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Clinical Appropriateness Guidelines

Advanced Imaging

Appropriate Use Criteria:

Advanced Imaging for Vascular Indications

Proprietary

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Table of Contents

Table of Contents	2
Description and Application of the Guidelines	3
General Clinical Guideline	4
Clinical Appropriateness Framework	4
Simultaneous Ordering of Multiple Diagnostic or Therapeutic Interventions	4
Repeat Diagnostic Intervention	4
Repeat Therapeutic Intervention	5
Advanced Imaging for Vascular Indications	6
General Information/Overview	6
Clinical Indications	7
General Vascular	7
Procedure-related Imaging	8
Brain, Head and Neck	8
Chest	15
Abdomen and Pelvis	19
Upper Extremity	24
Lower Extremity	25
MR Angiography of the Spinal Canal	27
References	27
Codes	32
History	34

Description and Application of the Guidelines

The Carelon Clinical Appropriateness Guidelines (hereinafter “the Carelon Clinical Appropriateness Guidelines” or the “Guidelines”) are designed to assist providers in making the most appropriate treatment decision for a specific clinical condition for an individual. The Guidelines establish objective and evidence-based criteria for medical necessity determinations, where possible, that can be used in support of the following:

- To establish criteria for when services are medically necessary
- To assist the practitioner as an educational tool
- To encourage standardization of medical practice patterns
- To curtail the performance of inappropriate and/or duplicate services
- To address patient safety concerns
- To enhance the quality of health care
- To promote the most efficient and cost-effective use of services

The Carelon guideline development process complies with applicable accreditation and legal standards, including the requirement that the Guidelines be developed with involvement from appropriate providers with current clinical expertise relevant to the Guidelines under review and be based on the most up-to-date clinical principles and best practices. Resources reviewed include widely used treatment guidelines, randomized controlled trials or prospective cohort studies, and large systematic reviews or meta-analyses. Carelon reviews all of its Guidelines at least annually.

Carelon makes its Guidelines publicly available on its website. Copies of the Guidelines are also available upon oral or written request. Additional details, such as summaries of evidence, a list of the sources of evidence, and an explanation of the rationale that supports the adoption of the Guidelines, are included in each guideline document.

Although the Guidelines are publicly available, Carelon considers the Guidelines to be important, proprietary information of Carelon, which cannot be sold, assigned, leased, licensed, reproduced or distributed without the written consent of Carelon. Use of the Guidelines by any external AI entity without the express written permission of Carelon is prohibited.

Carelon applies objective and evidence-based criteria, and takes individual circumstances and the local delivery system into account when determining the medical appropriateness of health care services. The Carelon Guidelines are just guidelines for the provision of specialty health services. These criteria are designed to guide both providers and reviewers to the most appropriate services based on a patient’s unique circumstances. In all cases, clinical judgment consistent with the standards of good medical practice should be used when applying the Guidelines. Guideline determinations are made based on the information provided at the time of the request. It is expected that medical necessity decisions may change as new information is provided or based on unique aspects of the patient’s condition. The treating clinician has final authority and responsibility for treatment decisions regarding the care of the patient and for justifying and demonstrating the existence of medical necessity for the requested service. The Guidelines are not a substitute for the experience and judgment of a physician or other health care professionals. Any clinician seeking to apply or consult the Guidelines is expected to use independent medical judgment in the context of individual clinical circumstances to determine any patient’s care or treatment.

The Guidelines do not address coverage, benefit or other plan specific issues. Applicable federal and state coverage mandates take precedence over these clinical guidelines, and in the case of reviews for Medicare Advantage Plans, the Guidelines are only applied where there are not fully established CMS criteria. If requested by a health plan, Carelon will review requests based on health plan medical policy/guidelines in lieu of the Carelon Guidelines. Pharmaceuticals, radiotracers, or medical devices used in any of the diagnostic or therapeutic interventions listed in the Guidelines must be FDA approved or conditionally approved for the intended use. However, use of an FDA-approved or conditionally approved product does not constitute medical necessity or guarantee reimbursement by the respective health plan.

The Guidelines may also be used by the health plan or by Carelon for purposes of provider education, or to review the medical necessity of services by any provider who has been notified of the need for medical necessity review, due to billing practices or claims that are not consistent with other providers in terms of frequency or some other manner.

General Clinical Guideline

Clinical Appropriateness Framework

Critical to any finding of clinical appropriateness under the guidelines for a specific diagnostic or therapeutic intervention are the following elements:

- Prior to any intervention, it is essential that the clinician confirm the diagnosis or establish its pretest likelihood based on a complete evaluation of the patient. This includes a history and physical examination and, where applicable, a review of relevant laboratory studies, diagnostic testing, and response to prior therapeutic intervention.
- The anticipated benefit of the recommended intervention is likely to outweigh any potential harms, including from delay or decreased access to services that may result (net benefit).
- Widely used treatment guidelines and/or current clinical literature and/or standards of medical practice should support that the recommended intervention offers the greatest net benefit among competing alternatives.
- There exists a reasonable likelihood that the intervention will change management and/or lead to an improved outcome for the patient.

Providers may be required to submit clinical documentation in support of a request for services. Such documentation must a) accurately reflect the clinical situation at the time of the requested service, and b) sufficiently document the ordering provider's clinical intent.

If these elements are not established with respect to a given request, the determination of appropriateness will most likely require a peer-to-peer conversation to understand the individual and unique facts that would justify a finding of clinical appropriateness. During the peer-to-peer conversation, factors such as patient acuity and setting of service may also be taken into account to the extent permitted by law.

Simultaneous Ordering of Multiple Diagnostic or Therapeutic Interventions

Requests for multiple diagnostic or therapeutic interventions at the same time will often require a peer-to-peer conversation to understand the individual circumstances that support the medical necessity of performing all interventions simultaneously. This is based on the fact that appropriateness of additional intervention is often dependent on the outcome of the initial intervention.

Additionally, either of the following may apply:

- Current literature and/or standards of medical practice support that one of the requested diagnostic or therapeutic interventions is more appropriate in the clinical situation presented; or
- One of the diagnostic or therapeutic interventions requested is more likely to improve patient outcomes based on current literature and/or standards of medical practice.

Repeat Diagnostic Intervention

In general, repeated testing of the same anatomic location for the same indication should be limited to evaluation following an intervention, or when there is a change in clinical status such that additional testing is required to determine next steps in management. At times, it may be necessary to repeat a test using different techniques or protocols to clarify a finding or result of the original study.

Repeated testing for the same indication using the same or similar technology may be subject to additional review or require peer-to-peer conversation in the following scenarios:

- Repeated diagnostic testing at the same facility due to technical issues
- Repeated diagnostic testing requested at a different facility due to provider preference or quality concerns

- Repeated diagnostic testing of the same anatomic area based on persistent symptoms with no clinical change, treatment, or intervention since the previous study
- Repeated diagnostic testing of the same anatomic area by different providers for the same member over a short period of time

Repeat Therapeutic Intervention

In general, repeated therapeutic intervention in the same anatomic area is considered appropriate when the prior intervention proved effective or beneficial and the expected duration of relief has lapsed. A repeat intervention requested prior to the expected duration of relief is not appropriate unless it can be confirmed that the prior intervention was never administered. Requests for ongoing services may depend on completion of previously authorized services in situations where a patient's response to authorized services is relevant to a determination of clinical appropriateness.

Advanced Imaging for Vascular Indications

General Information/Overview

Scope

These guidelines address vascular imaging (advanced imaging) in both adult and pediatric populations. For interpretation of the Guidelines, and where not otherwise noted, “adult” refers to persons aged 19 and older, and “pediatric” refers to persons aged 18 and younger. Where separate indications exist, they are specified as **Adult** or **Pediatric**. Where not specified, indications and prerequisite information apply to persons of all ages.

See the Coding section for a list of modalities included in these guidelines.

Technology Considerations

Advanced imaging is an umbrella term that refers to anatomy-based (structural), physiology-based (functional), and hybrid imaging methods that offer greater spatial and/or contrast resolution relative to conventional imaging methods in radiology such as radiography or ultrasound. Examples of advanced structural imaging include computed tomography (CT) and magnetic resonance imaging (MRI) and some technique variants. Advanced vascular imaging generally refers to CT or MR angiography, but may also include other modalities such as CT, MRI, and PET when done for vascular indications.

Computed tomography angiography (CTA) and **magnetic resonance angiography (MRA)** scans both provide high contrast and can yield a 3D map of vasculature, making them useful for imaging prior to intervention. CTA acquires images during the arterial phase of contrast to provide direct visualization of arterial blood flow and anatomy. MRA can be performed without contrast using time of flight techniques measuring flow related enhancement or with gadolinium contrast. Depending on the clinical scenario, MRA and CTA are alternatives to or add on tests following duplex ultrasound and may have comparable or greater diagnostic accuracy. CTA offers faster image acquisition and is less susceptible than MRA to respiration or motion artifact. CTA is reliable for vascular lesion localization and stenosis grading. Disadvantages of CTA include exposure to ionizing radiation and risks associated with infusion of iodinated contrast media, including allergic reactions or renal compromise. The presence of implantable devices such as pacemakers or defibrillators, a potential need for sedation in pediatric patients, and claustrophobia are the main limitations of MRA. Infusion of gadolinium may also confer an unacceptable risk in persons with advanced renal disease.

Computed tomography venography (CTV) and **magnetic resonance venography (MRV)** are similar to CTA and MRA but involve different timing of contrast administration (in the venous phase) and/or different MR pulse sequences to optimize visualization of the venous system. Since CTV and MRV are respectively part of the same current procedural terminology (CPT) as CTA and MRA CPT series and since Carelon does not manage advanced imaging technique variants, these terms will be used interchangeably throughout this document.

Definitions

Phases of the care continuum are broadly defined as follows:

- **Screening** is testing in the absence of signs or symptoms of disease
- **Diagnosis** is testing based on a reasonable suspicion of a particular condition or disorder, usually due to the presence of signs or symptoms
- **Management** is testing to direct therapy of an established condition, which may include preoperative or postoperative imaging, or imaging performed to evaluate the response to nonsurgical intervention. Patients will usually have new or worsening signs or symptoms although progressive imaging findings may be sufficient in some scenarios.
- **Surveillance** is the periodic assessment following completion of therapy, or for monitoring known disease that is stable or asymptomatic

Cannot be performed or is nondiagnostic – applies when the test:

- Is positive or indeterminate for clinically significant pathology when the information provided about the abnormality by the test is not sufficient to direct subsequent management
- Is negative when the negative likelihood ratio of the test is both insufficient to confidently exclude the absence of suspected disease and unable to direct subsequent management. This typically applies in scenarios with moderate to high clinical pretest probability with negative testing or low pretest probability with clear evidence for net benefit
- Has been previously nondiagnostic because of a persistent clinical factor (e.g., body habitus, immobility) that is very likely to make retesting nondiagnostic as well
- Cannot be performed due to a medical contraindication (e.g., contrast nephrotoxicity, allergy, or in highly radiation sensitive populations such as pediatrics and pregnancy) or reasonable unavailability related to lack of local expertise or service availability.

Clinical Indications

The following section includes indications for which advanced vascular imaging is considered medically necessary, along with prerequisite information and supporting evidence where available. Indications, diagnoses, or imaging modalities not specifically addressed are considered not medically necessary.

It is recognized that imaging often detects abnormalities unrelated to the condition being evaluated. Such findings must be considered within the context of the clinical situation when determining whether additional imaging is required.

General Vascular

Congenital or developmental vascular anomalies, not otherwise specified

Applies only to imaging not otherwise addressed in one of the condition-based indications within this document.

Advanced imaging is considered medically necessary for diagnosis and management.

IMAGING STUDY

- CTA head, neck, head/neck, chest, abdomen, pelvis, abdomen/pelvis, or extremities (based on location)
- MRA head, neck, chest, abdomen and pelvis, or extremities (based on location)
- CT brain
- CT or MRI chest; alternative to CTA or MRA chest

Traumatic vascular injury

Advanced imaging is considered medically necessary for diagnosis and management.

IMAGING STUDY

- CTA head, neck, head/neck, chest, abdomen, pelvis, abdomen/pelvis, or extremities (based on location)
- MRA head, neck, chest, abdomen and pelvis, or extremities (based on location)
- CT chest

Vasculitis

Advanced imaging is considered medically necessary for diagnosis and management.

IMAGING STUDY

- CTA head, neck, head/neck, chest, abdomen, pelvis, abdomen/pelvis, or extremities (based on location)
- MRA head, neck, chest, abdomen and pelvis, or extremities (based on location)
- MRI brain
- CT chest
- PET/CT

Procedure-related Imaging

Applies only to imaging not otherwise addressed in one of the condition-based indications in this document.

Advanced imaging is considered medically necessary in **ANY** of the following scenarios:

Vascular evaluation prior to transcatheter aortic valve implantation/replacement (TAVI/TAVR) or cardiac surgery

IMAGING STUDY

- CT chest
- CTA chest, abdomen and pelvis; CTA neck requires initial duplex arterial ultrasound
- MRA chest, abdomen and pelvis; MRA neck requires initial duplex arterial ultrasound

Vascular anatomic delineation prior to surgical and interventional procedures, not otherwise specified*

IMAGING STUDY

- CTA head, neck, head/neck, chest, abdomen, pelvis, abdomen/pelvis, or extremities (based on specific procedure)
- MRA head, neck, chest, abdomen and pelvis, or extremities (based on specific procedure)

***Exclusions:** stenting or angioplasty of the dural venous sinus

Evaluation for suspected vascular complications following a procedure

IMAGING STUDY

- CTA head, neck, head/neck, chest, abdomen, pelvis, abdomen/pelvis, or extremities (based on specific procedure)
- MRA head, neck, chest, abdomen and pelvis, or extremities (based on specific procedure)

Rationale

Vascular imaging may be requested for preoperative planning prior to stenting or angioplasty of the venous sinus in patients with multiple sclerosis. Evidence-based guidelines strongly recommend against performing this procedure based on lack of evidence.¹

Brain, Head and Neck

Aneurysm, intracranial

Advanced imaging is considered medically necessary in **ANY** of the following scenarios:

Screening in ANY of the following high-risk groups:

- Two (2) or more first-degree relatives with intracranial aneurysm or subarachnoid hemorrhage
- Condition associated with an increased risk of intracranial aneurysm*
- Known fibromuscular dysplasia

Diagnosis of clinically suspected intracranial aneurysm:

- CT or MRI findings suspicious for aneurysm
- Signs or symptoms suggestive of intracranial aneurysm with **ANY** of the following:
 - At least one first degree relative with intracranial aneurysm or subarachnoid hemorrhage
 - Presence of a condition associated with an increased risk of intracranial aneurysm*
 - Known fibromuscular dysplasia
 - Cranial nerve deficits
 - Headache with **ANY** of the following features:
 - Sudden onset worst headache of life (“thunderclap”)
 - Brought on by and occurring in association with exertion or Valsalva
 - Persistent headache that remains undifferentiated/unexplained by MRI

Management of known intracranial aneurysm:

- Evaluation for aneurysm progression or recurrence based on new or worsening symptoms
- Preoperative evaluation
- Initial postoperative evaluation

Surveillance

Initial evaluation at 6 to 12 months following diagnosis, then annually

**Examples include autosomal dominant polycystic kidney disease and Ehlers-Danlos syndrome type IV*

IMAGING STUDY

- CTA head
- MRA head
- MRI brain
- CTA head/neck

Rationale**SCREENING**

The incidence of intracranial aneurysm may be as high as 19% in patients with a significant family history of intracranial aneurysms as compared to 2% to 3.5% in the general population.^{2, 3} As a result, the American Heart and Stroke Foundation and the American Academy of Neurology strongly recommend screening in patients with ≥ 2 family members with intracranial aneurysm or subarachnoid hemorrhage by CTA or MRA.⁴⁻⁶ A 2016 prospective trial evaluated screening MRA in first-degree relatives of patients with ruptured intracranial aneurysms. Of the 305 total exams, unruptured intracranial aneurysms were seen in 2.3% of patients (95% CI, 1.02%-4.76%) and less than 1% of the screened population required an endovascular procedure or surgical intervention.⁷

In patients with autosomal dominant polycystic kidney disease, the incidence for intracranial aneurysm may be as high as 10%, and there is general agreement that these patients should be screened. The American Heart Association and American Stroke Association also recommends advanced imaging screening for patients with Type IV Ehlers-Danlos, microcephalic osteodysplastic primordial dwarfism, as well as selected conditions with an increased risk of intracranial aneurysm, such as aortic coarctation and bicuspid aortic valve.⁶ Both CTA and MRA are highly sensitive for aneurysm screening with sensitivities

above 95%.^{8,9} As MRA does not require ionizing radiation or contrast, it confers greater potential net benefit and is generally preferred unless contraindicated.

DIAGNOSIS

Symptoms of unruptured intracranial aneurysm (UIA) include headache, ischemic cerebrovascular events, and cranial nerve deficits.¹⁰ Headache is the most common but also the most nonspecific and the relationship to aneurysm as a cause is controversial.^{6,11} Certain headache patterns, including sudden onset worst headache of life (“thunderclap”) are classically associated with aneurysm rupture.¹⁰ Headaches brought on by and occurring in association with exertion or Valsalva including exercise or sexual activity are rare¹², but are more frequently associated with intracranial vascular abnormalities^{12,13} and advanced vascular imaging may be appropriate as suggested by clinical guidelines.^{14,15} The use of advanced imaging for diagnosis of clinically suspected aneurysm as well as management (including perioperative evaluation) of known aneurysm is appropriate. Both MRA and CTA can reliably detect intracranial aneurysms > 5mm,^{8,9} so modality selection is often based on factors such as patient preference, radiation sensitivity, contrast risk, and availability. For patients with a suspected subarachnoid hemorrhage, CT head without intravenous contrast is the most appropriate initial imaging modality.⁵

SURVEILLANCE

In the absence of new or worsening symptoms, the American Heart Association and American Stroke Association recommend aneurysm surveillance at 6 to 12 months following diagnosis, then every 1 to 2 years or as follow up after treatment with clips, endovascular coil, or stenting as medically necessary. In patients with unruptured intracranial aneurysm, approximately 12% will have continued growth of their aneurysms and a 24-fold increased risk of rupture.¹⁶ Surveillance is also recommended after surgical intervention by the American Heart Association and American Stroke Association as well as the American College of Radiology. Either MRA or CTA may be used for surveillance of untreated intracranial aneurysm, although follow up using the same imaging modality on which the aneurysm was initially found is preferred. In patients with treated aneurysms, MRA head without intravenous contrast is superior to CTA for the evaluation of coiled aneurysms, while CTA head with intravenous contrast is preferred for evaluation of clipped aneurysms.⁵ For monitoring of patients with a known cerebral aneurysm, the American College of Radiology considers CT head and MRI brain to be “usually not appropriate.”¹⁷

Aneurysm, extracranial (carotid or vertebral)

Advanced imaging is considered medically necessary for diagnosis and management.

IMAGING STUDY

- CTA neck
- MRA neck
- CTA head/neck

Arteriovenous malformation (AVM) or fistula (AVF)

Advanced imaging is considered medically necessary for diagnosis and management.

IMAGING STUDY

- CTA head or neck
- MRA head or neck
- MRI brain
- CTA head/neck

Dissection, intracranial or extracranial

Advanced imaging is considered medically necessary for diagnosis and management.

IMAGING STUDY

- CTA head or neck
- MRA head or neck

- CTA head/neck

Fibromuscular dysplasia

Advanced imaging is considered medically necessary for diagnosis and management.

IMAGING STUDY

- CTA head or neck
- MRA head or neck
- CTA head/neck

Rationale

An international consensus statement on fibromuscular dysplasia states that “there are inadequate data to recommend one imaging modality over another for the diagnosis of cerebrovascular FMD. Catheter-based angiography remains the gold standard, however, in most centers this modality has been replaced by CTA or contrast-enhanced MRA as the initial imaging modality... in high-volume centers with experience in vascular duplex ultrasonography for the evaluation of carotid FMD, it is reasonable to start with a carotid duplex exam although this modality is inadequate to assess the vertebral and intracranial arteries for FMD.”¹⁸

Hemorrhage, intracranial

Also see Brain Imaging guidelines.

ADULT

Advanced imaging is considered medically necessary in the diagnosis and management of patients with established hemorrhage in **EITHER** of the following scenarios:

- Intracerebral hemorrhage with clinical or imaging features atypical for hypertensive hemorrhage
- Subarachnoid hemorrhage suggested by lumbar puncture or by imaging

PEDIATRIC

Advanced imaging is considered medically necessary in the diagnosis and management of patients with intracerebral hemorrhage.

IMAGING STUDY

- CTA head
- MRA head

Rationale

There are four major forms of intracranial hemorrhage—epidural, subdural, subarachnoid, and intracerebral. All four types are typically medical emergencies. Subarachnoid hemorrhage, commonly due to ruptured intracranial aneurysm, can be traumatic or spontaneous. Intracerebral hemorrhage in the deep brain nuclei is commonly due to hypertension, but intracerebral hemorrhage can be associated with tumor or vascular malformations in atypical locations or patient populations.¹⁹ Advanced vascular imaging is helpful when underlying vascular malformation or aneurysm is suspected.²⁰

Horner’s syndrome

Also see Brain Imaging and Head and Neck Imaging guidelines.

Advanced imaging is considered medically necessary for evaluation of a suspected vascular lesion.

IMAGING STUDY

- CTA neck
- MRA neck

Pulsatile tinnitus

Also see *Brain Imaging and Head and Neck Imaging guidelines*.

Advanced imaging is considered medically necessary for evaluation of a suspected vascular lesion.

IMAGING STUDY

- CTA head or neck
- MRA head or neck
- CTA head/neck

Procedure related imaging of the intracranial vessels

Advanced imaging is considered medically necessary in **ANY** of the following scenarios:

- To exclude a tandem stenosis or occlusion prior to carotid revascularization
- To evaluate after prior intracranial stenting
- Patients with established Moya Moya disease who are being considered for revascularization

IMAGING STUDY

- CTA head
- MRA head
- CTA head/neck

Rationale

Intracranial vascular imaging may be used to diagnose and manage patients with known intracranial stenosis, especially when they are being considered for bypass²¹ and in patients with known or suspected Moya Moya.²² Intracranial vascular imaging may also aid in preoperative planning prior to revascularization.

Signs, symptoms, and abnormal imaging (including stroke or transient ischemic attack (TIA))

Advanced imaging is medically necessary for **ANY** of the following scenarios when CTA/MRA has not been performed for evaluation of these signs and symptoms:

- Hollenhorst plaques (cholesterol emboli) or retinal neovascularity on retinal examination
- Stroke or TIA within 30 days of the onset of signs/symptoms*
- Stroke or TIA greater than 30 days past the onset of signs/symptoms* when duplex arterial ultrasound cannot be performed or is nondiagnostic (for neck imaging only).
- Evidence of stroke on brain imaging
- Subclavian steal syndrome

**Examples include unilateral motor or sensory deficit, slurred speech and visual field deficits*

IMAGING STUDY

- CTA head (excluding Stroke or TIA greater than 30 days past the onset of signs/symptoms and Hollenhorst plaques)
- MRA head (excluding Stroke or TIA greater than 30 days past the onset of signs/symptoms and Hollenhorst plaques)
- CTA head/neck (excluding Stroke or TIA greater than 30 days past the onset of signs/symptoms and Hollenhorst plaques)

- CTA neck
- MRA neck

Rationale

Multiple guidelines recommend advanced imaging of the brain and vascular imaging of the head and neck to identify a thromboembolic source.^{5, 23-25} In the hyperacute setting, patients with acute stroke may be candidates for thrombolysis with tissue plasminogen activator (TPA) or mechanical thrombectomy which has been shown to offer net benefit in multiple randomized controlled trials.²⁴ Outside of the interventional window, medical management with dual antiplatelet therapy may benefit patients with acute stroke or TIA due to high-grade intracranial stenosis, but this is controversial. In the Clopidogrel plus aspirin versus aspirin alone for reducing embolization in patients with acute symptomatic cerebral or carotid artery stenosis (CLAIR) trial, patients with acutely symptomatic intracranial stenosis assigned to the dual antiplatelet arm (clopidogrel and aspirin) had a relative risk reduction of 42% (95% CI, 4.6%-65.2%) for the indirect primary outcome measure of microembolic events with no difference in adverse event rates, suggesting possible net benefit.²⁶ In the Clopidogrel with Aspirin in Acute Minor Stroke or Transient Ischemic Attack (CHANCE) trial, patients with symptomatic intracranial atherosclerotic disease had higher rates of recurrent stroke, but dual antiplatelet therapy did not offer risk reduction relative to monotherapy.²⁷ A large randomized controlled trial of Warfarin versus aspirin therapy for symptomatic intracranial stenosis showed a higher rate of major hemorrhage and no overall net benefit to Warfarin.²⁸

For subacute and chronic strokes or transient ischemic attacks (TIAs), primary medical management options include secondary stroke prevention with antiplatelets and risk reduction. Surgical options include carotid endarterectomy or stenting for patients with moderate or severe extracranial stenosis, or rarely extracranial-intracranial bypass.²⁹

Advanced vascular imaging has a high negative predictive value (91%; 95% CI, 89%-93%) for moderate to severe intracranial stenosis³⁰ and may be helpful for posterior circulation strokes or TIAs or for large vessel anterior circulation strokes in atypical cases that remain unexplained after the initial evaluation for an extracranial source when the results of imaging will impact medical or surgical management.

When evaluating a patient with syncope or presyncope, cardiac workup is appropriate for initial evaluation in many cases. The American College of Radiology, in their Appropriateness Criteria for syncope, state, "In patients with an abnormal ECG or findings on history or physical examination suggesting a cardiac etiology of syncope or presyncope, transthoracic echocardiography can be used to assess for structural heart disease or to help identify risk factors for malignant arrhythmias and is validated by multiple studies and supported by numerous societies."³¹ A guideline from the American College of Cardiology, American Heart Association, and Heart Rhythm Society states that in patients with uncomplicated syncope events in the absence of neurological features on history or examination, "The evidence suggests that routine neurological testing is of very limited value in the context of syncope evaluation and management," noting a low diagnostic yield in these patients. They recommend against carotid artery imaging and neuroimaging in these patients.³²

Stenosis or occlusion of the carotid and vertebrobasilar arteries without symptoms

Advanced imaging is considered medically necessary when the results are expected to influence patient management, including determining need for procedures or a change in medication regimen in **ANY** of the following scenarios:

- Screening of asymptomatic patients when duplex arterial ultrasound cannot be performed or is nondiagnostic
 - Starting 5 years post-neck irradiation and every 3 years thereafter
- Surveillance of established carotid disease in asymptomatic persons with no prior revascularization:
 - Moderate (50%-69%) stenosis: every 12 months when duplex arterial ultrasound cannot be performed or is nondiagnostic
 - Severe (70% or greater) stenosis: every 6 months
- Post-revascularization when duplex arterial ultrasound cannot be performed or is nondiagnostic:
 - Baseline evaluation, then every 6 months for 2 years, then annually

Note: Revascularization refers to carotid endarterectomy or carotid artery stenting.

IMAGING STUDY

- CTA neck
- MRA neck
- CTA head/neck

Rationale

Outside of acute stroke or TIA (see separate criteria), ultrasound is recommended in the initial evaluation of known or suspected carotid stenosis with CTA or MRA used as an add-on or alternative test when duplex ultrasound is not available or is nondiagnostic.³³⁻³⁵ While operator dependent, duplex ultrasound has diagnostic accuracy for carotid stenosis comparable to advanced vascular imaging with sensitivities and specificities of 92% and 89% respectively, based on a recent systematic review.^{35, 36} Duplex ultrasound is further readily available, does not require contrast, is non-ionizing (versus CTA), and less prone to motion (versus MRA). Duplex ultrasound is less accurate in evaluating lesions in the distal cervical internal carotid artery and in differentiating high grade stenosis from occlusion. It may also be nondiagnostic due to patient-related or technical factors such as in the presence of moderate or severe calcified plaque in the carotid bulbs.⁵ Duplex ultrasound has poor diagnostic accuracy for evaluation of the posterior (vertebrobasilar) circulation.

Recommended intervals for follow-up of carotid artery stenosis depends upon the degree of stenosis detected. Professional society guidelines do not recommend routine surveillance in patients with less than 50% stenosis.³³ For surveillance after carotid artery intervention (in patients who are asymptomatic or with stable symptoms after baseline imaging), duplex ultrasound every 12 months after the first two years is considered appropriate.³⁷

Trigeminal neuralgia

Advanced imaging is considered medically necessary for evaluation of a suspected vascular lesion.

IMAGING STUDY

- CTA head
- MRA head

Venous thrombosis or compression, intracranial

Includes dural venous sinus thrombosis, venous sinus thrombosis, and cerebral vein thrombosis

Advanced imaging is considered medically necessary in **ANY** of the following:

- Suspected venous sinus thrombosis in setting of headache, visual changes, eye pain or other neurologic symptoms, with **ANY** of the following:
 - Papilledema, cranial nerve palsy, or focal neurologic deficit on exam
 - Risk factor for venous thrombosis
 - Elevated D-dimer
 - Suspicious or nondiagnostic CT head or MRI brain
- History of venous sinus thrombosis, with current signs or symptoms of recurrent thrombosis
- Follow-up of known venous sinus thrombosis
- To exclude venous compression by an adjacent intracranial mass

IMAGING STUDY

- CTA head
- MRA head
- CT brain
- MRI Brain

Rationale

Intracranial venous sinus thrombosis (VST) includes thrombosis of both the dural sinuses and cerebral veins with an estimated annual incidence of 5 per million.³⁸ Risk factors for VST include medical conditions (eg, thrombophilias, hyperthyroidism, malignancy), transient situations (eg, pregnancy, dehydration, infection), selected medications (eg, oral contraceptives, steroids), and unpredictable events (eg, head trauma).

Headache is the most common manifestation of venous sinus thrombosis and occurs in nearly 90% of cases. Increased intracranial pressure can lead to other signs and symptoms including nausea, visual changes, other cranial neuropathies, and papilledema. Follow up of venous sinus thrombosis in patients with established disease may be helpful to direct management.

Venous thrombosis or compression, extracranial

Advanced imaging is considered medically necessary for diagnosis and management, following nondiagnostic venous ultrasound.

IMAGING STUDY

- CTA neck
- MRA neck

Chest

Aortic dissection and other aortopathies

Includes aortic dissection, intramural hematoma, penetrating ulcer, and pseudoaneurysm

Advanced imaging is considered medically necessary in **ANY** of the following scenarios:

- Initial diagnosis of suspected disease
- Management of known disease
- Annual surveillance of clinically stable disease
- Baseline, 6 months and 12 months after endovascular repair for dissection, then annually

IMAGING STUDY

- CT chest
- CTA chest
- MRA chest

Thoracic aortic aneurysm

Also see Cardiac Imaging guidelines.

Advanced imaging is considered medically necessary in **ANY** of the following scenarios:

Screening

- Annual evaluation of patients with connective tissue disease or genetic mutations that predispose to aortic aneurysms as an alternative to screening with echocardiography or when echocardiography is nondiagnostic

(For bicuspid aortic valve, see Cardiac Imaging guidelines).

Diagnosis of suspected thoracic aneurysm based on signs, symptoms, or other nondiagnostic imaging

Management

- Evaluation for disease progression based on new or progressive signs, symptoms or enlargement by imaging.
- 6-month follow up of newly diagnosed aneurysms to establish stability
- Pre-procedure* planning
 - * *Surgical or endovascular repair*

Surveillance

- Annual surveillance for aneurysms \leq 4.4 cm
- Every 6 months for aneurysms larger than 4.4 cm

Post procedure imaging

- Baseline and 12 months following endograft repair, then annually
- Stable aneurysms treated with open surgical repair: every 5 years
- Aneurysm sacs that are increasing in size or endoleaks after endograft repair

IMAGING STUDY

- CTA chest
- MRA chest
- CT or MRI chest; alternatives to CTA or MRA chest

Rationale

Echocardiography, CT, and MRI have high and comparable diagnostic accuracy for the evaluation of thoracic aortic aneurysms with positive likelihood ratios all greater than 10 and overlapping confidence intervals.³⁹

CTA and MRA are important modalities in the diagnosis and management of aortic disease. Unlike TTE, they are less operator dependent and can visualize the entire length of the thoracic aorta and hence serve as alternatives to TTE or add on tests when TTE is nondiagnostic. In several reports, CT was found to have a pooled sensitivity of 100% and a pooled specificity of 98% for the detection of thoracic aortic dissection or intramural hematoma. MRI reliably demonstrates the relevant features of aortic disease, such as aortic diameter and the relationship of aortic branches to an aneurysm or dissection. Advantages of MRI include the lack of ionizing radiation and ability to avoid the use of iodinated contrast. Disadvantages include longer image acquisition times and reduced ability to monitor potentially unstable patients.⁴⁰

A recent American multispecialty society endorsed guideline on the diagnosis and management of patients with thoracic aortic disease makes a strong recommendation based on low to moderate quality evidence for screening patients with predisposing genetic syndromes like Marfan's or for patients with at least one affected first degree relative.⁴¹ When planning for endovascular repair of a thoracic aortic aneurysm, CTA is the imaging modality of choice. It allows for accurate measurement of the length of the aneurysmal segment, evaluation of involved branches, and assessment of the healthy aortic segments above and below the graft. When evaluating patients after repair, CT or CTA is the study of choice. MRI is a reasonable alternative for surveillance imaging after TEVAR (thoracic endovascular aneurysm repair) but can be limited by metallic artifact. Following endovascular repair, imaging is appropriate at 1 month, 12 months, and annually thereafter for aneurysm. Annual evaluation is appropriate following endovascular repair of aortic dissection. Following surgical repair, less-frequent imaging may be performed after 1 year of stability has been established.⁴²

Atheromatous disease (Adult only)

Advanced imaging is considered medically necessary for evaluation of the thoracic aorta as a source of distal emboli when a cardiac source has not been identified on echocardiography.

IMAGING STUDY

- CTA chest
- MRA chest when CTA cannot be performed or is nondiagnostic

Pulmonary hypertension

Advanced imaging is considered medically necessary for diagnosis and management in **EITHER** of the following scenarios:

- To evaluate suspected pulmonary hypertension, including chronic thromboembolic pulmonary hypertension (CTEPH)
- To evaluate disease extent after diagnosis of chronic thromboembolic pulmonary hypertension (CTEPH) in patients being considered for surgery

IMAGING STUDY

- CT chest
- CTA chest

Rationale

Chronic pulmonary thromboembolism (CTEPH) is an uncommon but potentially treatable complication of venous thromboembolism (VTE), with an incidence of less than 2%.⁴³ Guidelines do not recommend routine use of advanced imaging in asymptomatic patients following VTE,⁴⁴ but suggest VQ scintigraphy for the initial evaluation of symptomatic patients due to the higher sensitivity of this modality for pulmonary perfusion abnormalities and high negative likelihood ratio.^{44, 45} In patients with established chronic pulmonary thromboembolism, CTA is suggested instead of VQ scintigraphy to evaluate the anatomic extent of surgically accessible disease and MRA is not recommended.⁴⁴

Pulmonary embolism

Also see Cardiac Imaging guidelines.

ADULT

Advanced imaging is considered medically necessary in **ANY** of the following scenarios:

- **Pulmonary embolism likely** based on modified Wells criteria⁴⁶ (> 4 points)
- **Pulmonary embolism unlikely** based on modified Wells criteria⁴⁶ (≤ 4 points) with a positive D-dimer
- Suspected pulmonary embolism in pregnancy when PE cannot be excluded by YEARS algorithm (**EITHER** of the following scenarios):
 - D-dimer ≥ 1000 ng/mL
 - D-dimer ≥ 500 ng/mL and **ANY** of the following:
 - Clinical signs of deep-vein thrombosis, after normal compression ultrasonography
 - Hemoptysis
 - Pulmonary embolism as the most likely diagnosis

PEDIATRIC

Advanced imaging is considered medically necessary in **EITHER** of the following scenarios:

- Moderate or high clinical suspicion of pulmonary embolism
- Concern for recurrent embolism in patients on adequate medical therapy

IMAGING STUDY

- CT chest; alternative to CTA chest
- CTA chest (preferred)

Rationale

Clinical signs and symptoms of pulmonary embolism (PE) are notoriously nonspecific, and relatively few patients will present with the classic constellation of pleuritic chest pain, dyspnea, and hypoxia. Furthermore, incidence of the condition is rare relative to mimics like pneumonia, pleurisy, pericarditis, and myocardial infarction; thus, chest radiograph may help detect an alternate explanation for symptomatology. Vascular imaging plays an important role in establishing the diagnosis of PE, but there is evidence that vascular imaging is overutilized in select patient populations where diagnostic yield can be as low as 5%.⁴⁷

LOW PRE-TEST PROBABILITY OF PULMONARY EMBOLISM

Consensus exists among multiple high-quality evidence-based guidelines that CTA or other forms of vascular imaging are not indicated in patients with a low pretest probability of PE. The American College of Physicians recommends clinicians use validated clinical prediction rules to estimate the pretest probability in patients with suspected PE. Clinicians should not obtain D-dimer measurements or imaging studies in patients with a low pretest probability of PE and who meet all Pulmonary Embolism Rule-out Criteria. Clinicians should obtain a high-sensitivity D-dimer measurement as the initial diagnostic test in patients who have an intermediate pretest probability of PE, or in patients with low pretest probability of PE who do not meet all Pulmonary Embolism Rule-out Criteria. Clinicians should not use imaging studies as the initial test in patients who have a low or intermediate pretest probability of PE.⁴⁸⁻⁵¹

In a 2016 meta-analysis, Crawford et al. concluded that a negative D-dimer test is valuable in ruling out PE in patients who present to the emergency setting with a low pretest probability. They noted high levels of false-positive results, especially among those over the age of 65 years with estimates of specificity from 23% to 63%. No empirical evidence was available, however, to support an increase in the diagnostic threshold of interpretation of D-dimer results for those over the age of 65 years.^{52, 53}

In a 2016 multicenter prospective cohort management study of 808 consecutive patients with suspected PE, Bates et al. evaluated whether PE can be safely excluded in patients with negative D-dimer testing without incorporating clinical probability assessment. Ninety-nine (12%) were diagnosed with venous thromboembolism (VTE) at presentation. Four hundred and twenty (52%) had a negative D-dimer level at presentation and were treated without anticoagulation; of these, 1 had venous thromboembolism during follow up. The negative predictive value of D-dimer testing for PE was 99.8% (95% CI, 98.7%-99.9%).⁵⁴

MODERATE TO HIGH PRE-TEST PROBABILITY OF PULMONARY EMBOLISM

Consensus exists among multiple high-quality evidence-based guidelines that CT/CTA is indicated in patients with intermediate or high clinical suspicion for PE. CT should be offered to patients in whom PE is suspected with a likely Wells score or with an unlikely two-level pulmonary embolism Wells score and positive D-dimer.^{49, 55-59} Patients with intermediate or high pretest probability of PE require diagnostic imaging studies,⁶⁰ and additional diagnostic testing should be considered if CT is negative.⁶¹ In patients with an elevated D-dimer level, imaging should be obtained.^{58, 59} The American College of Radiology considers CT pulmonary angiography to be “usually appropriate” in patients with a positive plasma D-dimer test.⁶²

In pregnant patients, though overlap exists between the clinical symptoms of VTE and symptoms caused by physiological changes in pregnancy (e.g., tachycardia, swelling of the legs, dyspnea), the threshold to test for PE is low because of the well-known elevated risk of VTE/PE. However, both CT/CTA and ventilation-perfusion scanning involve radiation exposure to the mother and fetus. A prospective study found PE to be safely ruled out by using the pregnancy-adapted YEARS algorithm (consisting of the three most predictive criteria of the Wells criteria – clinical signs of deep vein thrombosis, hemoptysis, and whether PE is the most likely diagnosis - and incorporates variable D-dimer thresholds depending on the number of criteria filled); CTA was avoided in 32%-65% of patients (variable by trimester, with decreasing specificity attributed to the physiologic rise of D-dimer that also commonly occurs during pregnancy).⁶⁰

MRI OR MRA FOR EVALUATION OF PULMONARY EMBOLISM

There is no consistent evidence that MRA or MRI have comparable reliability or diagnostic accuracy to either CTA or VQ scintigraphy.

In a 2016 systematic review/meta-analysis, Li et al. concluded that MRA can be used for the diagnosis of acute PE; however, due to limited sensitivity, it cannot be used as a stand-alone test to exclude acute PE. Five studies were included in the meta-analysis. The pooled sensitivity 0.83 (0.78-0.88) and specificity 0.99 (0.98-1.00) demonstrated that MRA had limited sensitivity and high specificity in the detection of acute pulmonary embolism.⁶³ Zhou et al. conducted a meta-analysis of 15 studies for patient accuracy and 9 studies for vessel accuracy on MRI. Authors concluded that MRI exhibits a high diagnostic capability with proximal arteries but lacks sensitivity for peripheral embolism. The patient-based analysis yielded an overall sensitivity of 0.75 (0.70-0.79) and 0.84 (0.80-0.87) for all patients and patients with technically adequate images, respectively. The overall specificity was 0.80 (0.77-0.83) and 0.97 (0.96-0.98). On average, MRI was technically inadequate in 18.89% of patients (range, 2.10%-27.70%).^{64, 65}

VQ SCINTIGRAPHY FOR EVALUATION OF PULMONARY EMBOLISM

For patients with suspected PE of moderate to high pretest probability, the majority of high-quality evidence based guidelines recommend the use of VQ scintigraphy as an add-on test when CTA is nondiagnostic or cannot be performed due to contrast allergy or nephrotoxicity.^{1, 66} While systematic reviews of comparative diagnostic accuracy are mixed,^{67, 68} many cited studies used earlier generations of CT technology, limiting the applicability of this literature to contemporary clinical practice. CT has fewer nondiagnostic studies³ and is widely available. Comparative effective radiation dose between VQ scintigraphy and CT is also controversial, but a normal VQ or Q scan may offer a lower radiation dose than CT and confidently exclude PE when negative (negative likelihood ratio 0.05).⁶⁷ Scintigraphy is also recommended by consensus based guidelines as an alternative test in pregnant patients.⁶⁹

EVALUATION OF PULMONARY EMBOLISM IN PEDIATRIC POPULATIONS

The evidence base for diagnosis of PE is limited in children and the diagnostic testing strategy is not well defined.⁷⁰ Further research is very likely to change recommendations for the appropriate use of advanced imaging in pediatric populations. Hence, evaluation of PE is primarily based on clinical gestalt and selection of initial imaging modality based on local practice experience and expertise.

Other vascular indications in the chest

Also see Cardiac Imaging guidelines.

Advanced imaging is considered medically necessary for diagnosis and management of **ANY** of the following conditions.

- Hematoma
- Pulmonary arteriovenous malformation
- Pulmonary sequestration
- Subclavian steal syndrome
- Superior vena cava syndrome
- Thoracic outlet syndrome

IMAGING STUDY

- CTA chest
- MRA chest
- CT chest or MRI chest (alternative modalities for evaluation of superior vena cava syndrome and thoracic outlet syndrome)

Abdomen and Pelvis

Aortic dissection and other aortopathies

Includes aortic dissection, , intramural hematoma, penetrating ulcer, and pseudoaneurysm

Advanced imaging is considered medically necessary in **ANY** of the following scenarios:

- Initial diagnosis of suspected aortic disease
- Management of known aortic disease
- Annual surveillance of clinically stable aortic disease

IMAGING STUDY

- CTA abdomen or CTA Abdomen/Pelvis
- MRA abdomen with or without MRA pelvis

- CT abdomen or CT abdomen/pelvis

Aneurysm of the abdominal aorta or iliac arteries

Advanced imaging is considered medically necessary in **ANY** of the following scenarios:

Screening

One time evaluation when duplex arterial ultrasound cannot be performed or is nondiagnostic:

- Males between 60 and 75 years who have ever smoked **OR** have a first-degree relative with an abdominal aortic aneurysm (AAA)
- Females between 60 and 75 years who have ever smoked **AND** have a first-degree relative with AAA
- Previously diagnosed aneurysm of the thoracic aorta, iliac, femoral or popliteal arteries

Suspected aortic or iliac aneurysm presenting with **ANY** of the following when duplex arterial ultrasound cannot be performed or is nondiagnostic:

- Pulsatile abdominal mass or bruit
- Other imaging that is suggestive but not diagnostic

Management of known aneurysm

- New or worsening symptoms or signs of aortic disease or enlargement by imaging
- Pre-procedure planning

Surveillance

Stable aortic aneurysm without prior repair when duplex arterial ultrasound cannot be performed or is nondiagnostic:

- 4.5 cm or greater: every 6 months
- 3.5 to 4.4 cm: 6 months and 12 months following diagnosis, then annually
- 3 to 3.4 cm: one year following diagnosis, then every 3 years.

Stable iliac aneurysm without prior repair when duplex arterial ultrasound cannot be performed or is nondiagnostic:

- 3 cm or greater: every 6 months
- Less than 3 cm: annually

Post procedure imaging

- Baseline and initial 12-month evaluation following endograft repair
- Every 6 months for aneurysm sacs that are increasing in size or endoleaks after endograft repair
- Stable aneurysms treated with endografts: annually when duplex arterial ultrasound is nondiagnostic, otherwise every 5 years
- Stable aneurysms treated with open surgical repair: every 5 years

IMAGING STUDY

- CT abdomen and/or pelvis
- CTA abdomen and/or pelvis
- MRI abdomen and/or pelvis
- MRA abdomen and/or pelvis

Rationale

Given its wide availability and ability to diagnose or exclude a wide variety of causes of symptoms, ultrasound is generally the initial modality used in the evaluation of abdominal aortic aneurysm (AAA). Several studies have reported high sensitivity and specificity, 94%-100% and 98%-100%, respectively.⁷¹

CT is less operator-dependent and allows for more reproducible measurements over serial scans, in addition to providing detail about many aneurysm features relevant to clinical decision making. When endovascular repair of an aneurysm is planned, contrast-enhanced CT or CTA is essential for procedural planning. This modality allows accurate measurements to be taken at the proximal and distal landing sites for the stent graft as well as for evaluation of the relationship between the aneurysm and aortic branches, and for evaluation of the iliac arteries.⁴⁰

MRI and MRA are able to reliably depict the anatomic features of aneurysms such that these modalities are well suited to aortic evaluation. Limitations include potential for artifact due to longer image acquisition times, and less accessibility for monitoring of potentially unstable patients. Given the lack of ionizing radiation and absence of a need for iodinated contrast use, these modalities may be considered in cases where serial follow-up studies are needed.⁴⁰

A high-quality evidence-based guideline recommends follow up surveillance of AAA at 12-month intervals for AAA of 35 to 44 mm in diameter and at 6-month intervals for AAA 45 to 54 mm in diameter.⁴⁰ Following endovascular repair, surveillance is recommended after 1 month, 12 months, and annually thereafter. Shorter intervals may be appropriate when there are abnormal findings warranting closer surveillance. If there is no evidence of endoleak or AAA sac enlargement in the first year after endovascular repair, using duplex ultrasound for annual screening supplemented with noncontrast CT at 5-year intervals may be considered. Following open surgical repair, surveillance may be considered at approximately 5-year intervals.⁷¹

Four randomized trials compared the outcomes of population-based studies with or without screening for AAA. The prevalence of AAA was 5.5% in these studies, and AAA screening in men greater than 65 years of age was associated with a statistically significant decline in AAA-related mortality over 10 years. No similar benefit was seen in women, though women were included in only 1 of the trials and comprised a small number of patients (9342 out of a total 127,891 patients). Rescreening of patients has demonstrated few positive results, suggesting that a single ultrasound scan should be sufficient for screening.⁷¹ The Society for Vascular Surgery strongly recommends a one-time screening duplex ultrasound in patients 65-75 with a first degree relative with AAA. They do note that screening in women is more controversial due to limited data being available, and note that the USPSTF recommended against screening women aged 65-75 who had never smoked, and stating that there was insufficient evidence to recommend for or against screening in women aged 65-75 with a smoking history.⁷¹

Arteriovenous malformation (AVM) or fistula (AVF)

Advanced imaging is considered medically necessary for diagnosis and management.

IMAGING STUDY

- CTA abdomen and/or pelvis
- MRA abdomen and/or pelvis

Hematoma/hemorrhage within the abdomen or pelvis

Advanced imaging is considered medically necessary for diagnosis and management.

IMAGING STUDY

- CTA abdomen and/or pelvis
- CT abdomen and/or pelvis; alternative to CTA

Mesenteric ischemia or mesenteric stenosis/occlusion

Advanced imaging is considered medically necessary for diagnosis and management.

IMAGING STUDY

- CTA abdomen and/or pelvis
- MRA abdomen and/or pelvis

Rationale

While an evidence-based guideline from the European Society for Vascular Surgery recommends duplex ultrasound as the first-line test in mesenteric ischemia⁷², advanced imaging modalities may be indicated for further anatomic delineation. MRA may be considered an alternative to CTA for diagnosis of suspected chronic mesenteric ischemia, although there is some evidence that images obtained with MRA are not as accurate or complete as those obtained with CTA.⁷³

Portal hypertension

Advanced imaging is considered medically necessary for diagnosis and management.

IMAGING STUDY

- CTA abdomen
- MRA abdomen

Renal artery stenosis (RAS)/Renovascular hypertension

Advanced imaging is considered medically necessary in **ANY** of the following high pre-test likelihood scenarios:

- Refractory hypertension, in patients receiving therapeutic doses of 3 or more anti-hypertensive medications
- Rapid and persistent worsening of previously controlled hypertension
- Hypertension developing in patients younger than age 30
- Hypertensive crisis (systolic blood pressure > 180 or diastolic blood pressure > 110, with or without end-organ damage)
- Hypertension with renal failure or progressive renal insufficiency
- Severe hypertension in patients over age 55 with chronic kidney disease (CKD) or heart failure
- Hypertension and abdominal bruit, suspected to originate in the renal artery
- Unexplained episodes of “flash” pulmonary edema
- Unexplained atrophic kidney or renal size asymmetry (greater than 1.5 cm difference in renal size on ultrasound)

IMAGING STUDY

- CTA abdomen
- MRA abdomen

Rationale

While the majority of hypertension is essential, renal artery stenosis is the most common secondary cause, with an estimated prevalence between 0.5 and 5% of the population.⁷⁴ Following the Cardiovascular Outcomes in Renal Atherosclerotic Lesions (CORAL) trial, there is no net benefit to routine revascularization in patients with RAS secondary to atherosclerosis. Guidelines from both the American College of Radiology (ACR)⁷⁴ and the European society for cardiology (ESC)/European Society for Vascular Surgery (ESVS)²⁹ recommend diagnostic testing only in patients with high pretest likelihood of disease.

Duplex ultrasound, MRA and CTA all have good diagnostic accuracy in establishing the diagnosis of renal artery stenosis with sensitivities and specificities above 85%.⁷⁵ The negative likelihood ratio for duplex ultrasound is very good, approximately 0.16 depending on the criteria for peak systolic velocity used.²⁹ As such, a normal renal artery ultrasound makes renovascular hypertension unlikely. Ultrasound is also nonionizing and does not require contrast, and hence should be considered initial evaluation of renal artery stenosis, especially in patients with diminished renal function.⁷⁴ However, renal artery ultrasound however has a lower positive likelihood ratio and can overestimate the degree of stenosis; it is further operator dependent and requires specialized expertise that may limit availability.²⁹

Stenosis or occlusion of the abdominal aorta or iliac arteries (aortoiliac peripheral arterial disease)

Advanced imaging is considered medically necessary in **ANY** of the following scenarios:

Intermittent Claudication with any of the following:

- Persistent thigh or buttock claudication following a trial of 3 months of guideline directed medical therapy including a structured exercise therapy program in patients being evaluated for revascularization
- New or worsening claudication after prior surgical or endovascular procedure involving the abdominal aorta or iliac arteries

Chronic limb threatening ischemia (critical limb ischemia) with any of the following:

- Ischemic rest pain (pain in the foot that worsens with elevation of the foot and improves with dependency of the foot)
- Non healing ulcers
- Gangrene

Signs of atheroembolic disease of the lower extremities (such as discolored toes or livedo reticularis)

Acute limb ischemia (sudden onset of pain associated with pulselessness, pallor, loss of motor or sensory function)

Post-Procedure Surveillance if ultrasound cannot be performed or is non-diagnostic

- Post-procedure baseline evaluation
- After surgical or endovascular revascularization involving the aortoiliac vessels: 6 months and 12 months after the procedure and annually thereafter

IMAGING STUDY

- CTA abdomen and/or pelvis
- MRA abdomen and/or pelvis

Rationale

Evidence-based guidelines recommend baseline evaluation after aortoiliac revascularization using either open or endovascular approaches, followed by surveillance at 6 months, 12 months, and then annually. ABI, with or without duplex ultrasound, is the preferred imaging modality for this surveillance.⁷⁶ When ultrasound evaluation cannot be performed or is nondiagnostic, CTA or MRA is a reasonable alternative.

Venous Indications

Advanced imaging is considered medically necessary in **ANY** of the following scenarios:

- Suspected or known pelvic venous disease (pelvic congestion syndrome)
- Evaluation of the hepatic or portal veins when duplex venous ultrasound cannot be performed or is nondiagnostic
- Suspected or known venous thrombosis, stenosis, or occlusion in all abdominal/pelvic veins aside from the hepatic or portal veins

IMAGING STUDY

- CTA abdomen or CTA abdomen/pelvis
- MRA abdomen with or without MRA pelvis

Rationale

There is little comparative data addressing the preferred modality for assessing pelvic venous disease. In general, duplex ultrasound allows for evaluation of the vascular size as well as direction and velocity of flow; however, there can be technical limitations due to factors such as body habitus and bowel gas, as well as variable operator experience. MR venography is also widely considered to allow evaluation of pelvic venous structures. There is insufficient evidence to establish a clear preferred method for assessing pelvic venous disease.⁷⁷⁻⁷⁹

Visceral artery aneurysm

Advanced imaging is considered medically necessary for diagnosis, management, and surveillance of visceral artery aneurysm.

IMAGING STUDY

- CTA abdomen and/or pelvis
- MRA abdomen and/or pelvis

Upper Extremity

Peripheral arterial disease (PAD)

Advanced imaging is considered medically necessary for diagnosis, management, and surveillance in **ANY** of the following scenarios:

Signs or Symptoms of PAD in **ANY** of the following scenarios:

- Ischemic rest pain
- Signs of atheroembolic disease of the upper extremities (such as ischemic or discolored fingers, livedo reticularis etc.)
- Non healing upper extremity ulcers or gangrene
- Persistent upper extremity claudication despite a 3 month trial of guideline directed medical therapy in patients being evaluated for revascularization.
- Post-revascularization, with any new or worsening upper extremity signs or symptoms

Post-Procedure Surveillance when duplex ultrasound is nondiagnostic

- Post procedure baseline evaluation
- After surgical or endovascular revascularization: At 3-month intervals within the first 2 years, and annually thereafter

IMAGING STUDY

- CTA upper extremity
- MRA upper extremity

Rationale

There is limited data regarding the evaluation and management of upper extremity peripheral arterial disease. Professional society guidance indicates that either physiologic testing or duplex ultrasound is considered generally appropriate in symptomatic individuals with clinical concern for peripheral arterial disease.⁸⁰ As in lower extremity peripheral arterial disease, anatomic studies are generally indicated in the presence of more severe symptoms and when revascularization is being considered.

Procedure related imaging

Advanced imaging is considered medically necessary in **ANY** of the following scenarios when ultrasound cannot be performed or is nondiagnostic:

- Evaluation of native arteries prior to arteriovenous fistula or graft for dialysis access
- Planned arterial harvesting (e.g., for CABG)

IMAGING STUDY

- CTA upper extremity
- MRA upper extremity

Venous thrombosis or occlusion

Advanced imaging is considered medically necessary for the diagnosis and management when ultrasound cannot be performed or is nondiagnostic.

IMAGING STUDY

- CTA upper extremity
- MRA upper extremity

Other vascular indications in upper extremity

Advanced imaging of the upper extremity is considered medically necessary when the results of imaging are essential to establish a diagnosis and/or direct management of the following vascular conditions:

- Aneurysm
- Arterial entrapment syndrome (vascular thoracic outlet syndrome)
- Arteriovenous malformation (AVM) or fistula (AVF)
- Dissection or intramural hematoma

IMAGING STUDY

- CTA upper extremity
- MRA upper extremity

Lower Extremity

Peripheral arterial disease (PAD)

Advanced imaging is considered medically necessary in **ANY** of the following scenarios when Duplex ultrasound is nondiagnostic or advanced imaging is needed to plan a procedure:

Intermittent Claudication with any of the following:

- Persistent claudication following a trial of 3 months of guideline directed medical therapy including a structured exercise therapy program in patients being evaluated for revascularization
- New or worsening claudication after prior revascularization in the same limb

Chronic limb threatening ischemia (critical limb ischemia) with any of the following:

- Ischemic rest pain (pain in the foot that worsens with elevation of the foot and improves with dependency of the foot)
- Non healing lower extremity ulcers or gangrene

Acute limb ischemia (sudden onset of pain associated with pulselessness, pallor, loss of motor or sensory function)

Post-Procedure Surveillance if ultrasound is nondiagnostic

- Post-procedure baseline evaluation
- After surgical or endovascular* revascularization: At 3-month intervals within the first 2 years, and annually thereafter

**Endovascular revascularization may include angioplasty, thrombectomy, atherectomy, or stent placement*

IMAGING STUDY

- CTA abdominal aorta with bilateral lower extremity runoff
- CTA lower extremity
- MRA lower extremity

Rationale

An estimated 8 to 12 million people in the U.S. are affected by peripheral arterial disease (PAD). Symptomatic PAD often presents as intermittent claudication. Presenting signs and symptoms in the lower extremity may also include weak or absent distal pulses, absent distal hair growth, dry skin, and poor skin healing. Though evidence does not support the use of screening studies for PAD in the general population, the primary study for making the diagnosis in symptomatic patients is the ankle-brachial index (ABI).⁷⁶ Compared with arteriography, an ABI of 0.90 or less has a high sensitivity and specificity for hemodynamically significant PAD.⁸¹ Additional imaging (Duplex, CTA, or MRA) should be reserved for patients in whom revascularization treatment is being considered. Advanced imaging is not indicated for patients with asymptomatic PAD or intermittent claudication who are not appropriate candidates for revascularization.⁸¹

The 2024 American Heart Association/American College of Cardiology Guideline for the Management of Lower Extremity Peripheral Artery Disease states, “The ABI, a simple, noninvasive physiological test, remains the cornerstone for initial diagnosis of PAD.” They state that “arterial imaging studies are generally obtained when revascularization is being considered but may also be used when there is clinical suspicion of PAD and the ABI and physiological tests are inconclusive.” This group further recommends against performing angiography, either invasive or noninvasive, to evaluate patients with asymptomatic PAD or those with chronic symptomatic PAD being managed with GDMT for whom no revascularization is being considered, stating that in these patients “there is no need to define lower extremity artery anatomy, and the risks of these imaging studies outweigh any potential benefit.”⁸²

Evidence-based guidelines state that in patients with PAD who have undergone lower extremity revascularization (ie, surgical, endovascular, or both) with new lower extremity signs or symptoms, ABI and arterial duplex ultrasound is recommended,⁸² and “in patients with PAD who have undergone infrainguinal autogenous vein bypass graft(s) without new lower extremity signs or symptoms, it is reasonable to perform ABI and arterial duplex ultrasound surveillance within the first 1 to 3 months postprocedure, then repeat at 6 and 12 months, and then annually.”⁸²

The Society for Vascular Surgery commissioned a systematic review which suggested that there was no clear benefit to screening for PAD in asymptomatic patients. The U.S. Preventive Services Task Force concluded in 2013 that there is insufficient evidence to support screening for PAD with the ABI, a recommendation that has remained consistent following literature surveillance in August 2023.⁸³

Venous thrombosis or occlusion

Advanced imaging is considered medically necessary for diagnosis and management when venous ultrasound cannot be performed or is nondiagnostic.

IMAGING STUDY

- CTA lower extremity
- MRA lower extremity

Other vascular indications in lower extremity

Advanced imaging of the lower extremity is considered medically necessary when the results of imaging are essential to establish a diagnosis and/or direct management of the following vascular conditions:

- Arterial entrapment syndrome
- Aneurysm/dilation
- Arteriovenous malformation or arteriovenous fistula
- Dissection or intramural hematoma

IMAGING STUDY

- CTA lower extremity
- MRA lower extremity
- CTA abdominal aorta with bilateral lower extremity runoff indicated for arterial evaluation when there is evidence of disease originating in the abdominal aorta or branch vessels

MR Angiography of the Spinal Canal

MR angiography of the spinal canal

Advanced imaging is considered medically necessary in **EITHER** of the following scenarios:

- Preoperative or postoperative imaging
- Follow up of prior imaging findings suggestive of a vascular lesion

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Codes

The following code list is not meant to be all-inclusive. Authorization requirements will vary by health plan. Please consult the applicable health plan for guidance on specific procedure codes.

Specific CPT codes for services should be used when available. Nonspecific or not otherwise classified codes may be subject to additional documentation requirements and review.

CPT/HCPCS

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70450	CT head, without contrast
70460	CT head, with contrast
70470	CT head, without contrast, followed by re-imaging with contrast
70471	CT angiography head and neck, with contrast
70496	CT angiography head, with contrast material(s), including noncontrast images, if performed, and image post-processing
70498	CT angiography neck, with contrast material(s), including noncontrast images, if performed, and image post-processing
70544	MR angiography head, without contrast
70545	MR angiography head, with contrast
70546	MR angiography head, without contrast, followed by re-imaging with contrast
70547	MR angiography neck, without contrast
70548	MR angiography neck, with contrast
70549	MR angiography neck, without contrast, followed by re-imaging with contrast
70551	MRI head, without contrast
70552	MRI head, with contrast
70553	MRI head, without contrast, followed by re-imaging with contrast
71250	Computed tomography, thorax, diagnostic; without contrast material
71260	Computed tomography, thorax, diagnostic; with contrast material(s)
71270	Computed tomography, thorax, diagnostic; without contrast material, followed by contrast material(s) and further sections
71275	CT angiography of chest (non-coronary), with contrast material(s), including non-contrast images, if performed, and image post-processing
71550	MRI chest, without contrast
71551	MRI chest, with contrast
71552	MRI chest, without contrast, followed by re-imaging with contrast
71555	MR angiography chest (excluding the myocardium) without contrast, followed by re-imaging with contrast

72159	MR angiography spinal canal
72191	CT angiography pelvis, with contrast material(s), including non-contrast images, if performed, and image post-processing
72192	CT pelvis, without contrast
72193	CT pelvis, with contrast
72194	CT pelvis without contrast, followed by re-imaging with contrast
72195	MRI pelvis, without contrast
72196	MRI pelvis, with contrast
72197	MRI pelvis, without contrast, followed by re-imaging with contrast
72198	MR angiography pelvis; without contrast, followed by re-imaging with contrast
73206	CT angiography upper extremity, with contrast material(s), including non-contrast images, if performed, and image post-processing
73225	MR angiography upper extremity, without and with contrast
73706	CT angiography lower extremity, with contrast material(s), including noncontrast images, if performed, and image post-processing
73725	MR angiography lower extremity, without and with contrast
74150	CT abdomen, without contrast
74160	CT abdomen, with contrast
74170	CT abdomen, without contrast, followed by re-imaging with contrast
74174	CT angiography abdomen and pelvis, with contrast material(s), including noncontrast images, if performed, and image post-processing
74175	CT angiography abdomen, with contrast material(s), including non-contrast images, if performed, and image post-processing
74176	CT abdomen and pelvis, without contrast
74177	CT abdomen and pelvis, with contrast
74178	CT abdomen and pelvis, without contrast, followed by re-imaging with contrast
74181	MRI abdomen, without contrast
74182	MRI abdomen, with contrast
74183	MRI abdomen, without contrast, followed by re-imaging with contrast
74185	MR angiography abdomen; without or with contrast
75635	CT angiography abdominal aorta and bilateral iliofemoral lower extremity runoff, with contrast material(s), including non-contrast images, if performed, and image post-processing
C8900	MR angiography with contrast, abdomen
C8901	MR angiography without contrast, abdomen
C8902	MR angiography without contrast followed by with contrast, abdomen
C8909	MR angiography with contrast, chest (excluding myocardium)
C8910	MR angiography without contrast, chest (excluding myocardium)
C8911	MR angiography without contrast followed by with contrast, chest (excluding myocardium)
C8912	MR angiography with contrast, lower extremity
C8913	MR angiography without contrast, lower extremity
C8914	MR angiography without contrast followed by with contrast, lower extremity
C8918	MR angiography with contrast, pelvis
C8919	MR angiography without contrast, pelvis
C8920	MR angiography without contrast followed by with contrast, pelvis
C8931	MR angiography with contrast, spinal canal and contents
C8932	MR angiography without contrast, spinal canal and contents
C8933	MR angiography without contrast followed by with contrast, spinal canal and contents
C8934	MR angiography with contrast, upper extremity

C8935	MR angiography without contrast, upper extremity
C8936	MR angiography without contrast followed by with contrast, upper extremity

ICD-10 Diagnosis

Refer to the ICD-10 CM manual

History

Status	Review Date	Effective Date	Action
Revised	01/29/2026	09/19/2026	Independent Multispecialty Physician Panel (IMPP) review. Separated Vascular Imaging guideline into Advanced Imaging for Vascular Indications and Vascular Ultrasound and Physiologic Testing. Added allowances for CTA Head/neck. Revised indications: Vasculitis, Aneurysm, intracranial, Signs, symptoms, and abnormal imaging, Aortic dissections and other aortopathies, Thoracic aortic aneurysm, Other vascular indications in the chest, Aneurysm of the abdominal aorta or iliac arteries, Renal artery stenosis/renovascular hypertension, Stenosis or occlusion of the abdominal aorta or iliac arteries, Venous indications, Peripheral arterial disease, and Procedure related imaging.
History of Vascular Imaging			
Updated codes 01/01/2026	n/a	Unchanged	CPT code update: added code 70471.
Revised	01/30/2025	11/15/2025	IMPP review. Revised indications: Vascular evaluation prior to transcatheter aortic valve implantation/replacement (TAVI/TAVR) or cardiac surgery, Stenosis or occlusion, extracranial carotid arteries, Stroke or transient ischemic attack (TIA), intracranial evaluation, Stroke or transient ischemic attack (TIA), extracranial evaluation, Venous thrombosis or compression, intracranial, Acute aortic syndrome, Physiologic testing for peripheral arterial disease, and Physiologic testing for peripheral arterial disease.
Revised	01/23/2024	10/20/2024	Independent Multispecialty Physician Panel (IMPP) review. Revised indications: Aneurysm, intracranial, Stenosis or occlusion, vertebral or basilar arteries, Stroke or transient ischemic attack (TIA), intracranial evaluation, Venous thrombosis or compression, intracranial, Hematoma/hemorrhage within the abdomen or pelvis, IVC and iliac vein evaluation, Vascular access procedures (Upper and Lower extremity), and Peripheral arterial disease (Lower extremity).
Updated	01/23/2024	Unchanged	Expanded guideline rationale. Added required language per new Medicare regulations.
Revised	01/24/2023	09/10/2023	IMPP review. Revised indications: Vascular anatomic delineation prior to surgical and interventional procedures, not otherwise specified, Vascular evaluation prior to transcatheter aortic valve implantation/replacement, Stenosis or occlusion, extracranial carotid arteries,

Status	Review Date	Effective Date	Action
			Pulmonary hypertension, Unexplained hypotension, Venous thrombosis or occlusion, Peripheral arterial disease, and Popliteal artery aneurysm.
Revised	11/11/2021	09/11/2022	IMPP review. Revised indications: Pulsatile tinnitus, Stenosis or occlusion, extracranial carotid arteries, Stroke or transient ischemic attack (TIA), intracranial evaluation, Stroke or transient ischemic attack (TIA), extracranial evaluation, Acute aortic syndrome, Pulmonary embolism, Aneurysm of the abdominal aorta or iliac arteries, Venous thrombosis or occlusion, and Peripheral arterial disease. Added indication for Popliteal artery aneurysm.
Revised	11/11/2021	06/12/2022; 09/11/2022 for Anthem Medicaid	IMPP review. Revised indications: Stenosis or occlusion, extracranial carotid arteries, Stroke or transient ischemic attack (TIA), intracranial evaluation, Stroke or transient ischemic attack (TIA), extracranial evaluation, Pulmonary embolism, and Aneurysm of the abdominal aorta or iliac arteries.
Revised	12/03/2020	09/12/2021	IMPP review. Revised definitions and these indications: Congenital or developmental vascular anomalies, not otherwise specified, Aneurysm, intracranial, Hemorrhage, intracranial, Horner's syndrome, Pulsatile tinnitus, Stenosis or occlusion, intracranial, Stenosis or occlusion, extracranial carotid arteries, Stenosis or occlusion, vertebral or basilar arteries, Stroke or transient ischemic attack (TIA), acute (7 days or less), Trigeminal neuralgia, Venous thrombosis or compression, intracranial, Aortic aneurysm, Pulmonary embolism, Acute aortic syndrome, Aneurysm of the abdominal aorta or iliac arteries, Hematoma/hemorrhage within the abdomen, Renal artery stenosis (RAS)/Renovascular hypertension, Stenosis or occlusion of the abdominal aorta or branch vessels, not otherwise specified, Venous thrombosis or occlusion, Peripheral arterial disease (PAD).
Revised	-	03/14/2021	Added HCPCS codes C8900, C8901, C8902, C8909, C8910, C8911, C8912, C8913, C8914, C8918, C8919, C8920, C8931, C8932, C8933, C8934, C8935, and C8936.
Revised	-	01/01/2021	Annual CPT code update: revised descriptions for 71250, 71260, 71270.
Revised	08/12/2019	05/17/2020	IMPP review. Surveillance of stable abdominal aortic or iliac aneurysms in patients who have had open surgical repair changed to every 5 years. Added annual surveillance of stenosis or occlusion of abdominal aortic/branch vessels in patients who have had surgical bypass grafts.
Revised	03/25/2019	11/10/2019	IMPP review. Added arterial ultrasound guideline content. Aligned peripheral arterial ultrasound and advanced vascular imaging criteria. Added clinical content to all document sections based on literature surveillance. Added CPT codes 93880, 93882, 93922, 93923, 93924, 93925, 93926, 93930, 93931, 93978, 93979.
Restructured	09/12/2018	01/01/2019	Advanced Imaging guidelines redesigned and reorganized to a condition-based structure

Status	Review Date	Effective Date	Action
Revised	07/11/2018	03/09/2019	IMPP review. Renamed the Administrative Guidelines to "General Clinical Guideline." Retitled Pretest Requirements to "Clinical Appropriateness Framework" to summarize the components of a decision to pursue diagnostic testing. Revised to expand applicability beyond diagnostic imaging, retitled Ordering of Multiple Studies to "Ordering of Multiple Diagnostic or Therapeutic Interventions" and replaced imaging-specific terms with "diagnostic or therapeutic intervention." Repeated Imaging split into two subsections, "repeat diagnostic testing" and "repeat therapeutic intervention."
Revised	03/01/2018	10/30/2018	IMPP review and revision.
Created	-	03/30/2005	Original effective date