

TECHNICAL STANDARD - NEONATAL CRANIAL ULTRASOUND SCANS

Background:

Cranial ultrasound scans (US) are an essential part of routine investigation during neonatal intensive care. Sequential scans are now standard, and the results are used to assist in diagnosis (e.g. hypoxic ischaemic encephalopathy, stroke), to aid decision making in possible withdrawal of intensive care and to monitor complications and interventions (e.g. ventriculo-peritoneal shunts). Medical and non-medical personnel of various specialities perform cranial US scans. There are no supporting professional standards. Clinical governance directs that a competency in cranial US is an important aspect of training and service provision.

This document was produced after wide consultation with neonatologists, radiologists and sonographers across the UK. The aim of this document is to provide a basic framework to provide a consistent standard achievable in all units. Some units may have to adapt their practice in order to meet the minimum standards proposed which should apply to a professional service for neonatal US scans.

THE MACHINE:

A high resolution real-time 2D machine with dedicated settings for cranial US. (Such a machine could be also used for cardiac imaging on the Neonatal Unit but would also need Doppler and colour flow capability).

Probe requirements:

High frequency transducer(s) (5-7 MHz) having a small footprint to match the size of the fontanelle, e.g. an electronic phased array or sector scanner. Depending on manufacturer, two probes may be needed, one of 5 MHz and one of 7.5 MHz (for large and small babies). Ideally a high frequency (7-10MHz) linear probe should also be available to scan the extra-cranial fluid spaces, and superior sagittal sinus.

Quality assurance (QA):

The scan machine should be checked (at least) annually for electrical safety, and regular image QA performed to ensure adequate resolution, correct grey scale setting, brightness, contrast etc. Most machines have an effective life of 5 years, before falling below current standard.

Hard Copy:

This is essential for record archive, audit and teaching purposes. On the Special Care Unit a thermal (paper) image printer is usually used unless optical disc archiving, with centralised digital image storage, is available. Paper prints are not ideal because they have a short shelf life, and the images are easily lost or damaged. Local arrangements for image storage and preservation should be defined (eg in the notes, neonatal unit or radiology file etc).

PERSONNEL REQUIREMENTS:

The operator (whether a sonographer, neonatologist or radiologist) should have achieved an acceptable level of competence before performing and reporting scans independently. This requires technical competence and training to recognise the appearance of the common ultrasound pathological findings, in preterm and term babies.

PROCEDURAL STANDARDS:**Gel and probe care:**

A suitable supply of ultrasound gel needs to be available to provide good contact between the probe and the baby's fontanelle.

Limitation of cross infection:

Standard incubator care procedures should apply – hand washing before and after scanning, removal of jewellery etc.

The probe should be wiped and cleaned between each patient with clean tissue. (With a specific risk of cross infection, the probe should be cleaned with an alcohol based wipe or 'probe safe' condoms used to cover the probe – gynaecology US departments routinely stock these special condoms).

After each scan the probe is stored securely in the holder on the ultrasound machine, to minimise probe damage.

Ensuring baby safety and continuation of intensive care:

Ultrasonographers should liaise with the baby's own nurse before scanning, and stop if the baby develops complications: it is not unusual for bradycardia to develop due to pressure on the fontanelle.

Documentation:

The machine should be programmed to automatically record the hospital name, date and time on each image.

- 1) The patient name should be entered onto the machine and on each image,
- 2) a second unique patient identifier (eg: hospital number) limits potential confusion between babies of similar identity (eg: Twin1/2, Smith, Begum etc)

Orientation:

A side identifying mark should be recorded on each image (e.g. Rt Coronal, midline, RT or LT sagittal etc). For consistency with MRI and CT practice, coronal images should be viewed with the right side of the baby on the left hand side of the screen, and sagittal images with the nose towards the left hand side of the screen (when looking at the screen).

Scan technique:

The head should be scanned in coronal (frontal) and sagittal/parasagittal (lateral) planes, supplemented by axial and surface scans.

Appropriate depth, gain (power) and slope (time gain curve) settings should be used to produce a uniform echo pattern in the near and far fields. Representative images should be recorded. The images should be symmetrical about the midline. The depth control should be adjusted for each image to ensure that the whole of the brain is included with optimum magnification, so that the image fills the screen.

OPERATOR REQUIREMENTS:

Competence:

The ability to perform and report neonatal cranial ultrasound scans accurately requires training and experience, and like all similar skills is based on a good theoretical grounding. There are several training courses in the UK teaching theoretical and practical US aspects. However regular scanning, and audit of image quality and scan interpretation by an experienced operator are needed to ensure competence. There are no formal requirements in existence at the present time. We propose that a minimum requirement consists of attendance at a course, plus scanning under direct supervision of a competent sonographer until the trainee is competent to scan independently.

RECORDED IMAGES:

A minimum standard set of images are suggested:

1) coronal (6+ images)

- anterior to the frontal horns of the lateral ventricles
- at the anterior horns of the lateral ventricles and Sylvian fissures
- at the third ventricle and thalami
- at the posterior horns of the lateral ventricles (with choroids)
- posterior to the choroids (posterior brain substance)
- an index measurement should be taken of the lateral ventricles at the level of the third ventricle at the foramina of Munro when there is lateral ventricular dilatation (ventricular index).

2) Sagittal (5+ images)

- Midline through 3rd ventricle, septum cavum pellucidum, cerebellum with 4th ventricle and foramen magnum.
- Through each lateral ventricle showing the anterior and posterior horns, with the caudothalamic notch imaged if possible (germinal matrix area).
- Through each hemisphere lateral to the ventricle for deep white matter.

Supplemental oblique, surface (for subarachnoid or subdural spaces) and axial images may be needed to record pathology.

Reporting:

Ideally, the same person who performs the scan should issue the report. For babies on the neonatal intensive care unit, a written report should be made in the clinical notes for every examination. A report should also be recorded on the hospital's (electronic) database to ensure a permanent record for medico-legal purposes.

TARGET FOR OUTCOME:

Achieving a consistent standard of image production, documentation, recording and interpretation. This can be assessed by regular audit of images and reports. It should be compared with findings from other imaging modalities or pathologist's reports, as available.

Extended scans:

- Additional views (via posterior or lateral fontanelles may be used)
- Doppler and colour flow imaging may give additional data.
- Video recording may give additional real time information, but hard copy images must also be recorded.

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VERSION 09.01.03