ASUM

Standards of Practice

Promoting ultrasound excellence



Guidelines, Policies and Statements

Guidelines on the Performance of an Intracranial Cerebrovascular 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

These Guidelines are intended to set out the performance levels expected in clinical practice for the medical sonographer/sonologist. These standards state the general principles and techniques for the conduct of an intracranial cerebrovascular ultrasound.

1.2. Scope/Applicability

These Guidelines apply to all ultrasound practitioners.

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.

Transcranial Doppler provides real-time spectral display of Doppler-shifted frequencies and digital display of velocity and pulsatility parameters, assuming an angle of insonation less than 15 degrees. Transcranial duplex combines greyscale (B-mode) images of the intracranial vessels, superimposed colour Doppler flow images, and angle-corrected Doppler spectral analysis.

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2.2. Specific Characteristics

Transcranial Doppler

- Range-gated pulsed Doppler frequencies of 2-2.5 MHz ultrasound
- Adjustable sampling depth from 30-130 mm
- Adjustable sample volume
- Adjustable gain
- Adjustable power
- Audio output and visual display of Doppler spectrum.

Transcranial duplex (in addition to above)

- Doppler angle-correction
- B-mode imaging frequency 2.0-3.5 MHz
- Colour flow Doppler imaging frequency between 2.0-2.5 MHz.

3. Indications and Techniques

3.1. Indications

Appropriate indications include:

- Demonstrated extracranial carotid disease: Transcranial Doppler examination identifies collaterals, haemodynamic insufficiency, and impaired autoregulatory reserve. Reactivity of vessels following carbon dioxide inhalation or acetazolamide administration is measured in some laboratories
- Cerebral ischaemia with suspected intracranial stenosis/occlusion: Using Duplex or injectable contrast may improve accuracy compared to Doppler alone.
- Detection of embolic signals: Intraoperative monitoring detects high intensity transient signals (HITS) in some patients undergoing open heart surgery or carotid endarterectomy.
- Subarachnoid haemorrhage: Sequential examinations detect vasospasm before clinical deterioration, providing a window of opportunity for therapy.
- Arteriovenous malformations
- Brain death.

3.2. Techniques

- Transcranial Doppler: The anterior, middle and posterior cerebral arteries and the distal internal carotid artery are insonated through the temporal bone ultrasonic window. The intracranial vertebral and basilar arteries are insonated through the foramen magnum. The ophthalmic and intracranial internal carotid arteries are insonated through the orbit. The manufacturer's safety limits for ultrasound power should never be exceeded, and power should be reduced to 10-25% of maximum when insonating through the orbit. In general, the sample volume should be kept as low as possible, provided there is adequate signal to noise. Velocity and pulsatility measures should be taken at (approximately 5 mm) depth increments along each vessel.

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- Transcranial duplex: The principles are similar to transcranial Doppler except that transorbital examination is not performed. Section 3: Diagnostic Criteria Haemodynamic parameters Velocity, pulsatility and other Doppler parameters should be based on published or internally generated criteria.

4. Diagnostic Criteria

4.1. Haemodynamic parameters

Velocity, pulsatility and other Doppler parameters should be based on published or internally generated criteria.

4.2. Collaterals

Periorbital and anterior communicating artery collaterals are detected by flow reversals whilst posterior communicating artery collateral is inferred from increased velocity along the length of the basilar artery.

4.3. Intracranial Stenosis

Focal increase in Doppler velocity and turbulence

4.4. Vasospasm

Diagnosis should be based on validated velocity and velocity ratio criteria

4.5. Emboli

Identification of high intensity transient signals requires strict adherence to published consensus criteria. The dB intensity threshold should be stated in reports.

4.6. Brain Death

Published criteria should be adopted.

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/sonologist 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

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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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