Cardiac Cath Lab: Post Procedure Care

(Includes Site Management: Femoral, Radial and Ongoing Care)

Site Applicability

PHC – Cardiac Cath lab, Cardiac Short Stay Unit, Cardiac Intensive Care Unit, Cardiac Inpatient Unit

Practice Level

- **Sheath Removal –** restricted to Registered Nurses in CSSU, CICU and Cardiac Cath Lab
- **Site Management following sheath removal, including care of the patient with a closure device –** restricted to Registered Nurses working in cardiac specialty areas

Quick links

1. Part One - Site Management
2. Arterial Sheath Removal – timing of events
3. Femoral Venous Sheath Removal – timing of events
4. ACT Guided Sheath Removal (CSSU only)
5. Femoral Sheath Removal – assessment, interventions and procedure
6. Radial Compression Band Removal
7. Part Two – Ongoing Post Procedure Care
8. Patient and Family Education

Requirements

1. In CSSU, a sheath may be removed earlier if there is a documented activated clotting time (ACT) of less than 150 seconds. ACT-guided sheath removal can be initiated by the CSSU nurse to expedite sheath removal and facilitate timely transfer or discharge.
2. Nurses are ***not*** responsible for removing sheaths larger than ***#8F*** in an ***artery*** or ***#14F*** in a ***vein***.
3. Arterial sheath removal requires one to one nursing care until hemostasis is achieved.
4. Nurses are ***not*** responsible for sheath removal in patients with rapidly expanding hematomas. Signs of bleeding and presence of new hematomas must be reported to the cardiologist who will specify timing and method of sheath removal.
5. Staffing: In CSSU and CICU the following standards must be met:
    - In CSSU, at least three nurses in the unit, one not currently removing sheath or staggered by at least 10 minutes, with first patient stabilized before second sheath removed.

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- In CICU, at least one other RN not necessarily trained in sheath removal, on the ward for the duration of the procedure. Sheath nurse ascertains that all patients on the ward are stable prior to initiating sheath removal. The sheath nurse delegates the care of his/her patients while performing sheath removal.
- In all areas: there will be no simultaneous clamping by one nurse.

Need to Know

Research has demonstrated that earlier sheath removal is associated with fewer bleeding and hemodynamic complications.

1. The timing of sheath removal is dependent on the administration and timing of anticoagulation agents:
    - If ***no heparin*** was given, the sheath may be removed immediately post-procedure.
    - If ***heparin*** was given, the sheath may be removed 3 hours after the last bolus.
    - If ***heparin infusion was discontinued***, the sheath may be removed 2 hours after the time the infusion was stopped. If the patient ***also*** received a bolus, the sheath is removed 3 hours after the bolus.
    - If ***bivalirudin*** was given, the sheath may be removed 2 hours following discontinuation of the infusion.
    - If patient has received ***Low Molecular Weight Heparin (e.g. enoxaparin)*** the sheath is removed 8 hours following the last dose.
2. Patients admitted for percutaneous cardiac cath lab procedures routinely undergo arterial puncture and sheath insertion. The most frequently used site is the right radial artery. The femoral artery or brachial artery may also be used. **Nurses are *not* responsible for removing sheaths placed in the brachial artery**.
3. The timing of sheath removal is dependent on the administration of heparin during the procedure. Heparin is *not* usually given to patients undergoing *diagnostic* procedures (selective coronary angiography, LV angiogram, right heart catheterization, cardiac biopsy). Heparin is *almost always* given to patients undergoing *interventional* procedures (coronary angioplasty and stent placement, valvuloplasty, VSD/ASP/PFO closure) to prevent thrombus formation. Note that heparin is almost always given for diagnostic procedures performed through the radial artery. The RN must check the MAR and note the time of heparin administration to determine timing of sheath removal.
4. Patients in CICU are presumed to be more complex and more ill than elective patients. Thus longer bedrest times are required.
5. In assessing for complications, it is most important to check the sheath insertion site. VS are not always the best indicators of bleeding.
6. An intravascular closure device may be used to achieve hemostasis in certain special cases (1) to avoid interruption of heparin therapy, (2) to facilitate patient care (e.g. extreme agitation or back pain) or (3) to facilitate timely transfer to referring hospital (e.g. STEMI patients undergoing direct

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PCI). The device may involve intravascular stitching or the placement of a collagen plug. Required bedrest time is determined from the time the intravascular closure device was placed. If the device fails, the patient may require placement of a compression device to control bleeding.

7. Venous sheaths are required to perform Right Heart Catheterizations (7F sheath), Cardiac Biopsies (9F sheath) and a variety of right heart interventions (sheath size varies).
8. Venous sheath removal can be performed using either manual pressure or a compression device. Venous hemostasis can be routinely achieved in approximately ten minutes; however, clinical indications, patient status and the procedure performed may warrant lengthening the timing of sheath removal, bedrest and ambulation.
9. Closure devices or suturing techniques are occasionally used by physicians to achieve venous hemostasis.

Non Coronary Interventions

1. In addition to coronary angiography, percutaneous coronary interventions and right heart catheterization, patients undergo other established and investigational procedures in the cardiac catheterization laboratory. These include closure of cardiac defects (e.g. VSD, ASD, PFO closures), congenital heart lesion interventions (e.g. "Baffle" stenting, coarctation of aorta repair), valvular heart disease interventions (e.g. mitral/aortic valvuloplasty, mitral/tricuspid repair, aortic/mitral/tricuspid replacement), and septal artery ablation.
2. Some of these procedures are well established in interventional practice, others are innovative and under investigation. Interventional cardiologists and research coordinators facilitate research protocols and may also act as resources for procedures performed under Health Canada's Special Access Program.
3. Information about new procedures may be beyond the scope of this protocol. Consult the CNL, Nurse Educator, Clinical Nurse Specialist and/or Interventional Cardiology Research Coordinators as appropriate to obtain further information.

Following non-coronary procedures, patients may be discharged home from CSSU or transferred to CICU, 5A or other inpatient units, depending on the patient's condition and the procedure performed

Protocol

Assessment

Immediately before sheath removal:

1. Sheath site:
    - Location: femoral or radial. If brachial, contact cardiologist for removal. If two sheaths are present, the arterial sheath is the outer/lateral site and usually green, the venous sheath is closer to the patient's midline.
    - Femoral sheath size:

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  - #5F: most commonly used for arterial waveform monitoring during venous cases
  - #6F: most commonly used for SCA and PCI
  - #7F: most commonly used for right heart catheterization (venous)
  - #8F: infrequently used, for inserting larger equipment during case
  - #9F: long venous sheath for cardiac biopsy
- Assess VS and vascular status of affected limb. If limb is pulseless and cold/mottled, notify interventional cardiologist immediately.
- Ensure patent IV access. Ensure atropine, NS 1 L. and sheath removal equipment available.
- Continue or initiate cardiac monitoring or use non-invasive blood pressure monitoring to continuously monitor heart rate during sheath removal process.
- Encourage patient to empty bladder.

2. Check Cardiology Intervention Procedure Report for procedure performed (**Diagnostic** – SCA, LVA, RHC, biopsy or **Interventional** – PCI angioplasty and/or stenting, valvuloplasty, valve repair/replacement, ASD/VSD/PFO closure) and Cerner documentation to determine *administration of heparin.*

Part 1 Site Management

Interventions

Immediately before sheath removal:

- If there is bleeding or signs of hematoma consult interventional cardiologist or delegate for further instructions re sheath removal and patient transfer.
- Assess and treat as per orders for pain, agitation or anxiety.

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Table 1

Femoral/Radial ARTERIAL Sheath Removal and Closure Device Site Management: Timing of Events				
	Sheath Removal Timing	**Patient Assessment** • Access Site Assessment • Vital Signs • CWMS	**Bedrest**	**Transfer/Discharge from CSSU**
Femoral Sheath: CSSU Elective or from Referring Hospital	**No heparin bolus:** Immediate **Heparin bolus:** 3 hours post bolus **Heparin infusion only:** 2 hours post infusion stop **Bivalirudin:** 2 hours post infusion stop	**Prior to clamping:** Q15 min x 1 hour, Q30 min x 1 hour, Q1H until sheath out **While Clamping**: Q 15 min and PRN **Post clamping:** Q15 min x4 then Q1H	**No heparin:** 2 hours post hemostasis **Heparin Bolus PCI:** 4 hours post hemostasis **Heparin FFR:** 3 hours post hemostasis **Heparin Infusion** 3 hours post hemostasis **Bivalirudin:** 4 hours post hemostasis	**No Heparin:** • *Elective outpatient's and non-cardiac wards:* 30 MIN supervised ambulation • *Cardiac ward:* once hemostasis achieved and staffing permits **Heparin bolus/Bilvalirudin:** • *Elective outpatients*: 30MIN supervised ambulation • *Referring hospital:* 1 hour post hemostasis or earlier as per interventionalist • *Cardiac ward:* post hemostasis and once staffing permits • *Non-Cardiac ward:* 4 hours post hemostasis
Femoral Sheath: CICU	**No heparin bolus:** Immediate **Heparin bolus:** 3 hours post bolus **Heparin infusion only:** 2 hours post infusion stop **Bivalirudin:** 2 hours post infusion stop	**Prior to clamping:** Q15 min x 1 hour, Q 30 min x 1 hour, Q1H until sheath out **While clamping:** Q15 min and PRN **Post clamping:** Q15 min x 4, then Q1H s3, Q4h x 24 hours and PRN	**No Heparin:** 3 hours post hemostasis **Heparin Bolus:** 4 hours post hemostasis **Heparin Infusion:** 4 hours post hemostasis **Bivalirudin:** 4 hours post hemostasis	N/A

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	Sheath Removal Timing	Patient Assessment • Access Site Assessment • Vital Signs • CWMS	Bedrest	Transfer/Discharge from CSSU
Radial Sheath	**The timing of radial sheath removal is not affected by antithrombotic use** Radial sheath removed in Cath Lab and Terumo TR Band applied Terumo TR Band deflation initiated 60 minutes after initial application Deflate by 1 to 2 mL of air Q5 to 10 minutes until the band does not provide compression	**Prior to deflation:** Q15 minutes **During deflation:** • Q15 minutes **Post deflation:** **CSSU:** Q15 minutes x 1 hour Q1H x 4 and PRN Site check Q15 min x 4 **CICU and 5A:** Q15 minutes x 4 Q1H x 4 Q4H x 4 and PRN	**PCI/FFR** • 60 MINS post hemostasis **SCA** • 30 MINS post hemostasis **Avoid using affected limb for rest of day**	**No PCI performed:** • *Elective outpatient/Non-Cardiac Ward:* supervised ambulation for 30MINS • *Cardiac ward:* Upon hemostasis and staffing permits • *Referring hospital*: Upon hemostasis **PCI performed:** • *Elective outpatient/Non-cardiac Ward:* Observation for minimum 4 hours post procedure • *Cardiac ward*: Upon hemostasis and staffing permits. • *Referring hospital:* 1 hour post hemostasis or earlier as per interventionalist. **FFR performed:** • *Elective outpatient/transfer to non-cardiac Ward:* Observation for minimum 3 hours post procedure • *Transfer to cardiac ward:* Upon hemostasis and as staffing permits. • *Transfer to referring hospital:* 1 hour post hemostasis or earlier as per interventionalist.

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	Sheath Removal Timing	Patient Assessment • Access Site Assessment • Vital Signs • CWMS	Bedrest	Transfer/Discharge from CSSU
Closure Device	**N/A**	**CSSU:** Q15 minutes x 1 hour Q1H x 4 and PRN Site check Q15 min x 4 **CICU and 5A:** Q15 minutes x 4 Q1H x 4 Q4H x 4 and PRN	• 2 hours post closure device insertion • Longer if bleeding present or ↑ BP	**No heparin:** • *Elective outpatients/Non-cardiac ward*: 30 minutes supervised ambulation • *Cardiac ward:* post hemostasis and once staffing permits. • *Referring hospital:* 1 hour post hemostasis or earlier as per interventionalist **Heparin/Bilvalirudin:** • *Elective outpatient/non-cardiac ward:* 2 hours observation with supervised ambulation. • *Cardiac ward:* Post hemostasis and staffing permits. • *Referring hospital:* 1 hour post hemostasis or earlier as per interventionalist.

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Femoral VENOUS Sheath Removal: Timing of Events				
	Sheath Removal Timing	**Patient Assessment** • Access Site Assessment • Vital Signs • CWMS	**Bedrest**	**Transfer/Discharge from CSSU**
9F sheath and smaller	**No Heparin/Bivalrudin:** Immediate sheath removal **Heparin/Bivalrudin:** 1 hour post bolus or infusion discontinuation	• Prior to sheath removal • Immediately post sheath removal • 30 minutes post hemostasis	1 hour post hemostasis	• Supervised ambulation for 30 minutes.
10F sheath and larger	**See physicians orders**			

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ACT guided Sheath Removal – CSSU ONLY

Use activated clotting time (ACT) guided sheath removal as necessary to facilitate transfer/discharge of interventional patients

Sheath may be removed as soon as ACT less than 150 seconds is obtained

Table 2

Measure ACT **One hour after heparin bolus or infusion discontinued**			
If ACT:			
150 seconds or less	151 to 200 seconds	Over 200 seconds	Over 200 seconds after 6 hours
Remove sheath	Repeat ACT in 1 hour	Repeat ACT in 2 hours and alert CNL/CN for possible need for admission	Send blood for PTT and inform interventionalist

Procedure for Femoral Sheath Removal

Equipment

1. Compression device and sterile disc	5. Non sterile 4 x 4 gauze
2. Stitch cutter (if sheath sutured)	6. Tegaderm dressing
3. Non-sterile gloves	4. Sterile 4 x 4
5. Eye protection	7. 2 to 3 vials atropine 1 mg

Procedure

Procedure	Rationale
1. Consider analgesia/sedation PRN.	
2. Position patient supine, pelvis parallel to bed, spine in straight alignment, with affected leg close to edge of bed. Feet should be pointing out, approx. 12”apart	Compressor base fits under mattress. Disc should remain flush with skin if patient is flat. Separating feet flattens inguinal area.
3. Use goggles and gloves	High risk procedure for exposure to blood

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4. Place compression device under mattress. Align clamp with patient's hips at femoral sheath site	Taking the time to landmark the correct position for the clamp will minimize/prevent complications
5. Remove sheath sutures if present. Ensure no IV running through side arm. Dry skin around sheath	Dry surface will prevent compression device from slipping
6. Place disc on compression device	
7. Locate femoral pulse. Lower arm of compression device to sheath site. Position top of disc's notch just above puncture site with opening towards foot	Ensure centre of disc compresses area above puncture site. Arterial puncture is not performed at straight angle to patient but rather on a medial plane. The actual arterial puncture is "up and medial" to skin incision site.
8. Grasp hub of femoral sheath and remove while applying strong downward pressure to device arm. Continue applying pressure until no visible bleeding from site. Secure with locking device.	Initial strong pressure will ensure hemostasis
9. Assess cardiac rate and rhythm, BP and pain. Implement emergency interventions if required (see Emergency Interventions). Remind patient to breathe normally.	Hypotension and bradycardia are signs of vagal reaction. A vagal reaction can occur initially or any time during the procedure.
10. Stay with patient and keep site visible at all times while maintaining pt's privacy. Monitor vascular status of limb throughout clamping procedure. Pulses should be occluded for maximum 5 minutes.	Constant visualization of site will ensure immediate intervention if complications occur. Expect pedal pulses to be temporarily diminished. Limb colouring may be mottled.
11. Release pressure slightly 5 to 10 minutes after applying clamp to optimize perfusion and patient comfort while maintaining hemostasis. Release clamp Q5 MIN till pressure fully released	Release pressure slowly as rapid increase in flow could dislodge newly formed clot. Total clamp release time is approx. 20 MIN. for diagnostic procedures, 20 to 45 minutes for interventional procedures
12. If bleeding occurs during release procedure, re-apply pressure to achieve hemostasis. If bleeding is significant (arterial), restart clamp time. If bleeding is minimal (subcutaneous, venous) extend clamp time to ensure hemostasis	
13. Apply a twice folded sterile 4 x 4 to the puncture site covered by a tegaderm dressing.	Note: There is *no evidence* for the use of pressure dressings or the use of sand bags over puncture sites post procedure. If the site is oozing manual pressure or re-clamping is the method to use.

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Assessment

Immediately after removal:

1. Assess VS as per protocol (Table1). Ensure patient is breathing easily.
2. Assess for signs of pain and anxiety
3. Ensure hemostasis is maintained. Apply additional clamp pressure as required

Interventions

Immediately after removal **– Routine:**

1. Remain with patient continuously until clamp is removed.
2. If pedal pulses remain absent after clamp release initiated or extreme pain 3-5 minutes following initial application of clamping device, reduce device pressure while maintaining hemostasis until return of normal findings. Consider changing to manual pressure.
3. Once clamp released and hemostasis achieved, elevate HOB to 30° to promote comfort. Instruct patient to keep affected limb straight, to apply manual pressure prior to coughing and to alert nursing staff if signs of bleeding. Patients may turn to side (with assistance) one hour after hemostasis achieved. Avoid hip flexion for first hour after hemostasis.

Immediately after removal **– Emergency**

1. Vasovagal reaction defined as SBP less than 90 without appropriate tachycardia (HR over 90) and/or isolated bradycardia. Administer NS 250 mL, may repeat x 1, and atropine 0.6 mg IV. If no improvement, repeat atropine and inform procedure cardiologist. Continue cardiac and hemodynamic monitoring.
2. Yawning and lightheadedness may be signs of hypotension. Check BP.
3. If hematoma forms during compression assess disc position, reposition if necessary and/or increase compression device pressure.

   If hematoma forms after compression device removed (or following placement of vascular closure device), apply manual pressure. Consider re-applying compression device. Assess VS and vascular status distal to hematoma. Mark edges of hematoma with felt pen. Notify procedure cardiologist if hematoma is greater than 5 cm or expanding.

   - If patient becomes agitated or bleeding becomes unmanageable, request assistance/emergency help and stay with patient. Implement emergency procedures as required.

Procedure for Radial Compression Band (Terumo TR Band) Removal:

1. Radial sheaths are removed in the Cardiac Cath Lab by the interventional cardiologist in collaboration with the scrub nurse. The Terumo TR Band™ is applied over the radial puncture site. Air is injected into the radial band to compress the radial artery. The *maximum* amount of air that can be injected into the Terumo TR Band™ injector port is 18 mL. The amount of air

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in the band is documented on the nursing record in the intra-procedure section and communicated to the CSSU RN receiving the patient from the Cath Lab.

2. Compression band deflation timing: 60 minutes following the initial application of the band in the Cath Lab.
3. The Terumo TR™ Inflator syringe must travel with the patient from the Cath Lab to CSSU.

Procedure	Rationale
1. Prepare patient: Consider sedation/analgesia, ensure patent IV.	IV may be required for emergency interventions.
2. Assist patient to comfortable position. Instruct re: need to keep affected arm immobilized.	Patient comfort will optimize hemostasis
3. Leave Terumo TR Band™ in place for 60 minutes post procedure without deflating air from the cuff. However: • If patient complains of discomfort confirm there is no bleeding and remove 1 to 2 mL of air from the air injection port using the TR Band™ Inflator syringe. • If bleeding occurs add 1 to 2 mL of air into the air injection port using the TR Band™ Inflator syringe until hemostasis is achieved without exceeding 18 mL of air	
4. No atropine is given unless patient has vagal complications.	Atropine is not routinely given, as the sheath is removed immediately following the procedure.
5. After 60 minutes post initial application of Terumo TR Band™: • Remove 1 to 2 mL of air from the air injection port using the TR Band™ Inflator syringe every 5 to 10 minutes until band is not providing compression	Interventional procedures are more likely to cause increased bleeding and longer clot formation time.
6. If hematoma or bleeding develops, re-inject 1 to 2 mL of air until hemostasis is achieved without exceeding 18 mL of air. Wait 10 minutes before attempting to deflate again. *If* unable to control bleeding or hematoma without exceeding 18 mL of air in the cuff, remove the cuff and apply direct manual pressure to site.	
7. Instruct patient to call for assistance for voiding, discomfort or signs of complications. Instruct re: duration of bed rest and avoidance of use of affected arm for 24 hours	
8. Site is covered with sterile 2 x 2 and transparent dressing	Minimal dressing optimizes site inspection for early detection of bleeding complications.

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Documentation

1. Record VS, vascular status and site observations using Cerner, except during downtime when downtime paper Cardiac Short Stay Unit tri-fold can be used.

Part 2 Ongoing Post Procedure Care

Initial and On-going Assessment:

1. Assess respiratory status. Measure SpO_2 PRN as required.
2. Assess neurological status (ability to move and to speak, Glasgow Coma Scale in CICU)
3. Monitor cardiac rhythm continuously during sheath removal.
4. Assess for signs and symptoms of ischemia.
5. CSSU/CICU only: If signs and symptoms of ischemia present, initiate ST segment monitoring specific to culprit lesion(s). Set high and low limits and continue monitoring until ischemia has resolved.
6. Assess other pain status and anxiety
7. Assess skin for itchiness/rash if allergic reaction occurred. Treat as per medical orders.
8. Assess for hematuria, epistaxis, bleeding from gums, bruising if anticoagulated.

Initial and On-going Interventions:

1. If patient experiences chest pain or demonstrates signs and symptoms of ischemia, obtain STAT 12 lead ECG and implement protocol for the management of chest pain. Notify physician.
2. Notify physician if patient becomes unstable. This includes changes in cardiac rhythm, hemodynamic compromise, ST segment changes (CSSU/CICU), respiratory decompensation, altered level of consciousness.
3. Consider transducing arterial sheath if vascular access sheath is to remain in patient overnight.
4. Provide analgesia for back or other discomfort
5. Assist with turning Q2H until activity restrictions are removed
6. Provide skin and back care Q2H while patient on bed rest
7. NPO until sheath removed, progress from fluids to diet as tolerated
8. If bleeding at puncture site occurs after hemostasis achieved:
    - Reinforce dressing if only oozing
    - If persistent/moderate to severe re-bleed, apply manual pressure 1-2 cm above skin puncture site or re-apply compression device and follow procedure.
    - Ensure proper limb alignment and continue bed rest
    - Provide sedation PRN
        - Notify physician if bleeding not controlled after above interventions
9. **ON 5A** if bleeding at puncture site occurs after hemostasis achieved:
    - Apply manual pressure 1 to 2 cm above skin puncture site for 15 minutes. If bleeding stops, continue bed rest as per Table 1.

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- Do not use a pressure dressing or sand bag to cover the puncture site.
- If bleeding does not stop, during CSSU hours notify the CSSU CNL or charge nurse or, if after hours, call the CICU charge nurse.
- 5A CNL and CICU/CSSU CNL will determine appropriate location for on-going care of patient
- If at any time the patient deteriorates, call a code blue.

10. Patients returning to hospital of origin: if procedure site, VS and/or patient condition unstable, hold transfer and notify physician.
11. Following bed rest, assess patient's ability to ambulate. Sit patient up in bed for 5-10 min. Assess for dizziness.
12. Encourage patient to ambulate. Observe puncture site for signs of bleeding, bruising or swelling after ambulation.
13. Encourage patient to take fluids to promote renal excretion of contrast media and nourishment.
14. CSSU Patients: discontinue IV upon discharge.
15. CSSU Patients: If the patient requires an overnight stay, they must have stable VS, no uncontrolled bleeding, no angina or ST segment changes since leaving lab if being transferred to cardiology ward from CSSU. Any patients not fitting these criteria must be transferred to CICU instead.

Patient and Family Education

1. Prior to sheath removal
   - Explain pain/discomfort involved, duration of procedure, positioning requirements. Explain need to inform nurse of pain/discomfort.
   - Reinforce need for normal breathing and avoidance of Valsalva manoeuvres.
   - Explain that RN will be constantly present during procedure.
2. Following full release of compression device:
   - Inform patient of length of bed rest and activity restrictions. Instruct re: proper positioning (flat on back for one hour, then able to turn from side to side while maintaining affected leg straight) with head on pillow at all times.
   - Reinforce avoidance of Valsalva manoeuvres, need to call nurse if pressure, pain or sensation of bleeding, or need to void. Instruct patient to place hand over site if needing to sneeze/cough. Ensure call bell is within reach.
   - Patients may eat/drink one hour following removal of compression device.
   - Reinforce need to communicate presence of chest pain or other discomfort.

3. Post Procedure
   - Reinforce pre-procedure teaching re: bed rest and avoiding straining and need to report signs and symptoms of ischemia
   - Provide risk factor assessment and counseling

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- Upon discharge, provide patient with copy of Discharge Guidelines, patient's coronary diagram and appropriate teaching materials and prescriptions.

Related Documents

- B-00-13-10062 – Cardiac Cath Lab: CICU/5A Patient Undergoing Percutaneous Transcatheter or Electrophysiology Procedures

References

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3. Andersen, K., Bregendahl, M., Kaestak, H., Skriver, M., & Ravkilde, J. (2005). Haematoma after coronary angiography and percutaneous coronary intervention via the femoral artery: frequency and risk factors. *European Journal of Cardiovascular Nursing, 4*, 123-127

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