

PERIPHERAL VASCULAR DISEASE IMAGING GUIDELINES

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MedSolutions, Inc. Clinical Decision Support Tool for Advanced Diagnostic Imaging

Common symptoms and symptom complexes are addressed by this tool. Imaging requests for patients with atypical symptoms or clinical presentations that are not specifically addressed will require physician review. Consultation with the referring physician may provide additional insight.

This version incorporates MSI accepted revisions prior to 11/30/08

ABBREVIATIONS and GLOSSARY
PERIPHERAL VASCULAR DISEASE GUIDELINES
 (also see Cardiac Guidelines Glossary)

AAA	abdominal aortic aneurysm
ABI - ankle brachial index: a noninvasive, non-imaging test for arterial insufficiency – see toe-brachial index below. This testing can also be done after exercise if resting results are normal.	
Claudication or Intermittent claudication: usually a painful cramping sensation of the legs with walking or severe leg fatigue	
CTA	computed tomography angiography
CTV	computed tomography venography
DLCO	diffusion capacity: defined as the volume of carbon monoxide transferred into the blood per minute per mmHg of carbon monoxide partial pressure
DVT	deep venous thrombosis
ECG	electrocardiogram
ENT	Ears, Nose, Throat
HbA1C	hemoglobin A1C: test used to determine blood sugar control for patients with diabetes
MRA	magnetic resonance angiography
MRV	magnetic resonance venography
PAD	peripheral artery disease
PAH	pulmonary artery hypertension
PFT	pulmonary function tests
PVD	peripheral vascular disease
SVC	superior vena cava
TIA	transient ischemic attack
TTE	transthoracic echocardiogram
Toe-Brachial Index: useful in patients with ABI above the normal range due to noncompressible posterior tibial or dorsalis pedis arteries	
V/Q Scan: ventilation and perfusion scan	

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PERIPHERAL VASCULAR DISEASE GUIDELINES

PVD-1~GENERAL GUIDELINES

- The same general risk factors apply for coronary disease as for vascular disease in the non-coronary bed (see CD-8 CT of the Heart and CTCA Evidence Based Clinical Support section in the Cardiac guidelines).
- Diabetes is a particularly high risk factor for the development of vascular disease.
- Even patients less than age 50 with at least one risk factor are considered “at risk” for vascular disease.
- The presence of erectile dysfunction can be associated with vascular disease* (see PV-15 Impotence/Erectile Dysfunction in the Pelvic guidelines). If this is the only indication listed for advanced imaging, Medical Director review is needed.

**Arch Int Med 2006;166:201-206*

- **Post angioplasty/reconstruction:** Follow-up imaging is principally guided by symptoms
 - Also see
 - AB-22 Abdominal Aortic Aneurysm and Iliac Artery Aneurysm—Follow-up of Known Aneurysms and Pre-op Evaluation in the Abdomen guidelines
 - AB-23 Abdominal Aortic Aneurysm and Iliac Artery Aneurysm—Post Endovascular or Open Aortic Repair in the Abdomen guidelines
 - CH-30 Thoracic Aortic Dissection or Aneurysm in the Chest guidelines.
- **Imaging Studies:**
 - Carotid studies (neck MRA or CTA) capture the area from the top of the aortic arch (includes the origin of the innominate artery, common carotid artery, and subclavian artery, which gives off the vertebral artery) to the base of the skull.
 - CTA/ MRA abdomen (CPT 74175/74185) images from the diaphragm to the umbilicus or iliac crest.
 - CTA/MRA chest (CPT 71275/71555) images from the base of the neck to the dome of the liver.
 - Runoff studies (CPT 75635 for CTA or 74185, 73725, and 73725 for MRA) image from the umbilicus to the feet.
- **CPT Coding:**
 - CTA of the abdomen and lower extremities should be coded as CPT 75635 rather than using the individual CPT codes for the abdomen, pelvis, and legs.
 - MRA of the abdomen, pelvis and lower extremities should be coded as CPT 74185, 73725, and 73725. The CPT code for MRA pelvis should not be included in this circumstance.

PVD-2~SCREENING ASYMPTOMATIC PATIENTS

- Over 50% of individuals with peripheral artery disease (PAD) are asymptomatic or have atypical symptoms. One third of patients with PAD have claudication.*
**N Engl J Med 2001 May;344:1608-1621*

- U.S. Preventive Services Task Force (USPSTF) recommends against routine screening for peripheral vascular disease because screening for PAD among asymptomatic adults in the general population would have few or no benefits due to the low prevalence of PAD.
 - There is little evidence that treatment of PAD at this asymptomatic stage, beyond treatment based on standard cardiovascular risk assessment, improves health outcomes.
 - Furthermore, USPSTF found fair evidence that screening asymptomatic adults with the ankle brachial index (ABI) could lead to some small degree of harm, including false-positive results and unnecessary workups.
 - Thus, the USPSTF concludes that, for asymptomatic adults, the harms of routine screening for PAD exceeds benefits.
- **Individuals with diabetes:**
 - PAD is more than twice as common among diabetics compared with non-diabetic individuals and is a strong predictor of subsequent cardiovascular morbidity and mortality.*
 - Elevated HbA1C levels are associated with an increased risk of PAD independently of known risk factors.*
 - **Diabetes Care 2006;29:877-882*
 - Many diabetics with PAD are asymptomatic.
 - Thus, screening for PAD in diabetic individuals should be performed.
 - Screening should be done initially with clinical assessment followed by ABI and/or duplex ultrasound.
 - ABI <0.90 has been shown to have 79% sensitivity and 90% specificity for detecting angiogram-positive PAD (stenosis of $\geq 50\%$).*
 - **Diabetes Care 2006;29:877-892*

PVD-3~CEREBROVASCULAR AND CAROTID DISEASE

- See also (in Head guidelines):
 - HD-17 Hyperacute Headache/Berry Aneurysm/Subarachnoid Hemorrhage
 - HD-30 General Stroke/TIA
 - HD-31 Special Stroke/TIA
 - HD-33 Cerebral Vasculitis
 - HD-47 Tinnitus
- Carotid intima-media thickness using duplex ultrasound imaging is being advocated as a screening test for vascular disease. This does not involve advanced imaging.
 - Outcomes data are currently lacking.
- **PVD-3.1 Duplex ultrasound** should be performed initially to evaluate possible carotid artery disease, including carotid bruit, prior to considering advanced imaging.
 - If the bruit originates from the external carotid artery, further imaging is not necessary.

- If ultrasound shows > 50% occlusion/stenosis of the internal carotid artery, then neck MRA with contrast (CPT 70548) or CTA (CPT 70498) can be performed.
- The presence or absence of a carotid bruit is not particularly useful in estimating the presence or severity of carotid occlusive disease.
- **PVD-3.2 Patients with typical symptoms of TIA/stroke or carotid dissection:**
 - Carotid imaging with MRA (CPT 70548 for TIA/Stroke, or CPT 70549 for carotid dissection) or CTA (CPT 70498) can be performed initially.
 - Also see HD-30 General Stroke/TIA and HD-31 Special Stroke/TIA in the Head guidelines.
- **PVD-3.3 Patients with suspected vertebrobasilar pathology:**
 - Brain MRI (CPT 70553) and brain MRA (CPT 70544) are generally appropriate.
 - Also see HD-31 Special Stroke/TIA and HD-31 Evidence Based Clinical Support section in the Head guidelines.
 - Evaluation by a neurologist is helpful in determining the appropriate imaging pathway.
 - **Surveillance of individuals who are asymptomatic or have unchanged symptoms and known vertebrobasilar disease:**
 - There is no evidence of-based data supporting serial follow-up advanced imaging in these patients.
 - **Surveillance of individuals who are asymptomatic or have unchanged symptoms who are status post vertebrobasilar stenting:**
 - Follow-up imaging studies should be at the discretion of the specialist who performed the stenting or the vascular specialist who is following the patient.
- **Subclavian Steal Syndrome**—see CH-28 Subclavian Steal Syndrome in the Chest guidelines
- **PVD-3.4 Surveillance after intracranial hemorrhage:**
 - The preference of the neurosurgeon or neurologist following the patient should be honored. There is no precise schedule for follow-up imaging in these patients.
- **PVD-3.5 Surveillance of individuals with known carotid disease who are asymptomatic or have unchanged symptoms and who have not undergone carotid endarterectomy or carotid angioplasty/stenting:**
 - **In non-diabetics**, follow-up of a known cervical internal carotid stenosis of >50% by ultrasound, neck MRA (CPT 70548), or neck CTA (CPT 70498) can be performed every year for two years.
 - If there is no change in stenosis category after two years, the imaging interval should be increased to every other year.
 - There is no evidence-based data to support continued yearly imaging in these individuals in the absence of disease progression.
 - If there is a change in stenosis category, imaging can remain on a yearly basis until there is no change in stenosis category for two years.
 - Example of a stenosis categories:

- Mild stenosis (<30%)
 - Moderate stenosis (30-68%)
 - Severe stenosis (70-99%)
- **In diabetics**, follow-up of a known cervical internal carotid stenosis of >50% by ultrasound, neck MRA (CPT 70548), or neck CTA (CPT 70498) can be performed every year for three years.
 - If there is no change in stenosis category after three years, the imaging interval should be increased to every other year.
 - There is no evidence-based data to support continued yearly imaging in these individuals in the absence of disease progression.
 - If there is a change in stenosis category, imaging can remain on a yearly basis until there is no change in stenosis category for three years.
- **PVD-3.6 Surveillance of individuals who are asymptomatic or have unchanged symptoms who are status post carotid angioplasty or endarterectomy:**
 - Surveillance imaging of asymptomatic patients who have undergone prior endarterectomy has not been proven to reduce neurologic events.*
 - **J Vasc Surg* 1997 Jan;25(1):55-63
 - There is insufficient evidence-based data to support serial follow-up MRA, CTA, or other advanced imaging in patients who have undergone prior endarterectomy who are asymptomatic or have unchanged symptoms.
- **PVD-3.7 Surveillance of individuals who are asymptomatic or have unchanged symptoms who are status post carotid stenting:**
 - There are currently no published recommendations regarding the type or frequency of imaging studies for patients who have undergone carotid stenting.
 - Ultrasound should be the initial study unless the vascular specialist has a documented reason why advanced imaging is needed.
 - The preference of the vascular specialist should be honored in terms of frequency of follow-up imaging studies.
- **PVD-3.8 New signs and symptoms** consistent with progressive carotid artery disease are an indication to re-image the neck vessels using ultrasound, neck MRA (CPT 70548) or neck CTA (CPT 70498).

PVD-4~UPPER EXTREMITY PERIPHERAL VASCULAR DISEASE

- MRA (or MRV) of the chest (CPT 71555) and/or upper extremities (CPT 73225) may be required when clinical evidence points to arterial or venous insufficiency.
 - Symptoms can include muscular limb pain, particularly with exertion, or otherwise unexplained swelling of the upper extremities.
- **Superior vena cava syndrome:** Chest MRV (CPT 71555) may be indicated when this syndrome is suspected. This syndrome is frequently associated with aggressive thoracic cancers or metastases.*
 - Also see CH-29 Superior Vena Cava Syndrome in the Chest guidelines.
 - **Applied Radiology*. February 2004, pp.26-33

- **Upper extremity DVT**
 - Evaluation should begin with chest x-ray (especially if prior intravenous catheter was placed) and duplex ultrasound.
 - Request for advanced imaging should be sent for Medical Director review.
 - MRI of the upper extremity (CPT 73219) and chest (CPT 71551) and/or MRV (CPT 73225 and 71555) are useful for evaluating suspected or known central venous obstruction.
 - CT of the upper extremity (CPT 73201) and chest (CPT 71260) with contrast and/or CTA (CPT 73206 and 71275) can occasionally be helpful.
 - **Reference:**
 - ACR Appropriateness Criteria, Suspected upper extremity deep vein thrombosis, 2005
- Fibromuscular Dysplasia Brachial Artery
 - Usually affects renal and carotid arteries
 - Appears as “string of beads” abnormality on angiography but ultrasound exam with advanced dynamic flow mode may be superior
 - **Reference:**
 - Circulation 2008;117:2542-2543

PVD-5~PULMONARY ARTERY HYPERTENSION

- Pulmonary artery hypertension (PAH) comprises a spectrum of diseases characterized by elevated pulmonary artery pressure with a mean above 25 mmHg at rest or 30 mmHg with exercise, or systolic pulmonary artery pressure at rest > 39 mmHg.
- Confirmatory tests include ECG (right ventricular hypertrophy with/ without strain, right atrial dilatation); chest x-ray; transthoracic echocardiogram (TTE).*
- Identifying the clinical class can be accomplished by arterial blood gas, PFT's, V/Q scan, TTE.*
 - *Eur Heart J 2004 Dec;25(24):2243-2278
- Types of pulmonary hypertension:
 - **Pulmonary arterial hypertension**
 - Includes idiopathic and PAH from e.g. collagen vascular disease, portal hypertension from cirrhosis, etc.
 - **Pulmonary venous hypertension**
 - Due to cardiac disease
 - Stress echocardiogram or left heart catheterization is indicated.
 - **Pulmonary hypertension associated with hypoxemia**
 - PAH secondary to lung disorders
 - PFT's should be obtained: if restrictive disease is present and DLCO is decreased, high resolution chest CT (CPT 71250) should be obtained to rule out restrictive lung disorders such as idiopathic pulmonary fibrosis.
 - **PAH secondary to chronic thromboembolic disease**
 - Only form of PAH that has potentially curative treatment.
 - **Reference:**
 - Preston I. PAH: Identification and Treatment Based on Disease Severity February 28, 2006, <http://www.medscape.com>. Accessed November 30, 2006

- **Chest CTA** (CPT 71275) for evaluation of pulmonary hypertension is appropriate if the etiology is felt to be pulmonary embolism. Otherwise, requests should be sent for Medical Director review.
- Obstructive sleep apnea is associated with pulmonary hypertension and can be associated with right heart failure (cor pulmonale).
 - Cardiovascular advanced imaging is generally not indicated in the evaluation of obstructive sleep apnea.
 - ENT imaging in certain settings of nasopharyngeal abnormalities or deformities may be indicated for sleep apnea evaluation.
 - Also see HD-27.2 Sleep apnea in the Head guidelines.

PVD-6~AORTIC DISORDERS AND RENAL VASCULAR DISORDERS and VISCERAL ARTERY ANEURYSMS

- See also (in Abdomen guidelines):
 - AB-22 Abdominal Aortic Aneurysm and Iliac Artery Aneurysm—Follow-up of Known Aneurysms and Pre-op Evaluation in the Abdomen guidelines
 - AB-23 Abdominal Aortic Aneurysm and Iliac Artery Aneurysm—Post Endovascular or Open Aortic Repair in the Abdomen guidelines
 - AB-41 Renovascular Hypertension
- See also CH-30 Thoracic Aortic Dissection or Aneurysm in the Chest guidelines
- **Thoracic Aortic Disease**
- Chest CT (CPT 71260 or 71270), chest CTA (CPT 71275), or chest MRA (CPT 71555) can be used for surveillance or follow-up of thoracic aortic abnormalities in patients with Loeys-Deitz syndrome, Marfan syndrome, Takayasu’s arteritis, or Kawasaki syndrome.*

**N Engl J Med 2006 August;355:788-798*

- Less lethal disorders such as Turner syndrome and tuberous sclerosis have also been associated with aortic dissection.*

**Clin.Cardiol 2006;29:383-386*

- **Renal Artery disease:**
 - See AB- 41 Renovascular Hypertension in the Abdominal guidelines.
- **Abdominal aortic abnormality:**
 - Also see AB- 22.1 Abdominal Aortic Aneurysm and AB-23 Abdominal Aortic Aneurysm and Iliac Artery Aneurysm—Post Endovascular or Open Aortic Repair in the Abdomen guidelines.
 - Ultrasound should be performed initially in any patient with a pulsatile or expansile abdominal mass.
 - **Exception:** In circumstances in which ultrasound is technically difficult (e.g. obese body habitus), CTA (CPT 74175) [preferred] or MRA (CPT 74185) can be performed initially.
 - If suspicion of lower extremity vascular insufficiency is warranted (see PVD- 7 Lower Extremity Peripheral Vascular Disease), aortoiliofemoral run-off studies from the abdomen to the extremities (CTA--CPT 75635, or MRA—CPT 74185, 73725, and 73725) can be performed.*

**Clev Clin J Med 2006 Jan;73(1):9-19*

- Certain forms of bacterial endocarditis/vasculitis, such as seen in *salmonella* infections, can result in both pseudoaneurysms and true aneurysms of the aorta and require advanced imaging to confirm their presence.
 - Outpatient assessment can be done in settings of suspected salmonellosis, but patients usually undergo inpatient assessment.
- There is insufficient evidence-based data to support using advanced imaging to screen for thoracic aortic aneurysm in patients with known abdominal aortic aneurysm.
- **Mesenteric ischemia:**
 - Also see AB-9 Mesenteric/Colonic Ischemia in the Abdominal guidelines.
 - CTA of the abdomen (CPT 74175), unless contraindicated, is preferred over MRA (CPT 74185) for evaluation of mesenteric ischemia.
 - Conventional angiography is still favored by many specialists.
- **Visceral artery aneurysms**
 - These include arteries to the spleen, kidney, liver and intestines.
 - Aneurysm of these arteries is defined by an increase of more than 50% of the original arterial diameter.
 - Risk for rupture is high when the aneurysm is greater than 2 cm or is increasing rapidly*
 - **Visceral artery aneurysms. UC Davis Vascular Center.*
<http://www.ucdmc.ucdavis.edu>. Accessed September 27, 2007
 - Vascular specialist consultation is beneficial in order to determine the time-frame to intervention.
 - Monitoring by ultrasound or CT with contrast is appropriate, although ultrasound should be attempted first.
 - Celiac artery aneurysm can be evaluated by CT abdomen with contrast (CPT 74160), CTA abdomen (CPT 74175), or ultrasound.*
 - **Arch Surg 2002;137:670-674*
 - No definitive time period for serial studies has been established.
 - Initial evaluation with six month follow-up is reasonable.
 - Yearly follow-up in conjunction with vascular specialist consultation should be performed if no significant enlargement is seen.
- **Follow-up imaging after stent placement**
 - No definitive guidelines have been established for follow-up imaging, but it would be reasonable to follow the same time table as for endovascular aortic repair: CTA of abdomen (CPT 74175), MRA of abdomen (CPT 74185), or CT abdomen (CPT 74160) at 1 month, 6 months, and 12 months following stent placement, then every year. An additional study can be done at 3 months if there was evidence of endoleak on the 1 month study.

PVD-7~LOWER EXTREMITY PERIPHERAL VASCULAR DISEASE

• Individuals at Risk for Lower Extremity Peripheral Arterial Disease*

- Age less than 50 years, with diabetes and one other atherosclerosis risk factor (smoking, dyslipidemia, hypertension, or hyperhomocysteinemia)
- Age 50 to 69 years and history of smoking or diabetes
- Age 70 years and older
- Leg symptoms with exertion (suggestive of claudication) or ischemic rest pain
- Abnormal lower extremity pulse examination
- Known atherosclerotic coronary, carotid, or renal artery disease

**J Am Coll Cardiol 2006;47:1-192*

- Asymptomatic (non painful) peripheral vascular disease may carry a worse prognosis from a functional viewpoint.* Therefore, investigation of the lower extremities as outlined in PVD-7.1 Claudication despite lack of symptoms may be warranted.

**Circulation 2008;117:2484-2491*

• PVD-7.1 Claudication

- ABI is the preferred initial test*
 - If ankle brachial index (ABI) and post-exercise ABI are normal, no advanced imaging is indicated.
 - Normal ABI range is 0.9 to 1.3.
 - If ABI is greater than 1.3, this suggests severe peripheral vascular disease and arteries that are inelastic or “stiff.”
 - A toe-brachial index may be used as further screening in patients with ABI’s greater than 1.3
 - Advanced imaging may be indicated in these patients, including CTA with run off (CPT 75635) or MRA of the aortoiliac system (CPT 74185, 73725, and 73725).

**ACR Appropriateness Criteria, Claudication, 2005*

**J Am Coll Cardiol 2008;51:1292-1298*

- ABI may not be needed if a vascular specialist documents classic signs and symptoms of extremity vascular insufficiency and worsening symptoms and indicates why ABI documentation is not necessary (since it may prove useful for comparison to post procedure evaluation)
- ABI is the preferred initial test, but lower extremity duplex ultrasound and Doppler studies are adjuncts.* and should be performed prior to considering advanced imaging.

**Postgrad Med 2006;119(2):21-27*

**Radiology 2005;236:1083-1093 and 1094-1103*

- Duplex ultrasound with Doppler is useful for identifying location and extent of disease.
- Evaluation by a vascular surgeon or other vascular specialist is helpful in determining the need for advanced imaging.

- Advanced imaging is not medically indicated in patients who have claudication symptoms that are improving with medical therapy (walking exercise, rehabilitation and medications).
- Advanced imaging is indicated for the following:
 - After vascular disease is confirmed to be significant by noninvasive testing and an invasive procedure is being considered
 - When conservative medical therapy has failed and an invasive procedure is being considered
 - When there is evidence of potentially limb-threatening vascular disease, such as skin breakdown, nonhealing ischemic ulcers, resting leg pain, or gangrene
 - Preoperative planning for an invasive procedure (endovascular or open surgery)
- If advanced imaging is indicated, MRA of the aorta, pelvic vessels, and lower extremities (CPT 74185, 73725 and 73725) or CTA (CPT 75635) can be performed to further evaluate the lower extremity arteries.
 - Although MRA may be preferred for infrapopliteal and foot vessels either MRA or CTA may be chosen to visualize these vessels*
 - *[J Am Coll Cardiol 2006;47:1-192](#)
- **Pseudoclaudication:**
 - See SP-4 Lumbar Spinal Stenosis in the Spine guidelines.
 - Post-exercise ABI is often one of the first tests ordered for suspected pseudoclaudication in order to delineate vascular vs nonvascular causes.
- **Popliteal Artery Entrapment Syndrome:**
 - Popliteal artery stenosis or occlusion due to compression by adjacent muscle and tendons.
 - Usually seen in young men (ages 20-40)
 - Diagnosis can be made by ultrasound, lower extremity CTA (CPT 73706), or lower extremity MRA (CPT 73725)
 - CT or MRI of the lower extremity (contrast as requested) can be performed to evaluate the structures impinging on the popliteal artery if requested by the operating surgeon.
 - **References:**
 - [Diagn Intervent Radiol 2005;11:222-224](#)
 - [AJR 2003;181:1259-1265](#)
- **PVD-7.2 Lower extremity artery aneurysms**
 - **Iliac artery aneurysm:**
 - AB-22 Abdominal Aortic Aneurysm and Iliac Artery Aneurysm—Follow-up of Known Aneurysms and Pre-op Evaluation in the Abdomen guidelines.
 - **Femoral artery aneurysm**
 - Patients present with local pressure symptoms, thrombosis, or distal embolization.
 - A pulsatile mass can be felt in the groin.
 - Ultrasound should be performed initially.
 - Vascular specialist consultation is helpful in determining the need for advanced imaging and the time-line to intervention.

- Advanced imaging (CTA [CPT 73706] or MRA [CPT 73725]) is generally reserved as a preoperative study for patients with no plans for invasive angiography and/or who have technically limited or abnormal ultrasound results.
- **Popliteal artery aneurysm:**
 - Account for 80% of all peripheral aneurysms.
 - Patients with this aneurysm are at risk for other types of aneurysm (e.g. aortic aneurysm).
 - Ultrasound should be the initial imaging study to assess for other aneurysms (especially aortic aneurysm).
 - Vascular specialist consultation is helpful in determining the need for advanced imaging and the time-line to intervention.
 - Advanced imaging (CTA—CPT 73706 or MRA—CPT 73725) is generally reserved as a preoperative study for patients with no plans for invasive angiography and/or who have technically limited or abnormal ultrasound results.
 - Post procedure surveillance imaging is unnecessary and has not been shown to alter patient management. Post interventional functional testing (ABI) may be useful as establishing a new baseline for the patient.
- **Reference:**
 - *Aneurysms and Dissection of Arteries*. PatientPlus, <http://www.patient.co.uk>. Accessed December 5, 2007
- **PVD-7.3 Lower extremity edema**
 - Patients presenting with lower extremity edema should have venous duplex study as the initial imaging study to rule out deep venous thrombosis (DVT)
 - In patients with negative venous duplex study and unilateral calf edema, a dedicated ultrasound of the popliteal fossa to rule out popliteal (Baker's) cyst should be performed initially.
 - In patients with negative venous duplex study and persistent unexplained unilateral or bilateral lower extremity edema, abdominal and pelvic ultrasound should be performed.
 - If the above ultrasound studies are negative, CT of the abdomen and pelvis with contrast (CPT 74160 and 72193) or CT scan of the pelvis (CPT 72193) alone can be performed.
 - CT or MRI of the lower extremity without contrast (CPT 73700 or 73718) can be performed in patients with persistent unilateral calf edema and negative ultrasound studies.
 - Although uncommon, diabetic muscle necrosis can present with acute painful swelling in the lower extremity. MRI of the extremity (contrast as requested) is the diagnostic method of choice.
 - The documented presence of chronic lower extremity edema due to chronic venous insufficiency generally will not respond to intervention, and advanced imaging is not routinely indicated.
 - If there is documented need to exclude other more treatable causes such as thigh or abdominal/pelvic clot(s) or masses, MRV (or CTV) can be helpful (CPT 74185 and 72198 or 74175 and 72191). These cases should be sent for Medical Director review.

- CT venography of the abdomen and pelvis (CPT 74175 and 72191) or MRV (CPT 74185 and 72198) may be appropriate if venous thrombosis is suggested but is indeterminate on other imaging tests, or if the extent of thrombosis needs more detailed assessment.
- Phlegmasia cerulea dolens can be evaluated by MRV, CTV or CTA with run off to assess the arterial system. MRA (CPT 74185, 73725, and 73725) may also be required for this problem, which can reflect both arterial and venous compromise and produce substantial lower extremity edema.

Evidence Based Clinical Support
PVD-4~UPPER EXTREMITY PERIPHERAL VASCULAR DISEASE

- Upper extremity claudication is rare and can be manifested as fatigue and cramping pain along with muscle weakness. Positional tests such as Adson's maneuver can be done on physical examination and demonstrate pulse deficit in certain positions, which may suggest extravascular compromise (e.g. vascular thoracic outlet syndrome). Not all patients with a positive Adson test have thoracic outlet syndrome. Surgery or stenting of the arterial or venous segments is sometimes performed.
- Superior vena cava syndrome is usually manifested as facial and upper truncal and neck swelling, usually in the presence of a malignancy or blood clotting disorder, or in patients with central venous catheters which can cause clotting or scarring of veins.

Evidence Based Clinical Support
PVD-5~PULMONARY ARTERY HYPERTENSION

- Primary pulmonary artery hypertension is more frequent in young females than males and can be manifested as dyspnea on exertion, chest pain, and less commonly, hemoptysis.
- Secondary pulmonary hypertension can be due to multiple or single large pulmonary emboli or obstructive sleep apnea.

Evidence Based Clinical Support
PVD-6~AORTIC DISORDERS, RENAL VASCULAR DISORDERS, and VISCERAL ARTERY ANEURYSMS

- Takayasu's aortitis is a rare disorder with a predilection for women aged 25-30. It is manifested by hypertension, pulse deficits (arm/leg claudication), bruits. Blood pressure measurements should be performed in all four extremities prior to imaging. Most commonly affected areas include abdominal aorta, descending thoracic aorta and finally the aortic arch.* Also affects heart vessels (see CD-8.6).

**Circulation 2008;117:3039-3051*

Evidence Based Clinical Support
PVD-7~LOWER EXTREMITY PERIPHERAL VASCULAR DISEASE

- **PVD-7.1 Claudication**
 - ABI measurements:
 - 0.9-1.3 is probably within normal limits
 - ABI 0.5-0.89 represents moderate disease
 - ABI < 0.5 represents severe disease
 - ABI > 1.3 represents "stiff" arterial vessels and may be due to atherosclerotic obstruction, but further testing is justified

- There is a 5% false negative rate due to calcification of the lower extremity arteries
- CTA versus MRA of the infrapopliteal vessels:
 - In patients with critical limb ischemia, CT imaging is limited by adequate contrast delivery and the adjacent bone which limits volumetric analysis of the dataset.
 - MRA is an excellent imaging study, but requires expertise by the technologist performing the study to avoid mistaking the paratibial veins for arteries.

PERIPHERAL VASCULAR DISEASE GUIDELINE REFERENCES

PVD-1~General Guidelines

- Min JK, Williams KA, Okwuosa TM, et al. Prediction of coronary heart disease by erectile dysfunction in men referred for nuclear stress testing. *Arch Int Med* 2006;166:201-206.

PVD-2~Screening Asymptomatic Patients

- Hiatt WR. Drug therapy: Medical treatment of peripheral arterial disease and claudication. *N Engl J Med* 2001 May;344:1608-1621.
- Selvin E, Wattanakit K, Steffes MW, Sharrett AR. HbA_{1c} and peripheral arterial disease in diabetes. *Diabetes Care* 2006;29:877-882.

PVD-3~Cerebrovascular and Carotid Disease

- Golledge J, Cuming R, Beattie DK, et al. Clinical follow-up rather than duplex surveillance following carotid endarterectomy. *J Vasc Surg* 1997 Jan;25(1):55-63.

PVD-4~Upper Extremity Peripheral Vascular Disease

- Kinsky G. Body MR venography: the new gold standard. *Applied Radiology* February 2004, pp.26-33.
- *ACR Appropriateness Criteria, Suspected upper extremity deep vein thrombosis, 2005.*
- Yoshimuta T, Akutsu K, Okajima T, et al. "String of beads" appearance of bilateral brachial artery in fibromuscular dysplasia. *Circulation* 2008;117:2542-2423.

PVD-5~Pulmonary Artery Hypertension

- Galiè N, Torbicki A, Barst R, et al. (Task Force members). Guidelines on diagnosis and treatment of pulmonary arterial hypertension: The Task Force on Diagnosis and Treatment of Pulmonary Arterial Hypertension of the European Society of Cardiology. *Eur Heart J* 2004 Dec;25(24):2243-2278.
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PVD-6~Aortic Disorders, Renal Vascular Disorders, and Visceral Artery Aneurysms

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