The perils of femoral vein catheterization

Introduction

Femoral vein catheterization can be undertaken easily and quickly by inexperienced physicians. However, accurate vein puncture is critical to reducing complications that include pseudoaneurysm and arteriovenous fistulae formation.

Discussion

The femoral vein is often used for percutaneous catheterization. The procedure can be undertaken easily, quickly and be performed by relatively inexperienced physicians. It is believed to present minimal risk of injury and the danger of infections may be acceptable, when compared to other routes of central venous access.

Kim et al (1992) studied the morbidity associated with femoral vessel puncture and advocated the use of fluoroscopy to identify a safe puncture site of the femoral vein or artery. However, fluoroscopy is rarely undertaken in an emergency setting, and is often impractical.

The anatomical position of the femoral vessels is well described as they transit the inguinal ligament and lend themselves to a 'landmark technique' for catheter insertion. Both artery and vein lie within the femoral canal (*Figure 1*), contained in a common vascular sheath, the femoral vein lying medial to the common femoral artery at the level of the inguinal ligament. A common error with this practice is assuming the groin crease represents the landmark for the inguinal ligament. However, this structure is a skin-fold, therefore highly mobile and often lying far below the inguinal ligament. Insertion here exposes the patient to the risk of femoral artery damage.

Anatomical bifurcation of the common femoral artery is variable, but fluoroscopic studies have identified branching occurring in most patients within 3 cm below, or 2 cm above, the inferior border of the femoral head (Altin et al, 1989). At its bifurcation the profunda femoris artery is given off and the femoral artery continues as the superficial femoral artery. This small calibre vessel is highly variable in its course and often lies anterior to the femoral vein. It is this anatomical relationship which exposes the femoral artery to collateral damage and inadvertent transfixation, when 'low' insertion occurs.

The likelihood of forming pseudoaneurysms and arteriovenous fistulae is significantly increased with low punctures (Altin et al, 1989). A pseudoaneurysm is a haematoma with persistent communication with the artery lumen. Below the common femoral artery bifurcation, the vessel is not compressible by the femoral head, and the haematoma is contained locally within the femoral sheath, both factors contributing to its formation (Rapaport et al, 1985). Accurate femoral vein puncture is therefore critical to reducing this complication. Similarly, high puncture occurring cephalad to the inguinal ligament is not without significant morbidity. Damage to the iliac vessels may result in occult bleeding into the retro-peritoneum or the prevesical space of Retzius.

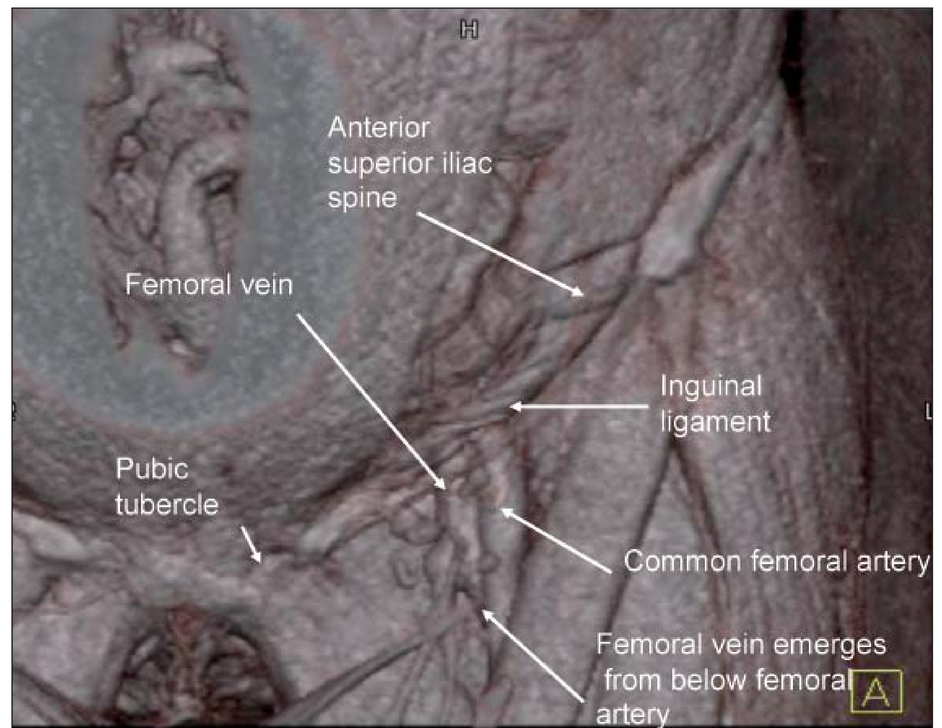
Dr Navkiran Kaur *is Consultant in Anaesthesia and* **Dr David A Walker** *is Consultant in Critical Care and Anaesthesia in the Anaesthetics Department, University College Hospital, London NW1 2BU*

Correspondence to: Dr N Kaur

Case Report

A 69-year-old patient was admitted to the intensive care unit for haemofiltration following an overdose of lithium carbonate. A venous haemofiltration catheter was passed 4 cm below the inguinal ligament, 1 cm medial to the femoral artery pulsation, into the femoral vein. Non-pulsatile blood was aspirated easily from the catheter and the patient commenced filtration. Three hours later, clinical examination revealed a cold pulseless leg. Pressure transduction of the femoral catheter showed venous waveform and a central venous pressure of 18 mmHg. Digital subtraction angiography of the femoral vessels revealed complete occlusion of the superficial femoral artery. The patient underwent surgical exploration, where the catheter was found to have transected the artery and occluded its lumen, before entering the femoral vein which lay directly beneath. Surgical repair was carried and the patient made an uneventful recovery.

Figure 1. The relationship between the common femoral artery and femoral vein, where distally they lie one over the other.



Cannulating the femoral vein by a double wall technique and thus transfixing the vessel by puncturing both front and back walls of the vein may also cause problems. This technique allows the cannula to be pulled back into the lumen of the vein and will not allow recognition of an inadvertent simultaneous arterial-venous cannulation.

Advanced Trauma Life Support guidelines suggest identifying the vein for cannulation by approximation of a point 1 cm medial to the femoral artery pulsation (American College of Surgeons, 1997). No guidelines are given to identify at which level below the inguinal ligament safe cannulation should take place and the dangers of low puncture are not highlighted.

When venous cannulation of the femoral vein is required, the authors advocate a precise puncture site close to the inguinal ligament. The vessels here are larger, more superficial and less prone to anatomical variation. A single wall technique is preferred to avoid accidental double vessel cannulation. It should be recognized that pressure transduction and blood gas analysis from the catheter may be falsely reassuring, and is no safeguard against collateral structure damage. The authors advocate bedside ultrasonography and Doppler as an adjunct to safe insertion and close clinical observation of newly placed vascular cannulae at all times. **BJHM**

Altin RS, Flicker S, Naidech HJ (1989) Pseudoaneurysm and arteriovenous fistula after femoral artery catheterisation: associated with low femoral punctures. *Am J Roentgenol* **152:** 629–31

American College of Surgeons (1997) *Advanced Trauma Life Support handbook.* Students manual. American College of Surgeons, Chicago, USA

Kim D, Orron DE, Porter DH (1992) *Venographic Anatomy, Technique and Interpretation. Peripheral Vascular Imaging and Intervention.* Mosby-Year Book, Inc, St Louis

Rapaport S, Sniderman DW, Morse SS et al (1985) Pseudo-aneurysm: a complication of faulty technique in femoral artery punctures. *Radiology* **154:** 529–30

Chest pain and dyspnoea resulting from a perforated duodenal ulcer

A 45-year-old man presented with a 2-day history of sudden severe central chest pain associated with dyspnoea. On examination, he was hypoxic, tachypnoeic, hypotensive and tachycardic. Chest examination revealed bilateral reduction in air entry, whereas on abdominal examination the abdomen was soft, non-tender but distended with absent bowel sounds. Electrocardiogram showed no features of myocardial ischaemia, whereas a plain chest X-ray was suspicious for pneumoperitoneum (*Figure 1*).

Given the patient's clinical condition and atypical presentation, an abdominal computed tomography scan was performed which revealed hydropneumoperitoneum (*Figure 2*). After a brief period of resuscitation, an emergency laparotomy revealed a perforated ulcer at the superior aspect of the duodenal bulb, which was repaired with an omental patch. Despite an intraoperative cardiac arrest and a prolonged postoperative hospital stay, the patient fully recovered and is alive and well 1 year after presentation.

Although a perforated duodenal ulcer usually presents with acute abdominal pain, this case demonstrates that such an ulcer can also present with acute non-cardiac chest pain. In such cases, early surgical consultation should be sought and urgent abdominal imaging should be performed to rule out a gastrointestinal perforation such as a perforated duodenal ulcer. **BJHM**

Mr Ahmed N Assar *is Specialist Registrar in General Surgery,* **Dr Caroline L Sinclair** *is Foundation Year 1 Doctor in General Surgery and* **Mr Deepak B Shrestha** *is Clinical Fellow in General Surgery in the Department of General Surgery, Luton and Dunstable Hospital NHS Trust, Luton, Bedfordshire*

Correspondence to: Mr AN Assar, Department of Surgery, Stanford University, Stanford, California 94305, USA

Figure 1. Plain chest X-ray showing free air under both hemidiaphragms (arrows).

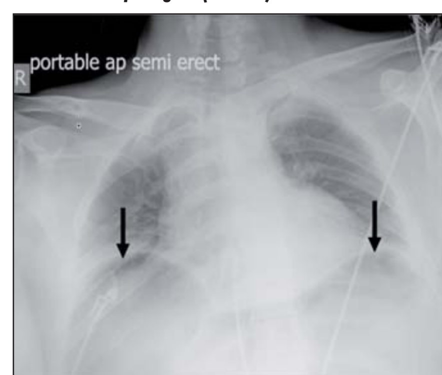


Figure 2. Abdominal computed tomography scan showing free air (arrow) and free fluid (arrow heads) in the peritoneal cavity.