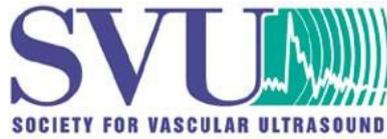


All substantive updates/changes to the last version of this Guideline have been highlighted below. Small changes, such as formatting or slight rewording, may not be highlighted.



The VOICE for the Vascular Ultrasound Profession since 1977

VASCULAR TECHNOLOGY PROFESSIONAL PERFORMANCE GUIDELINES

Abdominal Aortoiliac Duplex Evaluation

This Guideline was prepared by the Professional Guidelines Subcommittee of the Society for Vascular Ultrasound (SVU) as a template to aid the vascular technologist/sonographer and other interested parties. It implies a consensus of those substantially concerned with its scope and provisions. **The guidelines contain recommendations only and should not be used as a sole basis to make medical practice decisions.** This SVU Guideline may be revised or withdrawn at any time. The procedures of SVU require that action be taken to reaffirm, revise, or withdraw this Guideline no later than three years from the date of publication. Suggestions for improvement of this Guideline are welcome and should be sent to the Executive Director of the Society for Vascular Ultrasound. No part of this Guideline may be reproduced in any form, in an electronic retrieval system or otherwise, without the prior written permission of the publisher.

Abdominal Aortoiliac Duplex Evaluation

PURPOSE

Evaluation of aortoiliac disease and its effect on blood flow dynamics using duplex ultrasound technology.

APPROPRIATE INDICATIONS

Common indications for performance of this examination include, but are not limited to:

- Pulsatile abdominal mass
- The presence of an aneurysm of another anatomical location, (e.g., iliac, common femoral, popliteal arteries)
- A history of hypertension with a family history of abdominal aortic aneurysm (AAA) and age >50 years old.
- Surveillance of known abdominal aortic or iliac artery aneurysm.
- Aortic coarctation
- Severe sudden pain in the abdomen or lower back
- Evidence of distal arterial emboli
- Evidence of lower extremity inflow (aortoiliac) arterial disease (e.g., absent common femoral pulse and/or buttock claudication that interferes with patient's life style or ischemic rest pain, or following lower extremity physiological studies that indicate inflow disease)
- Surveillance of arterial vascular intervention/reconstruction
- Abdominal and/or groin bruit
- Post-endograft surveillance

CONTRAINDICATIONS AND LIMITATIONS

Contraindications and limitations may include the following:

- Large firm tense abdomen
- Significant amount of overlying bowel gas
- Abdominal wounds, fresh sutures/staples, peritoneal dialysis catheters, ostomy bags
- Patients with large hiatal hernias

PATIENT COMMUNICATION

- Exams may be successful without having the patient fast, however, if scheduled in advance the patient should fast overnight or 4 to 6 hours prior to exam to minimize bowel gas.
- A bowel prep is usually not necessary, however, in the advent of poor visualization due to bowel contents, a bowel prep may be utilized.
- The patient should not chew gum or smoke the morning of the exam as this may increase swallowing of air.
- Consideration is advised when scheduling diabetic patients. Instruct diabetic patients to closely monitor glucose levels when fasting for examinations and to react accordingly.
- Early morning appointments are preferred to reduce the amount of bowel gas and air in the

alimentary tract.

- Patients should take all medications with a small sip of water.

PATIENT COMMUNICATION

Prior to beginning the exam, the sonographer or examiner should:

- Introduce self and explain why the examination is being performed and indicate how much time the examination will take.
- Verify the patient's name and date of birth or utilize facility-specific patient identifiers.
- Explain the procedure, taking into consideration the age and mental status of the patient and ensuring that the necessity for each portion of the evaluation is understood.
- Respond to questions and concerns about any aspect of the evaluation.
- Educate the patient about risk factors for and symptoms of abdominal aortic aneurysm (AAA) or atherosclerotic disease and signs and symptoms associated with reduced blood flow to the lower extremities and endovascular graft dysfunction, when appropriate.
- Refer specific diagnostic, treatment or prognosis questions to the patient's physician.

PATIENT ASSESSMENT

A patient assessment should be completed before the evaluation is performed. This includes an assessment of the patient's ability to tolerate the procedure and an evaluation of any contraindications to the procedure. The sonographer or examiner should obtain a complete, pertinent history by interview of the patient or patient's representative and a review of the patient's medical record, if available. A pertinent history includes:

- Current medical status
- Prior vascular/cardiovascular history & surgeries
- Current, pertinent medications or therapies
- Review of vascular-related risk factors such as hypertension, hypercholesterolemia, peripheral vascular disease, family history of aneurysmal disease, advanced age, and smoking.
- Review symptoms of aortoiliac disease; aneurysmal vs. occlusive disease, back pain, increased pulsation of abdomen, groin, or popliteal fossa.
- Review signs/symptoms of distal emboli and buttock/thigh claudication.

PATIENT POSITIONING

The optimal positioning for viewing the aorta and iliac vessels includes the following:

- Place the patient in the supine position with the head slightly elevated for comfort.
- The lateral decubitus position may be useful when supine acoustic windows prove inadequate, especially in individuals with a large abdominal girth. This position will allow the abdomen to fall forward, thereby, decreasing the depth of the vascular structures being evaluated.
- The upright position may be utilized to aid in visualization of the proximal aorta region by using the liver as an acoustical window.

INSTRUMENTATION

Utilize appropriate duplex instrumentation with the appropriate frequencies for the vessels being examined:

- Typically, a 2-6 MHz curvilinear or phased array transducer
 - Utilize multiple transducers, if available, to visualize anteriorly and through the intercostal rib spaces.
- Display of two-dimensional structures and motion in real-time
 - Doppler ultrasonic signal documentation
 - Spectral analysis with color and/or power Doppler imaging
- Digital storage of ultrasound images

EXAM PROTOCOL

Sonographers should follow a standard imaging protocol. A complete evaluation includes B-mode imaging, spectral Doppler analysis, and color Doppler imaging of all accessible portions of the abdominal aorta and iliac arteries.

Throughout each examination, the sonographer or examiner should:

- Observe sonographic characteristics of normal and abnormal tissues, structures, and blood flow, allowing necessary adjustments to optimize exam quality.
- Assess and monitor the patient's physical and mental status, allowing modifications to the procedure plan according to the patient's clinical status.
- Analyze sonographic findings to ensure that sufficient data is provided to the physician to direct patient management and render a final diagnosis.
- Accurately annotate B-mode, color and spectral Doppler images.

Abdominal Aortic Aneurysm Evaluation

Sonographer should follow a standard exam protocol for abdominal aortic aneurysm evaluation.

- Utilize B-mode imaging to examine the aorta beginning at the diaphragm and progressing to the iliac arteries bilaterally to the groins.
- Longitudinal grayscale images should include:
 - Proximal aorta
 - Mid aorta
 - Distal aorta
- Additional images proximal and distal to an aneurysmal segment **should** be included
 - Transverse aortic and iliac artery diameters by measuring outer wall to outer wall at region of greatest dilation at these specific locations
 - Proximal aorta
 - Mid aorta
 - Distal aorta
 - Common iliac arteries at the bifurcation
- Examine the length of the iliac artery bilaterally and document any abnormalities.
- Identify the internal iliac arteries and measure size, if possible.
- Use color duplex to demonstrate the lumen and to confirm patency of the abdominal aorta and iliac segments.

Abdominal Aortoiliac Duplex Evaluation

- Document the presence of abnormalities such as, but not limited to:
 - Thrombus, residual lumen
 - Dissection, flaps
 - Pseudoaneurysm
 - Arterial wall defects
 - Focal stenosis and/or occlusion

Document stenosis and sites of pathology using angle corrected pulsed wave Doppler by recording spectral Doppler waveforms with the angle cursor adjusted parallel to the vessel wall. Interrogate the following locations:

- Proximal abdominal aorta at or proximal to renal artery
- Mid aorta
- Distal aorta
- Right and left common iliac arteries
- Right and left external iliac arteries
- Additionally, if identified, record spectral waveforms from the internal iliac vessel.

Abdominal Aortoiliac Duplex Evaluation for Occlusive Disease

Follow a standard exam protocol for evaluation of abdominal aortoiliac occlusive disease.

- Use B-Mode imaging to examine the native aorta with B-mode imaging from the level of the diaphragm through the length of the aorta and through the length of the iliac arteries bilaterally to the groin.
- Document aortic and iliac artery transverse diameters by measuring outer wall to outer wall
- Document the presence, extent and surface characteristics of plaque, dissection and thrombus
- Examine the length of the iliac artery bilaterally and document any anatomic or pathologic abnormalities
- Use color and pulsed wave Doppler information to:
 - Document patency of the aorta and its branches
 - Record representative images confirming patency, residual lumen and wall defects
- Confirm abnormalities including but not limited to:
 - Presence of plaque
 - Thrombus
 - Dissections
 - Pseudoaneurysm
 - True aneurysms
 - Arterial wall defects,
 - Stenosis and/or occlusion

Record pulse wave velocity proximal to, at site of and distal to region of stenosis using a Doppler angle of (45 to 60 degrees, 60 degrees is optimal with the cursor aligned parallel to vessel wall).

Document branch artery anatomy and patency (celiac, superior mesenteric, inferior mesenteric, renal and hypogastric arteries) per lab protocol.

General Considerations:

- Color Doppler and pulsed wave spectral Doppler are required for the assessment of the aorta and its branches. Color Doppler is necessary for identification of accessory renal arteries, inferior mesenteric, and lumbar arteries.
- Additionally, color Doppler is useful in differentiating vascular from nonvascular structures; provides greater definition of the residual lumen; enhances sensitivity in detecting low-velocity flow states and allows the ability to readily visualize direction of flow.

Endovascular Aortoiliac Stent Graft Evaluation

Follow a standard exam protocol for each endovascular stent graft evaluation.

- Use B-Mode imaging to:
 - Evaluate and document the location and position of the stent fixation sites to evaluate stent for apposition to the wall and/or endoleak.
 - Record the maximum cross-sectional aneurysm diameter(s) to assess for aneurysm enlargement.
 - Ensure proper alignment of the cross-sectional image to the axis and orientation of the longitudinal image to reduce foreshortening or elongating the true transverse view.
 - Examine the residual aneurysmal sac for areas of echolucency or motion/pulsation in the excluded lumen that may represent endoleak.
- Record color Doppler images of renal and visceral arteries to demonstrate patency, stenosis or occlusion.
- Record spectral **Doppler** waveforms from the body of the graft and each limb of the stent graft and **evaluate for any evidence of** twisting, kinking, or deformity of the graft.
- Use color and spectral Doppler to assess the attachment/fixation sites with attention to the detection of any flow outside the lumen of the graft.
- **Obtain transverse color Doppler images of the aneurysm sac demonstrating color filling of stent graft limbs to demonstrate patency.**
 - **Examine the aneurysm sac in both sagittal and transverse planes to detect flow that may represent endoleak.**
- **Equipment settings for color Doppler to detect endoleak should be altered from general arterial settings to low flow settings**
- **Special attention should be directed to hypoechoic areas within the aneurysm sac that demonstrate the presence of color Doppler to confirm flow with pulsed wave Doppler.**
- **Record color Doppler image of patent aneurysm sac branches (i.e. lumbar, inferior mesenteric artery, internal iliac artery) and document flow direction.**
- Record spectral **Doppler** waveforms from any region of extra graft flow detected within the aneurysmal sac and from aortic side-branches (document direction of flow and the source of flow and characteristics of the waveform: low resistance, high resistance or to-fro).
- Any complications following endograft placement (e.g., stenosis, occlusion, hematoma, arteriovenous fistula, intimal flaps, dissection or pseudoaneurysm, at access sites) should be thoroughly documented.

- When intervention (PTA with or without stent) has occurred for occlusive disease, the length of treated area should be carefully assessed, particularly if stent(s) have been placed. The stent should be evaluated for alignment, full deployment and relationship to the vessel wall. The Doppler cursor should be carefully “walked” throughout the entire length of the stent(s).

General considerations:

- Color Doppler imaging settings should be **optimized** to demonstrate and detect **low flow** aneurysmal sac endoleaks. The color scale should be decreased as low as possible and low filter settings should be utilized.
- Color Doppler imaging is a useful component as it assists with locating endoleaks, assists with vessel localization and aids in following vessels.

REVIEW OF THE DIAGNOSTIC EXAM FINDINGS

The sonographer or examiner should:

- Review data acquired during the evaluation to ensure that a complete and comprehensive evaluation has been performed and documented.
- Explain and document any exceptions and limitations to the evaluation protocol (i.e., study limitations, omissions or revisions).
- Record all technical findings required to complete the final diagnosis in the patient’s medical record
- Document exam date, clinical indication(s), technologist performing the evaluation and exam summary in the patients’ medical record.
- Review previous exam documentation and compare to the current exam to document any change.

PRESENTATION OF EXAM FINDINGS

The sonographer or examiner should:

- Provide preliminary results when necessary as provided for by laboratory specific guidelines.
- Present record of diagnostic images, data, explanations, and technical worksheet to the interpreting physician. Interpretation must be available within two business days.
- The sonographer’s and interpreting physician’s names must appear on the final report. The finalized/signed report should be available within four business days.
- Alert the vascular laboratory medical director or appropriate healthcare provider when immediate medical attention is indicated based on departmental guidelines and procedures.

EXAM TIME RECOMMENDATIONS

High quality, accurate results are fundamental elements of the aortoiliac artery duplex examination. A combination of indirect and direct exam components is the foundation for maximizing exam quality and accuracy.

- Indirect exam components include:
 - Pre-exam activities: obtaining previous exam data, initiating exam worksheet and paperwork, equipment and exam room preparation, patient assessment and positioning, and patient communication
 - Post-exam activities: exam room cleanup, compiling and processing exam data for preliminary and/or formal interpretation, and exam billing activities.
- Direct exam components include:
- Equipment optimization and the actual hands-on, examination process

REFERENCES

- Zanetti S, DeRango P, et al. Role of Duplex Scan in Endoleak Detection after Endoluminal Aortic Repair. *Eur J Vasc Endovasc Surg.* 2000; 19, 531-535.
- Johnson BL, Harris Jr EJ, Fogarty TJ, Olcott C, Zarins CK. Color Duplex Evaluation of Endoluminal Aortic Stent Grafts. *J Vasc Tech.* 1998; 22(2):97-104.
- Meier GH, Carter KA. The Role of Color Duplex Ultrasound in Patients with Abdominal Aortic Aneurysms and Stent Grafts. *Non-invasive Vascular Diagnosis*, pp 476-490, 2007.
- Intersocietal Accreditation Commission. Essential Standards in Non-Invasive Vascular Testing. Part 5B; Visceral Vascular 48-55.
<http://www.intersocietal.org/vascular/standards/IACVascularTestingStandards2016.pdf>