Local Guideline

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

NSW GOVERNMENT Health
Hunter New England Local Health District

MRI -Preparation and transfer of infant in NICU

Sites where Local Guideline applies	Neonatal Intensive Care Unit JHCH
This Local Guideline applies to:	
1. Adults	No
2. Children up to 16 years	Yes
3. Neonates – less than 29 days	Yes
Target audience	Clinical staff in NICU and technical staff accompanying infants to MRI
Description	Provides guidance for staff to ensure MRI's attended to in a safe manner for infants and staff
National Standard	Comprehensive Care

Go to Guideline

Keywords	Transfer, Neonate, MRI, Imaging, NICU, JHCH
Document registration number	JHCH_NICU_05.01
Replaces existing document?	Yes
Registration number and dates of superseded documents	JHCH_NICU_05.01 June 2011

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:

- NSW health Policy Directive PD 2017_013 Infection Control and prevention Policy
- NSW Health Policy Directive PD2017_032 Clinical Procedure Safety
- Medication Safety in HNE Health PD2013_043:PCP31

Prerequisites	All clinicians accompanying infants for MRI are to have completed online MRI safety training and ALS
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.
Position responsible for the Local Guideline and authorised by	Jason Simpson. General Manager / Director of Nursing CYPFS
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Note: Over time links in this document may cease working. Where this occurs please source the document in the PPG Directory at: http://ppg.hne.health.nsw.gov.au/

Purpose and risks

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 receiving a MRI scan are prevented, identified and managed.

The risks are:

- *Incorrect equipment for MRI environment*
- *Poor sedation of neonate*

The risks are minimised by:

- *Staff accompanying patients to MRI to have completed online training*
- *Clinicians having knowledge of MRI environment*
- *Clinicians seeking assistance if the therapy is outside their scope of practice*
- *Following the instructions set out in the clinical procedure*

Ensuring appropriate sedation administered to the neonate prior to procedure

Glossary

Acronym or Term	Definition
ALS	Advanced Life Support
CPAP	Continuous Positive Airway Pressure
CXR	Chest X-Ray
ECG	Electro-cardiogram
ETT	Endo tracheal tube
GA	General Anaesthetic
IV	Intravenous
IVT	Intravenous Therapy
MRI	Medical Resonance Imaging
NICU	Neonatal Intensive Care Unit
NUM	Nurse Unit Manager
OGT	Orogastric Tube
SaO2	Oxygen Saturations
TA	Technical Assistant

Rationale

All infants requiring transfer to Medical Imaging for Medical Resonance Imaging (MRI) investigations will be assessed in terms of anaesthetic requirements, sedation for the procedure, requirement of intubation and general anaesthetic, and nutritional status. This assessment will then determine the preparation of the infant in the NICU prior to transfer to Medical Imaging. Once assessed and appropriately prepared, the infant will be safely transported and escorted to Medical Imaging.

Outcomes

- The infant will be assessed for the need for appropriate anaesthetic/sedation for the procedure, to optimize the quality of the investigation. The need for contrast and intravenous access should be discussed between the Neonatologists and MRI staff prior to transfer.
- Following discussion with the Neonatologist the infant will be prepared for the correct procedure, either MRI under General Anaesthetic (GA) requiring ventilation or non-ventilated.
- The infant will be safely transported to and from Medical Imaging for the procedure and the staff accompanying the infant will be aware of MRI Safety.
- The infant will be monitored during transfer to and from Medical Imaging and during the procedure.
- Resuscitation equipment is set up ready to be used during transport on the giraffe or open care bed.
- Appropriate paperwork will accompany the infant to MRI

Staff Safety

- Entry into the MRI scanning rooms is at the discretion of the MRI Radiographers. Only staff required for patient care will be allowed entry into the scanner rooms after the appropriate safety checks have been undertaken.

- It is essential to complete the MRI Safety Screening Questionnaire -any staff member accompanying an infant will be required to take the completed form to Medical Imaging. This form identifies possible implants/prosthesis or health issues for staff that may result in serious injury in a strong magnetic field.

- Before entering the scan room **all** metallic objects must be removed including watches, jewellery, hearing aids, wallet, credit cards, coins, keys, pencils/pens, scissors, mobile phones, hair pins, clips, piercings, clothing with metal e.g. bra, jeans, zips, studs. There are lockers available.

- It is desirable for all staff transferring infants to MRI to undertake the ‘on-line MRI Safety Training’ –Logon to ‘My Health Learning’ and search ‘MRI’ in catalogue. Enrol in MRI Safety course.

Procedure: Ventilated infant

1. Ensure parents/guardians have given informed consent and appropriate documentation is completed and signed.
2. Ensure the infant is wearing two (2) correct identification bands that correlate with the request form.
3. Assess temperature pre/post transfer and apply warmed blankets/clothing if necessary.
4. The infant is transferred to a Giraffe bed, which is fitted with full air and oxygen cylinders, Neopuff and mask and portable suction equipment. A Laerdal bag should always be available. Ensure this is done with appropriate time to intubate and stabilise the infant prior transfer if required.
5. Monitoring is maintained by the portable monitor which, is linked to the Philips monitoring at the bedside. Ensure that both ECG and Sao2 monitoring is attached.
6. Ensure extra equipment is available in the incubator draw e.g. current size ETT + size smaller, laryngoscope, introducer, pedicap, neobar, suction catheters, stethoscope, tapes, OGT Size 8FG, syringes, ear muffs, and a pacifier to settle.
7. The infant is intubated in NICU by Neonatal staff. Provide sedation as ordered.
8. Ensure a CXR is performed in all recently intubated infants to ensure correct tube placement.
9. Ensure blood results and the blood sugar level is normal before transporting to MRI.
10. Intravenous (IV) fluids are changed to a syringe driver or temporarily ceased (after discussion with Medical Officer). Attach long extension tubing to a **30ml syringe** (only a 30ml syringe will pass through the hole into the scan room) and connect to the pump outside the room. **This is done by adding 1 set of extension tubing to 1 x 6m extension tubing.**
11. **TO AVOID MEDICATION ERRORS.** Make up any required medications in a 50ml syringe as per the Neomed guideline and decant into a 30ml syringe. **PLEASE ensure** that you document the decanting on the blue IVT label. There is no need to change this solution when returning to NICU. To avoid unnecessary line breaking please change when solution is due to be changed.
12. Ensure the infant does not have ANY metal on their body (ECG leads, clothing with studs, pins).
13. Ensure the patient's notes, bedside chart and request form are taken with the patient (underneath bed) for the procedure.

14. Set up Hamilton MRI ventilator (see appendix below) and select either conventional ventilation mode or CPAP mode. Connect the Hamilton MRI ventilator to the power source and wall oxygen at the T-piece until ready to use the portable **oxygen cylinder**. Calibrate sensors for either mode and apply desired settings.

15. Ensure that oxygen and air cylinders are attached to the bed with the neopuff attached to both cylinders. Ensure cylinders are full.

16. Transfer the infant from the Fabian ventilator to the Hamilton MRI ventilator 45min prior to transfer to MRI department. Attend a blood gas ½ hour post attachment to MRI ventilator. Ensure infant is stable on the ventilator before transfer to Medical Imaging.

17. When ready to transfer infant to MRI, attach oxygen hose to portable oxygen cylinder and turn on. Disconnect from the wall oxygen.

18. Call the Technical Assistant (TA) x2 for assistance in transferring the Giraffe bed to Medical Imaging. The neonatal nurse (who has attended ALS training) caring for infant will accompany the infant to Medical Imaging. Ensure the NUM 2/In-charge nurse is aware of the transfer. **A medical team member must also accompany the infant.**

19. The Hamilton MRI ventilator will remain attached to the stand the whole time

20. The infant can then be transferred to Medical Imaging attached to the Hamilton MRI compatible ventilator (see Appendix 2). Ensure ETT is secure during transfer to MRI department.

21. The infant is safely transferred to Medical Imaging for the procedure via the theatre lifts

22. Once in the MRI department, a check and review by the MRI Radiographer is carried out.

23. Plug the open care/Giraffe bed to power source in MRI department. Ensure MRI bed is provided in the assessment bay. Ensure MRI oxygen extension hose is attached to MRI ventilator T-piece oxygen hose. Turn off portable oxygen once attached to MRI oxygen. Place infant on bed and ensure ETT is in a secure position and the infant's observations are within normal limits and ventilating appropriately. There is **NO NEED TO NEOPUFF INFANT**. Infant should remain ventilated at all times. Turn OFF portable air cylinders and portable Phillips monitor.

24. Assist the radiographer to swaddle/wrap the infant as this is very important for optimizing the quality of the images. Under guidance from the MRI Radiographer,

the infant is transferred to the MRI room on the MRI bed. MRI safe monitoring equipment is connected and checked.

25. The IVT syringe driver is not allowed in the MRI room so removal of the syringe from pump is required and handed to MRI staff to pass through the hole in the scanning room. Reinsert syringe in driver and recommence infusion.
26. MRI undertaken
27. Once MRI finished, call the TAs for assistance to transfer open care/Giraffe bed back to NICU.
28. Turn cylinders and Phillips monitor back on prior to infant moving to open care/Giraffe bed.
29. The infant is transferred from the MRI room to the open care bed/Giraffe in the MRI department. Attach the ventilator oxygen hose back onto the portable cylinders, then disconnect from the MRI wall gas supply. MRI safe monitoring equipment is removed and the transport monitoring is recommenced.
30. Transfer infant back to NICU and attend a set of observations upon return

If difficulty or concerns during procedure or transport, **contact NICU directly** for assistance (NICU DECT ph. **23171**)**.**

Procedure: Non- Ventilated Infant

1. Ensure parents/guardian has given informed consent and appropriate documentation is completed and signed.
2. Ensure the infant is wearing two (2) correct identification bands.
3. The infant is transferred to MRI on an open care bed/Giraffe bed, which is fitted with full air and oxygen cylinders (ensure key available), Neopuff and portable suction equipment. A Laerdal bag should always be available either on the bed or in the drawer.
4. Assess temperature pre/post transfer and apply warmed blankets/clothing if necessary
5. Include intubation equipment in case of an emergency in the drawer.
6. Monitoring is maintained by the portable monitor. Ensure that both ECG and Sao2 is attached.
7. Ensure the infant does not have ANY metal on their body (i.e. ECG leads, CPAP pins, clothing)

8. Either use a Canberra hat to secure tubing or tape CPAP tubing using stretchy Leucoplast tape (see appendix)
9. Give the infant a feed, either enteral or sucking feed just prior to transfer to Medical Imaging. Ensure consent for a pacifier is obtained from parents and take to MRI.
10. Wrap infant securely in sheet/wrap.
11. Ensure all patient notes, bedside chart and the request form are taken with the patient (underneath bed) for procedure.
12. Connect the Hamilton MRI ventilator to the power source and wall oxygen at the T-piece until ready to use the portable **oxygen cylinder**. Calibrate sensors for CPAP mode and apply desired settings.
13. When ready to transfer infant to MRI, attach oxygen hose to portable oxygen cylinder and turn on. Disconnect from the wall oxygen.
14. Call for assistance of TAs in transferring open care bed/giraffe bed to MRI department. The neonatal nurse (who has attended ALS training) caring for the infant will accompany the infant to Medical Imaging. Ensure neonatologist on service and NICU Team Leader are aware of infant's transfer to Medical Imaging.
15. Infant is safely transferred to Medical Imaging for procedure via theatre lifts.
16. In the MRI department ensure MRI bed is in assessment bay. Place and swaddle infant into the "bean bag" with the assistance of the radiographer. Attach MRI oxygen extension hose to MRI ventilator. Turn off portable oxygen and air cylinders. Ensure the infants observations are within normal limits and CPAP is effective prior to transferring into MRI room. Attach the infant to the MRI safe monitoring equipment and re-wrap securely in the blanket.
17. Following check by the Radiographer, the infant is transferred to the MRI room, by the MRI Radiographer. MRI safe monitoring equipment is connected and checked.
18. MRI undertaken
19. Call for the NICU TA assistance to transfer Giraffe bed back to NICU. Turn on oxygen and air cylinders on bed and turn on monitoring.
20. The infant is transferred from MRI room to the open care bed in the MRI department. Reattach the oxygen hose to the portable cylinders. Disconnect from MRI oxygen supply. The MRI safe monitoring is removed and the transport monitoring is reconnected. The infant is transferred back to NICU.

If difficulty or concerns during procedure or transport, **contact NICU directly** for assistance (NICU DECT ph. **23171**).

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Ratified	NICU Operational, Planning & Management Committee JHCH CQ&PCC	13/02/2019 28/05/2019

References

Shellock, Frank G Manual for Magnetic Resonance Safety, Implants and Devices 2010 Edition

Appendix

1. MRI Safety Screening Questionnaire Hunter New England Imaging
2. Hamilton MRI ventilator setup instructions, calibrations, CPAP setup and video links

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.

Implementation, monitoring compliance

1. Approved clinical guideline will be uploaded to the PPG and communication of updated ‘MRI- Preparation and transfer of infant in NICU’ clinical guideline to NICU staff will be via email and message on the HUB.
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. The person or leadership team who has approved the Guideline and Procedure is responsible for ensuring timely and effective review of the Guideline and Procedure.
5. 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.

Feedback

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

Appendix 1

Imaging Office Use Only

NSW GOVERNMENT Health
Hunter New England Imaging

MRI Safety Screening Questionnaire

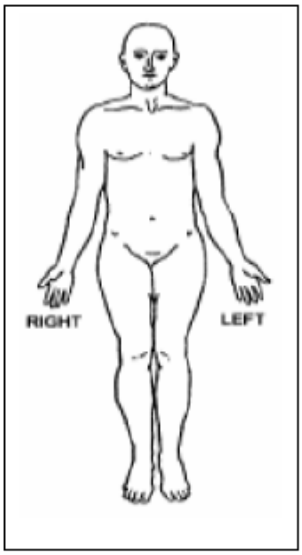
PATIENT DETAILS (please print clearly)

Name_____DOB_____

Weight_____kg/stone Height_____cm/feet inches

WARNING: Due to the MRI system having a very strong magnetic field that is always on, it may be inappropriate/ hazardous for some individuals to have a scan. Therefore all questions must be answered accurately to determine your eligibility. Incorrect information could result in serious injury. If you do not fully understand any of the questions please ask for help.

Have you ever had an operation of any kind, at any time in your life? ❒Yes ❒No
List all operations, approximate dates, and mark the operation areas on the figure opposite.



Have you had an MRI examination before? ❒Yes ❒ No If yes, when and where? _____

Do you have any of the following? (Please circle Yes or No for all questions)

Yes No Cardiac pacemaker/ Defibrillator/ Pacing wires
Yes No Artificial heart valve
Yes No Aneurysm clip
Yes No Brain shunt
Yes No Ear implant (e.g. Stapes, Cochlear)/ Bionic ear
Yes No Vascular implant/ Stent/ Coil/ Filter/ Aortic graft
Yes No Neurostimulator or Drug infusion pump
Yes No Electronic or Magnetically activated implant or device
Yes No Any other prosthesis/ implant (eye, penile, pessary etc.)

If you answered yes to any of these questions in this section, please call John Hunter Hospital on 49 213396, or Calvary Mater Hospital on 40 144603, to allow implants to be checked to assess your suitability for MRI.

Yes No Joint replacement or artificial limb
Yes No Metal rods, plates or screws in/on bones
Yes No Metal/ Shrapnel/ Bullet injuries
Yes No Hearing aid

Yes No False teeth/ Removable bridgework
Yes No Body piercing
Yes No Tattoos
Yes No Nicotine or medication patches

Yes No Do you have a history of kidney (renal) disease?
Yes No Have you had an allergic reaction to contrast media?
Yes No Do you suffer from claustrophobia?

Yes No Do you have an IUD? Type:_____
Yes No Are you breastfeeding?
Yes No Are you possibly pregnant?

Yes No Have you ever been a metal worker (e.g. welding, grinding, lathe)?
Yes No Have you ever had metal in your eye following an injury or operation? If yes, has it been removed? ❒Yes ❒No

Yes No Is there any possibility of metal in your body through injury or surgery, other than that stated on this sheet?
Yes No Have you filled out and understood all questions on this form?

I hereby confirm that I have read, understood and correctly answered the above questions and agree to have an MRI and procedures necessary to complete the examination, including the administration of an MRI contrast.

Signature of person completing form: _____ Date ____/____/____

Form completed by: ❒Patient ❒Relative ❒Doctor ❒Other (please specify) _____
Print Name and contact number

WARNING: Before entering the scan room all metallic objects must be removed including watches, jewellery, hearing aids, wallet, credit cards, coins, keys, pens/pencils, scissors, mobile phones, hair pins, clips, piercings, clothing with metal e.g. bra, jeans, zips, studs. Lockers available.

MRI OFFICE USE ONLY

Form information reviewed by, and first time out identification:_____(Signature) _____(Print Name)

Second Time Out identification by: _____(Signature) _____(Print Name)

Contrast Administering Clinician Signature	Contrast Checking Clinician Signature	Medical Officer Signature
Print Name:_____	Print Name:_____	Print Name:_____
Signature:_____	Signature:_____	Signature:_____

Version 2 – updated 14 June 2017

Medical officers only required to sign if the eGFR <30 and/or the dose varied from standard protocol.

Appendix 2

Hamilton MRI ventilator- for ventilated babies

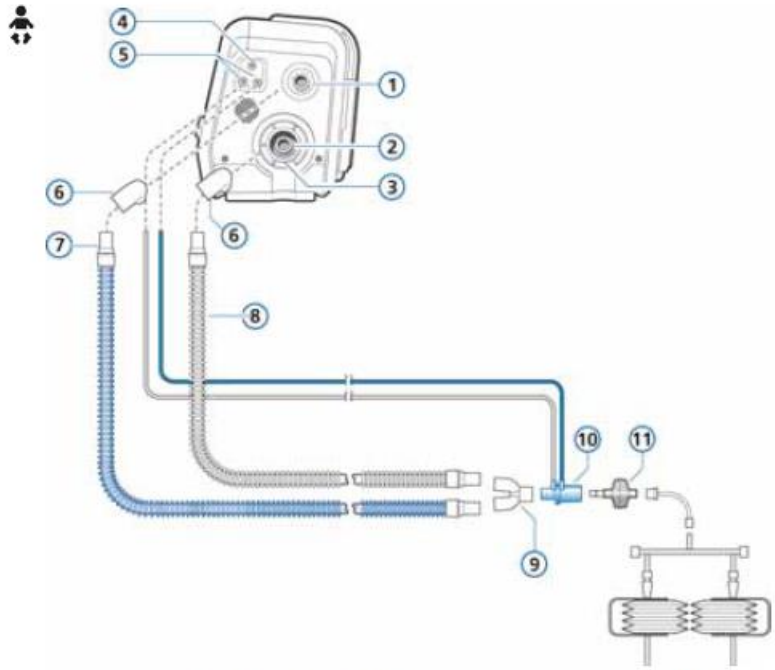
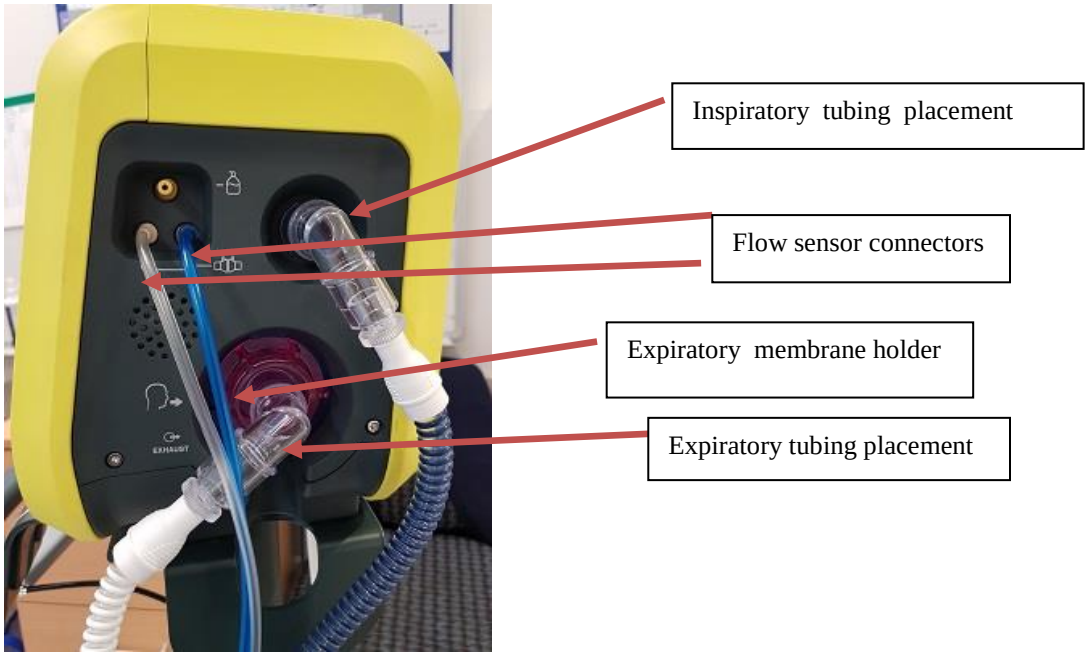


Figure 6-5. MR Safe dual-limb breathing circuit with HMEF/HME for use in MRI environment (neonatal)

1	To patient	**7**	Inspiratory limb
2	From patient	**8**	Expiratory limb
3	Expiratory valve with membrane cover	**9**	Y-piece
4	Nebulizer outlet	**10**	Flow sensor
5	Flow sensor connectors	**11**	HMEF/HME (infant)
6	Elbow adapters (optional)		



Hamilton MRI ventilator- CPAP SET UP

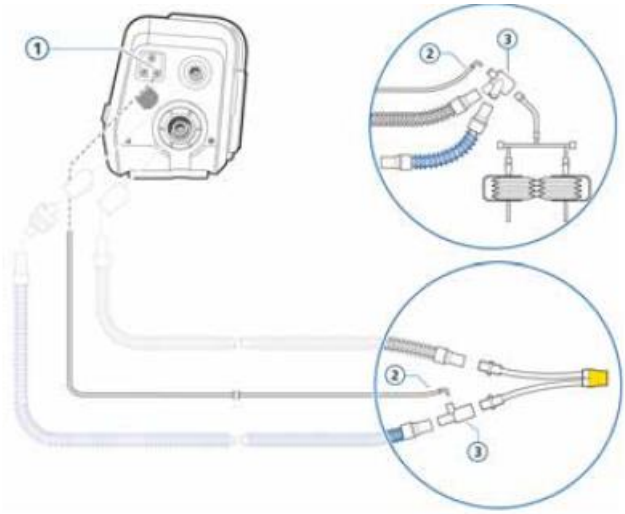
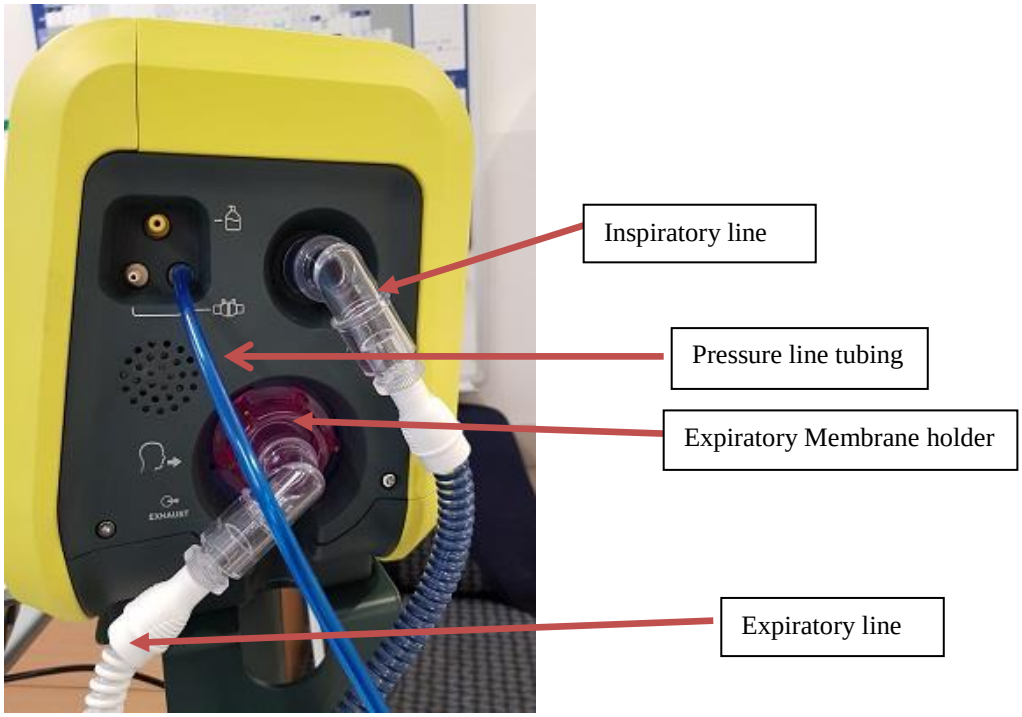


Figure 6-8. Connecting the pressure line

1	Pressure line connector (blue)	3	T-piece with pressure line or Y-piece with pressure line
2	Pressure line		



Hamilton MRI calibrations

- Put in the infant's weight in the main screen and confirm
- Select mode of ventilation (nCPAP or SIPPV) and confirm

Tests and calibrations

In the system tab select test and calibration window

- Perform the tightness test. (This test checks for leakage in the patient breathing circuit.) Perform the tightness test every time after installing a new flow sensor or pressure line.
- Disconnect patient will now be displayed.
- Disconnect the breathing circuit at the patient end of the flow sensor. Do not block the open end of the flow sensor. The text 'tighten patient system is now displayed'.
- Block the opening (wearing a clean glove). The text 'connect patient' is now displayed.
- Connect the patient.
- When the test is complete there will be a green tick displayed in the tightness checkbox. Please refer to **section 6.2.5.1** in the neonatal guide if the test fails.

Calibrating the flow sensor

For ventilation mode

- A flow sensor is required with conventional ventilation and a pressure line is used with nCPAP mode.
- Calibrate the flow sensor after connecting a new flow sensor or when the flow sensor calibration needed alarm is generated.
- In the system tab select tests and calibration window then select flow sensor.
- 'Disconnect patient' will be displayed

Disconnect patient

Attach flow sensor calibration adapter

Turn flow sensor adapter to ventilation line

- When prompted turn the flow sensor back to its starting position and remove the calibration adapter
- When the calibration is complete verify that there is a green tick in the check box. If calibration fails see **section 6.2.5.2** of the neonatal guide.
- If calibration is successful connect the patient and touch the start ventilation button in the standby window to start ventilation.

For nCPAP mode

- You must always ensure that the pressure line is used for nCPAP mode to measure the inspiratory pressure. DO NOT USE A FLOW SENSOR IN THIS MODE.
- This calibration ensures that the breathing circuit resistance compensation is accurate.
- In the system tab go to the tests and calibration window. Select circuit. Disconnect patient is displayed. Follow the instructions on the screen.
- When calibration is complete verify that there is a green tick in the circuit checkbox. If successful, start nCPAP mode by pressing the start ventilation button in the standby window and connect to the patient. If calibration fails please **see section 6.2.5.3** of the neonatal guide.

One long piece of Leucoplast tape to secure tubing to CPAP hat. Then 1 piece crossed over inspiratory tubing and another crossed over expiratory tubing to firmly secure tubing to hat.

https://www.google.com.au/search?q=canberra+hat+cpap&source=lnms&tbm=isch&sa=X&ved=0ahUKEwix_fu0gpXhAhXI7nMBHT2FBdEQ_AUIDygC&biw=1536&bih=751&dpr=1.25#imgrc=zca5YI54TG63sM:

Neonatal ventilation: Setup and operation on the HAMILTON-C1/T1/MR1
https://www.youtube.com/watch?v=hVbD049umf8

HAMILTON-T1: Device overview
https://www.youtube.com/watch?v=lmpnK_ATgjo

HAMILTON-T1/C1/MR1: User Interface
https://www.youtube.com/watch?v=ps4jecQMKD8

HAMILTON-T1/C1/MR1: Alarm Management
https://www.youtube.com/watch?v=ByBbs6ldwRg