MRI - Preparation of infant in Newborn Intensive Care Unit (NICU)

Guideline Responsibilities and Authorisation

Department Responsible for Guideline	NICU
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Document Owner Title	CNM
Target Audience	Nurses

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Guideline Review History

Version	Updated by	Date Updated	Summary of Changes
2	Jayne Bennett	Aug 2013	Due for review
3	Joyce Mok	April 2015	• Add safety measures • Changes in management of equipment and infusion lines and pumps
4	Richard Pagdanganan	Oct 2018	3-yearly review
5	Richard Pagdanganan	September 2021	3-yearly review
5.1	Leanne Baker / Kelly Ashton	JAN 2024	Appendix B – added checklist for transport to MRI

1 Overview

1.1 Purpose

To outline steps for preparation of infants for magnetic resonance imaging (MRI) to ensure safety of infant and staff during procedure.

1.2 Staff group

Waikato staff working in Newborn Intensive Care Unit (NICU).

1.3 Patient / client group

Babies and infants in Newborn Intensive Care Unit (NICU).

1.4 Definitions

CPAP	Continuous Positive Airway Pressure
CVAD	Central Venous Access Device
ECG	Electrocardiograph
ET	Endotracheal
IV	Intravenous Line
L1 and Level 2	Designed to provide **basic care** for newborns with conditions that are expected to resolve without need for intensive care.
MRI (Magnetic Resonance Imaging)	This is a relatively non-invasive imaging technology for diagnostic and evaluation purpose. It often provides more sensitive and specific imaging information about paediatric central nervous system abnormalities than ultrasonography or Computed Tomography (CT). Brain MRI has the advantages of not exposing infants to ionising radiation, and provides detailed information about brain parenchyma and changes induced by hypoxia / ischaemia. MRI is a relatively safe procedure provided specific guidelines are strictly maintained.
NBM	Nil by mouth
PAL	Peripheral Arterial Line
UAC	Umbilical Arterial Line
MR1 Ventilator	The Hamilton MR1 ventilator is fully compatible for use in the MRI scanner room. Refer Appendix B

2 Clinical Management

2.1 Competency required

- Registered Nurse who has completed Level 3 orientation and preferably ventilator trained
- Registered Nurse who has completed Level 2 orientation for L2/L1 babies.

2.2 Equipment

- Bean bag (in store room)
- Laerdal Silicone Resuscitator (LSR) (bag) and infant mask size 0/1
- Green (oxygen) tubing – cut an 8 metre length from the roll (in Technician's room)
- Simms connectors for oxygen tubing x 2
- Neopuff + gas supply + flow meter (e.g. oxygen and air cylinders with regulators)
- Air and oxygen hose to connect ventilator/CPAP to wall supply at MRI waiting room
- For baby on ventilator/CPAP: Transport incubator / radiant warmer/incubator + respiratory systems + gas supplies (D-size oxygen and air cylinders)
- For baby who is in a cot and on low flow: Normal nasal cannula + portable oxygen cylinder

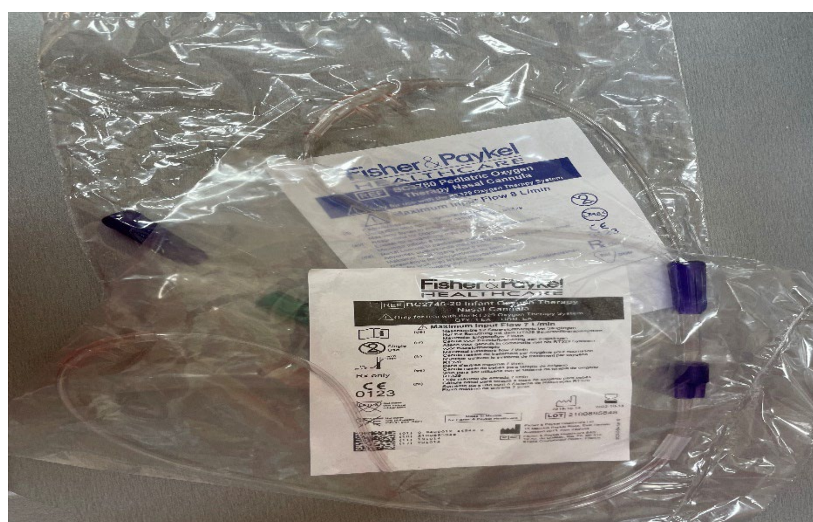

Figure 1

- Special notes:
  - Optiflow cannula is not allowed to be used because it has metal components.
  - Infant Oxygen Therapy Nasal Cannula: available from paediatric ward (E4/E5) or in the technician's office.
- Portable suction system + suction catheter (on shelf next to transport incubator)
- Monitor for transport (check battery 2+hours): Massimo for Level 1/Level 2 babies and a PhillipsX2 monitor for Level 3 babies.
- Clean nappy
- Completed safety checklist with signed consent forms. The safety checklist is kept in the shelf in the office with NICU Pre--op checklist.
- Parents have signed the consent form and completed and signed MRI safety questionnaire

- Patient clinical notes
- Completed and signed MRI safety questionnaire
- Baby with IV Infusion, i.e. CVAD/IV/Arterial/Venous Lines: 8 metres of tubing is required to ensure each fluid and medication is primed through line and run from the infusion pumps.
  - IV/CVAD/UVC fluid:
  - Asena extension set with pressure disc + 2-3 packs spiral extension tubing (each tubing = approx. 400cm in length) kept in the IV trolleys in L3 nurseries.
- Baby with UAC/PAL:
  - No transducer
  - 2 packets spiral extension tubing
- If needed, bring with you Dextrose Gel/Sucrose in its original container
- 1ml syringe + medication label + gauze
- Arrange orderly (may need two if ventilator/CPAP + gas cylinders) to assist with transport to MRI room and back to NICU

NOTE: Refer NICU Nursing Procedure: Preparation of NICU Patients with Respiratory Support for Interdepartmental Transfer.

2.3 Guideline

1. Informed Consent

- Medical staff to explain and discuss with parents about procedure and possible complications and answer their questions to alleviate parent's concerns and anxiety.
- Inform parents about the possibility of baby being intubated on return.
- Obtain written parental consent by medical staff because anaesthesia and contrast may be used.

2. Safety measures before MRI

- Safety questionnaire must be completed and signed to ensure safety of baby before the procedure.
- All individuals (e.g. patients, personnel, parents) must undergo MRI safety screening and instructions before entering the MRI examination room.
- All personnel and all monitoring and support equipment must be safe for the magnet.
- Most resuscitation equipment is not magnet-safe and thus cannot be brought into the MRI scanning room.
- An unstable patient can undergo MRI if the clinical indication is urgent and no acceptable imaging alternative is available. However, magnet-safe monitoring equipment must be used, and, if resuscitation is required, the patient must be moved out of the MRI examination room to an appropriate site.

NOTE: If baby is on respiratory support, refer to NICU Nursing Procedure: *Preparation of NICU Patients with Respiratory Support for Interdepartmental Transfer (5696)*

See Appendix B if using MR1 Ventilator

- Check instructions from anaesthetist about the required time for NBM prior to procedure and ensure this is documented to ensure safety of infant in case intubation is required.
- Discuss with consultant to ensure MRI department will give sufficient notice of procedure time, preferably 4-6 hours in advance, for staff to prepare infant's infusions and respiratory support systems for the safe transfer of infants to and from MRI department.
- Isolate CVAD lines from the skin and attach it well to an area that is not being scanned as metal inside hub of catheter can heat causing melting of line or burning of baby.
- BP transducer is not allowed in the MRI scanning room.
- Ensure arterial line is taped securely because no BP monitoring/alarm is available during transport and scanning.
- Remove monitoring probes/electrodes, e.g. electrodes of BRAINZ monitor, rectal and skin temperature probes.
- Connect ventilator using the oxygen and air hose to wall gas supply while in MRI waiting room to conserve gas in cylinders.

3. Management of infusions, lines and pumps

- As pumps have metal components, tubing must be long enough so that syringe/infusion pumps may be left outside the MRI scanning room.
- Syringe pumps and infusion pumps need approximately 8 metres of tubing primed with medication.
- Keep extensions and lines tidy to prevent tangles because of extra length of the extensions by winding up the extensions to ensure each set of tubing is coiled neatly in a single file and secure the coil with Coban loosely to enable easy uncoiling and prevent tangling.

4. Transferring infants

- Change baby's nappy before leaving unit and take spare one because a wet nappy can distort imaging.
- If baby is in a cot, dress baby in clothing with no metal buttons because metal should not be brought into MRI scanning room.
- Wrap/cover baby in blankets and put hat on baby before leaving and on returning to the unit to reduce heat loss during transfer.
- Arrange orderly to assist with the transport of baby to MRI and back to NICU.

5. Monitoring during scanning

- Site of arterial line must be visible or maintain constant observation on arterial line to ensure no disconnection or traction on the lines and arterial catheter.
- All metal monitoring e.g. ECG leads, saturation probes, must be removed from baby prior to entry into MRI room.
- Monitor infant by using the designated SpO_2 monitor in the scanning room.
- Baby is placed in bean bag to minimise movement of baby during scanning.
- Attach Bean bag nozzle to wall suction, sucking air out of bag causing baby to be held still inside bag.
- When scanning is completed, ensure airway is patent, all lines are secured and infusing, and recommence standard NICU monitoring during transport.

6. Management of airway/respiration

- Baby on nasal flow:
  - Infant Oxygen Therapy Nasal Cannula tubing will be connected to wall oxygen in scan room.
  - No oxygen tanks to be taken inside scanning room as they are metal containers.
- Baby on CPAP:
  - To be changed to low flow if baby can tolerate it, otherwise baby may need to be intubated as CPAP systems are not available at MRI scanning room.
  - Occasionally, baby may be put on single (naso-pharyngeal) prong using ivory ET tube and medical staff to provide CPAP using a Laerdal bag.
- Baby on ventilator:
  - NICU medical staff use Laerdal bag to manually ventilate infant.
  - Anaesthetist, if present, uses MRI anaesthetic tubing to ventilate baby manually.

3 Evidence base

3.1 Bibliography

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- The Royal Children’s Hospital (2017) Magnetic Resonance Imaging (MRI) in Newborn: Guideline for use. Retrieved from https://thewomens.r.worldssl.net/images/uploads/downloadable-records/clinical-guidelines/magnetic-resonance-imaging-mri-in-the-newborn_150517.pdf
- The Royal Women’s Hospital (2020: Magnetic Resonance Imaging in Newborn: Guidelines for use. Retrieved from https://thewomens.r.worldssl.net/images/uploads/downloadable-records/clinical-guidelines/magnetic-resonance-imaging-mri-in-the-newborn-guidelines_280720.pdf

3.2 Associated Te Whatu Ora Waikato Documents

- Preparation of NICU Patients with respiratory support for interdepartmental transfer (5696)

Appendix A – MRI Safety Checklist for Ventilated NICU Patient – (non MR1 patient)

Bring the following:

☐ Oxygen regulator or blender

☐ Blue connector/adaptor for ET

☐ 2-3 extension tubings for each IV line

☐ Anaesthetic bag with connector (inside anaesthetic bag packet)

☐ Spigot for O2

☐ Spare O2 and Air size D cylinders (can bring during transport of present to MRI department for return trip, if needed)

☐ If medical air to be pumped into room from the shuttle

- ○ Long medical air lines (5m) to reach the wall to the shuttle
- ○ Long green O2 tubing (10m) to enter room via door

☐ Bean bag

☐ Blue posey wrap to be used with MRI pulse oximeter

☐ +/_ IV access if requested

☐ MRI consent for procedure contrast completed by parent

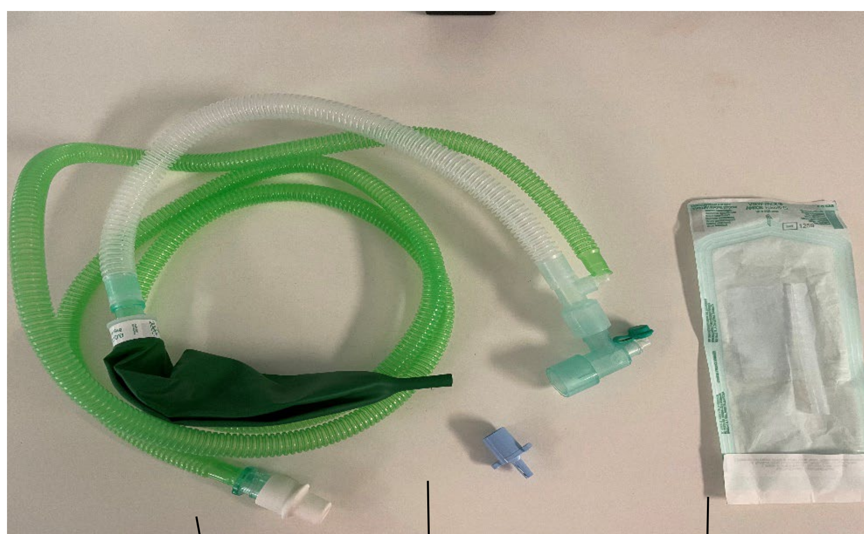
Check:

☐ No metallic tubing in nasal O2 lines

☐ No unremovable monitoring devices

☐ No metal in patient's clothing

☐ If any concerns ring Anaesthetic Technician (#23813)



Appendix B – MRI Checklist for Using MR1 Ventilator for CPAP or ventilated baby

1. Preparation for leaving

☐ In collaboration with medical team, assess baby's condition for procedure
☐ Ensure parents/carers have given signed informed consent and appropriate documentation is completed
☐ All IV/Arterial infusions changed with extra extension lines added and using Alaris syringe drivers for procedure (refer to guideline) – [consider stopping infusions temporarily if able]
☐ Organise NICU personnel - x2 RN, x1 Registrar/NNP/SMO, x2 attendants
☐ All babies on ventilator or CPAP should have a patent PIV in place and ID label on baby
☐ Confirm time and book attendants [allow minimum 20 minutes for journey from NICU to MRI suite]
☐ Prepare incubator/open warmer and shuttle for transport:
- Insert bracket to back of incubator/open warmer - attach Hamilton ventilator and strap (refer to cheat sheet)
- Consider placing monitor next to ventilator for transport
- Ensure pre-warmed blankets/clothing are available
- Check gas bottles on shuttle are full
- Neopuff, self-inflating bag and portable suction are available and working
- Cardiorespiratory monitor set up and ready
- Beanbag

☐ Additional equipment collected and placed in incubator drawer – **ensure ETT is secure prior to transport**
- Endotracheal tubes (ETT) in appropriate sizes
- Laryngoscope
- Stethoscope
- Introducer
- Purple gastric syringe for OGT decompression
- CO_2 detector (Pedicap)
- Suction catheters
- Scissors and precut ETT tapes and silk – include spare roll of sleek tape
- Pacifier
- Ear muffs

☐ Consider sedation prior to procedure if baby sensitive to noise and motion (**pre-charted and prepared**)
☐ Baseline observations and temperature prior to departure (**including ETT position**)
☐ Patient clinical notes and consent forms to go with baby
☐ Staff consider removing metal objects e.g hair clips, pens, scissors, badges, fob clips etc – prior to leaving

2. In transit

☐ RNs to assist to open doors
☐ Ensure slow crossing over bumps
☐ Registrar/NNP/SMO to monitor and observe baby in transit
☐ RN to watch monitor and equipment

3. On Arrival in MRI Suite

- ☐ Nurse to plug in incubator to wall power and wall gas supply
- ☐ Orderly to let reception know NICU team have arrived
- ☐ Wait for MRI nurse to come and take details and provide further instructions
- ☐ Record patient observations

4. Inside MRI Control room

- ☐ Disconnect power and gas from waiting area wall – back to shuttle supply – move shuttle and Incubator into Control room
- ☐ Move ventilator from incubator onto Hamilton ventilator stand (stand stays in MRI suite)
- ☐ Check baby temperature prior to transfer to bed
- ☐ Consider sedation if not on fentanyl infusion or none given prior to transport (**pre-charted and prepared**)
- ☐ **RN** to pass white 02 tubing to MRI staff to reconnect to oxygen supply in Magnet room
- ☐ Prepare bean-bag on MRI bed and 2 RN's to transfer baby to beanbag
- ☐ Place vent/CPAP tubing alongside baby and sleek tape securely to bed to avoid
- ☐ Once baby is settled on MRI bed document a full set of observations and ventilation settings, including ETT position if applicable
- ☐ Check position of infusion pumps and slowly extend tubing as bed is moved – ensure no kinking or pulling
- ☐ Disconnect incubator from shuttle and move incubator to control room (shuttle stays pugged in in waiting area)
- ☐ MRI screened medical team member to assist with moving bed and baby into the magnet room with MRI staff – ensure shuttle/incubator does not cross hazard line/barrier to magnet room.
- ☐ Slowly move bed and ventilator together into the magnet room – person responsible for moving ventilator to attach the yellow tether strap to the safety anchor in MRI room
- ☐ Check ventilator tubing directed toward scanner and positioned with adequate length to reach inside scanner
- ☐ Extra RN and/or medical staff must be prepared to enter the MRI room at any stage during scan if baby deteriorates or troubleshooting is required.
- ☐ 1 RN to be assigned for documenting observations, vent settings and assessing equipment positioning during transfer and procedure
- ☐ Ensure AMBUBAG and appropriate size mask is with baby in side scanner room during procedure (to be kept at base of MRI bed)

5. After procedure

- ☐ Bring shuttle back into control room
- ☐ Leave ventilator tether on while wheeling baby on MRI bed back to control room – disconnect tether at door, MRI team to decompress beanbag
- ☐ 2 nurse transfer of baby back in to incubator
- ☐ Transfer oxygen tubing back to shuttle 02 source
- ☐ Ask MRI team to request x2 attendants for return transfer to NICU
- ☐ Disconnect ventilator from stand and re-secure to incubator bracket
- ☐ Check patient full set of patient observations, temperature, ventilator/CPAP/Fluid connections
- ☐ Request MRI staff to call orderlies to assist with transport back to NICU