Aspiration Mechanical Thrombectomy for Acute Lower-Limb Ischemia Secondary to Thrombosed Popliteal Artery Aneurysm

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Abstract: Prompt diagnosis and early restoration of flow are essential in the treatment of thrombosed popliteal artery aneurysms to minimize adverse outcomes. During recent years, complete endovascular treatment has become an acceptable alternative to open surgery. This case report shows our initial experience with the Indigo vacuum-assisted thrombectomy system as an alternative therapy for the treatment of popliteal artery aneurysm.

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Popliteal artery aneurysms (PAAs) are the most common type of peripheral arterial aneurysm, with an incidence of approximately 0.1%-2.8%.1 The thromboembolic events associated with PAA are limb- and life-threatening, with thromboembolism of distal arteries resulting in major amputations and a rise in perioperative morbidity and mortality.2 Prompt diagnosis and early restoration of flow are essential in the treatment of thrombosed PAAs to minimize adverse outcomes. During recent years, complete endovascular treatment has become an acceptable alternative to open surgery.3,4

The efficacy of vacuum-assisted thrombectomy (VAT) using the Penumbra system (Penumbra, Inc) in the neurovasculature has been extensively validated. The utility of this device in stroke care has led to the use of the Penumbra system in the peripheral vasculature as well. Penumbra’s Indigo system actively extracts thrombus using a continuous vacuum pump, enabling aspiration of thrombus of various sizes and lengths. When compared with catheter-directed thrombolysis (CDT) and open surgery, this technique results in faster revascularization with fewer bleeding complications. This case report shows our initial experience with the Indigo VAT system as an alternative therapy for the treatment of PAA.

CASE REPORT

An 81-year-old male with a history of hypertension and left lower-extremity claudication presented with <24-hour history of acute left-limb ischemia. Preintervention computed tomography angiogram with run-off, as well as the initial angiogram, showed complete thrombosis of the patient’s left popliteal artery starting at the Hunter’s canal due to a thrombosed PAA (Figure 1). The patient was taken emergently to the catheterization lab, where 10 mg of tissue plasminogen activator (tPA; Roche Pharmaceuticals) was infused into the lesion via a Prostream infusion catheter (ev3/Medtronic). In the same fashion, the posterior tibial artery was infused with 5 mg of tPA. Dwell time was 15–20 minutes. After upsizing to an 8 Fr sheath, the Indigo CAT8 device (Penumbra, Inc) was advanced over the wire until the distal tip was engaged within the thrombus at the level of the proximal left popliteal artery. Initial aspiration resulted in recanalization of the popliteal artery (Figure 2). A CAT6 device was then inserted coaxially through the CAT 8 device to restore flow to

Figure 1. (A) Preintervention computed tomographic angiogram with run-off and (B) initial angiogram showed complete thrombosis of the patient’s left popliteal artery starting at Hunter’s canal with a large similarly thrombosed popliteal artery aneurysm.
the remaining part of the popliteal artery and the tibioperoneal trunk. Distally, the flow was sluggish at the trifurcation (Figure 3). Selective catheterization of the left posterior tibial and peroneal arteries was obtained and aspiration thrombectomy was performed with the Indigo CAT 3 device coaxially inside the Indigo CAT 6 and CAT 8 devices (Figure 4). Intravascular ultrasound was performed, revealing residual chronic disease at the popliteal and tibial arteries. Balloon angioplasty of the left posterior tibial artery was performed using a 2.5 x 3 x 200 mm balloon. The left PAA was stented using a 7 x 150 mm Viabahn stent (Gore) (Figure 5). Completion angiogram revealed excellent flow down the popliteal artery through the stent-graft with exclusion of the aneurysm (Figure 6). Acute and chronic thrombus were noted in the aspiration canister (Figure 7). At the completion of the case, the patient’s foot had regained color and warmth. There was a posterior tibial artery Doppler signal.

The postoperative course was uncomplicated and the patient was discharged home on the second postoperative day, having regained sensation, mobility, and warmth in the left lower extremity. No invasive study was performed prior to discharge. At 2-month follow-up, left foot function was intact and duplex ultrasound demonstrated patency. Four months later, the patient underwent right PAA repair with polytetrafluoroethylene (PTFE) bypass. This was complicated by postoperative graft infection requiring multiple surgical procedures and revisions. The patient presented 611 days after his initial intervention with a sudden onset of left calf pain and a numb, cold foot. Angiogram demonstrated left popliteal stent thrombosis, and the patient underwent thrombolysis followed by suction thrombectomy using

Figure 2. Initial aspiration resulted in recanalization of the popliteal artery.

Figure 3. Sluggish flow distally after initial aspiration.
CASE REPORT

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the Penumbra CAT5 catheter on the following day. The superficial femoral and popliteal stents were ballooned, and flow was restored. The patient had complete resolution of his symptoms and was ready for discharge home on postoperative day 2. The patient died of unknown causes 1 month later.

DISCUSSION

Thrombosed PAAs resulting in acute limb ischemia carry a high risk for amputations in the absence of infrapopliteal vessel runoff. While the treatment goal of re-establishing distal blood flow remains the same, current treatment strategies are evolving, with endovascular repair offering lower complication rates and shorter hospital stays compared with open repair. Several neurological reports have emphasized the safety and remarkable outcomes of VAT as a strategy for recanalization of native and stented arteries of the cerebrovascular and peripheral circulation. Similarly, several studies have reported that the use of aspiration thrombectomy in treating acute lower-limb ischemia is effective and safe, reducing

Figure 4. Selective catheterization of left posterior tibial and peroneal arteries was performed and aspiration thrombectomies were performed with the Indigo CAT3 coaxially inside an Indigo CAT6 device and a CAT8 device, resulting in significant recanalization.

Figure 5. The left popliteal artery aneurysm was stented using a 7 mm x 150 cm Viabahn stent (Gore).
the need for catheter-directed thrombolysis with its high cost and associated risk of hemorrhage.\textsuperscript{9-12} However, the use of aspiration thrombectomy in the setting of a thrombosed PAA has not been well examined. This report highlights an emerging and feasible technique for quick thrombus dissolution resulting in in-line flow to an ischemic lower extremity after a thrombosed PAA.

The Indigo system consists of a catheter-separator device combination that is designed for thrombus removal in the peripheral arterial and venous systems. These catheters are reinforced to handle the continuous vacuum Penumbra pump. The catheter construction consists of multiple material transitions that allow for pushability at the proximal end, while the distal end is soft and atraumatic. The Indigo catheters range from 3.4 to 8.0 Fr outer diameter and are selected according to the occluded vessel size and location of the thrombus. The separator technology is optional and allows the catheter tip to remain patent for the duration of the procedure, minimizing catheter-exchange and procedural times. This technology allows mechanical thrombectomy with reduction or elimination of thrombolytic usage, thereby providing an option for patients with contraindications to thrombolytic therapy or those who cannot withstand a longer period of ischemia.

In a single setting and with minimal local tPA, the patient in the case presented was able to be successfully treated with an endovascular approach. This approach provided multiple benefits, including a short hospital stay and no need for Intensive Care Unit stay or the prolonged use of a thrombolytic. By minimizing ischemia time and reducing the need for open surgery, this technology is potentially able to increase the rate of limb salvage. In addition, minimizing the ischemia time can potentially lead to fewer very morbid fasciotomy procedures. In contrast, the patient’s other limb was treated with open repair that was complicated by multiple additional surgical procedures and revisions due to infection. The endovascular repair, on the other hand, remained patent for more than 600 days, required only a single reintervention, and then remained patent until the patient passed away.

**CONCLUSION**

The Indigo system appears to be a safe and efficient method for providing rapid thrombus evacuation and restoration of distal...
flow to the affected extremity. This procedure, via a percutaneous approach, may be performed with a lower dose of thrombolytic and the potential to reduce costs and hospital stay. Further research is needed to validate length of stay and cost reductions.

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