North Clin Istanb 2022;9(5):530–532
doi: 10.14744/nci.2020.11298

Case Report CARDIAC SURGERY

Endovascular closure of an arterivenous graft for dialysis-associated steal syndrome of lower extremity

Sebnem Albeyoglu, Osman Eren Karpuzoglu, Sevinc Bayer Erdogan, Murat Bastopcu, Arif Yasin Cakmak, Emine Dudu Can, Halit Er

Siyami Ersek Thoracic and Cardiovascular Surgery Training and Research Hospital, Istanbul, Turkiye

ABSTRACT

Steal syndrome causing limb ischemia is a rare but important complication of arteriovenous fistulas. When surgical or endovascular means to resolve ischemia are inconclusive, closure of the fistula becomes required. Our case presented with lower extremity ischemia resulting from an arteriovenous fistula graft. We present the successful endovascular closure of the lower extremity graft using the Amplatzer Vascular Plug.

Keywords: Arteriovenous fistula; dialysis-associated steal syndrome; endovascular.

Cite this article as: *Albeyoglu S, Karpuzoglu OE, Bayer Erdogan S, Bastopcu M, Cakmak AY, Can ED, et al. Endovascular closure of an arterivenous graft for dialysis-associated steal syndrome of lower extremity. North Clin Istanb 2022;9(5):530–532.*

Dialysis-associated steal syndrome (DASS) is a complication of arteriovenous fistulas (AVF) [1]. Although the upper extremity veins are prioritized in dialysis access, patients with exhausted options can require lower extremity AVF, which makes DASS in the legs a rare but important complication.

The Amplatzer Vascular Plug (St. Jude Medical, St. Paul, MN) is utilized for endovascular closure of AVF and the success of this intervention for upper extremities are reported in the literature [2, 3]. We report a successful endovascular closure of a lower extremity AVF with a graft between the femoral artery and vein due to DASS of the lower extremity of a patient with a high surgical risk.

CASE REPORT

A 71-year-old female patient who had been operated for an AV fistula with a synthetic graft between the left femoral artery and vein 2 months prior presented with pain of the left lower extremity. Inspection revealed ischemic ulcers on the left foot, a cold, and cyanotic left leg. The posterior tibial artery pulse was non-palpable and the dorsalis pedis artery had a biphasic waveform. The patient had a history of coronary artery bypass 10 years ago using the left radial artery. At the different institution, where the fistula operation had been performed, the right arm was evaluated to be unsuitable for an AV fistula and a dialysis access was created with a synthetic graft in the left femoral region.

The patient was multimorbid with hypertension, diabetes, obesity, and peripheral arterial disease. She had a history of an abdominal surgery with a resulting colostomy, a low left ventricular ejection fraction, and an implantable cardioverter-defibrillator.

A Doppler ultrasound of the fistula measured a flow of 2100 ml/min. A decision to close the fistula was made and an endovascular approach was decided considering the patient's high surgical risk.

Received: March 09, 2020 *Revised:* June 20, 2020 *Accepted:* August 28, 2020 *Online:* October 27, 2022

Correspondence: Arif Yasin CAKMAK, MD. Siyami Ersek Gogus Kalp ve Damar Cerrahisi Egitim ve Arastirma Hastanesi, Istanbul, Turkiye.
Tel: +90 216 542 44 44 e-mail: arifyasin_61@hotmail.com

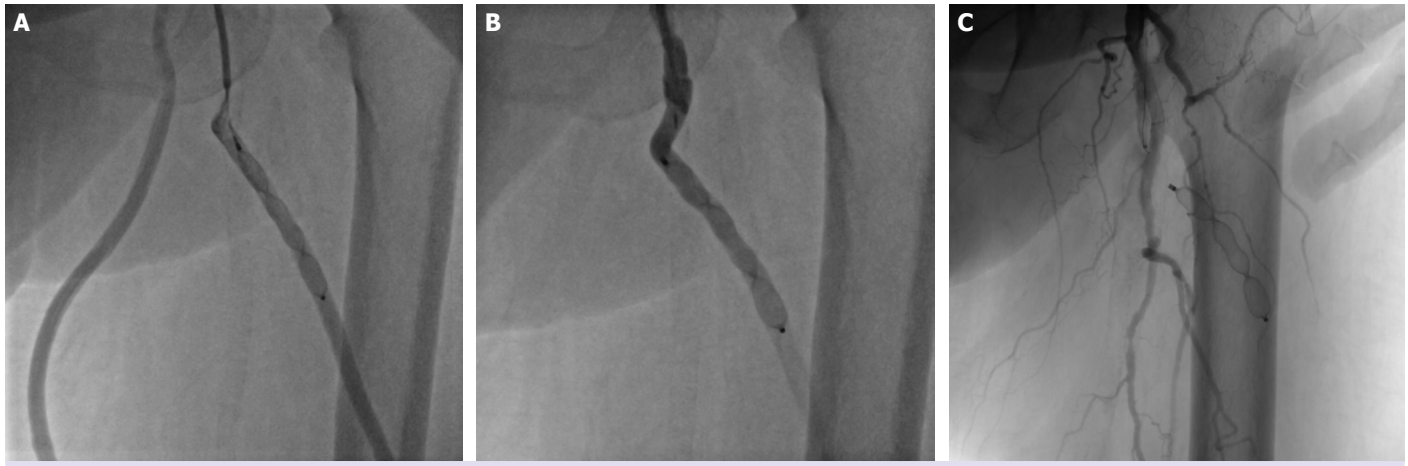

FIGURE 1. **(A)** Placement of the amplatzer vascular plug in the arteriovenous fistula graft. **(B)** Cessation of contrast flow into the graft following opening of the amplatzer vascular plug. **(C)** Closure of the arteriovenous fistula graft and contrast flow through the deep femoral artery.

Through a sheath in the right common femoral artery the left femoral artery was reached. Angiography showed a patent graft between the left common femoral artery and common femoral vein. The superficial femoral artery was totally occluded distally with the popliteal artery receiving flow from collateral vessels. The deep femoral artery was patent with low flow due to the created AV fistula. Revascularization of the superficial femoral artery was attempted unsuccessfully. The procedure was continued to closure of the AVF. The Amplatzer II Vascular plug was placed just distal to the arterial anastomosis to the proximal part of the graft (Fig. 1A). Following closure of the AVF, flow was improved in the deep femoral artery and restored to the popliteal and distal arteries (Fig. 1B, C). Pain and ischemic symptoms resolved after the procedure and the patient was discharged with a tunneled catheter in the left femoral vein. Written informed consent was obtained from the patient for the publication of the case report and the accompanying images.

DISCUSSION

DASS is a serious complication of AVFs that can cause pain, loss of motor function, or even the loss of the extremity. DASS occurs in 1–2% of distal fistulas and 5–10% of proximal fistulas of the upper extremity [4, 5]. Studies on lower extremity AVF with synthetic grafts report ischemic complications in 1–7% of patients [6, 7]. When untreated, DASS can result in the pain, paresthesia, and ulcerations of the limb. Once the diagnosis is made, treatment should follow in a timely fashion.

Several workarounds are practiced to preserve a functioning dialysis access while correcting ischemia of the extremity, such as the distal revascularization with interval ligation, revision using distal inflow, and among others. These options may be inconclusive or infeasible due to patient comorbidities, complex vascular anatomy of the extremity with the AVF, or edema and wounds in the extremity which hinder the healing process. Choices for vascular access may be limited in patients with exhausted upper extremity routes and the lower extremity vessels may be considered in this difficult group of end-stage renal disease patients. It should be noted that lower extremity arterial disease is more prevalent in patients with chronic renal failure [8] and must be evaluated before the decision to create an AVF in the lower extremity to avoid difficult to manage complications.

If closure of the fistula becomes necessary, surgical ligation of arteriovenous fistula is the conventional approach; however, recent progress with endovascular experience has made closure with the Amplatzer Vascular Plug another alternative. The Amplatzer Vascular Plug has been used in the upper extremity for cases that required AVF closure due to DASS, heart failure, and central venous occlusion [2, 3, 9]. The same device can be used to treat DASS in the lower extremity as presented in our case.

Surgery is the first choice to be considered when an AVF requires closure. Endovascular methods can be safely considered in patients who require AVF closure and are not good surgical candidates.

Informed Consent: Written informed consent was obtained from the patient for the publication of the case report and the accompanying images.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study has received no financial support.

Authorship Contributions: Concept – SA, OEK, SBE; Design – MB, AYC, EDC, HE; Supervision – OEK; Materials – OEK, AYC; Data collection and/or processing – SA, OEK, SBE; Analysis and/or interpretation – MB, AYC, EDC, HE; Literature review – MB, AYC, EDC, HE; Writing – MB, AYC, EDC, HE; Critical review – SA, OEK, SBE.

REFERENCES

1. Al-Jaishi AA, Liu AR, Lok CE, Zhang JC, Moist LM. Complications of the arteriovenous fistula: a systematic review. J Am Soc Nephrol 2017;28:1839–50. [CrossRef]
2. Filippo MD, Barbarisi D, Ferrara D, Brancaccio S, Del Guercio L, Bracale R, et al. Hemodialysis arteriovenous access occlusion using the amplatzer vascular plug in patients with intractable arm edema. Case Rep Nephrol Dial 2017;7:63–72. [CrossRef]
3. Bozkurt A, Kırbaş İ, Kasapoglu B, Teber MA. Use of the amplatzer type 2 plug for flow redirection in failing autogenous hemodialysis fistulae. Cardiovasc Intervent Radiol 2015;38:887–93. [CrossRef]
4. Davidson D, Louridas G, Guzman R, Tanner J, Weighell W, Spelay J, et al. Steal syndrome complicating upper extremity hemoaccess procedures: incidence and risk factors. Can J Surg 2003;46:408–12.
5. Zamani P, Kaufman J, Kinlay S. Ischemic steal syndrome following arm arteriovenous fistula for hemodialysis. Vasc Med 2009;14:371–6.
6. Kim D, Bhola C, Eisenberg N, Montbriand J, Oreopoulos G, Lok CE, et al. Long-term results of thigh arteriovenous dialysis grafts. J Vasc Access 2019;20:153–60. [CrossRef]
7. Antoniou GA, Lazarides MK, Georgiadis GS, Sfyroeras GS, Nikolopoulos ES, Giannoukas AD. Lower-extremity arteriovenous access for haemodialysis: a systematic review. Eur J Vasc Endovasc Surg 2009;38:365–72. [CrossRef]
8. Younes HK, Davies MG, Peden EK. End-stage renal disease and limb salvage. Methodist Debakey Cardiovasc J 2013;9:108–11. [CrossRef]
9. Bui JT, Gaba RC, Knuttinen MG, West DL, Owens CA. Amplatzer vascular plug for arteriovenous hemodialysis access occlusion: initial experience. J Vasc Access 2009;10:5–10. [CrossRef]