ASUM

Standards of Practice

Promoting ultrasound excellence



Guidelines, Policies and Statements

Peripheral Venous Ultrasound

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1. Introduction

The Australasian Society for Ultrasound in Medicine (ASUM) is a multidisciplinary society whose mission is to advance the clinical practice of diagnostic medical ultrasound for the highest standards of patient care. A primary aim of ASUM is to promote, educate and disseminate standards of ultrasound practice in this continually developing specialty.

1.1. Purpose

This statement covers two types of venous ultrasound assessment, the assessment of deep and superficial vein thrombosis (DVT & SVT) and venous reflux which, in this statement, is called chronic venous insufficiency (CVI).

Duplex ultrasound must be utilised as the primary diagnostic device for peripheral venous testing.

2. Instrumentation

2.1. 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:

- Imaging frequencies of ≥3.5 MHz for DVT assessment and ≥5 MHz for CVI assessment.
- For CVI assessment a linear array transducer is required.
- Doppler frequencies ≥3.0 MHz, appropriate for the depth of the vessels being evaluated, should be used.

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- For CVI assessment a suitable method of supporting the patient in a erect or semi erect position ≥60º elevation is required, allowing the patient to be safely supported whilst weight bearing on the contralateral leg.
- Colour Doppler capability

2.2. Secondary Instrumentation

Secondary techniques should be implemented in the accepted manner utilising appropriate equipment and protocol. All plethysmographic devices should have a simultaneous acquire & display and a method of recording the images/traces to support the diagnosis.

3. Indications and Techniques

3.1. Indications

- Venous testing shall be done for appropriate indications and include:
- Evaluating possible venous thrombosis (DVT & SVT) or obstruction.
- Venous mapping prior to bypass surgery. (Is this adequately addressed?)
- Dialysis graft or fistula flow assessment. (Is this adequately addressed?)
- CVI.

3.2. Techniques

Appropriate techniques should be used for the evaluation of the venous system.

3.2.1. DVT - General

a) B - Mode
   - should be used to image the vein and its contents. This should be followed with compression of the vein in the transverse plane by applying pressure to bring the walls of the vein together.

b) Spectral Doppler
   - should be used to determine the direction of blood flow and to detect abnormal blood flow patterns which may suggest expanding the examination.
   - can be used as an aid to diagnose, but not to exclude DVT.

c) Colour Doppler
   - may be used as a guide to the placement of the spectral Doppler sample
   - may be used for the detection of thrombus as an aid to the B-mode procedure.
   - is an essential requirement for assessment of veins in the abdomen and thorax.

d) Imaging recording
   - evidence to support the diagnosis should be recorded on hard copy.

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3.2.2. DVT Ultrasound Assessment of the Lower Limb, Pelvis and Abdomen

a) Leg Veins

- The DVT ultrasound assessment should be from the lower external iliac vein to the lower calf and include both deep and superficial veins. The examination may include one or both lower limbs depending upon clinical symptoms and departmental policy.
- The examination is required to include the iliac veins (CIV, EIV & IIV) and IVC if venous obstruction is suspected above the femoral canal. It is necessary to investigate alternative or concomitant abnormalities eg Baker's cyst, muscle tear etc. The inclusion of superficial veins into the procedure should be determined by clinical evidence.

b) Pelvic and Abdominal veins

- The examination is required to include the iliac veins (CIV, EIV & IIV) and inferior vena cava.
- Colour Doppler should be used to image the lumen of the veins. B-Mode should be used to evaluate the paravenous structures.

3.2.3. DVT Ultrasound Assessment of the Upper Limb

- The examination is required to include the deep veins from the brachiocephalic venous trunk to the lower forearm. The jugular veins should also be examined.
- The examination is required to include the superficial veins of the shoulder and arm.
- Colour Doppler should be used to image the lumen of the subclavian and axillary veins.
- B-Mode should be used to evaluate the para venous structures.

3.2.4. CVI Ultrasound Assessment of the Lower Limb

- The CVI examination should also include an assessment to exclude venous obstruction.
- The assessment should be performed from the common femoral vein to the lower calf and all deep veins should be examined.
- The long and short saphenous veins, anterior vein of thigh and Giacomini veins should be included.
- All varicosities should be traced to their source, eg saphenous veins, perforators, vulval veins, round ligament veins etc
- The examination may include one or both lower limbs depending upon clinical symptoms and departmental policy.

a) B-Mode assessment.

- should include a B-Mode component to examine for venous obstruction. It should also be used to assess venous anatomy and determine the placement of the Doppler spectral sample.

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- should include a recording of the diameter of the perforator as it crosses the fascial plane.

b) Doppler assessment of axial veins

- should be taken with the patient elevated or supported in the erect position of ≥60º with the leg being examined non weight bearing.
- recognised augmentation techniques should be used.

c) Doppler assessment of perforators

- should include all perforators identified being tested using recognised augmentation techniques.
- should be performed with the Doppler sample placed within the perforator at the level of the deep fascial plane.

4. Diagnostic Criteria

4.1. DVT

Accepted diagnostic criteria should be used to assess the venous flow, venous anatomy and relevant surrounding structures.

Evidence to differentiate between chronic and acute DVT should be sought.

Accepted diagnostic criteria should be used to evaluate the following:

a) B-Mode

- intravascular filling defects such as thrombus, webs or calcium deposits should be recorded.
- structures causing extrinsic compression should also be identified and recorded.
- the particular vessel involved in an abnormal finding and to what extent should also be noted.
- the vein wall thickness and reflectivity should be noted and in equivocal situations a comparison to normal contralateral anatomy should be under taken where possible.
- the inability to compress the vein walls together in the transverse section either totally or partially should be recorded.

b) Spectral Doppler

- the cardiac or respiratory phasic Doppler flow should be recorded and evaluated.
- direction of flow should be assessed to exclude collateral flow.
- disruption of the normal Doppler signal should be noted.

c) Colour Doppler

- may be used to diagnose non occlusive and recanalised thrombus.
- the presence of colour fill may add evidence to the presence of flow.
- the absence of colour fill does not necessarily indicate the presence of thrombus.

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4.2. Venous Reflux

Accepted diagnostic criteria should be used to assess the venous flow, venous anatomy and relevant surrounding structures. Accepted diagnostic criteria should be used to evaluate the following:

- abnormal venous anatomical pathways.
- the presence and degree of venous reflux.
- the particular vein and its segments involved.
- the presence, position and size of perforators with abnormal flow profiles.

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.

5. 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.

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