



**PEDIATRIC NEWBORN
MEDICINE CLINICAL
PRACTICE GUIDELINES**

MRI Protocol



Clinical Practice Guideline:

Points of emphasis/Primary changes in practice:

1. Process for newborns who require an MRI and who are cared for on CWN 9 or 10 has been defined.
2. Updated contact information for all scanner locations at BWH including: Lee Bell, L1, and Building for Transformative Medicine.
3. Defined EPIC language and process for ordering an MRI at BWH, including the discontinuation of faxing of the order prior to the scan.
4. Updated fluid builder and syringe medication ordering instructions.

Rationale for change:

The Neonatal MRI practice guideline was updated to include relevant workflows for well newborns who require an MRI as well as updated processes related to EPIC changes and ordering enhancements.

Clinical Guideline Name	Clinical Practice Guideline
Effective Date	02/2020
Approved By	Department of Pediatric Newborn Medicine Clinical Practice Council _____ CWN PPG _____ BWH SPP Steering _____ Nurse Executive Board/CNO _____

I. Purpose

The Neonatal MRI Program at BWH aims to provide and optimize MRI services available to infants admitted to Brigham and Women’s Hospital. This guideline outlines the process by which a neonatal MRI is scheduled and performed at BWH as well as the workflows for an infant requiring an MRI at Boston Children’s Hospital.

II. All CPGs will rely on the [NICU Nursing Standards of Care](#).

III. Scope

This clinical practice guideline is for all staff who provide care to inpatient newborns at Brigham and Women’s Hospital.

IV. Guidelines

I. Contacts

MRI Equipment and NICU Preparation/Transport:

Debra Marks, [damarks@bwh.harvard.edu](mailto:dmarks@bwh.harvard.edu), Pager: 39138

Julie Cadogan, jcadogan@bwh.harvard.edu Phone: 617-935-4475

Mimi Pomerleau, mpomerleau@bwh.harvard.edu Phone: 857-424-9668

MRI Respiratory Therapy: Cindy Phillips, caphillips@partners.org, 617-438-5214

MRI Safety and Sequence Protocols:

Vera Kimbrell, vkimbrell@partners.org, 617-435-8656 pager 38540

NICU/ Lee Bell Scheduling and Facility Management:

Maren Levangie, (Lee Bell Clinical Manager) mlevangie@bwh.harvard.edu, 617-602-2790, Pager 36138

Noreen Dunham (LeeBell Lead Tech) x58662

L1 Scheduling and Facility Management:

Nancy Trane (L1 Clinical Manager), ntrane@partners.org,

617-732-7979, pager 13015
Weekends: Tuan Luu, 617-732-5500 x33224

Building for Transformative Medicine (BTM Building):

Kelsey Gentile, Radiology Clinical Manager, kgentile1@bwh.harvard.edu
BTM MRI phone: 857-307-5310
Kelsey Gentile: 617-525-3481

Boston Children's MRI Scheduling

(Radiology Contact info), 1-617-355-6300

Overall Programmatic Questions:

Mohamed El-Dib, mel-dib@bwh.harvard.edu, Pager: 617-280-1792
Ann Velie, MD, avelie@bwh.harvard.edu, pager 39980

II. Who can have an MRI at BWH?

- Any infant who requires a brain MRI can have their MRI performed at BWH.
- Infants who are ventilated and critically ill CAN undergo an MRI at BWH.
- Few exceptions where babies might require an MRI at BCH are:
 - MRI with contrast (extremely rare)
 - MRI on other body parts other than the brain
 - Urgent MRI in absence of availability at BWH
 - Case by case after attending discussed indications with the Director of Neurocritical Care.

III. How to schedule a brain MRI at BWH

- All infants require an order to be placed into EPIC prior to scheduling the scan. Please see section 2 on how to order an MRI for both BWH and BCH scans.
- The NICU currently has standing MRI slots at the Lee Bell scanner Monday-Friday at 2 pm, as well as the L 1 scanner on the weekends at 2pm. All infants within CWN are eligible to be scanned at either of these scanners.
- If an infant has a prenatal finding indicative of needing a post-partum brain MRI, the triage attending/DR I resident should be made aware and will schedule the brain MRI for the next day's MRI slot on the MRI calendar.
- For infants in the well nursery who are identified needing a brain MRI after birth, the covering LIP may schedule the MRI by contacting the NICU birth and transition team to

see when the next available time slot is on their MRI calendar. Once a slot is secured for the infant by the triage team an MRI order for the brain scan will be placed into EPIC and the RN NICU triage team will be contacted by the well newborn nurse to coordinate timing for transport to triage for the infant's MRI preparation.

IV. Location

- The primary location for neonatal MRIs is the Lee Bell Imaging Center x58662 with weekend use of the L1 scanner x33224.
- **Lee Bell MRI:** The MRI in Lee Bell is on the second floor of the CWN building. To get to Lee Bell MRI, take the staff elevators to the second floor. There is a door that has ID badge access that enters into the Lee Bell Center. Use your badge to access through this door. Take a right and go to the end of the hallway. The MRI room is on the left.
- L 1 Scanner: Take the service elevator in CWN to L1 and follow signs for the L1 MRI scanner
- Hale Building for Transformative Medicine-60 Fenwood Rd. Take the pike over to the Hale (BTM) building and follow the signs for the R-S elevators. Take the elevator to radiology on L2.

V. Preparation for MRI

- Adequate preparation is essential in acquiring a good quality MRI in a safe manner. Please follow the instructions enclosed in this document to correctly order and prepare an infant for MRI. Of particular importance is obtaining the equipment well in advance of the scheduled MRI and ordering syringes from pharmacy for any fluid infusions that you will need during transport (outlined in NICU preparation section).
- For any well newborn who requires an MRI at BWH, their MRI preparation will occur within the Triage room by an assigned NICU RN.
- For any well newborn who requires an MRI at BCH, their preparation will occur at BCH by the BCH radiology staff, with transportation by the well newborn staff.

VI. Can Parents Come to the MRI?

- Parents can come to the MRI but will not be allowed in the MRI room. They must wait in the patient waiting area during the MRI.

VII. Interpretation of Results

- MRIs will be read by a focused team of neuroradiologists from Boston Children's Hospital.
- For studies done at BWH, the reading will be in Epic; for studies done at BCH, the reading will be in BCH Power Chart.
- A preliminary report will be available shortly after the MRI, with a final read available within 24 hours.

SECTION 2: ORDERING AN MRI AT BWH

- When the decision has been made that a patient will need an MRI, a folder with screening documents and consent form will be retrieved from NICU front desk and placed at the bedside in the NICU.
- If the infant is in the well nursery, please obtain this folder from the MRI binder in the nursery procedure room on 9 and 10 if the packet is not readily available in baby's skinny chart. The specifics of these documents are outlined below. Many of these can be completed in advance.

I. Consent

- Typical neonatal MRI protocols include sequences that are non-standard sequences. This is necessary to acquire good quality MRIs. However, because these are non-standard sequences, consent will need to be obtained prior to all MRIs.
- The physician ordering the MRI should obtain consent from the family.
- Boston Children's Hospital does not require an additional consent for a scan performed at their facility.

II. Place MRI order in EPIC

- The MRI should be ordered in Epic by a physician caring for the infant.

Order Details:

- To order MRI on Epic: Please use order **MRI Brain w/SPECT**, and sign both orders (All MRIs done at BWH will include MRS)

New Orders

MRI BRAIN W/SPECT

1 MRI Brain

P Routine, 1 time imaging, First occurrence today at 1857

Is a particular imaging focus suggested (radiology may call to confirm)? Per Radiologist discretion/standard based on indications

Intravenous Contrast Request: Per Radiologist discretion/standard protocol based on indications

1 MRI Spectroscopy

P Routine, 1 time imaging, First occurrence today at 1857

Intravenous Contrast Request: Per Radiologist discretion/standard protocol based on indications

- For babies undergoing an MRI after therapeutic hypothermia, in addition MRV needs to be ordered separately (**MRI Angio Brain**)

New Orders

1 MRI Angio Brain

P Routine, 1 time imaging, First occurrence today at 1900

Is a particular imaging focus suggested (radiology may call to confirm)? Per Radiologist discretion/standard based on indications

Intravenous Contrast Request: Per Radiologist discretion/standard protocol based on indications

III. Complete MRI Screening Form for the Patient

- The MRI screening form should be completed by the patient's nurse.
- If the patient has had any operative procedures, please attach the operative notes to the screening form. The MRI technicians will need to verify that the patient does not have any implants or devices such as PDA clips that can be MR Conditional and require different sequencing.

IV. Secure a timeslot for scan

- The ordering physician or LIP should communicate with the NICU charge RN and/or at the morning interdisciplinary huddle in the NICU to identify the next available MRI slot for your patient.
- If the infant is in well newborn, please inform the birth and transition team members regarding the need for a BWH MRI to arrange a slot.
- Please communicate with our radiology colleagues regarding the 2pm slot by 10 am. If this slot is not filled by an infant it will be released to adult patients.

- If the 2pm or designated time for an MRI is unable to be completed, please call radiology to reschedule.

SECTION 2b: Ordering an MRI Scan at Boston Children's Hospital

- For infants in the NICU who require a scan at BCH (any MRI other than a brain MRI or when a BWH scanner is unavailable) a Fellow or BCH resident can place the order into Power chart.
- For well newborn infants who require a scan at BCH, a consult with the appropriate BCH service is required. The MD from that BCH service will place the MRI order in Power chart at BCH and schedule the exam. The BCH MRI suite can be contacted at 1-617-355-6315 for any further questions.

SECTION 3: Neonatal PREPARATION FOR MRI at BWH

ON THE DAY OF MRI (AFTER THE MRI IS ORDERED)

- Call the MRI suite to confirm the date/time of the MRI.
- Well newborn nurse will call NICU triage to confirm date/time of MRI and time for infant to arrive in triage for preparation
 - Phone for Lee Bell: 617-525-8662
 - Fax # for Lee Bell MRI: 617-264-5150

 - Phone for L1: 617-732-7970 or X33224
 - Fax for L1: 617-732-7963
- Make sure all staff accompanying the infant have a screening form on file if they have completed MRI safety training and if not, they should complete the staff screening form and fax to MRI prior to accompanying the infant to the scan

FOUR HOURS PRIOR TO MRI PREPARE MEDICATIONS

- If the infant is on any continuous infusions, determine which infusions are necessary to continue during the MRI.
- All medications and fluids should be in a syringe for MRI to allow them to be passed through the waveguide (the hole in the wall) with the IV lines.

- All continuous infusion medications (i.e. dopamine, epinephrine, morphine, etc.) are now normally prepared in a syringe. These orders do not need to be modified for MRI.
- Most large volume fluids are not prepared in syringes.
- These fluids should be ordered from the Neonatal Maintenance Fluid Builder with a volume of '50 mL' and a note to pharmacy stating 'Syringe for MRI':

Neonate Maintenance Fluid Builder

Order Inst.: To build a custom dextrose infusion, select desired dextrose %, then select sterile water as the QS base. To use D5W, D10W, or D20W as the base, do not select dextrose; instead select D10W or D5W as the QS base. Standard volume is 500 mL.

Dose: 60 mL/kg/day 80 mL/kg/day 100 mL/kg/day

Volume: 50 mL 100 mL 250 mL 500 mL

Is the RN allowed to titrate this medication with the following parameters listed below?
Yes No

Route: Intravenous Intra-arterial

Frequency: Continuous Continuous

For: Hours Days

Starting: 7/12/2019 Today Tomorrow At: 1600 Show Additional Options

Starting: Today 1600 Until Discontinued

Scheduled Times
07/12/19 1600

Admin. Inst.: + Add Administration Instructions

Prod. Admin. Inst.: (none)

Note to Pharmacy: Syringe for MRI

- Extra syringes of medications or fluids may be needed to prime the lines or upon return from MRI. Communicate these needs to the NICU pharmacist.
- Syringes for MRI should be ordered 4 hours prior to leaving for the MRI to ensure time for preparation and delivery of products as well as nursing preparation and priming of lines.
- If a fluid was changed to a syringe for MRI, nursing may prefer this to be changed back to a bag upon return from MRI. Anticipate these needs and enter orders in advance to ensure products available upon return.

- Once back from MRI, discontinue any orders entered specifically for MRI that are no longer necessary.

MRI Conversion Table

<u>Drug</u>	<u>Current admixture</u>	<u>Order</u>
Alprostadil	500 mcg / 50 mL	500 mcg / 50 mL syringe
	500 mcg / 100 mL	250 mcg / 50 mL syringe
	500 mcg / 250 mL	100 mcg / 50 mL syringe
Arginine	30,000 mg / 300 mL	5,000 mg / 50 mL syringe
Dexmedetomidine	200 mcg / 50 mL	200 mcg / 50 mL syringe
	100 mcg / 100 mL	50 mcg / 50 mL syringe
Dobutamine (Dobutrex)	1000 mg / 250 mL	200 mg / 50 mL syringe
	500 mg / 250 mL	100 mg / 50 mL syringe
	250 mg / 250 mL	50 mg / 50 mL syringe
Dopamine (Intropin)	800 mg / 250 mL	160 mg / 50 mL syringe
	400 mg / 250 mL	80 mg / 50 mL syringe
	200 mg / 250 mL	40 mg / 50 mL syringe
Epinephrine	4 mg / 250 mL	0.8 mg / 50 mL syringe
	1 mg / 100 mL	0.5 mg / 50 mL syringe
Fentanyl citrate	1000 mcg / 100 mL	500 mcg / 50 mL syringe
	500 mcg / 100 mL	250 mcg / 50 mL syringe
	250 mcg / 100 mL	125 mcg / 50 mL syringe
Heparin	3000 units / 30 mL	3000 units / 30 mL syringe
Lidocaine	2000 mg / 250 mL	400 mg / 50 mL syringe
Midazolam (Versed)	50 mg / 100 mL	25 mg / 50 mL syringe
	10 mg / 100 mL	5 mg / 50 mL syringe
Milrinone (Primacor)	20 mg / 100 mL	10 mg / 50 mL syringe
	5 mg / 50 mL	5 mg / 50 mL syringe
Morphine	100 mg / 100 mL	50 mg / 50 mL syringe
	50 mg / 100 mL	25 mg / 50 mL syringe
	10 mg / 100 mL	5 mg / 50 mL syringe
	2 mg / 100 mL	1 mg / 50 mL syringe
Norepinephrine	8 mg / 250 mL	1.6 mg / 50 mL syringe
	8 mg / 500 mL	0.8 mg / 50 mL syringe
Sildenafil	10 mg / 12.5 mL	20 mg / 25 mL syringe
Sodium phenylacetate/sodium benzoate (Ammonul)	4500 mg / 500 mL	450 mg / 50 mL syringe
Vecuronium	10 mg / 10 mL	20 mg / 20 mL syringe

TWO HOURS PRIOR TO MRI

- If your patient is on feeds, try to time the feeding to complete 30-45 minutes prior to leaving the NICU for MRI.
- Infants in well newborn, should arrive to NICU triage approximately one hour prior to the scheduled scan.
- Please attempt to coordinate feeds as close to the transfer to the NICU as possible to facilitate a satiated baby to maximize scan quality. (A parent may accompany the baby to the MRI suite but is unable to physically enter the MRI Scanning room.)

Infants will need the Hugs Tag placed in transport mode prior to leaving for NICU, discharged and removed prior to leaving for their BWH MRI and reapplied upon return to the well newborn floor.

- The MRI assessment form should be obtained from the MRI reference binder found in the MRI preparation cart as well as within the well newborn procedural areas.

The nurse caring for the infant (NICU or Well Newborn) should complete the top section of the form (specifically demographic info, history, medications) prior to starting preparation of the infant. Stop at the Two Person check section. This will be completed later

ONE HOUR PRIOR TO MRI:

Equipment

- Gather all necessary equipment for MRI from the MRI cart and have available prior to preparation of the infant.
- The MRI monitor with wireless modules (for ECG and pulse ox) is found in the MRI cart. Extra batteries are found charging on top of the cart. Please note that there is a specific designated sat probe small monitor that is labeled specifically for L 1. This monitor is set for the appropriate wave form needed for the device to work in that MRI suite.
- An MRI compatible ventilator is stored in the Lee Bell Center. If your patient is ventilated, let RT know that you will be doing an MRI. The RT will go to Lee Bell and have the ventilator placed in the MRI prep area and set to the infant's ventilator settings.

- The MRI cart is located in the alcove next to the conference room without windows and contains all other equipment that you will need. It is yellow and is labeled with a sign that says, “MRI Cart.” The cart contains the following:
 - Top of cart: Orange respiratory box, binder with policy/CPG, battery chargers
 - Drawer 1: Cardiac monitor, EKG cable, extra battery packs for portable monitor
 - Drawer 2: Ear protection (mini muffs, ear plugs, hats), neonatal quaterodes for EKG
 - Drawer 3: BP cuffs, IV tubing, MRI safe oxygen probes, self-inflating ambu bag
 - Drawer 4: MRI containment nest options-blue and white.

SECTION 3b: Neonatal PREPARATION FOR MRI at Boston Children’s Hospital (BCH)

- Preparation of the infant including MRI compatible monitoring (Well newborn or NICU patient) is completed at Children’s Hospital Boston by the radiology staff.
- Once order is placed, infant’s nurse will contact BCH radiology at: 1-617-355-6300, for scan time.
- A green billing sheet, found at the Unit Coordinator’s Desk in the NICU, must be filled out by covering physician and will accompany the baby to the scan.

Preparation for Transport to BCH:

- One hour prior to scan time, please try to coordinate a feeding to ensure the infant is satiated and calm for the scan.
- To minimize wait time at BCH, the infant’s nurse should contact the radiology department thirty minutes prior to scan to confirm scheduled appointment.
- Infant will need the Hugs Tag discharged and removed prior to leaving BWH and reapplied upon return.
- Infant’s nurse will prepare for transport to BCH according to infant transport policy specific to the infant’s disposition at BWH (well newborn vs NICU) and acquire the appropriate safety equipment. Infant to be transported in crib/isolette/stroller to BCH via the connector bridge between BCH and BWH. Once over the bridge and at BCH, follow the yellow signs for “Farley/Pavilion” and then Radiology and MRI.

- Allow for a minimum of 15 minutes travel time from CWN to BCH radiology.
- Please remember to bring the green billing sheet upon transport and give this to the reception desk upon checking the infant into radiology.
- Parents may accompany the infant for transfer to BCH but will be asked to wait in the waiting area of the radiology department for the scan.
- The BWH nurse caring for the infant undergoing a scan at BCH must stay with the infant for the entirety of the scan. While at BCH, the infant is cared for by the Children’s staff. They will direct the BWH nurse as to the appropriate place to wait and for procedures regarding MRI safety protocols for their institution.
- BCH staff will prepare the infant for the MRI and will ask the BWH RN to fill out a safety questionnaire for the infant as well as themselves.
- The goal is to do all MRI scans with no sedation. Occasionally, a scan might need to be rescheduled to a different day when excessive movements are interfering with reliable scans. In the rare occasions when an infant requires sedation to complete a scan at BCH, the BWH RN will contact the covering LIP at BWH to inform them of the situation. If an infant requires sedation, a LIP is required to write an order, bring the appropriate Drug Administration Guideline for the medication as well as the medication itself. The LIP is then required to be present for the medication administration and remainder of the scan for their BWH patient. The BWH RN will then document the medication in EPIC along with a procedural note upon return to BWH.
- Once the scan is complete, infant is transported back to the unit, and the hugs tag is reapplied.
- Parents can anticipate the MRI scan should take approximately one hour to complete and final results should be relayed by the ordering physician’s team within 24 hours

SECTION 4: PREPARATION OF THE HIGHER ACUITY INFANT

Please note that preparation for MRI should begin at least 60 minutes prior to the infant’s MRI time. Longer time may be needed depending on each infant’s clinical status.

I. Transition all equipment:

- Obtain a set of vital signs in EPIC

- If the infant has a PIV but does not need any continuous infusion through this line, saline lock the PIV. If you will be infusing fluids or medications, assess your PIV or line closely to make sure it is patent and has no s/s of swelling, redness, and is taped securely prior to transporting the infant to MRI.
- Tubing change is required for all IV lines that will be used during the transport and MRI. This is necessary because the IV pump cannot go in the MRI room so additional longer tubing will be needed to extend out of the room.
 - Coil tubing should be used for MRI (limits the amount of tubing that gets tangled during transport)
 - 30 ft of tubing will be needed
 - The standard tubing in the cart needs to be flushed with 10 mL
 - The tubing should be connected to the medication syringe you acquired from pharmacy
- If the infant has a UAC, continuous infusion of fluids will be maintained, but the **UAC will not be transduced as the transducer is not MRI compatible**. Remove the transducer of your arterial line set up and simply run your fluid to keep the line open. While in MRI you can utilize the MRI compatible BP cuff which can be cycled during the scan for monitoring purposes.
- If the infant has NIRS, aEEG leads, or non-compatible cEEG leads they will need to be removed. The green sponge (part of the cEEG set up) for MRI Compatible leads needs to accompany infant to MRI.
- Confirm workflow process with your Respiratory Therapist if your infant is on any respiratory support. Evaluate whether your ETT needs retaping prior to transporting your infant.
- Place two blankets under the infant. One blanket should be folded as a standard swaddle and is placed on the bed first. This blanket will be for wrapping the infant's body. The second blanket should be folded in half and placed above the first blanket but overlapping slightly. This blanket is for wrapping the head.



- Place the infant on the blankets with approximately 6 inches of the blanket visible above the head.
- Keep the NICU pulse ox probe on the infant while connecting to the MRI pulse ox probe and ECG leads. This allows you to have accurate saturation and heart rate monitoring while transitioning equipment.
- Place the MRI pulse ox probe on one foot. Wrap the probe with pulse ox wrap to maintain good placement.
- Connect the MRI compatible quatrobe chest lead to the transport monitor white cables (4) prior to adhering the lead to the infant. Adhere the quatrobe lead onto the infant's chest.



- Verify that the MRI monitor has a good waveform and appropriate heart rate and oxygen saturation. Also check that the MRI monitor readings are similar to the NICU pulse ox. If the infant is stable and the monitor has a good waveform with adequate readings, remove the NICU pulse ox probe.
- Fold a 4x4 in thirds and place under the top wires of the quatrode to prevent any skin irritation or burns. Repeat for the bottom wires. No wires should be in direct contact w/ the infants' skin during the MRI.



- If blood pressure monitoring is needed, connect the BP hose to the Invivo monitor if it is not already connected. There are two screws located on the bottom of the monitor that the hose connects to.
- Place the appropriate blood pressure cuff on the infant. The arm is the preferred location, but the leg without the pulse ox probe can also be used.
- If end tidal CO2 monitoring is needed, connect this to the ventilator and to the Invivo monitor.
- Place the earplugs over the ear canal but not in it. You may place the earplugs in the minimuffs and then place the minimuffs over the ears as shown below.



Complete a two person check for the following:

- All metal is removed from the infant. This includes clothing with metal buttons and temperature probe hearts.
- No wires are looped, crossed, or touching the infant.
- Ear protection is placed.
- The infant should only have a diaper and MRI approved vital sign devices in contact w/ their skin.

Check these off on the tracking form with second person check initials and document within EPIC under your procedure note for the MRI procedure that a two-person safety check was performed prior to the initiation of the scan.

II. Wrapping the infant

- Wrap the top blanket around the infant's head, over the shoulders and tuck under the arms. Leave all wires outside of the wrap.



- Wrap the second blanket around the body like a standard swaddle, but leave the chest leads and wires out of the wrap and visible. Also keep the leg with the pulse ox probe out of the swaddle for easy access and visualization.



- Place the papoose on the transport bed that will be used (radiant warmer, isolette, crib, or stroller). The bed to be used should be catered to each patient.

- If the papoose is placed on the transport bed, place the infant on the papoose so that approximately 6 inches of the papoose is visible above the head. Place a 4x4 or face cloth over the leads. Do not wrap the papoose – this will be completed in the MRI suite.



- Once the infant is fully prepped and wrapped, transition to the transport isolette and the neopuff if the baby is on a ventilator. This should be done by a Respiratory Therapist.
- Connect the IV pumps to an IV pole. For ease of transition of fluids advanced into the MRI, it is best to bring a separate IV pole and not use the one attached to the isolette.

SECTION 5: TRANSPORT AND MRI PROCEDURES

I. Prior to Transport

- Call the MRI suite just prior to departure from NICU to alert the MRI staff that the infant is en route.
 - Phone for Lee Bell: ext: 58662
 - Phone for L1: ext: 27970

Note:

- Any member of the medical team who accompanies neonates to MRI need to undergo MRI safety training.
- If you have completed MRI safety training, your screening form should be on file in the MRI system. This is relevant for BWH scans only. For infants scanned at BCH, the BWH RN does not have to be MRI safety certified as the infant's care is resumed by the BCH staff while at BCH.

II. Transport of the Infant

- Equipment to Bring
 - Airway box and the patient's own bag and mask or self-inflating mask for transport.
 - Any additional equipment/supplies tailored for each patient
 - i.e.: extra endotracheal tubes, ng/og tubes, milk/formula if able to PO, sweet ease, pacifier, etc
 - MRI Assessment Form
 - Patient's bedside chart can be brought if it contains pertinent information. The RN can also print out the latest attending summary for complete history for transport and for any questions the scanning team may need regarding the patient's course.
- Personnel for Transport
 - For the stable, nonventilated infant
 - 1 nurse can transport the infant
 - For the ventilated/higher acuity infant
 - 1-2 nurses
 - RT if the patient is on respiratory support.
 - Physician

- Prior to departure from the NICU, notify unit coordinators that you are going to MRI- the LOA (leave of absence) process is not required for a scan being performed within BWH, only when the infant is leaving BWH to go to BCH.

III. Arrival to MRI

- On arrival to MRI, stop in the area labeled “MRI Prep Area”
- Provide introductions and define roles for the MRI process and in the event of an emergency.
- In an emergency:
 - **CALL 26555 and ask for a Code Blue Newborn**
- The MRI tech will be responsible for stopping the scan and calling for help.
- The nurse will be responsible for removing the baby from the MRI to the resuscitation area outside of the magnet.
- All staff must remove any items not safe for MRI (metal, pager, stethoscope, etc.). After removing all items, you must be cleared by the MRI tech before proceeding to preparing the infant for entering the MRI scanner.
- After all staff are cleared, proceed with preparing the infant.
- **Monitor:** The MRI tech will ensure that the monitor in the MRI area is turned on and is set on the same channel as the infant’s monitor, with the infants’ vital signs prominently displayed.
- **Suction:** Check that the suction is set at 80-100
- **IV tubing:** The nurse will run the length of the IV tubing and make sure there are no knots and the tubing is not tangled.
- **Ventilator:** If the infant is ventilated, the RT will set up the vent while the nurse is handling the tubing. The vent should be positioned on the right side of the MRI and connected to the wall – oxygen and air sources. Check that the appropriate length of ventilator tubing is connected. The tubing should easily reach the MRI table and be able to extend outside the door of the MRI. Set the ventilator to the infant’s settings if not already done.
- The MRI tech will facilitate the movement of infant into the MRI suite with the NICU team.

- Once the infant is cleared of the safety check, he/she can be wrapped in the papoose.



- **If the infant is ventilated**, the RT will bring the ventilator tubing outside of the MRI room and connect the infant to the ventilator.
- **If the infant is on infusions**, the nurse will remove the medication syringes from the pump. Bring the syringes in the MRI room and feed them through the waveguide (the hole in the wall for IV lines). They will come through the wall so that they are going from inside the MRI room to outside the MRI room. Reconnect them to the pump. The pumps can be maintained on the IV pole.
- After the infant has been cleared by the tech, wrapped in the papoose, is connected to the ventilator (if needed), and the IV lines have all been threaded through the waveguide (if needed) then the infant can be wheeled into the MRI room.
- Move the infant to the MRI table.
- Remove all air from the papoose to prevent the infant from moving his/her head and body during the MRI.

- At the bottom of the papoose is the suction valve. Be sure that this is tightened (turn to right).



- Form the papoose around the infant's head and connect the wall suction to the suction valve.
 - The papoose will form around the infant's head and body and maintain its shape. If it does not maintain shape, check again that the suction valve is tightened.
 - Additional blankets, towels, etc. can be used around the infant's head to ensure there is no movement of the head.
- Place the infant on the table so that the head is in the middle of the coil. If necessary, place foam or towels under the infants' head to make sure the head is in the middle of the coil. Have the MRI tech check placement of the infant and assist with appropriate adjustments.
 - If necessary, consider adding a blanket under the infant for stability and to ensure the infant is laying flat.
 - Place an MRI strap over the infant.
 - The infant is now ready for the MRI scan to begin.

IV. During the MRI

- Record vital signs every 10 minutes via electronic health record.
 - Heart rate and saturations are standard
 - Depending on infant stability, may also record blood pressure, respiratory rate, and end tidal CO₂

V. Return to the NICU or well newborn nursery

- After the MRI scan is complete, the infant will be transitioned from the table back to the transport bed and equipment in a similar way as the transition to the MRI bed.
- Check that you have all NICU supplies prior to leaving the MRI suite (airway box, medications, etc)
- Well newborns will be returned to the mother on CWN 9 or 10 and have a HUGs tag reapplied.
- Upon arrival to the NICU transition the infant back to all NICU equipment.
- Notify the UC that you have returned and complete the LOA algorithm if your scan was at BCH.

SECTION 6: RADIOLOGY PREPARATION FOR INFANTS

FOR NEONATAL EMERGENCIES, CALL 26555 and ask for a CODE BLUE NEWBORN

I. Screening, Scheduling, and Coordination

- Verify the date/time of the MRI with the NICU for all newborn scans as the NICU will be preparing the well newborns from well newborn for their scans as well.
 - NICU Main Desk: 732-5420
 - Ask to speak with patient's nurse.
 - Confirm date/time with patient's nurse. Get contact information for the nurse accompanying the baby in case tech has additional questions or concerns.
- The NICU will be calling just prior to transport of the infant. If the NICU has not called, contact the bedside nurse to ensure that patient will be prepped in time for scheduled slot. Ideally contact nurse directly with contact information he/she has given you. If not available, contact the NICU (732-5420) and ask to speak with the nurse.
- Order form, MRI screening form, operative notes (if any), consent, and staff screening forms received at Lee Bell and reviewed by technologist.

- Check that MR safety screening forms for non-MR safety trained staff (master list on-site) raise no MR safety concerns.
- Patient verified as safe to scan
 - All patient related information has been reviewed
 - Patient is cleared for MR (no implanted devices).
 - Patient has been visually screened by MR technologists (this occurs after patient arrives)
 - All visible leads confirmed MR safe
 - Nurse confirms no metal on patient in areas not visible by technologist and that two-person check has been completed.
 - Ferrous metal screening wand detects no metal (also occurs after patient arrives)

II. Scanner Preparation

- Check that the neonatal code cart is in place just outside the door to the MRI in Lee Bell and NICU equipment tackle box in place on top of the code cart.
- Scan room space cleared and MRI safe stretcher for patient prep/transfer is in the holding area.
- All MRI staff is aware of time NICU patient will arrive.
- Oxygen and air are transitioned to neonatal regulators
- Appropriate coil based on head size (isolette or 12 channel head coil)
- Review the protocol for appropriateness (discussed with neuroradiology fellow/staff as needed)
- Folder containing prescribed sequence located
- Equipment/materials to prepare:
 - 1 blanket and 1 sheet to line brain coil as needed.
 - 1 pillow to keep EKG/BP leads horizontal with table for better signal strength
 - Positioning sponges
 - One table strap for baby
 - warm blankets
- MRI monitor turned on and set to the neonatal setting.
- For Lee Bell MRI: Channel B
- For L1 MRI: Channel C

III. After Patient Arrival

- All NICU personnel present confirmed MR safety trained
 - Nurses have current monitor training
 - Resp Therapists have current Ventilator safety training
 - All NICU personnel have current MR safety approval

- Wand check of patient reveals no unexpected metal
- All leads/wires and connections checked for MR safety
- All equipment checked thoroughly with a test magnet prior to being brought into scan room
- Ventilator: Servo-i
 - Confirm servo-i MR conditional ventilator
 - no added or modified components
 - tethered outside of 200g line (red line) in scan room
 - only used by MR safety trained respiratory therapist
- Monitor: Invivo
 - Confirm MRI Site Invivo MR conditional monitor
 - No added components
- IV pumps positioned outside scan room with tubing routed through wave-guide (no IV pump in scan room)