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Seldinger Technique: Retrograde Approach through the Common Femoral Artery

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Abstract **Review Article**

The Seldinger technique is the mainstay of vascular and other luminal access in interventional radiology. It provides a safe and simple way to access arteries, and the retrograde approach through the common femoral artery is the vascular radiologist's basic approach serving both diagnostic and therapeutic roles in different patients. This technique is not without complications, and experience and improved equipment will undoubtedly eliminate this potential complication and prevent failure.

Keywords: Seldinger technique, retrograde approach, Common femoral artery, vascular, interventional radiology.

INTRODUCTION

The Seldinger technique, also known as Seldinger wire technique, is a medical procedure to obtain safe access to blood vessels and other hollow organs.

In 1953, Sven-Ivar Seldinger first described percutaneous arterial catheterization using a needle, guidewire, and catheter. This technique consists of puncturing an artery, introducing the guidewire through it, and then using the guidewire to advance a catheter or introducer sheath through the artery [1].

Retrograde access to the femoral artery is the vascular radiologist's basic approach to the arterial system for nearly any procedure, whether diagnostic or therapeutic.

The common femoral artery (CFA) is the safest and simplest arterial access route because it is large, superficial, usually disease free, and can be compressed against the femoral head to close the puncture. However, this approach should be avoided when the patient has a CFA aneurysm, local infection, overlying bowel, or a fresh incision. Classically, the inguinal fold is used as a reference for the puncture; the pulse is palpated cephalad to the fold and the skin is punctured caudal to it using a 45° angle toward the site where the pulse was palpated [2].

When the skin is punctured over the bottom of the femoral head and the needle is angled at 45 degrees, the needle usually enters the CFA at its midpoint (Figure 1).

The inguinal crease is an imprecise landmark for skin puncture and the bony landmarks for the inguinal ligament (a line running from the anterior superior iliac spine to the pubic tubercle) provide only a rough approximation [3].

If the puncture is low (into the superficial femoral artery (SFA) or deep femoral artery (DFA), the risk of thrombosis, pseudoaneurysm, or arteriovenous fistula formation is significantly increased [4]. If the puncture is too high (into the external iliac artery above the inguinal ligament), the risk of retroperitoneal or intraperitoneal bleeding is increased [5].

The impalpable artery can be located in various ways. Fluoroscopy will show the anticipated path of the artery and ideal puncture site. It may also show arterial wall calcification to guide needle puncture. The opposite common femoral artery may have already been catheterised, if a bilateral approach is used. In this situation, an angiographic roadmap of the common femoral on the impalpable side can be used to guide the needle. Ultrasound can be used to locate the artery and guide needle puncture (Figure 2). Ultrasound will also show the bright arcuate shadow of the femoral head which will enable puncture at the correct level.

Ultrasound localisation has been shown to reduce the number of needle passes required to access the artery [6].

Equipment List: Figure (3 a,b,c,d)

1. 10 and 20 mL syringes.
2. 21½G intramuscular needle.
3. Injectable 1 or 2% lidocaine solution.
4. 18 G Needle.
5. 0.035 in. conventional curved-tip guidewire.
6. Valved introducer sheath.
7. Heparinized saline solution.
8. Scalpel blade

Preparation

Sterile puncture-site preparation (iodinated scrub following groin shave) and draping of patient.

The patient must be in a comfortable position that can be tolerated for the duration of the procedure prior to preparation.

All patients subjected to any angiographic or interventional procedure under conscious sedation should have continuous physiologic monitoring.

Infuse local anesthesia with 1% to 2% lidocaine (Xylocaine) at the skin entry site (Fig 4a).

Procedure Steps

After selecting a skin entry site with fluoroscopy and applying local anesthesia, a small, superficial skin nick is made directly over the arterial pulse.

The course of the artery is palpated while an 18-gauge needle is advanced at a 45-degree angle toward the femoral head (Fig 4b).

The hub of the needle is depressed and then slowly withdrawn until adequate pulsatile reflow blood. (Fig 4c), a 0.035- or 0.038-inch Bentson or other floppy-tipped guidewire is carefully inserted and advanced up the femoral artery, through the iliac arteries, and into the aorta under fluoroscopic guidance (Fig 4d & Fig 4e).

Slow return of dark blood usually is a sign of venous entry; the site is then compressed and a more lateral puncture is made.

Resistance to passage usually means that the tip of the needle is partially subintimal, up against the sidewall, or abutting common femoral or iliac artery plaque.

The wire should never be forced. A small change in needle position (e.g., medial to lateral, shallow to steep angle, slight with-drawal) usually allows the wire to pass; if not, contrast can be injected to identify the reason for resistance. If the guidewire still cannot be advanced, the needle is removed, compression is applied for about 5 minutes, and the artery is repunctured. Occasionally, the guidewire enters the deep iliac circumflex artery rather than the external iliac artery. In this case, it is withdrawn and redirected.

After the guidewire is advanced to the abdominal aorta under fluoroscopy (Fig 4e), an introducer sheath is placed (Fig 4f). After removal of the dilator (Fig 4g), we check for adequate blood reflow, and we wash the introducer sheath with heparinized saline solution (Fig 4h). Then a catheter can be inserted into the artery.

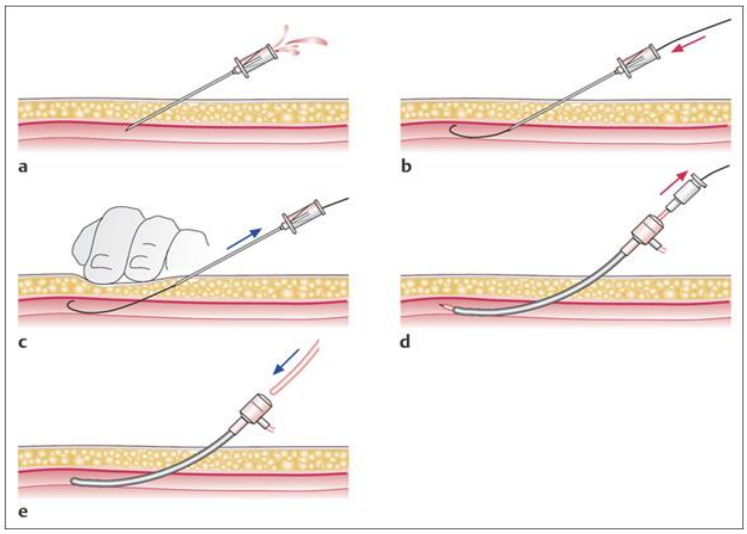


Figure 1: Diagram showing the Seldinger technique with sheath introduction (reference: Arterial and Venous Access Thoracic Key): a) The puncture needle is advanced into the artery until pulsating blood exits. b) The guidewire is then advanced into the artery via the needle. c) The needle is removed under compression of the puncture site. d) The sheath is advanced with the dilator inserted. e) After removal of the dilator, a catheter can be inserted into the artery.

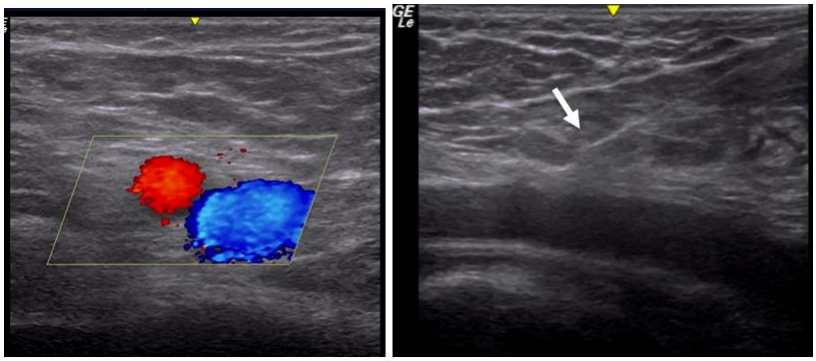
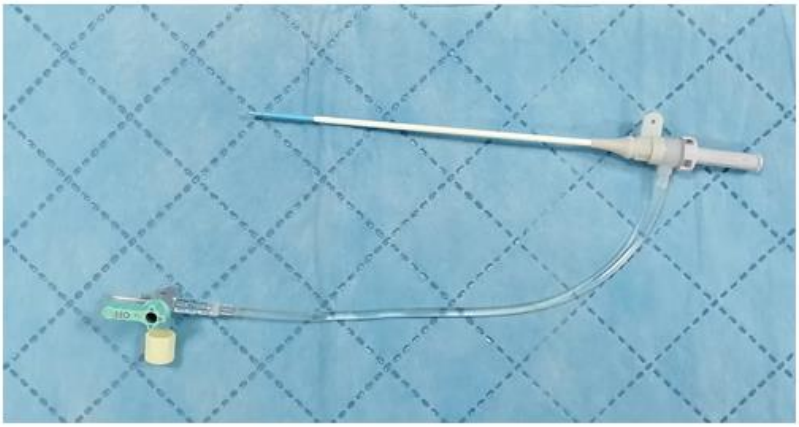
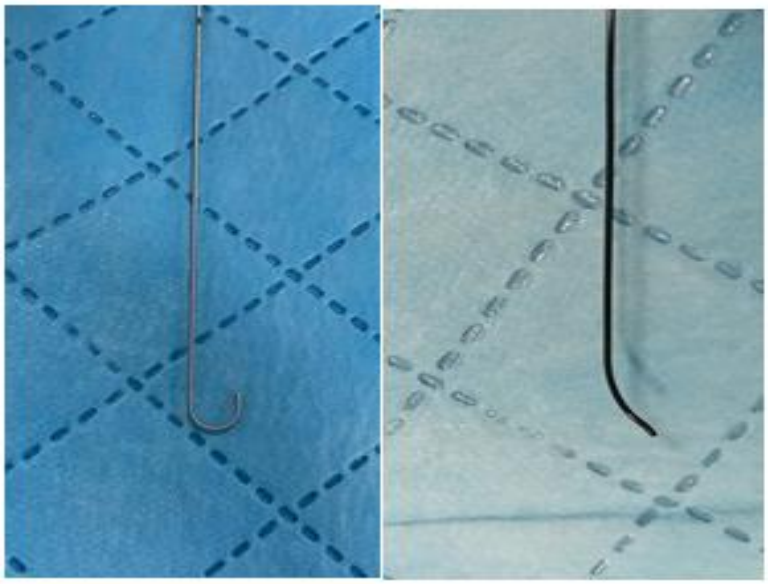


Figure 2: US-guided vascular access. (a) Color-Doppler shows the common femoral artery and the femoral vein. (b) The image shows the tip of the needle (arrow) as it enters the femoral artery

3a: 18-gauge Needle Without a Stylet (Standard arterial puncture needle) and Cannulated needle



3b: 5F introducer sheath



3c: Distal tip of a conventional J-tipped guidewire and a curved tip hydrophilic guidewire

Figure 3: a, b, c: Equipment List

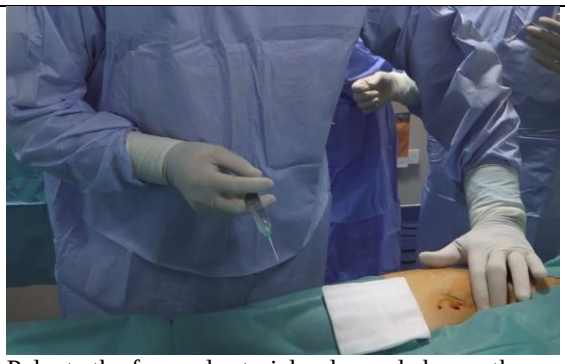


Figure 4a: Palpate the femoral arterial pulse and choose the puncture site.

Figure 4b: Infiltrate local anesthetic. (Xylocaine 1%)

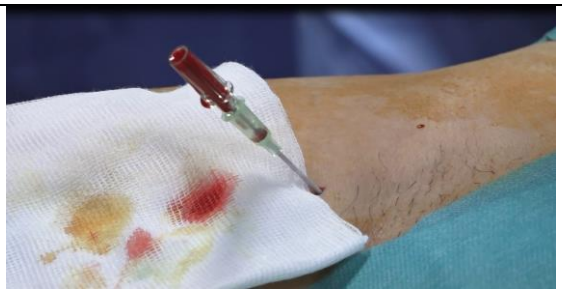


Figure 4c: Puncture the artery with a 18G Needle.

Figure 4d: Withdraw the metallic guidewire from the needle, check for adequate blood reflow and introduce the 0.035'' guidewire.

Figure 4e: Advance the guidewire and use fluoroscopy to check for the correct position.

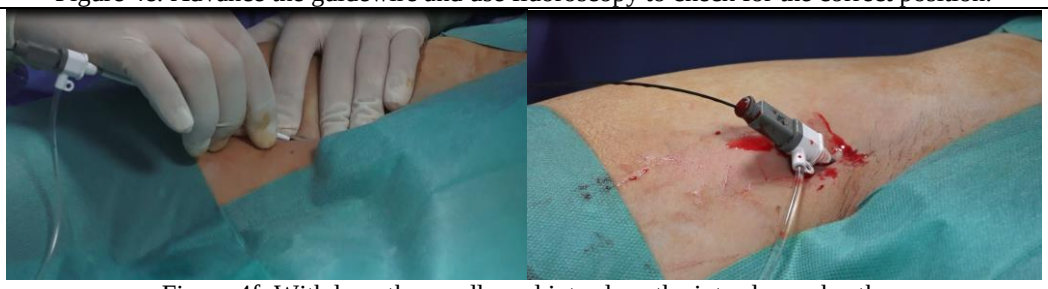


Figure 4f: Withdraw the needle and introduce the introducer sheath.

Figure 4g: Withdraw the dilator from the introducer sheath and check for adequate blood reflow.

Figure 4h: Wash the introducer sheath with heparinized saline solution.

Figure 4: Procedure Steps (Step a to h)

Complications

The risk of major complications after vascular access is very low (generally less than 2%), although it depends on the approach, the radiologist's experience, and other factors like anticoagulant treatment or the type of intervention. The most common complication of the arterial approach is mild bleeding or hematoma (6–10%), followed by pseudoaneurysms (1–6%). The risk of major complications like bleeding that requires transfusion, arterial dissection, arterial occlusion, arteriovenous fistula, or distal embolism is much lower (all below 1%) [7].

CONCLUSION

The Seldinger technique provides a safe way to access arteries. The retrograde approach through the common femoral artery may serve both diagnostic and therapeutic roles in different patients. This technique is not without complications, and no doubt, experience and improved equipment will eliminate this possible complication and avoid failure.

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