Closure of femoral artery puncture site with antegrade placement of Prostar XL vascular closure device

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Abstract

Groin compression and patient stabilization are the conventional methods of achieving hemostasis following angiographic interventions performed by means of common femoral artery (CFA) punctures, but these methods are rather uncomfortable, and they necessitate longer hospital stays. Another disadvantage of these post-interventional measures is that they bear the risk of development of several serious complications including hematoma at the puncture site, retroperitoneal hemorrhage, and pseudoaneurysm and arteriovenous fistula formation. The Prostar XL vascular closure kit has been developed with the purpose of implanting surgical sutures at the CFA puncture site, following both diagnostic and interventional procedures. Here, we report a case of closure of femoral artery puncture site with antegrade placement of Prostar XL vascular closure device instead of the retrograde entry as it is commonly used.

Introduction

The technological improvements in the vast field of interventional radiology have created a need for the utilization of even bigger cuffs than the present ones in routine use, in accordance with a simultaneous usage of anticoagulant-antiplatelet therapy [1]. Groin compression and patient stabilization are the conventional methods of achieving hemostasis following angiographic interventions performed by means of common femoral artery (CFA) punctures, but these methods are rather uncomfortable, and they necessitate longer hospital stays. Another disadvantage of these post-interventional measures is that they bear the risk of development of several serious complications including hematoma at the puncture site, retroperitoneal hemorrhage, and pseudoaneurysm and arteriovenous fistula formation [2]. These vascular devices have been being utilized in the percutaneous stent-graft procedures performed for the treatment of aortic aneurysms, by means of retrograde entries from the CFA. The Prostar XL vascular closure kit has been developed with the purpose of implanting surgical sutures at the CFA puncture site, following both diagnostic and interventional procedures [3]. It is an effective and safe device especially for use in percutaneous closure of large CFA access sites, comparable to surgical cut-down [4]. Although the Prostar XL vascular closure device is generally used with retrograde entries from the CFA, it was, in our case, utilized following an antegrade entry to the vessel. Here, we report a case in whom we performed the closure of femoral artery puncture site with antegrade placement of Prostar XL vascular closure device (Figure 1).

Case Report

Our patient was a 24-year-old male who had developed chronic high-flow arteriovenous fistulae following a fire-arm injury 12 years ago. The patient had no other symptoms than a difference in the diameters of his lower extremities. A computed tomographic angiographic study revealed the presence of fistulous connections at the superficial femoral and popliteal artery sites of the right leg. A plan was made with the aim of canceling the fistulous connections by means of implanting a stent-graft. Written informed consent was obtained from the patient. An antegrade entry was established through the right CFA under sedation, and a 10F Prostar XL vascular closure device was placed antegradey. Following this initial procedure, the localizations of the fistulae were mapped with contrast injections made through an
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11F vascular sheath placed in the superficial femoral artery (SFA). Angiogram demonstrated multiple fistulous connections in the adductor canal between distal SFA-popliteal artery and distal femoral vein-popliteal vein (Figure 2). After replacing a stent graft with 12 mm diameter (Atrium Advanta V12, 12 mm × 61 mm, Atrium Medical Corporation, Hudson, NH, USA), the proximal part was opened with 12 mm balloon at last and distal part at popliteal artery was opened with 8 mm balloon because of the diameter difference between distal SFA and popliteal artery (Figure 3a and b). After opening the proximal segment with 12 mm balloon, another stent graft with 16 mm diameter (Figure 4) (Atrium Advanta V12, 16 mm × 41 mm, Atrium Medical Corporation, Hudson, NH, USA) was replaced at the wide part of the SFA overlapping the other stent (Figure 5). The fistulous connections were cut off by the utilization of stent-grafts and control angiogram showed no fistulous connections (Figure 6). Hemostasis at the puncture site of the right femoral artery was provided by means of Prostar sutures which had been placed antegradely. Ultrasound and color Doppler ultrasound controls disclosed no complications.

Discussion

Arteriovenous fistulas (AVFs) may be congenital or acquired. The leading types of acquired AVFs are the ones which develop after traumas. The pathophysiological alterations which follow the trauma depend upon several factors such as the duration of the fistula, the size of the arteriovenous shunt, and its location of formation. Peripheral AVFs

![Figure 1. Antegrade placement of Prostar XL vascular closure device through common femoral artery.](image1)

![Figure 2. Angiogram demonstrates fistulous connections between distal superficial femoral artery-popliteal artery and distal femoral vein-popliteal vein. And also diameter difference between distal superficial femoral artery and popliteal artery can be seen.](image2)

![Figure 3. (a and b) After replacing stent graft, proximal part was opened with 12 mm balloon at last and distal part at popliteal artery was opened with 8 mm balloon.](image3)

![Figure 4. After opening the proximal segment with 12 mm balloon, another stent graft with 16 mm diameter was replaced at the wide part of the superficial femoral artery overlapping the other stent.](image4)
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may lead to focal or central changes. Small AVFs located at the extremities usually go asymptomatic, and they may be diagnosed only by the trill they create. Chronic AVFs, on the other hand, may give way to venous hypertension and valvular insufficiency. They may even lead to cardiac failure when not treated properly, due to the high flow they create. The dilatation and the elongation of the feeding artery is a typical finding in chronic AVFs. In such circumstances, the peripheral arterial pulses diminish and sometimes even disappear. This may lead to ischemia in the extremities. In these cases, the drainage veins enlarge and become arterialized [5].

There were no other complaints in our patient than a difference in the diameters of his lower extremities. Clinical pulse examinations performed prior to the intervention showed that the posterior tibial artery and the dorsalis pedis artery pulses could only be weakly detected. These pulses were found to have become definitely more prominent and detectable at the pulse examinations done following the interventional procedure. At angiography, the SFA was found to be substantially dilated and elongated. The draining vein had become dilated and arterialized. The prominently dilated situation of the SFA enabled the successfully performed antegrade placement of the Prostar XL vascular closure device.

The conventional means of therapy in traumatic vascular injuries is surgery. The utilization of endovascular therapy techniques has been increasing in selective cases. The principal advantages of endovascular therapy can be summarized as follows: The minimally invasive character of the procedure, diminished level of blood loss, and short hospitalization periods. Some important factors in choosing the right endovascular therapy option in the treatment of AVFs are the location of the fistula, the speed of flow in the fistula, the situation of the vessels, which form the fistula, etc. [6].

Coil embolization can be used for the treatment of AVFs. However, coil sizes must be compatible with the length and diameter of the fistulous tract to avoid protrusion to the arterial and venous lumen. In the case of a large connection between arteries and veins, surgical ligation can be preferred. When there are multiple connections in different levels as in our case, stent graft insertion seems to be the most logical approach for the treatment, especially in patients with high surgical risk. On the other hand, long-term patency of the stent grafts must be taken into consideration when choosing this method. But stent grafts show favorable long-term patency rates in obstructive femoropopliteal arterial lesions in recent studies [7].

Many studies can be found in the literature concerning the safe usage of vascular closure devices in retrograde entries into the CFA, with only low levels of complication statistics. In our case, the Prostar XL vascular closure device was successfully administered by means of an antegrade entry into the CFA, instead of a conventional retrograde entry. Because the SFA had been dilated in our patient due to the presence of the AVF, the utilization of the Prostar XL vascular closure device in an antegrade fashion had become easier. The technique of antegrade approach for the Prostar application is not much different from the retrograde approach. The caliber of the SFA is of concern when 10F device is to be advanced which was not the case in our case due to high-flow fistula enlarging the arteries. In general, obese patients are not good candidates for antegrade CFA puncture which is also true for antegrade Prostar XL application. More prospective studies are needed to be accomplished in order to demonstrate that the Prostar XL can, in fact, be used safely and successfully in antegrade entries in patients with normal arterial diameters.
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References