1.0 Background

Cranial ultrasound scans are an essential part of routine investigation during Neonatal intensive care. Sequential scans are now standard for premature babies and the results used to assist in diagnosis (IVH, PVL), to monitor complications and interventions (hydrocephalus and VP shunts), as an aid to prognostication and to guide decision making. Scans are also indicated in the management of more mature babies who are sick with a variety of different pathologies.

The Responsibility for scanning falls to different professionals in different units, depending upon the resources available. No matter who the role falls to in each unit, the individuals performing the scans must be adequately trained and have equipment that is fit for purpose. The equipment should comply with the standards set out by the Royal college of Radiologists.

The British Society of Paediatric Radiologists have published technical standards for performing cranial ultrasound scans in neonates, which provide a framework that enables units to offer a consistent scanning service. The document gives guidance on many areas, including equipment and staff training requirements, quality assurance, image acquisition and storage as well as patient safety and infection control

2.0 Scanning Frequency

2.1 Routine Scans for Preterm and Very Low Birth Weight Babies

Cranial ultrasound scans are most commonly performed in premature and very low birth weight babies. All babies born at less than 32\(\frac{6}{7}\) weeks or with birth weight of 1.5kg or below should be scanned.

In the absence of strong evidence to guide scanning frequency, the table below is suggested as a minimum standard for the timings of routine screening scans in these babies.

Scans may need to be repeated more frequently, especially if the baby is particularly unwell or if scans are abnormal. The professional responsible should plan the scanning frequency.

<table>
<thead>
<tr>
<th>Scan Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gestation</td>
</tr>
<tr>
<td>23” - 27”</td>
</tr>
<tr>
<td>28” – 32”</td>
</tr>
<tr>
<td>IUGR &lt;1.5kg</td>
</tr>
</tbody>
</table>
2.1 *Routine Scans for Ventilated babies*

Babies of all gestations requiring ventilation should have **routine screening scans** on a weekly basis until extubation. The scan should also be repeated during the discharge planning process.

<table>
<thead>
<tr>
<th>Scan Timing</th>
<th>Ventilated Baby</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Day1</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

2.2 *Other indications for performing Cranial Ultrasound Scans.*

- Preterm Babies transferred into the unit
- Preterm Infants after undergoing major surgery
- Babies with abnormal neurological symptoms and signs
- Antenatal diagnosis suggesting cranial / cerebral abnormality
- Babies with significant dysmorphic features
- Maternal Cocaine use in pregnancy
- Family History of cranial abnormalities

<table>
<thead>
<tr>
<th>Scan Timing</th>
<th>At Presentation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Day1</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>If indicated</td>
<td>If preterm</td>
</tr>
</tbody>
</table>

Any baby with abnormal or equivocal scan findings should have repeat scans, the timing to be dictated by the team responsible.

MRI should be considered for suspected structural abnormalities when cranial ultrasound findings are equivocal, or following hypoxic ischaemic insult.

3.0 **Suggested Views to Image**

These are considered the minimum

The brain should be imaged in both Coronal and Sagittal planes. Conventionally, in coronal views the infants right side is on the left side of the screen. The infant faces left in sagittal views.

**Coronal**
- Anterior to Frontal horns of lateral ventricles
- At the Anterior horns of lateral ventricles and Sylvian Fissures
- Through the 3rd ventricle & Thalami
- At the posterior horns of the lateral ventricles - with choroids
- Posterior to the Choroids - posterior brain substance

If there is ventricular dilatation, measure the Ventricular Index (VI). Measure horizontally from the midline to the most lateral aspect of the ventricle in the plane of the foramen of Munro *(see appendix 1)*. Serial measurements should be plotted on Levene’s centile chart *(appendix 2)*. Intervention for post haemorrhagic ventricular dilatation is usually indicated when the VI is >4mm above the 97th Centile.
Sagittal (Para-Sagittal)
• Midline
• Through each lateral ventricle - showing caudo-thalamic notch
• Through each lateral ventricle - showing Anterior and Posterior Horns
• Parenchyma lateral to the ventricle - for deep white matter imaging

4.0 Image storage
All images should include the infant’s name and hospital number as well as the date performed. Electronic PACS preferred or hard copy should be kept for record, audit and teaching purposes. Printed thermal paper images degrade with time and are not recommended for storage.

5.0 Reporting
The person who performs the scan is in the best position to report their findings, as they have seen the images in real time. A written report for each study should be filed in the notes, and it is recommended also kept on a central database. ( PACs )

Reports should include comments about.....
• The ventricular system - size, shape, measurements (if appropriate)
• Presence or absence of Haemorrhage and a description of this
• Presence or absence of Periventricular parenchymal changes
• Any other findings
• Recommendation for follow up imaging if indicated.

It is good practice to describe the appearance of the images, as there has been a move away from classifying haemorrhages according to ‘grade’ in recent years. These classifications do not correlated to the pathological processes.

6.0 Documentation
Accurate documentation is essential.

• Patient Name and Hospital number to be documented on each image
• Archive to PACs preferred
• File Hard copy of images in the notes or scanning folder.
• File copy of report in the notes
• If a re-scan is appropriate document this according to local procedures
• Document when a scan is reviewed by a Consultant/senior colleague

7.0 Communication with Parents
It is important to explain to parents about the routine nature of cranial ultrasound scanning in sick and premature babies at an early stage of their child’s admission.

Parents become extremely anxious about the results of scans and so it is essential to explain scan results to parents, even when normal. Parents must also be told of the limitations of scanning as a predictor of long term functional outcome.

8.0 Audit
This guideline should be regularly audited. Suggested specific standards include:
• Percentage of preterm infants scanned according to suggested timetable
• Documentation of timely discussion about scan findings with parents
9.0 References / Supporting information

1. Standards for Ultrasound Equipment  (click for link)
   Royal College of Radiologists – 2005

2. Technical Standards for Newborn cranial ultrasound  (click for link)
   British Society of Paediatric Radiologists


4. Appendix 2 - Ventricular index centile chart
   ‘Measurement of the growth of the lateral ventricles in preterm infants with real-time ultrasound.’ Levene MI Arch Dis Child 1981;56:900-904
How to Measure Ventricular Index

Image in the Coronal plane

Capture an image showing both the Lateral ventricles and the Third ventricle

Measure Horizontally from the midline, to the lateral most border of each Lateral ventricle
Appendix 2

Gestational age (weeks)

<table>
<thead>
<tr>
<th>20</th>
<th>26</th>
<th>28</th>
<th>30</th>
<th>32</th>
<th>34</th>
<th>36</th>
<th>38</th>
<th>40</th>
</tr>
</thead>
</table>

Ventricular index (mm)

| 20 | 18 | 16 | 14 | 12 | 10 | 8  |

97th centile

4mm over

97th centile

Source:

1981: 56:900-904
Arch Dis Child
Levene et al.

PID
Name
DoB

4mm patient label