

Magnetic Resonance Imaging (MRI) in the Newborn: Guidelines for use



1. Purpose

Magnetic resonance imaging (MRI) provides detailed structural and functional information about the newborn brain. It is an important adjunct to cranial ultrasound and in specific groups of infants, has been shown to provide important prognostic information that can assist in directing care (1). The ideal timing of the MRI examination and the optimal MR sequences will differ depending on the clinical scenario and question. Every case should thus be discussed with the attending Neonatologist, Neonatal Neurology and/or Neuroradiology.

Although MRI is the preferred second line investigation of the newborn central nervous system, there are specific situations where computed tomography (CT) may be the investigation of choice. This is for the evaluation of an acute cerebral haemorrhage (subdural, subarachnoid, posterior fossa) especially if there is midline shift on cranial ultrasound and neurosurgical intervention may be necessary.

This clinical guideline outlines the requirement for the use of Magnetic Resonance Imaging (MRI) in the Newborn at the Women's.

2. Definitions

Not applicable

3. Responsibilities

Staff caring for a newborn and considering MRI as one of the investigation options should follow this guideline.

4. Guideline

4.1 Indications for requesting an MRI examination:

Term infants (Stage II and III Hypoxic Ischaemic Encephalopathy)

Diagnosis and prognosis: The patterns of injury on conventional T1- and T2- weighted images, and diffusion weighted imaging (DWI) provides information about diagnosis (e.g. global hypoxia-ischaemia, focal arterial infarction), timing of injury and prognosis. In addition, a high lactate and low N-acetyl aspartate peak on proton MRS is prognostic of poor neuromotor outcome. The sensitivity and specificity of MRI for prognostication in hypoxic ischemic encephalopathy (HIE) has been based on studies prior to hypothermia treatment and should be taken into consideration.

Timing of scan: The prognostic utility of MRI has been shown from Day 3 up till Day 14 (1-4). The recommended time is **Day 5-10**. In special circumstances where a brain MRI may be useful in redirection of care, MRI can be performed prior to Day 3 but this should be discussed on an individual case by case basis with the neonatologist, neonatal neurology and/or neuroradiology.

Additional MR sequences: In some circumstances, it may be beneficial to have additional MR sequences in addition to the standard protocol for HIE (e.g. MRA if there is a suspicion of an arterial infarction, specific MRS for non-ketotic hyperglycinaemia). It is thus imperative that every case be discussed with either Neonatal Neurology or Neuroradiology when the request is made.

Preterm infants

Diagnosis and prognosis: The patterns of injury are different depending on the gestation of the infant.

Timing of scan: The best time for prognosis is an MRI at term-corrected age. However, an earlier MR scan may be required depending on the clinical situation.

- **Congenital malformations of the central nervous system**

Many of these cases would have been picked up on antenatal ultrasound and/or MRI. A postnatal MRI should be performed soon after birth when the infant is clinically stable.

- **Incidental abnormal findings on cranial ultrasound**

An MRI should be considered if it is unclear from ultrasound what the nature of the lesion is. The MRI should be performed when the infant is clinically stable.

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- **Extremely preterm infants**

White matter abnormalities in the extremely preterm infant predict cerebral palsy, neurosensory impairment and severe cognitive delay (5) and these lesions are more easily seen on MRI compared to cranial ultrasound. However, there is insufficient evidence to advocate a routine cerebral MRI for every extremely preterm infant. Preterm infants with an established brain lesion (e.g. severe intraventricular haemorrhage, periventricular leukomalacia) should be considered for an MRI at term corrected age, especially if the clinical findings at term are inconsistent with what we would have expected from the ultrasound findings.

- **Severe hyperbilirubinaemia**

An MRI should be considered for infants with bilirubin encephalopathy. This should be performed when the infant is clinically stable.

- **Postnatal cardiac arrest**

If there has been a significant period of hypoxia and subsequent encephalopathy, an MRI should be considered. The best timing would be Day 3-5 after the event.

4.2 Post discharge MRI examination:

There will be times when a post discharge MRI is indicated. The decision may have been made either prior to discharge (i.e. while the baby is still an inpatient) or after the baby has gone home from NISC or the postnatal ward. The following procedure outlines the processes involved.

- **MRI booking**

- The Neonatal resident or Fellow completes a Medical Imaging Request form, clearly documenting the clinical indication for the brain MRI examination.
- Obtain a date and time for the MRI from Radiology, and document this information in the patient notes and CLARA discharge summary. Please **DO NOT** just send the form to Radiology, expecting the Radiology department to make the booking and contact the family. It is the responsibility of the Neonatal team to do so.
- Written information about the date and time of MRI ([Post discharge MRI letter](#)) should be given to the family as part of the discharge paperwork.
- For babies who are not inpatients, the Neonatal resident or Fellow should contact the family by telephone to inform them of the date and time of MRI, as well as when they should present to NISC on the day. Where possible, the information pamphlet with details of the MRI should also be sent to the family.

- **Day admission booking**

- Once the date of the MRI is confirmed, the Neonatal resident or Fellow responsible for the MRI booking should inform the Floor Coordinator about the planned day admission of the baby. This should preferably be done by e-mail (neonatal.admissions@thewomens.org.au) with the following details i.e. name, RWH UR, date of birth, date of MRI and admission time. The admission time should be at least 2 hours prior to the time the study is to be performed.

- **On the day of the MRI**

- Clerk the admission and fill in the Newborn Assessment and Admission form (MR/1702). In particular, the baby needs to be assessed for suitability for sedation through documentation of a set of observations by the nursing staff and an examination by the medical team.
- Chart sedation: Chloral hydrate 50 mg/kg. A successful MRI is dependent on the babies lying still in the MR scanner. Adequate sedation will maximize a successful scan. Chloral hydrate doses lower than this may not be effective.

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- **Post MRI procedure**

- Babies will be monitored for 4 hours post MRI to ensure that all effects of sedation have worn off.
- Inform the family that they will not receive a MRI result that evening as the MRI will need to be reported by a specialist Radiologist.
- Clarify with the Neonatal Consultant how the results of the MRI will be conveyed to the family.
- Check that the family have an outpatient follow up appointment. If not, clarify the follow up plan with the Neonatal Consultant or Fellow.
- Complete the Neonatal Discharge Summary form (MR/1054). A CLARA discharge summary is not required.

5. Evaluation, monitoring and reporting of compliance to this guideline

Compliance to this guideline will be monitored via incidents reported through VHIMS

6. References

1. Ment LR, Bada HS, Barnes P, Grant PE, Hirtz D, Papile LA, et al. Practice parameter: Neuroimaging of the neonate: Report of the Quality Standards Subcommittee of the American Academy of Neurology and the Practice Committee of the Child Neurology Society. *Neurology* 2002;58(12):1726-1738.
2. Cheong J, Coleman L, Hunt RW, et al. Prognostic utility of magnetic resonance imaging in neonatal hypoxic-ischemic encephalopathy: substudy of a randomized trial. *Arch Pediatr Adolesc Med*. 2012;166(7):634-40.
3. Rutherford M, Ramenghi LA, Edwards AD, et al. Assessment of brain tissue injury after moderate hypothermia in neonates with hypoxic-ischaemic encephalopathy: a nested substudy of a randomised controlled trial. *Lancet Neurol*. 2010 ;9(1):39-45.
4. Shankaran S, Barnes PD, Hintz SR, et al. Brain injury following trial of hypothermia for neonatal hypoxic-ischaemic encephalopathy. *Arch Dis Child Fetal Neonatal Ed*. 2012;97(6):F398-404.
5. Woodward LJ, Anderson PJ, Austin NC, Howard K, Inder TE. Neonatal MRI to Predict Neurodevelopmental Outcomes in Preterm Infants. *N Engl J Med* 2006;355(7):685-694.

7. Legislation/Regulations related to this guideline

Not applicable

8. Appendices

[Appendix 1: Post discharge MRI letter](#)

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