Stent Graft Use in a Posttrauma Pseudoaneurysm

Management of an arteriovenous fistula and pseudoaneurysm 14 years after traumatic injury.

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Arterial pseudoaneurysm (APA), with or without an associated arteriovenous fistula (AVF), can result from traumatic vessel injuries or after interventional vascular procedures. These APAs/AVFs may spontaneously thrombose and occlude,[1,2] but those associated with large injuries to peripheral arteries may persist with significant late sequelae.[3-6] Early surgical treatment for these traumatic injuries included direct ligation of the involved vessel.[5,7,8] This, however, resulted in ischemia of the limb distal to the ligation. Currently, nonessential smaller vessels may adequately be treated by embolization; however, essential larger vessels would require division of the fistula and reconstruction of the injured vessels.[9] This article describes the endovascular treatment of a large APA associated with a high-flow AVF of the superficial femoral artery (SFA) and superficial femoral vein secondary to a gunshot wound sustained 14 years before presentation.

CASE REPORT

A 34-year-old man presented with a history of pain and swelling of his left thigh for several years, which recently had grown significantly worse. He had sustained a gunshot wound to the distal aspect of this left thigh in 1992 and had previously been told that he had an aneurysm. He also reported recent onset of shortness of breath on exertion. His medical history was unremarkable. He was taking no medications and had no allergies. He had a history of one pack of cigarettes per day and drinking two to three beers per day, as well as consuming .5 grams of heroin daily.

The results of a physical examination revealed a well-developed man in no acute distress with stable vital signs. The only positive finding was an edematous left lower extremity from the mid-thigh to the foot. There was a 5-cm pulsatile, nontender mass on the medial aspect of the thigh just proximal to the adductor canal. A palpable thrill was present, and a bruit could be auscultated. His left foot was warm without sensory deficit, and the left femoral and pedal pulses were palpable.

A limited duplex scan of the extremity was performed with real-time imaging and multifrequency transducer for pulsed color Doppler and grayscale analysis using the Philips-ATL 5000 (Philips Medical Systems, Best, The Netherlands). A 4.2-cm X 5.4-cm APA with a 2.3-cm X 2.3-cm active portion and a .7-cm neck were discovered. No AVF was detected at this time.

Figure 1. Initial angiography revealing a large APA along with an AVF.

The patient was admitted electively and underwent left lower-extremity angiography via a right femoral puncture, which revealed a large APA originating from the mid-to-distal portion of the SFA (Figure 1).

In addition, a very rapid- and high-flow AVF with brisk contrast filling of the superficial femoral vein was noted. Intravascular ultrasound imaging and measurements were performed (Boston Scientific Corporation, Natick, MA). The SFA proximal to the AVF measured 13.1 mm (Figure 2), whereas just distally, the

Figure 2. IVUS of the SFA proximal to APA/AVF.

Figure 3. IVUS of the SFA distal to APA/AVF.

artery was only 8 mm in diameter (Figure 3).

Stent grafts of adequate size were not available at this time. Therefore, the patient was readmitted approximately 1 month later and taken to the operating room, where two overlapping Wallgraft Endoprostheses (Boston Scientific Corporation) measuring 14-mm X 50-mm and 12-mm X 50-mm were deployed via a left femoral cutdown (Figure 4).

The stent grafts were postdilated, and a completion angiogram revealed complete exclusion of the APA and obliteration of the AVF (Figures 5 and 6).

A follow-up duplex scan several weeks later revealed excellent patency of the SFA and the stent grafts. However, there was an acute thrombosis of the popliteal vein and superficial femoral vein. Systemic anticoagulation was recommended.

DISCUSSION

The iatrogenic incidence of APA/AVF formation has increased because more and more diagnostic and therapeutic procedures are being performed. The availability and use of high-velocity firearms has also contributed to their traumatic formation. Traumatic APAs appear to result most often from penetrating trauma, not blunt trauma. In a review of the Vietnam Vascular Registry, Rich et al reported on 296 APAs, only 1.2% of which were a result of blunt trauma.[10]

Although some small APAs/AVFs may thrombose/occlude spontaneously or with external compression, larger ones will persist, and additional vascular complications may result if they are not surgically repaired. Arterial thrombosis, compression of adjacent neurovascular structure, and hemorrhage may follow enlargement of an untreated APA. High-output congestive heart failure, venous hypertension with extremity edema, and ulceration may result from a large AVF. A chronic AVF may masquerade as postthrombotic syndrome, and the patient may be misdiagnosed and treated for varicose veins and chronic venous insufficiency.[11,12] Portela reported the resolution of high-output heart failure in a 21-year-old patient with a femoral AVF caused by a firearm wound utilizing a PTFE-covered stent.[13]

When severe injuries are encountered that demonstrate pulse deficit and severe ischemia, expanding hematoma, or active hemorrhage, urgent surgical exploration and vascular repair are the proper management choices.[14] Traditional surgical repair of an APA/AVF may be complicated by difficult-to-access anatomic locations, such as the chest or abdomen, and by excessive bleeding secondary to venous hypertension. Therefore, if the patient remains stable after the trauma, such injuries may be treated by catheter-directed transvascular placement of stent graft devices.[9,15,16] These devices permit minimally invasive arterial repairs to be performed from easily accessible sites in the vasculature, which are remote from the area of the trauma.

Stent grafts have been extensively studied and have demonstrated acceptable graft patency and satisfactory incorporation of the grafts into the adjacent arterial wall.[17] Lin et al evaluated the safety and efficacy of endovascular repair of pseudoaneurysms created in a porcine arteriovenous graft model utilizing a Wallgraft endoprosthesis.[18] They concluded that this therapy provided adequate exclusion of the pseudoaneurysms. The first successful in-man use of a covered stent to treat a traumatic subclavian AVF was reported by Parodi and Barone.[19] The first reported case of repair of a femoral AVF with a percutaneously inserted stent graft was reported by Marin et al.[9] Vinces and Sperling reported the endovascular treatment of a combined APA/AVF of the subclavian artery secondary to a gunshot wound to the chest.[20] Xenos et al treated seven patients and reported that this modality is a feasible alternative to open repair resulting in shorter procedure time and less blood loss,[21] in addition to reduced risk of infection and shorter hospital stay.

Figure 4. Stent graft deployment in the SFA.

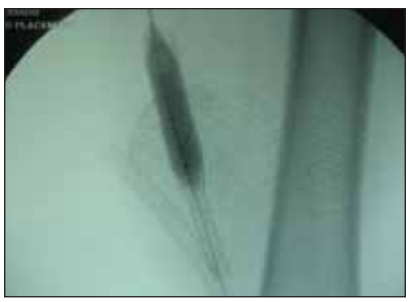

Figure 5. Postdeployment balloon dilation of stent grafts.

Figure 6. Completion angiogram.

Obliteration of the AVF in this patient resulted in acute deep vein thrombosis (DVT), an important disease with serious possible clinical sequelae. The goals of treatment include prevention of pulmonary embolism and recurrent thrombosis and preservation of venous valve function. Treatment of acute DVT can be divided into noninvasive conventional systemic anticoagulation versus invasive therapy consisting of thrombolysis and/or thrombectomy. Invasive therapy can consist of systemic thrombolytic therapy, catheter-directed thrombolysis, or percutaneous mechanical thrombectomy. The question arises as to the adequacy of the conventional therapy with regard to prevention of postthrombosis syndrome and whether thrombolytic/thrombectomy therapy can offer a decreased chance of developing postthrombosis syndrome. It has been reported that there is a 10% risk of moderate-to-severe postthrombosis syndrome with conventional therapy.[22-24]

A review of the literature revealed 18 studies comparing systemic thrombolytic therapy with conventional treatment. Only eight of these trials reported the incidence of postthrombosis syndrome. Currently, no adequate randomized controlled studies have compared catheter-directed thrombolysis or percutaneous mechanical thrombectomy with the conventional therapy. Also, there have been no randomized trials to date that address the likelihood that thrombolytic therapy will decrease the incidence of long-term postthrombosis syndrome.

CONCLUSION

This case report demonstrates the feasibility of endovascular treatment of traumatic APA/AVF utilizing stent grafts. Obliteration of the fistula may result in DVT, which can be treated with either conventional systemic anticoagulation or thrombolytics. ■

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