

Radial and Femoral Artery Catheterization Techniques



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KEYWORDS

• Radial artery • Femoral artery • Catheterization techniques • Indications • Complications

KEY POINTS

- The radial and femoral arteries are used for invasive intraoperative blood pressure monitoring and blood sampling in cases where major blood loss or fluid shifts are anticipated.
- The physiologic changes that occur in the perioperative period can be assessed beat-to-beat by invasive monitoring.
- The radial artery is commonly used for catheterization because it is easy to access and has a higher patient satisfaction.

Introduction

The radial and femoral arteries are used for invasive intraoperative blood pressure monitoring and blood sampling in cases where major blood loss or fluid shifts are anticipated. This is also used in the critical care setting for close hemodynamic monitoring.

The physiologic changes that occur in the perioperative period can be assessed beat-to-beat by invasive monitoring, thus aiding in the management of patients' ventilatory and hemodynamic changes. A thorough understanding of the anatomy is required for safe and quick access to the arteries for the same purpose (Fig. 1). The radial artery is commonly used for catheterization because it is easy to access and has a higher patient satisfaction. Techniques and pitfalls for these procedures are discussed in this article.

Radial artery catheterization

Indications

- Frequent blood sampling
- Continuous real-time monitoring, when beat-to-beat blood pressure changes are anticipated
- Major blood loss or fluid shifts are anticipated
- Deliberate induced hypotension and administration of vasoactive infusion
- End-organ disease necessitating beat-to-beat blood pressure regulation
- Inability to use noninvasive blood pressure monitoring (severe burns, morbid obesity)

Contraindications

- Avoid in arteries without documented collateral flow

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- Suspicion of pre-existing vascular insufficiency
- Thromboangitis obliterans
- Full-thickness burns over site of insertion
- Skin infection over site of insertion

Radial artery equipment

The following radial artery equipment is shown in Fig. 11:

- Sterile towels
- ChloroPrep or povidone-iodine solution
- Gauze pad
- 20 gauge \times 1 to 0.50-inch radiopaque polyurethane over 22-gauge needle with 0.18-inch diameter spring wire guide
- Injection needle 18 gauge \times 1 to 0.5 inch
- Injection needle 26 gauge \times five-eighths inch
- 3-mL Luer lock syringe
- 2-mL ampule of 1% lidocaine solution
- 3.0 silk with straight needle
- 20-gauge angiocatheter with guidewire
- Pressure tubing with transducer
- 500 mL of normal saline with pressure bag

Preprocedure and planning

- Palpate both radial arteries at wrists and choose the artery with more pulsatile flow for the catheterization
- Perform Allen test to confirm ulnar collateral circulation (not completely reliable)
 - Ask patient to clench wrist so as to exsanguinate the hand
 - Occlude the radial and ulnar artery with fingertips and ask patient to relax the blanched hand
 - Collateral flow through the arterial arch is confirmed by flushing of the thumb within 5 seconds when pressure on the ulnar artery is released
 - Delayed flushing of the thumb, 5 to 10 seconds, is an equivocal result
 - Delayed flushing of the thumb greater than 10 seconds indicates insufficient collateral circulation

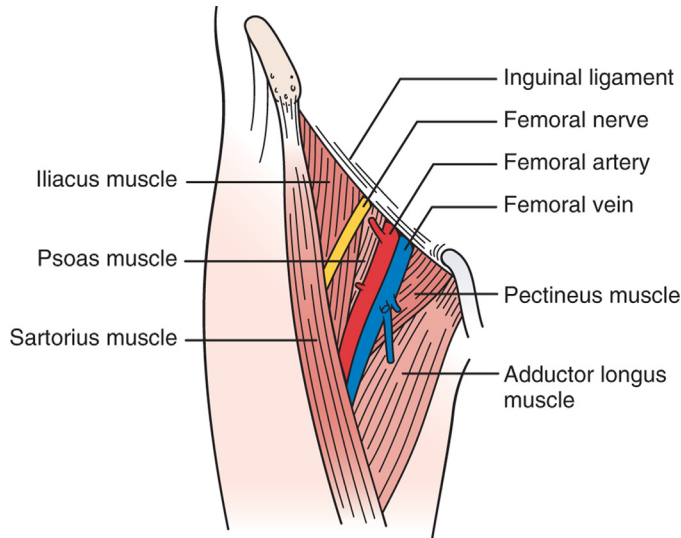


Fig. 1 Femoral artery anatomy. (From Magee DJ. Hip. Orthopedic physical assessment. 5th edition. Philadelphia: Elsevier; 2008; with permission.)

Preparation and positioning

- Position the patient's wrist/hand by dorsiflexing the wrist over a rolled towel pad (Fig. 2)
- Tape thumb and palm of hand down on to the table to provide maximal extension
- Palpate radial artery and feel for the radial pulse area of maximal impulse
- Prepare the area with Chloraprep or povidone-iodine solution
- Drape with sterile towel

Procedure

Figs. 3–10 illustrate the procedure.

- Infiltrate skin with 0.5 mL of 1% lidocaine with 25-gauge needle directly over the artery
- Using sterile technique insert 20-gauge Teflon catheter over needle at 45-degree angle into the skin at the site of maximal impulse
- Advance needle into artery until you see a flash back
- Lower the needle to 30° and advance another 2 mm to make sure the tip of the catheter is in the lumen
- Advance the catheter over the needle and withdraw the needle
- Alternatively once the needle is within the vessel lumen confirmed by flash back withdraw the needle and pass a guidewire into the lumen of 20-gauge catheter and then advance the catheter over the guidewire (Seldinger technique)
 - Remove the guidewire; pulsating arterial flow from the catheter confirms that the catheter is intra-arterial
 - There should not be any resistance when the guidewire is placed through the catheter
- Connect pressure tubing and transducer, level the transducer at heart level, zero the transducer, and verify arterial wave form
- Suture arterial line with silk and dress with transparent bio-occlusive dressing



Fig. 2 Prep and positioning.

Complications

- Hematoma
- Vasospasm
- Arterial thrombosis
- Pseudoaneurysm
- Limb ischemia
- Embolization of air bubble or thrombi
- Nerve damage
- Infection
- Unintentional intra-arterial drug injection

Troubleshooting

- Unable to thread catheter; needle in false lumen
 - Withdraw needle and reinsert
- Absence of pulsatile flow when needle/guidewire is removed
 - Possibly in vein or false lumen
- Resistance in threading guidewire (Seldinger technique)
 - Gradually withdraw catheter until pulsatile blood flow is noted
 - Reinsert guidewire and advance catheter over guidewire

Femoral artery catheterization

In situations when radial artery catheterization is not possible then the femoral artery is used.

Indications

- Inability to use radial artery
- Frequent blood sampling
- Continuous real-time monitoring; when beat-to-beat blood pressure changes are anticipated
- Major blood loss or fluid shifts are anticipated
- Deliberate induced hypotension and administration of vasoactive infusion
- End-organ disease necessitating beat-to-beat blood pressure regulation
- Inability to use noninvasive blood pressure monitoring (severe burns, morbid obesity)

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