Brief communication - Cardiopulmonary bypass

Total percutaneous cardiopulmonary bypass with Perclose ProGlide

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Abstract

Suture-mediated closure devices have been previously described as an interesting alternative to femoral cutdown during endovascular aortic procedures. The insertion of two or three devices before the cannulation (preclose technique) permits successful percutaneous access also with a large sheath up to 24 Fr diameter. The main benefit of percutaneous access is a lower rate of complication at the groin. The same technique can be applied to cardiac procedures where femoral cannulation for cardiopulmonary bypass (CPB) is required. We report a series of 12 patients in whom total percutaneous CPB was successfully established using a Perclose ProGlide for the arterial access.

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1. Introduction

Percutaneous femoral arterial access with a large-size sheath (12–25 Fr) has been described by different authors in the setting of endovascular aneurysm repair [1]. In selected patients, the use of suture-mediated closure devices (SMCDs) is associated with a satisfactory success rate and lower incidence of access-related complications when compared with surgical femoral cutdown. In this report, we describe our technique of percutaneous femoral arterial cannulation with a 6 Fr Perclose ProGlide (Abbott Vascular, Redwood City, CA, USA) during two different cardiac procedures requiring cardiopulmonary bypass (CPB). To our knowledge, this is the first description of this technique to achieve total percutaneous cannulation for CPB.

2. How to do it

Between September 2010 and February 2011, 12 different patients requiring femoro-femoral CPB were selected for percutaneous cannulation. Eleven patients underwent minimally-invasive mitral valve repair through a right mini-thoracotomy, and the other patient, considered at high-risk for re-do coronary artery bypass surgery because of recurrent unstable angina, required arteriovenous extracorporeal membrane oxygenation (ECMO) support during left main coronary artery stenting.

In all cases, the arterial cannula was 18 Fr in size, and the venous cannula was 25 Fr. A 1-cm transverse skin incision for the arterial cannulation and a 1.5–2.0-cm incision for the venous site was performed in all patients, together with dissection of the subcutaneous fat in order to facilitate the introduction of the large cannula. Percutaneous femoral arterial access was obtained under ultrasound guidance to mark the common femoral artery bifurcation and to avoid any calcification of the common femoral artery. A 6 Fr sheath (Avanti, Cordis, a Johnson & Johnson company, Miami Lakes, FL, USA) was then exchanged over a wire (Rosen Curved Wire, Cook Inc, Bloomington, IN, USA) with the 6 Fr Perclose ProGlide.

Two or three devices can be used. The first device was inserted at 45° to the common femoral artery, and the sutures were deployed with a 45° medial orientation (Fig. 1). After securing the suture with Surgi-strips (Surgi-suppliers Int. PTY Lmt, Melbourne, Australia), the second device was introduced over the wire, again at a 45° angle to the femoral artery; the sutures were then deployed rotating the device laterally in order to obtain a 45° angle if three sutures were used, or a 90° angle if two sutures were used.

The femoral access was then gradually dilated with serial vessel dilators, and finally the arterial cannulation was obtained. CPB was then established after percutaneous venous cannulation. None of the mitral cases required adjunctive fluoroscopy. In the first three mitral cases, we used three devices for access (Fig. 2), instead of two as we normally do for an endoluminal aortic procedure with a 18–24 Fr sheath. This precaution was taken because of the initial lack of experience with the ‘preclose technique’ in fully heparinised patients. In the following eight cases, two ProGlides were enough to achieve haemostasis.

At the end of the procedure, the femoral artery was decannulated after regaining wire access. In order to obtain...
a good seal, the medially oriented pre-knotted suture was tied first, and then the remaining sutures were sequentially tied as placed after a brief haemostatic check, prior to removing the wire and losing access. Skin was closed with a subcutaneous suture and the venous site with a horizontal mattress and brief direct pressure. Technical success was obtained in all patients without femoral cutdown or adjunctive manual compression. A femoral arterial ultrasound was performed in all cases prior to discharge; no haematoma or flow disturbance was detected. No late revisions were required for infection, lymph leak, lymphocele or pseudoaneurysm formation.

3. Discussion

An SMCD has been successfully described to obtain haemostasis after percutaneous arterial access without manual compression or femoral cutdown [1] or when manual compression is not feasible due to anatomical constraints [2]. The deployment of the SMCD before the insertion of a large sheath up to 25 Fr (the ‘preclose’ technique) has been reported by several authors using both the Perclose Prostar XL [3] and the Perclose ProGlide [4] during endovascular aortic procedures. A recent systematic review on percutaneous endovascular aneurysm repair (1751 groins, with sheath size of 12–24 Fr) reported a 92% overall success rate of arterial closure, with an access-related complication rate of 4.4% (significantly lower when compared with the surgical cutdown; \( P=0.004 \)) [1]. Sheath size and obesity have been reported as significant predictors of device failure.

Although the procedure is associated with risks of arterial stenosis and subsequent claudication [5], the complication rate at a mean follow-up of almost one-year in a large group of patients is only 1.92% [6].

The main benefit of percutaneous arterial cannulation in patients undergoing minimally-invasive mitral valve surgery is related to a lower rate of complications at the femoral cutdown site. Seroma and lymph leak are potential causes of infection and warrant antibiotic therapy to prevent postoperative mitral endocarditis. In addition, groin wound complications may delay postoperative ambulation. For patients undergoing arteriovenous ECMO-supported coronary stenting for unstable left main disease, the main benefits of percutaneous cannulation are early mobilisation and a decreased systemic inflammatory response associated with surgical cutdown or manual compression [7]. In this regard, the combined use of an SMCD for the venous cannulation, successfully described by Mylonas et al. [8], could further decrease the inflammatory reaction.

4. Conclusion

Total percutaneous cannulation during femoro-femoral CPB is feasible and effective; in our early experience, no patient required femoral cutdown, and there were no in-hospital groin complications, such as haematoma or infection. These early results are encouraging for a routine introduction of the ‘preclose’ technique for peripheral bypass cannulation.

References


