The occasional femoral line

Dominique R. Ansell, MSc, MD
Sarah M. Giles, MD, CCFP, DTMeH
Department of Family Medicine, Faculty of Medicine, University of Ottawa, Ottawa, Ont.

Correspondence to: Sarah Giles; smgiles@dal.ca

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Femoral vein catheters are used in the rural setting to gain rapid intravenous access during trauma and cardiopulmonary resuscitation. The advantages of using the femoral vein are its large diameter and noninterference with cardiac compressions or intubation.[1] Additionally, there are no risks of pneumothorax with catheter insertion into a femoral vein, and it is easily compressed if bleeding occurs.[2] This article outlines the steps required to gain central venous access via the femoral vein.

INDICATIONS

- Obtaining vascular access quickly and efficiently when peripheral veins are inaccessible.[3]
- Infusing fluids or blood products in critically ill patients.[3]
- Administering potent vasoactive drugs, such as norepinephrine and dopamine, as well as solutions that are irritating or hypertonic, such as potassium chloride.[3]
- Measuring central venous pressure (e.g., during sepsis, congestive heart failure or pericardial effusion).
- Performing acute and subacute hemodialysis, as well as hemofiltration and cardiac pacing.[3]
- Administering nutritional therapy (total parenteral nutrition).

CONTRAINDICATION

The only contraindication to this potentially life-saving procedure is refusal by a competent patient.

RELATIVE CONTRAINDICATIONS

- Femoral vein catheters should not be used if a safer option exists.
- Sites with anatomic distortion, cutaneous burns, proximal vascular injury (e.g., thrombus) and infection should be avoided when inserting the femoral catheter, because complications are more likely to occur.
- Patients with coagulopathies are at higher risk of hemorrhage.[4]
- Do not use the femoral vein as a site for central venous access in cases of penetrating abdominal trauma or known vena cava disruption.

COMPLICATIONS

One study reports that more than 15% of patients who undergo venous catheterization for central venous access experience complications.[1] The most common complications include arterial puncture, infection, thrombosis and hematoma. Femoral vein catheters are associated with a higher thrombosis rate than all other central venous access sites.[1] Despite the femoral line's reputation as a "dirty" site, a recent study has shown no difference between catheter-insertion sites in the rate of catheter-related bloodstream infections.[5] Femoral vein catheterization is recommended for short-term use, and femoral venous lines should be removed when no longer needed to avoid complications.[2]

THEORY

The femoral vein travels in the femoral

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sheath with the femoral artery, nerve and lymphatics. Anatomically, the femoral vein lies behind the inguinal ligament, about 1 cm below it, and just medial to the femoral artery. It is located very close to the skin and is easily accessible.[6]

EQUIPMENT

- Sterile personal protective gear (e.g., gloves, gown and mask)
- Sterile drape and towels
- Sterile preparation solution (e.g., chlorhexidine)
- Three 10-mL syringes containing sterile normal saline flush
- 3 intravenous caps
- Ultrasound machine (if available)
- Sterile sheath for ultrasound probe
- Coupling gel for ultrasound probe
- Central venous catheter set containing
  - 1% lidocaine, small-gauge needle and 10-mL syringe
  - 18-gauge introducer needle
  - Guidewire
  - #11-blade scalpel
  - Venodilator
  - Single- or multilumen catheter
  - Gauze pads measuring 4" × 4"
  - 3–0 or 4–0 silk suture with straight needle or needle driver
  - Sterile transparent dressing

ULTRASOUND GUIDANCE

If available, ultrasound guidance is highly recommended during central venous catheterization. As reported by Rothschild[7] and by Cheung and colleagues,[8] ultrasound guidance of central lines improves success rates for catheter insertion. Ultrasound guidance also reduces the number of venipuncture attempts before successful line insertion, and reduces the risk of complications.[7,8]

CONSENT

Before attempting the procedure, explain it to the patient and discuss possible complications. Obtain consent after ensuring the patient understands the risks and benefits of femoral vein catheterization. In an emergency situation, consent is implied.

THE PROCEDURE

1. The insertion of a femoral catheter should be performed under sterile conditions. Ensure that you are gowned and gloved, and wearing a facial mask and hair cover before beginning. After

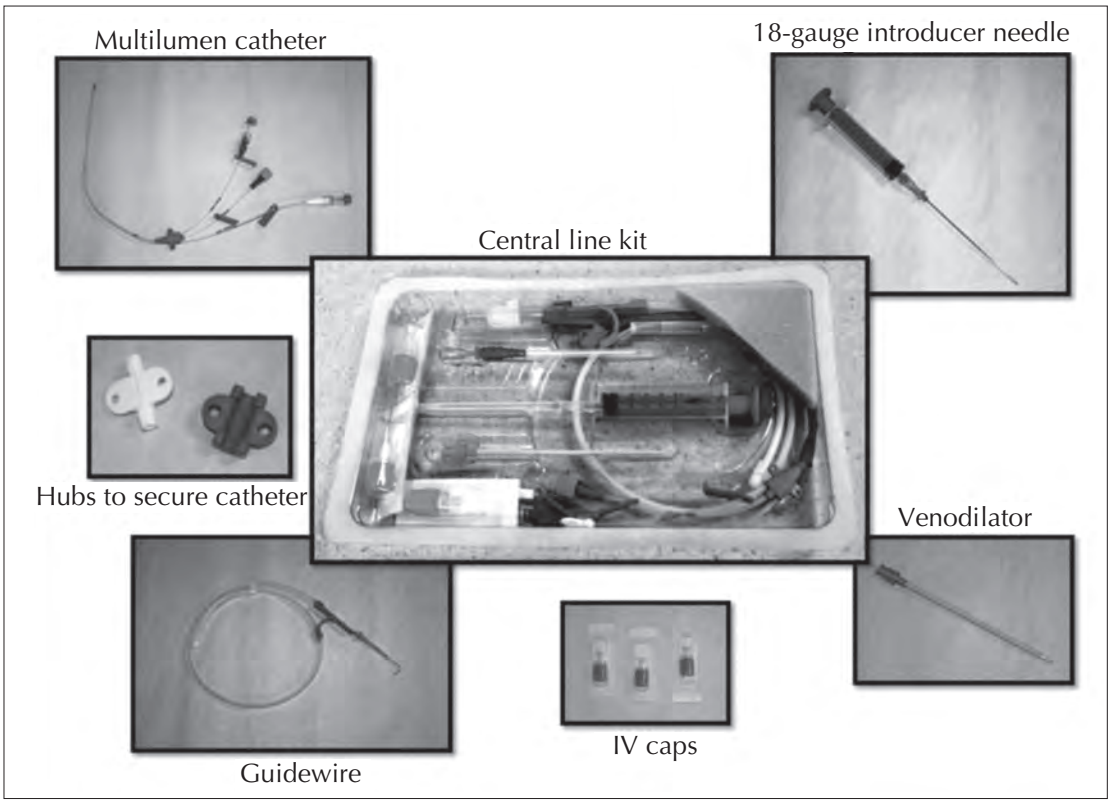


Fig. 1. A standard central venous catheter kit by Arrow Medical Products. IV = intravenous.

donning protective gear, open the standard kit (Fig. 1).

2. Expose the patient's femoral region by externally rotating and abducting the patient's leg away from the midline. Clean the groin area with disinfectant (chlorhexidine) 3 times with 3 different sterile sponges. Place a large sterile sheet on the patient's upper body and legs to create a sterile field. Palpate for the femoral artery to anatomically locate the femoral vein, which will be medial to the femoral artery. Inject 1–2 mL of 1% lidocaine subcutaneously using the small (25-gauge) needle to freeze the skin.
3. If bedside ultrasonography is available, use a linear probe to localize the femoral vein (Fig. 2). Orient the probe so that the patient's right side is on the right of the ultrasound monitor. If possible, place the probe in a sterile sheath with coupling gel inside. The femoral vein is collapsible, whereas the artery is not. Position the vein in the centre of the ultrasound monitor (Fig. 3).
4. Insert the 18-gauge introducer needle at a 30-degree angle from the skin while pulling back on the plunger of the syringe (Fig. 4). Confirm that the needle is in an appropriate position, with the help of the ultrasound images. Ultrasonography, venous manometry, pressure-waveform analysis or venous blood gas measurement can be used to confirm placement of the catheter. Once you observe a return of blood in the syringe, manually anchor the needle to avoid dislodging it. The blood seen in the syringe should be dark and nonpulsatile.
5. Detach the syringe and thread the guidewire through the needle (Fig. 5). The guidewire comes wrapped in a circular tube and has a plastic adaptor that feeds it into your needle. The guidewire has a folded tip that prevents it from lacerating the vein. It should pass smoothly and without resistance into the femoral vein. If you feel resistance, stop and evaluate the source. Once the guidewire is in the femoral vein, grasp



Fig. 2. Localization of the femoral vein using ultrasonography.

the guidewire firmly and remove the introducer needle (Fig. 6). Secure the guidewire to ensure it does not get lost inside the body (Fig. 7).

6. Pass the venodilator over the guidewire. At the skin, use the scalpel to make a small (0.5 cm) incision at the wire-entry site while maintaining a hold of your guidewire. Next, advance the venodilator over the wire to create a tract for the catheter.
7. Remove the venodilator from the femoral vein while continuing to hold on to the guidewire. Next, place the multilumen catheter on the guidewire and advance it into the femoral vein (Fig. 8). The guidewire will be pushed out of the port of the multilumen catheter. Remove the guidewire. Once the guidewire is removed, blood will flow up from the lumen of the catheter. The flow of blood will clear the air from the line. You can now attach the intravenous cap to a 10-mL syringe and flush normal

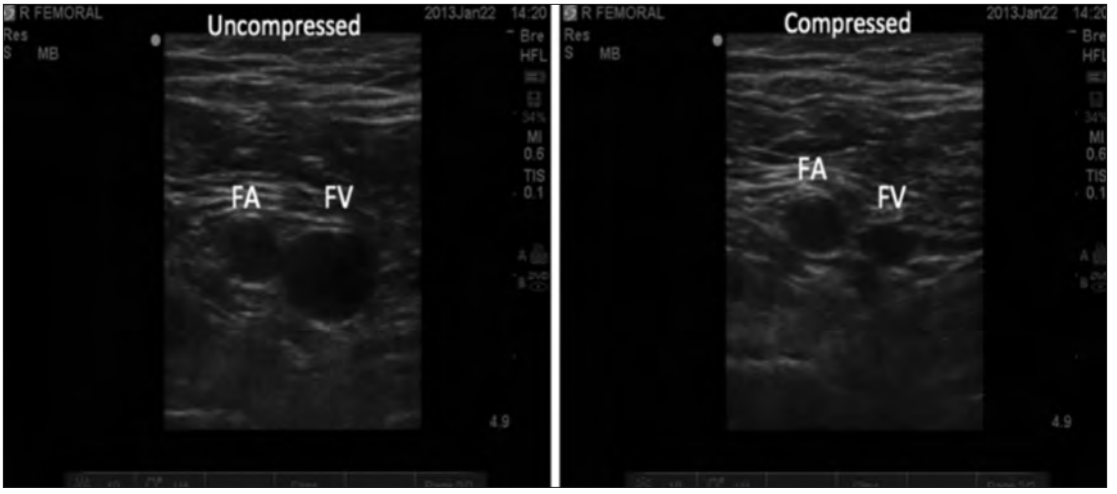


Fig. 3. Ultrasound images of the femoral vein (FV) and femoral artery (FA). The image on the left shows the femoral vein uncompressed, and the image on the right shows the femoral vein being compressed by the ultrasound probe. Images courtesy of A. Smith and B. Metcalfe at Memorial University.



Fig. 4. Insertion of the introducer needle with ultrasound guidance.



Fig. 5. Feeding of the guidewire through the introducer needle.

saline through the cap. Do the same for the other lumens of the catheter: bleed them back, attach the intravenous cap and then flush.

8. Secure the catheter by placing sutures through the hub openings on each side of the catheter (Fig. 9).

AFTER FEMORAL LINE INSERTION

After completion of the procedure, confirm venous placement of the wire before use of the line. Also confirm the final position of the catheter tip, which should lie in the inferior vena cava below the renal veins and above the confluence of the iliac veins. This last step can be done with abdominal radiography, fluoroscopy or continuous electrocardiography. However, radiography would be the likely method of choice in a rural location.[9]

CONCLUSION

The femoral vein provides a reliable site for central venous access and is relatively easy to catheterize. It is an advantageous site because it does not cause lung collapse or carotid punctures during insertion. Good aseptic technique and ultrasonographic assistance have led to successful femoral line insertions



Fig. 6. Feeding of the guidewire into the femoral vein.



Fig. 7. Securing of the guidewire.



Fig. 8. Insertion of the multilumen catheter.



Fig. 9. Securing of the catheter.

and minimal complications.[4] Remember to remove central venous catheters as soon as possible to avoid complications and to reassess daily the need for keeping the catheter in place.[2]

PROCEDURE SUMMARY

1. Sterile preparation and equipment set-up
2. Positioning of the patient and locating of the femoral vein
3. Anesthesia
4. Location of the vein with ultrasonography
5. Placement of the introducer needle in the vein
6. Assessment of catheter placement with ultrasonography
7. Insertion of the guidewire
8. Removal of the introducer needle
9. Skin incision
10. Insertion of the venodilator and catheter
11. Removal of the dilator and guidewire
12. Flushing and capping of the lumens
13. Securing of the catheter
14. Confirmation of catheter tip position before use of the central line

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REFERENCES

1. Emerman CL, Bellon EM, Lukens TW, et al. A prospective study of femoral versus subclavian vein catheterization during cardiac arrest. *Ann Emerg Med* 1990;19:26-30.
2. Burchell PL, Powers KA. Focus on central venous pressure monitoring in an acute care setting. *Nursing* 2011;41:38-43.
3. Taylor RW, Ashok V, Palagiri V. Central venous catheterization. *Crit Care Med* 2007;35:1390-6.
4. McGee DC, Gould MK. Preventing complications of central venous catheterization. *N Engl J Med* 2003;348:1123-33.
5. Marik PE, Flemmer M, Harrison W. The risk of catheter-related bloodstream infection with femoral venous catheters as compared to subclavian and internal jugular venous catheters: a systematic review of the literature and meta-analysis. *Crit Care Med* 2012;40: 2479-85.
6. Tsui JY, Collins AB, White DW, et al. Placement of a femoral venous catheter. *N Engl J Med* 2008;358:e30.
7. Rothschild JM. Ultrasound guidance of central vein catheterization. In: Shojania KG, Duncan BW, McDonald KM, et al., editors. *Making health care safer: a critical analysis of patient safety practices*. Rockville (MD): Agency for Healthcare Research Quality Archives; 2001. p. 245-53. Available: http://archive.ahrq.gov/clinic/ptsafety/chap21.htm (accessed 2013 Mar. 16).
8. Cheung E, Baerlocher MO, Asch M, et al. Venous access: a practical review for 2009. *Can Fam Physician* 2009;55:494-6.
9. Practice guidelines for central venous access: a report by the American Society of Anesthesiologists Task Force on Central Venous Access. *Anesthesiology* 2012;116:539-73.