

## An alternative peripheral arterial cannulation in minimally invasive and robotic cardiac surgery

Burak Onan, Ünal Aydın, Ersin Kadiroğulları, Korhan Erkanlı

Department of Cardiovascular Surgery, İstanbul Mehmet Akif Ersoy Thoracic and Cardiovascular Surgery Training and Research Hospital, İstanbul, Turkey

**Received:** November 27, 2016 **Accepted:** December 01, 2016 **Published online:** January 11, 2017

### ABSTRACT

Peripheral cannulation is a major step for establishing of cardiopulmonary bypass in minimally invasive cardiac surgery and in certain open chest procedures. Traditionally, a transverse arteriotomy incision or a purse suture over the arterial wall can be used during open cannulation of the femoral artery. Herein, we present an alternative technique for femoral artery cannulation with the Seldinger method, which uses double-pledgeted horizontal sutures on the anterior wall of the femoral artery.

**Keywords:** Minimally invasive cardiac surgery; peripheral cannulation; robotic cardiac surgery.

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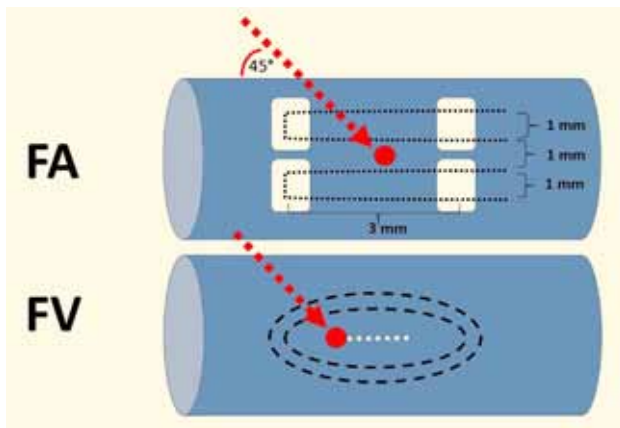
### SURGICAL TECHNIQUE

After marking the course of the femoral artery in the groin, an oblique 3 cm incision was made 1 cm above the inguinal crease. The subcutaneous tissue and femoral sheath were opened using a scissor. Dissection was made laterally to the femoral vessels to avoid lymphatic injury and lymphorrhea. Only anterior surfaces of the femoral artery and vein were dissected and exposed (Figure 1). The fascia and surrounding tissue around the vessels were kept intact. Systemic heparinization was made, before the suture placement and cannulation. A double pledgeted U-suture of 5/0 polytetrafluoroethylene was, then, placed at the anterior side of the common femoral artery (Figure 2). Bites were superficially taken through the adventitial layer of the femoral artery. There should be two pledgeted U-sutures on the anterior surface of the femoral artery. The



**Figure 1.** Surgical exposure of common femoral artery and vein (upper image), placement of double-pledgeted polytetrafluoroethylene sutures on the femoral artery and prolene sutures on the common femoral vein (lower image).

**Corresponding author:** Burak Onan, MD. Mehmet Akif Ersoy Göğüs Kalp ve Damar Cerrahisi Eğitim ve Araştırma Hastanesi Kalp ve Damar Cerrahisi Kliniği, 34307 Küçükçekmece, İstanbul, Turkey.  
Tel: +90 553 - 622 38 78 e-mail: burakonan@hotmail.com



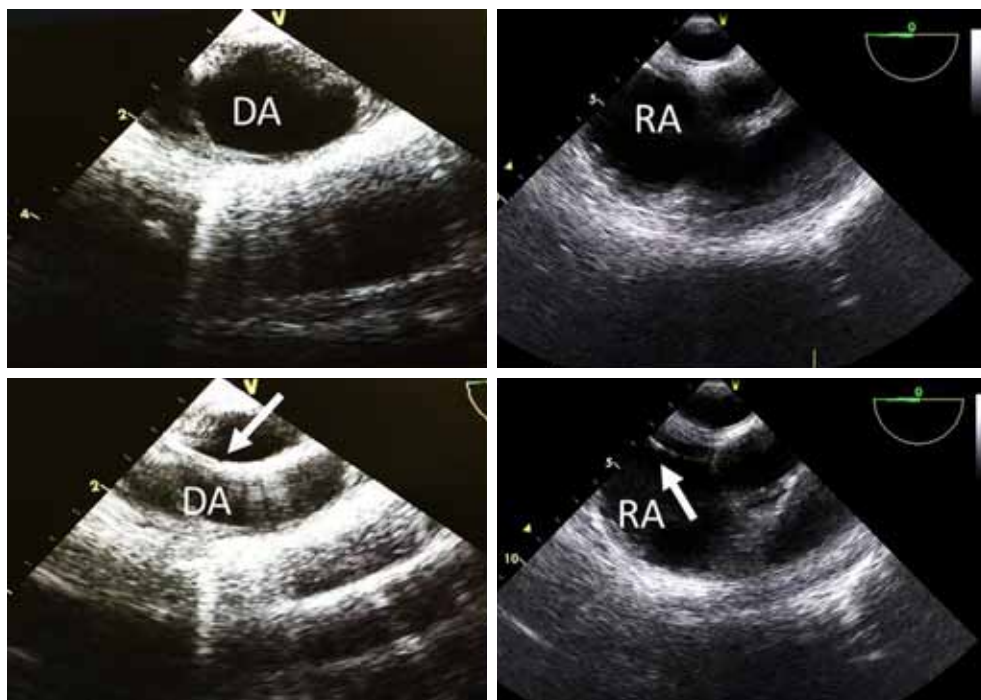
**Figure 2.** Placement of the sutures. Double-pledgeted sutures are horizontally placed through the adventitial layer of the femoral artery (FA) (top image). Red dot shows the puncture site in the middle of two-layered horizontal sutures. Note the distances of sutures. Double purse suture on the anterior surface of the common femoral vein (FV) (bottom image). Red dot shows the puncture site and dotted white line shows the 3 mm incision horizontal and superior incision before insertion of venous cannula.

distance between each suture line should be 1 mm, and the length of each bite should be 3 mm long horizontally. If the anterior wall was calcified, the

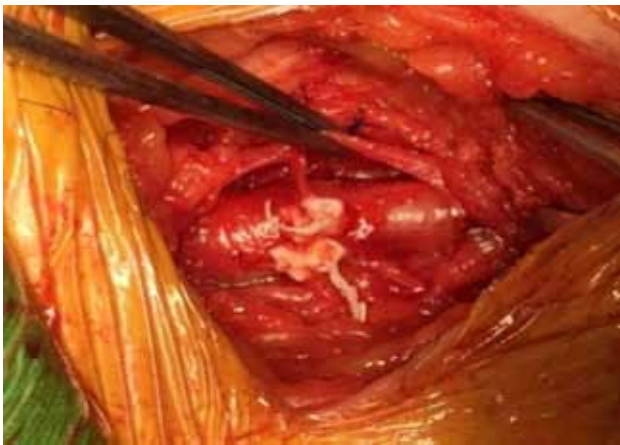


**Figure 3.** Double-pledgeted sutures on the femoral artery and a 3 mm incision over the femoral vein before insertion of the venous cannula.

sutures were placed more laterally or medially in a suitable plaque-free area. Femoral access was, then, performed using the Seldinger technique in the midpoint between the two pledgeted sutures. After the dilatation of the artery with a 15-F or 17-F



**Figure 4.** An intraoperative transesophageal echocardiography guidance view during peripheral cannulation. In the left lower view, guidewire (arrow) is shown in the descending aorta (DA). In the right lower view, guidewire is seen in the right atrium (RA).



**Figure 5.** Femoral artery and vein after tying sutures.

dilatator over the 0.035-inch guidewire, the arterial cannula was inserted. An oval shaped, double purse-string suture (5/0 polypropylene) was placed at the anterior side of the common femoral vein. Each suture should be 1 mm away from each other. Using the Seldinger technique, the vein was punctured inferiorly to the oval-shaped purse suture (Figure 3). The puncture site was dilated using a 15-F or 17-F dilatator over the 0.035-inch guidewire. Before the insertion of the venous cannula, the anterior wall of the femoral vein, lying in the oval purse suture, was incised 2 mm superiorly (Figures 2 and 3). The venous cannula was, then, immediately inserted through the vein with gentle maneuvers. All these steps of peripheral cannulation were performed under the guidance of transesophageal echocardiography (Figure 4). At the end of the procedure, the arterial cannula was removed, and the cannulation site was washed out in an antegrade and retrograde fashion. All two pledgeted sutures were, then, ligated (Figure 5). Sutures on the vein were also tied, before the delivery of the protamine following cardiopulmonary bypass.

A postoperative computed tomography angiography image revealed a natural course of the femoral artery with a gentle curve (Figure 6). The



**Figure 6.** A computed tomographic image following peripheral cannulation of the femoral vessels.

diameters of the proximal and distal segment of the common femoral artery in the cannulation site were similar without a stenosis or occlusion.

In conclusion, in patients undergoing minimally invasive cardiac surgery, particularly with mini-incisions such as port-access operations or robotic approach, peripheral cannulation is of paramount importance for establishing cardiopulmonary bypass. Our experience shows that this technique is simple, safe, and feasible for peripheral cannulation. Over the past five years, this technique has been routinely used in more than 300 minimally invasive and robotic procedures, as well as redo surgeries in our hospital. No procedure-related morbidity including leg ischemia perioperatively, or a vascular morbidity such stenosis, thrombosis, dissection or occlusion has been reported during follow-up to date.

#### **Declaration of conflicting interests**

The authors declared no conflicts of interest with respect to the authorship and/or publication of this article.

#### **Funding**

The authors received no financial support for the research and/or authorship of this article.