Blood Flow of Dialysis Arteriovenous Graft Compromised by a Brachial Artery-Brachial Vein Fistula

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INTRODUCTION

Thrombosis of a dialysis arteriovenous graft (AVG) usually occurs because of obstruction at the graft-venous junction or outflow veins. This case report presents an unusual cause of AVG thrombosis involving competing flow from a brachial artery-brachial vein (B-B) fistula.

CASE DESCRIPTION

An 82-year-old woman was referred for endovascular thrombectomy of the dialysis AVG. The patient had a history of diabetes, coronary artery disease, peripheral arterial occlusive disease, and paroxysmal atrial fibrillation under therapy with clopidogrel and apixaban. The patient began undergoing hemodialysis from May 2019, initially via a central vein catheter at the left internal jugular vein. A 7-mm loop polytetrafluoroethylene AVG was created in Jan, 2020. The patient began to use the AVG for hemodialysis on May 9, 2020. After dialysis via the AVG twice, thrombosis developed without any preceding physical or hemodynamic abnormalities. Endovascular thrombectomy was performed to salvage vascular access. Before the procedure, 5000 units of heparin was administered. A 7F short sheath was placed in the arterial limb of the graft, and clots in the venous limb were fragmented with a 7-mm x 4-mm angioplasty balloon (Wanda, Boston Scientific, Boston, MA, USA) and aspirated from the sheath as much as possible. Another 7F short sheath was placed in the venous limb of the graft. After passing the guidewire through the brachial artery, the arterial plug was flattened with balloon dilatation, and clots were aspirated from the sheath. On performing angiogram of the outflow veins from the arterial sheath, the flow observed was slow. The outflow vein was wired smoothly with the free advancement of the inflated angioplasty balloon to the central veins. Nonetheless, blood flow was still compromised. We tried to evaluate the outflow veins by injecting contrast from the central lumen of the angioplasty balloon, by placing it at the outflow vein. Unexpectedly, the angiogram showed that the balloon directed to the outflow vein was in the brachial artery through a B-B fistula (Figure 1). There was no significant obstruction from the graft-venous junction to outflow vein. Because the flow from the graft to the outflow vein was compromised by the competing flow from the B-B fistula, we placed the wire back into the outflow veins. A 7-mm x 10-cm stent graft was deployed from the graft-venous junction to the brachial vein distal to the connection of the B-B fistula. The size of stent graft was determined by the diameter of vessel proximal to the lesion. After deployment of stent graft, no residual shunt was found in the angiography from brachial artery. A uniform brisky thrill resumed after stenting at the graft-venous junction, and the AVG has functioned well without further complications since.

DISCUSSION

The most common cause of AVG thrombosis is a ste-
nosis at the graft-venous junction or outflow veins. While performing thrombectomy, blood flow to the outflow vein may sometimes be compromised by a migrating thrombus, spasm, residual stenosis, or dissection of the outflow veins. In the present case, we excluded these complications at the outflow vein by selective angiography and the movement of balloons. The first evidence to find a B-B fistula is careful observation of the flow after thrombectomy. In this case, a competing flow was noted after the completion of thrombectomy. The second evidence for diagnosis is the comprehensive evaluation of the pathology at the outflow veins. Here, the graft was connected to a relatively small brachial vein, and we attempted to identify all possible communications by selected angiography, as the illustration of the Figure 2. The wire was eventually advanced into the B-B fistula, which was then demonstrated by selective angiography. The third evidence is careful observation of the movement of the guidewire, which twists along with the pulsation of the brachial artery. In our case, the selected angiogram confirmed the presence of a fistula and demonstrated a retrograde flow to the graft competing with the antegrade flow from the AVG.

Arteriovenous fistulas might be congenital or acquired from secondary trauma or iatrogenic injury. Abnormal arteriovenous communications may be asymptomatic in nature and can be found incidentally during any anatomical dissection or autopsy. The brachial vein is anatomically close to the brachial artery. Nonetheless, it is unusual to find a communication between the brachial artery and brachial veins, unless created surgically for hemodialysis patients. There are reports that abnormal communications between a brachial artery and brachial vein may be caused by trauma. Arteriovenous (AV) fistula formation following needle puncture for angiography, blood sampling, blood donation, or placement of a central venous catheter has also been reported, probably secondary to puncture into the brachial artery nearby. In this case, it might have been secondary to previous venous punctures or injury during creative sur-
gery or angioplasty procedures. Nonetheless, it was not possible to define the true etiology because detailed history of punctures or operation was illusive to support the causal relationship.

The treatment of AV fistula includes surgical repair, embolization, and a stent graft, depending on the location of the AV fistula. In this case, a stent graft was used to seal the B-B fistula because thrombosis may recur before surgical ligation could be performed. The flow of AVG recovered after stenting, and the hemodialysis sessions could be resumed via the AVG immediately after the procedure.

CONCLUSION

This case demonstrated a rare condition, B-B fistula, which might contribute to thrombosis of AVG. Detailed identification of the outflow vein anatomy is warranted when unexpected flow after thrombectomy is found, especially when the graft is connected to the brachial vein. Careful observation of flow pattern, wire motion, and selective angiography at the outflow vessels will help identify such a rare fistula. When the blood flow is compromised by a B-B fistula, graft stenting across the communication is a convenient and effective treatment option.

LEARNING POINTS

- Detailed identification of the outflow vein anatomy is warranted when unexpected flow after thrombectomy is found.
- Careful observation of flow pattern, wire motion, and selective angiography at the outflow vessels will help identify brachial artery-brachial vein fistula.

DECLARATION OF CONFLICT OF INTERESTS

The authors declare no potential conflicts of interest to the research, authorship, and/or publication of this article.

ETHICAL APPROVAL

A written inform consent for publication of case report was acquired from the patient.

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