



Promoting Excellence In Ultrasound

Policies and Statements

D15

Peripheral Arterial Ultrasound

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This section covers peripheral arterial assessment of upper and lower limbs using imaging and non-imaging modalities.

SECTION 1: INSTRUMENTATION

Essential equipment

Regular equipment maintenance is to be performed on all equipment used for vascular ultrasound.

The duplex Doppler ultrasound machine is used to provide simultaneous or sequential real-time greyscale (B-mode) imaging of the vessel wall and plaque analysis of the angle corrected Doppler frequency spectrum from a selected sample volume within the vessel lumen. As well as the essential characteristics of both B-mode imaging and duplex Doppler spectral analysis for quantification of blood flow velocities (or Doppler frequency shift) the ultrasound machine should have colour Doppler imaging. Colour Doppler provides a qualitative, simultaneous display of flow information superimposed on the real time greyscale image.

Required characteristics:

- ◆ Imaging frequencies as specified in anatomic regional sections
- ◆ Range-gated Doppler with the ability to adjust the position and size of the range gate/sample volume
- ◆ Provision for the measurement and display of the Doppler angle
- ◆ Provision of visual and audible output of Doppler signal
- ◆ Provision for hard copy or other form or recording

Specific Characteristics

- Ankle Brachial Index
CW Doppler with transmitting frequencies of 4-10 MHz. Sphygmomanometer and appropriate size blood pressure cuffs.
- Duplex Ultrasonography
Imaging frequencies and focal depths must be appropriate for the vessels and structures involved. Imaging frequencies of $>$ or $=$ 3.5 MHz for aortoiliac vessels, and a linear array transducer with imaging frequencies of at least 5 MHz should be available. Colour Doppler imaging capabilities and Doppler transmitting frequencies of at least 3.0 MHz should be available.

Secondary Techniques

Secondary techniques should be implemented using appropriate equipment and protocols. Plethysmographs should have hardcopy readout. CW Dopplers used for waveforms analysis should have hardcopy readout and bidirectional flow detection

SECTION 2: INDICATIONS AND TECHNIQUES

Indications

Peripheral arterial testing should be done for appropriate indications in patients with suspected peripheral arterial disease.

Appropriate indications include:

- Exercise-related limb pain
- Limb pain at rest
- Extremity ulcer/gangrene
- Follow-up of limb revascularization
- Absent peripheral pulses
- Digital cyanosis, cold sensitivity
- Arterial trauma
- Assessment of high-risk patients
- Peripheral arterial aneurysm
- Arterial dissection
- Arteriovenous fistula or malformation
- Dialysis access malfunction

Techniques

Appropriate techniques shall be used for evaluation of the peripheral arterial circulation.

- *Ankle Brachial Index*
Systolic pressure is measured at the ankle using CW Doppler ultrasound to detect the presence of arterial flow distal to the cuff. Pressures are compared to the contralateral leg and to the higher brachial systolic pressure. Doppler waveform analysis should be performed at the pedal arteries. Where appropriate, segmental limb pressure may be repeated after inducing reactive hyperaemia, treadmill exercise or active plantar pedal flexion.
- *Arterial Duplex Ultrasonography*
The major arteries are evaluated and the presence and extent of disease is documented. The examination may include the abdominal aorta, iliac, femoral, popliteal and tibial arteries, as well as the extremity branches. B mode imaging, colour Doppler imaging and pulsed Doppler information should be used to evaluate these vessels. Flow characteristics are documented by Doppler sampling at both normal and abnormal vessel segments. Angle correction for Doppler angle is essential whenever spectral analysis is performed. Sites of suspected stenosis are evaluated with Doppler measurements proximal to, within and distal to maximum stenosis.

Secondary Techniques should be implemented in an accepted manner using appropriate equipment and protocols.

- *Upper Extremity Arterial Testing*
Upper limb segmental pressures (with and without exercise), duplex imaging, photoplethysmography and digital pressures should be performed in an accepted manner where indicated.

SECTION 3: DIAGNOSTIC CRITERIA

Ankle Brachial Index

The primary diagnostic criteria are the absolute segmental systolic pressures relative to systemic (higher brachial artery) pressure. Interpretation to determine haemodynamic severity of disease should be based on published criteria. Limitations of this technique, for example, the presence of vessel incompressibility or limb oedema, should be noted.

Pressure changes in response to exercise or reactive hyperaemia are measured at timed intervals and compared to the resting baseline pressure measurement.

Duplex Ultrasonography

Interpretation of B-mode data should include anatomic information about the location and orientation of arterial structures as well as the site, size and extent of abnormalities. Limitations in image quality and completeness of exam should be noted. Arterial haemodynamics assessed with duplex ultrasound should categorize the severity of stenosis or presence of occlusion using validated methodologies relating Doppler velocity (frequency shift) and waveform measurements to predicted degree of disease.

Secondary Techniques

Upper Extremity Arterial Testing

As above for lower extremity.

A detailed description of the diagnostic criteria used for each examination should be able to be provided. This should accompany any charts, graphics or formulae used in the interpretation of the examination results. Specific references, including text or article, author, date, name and volume number of journal, or name of text and publisher should be provided.

Diagnostic criteria that have been developed within the vascular practice or modified from standard published criteria should be internally validated where possible.

SECTION 4: SUMMARY

Once the clinical indications for the examination have been elicited from the patient and the sonographer has addressed any questions or concerns raised by the patient, the examination can commence after informed consent has been obtained from the patient. A complete and thorough examination should be performed (using the guidelines above) and extended as necessary. Adequate, representative hard copy should be made of all aspects of the examination, including a written worksheet for the reporting physician.

Additional Valuable information is available in the following references:

W Lewis "*Duplex applications for the renal patient - evaluating renal artery stenosis and dialysis fistula*" 1998 ASUM Bulletin vol 1 no 3 pp13-17.

J Kidd "*Duplex ultrasound for the planning and follow-up of endovascular interventions*" 1998 ASUM Bulletin vol 1 no 3 pp24-30.



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