Medtronic ACT Plus®

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April 2024

MUNSON HEALTHCARE

Goal and Objectives

Goal

This course, in conjunction with direct observation of the Medtronic ACT Plus® procedure, will complete the annual competency requirement.

Objectives

1. List steps required in the completion of the Medtronic ACT Plus® procedure.
2. State procedure to follow if the heparinized-samples match is not within 12%.
3. Obtain 80% or better on the Medtronic ACT Plus® exam.

Overview

The activated clotting time (ACT) test measures the clotting time of fresh whole blood.

Hattersley's original procedure used diatomaceous earth as the activating reagent. Medtronic Activated Clotting Time cartridges use kaolin suspended in buffer as an activating reagent.

The end point of the test is the detection of a clot formation.

The Medtronic ACT Plus® automated coagulation timer detects clot formation by measuring the rate of the fall of the plunger contained in each cartridge channel.

- The plunger assembly falls rapidly through an unclotted sample.
- A fibrin web formed during clotting impedes the rate of the plunger assembly descent.

Overview *(cont.)*

Clot formation is detected by a photo optical sensor located in the actuator assembly of the instrument.

The ACT Plus instrument performs simultaneous duplicate tests using a two-channel cartridge. The clotting times for each channel and the average are displayed in seconds following completion of the test.

The HR-ACT cartridge is intended for monitoring heparin levels >1.0 u/mL, using freshly-drawn whole blood.

Clinical Significance

Activated clotting time (ACT) and its variations have been widely used to monitor the anticoagulant effect of heparin.

Reagent Cartridges

High Range Activated Clotting Time Cartridge (HR-ACT)

Storage and Stability

- Room temperature (2 - 25°C) until the expiration date on the cartridge tray label.
- Cartridges should be stored in the original tray to reference the expiration date.
- Cartridges should be disposed of when the expiration date is unknown.

Contents

- 12% kaolin
- 0.05M $CaCl_2$
- HEPES buffer
- Sodium azide

Reagent Cartridges *(cont.)*

Regent Preparation

- Pre-warm the cartridge for at least 3 -5 minutes prior to adding sample.
- Tap the cartridge to re-suspend the kaolin prior to adding sample.
  - Kaolin is the white mixture in the bottom of the cartridge.

Entering Cartridge Information

1. From the Main Menu, select 'Cartridge Lot'.
2. Select the desired cartridge type (HR-ACT) by using the arrows on either side of the box to navigate through the list.
3. Press 'Add New Lot Number' and type it in.
4. Press 'Enter'.
5. Press 'Add Expiration Date' and type it in for the selected lot number.
6. Press 'Enter'.


Kaolin mixture

Reagent Cartridges *(cont.)*

Entering Second Cartridge Information

1. Go to Main Menu and select 'Cartridge Lot'.
2. Press 'Add Lot/Expiration Date'.
3. Enter the second lot number and expiration date.

Change the Lot Number of the Cartridge in Use

1. From the Main Menu select 'Cartridge Lot'.
2. Use the up/down arrows to select the cartridge type.
3. Press 'Toggle Activate' to move the * to the desired cartridge lot number.

Note: You should be checking the cartridge lot number and updating the information on the instrument.
If the cartridge lot number on the instrument is expired, it will not let you continue testing until the new lot number is updated.

Daily Electronic Quality Control

ACTtrac Electronic Quality Control (EQC)

There are **3 levels** of the EQC total. You must at least run 2 levels daily, one normal and one abnormal.

- Daily: NORMAL setting (98-102)
- Daily: One ABNORMAL setting (190-204) or (490-510)
- **Record on the EQC sheet (if any of the EQC does not pass, the instrument needs to be pulled and the POC Coordinator contacted).**

Daily EQC

Performing EQC

1. From the Main Menu, set the cartridge type to ACTtrac.
2. Press the 'Quality Control' key.
3. From the 'Quality Control Menu', select the 'Control Type' that corresponds with the time setting on the ACTtrac.
4. Set the timer selector on the ACTtrac to the same time.
5. Place the ACTtrac into the actuator heat block and close the actuator to initiate the test.
6. Monitor the status indicator. During the test, the status indicator will flicker to show the test is running.
7. At the completion of the test, the ACT Plus® sounds an audible tone, displays the results, and displays a Pass/Fail message.
8. Change the test time setting on the ACTtrac and the 'Control Type' in the ACT Plus® to run the second time setting.

Weekly Liquid Quality Control (LQC)

There are **two levels** of LQC that must be performed on a weekly basis. They must be within acceptable range on the QC package insert and documented properly on the weekly QC log.

Liquid CLOTtrac HR Normal Control (Red)

- Store refrigerated (2 – 10^{0}C) until used.
- Stable until the manufacturer's expiration date printed on the box and vials.
- Stable for 2 hours at room temperature after reconstitution.

Liquid CLOTtrac HR Abnormal Control (White)

- Store refrigerated (2 – 10^{0}C) until used.
- Stable until the manufacturer's expiration date printed on the box and vials.
- Stable for 1 hour at room temperature after reconstitution.

Weekly LQC

Preparation of liquid controls:

- Bring controls and diluent to room temperature (~10 minutes).
- Reconstitute each lyophilized control with 1.8 mLs of the corresponding diluent.
- Let it sit for at least 10 minutes for adequate rehydration.
  - ***DO NOT** agitate or mix until completely rehydrated!*
- Shake the control vigorously to mix.
  - Red blood cells should be uniformly dispersed.

Weekly LQC *(cont.)*

Entering control lot information

1. From the Quality Control Menu, select 'Control Lot'.
2. Select the desired control using the arrows on either side of the box to navigate through the list.
3. Press 'Add Lot Number' and type it in.
4. Press 'Enter'.
5. Press 'Add Expiration Date' and type it in for the selected lot number.
6. Press 'Enter'.
7. Press 'Select Range' and type in the control range.
8. Press 'Enter'.

Entering a second lot of control information

1. Go to the Quality Control Menu and select 'Control Lot'.
2. Press 'Add Lot/Expiration Date'.
3. Enter the second lot number, the expiration date, and the range.

Weekly LQC *(cont.)*

Running Liquid CLOTtrac Normal and Abnormal Controls

1. Pre-warm the cartridge 3 – 5 minutes before testing.
2. On the Main Menu, select/confirm the appropriate cartridge type (HR-ACT).
3. Press 'Enter' to confirm the change.
4. Press the 'Quality Control' key.
5. On the 'Quality Control Menu', select 'Control Type'; press until the correct control is displayed.
6. Press 'Enter' to confirm. The current control lot number displays.

Weekly LQC *(cont.)*

7. Tap the cartridge to re-suspend the kaolin reagent.
8. Fill each chamber with 400µL of reconstituted and mixed control.
9. Insert the cartridge into the ACT Plus® instrument and close the actuator heat block to start the test. Clot formation is signaled by an audible tone, the actuator heat block opens, and the results are displayed.
10. Record the result and any other required information on the quality control log.

Repeat the process for the second level of QC.

Note: If any quality control is out of acceptable range, you must pull the instrument and contact the POC Coordinator.

Maintenance

- Clean the outside of the instrument after use with each patient.
- Clean the actuator assembly once a week or more frequently, if needed, using swabs and Liqui-Nox.
- Check the actuator heat block temperature once a month, using the temperature verification cartridge or the temperature located on the screen.
- **Record all maintenance on the maintenance log.**

Patient Testing

- The sample must be tested as quickly as possible.
- Baseline samples must be tested within 60 seconds after collection.
- Heparinized-samples must be tested within two minutes after collection.
- Sample collection is very important for accurate results.
- If collected using venipuncture, the first few milliliters of the sample should be discarded to avoid contamination with tissue thromboplastin.
- When blood is taken from any indwelling line, the line should be flushed thoroughly first.

Patient Testing *(cont.)*

1. Identify the patient with at least two unique identifiers.
2. The cartridge must be pre-warmed in the heat block for at least 3-5 minutes before testing.
3. Tap the cartridge to re-suspend the kaolin.
4. Collect the sample.
5. Fill each chamber of the cartridge with approximately 400µL of fresh blood. There are indicator lines on the cartridge. Try to avoid getting blood on the flags.
6. Insert into the analyzer and close the actuator heat block, making sure both flags are facing inward.
7. The analyzer will give an audible tone when it is done testing. The actuator heat block will open.
8. Dispose of the used cartridge in biohazard waste.
9. Results from both channels must be within 12% or the test will fail.
10. Record the results in the patient's chart.

Results and Troubleshooting

- Results can be between 0 - 600 seconds.
- Results <50 should be repeated.
- Results >600 should be reported as >600.
- Results for baseline samples should match within 10%.
- Results for heparinized samples should match within 12%.
- When results don't match, a new specimen should be tested.
- Remember, there are many drugs and other factors that can affect ACT testing. If in doubt, recollect and retest.

References

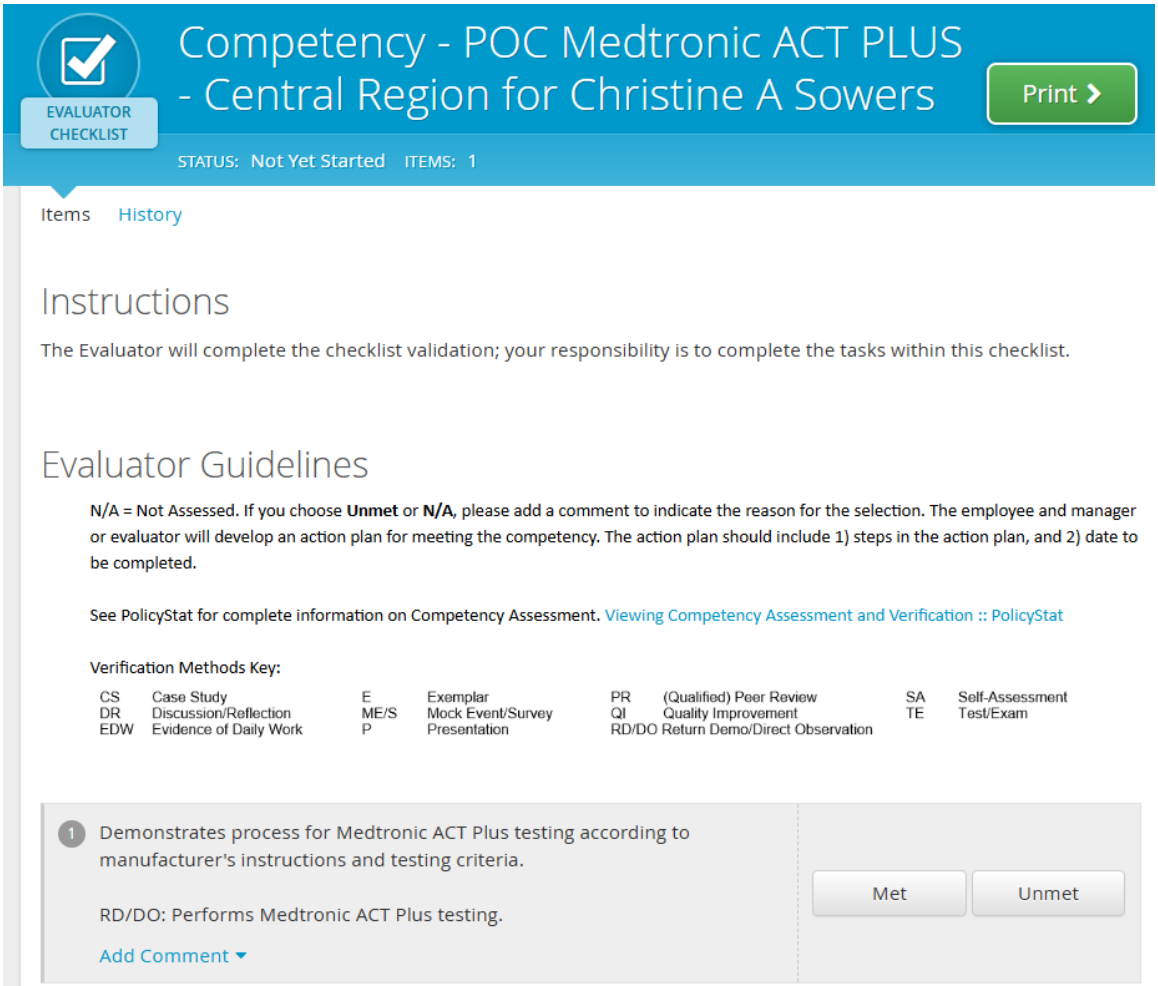
ACT Plus System Reference Manual, Medtronic, Inc.,710 Medtronic Parkway Minneapolis, MN 55428.

Medtronic Activated Clotting Time Cartridges Instructions for Use.

Medtronic ACTtrac Operator's Manua.l

Medtronic CLOTtrac Normal and Abnormal Controls Instructions for Use.

Medtronic Temperature Verification Cartridge Instructions for Use.


EVALUATOR CHECKLIST
Competency - POC Medtronic ACT PLUS - Central Region for Christine A Sowers
Print
STATUS: Not Yet Started ITEMS: 1
Items History
Instructions
The Evaluator will complete the checklist validation; your responsibility is to complete the tasks within this checklist.
Evaluator Guidelines
N/A = Not Assessed. If you choose Unmet or N/A, please add a comment to indicate the reason for the selection. The employee and manager or evaluator will develop an action plan for meeting the competency. The action plan should include 1) steps in the action plan, and 2) date to be completed.
See PolicyStat for complete information on Competency Assessment. Viewing Competency Assessment and Verification :: PolicyStat
Verification Methods Key:
CS Case Study
DR Discussion/Reflection
EDW Evidence of Daily Work
E Exemplar
ME/S Mock Event/Survey
P Presentation
PR (Qualified) Peer Review
QI Quality Improvement
RD/DO Return Demo/Direct Observation
SA Self-Assessment
TE Test/Exam
1 Demonstrates process for Medtronic ACT Plus testing according to manufacturer's instructions and testing criteria.
RD/DO: Performs Medtronic ACT Plus testing.
Add Comment
Met
Unmet

MUNSON HEALTHCARE

Overview of Procedural Sedation

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October 2023

Goal and Objective

Goal

This course will ensure standardized practice for delivering sedation/analgesia during diagnostic and therapeutic procedures performed outside of the operating room, according to MHC policy. The ultimate outcome is to provide for the safety of our patients during sedation.

Objective

After completing this course, the participant will be able to identify the four levels of sedation.

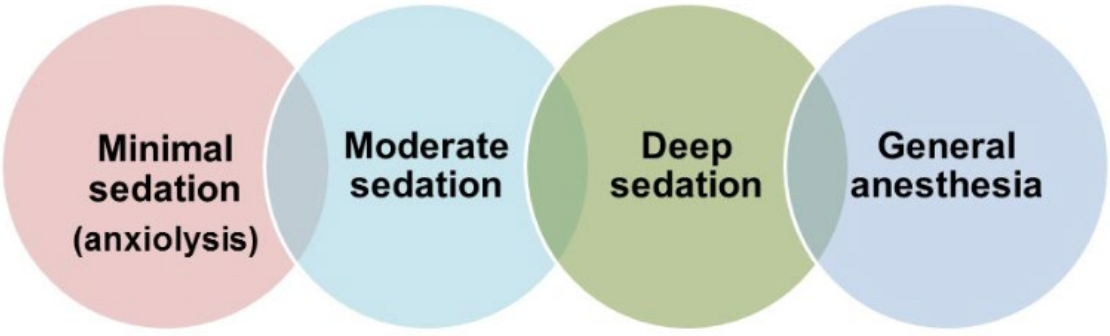
Exclusion List: Non-Procedural Sedation

The sedation policy and this education module **do not apply** when analgesics or sedative agents are given for the following:

- Pain management (analgesics given by **any** route).
- Minimal sedation (anxiolysis).
- Sedation during emergent medical care in an unstable patient.
- Sedation during ongoing ventilation therapy.
- Sedation for end of life/palliative care.
- Treatment of medical conditions such as delirium, alcohol withdrawal, traumatic brain injury, etc.

Four Levels of Sedation

In order to provide safe and effective care for patients receiving sedation, it is imperative that health care providers understand the four levels of sedation:



Minimal Sedation

This is a continuum. To understand, we will begin with minimal sedation, also known as anxiolysis.

Description	*Minimal Sedation*	*Moderate Sedation/Analgesia*	*Deep Sedation/Analgesia*	*General Anesthesia*
Responsiveness	Normal response to verbal stimulation	Purposeful response to verbal or tactile stimulation	Purposeful response following repeated or painful stimulation	Unarousable even with painful stimulus
Airway	Unaffected	No intervention required	Intervention may be required	Intervention often required
Spontaneous Ventilation	Unaffected	Adequate	Maybe inadequate	Frequently inadequate
Cardiovascular Function	Unaffected	Usually maintained	Usually maintained	May be impaired

Minimal Sedation (Anxiolysis)

Key Points – Minimal Sedation

- Anxiolysis is medication therapy given to reduce anxiety and to help patients relax, e.g., diazepam (Valium) PO or midazolam (Versed) IVP prior to a procedure.
- The patient continues to respond normally to verbal commands.
- This level of sedation has no effect on airway, breathing, or the cardiovascular system.
- Cognitive function and physical coordination may be impaired.

Moderate Sedation/Analgesia

Description	Minimal Sedation	Moderate Sedation/Analgesia	Deep Sedation/Analgesia	General Anesthesia
Responsiveness	Normal response to verbal stimulation	Purposeful response to verbal or tactile stimulation	Purposeful response following repeated or painful stimulation	No response even with painful stimulus
Airway	Unaffected	No intervention required	Intervention may be required	Intervention often required
Spontaneous Ventilation	Unaffected	Adequate	Maybe inadequate	Frequently inadequate
Cardiovascular Function	Unaffected	Usually maintained	Usually maintained	May be impaired

Moderate Sedation

During moderate sedation, the patient experiences a depressed level of consciousness during which they retain their ability to maintain a continuously patent airway. The patient will respond appropriately to physical stimulation and verbal commands, yet maintain partial amnesia.

The patient receives relief from anxiety and pain, allowing them to tolerate unpleasant procedures.

Moderate sedation/analgesia also expedites the course of procedures that are uncomfortable and require the patient to not move:

- Central line placements
- Scope procedures (endoscopy, bronchoscopy)
- Chest tube placement
- Painful wound debridements

Moderate Sedation *(cont.)*

Key Points – Moderate Sedation

- The patient is able to respond to verbal commands.
- No interventions are needed to protect the airway or maintain heart rate and blood pressure, but close monitoring is essential.
- Cardiac monitoring is required for a patient with cardiovascular disease or dysrhythmia.
- Consents need to be signed before sedation is administered.

Clinical Characteristics of Moderate Sedation

Clinical characteristics of moderate sedation include:

- Maintenance of protective reflexes, i.e., gag reflex, ability to swallow, and ability to breathe without assistance.
- Independent and continuous maintenance of a patent airway.
- Purposeful response to physical stimulation and/or verbal commands.
- Easily aroused, with the provider talking in a normal tone of voice.
- Minimally depressed level of consciousness.
- Slightly slurred speech.

Example:

In a normal tone of voice, the nurse asks the patient to take a deep breath and open their eyes. The patient should be able to follow this type of command at this level of sedation.

Clinical Characteristics of Moderate Sedation *(cont.)*

Key Points – Moderate Sedation

- Important: A reflex withdrawal from a painful stimulus is not considered a purposeful response and is a sign the patient is progressing to general anesthesia.
- All practitioners involved with moderate sedation must be prepared to "rescue" the patient from a deeper level of sedation than was intended.

Knowledge Check

During a procedure requiring moderate sedation, who is required to know how to rescue a patient from a deeper level of sedation than intended?
(Choose all that apply.)

- [x] The registered cardiovascular invasive specialists (RCIS) assisting with the procedure
- [x] The registered nurse (RN) assisting with the procedure
- [x] The provider performing the procedure

Deep Sedation/Analgesia

Description	Minimal Sedation	Moderate Sedation/Analgesia	Deep Sedation/Analgesia	General Anesthesia
Responsiveness	Normal response to verbal stimulation	Purposeful response to verbal or tactile stimulation	Purposeful response following repeated or painful stimulation	Unarousable even with painful stimulus
Airway	Unaffected	No intervention required	Intervention may be required	Intervention often required
Spontaneous Ventilation	Unaffected	Adequate	Maybe inadequate	Frequently inadequate
Cardiovascular Function	Unaffected	Usually maintained	Usually maintained	May be impaired

Deep Sedation

Deep sedation is used for procedures such as cardioversions, closed reductions of joint dislocations, or fractures. Patients who are deeply sedated cannot be easily aroused, but they do respond purposefully to repeated or painful stimulation, such as a vigorous sternal rub.

Deep Sedation *(cont.)*

Key Point: A reflex withdrawal from a painful stimulus is **not** considered a purposeful response and is a sign the patient is progressing to general anesthesia.

The patient's respiratory status may be affected and spontaneous respirations may be inadequate.

- Assistance may be needed to maintain a patent airway.
- Ventilation assistance may be required.

Progression from Moderate to Deep Sedation

Clinical indications: Progression from moderate to deep sedation/anesthesia:

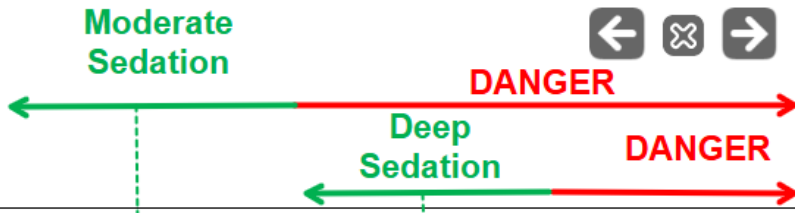
- Not easily aroused
- Partial or complete loss of protective reflexes
- Difficulty maintaining a patent airway independently
- Unable to respond to physical stimulation or verbal commands
- Severely slurred speech

Key Point:
ALL practitioners involved with deep sedation MUST be prepared to "rescue" the patient from deep sedation or general anesthesia.

Progression from Moderate to Deep Sedation *(cont.)*

Clinical indications: Identifying a patient is in deep sedation:

- Similar to general anesthesia, the patient may be unable to maintain a patent airway.
- Loss of protective reflexes (unable to swallow, no cough, no gag reflex).
- The patient purposefully responds to repeated painful stimulation, such as a vigorous sternal rub.



	Minimal Sedation Anxiolysis	*Moderate Sedation/ Analgesia ("Conscious Sedation")*	*Deep Sedation/ Analgesia*	*General Anesthesia*
Responsiveness	Normal response to verbal stimulation	Purposeful** response to verbal or tactile stimulation	Purposeful** response following repeated or painful stimulation	Unarousable even with painful stimulus
Airway	Unaffected	No intervention required	Intervention may be required	Intervention often required
Spontaneous Ventilation	Unaffected	Adequate	May be inadequate	Frequently inadequate
Cardiovascular Function	Unaffected	Usually maintained	Usually maintained	May be impaired

Knowledge Check

Characteristics of anxiolysis include: (Choose all that apply.)

- [ ] Reflex withdrawal from a painful physical stimulus
- [x] Ability to respond normally to verbal commands
- [ ] Diminished respiratory rate or blood pressure
- [x] Ability to maintain a patent airway
- [x] Administering midazolam (Versed) to a stressed patient prior to a procedure

Knowledge Check *(cont.)*

Drag the type of sedation to the light blue box beside its description.

Type of Sedation	Description
Deep Sedation	The patient is unresponsive to verbal commands, but does purposefully resond to a sternal rub. Assistance may be needed to maintain a patent airway and adequate ventilation.
Minimal Sedation (Anxiolysis)	The patient continues to respond normally to verbal commands. This level of sedation has no effect on airway, breathing, or the cardiovascular system.
Moderate Sedation	The patient is able to open their eyes and raise their hand when asked.

References

American Society of Anesthesiologists. *Position on monitored anesthesia care*. Last amended on October 23, 2019.

Munson Healthcare Policies and Procedures. (2022, December 16). *Sedation*. PolicyStat.

MUNSON HEALTHCARE

Procedural Sedation: Roles and Responsibilities

Amy Krug, BSN, RN, CGRN
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October 2023

Goal and Objectives

Goal

This course will ensure standardized practice for delivering sedation/analgesia during diagnostic and therapeutic procedures performed outside of the operating room, according to MHC policy. The ultimate outcome is to provide for the safety of our patients during sedation.

Objectives

1. Identify who is qualified to order, administer, and monitor patients receiving moderate and deep sedation.
2. Describe the expected nursing care during procedural sedation.

Responsibilities

At MHC, Registered Nurses (RNs) and Registered Cardiovascular Invasive Specialists (RCIS) who will be monitoring sedated patients during procedures and administering moderate sedation are responsible for the following:

- Knowing the Sedation policy.
- Maintaining competence in sedation medication administration.
- Identifying when a patient has progressed to a deeper level of sedation than intended and intervening as needed.

NOTE: RNs and RCIS do not administer deep sedation for procedures.

Education Requirements

The education requirements for RNs and RCISs include:

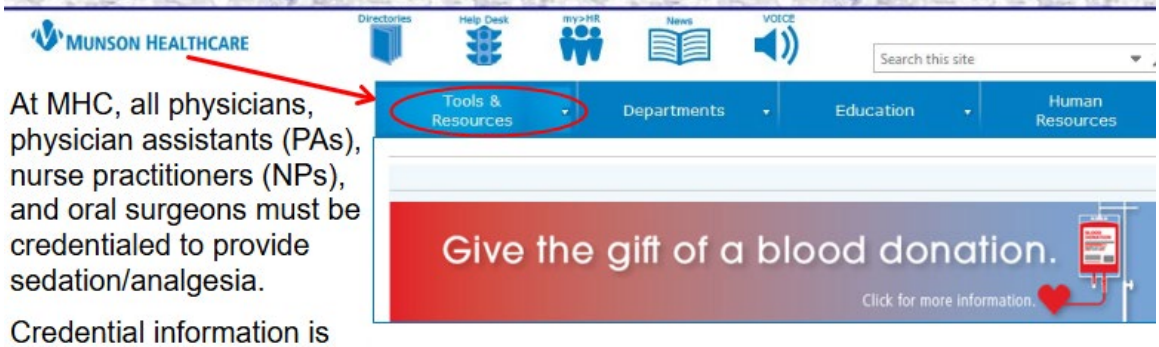
Upon hire:

- Current BLS certification.
- Completion of the online HealthStream assignment.
- Completion of the airway station during RN orientation.
- Completion of the cardiac rhythm competency, the Basic ECG interpretation exam, or current ACLS certification.

Periodically thereafter:

Completion of periodic sedation education and demonstration of competence.

Provider Credential Check

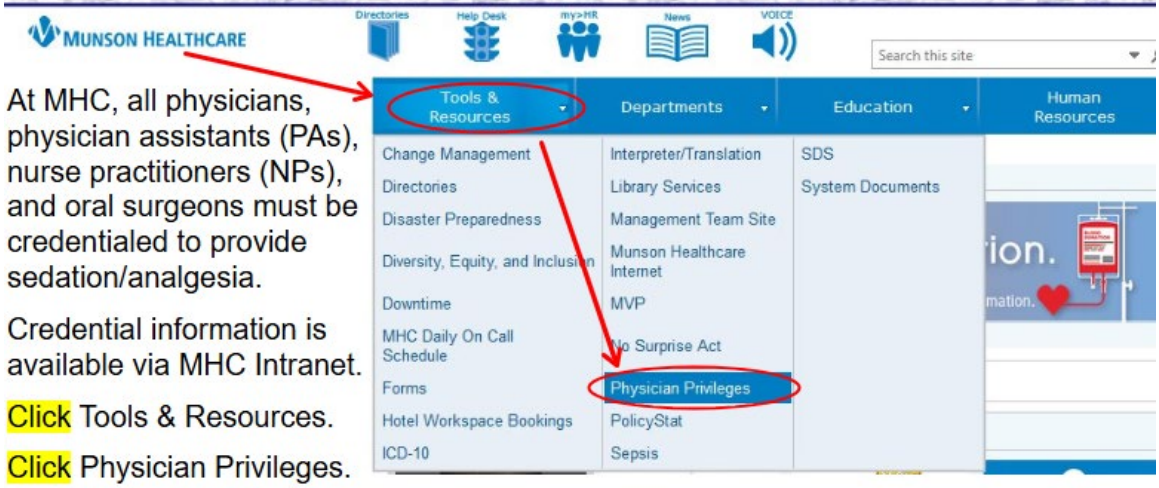


At MHC, all physicians, physician assistants (PAs), nurse practitioners (NPs), and oral surgeons must be credentialed to provide sedation/analgesia.

Credential information is available via MHC Intranet.

Click Tools & Resources.

Provider Credential Check



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Click Tools & Resources.

Click Physician Privileges.

Provider Credential Check

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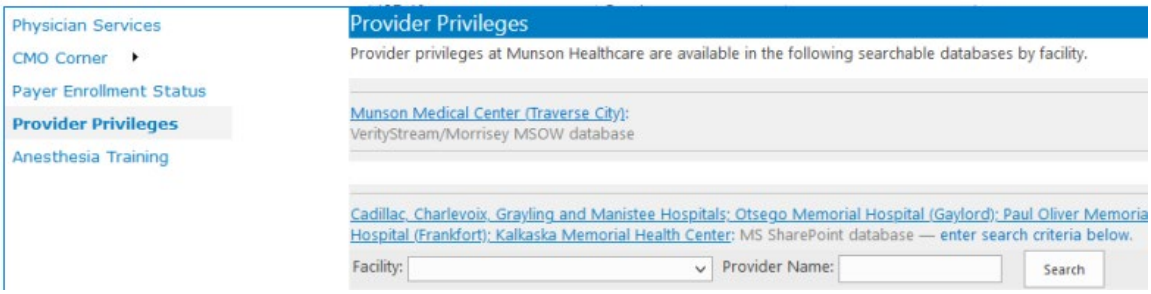


Knowledge Check

Who can administer moderate and deep sedation for procedural sedation (assuming they have the proper credentials and have completed the education)? (Choose all that apply.)

- [x] Oral Surgeon
- [ ] ICU RN who is ACLS-certified
- [x] Physician
- [x] Physician Assistant
- [x] Nurse Practitioner

Pre-procedure Responsibilities: Provider Assessment

The proceduralist/provider is required to complete a comprehensive assessment of the patient prior to performing the procedure. This includes:

- A determination of the patient's American Society of Anesthesiologists Classification (ASA Class).
  - This is used as a guideline for **NPO status**.
- An airway assessment.

Key Points:

- Anesthesiology can be consulted on any case, but consultation is **advisable** for patients with an ASA Class of IV or V.
  (See next page for description.)
- The pre-procedure assessment must be documented by the anesthesia provider.

Pre-procedure Responsibilities: ASA Classification

American Society of Anesthesiologists Classification ("ASA Class") [6]	
ASA I	A normal healthy patient
ASA II	A patient with mild systemic disease
ASA III	A patient with severe systemic disease that limits activity but is not incapacitating
ASA IV	A patient with severe systemic disease that is a constant threat to life
ASA V	A moribund patient who is not expected to survive without the operation or procedure
ASA VI	A declared brain-dead patient whose organs are being removed for donor purposes

= Anesthesia consultation advised.

Pre-procedure Responsibilities: RN/RCIS Role

The RN or RCIS assisting with a procedure requiring sedation must ensure the following documentation is complete:

- Patient/family education
- Patient monitoring during procedure
- Time-based documentation during procedure

Prior to the procedure, the RN/RCIS must ensure all necessary supplies and equipment are available.

Pre-procedure Responsibilities: Patient Preparation

Procedural sedation preparation is the same as any other procedure or surgery.

- Ensure all orders and diagnostic tests are complete, e.g., lab tests, x-rays, skin preps, etc.
- Verify the patient's NPO status. Follow orders based on ASA class.
- Educate the patient and family regarding the procedure scheduled and expectations of sedation; CONSENT SIGNED prior to any administration of sedation.

Pre-procedure Responsibilities: Patient Preparation *(cont.)*

Validate all required components are complete:

1. Valid H&P is less than 30-days old with reassessment of the patient documented within 24-hours of admission prior to the procedure.
2. Validation of the correct surgical/invasive procedure
3. Evaluation immediately prior to the procedure
4. Medications
5. Allergies and previous drug reactions
6. Patient's age
7. Patient's weight
8. Pre-procedure laboratory and other diagnostic testing
9. Consent

Pre-procedure Responsibilities: Patient Preparation *(cont.)*

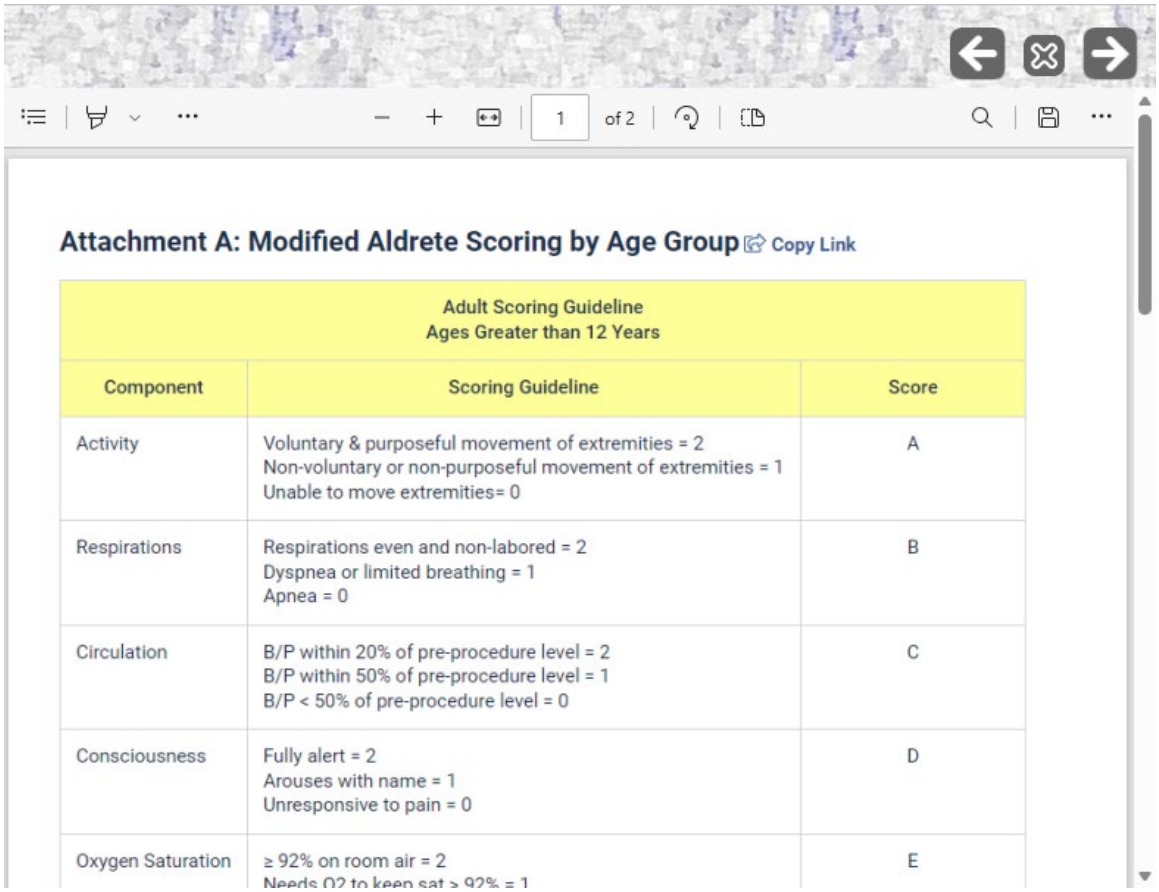
- Ensure a comprehensive assessment of the patient is completed.
- Perform a baseline pain assessment.
- Verify patent IV access.
- Pre-oxygenate the patient via nasal cannula at a flow rate of 2 L/m (unless medically contraindicated).
- Verify emergency equipment is available and in working condition.
- Identify the patient, using two identifiers. Validate the correct patient, procedure, and site.
- Perform a time-out prior to beginning the procedure.

Pre-procedure Responsibilities: The Modified Aldrete Score (or validated tool)

Modified Aldrete Scoring is a measurement tool rating post-procedure recovery of consciousness, activity, respirations, and blood pressure.

- A pre-procedural Aldrete score is necessary to establish an accurate baseline of the patient's status.
- Pre-existing conditions should be considered when evaluating the patient's score.
- A post-procedural score should equal the pre-procedural baseline score prior to discharge from the recovery area.

PRINT the Modified Aldrete Scoring document for use with answers on the quiz.



Attachment A: Modified Aldrete Scoring by Age Group Copy Link

Adult Scoring Guideline Ages Greater than 12 Years		
Component	**Scoring Guideline**	**Score**
Activity	Voluntary & purposeful movement of extremities = 2 Non-voluntary or non-purposeful movement of extremities = 1 Unable to move extremities= 0	A
Respirations	Respirations even and non-labored = 2 Dyspnea or limited breathing = 1 Apnea = 0	B
Circulation	B/P within 20% of pre-procedure level = 2 B/P within 50% of pre-procedure level = 1 B/P < 50% of pre-procedure level = 0	C
Consciousness	Fully alert = 2 Arouses with name = 1 Unresponsive to pain = 0	D
Oxygen Saturation	≥ 92% on room air = 2 Needs O2 to keep sat ≥ 92% = 1	E

Knowledge Check

The Modified Aldrete Scoring Guideline used to compare the patient's pre- and post-sedation status includes: (Choose all that apply.)

- [x] Activity
- [x] Respirations
- [ ] Pulse
- [ ] Cardiac rhythm
- [x] Blood pressure

Pre-procedure Responsibilities: Baseline Assessment

Immediately prior to medication administration, assess the following baseline parameters:

- Blood pressure
- Heart rate
- Respiratory rate
- Oxygen saturation
  - Maintain adult $SpO_2 \geq 92\%$ and pediatric $SpO_2 \geq 95\%$.
- End-tidal CO_2 level
  - Maintain CO_2 at 35 – 45 mmHg.
  - The CO_2 level will increase if the patient's ventilatory status is compromised.
- Level of consciousness
- Cardiac rhythm
  - Continuous ECG monitoring is required for **all** patients with a cardiac history or expected dysrhythmias, and for **all** deep sedation cases.
- Modified Aldrete score

Knowledge Check

Pre-oxygenation at 2 L/m via nasal cannula is required for all procedural sedation cases, unless medically contraindicated.

- (●) True
- ( ) False

Pre-procedure Responsibilities: Time-Out

Key Point: A "time-out" is **mandatory** prior to the start of the procedure.

During the time-out, the entire procedural team must pause, including the patient when possible, and verify the:

- Correct patient, using two patient identifiers
- Correct procedure
- Correct site (if applicable), including laterality

There must be **100% agreement** of the team **prior to starting** the procedure.

The time-out **must be documented** in the patient's medical record.

Intra-procedure Responsibilities: Monitoring

At a minimum, the following parameters should be monitored and documented **after every medication administration** and **every 5-10 minutes** during the procedure, following each additional dose of medication and more frequently as the patient's clinical needs dictate.

- Blood pressure
- Heart rate
- Respiratory rate
- Oxygen saturation
  - Maintain adult $SpO_2 \geq 92\%$
  - Maintain pediatric $SpO_2 \geq 95\%$.
- Identification and management of adverse events
- Level of consciousness
- Medication: dose, route, time
- Modified Aldrete score
- Pain level
- $EtCO_2$ level

Intra- & Post-procedure Assessment Considerations

Monitor the following to determine the patient's tolerance to the procedure:

- Significant variances in blood pressure, heart rate, respiratory rate and effort, SpO_2, and end-tidal CO_2.
- The patient's response **or** lack of response to verbal and physical stimuli.
- Facial grimacing and physical posturing, tensing, or flaccidity.

When observing the above, ask yourself:

- "Is the patient sedated enough?"
- "Is the patient experiencing pain?"
- "Is the patient over-sedated or at risk of being over-sedated?"

Post-procedure Monitoring

Post-procedure, the following page lists parameters which should be monitored continuously and documented **every 15 minutes**, depending on the patient's condition and the procedure performed.

Documentation will continue through the post-procedure period until the patient reaches 8 or greater on the Modified Aldrete score.

Post-procedure Responsibilities: Monitoring

At a minimum, the following parameters should be monitored and documented **after every medication administration** and **every 5-10 minutes** during the procedure, following each additional dose of medication and more frequently as the patient's clinical needs dictate.

- Blood pressure
- Heart rate
- Respiratory rate
- Oxygen saturation
  - Maintain adult $SpO_2 \geq 92\%$
  - Maintain pediatric $SpO_2 \geq 95\%$.
- Identification and management of adverse events
- Level of consciousness
- Medication: dose, route, time
- Modified Aldrete score
- Pain level
- $EtCO_2$ level

Post-procedure Responsibilities: Monitoring *(cont.)*

- Blood pressure
- Heart rate
- Respiratory rate
- Oxygen saturation
  - Maintain adult $SpO_2 \geq 92\%$
  - Maintain pediatric $SpO_2 \geq 95\%$.
- Identification and management of adverse events.
- Level of consciousness
- Medication: dose, route, time
- Modified Aldrete score
- Pain level
- Nausea
- End-tidal CO_2 level
  - Maintain CO_2 at 35 – 45 mmHg.
  - The CO_2 level will increase if the patient's ventilatory status is compromised.
- Cardiac rhythm
  - Continuous ECG monitoring is required for **all** patients with a cardiac history or expected dysrhythmias and for **all** deep sedation cases.

Post-procedure Assessment Considerations

- Patients may continue to be at significant risk for persistent/residual sedation effects or for developing complications after the procedure is completed.
- The reassessment and documentation of vital signs will revert to unit-specific standards of practice once the post-procedure monitoring criteria have been met.
- The patient's pain level may become more acute as the level of sedation decreases and will need to be treated accordingly.

Post-procedure and Over-Sedation

Over-sedated patients will require an extended recovery period.

Key Points:

- Monitor Patient - If the patient received a reversal agent due to over-sedation, they must be monitored for a minimum of two hours after the last dose of the reversal agent.
- Submit a VOICE File:
  - When a reversal agent is used to rescue a patient.
  - If there are any complications or adverse outcomes.

Discharge from Procedural Units

Patients are either discharged to their inpatient unit or discharged to home from the procedural unit.

Patients may be discharged when **at least** 30 minutes have elapsed since the last dose of sedation/analgesia was given.

Key Points:

If a reversal agent was administered, the patient must be monitored for at least 2 hours after the last dose of reversal agent was given.

Monitoring can continue on an inpatient unit.

Discharge Criteria

Prior to discharge, the following criteria must be met:

- Vital signs must be stable.
- Modified Aldrete score must be ≥ 8.
- None, or mild nausea with no active emesis.
- Patient is arousable with protective reflexes intact.
- Pain-free, mild discomfort, or controlled with analgesics.
- Mobility must be back to pre-procedure baseline.

Interpreting the Modified Aldrete Score

A patient requires either **a score ≥ 8** or **a proceduralist/provider's order** to be transferred or discharged from the procedural unit. Other department/ procedural-specific discharge criteria may also need to be applied.

Key Point:

A score < 8 indicates the patient should be closely monitored with interventions applied as indicated.

Discharging Inpatients vs. Outpatients

Inpatients:

- A full hand-off report must be given to the next provider of care.

Outpatients:

- Written discharge instructions must be reviewed with the patient and responsible party.
- Discharge instructions include the hospital- and department-specific instructions and the 24-hour minimum restrictions mandated for patients who have received pain or sedative agents, including an emergency phone number.

Key Point:

A responsible individual **must** be available to transport the patient home.

Knowledge Check

You are caring for a patient immediately post-bronchoscopy. She is very groggy, but arouses when you call her name. She can move her extremities when asked, but she keeps falling back to sleep. Her respirations are non-labored, but her respiratory rate is 9-10. Her blood pressure is 108/68 (baseline was 124/78). She needs O_2 at 2 L/m via nasal cannula to keep her oxygen saturation at 93%.

What is her Modified Aldrete Score?

- ○ 4
- ○ 5
- ○ 6
- ◉ 7
- ○ 8

Knowledge Check *(cont.)*

Continuing with the same patient in the previous question, what does her score need to be for her to be discharged from the procedural area?

- ○ Greater than or equal to 4
- ○ Greater than or equal to 6
- ◉ Greater than or equal to 8
- ○ Greater than or equal to 10

Reference

Munson Healthcare Policies and Procedures. (2022, December 16). *Sedation*. PolicyStat.

Symptom Management for Procedural Sedation

Amy Krug, BSN, RN, CGRN
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October 2023

Goal and Objectives

Goal

This course will increase the participant's knowledge of managing potential symptoms associated with patients receiving procedural sedation.

Objectives

1. Identify when a patient has progressed to a deeper level of sedation.
2. Identify nursing interventions appropriate to the patient's rescue needs.

Common Side Effects of Sedation

The most common side effects of sedation administration are:

- Respiratory depression
- Hypotension
- Nausea and vomiting
- Paradoxical response

The most common adverse effect of opioids, especially when combined with sedatives, is respiratory depression.

If left untreated, respiratory depression can progress to apnea, followed by cardiac arrest.

$EtCO_2$ and pulse oximetry may show early signs of respiratory distress.

Treatment of Respiratory Depression

- **Stop all administration of opioids and sedatives!**
  - The duration of these medications depends on the drug, dose, route of administration, and the patient's condition.
- Maintain an open airway:
  1. Reposition the head/neck using the chin-lift or jaw-thrust.
  2. Provide oxygen therapy. Be prepared to use an ambu bag if necessary.
  3. Insert a nasal or oropharyngeal airway as necessary.
- If airway management is not effective, administer the appropriate reversal agent:
  - Flumazenil (Romazicon) for benzodiazepines.
  - Naloxone (Narcan) for opioids.
- Call MRT as appropriate.

If the patient does not respond to airway management maneuvers and the reversal agent, call a Code Blue (5-5555)!

Knowledge Check

The most common side effect of sedation administration is:

- (●) Respiratory Depression
- ( ) Paradoxical Response
- ( ) Nausea and Vomiting
- ( ) Hypotension

Knowledge Check *(cont.)*

If respiratory depression occurs while I am assisting with a procedure that requires sedation, I should do all of the following: (Choose all that apply.)

- [ ] Reposition the head/neck by tucking the chin to the chest.
- [x] Provide oxygen therapy, assisting with ventilation, if necessary.
- [x] Insert an oropharyngeal airway, if needed.
- [x] Administer the appropriate reversal agent.

Hypotension

Hypotension is most likely caused by vasodilation, blood loss during the procedure, or a pre-existing condition, but could also be caused by sedation. The cause of the hypotension determines the treatment.

Possible treatments:

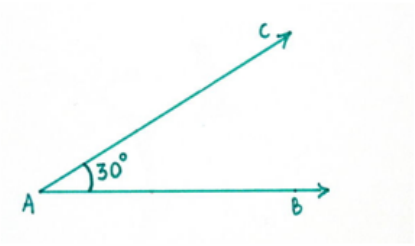
- IV fluid replacement
- Vasopressors
- Blood transfusion
- If you suspect the cause is over-sedation, administer reversal agents per protocol:
  - Flumazenil (Romazicon) for benzodiazepines.
  - Naloxone (Narcan) for opioids.

Nausea and Vomiting

Aspiration is a major concern with the patient receiving sedation.

Treatment for nausea and vomiting:

- Position the patient to prevent aspiration. The preferred position is Semi-Fowlers with the head of the bed at 30 degrees and the patient on his/her side.
- Suction as necessary to maintain a patent airway.
- Administer an antiemetic.
- Patient to remain NPO until awake and alert.



Paradoxical Responses

The desired effect of moderate sedation or analgesia is a relaxed and cooperative patient. The patient is sedated but can be aroused and is able to follow simple commands.

If a patient has a sensitivity to a specific drug, a paradoxical response can occur. Consider a paradoxical response if the patient becomes any of these:

- Agitated
- Uncooperative
- Combative
- Disoriented

Paradoxical Responses *(cont.)*

A thorough patient assessment is imperative to determine the actual cause of the patient's symptoms.

Paradoxical responses are seen more often in patients with a history of alcohol or IV drug abuse (most frequent).

Other causes to consider include:

- Hypoventilation due to hypoxia.
- Inadequate dosing of pain medication during a painful procedure.

Over-sedation

Symptoms:

- Decreased respiratory function (hypoventilation, decreased respiratory rate, or apnea)
- Decreased cardiovascular function (hypotension or dysrhythmias)
- Confusion
- Decreased level of consciousness that can progress to coma
- Depressed/absent cough and gag reflex
- Decreased response to physical/verbal stimuli

Treatment of Over Sedation

Treatment:

- Ensure an open airway.
- Encourage or stimulate the patient to breathe.
- Administer supplemental oxygen to increase or maintain oxygen saturation greater than or equal to 92%.
- Ventilate with ambu bag if spontaneous ventilation is inadequate.
- Administer reversal agents per protocol:
  - flumazenil (Romazicon) for benzodiazepines.
  - naloxone (Narcan) for opioids or narcotics.
- If hypotensive, infuse IV fluids or consider vasopressors.
- Reposition patient to semi-fowlers.
- Consider MRT or RT evaluation, if approriate.
- If patient uses home CPAP/BiPAP, also use it post-procedure.

If the patient does not respond to airway management maneuvers and the reversal agent, call a Code Blue (5-5555)!

Knowledge Check

Symptoms of over-sedation include: (Choose all that apply.)

- [x] Decreased response to stimuli
- [x] Decreased respiratory rate
- [ ] Agitation
- [x] Hypotension

Knowledge Check *(cont.)*

If a patient is in respiratory arrest and does not respond to airway management and reversal agents, I should:

- (●) Call a Code Blue.
- ( ) Call and MRT.
- ( ) Call the provider.

Reporting Requirements

Whenever it is necessary to administer a reversal agent, a VOICE file must be completed. Access the form from the MHC Intranet.

Other complications related to sedation to be reported include:

- Incidents in which the patient slips into a level of sedation that is greater than intended, e.g., moderate to deep sedation.
- Profound hypotension (50% decrease from pre-procedure mean blood pressure)
- Cardiac arrest
- Defibrillation
- Respiratory arrest
- Seizures
- Aspiration
- Medication errors
- Vomiting

Knowledge Check

I must fill out a VOICE file for the following situations: (Choose all that apply.)

- [x] If a patient slips into a deeper level of sedation than intended.
- [x] Profound hypotension
- [x] Medication errors
- [x] If a reversal agent is required to control an adverse reaction, such as respiratory depression.

References

Munson Healthcare Policies and Procedures. (2022, December 16). *Sedation.* PolicyStat.

Munson Healthcare Policies and Procedures. (2021, April 20). *Flumazenil Protocol*. PolicyStat.

Munson Healthcare Policies and Procedures. (2022, February 21). *Standing Order/Protocol for Adult Naloxone (Narcan)*. PolicyStat

Procedural Sedation Medication Guidelines

Lauren Wolf, PharmD, BCPS, BCCCP

December 2025

Goal and Objectives

Goal

This course will increase the participant's knowledge of administering medications for procedural sedation.

Objectives

1. Identify staff who can administer sedation.
2. Select the appropriate medication and dose for reversing over sedation.

Introduction

Dosage guidelines for procedural sedation and reversal agents are approved by the Pharmacy and Therapeutics (P & T) Committee at Munson Medical Center.

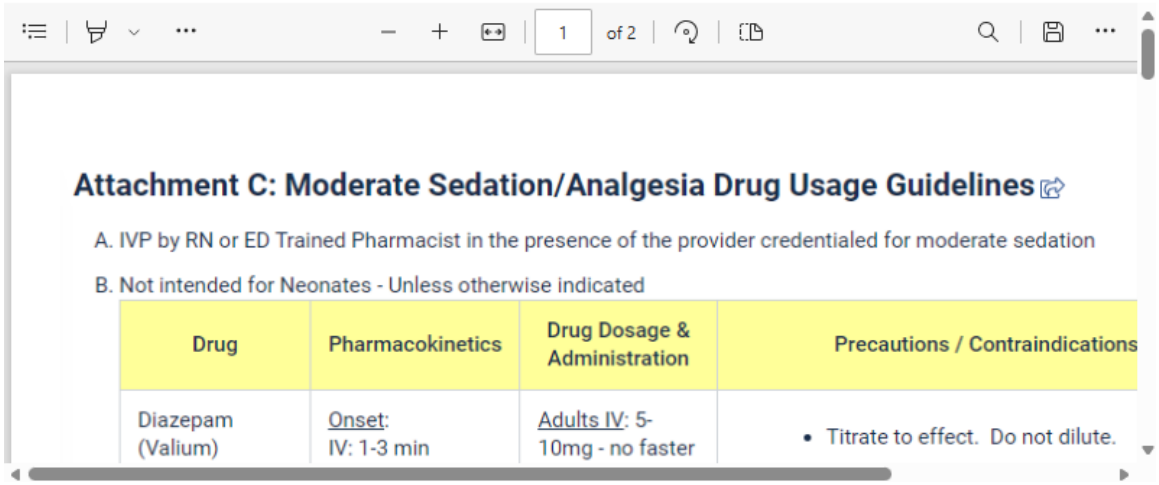
These guidelines are intended for initial doses and may be exceeded or decreased according to the patient's history, previous response to sedatives or other clinical circumstances.

Prior to administration, the P & T Committee must review and approve the use of all medications not listed in the approved guidelines.

Guidelines Location

Nurses and Registered Cardiovascular Invasive Specialists (RCIS) should be familiar with medication guidelines before administering sedation. The medication guidelines are attached to the Sedation policy.

Moderate & Deep Sedation/Analgesia Drug Usage Guidelines are listed below. **Print** the document to use as a reference for upcoming questions.



Facility-specific IV Push and Infusion Guidelines

Munson Healthcare has an IV Push/Infusion Chart to assist staff with decisions regarding the administration of medications. This chart can be found on the Intranet on the Pharmacy Department site.

The chart contains various topics, including:

- Medications administered by IV push or by infusion.
- Approved medications per department.
- Medications a nurse can give during a Code Blue.
- Medications requiring a physician be present during administration.

NOTE: See the IV Push Chart on the next slide.

MMC IV Push Chart

MUNSON HEALTHCARE

IV MEDICATION ADMINISTRATION GUIDELINES

Definitions	
Level 1	Units with general nursing and monitoring capabilities (ex. med-surg).
Level 2	Intermediate and telemetry units. RNs working on these units have more advanced training and advanced monitc telemetry) are present. Level 2 may be further divided into level 2a (telemetry units) or level 2b (step-down units)
Level 3	Critical and emergency care units (including operating rooms). Licensed clinicians working on these units are trai emergencies and manage critically ill patients. Advance monitoring and treatment resources are readily available.
OB	Birthing units and units dedicated to the care of antepartum and postpartum patients. OB units follow level 1 crite noted.
PEDS	Any unit caring for patients 18 years of age or less. Peds may be further subdivided as **level 1, level 2, and level** criteria above.

Exclusions

- Chemotherapy/antineoplastic agents
- Biologics and immune therapies typically restricted to outpatient administration (ex. Infliximab, vedolizumab)
- Basic IV hydration fluids (ex. 0.9% normal Normosol, lactated ringers)
- Non-intravenous parenterally administere

Who Can Administer Sedation?

Medications for **moderate** sedation may be given by a registered nurse (RN) or registered cardiovascular invasive specialist (RCIS) in the presence of the physician, physician assistant (PA), nurse practitioner (NP), or oral surgeon credentialed in moderate sedation and in advanced airway management.

Who Can Administer Sedation? *(cont.)*

Medications for **deep** sedation, can **ONLY** be administered by a provider credentialed in deep sedation.

- **Exception: Propofol** - a critical care RN may give propofol (Diprivan) IVP for an emergent intubation while a physician is present and performing the intubation.
  - Critical care is defined by the IV Push/Infusion Chart to include these units:
    - ✓ ICU
    - ✓ ED
    - ✓ PACU
    - ✓ OR
    - ✓ A2 (critical)
    - ✓ A3 (critical)
    - ✓ IR

Knowledge Check

A patient is scheduled for a wound debridement at the bedside. The physician orders hydromorphone (Dilaudid) 0.1-0.5mg IV titrated over 1 minute for moderate sedation.

This is an approved dose according to the MMC Moderate Sedation Guidelines.

- (●) True
- ( ) False

Knowledge Check *(cont.)*

A patient is scheduled for a synchronized cardioversion. The physician orders propofol (Diprivan) at 1mg/kg per minute over 60 seconds.

How long do the effects of propofol (Diprivan) last?

- ( ) 1-2 minutes
- (●) 3-10 minutes
- ( ) 12-20 minutes
- ( ) 25-30 minutes

Knowledge Check *(cont.)*

A registered nurse from the ICU can give propofol (Diprivan) IV push with a physician order, if the physician is present in the room, but is not intubating the patient.

- ○ True
- ◉ False

Reversal Agents

- Reversal agents may be indicated when:
  - ➢ The level of sedation is deeper than desired.
  - ➢ The patient's responsiveness or cardio-respiratory status is compromised.
  - ➢ An idiosyncratic reaction occurs.
- If a reversal agent is administered for the undesired effects, a **VOICE** file is required.
- A patient should be monitored for a minimum of two hours after giving a reversal agent.

Commonly Used Opioids

If a patient becomes difficult to arouse with verbal or physical stimuli related to sedation from an opioid, follow the Standing Order/Protocol for Adult Naloxone (Narcan) Protocol. The naloxone (Narcan) protocol can be located:

- Policy website on the Intranet
- Pharmacy website on the Intranet
- Side of the crash cart

Examples of commonly used opioids include:

Codeine	Morphine
Demerol (meperidine)	Norco (hydrocodone + acetaminophen)
Dilaudid (hydromorphone)	Oxycontin (oxycodone)
Dolophine (methadone)	Percocet (oxycodone + acetaminophen)
Duragesic (fentanyl patch)	Sublimaze (fentanyl injection)

naloxone (Narcan) Protocol

The naloxone protocol allows the registered nurse or RCIS to:

- Titrate oxygen to maintain an oxygen saturation of at least 92%.
- Perform further interventions, including the administration of naloxone depending on the patient's mental status and O_2 saturation.
- For patients with oxygen saturations ≥ to 80%, dilute the naloxone 0.4 mg in 9 ml of normal saline and administer in small, 1mL doses following the protocol. This allows for better titration of the dosing [so the patient doesn't over respond to the naloxone and end up in severe pain].
- Give naloxone 0.4 mg **undiluted** for an O_2 saturation below 80% or respiratory arrest.

NOTE: Click the button.

Review the naloxone (Narcan) Protocol

Show Changes

Tag Policy

Standing Order/Protocol for Adult Naloxone (Narcan)

Purpose

To provide a policy for Adult Naloxone (Narcan) standing orders/protocols.

Policy

A. The Protocol for Adult Naloxone (Narcan) shown below, is approved as a standing order and may be initiated by a Registered Nurse (RN) or Licensed Practical Nurse (LPN) without a provider order for any patient if:

1. Patient is difficult to arouse with verbal/physical stimuli **~AND~**
2. Patient is on, or recently was on, opioids or suspected that the patient has consumed opioids

. This protocol is not applicable for end of life/palliative or comfort care/hospice patients. Call provider to clarify if any questions.

C. If criteria above are met then the initiating [illegible] would enter by Physician Order Entry (POE) using

naloxone (Narcan) Points to Remember

- The onset of action for naloxone is within 2 minutes.
- The half-life of naloxone is 30-90 minutes.
- Many opioids have a longer half-life than naloxone, so it is important to monitor your patients closely. A repeat dose of naloxone may be required.

Knowledge Check

A 52-year-old female was admitted post-intervention to her right coronary artery. She received an initial dose of morphine sulfate 2 mg IV push prior to her sheath pull. She continued to complain of discomfort @ 8/10. An additional morphine sulfate 4 mg IV push was administered for discomfort. Respirations are now 5/minute; oxygen saturation is 82%. The patient is not arousable to verbal stimuli, but is arousable to a sternal rub.

Which dose of reversal agent should be initiated?

- (●) naloxone 0.4 mg diluted in 9 mL of normal saline, and give 1 mL IV push
- ( ) naloxone 0.4 mg diluted in 9 mL of nomal saline, and give IV push
- ( ) naloxone 0.4 mg IV push (undiluted)
- ( ) naloxone 0.4 mg diluted in 9 mL of normal saline, and give 2 mL IV push

Treating Over Sedation from a Benzodiazepine

If a patient becomes difficult to arouse with verbal or physical stimuli related to sedation from a benzodiazepine, follow the flumazenil (Romazicon) protocol.

The flumazenil protocol can be located:

- Policy website on Intranet
- Pharmacy website on Intranet
- Side of the crash cart

Commonly Used Benzodiazepines

The most commonly used benzodiazepines are:

alprazolam (Xanax) ★	flurazepam (Dalmane)
chlordiazepoxide (Librium)	**lorazepam (Ativan)** ★
clonazepam (Klonopin)	**midazolam (Versed)** ★
clorazepate (Tranxene)	oxazepam (Serax)
diazepam (Valium) ★	**temazepam (Restoril)** ★
estazolam (Prosom)	triazolam (Halcion)

★ = MMC formulary benzodiazepines

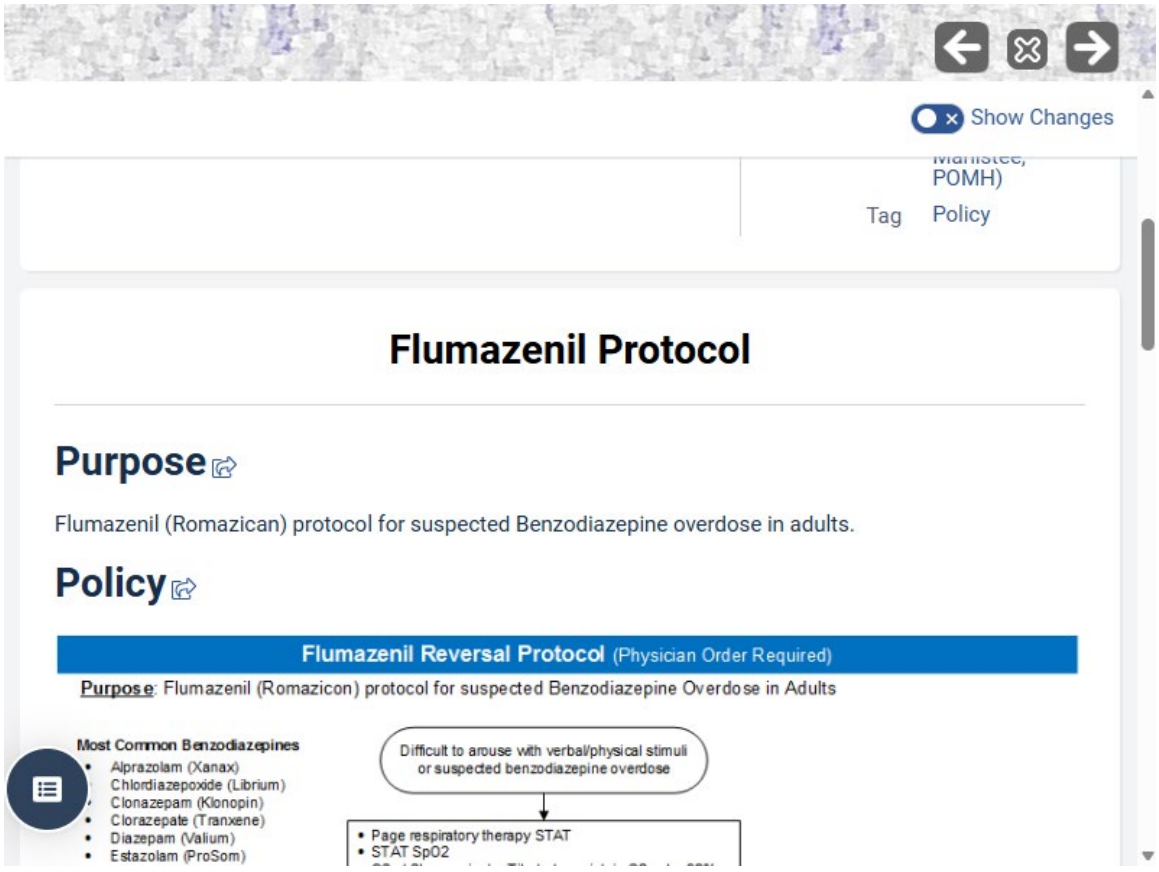
flumazenil (Romazicon) Protocol

The flumazenil Protocol allows the registered nurse or RCIS to:

- Titrate oxygen to maintain an oxygen saturation of at least 92%.
- Perform interventions, including administering flumazenil if the patient is unarousable AND:
  - Oxygen saturation is less than 89% **OR**
  - Respiratory rate is less than 6.
- Initial dose: flumazenil 0.2 mg IV push over 30 seconds

NOTE: Click the button to review the flumazenil protocol; check for repeat dosing and the complete intervention sequence.

Review the flumazenil (Romazicon) Protocol



- The onset of action is 1-2 minutes.
- Duration:
  - ➢ Re-sedation occurs after approximately 1 hour (range: 19-50 minutes).
- Many benzodiazepines have a longer half-life than flumazenil, so it is important to monitor your patients closely. A repeat dose may be required.
- Avoid use of flumazenil in patients with chronic benzodiazepine use. Its use may precipitate seizures.

Knowledge Check

You are assigned to an 88-year-old man who arose from a sitting position and had a syncopal episode. He was placed on the stroke unit for telemetry monitoring. At the start of your evening shift, he becomes very agitated. An order is obtained to give him lorazepam (Ativan). He finally falls asleep after 0300. At the end of the shift (0700), you find him difficult to arouse to both verbal and physical stimuli. His respirations are 5/minute and his oxygen saturation is 86%.

Which reversal dosing agent is appropriate for this patient?

- ○ Undiluted naloxone (Narcan) 0.4 mg IV push STAT
- ○ Diluted naloxone (Narcan) 0.4 mg in 9 mL normal saline
- ◉ flumazenil (Romazicon) 0.2 mg IV push over 30 seconds
- ○ flumazenil (Romazicon) 0.4 mg IV push over 30 seconds

Selecting naloxone (Narcan) vs. flumazenil (Romazicon)

When a patient has received/taken both a benzodiazepine and an opioid, and a reversal agent is needed, **give the naloxone first**.

Reasons:

- Opioids are more likely to cause respiratory depression and other adverse effects, such as hypotension.
- flumazenil can cause seizures in patients with a history of long-term use of benzodiazepines.

Knowledge Check

A 21-year-old female patient has returned following endoscopy in the Medical Procedure Room. She received Demerol 75 mg and Versed 7.5 mg during the procedure.

She has a history of taking Xanax 0.25 mg three times per day for anxiety and Vicodin PRN for pain. She was discharged to B2 following an uneventful recovery with an Aldrete score of 8. Respirations are now 5/minute with an oxygen saturation of 85%. The patient is not arousable to verbal stimuli, but does arouse to a sternal rub.

Which reversal agent protocol should be used first?

- (●) naloxone (Narcan) Protocol
- ( ) flumazenil (Romazicon) Protocol

Knowledge Check *(cont.)*

A 21-year-old female patient has returned following endoscopy in the Medical Procedure Room. She received Demerol 75 mg and Versed 7.5 mg during the procedure.

She has a history of taking Xanax 0.25 mg three times per day for anxiety and Vicodin PRN for pain. She was discharged to B2 following an uneventful recovery with an Aldrete score of 8. Respirations are now 5 minute with an oxygen saturation of 85%. The patient is not arousable to verbal stimuli, but does arouse to a sternal rub.

Which dose of Narcan (naloxone) should be administered?

- ( ) naloxone 0.4 mg IV push (undiluted)
- ( ) naloxone 0.4 mg diluted in 9 mL of nomal saline, and give IV push
- ( ) naloxone 0.4 mg diluted in 9 mL of normal saline, and give 2 mL IV push
- (●) naloxone 0.4 mg diluted in 9 mL of normal saline, and give 1 mL IV push

Treating Patients Who Revert to a Deeper Level of Sedation

- Remember, the effects of opioids and benzodiazepines last longer than the effects of the reversal agents.
- Continue to monitor the patient for signs of progression to a deeper level of sedation for a minimum of 2 hours.
- Repeated dosing of the reversal agents may be needed.
- Create and submit a **VOICE** file.

Dissociative Sedation

Dissociative sedation is a trance state where the patient remains awake, but is unaware of pain and will have no memory of the event.

- In comparison to deep sedation, which causes the patient to:
  - Be unarousable, except with repeated or painful stimuli
  - Experience respiratory depression

Ketamine for Dissociative Sedation

Ketamine will be administered by providers credentialed for deep sedation.

1. A pharmacist, nurse, or non-credentialed provider may administer medications for dissociative sedation in the Emergency Department, as long as a provider credentialed for deep sedation, an RN, and a respiratory therapist are ***ALL*** present.
2. Respiratory adverse events, such as apnea or laryngospasm (although uncommon), may still occur, and providers must always be prepared to rescue the patient from a deep sedation state anytime ketamine is administered.
3. Ketamine (IM/IV) is used for dossociative sedation in both children and adults (including the mentally disabled) for medical procedures such as, but not limited to: fracture reduction, laceration repair, abscess drainage, foreign body removal.
4. If Ketamine is administered IM, IV access should be immediately available.

References

Lexicomp. (2023, November 29). *Flumazenil*. Retrieved December 5, 2023.

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Munson Healthcare Policies and Procedures. (2022, February 21). *Standing Order/Protocol for Adult naloxone (Narcan)*. PolicyStat.

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Exit Next

Radiation Safety for Patients
Fluoroscopy

Dennis Aurand, MS, DABR
Radiation Safety Officer
August 2023

MUNSON HEALTHCARE

Back Exit Next

Goal and Objectives

Goal

This course will provide information about worker and patient radiation safety during fluoroscopy.

Objectives

1. Identify three ways to reduce personnel radiation dose.
2. Determine best patient/source/receptor relationship.
3. Select ways to reduce patient dose.
4. State warning levels for patient dose.

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Reasons

Patients undergoing diagnostic and interventional fluoroscopic and/or angiographic procedures can receive high skin doses.

The FDA has reported skin injury from such procedures.

The Joint Commission added fluoroscopy with cumulative dose greater than 1500 rads (15,000 mGy) to a single field as a reviewable sentinel event.

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Radiation Dose Effects

Effect	Single-dose threshold (mGy)	Onset time
Early transient erythema	2,000	Hours
Main erythema	6,000	~10 d
Temporary epilation	3,000	~3 wk
Permanent epilation	7,000	~3 wk
Dry desquamation	14,000	~4 wk
Secondary ulceration	24,000	>6 wk
Late erythema	15,000	~8-10 wk
Skin cancer	Unknown	>5 yr

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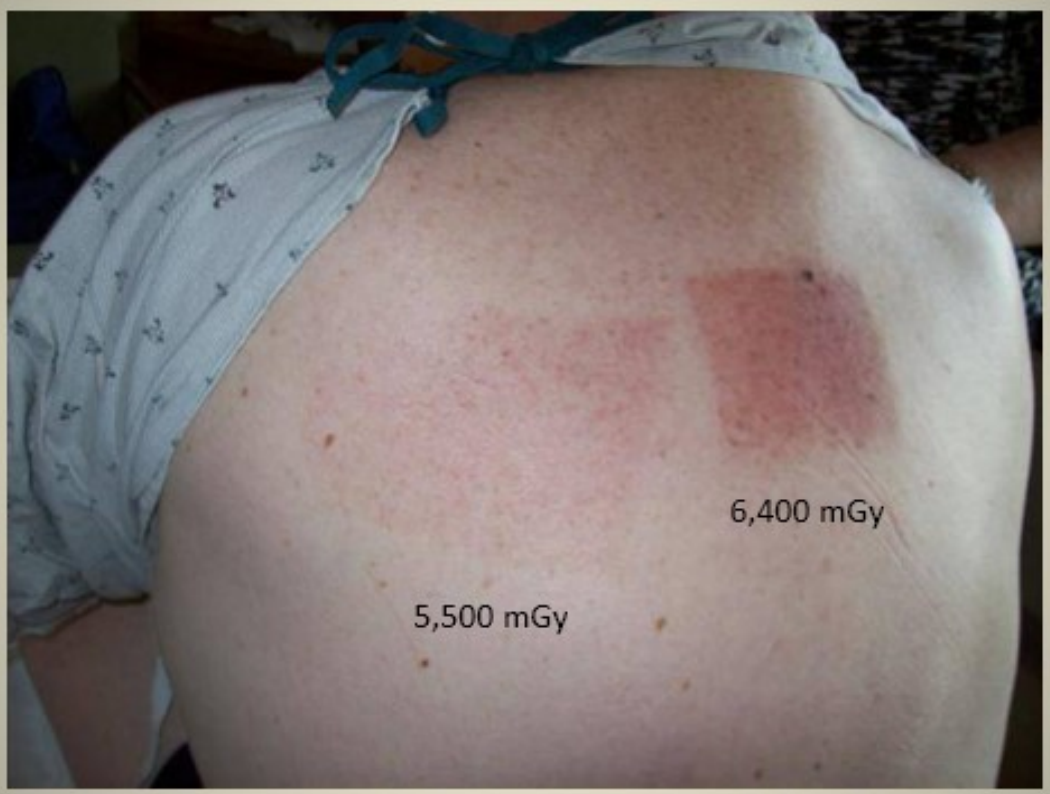
Radiation Dose Effects *(cont.)*



62 y.o. patient, 2 procedures 2 weeks apart

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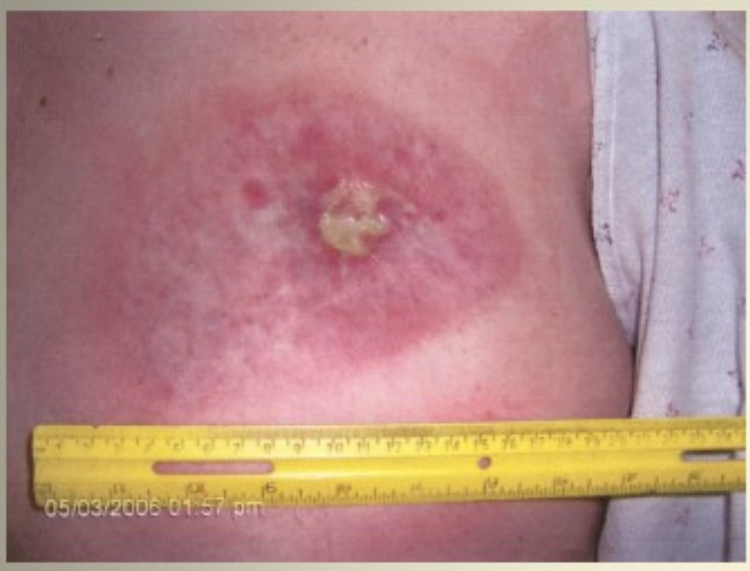
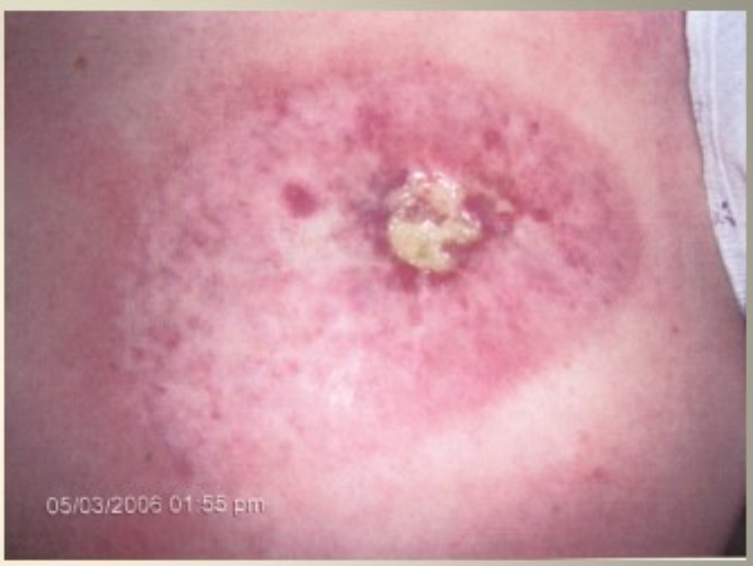
Radiation Dose Effects *(cont.)*





47 y.o. patient, lupus, estimated 6,100 mGy
(later estimated at 15,000-20,000 mGy)

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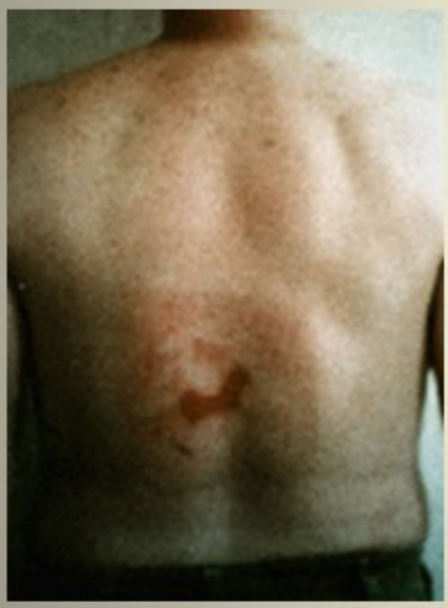
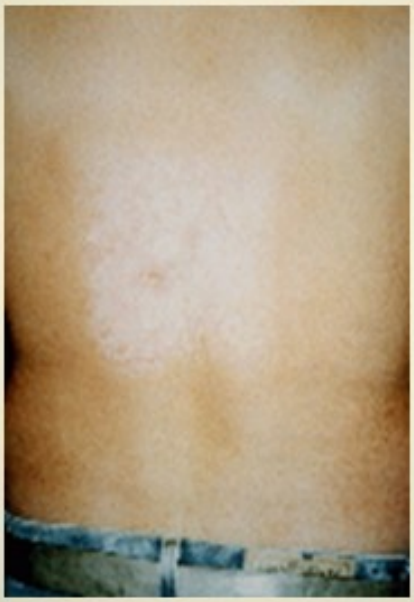
Radiation Dose Effects *(cont.)*

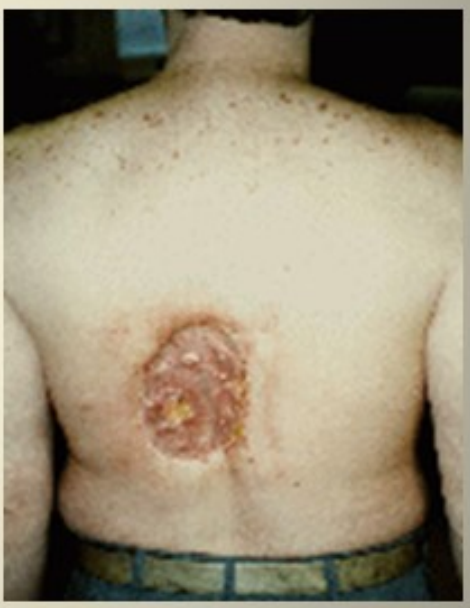
After multiple coronary angiography and angioplasty procedures
(120 minutes of fluoro and dose of 20,000 mGy)



> 6-8 weeks
redness, peeling



16-18 weeks
Small ulcerated area



18-21 month
Tissue necrosis

Shope T. Radiation-induced skin injuries from fluoroscopy. FDA/CDRH, 1995

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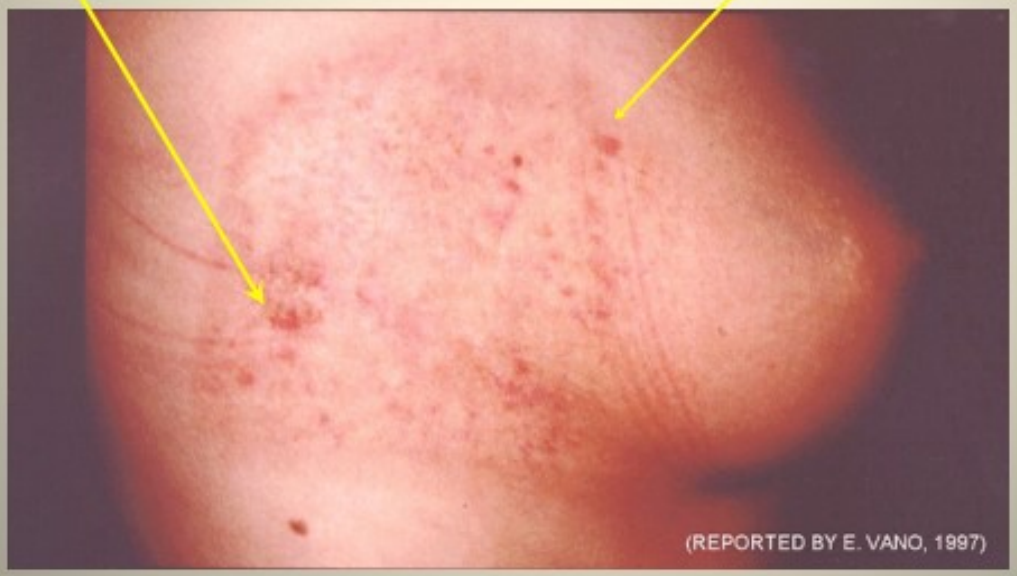
Radiation Dose Effects *(cont.)*

Chronic radiodermatitis in 17-year-old female patient after x2 radiofrequency ablation procedures

Atrophic indurated plaque

Hyper- and hypo-pigmentation, with telangiectasia



Reproduced with permission from Vañó, Br J, Radiol 1998; 71, 510 - 516.

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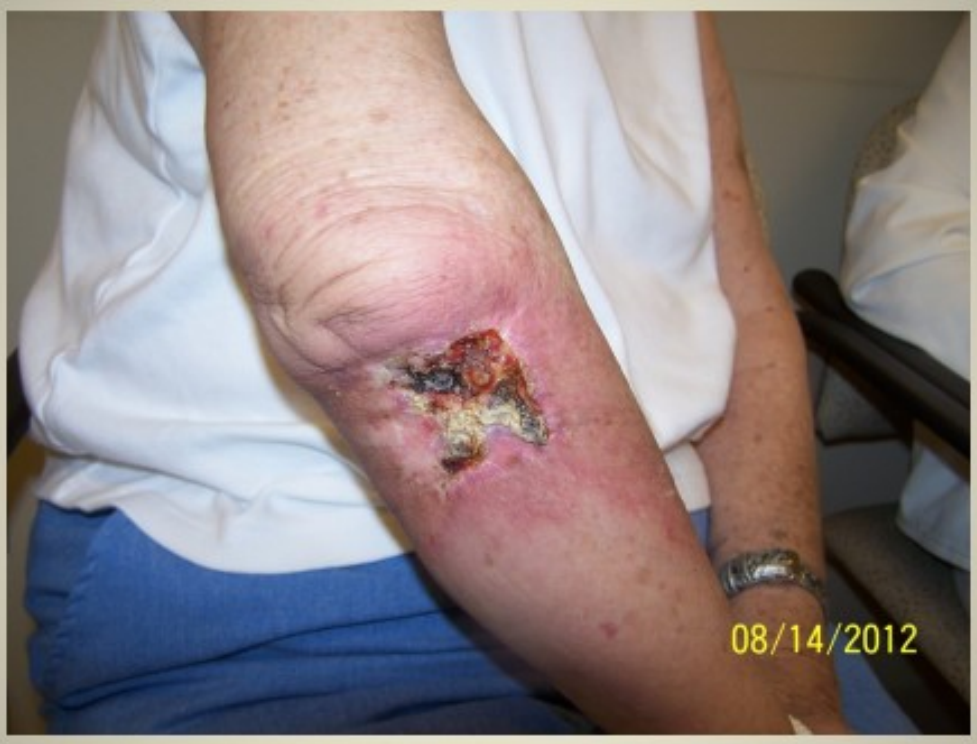
Radiation Dose Effects *(cont.)*



The patient's arm was in the beam near the x-ray tube.

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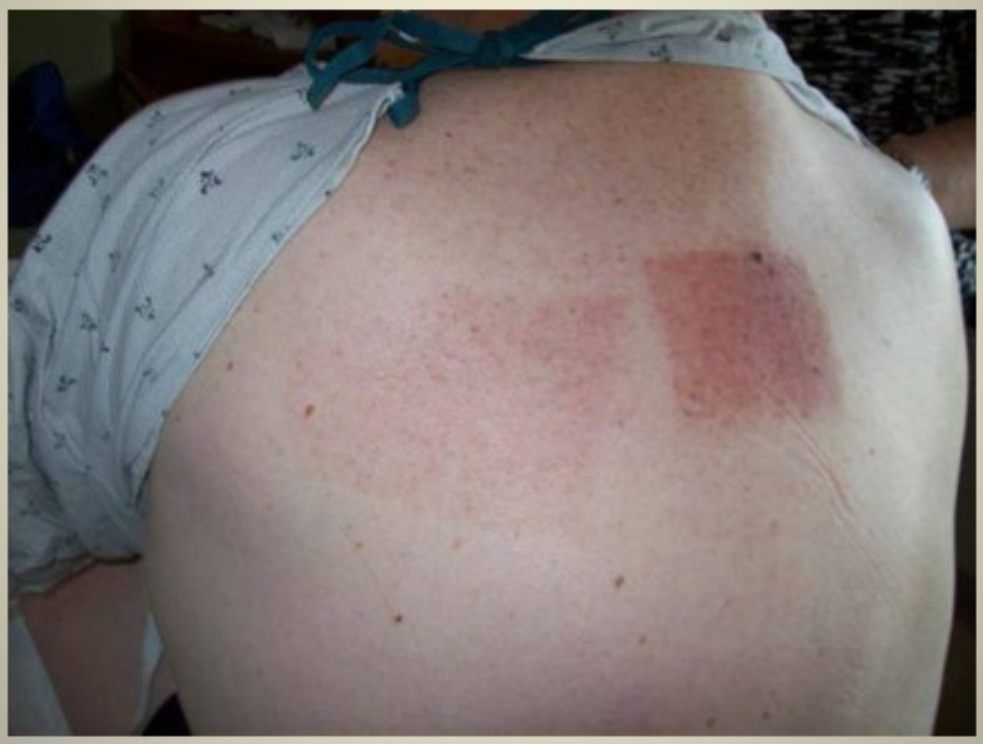
Erythema

Radiation-induced erythema is caused by cell death.



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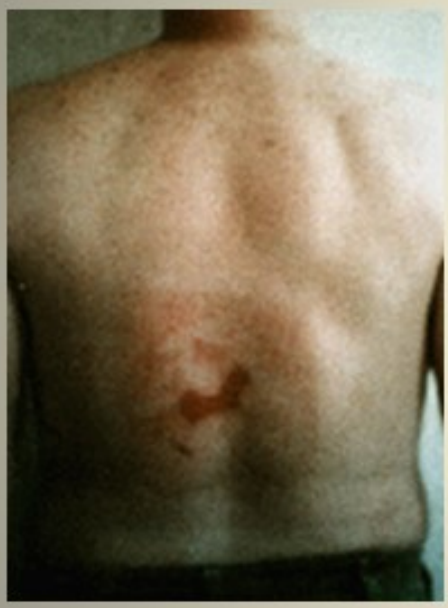
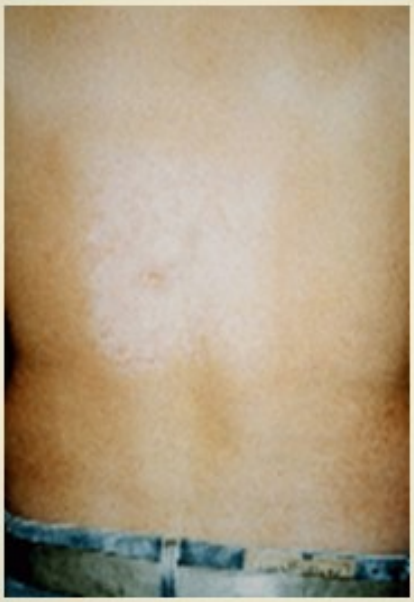
Injury

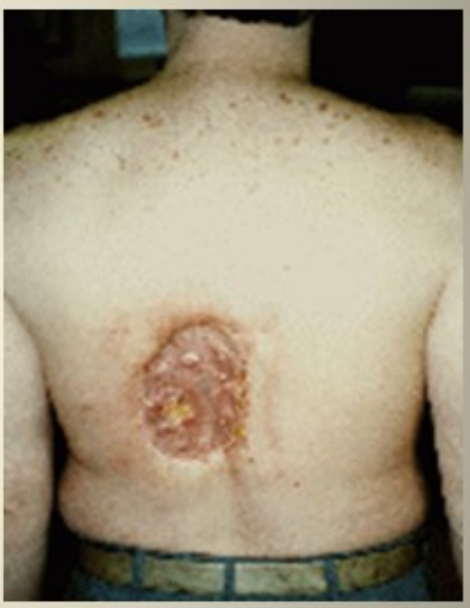
Radiation injury can be cyclic -- appears, fades, re-appears.



> 6-8 weeks
redness, peeling



16-18 weeks
Small ulcerated area



18-21 month
Tissue necrosis

Shope T. Radiation-induced skin injuries from fluoroscopy. FDA/CDRH, 1995

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Responsibility

The operator (the person activating the radiation) of the machine is responsible for:

- Patient dose
- Worker dose
- Operator dose
- Making certain each person in the room is prepared
  - Wearing dosimetry badges
  - Wearing radiation protection apparel

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Time as a Protection Method

X-ray beam-on time is directly proportional to dose.

- Short intermittent exposure vs. extended continuous exposure.
- Be aware of the 5-minute timer alarm.

Be efficient and reduce the fluoroscopy times.

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Distance as a Protection Method

Extremely effective ($1/d^2$) - By doubling the distance between yourself and the source of radiation, you decrease your dose by a factor of four.

Increase your distance from the patient and the x-ray machine when it is not necessary to stand immediately next to the patient.

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Shielding - Personal Radiation Protection Apparel

Personnel are required to wear approved apparel during x-ray exposures.

Shielding of 0.5 mm lead equivalent will reduce scatter radiation by ~90%.

There are MHC policies for proper use and care, labeling, and annual integrity testing.

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Trained Operators

Registered x-ray technologists control and operate the x-ray equipment in the OR.

Non-radiology physicians may be authorized to operate x-ray equipment, if they complete the required training and testing.

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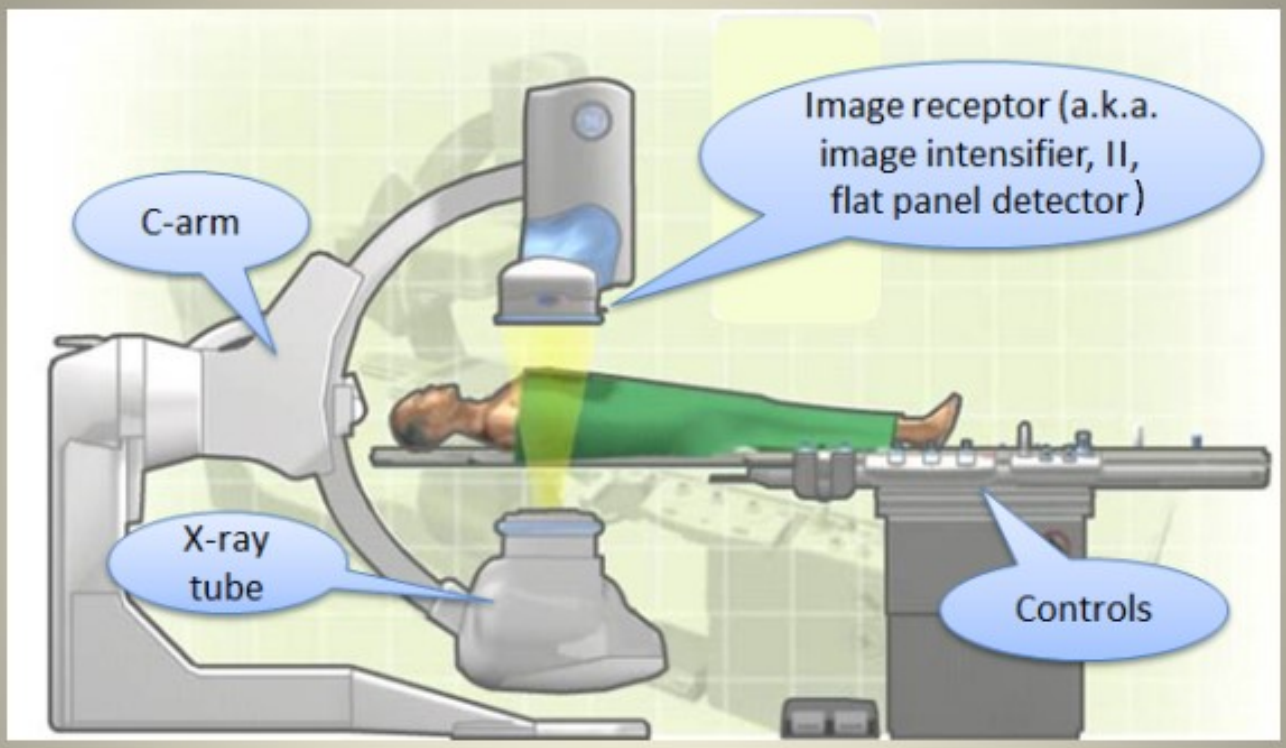
Positioning



To reduce dose:

- The patient should be placed as far from the x-ray tube as possible.
- The patient should be placed as close to the image receptor as possible.

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Pulse Rate

Patient dose is nearly proportional to pulse rate.

Suggested pulse rate and approximate dose rate:

Area	Pulse Rate	Dose Rate
Coronary Arteries	15 frames/second	3.0 R/min
Peripheral Vascular	7.5 frames/second	1.5 R/min
Non-vascular	4 frames/second	0.8 R/min

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Magnification

Patient dose increases rapidly with increased magnification (reduced image receptor size).

Receptor	Dose Rate	Increase
Normal	3 R/min	-
Mag 1	4 R/min	33%
Mag 2	6 R/min	50% (100% over Normal)

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Cine Acquisition

Patient dose is at least 6 times greater when using cine instead of fluoro.

Receptor	Dose Rate Fluoro	Dose Rate Cine
Normal	3 R/min	18 R/min
Mag 1	4 R/min	24 R/min
Mag 2	6 R/min	50 R/min

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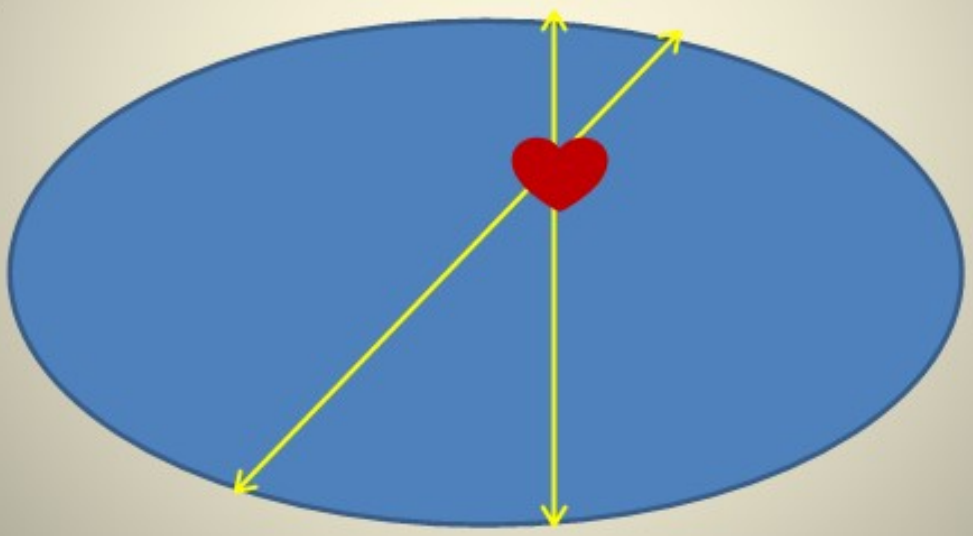
Beam Angulation

Skin dose will double with each 4 – 6 cm increase in path length through the patient.

Changing from vertical to 35 degrees will often increase the path length 4 - 6 cm.



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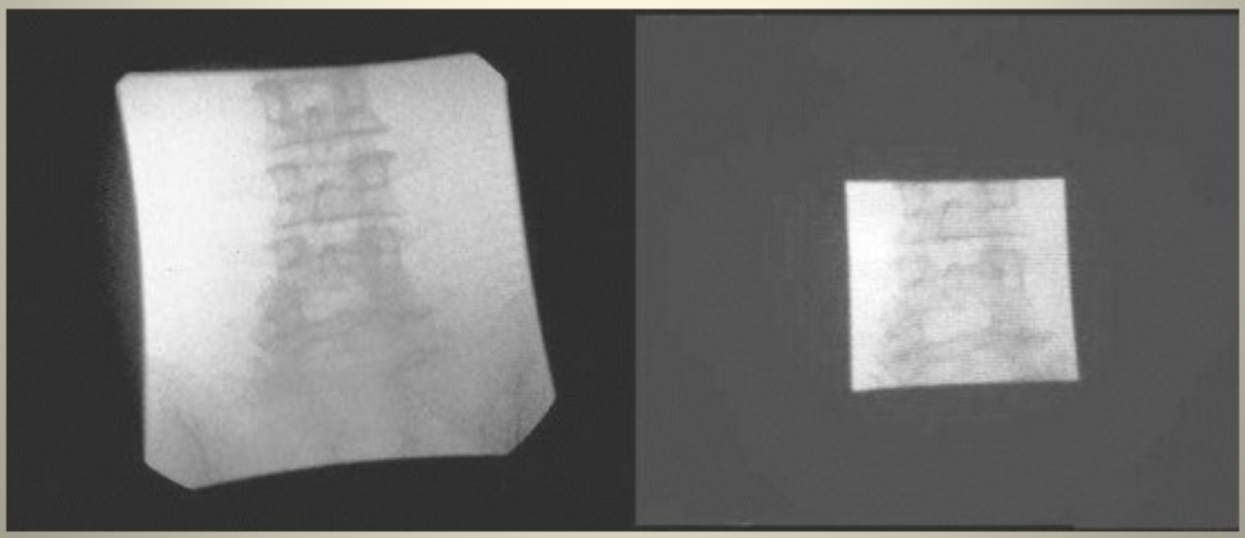
Collimation

Proper collimation:

- Reduces patient dose
- Improves image quality by reducing scattered radiation
- Reduces scatter to personnel
- Reduces overlap of fields when beam is reoriented



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Notifications

The dose (mGy) displayed on the monitor **($K_{a,r}$)** is not necessarily the patient skin dose. It is the dose to a reference point between the x-ray tube and the image receptor.

Technologist, nurse, or control room personnel will notify the operator when the dose displayed on the monitor **($K_{a,r}$)** reaches certain levels.

The notification levels are 3000 mGy, 4000 mGy, 5000 mGy, etc. (Think 3, 4, 5...)

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Notifications *(cont.)*

Notifications are for operator information and not intended to stop a procedure. The operator should take into consideration the benefit vs. risk of continuing.

When a procedure exceeds 5000 mGy, the diagnostic medical physicist will be notified. A peak skin dose calculation will be performed.

The operator will receive notification of peak skin doses that exceed 3000 mGy so patients may receive appropriate follow-up for skin injury.

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Patient Size

Large patients and steep beam angulation are the most common factors related to injuries.

Thick body masses exponentially decrease penetration and cause the skin to be positioned closer to the x-ray port.

Skin dose will double with each 4 – 6 cm increase in path length through the patient.

Large patients result in poorer image quality and require more time.

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Patient History

Review patient history for previous fluoroscopically-guided procedures and radiation therapy within 6 months:

- Consider changing the beam geometry.
- The operator may request peak skin doses from previous procedures.
- Discuss possibility of radiation-induced injury during patient consent.

Review patient history for skin sensitizing conditions:

- Connective tissue diseases (e.g., scleroderma, lupus erythematosus)
- Diabetes mellitus
- Hyperthyroidism
- Chemotherapy agents
- Homozygous form of ataxia telangiectasia

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Informed Consent

Radiation information for consent:

Make sure the following risk factors associated with the procedure have been shared with the patient. Risks associated with the procedure include:

- Infection
- Bleeding
- Radiation induced skin injury
- Temporary or permanent hair loss
- Damage to organs
- Heart or lung complications
- And even death

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Test Your Knowledge

Click **Yes** for the statements below that will reduce patient dose.
Click **No** for statements that will not change or increase patient dose.

Using a large distance between x-ray tube and patient.	Yes	No
Using a large distance between patient and image receptor.	Yes	No
Using a high pulse rate.	Yes	No
Avoiding steep beam angulation.	Yes	No
Using cine acquisition instead of fluoroscopy looping.	Yes	No
Using high image magnification (small receptor size).	Yes	No
Collimating to a small area of interest.	Yes	No

Please complete this exercise.

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References

Hirshfeld J, Ferrari V, Bengel F, et al. 2018 ACC/HRS/NASCI/SCAI/SCCT Expert Consensus Document on Optimal Use of Ionizing Radiation in Cardiovascular Imaging: Best Practices for Safety and Effectiveness. J Am Coll Cardiol. 2018 Jun, 71 (24) e283–e351 https://doi.org/10.1016/j.jacc.2018.02.016

Hirshfeld J, Ferrari V, Bengel F, et al. 2018 ACC/HRS/NASCI/SCAI/SCCT Expert Consensus Document on Optimal Use of Ionizing Radiation in Cardiovascular Imaging—Best Practices for Safety and Effectiveness, Part 2: Radiological Equipment Operation, Dose-Sparing Methodologies, Patient and Medical Personnel Protection. J Am Coll Cardiol. 2018 Jun, 71 (24) 2829–2855. https://doi.org/10.1016/j.jacc.2018.02.018

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Radial Artery Access and Care

Magdalena Stewart, DNP, AGPCNP-BC, AGCNS-BC, CCRC
Todd Adams, DO, FACC

October 2025

MUNSON HEALTHCARE

Goal and Objectives

Goal

The goal for this course is to educate the nurse on radial access anatomy, care, and complications.

Objectives

1. Describe three benefits and limitations of radial artery access.
2. Differentiate three radial post-procedural complications and their treatments.
3. Explain radial artery patency in relation to radial artery occlusion.

Background, Benefits, and Limitations of Radial Access

- On August 14th, 1992, the first interventional coronary procedure was performed using the radial artery.
- **Radial artery access** is now the ***Gold Standard*** of practice in the Cath Lab and Interventional Radiology (IR).

Benefits	Limitations
Early ambulation	Prone to vasospasm
Fewer bleeding complications	Arterial vessel size limitations: Women have smaller vessels
Faster discharge rate	Difficult tortuosity
Collateral circulation prevents hand ischemia	Vessel accommodates up to 6fr sheath
Absence of major nerve structures minimizes neurological complications	Radial/brachial anatomical loops

Review of Radial Anatomy

The radial artery arises together with the ulnar artery from the bifurcation of the brachial artery just below the bend of the elbow.

It passes along the lateral side of the forearm from the neck of the radius to the styloid process in the wrist and is smaller than the ulnar artery.

The average diameter of the radial artery is:

- ***2.8mm in females***
- ***3.1mm in males***

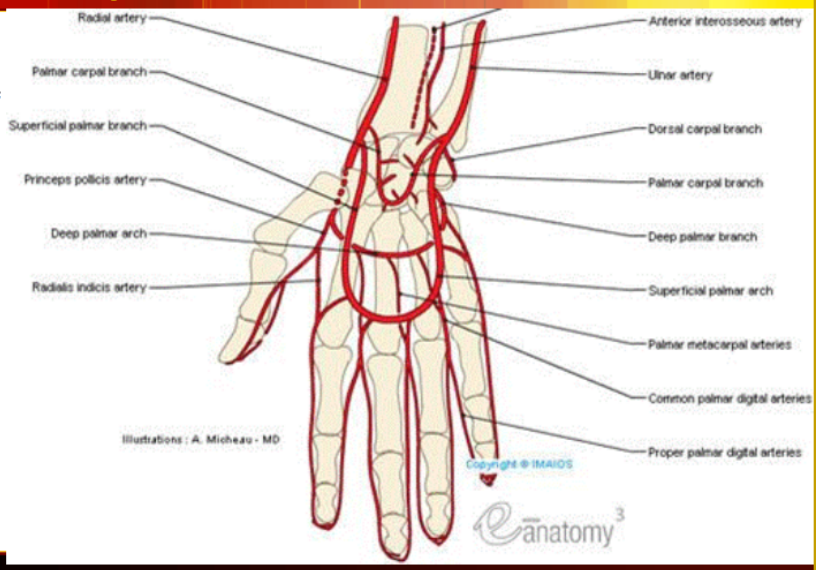
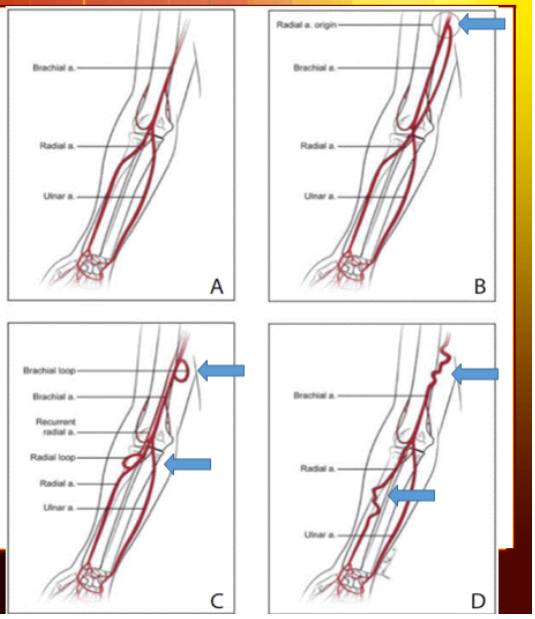


Image purchased from: https://www.imaios.com/en/e-anatomy/upper-limb/upper-extremity?mic=ms-

Anatomical Considerations

Common radial artery anatomic variants

- **Normal (A)**
- **Other variants:**
  - High take-off radial artery **(B)**.
  - Radial and/or brachial loop **(C)**.
  - Vessel tortuosity **(D)**.
- *Consider abnormal variants as possible limitations to radial access which may increase risk of complications.*

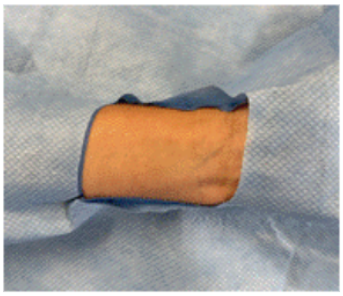


Krishna, H., & Shroff, A. (2018). Ten Common (and Uncommon) Reasons for Unsuccessful Transradial Procedures. [Figure 1]. *Endovascular Today*, *17*(11), 50. Retrieved from https://assets.bmctoday.net/evtoday/pdfs/et1118_SF2_Shroff.pdf

Pre-procedural Considerations

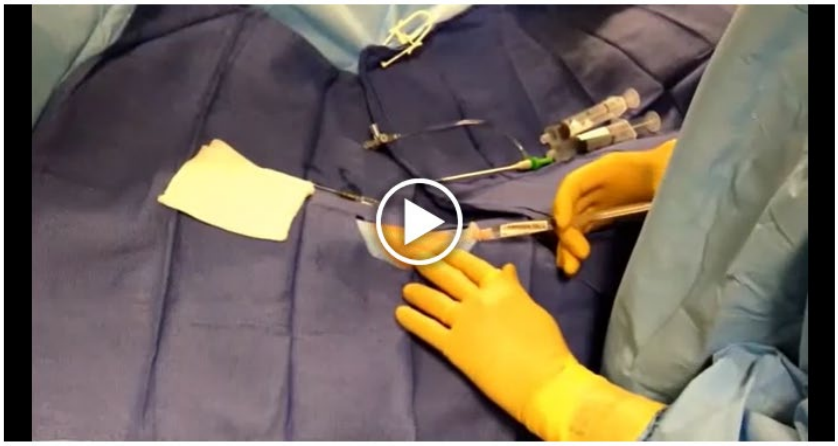
Pre-procedural care includes:

- Assessment ***and*** documentation of the radial pulse bilaterally.
- **Clip the wrist** from the base of the thumb, approximately **15cm** towards the antecubital area.
- **Clip the right groin** (may need to use femoral approach, if radial limitations occur).
- Avoid starting an IV within **9cm** of the wrist area.



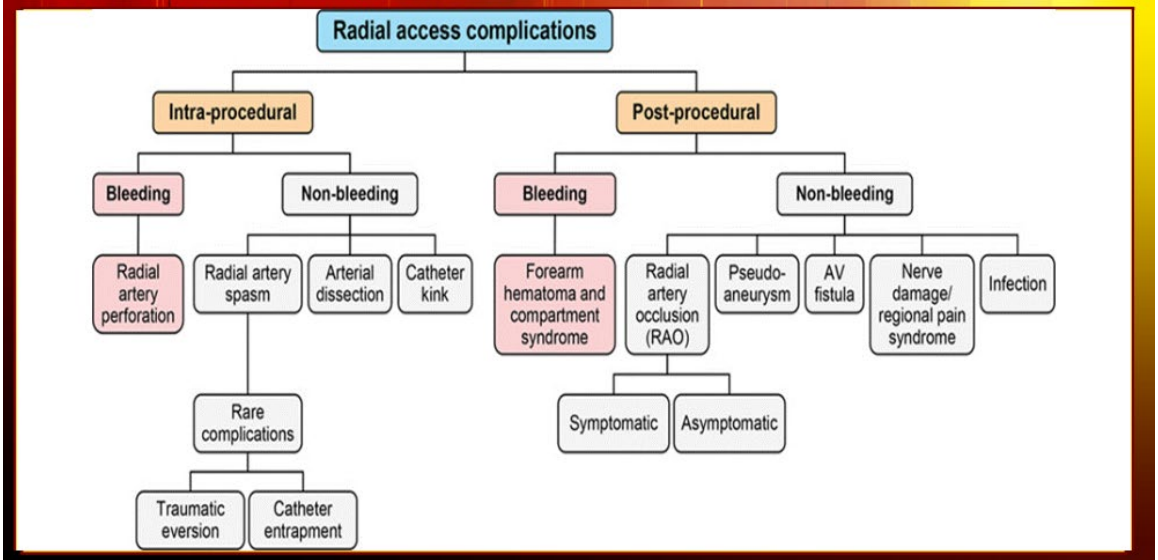
Radial Artery: Access Procedure

Radial Access Sheath Insertion



(1½ mins.)

Radial Access Complications



Radial Access Care

The compression device is used to apply direct pressure to the radial artery.

Upon receiving patient, verify the radial band is in the correct position (~2mm above the puncture site).

- **Elevate** the arm on a pillow with the site facing up.
- **Place** the limb-alert wrist band on the affected hand and leave it on for **2 days** post-procedure.
- Place the **Plethysmography/SpO_2** monitor on the ***affected*** hand (index finger or thumb).
  - **Verify patent hemostasis** by occluding the ulnar artery and ensuring blood flow to the hand (plethysmography wave form on monitor).
- **Assess** for signs and symptoms of bleeding, hematoma, pseudo-aneurysm, compartment syndrome, and radial artery occlusion.
- **Control** hypertension.
  - Place the blood pressure (BP) cuff on the ***non-procedural*** arm.
- **Verify** the type of procedure: Diagnostic vs Intervention
  - **Diagnostic procedure:** Remove 1-2cc of air, 1-hour post-procedure.
  - **Intervention (PCI, FFR, IVUS, OCT):** Remove 1-2cc of air, 2-hours post-procedure.
- Do not leave the radial compression band on the patient for an extended period of time.

Post-Procedural Complications: Re-bleed

Re-bleeding at the Access Site and Hematoma

- Bleeding can occur from the radial access site or from a small peripheral side branch of the radial artery.
- Local bleeding or hematomas may occur as a result of improper hemostatic device application, device failure, or vessel perforation.

What to do?

- **Compression of the radial artery**, ***both*** *proximal and distal* to the puncture site must be performed to control both antegrade and retrograde flow from the palmar arch collateral.
- **This can be achieved by** repositioning the hemostatic band or applying manual pressure.
- **If unable to control bleeding** or a growing hematoma at the access site, **occlude the brachial artery**, either manually or with a blood pressure cuff.

Post-Procedural Complications: Hematoma

Forearm Hematoma

- Bleeding may also rarely occur from a site on the radial artery remote from the puncture site. It can **occur from a perforation of a small side branch of the radial artery by a guide wire.**
- **If not controlled urgently** and appropriately, forearm hematomas can lead to the development of **compartment syndrome**. The forearm is anatomically susceptible to an increase in pressure, in case of a blood leak, as it has very little room for expansion.

Forearm Hematoma

What to do?

- Apply pressure to **occlude** the brachial artery by using the BP cuff to compress the brachial artery.
  - **Inflate the BP cuff** to **20mmHg above the systolic pressure.**
  - **Release the BP cuff pressure for 10-15 seconds every 10 minutes** to allow blood flow to the arm.
- **Assess** for pain, paresthesia, pallor, and pulselessness of the hand.
- **Protamine** can be used for Heparin reversal.
- **Control hypertension**, attain pain management, and closely monitor the distal perfusion bed with plethysmography.
- Assess the hematoma every 15 mins. by **measuring it with a measuring tape. Mark the borders with a marker** to check if the hematoma is growing.
- ***Suspect compartment syndrome?*** Consult a vascular surgeon.

Compartment Syndrome

This is a **rare** complication of radial artery catheterization. ***If not identified and treated emergently, it can lead to profound disability or limb loss.***

Compartment syndrome is an EMERGENCY!

Greater than expected **pain** is the earliest and most reliable indicator.

- Escalating pain unrelieved by immobilization and requiring increasing analgesics should illicit high suspicion.

A **swollen and tense** compartment is a direct manifestation of increased pressure.

An **abnormal sensation**, feeling like “pins and needles” and tingling, can be in the arm and hand.

Late indicators

- **Decreased pulses.**
- **Absence of pain** - due to tissue ischemia and necrosis or nerve injury.

Post-Procedural Complications - Pseudoaneurysm

Pseudoaneurysm

- Rarely occurs at the radial artery access site.
- Should be suspected in the presence of ***pulsatile swelling at the access site.***
- **Often painless**; however, some patients can have associated discomfort.
- ***Risk factors****:* systemic anticoagulation, inadequate compression post-procedure, infection, and multiple arterial punctures.

Diagnosis is confirmed by ultrasound.

What to do?

- **Apply pressure** to the brachial artery ***and*** **notify the provider.**
- Management options ordered by provider: compression with a radial hemostasis device, thrombin injection, ultrasound-guided compression, or surgical repair.

Post-Procedural Complications - Radial Artery Occlusion

Radial Artery Occlusion (RAO)

- Occurs in 1-12% of cases.
- **Often asymptomatic** and goes unnoticed.
- **Limits use of the radial artery for:** future cardiac catheterizations, use as a conduit in patients undergoing coronary artery bypass graft surgery, or for creation of an arteriovenous fistula in patients with end-stage renal disease.
- Hand ischemia is rare, but may occur.

Factors Impacting the Risk of RAO

Pre-procedural risk factors
- Elevated creatinine
- Female
- Low body weight
- Diabetes

Intra-procedural risk factors
- Artery to sheath ratio >1
- Vasospasm
- Longer procedure time

Post–procedural risk factors
- Longer compression
- Too much compression limiting blood flow through radial artery

Radial Artery Occlusion Risk Reduction

Factors that decrease the risk of RAO:
- Smaller catheters
- Heparin use during procedure
- Timely sheath removal
- **Patent hemostasis!!!**
- Short duration of compressive device

What is Patent Hemostasis?

Patent hemostasis is the technique of maintaining radial artery flow through guided artery compression during hemostasis.

- After the procedure is completed, the compression band is applied and 15-20cc of air is injected to exhibit pressure on the radial artery puncture site by the Cath Lab.
- The radial sheath is removed and no exterior bleeding should be observed at the arteriotomy (puncture) site.
- This volume of air typically creates radial artery total or partial collapse. At this point, slow balloon deflation (1cc/second) is performed until a small jet of bleeding is observed at the skin puncture site. In order to stop it, a quick insertion of 2cc of air is performed.

Radial Artery Patency (Patent Hemostasis)

Using a pulse oximetry waveform, radial artery patency should be assessed:

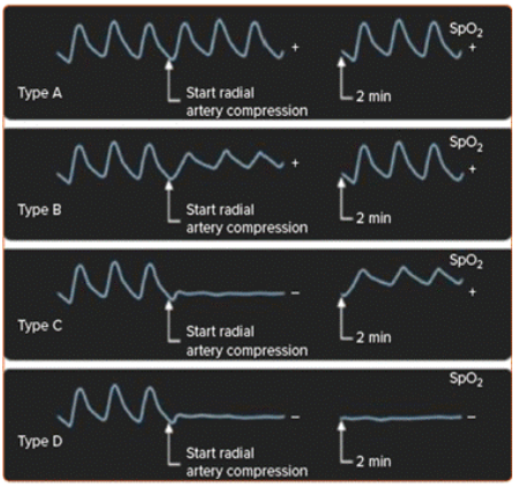
- Immediately after application of the compression device.
- On arrival to recovery room/inpatient unit.
- Whenever there is an increase in amount of air in the compression or adjustments to the compression band.
- After removal of the compression band.
- At the time of discharge.

How to Check Patent Hemostasis

- Patency of the radial artery is checked with a reversed Barbeau's test.
- Place the oximetry pulse detector on the patient's thumb or index finger on the affected hand. With the balloon inflated on the top of the radial artery, **simultaneous manual compression should be applied to collapse the ulnar artery.**
- If the inflated balloon has too much pressure, causing radial artery collapse, **the plethysmography pulse waveform will be flat**; in other words, there is no "flow" pulse/flow reaching the detector. In that case, an additional *1cc should be aspirated* from the balloon with the goal to reestablish flow through the radial artery.

What to Do for No-Flow on Pulse Oximetry

- If **no-flow** is identified, **remove 1-2cc of air** from the band until the flow is restored and patent hemostasis is achieved.
- **If bleeding occurs** and unable to maintain hemostatis, re-check in 15 minutes.
- **If *no-flow is* identified *after the band is removed*, immediately notify the provider.**
- **Document** patent hemostasis in IView.



A,B, and C show patent hemostasis
D indicated no flow

Site Assessment Post-Procedure

Thoroughly assess the radial access site for:

- Bleeding or oozing
- Hematoma formation
- Pain or tenderness
- Bruising/Discoloration

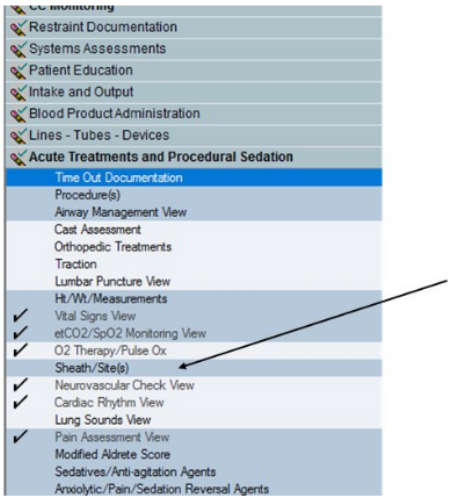
Perform neurovascular checks and document:

- Capillary refill
- Skin temperature and color: Compare with contralateral hand
- Radial and ulnar pulses: Presence, strength, and symmetry
- Sensation and motor function: Assess fingers for movement and any numbness/tingling
- Reversed Barbeau Test post-procedure to ensure collateral circulation

Post-Procedure Site Documentation

- Assess site immediately after arrival from the procedure.
- Verify the time and that the radial compression band was applied.
- Follow provider orders for frequency of site assessment.
- Assess site immediately before and immediately after any activity.
- Document the site assessment in PowerChart.

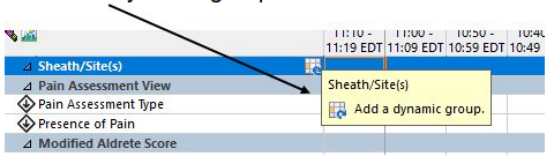
Sheath/Site Documentation



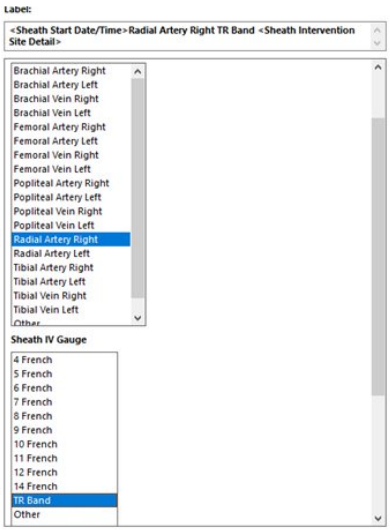
- Document sheath sites and neurovascular status in the Sheath/Site(s) section of the "Acute Treatments and Procedural Sedation" band in iView.

Sheath/Site Documentation (con't)

- Add a dynamic group for each site

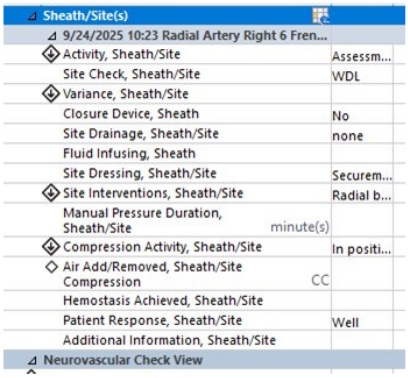


- Select the correct site and choose "TR band" for a radial site with a band in place



Sheath/Site Documentation (con't)

- Document the assessment including:
  - Site condition
  - Presence of a closure device
  - Compression activity/band
  - Drainage
  - Site interventions
- **NOTE:** A TR band is NOT a closure device.
- With each site assessment, document a neurovascular check of the affected limb.



Summary

- Radial approach is the gold standard of practice in the Cath Lab.
- It allows for early mobilization, increases patient satisfaction, and decreases bleeding complications.
- Nursing interventions include awareness and prevention of complications.
- A rare complication of radial access is compartment syndrome.
- With the increase in radial use, RAO is a potential concern with permanent consequences.
- Patent hemostasis is considered best practice to prevent RAO.

For any questions or concerns, please contact the Cath Lab Clinical Nurse Specialist.

Case Study #1

Patient: John D., 67-year-old male

Procedure: Coronary angiography via right radial artery

Post-procedure orders:

- Radial compression band applied
- Vital signs Q15 minutes X 1 hour, then Q30 minutes X 2 hours
- Assess neurovascular status and site per protocol

Situation:

One hour post-procedure, the nurse notes that the patient's right hand is cooler than the left, and capillary refill is sluggish. The radial pulse is weak but present. The compression band is still inflated at the same pressure as it was post-procedure.

Case Study #1 Questions

Question 1:

What is the nurse's priority action in response to the assessment findings?

- ○ Document findings and continue monitoring
- ○ Notify the provider immediately
- ◉ Deflate the radial band slightly and reassess perfusion
- ○ Apply a warm compress to the affected hand

Question 2:

Which of the following is a critical nursing intervention during the first hour after radial artery procedures?

- ○ Encourage full mobility to prevent stiffness
- ◉ Frequently assess for signs of bleeding and neurovascular compromise
- ○ Apply ice packs to prevent inflammation
- ○ Encourage the patient to flex the wrist to promote circulation

Case Study #2

Patient: Maria L., 58-year-old female

Procedure: Subclavian artery stent via left radial access

Post-procedure orders:

- Radial compression band to be weaned off over 2 hours
- Monitor access site for bleeding, swelling, and hematoma
- Patient instructed to report tingling or numbness

Situation:

90 minutes post-procedure, the nurse begins deflating the radial band as per protocol. As air is released, the patient reports feeling a "warm, wet sensation" at her wrist. On inspection, there is oozing at the site.

Case Study #2 Questions

Question 1:

What is the most appropriate immediate response by the nurse?

- ○ Continue deflating the band
- ◉ Re-inflate the band slightly and apply direct pressure
- ○ Remove the band and apply a gauze dressing
- ○ Notify the provider and document the finding

Question 2:

Which patient complaint would be most concerning during radial band monitoring?

- ◉ "My hand feels cold and numb"
- ○ "This band is tight, but not painful"
- ○ "I feel tired and want to sleep"
- ○ "I'm feeling a little thirsty"

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MUNSON HEALTHCARE

Femoral Post Sheath Removal Care

Magdalena Stewart, DNP, AGPCNP-BC, AGCNS-BC, CCRC

December 2025

Goal and Objectives

Goal

To educate health care providers in the care of the patient femoral post sheath removal.

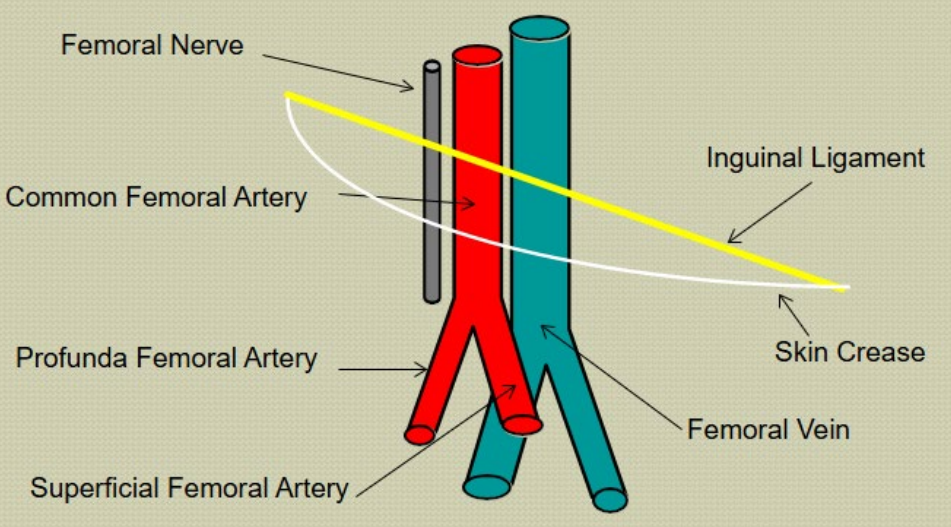
Objectives

1. Identify vascular anatomy.
2. State the process of hemostasis.
3. Define five complications that may occur femoral post sheath removal.
4. Identify potential complications associated with closure/compression devices.
5. State two nursing considerations for identified complications.

Progress

Vascular Anatomy

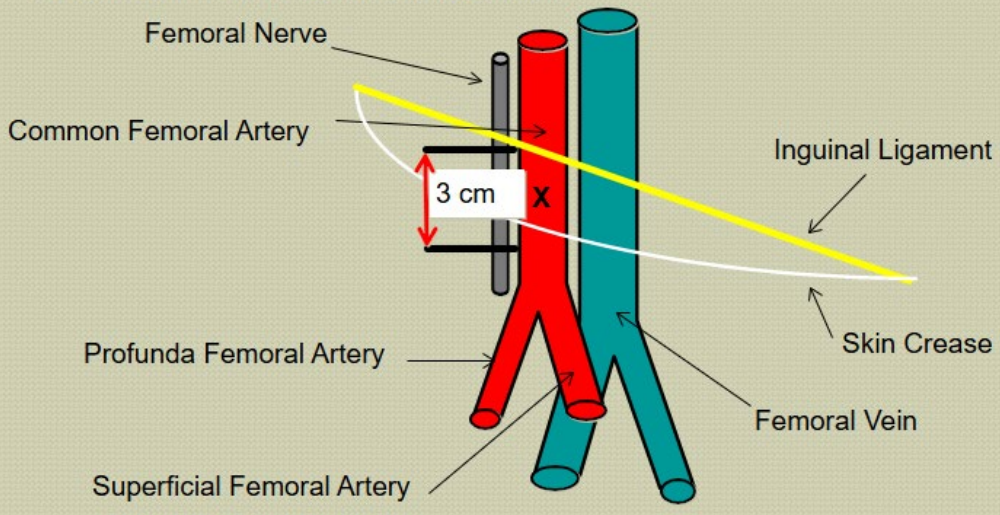
Identify the nerve, artery, vein, and ligament structures in the groin area.



Progress

Vascular Anatomy Relevant to the Sheath Insertion Site

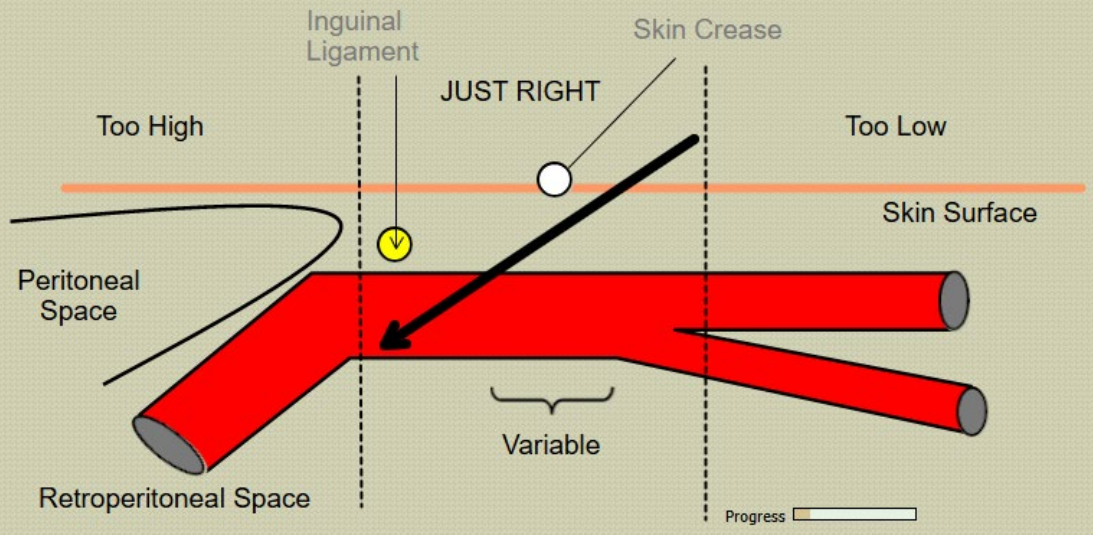
The arterial stick should be placed approximately 3 cm below the inguinal ligament and directly over the femoral artery pulse.



Progress

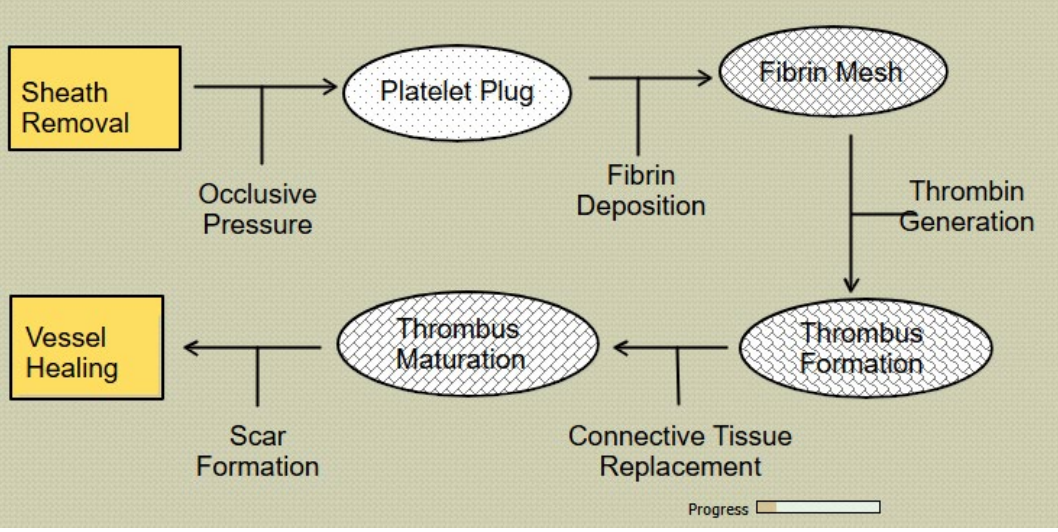
Arterial Puncture

If the arterial puncture is too high or too low, it may result in vascular complications. Review the correct position for puncture below.



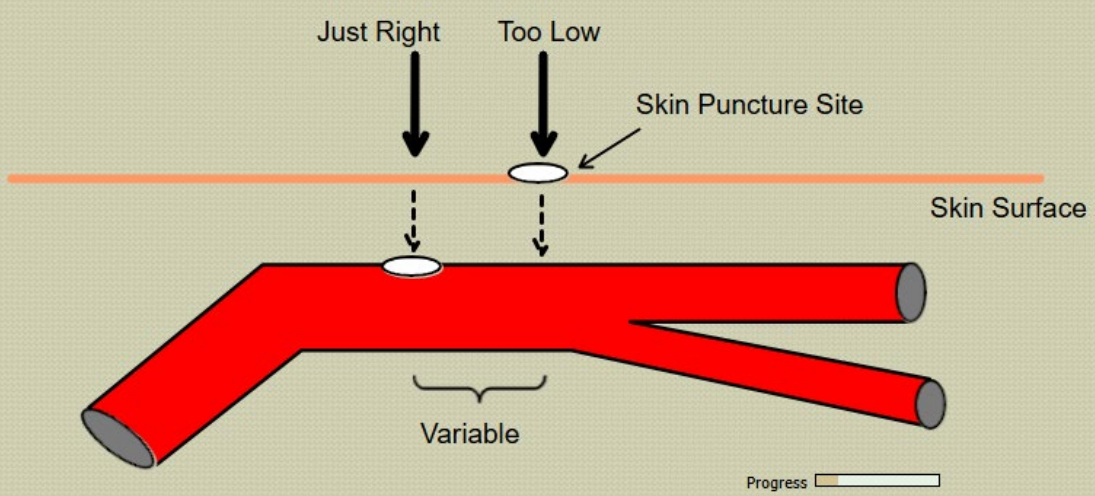
The Hemostasis Process

This is the normal hemostasis process. The process can be disrupted by certain drugs such as heparin and Integrilin.



Hemostasis

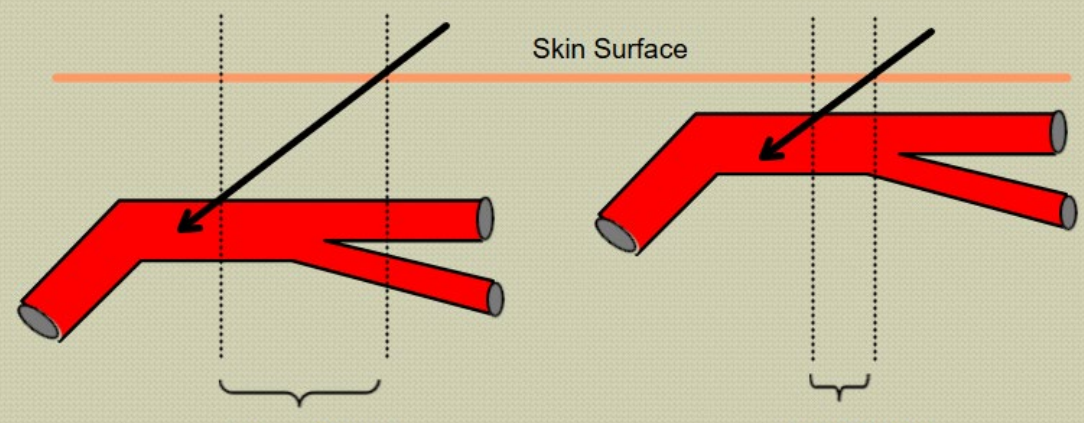
Manual pressure should be applied 2-3 cm above the skin puncture to achieve hemostasis.



Progress

Hemostasis *(cont.)*

Vascular anatomy may be displaced depending on the weight of the patient.



Progress

Post Sheath Pull:
Potential Vascular Complications

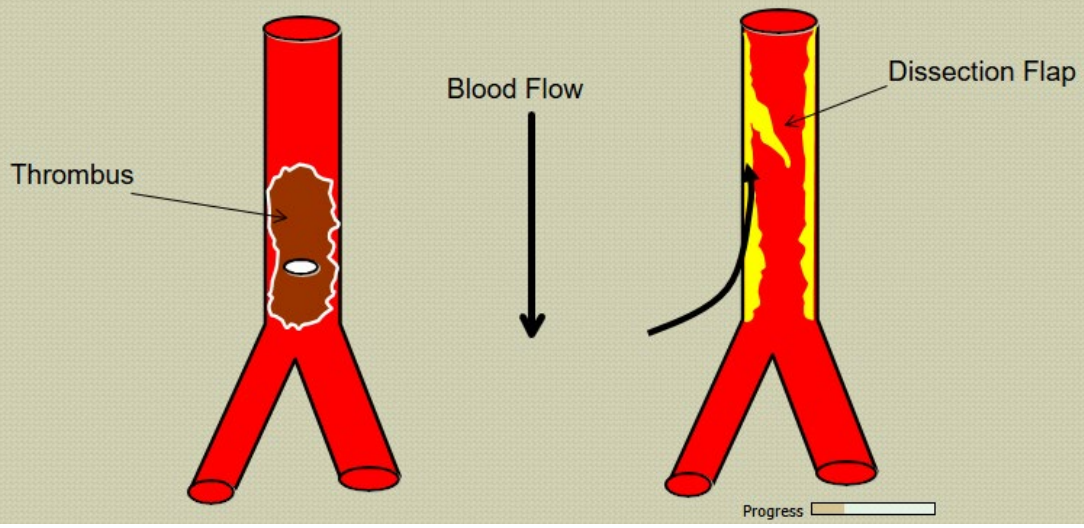
- Vessel thrombosis and dissection
- Bleeding
- Re-bleeding
- Femoral hematoma
- Retroperitoneal hemorrhage
- Pseudoaneurysm
- Arteriovenous fistula
- Atheroembolism

If any of the above complications occur, contact:
Cardiac Cath Lab - 231-935-9578
or the "neuro-on-call" if IR case

Progress

Vascular Complications:
Vessel Thrombosis and Dissection

Blood flow may be inhibited by a thrombus or dissection.



Progress

Vascular Complications: Vessel Thrombosis and Dissection *(cont.)*

Key Points

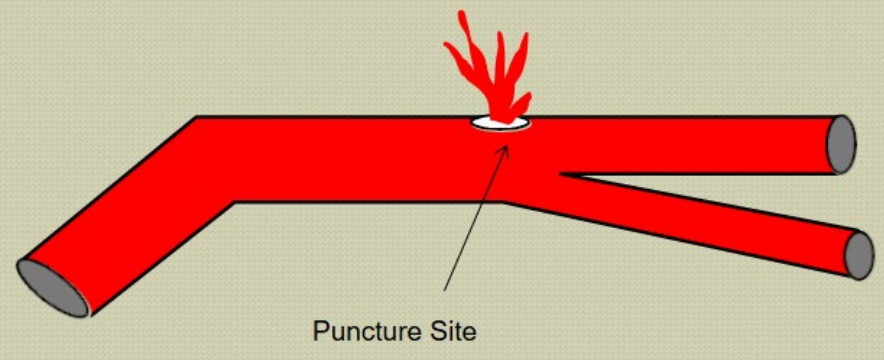
- Femoral artery thrombosis is rare and typically occurs in patients with small arterial lumens. Examples: peripheral vascular disease (PVD), diabetes mellitus (DM), and female gender.
- Dissection usually occurs in the setting of PVD or difficult arterial access.
- Patients commonly complain of leg pain or numbness.
- Physical exam reveals diminished or absent pulses.
- Rapid recognition is critical to avoid irreversible limb ischemia.
- Doppler ultrasound can be diagnostic.
- Urgent revascularization (surgical or percutaneous) is the treatment of choice.

Progress

Vascular Complications: Re-Bleeding

A re-bleed is uncontrolled bleeding from the puncture site.

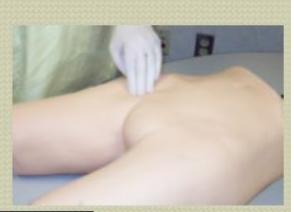
- It is possible for the Hematocrit to drop by $\geq$ 10% and the hemoglobin to drop by $\geq$ 3 g/dL.
- The patient may require a transfusion.



Progress

Nursing Considerations: Re-Bleeding

- Assess distal pulse prior to compression.
- Apply gloves and palpate artery just superior to puncture site.
- **Apply manual pressure above the site for a minimum of 20 minutes. No peeking!**
- Compression should be forceful enough to prevent bleeding, oozing, and hematoma formation.
- Delegate someone to call the cardiology provider.
- After bleeding stops, assess for hematoma.
- After hemostasis, restart bed rest and site checks per protocol.
- Document in a Focus Note in PowerChart.
- Assess distal pulses.
- Check Hgb/Hct, if indicated.

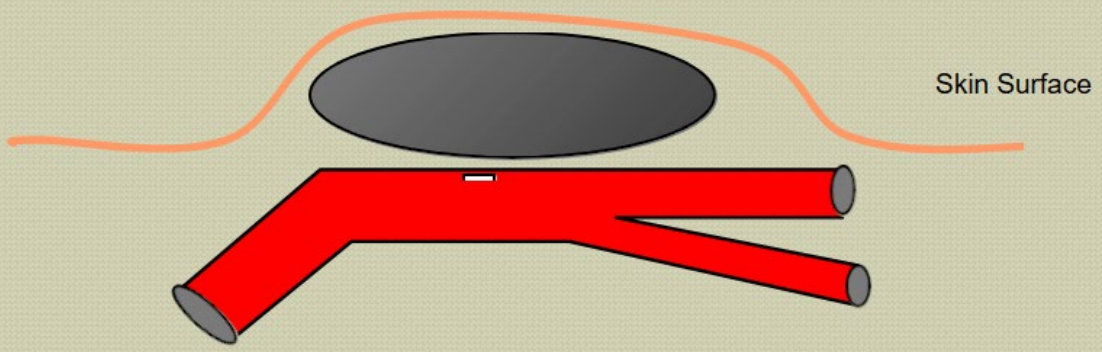


Progress

Vascular Complications: Hematoma

A hematoma is a collection of blood in the soft tissues of the upper thigh causing a tender mass of variable size.

- It is possible for the Hematocrit to drop by ≥ 10% and the hemoglobin to drop by ≥ 3 g/dL.
- The patient may require a transfusion.



Progress

Vascular Complications: Hematoma *(cont.)*

Risk Factors:

- Female gender
- Low platelet count
- Operator technique - inaccurate puncture of common femoral artery; number of arterial punctures
- Anticoagulation and/or platelet inhibitors
- Sheath size
- Delayed sheath pull
- Sheath pull technique
- Noncompliant patient or patient unable to comply with bed rest protocol

Progress

Vascular Complications: Hematoma *(cont.)*

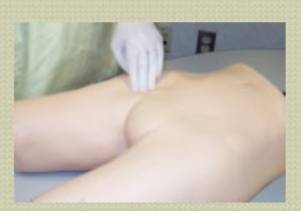
Key Points:

- Hematomas can occur at any time before or after sheath removal.
- Measure (by palpation or imaging) and document the maximal dimension of the hematoma in centimeters.
- Immediate treatment includes correct manual compression. Do not “mash on” or massage the hematoma as this can cause damage to the vessel.
- Serial Hgb measurements and blood transfusions as needed. These are the treatments of choice.
- 1 - 2 weeks is required to reabsorb the hematoma and the patient should be warned about normal changes in the hematoma’s appearance.
- Femoral nerve compression can occur from large hematomas.
- Surgical drainage is rarely needed.
- **Deaths do occur from hematomas - they must be respected.**

Progress

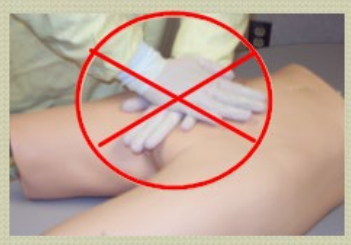
Nursing Considerations: Hematoma

- Assess distal pulse prior to compression.
- Apply gloves and palpate artery just superior to puncture site.
- **Apply manual pressure above the site for minimum of 20 minutes. No peeking!**
- Compression should be forceful enough to prevent increased hematoma formation, while maintaining distal pulses.
- Delegate someone to call the cardiology provider.
- Mark site: measure in centimeters.
- In PowerChart, document both a Focus Note and the hematoma size in Iview.
- Check Hgb/Hct, if indicated.

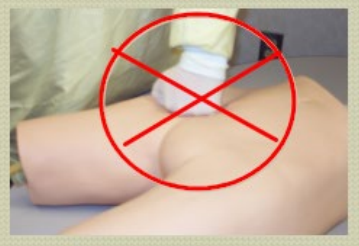


Progress

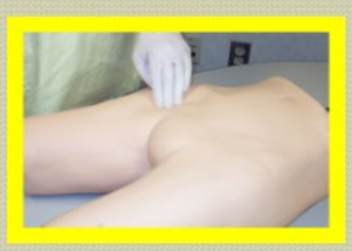
Nursing Considerations: Manual Compression Technique



Wrong Techniques



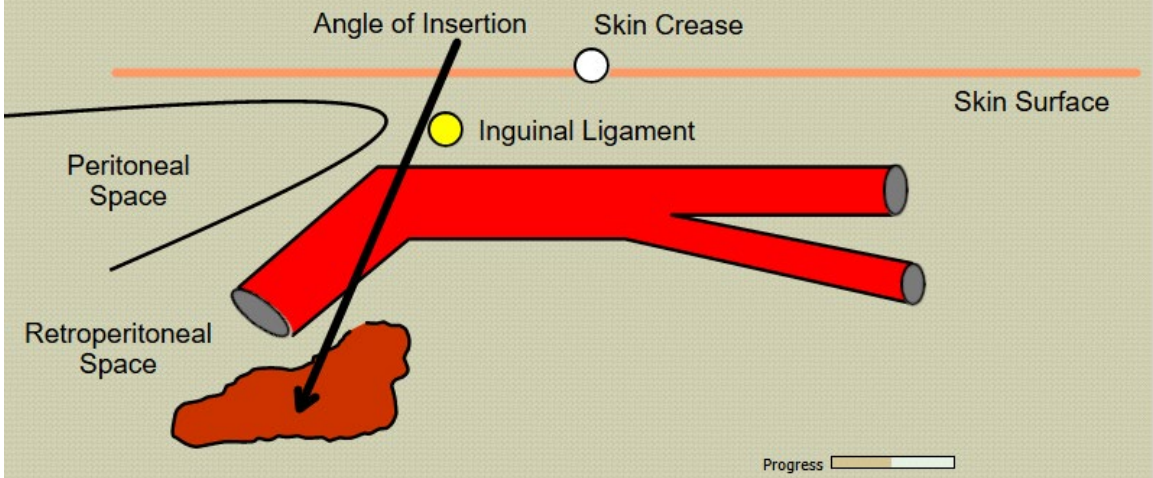
Correct Technique



Progress

Vascular Complications: Retroperitoneal Hemorrhage

A retroperitoneal hemorrhage is a hematoma extending into the retroperitoneal space that usually occurs from arterial puncture above the inguinal ligament.



Progress

Vascular Complications: Retroperitoneal Hemorrhage *(cont.)*

Risk Factors:

- Female gender
- Low platelet count
- Improper operator technique: a “high” stick above the inguinal ligament or a puncture through the back wall of the artery
- Anticoagulation and platelet inhibitors
- Sheath size
- Delayed sheath removal

Progress

Vascular Complications: Retroperitoneal Hemorrhage *(cont.)*

Key Points:

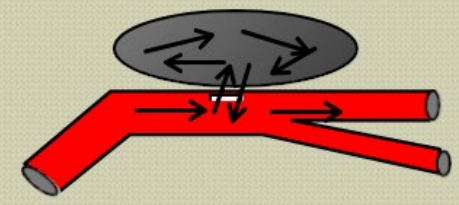
- This type of bleeding is not evident from the surface.
- Symptoms include hypotension, abdominal pain, and ipsilateral flank pain.
- Physical exam may reveal a palpable mass with discoloration over the flank or abdomen.
- Marked anemia can occur from blood loss.
- **This is a life-threatening situation!**
- CT scanning is the diagnostic test of choice.
- Treatment usually involves stopping anticoagulants, bed rest, and blood transfusion.

Progress

Vascular Complications: Pseudoaneurysm

A pseudoaneurysm is an interruption of the artery wall from the femoral artery puncture that does not thrombose when arterial sheaths are removed. This interruption in the arterial wall, caused by the original puncture, allows blood to jet back and forth from the bloodstream to the pouch. The aneurysm is termed "false." It does not involve any layers of the vessel wall as found with a true aneurysm.

"False" aneurysms can be masked by a hematoma and may rupture at any time. They continue to expand because they lack elastic fibers.



Progress

Vascular Complications: Pseudoaneurysm *(cont.)*

Risk Factors:

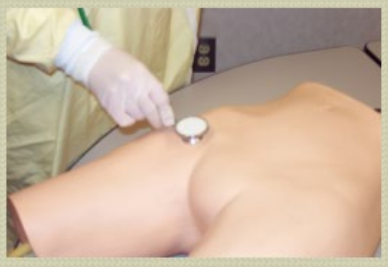
- Anticoagulation and platelet inhibitors.
- Obesity - causes difficulty in maintaining direct pressure.
- Advanced age - causes loss of tissue elasticity.
- Atherosclerotic occlusive disease.
- Increased sheath size - creates larger vascular interruption.
- Improper operator technique.
- Thrombolytic therapy - interrupts previously achieved hemostasis.
- Infection - impairs healing at the site of hemostasis.

Progress

Vascular Complications: Pseudoaneurysm *(cont.)*

Key Points:

- Physical exam reveals a pulsatile mass with a bruit auscultated superior to the puncture site. Bruits are heard when an artery is partially obstructed causing turbulent blood flow.
- Listen for bruits with the **bell** of the stethoscope **held lightly** against the skin.



Progress

Vascular Complications: Pseudoaneurysm *(cont.)*

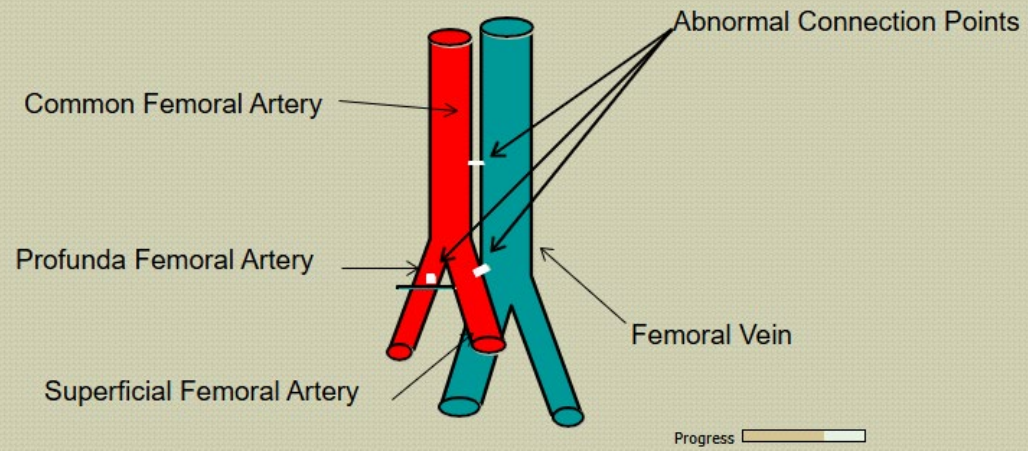
Key Points:

- Duplex ultrasound scanning allows a measure of size as well as distinction from intravenous fistula.
- There is a risk of enlargement and ultimate rupture if not detected and treated.
- Pseudoaneurysms smaller than 3 cm tend to close spontaneously or with compression.
- Those larger than 3 cm require alternative methods:
  - Ultrasound guided compression
  - Thrombin injection
  - Surgical repair

Progress

Vascular Complications: Arteriovenous Fistula

An arteriovenous fistula is an abnormal connection between an artery and a vein which forms when ongoing bleeding from the arterial puncture site decompresses into an adjacent venous structure.



Progress

Vascular Complications: Arteriovenous Fistula *(cont.)*

Risk Factors:

- Anticoagulation and platelet inhibitors.
- Female gender.
- Obesity - causes difficulty in maintaining direct pressure.
- Advanced age - causes loss of tissue elasticity.
- Atherosclerotic occlusive disease.
- Increased sheath size - creates larger vascular interruption.
- Improper operator technique.
- Poor sheath pull technique.
- Thrombolytic therapy - interrupts previously achieved hemostasis.
- Infection - impairs healing at the site of hemostasis.

Progress

Vascular Complications: Arteriovenous Fistula *(cont.)*

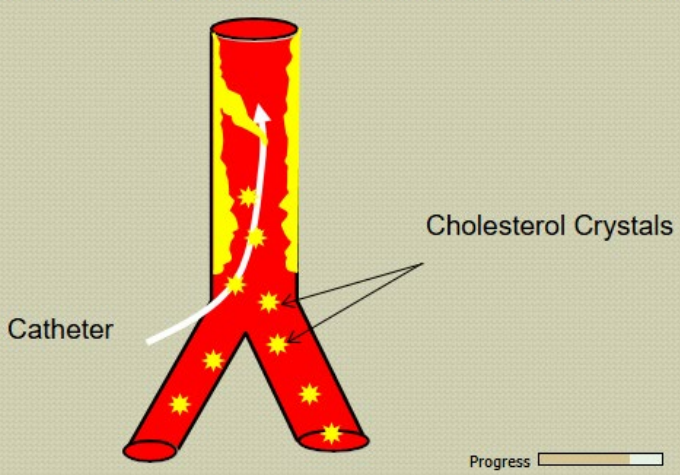
Key Points:

- AV fistulas may not present for days.
- Physical exam reveals a to-and-fro murmur or continuous bruit.
- AV fistulas tend to enlarge with time.
- If they do not close spontaneously after 2 - 4 weeks, surgical repair is indicated.

Progress

Vascular Complications: Atheroembolism

- The release of cholesterol crystals and other microscopic debris from the aorta after catheter manipulation results in mechanical trauma to friable atheromatous plaques.
- Distal embolization may occur to the lower extremities and abdominal viscera.



Progress

Vascular Complications: Atheroembolism *(cont.)*

Key Points:

- Physical exam may reveal a cyanotic foot in the case of microemboli and signs of limb ischemia in the case of macroemboli.
- Renal failure can occur if the renal arterial bed is involved.
- Distal gangrene and death can occur, in extreme cases.
- The onset is often insidious and can take days to months to become evident.
- Management is variable depending on the severity.

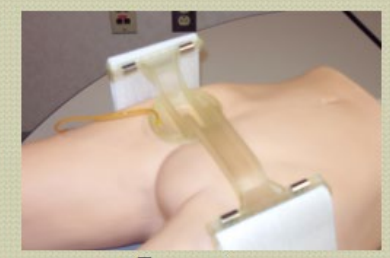
Progress

Compression and Closure Devices

Compression of an artery and the use of closure devices must be deployed correctly and appropriately to decrease the risks of vascular complications. You may need to perform manual pressure or utilize a Femostop if the patient re-bleeds.

Compression options:
- Manual pressure
- Femostop

Closure devices:
- Angioseal
- Perclose
- Vascade



Femostop

Note: Femostops should not be used on patients with peripheral vascular disease.

Progress

Compression and Closure Devices *(cont.)*

Key Points:

- Multiple studies have shown that the lowest complication rates occur with correctly applied manual pressure.
- Incorrect application of compression devices is a common error in post sheath removal care.
- Bleeding, despite a compression device (Femostop), mandates removal of the device and manual control of the hemorrhage.
- Closure devices are not a substitute for close observation and have their own set of possible complications.
- If a closure device fails, manual control of the hemorrhage is needed.

Progress

Nursing Considerations: Femoral Post Sheath Removal

- Post procedure checks per protocol (every 15 min x 4, every 30 min x 4, every 1 hour until stable, then prn).
- Document post procedure checks in IView.
- Per Interventional Order Set:
  - Bed rest and activity guidelines
  - PRN medications for back pain or discomfort
  - IV fluid discontinuation or restart
  - Ambulate at least 1 hour prior to discharge
- Patient education on re-bleeding and groin care.
- When receiving the patient, always check the site together with the recovery nurse before he/she leaves the room.

Progress

Nursing Considerations: Hypotension

Systolic BP < 90 mmHg:

- Increase IV fluids: Give 250 ml 0.9 NS bolus and call cardiologist for further orders.
- Give 0.5 mg – 1 mg Atropine IVP if suspect cause is due to vasovagal stimulation.
- Call cardiology provider if hypotension does not resolve quickly.
- Assess for signs of retroperitoneal bleeding (i.e., flank pain, increased heart rate, decreased blood pressure).
- Assess for signs of a pseudoaneurysm (i.e., auscultated bruit).

Progress

Nursing Considerations: Bradycardia Due to Vasovagal Stimulation

- Give 0.5 mg – 1 mg Atropine IVP.
- Treat cause of vasovagal response (i.e., anti-emetics for nausea/vomiting).
- Increase IV fluids for associated hypotension.
- Call cardiology provider if bradycardia does not resolve quickly or if ACLS treatment is required.
- Assess hand/Femostop positioning and adjust.

Progress

Nursing Considerations: Loss of Pedal Pulses

- Assess affected limb for pain, coolness, or mottling.
- Attempt to find pulse with a Doppler.
- Adjust amount of pressure to obtain a balance between hemostasis and adequate pulses.
- Call cardiology provider.

Progress

Patient Education: Femoral Post Procedure Instructions

- Can elevate HOB 30 degrees 1 hour post procedure. May log roll patient to affected side in 1 hour.
- Vital signs/groin assessment checks - every 15 minutes x 4, then every 30 minutes x 4, then every 1 hour until stable, and prn.
- Notify RN of any pain, change in sensation, warmth, or bleeding at the groin site.
- Notify RN of any signs and symptoms of angina: chest discomfort; jaw, neck, arm, or shoulder pain; shortness of breath; sweating; nausea; dizziness or lightheadedness.

Progress

Patient Education: Femoral Post Procedure Instructions *(cont.)*

- The RN may administer an anti-emetic agent to prevent vomiting which causes unnecessary strain at the groin site.
- Refrain from activities that will cause strain to the groin site; for example, do not lift head, raise up on elbows, or bend knees when repositioning.

Progress

References

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Progress

MUNSON HEALTHCARE

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Fire Safety in Anesthetizing/ Procedural Areas

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July 2024

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Goal and Objectives

Goal:

To educate anesthetizing/procedural area staff about the recommended actions for fire prevention and fire response.

Objectives:

After completing this activity, the participant will be able to:

1. Identify the three components of the fire triangle.
2. Identify steps for fire prevention interventions.
3. Describe the staff's role in fire safety.
4. Discuss the steps to extinguish a fire.

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Procedural Fire Facts

According to The Joint Commission (TJC)

- 90-100 surgical fires occur yearly.
- 70% involve use of an electrosurgical device (ESU), also known as a Bovie.
- 15% are related to use of a light source.
- Other contributing factors include:
  - Inadequate orientation, understanding and/or communication of fire risk in procedural areas
  - Insufficient time-out procedures
  - Overconfidence, distraction, or loss of situational awareness
  - Equipment malfunction

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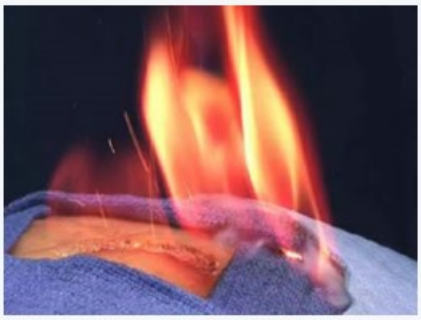
It Happens Here!

In the first quarter of 2022, an MHC OR had two fire/unintentional smoke events from equipment (laser and surgical drill). No patient or staff injury occurred.

Also in April 2022, a fire occurred when a patient applied petroleum jelly to their lips while on high-flow oxygen. The patient sustained first- and second-degree burns.



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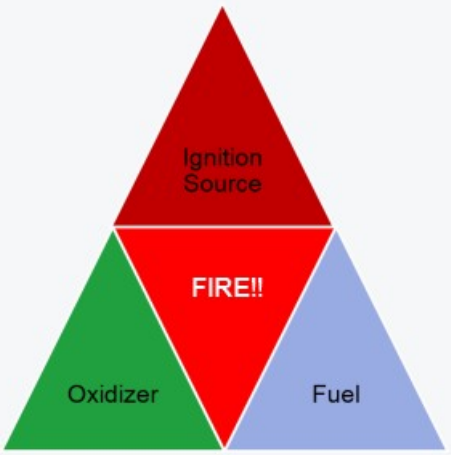
Fire Triangle

There are three elements necessary for a fire:

- Ignition source
- Fuel
- Oxidizer



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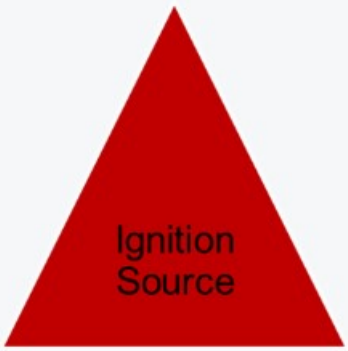
Common Ignition Sources

An ignition source is anything providing enough energy to start a fire:

- ESU/Bovie
- Argon beam coagulator
- Power tools (e.g., drills, burrs)
- Laser
- Fiber Optic light cords
- Defibrillator
- Electrical equipment



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Common Fuels

A fuel is anything that will burn:

- Alcohol-based skin antiseptic agents (preps)
- Drapes
- Gowns
- Endotracheal tubes
- Skin degreasers/tinctures/aerosols
- Body tissues and hair
- Intestinal gases
- Petroleum-based products

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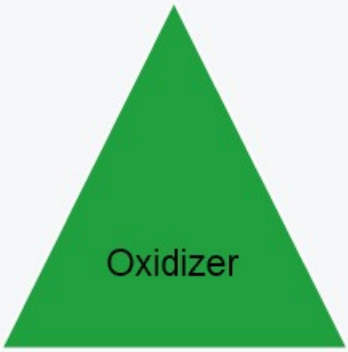
Common Oxidizers

An oxidizer is a gas which supports combustion:

- Oxygen
- Nitrous oxide



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Fire Risk Assessment

Fire risk assessment is a team effort.

As part of the preprocedural briefing process, the proecdural team should initiate a fire risk assessment to assess for the presence of the three elements of the fire triangle (AORN).

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Fire Risk Assessment *(cont.)*

Before each procedure, evaluate the following:

- Are there alcohol-based prep agents or other flammable solutions being used?
- Is the procedure being performed above the xiphoid process?
- Is there open oxygen or nitrous oxide being administered?
- Is an ESU, laser, fiber-optic light cord, defibrillator, drill, or saw being used?
- Are there other possible contributors?

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You must complete the activity.

Controlling Ignition Sources

Click each arrow:

Fiber-Optic Light Source:

- Place the light source in standby mode or turn it off when not in use.
- Inspect light cables before use. Remove from service if broken light bundles are visible.
- Place the scope and light source on a designated heat-resistant surface when not in use.

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Controlling Fuels

Surgical Skin Prep:

- Prevent pooling of skin prep solutions.
- Remove and discard prep-soaked materials, ensuring they are at least 3 feet from an ignition source.
- Skin prep dry time should follow manufacturer instructions for use to allow fumes to dissipate before draping.
- Allow chemicals to dry (e.g., alcohol, collodion, tinctures).
- Use water-soluble gel to cover facial hair.

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Controlling Oxidizers

Considerations for oxygen/flammable gas administration:

- Check the anesthesia circuits for possible leaks prior to the start of the procedure.
- Tent the surgical drapes to allow for free air flow.
- Keep the oxygen percentage as low as possible on non-intubated patients.
- Inform the surgeon when an open oxygen source is being used.
- Turn off oxygen or nitrous for 1 minute prior to use of an ignition source in head, neck, or upper chest procedures.

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Controlling Oxidizers *(cont.)*

Oropharynx Procedures

- Inflate the endotracheal tube cuff with tinted saline.
- Evacuate intended surgical smoke from small or enclosed spaces.
- Pack wet sponges around the back of the patient's throat.
- Document placement and removal of throat sponges.
- If oxygen is being used, suction the patient's oropharynx deeply before using the ignition source.

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See Unintended Smoke or Flames?

Pull the fire alarm!

All team members should be alerted to the presence of a fire or unintended smoke, no matter how small. Alerting other team members decreases the risk of injury to the patient and personnel.

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Fire Pull Station Locations and Responders

- It is the responsibility of each team member to be aware of the locations for fire pulls in his/her areas.
- When a fire pull is activated, the facility response team and the fire department will respond to the alarm.
- Assign a staff member to assist responders with donning disposable coveralls and lead them to the location of the fire.

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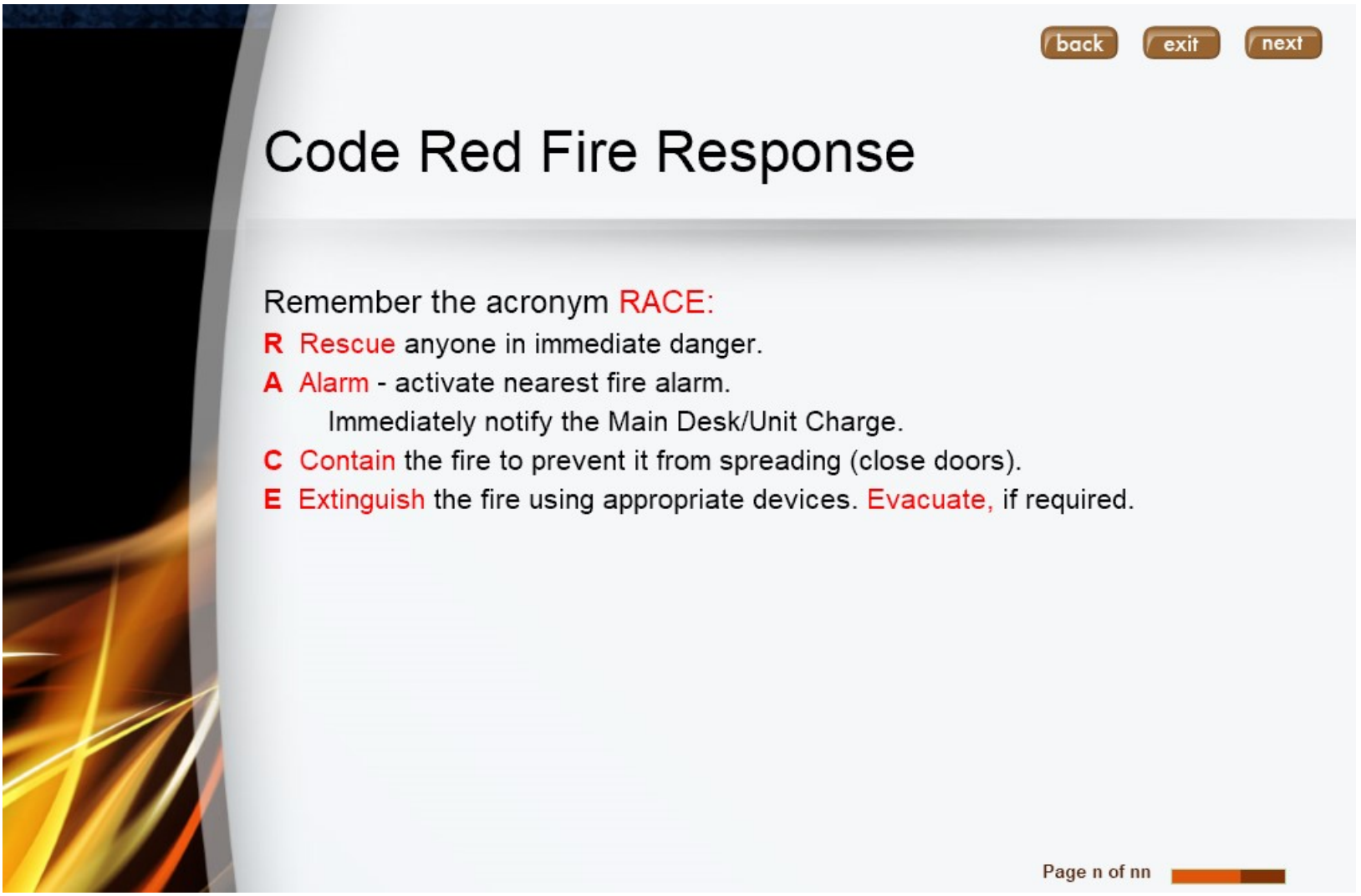
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Code Red Fire Response
Remember the acronym RACE:
R Rescue anyone in immediate danger.
A Alarm - activate nearest fire alarm.
Immediately notify the Main Desk/Unit Charge.
C Contain the fire to prevent it from spreading (close doors).
E Extinguish the fire using appropriate devices. Evacuate, if required.
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Medical Gas Shut-off

Be aware of the medical gas shut-off valve locations in your area. They are typically located outside the procedural suite and labeled.

In the event of a fire, the team should critically evaluate medical gas shut off for that specific area, then communicate medical gases have been emergently shut off in your location.

The decision to further shut off medical gases is made upon mutual consent among Nursing Administration, Respiratory Therapy, Facilities services, and anesthesia providers (if present).

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Extinguish a Fire Using Solution

- Douse the base of the fire with a nonflammable liquid (saline or water) if readily available.
- Impermeable drapes must be removed to effectively extinguish the fire.

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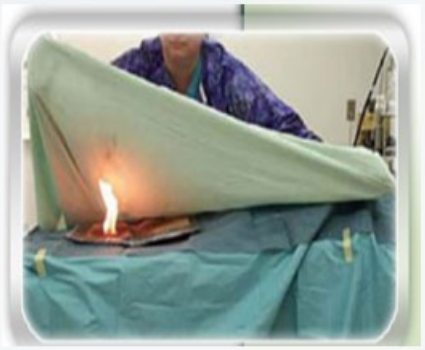
Extinguish a Fire by Smothering

- Keep your body away from fire.
- Hold towel between fire and patient's airway.
- Drop the end of towel closest to the head.
- Drop the other end of towel over the fire.
- Sweep hand over towel from head toward feet. DO NOT PAT the fire! This fans the flames and expands the fire.
- Lift the towel carefully to determine if flames are extinguished.
- Remove drapes or burned material from patient and inspect for injury.



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Extinguish a Fire Using a Fire Extinguisher

Remember the acronym PASS:

P Pull the pin.

A Aim nozzle at the base of the fire.

S Squeeze the handle to release the extinguishing agent.

S Sweep the stream over the base of the fire.

If possible, spray extinguisher away from the patient or other people.

http://www.dol.gov

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Fire Extinguisher Types

Most patient care areas have ABC multipurpose fire extinguishers available for use.

A. Fires involving wood, paper, cloth, and post plastics.
B. Fires involving flammable liquids or grease.
C. Fires involving energized electric equipment.

Some areas (OR, Sterile Processing, and MRI suites) may also have specialty extinguishers such as BC, CO_2, or water mist (non-magnetic) available for use.

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Airway Fire Management

Assist the anesthesia provider to:

1. Stop the medical gas flow.
2. Disconnect the breathing circuit.
3. Pour normal saline or water directly into the airway, if directed.
4. Remove the endotracheal tube, saving any burned segments.
5. Examine the airway.
6. Re-establish airway support.

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After a Fire is Extinguished

1. Inspect the area for a secondary fire on the underlying drapes or towels.
2. Assess the patient for injury.
3. Determine what needs to be done to complete the case (new room, tear down, supplies, instruments, etc.).
4. Complete an incident report using VOICE.
5. Notify nursing administration and the administrator on call.
6. Save all materials from the fire for inspection by facility specialists and the fire department.

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Fire Evacuation

Depending on the severity of the fire, evacuation may be limited to the immediate area followed by partial or total department evacuation.

Unless the patient and staff are in immediate danger, the decision to evacuate and the safest route to go occurs in conjunction with unit/facility leadership.

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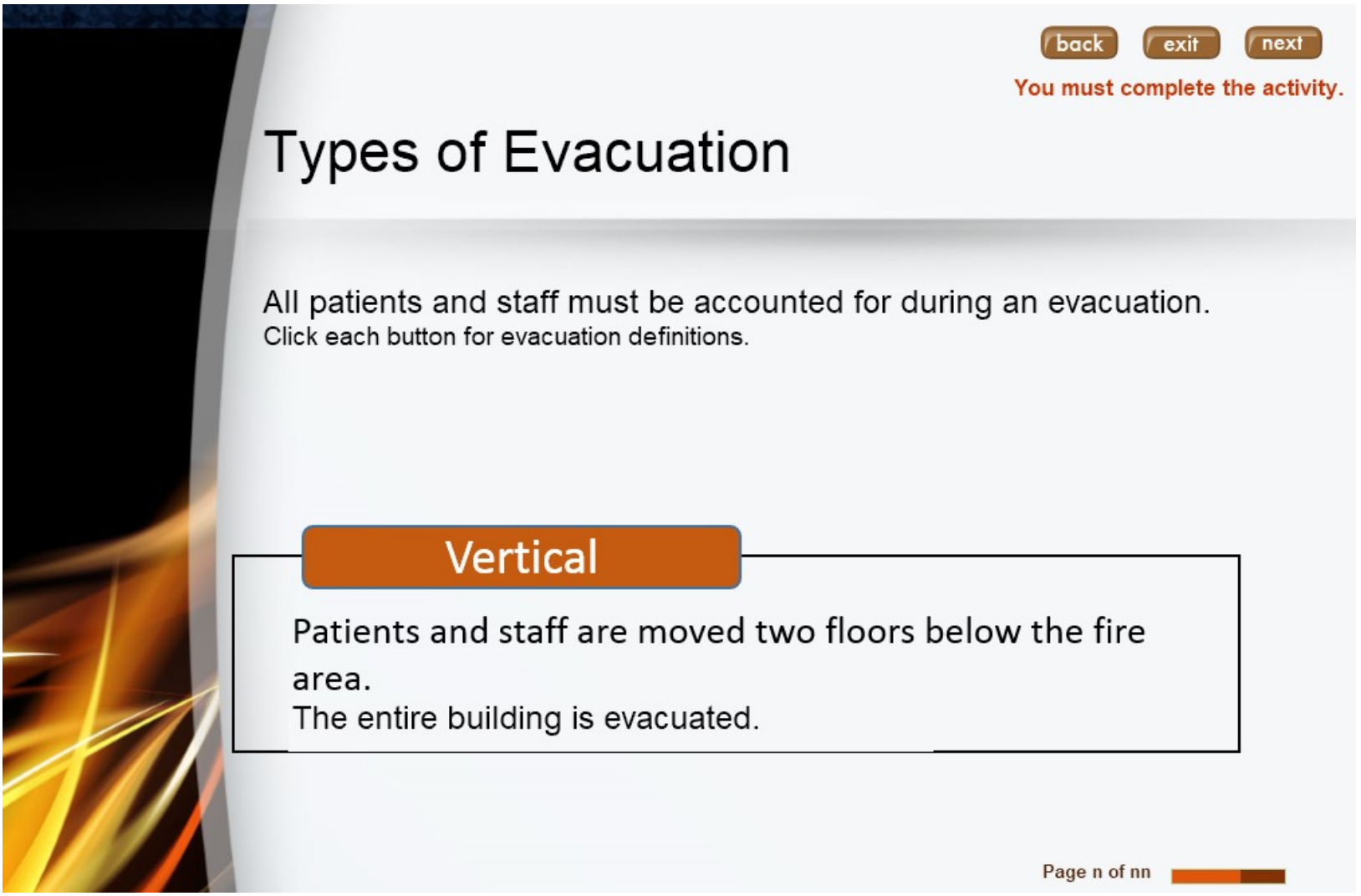
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You must complete the activity.
Types of Evacuation
All patients and staff must be accounted for during an evacuation.
Click each button for evacuation definitions.
Vertical
Patients and staff are moved two floors below the fire area.
The entire building is evacuated.
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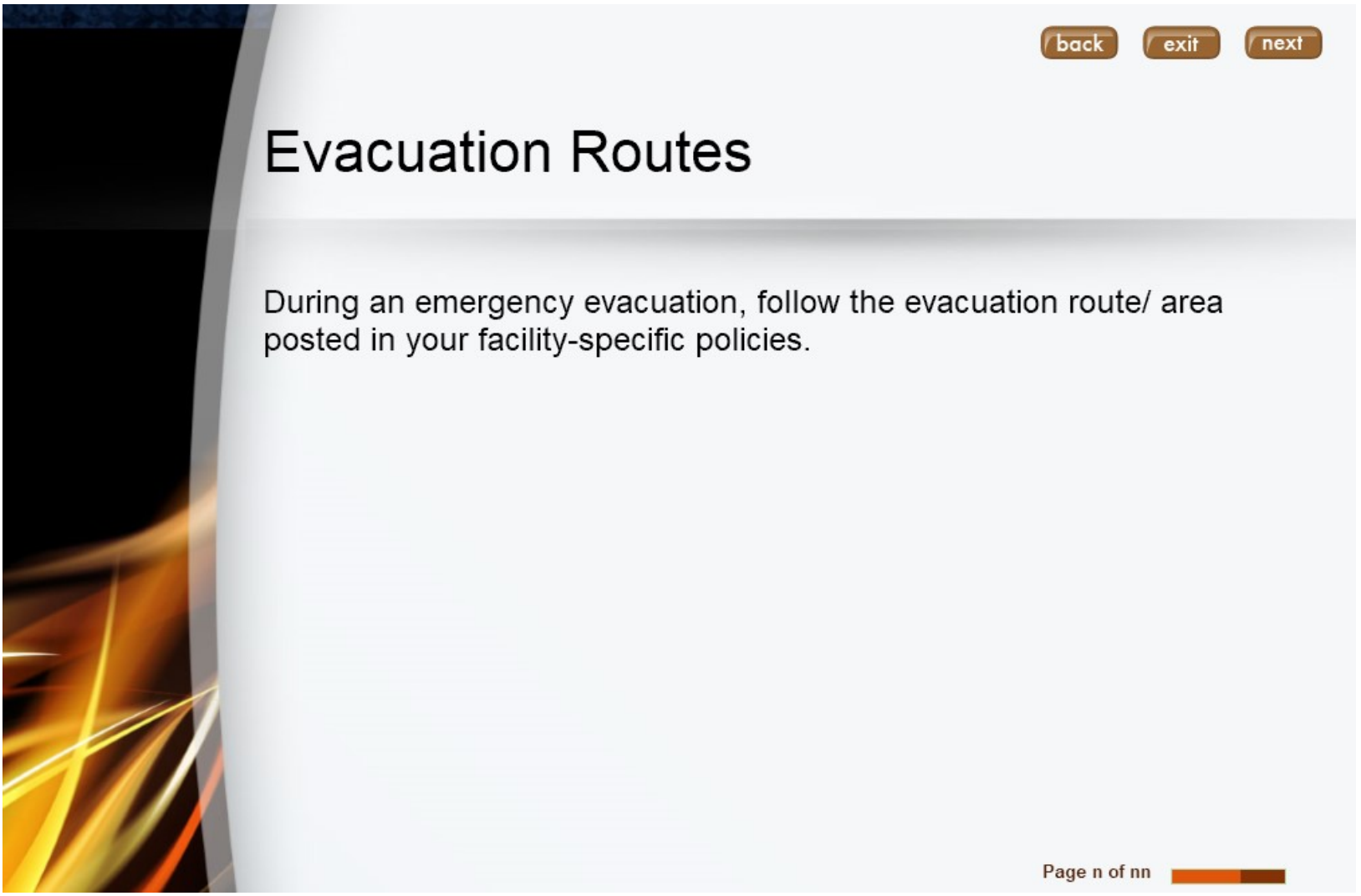
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Evacuation Routes
During an emergency evacuation, follow the evacuation route/ area posted in your facility-specific policies.
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Teamwork

Fire prevention and fire control takes a **critically-thinking team**.
Keep in mind the following:

- Location of the fire alarms, extinguishers, and gas shut-offs.
- Closest evacuation route.
- Cases that are at risk for fires.
- Steps to take to prevent fires.
- Steps to take when there is a fire.
- Who to contact STAT.

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Association of PeriOperative Registered Nurses. (2022). *Fire safety toolkit.* *https://test.aorn.org/guidelines/clinical-resources/tool-kits/fire-safety-tool-kit*

MHC PolicyStat Evacuation Plan

MHC PolicyStat Munson Medical Center Fire Plan

MHC PolicyStat Operating Room Fire Plan

Pfander, Valerie (2017-2022). Fire Safety in the Operating Room. Munson Medical Center

Philips Monitoring System (MUNSON)

Philips Monitoring System (MUNSON)

Introduction

Central Monitoring System

The Philips Patient Information Center is a regulated medical IT system that:

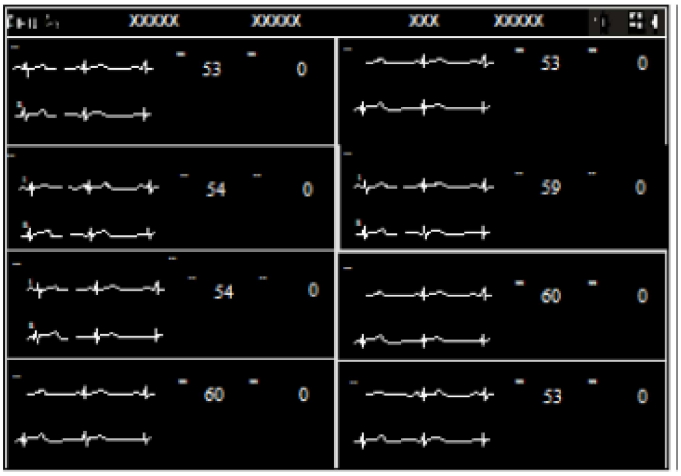
- Provides continuous monitoring of patient vital signs from admission to discharge.
- Consolidates and communicates vital signs data from monitors and third-party devices to caregivers and to the Electronic Medical Record (EMR) for a complete patient record.
- Supports industry standard interfaces to integrate into existing hospital IT infrastructure and EMR systems while meeting requirements for manageability, serviceability, and security.
- Meets the needs of caregivers on the go by means of remote access to patient vital signs for information anywhere.

Through a combination of advanced alarm management, mobility, and clinical decision support, Philips Patient Monitoring Systems enable reduction of non-actionable alarms, improve workflow efficiency, and facilitate early intervention of patient deterioration to improve patient care and outcomes.

The Information Center software runs on a PC workstation with one or two displays for viewing patient data and accessing clinical applications. A mouse and keyboard are provided for entering and changing patient data and other information. If you position the cursor on a labeled application button and click, the application is immediately displayed on the screen. Note that an on-screen keyboard is not available.

With a touchscreen, you can access patient data by either using the mouse or by touching the item on the screen with your finger or a stylus. The mouse is best for making precise selections and measurements, such as using calipers. The touchscreen is best for actions such as acknowledging alarms, accessing application windows, or recording strips. When using a touchscreen, keep the area free of items that can inadvertently touch the screen. If the touchscreen becomes unavailable for any reason, you can access patient data by using the mouse and keyboard.

The Main Screen displays real-time waves, numerics, and alarms from multiple patients. It can be configured to show up to 64 waves, and contains the following elements:



1 Caption Bar

2 Patient Sectors

 Select the Patient Window button to open the Patient window to Display a real-time view of the current patient's data. You also can choose to do an ECG analysis to view all available ECG leads. The Patient Window provides a real-time view of the patient's waves and numerics. You can view patient data and perform all tasks in the Patient Window. In addition to the waves and numerics, the Patient Window contains the following items:

- The Bed Label Pane - Displays the bed label and ID for the currently selected patient. Select the down arrow to select another patient to view.
- The Print Icon to start a printout of the Patient summary report.
- The Help Icon.
- Alarm message areas – All active alarms and technical alarms display on the top right of the patient window. Status messages are color-coded to indicate the message severity. Orange background indicates high severity. Black background indicates low severity. Select the status message to open System Help in the application window. The Help contains a list of status messages with the possible causes and recommended actions for each message.
- Patient Name - Displays the patient's name. Depending on the length of the complete string and the amount of available space, a minimum number of characters is shown, ending with an ellipsis (...). Three question marks (???) precede the patient's name when there is a problem identifying the patient. For example: Patient data between the Information Center and the bedside does not match. All required information was not entered when the patient was admitted.

Buttons in the sector become visible when you move the cursor into the sector or, if using a touch screen display, when you first touch the sector with a stylus or the tip of your finger. When you place the cursor inside a patient sector, the sector is outlined in an orange border. You can minimize the buttons by moving the cursor into the sector and holding down the **Ctrl** key. While the cursor is inside the sector, the buttons remain minimized until you press the **Ctrl** key again. If you move the cursor out of the active sector and move it back in, the buttons become visible.

 Select the Manage Patient icon, which will allow you to:

- Admit, discharge, and transfer patients.
- Enter or update patient demographic information.
- Manage the equipment associated with the patient.
- Temporarily place the bed in standby.
- Enter a temporary transport location, and/or select the patient's equipment to place in standby.
- Export ECG waveform data to a Philips Holter system for analysis.

To Admit a Patient: Use one of the following methods:

- Manually enter new patient information in the fields in the **Patient Demographics** section by typing a 1-30 character first and last name in the appropriate fields. You can use the TAB key to move from field to field. You can also admit a new patient by entering the MRN.
- Use the **Find Patient...** option to find a patient who is being monitored in another Information center or who has been recently discharged.

You can then choose the patient's gender from a drop-down list. It will default to Male while performing a 12-lead if not assigned. It will default to Female while measuring STE if not assigned. Specify the patients birth date by entering it on the calendar. This will update the age field. Enter the patient's height in the appropriate field. This can be in inches or centimeters according to your policy. Enter the Patient's weight using pounds or kilograms according to your policy. Select "Apply" after verifying all information is correct.

Read all confirmation messages and check patient alarms, settings, and paced status when automatic admission, discharge, or transfer is complete.

Viewing and Adjusting Waves:

When the ECG measurement is on, the first wave displayed is the primary ECG wave. The primary wave is always used for ECG analysis. A rhythm status message displays in the upper right corner of the wave, and an arrhythmia status message displays above and in the center of the wave.

Pleth waves on an Efficia monitor are labeled as SpO2.

Wave Adjustments

You can adjust waves in the patient sector or Patient Window layout by selecting a wave then selecting one or more options described below.

- Change Wave – Select a wave from the list. You cannot select the primary ECG wave.
- ECG Analysis – Available if you select an ECG wave. Select to access the ECG Analysis application.
- Primary Lead – Available if you select the primary ECG wave. Select the primary led from the list.
- Size up or Size down - Select to increase or decrease the size (gain) of the wave (if available).
- Set up ECG – Available if you select an ECG wave. Select to access the **Measurements** application ECG page, where you can change heart rate limits and asystole thresholds.

Manually Transferring a Patient to a New Bed: Transfer data for a patient by performing the following steps:

- Use one of the following methods to open the **Manage Patient** In the sector for the bed that you want to transfer, select the name field or select the **Manage Patient** shortcut button. In the application window task bar, select the **Manage Patient** button.
- Select the **..** button. The **Transfer Patient** dialog box displays a list of available beds in the institutions and units.
- To transfer this patient to another bed within this unit, select the bed from the list of beds in your unit. To transfer this patient to a bed in another unit, first select the unit name, then select a bed from the list.
- Specify whether to clear the sector (remove the bed from the sector) upon transfer by selecting or clearing the **Clear Sector** check box. The system can be configured so that the check box is selected by default. Depending on your unit practices, you may want to clear the check box so the sector is not cleared and the equipment remains assigned to the sector.
- Select "OK".
- Confirm the transfer by selecting the orange "TRANSFER" button.

To Discharge a Patient: Use one of the following methods to discharge a patient.

- Manually discharge a patient in the **Manage Patient** application.
- Discharge a patient directly from the hospital information system or bed management system.

Considerations

Before discharging a patient, note the following:

- Discharging the patient at the Information Center also discharges the patient from the bedside monitor. All monitor and MMS settings (including arrhythmia settings) reset to their defaults.
- When you discharge a patient, the Information Center saves the patient data for all admitted patients. The system stores seven days of data and purges the stored data seven days after discharge.

You can search discharged patient data without readmitting for up to seven days.

- If you readmit a patient, the discharge data is overwritten by new monitoring data as it occurs, and you will only see the full disclosure amount of data.
- Monitoring devices may be set up with predefined configurations called *profiles*. When you discharge a patient, the profile reverts to the default profile configured for the device. Refer to your monitoring device documentation for details. When

you discharge an admitted patient at the Patient Monitor, the Information Center discharges the patient and saves the data.

- *Important* — For MRx monitors, turning off the bedside monitor for more than 10 seconds discharges the patient at the MRx monitor and resets defaults, but it does not discharge the patient from the Information Center; the patient is still admitted at the Information Center. It is important to discharge the patient before turning the monitor off to avoid data being associated with the wrong patient.
- Patients that are discharged while the Information Center is in Local/Disconnected mode will be synchronized upon connection to the primary server.

Warning

Read all confirmation messages and check patient alarms, settings, and paced status when automatic admission, discharge, or transfer is complete.

Measuring ECG:

The electrocardiogram (ECG) measures the electrical activity of the heart and displays it on the

Information Center as a waveform and a numeric. In order to compare measured ECG signals, the electrodes are placed in standardized positions, forming "leads". To obtain ECG signals optimized for use in diagnosis and patient management in different care environments, different lead placements can be used.

Selecting the Primary and Secondary ECG Leads

The telemetry device or patient monitor uses the primary and secondary lead selected at the

Information Center to compute HR and to analyze and detect cardiac arrhythmias.

You should choose a primary and (if using multi-lead monitoring) secondary lead that have the

following characteristics:

- the QRS complex should be either completely above or below the baseline and it should not be biphasic
- the QRS complex should be tall and narrow
- the T-wave should be less than 1/3 the R-wave height
- the P-wave should be less than 1/5 the R-wave height

Documenting Patient Events

Documentation of patient events and procedures is a necessary element of patient care. You can print reports from the PIC iX to paper, electronically via PDF, or both.

Create a Saved Strip

You can create a saved strip with the PIC iX electronic caliper (eCaliper) measurements and comments in any strip tile in Alarm Review, General Review, or specialty review applications.

Note —You must have Full Permission Access to annotate and save a strip to the database.

- Select the strip that you want to annotate.
- Select the Annotate icon. The Saved strip dialog box opens. You can move the dialog box as needed.
- Select a label from the drop-down list to add labels. This field can be customized as needed in Alarm Review.
- Enter text in the second field, up to 30 characters. This value displays in the Comment field for the strip.
- Add eCaliper measurements. Consider changing the wave speed to 50 mm/sec. (Select the speed on the bottom right of the strip, then select a speed from the list.) Click and drag in the strip to and from the desired location in the wave. The measurement is displayed between the vertical lines. In the dialog box, click the measurement label to add the measured value. *Note* — Double-click the measurement to see the caliper bars at any time.
- Select another strip and repeat these steps as needed.
- When you are done, select Save. The measurements are saved to the strip.

Reviewing ECG Waves

Depending on the number of ECG leads and licensing, 3 to 12 waves are available for review. These waves can be reviewed with the other data tiles, such as with events and alarms.

Alarms:

Quickly Viewing Target Events - When reviewing patient data, it is often helpful to quickly view specific types of alarms or events.

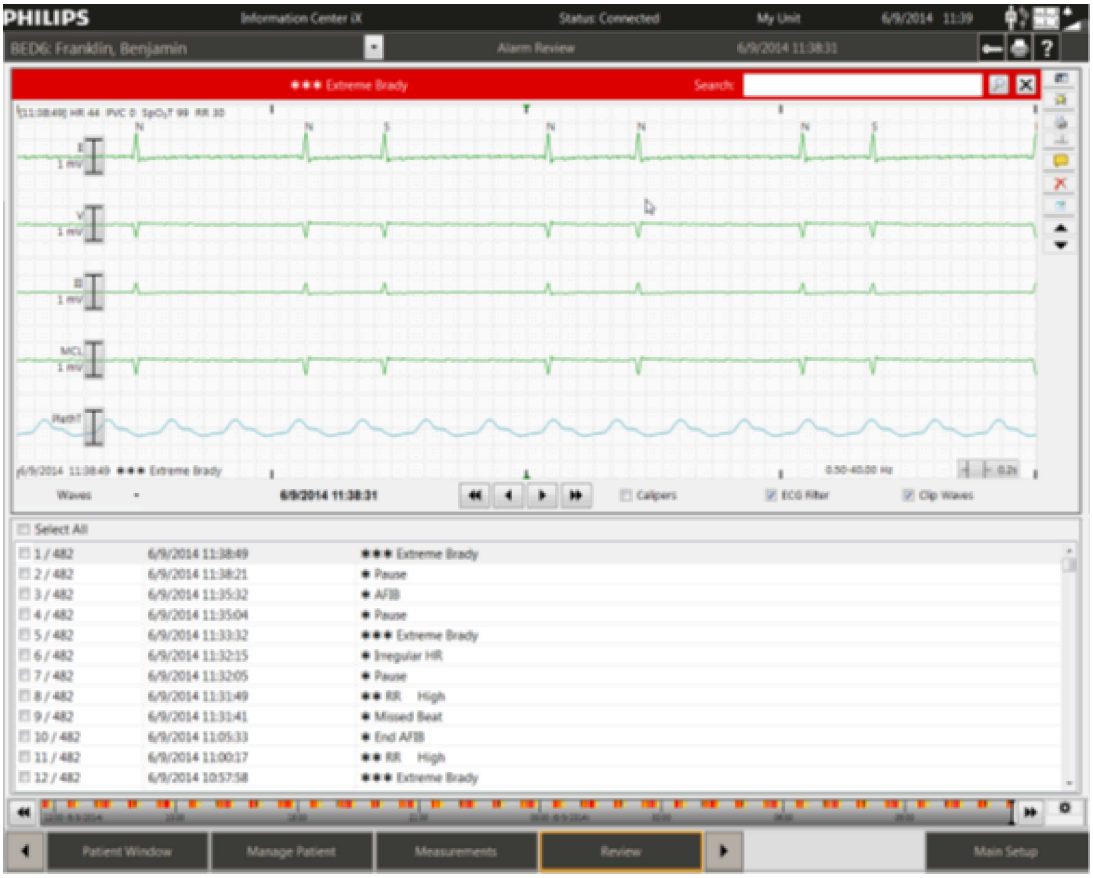
Fast Alarm Review - Select either the Acknowledge key, or the alarm banner in the sector to see alarming waves prior to being available in other applications. Alarm strips can be printed, annotated, or discarded. If you are using secondary notifications, such as with Philips CareEvent, you can manually page an alarm from this application.

Note — The Silence key is called the Acknowledge key.

Alarm Review

Alarm Review always opens with the most recent alarm strip. To review alarms, open Alarm Review from the Review sector button, if configured, or you can open Alarm Review from the main Setup menu or from the Review application menu in any open application. Use the toggle icon to switch between the three different tiles. The tile you prefer can be set up as a default on each host.

- **Tabular** tile – shows a detailed strip with multiple waves and a tabular list of alarms. Use the up and down arrow keys to quickly view alarm strips. This is the factory default tile.
- **Compressed** tile – shows 30 seconds of compressed waves for all strips.
- **Strip Window** tile – a combination of Compressed and Strip tiles.



Reviewing Alarms and Events in Other Applications

Within the factory default review applications (as well as custom applications that were created for your unit), there is a data type called the Event tile. You can use the Event tile to review alarms with other associated data, such as compressed wave storage or graphical trends. Arrhythmia events are also shown, even when a specific alarm is off, such as for yellow level ventricular alarms. The length of the colored box indicates the duration of the event.

- Open the review application. If opened from Alarm Review, the time focus is the selected alarm. If opened from another application, it opens at the current time minus the one minute for storage.
- The Event tile is highlighted below. Note the displayed number of events shown on the right. Alarms are shown with the corresponding color, and arrhythmia events are shown in cyan.

- Clear the check box next to the events you do not want to see. If licensed, specific events can be customized for each review application.
- Move the cursor over any alarm or event to see text that contains the details.
- Select the event to examine its associated waves, trends, and numerics.
- Use the arrow keys in the middle of the tile to quickly navigate to next or previous events.

 Alarms off. Displays next to the numeric when alarms are turned off for the numeric.

 Pause Alarms (Red and/or yellow). **PRESS THIS BUTTON AGAIN TO RESUME ALARMS!**

 Acknowledge/Review Button. Turns off the alarm sound and the sector background changes from blue to black.

 Volume icon. Select to adjust the alarm volume.

Physiological alarms are red and yellow alarms. A red alarm indicates a high priority patient alarm such as a potentially life-threatening situation (for example, asystole). A yellow alarm indicates a lower priority physiological alarm (for example, a respiration alarm limit violation). Additionally, there are short yellow alarms, most of which are specific to arrhythmia-related patient conditions (for example, ventricular bigeminy). Alarm message areas. All active alarms and technical alarms/INOPs display on the top right of the patient sector. A RED warning alerts you to a potential serious outcome, adverse event or safety hazard. Failure to observe a warning may result in death or serious injury to the user or patient. A YELLOW caution alerts you to where special care is necessary for the safe and effective use of the

product. Failure to observe a caution may result in minor or moderate personal injury or damage to the product or other property, and possibly in a remote risk of more serious injury. Technical alarms, or INOPs indicate that the monitoring device cannot measure or detect alarm conditions reliably. If a technical alarm interrupts monitoring and alarm detection (for example, LEADS OFF), the numeric is replaced by a question mark in the sector and Patient Window, and an audible indicator sounds. Technical alarms without this audible indicator indicate that there may be a problem with the reliability of the data, but that monitoring is not interrupted. Most technical alarms are light blue, however there are a small number of technical alarms that are always yellow or red to indicate a severity corresponding to red and yellow alarms.

There can be only one alarm sound annunciating at the Information Center at one time.

- If there is an unacknowledged red level alarm in the presence of any other level alarm, the sound for the red alarm annunciates.
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- If there is no unacknowledged red level alarm or long yellow level alarm condition and there is an arrhythmia or nurse call event, the short yellow (*) alarm sound annunciates.
- If there are no unacknowledged red or long/short yellow alarm conditions and there is any bed with an unacknowledged technical alarm condition, the sound for the technical alarm annunciates.
- If multiple sectors are in alarm, once the highest level alarm is acknowledged in a sector the next highest alarm annunciates.
- An alarm tone indicates the alarm type. There is no sound for soft INOPs/technical alarms.

Other Buttons and Icons:

 **Battery icon.** If there is at least one battery-operated device assigned to this patient, the battery icon indicates the device with the least amount of battery strength. Move your cursor over the icon to view a list of equipment for this patient sorted from the lowest to highest battery charge. The battery icon has five levels: approximately 100% to 80%, 80% to 60%, 60% to 40%,40% to 20%, or -Replace Battery strength. The number of segments indicates the approximate power level.

 **Help icon**. Select to view the online Help application. The Help application is always available and provides context-specific information on using the Information Center applications.

 **Manage Patient icon**. Available in sectors not currently monitoring a patient. Select the icon to access the **Manage Patient** application where you can assign a monitoring device.

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- Change alarm limits for a patient.
- Turn specific alarms on or off for a patient.
- Adjust measurement settings within a profile.
- Set up telemetry devices.
- Designate which alarms will generate a recording or report or initiate a page.
- View or print an Alarm Summary.
- Configure criteria to trigger alarm advisor notifications.
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Your choices in the application depend on how your unit is set up and the equipment assigned to the patient.

Paced Mode icon. Indicates the patient's current paced status.

-  On – The icon is white when **Paced Mode** is turned on.
-  Off – The icon is green with an X over it when **Paced Mode** is turned off.
-  Unconfirmed – A red question mark displays over the icon when the patient's paced mode is unknown or in conflict.

The pacer spike color is always white unless the ECG wave is white. If the ECG wave is white, then the pacer spike color is green. Pacer spikes may be configured to display with fixed amplitude for increased visibility.

Important — If **Paced Mode** is set to **Unconfirmed**, the ST/AR algorithm acts as though **Paced mode** is turned on. Select the icon to display a menu where you can turn **Paced Mode** on or off.

Warning - If the patient has a pacemaker, **Paced Mode** must be turned on, enabling the ST/AR algorithm to detect and reject pace pulses (spikes) from the HR count. Otherwise, pace pulses could be detected as beats and the monitor may not alarm for an asystole condition. If the patient does not have a pacemaker, turn **Paced Mode** off to allow the ST/AR algorithm to work most effectively.

 **Print/record Icon**. Depending on your system setup, select this icon to do the following:

- **Record All** — make a delayed recording for all sectors that currently have patient data.
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If you select this icon, a message asks you to confirm that you want to proceed with the action. Select **Yes** to confirm. Your system may be set up to just record, record and save a strip, or to just save a delayed strip.

Resuscitation Status Icons:

 Do Not Resuscitate. Resuscitation icon. Indicates the patient's current resuscitation status.

 Modified. The icon is solid white when the patient's resuscitation status is set to **DNR** (Do Not Resuscitate). The icon is a white outline when the patient's status is set to **Modified**. The icon does not display if the patient's resuscitation status is set to **Full**. Select the icon to access the **Manage Patient** application where you can change the resuscitation status.

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Patient data can be stored up to 7 days for each patient of Retrospective Review at Central Station. Data stored upon discharge, or from another unit with a transfer, will be shown separately from current data.

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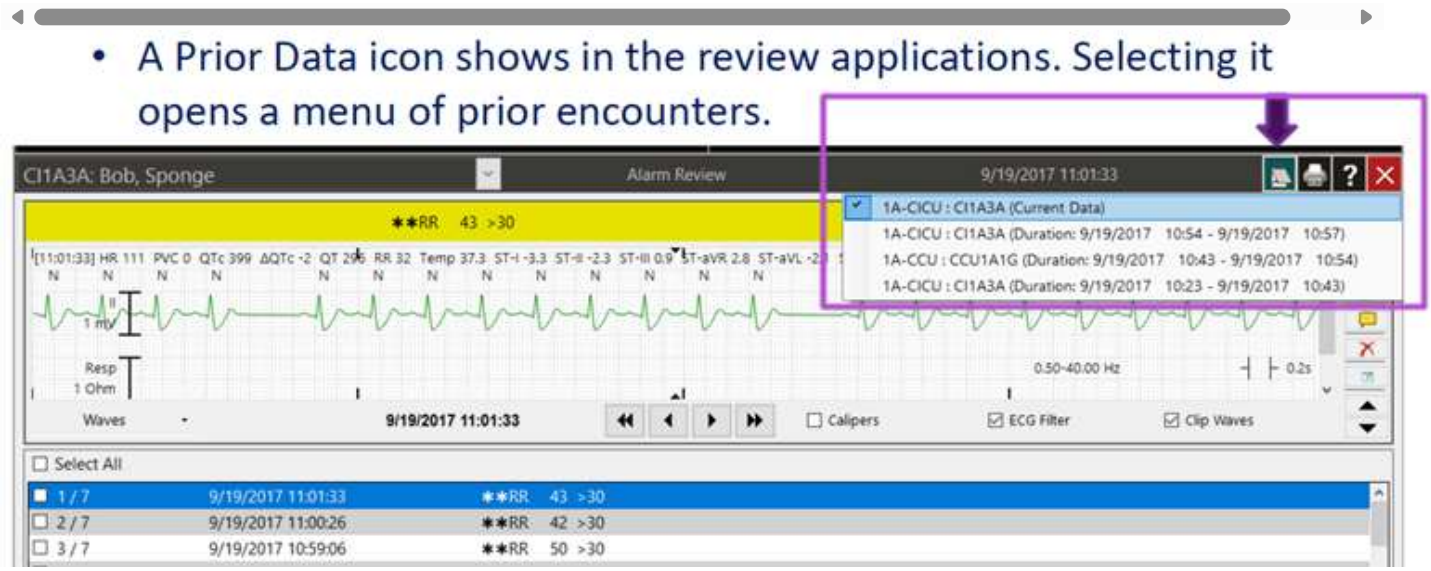

Once you are into this window –

- The Information Bar at the top turns teal green (states 'Prior Data')
- The only smart key on the bottom task bar will be 'Review'
- Main Screen button becomes 'Current Unit'
- To close the application, use the red X in the upper right or choose the Current Unit button

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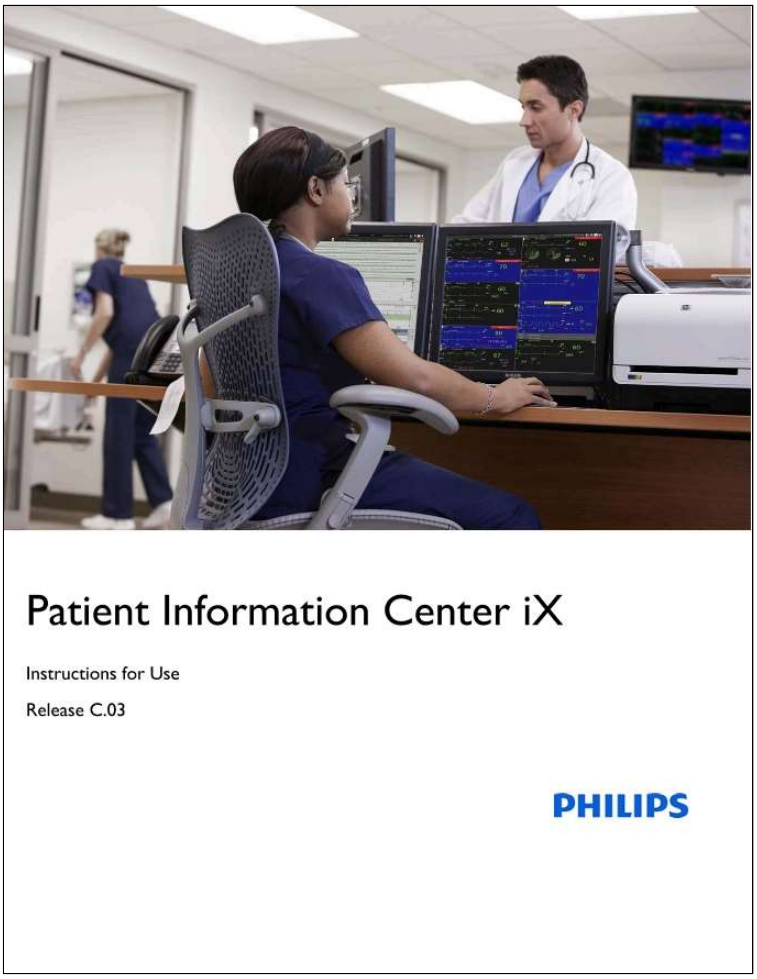

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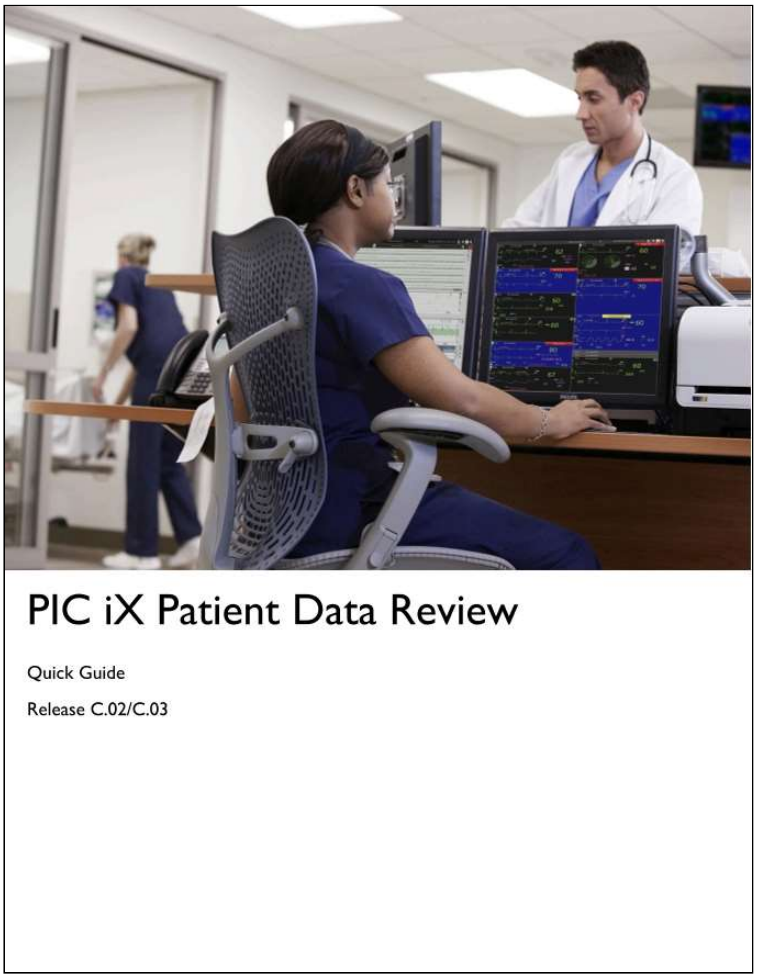

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Car Seat Quick Guide

Car Seat Assessment Record (CAR)
Quick Guide

1. Place baby in car seat.
2. Change Screen to **CAR SEAT TEST.**

3. Touch SmartKey – **START CAR.**
4. Select amount of time for Test Duration *(based on hospital protocol)*.

5. Touch **CONFIRM** key.

CAR is now in progress
Monitoring is continued during CAR.

6. If at any time during CAR you need to exit or stop – press the SmartKey **STOP CAR** and **CONFIRM**.

   At any time you can also switch back to your default monitoring screen by touching **Change Screen**, then touch the back arrow at the top of that menu. *CAR will continue to run in the back ground.*

7. When CAR is complete, the countdown timer (to the far right in the CAR Screen) will turn **RED**.

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Philips Monitoring System (MUNSON)

Philips Monitoring System (MUNSON)

Introduction

Central Monitoring System

The Philips Patient Information Center is a regulated medical IT system that:

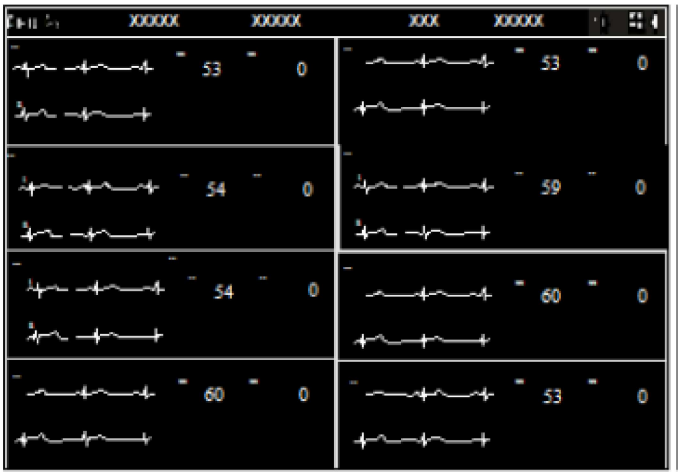
- Provides continuous monitoring of patient vital signs from admission to discharge.
- Consolidates and communicates vital signs data from monitors and third-party devices to caregivers and to the Electronic Medical Record (EMR) for a complete patient record.
- Supports industry standard interfaces to integrate into existing hospital IT infrastructure and EMR systems while meeting requirements for manageability, serviceability, and security.
- Meets the needs of caregivers on the go by means of remote access to patient vital signs for information anywhere.

Through a combination of advanced alarm management, mobility, and clinical decision support, Philips Patient Monitoring Systems enable reduction of non-actionable alarms, improve workflow efficiency, and facilitate early intervention of patient deterioration to improve patient care and outcomes.

The Information Center software runs on a PC workstation with one or two displays for viewing patient data and accessing clinical applications. A mouse and keyboard are provided for entering and changing patient data and other information. If you position the cursor on a labeled application button and click, the application is immediately displayed on the screen. Note that an on-screen keyboard is not available.

With a touchscreen, you can access patient data by either using the mouse or by touching the item on the screen with your finger or a stylus. The mouse is best for making precise selections and measurements, such as using calipers. The touchscreen is best for actions such as acknowledging alarms, accessing application windows, or recording strips. When using a touchscreen, keep the area free of items that can inadvertently touch the screen. If the touchscreen becomes unavailable for any reason, you can access patient data by using the mouse and keyboard.

The Main Screen displays real-time waves, numerics, and alarms from multiple patients. It can be configured to show up to 64 waves, and contains the following elements:



1 Caption Bar

2 Patient Sectors

 Select the Patient Window button to open the Patient window to Display a real-time view of the current patient's data. You also can choose to do an ECG analysis to view all available ECG leads. The Patient Window provides a real-time view of the patient's waves and numerics. You can view patient data and perform all tasks in the Patient Window. In addition to the waves and numerics, the Patient Window contains the following items:

- The Bed Label Pane - Displays the bed label and ID for the currently selected patient. Select the down arrow to select another patient to view.
- The Print Icon to start a printout of the Patient summary report.
- The Help Icon.
- Alarm message areas – All active alarms and technical alarms display on the top right of the patient window. Status messages are color-coded to indicate the message severity. Orange background indicates high severity. Black background indicates low severity. Select the status message to open System Help in the application window. The Help contains a list of status messages with the possible causes and recommended actions for each message.
- Patient Name - Displays the patient's name. Depending on the length of the complete string and the amount of available space, a minimum number of characters is shown, ending with an ellipsis (...). Three question marks (???) precede the patient's name when there is a problem identifying the patient. For example: Patient data between the Information Center and the bedside does not match. All required information was not entered when the patient was admitted.

Buttons in the sector become visible when you move the cursor into the sector or, if using a touch screen display, when you first touch the sector with a stylus or the tip of your finger. When you place the cursor inside a patient sector, the sector is outlined in an orange border. You can minimize the buttons by moving the cursor into the sector and holding down the **Ctrl** key. While the cursor is inside the sector, the buttons remain minimized until you press the **Ctrl** key again. If you move the cursor out of the active sector and move it back in, the buttons become visible.

 Select the Manage Patient icon, which will allow you to:

- Admit, discharge, and transfer patients.
- Enter or update patient demographic information.
- Manage the equipment associated with the patient.
- Temporarily place the bed in standby.
- Enter a temporary transport location, and/or select the patient's equipment to place in standby.
- Export ECG waveform data to a Philips Holter system for analysis.

To Admit a Patient: Use one of the following methods:

- Manually enter new patient information in the fields in the **Patient Demographics** section by typing a 1-30 character first and last name in the appropriate fields. You can use the TAB key to move from field to field. You can also admit a new patient by entering the MRN.
- Use the **Find Patient...** option to find a patient who is being monitored in another Information center or who has been recently discharged.

You can then choose the patient's gender from a drop-down list. It will default to Male while performing a 12-lead if not assigned. It will default to Female while measuring STE if not assigned. Specify the patients birth date by entering it on the calendar. This will update the age field. Enter the patient's height in the appropriate field. This can be in inches or centimeters according to your policy. Enter the Patient's weight using pounds or kilograms according to your policy. Select "Apply" after verifying all information is correct.

Read all confirmation messages and check patient alarms, settings, and paced status when automatic admission, discharge, or transfer is complete.

Viewing and Adjusting Waves:

When the ECG measurement is on, the first wave displayed is the primary ECG wave. The primary wave is always used for ECG analysis. A rhythm status message displays in the upper right corner of the wave, and an arrhythmia status message displays above and in the center of the wave.

Pleth waves on an Efficia monitor are labeled as SpO2.

Wave Adjustments

You can adjust waves in the patient sector or Patient Window layout by selecting a wave then selecting one or more options described below.

- Change Wave – Select a wave from the list. You cannot select the primary ECG wave.
- ECG Analysis – Available if you select an ECG wave. Select to access the ECG Analysis application.
- Primary Lead – Available if you select the primary ECG wave. Select the primary led from the list.
- Size up or Size down - Select to increase or decrease the size (gain) of the wave (if available).
- Set up ECG – Available if you select an ECG wave. Select to access the **Measurements** application ECG page, where you can change heart rate limits and asystole thresholds.

Manually Transferring a Patient to a New Bed: Transfer data for a patient by performing the following steps:

- Use one of the following methods to open the **Manage Patient** In the sector for the bed that you want to transfer, select the name field or select the **Manage Patient** shortcut button. In the application window task bar, select the **Manage Patient** button.
- Select the **..** button. The **Transfer Patient** dialog box displays a list of available beds in the institutions and units.
- To transfer this patient to another bed within this unit, select the bed from the list of beds in your unit. To transfer this patient to a bed in another unit, first select the unit name, then select a bed from the list.
- Specify whether to clear the sector (remove the bed from the sector) upon transfer by selecting or clearing the **Clear Sector** check box. The system can be configured so that the check box is selected by default. Depending on your unit practices, you may want to clear the check box so the sector is not cleared and the equipment remains assigned to the sector.
- Select "OK".
- Confirm the transfer by selecting the orange "TRANSFER" button.

To Discharge a Patient: Use one of the following methods to discharge a patient.

- Manually discharge a patient in the **Manage Patient** application.
- Discharge a patient directly from the hospital information system or bed management system.

Considerations

Before discharging a patient, note the following:

- Discharging the patient at the Information Center also discharges the patient from the bedside monitor. All monitor and MMS settings (including arrhythmia settings) reset to their defaults.
- When you discharge a patient, the Information Center saves the patient data for all admitted patients. The system stores seven days of data and purges the stored data seven days after discharge.

You can search discharged patient data without readmitting for up to seven days.

- If you readmit a patient, the discharge data is overwritten by new monitoring data as it occurs, and you will only see the full disclosure amount of data.
- Monitoring devices may be set up with predefined configurations called *profiles*. When you discharge a patient, the profile reverts to the default profile configured for the device. Refer to your monitoring device documentation for details. When

you discharge an admitted patient at the Patient Monitor, the Information Center discharges the patient and saves the data.

- *Important* — For MRx monitors, turning off the bedside monitor for more than 10 seconds discharges the patient at the MRx monitor and resets defaults, but it does not discharge the patient from the Information Center; the patient is still admitted at the Information Center. It is important to discharge the patient before turning the monitor off to avoid data being associated with the wrong patient.
- Patients that are discharged while the Information Center is in Local/Disconnected mode will be synchronized upon connection to the primary server.

Warning

Read all confirmation messages and check patient alarms, settings, and paced status when automatic admission, discharge, or transfer is complete.

Measuring ECG:

The electrocardiogram (ECG) measures the electrical activity of the heart and displays it on the

Information Center as a waveform and a numeric. In order to compare measured ECG signals, the electrodes are placed in standardized positions, forming "leads". To obtain ECG signals optimized for use in diagnosis and patient management in different care environments, different lead placements can be used.

Selecting the Primary and Secondary ECG Leads

The telemetry device or patient monitor uses the primary and secondary lead selected at the

Information Center to compute HR and to analyze and detect cardiac arrhythmias.

You should choose a primary and (if using multi-lead monitoring) secondary lead that have the

following characteristics:

- the QRS complex should be either completely above or below the baseline and it should not be biphasic
- the QRS complex should be tall and narrow
- the T-wave should be less than 1/3 the R-wave height
- the P-wave should be less than 1/5 the R-wave height

Documenting Patient Events

Documentation of patient events and procedures is a necessary element of patient care. You can print reports from the PIC iX to paper, electronically via PDF, or both.

Create a Saved Strip

You can create a saved strip with the PIC iX electronic caliper (eCaliper) measurements and comments in any strip tile in Alarm Review, General Review, or specialty review applications.

Note —You must have Full Permission Access to annotate and save a strip to the database.

- Select the strip that you want to annotate.
- Select the Annotate icon. The Saved strip dialog box opens. You can move the dialog box as needed.
- Select a label from the drop-down list to add labels. This field can be customized as needed in Alarm Review.
- Enter text in the second field, up to 30 characters. This value displays in the Comment field for the strip.
- Add eCaliper measurements. Consider changing the wave speed to 50 mm/sec. (Select the speed on the bottom right of the strip, then select a speed from the list.) Click and drag in the strip to and from the desired location in the wave. The measurement is displayed between the vertical lines. In the dialog box, click the measurement label to add the measured value. *Note* — Double-click the measurement to see the caliper bars at any time.
- Select another strip and repeat these steps as needed.
- When you are done, select Save. The measurements are saved to the strip.

Reviewing ECG Waves

Depending on the number of ECG leads and licensing, 3 to 12 waves are available for review. These waves can be reviewed with the other data tiles, such as with events and alarms.

Alarms:

Quickly Viewing Target Events - When reviewing patient data, it is often helpful to quickly view specific types of alarms or events.

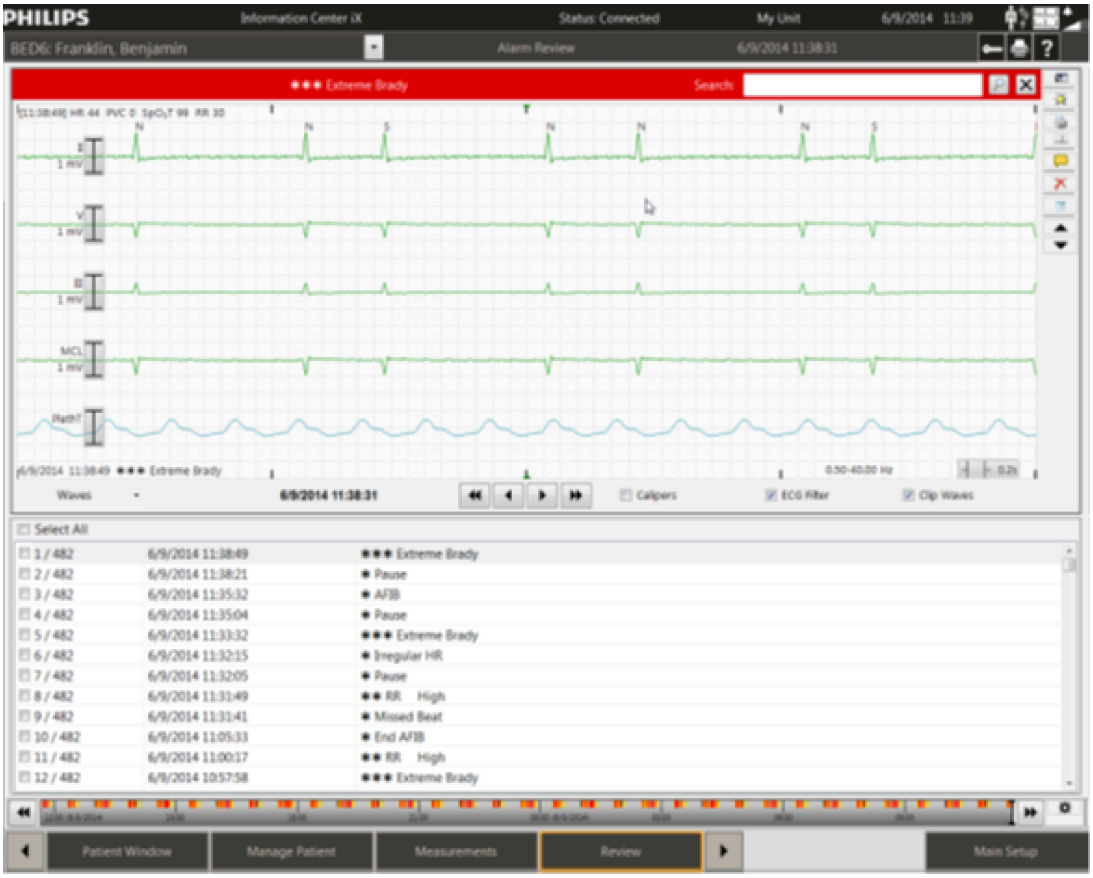
Fast Alarm Review - Select either the Acknowledge key, or the alarm banner in the sector to see alarming waves prior to being available in other applications. Alarm strips can be printed, annotated, or discarded. If you are using secondary notifications, such as with Philips CareEvent, you can manually page an alarm from this application.

Note — The Silence key is called the Acknowledge key.

Alarm Review

Alarm Review always opens with the most recent alarm strip. To review alarms, open Alarm Review from the Review sector button, if configured, or you can open Alarm Review from the main Setup menu or from the Review application menu in any open application. Use the toggle icon to switch between the three different tiles. The tile you prefer can be set up as a default on each host.

- **Tabular** tile – shows a detailed strip with multiple waves and a tabular list of alarms. Use the up and down arrow keys to quickly view alarm strips. This is the factory default tile.
- **Compressed** tile – shows 30 seconds of compressed waves for all strips.
- **Strip Window** tile – a combination of Compressed and Strip tiles.



Reviewing Alarms and Events in Other Applications

Within the factory default review applications (as well as custom applications that were created for your unit), there is a data type called the Event tile. You can use the Event tile to review alarms with other associated data, such as compressed wave storage or graphical trends. Arrhythmia events are also shown, even when a specific alarm is off, such as for yellow level ventricular alarms. The length of the colored box indicates the duration of the event.

- Open the review application. If opened from Alarm Review, the time focus is the selected alarm. If opened from another application, it opens at the current time minus the one minute for storage.
- The Event tile is highlighted below. Note the displayed number of events shown on the right. Alarms are shown with the corresponding color, and arrhythmia events are shown in cyan.

- Clear the check box next to the events you do not want to see. If licensed, specific events can be customized for each review application.
- Move the cursor over any alarm or event to see text that contains the details.
- Select the event to examine its associated waves, trends, and numerics.
- Use the arrow keys in the middle of the tile to quickly navigate to next or previous events.

 Alarms off. Displays next to the numeric when alarms are turned off for the numeric.

 Pause Alarms (Red and/or yellow). **PRESS THIS BUTTON AGAIN TO RESUME ALARMS!**

 Acknowledge/Review Button. Turns off the alarm sound and the sector background changes from blue to black.

 Volume icon. Select to adjust the alarm volume.

Physiological alarms are red and yellow alarms. A red alarm indicates a high priority patient alarm such as a potentially life-threatening situation (for example, asystole). A yellow alarm indicates a lower priority physiological alarm (for example, a respiration alarm limit violation). Additionally, there are short yellow alarms, most of which are specific to arrhythmia-related patient conditions (for example, ventricular bigeminy). Alarm message areas. All active alarms and technical alarms/INOPs display on the top right of the patient sector. A RED warning alerts you to a potential serious outcome, adverse event or safety hazard. Failure to observe a warning may result in death or serious injury to the user or patient. A YELLOW caution alerts you to where special care is necessary for the safe and effective use of the

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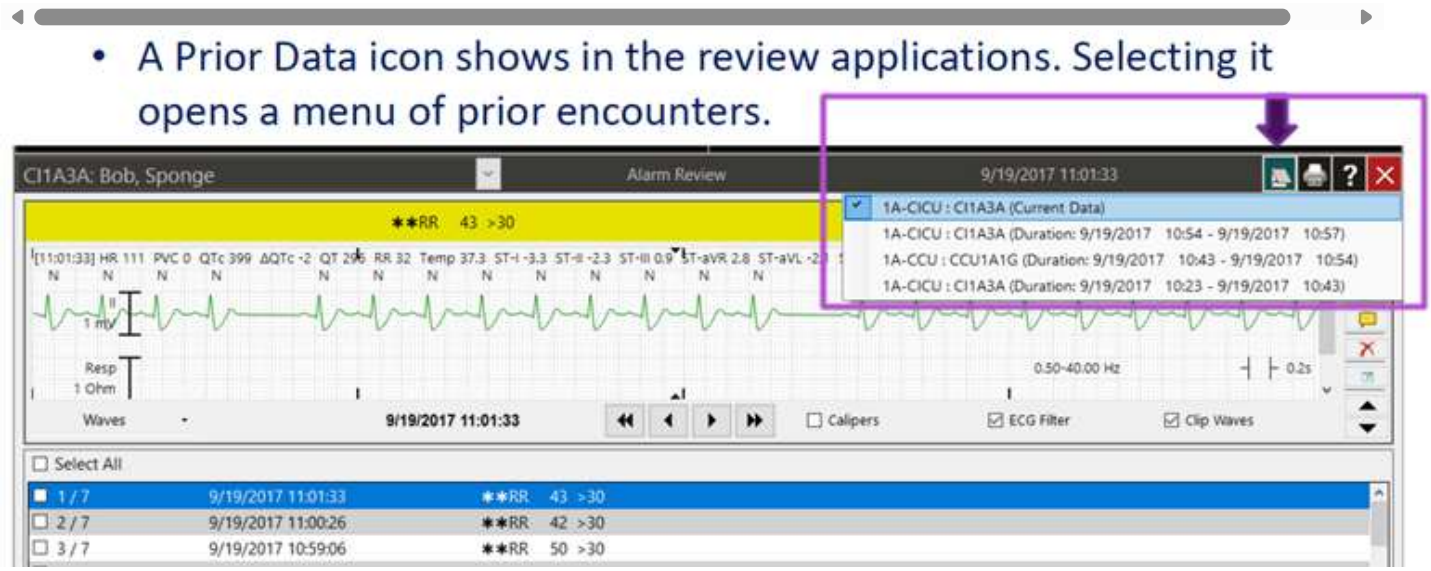

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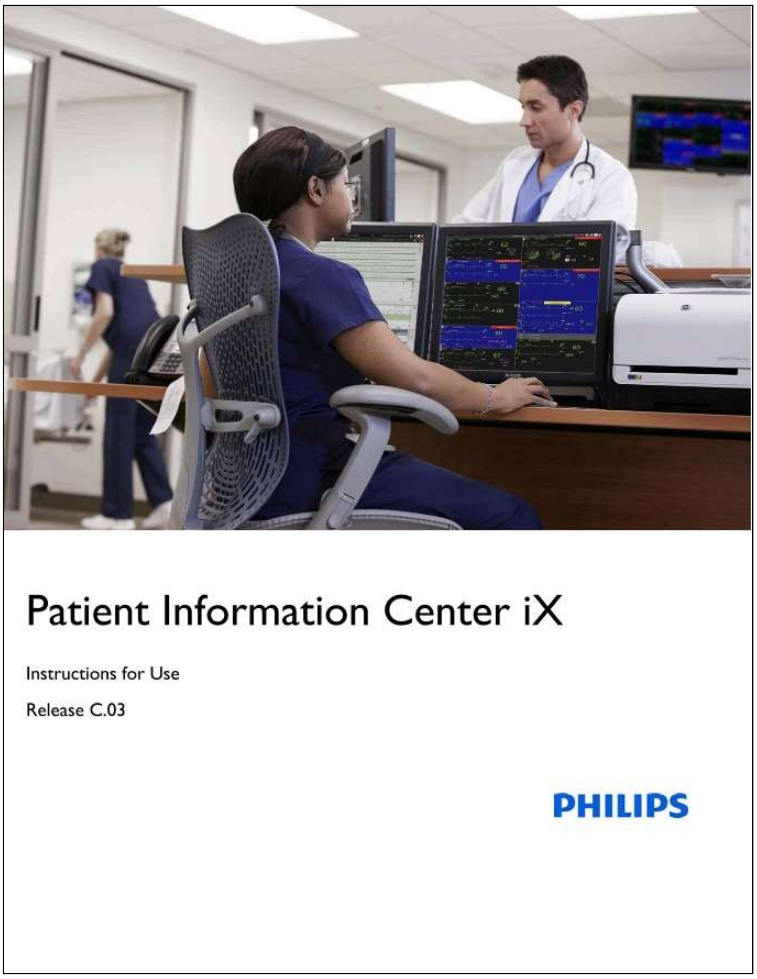

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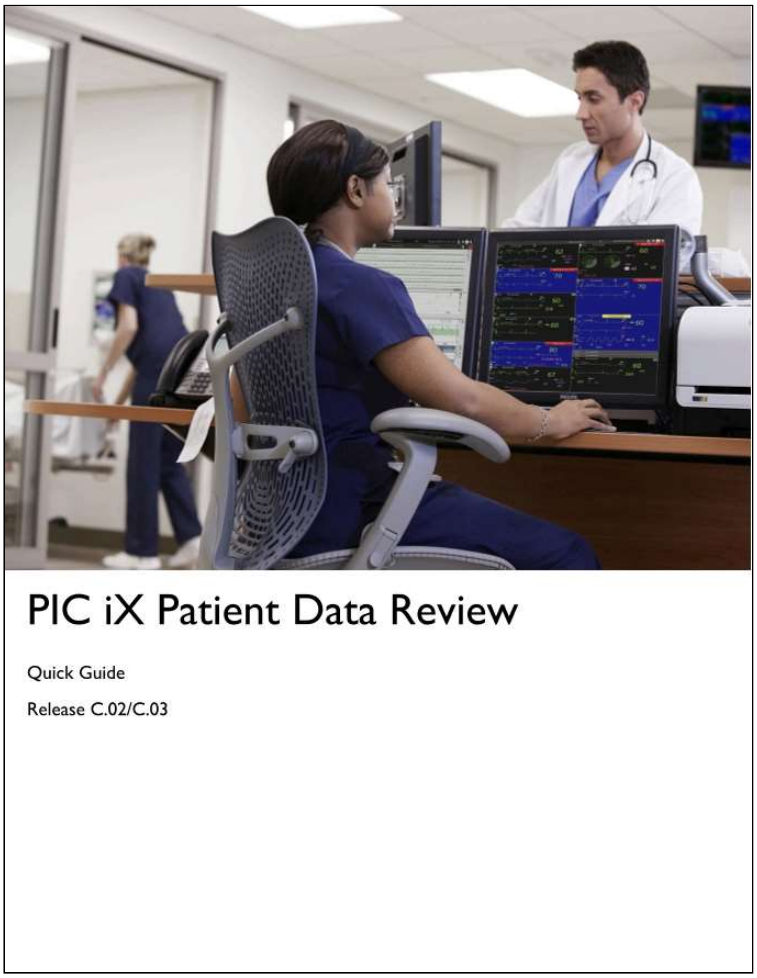

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Monitoring is continued during CAR.

6. If at any time during CAR you need to exit or stop – press the SmartKey **STOP CAR** and **CONFIRM**.

   At any time you can also switch back to your default monitoring screen by touching **Change Screen**, then touch the back arrow at the top of that menu. *CAR will continue to run in the back ground.*

7. When CAR is complete, the countdown timer (to the far right in the CAR Screen) will turn **RED**.

View image in PDF format.

Status Active PolicyStat ID 14167370

Origination	2/14/2019
Last Approved	8/14/2024
Effective	8/14/2024
Last Revised	8/14/2024
Next Review	8/14/2027

Owner	Joseph Santangelo: Chief Medical Quality & Safety Officer
Area/ Department	Medical Staff
Applicability	Munson Healthcare Systemwide
Tags	Policy

Universal Protocol: For Surgical and Non-Surgical Invasive Procedures

Purpose

To provide a policy for surgical and non-surgical invasive procedures.

Policy

A. The Universal Protocol is a multi-disciplinary process encompassing the multiple phases of pre-surgical/procedural preparation to improve patient safety and prevent procedural errors.

B. The Universal Protocol consists of three components, a pre-procedure verification process, marking of the surgical/procedural site and the time out just before starting the procedure.

C. The protocol applies to all surgical and non-surgical invasive procedures. These procedures may occur in settings other than the Operating Room (OR), i.e. medical procedure room (MPR), emergency department (ED), radiology, cardiac diagnostic unit, nursing units, or ambulatory setting. Invasive procedures are procedures involving a puncture or incision to the skin, insertion of an instrument, or insertion of foreign material into the body. PICC lines, central line insertions, chest tube insertion, and other similar procedures are within the scope of the protocol.

D. Refer to Addendum A for invasive procedures specific to the protocol. Minimal risk procedures such as venipuncture, peripheral line placement, NG tube insertions, or urinary bladder catheters are not part of the protocol.

Pre-Procedure Verification Process

A. **Purpose**

1. To ensure that all of the relevant documents, related information and/or equipment are:
    a. Available prior to the start of the procedure
    b. Have been correctly identified, labeled, and matched to the patient's identifiers
    c. Have been reviewed and are consistent with the patient's expectations and with the team's understanding of the intended patient, procedure, and site. The patient (or guardian if the patient is a minor or incompetent) is involved in the verification process when possible.

B. **Process**

1. An ongoing process of information gathering and verification, beginning with the decision to perform a procedure, continuing through all settings and interventions involved in the pre-procedure preparation of the patient, up to and including the "**time out**" just before starting the procedure. Missing information or discrepancies are addressed before starting the procedure. Pre-procedure verification is required for elective and emergent cases.

Detailed Requirements

A. Verification of the correct person, procedure, and site occurs:
    1. At the time the procedure is scheduled.
    2. At the time of preadmission testing and assessment.
    3. At the time of admission or entry into the facility for a procedure whether elective or emergent.
    4. Before the patient leaves the pre-procedure area or enters the procedure room.
    5. Anytime the responsibility of care is transferred to another member of the procedural care team, (including the anesthesia providers) at the time of and during the procedure.

B. Verification of the correct person, procedure, and site should occur as the final step in preparing the patient for an invasive procedure, prior to when the time-out occurs. When possible, the patient (or guardian if the patient is a minor or incompetent) should be involved in the process. Each department will determine the location where the verification process will occur (i.e., prior to the patient leaving the pre-procedure area or entering the procedure room).

C. A standardized list will be used in the verification process to validate the correct patient, procedure, and site and to ensure all relevant items are available for the procedure.
    1. At minimum, the list must include:
        a. Patient identified using 2 patient identifiers
        b. Validation of the correct procedure(s)

c. Validation of the correct site(s)

d. Validation of the physicians order(s)

e. A valid consent form(s) that has been signed by the patient (or guardian if the patient is a minor or incompetent) and witnessed.

f. Relevant documentation, (i.e. a valid, relevant, updated H&P, consultation, or handwritten progress notes; nursing and pre-anesthesia/sedation assessment).

g. Correct diagnostic and radiology test results that are properly labeled, if applicable.

h. Require d blood products, implants, devices, and/or special equipment available prior to start of the procedure, if applicable.

2. Each area may add additional items to the list, as applicable.
3. Each area will be responsible to ensure the list is available and consistently used as a reference during the verification process.
4. It is not necessary to document that a standardized list was used for each patient.

Marking the Operative/Procedure Site

A. For patient safety, regulations require uniformity in site marking practices to prevent errors. The method of marking the site and the type of mark is to be unambiguous and be used consistently throughout the organization. **The approved site marking is the initials of the person performing the procedure.**

1. ***The person performing the procedure must do the site marking, this cannot be delegated. This individual must be directly involved and present at the time the procedure is performed.***
2. Marking should take place with the patient involved, awake and aware, if possible.
3. The mark is made at or near the procedure or the incision site. Do **NOT** mark any non-procedure site(s) unless necessary for some other aspect of care.

    a. The mark must be visible after the patient's skin is prepped, the patient is in their final position and sterile draping is completed.

    b. The mark must be made using a marker that is sufficiently permanent to remain visible after completion of the skin prep and sterile draping. Adhesive site markers are not used as the sole means of marking the site.

    c. The procedural physician may elect to write certain aspects of the procedure with the site marking, such as the vertebral level.?

4. Site marking is required for the following procedures involving incisions or percutaneous puncture or insertion of foreign material into the body.

    a. Marking includes laterality, surface (flexor, extensor), the level (spine), specific lesion or digit to be treated.

    b. For midline incision approach for organs of laterality, the site is still

marked and the laterality noted.

c. A wrist/ankle band labeled "Operative or Procedural Side" (written with an indelible marker) will be placed on the limb of the correct side for identifying laterality for a natural orifice or perineum approach.?

d. Spinal procedures require a two stage marking process, marking of the site and identification of the vertebral level(s).

    i. Marking of the skin at the general spinal region.

    ii. The use of radiographic intraoperative techniques is required to mark the exact vertebral level.

e. Interventional radiology cases where the side or individual structure is identified by imaging guidance during the procedure.

5. For cases involving more than one procedure and different providers who are not involved in the previous procedure, site marking will occur when he/she enters the case, whether the patient is re-draped or not.
6. Final verification of the site mark should take place during the "time out".

Exemptions from Site Marking

A. Interventional procedure cases in which the catheter/instrument insertion site is not predetermined (i.e. pacemaker insertions and cardiac catheterizations).

B. Midline, single organ procedures and endoscopies without intended laterality.

C. Interventional radiology cases where

1. The site has been identified during intra-procedural imaging
2. Routine nephrostomy tube exchange

Alternate Marking Conditions

A. An alternate marking process will be used for cases in which it is technically or anatomically impossible or impractical to mark the site (mucosal surfaces, perineum, premature infants) or for patients who refuse site marking.

1. Premature infants for whom the mark may cause a permanent tattoo. For side identification, a wrist/ankle band labeled "Operative or Procedural Side" (written with an indelible marker) will be placed on the limb of the correct side.
2. Minimal access procedures: Minimal access procedures intended to treat a lateralization of an internal organ (percutaneous approach or through a natural orifice), initial the intended site at or near the insertion site. The marked site must remain visible after completion of the skin prep and sterile draping.
3. Teeth: Indicate the operative tooth name(s) and number on documentation **or** mark the operative tooth (teeth) on the dental radiographs or dental diagram. The documentation, images, and or diagrams are available in the procedure room before the start of the procedure.

4. Lesions and wounds: Site marking is not required if there is an obvious wound or lesion that is the site of the intended procedure. However, if there are multiple wounds or lesions and only some of them are to be treated, and the decision and direction for which ones are to be treated is determined prior to the procedure itself, then the sites to be treated should be marked as soon as possible after the decision is made.

Site Marking Refusal by the Patient

A. If a patient refuses the surgical/procedural site marking, the proceduralist will provide the patient with information on why site marking is appropriate and desirable for his/her safety. This allows the patient to make an informed decision.
    1. The proceduralist will validate the surgical/procedural site with the patient and another member of the surgical/procedural team
        a. For side identification, a wrist/ankle band labeled "Operative or Procedural Side" (written with an indelible marker) will be placed on the limb of the correct side.
    2. The proceduralist will document in the patient's medical record the intended site and the reason why the patient refused site marking.

Time Out Process

A. **Purpose**
    1. To conduct a final assessment validating the correct patient, correct procedure, and correct procedural or operative site immediately before starting the invasive procedure or making an incision.

B. **Process**
    1. Active communication among all relevant members of the surgical/procedure team during the time out. The process is consistently initiated by a designated member of the team and the procedure is not started until all questions or concerns are resolved. See Attachment 1. AORN Comprehensive Surgical Checklist.

Detailed Requirements

A. *During the time out, the operative or procedural team must agree, at a minimum, the correct patient, correct procedure, and correct site. Areas may elect to add more elements to the time-out as deemed appropriate by that unit.*

B. The time-out process will be standardized throughout the organization and will be conducted prior to starting the procedure or making an incision.

C. The time-out applies to all procedural cases, including cases where the procedural physician is present at the time of the decision to perform the procedure and remains with the patient to the start of the procedure.

D. There will be a separate time out performed prior to any regional anesthetic involving laterality.

E. When more than one consent form is completed for more than one procedure being performed on the same patient, a time out will be completed to confirm each subsequent procedure before it is initiated.

F. For cases involving more than one procedure and different providers, who are not involved in the previous procedure, site marking will occur when he/she enters the case, whether the patient is re-draped or not.

G. All activities will be suspended (an actual pause), to the extent possible without compromising patient safety, allowing all members to focus on active confirmation of the correct patient, procedure, site, and other critical elements.

H. A pre-designated member of the team will initiate the time out.

    1. All immediate members of the team who will be participating in the procedure at its inception will participate in the time-out (i.e. physicians, anesthesia providers, nurses, technicians, etc.).

    2. Interactive verbal communication is expected of all team members. All team members will be allowed to express concerns about the procedure. Concerns will be addressed prior to proceeding with the procedure.

I. Completion of the time-out must be documented in the patient record validating the correct patient, procedure, and site.

Compliance Monitoring

A. All hospital staff and physicians involved in the validation process have the responsibility to ensure patient safety. Failure to follow the Universal Protocol or to resolve issues regarding the performance of the verification, site marking, and the time out must be reported using the appropriate chain of command.

B. Physicians and hospital staff should follow the department and/or Medical Staff Section chain-of-command for assistance in resolving discrepancies. Refer to the Chain of Command: Paging Response Time and Resolving Questions of Care and or Safety policy.

C. Non-compliance or resistance to this policy will be reported through the electronic occurrence reporting system for review. All actual and "near miss" situations, where any of the steps of this procedure is not followed or is performed incorrectly, should be reported.

D. Individual occurrences and aggregate occurrence data will be reviewed by Risk Management and referred to the appropriate Medical Staff and/or Nursing Administration leadership and peer review committee.

References

1. Joint Commission. (2019). *Hospital Accreditation Program. Chapter: National Patient Safety Goals.* Effective January 2019.? Retrieved from the Joint Commission Website https://www.jointcommission.org/hap_2017_npsgs

Addendum A

Invasive Procedures Specific to the Universal Protocol

A. The Universal Protocol applies to the following invasive procedures according to the Universal Protocol: For Surgical and Non-surgical Invasive Procedures policy.

B. **This list is not all-inclusive:**

1. All taps (i.e., thoracentesis, amniocentesis, paracentesis, pericardiocentesis, pleuracentesis, arthrocentesis, and lumbar puncture).
2. Invasive pain control procedures (i.e., diagnostic or therapeutic blocks, epidural analgesia).
3. Invasive radiological procedures (i.e., angiography, arthrogram, biopsy, lymphangiogram, myelogram, splenogram, ventriculogram, Whitaker test).
4. Endoscopy procedures (i.e., bronchoscopy, colonoscopy, gastroscopy, sigmoidoscopy bronchoscopy, colonoscopy, gastroscopy, sigmoidoscopy, esophageal dilation, ERCP).
5. Invasive cardio/thoracic procedures. (i.e., angioplasty, cardiac catheterization, implantation of pacer or cardioverter, intra-aortic balloon pump, stent placement, intravascular ultrasound, athrectomy).
6. Biopsy/excision and drainage or aspiration (i.e., bone marrow, cisternal puncture, breast biopsy).
7. Chest tube insertions
8. Central line placement (i.e., CVP, Swan-Ganz).
9. Peritoneal dialysis catheter insertion
10. Percutaneous nephrostomy.
11. IVC (inferior vena cava) filter placement.
12. Embolization.

Document ID: 019.066

Attachments

AORN-Comprehensive-Surgical-Check-2019.pdf

Approval Signatures

Step Description	Approver	Date

System Policy Overnight Committee	Terri Fries: Document Mgmt Spec	8/14/2024
PLC	Joseph Santangelo: Chief Medical, Quality & Safety Officer [AM]	8/2/2024
Med Staff Leads (MEC)	Heather Flint: Sr Spec Lead, Med Staff Services SNE - South Regio	12/28/2023
Med Staff Leads (MEC)	Katryna Glettler: Sr Spec Lead, Med Staff Services SNE - Central Reg	10/6/2023
Med Staff Leads (MEC)	Angela Gee: Sr Spec Lead, Med Staff Services SNE - East Region	10/5/2023
Med Staff Leads (MEC)	Teresa Smith: Executive Office Coordinator	9/26/2023
Document Owner	Joseph Santangelo: Chief Medical, Quality & Safety Officer [AM]	9/26/2023

Applicability

Cadillac Hospital, Charlevoix Hospital, Grayling Hospital, Kalkaska Memorial Health Center, MHC Corporate (Home Health, Dialysis, NMSA, etc.), Manistee Hospital, Munson Medical Center, Otsego Memorial Hospital, Paul Oliver Memorial Hospital

Standards

No standards are associated with this document

Status **Active** PolicyStat ID **18172871**

Origination	2/20/2020	Owner	Magdalena Stewart: Radiation Safety Officer
Last Approved	6/16/2025		
Effective	6/16/2025	Area/ Department	Radiation Safety
Last Revised	6/16/2025	Applicability	Munson Healthcare Systemwide
Next Review	6/15/2028	Tags	Policy

Munson Healthcare Radiation Safety Policy

Purpose

The following guidelines shall be followed to monitor and mitigate radiation exposure to all Munson Healthcare (MHC) patients, visitors, and employees, to ensure the safety of individuals engaged in procedures involving ionizing radiation.

Scope

MHC has adopted this policy for all of its subsidiaries, including but not limited to Munson Medical Center (MMC), Munson Healthcare Cadillac Hospital (CAD), Munson Healthcare Charlevoix Hospital (MHCH), Munson Healthcare Grayling Hospital (GRY), Kalkaska Memorial Health Center (KMHC), Munson Healthcare Manistee Hospital (MHMH), Munson Healthcare Otsego Memorial Hospital (OMH), Paul Oliver Memorial Hospital (POMH), Cowell Family Cancer Center, MHC operated clinics and outpatient service locations.

Procedure

Radiation Safety For Patients

A. **Steps to reduce exposure during general radiologic procedures and fluoroscopy:**

1. Review patient history to verify that you're doing the correct exam and for previous (within 6 months) procedures that might indicate a duplicate order.
2. Use ***pulsed fluoro*** when available and when practicable.

3. Collimate the fluoroscopic beam to the area of interest during all procedures.
4. Reduce the source-to-detector distance as much as possible to reduce patient exposure.
5. Ask female patients between the ages of 14 - 55 who are undergoing procedures involving radiation directly to the abdomen and/or pelvis if they might be pregnant. If yes, consult with the radiologist before proceeding with the procedure.
6. Follow standardized protocols established by the radiology physicians' group for each procedure, limiting the views for every exam to the minimum required to establish a diagnosis.
7. Gonadal shields and fetal shielding are no longer required. The American Association of Physicists in Medicine (AAPM) has a position statement eliminating the need to use gonadal and fetal shielding on patients, citing that it may inadvertently hide clinical pathology, that it may cause increased exposure by creating the need for extra exposures to image the covered anatomy, may interfere with the automatic exposure control of the imaging system, and that science hasn't been able to prove that there are any increased cancer risks associated with radiography procedures.
8. Record fluoroscopy skin dose after each fluoroscopy procedure. This can be accomplished by the radiologist dictating it into the patient's report or adding an electronic note to the picture archiving and communication system (PACS) record. Report as air kerma (mGy) or kerma area product (mGy*cm^2).
9. All operators (physicians, non-physicians, and ancillary personnel) performing fluoroscopy procedures will complete an in-service on radiation dose optimization techniques and tools for pediatric and adult patients. See http://www.imagegently.org.
10. All computed tomography (CT) technologists will receive training in radiation dose optimization techniques and how to operate CT equipment safely.
11. Before imaging, the CT, nuclear medicine (NM), and polyethylene terephthalate (PET) technologists will verify the correct positioning, imaging protocol, and the appropriate age/size-specific protocol.
12. Incidents, where CT/fluoroscopy radiation dose indices exceeded the expected dose index range, will be reviewed, analyzed, and compared to external benchmarks. See C6 below.
13. An annual performance evaluation by a qualified medical physicist will be performed on all CT scanners, nuclear medicine cameras, PET scanners, MRI scanners, mammography machines, and the corresponding imaging monitors. Records of these evaluations and corrective action taken will be stored for at least 3 years.
14. At a minimum, when performing annual evaluations on CT scanners, the qualified medical physicist will measure the CT radiation dose index (CTDI) for adult brain, adult abdomen, pediatric brain, and pediatric abdomen, or other commonly used protocols, verifying that the dose for these procedures is at an acceptable and predicted level and the radiation dose for each protocol will be verified to be within 20% of the dose displayed.

B. **Most patients have no ill effects caused by radiation exposure during general radiological procedures, however in rare instances such as *lengthy* fluoroscopy cases, minor injuries may result. These issues may be mitigated by:**

1. Items 1 - 5 above.
2. The operator may request peak skin doses from previous procedures.
3. Reviewing patient history for skin sensitizing conditions such as connective tissue diseases (scleroderma, lupus erythematosus), diabetes mellitus, hyperthyroidism, chemotherapy agents, or homozygous form of ataxia telangiectasia.

C. **Patients undergoing *lengthy* diagnostic and interventional fluoroscopic and/or angiographic procedures can receive high skin doses and the FDA has reported skin injury from such procedures. Concomitantly, the Joint Commission (TJC) added that prolonged fluoroscopy with a cumulative dose greater than 1500 rads (15,000mGy) to a single field was a reportable sentinel event (January 2007). Consequently:**

1. Monitor fluoroscopy patient skin dose for all procedures done throughout the MHC System. Refer to the Threshold Criteria for Applying for Fluoroscopy Privileges policy.
2. The technologist, nurse, or control room personnel will notify the operator (physician) when the dose displayed on the monitor (Ka,r) equals or exceeds 3000 mGy.
3. Notification continues every 1000 mGy, e.g. after 4000mGy, 5000 mGy, and so on.
4. The displayed dose estimate (mGy) shall be entered in the patient record, i.e. Radiologist's report electronic note in PACS, for **ALL FLUORO PATIENTS**.
5. The physician or designee will notify the MHC diagnostic medical physicist, by email or (231) 392-8612 when Ka,r > 5000 mGy, providing the patient name, medical record number, date of the procedure, hospital location/room number and Ka,r.
6. When the patient dose exceeds 5000 mGy, the MHC diagnostic medical physicist will calculate the patient-specific estimated peak skin dose.
7. If the peak skin dose exceeds 3000 mGy, the medical physicist will:
    a. Inform the operator (physician) in writing (electronic) with a copy sent to the patient's primary care physician.
    b. Report it at the quarterly Radiation Safety Committee meeting.
8. If the peak skin dose exceeds 3000 mGy, the operator (physician) will:
    a. Decide how the patient will be notified.
    b. Determine how skin will be monitored.
    c. Determine how skin care will be provided, if necessary.
    d. Report results to the diagnostic medical physicist for tracking and quality improvement.

D. **When completing the consent process, discuss the possibility of radiation-induced injury during the procedure and explain:**

1. The patient will be undergoing a procedure that uses X-ray imaging.
2. Radiation-induced effects can appear a few weeks or even several months after the procedure. If at any time a skin change is noticed, patient shall contact the primary care provider for further evaluation.

E. **Treatment of Radiation-Induced Skin Injuries:**

1. The patient may be referred to a wound care specialist.
2. Note areas of early erythema and photograph.
3. ***Initial Stage*** treatment includes prevention and treatment of infections, antihistamines, topical antipruritic preparations, which act against itch and postpone the manifest stage, and anti-inflammatory medications.
4. ***Latent Stage*** treatment requires anti-inflammatory medications, and sedatives, and at mid-stage, use proteolysis inhibitors, i.e. Gordox.
5. ***Manifest Stage*** treatment requires topical ointments containing corticosteroids along with locally acting antibiotics and vitamins. Stimulate regeneration of deoxyribonucleic acid (DNA) with Lioxasol, and stimulate blood supply using Pentoxifyline.
6. ***Late Effects*** such as fibrosis, late ulcers, and necrosis, may require plastic/ reconstructive surgery/hyperbaric oxygen treatment.

Radiation Safety for Visitors

A. **Visitors are not be allowed in the procedure rooms unless:**

1. The visitor is needed to hold their child during a procedure, i.e. parent or guardian.
    a. If a visitor is required to assist in holding a child, that visitor will be provided with radiation protection apparel.
    b. Pregnant mothers are not allowed into the procedure room to hold a child.

Radiation Safety for Workers

A. **All MHC employees who work in and around a radiation area will take the following steps to monitor and reduce radiation exposure.**

1. Staff are not required to hold patients. Family members or immobilizing devices will be used to reduce staff exposure whenever possible.
2. Staff working in a fluoroscopic, c-arm, or O-arm procedure must wear radiation protection apparel.
3. System operator and personnel will limit the length of time in close proximity to the radiation source and the patient according to the organizational radiation safety policy. TIME - DISTANCE - SHIELDING are the best methods to reduce personnel exposure.
4. Staff in the procedure area will not turn their back towards the exposure area during exposures. The radiation protection apparel must be kept between the exposure field and the staff member.

5. System operator will use proper collimation and lowest pulse rate fluoroscopy practicable.
6. It is each individual's responsibility to wear assigned radiation monitoring (dosimetry) badges during procedures involving ionizing radiation.
7. Two radiation monitoring badges (collar and waist) will be provided for some individuals who work in fluoroscopy procedures (radiological technologists, cath laboratory technologists, vascular surgeon and support staff, and radiology physicians.
    a. One collar badge (red silhouette) is worn outside the radiation protection apparel at collar level and
    b. One waist badge (yellow silhouette) under the apron at the waist.
8. One radiation monitoring badge (collar) will be provided for most Operating Room (OR) Staff and individuals who work in other areas and wear radiation protection apparel.
9. One radiation monitoring badge (chest) will be provided for individuals who work in other areas and don't wear radiation protection apparel..
    a. The chest badge (black silhouette) is to be worn on the front of torso.
    b. Individuals working in radiation oncology will be assigned neutron sensitive dosimeters.
10. An extremity radiation monitor (ring) will be provided for individuals who work with radionuclides.
11. Women who become pregnant have the option of notifying the Radiation Safety Officer (RSO) or assignee.
    a. A fetal badge (black silhouette with fetus) may be issued and worn at the waist level under radiation protection apparel.
    b. The fetal badge is to be returned monthly.
12. The radiation monitoring badges, wear periods, and assigned dose method for groups and individuals is at the discretion of the RSO and Radiation Safety Committee.
    a. Groups and individuals who have received quarterly readings above ALARA Level 1 will generally have monthly monitoring.
    b. CT and mammography technologists are assigned a chest badge.
    c. Vascular surgeons are assigned collar and waist badges.
    d. Interventional Radiologists who are Authorized Users for Y-90 are assigned a ring dosimeter.
13. An individual visiting in rooms where x-ray radiation is being used, e.g. students or interns, will be badged at the discretion of the RSO, based on projected time spent near radiation sources.
14. Name, birthdate, and employee number* are required for radiation monitoring

badges. Individuals assigned radiation monitoring badges at more than one location are required to supply their Social Security Number at all locations to aid summation of exposures, *non-employees will supply the last four digits of their social security number.

15. Each individual is required to store the assigned badges in an area where there is only background radiation.
16. Each individual is responsible for return of badges for exchanges (monthly or quarterly) within one week of the exchange date at the designated return location.
17. When a protective apron is worn while working fluoroscopy procedures, the effective dose equivalent (assigned dose) will use one of the following:
    a. Assigned dose is collar dose.
    b. Assigned dose is 0.3* collar dose, when collar dose exceeds 25% of limit.
    c. Assigned dose is 1.5* waist dose + 0.04* collar. (*Michigan Radiation Safety Section Rule 57(1)).
18. Dosimetry results will be reviewed at least quarterly by the RSO.
19. Reports are subject to correction.
    a. Badges worn incorrectly
    b. Badges not returned on time.
    c. Badges not returned.
20. Reports from each wear period are stored indefinitely.
    a. Individuals can access their reports either on-line through Landauer (www.myldr.com) or from the RSO.
    b. User name facility dependent: munsonmc, Munsoncad, Munsonchar, Munsongray, Munsonkal, Munsonpomh, MunsonMAN, Munsonots.
    c. Password: Radiation!
    d. Sign up for Individual Dose Review
    e. Questions about reports should be directed to the RSO or assignee.
    f. The RSO or assignee will notify each individual with elevated exposure and perform an appropriate follow-up.
    g. Individuals must respond to investigative queries and cooperate with report completion information.
    h. Notified individuals will have 10 working days to complete the follow-up requirement. If not completed, individuals will not be allowed to participate in cases requiring ionizing radiation.
    i. The table below lists the quarterly exposure limits and actions of the RSO or assignee:

Assigned Dose *(dose in millirem/ quarter)*	ALARA Levels		Annual Limit*
	Level I	**Level II**	
Whole Body (EDE)	125	375	5000
Collar (LDE)	125	375	15000
Ring (Finger/ Shallow)	1250	3750	50000
Action Taken	Internal Notice (e-mail)	Level I and Investigation & Internal Report	Level II and Nuclear Regulatory Commission (NRC) and/or State Report

Radiation Safety In the OR

A. OR Radiation Safety Representative:

1. At MMC, the operating room (OR) electromagnetic interferance (EMI) acts as the OR Radiation Safety Representative, to coordinate radiation safety practices in the OR, including staff education, management of protective shielding apparel, and management of the dosimetry badges. The RSO oversees radiation safety practices in the OR. At all other MHC locations, the department managers will manage the dosimetry badges and the MHC RSO will oversee these processes.

B. Radiation Protection Apparel:

1. All personnel in the OR during a c-arm procedure or other procedures producing radiation must wear radiation protection apparel (lead apron) and radiation dosimetry (badge). This includes the Fluoroscan (mini C-arm). Wearing of radiation protection apparel is optional for single-shot exposures where a leaded wall is between the staff member and the exposure beam.
2. Staff in the procedure area will not turn their back towards the exposure area during exposures. The radiation protection apparel must remain between the exposure field and the staff member.
3. Thyroid shields that are physically attached (strap and ring) to aprons or vests are not to be detached.
4. Requests for assignment of radiation protection apparel from current unassigned inventory in the OR are coordinated through the OR radiation safety representative at MMC or the local radiology manager.
5. Purchase requests for radiation protection apparel in MMC's OR must be through the Service Line Coordinator. The Service Line Coordinator will initiate the purchase

through the OR radiation safety representative, who will coordinate the purchase and approval through the Operating Manager and Surgical Services Director. The radiology manager will handle the radiation protection apparel purchases for all other locations.

6. All new radiation protection apparel at MMC must be routed through the RSO for inspection before putting into service. The radiology manager will perform this function at all other locations.
7. All radiation protection apparel will contain at least 0.5 mm lead (Pb) equivalent.
8. Radiation protection apparel will be assigned to high-volume radiation practice service lines, i.e. Orthopedic Surgery, Neuro Surgery, Urology, and Endo Vascular Surgery.
9. Radiation protection apparel will be stored in the OR where those surgeries are performed. Radiation protection apparel racks will be provided for safe storage to prevent damage.
10. Unassigned radiation protection apparel is available to other staff who may be pulled into a case with radiation exposure.
11. Any radiation protection apparel at MMC that is heavily soiled or damaged is to be given to the OR radiation safety representative for cleaning or replacement. At all other locations, the radiology manager will perform or assign this function.
12. All radiation protection apparel will be cleaned using a hospital-approved disinfectant. All personnel are required to clean any apparel suspected of contamination or that is visibly soiled.

C. Radiation Exposure Monitoring in the OR:

1. The OR radiation safety representative is responsible for requesting and exchanging dosimetry badges.
2. One dosimeter radiation monitoring badge (collar) will be provided for all personnel who work in the OR. It is each individual's responsibility to wear the badge as part of their surgical uniform daily. For Endovascular staff, a second (waist) badge will be provided.
3. Dosimetry rings must be worn by individuals with hand exposure to radiation, i.e. brachytherapy seed implantation.
4. It is each individual's responsibility to exchange dosimetry badges at the badge storage areas in the OR at the end of the monitoring period. Used badges, along with the control, will be returned the supplier for reading.
5. Fetal dosimetry badges will be assigned when a staff member declares pregnancy to the RSO or designee.

Education

A. New hires are provided education on radiation safety, including proper usage and care of radiation protection apparel, use of radiation protection screens, and wearing radiation dosimetry badges.

B. Radiation safety reviews will be provided by the MHC RSO via live, recorded, or written presentations.

Radiation Protection Apparel

A. **Procurement and Distribution**

1. New radiation protection apparel will be ordered with split ring key rings (except caps).
2. Radiation protection apparel will contain at least 0.5 mm of lead (Pb) equivalent.
3. Contact the Medical Physicist for vendor and item number.
4. Before distribution to the work area, radiation protection apparel will be inspected and labeled / embroidered with a unique apparel code. This code includes site designation (two to four letters) followed by the item number (1 to 5 digits), i.e. OR 150 or DI 1707.

B. **Inspection and Documentation**

1. The designated radiation protection apparel inspector inspects and documents the integrity of all new and repaired radiation protection apparel before release for service. The RSO or assignee will record these inspections on a protected spreadsheet.
2. Each piece of radiation protection apparel will be inspected annually for wear, appearance, holes, cracks, and tears. Inspect visually and fluoroscopically/ radiographically. Perform annual inspections during the fourth calendar quarter. Check apparel at other times if there is concern about integrity.
3. Apparel that passes inspection will have a color-coded tag affixed. Color will vary with the year and will be on a 3-year cycle. This is to make it easy to identify apparel integrity status or inspection status. Tags will be provided through the MHC RSO.

Color	Calendar Year
Red	2024, 2027, 2030 etc.
Yellow/Blue	2025, 2028, 2031 etc.
White	2026, 2029, 2032 etc.

4. Inspectors must receive training, testing, and approval from the MHC RSO. Inspectors must:
    a. Review "Radiation Protection Apparel Inspector Training".
    b. Pass the "Radiation Protection Apparel Inspector Training" test.
    c. Pass skills validation by the RSO or designee including properly identifying defects visually and under radiographic imaging.
    d. Review "Radiation Protection Apparel Inspector Training" annually to maintain qualification.
5. Responsibilities of the radiation protection apparel inspector are:
    a. Proper wearing of radiation protection apparel and radiation badges while

conducting the fluoroscopy inspection of apparel.

b. Providing guidance on the proper use, care and storage of radiation protection apparel to prevent defects.
c. Understanding Munson apparel coding system.
d. Conducting the integrity inspection of radiation protection apparel when new and at least annually.
e. Removal and proper disposal of damaged apparel.
f. Documentation of the type and location of damage to apparel, (e.g., rupture in left upper quadrant of vest).
g. Completing the "Radiation Protection Integrity Inspection Checklist", or equivalent.
h. Notifying the wearer or department.

6. Record keeping for all items tested including:
    a. MHC apparel code.
    b. Description.
    c. Test date.
    d. Inspector initials.
    e. Test result (PASS / FAIL)
    f. Comments as needed (i.e., "disposed of by Environmental Services", or "Sent out for repair", "missing").
    g. Reporting results to the MHC RSO.
7. Each department has a radiographic room that will assign and train a radiation protection apparel inspector to perform and document the results of the apparel check. Contact the RSO for assistance.
8. Departments may arrange with Diagnostic Radiology to perform the radiation protection apparel checks, i.e., OR. In this case, the department is responsible for:
    a. Making arrangements for the integrity checks.
    b. Transporting the apparel to and from Diagnostic Radiology at the arranged time.
    c. Repair or replacement of damaged items.
9. Record any apparel not located for inspection "Missing" and notify the respective department of the missing item.
10. Remind departments with missing apparel to search for missing items approximately one month after initial notification. The department manager must respond to the reminder within 10 days.
11. Inspect apparel found after the annual inspection before use and as soon as reasonably practicable. Record the inspection in the spreadsheet.

12. Remove from service any radiation protection apparel without a Munson apparel code and report it to the inspector for identification and inspection.
13. The Radiation Safety Committee (RSC) and Environment of Care Committee (EOC) review the results of the annual inspections.

C. **Rejection Criteria and Disposal**

1. The radiation protection apparel rejection criteria for holes, cracks, or tears are set at an aggregate surface area of 15mm² (equivalent to a 4.3mm diameter circular hole). The gonadal or thyroid apparel rejection criteria are set at 11 mm² (equivalent to a 3.8 mm diameter circular hole).
2. Rejection criteria are based on the recommendations of Kent Lambert (Medical Health Physicist and RSO at Drexel University) and Tara McKeon (Clinical Physicist at Drexel University) from their article "Inspection of Lead Aprons: Criteria for Rejection", Operational Radiation Safety, Supplement to Health Physics, 80 supplements 5, May 2001 and approved by the RSO, the RSC, and the EOC.
3. Radiation protection apparel that exceeds the specified rejection criteria will be removed from service and the date of removal will be recorded in the spreadsheet. Environmental Services (EVS) disposes of radiation protection apparel based on proper disposal guidelines. Radiology Imaging Solutions, Inc. of Grand Rapids can also be contacted as they are licensed for disposal, (800) 747-1777.

D. **Cleaning and Storage**

1. See Stevens-Moon Apron Cleaning Instructions.
2. Storage racks will be provided for apparel to preserve the integrity of the apparel.

E. **Responsibility**

1. RSO:
    a. System coordinator of radiation protection apparel integrity testing program.
    b. Purchases and distributes colored tags.
    c. Maintains radiation protection apparel spreadsheet.
2. Site radiology manager:
    a. Directs local radiation protection apparel integrity testing.
    b. Directs local purchasing of radiation protection apparel.
    c. Reports findings of apparel inspections to RSO.
3. It is the responsibility of management and the RSC to enforce the provisions of this policy.
4. This policy may be amended to update and define new requirements as needed.

Radiation Shielding

A. A Medical Physicist will perform a structural radiation shielding design assessment before

imaging equipment installation or room modification. A copy will be kept indefinitely.

B. A Medical Physicist will perform a radiation protection survey of the room after installation of the room is complete and before first use. A copy of this report will be kept indefinitely.

Radiation Safety in Nuclear Medicine / PET

A. **When Handling Isotopes:**

1. Staff will wear radiation dosimeter badges, including a ring badge.
2. Staff will wear gloves when handling isotopes.
3. Staff will use syringe shields when handling and transporting radioactive doses.
4. Staff will not eat, drink, or smoke while handling isotopes.

B. **Doses:**

1. The hot lab will be locked at all times when staff are not present.
2. All doses will be under direct observation at all times or will be locked in the hot lab.
3. All doses will be assayed prior to administration and will be within +/- 20% of the policy on prescribed dosing guidelines which is posted in all hot labs.
4. The following doses/procedures will require a written directive from an authorized user (Radiologist/Radiation Oncologist).

Radiopharmaceutical	Type Procedure
I-131	Thyroid ablation
I-131	Hyperthyroidism
I-131	Total Body Scan
Ra-223	Xofigo
Sm-153	Quadramet
Y-90	TheraSphere
I-125, Pd-103, Sr-90	Manual Brachytherapy

C. **Spills:**

1. Evacuate the area.
2. Contain the spill with absorbent towels.
3. Wear gloves and clean the area with absorbent toweling and Radiaque wash.
4. Dispose of toweling in radiation shielded (lead) container in the hot lab. (Store for a minimum of 10 half-lives of the isotope or until it has reached background levels. Then it can be sent to regular trash).
5. Survey the area with a geiger counter and continue cleaning until the area has reached background levels (.03 mR/hr, 20 cpm) or secure area.

D. **Pregnant Patient / Lactating Mothers:**

1. Women of childbearing age should be asked if they might be pregnant. If yes,

consult with the Radiologist.

2. All lactating mothers who have nuclear medicine studies will be required to discard their breast milk for 48 hours after receiving an isotope or ten half-lives of the isotope. It should be documented in the patient's record, i.e. PACS notes or in the report.

E. **Ordering Isotopes:**

1. The RSO or a designee, i.e. NM technologist, must authorize each order for radioactive materials and ensure that the requested materials and quantities are authorized by the license for use by the requesting authorized user and that possession limits are not exceeded.
2. Ordering of specially used materials (therapeutic use) requires a written directive. A written directive must be completed by the authorized user who will be performing the procedure. The written directive will identify the isotope, compound, activity level requested, patient name, date, and signature of the physician.

F. **Receiving Isotopes:**

1. The RSO will establish and maintain a system for ordering and receiving radioactive material. The system must contain the following information:
    a. Written records that identify the authorized user or department, isotope, chemical form, activity, and supplier.
    b. The above records will be checked to confirm that the material received was ordered through proper channels.
2. For deliveries during normal working hours, packages are received in the hot lab by a nuclear medicine technologist and locked in the hot lab. Deliveries received at the shipping dock at MMC will be secured in the designated area and the department notified.
3. If off-duty deliveries are necessary, the carrier will be escorted to the NM department by security personnel or their assignee and the package will be placed within the secured designated area, i.e. behind locked doors in the Nuclear Medicine Department.
4. Carriers/couriers will be trained by the nuclear pharmacy, i.e. Cardinal Health or Pharmacologic, in safe handling of radioactive materials. Security and/or their assignees will receive appropriate radiation safety training.
5. All packages containing radioactive material will be stored in a secured area to prevent unauthorized access to these items, i.e. locked in the NM Department or hot lab.
6. If at any time Security or other personnel identifies an unattended package containing radioactive material, (package containing white or yellow radiation warning label) the below steps must be followed:
    a. Security or other personnel finding the package will not leave the package unattended. Someone will stay with the package until it is locked securely in the NM department.

b. If the package appears wet or damaged, do not touch it. Call the nuclear medicine technologist immediately. The carrier should remain until the technologist has arrived and determined the extent of radioactive contamination of the delivery personnel and vehicle. The technologist should contact the RSO.

c. Call a nuclear medicine technologist to secure the package. If it is after normal working hours, have the operator page the technologist on call or contact general radiology for nuclear medicine technologist contact information. The RSO may be contacted.

7. Below are immediate contacts for nuclear medicine departments within the **MHC System:**

Facility Name	Contact	Telephone Number
MHC System (all facilities)	RSO	(231) 392-8612 TelemedIQ - RSO
	Medical Physics Consultants	(734) 662-3197
MMC	NM	(231) 935-7229
	Radiology	(231) 935-6429 or 33620
	Traverse Heart and Vascular (THV)	(231) 395-3261
CAD	NM	(231) 876-7264
	Radiology	(231) 876-7675
GRY	NM	(989) 348-0805
	Radiology	(989) 344-4997
MHCH	NM	(231) 547-8672
	Radiology	(231) 547-8792
MHMH	NM	(231) 398-1178
	Radiology	(231) 398-1147
OMH	NM	(989) 731-2188
	Radiology	(989) 731-2175

G. **Opening Radioactive Packages:**

1. Put on ring badge (if not already on), then gloves to prevent hand contamination.
2. Visually inspect the package for any sign of damage (e.g., wet or crushed). If damage is noted, stop and notify the RSO.
3. Measure and record the exposure rate from the package at 1 meter. If the rate is greater than 10 mR/hr, stop and immediately notify the RSO, the final delivery carrier, and the NRC regional office by telephone (301) 816-5100) and fax.
4. Measure and record the exposure rate on the surface of the package in the same orientation as the data taken in Step 3 above. If the rate is greater than 200 mR/hr,

stop the procedure and immediately notify the RSO, the final delivery carrier, and the NRC regional office by telephone (301) 816-5100 and fax.

5. Wipe 300 cm² external surface area of the package in compliance with 10 CFR 20.1906 (D.O.T. 49 CFR 173.443). Assay the wipe sample with a suitable instrument sufficient to detect 2400 dpm to determine if there is any removable activity. If there is any contamination over 7200 dpm/300cm², immediately notify the RSO, the final delivery carrier, and the regional office of the NRC by telephone (301) 816-5100 and fax. **DO NOT OPEN THE PACKAGE!!**
6. Follow the steps listed below when opening a normal package:
    a. Remove the packing slip.
    b. Open the outer package following the supplier's instructions, if available.
    c. Open the inner package and verify that the contents agree with the packing slip.
    d. Check the integrity of the final source container. Look for broken seals or vials, loss of liquid, condensation, or discoloration of the packing material.
    e. If anything unusual is noticed, stop and notify the RSO.
7. Verify that the material received is the material ordered.
8. Verify that the manufacturer receives the material being returned.
9. Monitor the packing material and the empty packages for contamination with a GM survey meter before discarding. If contaminated, treat it as radioactive waste. If not contaminated, deface all radiation labels before discarding.
10. Record the receipt and all readings taken.
11. The diamond label used is determined by the exposure measurements noted below. Ensure the package conforms to these exposure levels/label pairings.

	Surface	One Meter
WHITE I	Less than 0.5 mR/hr	Background 0.03mR/hr
YELLOW II	0.5 - 50 mR/hr	Less than 1 mR/hr
YELLOW III	50 - 200 mR/hr	1 - 10 mR/hr
	200 - 1000 mR/hr	Greater than 10 mR/hr
Exclusive Use Only		

H. **Storage of Radioactive Material:**

1. All MHC facilities adhere to the NRC regulations for securing licensed radioactive material. All radioactive material will be secured from unauthorized access or removal. Rooms/areas containing stored radioactive material will be actively secured. Stored radioactive material will be secured from unauthorized removal. Control and constant surveillance will be maintained over radioactive material not in storage, such as patient doses.
2. We will maintain records of receipt, transfer, and disposal of licensed material, and we, or an assignee, will conduct physical inventories at required frequencies to

account for sealed sources as required.

l. **Equipment:**

1. A performance evaluation on all Nuclear Medicine and PET cameras and their associated review monitors will be performed at least annually by a Medical Physicist.

Update Responsibility

A. MHC RSO

Distribution

A. All MHC departments using ionizing radiation (x-ray) producing machines or radioactive materials

Reference

1. Position Statement on the Use of Patient Gonadal and Fetal Shielding (2019)

Attachments

- ALARA-LEVEL-I-Notification-fillable-2.pdf
- ALARA-LEVEL-II-Investigation-and-Questionnaire-fillable-3.pdf
- Excerpt Radiation Safety Policy July 2024.pdf
- Pregancy Declaration MHC March 2024.pdf

Approval Signatures

Step Description	Approver	Date
System Policy Oversight Committee	Terri Fries: Document Mgmt Spec	6/16/2025
System Director Radiology	Branden Hill: Sys Dir Radiology	6/16/2025
Document Owner	Dennis Aurand: Medical Physicist	5/15/2025

Applicability

Cadillac Hospital, Charlevoix Hospital, Grayling Hospital, Kalkaska Memorial Health Center, MHC Corporate (Home Health, Dialysis, NMSA, etc.), Manistee Hospital, Munson Medical Center, Otsego Memorial Hospital, Paul Oliver Memorial Hospital

Standards

No standards are associated with this document