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, specialist and/or patient’s Primary Care Physician (PCP) may provide additional insight.

This version incorporates MSI accepted revisions prior to 7/22/11
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### EVIDENCE BASED CLINICAL SUPPORT

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### ABBREVIATIONS and GLOSSARY

**PERIPHERAL VASCULAR DISEASE GUIDELINES**
*(also see Cardiac Imaging Guidelines Glossary)*

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Definition</th>
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<tr>
<td>AAA</td>
<td>Abdominal aortic aneurysm</td>
</tr>
<tr>
<td>ABI</td>
<td>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.</td>
</tr>
<tr>
<td>Claudication or Intermittent claudication</td>
<td>Usually a painful cramping sensation of the legs with walking or severe leg fatigue</td>
</tr>
<tr>
<td>CTA</td>
<td>Computed tomography angiography</td>
</tr>
<tr>
<td>CTV</td>
<td>Computed tomography venography</td>
</tr>
<tr>
<td>DLCO</td>
<td>Diffusion capacity: defined as the volume of carbon monoxide transferred into the blood per minute per mmHg of carbon monoxide partial pressure</td>
</tr>
<tr>
<td>DVT</td>
<td>Deep venous thrombosis</td>
</tr>
<tr>
<td>ECG</td>
<td>Electrocardiogram</td>
</tr>
<tr>
<td>ENT</td>
<td>Ears, Nose, Throat</td>
</tr>
<tr>
<td>HbA1C</td>
<td>Hemoglobin A1C: test used to determine blood sugar control for patients with diabetes</td>
</tr>
<tr>
<td>MRA</td>
<td>Magnetic resonance angiography</td>
</tr>
<tr>
<td>MRV</td>
<td>Magnetic resonance venography</td>
</tr>
<tr>
<td>PAD</td>
<td>Peripheral artery disease</td>
</tr>
<tr>
<td>PAH</td>
<td>Pulmonary artery hypertension</td>
</tr>
<tr>
<td>PFT</td>
<td>Pulmonary function tests</td>
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<td>PVD</td>
<td>Peripheral vascular disease</td>
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<td>SVC</td>
<td>Superior vena cava</td>
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<td>TIA</td>
<td>Transient ischemic attack</td>
</tr>
<tr>
<td>TTE</td>
<td>Transthoracic echocardiogram</td>
</tr>
<tr>
<td>Toe-Brachial Index</td>
<td>Useful in patients with ABI above the normal range due to noncompressible posterior tibial or dorsalis pedis arteries</td>
</tr>
<tr>
<td>V/Q Scan</td>
<td>Ventilation and perfusion scan</td>
</tr>
</tbody>
</table>
PVD-1~GENERAL GUIDELINES

- **PVD-1.1 General Considerations**
  - 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 CCTA Evidence Based Clinical Support** section in the Cardiac Imaging 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-18 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 Imaging Guidelines
      - **AB-23 Abdominal Aortic Aneurysm and Iliac Artery Aneurysm—Post Endovascular or Open Aortic Repair** in the Abdomen Imaging Guidelines
      - **CH-32 Thoracic Aorta** in the Chest Imaging Guidelines.
      - **PVD-7.2 Post-Procedure Studies**
  - 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 CPT®74185, CPT®73725, and CPT®73725 for MRA) image from the umbilicus to the feet.
- If a prior imaging study (ultrasound, MRA, CTA, catheter angiogram, etc.) has been completed for a condition, a follow-up, additional, or repeat study for the same condition is generally not indicated unless there has been a change in the patient’s condition, previous imaging showed an indeterminate finding, or MedSolutions’ guidelines support routine follow-up imaging.
  - **Equivocal findings**
    - CTA may be indicated to evaluate equivocal findings on angiography or MRA if the results will affect patient management decisions.
    - MRA may be indicated to evaluate equivocal findings on angiography or CTA if the results will affect patient management decisions.

### PVD-1.2 CODING NOTES

- **PVD-1.2.1 Ankle/Brachial Index**
  - **NOTE:**
    - Ankle-brachial index (ABI) by itself has no CPT® code and is insufficient to support separate billing. It is included as part of the physical exam. In order to be separately billable, the ABI must be performed with simultaneous Doppler waveform recording and analysis, or with volume plethysmography or with transcutaneous oxygen tension measurements. These more sophisticated ABI studies are generally performed in vascular laboratories by vascular specialists.
    - In general, ABI should be measured first. **If ABI is normal, then further vascular studies are generally not indicated.** If ABI is abnormal, then arterial duplex scans (CPT®93925, 93926, 93930, 93931) are usually performed as the next study.
  - **CPT®93922** Limited bilateral noninvasive physiologic studies of upper or lower arteries (e.g. for lower extremity: ankle/brachial indices at distal posterior tibial and anterior tibial/dorsalis pedis arteries plus bidirectional, Doppler waveform recording and analysis at 1-2 levels, or ankle/brachial indices at distal posterior tibial and anterior tibial/dorsalis pedis arteries plus volume plethysmography at 1-2 levels, or ankle/brachial indices at distal posterior tibial and anterior tibial/dorsalis pedis arteries with transcutaneous oxygen tension measurements at 1-2 levels)
    - **Use CPT®93922 as the default code for ABI studies**
    - **CPT®93922 and CPT®93923 should not be ordered on the same request nor billed together for the same date of service.**
    - **CPT®93924 and CPT®93922 and/or CPT®93923 should not be ordered on the same request and generally should not be billed together for the same date of service.**
CPT®93923 Complete bilateral noninvasive physiologic studies of upper or lower extremity arteries, 3 or more levels (e.g. for lower extremity: ankle/brachial indices at distal posterior tibial and anterior tibial/dorsalis pedis arteries plus segmental blood pressure measurements with bidirectional, Doppler waveform recording and analysis, at 3 or more levels, or ankle/brachial indices at distal posterior tibial and anterior tibial/dorsalis pedis arteries plus volume plethysmography at 3 or more levels, or ankle/brachial indices at distal posterior tibial and anterior tibial/dorsalis pedis arteries plus segmental transcutaneous oxygen tension measurements at 3 or more levels, or single level study with provocative functional maneuvers e.g., measurements with postural provocative tests, or measurements with reactive hyperemia).

CPT®93924 Non-invasive physiologic studies of lower extremity arteries, at rest and following treadmill stress testing (i.e. bidirectional Doppler waveform or volume plethysmography recording and analysis at rest with ankle/brachial indices immediately after and at timed intervals following performance of a standardized protocol on a motorized treadmill plus recording of time of onset of claudication or other symptoms, maximal walking time, and time to recovery) complete bilateral study

PVD-1.2.2 External Counterpulsation (ECP)

See CD-1.6 External Counterpulsation in the Cardiac Imaging Guidelines

The usual procedure code for ECP is G0166, which is an all-inclusive code

- External cardiac assistance (CPT®92971), ECG rhythm strip and report (CPT®93040 or CPT®93041), pulse oximetry (CPT®94760 or CPT®94761), and plethysmography (CPT®93922 or CPT®93923) should not be separately requested or billed with G0166.

- MedSolutions does not currently prior authorize the G0166 code

PVD-1.2.3 Ultrasound Codes

Cerebrovascular Artery Studies (Carotid and vertebral arteries) and Vein Studies

- CPT®93875 Non-invasive physiologic studies of extracranial arteries, complete bilateral study (e.g. periorbital flow direction with arterial compression, ocular pneumoplethysmography, Doppler ultrasound spectral analysis)

  - This study is rarely performed due to the excellent images produced by duplex scan of the extracranial arteries.

  - Requests for this study should be sent for Medical Director review.

- CPT®93880 Duplex scan of extracranial arteries; complete bilateral study

- CPT®93882 Duplex scan of extracranial arteries; unilateral or limited study

- CPT®93970 Duplex scan of extremity veins, including responses to compression and other maneuvers; complete bilateral study

  - Use for duplex study of extracranial veins such as jugular veins
• **CPT®93971** Duplex scan of extremity veins, including responses to compression and other maneuvers; unilateral or limited study
  - Use for duplex study of extracranial vein such as **jugular vein**

> **Arterial Duplex Scans—Upper and Lower Extremities**

• **NOTE:** In general, ABI should be measured first. If ABI is normal, then further vascular studies are generally not indicated. If ABI is abnormal, then arterial duplex scans (CPT®93925, 93926, 93930, 93931) are usually performed as the next study.

• **CPT®93925** Duplex scan of lower extremity arteries or arterial bypass grafts; complete bilateral
  - A complete duplex scan of the lower extremity arteries includes examination of the full length of the common femoral, superficial femoral and popliteal arteries. The iliac, deep femoral, and tibioperoneal arteries may also be examined.

• **CPT®93926** Duplex scan of lower extremity arteries or arterial bypass grafts; unilateral or limited study
  - The limited study should be reported when only one extremity is examined or when less than a full examination is performed (e.g. exam of only one or two vessels, follow-up exam, etc.)

• **CPT®93930** Duplex scan of upper extremity arteries or arterial bypass grafts; complete bilateral
  - A complete duplex scan of the upper extremity arteries includes examination of the subclavian, axillary, and brachial arteries. The radial and ulnar arteries may also be included.

• **CPT®93931** Duplex scan of upper extremity arteries or arterial bypass grafts; unilateral or limited study
  - The limited study should be reported when only one extremity is examined or when less than a full examination is performed (e.g. exam of only one or two vessels, follow-up exam, etc.)

> **Venous Duplex Scans**

• **CPT®93965** Non-invasive physiologic studies of extremity veins, complete bilateral study (e.g. Doppler waveform analysis with responses to compression and other maneuvers, phleborheography, impedance plethysmography)
  - This study requires two separate pieces of equipment (ultrasound for the Doppler waveform and another piece of equipment for the plethysmography). Therefore, **this study is rarely performed** and should not be requested with 93970 or 93971 for the same imaging session.

• **CPT®93970** Duplex scan of extremity veins, including responses to compression and other maneuvers; complete bilateral study

• **CPT®93971** Duplex scan of extremity veins, including responses to compression and other maneuvers; unilateral or limited study

> **Duplex Scan of Hemodialysis Access**

• **CPT®93990** Duplex scan of hemodialysis access (including arterial inflow, body of access and venous outflow)
- **PVD-1.2.4 CTA and MRA Codes**
  - CTA of the abdomen and lower extremities should be reported 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 reported as CPT® 74185, CPT® 73725, and CPT® 73725. The CPT® code for MRA pelvis (CPT® 72198) 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 exceed benefits.
  - It should be noted that the ABI may have the greatest relevance as a biomarker for cardiovascular disease.*  
  *Circulation 2009;120:2033-2035

- **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 (CPT®93922). If ABI is abnormal, duplex ultrasound can be performed (CPT®93925 bilateral study or CPT®93926 unilateral study).
    - ABI <0.90 has been shown to have 79% sensitivity and 90% specificity for detecting angiogram-positive PAD (stenosis of >50%).*  
    *Diabetes Care 2006;29:877-892
3.1 Duplex Ultrasound

3.2 Patients with Typical Symptoms of TIA/Stroke or Carotid Dissection

3.3 Patients with Suspected Vertebrobasilar Pathology

3.4 Surveillance After Intracranial Hemorrhage

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

3.6 Surveillance of Individuals who are Asymptomatic or have Unchanged Symptoms who are Status Post Carotid Angioplasty or Endarterectomy

3.7 Surveillance of Individuals who are Asymptomatic or have Unchanged Symptoms who are Status Post Carotid Stenting

3.8 New Signs and Symptoms

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PVD-3~CEREBROVASCULAR AND CAROTID DISEASE

- See also (in Head Imaging Guidelines):
  - HD-17 Hyperacute Headache/Intracranial Aneurysm/AVM/Subarachnoid Hemorrhage
  - HD-29 General Stroke/TIA
  - HD-30 Special Stroke/TIA
  - HD-32 Cerebral Vasculitis
  - HD-46 Tinnitus

- Carotid intima-media thickness using duplex ultrasound imaging (Category III 0126T) is being advocated as a screening test for vascular disease. This does not involve advanced imaging.
  - Outcomes data are currently lacking.
  - Texas Heart Attack Preventive Screening Bill (HR 1290) mandates that insurers in Texas cover either a calcium scoring study (CPT®75571 or HCPCS S8092) or a carotid intima-media thickness study (ultrasound—Category III 0126T) once every five years for certain populations
    - To qualify, the following must apply:
      - Must be a Texas resident
      - Must be member of a fully-insured Texas health plan
      - Must be a man age 45-75 or a woman age 55-75
      - Must have either diabetes or a Framingham cardiac risk score of intermediate or higher
      - Must not have had a calcium scoring study or a carotid intima-media thickness study within the past 5 years
• **PVD-3.1 Duplex Ultrasound**
  o CPT®93880 bilateral study or CPT®93882 unilateral study should be performed initially to evaluate possible carotid artery disease, including carotid bruit, prior to considering advanced imaging.
  o If ultrasound shows > 50% occlusion/stenosis of the internal carotid artery, then neck MRA with contrast (CPT®70548) or neck CTA (CPT®70498) can be performed.
  o If ultrasound or other diagnostic imaging shows high grade stenosis of the internal carotid artery and the patient is actively being considered for carotid endarterectomy or stent, then head MRA (CPT®70544) and neck MRA with contrast (CPT®70548) or head CTA (CPT®70496) and neck CTA (CPT®70498) can be performed.
  o **Other indications for Duplex ultrasound of the carotid arteries** (CPT®93880 bilateral study or CPT®93882 unilateral study) include the following:
    ➢ Evaluation of hemispheric neurologic symptoms, including stroke, TIA, or amaurosis fugax
    ➢ Evaluation of nonhemispheric or unexplained neurologic symptoms
    ➢ Evaluation of known or suspected retinal arterial emboli
    ➢ Evaluation of suspected dissection
    ➢ Evaluation of pulsatile neck masses
    ➢ Evaluation of carotid bruit
      ▪ If the bruit originates from the external carotid artery, further imaging is not necessary
      ▪ The presence or absence of a carotid bruit is not particularly useful in estimating the presence or severity of carotid occlusive disease.
    ➢ Evaluation of abnormal findings on physical exam of the carotid arteries (e.g. aneurysm or absent carotid pulses)
    ➢ Preoperative evaluation of patients with evidence of severe diffuse atherosclerosis, scheduled for major cardiovascular surgical procedures
    ➢ Preoperative evaluation of patients prior to elective coronary artery bypass graft (CABG) surgery in patients older than 65 years of age and in those with left main coronary stenosis, peripheral artery disease, history of cigarette smoking, history of stroke or TIA, or carotid bruit.
    ➢ Evaluation of suspected Subclavian Steal Syndrome (See CH-30 **Subclavian Steal Syndrome** in the Chest Imaging Guidelines)
    ➢ Evaluation of blunt neck trauma
    ➢ Evaluation of vasculitis involving carotid arteries
    ➢ Surveillance imaging once a year for patients with fibromuscular dysplasia of the extracranial carotid arteries
    ➢ Follow-up imaging of known carotid disease (See **PVD-3.5** and **PVD-3.7**)
  o Ultrasound is not adequate to image the vertebrobasilar system.
  o **References:**
    ➢ *ACR-AIUM practice guideline for the performance of an ultrasound examination of the extracranial cerebrovascular system*, Rev 2007
    ➢ *J Am Coll Cardiol* 2011;57(8):1002-1044

- **PVD-3.2 Patients with Typical Symptoms of TIA/Stroke or Carotid Dissection**
  - Carotid imaging with ultrasound (CPT®93880 bilateral study or CPT®93882 unilateral study), MRA (CPT®70548 for TIA/Stroke, or CPT®70549 for carotid dissection) or CTA (CPT®70498) can be performed initially.
  - Also see **HD-29 General Stroke/TIA** and **HD-30 Special Stroke/TIA** in the Head Imaging Guidelines.

- **PVD-3.3 Patients with Suspected Vertebrobasilar Pathology**
  - Brain MRI (CPT®70553) and brain MRA (CPT®70544) are generally appropriate.
  - Also see **HD-30 Special Stroke/TIA** and **HD-30 Evidence Based Clinical Support** section in the Head Imaging Guidelines.
  - **Surveillance of individuals who are asymptomatic:**
    - There is no evidence of-based data supporting serial follow-up advanced imaging in these patients.
  - **Surveillance of individuals who have unchanged symptoms and known vertebrobasilar disease:**
    - Follow-up imaging studies should be at the discretion of the vascular specialist who is following the patient.
  - **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-30 Subclavian Steal Syndrome** in the Chest Imaging 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 (CPT®93882 unilateral study) 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%)

- Termination of surveillance imaging of the carotid arteries is reasonable when the patient is no longer a candidate for intervention.*
  
  *J Am Coll Cardiol 2011;57(8):1002-1044

- If ultrasound is technically difficult (e.g. high carotid bifurcation, patient with short neck, tortuosity of the carotid artery, etc.) or confirmation of the degree of stenosis found on ultrasound is needed because an interventional procedure (carotid endarterectomy or stent) is being considered, then neck MRA (CPT®70548) or neck CTA (CPT®70498) can be performed.

  - In diabetics, follow-up of a known cervical internal carotid stenosis of >50% by ultrasound (CPT®93882 unilateral study) 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.

    - Termination of surveillance imaging of the carotid arteries is reasonable when the patient is no longer a candidate for intervention.*
      
      *J Am Coll Cardiol 2011;57(8):1002-1044

- If ultrasound is technically difficult (e.g. high carotid bifurcation, patient with short neck, tortuosity of the carotid artery, etc.) or confirmation of the degree of stenosis found on ultrasound is needed because an interventional procedure (carotid endarterectomy or stent) is being considered, then neck MRA (CPT®70548) or neck CTA (CPT®70498) can be performed.

- PVD-3.6 Surveillance of Individuals who are Asymptomatic or have Unchanged Symptoms who are Status Post Carotid Angioplasty or Endarterectomy

  - Ultrasound (CPT®93882 unilateral study) of the carotid artery that is status post angioplasty or endarterectomy can be performed at 1 month, 6 months, and every year for 2 years following the procedure.

    - If there is no change in stenosis category after two years, the imaging interval should be increased to every other year.

    - 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%)
If ultrasound is technically difficult (e.g. high carotid bifurcation, patient with short neck, tortuosity of the carotid artery, etc.) then neck MRA (CPT®70548) or neck CTA (CPT®70498) can be performed.

- Surveillance imaging of the contralateral carotid artery should proceed based upon PVD-3.5.
- Termination of surveillance imaging of the carotid arteries is reasonable when the patient is no longer a candidate for intervention.
- Reference:
  - J Am Coll Cardiol 2011;57(8):1002-1044

### PVD-3.7 Surveillance of Individuals who are Asymptomatic or have Unchanged Symptoms who are Status Post Carotid Stenting

- Ultrasound (CPT®93882 unilateral study) of the carotid artery that has been stented can be performed at 1 month, 6 months, and every year for 2 years following the procedure.
  - If there is no change in stenosis category after two years, the imaging interval should be increased to every other year.
  - 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%)
  - If ultrasound is technically difficult (e.g. high carotid bifurcation, patient with short neck, tortuosity of the carotid artery, etc.) then neck MRA (CPT®70548) or neck CTA (CPT®70498) can be performed.

- Surveillance imaging of the contralateral carotid artery should proceed based upon PVD-3.5.
- Termination of surveillance imaging of the carotid arteries is reasonable when the patient is no longer a candidate for intervention.
- Reference:
  - J Am Coll Cardiol 2011;57(8):1002-1044

### PVD-3.8 New Signs and Symptoms

- New signs and symptoms consistent with progressive carotid artery disease (e.g. TIA, amaurosis fugax, change in nature of a carotid bruit) are an indication to re-image the neck vessels using ultrasound (CPT®93880 bilateral study or CPT®93882 unilateral study), neck MRA (CPT®70548) or neck CTA (CPT®70498).
One or more of the following imaging studies may be required when clinical evidence points to arterial or venous insufficiency (e.g. arm fatigue upon exercise, rest pain in the hand and digits, digital ischemia or gangrene, etc.), which may include emboli from aortic arch plaque rupture:

- CTA/CTV of upper extremity (CPT®73206) or MRA/MRV of upper extremity (CPT®73225), and/or
- Chest CTA/CTV (CPT®71275) or Chest MRA/MRV (CPT®71555)

- Symptoms can include pain and/or blue discoloration of fingers, muscular limb pain, particularly with exertion, or otherwise unexplained swelling of the upper extremities.

**Superior Vena Cava Syndrome**

- This syndrome is frequently associated with aggressive thoracic cancers or metastases.*
- Chest x-ray and CT of the chest with contrast (CPT®71260) are the initial imaging studies of choice for the evaluation of suspected SVC syndrome.
- MRV (CPT®71555) or CTV (CPT®71275) of the chest may be indicated when stenting of the SVC is being considered.*


**Upper Extremity DVT**

- Evaluation should begin with chest x-ray (especially if prior intravenous catheter was placed) and duplex ultrasound (CPT®93930 bilateral study or CPT®93931 unilateral study).
- Request for advanced imaging should be sent for Medical Director review.
- If duplex ultrasound is nondiagnostic:
  - MRI of the upper extremity (CPT®73219) and chest (CPT®71551) and/or MRV (CPT®73225 and CPT®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 CTV (CPT®73206 and CPT®71275) can occasionally be helpful.
- **Reference:**
  - ACR Appropriateness Criteria, Suspected upper extremity deep vein thrombosis, 2008

**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 (CPT®93930 bilateral study or CPT®93931 unilateral study) may be superior
- **Reference:**
  - Circulation 2008;117:2542-2543
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.

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 (CPT®93350 or CPT®93351) or left heart catheterization (see CD-9.1 Coding Notes: Heart Catheterization in the Cardiac Imaging Guidelines for correct coding) 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:**
  - *Eur Heart J* 2004 Dec;25(24):2243-2278

**Chest CTA** (CPT®71275) for evaluation of pulmonary hypertension is appropriate if the etiology is felt to be pulmonary embolism, acute or chronic. 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-26.3 Sleep Apnea** in the Head Imaging Guidelines.
• Duplex ultrasound for visceral vascular studies
  o The following ultrasound studies are rarely used but can be used to evaluate for stenosis/obstruction of the aorta, iliac vessels, renal artery and vein, mesenteric artery, and other visceral vessels. In clinical practice, other studies such as CT, CTA, MRA are usually preferred to evaluate for stenosis of these vessels rather than ultrasound (Exception: Duplex ultrasound is appropriate to rule out testicular or ovarian torsion):
    ➢ CPT®93975: Duplex scan of arterial inflow and venous outflow of abdominal, pelvic, scrotal contents and/or retroperitoneal organs; complete study
    ➢ CPT®93976: Duplex scan of arterial inflow and venous outflow of abdominal, pelvic, scrotal contents and/or retroperitoneal organs; limited study
    ➢ CPT®93978: Duplex scan of aorta, inferior vena cava, iliac vasculature, or bypass grafts; complete study
    ➢ CPT®93979: Duplex scan of aorta, inferior vena cava, iliac vasculature, or bypass grafts; unilateral or limited study

• See also (in Abdomen Imaging Guidelines):
  o AB-22 Abdominal Aortic Aneurysm, Iliac Artery Aneurysm, and Visceral Artery Aneurysms—Follow-up of Known Aneurysms and Pre-op Evaluation
  o AB-23 Abdominal Aortic Aneurysm and Iliac Artery Aneurysm—Post Endovascular or Open Aortic Repair
  o AB-43 Renovascular Hypertension

• Thoracic Aortic Disease
  o See also CH-32 Thoracic Aorta in the Chest Imaging Guidelines
  o Chest CT (CPT®71260 or CPT®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.*
  o 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
  o See AB-43 Renovascular Hypertension in the Abdomen Imaging Guidelines.
• **Abdominal Aortic Abnormality**
  o 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 Imaging Guidelines.
  o Ultrasound (CPT®76775) 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, CPT®73725, and CPT®73725) can be performed.*
  o 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.
  o 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**
  o Also see **AB-9 Mesenteric/Colonic Ischemia** in the Abdomen Imaging Guidelines.
  o CTA of the abdomen (CPT®74175), unless contraindicated, is preferred over MRA (CPT®74185) for evaluation of mesenteric ischemia.
  o Conventional angiography is still is favored by many specialists.

• **Visceral Artery Aneurysms**
  o These include arteries to the spleen, kidney, liver and intestines.
  o Aneurysm of these arteries is defined by an increase of more than 50% of the original arterial diameter.
  o Risk for rupture is high when the aneurysm is greater than 2 cm or is increasing rapidly*
    * *Circulation* 2006;113:e463-e654
  o Vascular specialist consultation is beneficial in order to determine the time-frame to intervention.
  o Monitoring by ultrasound or CT with contrast is appropriate, although ultrasound should be attempted first.
  o Celiac artery aneurysm can be evaluated by CT abdomen with contrast (CPT®74160), CTA abdomen (CPT®74175), or ultrasound (CPT®76700 or CPT®76705).*
    * *Arch Surg* 2002;137:670-674
  o 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.
2011 PERIPHERAL VASCULAR DISEASE IMAGING GUIDELINES

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**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

* Circulation 2006;113:e463-e654
  - 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**
  - “Since the presence and severity of arterial obstructions are reliably established using noninvasive hemodynamic tests such as the ankle brachial index (ABI), toe brachial index (TBI), segmental pressures, or pulse volume recordings (PVR), imaging studies are reserved for circumstances that warrant consideration for invasive therapy”*
    * ACR Appropriateness Criteria, Claudication, 2009
      * JAMA 2008;300(2):197-208
      * Ann Surg 1979;189(2):143-146
  - ABI (CPT®93922) is the preferred initial test*
    - Unless duplex ultrasound (CPT®93925 bilateral study or CPT®93926 unilateral study) is definitive, it should not replace ABI in determining the need for advanced imaging.

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- If there is intermittent claudication, the ABI should be measured after exercise (CPT®93924) if the resting ABI is normal.*
  *Circulation 2006;113:e463-e654
- If ankle brachial index (ABI) and post-exercise ABI are normal, no advanced imaging is indicated.

**ABI Measurements:**
- 0.9-1.3 is within normal limits
- 0.5-0.89 represents moderate disease
- Less than 0.5 represents severe disease
- Greater than 1.3 represents “stiff” arterial vessels and may be due to atherosclerotic obstruction, but further testing is justified
  - 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 aortoiliofemoral system (CPT®74185, CPT®73725, and CPT®73725).
  *ACR Appropriateness Criteria, Claudication, 2009
  *J Am Coll Cardiol 2008;51:1292-1298
- There is a 5% false negative rate due to calcification of the lower extremity arteries
  - 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 (CPT®93922) is the preferred initial test, but lower extremity duplex ultrasound (CPT®93925 bilateral study or CPT®93926 unilateral study) 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 and1094-1103
- Duplex ultrasound with Doppler (CPT®93925 bilateral study or CPT®93926 unilateral study) is useful for identifying location and extent of disease.
  - Claudication symptoms usually remain stable (70%-80% of patients) and do not worsen or improve at rapid rates.*
  *Circulation 1996;94:3026-3049
- **Advanced imaging is indicated for the following:**
  - 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)
  - **NOTE:**
    - Patients with intermittent claudication should have significant functional impairment with a reasonable likelihood of symptomatic improvement and absence of other disease that would comparably
limit exercise even if the claudication was improved (e.g. angina, heart failure, chronic respiratory disease, or orthopedic limitations)*

- Patients who are offered the option of endovascular or surgical therapy should be provided information regarding supervised claudication exercise therapy and pharmacotherapy, receive comprehensive risk factor modification and antiplatelet therapy, and have a significant disability, either being unable to perform normal work or having serious impairment of other activities important to the patient.*

* Circulation 2006;113:e463-e654

- **Blue Toe Syndrome**
  - Bluish discoloration of toes due to tissue ischemia
  - Causes include emboli from aortic plaque or mural thrombus, hyperviscosity syndrome, hypercoagulable states, and vasculitis
  - CTA of the abdomen and lower extremities (CPT®75635) can be performed
  - Ultrasound (CPT®76775) may be useful to identify a previously unknown abdominal aortic aneurysm (AAA) but is not required prior to CTA

  - If advanced imaging to evaluate claudication is indicated, MRA of the aorta, pelvic vessels, and lower extremities (CPT®74185, CPT®73725 and CPT®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*

  * Circulation 2006;113:e463-e654

- **Advanced imaging (usually as part of a work-up for consideration of an invasive procedure) is NOT generally indicated for the following:**
  - Individuals with no significant functional disability (e.g. exercise impairment sufficient to threaten the patient’s employment or to require significant alterations in the patient’s lifestyle)
  - Individuals with lifestyle-limiting symptoms who have not completed a three month supervised exercise program or a three month trial of pharmacological therapy, or who are improving with exercise or medical therapy

  - **Reference:**
    - Circulation 2006;113:e463-e654

- **Pseudoclaudication**
  - See **SP-4 Lumbar Spinal Stenosis** in the Spine Imaging Guidelines.
  - Post-exercise ABI (CPT®93924) 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 (CPT®93926 unilateral study), 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 Post-Procedure Studies**

- **Surveillance following aortoiliac and infrainguinal angioplasty** should consist of clinical examination, resting ABI (CPT®93922), and postexercise ABI (CPT®93924) at intervals to be determined by the vascular specialist. Imaging studies are not recommended.*
  * *Circulation* 2006;113:e463-e654*

- **Surveillance following lower extremity bypass graft using venous conduit**
  - Although the Vein Graft Surveillance Randomised Trial (VGST)1 showed that routine lower extremity bypass graft surveillance with ultrasound showed no additional health benefit but incurred greater cost, other studies2,3 have shown benefit for routine graft surveillance.
  - Therefore, it is reasonable to perform ABI (CPT®93922) or Duplex ultrasound (CPT®93926 unilateral study), but not both, yearly for routine surveillance after lower extremity bypass using a venous conduit.
  - If there are signs or symptoms of new or progressive arterial insufficiency, Duplex ultrasound (CPT®93926 unilateral study), should be performed initially. Further imaging studies such as CTA or MRA can be considered based on the evaluation by the vascular specialist.
  - **References:**

- **Surveillance following lower extremity bypass graft using synthetic graft (e.g. PTFE)** should consist of clinical examination, resting ABI (CPT®93922), and postexercise ABI (CPT®93924) at intervals to be determined by the vascular specialist.*
  * *Circulation* 2006;113:e463-e654*
  - There are no data to support performing routine imaging studies for graft surveillance of polytetrafluoroethylene (PTFE) grafts.
    * *J Vasc Surg* 1995;21(1):26-33*

- **Surveillance following endovascular stenting**
  - There are currently no established or evidence-based guidelines regarding the modality or imaging interval following this procedure.
  - It would seem reasonable to perform Duplex ultrasound (CPT®93926 unilateral study), at 1 month, 6 months, and every year
- Requests for more frequent imaging by Duplex ultrasound or requests for advanced imaging (CTA, MRA, etc.) should be sent for Medical Director review.

- **PVD-7.3 Lower Extremity Artery Aneurysms**
  - **Iliac artery aneurysm**: 
    - See AB-22 Abdominal Aortic Aneurysm, Iliac Artery Aneurysm, and Visceral Artery Aneurysms—Follow-up of Known Aneurysms and Pre-op Evaluation in the Abdomen Imaging Guidelines.
  - **Femoral artery aneurysm**
    - Patients present with local pressure symptoms, thrombosis, or distal embolization.
    - A pulsatile mass can be felt in the groin.
    - Ultrasound (CPT® 93925 bilateral study or CPT® 93926 unilateral study) should be performed initially.
    - Surveillance by ultrasound (CPT® 93926 unilateral study) can be performed once a year in patients with asymptomatic true femoral aneurysms smaller than 3 cm in diameter.*
      *Circulation 2006;113:e463-e654
    - 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 70% of all aneurysms in the lower extremities.
    - Patients with this aneurysm are at risk for other types of aneurysm (e.g. aortic aneurysm).
    - Ultrasound (CPT® 93925 bilateral study or CPT® 93926 unilateral study and CPT® 76770 or CPT® 76775) should be the initial imaging study to diagnose popliteal artery aneurysm and to assess for other aneurysms (especially aortic aneurysm).
    - Surveillance by ultrasound (CPT® 93926 unilateral study) can be performed once a year if there is a known popliteal artery 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) (CPT® 93922) may be useful in establishing a new baseline for the patient.

- **Reference:**
  - Circulation 2006;113:e463-e654
• **PVD-7.4 Lower Extremity Edema**
  o Patients presenting with lower extremity edema should have venous duplex study (CPT®93970 bilateral study or CPT®93971 unilateral study) as the initial imaging study to rule out deep venous thrombosis (DVT)
    - Duplex study of the arteries (CPT®93925 bilateral study or CPT®93926 unilateral study) is **not** indicated unless there is evidence of arterial insufficiency (see **PVD-7.1 Claudication**)
    - In patients with negative venous duplex study and unilateral calf edema, a dedicated ultrasound of the popliteal fossa (CPT®76882) 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 (CPT®76700 and CPT®76856 and/or CPT®76830 [transvaginal]) should be performed.
    - If the above ultrasound studies are negative, CT of the abdomen and pelvis with contrast (CPT® 74177) or CT scan of the pelvis (CPT®72193) alone can be performed.
      - CT or MRI of the lower extremity without contrast (CPT®73700 or CPT®73718) can be performed in patients with persistent unilateral calf edema and negative ultrasound studies.
  o 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.
  o 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 CPT®72198 or CPT®74175 and CPT®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 CPT®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, CPT®73725, and CPT®73725) may also be required for this problem, which can reflect both arterial and venous compromise and produce substantial lower extremity edema.
• **PVD-7.5 Lower Extremity Deep Venous Thrombosis (DVT)**
  - One third of all DVT cases are asymptomatic. Symptoms are often not apparent until there is involvement above the knee.
  - Signs and symptoms may include the following:
    - swelling
    - pain or tenderness
    - increased warmth in the skin of the affected leg
    - erythema
    - discomfort in the affected leg
    - Homans’ sign (calf pain on forced dorsiflexion of the foot while the knee is flexed to 90 degrees)—sensitivity and specificity are only 50%
    - phlegmasia cerulea dolens (reddish purple discoloration from venous engorgement)
  - **Risk factors for DVT:**
    - prolonged inactivity
    - dependent posture
    - cancer
    - coagulopathies
    - mechanical obstruction to venous outflow
    - postphlebitic syndrome
    - recent surgery
    - trauma
    - pregnancy
    - obesity
    - polycythemia
    - age >75
    - presence of an acute infectious process
    - history of prior DVT
  - The **Wells Clinical Prediction Rule for DVT** can be used to determine the probability of having a DVT: (NEXT PAGE)
Wells Clinical Prediction Rule for DVT

<table>
<thead>
<tr>
<th>Clinical Parameter Score</th>
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<tbody>
<tr>
<td>Active cancer (treatment ongoing, or within 6 mo or palliative)</td>
<td>+1</td>
</tr>
<tr>
<td>Paralysis or recent plaster immobilization of the lower extremities</td>
<td>+1</td>
</tr>
<tr>
<td>Recently bedridden for &gt;3 d or major surgery &lt;4 wk</td>
<td>+1</td>
</tr>
<tr>
<td>Localized tenderness along the distribution of the deep venous system</td>
<td>+1</td>
</tr>
<tr>
<td>Entire leg swelling</td>
<td>+1</td>
</tr>
<tr>
<td>Calf swelling &gt;3 cm compared with the asymptomatic leg</td>
<td>+1</td>
</tr>
<tr>
<td>Pitting edema (greater in the symptomatic leg)</td>
<td>+1</td>
</tr>
<tr>
<td>Previous DVT documented</td>
<td>+1</td>
</tr>
<tr>
<td>Collateral superficial veins (nonvaricose)</td>
<td>+1</td>
</tr>
<tr>
<td>Alternative diagnosis (as likely or greater than that of DVT)</td>
<td>-2</td>
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Total of Above Score

<table>
<thead>
<tr>
<th>Probability Level</th>
<th>Score</th>
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<tbody>
<tr>
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<td>≥3</td>
</tr>
<tr>
<td>Moderate probability</td>
<td>1 or 2</td>
</tr>
<tr>
<td>Low probability</td>
<td>≤ 0</td>
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</tbody>
</table>

**Diagnostic Studies**

- Duplex ultrasound (CPT®93970 bilateral study or CPT®93971 unilateral study) should be the initial imaging study
  - Sensitivity is 97% for proximal vein thrombosis
  - If Duplex ultrasound is normal, repeat Duplex ultrasound testing is not supported
- D-dimer can be useful in identifying new DVT’s—a negative test reduces the probability of having DVT; however, a positive test does not confirm the presence of DVT
- Impedance plethysmography (IPG)—CPT®93965 is a method of determining changing tissue volumes in the body based on the measurement of electric impedance at the body surface
  - Can be a useful test in detecting DVT
- Venography is more accurate but carries the risk of phlebitis
- MRV of pelvis (CPT®72198) and lower extremity (CPT®73725) or CTV of pelvis (CPT®72191) and lower extremity (CPT®73706) may be considered
to clarify results of other diagnostic studies such as an unrevealing Duplex ultrasound scan of the pelvic vessels.

- **Superficial venous thrombosis generally does not require advanced imaging.**

- **Although the use of CTA combined with venous phase imaging (CTA-CTV) for diagnosing PE was found to have a higher sensitivity (90%) than CTA alone (sensitivity 83%)*, there is insufficient data at this time to justify routinely performing CTA-CTV, including CTV of the pelvis and lower extremities, in patients with suspected PE.**

- **Duplex study of the arteries (CPT®93925 bilateral study or CPT®93926 unilateral study) is not indicated unless there is evidence of arterial insufficiency (see PVD-7.1 Claudication).**

  - **Follow-up imaging of known DVT:**
    - Calf vein thrombosis can be re-imaged with Duplex ultrasound (CPT®93970 bilateral study or CPT®93971 unilateral study) one week after the initial diagnosis in order to rule out proximal extension of the clot.
    - Long term anticoagulation therapy may be guided by repeat Duplex ultrasound (CPT®93970 bilateral study or CPT®93971 unilateral study) performed 3 months after initial diagnosis to determine venous recanalization.

  - **References:**
    - *ACR Appropriateness Criteria, Suspected lower extremity deep vein thrombosis, 2010*
    - *Arch Intern Med 2004;164(9):963-968*
    - *N Engl J Med 2003;349:1227-1235*
    - *Ann Intern Med 2009;150(9):577-585*
    - *AJR 2000;174(1):61-65*

- **PVD-7.6 Other Diseases of the Lower Extremity Veins**
  - **Venous duplex scan (CPT®93970 bilateral study or CPT®93971 unilateral study)** can be performed in patients who are candidates for anticoagulation or invasive therapeutic procedures for the following:
    - Post-thrombotic (post-phlebitic) syndrome
    - To confirm the diagnosis of venous insufficiency/valvular incompetence in patients with signs and symptoms of this disease (ulceration, thickening, and skin discoloration)
  - **Venous duplex scan (CPT®93970 bilateral study or CPT®93971 unilateral study)** can be performed for venous mapping prior to the following procedures:
    - Autologous vein graft harvesting (e.g. for cardiac bypass surgery)
  - **Venous duplex scan (CPT®93971 unilateral study) to rule out DVT can be performed following radiofrequency ablation of varicosities if the greater saphenous vein was closed.**
    - Venous duplex scan is not indicated if only superficial veins underwent ablation.
Duplex Ultrasound (CPT®93990)

- Indications for duplex scan of hemodialysis access (CPT®93990) include but are not limited to:
  - Patients with decreased flow rates during hemodialysis
  - Development of arm swelling or discomfort after access placement surgery or a hemodialysis session
  - Prolonged immaturity of a surgically created AV fistula
  - Suspected pseudoaneurysm
  - Suspected AV fistula or graft stenosis
  - Known or suspected fluid collection adjacent to an AV fistula or graft
**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**
  - 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

PVD-2~Screening Asymptomatic Patients

PVD-3~Cerebrovascular and Carotid Disease

PVD-4~Upper Extremity Peripheral Vascular Disease

PVD-5~Pulmonary Artery Hypertension

PVD-6~Aortic Disorders, Renal Vascular Disorders, and Visceral Artery Aneurysms
PVD-7~Lower Extremity Peripheral Vascular Disease


**Evidence Based Clinical Support References**

PVD-6~Aortic Disorders, Renal Vascular Disorders, and Visceral Artery Aneurysms,

**Evidence Based Clinical Support**