



Reading Hospital School of Health Sciences

Medical Imaging Program
MI 238: Clinical Seminar III
Mobile Radiography

- Merrill's Volume 3 - Chapter 20



2022

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Mobile Radiography



Mobile x-ray machine being transported through
WWII hospital camp in 1942.

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Portable or Mobile?

Portable units are carried or transported outside the hospital

Mobile units are battery operated units that can be driven

- However -

Most hospitals, including RH, refer to their mobile x-ray machines as "portables"

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Mobile units



Portable units

Handheld Portable Unit



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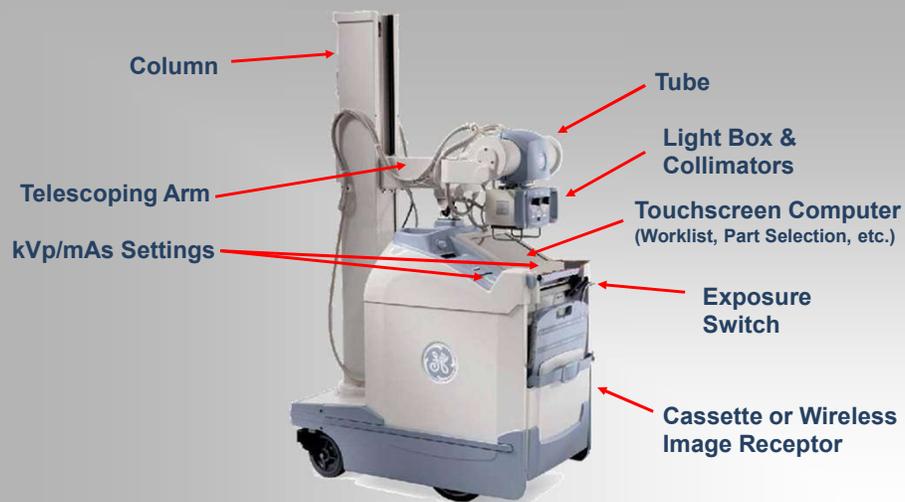
Mobile/Portable Clinical Applications

- MICU (Medical Intensive Care Unit) = critically ill patients
- SICU (Surgical Intensive Care) = Post surgery for long stay patients
- PACU = After anesthesia
- NICU = Neonates with life threatening issues or premature infants
- ED = Emergency Department (Trauma Bay or other ED Imaging)
- Regular Patient Floors
- Morgue
- Operating Room

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Portables



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Portables

“Portable” x-ray machines...

- High Frequency Generator— (Sometimes referred to as a Constant Potential Generator)
- Technical factors utilized in a radiographic room can be applied to mobile imaging.



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Portables



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RH Portable Activation

Log-In Phillips

- Turn key on to activate portable
- User – Technologist UC/U0 #
- Password – U12345

Log-In Shimadzu

- To activate portable turn key on
- Press 1-1-1-1 and then the key symbol closest to the #1
- After portable activation
 - User – Technologist UC/U0 #
 - Password – U12345

SICU Closet – Battery location--Code - 8421



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FYI...

- The Shimadzu/Philips portable has measurements in both centimeters and inches for collimation sizes at various SIDs, however the SID choices are marked in meters only. Please be aware of the following conversion of meters to inches in order to set the correct collimation.

1M = 39.4"

1.5M = 59"

2M = 78.7"



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Digital vs Computed

- Newer portables use **digital technology** to view images on a monitor immediately after the exposure
- Standard portables use **computed radiography** to expose a cassette that must be placed in a CR reader to be processed and viewed



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Portable Techniques

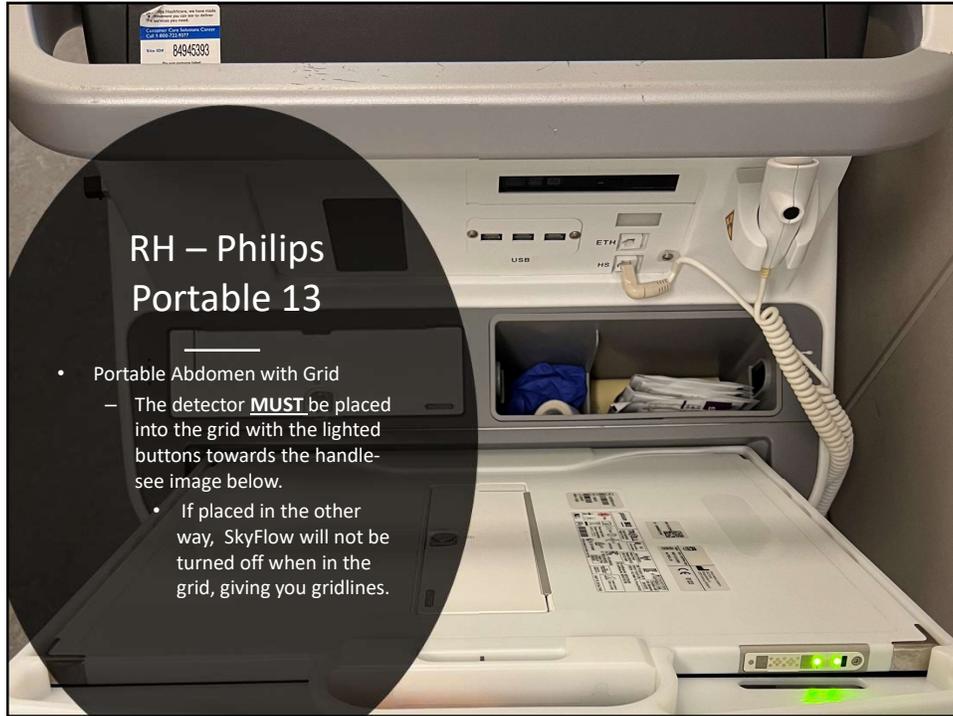
Must maintain proper positioning and central ray alignment as well as the following considerations taken into account:

Considerations:

- Grid
- Beam Restriction
- Anode Heel Affect
 - Place cathode where you want the greatest intensity of the beam
- SID (Source to image receptor distance)
- Artifacts (heating blanket, gel pads)



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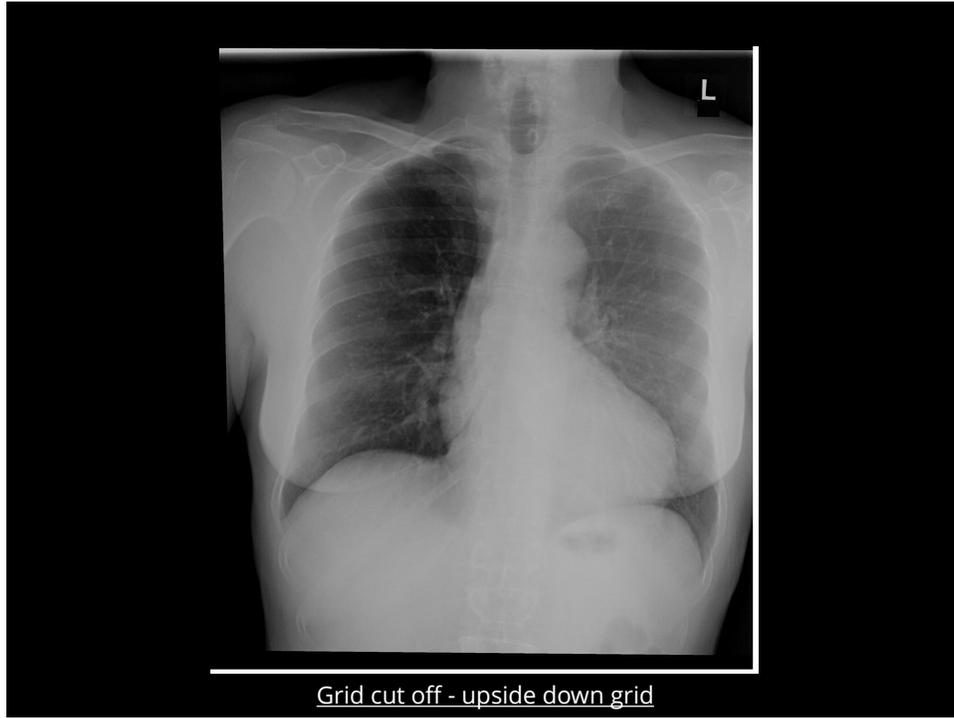


RH Grid Use

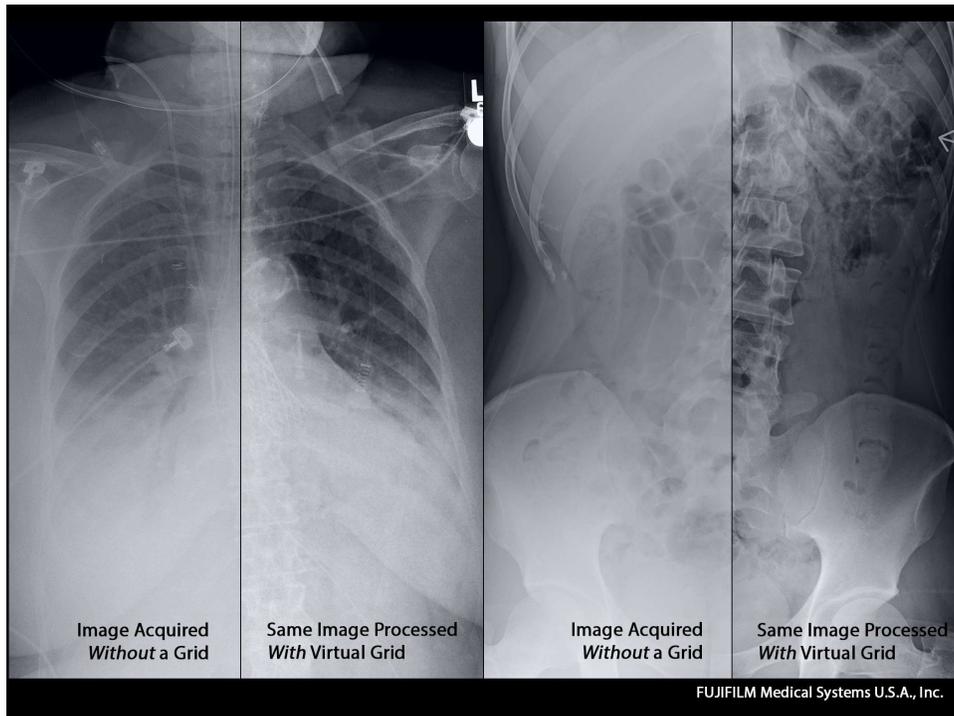
Digital portable

RH: Chest	≥ 30cm <i>Shimadzu portable only</i>
Extremities (*ASRT)	≥ 10cm (minimum kVp 60)
Abdomen <i>(unless pediatric)</i>	Always use grid

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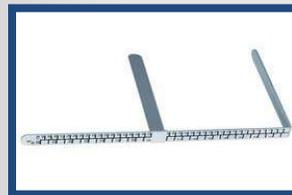


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Portable Techniques

- Technique is set manually or pre-programmed based on the body part and SID
- RH portables have flip book technique chart located in the bin with the detectors
 - Use those calipers ☺
 - Measure correctly
 - adjust kVp accordingly



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Portable Techniques kVp changes...

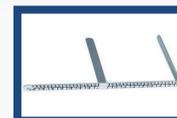
- Change kVp by ___ for every ___ cm in body thickness

****Example:**

Technique Chart: 20cm –60kVp 6 mAs

Patient measures 22cm

- Increased 2cm
- Need to increase kVp by 4
- New Technique: **64 kVp 6 mAs**



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Radiation Safety

****Mobile radiography produces some of the highest occupational radiation exposures for radiographers.**

****TIME—DISTANCE—SHIELDING****

<https://www.youtube.com/watch?v=l111uHQQL-k&feature=youtu.be>

The most effective means of radiation protection is DISTANCE!

Radiation protection **must** be considered for the: (Policy Review)*

- Radiographer
 - Lead apron and stand a recommended minimal distance of 6 feet (2m)
 - If 6 feet is unachievable the radiographer should stand at a right angle to the primary beam.
- Others in the immediate area
- Patient Shielding *(RH patient gonadal shielding is not required)*
 - Shield pediatrics
 - Reproductive age patients
 - When patient request
 - Gonads are near the useful beam
 - When shielding will not interfere



Reminder: Source-to-skin distance (SSD) cannot be less than 12" (30cm) in accordance with federal safety regulations.

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Portable Routine

1. Verify Orders in EPIC (prior to starting the exam)

- Check for isolation precautions
- Could check for pregnancy labs and patient weight, etc.
- Check for verbal report requirements (verbal report be documented in EPIC with the floors extension)
- Check in the procedure



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Portable Routine

2. Gather supplies

- Calipers
- IR covers
- Sponges/cushions
- Lead aprons for all including patient, others, etc.
- Sandbags if needed
- Markers



3. KNOCK on patient door prior to entering

4. Introduce yourself (also Technologist/Faculty)

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Portable Routine

6. Verify patient and look at armband

- Patient name and DOB or MRN
- Verify LMP and denial of pregnancy as necessary
 - If patient is not alert, verify LMP with patient's nurse or through labs--EPIC



7. Explain procedure, including breathing instructions, obtain history

8. Measure patient and immediately set technique

- *Tip: Could also write this on the request in case the technique times out and defaults back to what is set from the manufacturer*



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Portable Routine

9. Place patient in proper position and place cassette/IR
10. Align the tube with the cassette/IR with proper:
 - SID
 - Collimation
 - Remove Artifacts
11. Lead shields for all necessary (radiation badge outside leads)
12. Loudly announce “XRAY” to those in hallway
13. Give breathing instructions if necessary and expose image



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Portable Routine

14. Critique Image (positioning, REX #/EI, is all anatomy included, artifacts, etc.)
15. Annotations and adjust for proper orientation
 - Annotations: Chest X-rays = “Portable AP ERECT” or “Portable AP SUPINE”
 - Other Annotations: “Cross Table”, “PA”, “AP”, “AP SUPINE KUB”, etc.
16. Send image to PACS



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Portable Routine

Put everything back the way it was before you entered the room

- Raise the side rails, cover the patient, lower the bed, put their jewelry back on, let visitors back into the room
- Clean your hands and equipment
- Check with the patient if they need anything prior to you leaving



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Portable Routine

17. Complete document in EPIC (Remember to backtrack begin time, if necessary)

- Document this procedure was done “Portable” along with “AP Erect”, “AP Supine”, “Cross Table Lateral”, etc.
- Document any other special considerations (patient unable to cooperate...)
- Be aware of verbal reports
 - Indicate if procedure was Image Check or Verbal
 - Verbal report of Portable In-patient – enter the extension that should be called (Ordering floors extension)
 - Line/tube placements usually require verbal report documented in EPIC with the extension being the ordering floor



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Portable Maintenance

Portable equipment should be cleaned **every day**

- Use gloves and Fresh Breeze TB

Charge the battery between uses

- Digital portables – charge whenever not in use



******Keep the portables stocked with IR Covers

******Always keep the portable locked when not in use

******Be mindful of HIPAA with access to the computer screen in not leaving it unattended

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Special Considerations

- Isolation precautions
- Varying levels of consciousness
- Limited mobility or painful range of motion
- Spinal precautions on trauma patients
- Tubes, wires, lines and leads



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What to do with...

Isolation Precautions

- Follow precautions as indicated on the patient's door
- Place the IR in a bag for isolation patients and anyone who is wet in bodily fluids



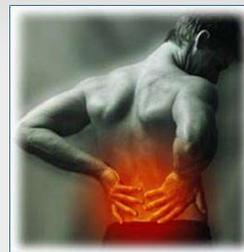
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What to do with...

Unconscious, sedated or confused patients

- Verify patient information using wrist bracelet
- Communicate with your patient throughout the procedure
- Never lift the patient for a CXR or KUB without assistance
- If patient is restrained, obtain RN help



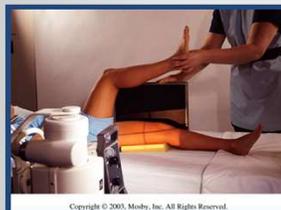
30



What to do with...

Limited mobility or painful range of motion

- Ask MD/RN **before** ever removing any splints or immobilizers
- If fracture present, use two people to hold/lift part and place IR carefully
- Use blankets, pillows or x-ray sponges to support the limb and/or IR (beware: artifacts)



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What to do with...

Spinal precautions on trauma patients

- **Never** move a collared patient without a nurse or physician present to hold the patient's head



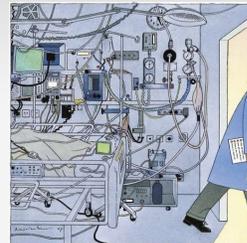
32



What to do with...

Tubes, wires, lines and leads other devices

- Pull all lines away from the area of interest but do not disconnect or remove any--Exceptions noted below
- Make notes in EPIC if there are IVs, name bracelets or other artifacts that you cannot remove or move away enough
- MRI Screening exceptions*
- Stone Protocol exceptions*



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During a code...

NEVER leave the **digital** IR under the patient during cardiac arrest

- The charge of the defibrillator will cause malfunctions in the IR and possibly redirect the charge from the patient



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Portable Procedures

Line Placements

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Central Line Placement

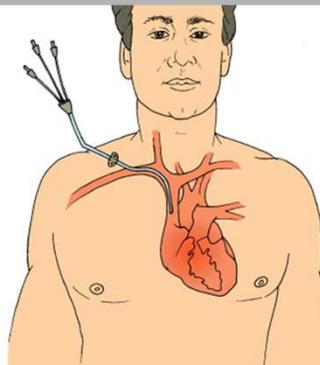


Figure 46-10 Placement of triple-lumen nontunneled percutaneous central venous catheter.

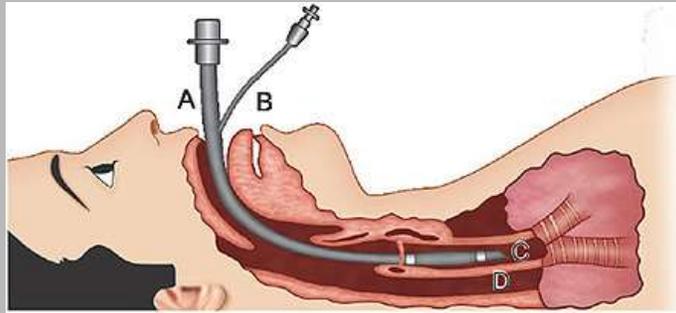
Copyright © 2005 Lippincott Williams & Wilkins. Instructor's Resource CD-ROM to Accompany *Fundamentals of Nursing: The Art and Science of Nursing Care*, Fifth Edition.

Portable Chest X-ray Performed to confirm placement

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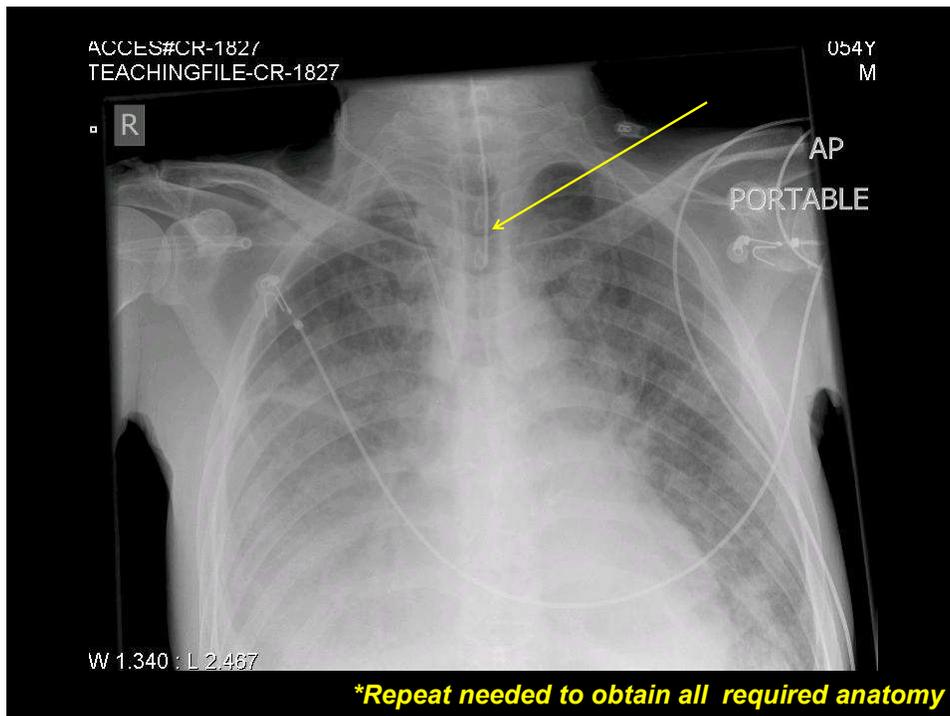


ET Tube Placement

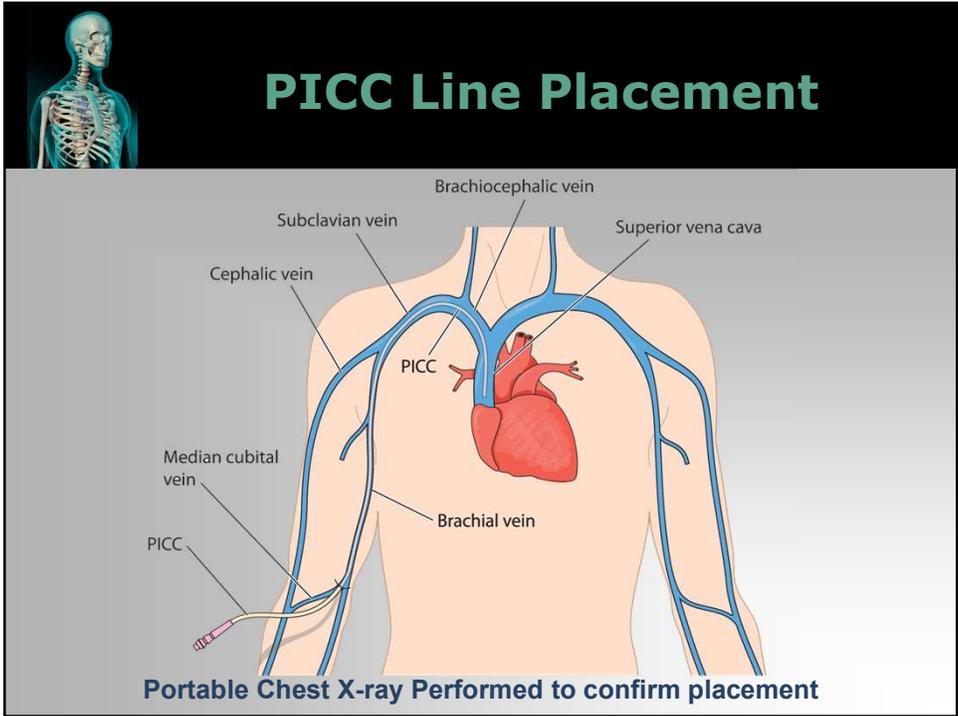


Portable Chest X-ray Performed to confirm placement

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PICC Line Xray

RHS-

- Patients are RPO 15°
- Mark side down (Right)
- Must include shoulder of insertion site and at least all of the mediastinum
- SID 45"

***Angle of the RPO allows visualization of tip of PICC line away from spine*

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NG Tube Placement

“KEOFEED”

NASAL CAVITY — NASOGASTRIC TUBE
TRACHEA
ESOPHAGUS
STOMACH

NASOGASTRIC TUBE

PORTABLE
SUPINE
Ⓛ

Portable Chest X-ray or Portable Abdomen Performed to confirm placement

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Chest Tube Placement

Thoracostomy (intrapleural) tubes

Pneumothorax

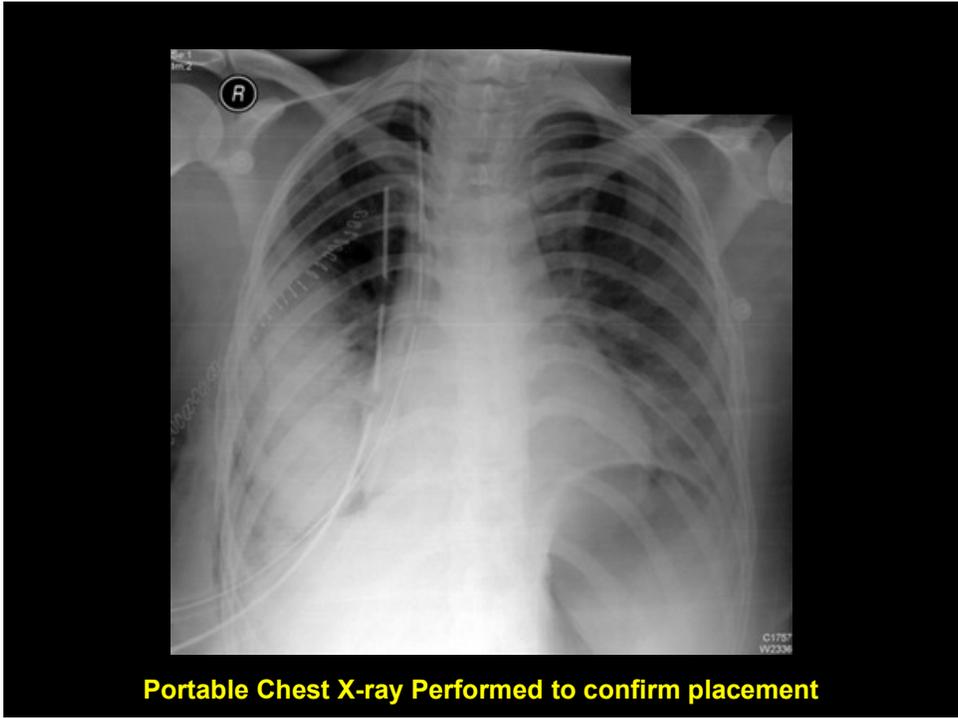
Chest tube

Re-expanded lung

adam.com

Portable Chest X-ray Performed to confirm placement

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Portable Procedures

Portable Extremities



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Portable Extremities

- Positioning: Follow regular protocol –*Image as ordered**
 - May have to make modifications to central ray and image receptor to match what the patient position presents or limitations the patient may have
- Views taken depend on what physician orders. Most charges reflect 2 views (AP/PA and Lateral would be views of choice)
 - Some portable orders could indicate 3 views or more
 - Example: Wrist –if this would be ordered 3 views or more then the normal protocol would be followed if it would be trauma or non-trauma.
- Must annotate that the image was obtained portably and also indicate portable in EPIC documentation

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Portable Extremities



Very often must move tube, IR versus the body part.

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Neonatal Intensive Care Unit (RH R2)

- **Neonate = Newborn**
- **Premature = Born before 37 weeks gestation**



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NICU Patients

- Indications for Imaging— Including but not limited to:
 - Prematurity
 - Line and/or tube placements
 - Respiratory distress
 - Congenital heart disease
 - Lung lesions
 - Abdominal pathologies
 - Birth related injuries – fractures



<https://radiopaedia.org>
<https://www.pedrad.org>

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RH

NICU Mobile Imaging

- All hospital staff must scrub their hands for **30 seconds** before caring for a NICU patient
 - *New touchless timers located at NICU sink to ensure proper hand hygiene.
- All staff must then use the hand sanitizer in between multiple patients



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NICU Mobile Imaging— Precautions/Preparation

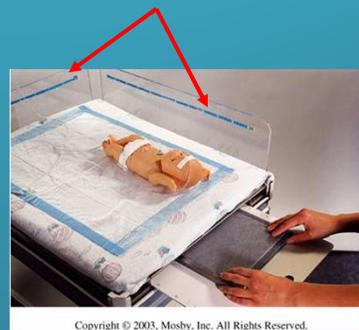
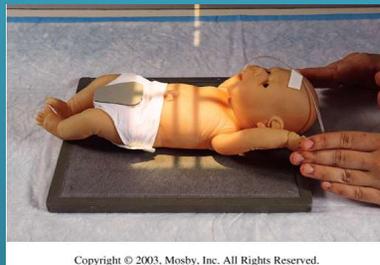
- **Equipment** – Shimadzu #8 and #10 utilized to obtain images.
 - Must be wiped down (Purple Sani Wipes—2-minute wet time) upon entering NICU
- **Digital Detector** – 11 x 12 housed in NICU (does not leave area)
 - Cleaned before and after each use (Purple Sani Wipes—2-minute wet time)
- **Lead Markers** – Disposable markers kept in NICU
- **Additional Note:**
 - **Lead Shielding** – *If requested*
 - Patient shields housed in NICU; Cleaned before and after each use (Purple Sani Wipes—2-minute wet time)
 - Shields to be covered with linen from baby's bed only



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NICU Mobile Imaging – IR Placement

- Will be dependent on type of bed/isolette
 - IR placed in tray or directly under the patient
 - Some beds have side measurements to aide in centering the IR in the tray below



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NICU Mobile Imaging – Beds/Isolettes

Isolette

- Imaging is possible through the plastic
- RN may lift the lid and tube would go under the lid (However--Short SID)



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NICU Mobile Imaging – Beds/Isolettes

Open-Bed Warmer

- Arm of heater may be moved for imaging
 - Important to remember to place arm of heater back over baby immediately when finished exposure



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NICU Mobile Imaging Routine

****Follow all proper preparation/precautions with hand hygiene and equipment cleaning prior to imaging****

- 1. Verify Orders in EPIC** (prior to starting the exam)
 - Check for isolation precautions
 - Check for patient weight (kg./lb.)
 - Check for verbal report requirements (verbal report identified and documented in EPIC with the floors extension)
 - Check in the procedure
- 2. Handwashing**
- 3. Gather supplies** 11 x 12 digital detector (no grid)
 - Lead aprons for all including self, others, etc. (NICU has their own lead for nurse)
 - Disposable Markers



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NICU Mobile Imaging Routine

- 4. Verify patient's ID and weight with RN and verify the patient's ID with the crib card**
- 5. Introduce yourself (also Technologist/Faculty) if parent or family is present**
 - Explain procedure to family if present
- 6. Set technique**
- 7. Radiation protection -NICU has their own lead for the nurse to wear**
- 8. Place IR** (Wrap the IR in the infant's own sheets (located under each bed) if IR placed directly under infant)



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NICU Mobile Imaging Routine

9. Align the tube with the IR with proper:

- SID
- Collimation
- Ask RN to position and guide in the positioning
- Remove Artifacts – ask RN to remove artifacts
- Marker placed

10. Loudly announce “XRAY”

11. Watch breathing and expose image

12. Critique Image (positioning, REX #/EI, artifacts, etc.)

13. Annotations and adjust for proper orientation

- Annotations: Chest X-rays = “Portable AP SUPINE”
- Other Annotations: “Cross Table”, “PA”, “AP”, “AP SUPINE”, etc.

14. Send image to PACS



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NICU Mobile Imaging Routine

15. Complete document in EPIC (Remember to backtrack begin time, if necessary)

- Document this procedure was done “Portable” along with “AP Supine”, “Cross Table Lateral”, etc.
- Document any other special considerations
- Be aware of verbal reports
 - Indicate if procedure was Image Check or Verbal
 - Verbal report of Portable In-patient – enter the extension to call to be the ordering floor
 - Line/tube placements usually require verbal report documented in EPIC with the extension being the ordering floor



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Mobile Imaging NICU Procedures



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Portable NICU Chest

- IR 11 x 12, Portrait
- AP supine, nurse holds for exposure
 - Do NOT attempt to move wires or tubes out of the light field--ask the RN to do so
 - Make sure RN is holding without rotation – tell RN
 - Make sure marker is truly in light
 - Shield placement
- CR at nipple line
- Tight collimation
- 40" SID
- Ensure all surrounding are shielded
- Loudly announce "x-ray"
- Watch breathing for inspiration



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Portable NICU “Babygram”

- IR 11 x 12, Portrait
- AP supine, nurse holds for exposure
 - Do NOT attempt to move wires or tubes out of the light field--ask the RN to do so
 - Make sure RN is holding without rotation – tell RN
 - Make sure marker is truly in light
 - No Shielding
- CR at region of diaphragm
- Tight collimation (Light to include just above shoulders and the symphysis pubis)
- 40” SID
- Ensure all surrounding are shielded
- Loudly announce “x-ray”
- Watch breathing for inspiration



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****RH PROTOCOL:**

**NEVER REPEAT A NICU EXAM WITHOUT
AUTHORIZATION FROM THE ORDERING
PHYSICIAN!!**



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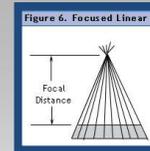


Grid Rules

Reminder

✘ The grid must be perpendicular to the primary beam in order to prevent

- ✘ Grid cutoff
- ✘ Elongation/Distortion



✘ The technique must be increased when using a grid

- ✘ 8:1 grid – free detector grid x 4 mAs (going from no grid to grid)
 - ✘ Phillips Portable
- ✘ 6:1 grid – CR grid x 3 mAs (going from no grid to grid)