Local Guideline

John Hunter Children's Hospital
CHILDREN, YOUNG PEOPLE AND FAMILIES

NSW GOVERNMENT Health
Hunter New England Local Health District

# Head Ultrasound in NICU

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|---|---|
| **Sites where Local Guideline applies** | Neonatal Intensive Care Unit, JHCH |
| **This Local Guideline applies to:** | |
| **1. Adults** | No |
| **2. Children up to 16 years** | No |
| **3. Neonates – less than 29 days** | Yes. Approved by CYPFS 26/09/2017 |
| **Target audience** | All NICU medical and Nursing staff |
| **Description** | This guideline provides information to the clinician regarding use of head ultrasound as a diagnostic tool |

**Go to Guideline**

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| **Keywords** | Head ultrasound scans (HUS), hydrocephalus, intracranial, intraventricular, perventricular haemorrhage premature, preterm, ultrasonographer, ventriculomegaly |
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| **Registration number and dates of superseded documents** | N/A |
| **Related Legislation, Australian Standard, NSW Ministry of Health Policy Directive or Guideline, National Safety and Quality Health Service Standard (NSQHSS) and/or other, HNE Health Document, Professional Guideline, Code of Practice or Ethics:** | |
| **Prerequisites (if required)** | NSW Health Policy Directive 2014_036 Clinical Procedure Safety<br>NSW Health Policy Directive PD 2017_013 Infection Control and Prevention Policy |
| **Local Guideline note** | This document reflects what is currently regarded as safe and appropriate practice. The guideline section does not replace the need for the application of clinical judgment in respect to each individual patient but the procedure/s **require mandatory compliance**. If staff believe that the procedure/s should not apply in a particular clinical situation they must seek advice from their unit manager/delegate and document the variance in the patients health record. |
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**Purpose and Risk**

*This local clinical procedure has been developed to provide instruction to the health clinician and to ensure that the risks of harm to the child associated with receiving a head ultrasound are, identified and managed.*

*The risks are:*

- *Missed procedure*
- *Cold infant*
- *Interruption to ventilatory support*

*The risks are minimised by:*

- *Clinicians booking in head ultrasounds at appropriate times*
- *Bedside nurse assisting ultrasonographer during procedure to minimize heat loss and disruption to ventilator support*
- *Following the instructions set out in the clinical procedure*

**Risk Category*:*** *Clinical Care & Patient Safety*

**GLOSSARY**

| Acronym or Term | Definition |
|---|---|
| HUS | Head Ultrasound Scan |
| IVH | Intraventricular Haemorrhage |
| PVL | Periventricular Leucomalacia |
| GA | Gestational age |
| NDI | Neurodevelopmental impairment |
| ELBW | Extremely low birth weight |
| CP | Cerebral Palsy |

**GUIDELINE**

This Guideline does not replace the need for the application of clinical judgment in respect to each individual patient.

# Cranial Ultrasounds for neonates

## Background

Head ultrasound scans (HUS) are commonly performed in neonates, particularly preterm neonates, for detection of cerebral lesions. The abnormalities most often detected in preterm neonates are intraventricular haemorrhage (IVH), white matter changes or periventricular leukomalacia (PVL), periventricular echogenicity (PVE) and ventriculomegaly[1]. HUS is an important tool for the diagnosis of lesions where medical management may be required (such as post-haemorrhagic hydrocephalus) and for detection of lesions, such as IVH and PVL, because of their potential association with adverse long term neurodevelopmental outcomes. Many premature neonates with IVH will be clinically asymptomatic, thus IVH would not be detected without the use of routine HUS.

## Who and when to screen with Cranial Ultrasound Scan

## Incidence of IVH

IVH has been attributed to alterations in cerebral blood flow which can lead to hypoxic ischaemic reperfusion injury of the germinal matrix. Potential risk factors for IVH in premature infants include,extreme prematurity ,ELBW, lack of antenatal steroids, chorioamnionitis / infection, hypotension, acidosis, asphyxia, birth outside a tertiary referral centre and a complicated respiratory course[1,2].

There is an increased risk of severity of IVH with decreasing gestational age and weight. NICUS data (1998-2004, n=2414) for <29 weeks GA neonates demonstrated 34% had a documented IVH, mainly grade I-II (63%) [3]. Our local IVH rates are similar to this. (IVH grading system as per ANZNN data dictionary attached in Appendix)

Australian and New Zealand Neonatal Network (ANZNN) data for the slightly older GA group demonstrate that up to 91% of babies born from 28-31 weeks will have no IVH and <1.4% will have a grade 4 IVH [4] (Table attached in Appendix). Harding *et al.* and Harris *et al*. similarly showed around a 1% rate of severe IVH in infants > 29 and > 30 weeks respectively and the infants with IVH all had risk factors for IVH or clinical symptoms that would warrant screening HUS [5,6]. Thus less intense monitoring is feasible in this more advanced GA group.

## When does an IVH occur?

The majority of cases of IVH in premature infants occur within the first 3 days of life [2,7,8]. Almost a third will have changes as early as 1 hour after birth and up to 50% occur on the first day. If HUS is performed on day 4-5, over 90% of IVH will be detected.

## Risk factors for IVH and other HUS abnormalities

Potential risk factors for IVH in premature infants are listed above. Neonates who have received postnatal steroids have been shown to be at a higher risk for developing cystic white matter lesions on HUS[1]. Ventriculomegaly is a common HUS finding most often due

to cerebral injury. Hydrocephalus can occur in preterm neonates mainly as a result of severe IVH and subsequent obstruction of CSF pathways in up to 30% of cases[10, 11].

## Why it is important to detect intracranial abnormalities

Infants with higher grades of IVH have significantly higher mortality rates. Bolisetty *et al.* showed a mortality rate of 62% in their cohort of <29 week neonates with grade III-IV IVH, as compared to a much lower 15% in the infants with a grade I-II IVH[3]. Mortality in this cohort includes those who died due to redirection of care. Neonates with no IVH in this cohort had a mortality rate of 11%. Higher rates of neurodevelopmental impairment (NDI) are seen in preterm babies with IVH compared to matched controls. The data presented by Bolisetty et al. showed the rate of moderate to severe NDI* for each grade of IVH respectively were; grade I 21%, grade II 24%, grade III 41% and grade IV 46%, compared to 12 % with no IVH.

**(Moderate neurosensory impairment (or NDI) was defined as the presence of developmental delay (GMDS-GQ or BSIDII-MDI between 2 and 3 SD below the mean), moderate CP (able to walk with the assistance of aids), or deafness (requiring amplification with bilateral hearing aids or cochlear implant). Severe neurosensory impairment was defined as developmental delay (GMDS-GQ or BSIDII-MDI <3 SD below the mean), severe CP (unable to walk with the assistance of aids), or bilateral blindness).*

Other HUS findings such as PVL and ventriculomegaly are also important to identify given their potential association with NDI[9]. Periventricular echodensities (PVE) are another common finding on preterm neonatal HUS[1]. PVE is generally seen within the first week of birth, the majority gradually resolving before term. However it must be noted that normal HUS does not preclude the development of NDI; up to 50% of children with CP born preterm in one study had normal HUS[9].

### *Thus who and when should we scan with cranial US*

1. ***Screening HUS***

   **Preterm neonates: <30 weeks and / or < 1250g**: 1st HUS on day 5-7, then 2nd on day 28

- If grade III-IV IVH has occurred then more frequent HUS are recommended, at least weekly in the first month, to monitor for the development of post-haemorrhagic hydrocephalus (see below).

- In ELBW neonates HUS are recommended at the discretion of the treating team when there is concern regarding clinical deterioration or if further information is needed.

*Our previous practice was to perform HUS on all babies <32 weeks GA, which has now been lowered to <30 weeks after review of the literature. With regard to this group of babies from 30-31 weeks completed GA, JHCH NICU incidence of IVH from 2011-2015 was 14%, with only 1% being grade III-IV, this is similar to published data (ANZNN data attached in appendix). Most babies with a severe IVH will be clinically unwell and have risk factors for IVH that would warrant a HUS. In terms of long term prognosis, the Epipage study[12] showed that if an isolated unilateral I-II IVH occurred at a gestation of 30-32 weeks the neonates are only slightly more likely to get CP than if no IVH occurred (i.e. 5.5 vs 4.4% (with no IVH)).*

## *2. Clinical Indications for HUS*

| Indication | Suggested Timing of HUS |
|---|---|
| Suspected Intracranial Bleeding e.g. bleeding disorder, severe thrombocytopenia, Haemoglobin drop, Signs of hypovolemic shock. | Within 24 hours |
| Significant ischemic or hypoxic event<br>Severe shock (eg. sepsis or NEC)<br>Prolonged period of hypotension (often requiring inotropes) | 24-72 hours, with repeat scan in 4 weeks* |
| Antenatally diagnosed intracranial abnormalities<br>Moderate to severe Hypoxic Ischaemic Encephalopathy<br>Seizures or abnormal neurological signs<br>Meningitis | 24-72 hours |
| Suspected congenital infection<br>Severe intrauterine growth restriction<br>Multiple congenital anomalies | Within 1 week |

* Following a clinical insult that has caused an ischaemic brain injury an area of echodensity may appear on HUS between 24 and 48h later, but cysts (such as will be seen with PVL) do not evolve for a further 2–4 weeks[13]. Thus repeat HUS can be a useful tool (in combination with other clinical information) regarding the potential neurodevelopmental impact of the clinical event/s.

NOTE* - HUS can be considered at the discretion of the treating team for neonates with other conditions not listed above.

## *3. Hydrocephalus monitoring recommendations*

Neonates with ventriculomegaly or hydrocephalus require ongoing HUSS monitoring, in concert with monitoring of their head circumference. The frequency of this will be decided on an individual basis by the treating teams, but usually every week until stable.

### Head Ultrasound Scan Procedure

HUSS will be performed by Hunter New England Health sonographers. If there is a clinical suspicion of an intracranial abnormality after hours that will impact on clinical management neonatology staff qualified in clinician performed ultrasound scans may perform a HUS (e.g. large IVH suspected in a deteriorating premature neonate). A report will be documented in the patient's notes regarding the scan results. The images will be stored as per radiology scans for future reference, and a radiology report will be requested by the clinician performing the ultrasound.

### Communication

It is important to inform the NICU families when a HUS is required to be performed on their baby. This should also be documented on the patient's care board. The informal report will be documented in the HUS folder, if normal scan any staff can inform the parents of the baby, if report findings indicate an abnormality this should be reported back to the families by a senior clinician, Neonatal Nurse Practitioner, Neonatal Fellow or Neonatologist.

## Patient Preparation

It is mandatory to ensure that the patient has received appropriate information to provide informed consent and, that patient identification, correct procedure and correct site process is completed prior to any procedure.

## Staff Preparation

It is mandatory for staff to follow relevant: “Five moments of hand hygiene”, infection control, moving safely/safe manual handling, documentation practices and to use HAIDET for patient/carer communication: **H**and hygiene **A**cknowledge, **I**ntroduce, **D**uration, **E**xplanation, **T**hank you or closing comment.

## Equipment Requirements

- Alcohol based hand rub
- Personal Protective Equipment
- Ultrasound Equipment and Qualified Sonographer

## Procedure Steps

Procedure carried out as per Radiology department practice for Cranial Ultrasound Scans

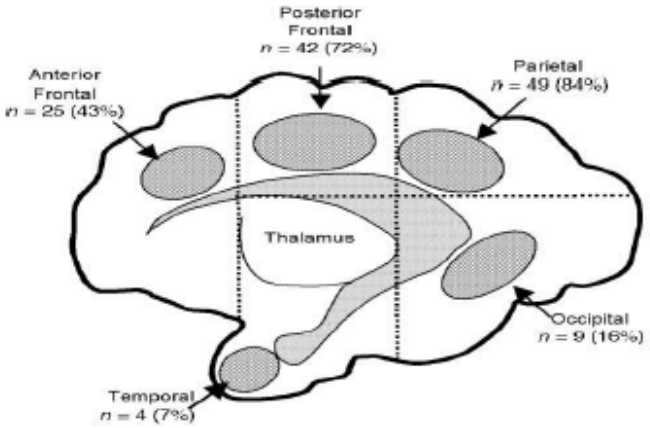
## APPENDICES

### 1. ANZNN Intraventricular Haemorrhage Grading Data Collection

***Grade 1*** − Subependymal germinal matrix haemorrhage
***Grade 2*** − Intraventricular haemorrhage
***Grade 3*** − Intraventricular haemorrhage with ventricle *distended with blood*
***Grade 4*** – **Localised** intraparenchymal haemorrhage
***Grade 4*** – **Extensive** intraparenchymal haemorrhage

Localised intraparenchymal haemorrhage / haemorrhagic infarction is defined as being solitary and mainly confined to one of the following territories:

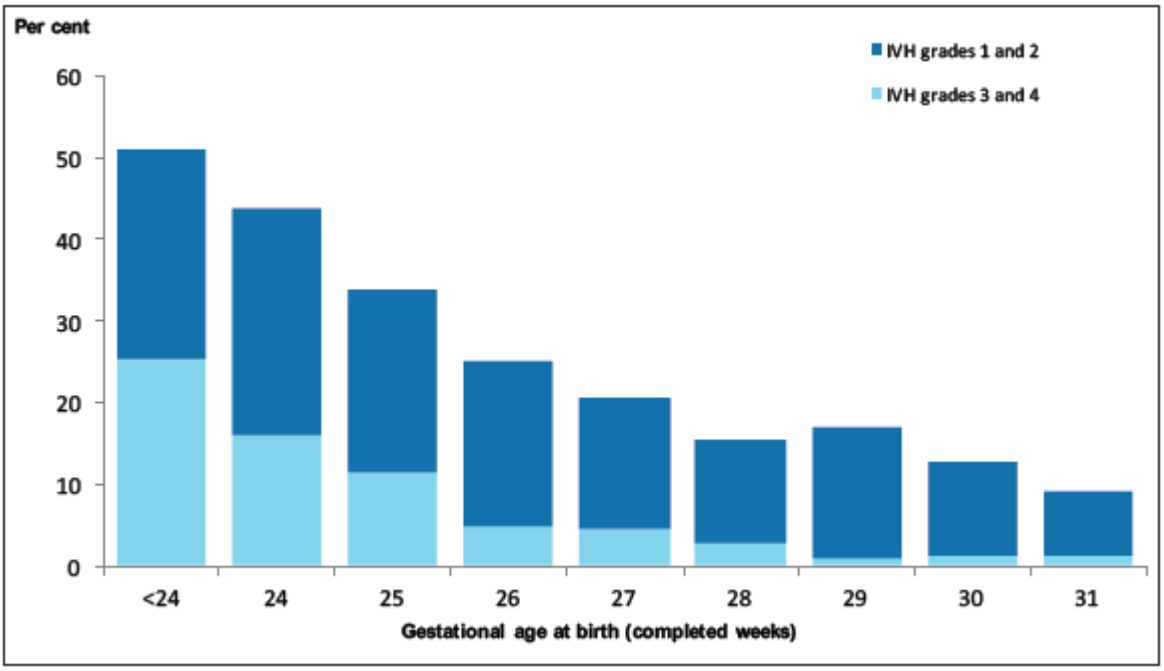
Anterior Frontal:
Posterior Frontal:
Parietal:
Occipital:
Temporal:
Thalamus:




Extensive intraparenchymal haemorrhage / haemorrhagic infarction is defined as involving two or more of the territories. Note: exclude echodensity which resolves within 10 days.

### 2. ANZNN Intraventricular Haemorrhage Data 2014

**FIGURE 7: Intraventricular haemorrhage in level III registrants born at less than 32 weeks gestation and survived to day 3, by gestational age, 2014**

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**FEEDBACK**

Any feedback on this document should be sent to the Contact Officer listed on the front page.

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|---|---|
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| **Approved** | Operational, Planning & Management Committee NICU, 07/09/17<br>Clinical Quality &Patient Care Committee 26/09/17 |

**COMMUNICATION and IMPLEMENTATION PLAN**

1. Awareness of this Guideline and Procedure will be promoted via email and the message board on the Neonatal HUB.
2. This new Clinical Guidelines, Procedures will be posted on the HNE Policy, Procedure and Guideline Directory and Hnehealthkids website.

**MONITORING AND EVALUATION**

1. Documentation in the head ultrasound folder to record due date for head ultrasound.
2. Incident investigations associated with this Guideline and Procedure will include a review of process.
3. The Guideline and Procedure will be amended in line with the recommendations.
4. Evaluation will include a review of the most current evidence as well as a consideration of the experience of Neonatal staff at JHCH in the implementation of the Guideline and Procedure.