THIS IS A DELEGATED MEDICAL FUNCTION FOR REGISTERED NURSES/TECHNOLOGISTS THAT REQUIRE CERTIFICATION PRIOR TO PERFORMING

POLICY

1. The removal of arterial and venous sheaths and the application of manual pressure to achieve hemostasis following a cardiac catheterization is a Delegated Medical Function. The catheterizing physician may also remove sheaths. The physician will then apply a mechanical groin compressor to achieve hemostasis. In this case, the RN/Technologist monitors the patient while the groin compressor is in place, loosens and removes the device as per protocol.

2. The RN/Technologist must be certified as competent to perform the above procedure and be re-certified on an annual basis. This policy and procedure is specific to RN/Technologist staff in the Cardiac Catheterization Lab.

3. During the first 3-5 minutes of manual or clamp pressure, the femoral artery is to be occluded so that hemostasis is achieved while retaining a palpable dorsalis pedis or posterior tibial pulse.

4. Notify the catheterizing physician or designate to remove sheaths when:
4.1 sheath size is larger than a #9
4.2 A brachial/radial entry is used.
4.3 A clamp will be used to achieve hemostasis.

5. Notify the catheterizing physician or designate for consultation and/or assistance under the following circumstances:

5.1 excessive bleeding is noted around the arterial or venous sheath prior to removal.
5.2 bleeding or a large hematoma that cannot be controlled manually.
5.3 the groin clamp needs to be re-applied.
5.4 chest pain is not relieved following treatment with nitroglycerin x 3 q 5 minutes.

GUIDING PRINCIPLES

1. Where a venous sheath is used, only five minutes of manual pressure is required.

2. Where a groin clamp is used, keep the site visible at all times while maintaining the patient’s privacy. This will ensure early intervention in the event of clamp displacement or excessive bleeding.

DEFINITIONS

Groin Compressor – a mechanical device consisting of a base, arm and disposable pressure disc used to apply direct pressure to the femoral artery until hemostasis is achieved. It allows controlled release of pressure therefore minimizing re-bleeding. This device may also be called a “groin clamp” or “C-clamp”.

EQUIPMENT

• Groin Compressor (base, clamp, disposable disc)
• Gloves
• Protective eyewear
• 4 x 4 gauze Dressings
• Elastoplast BandAid

PROCEDURE

1. Sheath Removal and Manual Pressure:

1.1 Review physician’s orders.

1.2 Gather equipment and take to bedside.

1.3 Explain procedure to patient. Ensure privacy and provide reassurance as necessary.

1.4 Position patient supine close to the edge of the stretcher on the side with the sheath. Ensure head of stretcher is flat. Adjust height of stretcher to suit individual.
1.5 Apply gloves. Palpate the artery (Compress the right femoral artery with the left hand and the left femoral artery with the right hand.) and apply gentle pressure.

1.6 When applying manual pressure, place the index finger of the compressing hand over the site where the sheath enters the femoral artery. Middle and ring fingers are used to reinforce compression.

1.7 Remove sheath while maintaining gentle manual pressure. It is good practice to see a flash of blood immediately following the removal of the sheath prior to applying firm pressure.

1.8 Apply manual pressure to the femoral artery for a 3–5 minute period to achieve hemostasis, while retaining a palpable dorsalis pedis or posterior tibial pulse.

1.9 Release pressure gradually until pedal pulse returns (palpate pedal pulse with non-compressing hand) and continue this pressure for five minutes.

1.10 Release pressure gradually for another 5-10 minutes allowing the pedal pulse to strengthen.

1.11 Assess for hematoma formation with non-compressing hand. If there is evidence of bleeding from the femoral puncture site or a hematoma, increase the amount of pressure to control bleeding.

1.12 If bleeding cannot be controlled manually, notify the catheterizing physician or designate immediately for assistance.

1.13 Apply bandage once bleeding has stopped.

2. **Sheath Removal and Clamp Pressure**

2.1 The catheterizing physician removes the sheath and applies the groin clamp.

2.2 The RN loosens & removes the groin clamp in the following manner:

   2.2.1 Maintain compression as set by physician for a maximum of 5 minutes. A weak dorsalis pedis or posterior tibial pulse should be palpable during this time period.

   2.2.2 Release clamp by turning the “vertical control knob” counter-clockwise x 4 turns or 1/8 inch (4mm) every 5 minutes x 2 or until the clamp disc is off the skin and all bleeding has stopped. Assess vascular status of the limb with each clamp release. Notify the catheterizing physician if pulse is further diminished or absent.

   2.2.3 Remove groin compressor clamp and apply Band-Aid.

   2.2.4 Monitor patient for vasovagal reaction throughout procedure.
2.2.5 Monitor vascular status of the affected limb noting pulses, color and temperature throughout procedure and notify physician of significant changes.

2.2.6 If bleeding reoccurs as pressure is being released, re-apply pressure by turning the “vertical control knob” clockwise until hemostasis is achieved. If re-bleeding is extensive, restart clamp time. If bleeding is minimal, extend clamp time to ensure hemostasis.

2.2.7 If brisk bleeding occurs at any time after the clamp is removed, apply manual pressure and notify catheterizing physician to re-apply the clamp.

3. Post Sheath Removal

3.1 Instruct the patient to:

3.1.1 hold pressure on affected groin for first 10 minutes after manual pressure by RN
3.1.2 keep arms below shoulder level
3.1.3 not to lift head from pillow
3.1.4 keep affected leg straight
3.1.5 apply manual pressure if he/she coughs, sneezes or strains
3.1.6 report signs of swelling or bleeding immediately to nurse

3.2 If patient develops symptomatic bradycardia with hypotension (drop in heart rate 10 beats/min., drop in BP greater than 10 mm. Hg., resting BP less than 100, nausea, diaphoresis), the nurse administers 0.6 mg IV atropine and 250-500 mL normal saline bolus. Notify the Catheterizing physician immediately.

3.3 Document the following in the patient’s record:

3.3.1 site appearance pre and post sheath removal.
3.3.2 who removed sheath and applied pressure
3.3.3 manual or clamp compression time
3.3.4 complications i.e.: hematoma, vasovagal episode
3.3.5 patient’s response to procedure

REFERENCES:

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


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.

LEARNING MODULE FOR
POST CARDIAC CATHETERIZATION
ARTERIAL/ VENOUS SHEATH REMOVAL:
APPLICATION OF MANUAL PRESSURE;
RELEASE/REMOVAL OF GROIN COMPRESSOR
(DELEGATED MEDICAL FUNCTION)
CC 10-009

Developed By: Linda Benn, RN, BScN - Nurse Educator
Approved By: Cheryl Hay – Interim Health Services Director
Date: January 2002
RVS Date: December 2003 (DMAC Approved July 2004)
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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-url)

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 Sledinger 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:**


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 palpating 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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<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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<tr>
<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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<tr>
<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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