Providence Health Care	Department: Respiratory Services	Date Originated: July 1995 Date Reviewed/Revised: **June 2008**
PROCEDURE	Topic: Critical Care – Arterial Line Insertion (Radial) by Respiratory Therapists Critical Care Number: B-00-12-12048	Related Links: B-00-11-12010

APPLICABLE SITES:

St. Paul's Hospital
Mount Saint Joseph Hospital

GENERAL INFORMATION:

Respiratory Therapists that have completed the PHC Arterial Line Insertion Training Program and are fully certified may perform this procedure.

The Registered Nurse will have primary responsibility for the preparation and setup of the pressure transducer and VAMP tubing. The Respiratory Therapist should be familiar with the setup and operation of the pressure transducer and monitor.

INDICATIONS FOR ARTERIAL LINE INSERTION:

1. Continuous arterial blood pressure monitoring
2. Repeated arterial blood sampling
3. Continuous infusion of vasoactive medications

CONTRAINDICATIONS TO ARTERIAL LINE INSERTION:

1. Marked bleeding disorders
2. Severe peripheral vascular disease
3. Poor or absent collateral circulation
4. Thrombolytic therapy (relative contraindication)

Avoid insertion sites where:

- Arterial circulation may be compromised
- Skin is infected or weepy
- Previous vascular surgery intervention has occurred
- Synthetic graft material is present
- PICC lines are in the immediate vicinity
- A-V fistula has been created

POTENTIAL COMPLICATIONS TO ARTERIAL LINE INSERTION:

1. Hemorrhage or hematoma
2. Vascular occlusion or insufficiency
3. Local infection or septicemia
4. Pseudoaneurysm
5. Arterio-venous fistula formation
6. Ateriospasm
7. Arterial thrombosis
8. Air embolism
9. Radial nerve injury

REQUIRED EQUIPMENT:

- Radial artery catheterization set
- Pressure transducer system with tubing (VAMP)
- Pressure infuser bag
- Heparin flush solution (500mL or 1L)
- Sterile dressing tray
- Sterile towels or drapes
- Disposable blue pad
- Chlorhexidene 0.5%
- Lidocaine 1% without epinephrine
- 1mL syringe with 25g needle
- Povidone iodine solution
- Transparent occlusive dressing
- Silk suture 2-0
- Tape
- Clean white towel
- Sterile and non-sterile gloves
- Personal protective equipment (gown, mask, face shield or goggles)

PROCEDURE FOR PRESSURE TRANSDUCER AND VAMP TUBING SET PREPARATION:

Pressure Transducer System Setup:

1. Obtain a prepared heparin normal saline flush IV solution. The RN will have to access the solution from the Automated Dispensing Machine (Omnicell).

2. Label the IV bag, indicating the date, time and your initials.

3. Open the pre-packaged pressure transducer VAMP system with tubing using aseptic technique. Tighten all components including stopcocks.

4. Spike the outlet port of the IV bag with the pressure tubing.

5. Open the roller clamp and squeeze the drip chambers to fill the chamber half full. This prevents air bubbles from entering the tubing.

6. Insert the IV bag into the pressure bag. Do not inflate the pressure bag at this point.

7. Flush the entire system, including transducer, stopcock, and pressure tubing with the flush solution.

    a. Depress the VAMP system control to minimize the amount of air that must be flushed through the system.

    b. Using the flush device, flush solution from the IV bag through to the tip of the pressure tubing.

    c. Turn the stopcock off to the patient end of the tubing.

    d. Using the flush device, flush solution from the IV bag through the stopcock.

    e. Replace the vented cap on the stopcock with a non-vented cap.

    f. Open the stopcock to the transducer

8. Inflate the pressure bag to 300 mmHg.

Monitor Setup:

1. Ensure the pressure cable is plugged in to the appropriate module on the monitor and the arterial blood pressure parameter is activated.

2. Set the appropriate scale for the pressure waveform, and appropriate alarm limits.

PROCEDURE FOR ARTERIAL LINE INSERTION:

1. Verify physician order for procedure and review the patient record for pertinent information, including anticoagulant therapy. Obtain patient consent where possible.

2. Verify patient identity and explain procedure.

3. Wash hands and don personal protective equipment as applicable. Non-sterile gloves may be worn for the following steps.

4. Perform a modified Allen test to assess for collateral circulation. If adequate collateral circulation is absent, an alternate site should be selected.

    a. Lift the patient's hand upwards and instruct the patient to open and close their hand several times.

    b. With the patient's fist clenched, apply direct pressure to both the radial and ulnar arteries.

    c. Instruct the patient to lower and open their hand.

    d. While maintaining pressure on the radial artery, release the pressure over the ulnar artery and observe the hand for the return of colour.

    e. Return of colour **< 7 seconds** indicates patency of the ulnar artery and an intact

superficial palmar arch; this is interpreted as a positive modified Allen test.

f. If colour returns **between 8 – 14 seconds** the test is considered neither positive nor negative.

g. If colour returns **> 15 seconds** or more, the test is considered abnormal and an alternate site should be considered.

NOTE: The test may be performed passively if the patient is unconscious or unable to assist.

5. Position the wrist for the procedure:

   a. Place the arm with the palm facing upwards on a bedside table.

   b. Place a blue pad underneath the wrist.

   c. Hyperextend the wrist by placing a rolled or folded towel underneath.

   d. Place tape across the palm of the hand and secure to the table to maintain position.

   NOTE: Ensure the blood pressure cuff has been removed from the arm in which the insertion is to be performed.

6. Palpate the chosen puncture area until you have established the location of the radial artery. Reposition the wrist as necessary.

7. Open the dressing tray and place on a flat working surface. Pour chlorhexidine 2% solution into one of the tray's compartments.

   NOTE: Always maintain the sterility of the tray's contents.

8. Using aseptic technique, clean the area thoroughly with sterile gauze soaked with the chlorhexidine 2% solution. Apply liberally for 30 seconds using a circular motion moving from the chosen insertion site outwards. Allow to air dry.

9. Wash hands and don sterile gloves, mask, and face shield or goggles.

10. Carefully drape the site using the sterile towels or drapes to provide an ample sterile field around the chosen insertion site.

11. Locally anesthetize the puncture site by Injecting lidocaine 1% just under the skin surface and into the surrounding tissues of the artery using the 1mL syringe and 25g needle. Approximately 0.2 – 0.3 mL is sufficient for an adult.

    NOTE: Aspirate before injecting the lidocaine to ensure a vessel has not been inadvertently punctured.

    NOTE: Local anesthetic may not be required in the non-awake patient.

12. Assess the arterial catheterization set for proper function.

13. Grasp the arterial catheterization set in the manner of performing an arterial blood gas and puncture the skin at a 30° - 45° angle towards the direction of flow, ensuring the bevel of the needle is pointing upwards.

    NOTE: A slow gradual puncture promotes entry into the artery without inadvertently passing through the posterior wall.

14. Blood return toward the distal end of the catheter hub indicates entry into the artery. Slowly advance the needle a few millimeters further to ensure the end of the catheter is in the artery.

    NOTE: If the artery has not been punctured, slowly withdraw the needle until the bevel is just below the skin and redirect the needle until blood flash is obtained.

    a) If the artery is not successfully punctured after two attempts, the needle should be withdrawn completely and the site re-evaluated.

    b) If the vein is punctured, the needle should be withdrawn completely, pressure applied to the site to stop any bleeding, and the site re-evaluated.

15. Level the catheter to just above the skin and stabilize the catheter position while carefully advancing the guide wire. If resistance is encountered remove the entire unit and attempt a new puncture. Do NOT force the guide wire into the vessel, nor retract it back into the needle.

    NOTE: Do not attempt to advance the guide wire if both vessel walls have been punctured as this may result in inadvertent arterial wall dissection.

16. Firmly hold the introducer needle hub in position while advancing the catheter forward into the vessel. During catheter advancement, a slight rotating motion of the catheter hub may be helpful to better position the catheter through the skin.

17. Hold the catheter in place and gently remove the introducer needle, guide wire, and chamber assembly. Free pulsatile blood flow indicates positive placement in the artery.

18. Attach the pressure transducer and tubing to the catheter hub and flush the catheter. Check the monitor for an arterial pressure waveform to confirm placement.

19. Assess for pulses and perfusion distal to the cannulation site.

20. Suture the catheter into place using the silk 2-0.

21. Apply povidone iodine solution to the puncture site and cover with a sterile occlusive dressing.

22. Clean up area of supplies and equipment. Properly dispose of all sharps. Remove personal protective equipment and wash hands.

23. Document into the patient record the following:

    - Date and time
    - Result of modified Allen test

- Anatomic site and catheter size
- Patient tolerance of procedure and post-procedure condition
- Amount of local anesthetic (lidocaine 1%) used
- Reason for arterial line insertion
- Aseptic technique used (i.e. sterile drapes, chlorhexidine)
- Name, designation, and signature

24. Inspect the site regularly for signs of Hematoma, infection, or other complications. Assessment should include the following:

    - Skin colour
    - Capillary refill
    - Skin temperature at the site
    - Patient sensation

25. Document the arterial line insertion into the QA Continuing Competency Log.

    NOTE: All arterial line insertion attempts must be recorded into the competency log, whether successful or unsuccessful.

PROCEDURE FOR LEVELING AND ZEROING THE PRESSURE TRANSDUCER:

Leveling the Transducer:

1. Position the patient in the supine position with the head of the bed 0 – 45 degrees.

2. Locate the phlebostatic axis. The phlebostatic axis is at approximately the level of the atria.

3. Move the pole-mounted transducer up or down until it is level with the phlebostatic axis.

    NOTE: When the patient's position has changed the transducer must be re-leveled to ensure accurate pressure readings.

Zeroing the Transducer:

1. Turn the stopcock off to the patient end of the tubing.

2. Remove the non-vented cap from the stopcock, opening the stopcock to ambient air pressure.

3. Push and release the zeroing button on the bedside monitor. Observe the digital reading until it displays a value of zero.

4. Place a new, sterile non-vented cap on the stopcock.

5. Turn the stopcock so that it is open to the transducer.

6. Assess the monitor for accurate waveform and arterial blood pressure measurement.