| National Imaging Associates, Inc.* | |
|---|---|
| **Clinical guidelines**<br>**BRAIN (HEAD) CTA** | **Original Date: September 1997** |
| **CPT Codes: 70496** | **Last Revised Date: ~~February~~ April 2021** |
| **Guideline Number: NIA_CG_004-1** | **Implementation Date: January 2022** |

**INDICATIONS FOR BRAIN CTA**

**Brain CT/CTA are not approvable simultaneously unless they meet the criteria described below in the Indications for Brain CT/Brain CTA combination studies section.**

Patients with claustrophobia, limited ability to cooperate, or an implanted device may be better suited for CTA~~,~~; whereas those **with** renal disease or iodine contrast allergy should have MRA (Chen, 2018).

**For evaluation of suspected intracranial vascular disease**
(~~ACR, 2017, 2019~~**Robertson, 2020; Salmela, 2017**)

Aneurysm screening

- Screening for suspected intracranial aneurysm in patient ~~whose~~ **with first-degree family history** (parent, brother, sister, or child) ~~has history~~ of intracranial aneurysm~~.~~
  **Note**: ~~If there is a first-degree familial history,~~ R~~r~~epeat study is recommended every 5 years (Chalouhi, 2011)~~.~~

- Screening for aneurysm in polycystic kidney disease (after age 30), Loeys-Dietz syndrome‡*, fibromuscular dysplasia, spontaneous coronary arteries dissection (SCAD), or known aortic coarctation (Hayes, 2018; Hitchcock, 2016~~; Macaya, 2019~~)~~.~~
  ‡*~~For~~ **For Loeys-Dietz imaging should be repeated at least every two years**

Vascular abnormalities

- Suspected vascular malformation (arteriovenous malformation (AVM) or dural arteriovenous fistula) in patient with previous or indeterminate imaging study~~.~~
- Thunderclap headache with continued concern for underlying vascular abnormality after initial negative work-up (Whitehead, 2019, Yeh, 2010, Yuan, 2018)~~.~~
  - ~~o~~ Negative Brain CT; AND

* National Imaging Associates, Inc. (NIA) is a subsidiary of Magellan Healthcare, Inc.

- Negative Lumbar Puncture; OR
- Negative Brain MRI

- Headache associated with exercise or sexual activity (ICHD-3, 2018)
- Isolated third nerve palsy (oculomotor) with pupil involvement to evaluate for aneurysm (Pula, 2016).
- Pulsatile tinnitus to identify a vascular etiology (Hofmann, 2013; Pegge, 2017).

Note: MRI is the study of choice for detecting cavernomas (Morrison, 2016; Zyck, 2021)

Cerebrovascular Disease

***Ischemic***

- Recent ischemic stroke or transient ischemic attack (See Background section) (Sanelli, 2014; Wintermark, 2013).
- Known or suspected vertebrobasilar insufficiency (VBI) in patients with symptoms such as dizziness, vertigo, headaches, diplopia, blindness, vomiting, ataxia, and weakness in both sides of the body, or abnormal speech (Lima-Neto 2017; Searls, 2012).

***Hemorrhagic***

- Known subarachnoid hemorrhage (SAH) (Colen, 2007).
- Known cerebral intraparenchymal hemorrhage with concern for underlying vascular abnormality

***Venous and MRV is contraindicated or cannot be performed-*** *CTV*** (Walecki, 2015).

- Suspected venous thrombosis (dural sinus thrombosis) (Ferro, 2017; GustavoSaposnik, 2011)
- Distinguishing benign intracranial hypertension (pseudotumor cerebri) from dural sinus thrombosis (Agarwal, 2010; Higgins 2005).

***Sickle cells disease (ischemic and/or hemorrhagic) and MRV is contraindicated or cannot be performed***

(Abboud, 2003; Thust, 2014)

- Neurological signs or symptoms in sickle cell disease
- Stroke risk in sickle cell patients (2 - 16 years of age) with a transcranial doppler velocity > 200.

**Vasculitis with initial laboratory workup (such as ESR, CRP, plasma viscosityserology)** (Berlit, 2014)

- Suspected secondary CNS vasculitis based on neurological signs or symptoms in the setting of an underlying systemic disease with abnormal inflammatory markers or autoimmune antibodies
- Suspected primary CNS vasculitis based on neurological signs and symptoms with completed infectious/inflammatory lab work-up (Godasi, 2019; Zuccoli, 2011).

**Other intracranial vascular disease**

- Suspected Moyomoya disease (Ancelet, 2015; Tarasow, 2011).
- Suspected reversible cerebral vasoconstriction syndrome (Singhal, 2016).
- 
- Giant cell arteritis with suspected intracranial involvement (Conway, 2018)

**For evaluation of known intracranial vascular disease**

(Robertson, 2020; Salmela, 2017)

(ACR, 2017, 2019)

- Known intracranial aneurysm or vascular malformation (i.e., AVM or dural arteriovenous fistula)
- Vascular abnormality visualized on previous brain imaging that is equivocal or needs further evaluation
- Known vertebrobasilar insufficiency with new or worsening signs or symptoms (VBI) (Lima-Neto, 2017; Searls, 2012).
- Known vasculitis, reversible cerebral vasoconstriction syndrome or Moyomoya disease (Ancelet, 2015; Godasi, 2019; Signhal, 2016; Tarasow, 2011).

**Pre-operative/procedural evaluation for ~~treatment, procedure, intervention, or~~ brain/skull surgery**

- Pre-operative evaluation for a planned surgery or procedure (Farsad, 2009).
- Pre-operative evaluation for a planned surgery or procedure if the imaging provides diagnostic information that is not available on prior studies (provider should be referred to the health plan for nondiagnostic surgical planning studies)
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**Post-operative/procedural evaluation**

(Sanelli, 2004; Wallace, 2007):

- A follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested.

**Indications for Brain CTA/Neck CTA combination studies**

- Recent ischemic stroke or transient ischemic attack (Sanelli, 2014).
- Known or suspected vertebrobasilar insufficiency (VBI) in patients with symptoms such as dizziness, vertigo, headaches, diplopia, blindness, vomiting, ataxia, and weakness in both sides of the body, or abnormal speech (Lima-Neto, 2017; Searls, 2012).
- Suspected carotid or vertebral artery dissection; due to trauma or spontaneous due to weakness of vessel wall leading to dissection (Franz, 2012; Shakir, 2016).
- Asymptomatic patients with an abnormal ultrasound of the neck or carotid duplex imaging (e.g., carotid stenosis ≥ 70%, technically limited study, aberrant direction of flow in the carotid or vertebral arteries) and patient is surgery or angioplasty candidate (Brott, 2011; DaCosta, 2019; Marquardt, 2010)

- Symptomatic patients with an abnormal ultrasound of the neck or carotid duplex imaging (e.g., carotid stenosis ≥ 50%, technically limited study, aberrant direction of flow in the carotid or vertebral arteries) and patient is surgery or angioplasty candidate (AAN, 2010; Brott, 2011; Rerkasem, 2011)
- Pulsatile tinnitus to identify vascular etiology (Hofmann, 2013; Pegge, 2017)~~.~~

**Indications for Brain CT/Brain CTA combination studies**
**(Robertson, 2020; Salmela, 2017)**
~~(ACR, 2017, 2019)~~

- Recent ischemic stroke or transient ischemic attack
- Acute, sudden onset of headache with personal history of a vascular abnormality or first-degree family history of aneurysm
- **Headache associated with exercise or sexual activity when MRI is contraindicated or cannot be performed ~~-~~(ICHD-3, 2018)**
- Suspected venous thrombosis (dural sinus thrombosis) – CTV and MRI ~~is~~ **are** contraindicated or cannot be performed

**Indications for Brain CT/Brain CTA/Neck CTA combination studies**

- Recent ischemic stroke or transient ischemic attack (TIA) **(Robertson, 2020; Salmela, 2017)**~~(ACR, 2017, 2019)~~
- Approved indications as noted above and being performed in ~~high risk~~**high-risk** populations (in whom MRI is contraindicated or cannot be performed) and will need anesthesia for the procedure and there is a suspicion of concurrent intracranial pathology

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**BACKGROUND**

Computed tomography angiography (CTA) is recognized as a valuable diagnostic tool for the management of patients with cerebrovascular disease. With its three-dimensional reconstructions, CTA can simultaneously demonstrate the bony skull base and its related vasculature. CTA use of ionizing radiation and an iodine-based intravascular contrast medium is a disadvantage when compared to magnetic resonance angiography (MRA), but it is quicker and requires less patient cooperation than MRA. CTA is much less invasive than catheter angiography which involves injecting contrast material into an artery.

**CTA for Evaluation of Aneurysm –** CTA is useful in the detection of cerebral aneurysms. The sensitivity of CTA to detect cerebral aneurysms ≤ 5 mm is higher than that with digital subtraction angiography (DSA). Most aneurysms missed with CTA are≤ 3mm. Aneurysms in the region of the anterior clinoid process may extend into the subarachnoid space where they carry the threat of hemorrhage. CTA can help delineate the borders of the aneurysm in relation to the subarachnoid space and may help detect acute ruptured aneurysms. It may be used in the selection of patients for surgical or endovascular treatment of ruptured intracranial aneurysms.

**CTA for Screening of Patients with first-degree relative (parent, brother, sister or child) who have a history of aneurysm –** Data has suggested that individuals with a parent, brother, sister, or child harboring an intracranial aneurysm are at increased risk of aneurysms. It is likely that multiple genetic and environmental risk factors contribute to the increased risk.

**CTA for evaluation of Arteriovenous Malformation (AVM)** – A good correlation has been found between catheter angiography and CTA in the detection of arteriovenous malformations. CTA allows calculation of the volume of an AVM nidus and identifies and quantifies embolic material within it. CTA may be used for characterization and stereotactic localization before surgical resection or radiosurgical treatment of arteriovenous malformations.

**CTA and non-aneurysmal vascular malformations** Non-aneurysmal vascular malformations can be divided in low flow vascular malformations and high flow vascular malformations. Low flow vascular malformations include dural venous anomalies (DVA), cavernomas and capillary telangiectasias. High flow vascular malformations include AVM and dural arteriovenous fistulas (dAVF). For low flow malformations, MRI is the study of choice. There is limited medical literature to support vascular imagining (CTA or MRA). CTA plays a limited role in the assessment of cavernoma but may be used to demonstrate a DVA. MRA is not usually helpful in the assessment of cavernoma, capillary telangiectasia, and DVA. Vascular imaging is indicated in high flow vascular malformations (ACR, 2017, 2019; Lee, 2012; **Robertson, 2020; Salmela, 2017)**).

**CTA and recent stroke or transient ischemic attack** A stroke or central nervous system infarction is defined as "brain, spinal cord, or retinal cell death attributable to ischemia, based on neuropathological, neuroimaging, and/or clinical evidence of permanent injury. … Ischemic stroke specifically refers to central nervous system infarction accompanied by overt symptoms, whereas silent infarction causes no known symptoms" (Sacco, 2013). If imaging or pathology is not available, a clinical stroke is diagnosed by symptoms persisting for more than 24 hours. Ischemic stroke can be further classified by the type and location of ischemia and the presumed etiology of the brain injury. These include large-artery atherosclerotic occlusion (extracranial or intracranial), cardiac embolism, small-vessel disease and less commonly dissection, hypercoagulable states, sickle cell disease and undetermined causes (Kernan, 2014). TIAs in contrast, "are a brief episode of neurological dysfunction caused by focal brain or retinal ischemia, with clinical symptoms typically lasting less than one hour, and without evidence of acute infarction on imaging" (Easton, 2009). On average, the annual risk of future ischemic stroke after a TIA or initial ischemic stroke is 3–4%, with an incidence as high as 11% over the next 7 days and 24–29% over the following 5 years. This has significantly decreased in the last half century due to advances in secondary prevention (Hong, 2011).

When revascularization therapy is not indicated or available in patients with an ischemic stroke or TIA, the focus of the work-up is on secondary prevention. This includes noninvasive vascular imaging to identify the underlying etiology, assess immediate complications and risk of future stroke. The majority of stroke evaluations take place in the inpatient setting. Admitting TIA patients is reasonable if they present within 72 hours and have an ABCD (2) score ≥ 3, indicating

high risk of early recurrence, or the evaluation cannot be rapidly completed on an outpatient basis ((Easton, 2009). Minimally, both stroke and TIA should have an evaluation for high-risk modifiable factors such as carotid stenosis atrial fibrillation as the cause of ischemic symptoms (Kernan, 2014). Diagnostic recommendations include neuroimaging evaluation as soon as possible, preferably with magnetic resonance imaging, including DWI; noninvasive imaging of the extracranial vessels should be performed, and noninvasive imaging of intracranial vessels is reasonable (Wintermark, 2013).

Patients with a history of stroke and recent work-up with new signs or symptoms indicating progression or complications of the initial CVA should have repeat brain imaging as an initial study. Patients with remote or silent strokes discovered on imaging should be evaluated for high-risk modifiable risk factors based on the location and type of the presumed etiology of the brain injury.

**CTA for Evaluation of Vertebrobasilar Insufficiency (VBI) –** Multidetector CT angiography (MDCTA) may be used in the evaluation of vertebral artery pathologies. The correlation between MDCTA and color Doppler sonography is moderate. CTA is used for minimally invasive follow-up after intracranial stenting for VBI. It enables visualization of the patency of the stent lumen and provides additional information about all brain arteries and the brain parenchyma.

**CTA and Intracerebral Hemorrhage –** CTA is useful as a screening tool for an underlying vascular abnormality in the evaluation of spontaneous intracerebral hemorrhage (ICH). Etiologies of spontaneous ICH include tumor, vascular malformation, aneurysm, hypertensive arteriopathy, cerebral amyloid angiopathy, venous thrombosis, vasculitis, RCVS, drug-induced vasospasm, venous sinus thrombosis, Moyomoya disease, anticoagulant use and hemorrhagic transformation of an ischemic infarct. History can help point to a specific etiology. Possible risk factors for the presence of underlying vascular abnormalities include age younger than 65, female, lobar or intraventricular location, and the absence of hypertension or impaired coagulation (Delgado, 2009).

**CTV and Central Venous Thrombosis**** – a CT Venogram is indicated for the evaluation of a central venous thrombosis/dural sinus thrombosis. The most frequent presentations are isolated headache, intracranial hypertension syndrome, seizures, focal neurological deficits, and encephalopathy. Risk factors are hypercoagulable states inducing genetic prothrombotic conditions, antiphospholipid syndrome and other acquired prothrombotic diseases, such as cancer, oral contraceptives, pregnancy, puerperium (6 weeks postpartum), infections, and trauma. Since venous thrombosis can cause SAH, infarctions, and hemorrhage, parenchymal imaging with MRI/CT is also appropriate (Bushnell, 2014; Courinho, 2015; Ferro, 2016; Walecki, 2015).

**MRA and dissection**- Craniocervical dissections can be spontaneous or traumatic. Patients with blunt head or neck trauma who meet Denver Screening criteria should be assessed for cerebrovascular injury (although about 20% will not meet criteria). The criteria include: focal or

lateralizing neurological deficits (not explained by head CT), infarct on head CT, face, basilar skull, or cervical spine fractures, cervical hematomas that are not expanding, glasgow coma score less than 8 without CT findings, massive epistaxis, cervical bruit or thrill (Franz, 2012; Liang, 2013; Mundinger, 2013; Simon, 2019). Spontaneous dissection presents with headache, neck pain with neurological signs or symptoms. There is often minor trauma or precipitating factor (i.e., exercise, neck manipulation). Dissection is thought to occur due to weakness of the vessel wall, and there may be an underlying connective tissue disorder. Dissection of the extracranial vessels can extend intracranially and/or lead to thrombus which can migrate into the intracranial circulation causing ischemia. Therefore, MRA of the head and neck is warranted (Nash, 2019; Shakir, 2016).

**POLICY HISTORY**

| Date | Summary |
|---|---|
| ~~February~~ ~~April~~June 2021 | • Updated references<br>• Reformatted and reordered indications<br>Added:<br>• ~~•~~ Brain CT/CTA are not approvable simultaneously unless they meet the criteria described below in the Indications for Brain CT/Brain CTA combination studies section<br>• ~~•~~ Headache associated with exercise or sexual activity (also in combo section if MRI contraindicated)<br>• ~~•~~ Note: MRI is the study of choice for detecting cavernomas<br>• ~~•~~ Giant cell arteritis with suspected intracranial involvement<br>• ~~•~~ Pre-operative evaluation for a planned surgery or procedure ~~if the imaging provides diagnostic information that is not available on prior studies (provider should be referred to the health plan for nondiagnostic surgical planning studies)~~<br>•<br>Clarified:<br>• *For Loeys-Dietz imaging should be repeated at least every two years<br>• Known vertebrobasilar insufficiency with new or worsening signs or symptoms<br>• Vasculitis with initial laboratory workup (such as ESR, CRP, serology) |
| May 2020 | • Updated background information references<br>• Reordered and categorized indications and background information |

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| | **Clarified:**<br>• Screening for aneurysm: polycystic kidney disease (after age 30)<br>• Suspected or known dural arteriovenous fistula as an example of a vascular malformation<br>• Recent ischemic stroke or transient ischemic attack (also in all combo sections)<br>• Cerebral intraparenchymal hemorrhage<br>• Suspected secondary CNS vasculitis based on neurological sign or symptoms in the setting of an underlying systemic disease<br>• Suspected primary CNS vasculitis based on neurological signs and symptoms<br>• Vascular abnormality visualized on previous brain imaging that is equivocal or needs further evaluation<br>• Reworded- Suspected carotid or vertebral artery dissection; due to trauma or spontaneous due to weakness of vessel wall leading to dissection – in the combo Neck/Brain CTA section<br>• Approved indications as noted above and being performed in high risk populations (in whom MRI is contraindicated or cannot be performed) and will need anesthesia for the procedure and there is a suspicion of concurrent intracranial pathology<br>**Added:**<br>• Patients with claustrophobia, limited ability to cooperate or an implanted device may be better suited for CTA, whereas those renal disease or iodine contrast allergy should have MRA<br>• Screening for aneurysm: Loeys-Dietz syndrome<br>• Thunderclap headache with continued concern for underlying vascular abnormality after initial negative work-up<br>○ Negative Brain CT; AND<br>○ Negative Lumbar Puncture; OR<br>○ Negative Brain MRI<br>• Isolated third nerve palsy (oculomotor) with pupil involvement to evaluate for aneurysm<br>• Vasculitis with initial laboratory workup (such as ESR, CRP, plasma viscosity)<br>• For venous studies that MRV is contraindicated or cannot be performed- CTV |

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| | • Acute, sudden onset of headache with personal history of a vascular abnormality or first-degree family history of aneurysm – in combo Brain CT/CTA section<br>Deleted<br>• Screening for aneurysm: Ehlers-Danlos syndrome, neurofibromatosis<br>• Clinical suspicion of subarachnoid hemorrhage (SAH) (i.e., thunderclap headache)<br>• Known or suspected carotid or cerebral artery occlusion in patients with a sudden onset of one-sided weakness or numbness, abnormal speech, vision defects, incoordination or severe dizziness - in the combo Neck/Brain CTA section<br>• Clinical suspicion of subarachnoid hemorrhage (SAH) (i.e., thunderclap headache) in the combo Brain CT/CTA section |
| August 2019 | • Reversible cerebral vasoconstriction syndrome or Moyomoya disease<br>• Clinical suspicion of subarachnoid hemorrhage (SAH) (i.e., thunderclap headache)<br>• Spontaneous intracerebral hemorrhage with concern for underlying vascular abnormality<br>• Suspected primary CNS vasculitis with infectious/inflammatory lab work-up, reversible cerebral vasoconstriction syndrome or Moyomoya disease<br>• Stroke risk in sickle cell patients (2 - 16 years of age) with a transcranial doppler velocity >200.<br>• Neurological signs or symptoms in sickle cell disease<br>• Further clarified:<br>○ Suspected vertebrobasilar insufficiency (VBI) symptoms<br>○ CTV for suspected central venous thrombosis<br>• For Brain CTA/Neck CTA combination studies:<br>○ Removed the past two-week restriction from 'recent stroke or TIA'<br>○ Clarified CVA symptoms to include - known or suspected carotid or cerebral artery occlusion with sudden onset of numbness or incoordination<br>○ Added spontaneous injuries due to weakness of vessel wall leading to dissection<br>○ Added Asymptomatic patients with an abnormal ultrasound of the neck or carotid duplex imaging (e.g. carotid stenosis ≥ 70%, technically limited study, |

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| | aberrant direction of flow in the carotid or vertebral arteries) and patient is surgery or angioplasty candidate<br>○ Added Symptomatic patients with an abnormal ultrasound of the neck or carotid duplex imaging (e.g. carotid stenosis ≥ 50%, technically limited study, aberrant direction of flow in the carotid or vertebral arteries) and patient is surgery or angioplasty candidate<br>• Added section for Brain CT/Brain CTA combination studies, including:<br>○ Clinical suspicion of subarachnoid hemorrhage (SAH) ie thunderclap headache<br>○ Suspected venous thrombosis (dural sinus thrombosis)<br>• Added section for Brain CT/Brain CTA/Neck CTA combination studies, including:<br>○ Recent stroke or transient ischemic attack (TIA)<br>○ Approved indications as noted above and being performed in a child under 8 years of age who will need anesthesia for the procedure and there is a suspicion of concurrent intracranial pathology<br>• Updated background info and refs |

~~August 2019~~
~~Added:~~

- ~~Reversible cerebral vasoconstriction syndrome or Moyomoya disease~~
- ~~Clinical suspicion of subarachnoid hemorrhage (SAH) (i.e., thunderclap headache)~~
- ~~Spontaneous intracerebral hemorrhage with concern for underlying vascular abnormality~~
- ~~Suspected primary CNS vasculitis with infectious/inflammatory lab work-up, reversible cerebral vasoconstriction syndrome or Moyomoya disease~~
- ~~Stroke risk in sickle cell patients (2 - 16 years of age) with a transcranial doppler velocity >200.~~
- ~~Neurological signs or symptoms in sickle cell disease~~
- ~~Further clarified:~~
  - ~~Suspected vertebrobasilar insufficiency (VBI) symptoms~~
  - ~~CTV for suspected central venous thrombosis~~
- ~~For Brain CTA/Neck CTA combination studies:~~
  - ~~Removed the past two-week restriction from 'recent stroke or TIA'~~
  - ~~Clarified CVA symptoms to include - known or suspected carotid or cerebral artery occlusion with sudden onset of numbness or incoordination~~
  - ~~Added spontaneous injuries due to weakness of vessel wall leading to dissection~~

- Added Asymptomatic patients with an abnormal ultrasound of the neck or carotid duplex imaging (e.g. carotid stenosis ≥ 70%, technically limited study, aberrant direction of flow in the carotid or vertebral arteries) and patient is surgery or angioplasty candidate
- Added Symptomatic patients with an abnormal ultrasound of the neck or carotid duplex imaging (e.g. carotid stenosis ≥ 50%, technically limited study, aberrant direction of flow in the carotid or vertebral arteries) and patient is surgery or angioplasty candidate

- Added section for Brain CT/Brain CTA combination studies, including:
  - Clinical suspicion of subarachnoid hemorrhage (SAH) ie thunderclap headache
  - Suspected venous thrombosis (dural sinus thrombosis)
- Added section for Brain CT/Brain CTA/Neck CTA combination studies, including:
  - Recent stroke or transient ischemic attack (TIA)
  - Approved indications as noted above and being performed in a child under 8 years of age who will need anesthesia for the procedure and there is a suspicion of concurrent intracranial pathology
- Updated background info and refs

May 2020

- Updated background information references
- Reordered and categorized indications and background information

Clarified:

- Screening for aneurysm: polycystic kidney disease (after age 30)
- Suspected or known dural arteriovenous fistula as an example of a vascular malformation
- Recent ischemic stroke or transient ischemic attack (also in all combo sections)
- Cerebral intraparenchymal hemorrhage
- Suspected secondary CNS vasculitis based on neurological sign or symptoms in the setting of an underlying systemic disease
- Suspected primary CNS vasculitis based on neurological signs and symptoms
- Vascular abnormality visualized on previous brain imaging that is equivocal or needs further evaluation
- Reworded- Suspected carotid or vertebral artery dissection; due to trauma or spontaneous due to weakness of vessel wall leading to dissection – in the combo Neck/Brain CTA section
- Approved indications as noted above and being performed in high risk populations (in whom MRI is contraindicated or cannot be performed) and will need anesthesia for the procedure and there is a suspicion of concurrent intracranial pathology

Added:

- ~~Patients with claustrophobia, limited ability to cooperate or an implanted device may be better suited for CTA, whereas those renal disease or iodine contrast allergy should have MRA~~
- ~~Screening for aneurysm: Loeys-Dietz syndrome~~
- ~~Thunderclap headache with continued concern for underlying vascular abnormality after initial negative work-up~~
    - ~~Negative Brain CT; AND~~
    - ~~Negative Lumbar Puncture; OR~~
    - ~~Negative Brain MRI~~
- ~~Isolated third nerve palsy (oculomotor) with pupil involvement to evaluate for aneurysm~~
- ~~Vasculitis with initial laboratory workup (such as ESR, CRP, plasma viscosity)~~
- ~~For venous studies that MRV is contraindicated or cannot be performed- CTV~~
- ~~Acute, sudden onset of headache with personal history of a vascular abnormality or first-degree family history of aneurysm – in combo Brain CT/CTA section~~

~~Deleted~~

- ~~Screening for aneurysm: Ehlers-Danlos syndrome, neurofibromatosis~~
- ~~Clinical suspicion of subarachnoid hemorrhage (SAH) (i.e., thunderclap headache)~~
- ~~Known or suspected carotid or cerebral artery occlusion in patients with a sudden onset of one-sided weakness or numbness, abnormal speech, vision defects, incoordination or severe dizziness - in the combo Neck/Brain CTA section~~
- ~~Clinical suspicion of subarachnoid hemorrhage (SAH) (i.e., thunderclap headache) in the combo Brain CT/CTA section~~

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## GENERAL INFORMATION

**It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.**

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