LEARNING MODULE FOR
POST CARDIAC CATHETERIZATION

ARTERIAL/ VENOUS SHEATH REMOVAL:
APPLICATION OF MANUAL PRESSURE;
RELEASE/REMOVAL OF GROIN COMRESSOR

(DELEGATED MEDICAL FUNCTION)

CC 10-009

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PURPOSE:

This learning module provides the Registered Nurse (RN) in the Cardiac Catheterization Laboratory with the theory and practice necessary to perform the delegated medical function of Post Cardiac Catheterization Arterial/Venous Sheath Removal: Application of Manual pressure; Release/Removal of Groin Compressor. After completing the learning objectives, the RN will demonstrate competency according to the proficiency standards.

LEARNING OBJECTIVES:

Following completion of the independent learning activities, the RN will be able to:

1. Describe the anatomy of the inguinal region.
2. Discuss the nursing interventions required prior to and following arterial or venous sheath removal.
3. Describe the theory and procedure related to preparation of the patient for sheath removal; removal of the venous or arterial sheath(s) using manual pressure, releasing/removing a groin compression device; management of post procedural complications; identify symptoms/signs of hematoma formation femoral pseudo aneurysm, AV fistula, or occlusion.
4. Demonstrate an ability to effectively teach patients regarding post sheath removal activity.
5. Discuss treatment of symptomatic hypotensive patients.
6. Demonstrate a calm confident approach to arterial and venous sheath removal and post sheath removal care.

METHOD:

The RN will perform the following independent learning activities:

2. Observe venous & arterial sheath removal by a catheterizing physician/Delegate.
4. Successfully remove 2 groin compression devices in the presence of a catheterizing physician/delegate.
6. Complete an annual recertification that consists of Method 1 and 5 and one demonstration of the skill in the presence of a catheterizing physician/delegate.
THEORY:

To perform cardiac catheterization, an arterial sheath is inserted in the femoral artery and/or a venous sheath may be inserted in the femoral vein.

The anatomy of the inguinal region is shown in Figure 1. A mnemonic to remember the important structures crossing the inguinal ligament is NAVEL where N = femoral nerve; A = femoral artery; V = femoral vein and eL = empty space with lymphatics. Move lateral to medial to locate these structures.

![Figure 1](image)

Femoral arterial or venous sheaths are generally removed immediately following cardiac catheterization by the cath lab nursing staff. On rare occasions the patient is returned to the nursing unit with sheaths in situ. Patients on anticoagulant therapy prior to or during their cardiac catheterization may require a 1-3 hour period for heparin to metabolize before their arterial sheath can be removed. When in doubt; check the patient's ACT prior to sheath removal. The ACT should be less than 150 sec. prior to sheath removal to ensure successful hemostasis.

After explaining the procedure to the patient assist him/her to move closer to the side of the stretcher. The head of the stretcher should be flat. Generally no pre-medication is required, as the local lidocaine anaesthesia in the groin area does not wear off for 60 -90 minutes. However; remember to assess the patient for increasing pain throughout sheath removal and administer pain medication if appropriate. This measure will assist in the prevention of a vasovagal episode, which may be induced by the pain of manual pressure. A vasovagal episode could precipitate abrupt closure of a coronary artery. After putting on a pair of non-sterile gloves the process of to begin sheath removal can be started.
Generally, the left hand is used to compress the right femoral artery while the right hand is used to compress the left femoral artery. Manual pressure is applied to the artery so that the index finger is placed on the site where the sheath enters the femoral artery. The middle and ring fingers of the same hand are used to reinforce compression. After the hand is placed on the artery, manual pressure is applied as the arterial sheath is gently removed from the site. Just enough pressure is applied to avoid excessive blood loss; however, a small amount of blood should be allowed to escape from the artery in case of thrombus formation associated with the sheath.

After allowing a small amount of blood to escape, firm pressure is applied to occlude the femoral artery just enough to achieve hemostasis and at the same time retain at least a weak dorsalis pedis or posterior tibial pulse. If necessary, an assistant can determine by Doppler the presence of the pedal pulse prior to and following compression. This compression rate should not exceed 5 minutes. Gradually release the pressure to allow the pedal pulse to increase in strength. Maintain a delay between when the pulse is felt by the compressing hand and when it is felt by the hand palpating the pedal pulse. Maintain this amount of pressure another 5 minutes. The pressure is gradually removed over 5-10 minutes allowing for a progressive strengthening of the pedal pulse.

With the non-compressing hand, palpate the femoral area around the compressing hand to ensure there is no occult hematoma formation. If there is evidence of bleeding from the puncture site, or increasing hematoma formation as pressure is released from the femoral artery, apply more pressure to the artery.

If despite 15-20 minutes of manual pressure, there is bleeding or continuing hematoma formation, then the catheterizing physician should be consulted. He/she may decide to continue compression with a mechanical clamp.

If a venous sheath was used, compress above and below the sheath entrance as the sheath is gently removed. Maintain firm pressure for 5 minutes.

If both arterial and venous sheaths are present, the arterial should be removed first and the venous 5 minutes later (or when arterial control is achieved if this is longer) to reduce the risk of A-V fistula formation.

The catheterizing physician may also remove the sheath(s). He/she will apply a mechanical groin compressor or clamp to the site to achieve hemostasis. This device consists of a base that slides under the stretcher mattress and an arm with a disposable, sterile compression disc positioned over the puncture site. The device must be monitored constantly as the “arm” can loosen if the patient is restless. The nurse is asked to release and remove the clamp according to the protocol outlined on page 3 and 4 of the policy and procedure.

Once bleeding has stopped, apply an Elastoplast Band-Aid to the puncture site and provide patient instructions as outlined in the policy & procedure.

**Description**

Arterial or venous sheaths consist of a polyethylene tube 15-cm or 23 cm in length connected to a hub that has a silicone coated latex one-way valve to prevent back bleeding and allows introduction of catheters. Expect back bleeding with some models. These are generally provided with an obturator to plug the one-way valve and prevent back bleeding. Some sheaths with obturators
(BARD Hemaflex, Cordis) allow the sheath to flex without kinking, allowing the patient to be nursed up to 60° semi-Fowler's position.

Arterial and venous sheaths have side arms that allow blood samples to be taken and arterial flush solutions, intravenous fluids and medications to be given.

Potential Complications of Sheath Removal

1. **Vasovagal Episode**

   a. Possible Cause:

      i. Discomfort/pressure caused by the indwelling arterial sheath.
      ii. Discomfort from compression during sheath removal.
      iii. Hematoma
      iv. Blood loss may make the patient more susceptible to vasovagal episodes. In fact, the mere "sight" of blood may actually precipitate a vasovagal event.

      The above result in bradycardia and vasodilation that leads to hypotension.

   b. Nursing Action

      i. Recognize vasovagal by patient signs and symptoms - yawning, cool, clammy skin, nausea, a decreased level of consciousness, reduction in systolic blood pressure to less than 90-100 mm Hg and heart rate less than 50-60 beats per minute where patients are beta blocked.

      ii. If the patient displays decreased BP or pulse and/or is symptomatic, administer an intravenous fluid bolus of 250-500 mL normal saline, atropine 0.6 mg IV and metoclopramide 10 - 20 mg IV, if necessary for nausea.

      iii. Check for hematoma formation, or blood loss from groin site and re-apply manual pressure if appropriate.

      iv. Check vital signs q 5 minutes until heart rate and blood pressure return to pre-vasovagal episode level.

      v. If the vasovagal episode does not respond to these simple measures, page the catheterizing physician to assess patient.

2. **Post Sheath Removal Bleed or Hematoma**

   a. Possible Cause

      Despite the most meticulous technique, some patients will bleed spontaneously or develop a hematoma following sheath removal. Patients with aortic insufficiency and brisk wide pulse pressures, hypertensive patients, obese patients and those on anticoagulants are most susceptible.
b. Nursing Action
   
i. Immediately re-apply pressure to femoral artery puncture site.

ii. Check vital signs and observe closely for any evidence of a vasovagal reaction and treat appropriately if occurs.

iii. Apply 10-15 minutes of further manual pressure. Do not occlude distal pulse.

iv. If bleeding cannot be controlled with manual pressure, notify the catheterizing physician.

3. Retroperitoneal hematoma
   
a. Possible Cause

   Although rare, this is a potentially fatal complication. This can occur when the common femoral artery is punctured above the inguinal ligament. The puncture site should be below the ligament.

b. Nursing Action

   i. Know signs and symptoms which include moderate-to-severe pain in the back, flank, lower abdominal quadrant, or groin, along with tachycardia and hypotension.

ii. Notify catheterizing physician immediately.

4. Pseudo aneurysm, Arterio/Venous Fistula
   
a. Possible Cause

   Inadequate hemostasis after a femoral artery puncture allows blood to enter the wall of the femoral artery and create a false lumen or "pseudo aneurysm". The thinner wall of this pseudo aneurysm may rupture and must be repaired surgically or by echo Doppler guided compression.

   An Arteriovenous fistula may be caused when the Seldinger or front wall needle, used during arterial cannulation, inadvertently enters both artery and vein and allows a tract or fistulous communication between the two. An arteriovenous fistula may also occur if venous and arterial sites are close together and both sheaths are removed simultaneously. An arteriovenous fistula must be corrected surgically.

b. Nursing Action

   i. Pseudo Aneurysm:

   • Know signs and symptoms that include pulsatile, usually painful mass over the artery at the puncture site and possible nerve compression by the
mass resulting in sharp, stabbing or shooting pain in the groin that may radiate down the thigh.

- Determine type of pain and auscultate femoral artery to assess for a bruit.
- Notify physician to assess need for ultrasound and compression.

ii. Arteriovenous Fistula:

- Know signs and symptoms, which include a continuous bruit over the puncture site. Pain and/or swelling may or may not be present at the puncture site.
- Determine type of pain and auscultate femoral artery for bruit.
- Notify catheterizing physician to assess need for corrective surgery.

5. Arterial Occlusion

a. Possible causes:

Rarely seen today with the increased use of anticoagulants and antiplatelet drugs before, during and following cardiac cath. However, if a thrombus should develop at the puncture site, this could still occur.

b. Nursing action:

i. Prior to compressing the artery, allow a small amount of blood to escape immediately following the removal of the sheath. This will expel any clot(s) that may have been forming at the end of the sheath.

ii. Know the signs and symptoms of an arterial occlusion, which may include sudden onset of severe pain or numbness, pallor, cyanosis, or absence of distal pulses in the affected limb.

iii. Notify catheterizing physician of suspicion and prepare patient for surgery.

6. Infection

a. Possible causes

Femoral catheterization can result in phlebitis, bacteremia and infection. Infection may not be apparent until a few days following the procedure. Although the use of sterile technique has greatly reduced the incidence, infection may still occur with repeated use of the same groin site. Switching to the opposite leg for the second procedure would help reduce this risk. Patients who have undergone a procedure in which the catheter has been passed through a femoral graft are also at higher risk (but still low risk) for infection.
b. Nursing action
   
i. Know the signs and symptoms of infection, which may include swelling, redness, warm skin, and purulent drainage at the insertion site.
   
ii. Educate patient on the signs and symptoms of infection, the precautions to take to prevent infection and the appropriate action to take if discovered.

REFERENCES:

   Beattie, S., (1999). Cut the risks for cardiac cath patients. RN, Jan., Vol. 62, No. 1


   O'Neill, Dr. B., MacRury-Sweet, K., MacDonald, L., Janes, S. and Petrie, J., (1994) Delegated medical acts - expanded role nurse, Department of Cardiac Sciences Nursing and the Department of Medicine, Division of Cardiology, Victoria General Hospital, Post PTCA & Late Cardiac Catheterization Arterial & Venous Sheath Removal.


PROFICIENCY STANDARDS:

To be certified as competent to perform the procedure of Arterial/Venous Sheath Removal, the RN will successfully:

- complete the learning objectives
- complete a written and/or verbal test
- perform all aspects of the proficiency standard skills checklist
TEST:

1. Describe the anatomy of the inguinal region.

2. What is an acceptable ACT for sheath removal following a Cardiac Catheterization?

3. Why is a small amount of blood allowed to escape from the artery immediately following sheath removal just prior to applying manual pressure?

4. What is the nursing implication for patients receiving anticoagulant therapy prior to sheath removal?

5. How long must manual pressure be maintained if a venous sheath is removed?

6. Indicate five potential complications of arterial sheath removal and the nursing actions of each.

7. What are the causes of a vasovagal episode?

8. Under what circumstances would the RN not remove arterial sheaths following a cardiac catheterization?

9. Describe the manual compression procedure for occluding the femoral artery following sheath removal.
ANSWERS TO TEST QUESTIONS:

1. The anatomy of the inguinal region consists of the
   a. femoral nerve
   b. femoral artery
   c. femoral vein
   d. empty space with lymphatics moving lateral to medial.

   Remember NAVEL.

2. Less than 150 seconds

3. To allow the escape of any thrombi that may have formed around the femoral sheath.

4. Patients on anticoagulant therapy for their cardiac catheterization require a 1-3 hour period for heparin to metabolize before their arterial sheath can be removed. Generally these patients are returned to the home unit with femoral sheaths in situ.

5. Five minutes

6. The possible complications of arterial sheath removal and the nursing actions are:
   Vasovagal Episode
   • Recognize symptoms
   • Give IV bolus 250-500 mL normal saline
   • Give atropine 0.6 mg direct IV
   • Reapply manual pressure if necessary
   • Check vital signs q 5 minutes until they return to pre-vasovagal episode level
   • If no response, page catheterizing physician to assess

   Retroperitoneal hematoma
   • Recognize the symptoms
   • Notify catheterizing physician to assess

   Bleeding or Hematoma
   • Reapply manual pressure to femoral artery x 10-15 minutes
   • Observe patient for vasovagal episode and treat if necessary
   • Contact catheterizing physician if still unable to control bleeding

   Pseudoaneurysm, AV Fistula
   • Assess for symptoms
   • Auscultate for femoral bruit and notify physician if present

   Arterial Occlusion
• Recognize symptoms
• Notify catheterizing physician & prepare patient for surgery

Infection

• Recognize signs & symptoms
• Educate patient about signs & symptoms and appropriate action to take

7. A vasovagal episode may occur as a result of:

• Discomfort/pressure caused by the indwelling arterial sheath
• Discomfort from compression during sheath removal
• Hematoma or blood loss

8. The RN would not remove arterial sheaths where:

• sheath size greater than #9
• brachial or radial entry was used
• ACT greater than 150
• A clamp will be used to achieve hemostasis.

9. Manual Compression
Assuming the right groin is affected, place the index finger of the left hand on the site where the sheath enters the femoral artery. The middle and ring fingers of the same hand are used to reinforce compression. Manual pressure is applied as the arterial sheath is gently removed from the site. A small amount of blood should be allowed to escape from the artery in case of thrombus formation. Apply firm pressure 3-5 minutes where the femoral artery is occluded just enough to achieve hemostasis and the pedal pulse can be palpated as “weak”. Gradually release pressure so that the pedal pulse begins to increase in strength. Maintain a delay between when the pulse is felt by the compressing hand and when it is felt by the hand palpatiing the pedal pulse. Maintain this amount of pressure another 5 minutes. The hand is then gradually removed over 5-10 minutes more allowing for a progressive strengthening of the pedal pulse.
CAPITAL DISTRICT HEALTH AUTHORITY
ACUTE CARE DIVISION
PROFICIENCY STANDARD SKILLS CHECKLIST


NURSING UNIT: ____________________________________________________________

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<tr>
<th>Sheath removal &amp; manual pressure:</th>
<th>YES</th>
<th>NO</th>
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<tr>
<td>1. Checks physician's order.</td>
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<td>2. Gathers equipment and takes to bedside.</td>
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<td>3. Explains procedure to patient.</td>
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<td>4. Positions patient.</td>
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<td>5. Compresses the artery by applying manual pressure with the index finger and reinforcing with the middle and ring finger.</td>
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<td>6. Removes sheath gently while maintaining manual pressure.</td>
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<td>7. Compresses femoral artery for 3-5 minutes to achieve hemostasis. Pedal pulse should be palpable as “weak”.</td>
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<td>8. Gradually releases pressure until pedal pulse ↑ in strength (palpate pedal pulse with non-compressing hand) then continue this pressure for five minutes.</td>
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<tr>
<td>9. Continues to gradually remove pressure for 5-10 minutes allowing the pedal pulse to increase in strength.</td>
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<td>10. Assesses for hematoma with non-compressing hand and increases pressure if bleeding or hematoma becomes evident.</td>
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<td>11. Calls catheterizing physician for assistance if bleeding cannot be controlled manually.</td>
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<td>12. Provides patient with post sheath removal instructions.</td>
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<tr>
<th>Release/Removal of Groin Compressor:</th>
<th>YES</th>
<th>NO</th>
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<tr>
<td>1. Maintains physician applied compression x 5 min.</td>
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<td>2. Releases clamp x 1/8 inch (4mm) q5 minutes x 2.</td>
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<td>3. Keeps site visible while groin clamp in place and monitors vascular status throughout procedure.</td>
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<td>4. Re-applies pressure by tightening clamp if bleeding occurs.</td>
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<td>5. Removes clamp and applies band-aid with hemostasis.</td>
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<td>6. Applies manual pressure and notifies catheterizing physician with re-bleeding after clamp is removed.</td>
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<td>7. Documents procedure in patient’s record.</td>
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