



CLINICAL GUIDELINES

Head Imaging Guidelines

Version 2.0.2022

Effective March 1, 2022



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

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Abbreviations for Head Imaging Guidelines

ACTH	adrenocorticotrophic hormone
AD	Alzheimer's Disease
ADH	antidiuretic hormone
AION	arteritic ischemic optic neuritis
AVM	arteriovenous malformation
CBCT	Cone-beam computerized tomography
CMV	Cytomegalovirus
CSF	cerebrospinal fluid
CT	computed tomography
CTA	computed tomography angiography
DNA	deoxyribonucleic acid
DWI	diffusion weighted imaging (for MRI)
EEG	electroencephalogram
ENT	Ear, Nose, Throat
ESR	erythrocyte sedimentation rate
FDG	fluorodeoxyglucose
FSH	follicle-stimulating hormone
FTD	Frontotemporal Dementia
GCA	giant cell arteritis
GCS	Glasgow Coma Scale
HIV	human immunodeficiency virus
LH	luteinizing hormone
MMSE	mini mental status examination
MRA	magnetic resonance angiography
MRI	magnetic resonance imaging
MRN	magnetic resonance neurography
MS	multiple sclerosis
MSI	magnetic source imaging
NAION	non-arteritic ischemic optic neuritis
NPH	normal pressure hydrocephalus
PET	positron emission tomography
PML	progressive multifocal leukoencephalopathy
PNET	primitive neuro ectodermal tumor
PWI	perfusion weighted imaging (for MRI)
SAH	subarachnoid hemorrhage
SIADH	Syndrome of Inappropriate Antidiuretic Hormone Secretion
SLE	systemic lupus erythematosus
TIA	transient ischemic attack
TMJ	temporomandibular joint disease
TSH	thyroid-stimulating hormone
VBI	vertebrobasilar insufficiency
VP	ventriculoperitoneal
XRT	radiation therapy

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HD-1.0: General Guidelines

- A pertinent clinical evaluation including a detailed history, physical examination including a neurological examination and appropriate laboratory studies should be performed prior to considering the use of an advanced imaging (CT, MR, Nuclear Medicine) procedure.
 - ◆ A pertinent clinical evaluation furnished via telehealth is treated the same as an in-person clinical evaluation.
 - ◆ An exception to a pertinent clinical evaluation can be made if the individual is undergoing a guideline-supported, scheduled follow-up imaging evaluation.
 - Scheduled follow-up of known problems such as, multiple sclerosis, tumors, or hydrocephalus, scheduled surveillance with no new symptoms, screening asymptomatic individual due to family history or otherwise meet criteria for repeat imaging, as well as appropriate laboratory studies and non-advanced imaging modalities
 - ◆ A detailed neurological exam is required prior to advanced imaging except in the following scenarios:
 - Tinnitus, TMJ, sinus or mastoid disease, ear pain, hearing loss, eye disease, and epistaxis. (A pertinent clinical evaluation is still required)
 - The request is from a neurologist or neurosurgeon who has seen the individual since onset of symptoms
 - ◆ Other meaningful contact (telephone call, electronic mail or messaging) with an established individual can substitute for a face-to-face clinical evaluation

HD-1.1: General Guidelines – Anatomic Issues

- If two studies using the same modality both cover the anatomic region of clinical interest, only one is generally needed, with the exception of the following scenarios:
 - ◆ CT Maxillofacial (CPT® 70486, CPT® 70487, or CPT® 70488) or CT Orbital/Temporal bone (CPT® 70480, CPT® 70481, or CPT® 70482): both cover the structures of the orbits, sinuses, and face. Two separate imaging studies are only supported if there is suspicion of simultaneous involvement of more posterior lesions, especially of the region involving the middle or inner ear.
 - ◆ Pituitary Gland: one study (either MRI Brain [CPT® 70553] or MRI Orbit, Face, Neck [CPT® 70543]) is adequate to report the imaging of the pituitary. If a previous routine MRI Brain was reported to show a possible pituitary tumor, a repeat MRI with dedicated pituitary protocol may be performed.
 - ◆ Internal Auditory Canal: (IAC) MRI can be reported as a limited study with one code from the set (CPT® 70540, CPT® 70542, or CPT® 70543), but should not be used in conjunction with MRI Brain codes (CPT® 70551, CPT® 70552, or CPT® 70553) if IAC views are performed as part of the brain.

- ◆ Mandible (jaw): CT Maxillofacial (CPT® 70486, CPT® 70487, or CPT® 70488) or CT Neck (CPT® 70490, CPT® 70491, or CPT® 70492) can be used to report imaging of the mandible. CT Neck will also image the submandibular space.
 - If MRI is indicated, MRI Orbit, Face, Neck (CPT® 70540, CPT® 70542, or CPT® 70543) can be used to report imaging of the mandible and submandibular space.
 - MRI Temporomandibular Joint(s) (TMJ) is reported as CPT® 70336. This code is inherently bilateral and should not be reported twice on the same date of service.

HD-1.2: General Guidelines – Modality

- MRI is preferable to CT for most indications. For exceptions, See **HD-1.4: General Guidelines – CT Head**.
- MRI may be performed for these indications following an initial CT:
 - ◆ MRI Brain without and with contrast (CPT® 70553) may be performed to follow-up abnormalities seen on CT Head without contrast (CPT® 70450) when a mass, lesion, or infection is found.
 - ◆ MRI Brain without contrast (CPT® 70551) or MRI Brain without and with contrast (CPT® 70553) (preferred) may be performed to follow-up abnormalities seen on CT Head without contrast (CPT® 70450) when there is suspected Multiple Sclerosis or other demyelinating disease.
 - ◆ MRI Brain without contrast (CPT® 70551) or MRI Brain without and with contrast (CPT® 70553) may be performed to follow up on stroke or TIA when initial CT Head was done on emergent basis.
 - ◆ MRI Brain without and with contrast (CPT® 70553) or MRI Brain without contrast (CPT® 70551) for evaluation of new onset seizures.

HD-1.3: General Guidelines – MRI Brain

- MRI Brain with contrast (CPT® 70552) should not be ordered except to follow-up on a very recent non-contrast MRI Brain (within two weeks).
- The AMA CPT manual does not describe nor assign any minimum or maximum number of sequences for any CT or MRI study. Both MRI and CT imaging protocols are often influenced by the individual clinical situation of the individual and additional sequences are not uncommon. There are numerous MRI sequences that may be performed to evaluate specific clinical questions, and this technology is constantly undergoing development. Additional sequences, however, are still performed and coded under the routine MRI Brain CPT® 70551, CPT® 70552, or CPT® 70553.

HD-1.4: General Guidelines – CT Head

- Scenarios in which MRI is contraindicated (i.e. pacemakers, ICDs, cochlear implants, aneurysm clips, orbital metallic fragments, etc.)
- CT Head without contrast (CPT® 70450) in nearly all cases, to show:
 - ◆ 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 may be approved).
 - ◆ Prior to lumbar puncture in individuals with cranial complaints (without contrast) (CPT® 70450)
 - ◆ In the evaluation of optic disc edema and/or papilledema, a non-contrast CT Head is useful to assess for space-occupying processes such as intracranial hemorrhage, mass effect, and hydrocephalus, See **HD-17.1: Papilledema/Pseudotumor Cerebri** and **HD-32.1: Eye Disorders and Visual Loss**.

HD-1.5: General Guidelines – CT and MR Angiography (CTA and MRA)

- MRA Head may be performed without contrast (CPT® 70544), with contrast (CPT® 70545), or without and with contrast (CPT® 70546).
- 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 Head is performed without and with contrast (CPT® 70496).
- CTA Neck is performed with and without contrast (CPT® 70498)
- Indications for CTA or MRA Head and Neck vessels include, but are not limited to the following:
 - ◆ Pulsatile tinnitus
 - ◆ Hemifacial spasm if consideration for surgical decompression
 - ◆ Evaluation of stroke or TIA (See **HD-21: Stroke/TIA**) including collateral assessment
 - ◆ Trigeminal neuralgia 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)
 - ◆ Noninflammatory vasculopathy, including radiation vasculopathy
 - ◆ Traumatic vascular injuries

- ◆ Vascular malformations, vascular anatomic variants and fistulas
 - ◆ Arterial 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
 - ◆ NOTE: Evaluation of posterior circulation disease requires both neck and head MRA/CTA to visualize the entire vertebral-basilar system.
- MRA Head without, with, or without and with contrast or CTA Head for follow up of aneurysm clipping or coiling procedures (See **HD-12.1: Intracranial Aneurysms**)
- 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

HD-1.6: General Guidelines – PET Coding Notes

- Metabolic Brain PET should be reported as Metabolic Brain PET (CPT® 78608)
- Amyloid Brain PET should be reported as limited PET (CPT® 78811) or limited PET/CT (CPT® 78814)

HD-1.7: General Guidelines – Other Imaging Situations

- Nausea and vomiting, persistent, unexplained and a negative GI evaluation: can undergo MRI Brain without contrast (CPT® 70551) or without and with contrast (CPT® 70553).
- 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) can be considered when performed in conjunction with conventional angiography (i.e.: conventional 4 vessel cerebral angiography).
- MRI Brain without and with contrast (CPT® 70553) is approvable for consideration of neurosarcoidosis.

- 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 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 or as ordered by a specialist (neurologist or neurosurgeon) or any provider in consultation with a specialist
- 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. If symptomatic, abdomen imaging (MRI or CT) may be approved as ordered by a specialist or any provider in consultation with a specialist
- For facial feminization/masculinization procedural planning:
 - ◆ Preoperative CT requests for CT Maxillofacial without contrast (CPT® 70486) with or without 3D rendering (CPT® 76376 or CPT® 76377), and/or CT Neck with contrast (CPT® 70491) are approvable if the individual has a health plan benefit covering the facial feminization/masculinization and laryngoplasty surgeries.
 - CT Head without (CPT® 70450) may be added for the following:
 - History of prior cranial surgery
 - History of head trauma
 - Presence of neurological signs or symptoms
 - ◆ Preoperative imaging is not approvable if the facial feminization/masculinization and laryngoplasty surgeries are not health plan covered benefits
- 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 See **HD-12.1: Intracranial Aneurysms**, **HD-12.2: Arteriovenous Malformations (AVMs) and Related Lesions**, **HD-21.1: Stroke/TIA**, and **HD-22.1: Cerebral Vasculitis**.
 - ◆ 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 **Preface-4.1: 3D Rendering** in the Preface Imaging Guideline

References

1. Grossman RI, Yousem DM. *Neuroradiology*. Philadelphia, PA: Mosby Elsevier; 2010.
2. Latchaw RE, Kucharczyk J, Moseley ME. *Imaging of the nervous system: diagnostic and therapeutic applications*. Philadelphia: Elsevier Mosby; 2005.
3. Elan Lewis, Stephan Mayer, Lewis Rowland 13th edition. *Merritt's neurology*. Philadelphia, PA: Lippincott Williams & Wilkins; 2015.
4. 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.
5. ACR-ASNR-SPR Practice Parameter for the Performance of Computed Tomography (CT) of the Extracranial Head and Neck Revised 2016. (Resolution 14). <https://www.acr.org/-/media/ACR/Files/Practice-Parameters/CT-Head-Neck.pdf>.
6. 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.
7. Shosha E, Dubey D, Palace J, et al. Area postrema syndrome. *Neurology*. 2018;91(17). doi:10.1212/wnl.0000000000006392.
8. Singh P, Yoon SS, Kuo B. Nausea: a review of pathophysiology and therapeutics. *Therapeutic Advances in Gastroenterology*. 2015;9(1):98-112. doi:10.1177/1756283x15618131.
9. Gutkowski P, et al. Secondary deterioration in patients with normal pressure hydrocephalus after ventriculoperitoneal shunt placement: a proposed algorithm of treatment. *Fluids Barriers CNS* 2020, v17:18. doi: <https://dx.doi.org/10.1186%2Fs12987-020-00180-w>.
10. Capitán L, Santamaría JG, Simon D, et al. Facial Gender Confirmation Surgery. *Plastic and Reconstructive Surgery*. 2020;145(4). doi:10.1097/prs.0000000000006686
11. Hatcher-Martin JM, et al. Telemedicine in Neurology. *Telemedicine Work Group of the American Academy of Neurology update*. *Neurology*® 2020;94:30-38. doi:10.1212/WNL.0000000000008708
12. ACR ASNR SPR Practice Parameter for the Performance of Computed Tomography of the Extracranial Head and Neck. Revised 2016.
13. ACR ASNR SPR Practice Parameter for the Performance and Interpretation of Cervicocerebral Computed Tomography Angiography (CTA) Revised 2020.
14. ACR ASNR SPR Practice Parameter for the Performance and Interpretation of Magnetic Resonance Imaging (MRI) of the Brain. Revised 2019.
15. Ederies A, Demchuk A, Chia T, Gladstone DJ, Dowlathshahi D, Bendavit G, Wong K, Symons SP, Aviv RI. Postcontrast CT extravasation is associated with hematoma expansion in CTA spot negative patients. *Stroke*. 2009 May;40(5):1672-6. doi: 10.1161/STROKEAHA.108.541201. Epub 2009 Mar 12.
16. Chuang WC, Short JH, McKinney AM, Anker L, Knoll B, McKinney ZJ. Reversible left hemispheric ischemia secondary to carotid compression in Eagle syndrome: surgical and CT angiographic correlation. *AJNR Am J Neuroradiol* 2007;28:143-5.
17. Chou DW, Tejani N, Kleinberger A, Shih C. Initial Facial Feminization Surgery Experience in a Multicenter Integrated Health Care System. *Otolaryngology–Head and Neck Surgery*. 2020;163(4):737-742. doi:10.1177/0194599820924635.
18. Raffaini M, Perello R, Tremolada C, Agostini T. Evolution of Full Facial Feminization Surgery. *Journal of Craniofacial Surgery*. 2019;30(5):1419-1424. doi:10.1097/scs.0000000000005221.
19. Eggerstedt M, Hong YS, Wakefield CJ, Westrick J, Smith RM, Revenaugh PC. Setbacks in Forehead Feminization Cranioplasty: A Systematic Review of Complications and Patient-Reported Outcomes. *Aesthetic Plastic Surgery*. 2020;44(3):743-749. doi:10.1007/s00266-020-01664-8.
20. Spiegel JH. Facial Feminization for the Transgender Patient. *Journal of Craniofacial Surgery*. 2019;30(5):1399-1402. doi:10.1097/scs.0000000000005645.
21. Callen AL, Badiie RK, Phelps A, Potigailo V, Wang E, Lee S, Talbott J, Glastonbury C, Pomerantz JH, Narvid J. Facial Feminization Surgery: Key CT Findings for Preoperative Planning and Postoperative Evaluation. *AJR* 2020 Dec 30 [published online]. Accepted manuscript. doi:10.2214/AJR.20.25228.
22. James SE, Herman JL, Rankin S, Keisling M, Mottet L, Anafi M. (2016). The Report of the 2015 U.S. Transgender Survey. Washington, DC: National Center for Transgender Equality.
23. Spiegel JH. Gender affirming and aesthetic cranioplasty: what's new? *Curr Opin Otolaryngol Head Neck Surg* 2020, 28:201-205. doi:10.1097/MOO.0000000000000640.
24. Pasternak JJ and Abcejo AS. Anesthesia and the brain after concussion. *Curr Opin Anesthesiol* 2020, 33:639–645. doi:10.1097/ACO.0000000000000906.
25. PRACTICE PARAMETER 1 Cervicocerebral MRA. <https://www.acr.org/-/media/ACR/Files/Practice-Parameters/cervicocerebralmra.pdf?la=en>.
26. ACR-ASNR-SIR-SNIS Practice Parameter for the Performance of Diagnostic Cervicocerebral Catheter Angiography in Adults. Revised 2016. (Resolution 13) <https://www.acr.org/-/media/ACR/Files/Practice-Parameters/CervicoCerebralCathAngio.pdf>
27. American College of Radiology ACR Appropriateness Criteria Headache. Revised 2019. <https://acsearch.acr.org/docs/69482/Narrative/>
28. American College of Radiology ACR Appropriateness Criteria Acute Mental Status Change, Delirium, and New Onset Psychosis. 2018. <https://acsearch.acr.org/docs/3102409/Narrative/>
American College of Radiology ACR Appropriateness Criteria Cerebrovascular Diseases – Aneurysm, Vascular Malformations, and Subarachnoid Hemorrhage. New 2021. <https://acsearch.acr.org/docs/3149013/Narrative/>

HD-2: Taste and Smell Disorders

HD-2.1: Taste and Smell Disorders

- MRI Brain without and with contrast (CPT® 70553) or without contrast (CPT® 70551) and/or MRI Orbit, Face, and Neck without (CPT® 70540) or without and with contrast (CPT® 70543) is considered with unexplained unilateral or bilateral anosmia (inability to perceive odor) or dysgeusia (complete or partial loss of taste).
- CT Maxillofacial (CPT® 70486, CPT® 70487 or CPT® 70488) may be considered initially if sinus or facial bone disorders are suspected.
- For individuals who test positive for SARS-CoV-2, MRI Brain without contrast (CPT® 70551) or without and with contrast (CPT® 70553) is approvable for neurologic symptoms or signs, other than change in taste or smell, for consideration of other pathology. See **HD-21.1: Stroke/TIA**

Practice Notes

- In those individuals with consideration of COVID-19 due to signs/symptoms, testing to identify for SARS-CoV-2 is encouraged.

References

1. Policeni B, Corey AS, Burns J, et al. ACR Appropriateness Criteria® Cranial Neuropathy. Journal of the American College of Radiology. 2017;14(11). doi:10.1016/j.jacr.2017.08.035.
2. Devere R. Disorders of Taste and Smell. CONTINUUM: Lifelong Learning in Neurology. 2017;23(2):421-446. doi:10.1212/con.0000000000000463.
3. ACR-ASNR-SPR Practice Parameter for the Performance of Computed Tomography (CT) of the Extracranial Head and Neck Revised Revised 2016 (Resolution 14). <https://www.acr.org/-/media/ACR/Files/Practice-Parameters/CT-Head-Neck.pdf>.
4. Politi LS, Salsano E, Grimaldi M. Magnetic Resonance Imaging Alteration of the Brain in a Patient With Coronavirus Disease 2019 (COVID-19) and Anosmia. JAMA Neurology. 2020. doi:10.1001/jamaneurol.2020.2125.
5. Symptoms of Coronavirus. Centers for Disease Control and Prevention. <https://www.cdc.gov/coronavirus/2019-ncov/symptoms-testing/symptoms.html>. Published May 13, 2020.
6. Soler ZM, Patel ZM, Turner JH, Holbrook EH. A primer on viral-associated olfactory loss in the era of COVID-19. International Forum of Allergy & Rhinology. 2020;10(7):814-820. doi:10.1002/alr.22578.

HD-3: Ataxia

HD-3.1: Ataxia

- MRI Brain without and with contrast (CPT® 70553) or MRI Brain without contrast (CPT® 70551) is considered in all individuals with ataxia:
 - ◆ MRI Cervical, Thoracic and/or Lumbar Spine without contrast or with and without contrast (CPT® 72141 or CPT® 72156, CPT® 72146 or CPT® 72157, CPT® 72148 or CPT® 72158) if spinal disease is suspected
 - ◆ If these symptoms are acute and stroke is suspected, See **HD-21: Stroke/TIA**
 - ◆ If MS is suspected, See **HD-16: Multiple Sclerosis (MS) and Related Conditions**
 - ◆ CT Head without contrast (CPT® 70450) and/or CT Temporal Bone without contrast (CPT® 70480) can be added if these symptoms are acute following head trauma. See **HD-13: Head and Facial Trauma**
- If brain tumor is suspected, See **ONC-2: Primary Central Nervous System Tumors** in the Oncology Imaging Guidelines.
- MRI Brain without contrast (CPT® 70551), or CT Head without contrast (CPT® 70450) if there is a contraindication to MRI, is considered for those with gait abnormalities, cognitive impairment and/or urinary symptoms (e.g. urgency, frequency and/or incontinence) for the evaluation of Normal Pressure Hydrocephalus

References

1. American College of Radiology (ACR) Appropriateness Criteria® Ataxia. Last review date: 2018.
2. Graff-Radford NR, Jones DT. Normal Pressure Hydrocephalus. CONTINUUM: Lifelong Learning in Neurology. 2019;25(1):165-186. doi:10.1212/con.0000000000000689.

HD-4: Behavioral Disorders

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HD-4.1: Behavioral Disorders	15

HD-4.0: Behavioral Disorders – General Information

- Autism
 - ◆ The group of diagnoses, including Asperger syndrome, are classified as pervasive development disorders (PDD). These diagnoses are established on clinical criteria, and no imaging study can confirm the diagnosis.
 - ◆ Comprehensive evaluation for autism might include history, physical exam, audiology evaluation, speech, language, and communication assessment, cognitive and behavioral assessments, and academic assessment.
 - MRI Brain without and with contrast (CPT® 70553) is indicated for new or worsening focal neurologic findings documented on a 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 investigational in the evaluation of individuals with autism spectrum disorders

HD-4.1: Behavioral Disorders

- Psychiatric diagnoses do not routinely require advanced imaging
- MRI Brain without contrast (CPT® 70551), or MRI Brain without and with contrast (CPT® 70553), or CT Head without contrast (CPT® 70450)
 - ◆ Acute mental status change, disturbance in consciousness or arousal state
 - ◆ Psychotic disorders (including schizophrenia), bipolar disorder and related disorders may require advanced imaging in the following clinical presentations:
 - Acute first episode onset
 - Late onset over age 40
 - 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 ECT treatment, utilize to screen for intracranial disease: either MRI Brain without contrast (CPT® 70551) or CT Head without contrast (CPT® 70450)
- Deep Brain Stimulation Therapy for psychiatric disorders is considered investigation and experimental, so imaging is not indicated.

Certain imaging studies/treatments are considered investigational by various payors, and their coverage policies may take precedence over eviCore's guidelines.

References

1. Ropper AH and Brown RH. Adams and Victor's principles of neurology. 8th Ed. New York: McGraw-Hill Companies, Inc. 2005.1285-1332.
2. Rowland LP, Pedley TA, Merritt HH. Merritt's neurology. 12th Ed. Philadelphia, PA: Lippincott Williams & Wilkins. 2010; 1053-1075.
3. Practice Guideline for the Treatment of Patients with Schizophrenia, 2nd Ed. American Psychiatric Association. Feb. 2004.
4. Uzelac A. Imaging of Altered Mental Status. Radiologic Clinics of North America. 2020;58(1):187-197. doi:10.1016/j.rcl.2019.08.002.
5. American College of Radiology ACR Appropriateness Criteria® Acute Mental Status Change, Delirium, and New Onset Psychosis. New 2018. <https://acsearch.acr.org/docs/3102409/Narrative/>.
6. Andrea S, Papirny M, Raedler T. Brain Imaging in Adolescents and Young Adults With First-Episode Psychosis. The Journal of Clinical Psychiatry. 2019;80(6). doi:10.4088/jcp.18m12665.
7. Savitz JB, Rauch SL, Drevets WC. Clinical application of brain imaging for the diagnosis of mood disorders: the current state of play. Molecular Psychiatry. 2013;18(5):528-539. doi:10.1038/mp.2013.25.
8. Nuttin B, Wu H, Mayberg H, et al. Consensus on Guidelines for Stereotactic Neurosurgery for Psychiatric Disorders. J Neurol Neurosurg Psychiatry 2014;85:1003–1008. doi:10.1136/jnnp-2013-306580
9. Hamani C, et al. Deep Brain Stimulation for Obsessive-Compulsive Disorder: Systematic Review and Evidence-Based Guideline Sponsored by the American Society for Stereotactic and Functional Neurosurgery and the Congress of Neurological Surgeons (CNS) and Endorsed by the CNS and American Association of Neurological Surgeons. Neurosurgery 75:327–333, 2014 doi: 10.1227/NEU.0000000000000499.
10. Bridgemohan CF. Autism spectrum disorder. Nelson Textbook of Pediatrics, Chapter 54. eds Kliegman RM, St. Geme JW III, Blum NJ, Shah SS, Tasker RC, Wilson KM. 21st edition. 2020, pp 294-302.
11. 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.
12. 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.

HD-5: Chiari and Skull-Base Malformation

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HD-5.1: Chiari I Malformations

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

- For initial evaluation, MRI Brain without contrast (CPT® 70551) or without and with contrast (CPT® 70553) and MRI of the entire spine without contrast (CPT® 72141, CPT® 72146, CPT® 72148) or without and with contrast (CPT® 72156, CPT® 72157, CPT® 72158) is indicated.
- For CSF flow imaging See **HD-24.4: CSF Flow Imaging**
- Repeat imaging may be approved at the discretion of or in consultation with the specialist coordinating the individual's care for this condition.
- Repeat MRI Brain without contrast (CPT® 70551) or without and with contrast (CPT® 70553) is indicated for individuals with a known Chiari I malformation when any of the following are present:
 - ◆ There are new or worsening signs or symptoms
 - ◆ A surgical procedure is actively being considered.
- Repeat MRI Spine imaging is not indicated for individuals with normal initial spine imaging unless there are new or worsening signs or symptoms from baseline that suggest spinal cord pathology.
- Repeat brain and spine imaging in individuals with Chiari I malformations and known syringomyelia or hydromyelia is highly individualized
- Familial screening is not indicated for Chiari I Malformations.

HD-5.2: Chiari II Malformations (Arnold Chiari Malformation)

These 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.

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

HD-5.3: Chiari III and IV Malformations

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

- Repeat brain and spine imaging in individuals with Chiari III and IV malformations is highly individualized and is indicated at the discretion of or in consultation with the specialist coordinating the individual's care for this condition.
- Familial screening is not indicated for Chiari III or IV Malformations.

HD-5.4: Basilar Impression

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

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

HD-5.5: Platybasia

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

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

References

1. Siegel MJ. Brain. In: pediatric sonography. 5th ed. Philadelphia. Wolters Kluwer. 2018 40-111.
2. Mistovich, RJ and Spiegel, DA. Cervical Anomalies and Instabilities. Nelson Textbook of Pediatrics, Chapter 700.3. eds Kliegman RM, St. Geme JW III, Blum NJ, Shah SS, Tasker RC, Wilson KM. 21st edition. 2020, pp 3649-3650.
3. 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.
4. 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.
5. 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.
6. 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.
7. Victorio MC, Khoury CK. Headache and Chiari I Malformation in Children and Adolescents. Seminars in Pediatric Neurology. 2016;23(1):35-39.
8. Radic JAE, Cochrane DD. Choosing Wisely Canada: Pediatric Neurosurgery Recommendations. Paediatrics & Child Health. 2018;23(6):383-387. doi:10.1093/pch/pxy012.
9. Smoker WRK and Khanna G. Imaging the craniocervical junction. Childs Nerv Syst. 2008 Oct; 24 (10): 1123-1145
10. Kinsman SL and Johnston MV. Congenital anomalies of the central nervous system. Nelson Textbook of Pediatrics, Chapter 609. eds Kliegman RM, St. Geme JW III, Blum NJ, Shah SS, Tasker RC, Wilson KM. 21st edition. 2020, pp 3063-3082

HD-6: Facial Palsy (Bell's Palsy)

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HD-6.1: Facial Palsy

Typical features of Bell's palsy include variable initial ipsilateral temporal and auricular pain before facial weakness, onset over 72 hours, ipsilateral complete facial weakness, and an otherwise normal neurological and systemic examination. There is usually slow improvement over several months. Unless "red flags" are present, imaging is not necessary.

- MRI Brain without and with contrast (CPT® 70553) (with attention to posterior fossa and IACs) or without contrast (CPT® 70551) and/or MRI Orbit, Face and Neck without contrast (CPT® 70540) or with and without contrast (CPT® 70543) are considered with the following "red flags" of unexplained facial paresis/paralysis in clinical scenarios with:
 - ◆ Trauma to the temporal bone
 - ◆ History of tumor, systemic cancer, HIV or Lyme disease
 - ◆ No improvement in 8 weeks
 - ◆ No full recovery in 3 months
 - ◆ Gradual onset over weeks to months
 - ◆ Vertigo or hearing loss
 - ◆ Bilateral involvement
 - ◆ Other atypical or inconsistent features including:
 - Second episode of paralysis on the same side
 - Paralysis of isolated branches of the facial nerve
 - Paralysis associated with other cranial nerves
- MRI Brain without and with contrast (CPT® 70553) may be considered for known sarcoidosis with suspected neurosarcoid or CNS involvement

HD-6.2: Hemifacial Spasm

- MRI Brain without and with contrast (CPT® 70553)
- May add CTA Head (CPT® 70496) or MRA Head (CPT® 70544, CPT® 70545, or CPT® 70546) prior to a vascular decompression surgical procedure to clarify the vascular anatomy in individuals who have failed conservative medical management

References

1. Baugh RF, Basura GJ, Ishii LE, et al. Clinical practice guideline. Bell's Palsy Executive Summary. *Otolaryngology–Head and Neck Surgery*. 2013;149(5):656-663. doi:10.1177/0194599813506835.
2. ACR Appropriateness Criteria® Cranial neuropathy. American College of Radiology (ACR). Revised 2017.
3. Yalthro TC, Jankovic J. The many faces of hemifacial spasm: Differential diagnosis of unilateral facial spasms. *Movement Disorders*. 2011;26(9):1582-1592. doi:10.1002/mds.23692.
4. Reich SG. Bell's Palsy. *CONTINUUM: Lifelong Learning in Neurology*. 2017;23(2):447-466. doi:10.1212/con.0000000000000447.
5. 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.

HD-7: Recurrent Laryngeal Palsy

HD-7.1: Recurrent Laryngeal Palsy

- The following can be considered with unilateral vocal cord/fold palsy identified by laryngoscopy:
 - ◆ MRI Brain without and with contrast (CPT® 70553) or MRI Brain without contrast (CPT® 70551) **and** MRI Orbit, Face and Neck with and without contrast (CPT® 70543) or CT Neck with contrast (CPT® 70491)
 - ◆ CT Chest with contrast (CPT® 71260) may be added with **left vocal cord palsy**

References

1. ACR Appropriateness Criteria® Cranial neuropathy. American College of Radiology (ACR). Revised 2017.
2. Myssiorek D. Recurrent laryngeal nerve paralysis: anatomy and etiology. Otolaryngologic Clinics of North America. 2004;37(1):25-44. doi:10.1016/s0030-6665(03)00172-5.
3. Martinez ARM, Martins MP, Moreira AL, Martins CR, Kimaid PAT, França MC. Electrophysiology of Cranial Nerve Testing. Journal of Clinical Neurophysiology. 2018;35(1):48-58. doi:10.1097/wnp.0000000000000423.

HD-8: Dementia	
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HD-8.1: Dementia

- For acute mental status change See **HD-4.1: Behavioral Disorders** and **HD-21.1: Stroke/TIA**.
- MRI Brain without contrast (CPT® 70551) or MRI Brain without and with contrast (CPT® 70553) or CT Head without contrast (CPT® 70450) is considered after an initial clinical diagnosis of dementia has been established.
 - ◆ The following components are required:
 - Established diagnosis of dementia: date of onset of symptoms with documentation of 6 months of cognitive decline based on a detailed history of memory loss with impairment of day-to-day activities confirmed by family members or others with knowledge of the individual's status OR
 - Results of bedside testing and/or neuropsychological testing can be performed when history and bedside mental status examination cannot provide a confident diagnosis.
 - Examples of abnormal bedside mental status testing such as Mini-Mental Status Exam (MMSE) with score <26, Montreal Cognitive Assessment Survey (MoCA) with score <26, Memory Impairment Screen (MIS) with score <5, or the St. Louis University Mental Status (SLUMS) with score <21.
 - Relevant laboratory tests (Such as B-12, thyroid function tests)
 - Presumptive causes or etiology/ies of dementia
 - Cannot occur exclusively during bouts of delirium
 - Cannot be explained by another mental disorder
- MRI Brain without contrast (CPT® 70551), or CT Head without contrast (CPT® 70450) if there is a contraindication to MRI and/or contrast, is considered for those with gait abnormalities, cognitive impairment and/or urinary symptoms (e.g. urgency, frequency and incontinence) for the evaluation of Normal Pressure Hydrocephalus. (See **HD-3.1: Ataxia**).
- 3D Brain imaging in dementia:
 - ◆ 3D analysis of the temporal lobes and hippocampus (also known as volumetric analysis or Neuro Quant) (CPT® 76376 and CPT® 76377) lacks sufficient specificity and sensitivity to be clinically useful in the evaluation or follow up of individuals with dementia. Its use is limited to research studies and it is otherwise considered to be investigational and experimental in routine clinical practice. Certain imaging studies are considered investigational by various payors, and their coverage policies may take precedence over eviCore's guidelines. Advanced imaging studies, or other procedures, may be considered investigational and experimental if there is a paucity of supporting evidence; if the evidence has not matured to exhibit improved health parameters or; the advanced imaging study/procedure lacks a collective opinion of support.

HD-8.2: Dementia - PET

- Prior to consideration of PET imaging for a diagnosis of dementia, all of the following components are required:
 - ◆ Established diagnosis of dementia: date of onset of symptoms with documentation of 6 months of cognitive decline based on a detailed history of memory loss with impairment of day-to-day activities confirmed by family members or others with knowledge of the individual's status OR
 - ◆ Results of bedside testing and/or neuropsychological testing can be performed when history and bedside mental status examination cannot provide a confident diagnosis.
 - Examples of abnormal bedside mental status testing such as Mini-Mental State Exam (MMSE) with score <26, Montreal Cognitive Assessment Survey (MoCA) with score <26, Memory Impairment Screen (MIS) with score <5, or the St. Louis University Mental Status (SLUMS) with score <21.
 - ◆ Results of any structural imaging (MRI or CT Head) performed.
 - ◆ Relevant laboratory tests (Such as B-12, thyroid function tests).
 - ◆ Presumptive causes or etiology/ies of dementia
 - Cannot occur exclusively during bouts of delirium
 - Cannot be explained by another mental disorder

CPT® 78608 is used to report FDG PET metabolic brain studies for dementia, seizure disorders, and dedicated PET tumor imaging studies of the brain.

CPT® 78609 is used to report PET Brain perfusion studies that are not performed with FDG. These scans are nationally noncovered by Medicare.

CPT® 78811 (limited PET) or CPT® 78814 (limited PET/CT) are used to report Amyloid Brain PET (these codes are for static images to measure amyloid, as opposed to the FDG PET which is a metabolic study).

- FDG PET for Dementia and Neurodegenerative Diseases
 - ◆ FDG Brain PET (CPT® 78608) may be useful in distinguishing between Alzheimer's disease and Frontotemporal dementia. It is otherwise considered investigational and experimental for the purpose of diagnosis and management of mild cognitive impairment (MCI) and other forms of dementia including, but not limited to, Lewy Body disease, Parkinson's disease, Normal Pressure Hydrocephalus and Chronic Traumatic Encephalopathy. Certain imaging studies are considered investigational by various payors, and their coverage policies may take precedence over eviCore's guidelines. Advanced imaging studies, or other procedures, may be considered investigational and experimental if there is a paucity of supporting evidence; if the evidence has not matured to exhibit improved health parameters or; the advanced imaging study/procedure lacks a collective opinion of support. Appropriate documentation should support concern for one of the variants of Frontotemporal dementia (Behavioral Variant or Primary Progressive Aphasia type FTD) based on a detailed history and exam findings (which may include neuropsychological testing) and meet the following criteria:
 - Meets diagnostic criteria for AD and FTLT; and
 - Has a documented cognitive decline of at least 6 months; and

- Evaluation has ruled out specific alternative neurodegenerative disease or causative factors; and
- Cause of clinical symptoms is uncertain; and
- The results are expected to help clarify the diagnosis between FTLT and AD and help guide future treatment.
- ◆ Medicare covers FDG PET for individuals with a recent diagnosis of dementia and documented cognitive decline of at least six months who meet diagnostic criteria for both Alzheimer's disease (AD) and Frontotemporal Dementia (FTD).
 - The individual must have been evaluated for specific alternate neurodegenerative diseases or other causative factors, but the etiology of the symptoms remains unclear
 - Other conditions must also be met. For the complete coverage policy, See the Medicare National Coverage Determinations (NCD) Manual, Section 220.6.13
 - Medicare also covers FDG PET for individuals with mild cognitive impairment or early dementia when the study is performed in the context of a CMS-approved clinical trial. Requirements are detailed in Section 220.6.13 of the NCD Manual
 - All other uses of FDG PET for individuals with a presumptive diagnosis of dementia-causing neurodegenerative disease for which CMS has not specifically indicated coverage continue to be noncovered. Examples of noncovered indications described in the NCD include: possible or probable Alzheimer's disease (AD), clinically typical fronto-temporal dementia (FTD), dementia of Lewy bodies, and Creutzfeld-Jacob disease.
http://www.cms.gov/Regulations-and-guidance/Guidance/Manuals/downloads/ncd103c1_Part4.pdf
- Amyloid Brain PET
 - ◆ Amyloid Brain PET (CPT® 78811 or CPT® 78814) imaging is considered experimental and investigational in the diagnosis of Alzheimer's disease and in differentiating between Alzheimer's disease and other neurodegenerative/neurologic disorders. Certain imaging studies are considered investigational by various payors, and their coverage policies may take precedence over eviCore's guidelines. Advanced imaging studies, or other procedures, may be considered investigational and experimental if there is a paucity of supporting evidence; if the evidence has not matured to exhibit improved health parameters or; the advanced imaging study/procedure lacks a collective opinion of support.
 - ◆ Amyloid PET studies may be approved one time for Medicare individuals enrolled in approved clinical trials under Coverage with Evidence Development (CED) program. For CMS, approval with CED is available for individuals enrolled in studies approved by CMS. See the link below for a list of the CMS approved clinical trials: <https://www.cms.gov/Medicare/Coverage/Coverage-with-Evidence-Development/Amyloid-PET.html>
 - Medicare will reimburse for Brain PET only through CED
 - Only one study will be paid per beneficiary and the radiopharmaceutical must be FDA-approved. Examples of radiopharmaceuticals which met this qualification include Amyvid™ (florbetapir F18), Neuraceq™ (florbetaben F18), Tauvid (flortaucipir F18) and Vizamyl™ (flutemetamol F18)

Practice Notes

- The frontotemporal dementias (FTDs) are a group of neurodegenerative disorders that differ from Alzheimer's disease. The basic pathology involves accumulation of tau proteins in the brain rather than amyloid. Onset tends to be younger (less than 65) and progression usually more rapid than in senile dementia-Alzheimer type (SDAT). There is no treatment, and the medications used to help memory in Alzheimer's disease are not effective.
- There are several subtypes of FTD; most common are the behavioral variant with early loss of executive functions, impaired judgment disinhibition and impulsivity, and the semantic variant with primary and progressive loss of language ability. Other less common subtypes include progressive supranuclear palsy, corticobasal syndrome, and FTD associated with motor neuron disease.
- Diagnosis is based on clinical features, neuropsychological testing, and brain imaging (preferably MRI) to rule out other structural disease. Metabolic (FDG) PET Brain may also be helpful by demonstrating patterns of abnormality more consistent with FTD than Alzheimer's disease.
- Health plans may have specific criteria that differ in their coverage policies

HD-8.3: Lewy Body Dementia (LBD) - SPECT Brain Scan

- Dementia with Lewy bodies is often hard to diagnose because its early symptoms may resemble those of Alzheimer's or a psychiatric illness. Over time people with LBD often develop similar symptoms due to the presence of Lewy bodies in the brain.
 - ◆ Clinicians and researchers may use the "1-year rule" to help make a diagnosis. If cognitive, psychiatric, emotional, and/or personality symptoms appear at the same time as or at least a year before movement problems/parkinsonism, the diagnosis is dementia with Lewy bodies. If cognitive problems develop more than a year after the onset of movement problems, Parkinson's disease, the diagnosis is Parkinson's disease dementia (PDD).
- Core Clinical Symptoms
 - ◆ Dementia
 - ◆ Movement problems/parkinsonism
 - ◆ Cognitive fluctuations
 - ◆ Visual hallucinations
 - ◆ REM sleep behavior disorder
- Supportive Clinical Symptoms
 - ◆ Extreme sensitivity to antipsychotic medications
 - ◆ Falls, fainting
 - ◆ Severe problems with involuntary functions (maintaining blood pressure, incontinence, constipation, loss of smell)
 - ◆ Changes in personality and mood (depression, apathy, anxiety)

- Prior to consideration of SPECT Brain Scan for a diagnosis of LBD, all of the following components are required:
 - ◆ Established diagnosis of dementia: date of onset of symptoms with documentation of 6 months of cognitive decline based on a detailed history of memory loss with impairment of day-to-day activities confirmed by family members or others with knowledge of the individual's status OR
 - ◆ Results of bedside testing and/or neuropsychological testing can be performed when history and bedside mental status examination cannot provide a confident diagnosis.
 - Examples of abnormal bedside mental status testing such as Mini-Mental State Exam (MMSE) with score <26, Montreal Cognitive Assessment Survey (MoCA) with score <26, Memory Impairment Screen (MIS) with score <5, or the St. Louis University Mental Status (SLUMS) with score <21.
 - ◆ Results of any structural imaging (MRI or CT Head) performed
 - ◆ Relevant laboratory tests (Such as B-12, thyroid function tests)
- SPECT Brain Scan (CPT® 78803 or CPT® 78830) may be approved after all of the above criteria are met
- PET Brain is not indicated for LBD

Practice Notes

- Test Results Supporting Diagnosis
 - ◆ Abnormal 123iodine-MIBG myocardial scintigraphy showing reduced communication of cardiac nerves
 - ◆ Sleep study confirming REM sleep behavior disorder without loss of muscle tone

References

1. McKhann GM, Knopman DS, Chertkow H, et al. The diagnosis of dementia due to Alzheimer's disease: Recommendations from the National Institute on Aging-Alzheimer's Association workgroups on diagnostic guidelines for Alzheimer's disease. *Alzheimer's & Dementia*. 2011;7(3):263-269. doi:10.1016/j.jalz.2011.03.005.
2. Lewis SL. Dementia Untangled. *CONTINUUM: Lifelong Learning in Neurology*. 2019;25(1):12-13. doi:10.1212/01.con.0000553293.87198.a4.
3. Decision Memo for Positron Emission Tomography (FDG) for Alzheimer's Disease/Dementia (CAG-00088N). CMS.gov. Centers for Medicare & Medicaid Services. <https://www.cms.gov/medicare-coverage-database/details/nca-decision-memo.aspx?NCAId=64&fromdb=true>.
4. ACR Appropriateness Criteria® Dementia and movement disorders. American College of Radiology (ACR). Last review date: 2015.
5. Knopman DS, DeKosky ST, Cummings JL, et al. Practice parameter: Diagnosis of dementia (an evidence-based review): Report of the Quality Standards Subcommittee of the American Academy of Neurology. *Neurology*. 2001;56(9):1143-1153. doi:10.1212/wnl.56.9.1143.
6. Johnson KA, Minoshima S, Bohnen NI, et al. Appropriate use criteria for amyloid PET: A report of the Amyloid Imaging Task Force, the Society of Nuclear Medicine and Molecular Imaging, and the Alzheimer's Association. *Alzheimer's & Dementia*. 2013;9(1):E1-E16. doi:10.1016/j.jalz.2013.01.002.
7. Decision Memo for Positron Emission Tomography (FDG) and Other Neuroimaging Devices for Suspected Dementia (CAG-00088R). CMS.gov. Centers for Medicare & Medicaid Services. [https://www.cms.gov/medicare-coverage-database/details/nca-decision-memo.aspx?NCAId=104&NcaName=Positron+Emission+Tomography+\(FDG\)+and+Other+Neuroimaging+Devices+for+Suspected+Dementia+\(1st+Recon\)&bc=AIAAAAAAEEAAA&](https://www.cms.gov/medicare-coverage-database/details/nca-decision-memo.aspx?NCAId=104&NcaName=Positron+Emission+Tomography+(FDG)+and+Other+Neuroimaging+Devices+for+Suspected+Dementia+(1st+Recon)&bc=AIAAAAAAEEAAA&)
8. NCD for FDG PET for Dementia and Neurodegenerative Diseases (220.6.13), Effective date 4/3/2009, Implementation date 10/30/2009. <http://www.cms.gov/medicare-coverage-database/details/ncd-details.aspx?NCDId=288&nacdver=3&bc=BAABAAAAAAA&>.
9. Rabinovici GD, Gatsonis C, Apgar C, et al. Association of Amyloid Positron Emission Tomography With Subsequent Change in Clinical Management Among Medicare Beneficiaries With Mild Cognitive Impairment or Dementia. *Jama*. 2019;321(13):1286-1294. doi:10.1001/jama.2019.2000.
10. Subramaniam RM, Frey KA, Hunt CH, et al. ACR-ACNM Practice Parameter for the Performance of Dopamine Transporter (DaT) Single Photon Emission Computed Tomography (SPECT) Imaging for Movement Disorders. *Clinical Nuclear Medicine*. 2017;42(11):847-852. doi:10.1097/rlu.0000000000001815.
11. Graff-Radford NR, Jones DT. Normal Pressure Hydrocephalus. *CONTINUUM: Lifelong Learning in Neurology*. 2019;25(1):165-186. doi:10.1212/con.0000000000000689.
12. Tartaglia MC, Rosen HJ, Miller BL. Neuroimaging in Dementia. *Neurotherapeutics*. 2011;8(1):82-92. doi:10.1007/s13311-010-0012-2.
13. ACR ACNM ASNR SNMMI Practice Parameter for Brain PET-CT Imaging in Dementia. 2020.
14. Consensus Recommendations for the Postmortem Diagnosis of Alzheimer's Disease. *Neurobiology of Aging*. 1997;18(4):S1-S2. doi:10.1016/s0197-4580(97)00057-2
15. Approaches and Tools for Primary Care Providers Developed by the GSA Workgroup on Cognitive Impairment Detection and Earlier Diagnosis. <https://www.geron.org/images/gsa/kaer/gsa-kaer-toolkit.pdf>
16. Lombardi G, Crescioli G, Cavado E, et al. Structural magnetic resonance imaging for the early diagnosis of dementia due to Alzheimer's disease in people with mild cognitive impairment. *Cochrane Database of Systematic Reviews*. Published online March 2, 2020. doi:10.1002/14651858.cd009628.pub2.
17. Yousaf T, Dervenoulas G, Valkimadi P-E, Politis M. Neuroimaging in Lewy body dementia. *Journal of Neurology*. 2019;266(1):1-26. doi:10.1007/s00415-018-8892-x.
18. Goto H, Ishii K, Uemura T, et al. Differential Diagnosis of Dementia with Lewy Bodies and Alzheimer Disease Using Combined MR Imaging and Brain Perfusion Single-Photon Emission Tomography. *American Journal of Neuroradiology*. 2010;31(4):720-725. doi:10.3174/ajnr.a1926.
19. McCleery J, Morgan S, Bradley KM, Noel-Storr AH, Ansorge O, Hyde C. Dopamine transporter imaging for the diagnosis of dementia with Lewy bodies. *Cochrane Database of Systematic Reviews*. Published online January 30, 2015. doi:10.1002/14651858.cd010633.pub2.
20. Armstrong MJ. Lewy Body Dementias. *CONTINUUM: Lifelong Learning in Neurology*. 2019;25(1):128-146. doi:10.1212/con.0000000000000685.
21. American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders*. 5th ed. American Psychiatric Association; 2013.
22. Diagnosis of Dementia. www.aan.com. <https://www.aan.com/Guidelines/home/GuidelineDetail/42>,
23. Zukotynski K, Kuo PH, Mikulis D, et al. PET/CT of Dementia. *American Journal of Roentgenology*. 2018;211(2):246-259. doi:10.2214/ajr.18.19822.

HD-9: Epilepsy/Seizures

HD-9.1: Epilepsy/Seizures	31
HD-9.2: Presurgical Work-Up for Drug-Resistant Epilepsy	31

HD-9.1: Epilepsy/Seizures

- MRI Brain without and with contrast (CPT® 70553) or MRI Brain without contrast (CPT® 70551) may be considered:
 - ◆ Evaluation of new onset seizures
 - ◆ Refractory or drug resistant seizures
 - ◆ Change in the type of seizure
 - ◆ If CT Head without contrast (CPT® 70450) was performed for an initial evaluation for new onset seizure, MRI (as described above) may be approved for additional evaluation
 - ◆ Follow-up studies after a previous routine normal study may be considered if performed with special “Epilepsy Protocol” (typically 3T magnet, thin sections with angled slices through hippocampus and temporal lobes)
- CT Head without contrast (CPT® 70450) may be approved for:
 - ◆ Evaluation of structural findings in seizure etiologies that contain dystrophic calcifications, such as with oligodendrogliomas and tuberous sclerosis.
 - ◆ Acute setting of seizure evaluation
- CT Head (contrast as requested)
 - ◆ MRI is contraindicated

HD-9.2: Presurgical Work-Up for Drug-Resistant Epilepsy

- The following requests may be approved for presurgical evaluation:
 - ◆ MRI Brain with and without 3T/7T (CPT® 70551 or CPT® 70553)
 - ◆ FDG PET (CPT® 78608)
 - Medicare covers FDG PET for pre-surgical evaluation for the purpose of localization of a focus of refractory seizure activity. The complete coverage policy is found in the Medicare National Coverage Determinations (NCD) Manual, Section 220.6.9
 - <https://www.cms.gov/medicare-coverage-database/details/ncd-details.aspx?NCDId=294&ncdver=1&DocID=220.6.9&SearchType=Advanced&bc=IAAABAAAA&>
 - ◆ Ictal SPECT (CPT® 78803)
 - ◆ Functional MRI (fMRI) (CPT® 70555 or CPT® 70554) See **HD-24.2: Functional MRI (fMRI)**
- When noninvasive EEG monitoring is insufficient, intracranial monitoring with stereo-EEG or grids/strips and electrodes may be required with approvable additional imaging for neuronavigation. See **HD-28.1: Neurosurgical Imaging Requests** and **HD-28.2: Neuronavigation**
 - ◆ Post-operative imaging including after intracranial (EEG) monitoring is approvable per neurosurgeon’s request.
- See **ONC-2.1: Primary Central Nervous System Tumors-General Considerations** in the Oncology Imaging Guidelines and/or **HD-28: Neurosurgical Imaging** for additional imaging requests for surgery

Practice Notes

- Below are examples of surgical treatment or an interventional modality that may be under active consideration for individuals with intractable epilepsy (not all inclusive):
 - ◆ 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 (Neuromodulation) including
 - Vagus Nerve Stimulation (VNS)
 - Responsive Neurostimulation (RNS) system also known as NeuroPace
 - Deep Brain Stimulation

Certain imaging studies are considered investigational by various payors, and their coverage policies may take precedence over eviCore's guidelines. Advanced imaging studies, or other procedures, may be considered investigational and experimental if there is a paucity of supporting evidence; if the evidence has not matured to exhibit improved health parameters or; the advanced imaging study/procedure lacks a collective opinion of support.

References

1. ACR Appropriateness Criteria® Seizures and epilepsy. *American College of Radiology (ACR)*. Last review date: 2019.
2. Krumholz A, Wiebe S, Gronseth G, et al. Practice Parameter: Evaluating an apparent unprovoked first seizure in adults (an evidence-based review): [RETIRED]. *Neurology*. 2007;69(21):1996-2007. doi:10.1212/01.wnl.0000285084.93652.43.
3. Hirtz D, Ashwal S, Berg A, et al. Practice parameter: Evaluating a first nonfebrile seizure in children: Report of the Quality Standards Subcommittee of the American Academy of Neurology, the Child Neurology Society, and the American Epilepsy Society. *Neurology*. 2000;55(5):616-623. doi:10.1212/wnl.55.5.616.
4. St. Louis EK, Cascino GD. Diagnosis of Epilepsy and Related Episodic Disorders. *Continuum (Minneapolis, Minn)*. 2016;22(1 Epilepsy):15-37. doi:10.1212/CON.0000000000000284.
5. Tranvinh E, Lanzman B, Provenzale J, Wintermark M. Imaging Evaluation of the Adult Presenting With New-Onset Seizure. *American Journal of Roentgenology*. 2019;212(1):15-25. doi:10.2214/ajr.18.20202.
6. Harden CL, Huff JS, Schwartz TH, et al. Reassessment: Neuroimaging in the emergency patient presenting with seizure (an evidence-based review): Report of the Therapeutics and Technology Assessment Subcommittee of the American Academy of Neurology. *Neurology*. 2007;69(18):1772-1780. doi:10.1212/01.wnl.0000285083.25882.0e.
7. Society of Nuclear Medicine Procedure Guideline for FDG PET Brain Imaging Version 1.0. approved February 8, 2009.
8. Varrone A, Asenbaum S, Borghat TV, et al. EANM procedure guidelines for PET brain imaging using [18F]FDG, version 2. *European Journal of Nuclear Medicine and Molecular Imaging*. 2009;36(12):2103-2110. doi:10.1007/s00259-009-1264-0.
9. Knowlton RC, Elgavish RA, Bartolucci A, et al. Functional imaging: II. Prediction of epilepsy surgery outcome. *Annals of Neurology*. 2008;64(1):35-41. doi:10.1002/ana.21419.
10. Shibasaki H, Ikeda A, Nagamine T. Use of magnetoencephalography in the presurgical evaluation of epilepsy patients. *Clinical Neurophysiology*. 2007;118(7):1438-1448. doi:10.1016/j.clinph.2007.03.002.
11. Spencer SS. The Relative Contributions of MRI, SPECT, and PET Imaging in Epilepsy. *Epilepsia*. 1994;35(s6). doi:10.1111/j.1528-1157.1994.tb05990.x.
12. Weil S, Noachtar S, Arnold S, Yousry TA, Winkler PA, Tatsch K. Ictal ECD-SPECT differentiates between temporal and extratemporal epilepsy: confirmation by excellent postoperative seizure control. *Nuclear Medicine Communications*. 2001;22(2):233-237. doi:10.1097/00006231-200102000-00016.
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. *Neurologia medico-chirurgica*. 2017;57(8):375-385. doi:10.2176/nmc.ra.2017-0008.
16. Identification and Treatment of Drug-Resistant Epilepsy. *CONTINUUM (MINNEAP MINN)*2019;25(2, EPILEPSY):362–380. doi: 10.1212/CON.0000000000000710.
17. Delev D, Quesada CM, Grote A, et al. A multimodal concept for invasive diagnostics and surgery based on neuronavigated voxel-based morphometric MRI postprocessing data in previously nonlesional epilepsy. *Journal of Neurosurgery*. 2018;128(4):1178-1186. doi:10.3171/2016.12.jns161676.

HD-10: Facial Pain/Trigeminal Neuralgia

HD-10.1: Facial Pain/Trigeminal Neuralgia

- MRI Brain without and with contrast (CPT® 70553) (with special attention to the skull base), and/or facial imaging, MRI Orbit without and with contrast (CPT® 70543) may be of value in a given case, including:
 - ◆ Suspected tic douloureux or one of its cranial nerve variants such as glossopharyngeal neuralgia (CN IX)
 - ◆ Concern about an underlying diagnosis of multiple sclerosis
 - ◆ Trigeminal neuralgia which involves the ophthalmic nerve, (periorbital or forehead pain), once post-herpetic neuralgia (a complication of shingles) has been excluded by history
- MRA Head (CPT® 70544, CPT® 70545 or CPT® 70546) or CTA Head (CPT® 70496) may be performed for:
 - ◆ Failed medical treatment
 - ◆ Surgical planning

Practice Notes

The differential diagnosis of facial pain is extensive, complex, and difficult, and there is considerable case-to-case variation in optimal imaging pathway.

References

1. Goh BT, Poon CY, Peck RHL. The importance of routine magnetic resonance imaging in trigeminal neuralgia diagnosis. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology*. 2001;92(4):424-429. doi:10.1067/moe.2001.115130.
2. Yaltho TC, Jankovic J. The many faces of hemifacial spasm: Differential diagnosis of unilateral facial spasms. *Movement Disorders*. 2011;26(9):1582-1592. doi:10.1002/mds.23692.
3. Cruccu G. Trigeminal Neuralgia. *CONTINUUM: Lifelong Learning in Neurology*. 2017;23(2):396-420. doi:10.1212/con.0000000000000451.
4. AAN Practice Parameter: The Diagnostic Evaluation and Treatment of Trigeminal Neuralgia. October 2008. Reaffirmed 7/21/2018.
5. American College of Radiology ACR Appropriateness Criteria® Cranial Neuropathy. Revised 2017. <https://acsearch.acr.org/docs/69509/Narrative/>.

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HD-11.1: Headache Non-Indications

- Advanced imaging of the head is NOT indicated for any of the following:
 - ◆ Primary headache disorder in the absence of focal neurological deficits or “red flags” (See **HD-11.2: Headaches with Red Flags** and **HD-11.17 Migraine Exceptions**)
 - ◆ Newly diagnosed migraine or tension-type headache with a normal neurologic exam or for chronic stable headache including migraine with no neurologic deficit.
 - ◆ Duplex Ultrasound Carotid Arteries (CPT® 93880) does not have a role in the evaluation of headaches (including migraines) and may NOT be approved except for suspected carotid dissection (See **PVD 3.1: Initial Imaging** in the Peripheral Vascular Disease Imaging Guidelines and **HD-21.1: Stroke/TIA**)
- CTA Neck (CPT® 70498) and MRA Neck (CPT® 70547, CPT® 70548, or CPT® 70549) are considered appropriate in the evaluation for headache with suspected carotid dissection and are approvable in certain high risk scenarios including, but not exclusive to: Fibromuscular dysplasia (FMD), Marfan Disease, acute MVA with whiplash, and acute headache and/or neck pain due to chiropractic manipulation. Other indications for headaches require additional information. See **HD-21.1: Stroke/TIA**, **HD-11.3: Sudden Onset of Headache**, **PVD-3.1: Initial Imaging** in the Peripheral Vascular Disease Imaging Guidelines and **HD-1.5: Skull Base, Orbit, Periorbital or Oromaxillary**

Practice Notes

- The yield of detecting abnormal, treatable lesions by CT or MRI in individuals with headache but normal neurological exam has been found to be low.

HD-11.2: Headaches with Red Flags

- Red Flags - If any of the below unusual symptoms or history are present advanced imaging studies may be considered (see relevant section):
 - ◆ Cancer history or immunosuppression (See **HD-11.8: Cancer** or **Immunosuppression**)
 - ◆ Sudden onset (See **HD-11.3: Sudden Onset of Headache**)
 - ◆ Headache accompanied by seizures, vomiting, focal neurological complaints including dizziness, visual change, acute hypertension or altered mental status (See **ONC-2.1: Primary Central Nervous System Tumors – General Considerations** in the Oncology Imaging Guidelines and **HD-21.1: Stroke/TIA**)
 - ◆ New onset age >50 (See **HD-11.7: New Headache Onset Older than Age 50** and **HD-11.17: Migraine Exceptions**)
 - ◆ History of head trauma (See **HD-11.12: Headaches Associated with Head Trauma**, and **HD-13: Head and Facial Trauma**)
 - ◆ Headache precipitated by cough or valsalva, physical exertion, or sexual activity (See **HD-11.11: Physical Exertion**)
 - ◆ Currently pregnant (including pregnancy and the immediate postpartum period) (See **HD-11.10: Pregnancy**)
 - ◆ Hypercoagulable state or bleeding disorder (See **HD-11.9: Abnormal Blood Clotting**)
 - ◆ New persistent headache (See **HD-11.17: Migraine Exceptions**)

- MRI Brain without and with contrast (CPT® 70553) or MRI Brain without contrast (CPT® 70551) or CT Head without contrast (CPT® 70450)
 - ◆ Unusual symptoms or history as detailed in the “Red Flag” sections above (For example: Headache awakens individual from sleep)
 - ◆ Abnormal examination findings (altered mental status, papilledema, focal signs or symptoms including unilateral weakness or sensory loss, loss of coordination, seizures, gait disturbance, cranial nerve abnormality, vision loss, nystagmus, dysarthria, dysphagia, fever, meningismus)
- Chronic headache with significant change in character, severity or frequency of headache (For example: progressively worsening headache over a period of days or weeks, transformation of established migraine to chronic daily headaches):
 - ◆ MRI Brain without and with contrast (CPT® 70553); or
 - ◆ MRI Brain without contrast (CPT® 70551); or
 - ◆ CT Head without contrast (CPT® 70450)
 - ◆ MRA/MRV Head (CPT® 70544, CPT® 70545, or CPT® 70546) or CTA/CTV Head (CPT® 70496) can be added to evaluate the recent onset of a progressive, severe, daily headache, with or without papilledema and concern for cerebral venous sinus thrombosis.
 - CT and MR Venography (CTV and MRV) are reported with the same codes as the CTA/MRA counterpart. 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
 - ◆ For papilledema: See **HD-17: Papilledema/Pseudotumor Cerebri**

Practice Notes

- Aura symptoms may accompany or precede a headache within 60 minutes and may include, but are not exclusive to the following symptoms:
 - ◆ Visual (flashing lights, loss of vision)
 - ◆ Sensory (paresthesia)
 - ◆ Speech and/or language (difficulty speaking)
 - ◆ Motor (any weakness)
 - ◆ Brainstem (dizziness, double vision) and retinal (visual complaints)

HD-11.3: Sudden Onset of Headache

- For sudden onset of headache including:
 - ◆ Worst, most severe headache ever experienced or thunderclap-type (example: awakening from sleep)
 - ◆ Sudden onset unilateral headache, suspected carotid or vertebral dissection or ipsilateral Horner’s syndrome
 - ◆ Consideration of reversible cerebral vasoconstriction syndrome (RCVS) (typically bilateral headache)

- If any of these onset of headache features are present, the following advanced imaging studies may be considered:
 - ◆ CT Head without contrast (preferred study) (CPT® 70450) **or**
 - ◆ MRI Brain without contrast (CPT® 70551) **or**
 - ◆ MRI Brain without and with contrast (CPT® 70553) **and/or**
 - ◆ CTA Head (CPT® 70496) **or** MRA Head (CPT® 70544, CPT® 70545, or CPT® 70546)
 - ◆ MRA Neck (CPT® 70547, CPT® 70548, or CPT® 70549) or CTA Neck (CPT® 70498) may also be performed if arterial dissection is suspected
 - CT and MR Venography (CTV and MRV) are reported with the same codes as the CTA/MRA counterpart. 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
- Repeat MRA/CTA Head and Neck imaging in 2-4 weeks is approvable if suspicion of Reversible Cerebral Vasoconstriction Syndrome (RCVS) is high
- See **HD-12.1: Intracranial Aneurysms** and **HD-21.1: Stroke/TIA**

HD-11.4: Trigeminal Autonomic Cephalgias

- Trigeminal autonomic cephalgias includes cluster headache, short-lasting, unilateral, neuralgiform headache attacks with conjunctival injection and tearing (SUNCT) syndromes; short-lasting unilateral neuralgiform headache attacks with cranial autonomic symptoms (SUNA) and hemicrania paroxysmal and continua.
 - ◆ May also include pituitary screening
- Cluster Headache (may also include pituitary)
- The following advanced imaging studies may be considered for trigeminal autonomic cephalgias and cluster headache:
 - ◆ MRI Brain without and with contrast (preferred study) (CPT® 70553); or
 - ◆ MRI Brain without contrast (CPT® 70551)
- See **HD-10: Facial Pain/Trigeminal Neuralgia**

HD-11.5: Skull Base, Orbit, Periorbital or Oromaxillary

- Skull base, orbital, periorbital or oromaxillary¹ imaging is appropriate for concern of skull base tumors in individuals with head and neck cancers, other skull base abnormalities seen on previous imaging, any invasive sinus infections as well as sinus tumors or orbital tumors with intracranial extension.
- In these clinical scenarios, ONE of the following procedures may be considered:
 - ◆ MRI Brain and Orbits without and with contrast (preferred study) (CPT® 70553 and CPT® 70543); **or**
 - ◆ MRI Brain and Orbits without contrast (CPT® 70551 and CPT® 70540); **or**
 - ◆ CT Head and Orbits without and with contrast (CPT® 70470 and CPT® 70482); **or**
 - ◆ CT Head and Orbits with contrast (CPT® 70460 and CPT® 70481)

HD-11.6: Suspected Intracranial Extension of Sinusitis or Mastoiditis

- For suspected intracranial extension of sinusitis or mastoiditis:
 - ◆ MRI Brain without and with contrast (CPT® 70553) may be considered (See **HD-26.1: Mastoid Disease or Ear Pain** and **HD-11.5: Skull Base, Orbit, Periorbital or Oromaxillary**)

HD-11.7: New Headache Onset Older than Age 50

- For new onset headache in individuals older than 50 years of age the following may be considered:
 - ◆ MRI Brain without and with contrast (preferred study) (CPT® 70553); **or**
 - ◆ MRI Brain without contrast (CPT® 70551); **or**
 - ◆ CT Head without contrast (CPT® 70450)
 - ◆ If Giant Cell Arteritis, also known as Temporal Arteritis, is suspected, MRA Head (CPT® 70544, CPT® 70545, or CPT® 70546) may be added

HD-11.8: Cancer or Immunosuppression

- For new headache in individuals with cancer or who are immunocompromised, the following may be considered:
 - ◆ MRI Brain without and with contrast (preferred study) (CPT® 70553); **or**
 - ◆ MRI Brain without contrast (CPT® 70551)

HD-11.9: Abnormal Blood Clotting

- MRI Brain without and with contrast (CPT® 70553); **or** MRI Brain without (CPT® 70551); **or** CT Head without contrast (CPT® 70450):
 - ◆ New onset headaches in individual with hypercoagulable states or bleeding disorder including pregnancy and the immediate postpartum period
 - MRA/MRV Head (CPT® 70544, CPT® 70545, or CPT® 70546) or CTA/CTV Head (CPT® 70496) may be added if there is concern for venous sinus thrombosis
 - CT and MR Venography (CTV and MRV) are reported with the same codes as the CTA/MRA counterpart. 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
 - ◆ Individuals with potential for bleeding diathesis
 - Taking anticoagulants or two or more antiaggregants or having a medical condition that predisposes to bleeding (for example, liver failure).

HD-11.10: Pregnancy

- For new onset headache during pregnancy or immediate post-partum period (within 3 months after delivery) the following may be considered:
 - ◆ MRI Brain without contrast (Gadolinium relatively contraindicated in pregnancy) (CPT® 70551), Postpartum: MRI Brain without and with contrast (CPT® 70553) if not breastfeeding, if unsure, MRI Brain without contrast (CPT® 70551);
 - ◆ MRA/MRV Head (CPT® 70544, CPT® 70545, or CPT® 70546) or CTA/CTV Head (CPT® 70496) may be added if there is concern for venous sinus thrombosis.
 - CT and MR Venography (CTV and MRV) are reported with the same codes as the CTA/MRA counterpart. 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
- For post LP/epidural anesthesia - See **HD-11.15: Low Pressure Headache and CSF Leak**

HD-11.11: Physical Exertion

- For onset of headache with Valsalva maneuver, cough, physical exertion, change in position, **or** sexual (post-coital) activity, but not merely a worsening of a pre-existing headache with these activities, the following procedures may be considered:
 - ◆ MRI Brain without and with contrast (preferred study) (CPT® 70553); **or**
 - ◆ MRI Brain without contrast (CPT® 70551); **or**
 - ◆ CT Head without contrast (CPT® 70450); **AND/OR**
 - ◆ MRA Head (CPT® 70544, CPT® 70545, or CPT® 70546) **or**
 - ◆ CTA Head without and with contrast (CPT® 70496)

HD-11.12: Headaches Associated with Head Trauma

- Requests for acute head trauma with headache, See **HD-13.1: Head Trauma**,
- For requests for an acute headache attributed to traumatic injury to the head that developed within 7 days of injury that does not meet criteria under **HD-13: Head and Facial Trauma**, other subsections may apply including, but not exclusive to: **HD-11.2 Headaches with Red Flags** and **HD-11.3-Sudden Onset of Headache**
- Requests for a new or progressively worsening headache with subacute head trauma, defined as within 7 days to three months post-trauma, with or without unexplained cognitive or neurologic deficits, may have the following approved:
 - ◆ CT Head without contrast (CPT® 70450); **or**
 - ◆ MRI Brain without contrast (CPT® 70551)
- For persistent headaches attributed to traumatic injury to the head persisting for longer than 3 months following the injury, with or without unexplained cognitive or neurologic deficits, the following may be considered:
 - ◆ MRI Brain without contrast (CPT® 70551); **or**
 - ◆ MRI Brain without and with contrast (CPT® 70553)

HD-11.13: Systemic Infections

- For headaches in the setting of acute, subacute, or chronic systemic infections the following may be considered:
 - ◆ MRI Brain without and with contrast (preferred study) (CPT® 70553); or MRI Brain without contrast (CPT® 70551)
 - ◆ MRA/MRV Head (CPT® 70544, CPT® 70545, or CPT® 70546)
 - CT and MR Venography (CTV and MRV) are reported with the same codes as the CTA/MRA counterpart. 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
 - ◆ CT Head, contrast as requested, when MRI Brain is contraindicated. See **HD-1.4: General Guidelines – CT Head** for additional CT Head indications.
- See **HD-14.1: CNS and Head Infection**

HD-11.14: Hydrocephalus Shunts

- Hydrocephalus may present with headaches
- 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. 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,
- For CSF flow imaging See **HD-24.4: CSF Flow Imaging**
- For Hydrocephalus Shunts, See **HD-1.7: General Guidelines – Other Imaging Situations** and **HD-1.4: General Guidelines – CT Head**

Initial Imaging Indications

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

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 specialist (neurologist or neurosurgeon) or any provider in consultation with a specialist.
- Rapid MRI Brain without contrast (CPT® 70551) or CT Head without contrast (CPT® 70450) is indicated in the postoperative period following shunt placement or ETV, with further follow-up imaging 6-12 months after the procedure and then every 12 months for 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) can be approved for suspicion of CSF pseudocyst formation or distal shunt outlet obstruction.
- Familial screening is not indicated for hydrocephalus except in siblings of individuals with aqueductal stenosis, for whom a one-time CT Head without contrast (CPT® 70450) or Rapid MRI Brain without contrast (CPT® 70551) is indicated.

Additional Rarely Used Studies

- Cisternogram (CPT® 78630) 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) 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) for the following:
 - ◆ Suspected malfunction of ventriculoperitoneal, ventriculopleural, or ventriculovenous shunts.

HD-11.15: Low Pressure Headache and CSF Leak

- CSF leaks may occur in:
 - ◆ CSF shunt overdrainage
 - ◆ Traumatic CSF leaks
 - Thecal holes and rents from lumbar punctures and epidural catheterizations
 - Spinal and cranial surgeries including skull base and some sinus surgeries
 - Proximal brachial plexus and nerve root avulsion injuries
 - ◆ Spontaneous leaks may occur in, but not exclusive to:
 - Pre-existing weakness of the dural sac including:
 - Disorders of connective tissue matrix including Marfan syndrome, Marfanoid features
 - Joint hypermobility
 - Trivial trauma in the setting of preexisting dural weakness
 - Spondylotic spurs, herniated discs
- Evaluation of suspected CSF leak (rhinorrhea/otorrhea) or refractory post-lumbar puncture/low pressure headache may include:
 - ◆ MRI Brain without and with contrast (CPT® 70553) and
 - ◆ MRI Cervical, Thoracic and Lumbar Spine, which according to facility protocols may be completed without contrast (CPT® 72141, CPT® 72146, and CPT® 72148), with and without contrast (CPT® 72156, CPT® 72157, and CPT® 72158) or with contrast only (CPT® 72142, CPT® 72147, and CPT® 72149) or CT myelography (CT Cervical, Thoracic, and Lumbar Spine with contrast [CPT® 72126, CPT® 72129, CPT® 72132])
- CT Head without contrast (CPT® 70450), CT Maxillofacial without contrast (CPT® 70486) or CT Temporal Bone without contrast (CPT® 70480) if concern for CSF rhinorrhea
- CSF Leakage Detection (CPT® 78650) (See **HD-36: Nuclear Medicine**) for evaluation of CSF rhinorrhea, otorrhea, or refractory post-lumbar puncture
- Cisternogram (CPT® 78630) for the following: (See **HD-36: Nuclear Medicine**)
 - ◆ Known hydrocephalus with worsening symptoms
 - ◆ Suspected obstructive hydrocephalus

HD-11.16: Cervicogenic Headaches including Occipital Neuritis/Neuralgia

- Cervicogenic Headache
 - ◆ Headache caused by a disorder of the cervical spine, usually accompanied by neck pain or other signs and symptoms of cervical disease. Typical findings include reduced cervical range of motion, side-locked pain, and symptoms exacerbated by provocative maneuvers such as head movement or digital pressure.

- Occipital Neuralgia/Neuritis - Occipital neuralgia is classified unilateral or bilateral paroxysmal, shooting or stabbing pain in the posterior part of the scalp, in the distribution(s) of the greater, lesser and/or third occipital nerves, sometimes accompanied by diminished sensation or dysaesthesia in the affected area and commonly associated with tenderness over the involved nerve(s).
 - ◆ Pain has at least two of the following three characteristics:
 - Recurring in paroxysmal attacks lasting from a few seconds to minutes
 - Severe in intensity
 - Shooting, stabbing or sharp in quality
 - ◆ Pain is associated with both of the following:
 - Dysaesthesia and/or allodynia apparent during innocuous stimulation of the Scalp and/or hair
 - Either or both of the following:
 - Tenderness over the affected nerve branches
 - Trigger points at the emergence of the greater occipital nerve or in the distribution of C2
 - ◆ Pain is eased temporarily by local anaesthetic block of the affected nerve(s)
- MRI Cervical Spine without contrast (CPT® 72141) or CT Cervical Spine without contrast (CPT® 72125) may be considered for approval.
 - ◆ Requests should follow **SP-3.1: Neck (Cervical Spine) Pain Without/With Neurological Features (Including Stenosis)** and **SP-3.2: Neck (Cervical Spine) Trauma** in the Spine Imaging Guidelines including 6 weeks of physician directed care within the last 3 months with re-evaluation.
 - Exemptions to the 6 weeks of conservative care include:
 - In cases of Cervical Spine injury, results of plain x-rays of the cervical spine and a 6 week trial of provider-directed treatment and clinical reevaluation are not required for individuals with a high risk mechanism of cervical spine injury within the last 3 months (See **SP-3.2: Neck (Cervical Spine) Trauma in the Spine Imaging Guidelines** in the Spine Imaging Guidelines)
 - **SP-1.2 Red Flag Indications** in the Spine Imaging Guidelines
 - ◆ May be approved for any of the following:
 - Bony abnormalities: Atlanto-axial dislocations/instability (including Down's syndrome, Ehlers-Danlos and Marfan syndromes and rheumatoid arthritis), platybasia, osteomas, callous formation of the posterior C1/2 arches
 - Posterior fossa lesions, Chiari malformations, demyelinating disease
 - Myelopathy/myelitis (See **SP-7.1: Myelopathy** in the Spine Imaging Guidelines)
- Requests for brain imaging are to follow applicable sections in **HD-11: Headache**.

HD-11.17: Migraine Exceptions

- Advanced imaging of the head is NOT indicated for newly diagnosed migraine with a normal neurological exam or chronic stable migraine with no neurological deficit and/or no red flags (See **HD-11.2: Headaches with Red Flags**). See below for advanced imaging indications related to migraines.
- MRI Brain without (CPT® 70551) preferred or MRI Brain with and without (CPT® 70553) or CT Head without (CPT® 70450) for the following:
 - ◆ Unusual, prolonged or persistent aura (greater than 60 minutes) (See Practice Note)
 - ◆ Worst migraine
 - ◆ Hemiplegic migraine
 - Migraine with any motor weakness.
 - ◆ Late-life migrainous accompaniments (age ≥50 years)
 - Passing neurological symptoms that can affect vision, speech, movement, and behavior-“mimic stroke”
 - ◆ Migraine aura without headache
 - Migraine with an aura in which the aura is neither accompanied nor followed by a headache within 60 minutes.
 - ◆ Side-locked migraine (unilateral)
 - Unilateral hemicranial pain – includes primary and secondary causes.
 - New daily persistent headache (new daily headache present greater than three months)
 - Trigeminal autonomic cephalgias includes cluster headache short-lasting, unilateral, neuralgiform headache attacks with conjunctival injection and tearing (SUNCT) syndromes; short-lasting unilateral neuralgiform headache attacks with cranial autonomic symptoms (SUNA) and hemicrania paroxysmal and continua. are covered in **HD-11.4: Trigeminal Autonomic Cephalgias**
 - ◆ Post-traumatic migraine
 - See **HD-13.1: Head Trauma** and **HD-11.12: Headaches Associated with Head Trauma**

Practice Notes

- Aura symptoms may accompany or precede a headache within 60 minutes and may include, but are not exclusive to, the following symptoms:
 - ◆ Visual (flashing lights, loss of vision)
 - ◆ Sensory (paresthesia)
 - ◆ Speech and/or language (difficulty speaking)
 - ◆ Motor (any weakness)
 - ◆ Brainstem (dizziness, double vision) and retinal (visual complaints)

References

1. ACR Appropriateness Criteria® Headache. American College of Radiology (ACR). Last review: 2019.
2. Silberstein SD. Practice parameter: evidence-based guidelines for migraine headache (an evidence-based review): report of the Quality Standards Subcommittee of the American Academy of Neurology. *Neurology*. 2000 Sep 26;55(6):754–763. Correction: *Neurology*. 2001;56(1):142-142. doi:10.1212/wnl.56.1.142-a.
3. Headache Classification Committee of the International Headache Society (IHS) The International Classification of Headache Disorders, 3rd edition. *Cephalalgia*. 2018;38(1):1-211.
4. Thurtell MJ. Idiopathic Intracranial Hypertension. *CONTINUUM: Lifelong Learning in Neurology*. 2019;25(5):1289-1309. doi:10.1212/con.0000000000000770.
5. Burch R. Headache in Pregnancy and the Puerperium. *Neurologic Clinics*. 2019;37(1):31-51. doi:10.1016/j.ncl.2018.09.004.
6. Jamieson DG, McVige JW. Imaging of Neurologic Disorders in Pregnancy. *Neurologic Clinics*. 2020;38(1):37-64. doi:10.1016/j.ncl.2019.09.001.
7. Tepper NK, Boulet SL, Whiteman MK, et al. Postpartum Venous Thromboembolism. *Obstetrics & Gynecology*. 2014;123(5):987-996. doi:10.1097/aog.0000000000000230.
8. Kamel H, Navi BB, Sriam N, Hovsepian DA, Devereux RB, Elkind MS. Risk of a Thrombotic Event after the 6-Week Postpartum Period. *New England Journal of Medicine*. 2014;370(14):1307-1315. doi:10.1056/nejmoa1311485.
9. Burton TM, Bushnell CD. Reversible Cerebral Vasoconstriction Syndrome. *Stroke*. 2019;50(8):2253-2258. doi:10.1161/strokeaha.119.024416.
10. ACR-ASNR-SPR Practice Parameter for the Performance of Computed Tomography (CT) of the Extracranial Head and Neck Revised 2016.
11. Friedman DI. Headaches Due to Low and High Intracranial Pressure. *CONTINUUM: Lifelong Learning in Neurology*. 2018;24(4):1066-1091. doi:10.1212/con.0000000000000623.
12. ACR Appropriateness Criteria® Cerebrovascular disease. American College of Radiology (ACR). Date of origin: 1996. Last review date: 2016.
13. Pruitt AA. Central Nervous System Infections Complicating Immunosuppression and Transplantation. *CONTINUUM: Lifelong Learning in Neurology*. 2018;24(5):1370-1396. doi:10.1212/con.0000000000000653.
14. Evans, RW, Burch RC, Frishberg BM, et al. Neuroimaging for Migraine: The American Headache Society Systematic Review and Evidence-Based Guideline. *Headache: The Journal of Head and Face Pain*. 2019;60(2):318-336. doi:10.1111/head.13720
15. ACR Appropriateness Criteria Head Trauma Revised 2020.
https://acsearch.acr.org/docs/69481/Narrative/?_ga=2.193988334.2104281731.1601900190-1591722820.1552404748
16. ACR ASNR SPR Practice Parameter for the Performance of Myelography and Cisternography. Revised 2019.
17. 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: The Journal of Head and Face Pain*. 2013;53(10):1651-1659. doi:10.1111/head.12233.
18. Sweet JA, Mitchell LS, Narouze S, et al. Occipital Nerve Stimulation for the Treatment of Patients With Medically Refractory Occipital Neuralgia. *Neurosurgery*. 2015;77(3):332-341. doi:10.1227/neu.0000000000000872.
19. <https://ichd-3.org/13-painful-cranial-neuropathies-and-other-facial-pains/13-4-occipital-neuralgia/>
20. <https://ichd-3.org/11-headache-or-facial-pain-attributed-to-disorder-of-the-cranium-neck-eyes-ears-nose-sinuses-teeth-mouth-or-other-facial-or-cervical-structure/11-2-headache-attributed-to-disorder-of-the-neck/11-2-1-cervicogenic-headache/>
21. Doddamani RS, Meena RK, Sawarkar D, Aggarwal D, Chandra PS. Management Options in Occipital Neuralgia: A. *Journal of Peripheral Nerve Surgery Vol*. 2020;4(1).
22. O'Neill F, Nurmikko T, Sommer C. Other facial neuralgias. *Cephalalgia*. 2017;37(7):658-669. doi:10.1177/0333102417689995.
23. Barmherzig R, Kingston W. Occipital Neuralgia and Cervicogenic Headache: Diagnosis and Management. *Current Neurology and Neuroscience Reports*. 2019;19(5). doi:10.1007/s11910-019-0937-8.
24. Labastida-Ramírez A, Benemei S, Albanese M, et al. Persistent post-traumatic headache: a migrainous loop or not? The clinical evidence. *The Journal of Headache and Pain*. 2020;21(1). doi:10.1186/s10194-020-01122-5.
25. Henderson FC, Austin C, Benzel E, et al. Neurological and spinal manifestations of the Ehlers-Danlos syndromes. *American journal of medical genetics Part C, Seminars in medical genetics*. 2017;175(1):195-211. doi:10.1002/ajmg.c.31549.
26. Chou DE. Secondary Headache Syndromes. *CONTINUUM: Lifelong Learning in Neurology*. 2018;24(4):1179-1191. doi:10.1212/con.0000000000000640.
27. Starling AJ. Unusual Headache Disorders. *CONTINUUM: Lifelong Learning in Neurology*. 2018;24(4):1192-1208. doi:10.1212/con.0000000000000636.
28. Burish M. Cluster Headache and Other Trigeminal Autonomic Cephalalgias. *CONTINUUM: Lifelong Learning in Neurology*. 2018;24(4):1137-1156. doi:10.1212/con.0000000000000625.
29. Friedman DI. Headaches Due to Low and High Intracranial Pressure. *CONTINUUM: Lifelong Learning in Neurology*. 2018;24(4):1066-1091. doi:10.1212/con.0000000000000623.
30. Karsan Net al. The Migraine Premonitory Phase Continuum *Neurology Headache* 2018, 24 (4) 996-1008, No.4. doi: 10.1212/CON.0000000000000624.

HD-12: Aneurysm and AVM	
HD-12.1: Intracranial Aneurysms	48
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HD-12.1: Intracranial Aneurysms

- CTA Head (CPT® 70496) or MRA Head (CPT® 70544, CPT® 70545, or CPT® 70546) can be performed in ANY of the following clinical scenarios:
 - ◆ Symptoms or signs of cerebral aneurysm, including:
 - “Thunderclap headache” See **HD-11.3: Sudden Onset of Headache**
 - Third nerve palsy with pupillary involvement (pupil-sparing third nerve palsies are not caused by external compression)
 - Suspicion of aneurysm bleed [CT Head or MRI Brain or CSF exam showing evidence of subarachnoid hemorrhage (SAH) or intracerebral hemorrhage]
 - Abnormal CT Head or MRI Brain suggesting possible aneurysm
 - ◆ Screening for High Risk Populations as defined by the following criteria (screening usually begins at age 20 unless unusual circumstances as aneurysms are uncommon in children and adolescents):
 - 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 age 20
 - One first degree relative (parent, sibling, or child) with history of cerebral aneurysm or SAH may also 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 and is repeated at ten-year intervals)
 - Coarctation of the aorta or bicuspid aortic valve
 - Neurofibromatosis Type 1
 - Type 4 (Vascular) Ehlers-Danlos Syndrome
 - Marfan Syndrome
 - Loeys-Dietz Syndrome
 - Microcephalic osteodysplastic primordial dwarfism
 - Presence of an azygos anterior cerebral artery
 - Diagnosis of fibromuscular dysplasia (one screening study after confirmed diagnosis)
 - Pseudoxanthoma elasticum
 - Hereditary hemorrhagic telangiectasia (Osler-Weber-Rendu Syndrome)
 - Alpha-1-antitrypsin deficiency
 - Pheochromocytoma
 - Klinefelter syndrome
 - Tuberous sclerosis
 - Noonan syndrome
 - Alpha-glucosidase deficiency
 - Klippel-Trenaunay-Weber Syndrome
 - Kawasaki disease
 - ◆ CTA Head (CPT® 70496) may be performed to confirm questionable or equivocal findings on an initial MRA Head.

- For suspected or confirmed cerebral aneurysm, ruptured or unruptured, for initial evaluation, treatment, intervention or follow up, 3D rendering (CPT® 76377 or CPT® 76376) with cervicocerebral angiography/arteriography and/or cerebral angiography, may be approved (See **HD-1.7: General Guidelines- Other Imaging Situations** and Practice Notes)
- Follow up of known cerebral aneurysm:
 - ◆ The optimal interval and duration for radiologic follow-up has not been determined. Radiographic follow-up with MRA Head (CPT® 70544, CPT® 70545, or CPT® 70546) or CTA (CPT® 70496) for unruptured or treated intracranial aneurysm is approvable upon request by the neurosurgeon or team managing the unruptured intracranial aneurysm.
- MRI Brain without contrast (CPT® 70551) or with and without (CPT® 70553) may be added in the following scenarios:
 - ◆ If there are new signs, symptoms or clinical findings
 - ◆ To evaluate and treat a giant aneurysm (>2.5 cm)
 - ◆ Posterior fossa aneurysms
 - ◆ Thrombosed or partially thrombosed aneurysms
 - ◆ To evaluate the relationship of the aneurysm to the dura
 - ◆ To evaluate for the presence of calcification
 - ◆ Other surveillance criteria as per the neurosurgeon or team managing the aneurysm repair
- Head imaging (CT Head or MRI Brain contrast as requested) is approvable to assess for subacute complications, (i.e. vasospasm, delayed cerebral ischemia and hydrocephalus), beginning days to weeks arising from a subarachnoid hemorrhage and aneurysm treatment upon request from the neurosurgeon and team managing the episode.
- MRI Spinal (Cervical, Thoracic, Lumbar (without and with contrast) [CPT® 72156, CPT® 72157, CPT® 72158]) is appropriate to evaluate individuals with SAH and negative studies for brain aneurysm in whom spinal abnormalities (i.e. AVM) may be suspected as the cause of hemorrhage.
- MRA Neck (CPT® 70547, CPT® 70548, or CPT® 70549) or CTA Neck (CPT® 70498) is not routinely supported for screening and for follow-up on surgically treated cerebral aneurysms, except if they are located in the vertebral-basilar system.
- Initial catheter arteriography can be negative in 10-20% of cases of subarachnoid hemorrhage (SAH). CTA Head (CPT® 70496) and/or MRA Head (CPT® 70544, CPT® 70545, or CPT® 70546) are approvable if these had not been initially performed.
- If an intracranial etiology for SAH has not been found, CTA (CPT® 70498) or MRA Neck (CPT® 70547, CPT® 70548, or CPT® 70549) may be approved to evaluate for less common causes of SAH.

HD-12.2: Arteriovenous Malformations (AVMs) and Related Lesions

- MRI Brain without and with contrast (CPT® 70553) or without contrast (CPT® 70551) in the following clinical scenarios:
 - ◆ AVM is suspected based on a history of SAH.
 - ◆ Screening for:
 - Hereditary hemorrhagic telangiectasia syndrome (Osler Weber Rendu)
 - Familial cavernous malformation: Screening should include MRI Brain without or without and with contrast (with gradient echo images)
 - ◆ 3D imaging (CPT® 76376 or CPT® 76377) may be approved with MRI Brain if requested
- CTA Head (CPT® 70496) or MRA Head (CPT® 70544, CPT® 70545, or CPT® 70546) can be performed if screening MRI Brain is positive.
- If a cerebral cavernous malformation is diagnosed in the brainstem or presented with a focal neurological deficit (ex. seizure) or intracranial hemorrhage, vessel and head imaging (MRI Brain without and with contrast (CPT® 70553) or without contrast (CPT® 70551), AND/OR MRA Head (CPT® 70544, CPT® 70545, or CPT® 70546) or CTA Head (CPT® 70496)) may be repeated when requested.
- MRI Brain without and with contrast (CPT® 70553) or without contrast (CPT® 70551), AND/OR MRA Head (CPT® 70544, CPT® 70545, or CPT® 70546) or CTA Head (CPT® 70496) for repeat advanced imaging when requested by a specialist or any provider in consultation with a specialist.
- 3D Rendering (CPT® 76377 or CPT® 76376) may be considered with cerebral angiography to define the presence, location, and anatomy of intracranial and cervical vascular malformations. See **HD-1.7: General Guidelines- Other Imaging Situations** and Practice Notes

Practice Notes

- Trauma is the most common reason for subarachnoid hemorrhage. Ruptured berry aneurysm is the most common reason for non-traumatic subarachnoid hemorrhage in adults.
- Small aneurysms are present in about 1% to 2% of adults, but very few ever reach a size for which bleeding is a risk (>5 mm). Small (<3 to 4 mm) unruptured aneurysms in those with no personal history of SAH have a 0.1% to 0.5% a year rate of bleeding. The risk of cerebral aneurysm with family history ranges from 2% with one first degree relative to 30% to 35% for identical twin or two parents. The risks and benefits of screening these populations need to be considered before advanced imaging.
- AVMs most often come to clinical notice either by bleeding or by acting as a seizure focus. They are usually congenital, recognized later in life and have an initial risk of bleeding of 2% per year.
- Cerebral angiography is a form of angiography which provides images of blood vessels in and around the brain and/or neck. This is a catheter based procedure, using x-ray imaging guidance and iodine-based contrast to visualize blood vessels. This procedure may be referred to as digital subtraction angiography (DSA), cervico-cerebral catheter angiography or cerebral angiography.

References

1. Rozenfeld MN, Ansari SA, Shaibani A, Russell EJ, Mohan P, Hurley MC. Should Patients with Autosomal Dominant Polycystic Kidney Disease Be Screened for Cerebral Aneurysms? *American Journal of Neuroradiology*. 2013;35(1):3-9. doi:10.3174/ajnr.a3437.
2. Vlak MHM, Rinkel GJE, Greebe P, Greving JP, Algra A. Lifetime risks for aneurysmal subarachnoid haemorrhage: multivariable risk stratification. *Journal of Neurology, Neurosurgery & Psychiatry*. 2013;84(6):619-623. doi:10.1136/jnnp-2012-303783.
3. Kelly AG. Unruptured Intracranial Aneurysms. *CONTINUUM: Lifelong Learning in Neurology*. 2014;20:387-398. doi:10.1212/01.con.0000446108.12915.65.
4. Thompson BG, Brown RD, Amin-Hanjani S, et al. Guidelines for the Management of Patients With Unruptured Intracranial Aneurysms. *Stroke*. 2015;46(8):2368-2400. doi:10.1161/str.0000000000000070.
5. Chu LC, Johnson PT, Dietz HC, Fishman EK. CT Angiographic Evaluation of Genetic Vascular Disease: Role in Detection, Staging, and Management of Complex Vascular Pathologic Conditions. *American Journal of Roentgenology*. 2014;202(5):1120-1129. doi:10.2214/ajr.13.11485.
6. Hishikawa T, Date I, Tokunaga K, et al. Risk of rupture of unruptured cerebral aneurysms in elderly patients. *Neurology*. 2015;85(21):1879-1885. doi:10.1212/wnl.0000000000002149.
7. Backes D, Rinkel GJE, Greving JP, et al. ELAPSS score for prediction of risk of growth of unruptured intracranial aneurysms. *Neurology*. 2017;88(17):1600-1606. doi:10.1212/wnl.0000000000003865.
8. Ding D, Etmann N. A model for predicting the growth of unruptured intracranial aneurysms. *Neurology*. 2017;88(17):1594-1595. doi:10.1212/wl.0000000000003874.
9. Kadian-Dodov D, Gornik HL, Gu X, et al. Dissection and Aneurysm in Patients With Fibromuscular Dysplasia. *Journal of the American College of Cardiology*. 2016;68(2):176-185. doi:10.1016/j.jacc.2016.04.044.
10. McDonald J. Hereditary Hemorrhagic Telangiectasia. *GeneReviews*® [Internet]. <https://www.ncbi.nlm.nih.gov/books/NBK1351/>. Published February 2, 2017.
11. 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.
12. Salmela MB, Mortazavi S, Jagadeesan BD, et al. ACR Appropriateness Criteria® Cerebrovascular Disease. *Journal of the American College of Radiology*. 2017;14(5). doi:10.1016/j.jacr.2017.01.051.
13. Rosser T. Neurocutaneous Disorders. *CONTINUUM: Lifelong Learning in Neurology*. 2018;24(1):96-129. doi:10.1212/con.0000000000000562.
14. Horne MA, Flemming KD, Su I-C, et al. Clinical course of untreated cerebral cavernous malformations: a meta-analysis of individual patient data. *The Lancet Neurology*. 2016;15(2):166-173. doi:10.1016/s1474-4422(15)00303-8.
15. Vella M, Alexander M, Mabray M, et al. Comparison of MRI, MRA, and DSA for Detection of Cerebral Arteriovenous Malformations in Hereditary Hemorrhagic Telangiectasia. *American Journal of Neuroradiology*. 2020;41(6):969-975. doi:10.3174/ajnr.a6549.
16. Lawton MT and Vates GE. Subarachnoid Hemorrhage. *N Engl J Med* 2017;377:257-66. doi: 10.1056/NEJMc1605827
17. Connolly ES, Rabinstein AA, Carhuapoma JR, et al. Guidelines for the Management of Aneurysmal Subarachnoid Hemorrhage. *Stroke*. 2012;43(6):1711-1737. doi:10.1161/str.0b013e3182587839.
18. Meschia JF, Bushnell C, Boden-Albala B, et al. Guidelines for the Primary Prevention of Stroke. *Stroke*. 2014;45(12):3754-3832. doi:10.1161/str.0000000000000046.
19. Michael B. Bober and Andrew P. Jackson, Microcephalic Osteodysplastic Primordial Dwarfism Type II: A clinical review *Current Osteoporosis Report* (2017) 15:61-69 doi: 10.1007/s11914-017-0348-1
20. Chen, C-J et al. Brain arteriovenous malformations: A review of natural history, pathobiology, and interventions *Neurology* 2020 95(20):917-927. doi: 10.1212/WNL.0000000000010968.
21. ACR-ASNR-SIR-SNIS Practice Parameter for the Performance of Diagnostic Cervicocerebral Catheter Angiography in Adults. Revised 2016. (Resolution 13) <https://www.acr.org/-/media/ACR/Files/Practice-Parameters/CervicoCerebralCathAngio.pdf>
22. American College of Radiology ACR Appropriateness Criteria Cerebrovascular Diseases – Aneurysm, Vascular Malformations, and Subarachnoid Hemorrhage. New 2021. <https://acsearch.acr.org/docs/3149013/Narrative/>

HD-13: Head and Facial Trauma

HD-13.1: Head Trauma	53
HD-13.2: Facial Trauma	54

HD-13.1: Head Trauma

Individuals with head trauma are at risk for facial and cervical trauma.

See **SP-3: Neck (Cervical Spine) Pain Without/With Neurological Features (Including Stenosis) and Trauma** in the Spine Imaging Guidelines

- CT Head without contrast (CPT® 70450) is the primary imaging in individuals with acute head trauma and ANY of the following modified Canadian CT Head Rule/New Orleans Criteria for those with loss of consciousness, amnesia or disorientation accompanying blunt head trauma within 24 hours. Otherwise, CT Head is not typically indicated unless one of the following is present:
 - ◆ Taking one anticoagulant or two antiaggregants, (e.g., aspirin and Plavix)
 - ◆ Known platelet or clotting disorder
 - ◆ Glasgow coma scale (GCS) score of less than 15 at 2 hours following injury
 - ◆ >30 minutes of amnesia before impact
 - ◆ Any “dangerous mechanism of injury” including, but not exclusive to:
 - Fall greater than 5 steps down stairs
 - Fall from height greater than 3 feet
 - Any pedestrian motor vehicle accident
 - High impact motor vehicle accident
 - ◆ Suspected open skull fracture
 - ◆ Signs of basilar skull fracture (Battle's sign, Raccoon eyes, CSF rhinorrhea, cranial nerve palsy, hemotympanum, acute hearing loss)
 - ◆ Vomiting
 - ◆ Individual >60 years old
 - ◆ Alcohol or drug intoxication
 - ◆ Visible trauma above clavicles
 - ◆ Deficits in short term memory, altered level of alertness, abnormal behavior or focal neurological deficit
 - ◆ Seizure
 - ◆ Headache
- MRI Brain without contrast (CPT® 70551) or CT Head without (CPT® 70450) are appropriate for the initial imaging of individuals with subacute or chronic head trauma and unexplained cognitive or neurologic deficits.
- MRI Brain without and with contrast (CPT® 70553) if post-traumatic infection is suspected
- Follow-up imaging, MRI or CT, for known subdural hematomas, intracerebral hemorrhage, or contusions can be done at the discretion of ordering specialist or any provider in consultation with a specialist. Short term follow-up imaging of acute TBI without neurologic deterioration, noncontrast CT is the most appropriate imaging study, but only in individuals with risk factors (such as subfrontal/temporal intraparenchymal contusions, anticoagulation, >65 years or intracranial hemorrhage. MRI may be approved as a complementary study when neurological findings or symptoms are not sufficiently explained by CT or in subacute and chronic TBI for new, persistent, or slowly progressive symptoms.

- For suspected intracranial venous or arterial injury, CTA/CTV Head (CPT® 70496) and MRA/MRV Head (CPT® 70544, CPT® 70545, or CPT® 70546) are approvable.
 - ◆ CT and MR Venography (CTV and MRV) are reported with the same codes as the CTA/MRA counterpart. 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

Practice Notes

SPECT, PET, CT/MRI perfusion, DTI (diffusion tensor imaging), functional MRI, and MR spectroscopy are not considered routine clinical practice at this time.

Recent studies have shown that Diffusion tensor MRI tractography may be more sensitive in demonstrating abnormalities such as axonal injury in closed head injury than conventional MRI, but these techniques are best described presently as research tools and their use in routine clinical practice is not determined.

Decisions regarding return to normal activities, including sports, are made based on the clinical status of the individual and repeat imaging is unnecessary.

In cases of post-traumatic infection, contrast-enhanced MRI or CT may be helpful

HD-13.2: Facial Trauma

- CT Maxillofacial without contrast (CPT® 70486) indicated for any concern regarding significant injury to facial structures including but not limited to:
 - ◆ Concern for orbital, maxillary, or mandibular fractures
 - ◆ Trauma with associated symptoms of anosmia, hearing, vision or speech changes, vertigo, facial numbness
 - ◆ Physical exam findings of CSF rhinorrhea (suspected post traumatic CSF leak), malocclusion, severe focal facial tenderness, focal loss of facial sensation
- CT Orbits/Temporal Bone without contrast (CPT® 70480):
 - ◆ Concern for orbital injury or orbital wall fracture
 - ◆ Symptoms of diplopia, blurred vision, vision loss
 - ◆ Physical exam findings of enophthalmos, entrapment of extraocular muscle(s)
 - ◆ Suspicion for temporal bone fracture
 - ◆ Suspected post-traumatic (CSF leak)

Note: Initial x-rays are not required before advanced imaging for the above indications

- CT Head cisternography with contrast if CT Maxillofacial or Temporal bone is inconclusive (See **HD-11.15: Low Pressure Headache and CSF Leak**)

Practice Note

Imaging is not necessary in the evaluation of simple nasal fractures if tenderness and swelling is limited to the nasal bridge, the individual can breathe through each naris, and there is no septal hematoma.

References

1. Stiell IG, Wells GA, Vandemheen K, et al. The Canadian CT Head Rule for patients with minor head injury. *The Lancet*. 2001;357(9266):1391-1396. doi:10.1016/s0140-6736(00)04561-x.
2. Giza CC, Kutcher JS, Ashwal S, et al. Summary of evidence-based guideline update: Evaluation and management of concussion in sports: Report of the Guideline Development Subcommittee of the American Academy of Neurology. *Neurology*. 2013;80(24):2250-2257. doi:10.1212/wnl.0b013e31828d57dd.
3. Wilde EA, McCauley SR, Hunter JV, et al. Diffusion tensor imaging of acute mild traumatic brain injury in adolescents. *Neurology*. 2008;70(12):948-955. doi:10.1212/01.wnl.0000305961.68029.54.
4. Mayer AR, Ling J, Mannell MV, et al. A prospective diffusion tensor imaging study in mild traumatic brain injury. *Neurology*. 2010;74(8):643-650. doi:10.1212/wnl.0b013e3181d0ccdd.
5. Mondin V, Rinaldo A, Ferlito A. Management of nasal bone fractures. *American Journal of Otolaryngology*. 2005;26(3):181-185. doi:10.1016/j.amjoto.2004.11.006.
6. Sun JK, Lemay DR. Imaging of facial trauma. *Neuroimaging Clinics of North America*. 2002;12(2):295-309. doi:10.1016/s1052-5149(02)00002-3.
7. Harmon KG, Clugston JR, Dec K, et al. American Medical Society for Sports Medicine position statement on concussion in sport. *British Journal of Sports Medicine*. 2019;53(4):213-225. doi:10.1136/bjsports-2018-100338.
8. American College of Radiology ACR Appropriateness Criteria Head Trauma. Revised 2020. <https://acsearch.acr.org/docs/69481/Narrative/>
9. Wintermark M, Sanelli PC, Anzai Y, et al. Imaging Evidence and Recommendations for Traumatic Brain Injury: Conventional Neuroimaging Techniques. *Journal of the American College of Radiology*. 2015;12(2). doi:10.1016/j.jacr.2014.10.014.
10. Smits M. External Validation of the Canadian CT Head Rule and the New Orleans Criteria for CT Scanning in Patients With Minor Head Injury. *Jama*. 2005;294(12):1519. doi:10.1001/jama.294.12.1519.
11. Reljic T, Mahony H, Djulbegovic B, et al. Value of Repeat Head Computed Tomography after Traumatic Brain Injury: Systematic Review and Meta-Analysis. *Journal of Neurotrauma*. 2014;31(1):78-98. doi:10.1089/neu.2013.2873.
12. Mower WR, Hoffman JR, Herbert M, Wolfson AB, Pollack CV, Zucker MI. Developing a Decision Instrument to Guide Computed Tomographic Imaging of Blunt Head Injury Patients. *The Journal of Trauma: Injury, Infection, and Critical Care*. 2005;59(4):954-959. doi:10.1097/01.ta.0000187813.79047.42.
13. Haydel MJ, Preston CA, Mills TJ, Luber S, Blaudeau E, Deblieux PM. Indications for Computed Tomography in Patients with Minor Head Injury. *New England Journal of Medicine*. 2000;343(2):100-105. doi:10.1056/nejm200007133430204.
14. https://www.cdc.gov/traumaticbraininjury/pdf/tbi_clinicians_factsheet-a.pdf.
15. ACR–ASNR–SPR Practice Parameter for the Performance of Computed Tomography (CT) of the Extracranial Head and Neck Revised 2016. (Resolution 14). <https://www.acr.org/-/media/ACR/Files/Practice-Parameters/CT-Head-Neck.pdf>.

HD-14: CNS and Head Infection

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HD-14.1: CNS and Head Infection

- Signs of intracranial infection include: 1) headaches, seizures, meningeal signs (neck stiffness), or new focal neurological deficits in a setting of fever or elevated white blood cell count (WBC); 2) known infection elsewhere; 3) or immunosuppression. ONE of the following studies may be considered for suspected intracranial infection if any of these signs of 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
 - See **HD-1.4: General Guidelines – CT Head** regarding additional indications for CT Head.
- See **HD-20.2: Skull Base Osteomyelitis (SBO)**, **HD-29.1: Sinus and Facial Imaging**, **HD-30.2: Dental/Periodontal/Maxillofacial Imaging**, and **HD-32.1: Eye Disorders and Visual Loss**
- FDG Brain PET (CPT® 78608) may be performed 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, if appropriate.

HD-14.2: Neuro-COVID-19

- The findings observed in the central nervous system in the acute-phase of COVID-19 may extend into a prolonged symptomatic phase of Neuro-COVID in long haulers with chronic COVID syndrome. Symptoms may include, but are not inclusive to: “brain fog”, dizziness, inability to concentrate, psychiatric symptoms, and confusion.
- Acute-phase neurologic manifestations of COVID-19 include: headache, dizziness, taste and smell dysfunction, impaired consciousness (described as confusion or agitation), cerebrovascular events (ischemic stroke, cerebral venous sinus thrombosis, cerebral hemorrhage), seizures, meningoencephalitis, and immune-mediated neurologic diseases (Guillan-Barre syndrome, Miller-Fisher syndrome, polyneuritis cranialis).
- MRI Brain without contrast (CPT® 70551) or MRI Brain with and without contrast (CPT® 70553), or CT Head without contrast (CPT® 70450) or CT Head without and with contrast (CPT® 70470) if there is a contraindication to MRI, may be approved for the evaluation of acute or chronic Neuro-COVID-19 syndrome.
- Repeat imaging may be considered on a case-by-case basis for a change in neurological symptoms or signs on the neurological exam and/or change in the treatment plan.
- According to the Centers for Disease Control (CDC), there is a plausible causal relationship between the Johnson & Johnson/Janssen COVID-19 vaccine and a rare and serious adverse event, blood clots with low platelets (thrombosis with thrombocytopenia syndrome TTS). It occurs at a rate of 7 per 1 million vaccinated women between 18-49 years old. For women 50 years and older and men of all ages, this adverse event is even more rare. Imaging listed above may be approved if this condition is suspected. See **HD-11.9: Abnormal Blood Clotting**.

References

1. Jordan JE, Kieffer SA, Booth TN, et al. ACR-ASNR-SPR Parameter for the performance of computed tomography (CT) of the brain. *American College of Radiology (ACR)*. Revised 2015 (Resolution 20).
2. Abdalkader M, Xie J, Cervantes-Arslanian A, Takahashi C, Mian AZ. Imaging of Intracranial Infections. *Seminars in Neurology*. 2019;39(03):322-333. doi:10.1055/s-0039-1693161.
3. Pruitt AA. Central Nervous System Infections Complicating Immunosuppression and Transplantation. *CONTINUUM: Lifelong Learning in Neurology*. 2018;24(5):1370-1396. doi:10.1212/con.0000000000000653.
4. Halperin JJ. Neuroborreliosis and Neurosyphilis. *CONTINUUM: Lifelong Learning in Neurology*. 2018;24(5):1439-1458. doi:10.1212/con.0000000000000645.
5. 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.
6. American College of Radiology ACR Appropriateness Criteria® Cranial Neuropathy. Revised 2017 <https://acsearch.acr.org/docs/69509/Narrative/>.
7. American College of Radiology ACR Appropriateness Criteria Acute Mental Status Change, Delirium, and New Onset Psychosis. New 2018. <https://acsearch.acr.org/docs/3102409/Narrative/>.
8. Baig AM. Deleterious Outcomes in Long-Hauler COVID-19: The Effects of SARS-CoV-2 on the CNS in Chronic COVID Syndrome. *ACS Chemical Neuroscience* 2020 11 (24), 4017-4020 doi: 10.1021/acscchemneuro.0c00725
9. Rubin R. As Their Numbers Grow, COVID-19 “Long Haulers” Stump Experts. *JAMA*. 2020;324(14):1381–1383. doi:10.1001/jama.2020.17709
10. E. M. Liotta et al. Frequent neurologic manifestations and encephalopathy-associated morbidity in Covid-19 patients. *Annals of Clinical and Translational Neurology* 2020; 7(11): 2221–2230 doi: 10.1002/acn3.51210.
11. Chen X, Laurent S, Onur OA, Kleineberg NN, Fink GR, Schweitzer F, Warnke C. A systematic review of neurological symptoms and complications of COVID-19. *Journal of Neurology*. 2021 Feb;268(2):392-402. doi: 10.1007/s00415-020-10067-3.
12. Johnson and Johnson Janssen Covid-19 Vaccine Overview and Safety. Centers for Disease Control and Prevention. Last updated June 23, 2021. <https://www.cdc.gov/coronavirus/2019-ncov/vaccines/different-vaccines/janssen.html>.

HD-15: Movement Disorders

HD-15.1: Movement Disorders

- The majority of movement disorders are diagnosed based on a clinical diagnosis and do not require imaging. These include:
 - ◆ Typical Parkinson's Disease
 - ◆ Essential Tremor or tremors of anxiety or weakness
 - ◆ Restless Leg Syndrome
 - ◆ Tics or spasms which can be duplicated at will
- MRI Brain without contrast (CPT® 70551) or without and with contrast (CPT® 70553) is considered in the following clinical scenarios:
 - ◆ Atypical Parkinsonism (Parkinson's Plus Syndromes – See Practice Notes) because of unusual clinical features (for example, persistent unilateral signs and symptoms, young onset under age of 50, rapid progression), incomplete or uncertain medication responsiveness, or clinical diagnostic uncertainty.
 - ◆ Suspected Huntington Disease
- Evaluation for surgical treatment of Essential Tremor, Parkinson's disease, and/or Spasmodic Torticollis/Dystonia See **Neck-10.2: Torticollis and Dystonia** in the Neck Imaging Guidelines
 - ◆ Deep Brain Stimulation (DBS) therapy
 - MRI Brain without contrast (CPT® 70551) or MRI Brain without and with contrast (CPT® 70553) and unlisted CT procedure code (CPT® 76497) are approvable
 - ◆ MR guided Focused Ultrasound:
 - CT Head without contrast (CPT® 70450) to evaluate bone density and MRI Brain without contrast (CPT® 70551) or MRI Brain without and with contrast (CPT® 70553) are approvable
 - ◆ Repeat imaging studies, MRI Brain without contrast (CPT® 70551) or without and with contrast (CPT® 70553) and CT Head without contrast (CPT® 70450), are approvable when ordered by a specialist or any provider in consultation with a specialist if greater than 6 months old **and/or** for new symptoms/signs
 - ◆ Post op imaging is approvable when ordered by a specialist or any provider in consultation with a specialist for either procedure

- DAT-SPECT Radiopharmaceutical Localization SPECT (Ioflupane I-123 SPECT) (CPT® 78803) may be considered:
 - ◆ Evaluate individuals in whom the diagnosis and differentiation between Parkinson's disease and Essential Tremor remains unclear after evaluation by a neurologist, medication trials and brain imaging
 - ◆ Imaging Radiopharmaceutical Localization SPECT with Ioflupane I-123 (CPT® 78803) can be approved for differentiation of essential tremor from tremor due to Parkinsonian syndrome (PS) such as Parkinson's disease, multiple system atrophy and progressive supranuclear palsy and in drug-induced tremor. See Practice Notes for additional information regarding Parkinson's Plus Syndromes.
 - ◆ DAT Scans are not useful for differentiation of subtypes of Parkinson's syndromes, to monitor progression of disease or predict risk of development of disease mainly to exclude other conditions with similar clinical presentations.
- MRI Brain with and without (CPT® 70553) for initial imaging for suspected motor neuron disease
- Dementia associated with movement disorder, See **HD-8: Dementia**

Practice Notes

- There is little evidence to support the use of MRA/CTA and PET in the evaluation of movement disorders.
- Parkinson's Plus Syndromes are a group of disorders characterized by atypical parkinsonism. They are NOT Parkinson's disease. They represent different neurodegenerative diseases with features of PD, and may be confused with PD. These syndromes include, but are not limited to:
 - ◆ Multiple system atrophy: orthostatic hypotension (dysautonomia), dysphonia, dysarthria
 - ◆ Progressive Supranuclear Palsy: balance difficulties, vertical gaze paresis,
 - ◆ Corticobasal Syndrome: dysphasia, apraxia, myoclonus, alien-limb phenomenon
 - ◆ Dementia with Lewy bodies (DLB): dementia prior to movement disorder. See **HD-8.3: Lewy Body Dementia (LBD) - SPECT Brain Scan**.
- These are distinct entities. Care must be taken to determine if there are unusual features present that will suggest atypical parkinsonian syndrome.

References

1. ACR Appropriateness Criteria® Dementia and movement disorders. *American College of Radiology (ACR)*. Revised: 2019.
2. Suchowersky O Reich S, Perlmutter J, Zesiewicz T, Gronseth G, Weiner WJ. Practice Parameter: Diagnosis and prognosis of new onset Parkinson disease (an evidence-based review). *Neurology*. 2006;66(7):968-975. doi:10.1212/01.wnl.0000215437.80053.d0.
3. Hess CW, Okun MS. Diagnosing Parkinson Disease. *CONTINUUM: Lifelong Learning in Neurology*. 2016;22:1047-1063. doi:10.1212/con.0000000000000345.
4. Subramaniam RM, Frey KA, Hunt CH, et al. ACR-ACNM Practice Parameter for the Performance of Dopamine Transporter (DaT) Single Photon Emission Computed Tomography (SPECT) Imaging for Movement Disorders. *Clinical Nuclear Medicine*. 2017;42(11):847-852. doi:10.1097/rlu.0000000000001815.
5. Bega D, Gonzalez-Latapi P, Zadikoff C, Spies W, Simuni T. Is There a Role for DAT-SPECT Imaging in a Specialty Movement Disorders Practice? *Neurodegenerative Diseases*. 2015;15(2):81-86. doi:10.1159/000370116.
6. Mohammed N, Patra D, Nanda A. A meta-analysis of outcomes and complications of magnetic resonance-guided focused ultrasound in the treatment of essential tremor. *Neurosurgical Focus*. 2018;44(2). doi:10.3171/2017.11.focus17628.
7. Schreglmann SR, Krauss JK, Chang JW, Bhatia KP, Kägi G. Functional lesional neurosurgery for tremor: a systematic review and meta-analysis. *Journal of Neurology, Neurosurgery & Psychiatry*. 2018;89(7):717-726. doi:10.1136/jnnp-2017-316302.
8. Halpern CH, Santini V, Lipsman N, et al. Three-year follow-up of prospective trial of focused ultrasound thalamotomy for essential tremor. *Neurology*. 2019;93(24). doi:10.1212/wnl.0000000000008561.
9. Pouratian N, Baltuch G, Elias WJ, Gross R. American Society for Stereotactic and Functional Neurosurgery Position Statement on Magnetic Resonance-Guided Focused Ultrasound for the Management of Essential Tremor. *Neurosurgery*. 2019. doi:10.1093/neuros/nyz510.
10. Shah BR, et.al. Advanced MRI techniques for transcranial high intensity focused ultrasound targeting. *Brain* 2020;1-9. doi:10.1093/brain/awaa107
11. Elias JW. A randomized Trial of Focused Ultrasound Thalamotomy for Essential Tremor. *N Engl J Med* 2016;375:730-9. doi: 10.1056/NEJMoa1600159
12. Rughani A, Schwalb JM, Sidiropoulos C, et al. Congress of Neurological Surgeons Systematic Review and Evidence-Based Guideline on Subthalamic Nucleus and Globus Pallidus Internus Deep Brain Stimulation for the Treatment of Patients With Parkinson's Disease: Executive Summary. *Neurosurgery*. 2018;82(6):753-756. doi:10.1093/neuros/nyy037.
13. Y. Xiao, J. C. Lau, D. Hemachandra, G. Gilmore, A. Khan and T. M. Peters, "Image guidance in deep brain stimulation surgery to treat Parkinson's disease: a comprehensive review," in *IEEE Transactions on Biomedical Engineering*, doi: 10.1109/TBME.2020.3006765.
14. Sakamoto F, Shiraishi S, Ogasawara K, et al. A diagnostic strategy for Lewy body disease using DAT-SPECT, MIBG and Combined index. *Annals of Nuclear Medicine*. 2020;34(6):415-423. doi:10.1007/s12149-020-01464-9.
15. Humanitarian Device Exemption. U.S. Food and Drug Administration (FDA). Page Last Updated: 07/12/2021. <https://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfhde/hde.cfm?id=H020007>

HD-16: Multiple Sclerosis (MS) and Related Conditions

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HD-16.1: Multiple Sclerosis (MS)

- MRI Brain without and with contrast (CPT® 70553) and/or MRI Cervical and Thoracic Spine without and with contrast (CPT® 72156 and CPT® 72157) use in these clinical scenarios requires:
 - ◆ Clinical suspicion based on recurrent episodes of variable neurological signs and symptoms or clinically isolated syndromes
 - ◆ Baseline exclusion of appropriate alternative conditions that can mimic MS
 - ◆ MRI Brain and Spine without and with contrast studies are preferred for initial imaging. However, if there is an allergy or significant concerns to gadolinium, (ex. GFR is compromised), then unenhanced studies could be approved
- MRI Orbit without contrast (CPT® 70540) or without and with contrast (CPT® 70543) may be considered if optic neuritis is suspected with supporting documentation, in addition to the above scenario
- At diagnosis, MRI Cervical Spine without or without and with contrast (CPT® 72141 or CPT® 72156) and MRI Thoracic Spine without or without and with contrast (CPT® 72146 or CPT® 72157) is recommended for prognostic information
- MRI Brain with contrast (CPT® 70552) may be approved within 2 weeks of previous non-contrast study, if a non-contrast study shows incidental evidence of possible demyelinating disease, as the presence of enhancing lesions may be helpful in confirming the diagnosis
 - ◆ MRI Brain with and without contrast (CPT® 70553) is appropriate. if non-contrast study was performed more than 2 weeks prior to the request for repeat imaging.
- If the diagnosis is still equivocal after initial screening, repeat studies in 3 to 6 months may be performed
 - ◆ Evidence does not support the use of 3T MRI as being more effective than 1.5T units for diagnosis or follow up of MS. Requests for repeat imaging should meet guidelines for timeliness as noted within these guidelines regardless of type of facility requested
- MRI Lumbar Spine is not needed since Cervical and Thoracic studies will usually visualize the entire spinal cord
- Repeat Brain and/or Spine imaging in an established individual may be considered in the following scenarios:
 - ◆ New episode of neurological deficit or re-evaluation of the diagnosis
 - ◆ Every 3-6 months until stable on disease modifying therapy
 - ◆ Annual surveillance in stable individuals
 - ◆ Re-establish baseline when instituting or changing immune-modulating agents (typically 6 months after the start of a new therapy)

- ◆ Symptoms suggestive of Progressive Multifocal Leukoencephalopathy (PML) during Tysabri therapy (or other medications with similar risk).
 - Screening for individuals on natalizumab (Tysabri) or other medications with risk of PML (Progressive Multifocal Leukoencephalopathy)
 - MRI Brain every 6 months while on treatment
 - MRI Brain every 3-6 months for high risk individuals positive for serum JC virus antibody and >18 months natalizumab exposure
- ◆ Repeat imaging requests for MRI without contrast or without and with contrast for follow up may be approved when requested by a specialist or any provider in consultation with a specialist (as long as request otherwise meets criteria above).
- Family members need not be screened, unless they exhibit suspicious signs or symptoms suggestive of MS.
- 3D analysis or rendering (CPT® 76376 and CPT® 76377) lacks sufficient specificity and sensitivity to be clinically useful in the evaluation or follow up of individual with multiple sclerosis. Its use is limited to research studies and it is otherwise considered to be investigational and experimental in routine clinical practice. Certain imaging studies are considered investigational by various payors, and their coverage policies may take precedence over eviCore's guidelines. Advanced imaging studies, or other procedures, may be considered investigational and experimental if there is a paucity of supporting evidence; if the evidence has not matured to exhibit improved health parameters or; the advanced imaging study/procedure lacks a collective opinion of support.

Practice Notes

- Multiple Sclerosis is common and variable with more women affected and at a younger age than men. MS tends to be relapsing-remitting (improves between episodes), relapsing-progressive (worsens with attacks) and chronic progressive (gradual and steady neurological decline).
- Medications with similar risks of PML as Tysabri include (but not limited to): Dimethyl fumarate (Tecfidera), Fingolimod (Gilenya), Ocrelizumab (Ocrevus), Mavenclad (cladribine), Vumerity (diroximel fumarate), Soliris (eculizumab), Zeposia (ozanimod), Lemtrada (alemtuzumab), Bafiertam (monomethyl fumarate), Rituxan (rituximab).
- Sagittal MRI Spinal Cord with phased array detector coil (CPT® 72156 or CPT® 72157) is an alternative spinal imaging.

HD-16.2: Neuromyelitis Optica and NMO Spectrum Disorders

- Neuromyelitis optica (NMO, Devic's disease) is an autoimmune disease causing inflammation and demyelination of the optic nerve, spinal cord and brain. Diagnosis is based on the clinical presentation, MRI findings, and presence of auto-antibodies.
- MRI Brain without and with contrast (CPT® 70553), MRI Orbit without and with contrast (CPT® 70543), MRI Cervical and Thoracic Spine without and with contrast (CPT® 72156, CPT® 72157)
 - ◆ Suspected Neuromyelitis Optica
 - ◆ New symptoms or signs in individual with known Neuromyelitis Optica.
 - ◆ Surveillance for recurrent disease should occur with any new neurologic signs, or yearly, or when requested by a neurology specialist or any provider in consultation with a specialist in the treatment of this condition.
 - ◆ Non-contrast studies may be considered when requested by a specialist or any provider in consultation with a specialist
- Repeat imaging requests for MRI Brain without contrast or with and without contrast (CPT® 70551 or CPT® 70553) for follow up may be approved when requested by a specialist or any provider in consultation with a specialist
- 3D analysis of the temporal lobes and hippocampus (also known as volumetric analysis or Neuro Quant) (CPT® 76376 and CPT® 76377) lacks sufficient specificity and sensitivity to be clinically useful in the evaluation or follow up of individual with multiple sclerosis. Its use is limited to research studies and it is otherwise considered to be investigational and experimental in routine clinical practice. Certain imaging studies are considered investigational by various payors, and their coverage policies may take precedence over eviCore's guidelines. Advanced imaging studies, or other procedures, may be considered investigational and experimental if there is a paucity of supporting evidence; if the evidence has not matured to exhibit improved health parameters or; the advanced imaging study/procedure lacks a collective opinion of support.

Practice Notes

- Medications with similar risks of PML as Tysabri include (but not limited to): Dimethyl fumarate (Tecfidera), Fingolimod (Gilenya), Ocrelizumab (Ocrevus), Mavenclad (cladribine), Vumerity (diroximel fumarate), Soliris (eculizumab), Zeposia (ozanimod), Lemtrada (alemtuzumab), Bafiertam (monomethyl fumarate), Rituxan (rituximab).
- Sagittal MRI Spinal Cord with phased array detector coil (CPT® 72156 or CPT® 72157) is an alternative spinal imaging.

HD-16.3: Anti-MOG Syndromes

- MOG (myelin oligodendrocyte glycoprotein)-IgG disorders are CNS inflammatory diseases, distinct from multiple sclerosis and NMO-spectrum disorders. MOG-IgG disorders can be associated with optic neuritis, transverse myelitis, brainstem encephalitis, encephalitis with seizures and acute disseminated encephalomyelitis (ADEM, occurs mainly in children but can occur in adults). Rarely individuals can present with intractable nausea or hiccups. There may be involvement of the conus therefore, lumbar spine imaging is appropriate. Diagnosis is based on the clinical presentation, MRI findings and presence of autoantibodies.
- For the following clinical scenarios, imaging may be approved as listed below:
 - ◆ Suspected Anti-MOG syndrome
 - ◆ New symptoms or signs in an individual with known anti-MOG syndrome (these may include loss or blurred vision, loss of color vision, weakness of a limb or limbs, including paraparesis or complete paralysis, loss of sensation, loss of bladder or bowel control, profound bladder retention, and seizures).
 - ◆ Evaluation for recurrent disease should occur with any new neurologic signs or symptoms
 - ◆ Annual yearly surveillance
- The following studies may be approved:
 - ◆ MRI Brain with and without contrast (CPT® 70553), MRI Orbit with and without contrast (CPT® 70543), MRI Cervical, Thoracic Spine and/or Lumbar Spine with and without contrast (CPT® 72156, CPT® 72157, and/or CPT® 72158)
 - ◆ Follow-up non-contrast studies may be considered when requested by a specialist or any provider in consultation with a specialist

References

1. Filippi M, Rocca MA, Ciccarelli O, et al. MRI criteria for the diagnosis of multiple sclerosis: MAGNIMS consensus guidelines. *The Lancet Neurology*. 2016;15(3):292-303. doi:10.1016/s1474-4422(15)00393-2.
2. 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.
3. Kaunzner UW, Gauthier SA. MRI in the assessment and monitoring of multiple sclerosis: an update on best practice. *Therapeutic Advances in Neurological Disorders*. 2017;10(6):247-261. doi:10.1177/1756285617708911.
4. FDA Drug Safety Communication: New risk factor for Progressive Multifocal Leukoencephalopathy (PML) associated with Tysabri (natalizumab). Originally issued February 13, 2018. U S Food and Drug Administration Home Page. <https://www.fda.gov/drugs/drug-safety-and-availability/fda-drug-safety-communication-new-risk-factor-progressive-multifocal-leukoencephalopathy-pml>
5. Hagens MHJ, Burggraaff J, Kilsdonk ID, et al. Three-Tesla MRI does not improve the diagnosis of multiple sclerosis. *Neurology*. 2018;91(3):e249-e257. doi:10.1212/wnl.0000000000005825.
6. Rae-Grant A, Day GS, Marrie RA, et al. Comprehensive systematic review summary: Disease-modifying therapies for adults with multiple sclerosis. *Neurology*. 2018;90(17):789-800. doi:10.1212/wnl.0000000000005345.
7. Shosha E, Dubey D, Palace J, et al. Area postrema syndrome. *Neurology*. 2018;91(17). doi:10.1212/wnl.0000000000006392.
8. Wingerchuk DM, Banwell B, Bennett JL, et al. International consensus diagnostic criteria for neuromyelitis optica spectrum disorders. *Neurology*. 2015;85(2):177-189. doi:10.1212/wnl.0000000000001729.
9. Kilsdonk ID, Barkhof F, Wattjes MP. 2010 revisions to McDonald criteria for diagnosis of multiple sclerosis: Impact of 3-tesla magnetic resonance imaging. *Annals of Neurology*. 2011;70(1):182-183. doi:10.1002/ana.22490.
10. Kaunzner UW, Gauthier SA. MRI in the assessment and monitoring of multiple sclerosis: an update on best practice. *Therapeutic Advances in Neurological Disorders*. 2017;10(6):247-261. doi:10.1177/1756285617708911.
11. 2018 Revised Guidelines of the Consortium of MS Centers MRI Protocol for the Diagnosis and Follow-up of MS. MRI Protocol - Consortium of Multiple Sclerosis Centers (CMSC). <http://www.ms-care.org/mri>.
12. American College of Radiology ACR Appropriateness Criteria® Orbits, Vision and Visual Loss Revised 2017. <https://acsearch.acr.org/docs/69486/Narrative/>.
13. 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.
14. Ciccarelli O, Cohen JA, Reingold SC, et al. Spinal cord involvement in multiple sclerosis and neuromyelitis optica spectrum disorders. *The Lancet Neurology*. 2019;18(2):185-197. doi:10.1016/s1474-4422(18)30460-5.
15. Ciron J, Audoin B, Bourre B, et al. Recommendations for the use of Rituximab in neuromyelitis optica spectrum disorders. *Revue Neurologique*. 2018;174(4):255-264. doi:10.1016/j.neurol.2017.11.005.
16. Rudie JD, Mattay RR, Schindler M, et al. An Initiative to Reduce Unnecessary Gadolinium-Based Contrast in Multiple Sclerosis Patients. *Journal of the American College of Radiology*. 2019;16(9):1158-1164. doi:10.1016/j.jacr.2019.04.005.
17. Major EO. Progressive Multifocal Leukoencephalopathy Lesions and JC Virus. *JAMA Neurology*. 2018;75(7):789. doi:10.1001/jamaneurol.2018.0004.
18. 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.
19. 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. https://download.lww.com/wolterskluwer_vitalstream_com/PermaLink/WNL/A/WNL_2018_04_19_RAEGRANT_NEUROLOGY2017835181R1_SDC3.pdf.
20. 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.000000000000099.
21. Bloomgren G, Richman S, Hotermans C, et al. Risk of Natalizumab-Associated Progressive Multifocal Leukoencephalopathy. *New England Journal of Medicine*. 2012;366(20):1870-1880. doi:10.1056/nejmoa1107829.
22. Hegen H, Reindl M. Recent developments in MOG-IgG associated neurological disorders. *Ther Adv Neurol Disord*. 2020 Jul 31;13:1756286420945135. doi: 10.1177/1756286420945135.
23. Lopez Chiriboga S, Flanagan EP. Myelitis and Other Autoimmune Myelopathies. *CONTINUUM: Lifelong Learning in Neurology*. 2021;27(1):62-92. doi:10.1212/con.0000000000000900.
24. Genovese AV, Hagemeyer J, Bergsland N, et al. Atrophied Brain T2 Lesion Volume at MRI Is Associated with Disability Progression and Conversion to Secondary Progressive Multiple Sclerosis. *Radiology*. 2019;293(2):424-433. doi:10.1148/radiol.2019190306
25. Jakimovski D, Zivadinov R, Bergsland N, Ramasamy DP, Hagemeyer J, Genovese AV, Hojnacki D, Weinstock-Guttman B, Dwyer MG. Clinical feasibility of longitudinal lateral ventricular volume measurements on T2-FLAIR across MRI scanner changes. *Neuroimage Clin*. 2021;29:102554. doi: 10.1016/j.nicl.2020.102554.
26. Saslow L, Li DKB, Halper J, et al. An International Standardized Magnetic Resonance Imaging Protocol for Diagnosis and Follow-up of Patients with Multiple Sclerosis. *International Journal of MS Care*. 2020;22(5):226-232. doi:10.7224/1537-2073.2020-094.

HD-17: Papilledema/Pseudotumor Cerebri

HD-17.1: Papilledema/Pseudotumor Cerebri

- See **HD-32.1: Eye Disorders and Visual Loss**
- Papilledema and Pseudotumor Cerebri:
 - ◆ MRI Brain without and with contrast (CPT® 70553) (preferred) and/or CT Head without contrast (CPT® 70450), when MRI contraindicated or for urgent evaluation, can be considered when there is suspected elevated intracranial pressure and papilledema such as with pseudotumor cerebri (idiopathic intracranial hypertension) to exclude cerebral mass lesions, obstructive hydrocephalus, etc. See **HD-1.4: General Guidelines – CT Head** regarding required use of CT Head prior to lumbar puncture and/or spinal tap.
 - ◆ MRI Orbit without and with contrast (CPT® 70543) or CT Orbit without and with contrast (CPT® 70482) may be considered if there is concern for orbital pseudotumor or a primary bilateral orbital disorder. See **HD-32: Eye Disorders and Visual Loss** regarding concern for orbital pseudotumor or primary orbital disorder.
 - ◆ Repeat imaging may be considered to evaluate either:
 - Shunt dysfunction in those individuals who have had ventriculoperitoneal (VP) or lumboperitoneal (LP) shunts
 - Clinical deterioration (with worsening or new neurological signs and symptoms)
 - ◆ MRA Head (CPT® 70544, CPT® 70545, CPT® 70546) or CTA Head (CPT® 70496) for suspected venous sinus thrombosis.
 - CT and MR Venography (CTV and MRV) are reported with the same codes as the CTA/MRA counterpart. 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
 - See **HD-21.1: Stroke/TIA**

References

1. Friedman DI. Papilledema and Idiopathic Intracranial Hypertension. CONTINUUM: Lifelong Learning in Neurology. 2014;20:857-876. doi:10.1212/01.con.0000453314.75261.66.
2. American College of Radiology ACR Appropriateness Criteria® Headache. Revised 2019. <https://acsearch.acr.org/docs/69482/Narrative>.
3. Thurtell MJ. Idiopathic Intracranial Hypertension. CONTINUUM: Lifelong Learning in Neurology. 2019;25(5):1289-1309. doi:10.1212/con.0000000000000770.
4. Wall M. Update on Idiopathic Intracranial Hypertension. Neurologic Clinics. 2017;35(1):45-57. doi:10.1016/j.ncl.2016.08.004.
5. Costello F, Scott JN. Imaging in Neuro-ophthalmology. CONTINUUM: Lifelong Learning in Neurology. 2019;25(5):1438-1490. doi:10.1212/con.0000000000000783.
6. Aylward SC, Reem RE. Pediatric Intracranial Hypertension. Pediatr Neurol. 2017 Jan;66:32-43. doi:10.1016/j.pediatrneurol.2016.08.010.

HD-18: Paresthesias and/or Weakness

HD-18.1: Sensory/Weakness Complaints

- Advanced imaging may be considered for approval for general complaints **specific** only for sensory and/or weakness that are unaccompanied by other signs or symptoms must have the following: (1) a thorough history and neurological exam, (including the symptomatic area), (2) documentation localizes to the central nervous system and (3) the use of imaging can verify a specific diagnosis.
- Imaging decisions based on the exam and documentation provided:
 - ◆ Criteria for approval of advanced imaging of the brain and/or spinal cord:
 - Abnormal exam findings: hyperreflexia, Babinski/Hoffman sign, increased tone in an affected limb, weakness of extensor muscles in an upper extremity and/or weakness of flexor muscles in the lower extremity and/or sensory or motor symptoms limited to two limbs on the same side of the body.
 - ◆ Criteria for approval of advanced imaging of the spinal cord:
 - Decreased pinprick sensation on one side, weakness and diminished proprioception on the other side
 - Sensory level on the trunk with sensory loss in both legs
 - ◆ Criteria NOT consistent with a spinal cord localization and do not warrant spinal cord imaging include the following :
 - Sensory loss that involves the hands and feet and not the trunk
 - Diminished reflexes in an affected limb
 - Limb pain
 - Weakness and diminished pain sensation in the same limb may be due to either a peripheral or brain/brainstem lesion
- For generalized pure motor syndromes, refer to the Peripheral Nerve Disorders (PND) Imaging Guidelines:
 - ◆ Myopathy or Inflammatory Muscle Diseases See **PN-6.2: Muscle Diseases** and **PN-6.3: Gaucher Disease (Storage Disorders)**
 - ◆ Motor Neuron Disease or Amyotrophic Lateral Sclerosis (ALS) See **PN-8: Neuromuscular Disorders**
 - ◆ Neuromuscular (Junction) Disease See **PN-6.1: Neuromuscular Junction Disorders**
 - ◆ Multifocal Motor Neuropathy and Chronic Inflammatory Demyelinating Polyneuropathy See **PN-3: Polyneuropathy**
- For pure sensory symptoms refer to the following Imaging Guidelines:
 - ◆ Proximal and distal symmetric pattern See **SP-7.1: Myelopathy** in the Spine Imaging Guidelines
 - ◆ Polyneuropathy See **PN-3: Polyneuropathy** in the Peripheral Nerve Disorders (PND) Imaging Guidelines
 - ◆ Proximal and distal asymmetric (20% may occur as part of a paraneoplastic syndrome) See **PN-3: Polyneuropathy** in the Peripheral Nerve Disorders (PND) Imaging Guidelines and **ONC-30.3: Paraneoplastic Syndromes** in the Oncology Imaging Guidelines

- For mixed sensory and motor symptoms refer to the Peripheral Nerve Disorders (PND) Imaging Subsections:
 - ◆ Proximal asymmetric symptoms may be due to a polyradiculopathy or radiculoplexopathy, See **PN-4: Brachial Plexus**, **PN-5: Lumbar and Lumbosacral Plexus**, and appropriate Spine Imaging Guidelines
 - ◆ For proximal and distal symmetric symptoms See **PN-3: Polyneuropathy**
- Focal symptoms should be referred to the following Imaging Guidelines:
 - ◆ Radiculopathy for the appropriate level in the Spine Imaging Guidelines
 - ◆ Plexopathy to Brachial Plexus or Lumbar and Lumbosacral Plexus See **PN-4: Brachial Plexus and Lumbar and Lumbosacral Plexus** or **PN-5: Lumbar and Lumbosacral Plexus** in the Peripheral Nerve Disorders (PND) Imaging Guidelines
 - ◆ Thoracic Outlet Syndrome See **CH-31: Thoracic Outlet Syndrome** in the Chest Imaging Guidelines
 - ◆ Mononeuropathy or Focal Neuropathy See **PN-2: Focal Neuropathy** in the Peripheral Nerve Disorders (PND) Imaging Guidelines

References

1. Paresthesia Information Page. National Institute of Neurological Disorders and Stroke. <https://www.ninds.nih.gov/Disorders/All-Disorders/Paresthesia-Information-Page>.
2. Levin MC, By, Professional.Manuals.TopicPage.LastRevisionDate| Content last modified Jan 2019. Numbness - Neurologic Disorders. Merck Manuals Professional Edition. <https://www.merckmanuals.com/professional/neurologic-disorders/symptoms-of-neurologic-disorders/numbness>.
3. London ZN. A Structured Approach to the Diagnosis of Peripheral Nervous System Disorders. CONTINUUM: Lifelong Learning in Neurology. 2020;26(5):1130-1160. doi:10.1212/con.0000000000000922
4. Hardy TA. Spinal Cord Anatomy and Localization. CONTINUUM: Lifelong Learning in Neurology. 2021;27(1):12-29. doi:10.1212/con.0000000000000899.
5. Larson ST and Wilbur J. Muscle Weakness in Adults: Evaluation and Differential Diagnosis. Am Fam Physician. 2020;101(2):95-108.
6. Filippakis A, Jara J, Ventura N, Scala S, Scopa C, Ruthazer R, Karakis I, Srinivasan J, Russell JA, Ho DT. A prospective study of benign fasciculation syndrome and anxiety. Muscle & nerve. 2018 Dec;58(6):852-4.

HD-19: Pituitary

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HD-19.1: Pituitary

- Endocrine laboratory studies should be performed prior to considering advanced imaging, except in the cases of stable, non-functioning microadenomas or macroadenomas and cysts.
- MRI Brain without and with contrast (CPT® 70553) or MRI Brain without contrast (CPT® 70551) with a specific pituitary protocol that includes fine cuts through the sella is the primarily performed pituitary imaging:
 - ◆ MRI Orbit, Face, Neck without and with contrast (CPT® 70543) or CT Head without and with contrast (CPT® 70470) are alternatives
 - ◆ CT Head without contrast (CPT® 70450) or without and with contrast (CPT® 70470) and/or CT Maxillofacial without contrast (CPT® 70486) may be used in addition to MRI to visualize perisellar bony structures in the preoperative evaluation of certain sellar tumors and for preoperative planning for transphenoidal approaches
 - See **HD-1.1: General Guidelines – Anatomic Issues** as CT Temporal bone (CPT® 70480) may be approved instead of CT Maxillofacial per surgeon's preference and contrast level
 - ◆ CTA Head (CPT® 70496) or MRA Head (CPT® 70544, CPT® 70545, or CPT® 70546) for surgical planning
 - ◆ MRI Brain without and with contrast (CPT® 70553) covers both brain and dedicated pituitary if performed at the same time; no additional CPT® codes are needed
- Repeat imaging for incidentally found lesions on other studies:
 - ◆ MRI Brain without and with contrast (CPT® 70553) or MRI Orbit/Face/Neck without and with contrast (CPT® 70543) follow-up dedicated pituitary study may be obtained if a pituitary abnormality is reported incidentally on a MRI Brain or CT Head performed for other reasons (MRI Brain without and with contrast [CPT® 70553] covers both brain and dedicated pituitary if performed at the same time; no additional CPT® codes are needed); further evaluation and subsequent imaging dependent on specific imaging and biochemical laboratory evaluation findings.
- For Amenorrhea: See **PV-3.1: Secondary Amenorrhea** in the Pelvic Imaging Guidelines

Pituitary Imaging

Indication	Initial Imaging	Repeat Imaging
Microadenoma: Nonfunctioning, unexplained pituitary asymmetries, or incidentally found small tumors (<10 mm)	➤ MRI Brain without and with contrast (CPT® 70553) or MRI Brain without contrast (CPT® 70551)	➤ MRI Brain without and with contrast (CPT® 70553) or MRI Brain without contrast (CPT® 70551) at 12 months and then (if stable in size), every 1-2 years for 3 years, and less frequently thereafter based on clinical status
Macroadenoma (≥10 mm): Nonfunctioning and not surgically removed (including those with a sizable post-operative remnant)	➤ MRI Brain without and with contrast (CPT® 70553) or MRI Brain without contrast (CPT® 70551)	➤ MRI Brain without and with contrast (CPT® 70553) or MRI Brain without contrast (CPT® 70551) every 6 months for the first year and then (if stable in size), every year for 3 years, and less frequently thereafter based on clinical status (longer if craniopharyngioma)
Acromegaly* (Elevated IGF-1 confirmed by lack of suppression of growth hormone on glucose suppression testing)	➤ MRI Brain without and with contrast (CPT® 70553) or MRI Brain without contrast (CPT® 70551)	➤ MRI Brain without and with contrast (CPT® 70553) or MRI Brain without contrast (CPT® 70551) ◆ At least 12 weeks after surgery to evaluate for residual tumor ◆ If treated with Pegvisomant, 6 to 12 months after treatment initiated, then annually if stable ◆ Long-term follow-up imaging based on clinical and biochemical status at the request of a specialist or any provider in consultation with a specialist

Indication	Initial Imaging	Repeat Imaging
Cushing's Disease** (Pituitary ACTH excess leading to hypercortisolism)	➤ MRI Brain without and with contrast (CPT® 70553) or MRI Brain without contrast (CPT® 70551)	➤ MRI Brain without and with contrast (CPT® 70553) or MRI Brain without contrast (CPT® 70551) ◆ At least 12 weeks after surgery as new baseline ◆ Annually after bilateral adrenalectomy for Cushing's disease or ectopic ACTH production ◆ Long-term follow-up imaging based on clinical and biochemical status at the request of a specialist or any provider in consultation with a specialist
Rathke's cleft cyst/Simple cyst	➤ MRI Brain without and with contrast (CPT® 70553) or MRI Brain without contrast (CPT® 70551)	➤ MRI Brain without and with contrast (CPT® 70553) or MRI Brain without contrast (CPT® 70551) in one year; if stable and without mass effect or invasion into surrounding structures, no further imaging is required.

Indication	Imaging
Prolactinomas***	➤ MRI Brain without and with contrast (CPT® 70553) or MRI Brain without contrast (CPT® 70551) with: ◆ Diagnosis: ■ Unexplained prolactin level above the normal range ◆ On Dopamine Agonist (DA) therapy with good response: ■ Macroadenomas 3 months after start of DA therapy ■ Microadenomas 1 year after start of DA therapy ■ To decide on stoppage of therapy after ~2 years if in “remission” (normal PRL and no visible tumor on MRI). ◆ On Dopamine Agonist therapy with suboptimal response: ■ PRL levels rise ■ New symptoms develop (galactorrhea, vision changes, headaches, pituitary deficiency) ■ If on high dose maximal DA and no plans for surgery/radiation therapy use guideline for microadenoma or macroadenoma ◆ After Dopamine Agonist therapy: ■ Rise in PRL level ■ For DA stoppage at menopause, use guideline for microadenoma or macroadenoma ◆ Galactorrhea/nipple discharge with normal prolactin and thyroid function levels: See <u>BR-6: Nipple Discharge/Galactorrhea</u> in the Breast Imaging Guidelines ◆ If the drug cannot be discontinued and the onset of the hyperprolactinemia does not coincide with therapy initiation, a MRI may be appropriate to differentiate between medication-induced hyperprolactinemia and symptomatic hyperprolactinemia due to a pituitary or hypothalamic mass

Indication	Imaging
TSH, FSH, or LH producing adenomas (inappropriate pituitary hypersecretion of TSH, FSH or LH)****	➤ MRI Brain without and with contrast (CPT® 70553) or MRI Brain without contrast (CPT® 70551) when hormone levels are inappropriately elevated and there is a concern for a pituitary lesion. ➤ Refer to appropriate post-operative, or Microadenoma/Macroadenoma guidelines based on the size of the lesion and initial management. ◆ Long-term follow-up imaging based on clinical and biochemical status at the request of a specialist or any provider in consultation with a specialist
Male Hypogonadism*****	➤ MRI Brain without and with contrast (CPT® 70553) or MRI Brain without contrast (CPT® 70551) if ONE of the following: ◆ Severe secondary hypogonadism (e.g., morning serum testosterone level <150 ng/dl and low or normal LH and FSH levels) ◆ Below normal testosterone level (serum total testosterone, free testosterone and/or bioavailable morning testosterone) AND low or normal LH and FSH levels, in an individual with either: ■ Panhypopituitarism ■ Hyperprolactinemia ■ Signs of tumor mass effect (headache, visual impairment, or visual field deficit) ■ Elevated sex hormone binding globulin (SHBG)
Hypopituitarism	➤ MRI Brain without and with contrast (CPT® 70553) or MRI Brain without contrast (CPT® 70551)

Indication	Initial Imaging	Repeat Imaging for Non-Operative Care
Diabetes Insipidus (DI)	➤ MRI Brain without and with contrast (CPT® 70553) or MRI Brain without contrast (CPT® 70551) if: ◆ Laboratory testing consistent with DI (serum osmolality should be high and urine osmolality should be low) and etiology uncertain	NA
Syndrome of Inappropriate ADH (SIADH)	➤ MRI Brain without and with contrast (CPT® 70553)) or MRI Brain without contrast (CPT® 70551) if: ◆ Etiology remains uncertain or is thought to be in the nervous system; ◆ Urine osmolality should be high and serum osmolality low	NA
Other Pituitary Region Tumors*****	➤ Evaluation may require CT in addition to MRI to evaluate for hyperostosis.	

Practice Notes

- ***Acromegaly:** A serum level of growth hormone greater than 1ng/mL when measured two hours following an oral glucose load confirms acromegaly.
- ****Cushing's Disease:** It is important to differentiate Cushing's syndrome (hypercortisolism from any source) from Cushing's disease which is ACTH hypersecretion from the pituitary gland. Hypercortisolism is quantified by 24hour urine cortisol collection, low dose dexamethasone suppression test and/or late night salivary cortisol measurement. ACTH is elevated in Cushing's disease and ectopic sources of ACTH production, but suppressed in other causes of hypercortisolism. A high dose dexamethasone suppression test can help determine if the elevated ACTH is from a pituitary or ectopic source. Petrosal sinus sampling may be required for tumor localization preoperatively in the setting of a normal pituitary MRI or a small adenoma. These tumors may be managed with surgery, medical therapy, radiation and/or bilateral adrenalectomy.
- *****Prolactinoma:** To establish the diagnosis of hyperprolactinemia, a single measurement of serum prolactin is recommended; a level above the upper limit of normal confirms the diagnosis as long as the serum sample was obtained without excessive venipuncture stress. Pregnancy and primary hypothyroidism should be excluded as physiologic causes of prolactin elevation and medications that may be contributing to prolactin elevation should be considered. Dopamine agonist therapy is typically stopped during pregnancy, monitoring of prolactin levels ceases. Routine imaging surveillance during pregnancy is not recommended due to risk to fetus. Repeat imaging with MRI without gadolinium can be performed however for new or worsening symptoms, such as headaches or visual symptoms.

- ******TSH, FSH, or LH producing adenomas:** These are the least common of all hormonally active pituitary tumors. Individuals with TSH secreting adenomas have inappropriate TSH elevation in the setting of hyperthyroidism (elevated thyroid hormone levels). Almost all gonadotroph adenomas are clinically non-functioning. The infrequent presentation of a functioning gonadotroph adenoma should be differentiated clinically from appropriate FSH and LH elevation seen in low estrogen states (including menopause) as well as primary hypogonadism (testicular failure). Functioning TSH, FSH or LH pituitary adenomas may be managed with surgical, radiation and/or medical therapies.
- *******Male Hypogonadism:** Alterations in sex hormone-binding globulin (SHBG) can impact testosterone levels. Free or bioavailable testosterone concentrations should be measured when total testosterone concentrations are close to the lower limit of the normal range and when altered SHBG levels are suspected (e.g. moderate obesity, nephrotic syndrome, hypo- and hyperthyroidism, use of glucocorticoids, progestins, estrogens, and androgenic steroids, anticonvulsants, acromegaly, diabetes mellitus, aging, HIV disease, liver cirrhosis, hepatitis). LH and FSH should be obtained to evaluate for secondary (central) hypogonadism, once low testosterone level is confirmed.
- *******Other Pituitary Region Tumor:** Craniopharyngiomas arise in the parasellar area. About 10% of meningiomas arise in this area.

HD-19.2: Additional Imaging

- For imaging in the immediate post-operative period or for acute surgical complications, See **ONC-2.1: Primary Central Nervous System Tumors** in the Oncology Imaging Guidelines.
- A routine post-operative MRI is generally done at 3 months and/or at the discretion of, or in consultation with, a specialist.
- Frequency of follow-up imaging depends on the post-operative size and/or functional status of the pituitary adenoma. Refer to the grid sections for Microadenoma/Macroadenoma as well as those for disorders of pituitary hormone excess.
- Individuals with hyper-functioning tumors such as acromegaly, Cushing's disease, and excess TSH secretion may be treated with a combination of surgery, medical therapy and radiation. Long-term monitoring of clinical status and repeat imaging at the discretion of, or in consultation with, a specialist is appropriate.

HD-19.3: Empty Sella Turcica

- Enlarged/Empty Sella Turcica: An enlarged sella turcica without evident tumor is an incidental finding on MRI Brain or CT Head from a defect in the dural diaphragm of the sella (especially if there is elevated intracranial pressure from another cause), pituitary surgery, or as a result of a pituitary tumor which has expanded the sella and then infarcted (pituitary apoplexy).
- MRI Brain with and without contrast (pituitary protocol) (CPT® 70553) with thin sections of pituitary or MRI Brain without contrast (CPT® 70551) if requested is approvable. CT Head with and without contrast (CPT® 70470) – If MRI is contraindicated.
 - ◆ Primary Empty Sella:
 - Incidentally found on other studies, asymptomatic and no related abnormalities: follow up at 2 years. No further imaging unless clinical symptoms develop (neuro-/ophthalmological symptoms, intracranial hypertension, or endocrine/hormonal abnormalities).
 - Following medical or surgical treatment of related endocrine, neurological, or ophthalmological problems: follow-up imaging every 6 months in the year after treatment and/or at the request of a specialist or any provider in consultation with a specialist. See **HD-17.1: Papilledema/Pseudotumor Cerebri** for additional imaging recommendations
 - ◆ Secondary Empty Sella:
 - Imaging according to the cause or if clinical disease progression (such as adenomas, infiltrative or malignant disorders, hormonal abnormalities, neuro-/ophthalmological symptoms).

References

1. American Association of Clinical Endocrinologists Medical Guidelines for Clinical Practice for the Evaluation and Treatment of Hypogonadism in Adult Male Patients—2002 Update. *Endocrine Practice*. 2002;8(6):439-456. doi:10.4158/ep.8.6.439.
2. Katznelson L, Laws ER, Melmed S, et al. Acromegaly: An Endocrine Society Clinical Practice Guideline. *The Journal of Clinical Endocrinology & Metabolism*. 2014;99(11):3933-3951. doi:10.1210/jc.2014-2700.
3. Melmed S, Casanueva FF, Hoffman AR, et al. Diagnosis and Treatment of Hyperprolactinemia: An Endocrine Society Clinical Practice Guideline. *The Journal of Clinical Endocrinology & Metabolism*. 2011;96(2):273-288. doi:10.1210/jc.2010-1692.
4. Hoang JK, Hoffman AR, González RG, et al. Management of Incidental Pituitary Findings on CT, MRI, and 18 F-Fluorodeoxyglucose PET: A White Paper of the ACR Incidental Findings Committee. *Journal of the American College of Radiology*. 2018;15(7):966-972. doi:10.1016/j.jacr.2018.03.037.
5. Marinis LD, Bonadonna S, Bianchi A, Maira G, Giustina A. Primary Empty Sella. *The Journal of Clinical Endocrinology & Metabolism*. 2005;90(9):5471-5477. doi:10.1210/jc.2005-0288.
6. Chiloire S, Giampietro A, Bianchi A, et al. DIAGNOSIS OF ENDOCRINE DISEASE: Primary empty sella: a comprehensive review. *European Journal of Endocrinology*. 2017;177(6). doi:10.1530/eje-17-0505.
7. Freda PU, Beckers AM, Katznelson L, et al. Pituitary Incidentaloma: An Endocrine Society Clinical Practice Guideline. *The Journal of Clinical Endocrinology & Metabolism*. 2011;96(4):894-904. doi:10.1210/jc.2010-1048.
8. Burns J, Policeni B, Bykowski J, et al. ACR Appropriateness Criteria® Neuroendocrine Imaging. *Journal of the American College of Radiology*. 2019;16(5). doi:10.1016/j.jacr.2019.02.017.
9. Thompson CJ et al. Posterior Pituitary. *Williams Textbook of Endocrinology*, Chapter 10, eds. Melmed S et al. 14th edition, 2019. pp 303-330.
10. Cooke DW et al. Normal and Aberrant Growth in Children. *Williams Textbook of Endocrinology*, Chapter 25, eds. Melmed S et al. 14th edition, 2019. pp 937-1022.
11. Styne DM. Physiology and Disorders of Puberty. *Williams Textbook of Endocrinology*, Chapter 26, eds. Melmed S et al. 14th edition, 2019. pp 1023-1164.
12. Bhasin S, Brito JP, Cunningham GR, et al. Testosterone Therapy in Men With Hypogonadism: An Endocrine Society* Clinical Practice Guideline. *The Journal of Clinical Endocrinology & Metabolism*. 2018;103(5):1715-1744. doi:10.1210/jc.2018-00229.
13. Chen CC, Carter BS, Wang R, et al. Congress of Neurological Surgeons Systematic Review and Evidence-Based Guideline on Preoperative Imaging Assessment of Patients With Suspected Nonfunctioning Pituitary Adenomas. *Neurosurgery*. 2016;79(4). Pp E524-526. doi:10.1227/neu.0000000000001391.
14. Nieman LK, Biller BMK, Findling JW, et al. Treatment of Cushing's Syndrome: An Endocrine Society Clinical Practice Guideline. *The Journal of Clinical Endocrinology & Metabolism*. 2015;100(8):2807-2831. doi:10.1210/jc.2015-1818.
15. Woodmansee WW, Carmichael J, Kelly D, Katznelson L. American Association Of Clinical Endocrinologists And American College Of Endocrinology Disease State Clinical Review: Postoperative Management Following Pituitary Surgery. *Endocrine Practice*. 2015;21(7):832-838. doi:10.4158/ep14541.dscr.
16. Ziu M, Dunn IF, Hess C, et al. Congress of Neurological Surgeons Systematic Review and Evidence-Based Guideline on Posttreatment Follow-up Evaluation of Patients With Nonfunctioning Pituitary Adenomas. *Neurosurgery*. 2016;79(4):E541-E543. doi:10.1227/neu.0000000000001392.
17. Jane JA, Jr. Surgical Treatment of Pituitary Adenomas. (Updated 10/4/2019) In: Feingold KR, Anawalt B, Boyce A, et al., editors *Endotext* [Internet]. South Dartmouth (MA): MD Text com, Inc; 2000.
18. Cardinale F, Pero G, Quilici L, et al. Cerebral Angiography for Multimodal Surgical Planning in Epilepsy Surgery: Description of a New Three-Dimensional Technique and Literature Review. *World Neurosurgery*. 2015;84(2):358-367. doi:10.1016/j.wneu.2015.03.028.
19. Prevedello D, Otto B, Carrau R, de Lara D, Ditzel Filho LeoFS. Application of Image Guidance in Pituitary Surgery. *Surgical Neurology International*. 2012;3(3):73. doi:10.4103/2152-7806.95418.
20. Guo Z, Liu C, Hou H, et al. Preoperative Computed Tomography (CT) Evaluation of Anatomical Abnormalities in Endonasal Transsphenoidal Approach in Pituitary Adenoma. *Medical Science Monitor*. 2018;24:1268-1275. doi:10.12659/msm.904402.
21. Aghi MK, Chen CC, Fleseriu M, et al. Congress of Neurological Surgeons Systematic Review and Evidence-Based Guidelines on the Management of Patients With Nonfunctioning Pituitary Adenomas. *Neurosurgery*. 2016;79(4):521-523. doi:10.1227/neu.0000000000001386.
22. Samperi I, Lithgow K, Karavitaki N. Hyperprolactinaemia. *Journal of Clinical Medicine*. 2019;8(12):2203. doi:10.3390/jcm8122203.
23. Esposito D, Olsson DS, Ragnarsson O, Buchfelder M, Skoglund T, Johannsson G. Non-functioning pituitary adenomas: indications for pituitary surgery and post-surgical management. *Pituitary*. 2019;22(4):422-434. doi:10.1007/s11102-019-00960.

HD-20: Scalp and Skull

HD-20.1: Scalp and Skull Lesions	82
HD-20.2: Skull Base Osteomyelitis (SBO)	82

HD-20.1: Scalp and Skull Lesions

The majority of these are benign soft tissue or bony lesions easily defined by physical examination or with skull x-rays or ultrasound.

- Ultrasound can be performed as initial imaging of scalp or skull lesions
- CT Head without or without and with contrast (CPT® 70450 or CPT® 70470) is appropriate for the following scenarios:
 - ◆ Any lesion on physician examination and skull x-ray or ultrasound which is not clearly benign.
 - ◆ In cases where surgical planning is in progress, x-rays and/or ultrasound are not required.
 - ◆ Langerhans' cell histiocytosis, myeloma, and metastatic cancer, when symptoms suggest bony lesions.
- MRI Brain without contrast (CPT® 70551) or with and without contrast (CPT® 70553) may be considered if there is concern for intracranial extension.
- See **HD-30.2: Dental/Periodontal/Maxillofacial Imaging** for mandibular masses

HD-20.2: Skull Base Osteomyelitis (SBO)

- Note: SBO may occur from the temporal bones or paranasal sinuses and imaging should be of the region of origin
- Neuroimaging is indicated in the diagnosis and treatment of skull base osteomyelitis and necrotizing external otitis. The following advanced imaging studies may be considered for the diagnosis of skull base osteomyelitis and necrotizing external otitis:
 - ◆ MRI Brain without and with contrast (CPT® 70553)
 - Will be positive earliest in disease
 - ◆ CT Head without contrast (CPT® 70450), CT Temporal bone without contrast (CPT® 70480), CT Temporal bone with contrast (CPT® 70481), CT Maxillofacial without contrast (CPT® 70486), CT Maxillofacial with contrast (CPT® 70487) or CT Neck with (CPT® 70491)
 - Will best define bony destruction, but is positive later in disease
 - ◆ Gallium-67 Scan
 - ◆ Bone Scan
 - Skull base osteomyelitis: + Gallium and + Bone scan
 - Necrotizing otitis externa: + Gallium and - Bone scan
 - ◆ Indium WBC may be substituted for or used in addition to Gallium scanning to evaluate response to therapy and may be especially useful in cases that have undergone surgical debridement.
- Treatment response: Gallium-67 Scan every 4-6 weeks till scan is negative
- Surveillance Scanning: Gallium-67 Scan at 4 weeks and 3 months post treatment

References

1. ACR–ASNR–SPR Practice Parameter for the Performance of Computed Tomography (CT) of the Extracranial Head and Neck Revised 2016 (Resolution 14). <https://www.acr.org/-/media/ACR/Files/Practice-Parameters/CT-Head-Neck.pdf revised 2016>.
2. Khan M, Quadri SQ, Kazmi A, et al. A comprehensive review of skull base osteomyelitis: Diagnostic and therapeutic challenges among various presentations. Asian Journal of Neurosurgery. 2018;13(4):959. doi:10.4103/ajns.ajns_90_17.
3. American College of Radiology ACR Appropriateness Criteria® Sinonasal Disease Revised 2017. <https://acsearch.acr.org/docs/69502/Narrative/>.

HD-21: Stroke/TIA

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HD-21.1: Stroke/TIA

- CT Head without contrast (CPT® 70450), CTA Head without and with contrast (CPT® 70496) and CTA Neck (CPT® 70498) and CT perfusion (CPT® 0042T) for acute stroke (within the first 24 hours), transient ischemic attacks (TIA) or concern for intracerebral or subdural hemorrhage.
- MRI Brain without contrast (CPT® 70551) or MRI Brain without and with contrast (CPT® 70553) to evaluate concern for new stroke or TIA. MRI is preferred for evaluation concern for new stroke or TIA. MRI is preferred for evaluation of stroke/TIA and can be approved either with or without a previous CT Head.
- A repeat CT Head without contrast (CPT® 70450) or with and without contrast (CPT® 70470) can be performed at any time if there has been a change in clinical status, such as clinical deterioration, or concern for hemorrhagic conversion, or new onset seizure, etc.
- CT Head without contrast (CPT® 70450) or with and without contrast (CPT® 70470) can be performed after 24 hours if there is a contraindication to MRI.
- TIA includes Amaurosis fugax or ocular microembolism (optic nerve/retinal arterial or Hollenhorst plaques seen on exam)
- MRA Head (CPT® 70544, CPT® 70545, CPT® 70546) or CTA Head (CPT® 70496) AND MRA Neck (CPT® 70547, CPT® 70548, or CPT® 70549) or CTA Neck (CPT® 70498) may be added to CT Head or MRI Brain for evaluation of stroke or TIA. A previously performed Duplex Ultrasound Carotid Arteries (CPT® 93880), should not preclude the approval of these studies. Duplex Ultrasound Carotid Arteries (CPT® 93880) is not sufficient to image the vertebral arteries.
 - ◆ 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)
- MR or CT Venography (MRA Head [CPT® 70544, CPT® 70545, CPT® 70546] or CTA Head [CPT® 70496]) may be performed to evaluate venous infarcts after diagnosis on MRI Brain or CT Head.
 - ◆ CT and MR Venography (CTV and MRV) are reported with the same codes as the CTA/MRA counterpart. 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.
- 3D Rendering (CPT® 76377 or CPT® 76376) performed with cerebral angiography may be considered as part of the stroke evaluation. See **HD-1.7: General Guidelines- Other Imaging Situations.**
- For consideration of Reversible Cerebral Vasoconstriction Syndrome (See **HD-11.3: Sudden Onset of Headache**)

- One time MRI Brain without contrast (CPT® 70551) or without and with contrast (CPT® 70553) screening to detect silent cerebral infarcts in adults with HbSS or HbSb thalassemia.
- Transcranial Doppler Studies may also be performed for individuals with documented stroke or TIA (See **HD-24.8: Transcranial Doppler (CPT® 93886)**).
- Repeat imaging for follow up and resolution of stroke or hemorrhage as determined by a specialist or any provider in consultation with a specialist.
- Evaluation of paradoxical venous thromboembolism in cryptogenic stroke with PFO, See **PVD-12.2: Acute Limb Swelling** in the PVD Imaging Guidelines
- MRI Brain without contrast (CPT® 70551) or MRI Brain without and with contrast (CPT® 70553) may be approved in the presence of neurological signs and/or symptoms, including headache, after COVID-19 infection and/or COVID-19 vaccination. See **HD-1.4: General Guidelines – CT Head**, **HD-11.9: Abnormal Blood Clotting**, and **HD-14.2 : Neuro-COVID-19**.

HD-21.2: Risk Assessment for Extracranial Carotid Disease

- Duplex Ultrasound Carotid Arteries (CPT® 93880 or CPT® 93882) may be approved for the following:
 - ◆ Asymptomatic or symptomatic cervical bruits;
 - ◆ Clinical suspicion of extracranial carotid occlusion and the rationale is included
 - ◆ Pulsatile neck mass
 - ◆ Evaluation of blunt or penetrating neck trauma
 - ◆ Amaurosis fugax or ocular microembolism (optic nerve/retinal arterial or Hollenhorst plaques seen on exam)
 - ◆ Recent history of focal cerebral or ocular transient ischemic attacks
- Follow-up with CTA or contrast enhanced MRA
 - ◆ CTA and contrast enhanced MRA are comparable noninvasive imaging alternatives each with their own advantages and disadvantages
- For additional indications for Duplex Ultrasound Carotid Arteries See **PVD-3.1: Initial Imaging** in the Peripheral Vascular Disease (PVD) Imaging Guidelines
- For repeat (Surveillance) Duplex Ultrasound Carotid Arteries (CPT® 93880 or CPT® 93882), See **PVD-3.2: Surveillance Imaging with NO History of Carotid Surgery or Intervention** and **PVD-3.3 Surveillance Imaging WITH History of Carotid Surgery or Intervention** in the Peripheral Vascular Disease (PVD) Imaging Guidelines.

- Duplex Ultrasound Carotid Arteries (CPT® 93880) may NOT be approved for the following:
 - ◆ Headaches (including migraines) except for consideration of carotid dissection
 - ◆ Syncope that is strongly suggestive of vertebrobasilar or bilateral carotid artery disease in etiology, as suggested by medical history and/or exam
 - Drop attack or syncope as they are rare indications See **HD-23.2: Syncope**
 - ◆ Dizziness unless associated with other localizing signs or symptoms to the vertebrobasilar circulation. CTA and MRA Neck are the preferred studies in 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.
 - ◆ Seizures
 - This includes true epilepsy, psychogenic epilepsy and convulsive syncope

HD-21.3: Cryptogenic Stroke

- 25% of individuals with ischemic stroke have no probable cause and is considered cryptogenic after a standard workup including an echocardiogram, inpatient cardiac telemetry or 24-Holter monitoring, CT or MRI Brain and vessel imaging of the brain or neck arteries and hematologic tests.
- A stroke may also be considered cryptogenic after a standard evaluation fails to yield an etiology in a person <50 years of age without risk factors with more extensive testing.
- Most cryptogenic sources are embolic in etiology from venous or arterial sources with investigations from disturbances in coagulation and sources of embolism including patent foramen ovale (PFO) and paroxysmal atrial fibrillation.
- Specialized evaluation may be considered with the following documentation:
 - ◆ MRI/CT Brain with results of stroke
 - ◆ Results of MRA/CTA Head and Neck
 - ◆ TTE or TEE
 - ◆ 24-Hr Holter monitor or Inpatient cardiac telemetry and 12-Lead ECG
- Hematologic testing to include: CBC, Platelet count, INR, PT, PTT, D-Dimer and Arterial and Venous Hypercoagulability tests
 - ◆ MRA or CTA Pelvis is approvable for the evaluation of paradoxical venous thromboembolism with PFO, See **PVD-12: Acute Limb Swelling** in the Peripheral Vascular Disease (PVD) Imaging Guidelines.
 - ◆ Workup for occult cancer, CT Chest Abdomen and/or Pelvis with contrast are approvable after the previously indicated tests with results are provided. See **ONC-30.3: Paraneoplastic Syndromes** in the Oncology Imaging Guidelines.
 - ◆ Cardiac CT (CPT® 75574 or CPT® 75572) may be performed instead of TEE if TTE is inconclusive)

HD-21.4: Transient Global Amnesia

- Transient Global Amnesia (TGA) is a clinical diagnosis with the differential diagnosis including, but not exclusive to: ischemic events, migraine headaches, and transient epileptic amnesia.
- Characteristics of TGA may include the following:
 - ◆ Witnessed episode
 - ◆ There must be anterograde amnesia during the attack
 - ◆ Cognitive impairment is limited to amnesia
 - ◆ No clouding of consciousness or loss of personal identity
 - ◆ No focal neurological signs/symptoms
 - ◆ No epileptic features
 - ◆ Attack must resolve within 24 hours
 - ◆ No recent head injury or active epilepsy
- Head and vessel imaging requests for ischemic etiology work-up should follow **HD-21.1: Stroke/TIA**

References

1. ACR Appropriateness Criteria® Cerebrovascular disease. *American College of Radiology (ACR)*. Date of origin: 1996. Last review date: 2016.
2. Kovacs MJ. Letter by Kovacs Regarding Article, "Diagnosis and Management of Cerebral Venous Thrombosis: A Statement for Healthcare Professionals From the American Heart Association/American Stroke Association." *Stroke*. 2011;42(7). doi:10.1161/strokeaha.111.619437.
3. Stam J. Thrombosis of the Cerebral Veins and Sinuses. *New England Journal of Medicine*. 2005;352(17):1791-1798. doi:10.1056/nejmra042354.
4. Schievink WI. Spontaneous dissection of the carotid and vertebral arteries. *The New England Journal of Medicine*. 2001;344(12):898-906. doi:10.1056/NEJM200103223441206.
5. Arnold M, Boussier M-G. Carotid and vertebral artery dissection. *Practical Neurology*. 2005;5(2):100-109. doi:10.1111/j.1474-7766.2005.00292.x.
6. Powers WJ, Rabinstein AA, Ackerson T, et al. Guidelines for the Early Management of Patients With Acute Ischemic Stroke: 2019 Update to the 2018 Guidelines for the Early Management of Acute Ischemic Stroke: A Guideline for Healthcare Professionals From the American Heart Association/American Stroke Association. *Stroke*. 2019;50(12). doi:10.1161/str.0000000000000211.
7. Burton TM, Bushnell CD. Reversible Cerebral Vasoconstriction Syndrome. *Stroke*. 2019;50(8):2253-2258. doi:10.1161/strokeaha.119.024416.
8. 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.
9. Osgood M, Budman E, Carandang R, Goddeau JRP, Henninger N. Prevalence of Pelvic Vein Pathology in Patients with Cryptogenic Stroke and Patent Foramen Ovale Undergoing MRV Pelvis. *Cerebrovascular Diseases*. 2015;39(3-4):216-223. doi:10.1159/000376613.
10. Messé SR, Gronseth GS, Kent DM, et al. Practice advisory update summary: Patent foramen ovale and secondary stroke prevention. *Neurology*. 2020;94(20):876-885. doi:10.1212/wnl.00000000000009443.
11. Demeestere J, Wouters A, Christensen S, Lemmens R, Lansberg MG. Review of Perfusion Imaging in Acute Ischemic Stroke. *Stroke*. 2020;51(3):1017-1024. doi:10.1161/strokeaha.119.028337.
12. Belani P, Schefflein J, Kihira S, et al. COVID-19 Is an Independent Risk Factor for Acute Ischemic Stroke. *American Journal of Neuroradiology*. 2020. doi:10.3174/ajnr.a6650.
13. Merkler AE, Parikh NS, Mir S, et al. Risk of Ischemic Stroke in Patients With Coronavirus Disease 2019 (COVID-19) vs Patients With Influenza. *JAMA Neurology*. 2020. doi:10.1001/jamaneurol.2020.2730.
14. Guzik A, Bushnell C. Stroke Epidemiology and Risk Factor Management. *CONTINUUM: Lifelong Learning in Neurology*. 2017;23(1):15-39. doi:10.1212/con.0000000000000416.
15. Tsvigoulis G, Alexandrov AV. Ultrasound in Neurology. *CONTINUUM: Lifelong Learning in Neurology*. 2016;22(5):1655-1677. doi:10.1212/con.0000000000000374.
16. Meschia JF, Bushnell C, Boden-Albala B, et al. Guidelines for the Primary Prevention of Stroke. *Stroke*. 2014;45(12):3754-3832. doi:10.1161/str.0000000000000046.
17. Lawton MT and Vates GE. Subarachnoid Hemorrhage. *N Engl J Med* 2017;377:257-66. doi: 10.1056/NEJMcip1605827
18. ACR AIUM SPR SRU Practice Parameter for the Performance of an Ultrasound Examination of the Extracranial Cerebrovascular System. 2016.
19. ACR-ASNR-SPR PRACTICE PARAMETER 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>.
20. Kamel H, et al. Tailoring the Approach to Embolic Stroke of Undetermined Source. A Review. *JAMA Neurol*;76(7):855-861. doi:10.1001/jamaneurol.2019.0591
21. Navi BB and and Iadecola C. Ischemic Stroke in Cancer Patients: A Review of an Underappreciated Pathology. *Ann Neurol*. 2018 May ; 83(5): 873–883. doi:10.1002/ana.25227.
22. Saver, JL. Cryptogenic Stroke. *N Engl J Med* 2016;374:2065-74. doi:10.1056/NEJMcip1503946
23. Swartzbach CJ, et al. Stroke and Cancer. The Importance of Cancer-Associated Hypercoagulation as a Possible Stroke Etiology. *Stroke*. 2012;43:3029-3034. doi: 10.1161/STROKEAHA.112.658625
24. Mangla A, Navi BB, Layton K, Kamel H. Transient global amnesia and the risk of ischemic stroke. *Stroke*. 2014;45(2):389-393. doi:10.1161/STROKEAHA.113.003916
25. Spiegel DR, Smith J, Wade RR, et al. Transient global amnesia: current perspectives. *Neuropsychiatric Disease and Treatment*. 2017;Volume 13:2691-2703. doi:10.2147/ndt.s130710.
26. Chandra A, Stone CR, Du X, Li WA, Huber M, Bremer R, Geng X, Ding Y. The cerebral circulation and cerebrovascular disease III: Stroke. *Brain circulation*. 2017 Apr;3(2):66.
27. Hakimi R, Sivakumar S. Imaging of Carotid Dissection. *Current Pain and Headache Reports*. 2019;23(1). doi:10.1007/s11916-019-0741-9.
28. Ghoneim A, Straiton J, Pollard C, Macdonald K, Jampana R. Imaging of cerebral venous thrombosis. *Clinical Radiology*. 2020;75(4):254-264. doi:10.1016/j.crad.2019.12.009.

29. Dmytriw AA, Song JSA, Yu E, Poon CS. Cerebral venous thrombosis: state of the art diagnosis and management. *Neuroradiology*. 2018;60(7):669-685. doi:10.1007/s00234-018-2032-2.
30. ACR-ASNR-SIR-SNIS Practice Parameter for the Performance of Diagnostic Cervicocerebral Catheter Angiography in Adults. Revised 2016. (Resolution 13) <https://www.acr.org/-/media/ACR/Files/Practice-Parameters/CervicoCerebralCathAngio.pdf>

HD-22: Cerebral Vasculitis

HD-22.1: Cerebral Vasculitis

- MRI Brain without and with contrast (CPT® 70553) is considered when CNS vasculitis is suspected
 - ◆ MRA Head (CPT® 70544, CPT® 70545, or CPT® 70546) and MRA Neck (CPT® 70547, CPT® 70548, or CPT® 70549); OR CTA Head (CPT® 70496) and CTA Neck (CPT® 70498) may be considered in addition to MRI Brain
- If initial vascular imaging is suspicious for vasculitis, may approve 3D rendering (CPT® 76377) with cervicocerebral angiography/arteriography (See **HD-1.7: General Guidelines- Other Imaging Situations**).
- Transcranial Doppler Studies may also be performed for individuals with documented vasculitis or concern for vasospasm (See **HD-24.8: Transcranial Doppler (CPT® 93886)**).
- FDG-PET is not supported due to lack of peer reviewed literature or expert consensus supporting the requested study for vasculitis. Certain imaging studies are considered investigational by various payors, and their coverage policies may take precedence over eviCore's guidelines. Advanced imaging studies, or other procedures, may be considered investigational and experimental if there is a paucity of supporting evidence; if the evidence has not matured to exhibit improved health parameters or; the advanced imaging study/procedure lacks a collective opinion of support

Practice Notes

Classification of vasculitides based on vessel size adapted from Younder. MRA and CTA are useful for the evaluation of the large proximal arteries; evaluation of a possible small vessel vasculitis may be beyond the resolution of routine MRA and CTA Head. However, other abnormalities, such as atherosclerotic disease, arterial dissection, Moyamoya disease, or reversible cerebral vasoconstriction may be demonstrated. Conventional angiogram is superior to MRA and CTA in demonstrating abnormalities in smaller vessels and is considered the “gold standard” in the evaluation of primary small vessel CNS vasculitis.

Dominant Vessel Involved	Primary	Secondary
Large arteries	➤ Giant cell arteritis ➤ Takayasu's arteritis	Aortitis with rheumatoid disease; Infection (e.g. syphilis)
Medium arteries	➤ Classical polyarteritis nodosa ➤ Kawasaki disease	Infection (e.g. hepatitis B)
Small vessels and medium arteries	➤ Wegener's granulomatosis ➤ Churg–Strauss syndrome ➤ Microscopic polyangiitis	Vasculitis with rheumatoid disease, systemic lupus erythematosus, Sjögren's syndrome, drugs, infection (e.g. HIV)
Small vessels	➤ Henoch-Schönlein purpura ➤ Essential cryoglobulinemia ➤ Cutaneous leukocytoclastic vasculitis	Drugs (e.g. sulphonamides, etc.) Infection (e.g. hepatitis C)

References

1. Younger DS. Epidemiology of Neurovasculitis. *Neurologic Clinics*. 2016;34(4):887-917. doi:10.1016/j.ncl.2016.06.006.
2. Soun JE, Song JW, Romero JM, Schaefer PW. Central Nervous System Vasculopathies. *Radiologic Clinics of North America*. 2019;57(6):1117-1131. doi:10.1016/j.rcl.2019.07.005.
3. Salmela MB, Mortazavi S, Jagadeesan BD, et al. ACR Appropriateness Criteria® Cerebrovascular Disease. *Journal of the American College of Radiology*. 2017;14(5). doi:10.1016/j.jacr.2017.01.051.
4. Okazaki T, Shinagawa S, Mikage H. Vasculitis syndrome-diagnosis and therapy. *Journal of General and Family Medicine*. 2017;18(2):72-78. doi:10.1002/jgf2.4.
5. Ikeda T, Furukawa F, Kawakami T, et al. Outline of guidelines for the management of vasculitis and vascular disorders in Japan, 2016 revised edition. *The Journal of Dermatology*. 2017;45(2):122-127. doi:10.1111/1346-8138.14086.
6. American College of Radiology ACR Appropriateness Criteria Cerebrovascular Diseases – Aneurysm, Vascular Malformations, and Subarachnoid Hemorrhage. New 2021. <https://acsearch.acr.org/docs/3149013/Narrative/>

HD-23: Dizziness, Vertigo and Syncope

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HD-23.1: Dizziness/Vertigo

- Dizziness, a common complaint, with benign and dangerous causes, may be continuous, triggered, or spontaneous.
- For the continuously dizzy individual with nystagmus at the time of evaluation, a head impulse test and a test of skew should be performed to determine if dizziness is due to a peripheral cause or a posterior circulation stroke. Abnormalities on exam may be indications for imaging as detailed below.
- For triggered dizziness, positional testing such as the Dix-Hallpike maneuver, and/or orthostatic blood pressure measurements, should be performed. If symptoms are reproduced on examination, triggered dizziness is confirmed. Imaging may be performed as indicated in the relevant sections below.
- Spontaneous dizziness may be due to vestibular migraine, TIA, or Meniere's disease, among other causes. A detailed neurologic examination should be performed, and imaging may be approved as detailed below.
- MRI Brain without contrast (CPT® 70551) or MRI Brain without and with contrast (CPT® 70553) may be approved when history and exam suggest non-benign dizziness such as:
 - ◆ Episodes lasting hour(s) or are continuous
 - ◆ Inconclusive positional testing or equivocal or unusual nystagmus findings
 - ◆ Visual disturbances including loss and diplopia
 - ◆ Headache
 - ◆ Subjective hearing loss
 - ◆ Unilateral tinnitus
 - ◆ Abnormal cranial nerve findings
 - ◆ Ataxia
 - ◆ Positive Romberg sign
 - ◆ Absent head thrust sign
 - ◆ Focal deficits
 - ◆ Dysarthria
 - ◆ Drop attacks
 - ◆ Weakness, including unilateral or hemibody weakness
 - ◆ Failure to respond to vestibular therapy or is unable to participate due to clinical condition
 - ◆ Consideration of vestibular migraine as it is a diagnosis of exclusion.
 - ◆ See **HD-21: Stroke/TIA**, **HD-11.2: Headaches with Red Flags** and **HD-16: Multiple Sclerosis (MS) and Related Conditions**
- CT Head without contrast (CPT® 70450) or without and with contrast (CPT® 70470) if concern for acute stroke (See **HD-21: Stroke/TIA**) and/or if MRI is contraindicated.
- Imaging may also be indicated in the setting of head trauma, See **HD-13.1: Head Trauma**

- The Dix-Hallpike maneuver should be performed or the individual should be referred to a clinician who could perform the procedure if Benign Paroxysmal Positional Vertigo (BPPV) is a consideration. (See **Practice Notes** for exclusions to this confirmatory test). Brain imaging is approvable if there are inconclusive or unusual findings or if the diagnosis remains unclear.
- Orthostatic hypotension (OH) and the subset of neurogenic orthostatic hypotension (nOH) should require a thorough history and physical including work-up (laboratory studies) and management prior to consideration of advanced imaging. BP/HR monitoring, medication review including reduction and modification(s), cardiology evaluation including EKG as appropriate, autonomic testing, plasma catecholamines, sudomotor function testing (QSART or thermoregulatory sweat testing) and 24-hour ambulatory blood pressure monitoring. Brain imaging is not indicated typically for OH. If orthostatic hypotension is suspected as part of an underlying movement disorder (such as Parkinsonism), See **HD-15.1: Movement Disorders**
- Associated asymmetric hearing loss (See **HD-27: Hearing Loss and Tinnitus**) and concern for vestibular schwannoma or possible Meniere's disease. (Note: MRI Brain should be performed with thin sections of IACs). Limited MRI Brain with attention to internal auditory canals (CPT® 70540, CPT® 70542, or CPT® 70543) can be approved when requested by the provider in place of a complete MRI Brain. Note: Limited MRI codes should not be used in addition to MRI Brain codes; IAC views are performed as additional sequences as part of the brain study. (See **HD-1.1: General Guidelines – Anatomic Issues**).
- CTA Head (CPT® 70496) and CTA Neck (CPT® 70498) or MRA Head (CPT® 70544, CPT® 70545, or CPT® 70546) and MRA Neck (CPT® 70547, CPT® 70548, or CPT® 70549) may be added if concern for vertebrobasilar disease including dissection (acute onset vertigo and associated symptoms or signs of weakness, ataxia, drop attacks, visual loss, diplopia, dysarthria).
- CT Temporal bone without contrast (CPT® 70480) may be added if history of head trauma or concern for semicircular canal dehiscence, temporal bone fractures in individuals with post-traumatic vertigo and diagnosing erosion in the bony labyrinth from inflammatory or iatrogenic causes. (See **Practice Notes** below).

Practice Notes

- The Head Impulse Test (HIT) is also known as the Head thrust test. It is designed to evaluate the vestibular-ocular reflex in an individual with concern for a peripheral vestibulopathy due to ACUTE spontaneous vertigo. The individual is instructed to look at the examiner during the entire test. The individual's head is then quickly turned or rotated to one side and then the other. If normal, the individual's eyes should remain locked on the examiner. If abnormal, the eyes will move in the direction of the head rotation and then quickly correct. This saccade indicates peripheral vestibular hypofunction on the side of the direction that the head is turned. The HIT test is abnormal in individuals with vestibular neuronitis, and normal in individuals with a posterior circulation stroke.
- Posterior Canal BPPV (85-95% of BPPV cases) is defined as:
 - ◆ Individual reports repeated episodes of vertigo with changes in head position relative to gravity.
 - ◆ Each of the following criteria is fulfilled on physical exam:
 - Vertigo associated with torsional (rotatory), upbeat (toward the forehead) nystagmus is provoked by the Dix-Hallpike test.
 - There is a latency period between the completion of the Dix-Hallpike maneuver and the onset of vertigo and nystagmus.
 - The provoked vertigo and nystagmus increase and then resolve within 60 seconds from the onset of the nystagmus.
- Lateral or Horizontal Canal BPPV (5-15% of BPPV cases) will have horizontal or no nystagmus to which a supine roll test assess for this condition.
- Exclusions for Dix-Hallpike maneuver
 - ◆ Individual previously diagnosed with BPPV and who on date of encounter in calendar year does not have positional dizziness or vertigo consistent with active BPPV
 - ◆ Individual has declined Dix-Hallpike maneuver
 - ◆ Individual has cervical spinal disease (i.e., cervical stenosis, severe kyphoscoliosis, limited cervical range of motion, Down's syndrome, severe rheumatoid arthritis, cervical radiculopathies, Paget's disease, ankylosing spondylitis, low back dysfunction, spinal cord injuries, spinal fractures)
 - ◆ Individual unable to lay flat (i.e., severe heart disease)
 - ◆ Individual has severe atherosclerotic disease or recent dissection involving the anterior or posterior cerebral circulation
 - ◆ Unable to be seated in exam chair (i.e., morbidly obese), or maneuver cannot be safely performed given morbid obesity
 - ◆ Ehlers Danlos/Marfans/Connective tissue disorder due to risk of cranio spinal instability/dissection
- Triggered episodic vestibular syndrome (t-EVS) usually last seconds to minutes with the most common triggers (vs. exacerbating factors) are head motion or change in body position. In the Emergency Department, benign paroxysmal positional vertigo (BPPV) is the second most common cause of t-EVS after orthostatic hypotension. Far lateral rotation of the neck leads to mechanical occlusion of one or both vertebral arteries causing temporary symptoms of vertigo and nystagmus when this position is maintained and may occur with the individual upright.

- Diagnoses or conditions associated with OH or nOH include: Parkinson Disease (PD), Multiple System Atrophy (MSA), Pure Autonomic Failure (PAF) or Dementia with Lewy Bodies (DLB), unexplained fall or syncope, peripheral neuropathies secondary to diabetes, amyloidosis and HIV), individuals ≥ 70 years of age and frail and on multiple medications and individuals with postural (orthostatic) dizziness or nonspecific symptoms that occur when standing. Symptoms may include: lightheadedness or dizziness, the sensation of blacking out, cognitive dysfunction, mental dulling, generalized weakness, neck pain or discomfort in the suboccipital and paracervical region (coat hanger) or playpnea (dyspnea while standing).
- Secondary or advanced laboratory testing is considered for use in select individuals for paraneoplastic syndromes (paraneoplastic panel) and serum and urine protein electrophoresis for monoclonal gammopathy for peripheral neuropathy. See **PN-3: Polyneuropathy** in the Peripheral Nerve Disorders Imaging Guidelines, **ONC-25: Multiple Myeloma and Plasmacytomas** in the Oncology Imaging Guidelines, and **ONC-30.3: Paraneoplastic Syndromes** in the Oncology Imaging Guidelines.
- Semicircular canal dehiscence (SCD) is a rare syndrome caused by dehiscence in the bony covering of the affected superior, posterior or lateral semicircular canal. When present, it can result in vestibular symptoms of vertigo associated with auditory symptoms including oscillopsia evoked by noise and conductive hearing loss. The vestibular symptoms in SCD can be debilitating. Individuals may note that loud noises cause them to see things moving or that they experience a similar sensation when they cough, sneeze, or strain to lift something heavy. The signs of vestibular abnormalities in SCD relate directly to the effect of the dehiscence which has created a third mobile window of the inner ear. Some individuals have a conductive hearing loss for low-frequency sounds that can resemble the pattern in otosclerosis.
- Occlusive carotid artery disease does not cause fainting but rather causes focal neurologic deficits such as unilateral weakness. Thus, carotid imaging will not identify the cause of the fainting and increases cost. Fainting is a frequent complaint, affecting 40% of people during their lifetime. (Choosing Wisely. An initiative of the ABIM Foundation. American Academy of Neurology. February 21,2013.)

HD-23.2: Syncope

- Advanced imaging (CT Head (CPT® 70450) or MRI Brain (CPT® 70551 or CPT® 70553) and vessel imaging (Carotid dopplers (CPT® 93880) and CTA Head (CPT® 70496) or CTA Neck (CPT® 70498) or MRA Head (CPT® 70544, CPT® 70545, or CPT® 70546) and/or MRA Neck (CPT® 70547, CPT® 70548, or CPT® 70549) is not indicated for simple syncope without focal signs of a neurological deficit, external evidence of head trauma or symptoms of stroke. A cardiac evaluation should be performed in the absence of focal signs and symptoms including a detailed history and examination (e.g. orthostatics), an EKG and/or additional evaluations including, but not exclusive to cardiac echocardiogram, tilt table testing, holter monitor, external loop recorder, etc.
- Exceptions of cases that require additional evaluation include frequent recurrent syncope with risk of injury or identified injury related to syncope, such as head trauma, See **HD-13.1: Head Trauma**
- Situational syncope is not an indication for advanced imaging. This includes, but is not exclusive to precipitating factors prior to syncope including coughing, defecation, eating, laughing and urination.
- Myoclonic jerks are frequently seen in vasovagal syncope and often misinterpreted as a sign of epilepsy. Loss of tone is usually seen in syncope whereas prolonged amnesia/confusion and tongue biting are symptoms and signs associated with a seizure. See **HD-9.1: Epilepsy/Seizure**.
- See **HD-21.1: Stroke/TIA** and **HD-13.1: Head Trauma**

References

1. Runser LA, Gauer RL and Houser A. Syncope: Evaluation and Differential Diagnosis. *Am Fam Physician*. 2017;95(5):303-312.
2. ACR Appropriateness Criteria® Hearing loss and/or vertigo. American College of Radiology (ACR). Date of origin: 1996. Last review date: 2018.
3. Cheshire WP. Syncope. *CONTINUUM: Lifelong Learning in Neurology*. 2017;23(2):335-358. doi:10.1212/con.0000000000000444.
4. Bhattacharyya N, Gubbels SP, Schwartz SR, et al. Clinical Practice Guideline: Benign Paroxysmal Positional Vertigo (Update). *Otolaryngology–Head and Neck Surgery*. 2017;156(3_suppl). doi:10.1177/0194599816689667.
5. ACR-ASNR-SPR Practice Parameter for the Performance of Computed Tomography (CT) of the Extracranial Head and Neck Revised 2016. (Resolution 14). <https://www.acr.org/-/media/ACR/Files/Practice-Parameters/CT-Head-Neck.pdf>.
6. Shen W-K, Sheldon RS, Benditt DG, et al. 2017 ACC/AHA/HRS Guideline for the Evaluation and Management of Patients With Syncope: A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines and the Heart Rhythm Society. *Circulation*. 2017;136(5). doi:10.1161/cir.0000000000000499.
7. Basura GJ, Adams ME, Monfared A, et al. Clinical Practice Guideline: Ménière's Disease. *Otolaryngology–Head and Neck Surgery*. 2020;162(2_suppl). doi:10.1177/0194599820909438.
8. Gibbons CH, Schmidt P, Biaggioni I, et al. The recommendations of a consensus panel for the screening, diagnosis, and treatment of neurogenic orthostatic hypotension and associated supine hypertension. *Journal of Neurology*. 2017;264(8):1567-1582. doi:10.1007/s00415-016-8375-x
9. Choosing Wisely. An initiative of the ABIM Foundation. American Academy of Neurology. Released February 21, 2013; Last reviewed 2019.
10. Choosing Wisely. An initiative of the ABIM Foundation. American College of Emergency Physicians. October 27, 2014.
11. Scott JW, Schwartz AL, Gates JD, Gerhard-Herman M, Havens JM. Choosing Wisely for Syncope: Low-Value Carotid Ultrasound Use. *Journal of the American Heart Association*. 2014;3(4). doi:10.1161/jaha.114.001063.
12. Dix-Hallpike maneuver performed for patients with BPPV. *www.aan.com*. <https://www.aan.com/policy-and-guidelines/quality/quality-measures2/quality-measures/other/dix-hallpike-maneuver-performed-for-patients-with-BPPV>.
13. Baloh RW. Vestibular Migraine I: Mechanisms, Diagnosis, and Clinical Features. *Seminars in Neurology*. 2020;40(01):076-082. doi:10.1055/s-0039-3402735.
14. Tehrani ASS, Kattah JC, Kerber KA, et al. Diagnosing Stroke in Acute Dizziness and Vertigo. *Stroke*. 2018;49(3):788-795. doi:10.1161/strokeaha.117.016979
15. Kligerman SJ, et al. ACR Appropriateness Criteria Syncope 2020.
16. Shmueli S, et al. Differentiating Motor Phenomena in Tilt-Induced Syncope and Convulsive Seizures. *Neurology*® 2018;90:e1339-e1346. doi:10.1212/WNL.0000000000005301.
17. Henderson FC, Austin C, Benzel E, et al. Neurological and spinal manifestations of the Ehlers-Danlos syndromes. *American journal of medical genetics Part C, Seminars in medical genetics*. 2017;175(1):195-211. doi:10.1002/ajmg.c.31549
18. Edlow JA, Gurley KL, Newman-Toker DE. A New Diagnostic Approach to the Adult Patient with Acute Dizziness. *The Journal of Emergency Medicine*. 2018;54(4):469-483. doi:10.1016/j.jemermed.2017.12.024.
19. Edlow JA. The timing-and-triggers approach to the patient with acute dizziness. *Emerg Med Pract*. 2019 Dec;21(12):1-24. Epub 2019 Dec 1. PMID: 31765116.
20. Krishnan K, Bassilious K, Eriksen E, et al. Posterior circulation stroke diagnosis using HINTS in patients presenting with acute vestibular syndrome: A systematic review. *European Stroke Journal*. Published online April 10, 2019:2396987319843701. doi:10.1177/2396987319843701.
21. Fife TD. Approach to the History and Evaluation of Vertigo and Dizziness. *CONTINUUM: Lifelong Learning in Neurology*. 2021;27(2):306-329. doi:10.1212/con.0000000000000938.
22. Hain TC, Cherchi M. Vestibular Testing. *CONTINUUM: Lifelong Learning in Neurology*. 2021;27(2):330-347. doi:10.1212/con.0000000000000978.
23. Steenerson KK. Acute Vestibular Syndrome. *CONTINUUM: Lifelong Learning in Neurology*. 2021;27(2):402-419. doi:10.1212/con.0000000000000958,

HD-24: Other Imaging Studies	
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Some payors may consider these techniques investigational, and their coverage policies may take precedence over eviCore's guidelines.

HD-24.1: Transcranial Magnetic Stimulation (TMS)

In TMS, an electromagnetic coil placed on the surface of the skull overlying the motor cortex depolarizes the motor axons, creating a motor evoked potential (MEP), which is recorded via superficial skin electrodes as it passes through the upper and lower motor pathways to an innervated muscle.

TMS is currently considered investigational by most payors. Certain imaging studies are considered investigational by various payors, and their coverage policies may take precedence over eviCore's guidelines. Advanced imaging studies, or other procedures, may be considered investigational and experimental if there is a paucity of supporting evidence; if the evidence has not matured to exhibit improved health parameters or; the advanced imaging study/procedure lacks a collective opinion of support.

HD-24.2: Functional MRI (fMRI)

- fMRI is useful in pre-operative scenarios to define the “eloquent” areas of brain
 - ◆ The ordering physician must be a neurologist, neurosurgeon or radiation oncologist or any provider in consultation with one of these specialists.
- Primary indications for fMRI include, but are not limited to, the following:
 - ◆ Assessment of intracranial neoplasm and other targeted lesions
 - ◆ Presurgical planning and operative risk assessment
 - ◆ Assessment of eloquent cortex (eg, language, sensory, motor, visual centers) in relation to a tumor or another focal lesion
 - ◆ Surgical planning (biopsy or resection)
 - ◆ Therapeutic follow-up, as a one-time, post-operative, follow up study
 - ◆ Evaluation of preserved eloquent cortex
 - ◆ Assessment of eloquent cortex for epilepsy surgery
 - ◆ Assessment of radiation treatment planning and post-treatment evaluation of eloquent cortex
- fMRI can be approved concurrently with PET Brain in epilepsy surgery planning
- Procedure codes for functional MRI:
 - ◆ CPT® 70554 MRI Brain, functional MRI, including test selection and administration of repetitive body part movement and/or visual stimulation, not requiring physician or psychologist administration
 - ◆ CPT® 70555 MRI Brain, functional MRI; requiring physician or psychologist administration of entire neurofunctional testing
 - ◆ MRA Head without contrast (CPT® 70544) may be erroneously ordered in place of fMRI, as the CPT codes are similar.
- MRI Brain (CPT® 70551 or CPT® 70553) and/or fMRI (CPT® 70554 or CPT® 70555) can be approved concurrently. (See **Preface-4.3: Unlisted Procedures/Therapy Treatment Planning** in the Preface Imaging Guidelines if MRI Unlisted is requested for surgical planning)

HD-24.3: Magnetic Resonance Spectroscopy (MRS)

- Certain imaging studies are considered investigational by various payors, and their coverage policies may take precedence over eviCore's guidelines. Advanced imaging studies, or other procedures, may be considered investigational and experimental if there is a paucity of supporting evidence; if the evidence has not matured to exhibit improved health parameters or; the advanced imaging study/procedure lacks a collective opinion of support
- MRS (CPT® 76390) involves analysis of the levels of certain chemicals in a pre-selected voxels (small regions) on an MRI scan done at the same time.
- When conventional imaging by magnetic resonance imaging (MRI) or computed tomography (CT) provides limited information regarding specific clinical questions, indications for MRS in adults and children include, but are not limited to, the following and is evaluated on a case-by-case basis, and may be considered:
 - ◆ Distinguish recurrent brain tumor from radiation necrosis as an alternative to PET (CPT® 78608)
 - ◆ Diagnosis of certain rare inborn errors of metabolism affecting the CNS (primarily pediatric individuals)
 - ◆ Evidence or suspicion of primary or secondary neoplasm (pretreatment and posttreatment)
 - ◆ Grading of primary glial neoplasm, particularly high-grade versus low-grade glioma
 - ◆ Evidence or suspicion of brain infection, especially cerebral abscess (pretreatment and posttreatment) and HIV-related infections
 - ◆ Seizures, especially temporal lobe epilepsy

Practice Note

- Evaluation of certain primary brain tumors where diagnostic accuracy has been established in peer-reviewed literature. See **ONC-2.1: Primary Central Nervous System Tumors – General Considerations**, **ONC-2.2: Low Grade Gliomas** and **ONC-2.3: High Grade Gliomas** in the Oncology Imaging Guidelines

HD-24.4: CSF Flow Imaging

- This is generally performed as a part of a MRI Brain study. It is not coded separately for preoperative evaluation of hydrocephalus, Chiari syndromes, Normal Pressure Hydrocephalus, Idiopathic Intracranial Hypertension (also known as pseudotumor cerebri), and spontaneous intracranial hypotension.
- There is no specific or unique procedure code for this study; it is done as a special sequence of a routine MRI Brain without contrast (CPT® 70551).
- If not previously performed as part of recent study, a second study for the purpose of evaluating CSF flow may be performed.

HD-24.5: CT or MRI Perfusion

- Performed as part of a CT Head or MRI Brain examination in the evaluation of individuals with very new strokes or brain tumors.
- A CT perfusion study, if performed in conjunction with a CT angiogram of the intracranial and/or cervical vessels, can be performed before, after, or concurrent with the CT angiogram. A CTA Head and/or Neck is approvable in conjunction with the CT Perfusion study when requested.
- 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 and to help identify those most likely to benefit from thrombolysis or thrombectomy.
- Secondary indications include, but are not exclusive to:
 - ◆ Follow-up of acute cerebral ischemia or infarction and/or reperfusion in the subacute or chronic phase of recovery
 - ◆ To assist in planning and evaluating the effectiveness of therapy for cervical or intracranial arterial occlusive disease (as an isolated test or in combination with a cerebrovascular reserve challenge) and/or chronic cerebral ischemia,
 - ◆ Identifying cerebral hyperperfusion syndrome following revascularization
 - ◆ Evaluation of the vascular status of solid tumors where MRI is degraded due to susceptibility artifact from air-containing spaces, surgical clips, or dental work
 - ◆ Follow-up of tumor response to therapy
- Other indications are usually regarded as investigational and experimental. Certain imaging studies are considered investigational by various payors, and their coverage policies may take precedence over eviCore’s guidelines. Advanced imaging studies, or other procedures, may be considered investigational and experimental if there is a paucity of supporting evidence; if the evidence has not matured to exhibit improved health parameters or; the advanced imaging study/procedure lacks a collective opinion of support.
- There is no specific CPT® code for MRI Perfusion. Perfusion weighted images are obtained with contrast and are not coded separately from a contrasted MRI Brain examination. If MRI Brain without and with contrast is approved, no additional CPT® codes are necessary or appropriate to perform MRI perfusion.
- Primary indications for perfusion magnetic resonance imaging (MRI) include the following:
 - ◆ Diagnosis and Characterization of Mass Lesions
 - Differential diagnosis (tumor versus tumor mimic)
 - Diagnosis of primary neoplasms (may include grading)
 - Surgical planning (biopsy or resection)
 - Targeting locations for biopsy
 - Guiding resection extent

- ◆ Therapeutic follow-up
 - Radiation necrosis versus recurrent or residual tumor
 - Chemonecrosis versus recurrent or residual tumor
 - Pseudoprogression and pseudoresponse
 - Monitor potential transformation of non-resectable low grade neoplasms to higher grade
- ◆ Assessment of Neurovascular Disease
 - Acute stroke (assessment of ischemic penumbra)
 - Assessment of the hemodynamic significance of cervical or intracranial vascular stenosis
 - Assessment of cervical or intracranial revascularization efficacy
 - Assessment of vasospasm

Practice Notes

- Pre-contrasted images for MRI perfusion are needed with contrasted images in case there is blood, calcification or to determine if there are artifacts if the area in question is close to bone. MRI Brain with and without should be the requested study for MRI Perfusion.

HD-24.6: Magnetic Resonance Neurography (MRN)

- MRN is currently considered investigational by most payors. Certain imaging studies are considered investigational by various payors, and their coverage policies may take precedence over eviCore's guidelines. Advanced imaging studies, or other procedures, may be considered investigational and experimental if there is a paucity of supporting evidence; if the evidence has not matured to exhibit improved health parameters or; the advanced imaging study/procedure lacks a collective opinion of support
- See **PN-7: Magnetic Resonance Neurography (MRN)** in the Peripheral Nerve Disorders (PND) Imaging Guidelines.

HD-24.7: Cone Beam Computed Tomography (CBCT)

- CPT® Codes: CPT® 70486, CPT® 70487, CPT® 70488, CPT® 70480, CPT® 70482 (No separate 3-D rendering codes should be reported)
- An alternative to traditional CT imaging is in-office cone beam testing and possible decreased radiation dosage. The indications for office-based CT imaging are the same as for traditional scanners, and they should not be used for diagnosing or managing uncomplicated acute bacterial rhinosinusitis (ABRS).
- See **HD-30: Temporomandibular Joint Disease (TMJ) and Dental/Periodontal/Maxillofacial Imaging**

HD-24.8: Transcranial Doppler (CPT® 93886)

- Transcranial Doppler (TCD) is a noninvasive ultrasonic technique that measures local blood flow velocity and direction in the proximal portions of intracranial and extracranial arteries

CPT® Code	Description	Additional Notes
93886	Transcranial Doppler study of the intracranial arteries; complete study	
93888	Transcranial Doppler study of the intracranial arteries; limited study	
93890	Transcranial Doppler study of the intracranial arteries; vasoreactivity study	
93892	Transcranial Doppler study of the intracranial arteries; emboli detection without intravenous microbubble injection	
93893	Transcranial Doppler study of the intracranial arteries; emboli detection with intravenous microbubble injection	Report 93893 if the study is performed with intravenous microbubble injection. Transcranial Dopple studies described as “with contrast” are performed with intravenous microbubble injection. The bubbles serve to enhance ultrasound thus enabling better visualization of the intracranial arteries.

- Transcranial Doppler studies are ordered either as a single complete or limited study or as a combination of the complete or limited study with additional studies for further evaluation of the condition being investigated.

- Evaluation of Stroke/TIA usually includes CPT® 93886 and CPT® 93890 (Vasoreactivity study) and either CPT® 93892 or CPT® 93893 (Emboli detection).
 - ◆ Examples include:
 - Evaluation of right to left cardiac shunts: Detection of microemboli in individuals with stroke or TIA. (CPT® 93892 or CPT® 93893 added to CPT® 93886)
 - Evaluation of intracranial occlusive disease in individuals with documented stroke or TIA (CPT® 93890 added to CPT® 93886)
 - Evaluation of hemodynamic effects of known severe extra-cranial occlusive disease (CPT® 93890 added to CPT® 93886)
- TCD studies are approvable for the following:
 - ◆ Evaluation of severe stenosis or occlusion of the extracranial ($\geq 60\%$ diameter reduction) and major basal intracranial arteries ($\geq 50\%$ diameter reduction)
 - ◆ Detection and serial evaluation of cerebral vasospasm in subarachnoid hemorrhage
 - ◆ Evaluation of cerebral embolization including in COVID-19 and refractory encephalopathy
 - ◆ Assessing the extent of collateral circulation in individuals with known regions of severe stenosis or occlusion
 - ◆ To detect residual right to left shunting after repair/closure of an intracardiac or intrapulmonary shunt
 - ◆ Evaluation of AVM both pre and post-surgical intervention.
 - ◆ Periprocedural monitoring to detect cerebral thrombosis, embolization, hypoperfusion, and hyperperfusion
 - ◆ Assessing the stroke risk in children aged two to sixteen with homozygous sickle cell disease
 - ◆ Annual screening for individuals with Sickle Cell Anemia (Hb-SS) and Sickle Beta Thalassemia (S β) (CPT® 93886) up to the age of 16.
- TCD studies are not indicated or approvable for evaluation of:
 - ◆ Brain tumors
 - ◆ Familial and degenerative disease of the brain
 - ◆ Psychiatric disorders
 - ◆ Epilepsy
 - ◆ Migraine or other primary headache disorders
 - ◆ Infectious and inflammatory conditions

Practice Notes

- Transcranial Doppler (TCD) ultrasound provides rapid, non-invasive, real time measure of cerebrovascular function.
- TCD can be used to measure flow velocity in the proximal cerebral arteries to assess relative changes in flow, diagnose focal vascular stenosis, or to detect embolic signals within these arteries.
- TCD can be used to measure blood flow responses to changes in blood pressure (cerebral autoregulation), changes in end-tidal CO₂ (cerebral vasoreactivity), or cognitive and motor activation (neurovascular coupling or functional hyperemia).
- A technical limitation of TCD includes inadequate temporal bone acoustic windows due to a thickened skull which limits ultrasound penetration
- Studies are ongoing regarding the use of TCD in the evaluation of dementia and psychiatric conditions such as depression.
- CPT® 93890, CPT® 93892, CPT® 93893 represent add on services that require additional expertise, lab time, and equipment not included in the complete and limited codes. These additional codes may be approved during the same encounter if medical necessity is documented.
- CPT® 93890 Vasoreactivity Study: Measures response of cerebral blood flow to increased CO₂ levels (following breath holding or administration of acetazolamide); It is used to evaluate risk of stroke and significance of carotid stenosis; individuals with loss of normal reactive changes are likely to be at increased risk of stroke.
- CPT® 93892/CPT® 93893: Identification of right to left shunts (microembolic signals may be detected during TCD monitoring) and may indicate source of emboli in individuals with stroke or TIA. TCD bubble test is very sensitive and may be superior to transthoracic and transesophageal echocardiography in detection of right to left shunts.
- Transcranial Doppler (TCD) is considered investigational and not medically necessary for the following indications:
 - ◆ Assessing individuals with migraine;
 - ◆ Monitoring during cardiopulmonary bypass and other cerebrovascular and cardiovascular interventions, and surgical procedures (except during carotid endarterectomy, as noted above);
 - ◆ Evaluation of individuals with dilated vasculopathies such as fusiform aneurysms;
 - ◆ Assessing autoregulation, physiologic, and pharmacological responses of cerebral arteries; and/or
 - ◆ Evaluating children with various vasculopathies, such as moyamoya disease and neurofibromatosis.

References

1. Tsvigoulis G, Alexandrov AV. Ultrasound in Neurology. CONTINUUM: Lifelong Learning in Neurology. 2016;22(5):1655-1677. doi:10.1212/con.0000000000000374
2. PRACTICE PARAMETER CT_Perfusion. <https://www.acr.org/-/media/ACR/Files/Practice-Parameters/ct-perfusion.pdf>
3. Connolly ES, Rabinstein AA, Carhuapoma JR, et al. Guidelines for the Management of Aneurysmal Subarachnoid Hemorrhage. Stroke. 2012;43(6):1711-1737. doi:10.1161/str.0b013e3182587839
4. ACR-ASNR-SPR Practice Parameter for the Performance of Computed Tomography (CT) of the Extracranial Head and Neck Revised 2016. (Resolution 14). <https://www.acr.org/-/media/ACR/Files/Practice-Parameters/CT-Head-Neck.pdf>
5. Demeestere J, Wouters A, Christensen S, Lemmens R, Lansberg MG. Review of Perfusion Imaging in Acute Ischemic Stroke. Stroke. 2020;51(3):1017-1024. doi:10.1161/strokeaha.119.028337
6. PRACTICE PARAMETER Transcranial Doppler Ultrasound. <https://www.acr.org/-/media/ACR/Files/Practice-Parameters/us-transcranial.pdf?la=en>
7. PRACTICE PARAMETER FMRI. <https://www.acr.org/-/media/ACR/Files/Practice-Parameters/fmr-brain.pdf?la=en>
8. PRACTICE PARAMETER 1 MR Spectroscopy. <https://www.acr.org/-/media/ACR/Files/Practice-Parameters/mr-spectroscopy.pdf?la=en>
9. PRACTICE PARAMETER MR_Perfusion. <https://www.acr.org/-/media/ACR/Files/Practice-Parameters/mr-perfusion.pdf?la=en>
10. Bradley WG. Magnetic Resonance Imaging of Normal Pressure Hydrocephalus. Seminars in Ultrasound, CT and MRI. 2016;37(2):120-128. doi:10.1053/j.sult.2016.01.005.
11. Farb R, Rovira A. Hydrocephalus and CSF Disorders. 2020 Feb 15. In: Hodler J, Kubik-Huch RA, von Schulthess GK. Hydrocephalus and CSF Disorders--Diseases of the Brain, Head and Neck, Spine 2020–2023: Diagnostic Imaging. Chapter 2
12. Antipova D, Eadie L, Macaden AS, Wilson P. Diagnostic value of transcranial ultrasonography for selecting subjects with large vessel occlusion: a systematic review. The Ultrasound Journal. 2019;11(1). doi:10.1186/s13089-019-0143-6
13. Batra A, Clark JR, LaHaye K, et al. Transcranial Doppler Ultrasound Evidence of Active Cerebral Embolization in COVID-19. Journal of Stroke and Cerebrovascular Diseases. 2021;30(3):105542. doi:10.1016/j.jstrokecerebrovasdis.2020.105542
14. Purkayastha S, Sorond F. Transcranial Doppler Ultrasound: Technique and Application. Seminars in neurology. 2012;32(4):411-420. doi:10.1055/s-0032-1331812
15. Feng Y, Su X, Zheng C, Lu Z. The Noninvasive Diagnostic Value of MRN for CIDP: A Research from Qualitative to Quantitative. Spine. 2020;45(21):1506-1512. doi:10.1097/brs.0000000000003599
16. AIUM Practice Guideline for the Performance of a Transcranial Doppler Ultrasound Examination for Adults and Children. Journal of Ultrasound in Medicine. 2012;31(9):1489-1500. doi:10.7863/jum.2012.31.9.1489
17. Robertson RL, Palasis S, Rivkin MJ, et al. ACR Appropriateness Criteria® Cerebrovascular Disease-Child. Journal of the American College of Radiology. 2020;17(5):S36-S54. doi:10.1016/j.jacr.2020.01.036
18. McGirr A, Vila-Rodriguez F, Cole J, et al. Efficacy of Active vs Sham Intermittent Theta Burst Transcranial Magnetic Stimulation for Patients With Bipolar Depression. JAMA Network Open. 2021;4(3):e210963. doi:10.1001/jamanetworkopen.2021.0963
19. Lacomis D, Gooch C. Upper motor neuron assessment and early diagnosis in ALS. Neurology. 2019;92(6):255-256. doi:10.1212/wnl.0000000000006867
20. Rosenfeld RM, Piccirillo JF, Chandrasekhar SS, et al. Clinical Practice Guideline (Update): Adult Sinusitis. Otolaryngology–Head and Neck Surgery. 2015;152(2_suppl):S1-S39. doi:10.1177/0194599815572097

HD-25: Epistaxis

HD-25.1: Epistaxis

- CT Maxillofacial without or with contrast (CPT® 70486 or CPT® 70487) and/or MRI Orbit, Face, and/or Neck without and with contrast (CPT® 70543) are appropriate based on endoscopic findings of mass lesion during ENT examination.

References

1. Kirsch CFE, Bykowski J, Aulino JM, et al. ACR Appropriateness Criteria®. Sinonasal disease. *American College of Radiology (ACR)*. Revised 2017.
2. Hoeffner EG, Mukherji SK, Gandhi D, et al. *Temporal bone imaging*. New York: Thieme; 2008.
3. ACR–ASNR–SPR PRACTICE PARAMETER FOR THE PERFORMANCE OF COMPUTED TOMOGRAPHY (CT) OF THE EXTRACRANIAL HEAD AND NECK Revised 2016 (Resolution 14). <https://www.acr.org/-/media/ACR/Files/Practice-Parameters/CT-Head-Neck.pdf>.
4. 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.

HD-26: Mastoid Disease or Ear Pain

HD-26.1: Mastoid Disease or Ear Pain

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

- Advanced imaging is not indicated in the overwhelming majority of individuals with ear pain.
- CT Temporal Bone without contrast (CPT® 70480) or without and with contrast (CPT® 70482), OR, MRI Brain without and with contrast with attention to internal auditory canals (CPT® 70553), OR MRI Orbits/Face/Neck without and with contrast (CPT® 70543) is indicated for the following:
 - ◆ Persistent ear pain without obvious cause.
 - ◆ Clinical suspicion for complicated or invasive infection such as mastoiditis.
 - ◆ Clinical suspicion of mass lesion causing ear pain.
 - ◆ Significant trauma with concern for hematoma formation.
 - ◆ Preoperative planning

References

1. ACR-ASNR-SPR Practice Parameter for the Performance of Computed Tomography (CT) of the Extracranial Head and Neck Revised 2016. <https://www.acr.org/-/media/ACR/Files/Practice-Parameters/CT-Head-Neck.pdf> revised.
2. 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):S1-S41. doi:10.1177/0194599815623467.

HD-27: Hearing Loss and Tinnitus

HD-27.1 Hearing Loss	112
HD-27.2: Tinnitus	112

HD-27.1 Hearing Loss

- An initial evaluation including hearing tests, by bedside testing or by formal audiology, is necessary to determine whether an individual's hearing loss is conductive (external or middle ear structures) or sensorineural (inner ear structures, such as cochlea or auditory nerve) hearing loss. See **HD-1.0: General Guidelines**
- CT Temporal Bone without (CPT® 70480) or MRI Brain without and with contrast (with IAC views) (CPT® 70553) or without contrast (CPT® 70551):
 - ◆ Conductive hearing loss should have a CT Temporal Bone initially in the absence of an evident mass in the middle ear
 - ◆ Mixed conductive (MC)/Sensorineural (SN) hearing loss or any sudden sensorineural hearing loss (MRI generally preferred for SN see Practice Notes)
 - ◆ Unilateral fluctuating or asymmetric hearing loss
 - ◆ Cholesteatoma
 - ◆ Congenital hearing loss
 - ◆ Surgical planning, including cochlear implants (both CT Temporal Bone and MRI Brain may be approved for surgical planning if requested by surgeon)
 - ◆ Hearing loss with vertigo (See **HD-23.1: Dizziness/Vertigo**)
- CT Temporal Bone with contrast (CPT® 70481):
 - ◆ Glomus tumors or other vascular tumors of the middle ear, and/or surgical planning
 - ◆ Acquired sensorineural hearing loss if MRI unavailable or contraindicated
- Limited MRI Brain with attention to internal auditory canals (CPT® 70540, CPT® 70542, or CPT® 70543) can be approved when requested by the provider in place of a complete MRI Brain. Note: Limited MRI codes should not be used in addition to MRI Brain codes; IAC views are performed as additional sequences as part of the brain study. (See **HD-1.1: General Guidelines – Anatomic Issues**)

Practice Notes

- Sensorineural (SN) hearing loss – MRI is generally preferable to CT. CT Temporal bone is appropriate in post-traumatic SN hearing loss, to evaluate for bony remodeling of the IAC due to vestibular schwannoma and labyrinthine ossification resulting from prior infection and for consideration of otospongiosis, a common cause of MC and SN hearing loss.

HD-27.2: Tinnitus

- A hearing evaluation is not required prior to imaging for tinnitus.
- The history in individuals with tinnitus should include a description of the tinnitus (episodic or constant, pulsatile or non-pulsatile, rhythmicity, pitch, quality of the sound), as well as inciting or alleviating factors. Continuous and pulsatile tinnitus are more concerning for an underlying and significant disorder. Audiometric assessment can be used as initial diagnostic testing particularly in individuals with tinnitus that is unilateral, persistent (>6 months) or associated with hearing difficulties. See **HD-1.0: General Guidelines**

- MRI Brain and internal auditory canal (IAC) without and with contrast (CPT® 70553), or MRI Brain and internal auditory canal (IAC) without contrast (CPT® 70551), or CT temporal bone without contrast (CPT® 70480) may be approved for:
 - ◆ Pulsatile tinnitus
 - ◆ Asymmetric or unilateral nonpulsatile tinnitus (i.e. tinnitus that localizes to one ear)
 - ◆ Tinnitus associated with focal neurologic abnormalities, including asymmetric hearing loss
 - ◆ Suspicion for vascular lesions
- MRA Head (CPT® 70544, CPT® 70545, or CPT® 70546) or CTA/CTV Head (CPT® 70496) **AND/OR** MRA Neck (CPT® 70547, CPT® 70548, or CPT® 70549) or CTA Neck (CPT® 70498) **AND/OR** CT Temporal Bone without contrast (CPT® 70480)
 - ◆ Pulsatile tinnitus or suspicion for vascular lesions
- Limited MRI Brain with attention to internal auditory canals (CPT® 70540, CPT® 70542, or CPT® 70543) can be approved when requested by the provider in place of a complete MRI Brain. Note: Limited MRI codes should not be used in addition to MRI Brain codes; IAC views are performed as additional sequences as part of the brain study. (See **HD-1.1: General Guidelines – Anatomic Issues**)
- CT and MR Venography (CTV and MRV) are reported with the same codes as the CTA/MRA counterpart. 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

Practice Notes

- Nonpulsatile tinnitus may be describes as ringing, buzzing, or clicking sensations which is constant and nonsynchronous.
- Pulsatile tinnitus is a repetitive sound coinciding with the individual's heartbeat. The symptom may be subjective or objective.

References

1. ACR Appropriateness Criteria® Hearing loss and/or vertigo. American College of Radiology (ACR). Date of origin: 1996. Last review date: 2018. <https://acsearch.acr.org/docs/69488/Narrative/>.
2. Isaacson J, Vora NM. Differential diagnosis and treatment of hearing loss. American family physician. 2003 Sep 15;68(6):1125-32.
3. Chandrasekhar SS, Do BST, Schwartz SR, et al. Clinical Practice Guideline: Sudden Hearing Loss (Update). Otolaryngology–Head and Neck Surgery. 2019;161(1_suppl). doi:10.1177/0194599819859885.
4. ACR–ASNR–SPR PRACTICE PARAMETER FOR THE PERFORMANCE OF COMPUTED TOMOGRAPHY (CT) OF THE EXTRACRANIAL HEAD AND NECK Revised 2016 (Resolution 14). <https://www.acr.org/-/media/ACR/Files/Practice-Parameters/CT-Head-Neck.pdf>.
5. Kessler MM, Moussa M, Bykowski J, et al. ACR Appropriateness Criteria® Tinnitus. Journal of the American College of Radiology. 2017;14(11). doi:10.1016/j.jacr.2017.08.052

HD-28: Neurosurgical Imaging

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HD-28.1: Neurosurgical Imaging Requests

- Typically advanced imaging requests for monitoring disease for mass lesions occurs after biopsy (histologic) confirmation. This ensures appropriate case review determination to phase of oncology imaging and alignment to appropriate diagnosis-specified guideline section.
 - ◆ However, it is reasonable to approve repeat imaging requests by neurosurgeons or others of the management team for areas of the central nervous system (CNS) where permanent neurologic damage would be excessive with even a limited biopsy attempt. Examples would include, but are not exclusive to: medically fragile individual, and tumors of the brainstem, eloquent areas of the brain, deep gray matter areas of the brain (ex. thalamus), and cavernous sinus.
- Repeat diagnostic head imaging may be approved if:
 - ◆ Previous diagnostic head imaging is determined to be inadequate or additional imaging sequences/protocols are required by the neurosurgeon or the treatment team
 - ◆ Prior imaging is greater than 6 months old

HD-28.2: Neuronavigation

- Neuronavigation
 - ◆ Neurosurgical navigation is “image-based” meaning that the necessary preoperative CT and MRI images are used for navigation in the operating room (image acquisition). Accurate registration (a process to match the preoperative images to the individual position) of preoperative images is necessary to guide surgery regardless of the navigation system that is used. Registration can be point-based or surface matched routines to allow the surgeon to view the overlapping data sets and the current situation to allow navigation.
 - ◆ The process of registration for neuronavigation via the acquisition of preoperative CT and MRI images does not require a radiologist interpretation.
 - It is not appropriate to request diagnostic imaging codes for the purpose of registration for neuronavigation.
 - Requests may refer to proprietary brand systems such as Brainlab or Stealth imaging procedures
 - See **Preface-4.3: Unlisted Procedures/Therapy Treatment Planning** in the Preface Imaging Guidelines and **ONC-1.5: Unlisted Procedure Codes** in Oncology in the Oncology Imaging Guidelines
- eviCore may not be contracted to review unlisted codes, and some health plans do not require prior authorization for the unlisted codes. Please refer to individual health plan policy.

- Advanced imaging for neuronavigation (image acquisition for registration for surgery) may be approvable with one of each of the following as unlisted codes apply:
 - ◆ Unlisted MRI procedure code (CPT® 76498)
 - ◆ Unlisted CT procedure code (CPT® 76497)
 - ◆ Due to variances with techniques currently available for neuronavigation, the following are approvable upon request:
 - CTA Head without and with contrast (CPT® 70496) or MRA Head (CPT® 70544, CPT® 70545 or CPT® 70546) (to avoid arterial and venous structures)
 - 3D (CPT® 76377 or CPT® 76376) See **HD-1.7: General Guidelines – Other Imaging Situations**
 - ◆ Diagnostic imaging codes should only be requested if radiological supervision and interpretation of imaging is necessary with supporting documentation
 - MRI Brain (contrast as requested) and/or CT Head (contrast as requested)
- Approvable post-operative imaging including MRI Brain (contrast as request) or CT Head (contrast as request) per neurosurgeon's or in concert with management team's request that includes, but not exclusive to:
 - ◆ Within 24-72 hours following brain surgery including to document the need for repeat surgery or if adjuvant intervention is necessary, concern or rule out for complication(s), evaluation if incomplete resection vs. consideration for plan for gross resection
 - ◆ Signs or symptoms indicating concern of clinical deterioration
 - ◆ Development of new neurological signs or symptoms
 - ◆ Follow-up on blood products, edema, and/or concern of cerebrospinal fluid leak
 - ◆ Follow up imaging per condition based guideline
- See additional condition -based guidelines:
 - ◆ Pediatric Neurosurgeries:
 - See **PEDHD-6.3 Special Imaging Studies in Evaluation for Epilepsy Surgery** in the Pediatric Head Imaging Guidelines
 - See **PEDONC-1.3 Modality General Considerations** and **PEDONC-4: Pediatric CNS Tumors** in the Pediatric Oncology Guidelines
 - ◆ Epilepsy
 - See **HD-9.2: Presurgical Work-Up for Drug-Resistant Epilepsy**
 - ◆ Movement Disorders
 - See **HD-15.1: Movement Disorders**
 - ◆ Pituitary or Sella Surgery
 - See **HD-19.1: Pituitary**
 - ◆ Acoustic Neuroma and Other Cerebellopontine Angle Tumors
 - See **HD-33.1: Acoustic Neuroma and Other Cerebellopontine Angle Tumors**
 - ◆ Central Nervous System Tumors
 - See **ONC-2: Primary Central Nervous System Tumors** and **ONC-31.3: Brain Metastases** in the Oncology Imaging Guidelines

References

1. Orringer DA, Golby A, Jolesz F. Neuronavigation in the surgical management of brain tumors: current and future trends. *Expert Review of Medical Devices*. 2012;9(5):491-500. doi:10.1586/erd.12.42
2. Rughani A, Schwalb JM, Sidiropoulos C, et al. Congress of Neurological Surgeons Systematic Review and Evidence-Based Guideline on Subthalamic Nucleus and Globus Pallidus Internus Deep Brain Stimulation for the Treatment of Patients With Parkinson's Disease: Executive Summary. *Neurosurgery*. 2018;82(6):753-756. doi:10.1093/neuros/nyy037
3. Kotecha R, Sahgal A, Rubens M, et al. Stereotactic radiosurgery for non-functioning pituitary adenomas: meta-analysis and International Stereotactic Radiosurgery Society practice opinion. *Neuro-Oncology*. 2019;22(3):318-332. doi:10.1093/neuonc/noz225
4. Xiao Y, Lau JC, Hemachandra D, Gilmore G, Khan AR, Peters TM. Image Guidance in Deep Brain Stimulation Surgery to Treat Parkinson's Disease: A Comprehensive Review. *IEEE Transactions on Biomedical Engineering*. 2021;68(3):1024-1033. doi:10.1109/tbme.2020.3006765
5. Delev D, Quesada CM, Grote A, et al. A multimodal concept for invasive diagnostics and surgery based on neuronavigated voxel-based morphometric MRI postprocessing data in previously nonlesional epilepsy. *Journal of Neurosurgery*. 2018;128(4):1178-1186. doi:10.3171/2016.12.jns.16166
6. Yang I, Udawatta M, Prashant GN, et al. Stereotactic Radiosurgery for Neurosurgical Patients: A Historical Review and Current Perspectives. *World Neurosurgery*. 2019;122:522-531. doi:10.1016/j.wneu.2018.10.193
7. ACR-ASNR-SPR PRACTICE PARAMETER FOR THE PERFORMANCE OF COMPUTED TOMOGRAPHY (CT) OF THE EXTRACRANIAL HEAD AND NECK Revised 2016 (Resolution 14). <https://www.acr.org/-/media/ACR/Files/Practice-Parameters/CT-Head-Neck.pdf>
8. Fitzpatrick JM. The role of registration in accurate surgical guidance. *Proceedings of the Institution of Mechanical Engineers, Part H: Journal of Engineering in Medicine*. 2009;224(5):607-622. doi:10.1243/09544119jeim589
9. Maurer CR, Fitzpatrick JM, Wang MY, Galloway RL, Maciunas RJ, Allen GS. Registration of head volume images using implantable fiducial markers. *IEEE Transactions on Medical Imaging*. 1997;16(4):447-462. doi:10.1109/42.611354
10. Pfisterer WK, Papadopoulos S, Drumm DA, Smith K, Preul MC. Fiducial Versus Nonfiducial Neuronavigation Registration Assessment and Considerations of Accuracy. *Operative Neurosurgery*. 2008;62(suppl_1):ONS201-ONS208. doi:10.1227/01.neu.0000317394.14303.99
11. Gumprecht HK, Widenka DC, Lumenta CB. Brain Lab VectorVision Neuronavigation System: Technology and Clinical Experiences in 131 Cases. *Neurosurgery*. 1999;44(1):97-104. doi:10.1097/00006123-199901000-00056
12. Grunert P, Darabi K, Espinosa J, Filippi R. Computer-aided navigation in neurosurgery. *Neurosurgical Review*. 2003;26(2):73-99. doi:10.1007/s10143-003-0262-0
13. Mezger U, Jendrewski C, Bartels M. Navigation in surgery. *Langenbeck's Archives of Surgery*. 2013;398(4):501-514. doi:10.1007/s00423-013-1059-4
14. Omay SB, Barnett GH. Surgical navigation for meningioma surgery. *Journal of Neuro-Oncology*. 2010;99(3):357-364. doi:10.1007/s11060-010-0359-6
15. Maciunas R. Computer-assisted neurosurgery. *Clin Neurosurg*. 2006;(53):267-271.
16. Kelly PJ, Kall BA, Goerss SJ. Results of Computed Tomography-based Computer-assisted Stereotactic Resection of Metastatic Intracranial Tumors. *Neurosurgery*. 1988;22(1):7-17. doi:10.1227/00006123-198801000-00002
17. Wang MY, Maurer CR, Fitzpatrick JM, Maciunas RJ. An automatic technique for finding and localizing externally attached markers in CT and MR volume images of the head. *IEEE Transactions on Biomedical Engineering*. 1996;43(6):627-637. doi:10.1109/10.495282.
18. American College of Radiology. ACR Practice Parameter for the performance of brain stereotactic radiosurgery.
19. American College of Radiology. ACR-ASNR-SPR practice parameter for the performance and interpretation of magnetic resonance imaging (MRI) of the brain.
20. PRACTICE PARAMETER 1 Cervicocerebral MRA. <https://www.acr.org/-/media/ACR/Files/Practice-Parameters/cervicocerebralmra.pdf?la=en>.
21. PRACTICE PARAMETER 1 Cervicocerebral CTA. <https://www.acr.org/-/media/ACR/Files/Practice-Parameters/CervicoCerebralCTA.pdf?la=en>.

HD-29: Sinusitis and Facial Imaging

HD-29.1: Sinus and Facial Imaging

- CT Maxillofacial without contrast (CPT® 70486) or limited CT Sinus without contrast (CPT® 76380) is considered for ANY of the following:
 - ◆ Acute sinusitis with no improvement in symptoms after a minimum of 4 weeks of treatment; or concern for complicated sinusitis (See **Practice Note** below)
 - ◆ Recurrent sinusitis (4 or more episodes of acute sinusitis within the past 12 months without symptoms or signs between episodes)
 - ◆ Chronic sinusitis (>12 weeks sinusitis) with at least two of the following signs and symptoms:
 - Mucopurulent drainage
 - Nasal obstruction
 - Facial pain, pressure, and/or fullness (may involve the anterior face, periorbital region, or manifest with headache that is localized or diffuse)
 - Decreased sense of smell
 - (Note: A trial of antibiotic therapy is not required prior to imaging if individual meets criteria for chronic sinusitis)
- Surgical candidate (See **Preface-4.3: Unlisted Procedures/Therapy Treatment Planning** in the Preface Imaging Guidelines if unlisted code is requested for surgical planning)
- Studies requested for the purpose of navigation for sinus surgery should be coded CPT® 77011 (CT guidance for stereotactic localization). It is not appropriate to report both CPT® 70486 and CPT® 77011 for the same CT stereotactic localization imaging session. See **Preface-4.2: CT-, MR-, or Ultrasound-Guided Procedures** in the Preface Imaging Guidelines
- For unexplained cough See **CH-3.1: Cough** in the Chest Imaging Guidelines
- CT Maxillofacial with contrast (CPT® 70487) can be approved if any of the following is present:
 - ◆ Orbital or facial cellulitis
 - ◆ Proptosis
 - ◆ Abnormal visual examination
 - ◆ Ophthalmoplegia
 - ◆ Cystic fibrosis
 - ◆ Immunocompromised individual
 - ◆ Fungal or vascular lesions visualized in nasal cavity
- CT Maxillofacial without contrast (CPT® 70486) or CT Maxillofacial with contrast (CPT® 70487) or MRI Maxillofacial without and with contrast (CPT® 70543):
 - ◆ Sinonasal obstruction, polyp, or suspected mass
 - ◆ Suspected orbital complication
 - ◆ Suspected invasive fungal sinusitis
 - ◆ Osteomyelitis and odontogenic infections (MRI is the preferred modality) See **HD-30.2: Dental/Periodontal/Maxillofacial Imaging**

- MRI Brain with and without contrast (CPT® 70553) for suspected intracranial complication
- CT Orbit without contrast (CPT® 70480) or CT Orbit without and with contrast (CPT® 70482) may be performed alone or added to CT Maxillofacial for:
 - ◆ Suspected orbital complications
- For Skull Base Osteomyelitis (SBO) See **HD-20.2: Skull Base Osteomyelitis (SBO)**
- Repeat imaging may be approved for ANY of the following scenarios:
 - ◆ An ENT specialist or any provider in consultation with an ENT specialist requests the imaging **and**
 - There is no improvement after an additional 3 weeks of conservative treatment after initial imaging was completed; **and**
 - There has been a follow-up visit since the previous imaging; **or**
 - If there is a new abnormality on exam such as obstructing mass
 - Planned sinus surgery (Balloon Sinus Ostial Dilation or Functional Endoscopic Sinus Surgery)

For Cone Beam Imaging requests, See **HD-24.7: Cone Beam Computed Tomography (CBCT)**

Practice Notes

- Rhinosinusitis is defined as inflammation of the nasal cavity and adjacent paranasal sinuses. Acute sinusitis refers to symptom duration <4 weeks, subacute 4 to 12 weeks, and chronic >12 weeks. Complicated sinusitis refers to symptoms suggesting spread of disease into adjacent structures, including orbital or intracranial complications.
- There is no evidence to support advanced imaging of acute (<4 weeks) and subacute (4 to 12 weeks) uncomplicated rhinosinusitis.
- There is no evidence to support routine follow-up advanced imaging after treatment with clinical improvement of sinusitis.
- Complication of ABRS (acute bacterial rhinosinusitis) is suspected based on:
 - ◆ Severe headache
 - ◆ Facial Swelling
 - ◆ Cranial nerve palsies
 - ◆ Photophobia
 - ◆ Orbital signs (cellulitis, impaired extraocular motility, decrease in vision or proptosis).
 - ◆ Fever
- CT findings that correlate with ABRS include opacification, air-fluid level, and moderate to severe mucosal thickening. Complications of ABRS are best assessed using iodine contrast-enhanced CT or gadolinium based MR imaging to identify extra-sinus extension or involvement. Suspected complications are the only indication for MR imaging of the paranasal sinuses in the setting of ABRS.

References

1. Rosenfeld RM, Piccirillo JF, Chandrasekhar SS, et al. Clinical Practice Guideline (Update): Adult Sinusitis. *Otolaryngology–Head and Neck Surgery*. 2015;152(2_suppl):S1-S39. doi:10.1177/0194599815572097.
2. Desrosiers M, Evans GA, Keith PK, et al. Canadian clinical practice guidelines for acute and chronic rhinosinusitis. *Allergy, Asthma & Clinical Immunology*. 2011;7(1). doi:10.1186/1710-1492-7-2.
3. ACR Appropriateness Criteria®. Sinonasal disease. *American College of Radiology (ACR)*. Revised 2017.
4. Huntzinger A. Guidelines for the Diagnosis and Management of Rhinosinusitis in Adults. *Am Fam Physician*. 2007 Dec 1; 76(11):1718-1724.
5. ACR–ASNR–SPR PRACTICE PARAMETER FOR THE PERFORMANCE OF COMPUTED TOMOGRAPHY (CT) OF THE EXTRACRANIAL HEAD AND NECK Revised 2016 (Resolution 14). <https://www.acr.org/-/media/ACR/Files/Practice-Parameters/CT-Head-Neck.pdf>.
6. Rosenfeld RM, Piccirillo JF, Chandrasekhar SS, et al. Clinical Practice Guideline (Update): Adult Sinusitis. *Otolaryngology–Head and Neck Surgery*. 2015;152(2_suppl). doi:10.1177/0194599815572097.
7. Abdalkader M, Xie J, Cervantes-Arslanian A, Takahashi C, Mian AZ. Imaging of Intracranial Infections. *Seminars in Neurology*. 2019;39(03):322-333. doi:10.1055/s-0039-1693161.

HD-30: Temporomandibular Joint Disease (TMJ) and Dental/Periodontal/Maxillofacial Imaging

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HD-30.1: Temporomandibular Joint Disease (TMJ)

- MRI TMJ (CPT® 70336) is the diagnostic study of choice and should be reserved for those who fail a minimum of 6 weeks of non-surgical treatment and who are actively being considered for TMJ surgery
- CT Maxillofacial without contrast (CPT® 70486) or without and with contrast (CPT® 70488) may be performed when there is suspicion of bony involvement from the MRI and if primary bony pathologies are suspected clinically
- Ultrasound (CPT® 76536) can be used to look for the presence of a joint effusion and to evaluate cartilage and disk displacement with open and closed mouth imaging and to guide injections
- TMJ imaging in children with Juvenile Rheumatoid Arthritis, See **PEDHD-25: Temporomandibular Joint (TMJ) Imaging in Children** in the Pediatric Head Imaging Guidelines

HD-30.2: Dental/Periodontal/Maxillofacial Imaging

- Cone beam CT may be supported for surgical planning when plain x-rays alone are insufficient. Potential indications include but are not limited to:
 - ◆ Impacted teeth
 - ◆ Supernumerary teeth
 - ◆ Dentoalveolar trauma
 - ◆ Root resorption
 - ◆ Foreign body
 - ◆ Odontogenic cysts, tumors, or other jaw pathology
 - ◆ Cleft pathology
 - ◆ Orthognathic surgery for dentofacial anomalies
 - ◆ Osteomyelitis and odontogenic infections (X-ray not required)
 - ◆ Bisphosphonate-related osteonecrosis of the jaw (X-ray not required)
 - ◆ Salivary gland stones
 - ◆ Maxillofacial bone graft planning
 - ◆ Dental implants related to tooth loss from injury, trauma, or jaw pathology such as cysts, tumors, or cancer
- Some payors do not include orthodontic clinical conditions such as replacement of teeth lost due to caries or periodontal disease, non-trauma related dental implantology, or endodontic treatment not related to trauma to the natural tooth in their coverage policies
 - ◆ Thus, Cone beam CT scans in these individuals would also not be included in the coverage policy
 - ◆ These coverage policies will take precedence over eviCore's guidelines
- Cone Beam CT: Report with CPT® Codes: CPT® 70486, CPT® 70487, CPT® 70488, CPT® 70480, CPT® 70482
- 3-D rendering (CPT® 76376 or CPT® 76377) should NOT be reported separately
- Cone beam CT (CBCT) may also be called i-CAT scanner or mini-CAT scanner

References

1. De Vos W, Casselman J, Swennen GRJ. Cone-beam computerized tomography (CBCT) imaging of the oral and maxillofacial region: A systematic review of the literature. *International Journal of Oral and Maxillofacial Surgery*. 2009;38(6):609-625. doi:10.1016/j.ijom.2009.02.028.
2. Scrivani SJ, Keith DA, Kaban LB. Temporomandibular Disorders. *New England Journal of Medicine*. 2008;359(25):2693-2705. doi:10.1056/nejmra0802472.
3. Bag AK. Imaging of the temporomandibular joint: An update. *World Journal of Radiology*. 2014;6(8):567. doi:10.4329/wjr.v6.i8.567.
4. Horner K, O'Malley L, Taylor K, Glenney A-M. Guidelines for clinical use of CBCT: a review. *Dentomaxillofacial Radiology*. 2015;44(1):20140225. doi:10.1259/dmfr.20140225.
5. ACR–ASNR–SPR PRACTICE PARAMETER FOR THE PERFORMANCE OF COMPUTED TOMOGRAPHY (CT) OF THE EXTRACRANIAL HEAD AND NECK Revised 2016 (Resolution 14). <https://www.acr.org/-/media/ACR/Files/Practice-Parameters/CT-Head-Neck.pdf>.
6. Guidelines for Diagnosis and Management of Disorders Involving the Temporomandibular Joint and Related Musculoskeletal Structures. *Cranio®*. 2003;21(1):68-76. doi:10.1080/08869634.2003.11746234
7. Mercuri LG. Management of temporomandibular joint disorders. *Journal of Oral Biology and Craniofacial Research*. 2012;2(3):141-142. doi:10.1016/j.jobcr.2012.10.010.
8. Gauer R, Semidey M. Diagnosis and Treatment of Temporomandibular Disorders. *Am Fam Physician*. 2015 Mar 15;91(6):378-386.
9. National Academies of Sciences. Temporomandibular Disorders: Priorities for Research and Care. Priorities for Research and Care | The National Academies Press. <https://doi.org/10.17226/25652>. Published March 12, 2020.

HD-31: Tinnitus

HD-31.1: Tinnitus

- See HD-27.2: Tinnitus

HD-32: Eye Disorders and Visual Loss

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HD-32.1: Eye Disorders and Visual Loss

- For specific conditions - See Practice Notes that include table of abbreviations
- Examination of ocular complaints and visual loss can include evaluation of pupillary responses, extraocular motility, visual acuity, visual field testing, and fundoscopic exam of retinae.
- MRI Orbits without contrast (CPT® 70540) or MRI Orbits without and with contrast (CPT® 70543) or CT Orbits with contrast (CPT® 70481) or CT Orbits without contrast (CPT® 70480) and/or MRI Brain without contrast (CPT® 70551) or MRI Brain with and without contrast (CPT® 70553):
 - ◆ Optic atrophy
 - ◆ Optic neuropathy
 - ◆ Papilledema/optic disc swelling - See **HD-17.1: Papilledema/Pseudotumor Cerebri**
 - ◆ Afferent Pupillary Defect (APD)
 - ◆ Pre-chiasm symptoms/signs (including bitemporal field deficit)
- For optic disc edema/papilledema, CT Head without contrast (CPT® 70450) is helpful to assess for space-occupying processes such as intracranial hemorrhage, mass effect and hydrocephalus.
- For suspected optic neuritis, MRI is preferred modality - See **HD-16.1: Multiple Sclerosis (MS)** and **HD-16.2: Neuromyelitis Optica and NMO Spectrum Disorders**
- Homonymous defects are associated with retrochiasmal pathology - See **HD-21.1: Stroke/TIA**; or **ONC-2: Primary Central Nervous System Tumors** in the Oncology Imaging Guidelines or **ONC- 31.3: Brain Metastasis** in the Oncology Imaging Guidelines
- MRI Orbits without contrast (CPT® 70540) or MRI Orbits without and with contrast (CPT® 70543) or CT Orbits with contrast (CPT® 70481):
 - ◆ Exophthalmos (including thyroid eye disease), enophthalmos or nontraumatic orbital asymmetry
 - ◆ Suspected orbital cellulitis or atypical pre-septal cellulitis, uveitis or scleritis
 - ◆ Orbital mass or metastasis
 - ◆ Orbital inflammatory syndrome (orbital pseudotumor) and dacryocystitis or dacryoadenitis
- CT Orbit without contrast (CPT® 70480) and/or CT Head without contrast (CPT® 70450)
 - ◆ Orbital trauma with visual defect
 - ◆ Exophthalmos (including thyroid eye disease)
- When requested by the surgeon or in consultation with surgeon, imaging may be approved at contrast level requested. This includes requests from Ophthalmologists and Oculoplastic surgeons. Contrast level preference may vary per institutional protocol.

- Binocular Diplopia from Cranial Nerve Palsies or Intracranial Disease
 - ◆ MRI Brain without contrast (CPT® 70551) or MRI Brain without and with contrast (CPT® 70553):
 - Fourth Nerve Palsy
 - Sixth Nerve Palsy
 - Internuclear Ophthalmoplegia or Skew deviation
 - Third nerve palsy with pupillary involvement or suspicion of aneurysm
 - MRA Head (CPT® 70544, CPT® 70545, or CPT® 70546) or CTA Head (CPT® 70496) is indicated. (See **HD-12.1: Intracranial Aneurysms**)
- Amaurosis Fugax - See **PVD-3.1: Initial Imaging** in PVD Imaging Guidelines and **HD-21.1: Stroke/TIA**
 - ◆ Individuals describe a monocular transient darkening or loss of vision
- Central Retinal Artery Occlusion, Branch Retinal Artery Occlusion, and Ophthalmic Artery Occlusion - See **HD-21.1: Stroke/TIA**
 - ◆ Individuals describe a sudden monocular loss of vision or visual field. Etiology is usually embolic and is considered a stroke to the retina

Practice Notes

- Imaging Non-Indications
 - ◆ Imaging is not necessary if visual loss or ocular symptom/sign is due to known intrinsic eye disease, such as refractive errors, amblyopia, pterygium, subconjunctival hemorrhage, conjunctivitis, cataracts, macular degeneration, central serous retinopathy, retinal vein occlusion, retinal detachment, etc. Monocular diplopia is not an indication for imaging. Physiologic anisocoria (difference in pupil diameter between the two eyes of 2 mm or less) and surgically distorted pupils are not indications for imaging.
 - ◆ Imaging is not typically necessary in cases of ptosis without concern for Horner's or 3rd nerve palsy
- Advanced imaging of the brain and orbit are not routinely paired. Medical necessity for each region is needed to image both regions, based on suspicion of these disorders.
- Orbital imaging alone may be sufficient unless other signs or symptoms suggest brain involvement.
- Thyroid function and iodine contrast: thyroid dysfunction can occur in susceptible individuals after iodine exposure.
- Autoimmune Retinopathy
 - ◆ Suspicion for CAR (Cancer associated retinopathy) or MAR (melanoma associated retinopathy) syndromes - See **ONC-30.3: Paraneoplastic Syndromes** in the Oncology Imaging Guidelines
- Oncologic conditions
 - ◆ Retinoblastoma - See **PEDONC-12: Retinoblastoma** in the Pediatric Oncology Imaging Guidelines
 - ◆ Uveal (choroidal) melanoma - See **ONC-5.9: Ocular Melanoma** in the Oncology Imaging Guidelines
- Temporal Arteritis (Giant Cell Arteritis) - See **HD-22.1: Cerebral Vasculitis**

➤ List of Abbreviations and Meanings:

Abbreviation	Meaning
AC	Anterior chamber
APD	Afferent pupillary defect
cc	With correction (current new or old glasses or contact lenses)
C/S	Conjunctiva/sclera
CVF	Confrontation visual field (testing of gross field of view)
DFE	Dilated fundus exam
EOM	Extraocular movements
ET	Esotropia
HT	Hypertropia
I	Iris
IOP	Intraocular pressure
K	Cornea
LLL	Lids, lashes, lacrimal gland
MRx	Manifest refraction
NSC or NS	Nuclear sclerotic cataract
OD	Right eye
OS	Left eye
ortho	Eyes are aligned on the same target
OCT	Ocular Coherence Tomography
ph or PH	Pinhole (crude assessment of best-corrected visual acuity)
PVD	Posterior vitreous detachment
sc	Without correction
SLE	Slit lamp examination
Ta	Applanation tonometry (intraocular pressure measurement)
Tp	Tonopen tonometry (intraocular pressure measurement)
Va	Visual acuity
VF	Visual field testing (formal automated perimetry versus confrontation visual field testing)
XT	Exotropia

HD-32.2: Pupillary Abnormalities including Horner's Syndrome

- Anisocoria and Other Pupillary Disorders
- ◆ Physiologic anisocoria (difference in pupil diameter between the two eyes of 2 mm or less) and surgically distorted pupils are not indications for advanced imaging.
 - ◆ Dilated pupil from suspected Third nerve palsy - See Binocular Diplopia in **HD-32.1: Eye Disorders and Visual Loss**
 - ◆ Horner's Syndrome (See below)
- Horner's Syndrome (anisocoria, ptosis, and ipsilateral anhidrosis) is caused by disruption of sympathetic innervation to the eye and face. Definitive diagnosis may be established by pharmacologic testing of the pupillary response with eye drops. Evaluation and imaging depends on determining whether the cause is a central lesion (brainstem or cervical spinal cord), preganglionic lesion (spinal cord or sympathetic chain in the chest), or postganglionic lesion (neck or carotid artery).

- MRI Brain without contrast (CPT® 70551) or MRI Brain without and with contrast (CPT® 70553) for suspected intracranial or brainstem lesions
- MRI Cervical Spine without contrast (CPT® 72141) or MRI Cervical Spine without and with contrast (CPT® 72156) for suspected spinal cord abnormality
- CT Chest with contrast (CPT® 71260) for suspected chest mass
- CT Neck with contrast (CPT® 70491) for suspected neck mass
- CTA Neck without and with contrast (CPT® 70498) or MRA Neck (CPT® 70547, CPT® 70548, or CPT® 70549) for suspected carotid injury or dissection
- MRI Orbits without contrast (CPT® 70540), MRI Orbits without or with contrast (CPT® 70543) or CT Orbit with contrast (CPT® 70481) for suspected orbit lesion or mass

References

1. ACR Appropriateness Criteria® Orbits, vision and visual loss. American College of Radiology (ACR). Date of origin: 1999. Last review date: 2017.
2. Lee JH, Lee HK, Lee DH, Choi CG, Kim SJ, Suh DC. Neuroimaging Strategies for Three Types of Horner Syndrome with Emphasis on Anatomic Location. American Journal of Roentgenology. 2007;188(1):W74-W81. doi:10.2214/ajr.05.1588.
3. Szatmáry G. Imaging in Patients With Visual Symptoms. CONTINUUM: Lifelong Learning in Neurology. 2016;22(5):1499-1528. doi:10.1212/con.0000000000000375.
4. Kawasaki AK. Diagnostic Approach to Pupillary Abnormalities. CONTINUUM: Lifelong Learning in Neurology. 2014;20:1008-1022. doi:10.1212/01.con.0000453306.42981.94.
5. Prasad S. Diagnostic Neuroimaging in Neuro-ophthalmic Disorders. CONTINUUM: Lifelong Learning in Neurology. 2014;20:1023-1062. doi:10.1212/01.con.0000453305.65851.1c.
6. ACR–ASNR–SPR PRACTICE PARAMETER FOR THE PERFORMANCE OF COMPUTED TOMOGRAPHY (CT) OF THE EXTRACRANIAL HEAD AND NECK Revised 2016 (Resolution 14). <https://www.acr.org/-/media/ACR/Files/Practice-Parameters/CT-Head-Neck.pdf>.
7. 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
8. Tamhankar MA, Volpe NJ. Management of acute cranial nerve 3, 4 and 6 palsies: role of neuroimaging. Curr Opin Ophthalmol. 2015;26(6):464–468. doi:10.1097/ICU.0000000000000200
9. Tamhankar MA, Biousse V, Ying GS, et al. Isolated third, fourth, and sixth cranial nerve palsies from presumed microvascular versus other causes: a prospective study. Ophthalmology. 2013;120(11):2264–2269. doi:10.1016/j.ophtha.2013.04.009
10. Pineles SL, Velez FG. Isolated Ocular Motor Nerve Palsies. J Binocul Vis Ocul Motil. 2018;68(3):70–77. doi:10.1080/2576117X.2018.1481266
11. Flaxel CJ, Adelman RA, Bailey ST, et al. Retinal and Ophthalmic Artery Occlusions Preferred Practice Pattern®. Ophthalmology. 2020;127(2):P259–P287. doi:10.1016/j.ophtha.2019.09.028
12. Dagi LR, Velez FG, Archer SM, et al. Adult Strabismus Preferred Practice Pattern®. Ophthalmology. 2020;127(1):P182–P298. doi:10.1016/j.ophtha.2019.09.023.
13. Sadaka A, Schockman SL, Golnik KC. Evaluation of Horner Syndrome in the MRI Era. Journal of Neuro-Ophthalmology. 2017;37(3):268-272. doi:10.1097/wno.0000000000000503.
14. Glisson CC. Approach to Diplopia. CONTINUUM: Lifelong Learning in Neurology. 2019;25(5):1362-1375. doi:10.1212/con.0000000000000786
15. Gross JR, McClelland CM, Lee MS. An approach to anisocoria. Current Opinion in Ophthalmology. 2016;27(6):486-492. doi:10.1097/icu.0000000000000316
16. Costello F, Scott JN. Imaging in Neuro-ophthalmology. CONTINUUM: Lifelong Learning in Neurology. 2019;25(5):1438-1490. doi:10.1212/con.0000000000000783.

HD-33: Acoustic Neuroma and Other Cerebellopontine Angle Tumors

HD-33.1: Acoustic Neuroma and Other Cerebellopontine Angle Tumors

- Initial diagnosis is usually made during evaluation for asymmetric hearing loss and/or vertigo. See **HD-23: Dizziness, Vertigo and Syncope** and **HD-27: Hearing Loss and Tinnitus** for evaluation of those problems
- MRI Brain without and with contrast (CPT® 70553) which should be done with attention to the internal auditory canals for initial diagnosis.
- MRI Brain without contrast (CPT® 70551) may be approved if performed with FIESTA protocol
- MRI Orbits, Neck, or Face without and with contrast (CPT® 70543) may be considered with audiologic or clinical features of retrocochlear hearing loss and a negative MRI Brain and in the rare individual in whom a detailed search is indicated for both a lesion of the cerebellopontine angle **and** lesions of the cerebral hemispheres
- Repeat imaging is approvable annually for 5 years and thereafter may be performed per specialist or any provider in consultation with a specialist.
- MRI Brain without and with contrast with attention to the internal auditory canals (CPT® 70553) is performed after surgical resection and following stereotactic radiation therapy at 6 to 12 months to document the completeness of tumor removal and to serve as a baseline for further follow-up. Additional follow up is done annually for 5 years and every 2 years thereafter.
- See **ONC-2.1: Primary Central Nervous System Tumors- General Considerations** in the Oncology Imaging Guidelines for additional imaging requests for surgery

References

1. Kesavadas C, Thomas B, Kapilamoorthy T, Hingwala D, Chatterjee S. Applications of 3D CISS sequence for problem solving in neuroimaging. Indian Journal of Radiology and Imaging. 2011;21(2):90. doi:10.4103/0971-3026.82283.
2. Camelio S, Schmid UD, Horsfield MA, et al. Visualization of cranial nerves I-XII: value of 3D CISS and T2-weighted FSE sequences. European Radiology. 2000;10(7):1061-1067. doi:10.1007/s003300000452.
3. Olson JJ, Kalkanis SN, Ryken TC. Congress of Neurological Surgeons Systematic Review and Evidence-Based Guidelines on the Treatment of Adults With Vestibular Schwannomas: Executive Summary. Neurosurgery. 2017;82(2):129-134. doi:10.1093/neuros/nyx586.
4. Zou J, Hirvonen T. "Wait and scan" management of patients with vestibular schwannoma and the relevance of non-contrast MRI in the follow-up. Journal of Otology. 2017;12(4):174-184. doi:10.1016/j.joto.2017.08.002.
5. Lin EP, Crane BT. The Management and Imaging of Vestibular Schwannomas. American Journal of Neuroradiology. 2017;38(11):2034-2043. doi:10.3174/ajnr.a5213.
6. Goldbrunner R, Weller M, Regis J, et al. EANO guideline on the diagnosis and treatment of vestibular schwannoma. Neuro-Oncology. 2019;22(1):31-45. doi:10.1093/neuonc/noz153.

HD-34: Pineal/Colloid Cysts

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

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

References

1. Ajtai B, Bertelson JA. Imaging of Intracranial Cysts. CONTINUUM: Lifelong Learning in Neurology. 2016;22(5):1553-1573. doi:10.1212/con.0000000000000372.
2. Tanaka T, Arnold L, Gabriela Mazuru D, Golzy M, Carr SB, Litofsky NS. Pineal cysts: Does anyone need long-term follow up? Journal of Clinical Neuroscience. 2021;83:146-151. doi:10.1016/j.jocn.2020.10.051.
3. Jussila M-P, Olsén P, Salokorpi N, Suo-Palosaari M. Follow-up of pineal cysts in children: is it necessary? Neuroradiology. 2017;59(12):1265-1273. doi:10.1007/s00234-017-1926-8.

HD-35: Arachnoid Cysts

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

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

References

1. Ajtai B, Bertelson JA. Imaging of Intracranial Cysts. CONTINUUM: Lifelong Learning in Neurology. 2016;22(5):1553-1573. doi:10.1212/con.0000000000000372.
2. Hall S, Smedley A, Sparrow O, Mathad N, Waters R, Chakraborty A, Tsitouras V. Natural History of Intracranial Arachnoid Cysts. World Neurosurg. 2019 Jun;126:e1315-e1320. doi: 10.1016/j.wneu.2019.03.087.

HD-36: Nuclear Medicine

- Nuclear Medicine
 - ◆ Nuclear medicine studies may be used in the evaluation of some head/brain disorders, and other rare indications as well:
 - Brain Scintigraphy with or without vascular flow (any one of CPT® 78600, CPT® 78601, CPT® 78605, or CPT® 78606)
 - Establish brain death (rarely done in outpatient setting)
 - Brain Imaging Radiopharmaceutical Localization SPECT (CPT® 78803)¹
 - Immunocompromised individuals with mass lesion detected on CT or MRI for differentiation between lymphoma and infection
 - In distinguishing recurrent brain tumor from radiation necrosis
 - Can be performed with vasodilating agent acetazolamide (Diamox) to assess functional reserve capacity to predict critically reduced perfusion in individuals with chronic cerebrovascular disease (for example, in Moya-Moya disease) and identify individuals who might benefit from an extracranial-to-intracranial (EC-IC) bypass to augment Cerebral Blood Flow, and to assess preoperatively the potential for ischemia following carotid artery sacrifice.
 - Brain Imaging Vascular Flow (CPT® 78610)
 - Cerebral ischemia
 - Establish brain death
 - CSF Leakage Detection (CPT® 78650)
 - Evaluation of CSF rhinorrhea, otorrhea, or refractory post-lumbar puncture headache
 - Suspected normal pressure hydrocephalus with gait disturbance and either dementia or urinary incontinence
- Radiopharmaceutical Dacryocystography (CPT® 78660)
 - ◆ Suspected obstruction of nasolacrimal duct due to excessive tearing
- Cisternogram (CPT® 78630) can be approved for the following:
 - ◆ Known hydrocephalus with worsening symptoms
 - ◆ Suspected obstructive hydrocephalus
- Cerebrospinal Ventriculography (CPT® 78635) can be approved for the following:
 - ◆ Evaluation of internal shunt, porencephalic cyst, or posterior fossa cyst
- Nuclear Medicine Shunt Evaluation (CPT® 78645) and CSF Flow SPECT (CPT® 78803) can be approved for the following:
 - ◆ Suspected malfunction of ventriculoperitoneal, ventriculopleural, or ventriculovenous shunts.
- Imaging Radiopharmaceutical Localization SPECT with Ioflupane I-23 (CPT® 78803) can be approved for differentiation of Parkinsonian syndrome (PS) and non-neurodegenerative disorders, such as essential tremor (ET) or drug-induced tremor, due to the overlap of clinical symptoms.² DAT-SPECT has significant impact on clinical diagnosis and management of diagnostic uncertainty in cases of PS.³ See **HD-15: Movement Disorders**

References

1. Bega D, Gonzalez-Latapi P, Zadikoff C, Spies W, Simuni T. Is There a Role for DAT-SPECT Imaging in a Specialty Movement Disorders Practice? *Neurodegenerative Diseases*. 2015;15(2):81-86. doi:10.1159/000370116.
2. Vagal A, Leach J, Fernandez-Ulloa M, Zuccarello M. The Acetazolamide Challenge: Techniques and Applications in the Evaluation of Chronic Cerebral Ischemia. *American Journal of Neuroradiology*. 2009;30(5):876-884. doi:10.3174/ajnr.a1538.
3. Subramaniam RM, Frey KA, Hunt CH, et al. ACR–ACNM Practice Parameter for the Performance of Dopamine Transporter (DaT) Single Photon Emission Computed Tomography (SPECT) Imaging for Movement Disorders. *Clinical Nuclear Medicine*. 2017;42(11):847-852. doi:10.1097/rlu.0000000000001815.
4. Giacino JT, Katz DI, Schiff ND, et al. Practice guideline update recommendations summary: Disorders of consciousness. *Neurology*. 2018;91(10):450-460. doi:10.1212/wnl.0000000000005926

HD-37: Sleep-Related Requests

HD-37.1: General Guidelines Sleep-Related Requests

- Oral Appliance: There is a lack of published case-controlled clinical studies in Sleep literature validating the use of advanced imaging with respect to oral appliance therapy (pretreatment assessment). Previous literature has demonstrated support for cephalometric studies (x-ray)¹ in predicting treatment success. Nasoendoscopy (sedated and non-sedated with provocative maneuvers such as Mueller maneuver) has been helpful as well in this regard.² Routine use of advanced imaging is not supported at this time
- Hypersomnolence: MRI Brain with and without contrast (CPT® 70553) may be indicated when there are focal neurologic signs or suspicion for an inflammatory neurologic process as the etiology. Recognition and treatment of a comorbid sleep disorders is paramount, and a complete neurologic history and examination should precede any request for advanced imaging
- Central Sleep Apnea: MRI Brain with and without contrast (CPT® 70553) may be indicated for unexplained central sleep apnea syndrome when a primary CNS etiology is suspected; i.e., unassociated with CHF, COPD or other potential etiology. Specific etiologies should be stated for imaging requests, including but not limited to, suspected Chiari malformation, stroke, CNS demyelinating disease, posterior fossa lesion, anoxia or infection

References

1. Guarda-Nardini L, Manfredini D, Mion M, Heir G, Marchese-Ragona R. Anatomically Based Outcome Predictors of Treatment for Obstructive Sleep Apnea with Intraoral Splint Devices: A Systematic Review of Cephalometric Studies. *Journal of Clinical Sleep Medicine*. 2015;11(11):1327-1334. doi:10.5664/jcsm.5198.
2. Sutherland K, Vanderveken OM, Tsuda H, et al. Oral Appliance Treatment for Obstructive Sleep Apnea: An Update. *Journal of Clinical Sleep Medicine*. Published online February 15, 2014. doi:10.5664/jcsm.3460.
3. Chervin RD. Use of clinical tools and tests in sleep medicine. In: *Principles and Practice of Sleep Medicine*. Kryger MH, Roth T, Dement WC. (eds). Elsevier Saunders: St Louis 2011. p.666.
4. Deak MC, Kirsch DB. Sleep-Disordered Breathing in Neurologic Conditions. *Clinics in Chest Medicine*. 2014;35(3):547-556. doi:10.1016/j.ccm.2014.06.009.