LEARNING MODULE FOR
RADIAL ARTERY COMPRESSION & CARING FOR THE
PATIENT FOLLOWING A TRANSRADIAL
CARDIAC CATHETERIZATION/ANGIOPLASTY

(POST ENTRY-LEVEL COMPETENCY)

(BEL-CC-001)

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Date: December 1998

Revision Date: July 2008
               May 2015
               September 2016
PURPOSE
This learning module will provide the Registered Nurse (RN) with the theory and practice necessary for caring for the patient undergoing radial artery compression following a Transradial Cardiac Catheterization or Angioplasty. After completing the learning objectives, the RN will demonstrate competency according to the proficiency standards.

LEARNING OBJECTIVES
Upon completion of the learning package, the Registered Nurse will be able to perform the following objectives:
1. Identify the indications for and benefits of accessing the radial artery during a cardiac catheterization / angioplasty.
2. Identify the criteria used when selecting a patient for radial artery access.
3. Identify the pertinent anatomical structures of the hand/wrist and discuss how it relates to radial artery compression.
4. List and discuss the potential complications of radial artery access and compression.
5. Discuss the nursing implications following a cardiac catheterization / angioplasty where the radial artery has been accessed.
6. Demonstrate safe management of the radial compression device.

METHOD
1. Self study using the policy and procedure and learning module entitled "Radial Artery Compression and Caring For the Patient Following Transradial Cardiac Catheterization/Angioplasty".

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2. Observation of the loosening and removal of a radial compression device by a physician/nurse delegate and return demonstration of same.

THEORY

The transradial approach has been used for cardiac catheterization since 1982, and for coronary intervention since 1993. It offers improved hemostasis compared to the femoral approach, since adequate compression over a bony structure is more easily achieved. Greater patient comfort may be expected due to the immediate ambulation that is possible with this approach.

The radial, ulnar and occasionally the volar interosseous arteries give rise to superficial and deep palmar arches. The deep arch is almost always complete, with a continuous path between radial and ulnar arteries, although the radial and ulnar ends of the arch may be of dissimilar calibre. The superficial arch is complete in 75-80% of cases, with the remainder having some area of discontinuity on the radial aspect of the hand. If either end of the deep arch is of small calibre, patients with discontinuous superficial arches would have areas of the hand compromised by occlusion of the radial artery. (Figure 1)

The continuous nature of the radial and ulnar arteries needs to be recognized when delivering nursing care to these patients. When controlling hemostasis of a femoral site, one applies manual or clamp pressure slightly proximal to the puncture. When applying manual or clamp pressure to a radial site, one applies pressure above & below the puncture in order to achieve effective hemostasis. Failure to apply pressure in this manner would lead to back bleeding of the ulnar artery through the palmar arches.

![Figure 1](https://example.com/image1.png)

The benefits of using a transradial approach include the following:

*Superficial palmar arch*
1. Early ambulation and increased patient comfort

2. More efficient use of nursing time.

3. Improved hemostasis. (The superficial nature of the radial artery and its close proximity to bony structures allows for better compression.) The routine use of smaller guiding catheters (6 French) creates smaller puncture holes which in turn, leads to fewer bleeding complications and a shortened hemostasis time.

4. Lower incidence of vascular complications. No major veins or nerves are located near the radial artery, minimizing the chance of related injury to these structures. Thrombotic or traumatic artery occlusion does not endanger the future use of the hand as long as an adequate collateral blood supply by the ulnar artery exists.

5. Decreased length of stay for angioplasty patients.

6. Immediate sheath removal, even with full anticoagulation.

The indications for choosing a transradial approach over the more traditional femoral or brachial approach include the following:

1. Anatomic conditions such as ilio-femoral occlusive disease, marked vessel tortuosity, and aortic diseases such as dissection or aneurysm.

2. Patient preference for early ambulation.

3. This may be a reasonable option for those patients who have great difficulty in maintaining the flat bed rest required with the femoral approach. Arthritic patients or those with respiratory difficulties would benefit from the effects of early ambulation.

Not all patients are considered to be ideal candidates for a transradial procedure. The physician must carefully assess his/her patient prior to choosing this approach. The need for a catheter size greater than a 6 French during the procedure (i.e. Directional Coronary Atherectomy, Brachytherapy) would exclude patients from having the radial approach as an option. The presence of Raynaud’s phenomenon or an absent radial or ulnar pulse would be contraindicated to the transradial approach. The palmar arches must be tested clinically to verify that they are patent. If ordered, insert the IV in the arm opposite to that selected for radial entry.

Patient preparation prior to the radial artery cardiac catheterization or angioplasty includes “clipping” of the selected wrist if excessive hair is noted at the site. (Refer to Hair Removal IC 06-008) Both groins are also “clipped” in a similar fashion. The 2006 Infection Control Guidelines for the Cardiac Catheterization Laboratory: Society Guidelines Revisited (Chambers et al, 2006) recommend that hair be removed from the access site(s) only if the hair at or around the incision site will interfere with the procedure. Hair removal should
occur with the use of an electrical surgical clipper. During the procedure a femoral approach may become necessary where the interventionalist is unable to access the radial artery, the insertion of an intra-aortic balloon becomes necessary or a larger sheath size is required.

After insertion of the radial artery sheath but prior to beginning the procedure, medication is administered to prevent radial artery spasm. Verapamil 1.25 – 2.5 mg alone or a “cocktail” consisting of nitroglycerin 100 mcg and verapamil 1 mg is administered intra-arterially. Heparin is also administered at a minimum dose of 5000 units, even for diagnostic catheterization as this has been shown to significantly reduce the risk of radial artery occlusion. The heparin dose for interventional procedures will be a minimum of 5000 units, but will be calculated by the interventionalist based on patient size and the possible plans for use of abciximab or eptifibatide. Alternatively, some interventionalists may choose to use bivalirudin (Angiomax®) in place of heparin. Special radial sheaths are used which have the dilator tapered down to the smaller sized guide wire used. These may be long or short and may also have a hydrophilic (“slippery”) coating. The catheterising physician will request the specific sheath required. The sheath is removed immediately after the procedure including interventional cases with full-dose heparin and abciximab or eptifibatide. The patient is then returned to the nursing unit with a radial compression device in place.

Upon the patient’s arrival on the nursing unit, the nurse will initiate the routine vital signs and post procedure site checks as outlined in the policy and procedure and mirrored in the PPO. The nurse will provide patient instructions. The nurse will loosen and remove the radial compression device at prescribed intervals as outlined in the policy and procedure and mirrored in the PPO. The nurse should be prepared to apply manual pressure or reapply the radial compression device to the puncture site should the need arise. It is a good idea to keep the radial compression device at the patient’s bedside for such an instance. The cardiologist should be notified of any post-procedure bleeding that cannot be controlled by manual pressure or reapplication of the radial compression device. The patient may ambulate immediately if so desired as long as the sedating effects of any medications given peri-procedure have worn off. The patient should be instructed to apply manual pressure to the puncture site and call the nurse if they notice bleeding. The nurse need not worry about vasovagal episodes as a result of this procedure as there is no stimulation of the vagal nerve when the radial approach is used. Keep in mind that a vasovagal episode could occur in relation to other complications such as an occlusion of the RCA or GI distress.

The pain experienced by patients undergoing radial compression can be unpleasant. The pressure applied to the wrist area by the radial compression band can be diffuse in nature. This leads to venous congestion of the hand and may result in pain and a tingling sensation in the hand. Pain medication should be offered and the patient should be reassured that increased comfort will become evident as soon as the loosening process for the radial compression band begins. Careful and regular monitoring of the site, color, sensation and movement of the affected limb will ensure that your patient is not being subjected to pain needlessly caused by a radial compression band which is too tight.

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The potential complications of a radial cardiac catheterization or angioplasty are rare due to the absence of any major neural or vascular structures immediately adjacent to the radial artery. Although rare, the nurse must be aware that the following complications are still remotely possible:

1. **Bleeding/hematoma** - Although bleeding is less likely with the small 6 Fr. Catheter used during a radial procedure, it may still occur. Heparin used during the procedure and the use of antiplatelet drugs such as clopidogrel, ticagrelor, abciximab and eptifibatide may increase bleeding. Bleeding and/or hematoma formation is most common in patients who have aortic insufficiency, a wide brisk pulse pressure and/or hypertension. As insufficient application of pressure, either manually or by radial compression device, may lead to bleeding, the nurse should increase the amount of pressure delivered when bleeding is evident. All hematomas should be marked and monitored regularly for any change in size by measuring limb circumference every ½ hour. The limb may also be elevated on pillows and an ice pack may be applied. The physician should be notified of any ongoing bleeding which cannot be controlled by manual pressure or radial compression device.

2. **Pseudoaneurysm** - This can occur when insufficient pressure is applied to the puncture site during sheath removal and blood enters the wall of the radial artery and creates a false lumen. This can rupture if not repaired. The nurse should observe the patient for the signs and symptoms of pseudoaneurysm which includes a pulsatile painful mass over the artery at the puncture site and a bruit on auscultation of the area. The physician should be notified of any signs or symptoms to arrange ultrasound and possible compression.

3. **Arteriovenous Fistula** - An AV fistula may occur when the needle used during the procedure enters both the artery and vein and forms a tract or fistula between the two. In such an instance the nurse would observe a continuous bruit over the puncture site. The area may or may not be painful and there may be no swelling. If suspected, the physician should be notified to arrange possible corrective surgery. The chance of an AV fistula occurring would be rare due to the anatomical distance between the radial artery and the cephalic vein.

4. **Arterial Occlusion/Embolism** - The mere presence of the arterial catheter during the procedure creates the potential for the formation of a thrombus around the tip which may loosen and cause arterial occlusion distal to the puncture site. An atheromatous plaque may inadvertently become loosened from the puncture site during the procedure and be released into the circulation. Arterial occlusion and ischemia of the hand would ensue. The risk of such unfortunate complications has been greatly reduced through the use of heparin during the procedure. The immediate removal of the arterial sheath following the procedure reduces the risk even further. If the radial artery does become occluded, no ischemia of the affected hand would be apparent if the collateral blood supply of the ulnar artery is adequate. The nurse must be diligent in observing the affected limb for any signs and symptoms of altered tissue perfusion which includes
diminished radial/ulnar pulses, or change in the colour, temperature or sensation of the arm/hand, painful fingers and diminished capillary refill.

5. **Compartment Syndrome** – Although rare, compartment syndrome is a complication that can occur following a transradial procedure. The accumulation of blood from a hematoma or the localized external pressure exerted by the radial compression device can lead to increased pressure within the muscle compartment which is primarily made up of inelastic fascia. Compartment syndrome can arise from any decrease in compartment size, and/or fluid content imbalance. If left undetected, this will eventually result in increased venous pressure, decreased arteriovenous gradient, a decreased local blood supply and finally tissue hypoxia, ischemia and necrosis of muscles, nerves and other tissues. Irreversible damage may occur within 4-12 hours after impaired perfusion. The condition can be aggravated where local arterial blood pressure is already reduced by PVD, hypotension, hemorrhage, arterial occlusion or elevation of the extremity above the level of the heart.

Signs and symptoms of compartment syndrome include pain that is more intense than would be anticipated, pain with passive extension and/or flexion, swelling, tense limb, paresthesias, and warm shiny skin. Peripheral nerve compression may present as loss of two-point discrimination. Late-stage findings may include altered sensation and paralysis.

If suspected, notify the physician and lower the limb below heart level. Treatment consists of fasciotomy to relieve pressure within the compartment which will prevent nerve and muscle cell death.

6. **Infection** - Infection at the puncture site can develop and spread to the bloodstream resulting in generalized sepsis. In order to prevent this, the nurse should follow strict aseptic technique and observe the patient for any signs and symptoms of infection which includes fever and drainage, redness, swelling & increased heat at the puncture site.

**REFERENCES**


TEST

1. If it is necessary to reapply the radial compression device, the nurse should:
   a. Apply pressure distal to the puncture site and call for a second nurse to provide assistance in reapplying the band.
   b. Apply pressure proximal to the puncture and call for a second nurse to provide assistance in reapplying the band.
   c. Apply pressure directly over the puncture and call for a physician to assess.
   d. Apply pressure directly over the puncture and call for a second nurse to provide assistance in reapplying the radial compression device.

   1. a
   2. b
   3. c
   4. d

2. The nurse should notify the physician under the following circumstances:
   a. Arterial bleeding cannot be controlled by either direct manual pressure or re-application of the radial compression device.
   b. The radial compression device becomes dislodged.
   c. Loss or diminution of affected radial or ulnar pulse and/or loss or decrease in the capillary refill of affected thumb is noted.
   d. The patient reports "mild" tingling in the affected hand.

   1. a and c
   2. a and d
   3. b and c
   4. b and d

3. The patient preparation for a radial cardiac cath/angioplasty includes clipping of:
   a. the volar aspect of the right wrist.
   b. The dorsal aspect of the wrist as ordered by the physician.
   c. The volar aspect of the left wrist.
   d. The volar aspect of the wrist as ordered by the physician and both groins.

4. Where should the nurse initiate the intravenous prior to a radial angioplasty?
   a. In the arm selected for radial entry, but above the anticubital fossa.
   b. In the arm opposite that selected for radial entry.
   c. An IV is not required prior to a radial angioplasty.
   d. In the arm selected for radial entry, but below the anticubital fossa.
5. After a radial cardiac catheterization/angioplasty the patient should be regularly assessed for the following:

   a. The presence and quality of the radial & ulnar pulses and the capillary refill of the affected thumb.
   b. The CSM (colour, sensation, movement) of the affected arm/hand.
   c. Any bleeding, swelling or hematoma formation at the puncture site and the proper positioning of the radial compression band.
   d. All of the above.

6. Immediately following the tightening of the hemostasis strap the nurse should:

   a. Check the radial and ulnar pulses and capillary refill of the thumb to ensure adequate tissue perfusion to the affected limb.
   b. Monitor the patient’s blood pressure and observe for any signs of a vasovagal episode.
   c. Evaluate the patient’s level of pain in the affected arm/hand.
   d. Place the affected arm in a sling to prevent venous congestion in the hand.

7. Following a radial cardiac cath/angioplasty the nurse should instruct the patient in the following “do’s & don’ts”:

   a. Remain on flat bed rest for 6 hours following your procedure.
   b. Do not raise the affected arm above the shoulder level.
   c. Avoid heavy lifting with the affected hand x 72 hours and do not subject this hand / arm to any forceful movements x 24 hours.
   d. You may return to all pre-procedure arm use (i.e. tennis) 24 hours following your procedure.

8. The continuous nature of the _________ artery and the _________ artery through the impacts on how the nurse will apply direct manual pressure to attain effective hemostasis for a radial artery bleed.

9. List the four most common exclusion criteria for a patient being considered for a cardiac cath/angioplasty using a radial approach.

   1.
   2.
   3.
   4.
10. List six possible complications of a radial cardiac cath/angioplasty:

1.

2.

3.

4.

5.

6.
Answers

1. 4

2. 1

3. d

4. b

5. d

6. a

7. c

8. Ulnar, Radial, Palmar arches

9. 1. The need for a catheter size greater than a #6 French during the procedure.
   2. The patient has Raynaud’s phenomenon.
   3. The radial or the ulnar pulse is absent.
   4. The patient exhibits a negative Allen’s test.

10. The six possible complications of a radial cardiac cath/angioplasty are:

    1. Bleeding / hematoma
    2. Pseudoaneurysm
    3. Arteriovenous fistula
    4. Arterial occlusion / embolism
    5. Infection
    6. Compartment Syndrome
**Nova Scotia Health Authority – Central Management Zone**  
**HEALTH SERVICES DIVISION**  
**PROFICIENCY STANDARD SKILLS CHECKLIST**

**TITLE:** Radial Artery Compression and Caring for the Patient Following a Transradial Cath/Angioplasty  
**UNIT:** 

### A. Preparing the patient for a radial cardiac cath / angioplasty

<table>
<thead>
<tr>
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<th>YES</th>
<th>NO</th>
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<tbody>
<tr>
<td>1.</td>
<td>Checks physicians order to determine which arm is selected for procedure.</td>
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<tr>
<td>2.</td>
<td>Assesses volar aspect of selected arm to determine need for hair removal.</td>
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<tr>
<td>3.</td>
<td>Explains procedure to patient/family.</td>
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<td>4.</td>
<td>Clips a 3 cm square around radial pulse of selected arm if appropriate.</td>
<td></td>
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<td>5.</td>
<td>Clips a 15 cm square around the femoral pulse bilaterally.</td>
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<td>6.</td>
<td>Initiates IV(s) in arm opposite to that selected for radial entry if appropriate.</td>
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### B. Caring for the patient following a radial cardiac cath / angioplasty

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<th>YES</th>
<th>NO</th>
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<tbody>
<tr>
<td>1.</td>
<td>Settles patient in bed and begins routine post procedure checks. (See Policy &amp; Procedure and PPO)</td>
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<tr>
<td>2.</td>
<td>Assesses patient’s ability for immediate ambulation and advises appropriately.</td>
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<tr>
<td>3.</td>
<td>Provides patient instructions.</td>
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<td>4.</td>
<td>Applies gloves and loosens and removes radial compression device according to protocol. (See Policy &amp; Procedure and PPO)</td>
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### C. Bleeding for patient who has Bengal or hemoSTOP radial compression device

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<th></th>
<th>YES</th>
<th>NO</th>
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<tbody>
<tr>
<td>1.</td>
<td>If bleeding occurs, applies gloves and tightens or reapplys radial compression band according to protocol. (See Policy &amp; Procedure and PPO)</td>
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OR
Applies direct manual pressure over puncture site.

2. Notifies physician of any difficulties with achieving hemostasis or suspected complications.

3. Applies sterile transparent dressing to radial puncture site when hemostasis is achieved.

4. Documents in the patient’s record. (See Policy & Procedure)

D. Bleeding for patient who has Terumo TR Band® radial compression device

<table>
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<tr>
<th>YES</th>
<th>NO</th>
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<tbody>
<tr>
<td>1. If bleeding occurs during the <strong>initial 1.5 hour</strong> compression period, notify the Interventional Fellow.</td>
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**OR**

If bleeding occurs during the **second 1.5 hours** (after removal of 5mL air from the TR Band®) **compression** period:

a. Insert air in 3mL increments until hemostasis is achieved.

b. Maintain for an additional 1.5 hour period.

**NOTE:** Maximum air volume of TR Band® is 18mL.

**OR**

If bleeding occurs following the removal of the TR Band®:

a. Put on clean gloves.

b. Apply direct pressure to puncture site and call for a second nurse to help.

c. Apply a manual blood pressure cuff to the affected arm; inflate the cuff to 20mmHg above the patient's systolic blood pressure to control bleeding.

d. Stop applying direct pressure over the puncture site and cleanse site.

e. Reapply the TR Band® by positioning the green dot directly over the insertion site. Re-inflate with the amount of air required to obtain hemostasis (maximum 18mL). The bracelet should be tight enough to ensure hemostasis but not occlude the flow to either the radial or ulnar arteries.

f. Release the manual BP cuff.

g. Re-start the removal procedure from the beginning.

h. Assess the radial/ulnar pulses and capillary refill of thumb of affected limb. Obtain vital signs and oxygen saturation as with initial post-procedure guideline.
2. Notifies physician of any difficulties with achieving hemostasis or suspected complications.

3. Applies sterile transparent dressing to radial puncture site when hemostasis is achieved.

4. Documents in the patient’s record. (See Policy & Procedure)