



ASUM

Standards of Practice

Promoting ultrasound excellence

Guidelines, Policies and Statements

Visceral Vascular Testing Using Ultrasound

Adopted by Council May 2006

Revised July 2007

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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.

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

- A wide range of imaging frequencies should be available
- A wide range of types of transducer (i.e. phased array, linear and sector) should be available.
- Colour Doppler image capabilities

3. Indications and Techniques

3.1. Indications

Indications will vary depending on clinical considerations assessed at the time of the examination. Generally accepted indications include:

3.1.1. Evaluation of the mesenteric arterial system:

- Suspected coeliac/SMA insufficiency

- Aneurysm/pseudoaneurysms

3.1.2. Evaluation of the hepato/portal circulation

- Suspected portal hypertension
- Suspected portal vein thrombosis
- Portal system to systemic shunt evaluation
- Suspected pseudoaneurysms/AV fistula
- Primary hepatic malignancies
- Suspected occlusion/stenosis/aneurysm
- Pre-op evaluation for hepatic transplants
- Suspected hepatic veno-occlusive disease
- Suspected heart disease/constrictive pericarditis
- Unexplained ascites
- Unexplained splenomegaly
- Pancreatic disease

3.1.3. Evaluation of native renal arteries/veins

- Screening for renovascular hypertension
- Screening for ischaemic nephropathy
- Monitoring of known renal artery stenosis
- Suspected renal vein occlusion
- Monitoring and review of renal artery intervention.

3.1.4. Evaluation of renal transplants

- Renal transplant dysfunction
- Presence of bruit over allograft

3.1.5. Evaluation of liver transplants

- Post-op hepatic dysfunction

4. Techniques

Appropriate techniques shall be used for the evaluation of the visceral vascular circulation. Patient preparation may be necessary to minimise bowel gas.

4.1. Evaluation of the mesenteric arterial system

The course of the abdominal aorta, coeliac axis, hepatic, splenic, superior mesenteric and inferior mesenteric arteries should be evaluated so that the presence and extent of disease can be documented

Imaging: The study should document vessel anatomy and morphology with high quality imaging.

Haemodynamics: The study documents vessel haemodynamics by sampling of the appropriate vessels. Velocity determinations are made with knowledge of the angle between the ultrasound beam and the vessel being examined. Velocity or frequency measurements and spectral waveform characteristics are recorded at representative sites within the vessels.

4.2. Evaluation of the hepato/portal circulation

Examination of the hepatic and splenic parenchyma is an essential part of the examination. A thorough examination of the arteries and veins within the hepato/portal circulation using B-mode imaging, colour Doppler imaging and pulsed Doppler modalities should be carried out. The course of the main portal vein, right and left portal veins, the hepatic veins, inferior vena cava, splenic vein, superior mesenteric vein, should be evaluated so that the presence and extent of disease can be documented. Regions of possible vessel recanalisation (e.g. Ligamentum Teres for paraumbilical vein), or of varix formation, as well as the inflow and outflow vessels of portosystemic shunts are to be part of the examination.

- Imaging: The study should document vessel and organ anatomy and morphology with high quality imaging.
- Haemodynamics: The study documents vessel haemodynamics by sampling of the appropriate vessels. The presence or absence, direction and type of flow within the vessels are documented. The presence of collateral vessels should be documented. Velocity or frequency measurements and spectral waveform characteristics are recorded at representative sites within the vessels

4.3. Evaluation of native renal arteries/veins

4.3.1. Renal Arteries

Examination of the renal parenchyma is an essential part of the examination with the pole to pole length being measured. A thorough examination of the arteries and veins within the renal circulation using B-mode imaging, colour Doppler imaging and pulsed Doppler modalities should be carried out. The course of the abdominal aorta, renal and intra renal arteries are to be evaluated so that the presence and extent of disease can be documented.

4.3.2. Renal Veins

Examination of the renal parenchyma is an essential part of the examination, with the renal length being measured. Evaluation of both kidneys and renal veins is essential. A thorough examination of the veins within the renal circulation using B-mode imaging, colour Doppler imaging and pulsed Doppler modalities should be carried out. The inferior vena cava, renal and intra renal veins are to be evaluated so that the presence and extent of disease can be documented.

Imaging: The study should document vessel and organ anatomy and morphology with high quality imaging. Renal size and the documentation of the parenchyma is an important part of this study.

Haemodynamics: The study documents vessel haemodynamics by sampling of the appropriate vessels. Velocity determinations are made with knowledge of the angle between the ultrasound beam and the vessel being examined. Velocity or frequency measurements and spectral waveform characteristics are recorded at representative sites within the vessels.

4.3.3. Evaluation of renal transplants

Examination of the renal parenchyma is an essential part of the examination with the pole to pole length being measured. A thorough examination of the transplant artery/ies and vein/s within the renal circulation using B-mode imaging, colour Doppler imaging and pulsed Doppler modalities should be carried out. The course of the abdominal aorta, ipsilateral iliac arteries and intra renal arteries are to be evaluated so that the presence and extent of disease can be documented.

- **Imaging:** The study should document vessel anatomy and morphology with high quality imaging.
- **Haemodynamics:** The study documents vessel haemodynamics by sampling of the appropriate vessels. Velocity determinations are made with knowledge of the angle between the ultrasound beam and the vessel being examined. Velocity or frequency measurements and spectral waveform characteristics are recorded at representative sites within the vessels.

4.4. Evaluation of liver transplants

- **Imaging:** The study should document vessel anatomy and morphology with high quality imaging.
- **Haemodynamics:** The study documents vessel haemodynamics by sampling of the appropriate vessels. Velocity determinations are made with knowledge of the angle between the ultrasound beam and the vessel being examined. Velocity or frequency measurements and spectral waveform characteristics are recorded at representative sites within the vessels.

5. Diagnostic Criteria

Accepted diagnostic criteria are used to assess the presence and severity of abnormality in the intra-abdominal and retroperitoneal circulation. The primary purpose of the duplex examination is to determine the presence or absence of disease in the intra-abdominal and retroperitoneal circulation, and if disease is present, to document its nature, location, extent and severity.

Imaging: The image provides anatomical information about the location and orientation of vessels as well as the presence of abnormalities. Interpretation of B-mode data should include anatomic information about the location and orientation of the abdominal vasculature and abdominal organs. Limitations in image quality and completeness of the examination should be noted.

Haemodynamics: Vessel haemodynamics assessed by Doppler ultrasound (and colour Doppler imaging) should be categorised according to the presence or absence of flow (occlusion) and the severity of stenosis. Velocity determinations are made with knowledge of the angle between the ultrasound beam and the vessel being examined.

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.

6. 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.