI perfusion.²⁰
- The timing of follow-up imaging for intracranial aneurysms in children is similar to that in adults. See **Intracranial Aneurysms (HD-12.1)** in the Head Imaging Guidelines.

- Screening MRI Brain or MRA Head for aneurysms is not supported in individuals with coarctation of the aorta repaired before 3 years of age since there is not an increased risk for intracranial aneurysm in this individual population.
- Screening MRI Brain or MRA Head for aneurysms is generally not supported in asymptomatic individuals under 20 years of age since only 0.6 % of ruptured aneurysms occur in the pediatric age range.
- Screening for High Risk Populations as defined as:
 - Positive Family History: Two or more first degree relatives (parent, sibling, or child) with history of cerebral aneurysm or SAH: screening every 5 years beginning at 20 years of age
 - One first degree relative (parent, sibling, or child) with history of cerebral aneurysm or SAH can have one screening study but risks and benefits should be discussed with individual
 - Autosomal dominant polycystic kidney disease (screening begins at age 20 to 65 years of age and is repeated at ten-year intervals)

Background and Supporting Information

- Prior CT Head (CPT[®] 70450) does not exclude indication for MRI Brain without and with contrast (CPT[®] 70553) **OR** MRI Brain without contrast (CPT[®] 70551)
- 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.

Pediatric Intracranial Arteriovenous Malformations (AVM) (PEDHD-10.2)

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- A pertinent 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 individual 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 individual since onset of symptoms.
- Vascular malformations include arteriovenous, venous, cavernous, and capillary malformations and vein of Galen Malformations.

Disorders	Indications (any of the following)	Supported Imaging
<ul style="list-style-type: none"> • Any aneurysmal and/or AVM Disorder listed in this guideline 	<ul style="list-style-type: none"> • When MRI is contraindicated • Any emergency setting 	<ul style="list-style-type: none"> • CT Head without contrast (CPT[®] 70450) <p>AND/OR</p> <ul style="list-style-type: none"> • CTA Head (CPT[®] 70496) <p>AND/OR</p> <ul style="list-style-type: none"> • CTA Neck (CPT[®] 70498)
<ul style="list-style-type: none"> • Suspected Vein of Galen malformation in the neonate 	<ul style="list-style-type: none"> • Confirmation by Ultrasound Head (CPT[®] 76506) 	<ul style="list-style-type: none"> • MRI Brain without contrast (CPT[®] 70551) <p>OR</p> <ul style="list-style-type: none"> • MRI Brain without and with contrast (CPT[®] 70553) <p>OR</p> <ul style="list-style-type: none"> • Catheter Angiography to precisely identify the feeding arteries and draining vein, especially if embolization is planned

Disorders	Indications (any of the following)	Supported Imaging
<ul style="list-style-type: none"> Low Flow Malformations 	<ul style="list-style-type: none"> When requested by a neurologist or neurosurgeon or any provider in consultation with a neurologist or neurosurgeon 	<ul style="list-style-type: none"> MRA Head (CPT[®] 70544, CPT[®] 70545, OR CPT[®] 70546) OR CTA Head (CPT[®] 70496)
<ul style="list-style-type: none"> Suspected AVM after the neonate period 	<ul style="list-style-type: none"> When requested by a neurologist or neurosurgeon or any provider in consultation with a neurologist or neurosurgeon 	<ul style="list-style-type: none"> MRI Brain without and with contrast (CPT[®] 70553) OR MRI Brain without contrast (CPT[®] 70551)
<ul style="list-style-type: none"> Known AVM 	<ul style="list-style-type: none"> When requested by a neurologist or neurosurgeon or any provider in consultation with a neurologist or neurosurgeon 	<ul style="list-style-type: none"> MRI Brain without contrast (CPT[®] 70551) OR MRI Brain without and with contrast (CPT[®] 70553) AND/OR MRA Head (CPT[®] 70544, CPT[®] 70545, OR CPT[®] 70546) OR CTA Head (CPT[®] 70496)

Disorders	Indications (any of the following)	Supported Imaging
<ul style="list-style-type: none"> Hereditary Hemorrhagic Telangiectasia (HHT; Osler-Weber-Rendu Syndrome) 	<ul style="list-style-type: none"> Suspected based on Family History with at least one affected first-degree relative. (biological parent or sibling) At diagnosis, especially if confirmed by Genetic Testing Screening for confirmed HHT Clinical signs or symptoms concerning for disease progression When requested by a neurologist or neurosurgeon or geneticist or any provider in consultation with a neurologist or neurosurgeon or geneticist 	<ul style="list-style-type: none"> MRI Brain without and with contrast (CPT[®] 70553) <p>OR</p> <ul style="list-style-type: none"> MRI Brain without contrast (CPT[®] 70551) <p>AND/OR</p> <ul style="list-style-type: none"> MRA Head (CPT[®] 70544, CPT[®] 70545 OR CPT[®] 70546) <p>OR</p> <ul style="list-style-type: none"> CTA Head (CPT[®] 70496)

Disorders	Indications (any of the following)	Supported Imaging
<ul style="list-style-type: none"> Capillary Malformation-Arteriovenous Malformation (CM-AVM) 	<ul style="list-style-type: none"> Suspected based on Family History with at least one affected first-degree relative (biological parent or sibling) At diagnosis, especially if confirmed by Genetic Testing Screening for confirmed CM-AVM Clinical signs or symptoms concerning for disease progression When requested by a neurologist or neurosurgeon or geneticist or any provider in consultation with a neurologist or neurosurgeon or geneticist 	<ul style="list-style-type: none"> MRI Brain without and with contrast (CPT[®] 70553) OR MRI Brain without contrast (CPT[®] 70551) <p>AND/OR</p> <ul style="list-style-type: none"> MRA Head (CPT[®] 70544, CPT[®] 70545 OR CPT[®] 70546) OR CTA Head (CPT[®] 70496) <p>AND/OR</p> <ul style="list-style-type: none"> MRI Cervical Spine without and with contrast (CPT[®] 72156) OR MRI Cervical Spine without contrast (CPT[®] 72141) <p>AND/OR</p> <ul style="list-style-type: none"> MRI Thoracic Spine without and with contrast (CPT[®] 72157) OR MRI Thoracic Spine without contrast (CPT[®] 72146)¹⁸

Disorders	Indications (any of the following)	Supported Imaging
<ul style="list-style-type: none"> Cerebral Cavernous Malformations (CCM) 	<ul style="list-style-type: none"> Suspected based on Family History with at least one affected first-degree relative (biological parent or sibling). At diagnosis, especially if confirmed by Genetic Testing Screening for confirmed CCM Clinical signs or symptoms concerning for disease progression When requested by a neurologist or neurosurgeon or geneticist or any provider in consultation with a neurologist or neurosurgeon or geneticist 	<ul style="list-style-type: none"> MRI Brain without and with contrast (CPT[®] 70553) OR MRI Brain without contrast (CPT[®] 7055) <p>AND/OR</p> <ul style="list-style-type: none"> MRA Head (CPT[®] 70544, CPT[®] 70545 OR CPT[®] 70546) OR CTA Head (CPT[®] 70496) <p>AND/OR</p> <ul style="list-style-type: none"> MRI Cervical Spine without and with contrast (CPT[®] 72156) OR MRI Cervical Spine without contrast (CPT[®] 72141) <p>AND/OR</p> <ul style="list-style-type: none"> MRI Thoracic Spine without and with contrast (CPT[®] 72157) OR MRI Thoracic Spine without contrast (CPT[®] 72146)

Disorders	Indications (any of the following)	Supported Imaging
<ul style="list-style-type: none"> Microcephalic Osteodysplastic Primordial Dwarfism, Type II (MOPDII)^{10,11} 	<ul style="list-style-type: none"> Suspected based on Family History with at least one affected first-degree relative (biological parent or sibling) At diagnosis, especially if confirmed by Genetic Testing Screening for confirmed MOPDII, repeated annually Clinical signs or symptoms concerning for disease progression When requested by a neurologist or neurosurgeon or geneticist or any provider in consultation with a neurologist or neurosurgeon or geneticist 	<ul style="list-style-type: none"> MRI Brain without contrast (CPT[®] 70551) OR MRI Brain without and with contrast (CPT[®] 70553) AND/OR MRA Head (CPT[®] 70544, CPT[®] 70545, OR CPT[®] 70546) OR CTA Head (CPT[®] 70496) AND/OR MRA Neck without contrast (CPT[®] 70547, CPT[®] 70548 OR CPT[®] 70549) OR CTA Neck (CPT[®] 70498)
<ul style="list-style-type: none"> Sturge-Weber Syndrome 	<ul style="list-style-type: none"> At diagnosis Clinical signs or symptoms concerning for disease progression When requested by a neurologist or neurosurgeon or any provider in consultation with a neurologist or neurosurgeon 	<ul style="list-style-type: none"> MRI Brain without and with contrast (CPT[®] 70553) OR MRI Brain without contrast (CPT[®] 70551) AND/OR MRI Orbits/Face/Neck without and with contrast (CPT[®] 70543) OR MRI Orbits/Face/Neck without contrast (CPT[®] 70540)

Additional indications

- CT Head without contrast (CPT[®] 70450) may be indicated for:

- Mass effect
- Urgent/emergent settings due to availability and speed of CT
- Trauma
- Recent hemorrhage, whether traumatic or spontaneous
- Prior to lumbar puncture in individuals with cranial complaints
- Scenarios in which MRI is contraindicated (i.e. pacemakers, ICDs, cochlear implants, aneurysm clips, orbital metallic fragments, etc.)

Background and Supporting Information

- Prior CT Head (CPT[®] 70450) does not exclude indication for MRI Brain without and with contrast (CPT[®] 70553) **OR** MRI Brain without contrast (CPT[®] 70551)
- 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.
- Hereditary AVMs usually have an autosomal dominant pattern of inheritance.^{5,6,18}

References (HDP-10)

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1. Montaser A, Smith ER. Intracranial Vascular Abnormalities in Children. *Pediatr Clin North Am*. 2021;68(4):825-843. doi:10.1016/j.pcl.2021.04.010
2. Beez T, Steiger H-J, and Hnggi D. Evolution of management of intracranial aneurysms in children: a systematic review of the modern literature. *J Child Neurol*. 2016; 31 (6): 773-783
3. Alvarez H, and Castillo M. Genetic markers and their influence on cerebrovascular malformations. *Neuroimag Clin N Am*. 2015 Feb; 25 (1): 69-82
4. Donti A, Spinardi L, Brighenti M, et al. Frequency of intracranial aneurysms determined by magnetic resonance angiography in children (mean age 16) having operative or endovascular treatment of coarctation of the aorta (mean age 13). *Am J Cardiol*. 2015 epub 2015 Aug; 116 (4):630-633
5. McDonald J, Stevenson DA. Hereditary Hemorrhagic Telangiectasia. In: Adam MP, Mirzaa GM, Pagon RA, et al., eds. *GeneReviews*®. Seattle (WA): University of Washington, Seattle; June 26, 2000. [Updated 2021 Nov 24
6. Morrison L, and Akers A. Cerebral cavernous malformation, familial. *GeneReviews*™ [Internet] eds. Pagon RA, Adam MP, Bird TD et al. version August 4, 2016
7. Linscott LL, Leach JL, Jones BV, et al. Developmental venous anomalies of the brain in children—imaging spectrum and update. *Pediatr Radiol*. 2016 Mar; 46 (3): 394-406
8. Ghali MGZ, Srinivasan VM, Cherian J, et al. Pediatric Intracranial Aneurysms: Considerations and Recommendations for Follow-Up Imaging. *World Neurosurgery*. 2018;109:418-431
9. Derdeyn CP, Zipfel GJ, Albuquerque FC, et al. Management of Brain Arteriovenous Malformations: A Scientific Statement for Healthcare Professionals From the American Heart Association/American Stroke Association. *Stroke*. 2017;48(8). doi:10.1161/str.000000000000134
10. Bober MB, Jackson AP. Microcephalic Osteodysplastic Primordial Dwarfism, Type II: a Clinical Review. *Current Osteoporosis Reports*. 2017;15(2):61-69. doi:10.1007/s11914-017-0348-1
11. Bober MB, Jackson AP. Erratum to: Microcephalic Osteodysplastic Primordial Dwarfism, Type II: a Clinical Review. *Curr Osteoporosis Rep*. 2017;15(4):399. doi:10.1007/s11914-017-0389-5
12. Madhuban A, van den Heuvel F, van Stuijvenberg M. Vein of Galen Aneurysmal Malformation in Neonates Presenting With Congestive Heart Failure. *Child Neurol Open*. 2016;3:2329048X15624704. Published 2016 Apr 4. doi:10.1177/2329048X15624704
13. Siegel MJ. Brain. In: pediatric sonography. 5th ed. Philadelphia. Wolters Kluwer. 2018 40-111
14. Hoh BL, Ko NU, Amin-Hanjani S, et al. 2023 Guideline for the Management of Patients With Aneurysmal Subarachnoid Hemorrhage: A Guideline From the American Heart Association/American Stroke Association [published online ahead of print, 2023 May 22]. *Stroke*. 2023;10.1161/STR.000000000000436. doi:10.1161/STR.000000000000436
15. Faughnan ME, Mager JJ, Hetts SW, et al. Second International Guidelines for the Diagnosis and Management of Hereditary Hemorrhagic Telangiectasia. *Ann Intern Med*. 2020;173(12):989-1001. doi:10.7326/M20-1443
16. Expert Panel on MR Safety, Kanal E, Barkovich AJ, et al. ACR guidance document on MR safe practices: 2013. *J Magn Reson Imaging*. 2013;37(3):501-530. doi:10.1002/jmri.24011
17. Sabeti S, Ball KL, Bhattacharya SK, et al. Consensus Statement for the Management and Treatment of Sturge-Weber Syndrome: Neurology, Neuroimaging, and Ophthalmology Recommendations. *Pediatr Neurol*. 2021;121:59-66. doi:10.1016/j.pediatrneurol.2021.04.013
18. Bayrak-Toydemir P, Stevenson DA. Capillary Malformation-Arteriovenous Malformation Syndrome. In: Adam MP, Mirzaa GM, Pagon RA, et al., eds. *GeneReviews*®. Seattle (WA): University of Washington, Seattle; February 22, 2011. Updated: September 12, 2019
19. Hammill AM, Wusik K, Kasthuri RS. Hereditary hemorrhagic telangiectasia (HHT): a practical guide to management. *Hematology Am Soc Hematol Educ Program*. 2021;2021(1):469-477. doi:10.1182/hematology.2021000281
20. ACR-ASNR-SPR PRACTICE PARAMETER FOR THE PERFORMANCE OF INTRACRANIAL MAGNETIC RESONANCE PERFUSION IMAGING. Revised 2022 (Resolution 24). *PRACTICE PARAMETER MR_Perfusion*. [https://www.acr.org/-/media/ACR/Files/Practice-Parameters/mr-perfusion.pdf? la=en](https://www.acr.org/-/media/ACR/Files/Practice-Parameters/mr-perfusion.pdf?la=en)

21. Crow YJ. Aicardi-Goutières Syndrome. In: Adam MP, Feldman J, Mirzaa GM, et al., eds. GeneReviews®. Seattle (WA): University of Washington, Seattle; June 29, 2005.

Syncope (PEDHD-11)

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Syncope (PEDHD-11.1)

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- 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 individuals with isolated syncope without focal neurologic findings. See **Syncope (PEDCD-5)** in the Pediatric Cardiac Imaging Guidelines and **Epilepsy and Other Seizure Disorders (PEDHD-6)** for additional imaging considerations.
- There is no role for advanced neuroimaging for Postural Tachycardia Syndrome (POTS).

References (HDP-11)

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1. Friedman KG, and Alexander ME. Chest pain and syncope in children: a practical approach to the diagnosis of cardiac disease. *J Pediatr.* 2013 Sep; 163 (3):896-901
2. Cannon B, and Wackel P. Syncope. *Pediatr Rev.* 2016 Apr; 37 (4):159-168
3. Fant C, Cohen A. Syncope In Pediatric Patients: A Practical Approach To Differential Diagnosis And Management In The Emergency Department. *Pediatric emergency medicine practice.* 2017 Apr;14(4):1-28

Pediatric Stroke (PEDHD-12)

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Pediatric Stroke General Considerations (PEDHD-12.1)

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

Pediatric Stroke Initial Imaging (PEDHD-12.2)

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- Children may not present with typical stroke findings. MRI Brain without contrast (CPT[®] 70551) or MRI Brain without and with contrast (CPT[®] 70553) is appropriate in the presence of neurological signs and/or symptoms with concern for stroke.¹
- ANY of the following studies are indicated for evaluation.
 - CT Head without contrast (CPT[®] 70450) **OR** MRI Brain without contrast (CPT[®] 70551)
 - MRA Head (CPT[®] 70544, CPT[®] 70545, **OR** CPT[®] 70546) **OR** CTA Head (CPT[®] 70496)
 - For suspected carotid dissection CTA Neck (CPT[®] 70498) **OR** MRA Neck (CPT[®] 70547, CPT[®] 70548 **OR** CPT[®] 70549)
 - Note: Both MRA **OR** CTA Head **AND** Neck are needed to visualize the posterior vertebrobasilar circulation for evaluation of the vertebrobasilar stroke/TIA (vertigo associated with diplopia, dysarthria, bifacial numbness or ataxia) or concern for arterial dissection (risks may include premature stroke [under age 50], head or neck trauma, fibromuscular dysplasia, Ehlers-Danlos syndrome, and chiropractic neck manipulation)
- In individuals with COVID-19, See **COVID-19 and Multisystem Inflammatory Syndrome in Children (MIS-C) (PEDHD-12.7)**

Pediatric Stroke Subsequent Imaging (PEDHD-12.3)

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- MRI Brain without contrast (CPT[®] 70551) **OR** MRI Brain without and with contrast (CPT[®] 70553) is indicated for any new or worsening neurological findings or seizure activity.
- Repeat imaging for follow up and resolution of stroke or hemorrhage as determined by a neurology specialist or any provider in consultation with a neurology specialist.
 - MRI Brain without contrast (CPT[®] 70551) **OR** MRI Brain without and with contrast (CPT[®] 70553)
 - MRA Head/MRV Head (CPT[®] 70544, CPT[®] 70545 **OR** CPT[®] 70546) **OR** CTA Head/CTV Head (CPT[®] 70496) for follow-up of known cerebral artery stenosis or thrombosis^{1,3,5}
 - Other surveillance imaging indications after stroke are listed in the disease-specific sections.

Background and Supporting Information

- CT and MR Venography (CTV and MRV) are reported with the same codes as the CTA/MRA counterpart (there is no specific code for CT/MR venography):
 - If arterial and venous CT or MR studies are both performed in the same session, only **one** CPT[®] code is used to report both procedures
 - If an arterial CTA **OR** MRA study has been performed and subsequently a repeat study is needed to evaluate the venous anatomy, then this study is supported
 - If a venous CTV **OR** MRV study has been performed and subsequently a repeat study is needed to evaluate the arterial anatomy, then this study is supported
 - MRA without and with contrast with venous sinus thrombosis to differentiate total from subtotal occlusion

Moyamoya Syndrome/Disease (PEDHD-12.4)

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See Moyamoya Syndrome/Disease (HD-21.5)

Sickle Cell Disease (PEDHD-12.5)

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- The following imaging is indicated for all sickle cell individuals with a severe phenotype (Hgb SS or Hgb S β ⁰):
 - Transcranial Doppler (TCD) Ultrasound (CPT[®] 93886 or CPT[®] 93888) annually for all individuals age 2 to 16:
 - A short interval repeat study is indicated for individuals with conditional (170-199 cm/sec) flow results, or with individuals undergoing transfusion therapy.
 - Transcranial Doppler (TCD) Ultrasound (CPT[®] 93886 or CPT[®] 93888)¹² for children aged 17 years old may be appropriate on a case-by-case basis.
 - See also **Stroke/TIA (HD-21.1)** in the Head Imaging Guidelines
 - After 17 years old, for individuals with a history of abnormal TCDs, TCDs may be repeated every 3 months.
 - TCD is not indicated for individuals with other phenotypes (Hgb SC, Hgb S β ⁺).
 - See indications below for advanced imaging with MR or CT.
- MRI Brain without contrast (CPT[®] 70551) **OR** MRI Brain without and with contrast (CPT[®] 70553) is indicated for any of the following:
 - 2 non-imaging Transcranial Doppler (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.
 - Persistently abnormal TCD velocities
 - For more regarding TCD, see **Background and Supporting Information**
 - Screening to detect silent cerebral infarcts
 - New symptoms or cognitive impairment occurs or a change in academic performance
 - After an infarct-like lesion is identified, repeat every 12-24 months to assess for cerebral infarct progression
 - Prior to any change in therapy¹³⁻¹⁸

Background and Supporting Information

- TCD is used to screen for overt and silent infarctions and monitor response to transfusion therapy
- Individuals 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 individuals 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.

CNS Vasculitis and Stroke (PEDHD-12.6)

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- MRI Brain without and with contrast (CPT[®] 70553) is the recommended initial study for all individuals 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.
 - Individuals with aggressive disease being treated with systemic therapy can have imaging for treatment response every 3 months during active treatment.
 - Annual surveillance imaging is appropriate to detect progressive vascular damage that may require intervention.

COVID-19 and Multisystem Inflammatory Syndrome in Children (MIS-C) (PEDHD-12.7)

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- Symptoms of MIS-C may include some or all of the following:
 - Headache **AND/OR** irritability
 - Mucocutaneous changes similar to Kawasaki disease (i.e. strawberry tongue, red cracked lips, rash of hands and/or feet)
 - Polymorphous **AND/OR** vasculitic rash
 - Non-exudative conjunctivitis
 - Tachycardia **AND/OR** hypotension
 - Cough **AND/OR** shortness of breath
 - Abdominal pain, vomiting **AND/OR** diarrhea
 - Lymphadenopathy, joint pain **AND/OR** sore throat
- MRA is the preferred study in children however, CTA Head (CPT[®] 70496) and/or Neck (CPT[®] 70498) is appropriate if MRA is contraindicated

Indication	Imaging Study
<ul style="list-style-type: none"> ◦ Imaging for neurological signs and/or symptoms, including headache, after known or presumed COVID-19 infection 	<ul style="list-style-type: none"> ◦ Any or all of the following sets of imaging: <ul style="list-style-type: none"> ▪ MRI Brain without contrast (CPT[®] 70551) OR ▪ MRI Brain without and with contrast (CPT[®] 70553) ▪ 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)

- If concern for CNS infection – See **CNS Infection (PEDHD-29.1)**
- See **Multisystem inflammatory syndrome in children (MIS-C) (PEDCD-12)** in the Pediatric Cardiac Imaging Guidelines

Background and Supporting Information

- COVID-19 infections in children are generally mild in comparison to that of adults, however a post viral syndrome in children has become increasingly noted.
- Multisystem Inflammatory Syndrome in Children (MIS-C) can cause an inflammatory vasculopathy, prothrombotic state and/or post viral myocarditis in children who have had a COVID-19 infection caused by SARS-CoV-2. The child may have had minor symptoms or been asymptomatic at the time of COVID-19 infection but the virus can trigger endothelial injury and activation of the IL-1 pathway similar to that in Kawasaki disease and acute rheumatic fever.

Multisystemic Smooth Muscle Syndrome (MSMS)/Smooth Muscle Dysfunction Syndrome (SMDS)/ACTA2 Mutations (PEDHD-12.8)

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See Multisystemic Smooth Muscle Syndrome (MSMS)/Smooth Muscle Dysfunction Syndrome (SMDS)/ACTA2 Mutations (HD-21.7)

References (HDP-12)

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1. Robertson RL, et al. American College of Radiology ACR Appropriateness Criteria® Cerebrovascular Disease–Child. New 2019. 1-23
2. Ferriero DM, Fullerton HJ, Bernard TJ, et al. Management of Stroke in Neonates and Children: A Scientific Statement From the American Heart Association/American Stroke Association. *Stroke*. 2019;50(3). doi:10.1161/str.000000000000183
3. Mirsky DM, Beslow LA, Amlie-Lefond C, et al. Pathways for Neuroimaging of Childhood Stroke. *Pediatric Neurology*. 2017;69:11-23. doi:10.1016/j.pediatrneurol.2016.12.004
4. Soliman M, Laxer R, Manson D, et al. Imaging of systemic vasculitis in childhood. *Pediatr Radiol*. 2015 Aug; 45(8):1110-1125
5. Khalaf A, Iv M, Fullerton H, Wintermark M. Pediatric Stroke Imaging. *Pediatric Neurology*. 2018;86:5-18. doi:10.1016/j.pediatrneurol.2018.05.008
6. ACR-ASNR- SPR Practice Parameters for the performance of Computed Tomography (CT) perfusion in neuroradiologic imaging. Revised 2017. Resolution 18. <https://www.acr.org/-/media/ACR/Files/Practice-Parameters/CT-Perfusion.pdf>
7. Debaun MR, Jordan LC, King AA, et al. American Society of Hematology 2020 guidelines for sickle cell disease: prevention, diagnosis, and treatment of cerebrovascular disease in children and adults. *Blood Advances*. 2020;4(8):1554-1588. doi:10.1182/bloodadvances.2019001142
8. McMurray JC, May JW, Cunningham MW, Jones OY. Multisystem Inflammatory Syndrome in Children (MIS-C), a Post-viral Myocarditis and Systemic Vasculitis-A Critical Review of Its Pathogenesis and Treatment. *Frontiers in Pediatrics*. 2020;8:626182. doi:https://doi.org/10.3389/fped.2020.626182
9. Jiang Li, et al. COVID-19 and multisystem inflammatory syndrome in children and adolescents. *Lancet Infect Dis* 2020;20:e276–88
10. Panda PK, Sharawat IK, Panda P, Natarajan V, Bhakat R, Dawman L. Neurological Complications of SARS-CoV-2 Infection in Children: A Systematic Review and Meta-Analysis [published online ahead of print, 2020 Sep 10]. *J Trop Pediatr*. 2020;fmaa070. doi:10.1093/tropej/fmaa070
11. Lin JE, Asfour A, Sewell TB, et al. Neurological issues in children with COVID-19. *Neurosci Lett*. 2021;743:135567. doi:10.1016/j.neulet.2020.135567
12. Bernaudin F, Verlhac S, Arnaud C, et al. Long-term treatment follow-up of children with sickle cell disease monitored with abnormal transcranial Doppler velocities. *Blood*. 2016;127(14):1814-1822. doi:10.1182/blood-2015-10-675231
13. Nickel RS, Kamani NR. Ethical Challenges in Hematopoietic Cell Transplantation for Sickle Cell Disease. *Biol Blood Marrow Transplant*. 2018;24(2):219-227. doi:10.1016/j.bbmt.2017.08.034
14. Krishnamurti L. Hematopoietic Cell Transplantation for Sickle Cell Disease. *Frontiers in Pediatrics*. 2021;8. doi:10.3389/fped.2020.551170
15. King AA, McKinstry RC, Wu J, et al. Functional and Radiologic Assessment of the Brain after Reduced-Intensity Unrelated Donor Transplantation for Severe Sickle Cell Disease: Blood and Marrow Transplant Clinical Trials Network Study 0601. *Biol Blood Marrow Transplant*. 2019;25(5):e174-e178. doi:10.106/j.bbmt.2019.01.008
16. Kanter J, Liem RI, Bernaudin F, et al. American Society of Hematology 2021 guidelines for sickle cell disease: stem cell transplantation. *Blood Adv*. 2021;5(18):3668-3689. doi:10.1182/bloodadvances.2021004394C
17. Jordan LC, Kassim AA, Wilkerson KL, Lee CA, Waddle SL, Donahue MJ. Using novel magnetic resonance imaging methods to predict stroke risk in individuals with sickle cell anemia. *Hematol Oncol Stem Cell Ther*. 2020;13(2):76-84. doi:10.1016/j.hemonc.2019.12.009
18. Hirtz D, Kirkham FJ. Sickle Cell Disease and Stroke. *Pediatr Neurol*. 2019;95:34-41. doi:10.1016/j.pediatrneurol.2019.02.018
19. ACR-ASNR-SPR PRACTICE PARAMETER FOR THE PERFORMANCE OF INTRACRANIAL MAGNETIC RESONANCE PERFUSION IMAGING. Revised 2022 (Resolution 24). PRACTICE PARAMETER MR_Perfusion.<https://www.acr.org/-/media/ACR/Files/Practice-Parameters/mr-perfusion.pdf? la=en>.

Benign Brain Lesions (PEDHD-13)

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Arachnoid Cysts (PEDHD-13.1)

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See Arachnoid Cysts (HD-35.1)

Pineal/Colloid Cysts (PEDHD-13.2)

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See Pineal/Colloid Cysts (HD-34.1)

Acoustic Neuromas (PEDHD-13.3)

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- See **Neurofibromatosis 2 (PEDPND-2.2)** in the Pediatric Peripheral Nerve and Neuromuscular Disorders Imaging Guidelines

Pediatric Demyelinating Diseases (PEDHD-14)

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Pediatric Demyelinating Disease General Considerations (PEDHD-14.1)

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- For evaluation of pediatric demyelinating disease the following imaging is supported:
 - MRI Brain without and with contrast (CPT[®] 70553) **AND/OR**
 - MRI Cervical Spine without and with contrast (CPT[®] 72156) **AND/OR**
 - MRI Thoracic Spine without and with contrast (CPT[®] 72157)
- MRI Lumbar Spine without and with contrast (CPT[®] 72158) is not indicated unless the individual 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.
- Metabolic (FDG) PET Brain (CPT[®] 78608) and MR Spectroscopy (CPT[®] 76390) are considered not medically necessary for evaluation of pediatric demyelinating diseases.
- See **Neurometabolic and Neurogenetic Disorders (PEDHD-19.4)**

Multiple Sclerosis (MS) (PEDHD-14.2)

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Indication	Supported Imaging
<p>Initial diagnosis in individuals with clinical signs and/or symptoms suggestive of MS</p>	<ul style="list-style-type: none"> • MRI Brain without and with contrast (CPT[®] 70553) AND/OR • MRI Cervical Spine without and with contrast (CPT[®] 72156) AND/OR • MRI Thoracic Spine without and with contrast (CPT[®] 72157) <p>If there is a contraindication to gadolinium administration, then</p> <ul style="list-style-type: none"> • MRI Brain without contrast (CPT[®] 70551) AND/OR • MRI Cervical Spine without contrast (CPT[®] 72141) AND/OR • MRI Thoracic Spine without contrast (CPT[®] 72146)

Indication	Supported Imaging
Disease monitoring whether or not receiving treatment ¹⁸	Every 6 months or for new signs/symptoms: <ul style="list-style-type: none"> • MRI Brain without contrast (CPT[®] 70551) OR • MRI Brain without and with contrast (CPT[®] 70553) Every 12 months or for new signs/symptoms: <ul style="list-style-type: none"> • MRI Cervical Spine without and with contrast (CPT[®] 72156) OR • MRI Cervical Spine without contrast (CPT[®] 72141) <p>AND/OR</p> <ul style="list-style-type: none"> • MRI Thoracic Spine without and with contrast (CPT[®] 72157) OR • MRI Thoracic Spine without contrast (CPT[®] 72146)
Optic Neuritis Suspected	<ul style="list-style-type: none"> • MRI Orbits/Face/Neck without and with contrast (CPT[®] 70543) may be added If there is a contraindication to gadolinium administration, then <ul style="list-style-type: none"> • MRI Orbits/Face/Neck without contrast (CPT[®] 70540) may be added
Symptoms suggestive of Progressive Multifocal Leukoencephalopathy (PML) during natalizumab (Tysabri [®]) therapy (or other medications with similar risk)	<ul style="list-style-type: none"> • MRI Brain without and with contrast (CPT[®] 70553) If there is a contraindication to gadolinium administration, then <ul style="list-style-type: none"> ◦ MRI Brain without contrast (CPT[®] 70551)

Indication	Supported Imaging
Screening for individuals on natalizumab (Tysabri [®]) or other drugs with risk of Progressive Multifocal Leukoencephalopathy (PML)	Every 6 months while on treatment: <ul style="list-style-type: none"> • MRI Brain without and with contrast (CPT[®] 70553) OR • MRI Brain without contrast (CPT[®] 70551) Every 3-6 months for high risk individuals positive for serum JC virus antibody and >18 months natalizumab exposure: <ul style="list-style-type: none"> • MRI Brain without and with contrast (CPT[®] 70553) OR • MRI Brain without contrast (CPT[®] 70551)
If MRI Brain without contrast (CPT [®] 70551) shows incidental evidence of possible demyelinating disease ¹⁹	<ul style="list-style-type: none"> • MRI Brain without and with contrast (CPT[®] 70553) OR • MRI Brain with contrast (CPT[®] 70552)
After an MRI Brain without contrast (CPT [®] 70551), a follow up MRI brain may be performed at the discretion of a neurologist, a neurosurgeon, or a neuro-ophthalmologist, or any provider in consultation with a neurologist, neurosurgeon, or neuro-ophthalmologist, and/or at the recommendation of the radiologist ¹⁹	<ul style="list-style-type: none"> • MRI Brain without and with contrast (CPT[®] 70553) OR • MRI Brain with contrast (CPT[®] 70552)

Background and Supporting Information

- 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 of 10 years.
- Common presentations of MS in children include ataxia, optic neuritis, diplopia, transverse myelitis or as an acute encephalitis-like illness.
- Among children with suspected demyelinating diseases, the principal differential diagnosis is often between MS, Acute Disseminated Encephalomyelitis (See **Acute Disseminated Encephalomyelitis (ADEM) and Other Pediatric Demyelinating Disorders (PEDHD-14.3)**) or MOG Antibody-Associated Disease (MOGAD). (See **MOG Antibody-Associated Disease (MOGAD) (HD-16.3)**).

- Medications with similar risks of Progressive Multifocal Leukoencephalopathy (PML) as Tysabri[®] include: dimethyl fumarate (Tecfidera[®]), fingolimod (Gilenya[®]), ocrelizumab (Ocrevus[®]), cladribine (Mavenclad[®]), diroximel fumarate (Vumerity[®]), eculizumab (Soliris[®]), ozanimod (Zeposia[®]), alemtuzumab (Lemtrada[®]), monomethyl fumarate (Bafiertam[®]), rituximab (Rituxan[®]).
- If a non-contrast study shows incidental evidence of possible demyelinating disease, repeat imaging is appropriate as the presence of enhancing lesions may be helpful in confirming the diagnosis.
- 3D imaging in the evaluation of Multiple Sclerosis is not supported as a separate code. Most scanners are capable of 3D acquisitions or other imaging sequences.

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

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- 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 without and with contrast (CPT[®] 70553) and MRI Cervical Spine without and with contrast (CPT[®] 72156) and MRI Thoracic Spine without and with contrast (CPT[®] 72157) are indicated for initial diagnosis in individuals with clinical signs and/or symptoms suggestive of ADEM.
 - MRI Brain without contrast (CPT[®] 70551) and MRI Cervical Spine without contrast (CPT[®] 72141) and MRI Thoracic Spine without contrast (CPT[®] 72146) are indicated if there is a contraindication to gadolinium.
- MRI Brain without and with contrast (CPT[®] 70553) **AND/OR** MRI Cervical Spine without and with contrast (CPT[®] 72156) **AND/OR** MRI Thoracic Spine without and with contrast (CPT[®] 72157) is/are indicated every 3 months for 1 year following diagnosis or if ordered out of sequence or beyond one year by a neurologist or any provider in consultation with a neurologist.
 - MRI Brain without contrast (CPT[®] 70551) **AND/OR** MRI Cervical Spine without contrast (CPT[®] 72141) **AND/OR** MRI Thoracic Spine without contrast (CPT[®] 72146) is/are indicated if there is a contraindication to gadolinium.
 - Most individuals will have complete clinical recovery by 12 months, while stable MRI abnormalities (gliosis) may persist. These findings do not require additional imaging unless the individual 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 (See **Neuromyelitis Optica Spectrum Disorders (HD-16.2)**)
 - Anti-MOG syndromes (anti-myelin oligodendrocyte glycoprotein) (See **Anti-MOG Syndromes (HD-16.3)**)
 - Demyelination secondary to infectious or inflammatory disorders (e.g. transverse myelitis) (See **General Guidelines – Other Imaging Situations (HD-1.7)**)
- 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 is supported.

- See **Neurometabolic and Neurogenetic Disorders (PEDHD-19.4)**

Transverse Myelitis (PEDHD-14.4)

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- Transverse myelitis is an inflammatory disorder of the spine and can be:
 - Idiopathic
 - Associated with autoimmune central nervous system inflammatory disease
 - First event of multiple sclerosis (MS)
 - Neuromyelitis optica (NMO)
 - MOG (Myelin Oligodendrocyte Glycoprotein) antibody disorder
 - Associated with connective tissue autoimmune disease
 - Systemic Lupus Erythematosus (SLE)
 - Systemic Sclerosis
 - Rheumatoid Arthritis (RA)
 - Sjogren's Syndrome (SS)
 - Neuro-Sarcoidosis (NS)
 - Post-infectious or post-vaccine neurological syndrome
- See **Transverse Myelitis (HD-16.4)**

References (HDP-14)

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1. Weygandt M, Hummel H-M, Schregel K, et al. MRI-based diagnostic biomarkers for early onset pediatric multiple sclerosis. *NeuroImage: Clinical*. 2015;7:400-408. doi:10.1016/j.nicl.2014.06.015
2. Tenenbaum SN. Pediatric multiple sclerosis. Distinguishing clinical and MR imaging features. *Neuroimag Clin*. 2017; 27:229-250
3. Van Haren K, Waubant E. Therapeutic Advances in Pediatric Multiple Sclerosis. *The Journal of Pediatrics*. 2013;163(3):631-637. doi:https://doi.org/10.1016/j.jpeds.2013.04.028
4. Ketelslegers IA, Neuteboom RF, Boon M, Catsman-Berrepoets CE, Hintzen RQ. A comparison of MRI criteria for diagnosing pediatric ADEM and MS. *Neurology*. 2010;74(18):1412-1415. doi:https://doi.org/10.1212/wnl.0b013e3181dc138b
5. Banwell B, Arnold DL, Tillema J-M, et al. MRI in the evaluation of pediatric multiple sclerosis. *Neurology*. 2016;87(9 Supplement 2). doi:10.1212/wnl.0000000000002787
6. Marin SE, Callen DJA. The Magnetic Resonance Imaging Appearance of Monophasic Acute Disseminated Encephalomyelitis. *Neuroimaging Clinics of North America*. 2013;23(2):245-266. doi:https://doi.org/10.1016/j.nic.2012.12.005
7. Neuteboom R, Wilbur C, Pelt DV, Rodriguez M, Yeh A. The Spectrum of Inflammatory Acquired Demyelinating Syndromes in Children. *Seminars in Pediatric Neurology*. 2017;24(3):189-200
8. Ruet A. Update on pediatric-onset multiple sclerosis. *Revue Neurologique*. 2018;174(6):398-407. doi:10.1016/j.neuro.2018.04.003
9. Troxell RM, Christy A. Atypical Pediatric Demyelinating Diseases of the Central Nervous System. *Current Neurology and Neuroscience Reports*. 2019;19(12). doi:10.1007/s11910-019-1015-y
10. Thompson AJ, Banwell BL, Barkhof F, et al. Diagnosis of multiple sclerosis: 2017 revisions of the McDonald criteria. *The Lancet Neurology*. 2018;17(2):162-173. doi:10.1016/s1474-4422(17)30470-2
11. Expert Panel on Neurologic Imaging; Kennedy TA, Corey AS, et al. ACR Appropriateness Criteria® Orbits Vision and Visual Loss. *J Am Coll Radiol*. 2018;15(5S):S116-S131. doi:10.1016/j.jacr.2018.03.023
12. Wingerchuk DM et al. International consensus diagnostic criteria for neuromyelitis optica spectrum disorders. *Neurology*. 2015;85(2):177-89. doi:10.1212/WNL.0000000000001729
13. Major EO. Progressive Multifocal Leukoencephalopathy Lesions and JC Virus. *JAMA Neurology*. 2018;75(7):789. doi:10.1001/jamaneurol.2018.0004
14. Vukusic S, Rollot F, Casey R, et al. Progressive Multifocal Leukoencephalopathy Incidence and Risk Stratification Among Natalizumab Users in France. *JAMA Neurology*. 2020;77(1):94. doi:10.1001/jamaneurol.2019.2670
15. Rae-Grant A, et al. Practice guideline: Disease-modifying therapies for adults with multiple sclerosis. Report of the Guideline Development, Dissemination, and Implementation Subcommittee of the American Academy of Neurology
16. Wattjes MP, Barkhof F. Diagnosis of natalizumab-associated progressive multifocal leukoencephalopathy using MRI. *Current Opinion in Neurology*. 2014;27(3):260-270. doi:10.1097/wco.0000000000000099
17. Barraza G, Deiva K, Husson B, Adamsbaum C. Imaging in pediatric multiple sclerosis. *Clinical Neuroradiology* 2021;31:61-71
18. Wattjes MP, Ciccarelli O, Reich DS, et al. 2021 MAGNIMS-CMSC-NAIMS consensus recommendations on the use of MRI in patients with multiple sclerosis. *The Lancet Neurology*. 2021;20(8):653-670. doi:10.1016/S1474-4422(21)00095-8
19. Tillema JM. Imaging of Central Nervous System Demyelinating Disorders. *Continuum (Minneapolis)*. 2023;29(1):292-323. doi:10.1212/CON.0000000000001246

Pituitary Dysfunction (PEDHD-15)

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Pituitary Dysfunction General Considerations (PEDHD-15.1)

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- 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.
- MRI Brain without and with contrast (CPT[®] 70553) or MRI Brain without contrast (CPT[®] 70551) when pituitary imaging is indicated.
 - Pituitary Gland: one study (either MRI Brain without and with contrast [CPT[®] 70553] **OR** MRI Orbits/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 MRI Brain with contrast (CPT[®] 70552) **OR** MRI Brain with and without contrast (CPT[®] 70553) is appropriate
- For association between pituitary dysfunction and optic nerve issues see **Eye Disorders and Visual Loss (HD- 32.1)** in the Head Imaging Guidelines
- For repeat imaging, See **Pituitary (HD-19.1)** in the Head Imaging Guidelines

Panhypopituitarism (PEDHD-15.2)

HDP.PD.0015.2.A

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- 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.
- Individuals with a normal pituitary on initial MRI do not need routine follow up imaging.
- Individuals with mass lesions should have follow up imaging according to the guidelines for the specific diagnosis

Isolated Growth Hormone Deficiency (PEDHD-15.3)

HDP.PD.0015.3.A

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- 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 or Tanner stage.
 - 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 **Background and Supporting Information**
- Individuals with a normal pituitary on initial MRI do not need routine follow up imaging.
- Individuals with mass lesions should have follow up imaging according to the guidelines for the specific diagnosis.

Background and Supporting Information

- 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.

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

HDP.PD.0015.4.A

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- 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
- Individuals 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 individuals, and MRI should be repeated if a significant rise in β -hCG is detected on screening.
- Individuals 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 indicated for initial evaluation of unexplained central (hypothalamic pituitary) SIADH.
- Individuals with a normal pituitary on initial MRI do not need routine follow up imaging.
- Individuals with mass lesions should have follow up imaging according to the guidelines for the specific diagnosis.

Background and Supporting Information

- See **Small Cell Lung Cancer-Suspected/Diagnosis (ONC-7.1)** and **Paraneoplastic Syndromes (ONC-30.3)** 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.

Precocious Puberty (PEDHD-15.5)

HDP.PD.0015.5.A

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- 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) and/or abdominal and/or pelvic ultrasound (See Peripheral Precocious Puberty below).
- 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 individuals with precocious puberty and concurrent CNS symptoms of severe headache, visual changes or seizures.
- Individuals with a normal pituitary on initial MRI do not need routine follow up imaging.
- Individuals with mass lesions should have follow up imaging according to the guidelines for the specific diagnosis. (**Benign Pituitary Tumors (PEDHD-15.6)** and **Pituitary Malignancies (PEDHD-15.7)**)

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
- 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 for initial imaging.
- See **CNS Germinomas and Non-Germinomatous Germ Cell Tumors (PEDONC-4.7)** in the Pediatric and Special Populations Oncology Imaging Guidelines for evaluation of HCG secreting CNS tumors

- See **Hepatoblastoma (PEDONC-11.2)** in the Pediatric and Special Populations Oncology Imaging Guidelines for evaluation of HCG secreting hepatic tumors
- See **Pediatric Germ Cell Tumors (PEDONC-10)** in the Pediatric and Special Populations Oncology Imaging Guidelines and **Testicular, Ovarian and Extragonadal Germ Cell Tumors (ONC-20)** in the Oncology Imaging Guidelines for evaluation of Leydig Cell tumors.
- See **Adrenal Cortical Lesions (AB-16.1)** in the Abdomen Imaging Guidelines for evaluation of adrenal virilizing tumors

Benign Pituitary Tumors (PEDHD-15.6)

HDP.PD.0015.6.A

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

Pituitary Malignancies (PEDHD-15.7)

HDP.PD.0015.7.A

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

References (HDP-15)

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1. Expert Panel on Neurologic Imaging; Burns J, Policeni B, et al. ACR Appropriateness Criteria[®] Neuroendocrine Imaging. *J Am Coll Radiol*. 2019;16(5S):S161-S173. doi:10.1016/j.jacr.2019.02.017
2. Kaplowitz P, Bloch C. Evaluation and Referral of Children With Signs of Early Puberty. *Pediatrics*. 2015;137(1). doi:10.1542/peds.2015-3732
3. Grimberg A, Divall SA, Polychronakos C, et al. Guidelines for Growth Hormone and Insulin-Like Growth Factor-I Treatment in Children and Adolescents: Growth Hormone Deficiency, Idiopathic Short Stature, and Primary Insulin-Like Growth Factor-I Deficiency. *Hormone Research in Paediatrics*. 2016;86(6):361-397. doi:10.1159/000452150
4. Thompson CJ et al. Posterior Pituitary. Textbook of Endocrinology. Chapter 10, eds. Melmed S, et al, 14th edition. 2019. pp 303-330
5. Cooke DW et al. Normal and Aberrant Growth in Children. Textbook of Endocrinology. Chapter 25, eds. Melmed S, et al, 14th edition. 2019. pp 937-1022
6. Styne DM et al. Physiology and Disorders of Puberty. Textbook of Endocrinology. Chapter 26, eds. Melmed S, et al, 14th edition. 2019. pp 1023-1164
7. IGFB3 - Clinical: Insulin-Like Growth Factor-Binding Protein 3, Serum. www.mayocliniclabs.com. <https://www.mayocliniclabs.com/test-catalog/Clinical+and+Interpretive/83300>
8. IGFMS - Clinical: Insulin-Like Growth Factor-1, LC-MS, Serum. www.mayocliniclabs.com. <https://www.mayocliniclabs.com/test-catalog/Clinical+and+Interpretive/62750>

Pediatric Ear Disorders (PEDHD-16)

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Hearing Loss (PEDHD-16.1)

HDP.ED.0016.1.A

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- A pertinent 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 Orbits/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 individuals 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 **Tinnitus (PEDHD-16.5)**
- Both modalities (CT and MRI) are supported 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) is supported 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 **General Guidelines – Anatomic Issues (HD-1.1)** in the Head Imaging Guidelines)

Ear Pain (PEDHD-16.2)

HDP.ED.0016.2.A
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- A pertinent 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, and referred pain from the oral pharynx, tonsillitis, and pharyngitis.
- Advanced imaging is not indicated in the overwhelming majority of pediatric individuals with ear pain.

Indications	Imaging Study
<ul style="list-style-type: none"> ◦ Any of the following <ul style="list-style-type: none"> ▪ 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 	<ul style="list-style-type: none"> ◦ ONE of the following: <ul style="list-style-type: none"> ▪ CT Orbits/Temporal Bone without contrast (CPT[®] 70480) OR ▪ CT Orbits/Temporal Bone 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)

Cholesteatoma (PEDHD-16.3)

HDP.ED.0016.3.A

v1.0.2025

- One of the following study is indicated for preoperative evaluation in children with cholesteatoma:
 - CT Orbits/Temporal Bone without contrast (CPT[®] 70480) **OR**
 - CT Orbits/Temporal Bone 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)
- ONE of the following study is indicated one time post-operatively to exclude residual or regrown cholesteatoma to avoid the need for a second-look surgery:
 - CT Orbits/Temporal Bone without contrast (CPT[®] 70480) **OR**
 - CT Orbits/Temporal 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)

Background and Supporting Information

- 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 a white mass in the middle ear cleft, painless drainage from the ear or chronic/recurrent ear infections. Advanced imaging for the diagnosis and management of suspected cholestatoma, in particular, should be reserved for the otolaryngologist or provider in consultation with the otolaryngologist.

Vertigo (PEDHD-16.4)

HDP.ED.0016.4.A

v1.0.2025

- A pertinent 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.

Background and Supporting Information

Isolated vertigo is an uncommon complaint during childhood. Middle ear/Eustachian tube problems are the most common cause of isolated vertigo in children.

Tinnitus (PEDHD-16.5)

HDP.ED.0016.5.A
v1.0.2025

- Tinnitus without hearing loss is a less common complaint during childhood.
- Children with hearing loss and tinnitus should be imaged according to **Hearing Loss (PEDHD-16.1)**. A pertinent 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 individuals with isolated tinnitus and normal hearing.

Indications	Imaging Study
<ul style="list-style-type: none"> • ANY of the following <ul style="list-style-type: none"> ◦ Clinical suspicion of mass lesion causing tinnitus ◦ Persistent tinnitus after recent significant trauma 	<ul style="list-style-type: none"> • ONE of the following <ul style="list-style-type: none"> ◦ CT Orbits/Temporal Bone without contrast (CPT[®] 70480) OR ◦ CT Orbits/Temporal Bone without and with contrast (CPT[®] 70482), OR ◦ MRI Brain without and with contrast with attention to internal auditory canals (CPT[®] 70553) OR ◦ MRI Brain without contrast with attention to internal auditory canals (CPT[®] 70553) OR ◦ MRI Orbits/Face/Neck without and with contrast (CPT[®] 70543)
<ul style="list-style-type: none"> • ANY of the following: <ul style="list-style-type: none"> ◦ Pulsatile tinnitus ◦ Suspicion for vascular lesions 	<ul style="list-style-type: none"> • 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)

References (HDP-16)

v1.0.2025

1. Expert Panel on Neurologic Imaging:, Sharma A, Kirsch CFE, et al. ACR Appropriateness Criteria® Hearing Loss and/or Vertigo. *J Am Coll Radiol*. 2018;15(11S):S321-S331. doi:10.1016/j.jacr.2018.09.020
2. Minovi A, and Dazert S. Diseases of the middle ear in childhood. *GMS Curr Top Otorhinolaryngol Head Neck Surg*. 2014 Dec; 13:1-29
3. Kerr R, Kang E, Hopkins B, Anne S. Pediatric tinnitus: Incidence of imaging anomalies and the impact of hearing loss. *International Journal of Pediatric Otorhinolaryngology*. 2017;103:147-149
4. Jahn K. Vertigo and dizziness in children. *Handbook of Clinical Neurology Neuro-Otology*. 2016:353-363. doi:10.1016/b978-0-444-63437-5.00025-x
5. Shekdar KV, Bilaniuk LT. Imaging of Pediatric Hearing Loss. *Neuroimaging Clinics of North America*. 2019;29(1):103-115. doi:10.1016/j.nic.2018.09.011
6. ACR-ASNR-SPR Practice Parameter for the Performance of Computed Tomography (CT) of the Extracranial Head and Neck Revised 2021. (Resolution 5). <https://www.acr.org/-/media/ACR/Files/Practice-Parameters/CT-Head-Neck>
7. Rosenfeld RM, Shin JJ, Schwartz SR, et al. Clinical Practice Guideline: Otitis Media with Effusion (Update). *Otolaryngology–Head and Neck Surgery*. 2016;154(1_suppl). doi:10.1177/0194599815623467
8. Rosenfeld RM, Schwartz SR, Cannon CR, et al. Clinical Practice Guideline. *Otolaryngology–Head and Neck Surgery*. 2014;150(1_suppl). doi:10.1177/0194599813517083
9. Rosenfeld RM, Schwartz SR, Pynnonen MA, et al. Clinical practice guideline: Tympanostomy tubes in children. *Otolaryngol Head Neck Surg*. 2013;149(1 Suppl):S1-S35. doi:10.1177/0194599813487302
10. Expert Panel on Neurologic Imaging:, Kessler MM, Moussa M, et al. ACR Appropriateness Criteria® Tinnitus. *J Am Coll Radiol*. 2017;14(11S):S584-S591. doi:10.1016/j.jacr.2017.08.052
11. Lieu JEC, Kenna M, Anne S, Davidson L. Hearing Loss in Children: A Review. *JAMA*. 2020 Dec 1;324(21):2195-2205. doi: 10.1001/jama.2020.17647
12. Aylward SC, Reem RE. Pediatric Intracranial Hypertension. *Pediatr Neurol*. 2017 Jan;66:32-43. doi: 10.1016/j.pediatrneurol.2016.08.010
13. Ropers FG, Pham ENB, Kant SG, et al. Assessment of the Clinical Benefit of Imaging in Children With Unilateral Sensorineural Hearing Loss: A Systematic Review and Meta-analysis. *JAMA Otolaryngol Head Neck Surg*. 2019;145(5):431-443. doi:10.1001/jamaoto.2019.0121
14. Campion T, Taranath A, Pinelli L, et al. Imaging of temporal bone inflammations in children: a pictorial review. *Neuroradiology*. 2019;61(9):959-970. doi:10.1007/s00234-019-02258-1

Autism Spectrum Disorders (PEDHD-17)

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Autism Spectrum Disorders (PEDHD-17.1)

HDP.AS.0017.1.A

v1.0.2025

- 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) **OR** MRI Brain without contrast (CPT[®] 70551) is indicated for new or worsening focal neurologic findings documented on a pertinent physical. Consider advanced imaging if there is loss of developmental milestones and/or regression in two or more areas of development.
- PET imaging is considered not medically necessary in the evaluation of individuals with autism spectrum disorders.

References (HDP-17)

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1. Baker E, and Jeste SS. Diagnosis and Management of Autism Spectrum Disorder in the Era of Genomics. *Pediatric Clinics of North America*. 2015;62(3):607-618. doi:10.1016/j.pcl.2015.03.003
2. Zürcher NR, Bhanot A, McDougle CJ, Hooker JM. A systematic review of molecular imaging (PET and SPECT) in autism spectrum disorder: Current state and future research opportunities. *Neuroscience & Biobehavioral Reviews*. 2015;52:56-73. doi:10.1016/j.neubiorev.2015.02.002

Behavioral and Psychiatric Disorders (PEDHD-18)

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Behavioral and Psychiatric Disorders (PEDHD-18.1)

HDP.BD.0018.1.A

v1.0.2025

- Behavioral and psychiatric disorders of childhood or adolescence, to include Attention Deficit Hyperactivity Disorder (ADHD), generally require no advanced imaging for diagnosis or management.¹
 - MRI Brain without and with contrast (CPT[®] 70553) **OR** MRI Brain without contrast (CPT[®] 70551) **OR** CT Head without contrast (CPT[®] 70450) is indicated for:
 - Acute onset mental status change
 - New or worsening focal neurologic findings
 - Presentation of acute psychiatric symptoms with comorbid serious medical illness
 - Non-auditory hallucinations (e.g., visual, tactile, olfactory) with no known etiology
 - Nonresponse to adequate medication trials
 - Symptoms of an organic brain disorder (e.g., focal deficits, severe headache, or seizures)
 - Prior to Electro-Convulsive Therapy (ECT) to screen for intracranial disease, see

Mental Health Related Disorders (HD-4.2)

- For concerns of PANS (Pediatric acute-onset neuropsychiatric syndrome) and PANDAS (Pediatric autoimmune neuropsychiatric disorder associated with streptococcal infection) see **Movement Disorders including Tourette Syndrome (PEDHD-26)**

Reference (HDP-18)

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1. Pereira-Sanchez V, Castellanos FX. Neuroimaging in attention-deficit/hyperactivity disorder. *Curr Opin Psychiatry*. 2021;34(2):105-111. doi:10.1097/YCO.0000000000000669

Developmental Disorders (PEDHD-19)

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Intellectual Disability (PEDHD-19.1)

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v1.0.2025

- Intellectual disability may be primary or secondary to a variety of heterogeneous disorders. See **Background and Supporting Information**.
- MRI Brain without and with contrast (CPT[®] 70553) **OR** MRI Brain without contrast (CPT[®] 70551) is indicated for new or worsening focal neurologic findings and/or new or worsening cognitive decline.⁷

Background and Supporting Information

- Intellectual disability is a condition characterized by significant limitations in both intellectual functioning and adaptive behavior that originates before the age of 22.¹¹ One way to measure intellectual functioning is an IQ test. Generally, an IQ test score of around 70 or as high as 75 indicates a significant limitation in intellectual functioning.¹¹

Cerebral Palsy (PEDHD-19.2)

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- MRI Brain without and with contrast (CPT[®] 70553) **OR** MRI Brain without contrast (CPT[®] 70551) is indicated for:
 - Initial evaluation of newly diagnosed cerebral palsy.
 - New or worsening focal neurologic findings documented on a physical examination, including the presence of developmental delay.
 - Re-evaluation after 24 months of age due to rapid myelination during the first 2 years of life.
- For spinal imaging requests, see **Myelopathy (SP-7.1)** in the Spine Imaging Guidelines

Background and Supporting Information

- Many individuals with intellectual disability also have cerebral palsy, but not all individuals 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

Developmental Motor Delay (PEDHD-19.3)

HDP.ID.0019.3.A

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- There are many causes for developmental motor delay. Individuals with motor delay can have decreased, normal, or increased muscular tone. Individuals with normal tone do not require imaging unless they have focal neurologic findings.
- MRI Brain without contrast (CPT[®] 70551) **OR** 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.
 - Re-evaluation after 24 months of age due to rapid myelination during the first 2 years of life.
- For spinal imaging requests See **Myelopathy (SP-7.1)** in the Spine Imaging Guidelines and **Tethered Cord (PEDSP-5)** in the Pediatric and Special Populations Spine Imaging Guidelines.

Neurometabolic and Neurogenetic Disorders (PEDHD-19.4)

HDP.ID.0019.4.A

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Imaging Supported	Indications	Suspected or known Neurometabolic and/or neurogenetic disorders, but not limited to
<p>MRI Brain without and with contrast (CPT[®] 70553)</p> <p>OR</p> <p>MRI Brain without contrast (CPT[®] 70551)</p> <p>AND/OR</p> <p>Magnetic Resonance Spectroscopy (MRS, CPT[®] 76390)</p>	<p>Requested by a neurologist or geneticist, or any provider in consultation with a neurologist or geneticist, for:</p> <ul style="list-style-type: none"> • Initial evaluation <p>AND/OR</p> <ul style="list-style-type: none"> • Disease monitoring <p>AND/OR</p> <ul style="list-style-type: none"> • New or worsening symptoms <p>AND/OR</p> <ul style="list-style-type: none"> • Change in therapy is being considered 	<ul style="list-style-type: none"> • X-linked adrenoleukodystrophy (X-ALD, CALD) • Alexander disease (ALX, AXD, dysmyelinogenic leukodystrophy) • Canavan disease • Creatine deficiency • Globoid Cell Leukodystrophy (Krabbe disease) • Hypomyelination and Congenital Cataract • Maple Syrup Urine disease • Megalencephalic leukoencephalopathy with subcortical cysts

Imaging Supported	Indications	Suspected or known Neurometabolic and/or neurogenetic disorders, but not limited to
<p>MRI Brain without and with contrast (CPT[®] 70553)</p> <p>OR</p> <p>MRI Brain without contrast (CPT[®] 70551)</p> <p>AND/OR</p> <p>Magnetic Resonance Spectroscopy (MRS, CPT[®] 76390)</p>	<p>Requested by a neurologist or geneticist, or any provider in consultation with a neurologist or geneticist, for:</p> <ul style="list-style-type: none"> • Initial evaluation <p>AND/OR</p> <ul style="list-style-type: none"> • Disease monitoring <p>AND/OR</p> <ul style="list-style-type: none"> • New or worsening symptoms <p>AND/OR</p> <ul style="list-style-type: none"> • Change in therapy is being considered 	<ul style="list-style-type: none"> • Metachromatic Leukodystrophy (MCL) • Mitochondrial disorders (such as, but not limited to Leigh's syndrome, Kearns-Sayre syndrome, Mitochondrial Encephalopathy with Lactic Acidosis and Stroke-Like Episodes (MELAS)) • Nonketotic hyperglycinemia • Pelizaeus-Merzbacher disease (PMD) • Vanishing White Matter (VWM) disease (Leukoencephalopathy with VWM, Childhood Ataxia with CNS Hypomyelination (CACH) syndrome)

References (HDP-19)

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1. Noritz GH, and Murphy NA. Motor delays: early identification and evaluation. *Pediatrics*. 2013;131(6)
2. Murias K, Moir A, Myers KA, Liu I, Wei X-C. Systematic review of MRI findings in children with developmental delay or cognitive impairment. *Brain and Development*. 2017;39(8):644-655
3. Haynes KB, Wimberly RL, Vanpelt JM, Jo C-H, Riccio AI, Delgado MR. Toe Walking. *Journal of Pediatric Orthopaedics*. 2018;38(3):152-156
4. Sanyal S, et.al. Magnetic Resonance Imaging of Brain in Evaluation of Floppy Children: A Case Series. *Iran J Child Neurol*. 2015 Autumn; 9(4):65-74. PMID: PMC4670981 PMID: 26664445
5. Ali AS, et al. Magnetic Resonance Imaging (MRI) Evaluation of Developmental Delay in Pediatric Patients. *J Clin Diagn Res*. 2015 Jan; 9(1): TC21-TC24. doi: 10.7860/JCDR/2015/11921.5478
6. Barkovich AJ. Magnetic resonance techniques in the assessment of myelin and myelination. *Journal of Inherited Metabolic Disease*. 2005;28(3):311-343. doi:10.1007/s10545-005-5952-z
7. Bonkowsky JL, Keller S; AAP Section on Neurology, Council on Genetics. Leukodystrophies in Children: Diagnosis, Care, and Treatment. *Pediatrics*. 2021;148(3):e2021053126. doi:10.1542/peds.2021-053126
8. Mankad K, Talenti G, Tan AP, et al. Neurometabolic Disorders of the Newborn. *Top Magn Reson Imaging*. 2018;27(4):179-196. doi:10.1097/RMR.000000000000176
9. Whitehead MT, Lai LM, Blüml S. Clinical ¹H MRS in childhood neurometabolic diseases - part 2: MRS signatures. *Neuroradiology*. 2022;64(6):1111-1126. doi:10.1007/s00234-022-02918-9
10. Aida N. ¹H-MR Spectroscopy of the Early Developmental Brain, Neonatal Encephalopathies, and Neurometabolic Disorders. *Magn Reson Med Sci*. 2022;21(1):9-28. doi:10.2463/mrms.rev.2021-0055
11. American Association on Intellectual and Developmental Disabilities. Defining Criteria for Intellectual Disability. Aaidd.org. Published 2019. <https://www.aaidd.org/intellectual-disability/definition>

Ataxia (PEDHD-20)

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Ataxia (PEDHD-20.1)

HDP.AT.0020.1.A
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- See also **Developmental Disorders (PEDHD-19)**
- A pertinent evaluation including a detailed history and physical examination with a thorough neurologic examination, should be performed prior to considering advanced imaging, unless the individual 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 individual since onset of symptoms.
- If spinal etiology of ataxia is suspected the following may be indicated
 - MRI Cervical Spine (CPT[®] 72141 or CPT[®] 72156) **AND/OR**
 - MRI Thoracic Spine (CPT[®] 72146 or CPT[®] 72157) **AND/OR**
 - MRI Lumbar Spine (CPT[®] 72148 or CPT[®] 72158)

Indications	Imaging Studies
<ul style="list-style-type: none"> • ANY of the following: <ul style="list-style-type: none"> ◦ Ataxia ◦ Hereditary Ataxia ◦ Slowly progressive ataxia 	<ul style="list-style-type: none"> • ONE of the following: <ul style="list-style-type: none"> ◦ MRI Brain without and with contrast (CPT[®] 70553) OR ◦ MRI Brain without contrast (CPT[®] 70551)
<ul style="list-style-type: none"> • Suspected Spinal Etiology 	<ul style="list-style-type: none"> • MRI Cervical Spine without contrast (CPT[®] 72141) OR • MRI Cervical Spine without and with contrast (CPT[®] 72156) AND/OR • MRI Thoracic Spine without contrast (CPT[®] 72146) OR • MRI Thoracic Spine without and with contrast (CPT[®] 72157) AND/OR • MRI Lumbar Spine without contrast (CPT[®] 72148) OR • MRI Lumbar Spine without and with contrast (CPT[®] 72158)

Indications	Imaging Studies
<ul style="list-style-type: none"> • Acute ataxia following significant head trauma 	<ul style="list-style-type: none"> • ONE of the following: <ul style="list-style-type: none"> ◦ CT Head without contrast (CPT[®] 70450) OR ◦ CT Head without and with contrast (CPT[®] 70470) OR ◦ MRI Brain without contrast (CPT[®] 70551) OR ◦ MRI Brain without and with contrast (CPT[®] 70553)
<ul style="list-style-type: none"> • Contraindication to MRI 	<ul style="list-style-type: none"> • ONE of the following: <ul style="list-style-type: none"> ◦ CT Head without and with contrast (CPT[®] 70470) OR ◦ CT Head with contrast (CPT[®] 70460)
<ul style="list-style-type: none"> • BOTH of the following: <ul style="list-style-type: none"> ◦ Contraindication to MRI AND ◦ Suspected Spinal Etiology 	<ul style="list-style-type: none"> • CT Cervical Spine without contrast (CPT[®] 72125) OR • CT Cervical Spine without and with contrast (CPT[®] 72127) AND/OR • CT Thoracic Spine without contrast (CPT[®] 72128) OR • CT Thoracic Spine without and with contrast (CPT[®] 72130) AND/OR • CT Lumbar Spine without contrast (CPT[®] 72131) OR • CT Lumbar Spine without and with contrast (CPT[®] 72133)

- 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)

- Repeat imaging may be appropriate no more frequently than every 12 months when requested by a neurologist and/or neurosurgeon or any provider in consultation with a neurologist and/or neurosurgeon unless there are new signs or symptoms.

Background and Supporting Information

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.

References (HDP-20)

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1. Expert Panel on Pediatric Imaging, Radhakrishnan R, Shea LAG, et al. ACR Appropriateness Criteria® Ataxia-child. *J Am Coll Radiol*. 2022;19(11S):S240-S255. doi:10.1016/j.jacr.2022.09.010
2. Salman MS, Chodirker BN, Bunge M. Neuroimaging Findings and Repeat Neuroimaging Value in Pediatric Chronic Ataxia. *Canadian Journal of Neurological Sciences / Journal Canadien des Sciences Neurologiques*. 2016;43(06):824-832
3. Vedolin L, Gonzalez G, Souza C, Lourenço C, Barkovich A. Inherited Cerebellar Ataxia in Childhood: A Pattern-Recognition Approach Using Brain MRI. *American Journal of Neuroradiology*. 2012;34(5):925-934. doi:10.3174/ajnr.a3055
4. Alves CAPF, Fragoso DC, Gonçalves FG, Marussi VH, Amaral LLFD. Cerebellar Ataxia in Children. *Topics in Magnetic Resonance Imaging*. 2018;27(4):275-302. doi:10.1097/rmr.000000000000175

Epistaxis (PEDHD-21)

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Epistaxis Imaging (PEDHD-21.1)

HDP.ET.0021.1.A

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- 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** CT Maxillofacial without and with contrast (CPT[®] 70488)
 - MRI Orbits/Face/Neck without and with contrast (CPT[®] 70543)

References (HDP-21)

v1.0.2025

1. Tunkel DE, Anne S, Payne SC, et al. Clinical Practice Guideline: Nosebleed (Epistaxis). *Otolaryngology–Head and Neck Surgery*. 2020;162(1_suppl). doi:10.1177/0194599819890327
2. ACR-ASNR-SPR Practice Parameter for the Performance of Computed Tomography (CT) of the Extracranial Head and Neck Revised 2021. (Resolution 5). <https://www.acr.org/-/media/ACR/Files/Practice-Parameters/CT-Head-Neck>

Papilledema/Pseudotumor Cerebri (PEDHD-22)

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Papilledema/Pseudotumor Cerebri (PEDHD-22.1)

HDP.PC.0022.1.A

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- Papilledema/Pseudotumor cerebri indications in pediatric individuals are identical to those for adult individuals. See **Papilledema/Pseudotumor Cerebri (HD-17.1)** in the Head Imaging Guidelines.

Cranial Neuropathies (PEDHD-23)

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Cranial Neuropathies (PEDHD-23.1)

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- See **Cranial Neuropathies (HD-31.1)**

Pediatric Sleep Disorders (PEDHD-24)

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Pediatric Sleep Disorders (PEDHD-24.1)

HDP.SD.0024.1.A

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- See **Pediatric Sleep Guidelines (SL-3)** in the Sleep Apnea and Treatment Clinical Guidelines
- For over 18 years of age OR regarding Oral Appliance OR Hypersomnolence
 - See **Sleep-Related Imaging Guidelines (HD-37)**
- For Obstructive Sleep Apnea:
 - There is NO indication for imaging prior to tonsillectomy (with or without adenoidectomy) for obstructive sleep apnea
 - Initially, endoscopic examination of the upper airway should be performed.
 - CT Maxillofacial without contrast (CPT[®] 70486) is supported for evaluation of obstructive anatomy if operative intervention, other than a tonsillectomy (with or without adenoidectomy), is being considered.
- For suspected Central Sleep Apnea, the following is supported:
 - MRI Brain without contrast (CPT[®] 70551) OR
 - MRI Brain without and with contrast (CPT[®] 70553)
- Advanced imaging is NOT indicated for the following:
 - Confusional arousals
 - Sleep terrors
 - Nightmare disorder
 - Sleep walking (Somnambulism)
 - Bed wetting (Enuresis)
 - Insomnia
 - Narcolepsy (without or with cataplexy)
 - Restless Leg Syndrome/Periodic Limb Movement Disorder
- For suspected sleep-related seizures, see **Epilepsy and Other Seizure Disorders (PEDHD-6)**

References (HDP-24)

v1.0.2025

1. Mitchell RB, Archer SM, Ishman SL, et al. Clinical Practice Guideline: Tonsillectomy in Children (Update). *Otolaryngology–Head and Neck Surgery*. 2019;160(1_suppl). doi:10.1177/0194599818801757

Temporomandibular Joint (TMJ)/Dental/Maxillofacial Imaging in Children (PEDHD-25)

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Temporomandibular Joint Imaging (PEDHD-25.1)

HDP.TJ.0025.1.A

v1.0.2025

- Temporomandibular Joint (TMJ) Imaging in Children indications in pediatric individuals are very similar to those for adult individuals. See **Temporomandibular Joint Disease (TMJ) (HD-30.1)** 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 individuals with arthritis
- MRI TMJ (CPT[®] 70336) is indicated annually for detecting silent TMJ arthritis in children with juvenile idiopathic arthritis (JIA) as requested by a rheumatologist and/or oral/maxillofacial surgeon (OMS) and/or any provider in consultation with a rheumatologist or OMS
- Repeat imaging with MRI TMJ (CPT[®] 70336) in patients with JIA is indicated for any of the following:
 - Change in signs or symptoms suggesting progression of disease
 - To monitor the effects of treatment⁷
- Bone Scintigraphy/Bone Scan 3 Phase Study (CPT[®] 78315) in individuals over 12 years of age⁷ is appropriate in anticipation or consideration of surgery⁶
- Unilateral condylar hyperplasia is manifested by slow growth in areas of the mandible causing facial asymmetry. It is usually a self-limiting condition seen predominantly in 12–30 year olds.

Dental/Periodontal/Maxillofacial Imaging (PEDHD-25.2)

HDP.TJ.0025.2.A

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- See Dental/Periodontal/Maxillofacial Imaging (HD 30.2)

References (HDP-25)

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1. Zwir LM, Terreri MT, Sousa SA, et al. Are temporomandibular joint signs and symptoms associated with magnetic resonance imaging findings in juvenile idiopathic arthritis patients? A longitudinal study. *Clin Rheumatol*. 2015 Dec; 34 (12) 057-2063
2. Navallas M, Inarejos EJ, Iglesias E, Lee GYC, Rodríguez N, Antón J. MR Imaging of the Temporomandibular Joint in Juvenile Idiopathic Arthritis: Technique and Findings. *RadioGraphics*. 2017;37(2):595-612. doi:10.1148/rg.2017160078
3. Stoll ML, Kau CH, Waite PD, Cron RQ. Temporomandibular joint arthritis in juvenile idiopathic arthritis, now what? *Pediatric Rheumatology*. 2018;16(1)
4. Miller E, Clemente EJI, Tzaribachev N, et al. Imaging of temporomandibular joint abnormalities in juvenile idiopathic arthritis with a focus on developing a magnetic resonance imaging protocol. *Pediatric Radiology*. 2018;48(6):792-800. doi:10.1007/s00247-017-4005-8
5. Hammer MR, Kanaan Y. Imaging of the Pediatric Temporomandibular Joint. *Oral and Maxillofacial Surgery Clinics of North America*. 2018;30(1):25-34. doi:10.1016/j.coms.2017.08.008
6. Lee YH, Hong IK, Chun YH. Prediction of painful temporomandibular joint osteoarthritis in juvenile patients using bone scintigraphy. *Clin Exp Dent Res*. 2019;5(3):225-235. doi:10.1002/cre2.175
7. Schmidt C, Ertel T, Arbogast M, et al. The Diagnosis and Treatment of Rheumatoid and Juvenile Idiopathic Arthritis of the Temporomandibular Joint. *Dtsch Arztebl Int*. 2022;119(4):47-54. doi:10.3238/arztebl.m2021.0388

Movement Disorders including Tourette Syndrome (PEDHD-26)

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Tourette Syndrome (PEDHD-26.1)

HDP.MD.0026.1.A

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

Movement Disorders (PEDHD-26.2)

HDP.MD.0026.2.A

v1.0.2025

- 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** MRI Brain 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)
- MRI Brain without contrast (CPT[®] 70551) **OR** MRI Brain without and with contrast (CPT[®] 70553) is supported for concerns of:
 - PANS (Pediatric acute-onset neuropsychiatric syndrome) and/or
 - PANDAS (Pediatric autoimmune neuropsychiatric disorder associated with streptococcal infection)
 - Only after a complete medical workup including labs, acute infection, and other comorbid psychiatric disorders (examples, such as Obsessive Compulsive Disorder (OCD), Attention Deficit Hyperactivity Disorder (ADHD) and Autism Spectrum Disorder (ASD) have been investigated.
 - Routine brain imaging is not routinely recommended for OCD, ADHD or ASD.
- See **Movement Disorders (HD-15.1)** in the Head Imaging Guidelines for the following
 - Suspected Huntington Disease
 - Evaluation for surgical treatment of Essential Tremor or Parkinson's disease, including Deep Brain Stimulator (DBS) placement

- Post-op imaging is supported when ordered by a neurologist or neurosurgeon or any provider in consultation with a neurologist or neurosurgeon for either procedure.

Background and Supporting Information

- There is little evidence to support the use of MRA/CTA and PET in the evaluation of movement disorders.
- Tourette syndrome (TS) is a neurological disorder characterized by repetitive, stereotyped, involuntary movements and vocalizations called tics. The first symptoms of TS are almost always noticed in childhood. Some of the more common tics include eye blinking and other vision irregularities, facial grimacing, shoulder shrugging, and head or shoulder jerking. Perhaps the most dramatic and disabling tics are those that result in self-harm such as punching oneself in the face, or vocal tics including coprolalia (uttering swear words) or echolalia (repeating the words or phrases of others). Many with TS experience additional neurobehavioral problems including inattention, hyperactivity and impulsivity, and obsessive-compulsive symptoms such as intrusive thoughts/worries and repetitive behaviors

Reference: <https://www.ninds.nih.gov/Disorders/All-Disorders/Tourette-Syndrome-Information-Page>

References (HDP-26)

v1.0.2025

1. Serajee FJ, Mahbulul Huq AH. Advances in Tourette syndrome: diagnoses and treatment. *Pediatr Clin North Am.* 2015;62(3):687-701. doi:10.1016/j.pcl.2015.03.007
2. Zinner SH, Mink JW. Movement Disorders I: Tics and Stereotypies. *Pediatrics in Review.* 2010;31(6):223-233. doi:10.1542/pir.31-6-223
3. Frankovich J, Swedo S, Murphy T, et al. Clinical Management of Pediatric Acute-Onset Neuropsychiatric Syndrome: Part II—Use of Immunomodulatory Therapies. *Journal of Child and Adolescent Psychopharmacology.* 2017;27(7):574-593. doi:10.1089/cap.2016.0148
4. Cooperstock MS, Swedo SE, Pasternack MS, Murphy TK, Consortium FTP. Clinical Management of Pediatric Acute-Onset Neuropsychiatric Syndrome: Part III—Treatment and Prevention of Infections. *Journal of Child and Adolescent Psychopharmacology.* 2017;27(7):594-606. doi:10.1089/cap.2016.0151
5. Thienemann M, Murphy T, Leckman J, et.al. Clinical Management of Pediatric Acute-Onset Neuropsychiatric Syndrome: Part 1-Psychiatric and Behavioral Interventions. *Journal of Child and Adolescent Psychopharmacology.* 2017;27(7):556-573. doi:10.1089/cap.2016.0145

Tuberous Sclerosis (PEDHD-27)

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Tuberous Sclerosis (PEDHD-27.1)

HDP.TS.0027.1.A

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- See **Tuberous Sclerosis Complex (TSC) (PEDONC-2.9)** in the Pediatric and Special Populations Oncology Imaging Guidelines

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

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Von Hippel-Lindau Syndrome (VHL) (PEDHD-28.1)

HDP.VL.0028.1.A

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- See **Von Hippel-Lindau Syndrome (VHL) (PEDONC-2.10)** in the Pediatric and Special Populations Oncology Imaging Guidelines

CNS Infection (PEDHD-29)

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CNS Infection (PEDHD-29.1)

HDP.CI.0029.1.A

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- CNS infection imaging indications in pediatric individuals are similar to those for adult individuals. See **CNS and Head Infection/Neuro-COVID-19 (HD-14)** in the Head Imaging Guidelines.
- CT Head (as per **General Guidelines – CT Head (HD-1.4)** in the Head Imaging Guidelines) may be considered in Pediatric CNS Infection.
- The following studies are supported for suspected intracranial infection if any signs of CNS infection are present:
 - MRI Brain without and with contrast (CPT[®] 70553) (preferred) **OR** MRI Brain without contrast (CPT[®] 70551)
 - CT Head (CPT[®] 70450, CPT[®] 70460, **OR** CPT[®] 70470) in cases where MRI is contraindicated or urgently required prior to lumbar puncture to evaluate for meningitis.
- Repeat imaging is supported if requested by infectious disease specialist, neurologist, ophthalmologist, neuro-ophthalmologist or neurosurgeon or any provider coordinating care with an infectious disease specialist, neurologist, ophthalmologist, neuro-ophthalmologist or neurosurgeon.
- 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) is supported as an initial imaging study
 - MRI Brain without and with contrast (CPT[®] 70553) is indicated if the ultrasound is abnormal.
 - Newborn infants with microcephaly should be evaluated as discussed in **Macrocephaly, Microcephaly, and Hydrocephalus (PEDHD-7)**
- The following imaging is considered for newborns or older infants with an open fontanelle and suspected meningitis:
 - Ultrasound Head (CPT[®] 76506) as an initial imaging study, but is not required
 - MRI Brain without and with contrast (CPT[®] 70553)² is indicated if the ultrasound is abnormal

- A wide spectrum of neurological diseases have been observed in children with COVID-19 infection in children including, but not limited to, Multisystem Inflammatory Syndrome.^{7,8}
 - MRI Brain without and with contrast (CPT[®] 70553) **AND/OR**
 - MRA Head (CPT[®] 70544, CPT[®] 70545 **OR** CPT[®] 70546) **OR** CTA Head (CPT[®] 70496) **AND/OR**
 - MRA Neck (CPT[®] 70547 **OR** CPT[®] 70548 **OR** CPT[®] 70549) **OR** CTA Neck (CPT[®] 70498) **AND/OR**
 - If Acute Necrotizing Myelitis is suspected, the following are indicated:
 - MRI Cervical Spine without and with contrast (CPT[®] 72156) **AND/OR**
 - MRI Thoracic Spine without and with contrast (CPT[®] 72157) **AND/OR**
 - MRI Lumbar Spine without and with contrast (CPT[®] 72158)
- Metabolic (FDG) Brain PET (CPT[®] 78608) is appropriate to evaluate individuals suspected of having encephalitis, including autoimmune encephalitis, if diagnosis remains unclear after evaluation with MRI Brain, CSF analysis, and lab testing including serology.⁹

Background and Supporting Information

- Neonatal meningitis most often is 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.

References (HDP-29)

v1.0.2025

1. De Vries LS, and Volpe JJ. Viral, protozoan, and related intracranial infections. In: Volpe JJ, ed. *Volpe's Neurology of the Newborn*. 6th ed. Philadelphia: Elsevier. 2018;973-1049
2. Melo AS, Aguiar RS, Amorim MM, et al. Congenital Zika Virus Infection: Beyond Neonatal Microcephaly. *JAMA Neurol*. 2016;73(12):1407-1416. doi:10.1001/jamaneurol.2016.3720
3. Levine D, Jani JC, Castro-Aragon I, et al. How does imaging of congenital Zika compare with imaging of other TORCH infections? *Radiology*. 2017;285:744-761
4. De Oliveria Melo AS, Aguiar RS, Amorim MM, et al. Congenital Zika virus infection: beyond neonatal microcephaly. *JAMA Neurol*. 2016 Dec 1;73:1407-1416
5. Rabe I, Meaney-Delman D, and Moore CA. "Zika Virus – What Clinicians Need to Know." clinician outreach and communication activity call. Centers for Disease Control and Prevention. 26 Jan. 2016. Available at: http://coursewareobjects.elsevier.com/objects/elr/ExpertConsult/Kliegman/nelson20e/updates/CDC_presentation_01262016.pdf
6. ACR-ASNR-SPR Practice Parameter for the Performance of Computed Tomography (CT) of the Extracranial Head and Neck Revised 2021. (Resolution 5). <https://www.acr.org/-/media/ACR/Files/Practice-Parameters/CT-Head-Neck>
7. Wong A, Toh CH. Spectrum of neuroimaging mimics in children with COVID-19 infection [published online ahead of print, 2021 Nov 15]. *Biomed J*. 2021;S2319-4170(21)00151-7. doi:10.1016/j.bj.2021.11.005
8. Lindan CE, Mankad K, Ram D, et al. Neuroimaging manifestations in children with SARS-CoV-2 infection: a multinational, multicentre collaborative study. *Lancet Child Adolesc Health*. 2021;5(3):167-177 doi:10.1016/S2352-4642(20)30362-X
9. Probasco JC, Solnes L, Nalluri A, et al. Abnormal brain metabolism on FDG-PET/CT is a common early finding in autoimmune encephalitis. *Neurology - Neuroimmunology Neuroinflammation*. 2017;4(4). doi:10.1212/nxi.0000000000000352
10. Mullins E, Perry A, Banerjee J, et al. Pregnancy and neonatal outcomes of COVID-19: The PAN-COVID study. *Eur J Obstet Gynecol Reprod Biol*. 2022;276:161-167. doi:10.1016/j.ejogrb.2022.07.010
11. Hwee TP, Koh Cheng T. Imaging of Congenital/Childhood Central Nervous System Infections. *Neuroimaging Clin N Am*. 2023;33(1):207-224. doi:10.1016/j.nic.2022.07.017

Scalp and Skull Lesions (PEDHD-30)

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Scalp and Skull Lesions (PEDHD-30.1)

HDP.SL.0030.1.A

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- Scalp and skull lesion imaging indications in pediatric individuals are identical to those for adult individuals with the exception of neonates. See **Scalp and Skull Lesions (HD-20.1)** 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) is supported as an initial imaging study.
 - MRI Brain without and with contrast (CPT[®] 70553) (preferred) or CT Head without and with contrast (CPT[®] 70470) is indicated if the ultrasound is abnormal and associated anomalies are suspected
- The following imaging is indicated for children and adults with Pott Puffy Tumor:
 - MRI Brain without and with contrast (CPT[®] 70553) OR CT Head without and with contrast (CPT[®] 70470)⁷
 - Repeat imaging is supported if requested by neurologist, neurosurgeon, otolaryngologist (ENT) and/or oral maxillofacial surgery (OMS) or any provider coordinating care with a neurologist, neurosurgeon, otolaryngologist (ENT) and/or oral maxillofacial surgery (OMS).

Background and Supporting Information

- Pott Puffy Tumor is an abscess involving the frontal bone with adjacent osteomyelitis as the result of a frontal sinus infection that spreads contiguously through the wall of the sinus or through hematogenous spread via the veins that drain sinus mucosa.⁷

References (HDP-30)

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1. Siegel MJ. Brain. In: *Pediatric sonography*. 5th ed. Philadelphia. Wolters Kluwer. 2018 40-111
2. Bansal AG, Oudsema R, Masseaux JA, Rosenberg HK. US of Pediatric Superficial Masses of the Head and Neck. *RadioGraphics*. 2018;38(4):1239-1263. doi:10.1148/rg.2018170165
3. Carratalá RM, Cabezuelo MEC, Herrera IH, et al. Nontraumatic Lesions of the Scalp: Practical Approach to Imaging Diagnosis: Neurologic/Head and Neck Imaging. *RadioGraphics*. 2017;37(3):999-1000. doi:10.1148/rg.2017160112
4. Kollipara R, Dinneen L, Rentas KE, et al. Current Classification and Terminology of Pediatric Vascular Anomalies. *American Journal of Roentgenology*. 2013;201(5):1124-1135. doi:10.2214/ajr.12.10517
5. Robinson AJ, Blaser S and Fink AM. Prenatal Imaging. Caffey's Pediatric Diagnostic Imaging, Chapter 19. Coley BR, et al. 13th edition. 2019, pp 158-161
6. Tobler JF, Slovis, TL and Rozzelle AA. Selected Craniofacial Syndromes, and Other Abnormalities of the Skull. Caffey's Pediatric Diagnostic Imaging, Chapter 20. Coley BR, et al. 13th edition. 2019, pp 162-180
7. Barnett RR, Piazza MG, Elton SW. Pediatric Neurosurgery in Primary Care: Masses of the Scalp and Skull in Children. *Pediatr Clin North Am*. 2021;68(4):743-757. doi:10.1016/j.pcl.2021.04.003

Eye Disorders (PEDHD-31)

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Eye Disorders (PEDHD-31.1)

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- Eye disorder imaging indications in pediatric individuals are close to identical to those for adult individuals. See **Eye Disorders and Visual Loss (HD-32.1)** in the Head Imaging Guidelines

Indication	Imaging Studies
<ul style="list-style-type: none"> ◦ Imaging is supported in the evaluation for congenital disorders or disorders that begin early in life, such as, but not limited to <ul style="list-style-type: none"> ▪ Optic Nerve Hypoplasia ▪ Septo-Optic Dysplasia ▪ Infantile Nystagmus Syndrome^{3,4} 	<ul style="list-style-type: none"> ◦ MRI Orbits/Face/Neck without contrast (CPT[®] 70540) OR ◦ MRI Orbits/Face/Neck without and with contrast (CPT[®] 70543) OR ◦ CT Orbits/Temporal Bone with contrast (CPT[®] 70481) OR ◦ CT Orbits/Temporal Bone without contrast (CPT[®] 70480) <p>AND/OR</p> <ul style="list-style-type: none"> ◦ MRI Brain without contrast (CPT[®] 70551) OR ◦ MRI Brain with and without contrast (CPT[®] 70553)^{3,4}

- Repeat imaging is supported if requested by a neurologist, ophthalmologist, neuro-ophthalmologist or neurosurgeon or any provider coordinating care with a neurologist, ophthalmologist, neuro-ophthalmologist or neurosurgeon.
- For traumatic retinal hemorrhages as seen in suspected shaken baby syndrome (See **(PEDHD-4.1)**)

References (HDP-31)

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1. Dumitrescu AV, Scruggs BA, Drack AV. Clinical Guidelines: Childhood Nystagmus Workup. American Academy of Ophthalmology. <https://www.aao.org/disease-review/clinical-guidelines-childhood-nystagmus-workup>. Published February 13, 2020
2. Ganau M, Huet S, Syrmos N, Meloni M, Jayamohan J. Neuro-Ophthalmological Manifestations Of Septo-Optic Dysplasia: Current Perspectives Eye and Brain. 2019;Volume 11:37-47. doi:10.2147/eb.s186307
3. Costello F, Scott JN. Imaging in Neuro-ophthalmology. *CONTINUUM (MINNEAP MINN)*. 2019;25(5, NEURO-OPHTHALMOLOGY):1438–1490
4. Bhat R, Al-Samarraie M, Nada A, Leiva-Salinas C, Whitehead M, Mahdi E. Spotlight on the pediatric eye: a pictorial review of orbital anatomy and congenital orbital pathologies. *Neuroradiol J*. 2021;34(1):21-32. doi: 10.1177/1971400920949232