Newborn Critical Care Center (NCCC) Clinical Guidelines

Cranial Ultrasounds in the Preterm Infant

BACKGROUND

The following is a guide for using cranial ultrasounds (US) to screen the premature infant for the presence of intraventricular hemorrhage (IVH), periventricular leukomalacia (PVL), or ventriculomegaly in the absence of IVH. There are two purposes for screening cranial ultrasounds in the preterm infant. Screening cranial ultrasounds may 1) diagnose brain injury in the newborn at risk so that appropriate medical management can be provided or 2) detect brain lesions associated with long-term neurodevelopmental disability so that early intervention and close follow-up can be initiated.

Very low birth weight (VLBW) infants (<1500g) are at high risk for germinal matrix hemorrhage and IVH, and severity of hemorrhage is inversely proportional to gestational age. Nearly one quarter of infants with a gestational age (GA) of $\leq$ 30 weeks have significant cranial US abnormalities that trigger important changes in acute and long-term care. Therefore, a routine screening cranial US should be performed on all infants with GA of ≤ 30 weeks.[2,3]

OBTAIN CRANIAL ULTRASOUND IN ALL INFANTS ≤ 30 WEEKS GESTATION

Obtain initial cranial ultrasound at 7 - 10 days of life. Approximately 90% of IVH occurs in the first 72 hours of life, and if progression to higher grades follows, it generally occurs quickly, approximately 1-3 days after the initial hemorrhage.[4] The initial cranial ultrasound may be obtained earlier than this 7-10 day window if clinical concerns arise, or circumstances warrant obtaining this information for decision-making purposes.

A screening head ultrasound may also be considered in infants >30 weeks if clinical risk factors are present. These risk factors include, but are not limited to, neurological abnormalities, placental abruption, extensive resuscitation efforts/low Apgars, hypotension requiring vasopressor support, severe acidosis, prolonged mechanical ventilation, confirmed sepsis, and/or pneumothorax.[2]

Important notes regarding HUS orders and timing:

EPIC order defaults to 7 days of life – the order date should be adjusted if a routine screening HUS would fall on a weekend day.

Routine screening cranial ultrasounds are performed Monday - Friday at 0400. However, if an ultrasound is needed urgently at another time, this can be arranged by ordering the exam STAT.

CLASSIFICATION OF FINDINGS

Intraventricular Hemorrhage

	Modified Papile[2]	Volpe[5]
Grade I	Minimal IVH	Germinal matrix hemorrhage with no or minimal IVH
Grade II	IVH occupying 10-50% of the ventricular area	IVH in 10–50% of ventricular area on parasagittal view
Grade III	IVH occupying >50% of the ventricular area	IVH in >50% of ventricular area on parasagittal view, usually distends lateral ventricle
Grade IV	*Parenchymal hemorrhage*, most likely attributable to venous infarction	periventricular hemorrhagic infarction (PVHI)

Ventriculomegaly (measured at the midbody of the lateral ventricle on sagittal scan):

- *Mild:* 0.5 - 1.0 cm
- *Moderate:* 1.0 - 1.5 cm
- *Severe:* > 1.5 cm

Periventricular Leukomalacia (PVL)

PVL is cystic or diffuse changes in the periventricular cerebral white matter, occurring most frequently in infants born between 26 and 30 weeks' gestation.[2] A periventricular hemorrhagic infarct (PVHI or sometimes referred to as grade IV IVH) is a parenchymal lesion usually associated with a large IVH. A PVHI is currently thought to be caused by venous infarction, and not an extension of the IVH into the parenchyma, as previously thought.[2]

FOLLOW-UP

If initial ultrasound is normal:

- Repeat head ultrasound at 4-6 weeks of age

AND

- Repeat at 36 - 40 weeks corrected gestational age or prior to discharge/transfer (if it has been at least 2 weeks from previous study)

This practice change is a recommendation by the AAP, as screening at 4-6 weeks is sensitive for the identification of PVL, and may identify a transient echogenicity not seen at term which places the infant at increased risk of neurodevelopmental impairment.[2] PVL identified on term head ultrasounds is associated with adverse neurodevelopmental outcomes. Thus, screening at both time points is the best way to identify lesions associated with cerebral palsy.[2]

If initial ultrasound is abnormal:

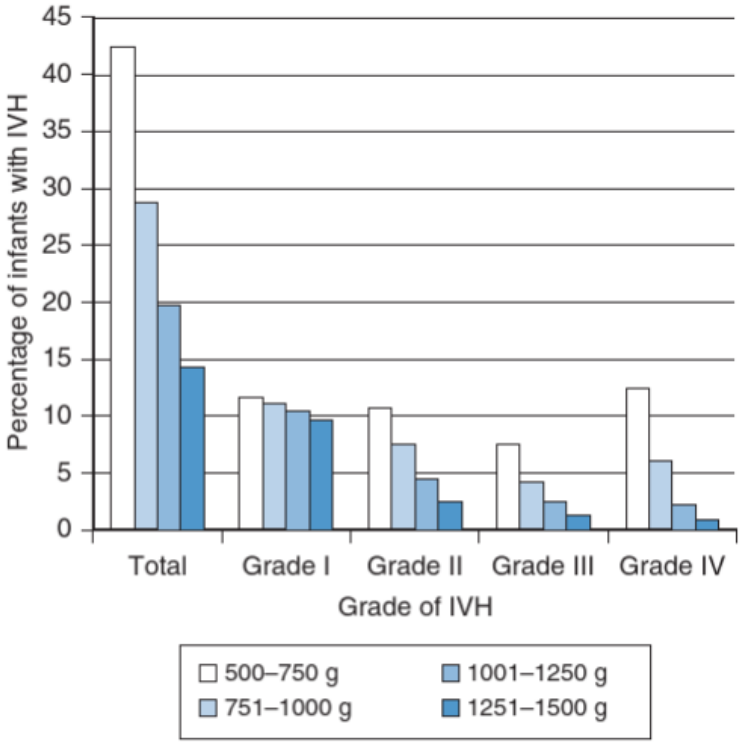
Determined by results of the study and infant's clinical course:

- All infants with IVH should be followed for progression of hemorrhage and hydrocephalus by clinical exam and serial head circumferences.

- If grade 2, 3 or 4 IVH is present on the screening cranial ultrasound, the cranial ultrasound should be repeated every 1 - 2 weeks until stable.
- All follow-up plans should be individualized

STATISTICS

Incidence:



Note: The percentage of very preterm infants with birthweight less than 1500 g with intraventricular hemorrhage (IVH) by birthweight groupings for 2013. Collected from the Vermont-Oxford Network in an assessment of 55,000 preterm infants.[5]

PROGNOSIS AND FAMILY COUNSELING

Infants with grade I or II IVH are at much lower risk of future neurologic and cognitive impairment, though it remains unclear how minor abnormalities in periventricular and subcortical white matter even at these low grades might impact future development, especially for those born at the lowest gestational ages.[4] Several studies have demonstrated no significant differences in neurodevelopmental outcomes with low grade hemorrhage, though additional research and follow up is needed.[4] Infants with grade III / IV IVH remain at significantly higher risk of neurodevelopmental impairment, which is often influenced by the degree of ventricular dilation that requires surgical intervention. Rates of CP in this group range from 7-63%, demonstrating the wide variability of outcomes.[4]

Overall, the risk of neurodevelopmental impairment increases with grade of initial hemorrhage, with severity of injury seen on term ultrasound, and with bilateral involvement. There is hope for a normal outcome for many patients, except those with the most extreme forms of ultrasound abnormalities, which are fortunately rare.

References:

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