



Balloon Angioplasty to Great Saphenous Vein Graft Interposed in RUDI

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ABSTRACT

Vascular access-induced ischemia is an arteriovenous fistula (AVF) complication that can be treated surgically by interposing grafts to improve distal flow. However, over time, the interposed grafts may occasionally experience narrowing, which may require surgical or endovascular interventions for treatment. In this case report, we present a patient who underwent balloon angioplasty to address the narrowing observed in the great saphenous vein graft that had been interposed during a Revision Using Distal Inflow (RUDI) procedure.

Key Words: Arteriovenous fistula; balloon angioplasty; dialysis; ischemia

RUDI İşleminde İnterpoze Edilen Safen Ven Greftine Balon Anjiyoplasti

ÖZET

Damar erişim yolu nedenli iskemi, arteriyovenöz fistül (AVF) yapılan hastalarda görülebilecek bir komplikasyondur. Bu komplikasyon, distal akımı sağlayacak bir greft interpozisyonu ile cerrahi olarak tedavi edilebilir. Fakat interpoze edilen greftler de zamanla tıkanabilir, bu durumun da cerrahi veya girişimsel işlemlerle tedavi şansı vardır. Bu olgu sunumunda, distal girişi kullanılarak yapılan revizyon (*revision using distal inflow-RUDI*) işleminde interpoze edilmiş olan safen ven greftinde daralma sonrası gerçekleştirilen balon anjiyoplasti vakası sunulmaktadır.

Anahtar Kelimeler: Arteriyovenöz fistül; balon anjiyoplasti; diyaliz; iskemi

INTRODUCTION

Arteriovenous fistula (AVF) remains to be the recommended type of vascular access (VA). Still, it may cause significant complications which may be challenging to manage. VA-induced ischemia is an AVF complication with a reported incidence of up to 30%, describing distal hypoperfusion resulting in ischemia that can be limb- and life-threatening⁽¹⁾. Revision using distal inflow (RUDI) is one of the relatively novel techniques performed to treat VA-induced ischemia surgically⁽²⁾. Still, complications may be observed occasionally regarding the interposed graft, which can be addressed via endovascular interventions. In this case report, we present a patient who had undergone balloon angioplasty due to the narrowing in the great saphenous vein graft which had been interposed in a RUDI procedure.

CASE REPORT

A 65-year-old man with end-stage renal disease (ESRD) had undergone a left brachiocephalic AVF (BCAVF) operation in an external medical center in September 2021. After one month, the patient was admitted to our clinic with a two-week history of ulceration on the fingertips. His hand was cold, and he had resting pain in his hand. Radial and ulnar pulses were diminished. The duplex ultrasound examination revealed a flow rate of nearly 1050 mL/min in the AVF. The arterial vasculature was normal in radial and ulnar arteries and no significant stenosis was observed. Manual compression of the AVF resulted in a temporary improvement in capillary refill time, warming of the hand, and pain relief. He was diagnosed with VA-induced ischemia, and a RUDI procedure was planned. Pre-operative mapping of upper and lower limb vasculature was performed with duplex ultrasound by the operating surgeon. A 4-5 cm autogenous graft with a diameter of 5 mm was

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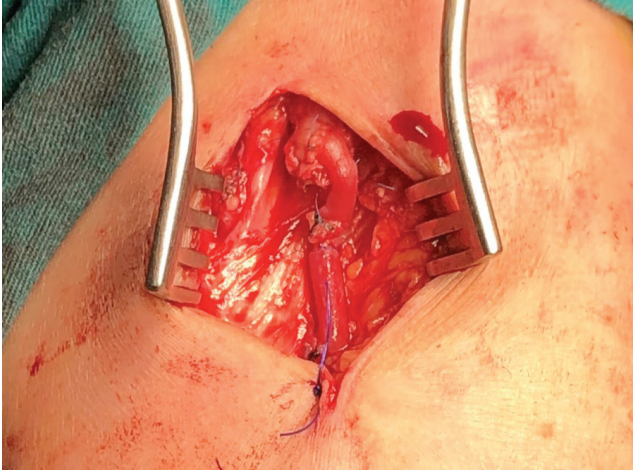


Figure 1. The harvested great saphenous vein graft was interposed between the proximal radial artery and cephalic vein.

excised from the left great saphenous vein, which had been partially harvested during a previous coronary artery bypass graft surgery. The current BCAVF was closed surgically and the harvested saphenous vein graft was interposed between the proximal radial artery and cephalic vein (Figure 1), both anastomoses were done in an end-to-side fashion. Postoperatively, the hand regained warmth and the ischemic symptoms showed regression. The patient was admitted to our clinic due to an inadequate flow rate, which hindered efficient hemodialysis, after two months of successful hemodialysis sessions. A duplex ultrasound examination revealed a narrowing in the saphenous

vein graft, and a percutaneous transluminal angioplasty (PTA) was planned. The angiography confirmed the narrowing (Figure 2-a). Pre-dilatation was performed using a regular 5 mm PTA balloon catheter (Admiral Extreme; Invatec/Medtronic, Frauenfeld, Switzerland) for a duration of three minutes. Subsequently, a 6 mm paclitaxel-coated balloon catheter (IN.PACT Admiral, Medtronic, Santa Rosa, California) was inflated for five minutes. The narrowing was dilated successfully (Figure 2-b). The flow rate in the saphenous vein graft was 200 mL/min and 500 mL/min before and after the PTA, respectively. The patient remained symptom-free at the end of his three-month clinical follow-up period, and the ulcerations regressed (Figure 3). Furthermore, the patient has been successfully undergoing hemodialysis sessions since the endovascular intervention. It is important to note that informed consent has been obtained from the patient for the publication of the case report and the accompanying images.

DISCUSSION

VA-induced ischemia is a limb-threatening complication of AVF that requires prompt management to prevent further ischemia⁽³⁾. Treatment options for VA-induced ischemia have expanded over time with the introduction of new surgical approaches. Surgical modalities that can be employed to address VA-induced ischemia include AVF ligation, banding, distal revascularization with interval ligation (DRIL), proximalization of the arterial inflow (PAI), and revision using distal inflow (RUDI)^(4,5). Ligation is one of the oldest techniques suggested

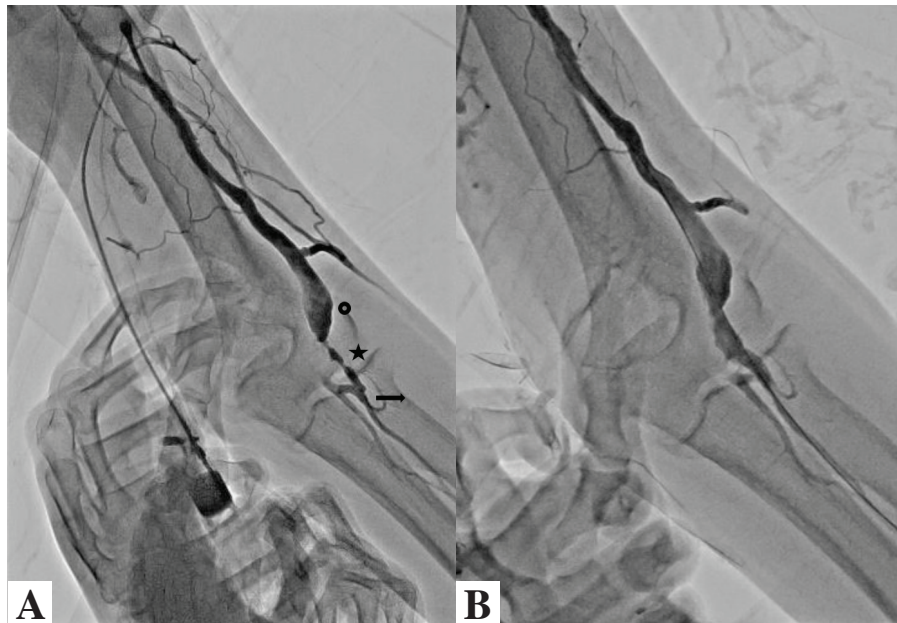


Figure 2. Narrowing in the great saphenous vein graft (A) before and (B) after balloon dilatation. Circle: Cephalic vein, star: Saphenous vein graft, arrow: radial artery. Since the image reflects reflux angiography, the brachial artery and the cephalic vein were compressed with the hand. This is the reason why the operator's hand can be seen in the X-ray beam.



Figure 3. The ischemic symptoms regressed after balloon angioplasty.

to treat VA-induced ischemia, which offers satisfactory rates of symptom improvement, but leaving the patient with no access is a major disadvantage⁽⁴⁾.

DRIL is the ligation of the artery below the AVF anastomosis and forming a bypass conduit from a more proximal arterial source⁽⁵⁾. It is one of the most commonly preferred modalities that preserve access, which offers long-term secondary patency rates up to 80%⁽¹⁾. Still, the complex nature of the DRIL procedure requires general anesthesia and a relatively long operative time, and thus the general condition of the patient should be evaluated cautiously, and the patient selection should be made accordingly⁽⁴⁾. Moreover, the native arterial vasculature is altered via the DRIL procedure and the perfusion of the hand, which is already suffering from ischemia, being dependent on a bypass graft remains a concern⁽¹⁾.

Whereas, RUDI is a relatively novel method, which includes ligation of the AVF at its origin and recreation of the fistula via interposing bypass graft between more distal arterial source and vein⁽²⁾. The procedure is applied to BCAVFs mostly and the most commonly used distal artery in RUDI operations is the proximal radial artery⁽³⁾, as done in our case. Angiography may be performed prior to surgery in selected cases. However, we did not prefer an angiography in this case because we did not doubt significant stenosis with the Duplex ultrasound examination. Prosthetic material such as polytetrafluoroethylene (PTFE) or autogenous grafts harvested from the great saphenous vein, cephalic vein, or basilic vein can be utilized as conduit materials. Autogenous grafts are more commonly

preferred due to better long-term patency, easier cannulation, lower infection rates, and superior cost-effectiveness⁽³⁾. RUDI operations may present higher postoperative bleeding risk⁽⁴⁾ and lower postoperative AVF flow rate compared to DRIL⁽¹⁾. Still, RUDI presents similar rates of patency, symptom relief, and survival with DRIL, and it is favorable, especially in higher flow fistulas⁽¹⁾.

A recent review revealed that VA-induced ischemia was resolved in 82% of the patients who were treated with RUDI and that the primary AVF was protected over a median of 1 year⁽³⁾. However, some complications such as thrombosis in AVF, digit-amputation, or permanent ischemic neuropathy can be seen⁽³⁾. Patients may present with stenosis in arteries or veins, which can be treated via endovascular interventions or surgery. A single-center study demonstrated that most of the cases requiring angioplasty were perianastomotic or outflow vein stenosis, similar to the observations in our case, which were seen in both RUDI and DRIL at comparable rates⁽¹⁾.

CONCLUSION

RUDI is a safe and reasonable surgical method for treating VA-induced ischemia with similar rates of patency and symptom relief compared to other treatment modalities. Interposed graft problems may emerge after RUDI operations, which can be fixed successfully via angioplasty techniques.

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