Arterial Line Placement

29

Ford Flippin, Federico Perez, and Emanuele Lo Menzo

Preference Card

- 18 ga, 22 ga, and 24 ga needles
- Arterial line catheter
- 5 or 10 ml syringe
- Vascular access needle with syringe
- Guidewire
- 11-blade scalpel
- 3-0 silk or Prolene suture
- Sterile saline flushes
- Local anesthetic lidocaine 1% with or without epinephrine
- Occlusive dressing

Patient Positioning

- Position the patient for appropriate visualization of the target artery.
- The wrist is placed on dorsiflexion slit (Fig. 29.1).
- Palpate the target artery with the second and third fingers.
- ChloraPrep is used as skin preparation.
- Maximum sterile barrier is used.

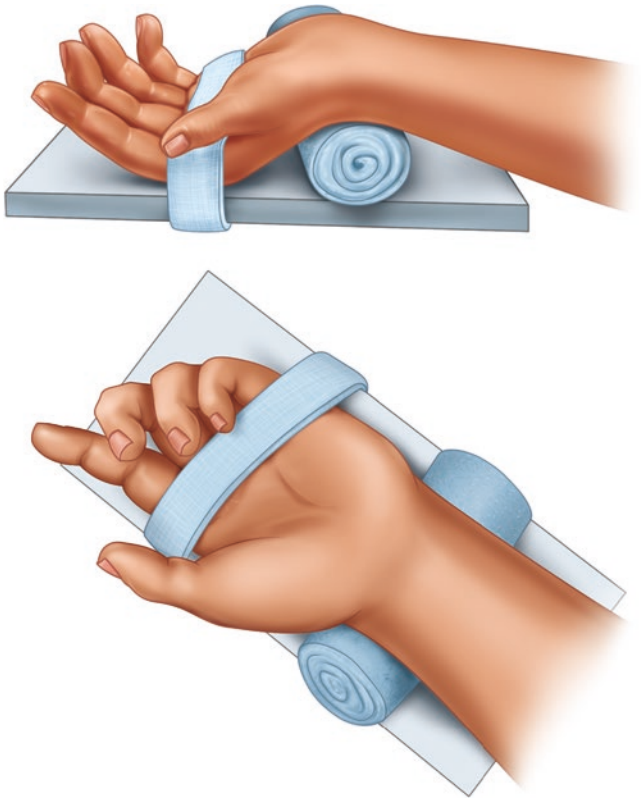

Fig. 29.1 The wrist is placed on dorsiflexion with appropriate access and visualization of the targeted artery

F. Flippin · F. Perez
Department of General Surgery, Cleveland Clinic Florida, Weston, FL, USA
e-mail: perezf@ccf.org

E. Lo Menzo (✉)
The Bariatric and Metabolic Institute, Digestive Disease Institute, Weston, FL, USA

Department of General Surgery, Cleveland Clinic Florida, Weston, FL, USA
e-mail: lomenze@ccf.org

Nodal Points

Skin Preparation and Artery Location

- Sterilely open the arterial catheter kit, and verify that all necessary components are present.
- Allen test should be performed to assess for adequacy of ulnar artery and palmar arch.

R. J. Rosenthal et al. (eds.), *Mental Conditioning to Perform Common Operations in General Surgery Training*,
https://doi.org/10.1007/978-3-319-91164-9_29

- Prep the area with ChloraPrep to a diameter of about 5 inches, wear sterile gloves, and place a sterile drape over the prepped area.
- Local anesthesia should be placed around the site by first drawing up the provided lidocaine (or other local anesthetic) with an 18 ga needle then instilled around the marked site with a 22 or 24 ga needle.
- A skin wheal should be avoided as it makes palpation of the arterial pulse more difficult.

Technique 1: Catheter-over-Needle

- Catheter-over-needle utilizes a needle with an integrated catheter similar to those used in standard intravenous cannulation.
- The skin is punctured 2–3 cm distal to the artery at a 30–45 degree angle advancing the needle toward the palpated pulsations (Fig. 29.2).
- When blood is observed to "flash back" into the catheter hub, the apparatus is advanced slightly (1–2 mm) to ensure cannulation of the artery.
- While holding the needle in place, the catheter is advanced up to its hub and the needle removed (Fig. 29.3).
- With blood return observed, the catheter is held in place, and the arterial line transducer tubing is connected to the catheter (Fig. 29.4).
- The catheter is secured in place with a barrier dressing such as Tegaderm®. Usually the tubing is then run between the thumb and index fingers and secured with tape when placed in the radial artery (Fig. 29.5).

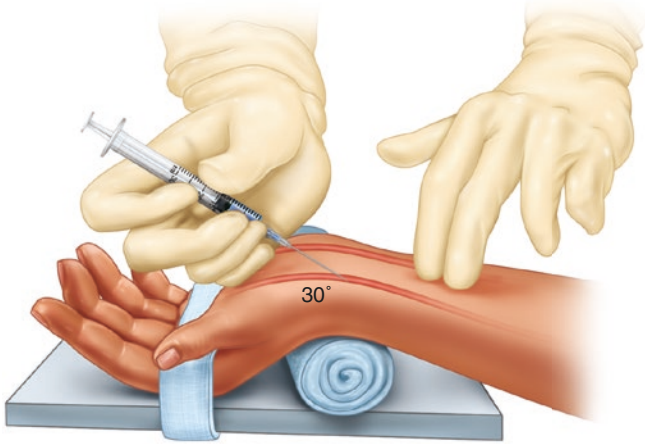

Fig. 29.2 The skin is punctured 2–3 cm distal to the artery at a 30–45 degree angle toward the palpated pulsations

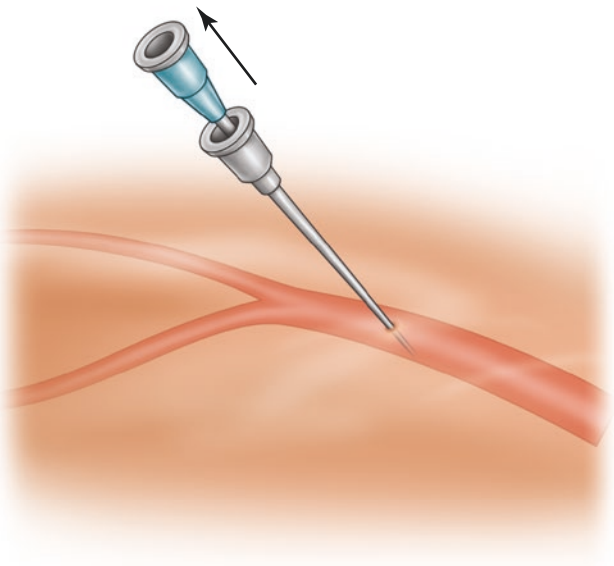

Fig. 29.3 Slowly advance the catheter into the artery

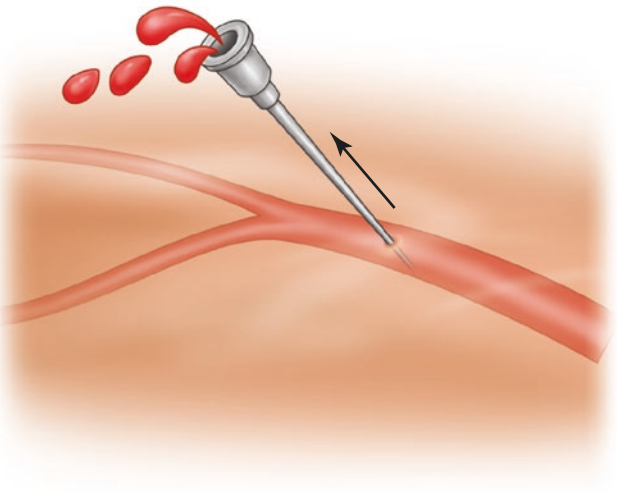

Fig. 29.4 Arterial blood is returned; the catheter is held in place

Fig. 29.5 The catheter is connected to the transducer; the line is sutured in placed and covered with an occlusive dressing

Technique 2: Seldinger

- The vascular access needle should be loaded onto a syringe (usually 10 ml)
- The needle should be held in the dominant hand and inserted at an approximately 30–45 degree angle to the skin in the direction of the palpated pulsations (Fig. 29.2).
- When blood return is obtained, the syringe is then removed while holding the needle in place.
- The guidewire is introduced through the needle leaving sufficient length outside the needle to maintain control of the wire. The wire should never be advanced with force. If resistance is met, the wire may be retracted several centimeters and advanced again. If resistance continues, the wire should be removed and steps 8–10 repeated (Fig. 29.6).
- With a firm grip on the end of the wire, it and the needle should be retracted together until the needle is fully extracorporeal.
- Control of the wire should then be established proximally (next to the skin) and the needle removed from the end of the wire.
- A #11 scalpel is then used to make a nick in the skin (a few millimeters is usually sufficient) next to the guidewire.
- The arterial line catheter is then threaded over the guidewire and inserted while ensuring control of and contact with the guidewire. Once inserted to its maximal depth, the guidewire is removed (Fig. 29.7).
- With blood return observed, the catheter is held in place, and the arterial line transducer tubing is connected to the catheter.
- The catheter is secured in place with a barrier dressing such as Tegaderm®. Usually the tubing is then run between the thumb and index fingers and secured with tape when placed in the radial artery (Fig. 29.5).

Fig. 29.6 Observed for blood flash back into the syringe to ensure cannulation of the artery

Fig. 29.7 Slowly advance the wire to assure cannulation of the vessel

Technique 3: Modified Seldinger

- The modified Seldinger technique uses the same principles as the Seldinger technique except that the needle, wire, and catheter are a single unit. Some units require assembly, while others are preassembled. In either case, prior to starting the procedure, the wire must be fully retracted to within the catheter before starting.
- If using ultrasound, the transducer should be held in the non-dominant hand or by an assistant. The needle should be held in the dominant hand and inserted at an approximately 30–45 degree angle to the skin either under ultrasound guidance or in the direction of the palpated pulsations (Fig. 29.2)
- When blood return is obtained, the ultrasound probe is placed to the side while keeping it sterile, and the blood visually verified to appear arterial.
- The needle should be stabilized in this position and the wire advanced to its maximal designed depth.
- The catheter is then advanced over the wire and needle assembly to its maximal depth, the catheter is held in place, and the needle and wire removed as a single unit.
- With blood return observed, the catheter is held in place, and the arterial line transducer tubing is connected to the catheter (Figs. 29.8 and 29.9).
- The catheter is secured in place with a barrier dressing such as Tegaderm®. Usually the tubing is then run between the thumb and index fingers and secured with tape when placed in the radial artery (Fig. 29.5).

Fig. 29.8 Observed for blood flash back into the catheter hub, the apparatus is advanced slightly (1–2 mm) to ensure cannulation of the artery

Fig. 29.9 Slowly advance the wire to assure cannulation of the vessel

Pitfalls and Pearls

- Using ultrasound to identify the anatomy will make the procedure easier as it is associated with fewer attempts.
- Hand vascularization should be assessed before catheterization. Multiple techniques can be used for this purpose including a modifier Allen test, pulse oximetry, or Doppler ultrasound.
- The use of local anesthesia will make the procedure easer.
- Arterial lines can cause severe complications if not handled correctly. It would be advisable not to keep arterial lines for longer than 1 week.
- Due to high pressure in the artery, full barrier precautions will minimize the risk of disease dissemination or infection.

Access Reader Checklist Appendix

☑ READER CHECKLIST
Arterial line Placement

☑ PREFERENCE CARD

►**Instruments**
__18 and 22 or 24 gauge needles
__Arterial line catheter
__5 or 10 ml syringe
__Vascular access needle with syringe
__Guidewire
__11-blade scalpel
__Sterile saline flushes
__Local anesthetic lidocaine 1% with or without epinephrine
__Occlusive dressing

►**Sutures**
__3-0 silk or prolene suture

☑ PATIENT POSITIONING/ OPERATING ROOM SETUP

►**Patient Positioning**
__Position patient for appropriate visualization of target artery.
__Wrist placed on dorsiflexion slit
__Palpate target artery with 2nd and 3rd fingers
__ChloraPrep used skin preparation
__Maximum sterile barrier used

☑ NODAL POINTS

►**Skin Preparation and Artery Location**
__Sterilely open arterial catheter kit and verify all necessary components present
__Allen test performed to assess for adequacy of ulnar artery and palmar arch
__Prep area with ChloraPrep to diameter of about 5 inches
__Wearing sterile gloves, place sterile drape over prepped area
__Local anesthesia placed around site by first drawing up provided lidocaine (or other local anesthetic) with 18 gauge needle then instill around marked site with 22 or 24 ga needle
__Skin wheel avoided as it makes palpation of arterial pulse more difficult

►**Technique**

Technique 1: Catheter-Over-Needle
__Catheter over needle utilizes needle with integrated catheter similar to those used in standard intravenous cannulation
__Skin punctured 2-3 cm distal to artery at 30-45 degree angle advancing needle toward palpated pulsations
__When blood observed to “flash back” into catheter hub, apparatus advanced slightly (1 – 2 mm) to ensure cannulation of artery
__While holding needle in place, catheter advanced up to its hub and needle removed
__With blood return observed, catheter held in place and arterial line transducer tubing connected to catheter
__Catheter secured in place with barrier dressing such as Tegaderm®.
__Tubing is then usually run between thumb and index fingers and secured with tape when placed in radial artery

Technique 2: Seldinger
__Vascular access needle loaded onto syringe (usually 10 ml)
__Needle held in dominant hand and inserted at approximately 30-45 degree angle to skin in direction of palpated pulsations
__When blood return obtained, syringe removed while holding needle in place
__Guidewire introduced through needle leaving sufficient length outside needle to maintain control of wire
__Wire should never be advanced with force.
__If resistance met, wire may be retracted several centimeters and re-advanced.
__If resistance continues, wire removed and steps repeated

Technique 2: Seldinger
__With firm grip on the end of wire, wire and needle retracted together until needle fully extracorporeal
__Control of wire established proximally (next to the skin) and needle removed from end of wire
__#11 scalpel used to make nick in skin (few millimeters usually sufficient) next to guidewire
__Aarterial line catheter threaded over guidewire and inserted while ensuring control of and contact with guidewire
__Once inserted to its maximal depth, guidewire removed
__With blood return observed, catheter held in place and arterial line transducer tubing connected to catheter
__Catheter secured in place with barrier dressing such as Tegaderm®
__Usually tubing is run between thumb and index fingers and secured with tape when placed in radial artery

Technique 3: Modified Seldinger
__Modified Seldinger technique uses same principles as Seldinger technique except that needle, wire, and catheter are single unit
__Some units require assembly while others are preassembled.
__In either case, prior to starting procedure, wire must be fully retracted to within catheter before starting
__If using ultrasound, transducer held in non-dominant hand or by an assistant
__Needle held in dominant hand and inserted at an approximately 30-45 degree angle to skin either under ultrasound-guidance or in direction of palpated pulsations
__When blood return obtained, ultrasound probe placed to side while keeping it sterile, and blood visually verified to appear arterial
__Needle stabilized in this position and wire advanced to maximal designed depth
__Catheter advanced over wire and needle assembly to its maximal depth
__Catheter held in place, and needle and wire removed as single unit
__With blood return observed, catheter held in place and arterial line transducer tubing connected to catheter
__Catheter secured in pla**ce with barrier dressing such as** Tegaderm®.
__Usually tubing is then run between thumb and index fingers and secured with tape when placed in radial artery