—Case Reports—

Venous Hypertension Improved by a Viabahn Stent Graft Blocking Regurgitation to the Periphery of the Basilic Vein in an Elderly Patient Undergoing Hemodialysis: A Case Report

Mitsutoshi Shindo[1,2], Sachiko Hirotani[2], Miho Tsukada[1] and Masamitsu Morishita[1,2]

[1]Department of Nephrology, Morishita Memorial Hospital, Kanagawa, Japan
[2]Department of Dialysis Vascular Surgery, Morishita Memorial Hospital, Kanagawa, Japan

Although necessary for hemodialysis (HD), arteriovenous grafts (AVG) frequently cause complications. Stenosis resulting in venous hypertension is a concern for physicians. Herein, we describe how venous hypertension was improved by using a Viabahn stent graft in an elderly HD patient. An 86-year-old woman started maintenance HD with a left-arm AVG. Two years later, she was referred to our hospital for treatment of juxta-graft-venous junction (GVJ) stenosis. Because of recurrence of stenosis at the juxta-GVJ, she underwent four percutaneous transluminal angioplasty (PTA) procedures during a period of 9 months. One month after the most recent PTA, the patient had redness, swelling, and pain in her left forearm. Venous hypertension was diagnosed on the basis of angiography findings showing regurgitation to the periphery of the basilic vein and juxta-GVJ stenosis. The stenosed juxta-GVJ was adequately expanded with a 7-mm balloon, and a 7-mm stent graft was inserted into the stenosis site. After successful treatment, there was no regurgitation to the periphery of the basilic vein and no symptoms. This complication should be considered when an AVG is created, because cutting off peripheral veins might prevent venous hypertension. Clinicians should perform regular postoperative monitoring.
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Key words: venous hypertension, viabahn stent graft, elderly patient, percutaneous transluminal angioplasty, hemodialysis

Introduction

Vascular access is a lifeline for patients undergoing hemodialysis (HD). An arteriovenous graft (AVG) is preferred when a native arteriovenous fistula (AVF) is difficult to establish. However, complications often occur with AVGs, including stenosis, thrombosis, bleeding, and infection. Stenosis, the main complication of an AVG, is a concern for physicians. Although percutaneous transluminal angioplasty (PTA) is a standard treatment for this complication and is an effective short-term treatment, reintervention is often needed for treatment of restenosis, as PTA may not result in long-term patency. A 60% restenosis rate at 12 months after successful PTA has been reported[1], and a study of 148 patients reported that the primary patency rate at 6 months after PTA was 34.2%[2]. Recently, stent graft replacement has been suggested as a superior treatment option to PTA alone[3]. As is the case for PTA, insertion of a stent graft is easier and faster than surgical treatment. Outflow stenosis is associated with a risk of venous hypertension, which causes redness, swelling, and pain in the arm with AVF/AVG and must be distinguished from infection. Moreover, these symptoms make it difficult to puncture vessels, and hemostasis takes longer. Venous hypertension may worsen if peripheral veins are not cut off when an AVF/AVG is created.

Herein, we describe how a Viabahn stent graft covered by expanded polytetrafluorethylene (ePTFE) blocked regurgitation to the periphery of the basilic vein and consequently improved venous hypertension, without surgical

Correspondence to Mitsutoshi Shindo, MD, MPH, Department of Dialysis Vascular Surgery, Morishita Memorial Hospital, 4–2–18 Higashirinkan, Minami-ku, Sagamihara, Kanagawa 252–0311, Japan
E-mail: mitsu_shin@hotmail.com
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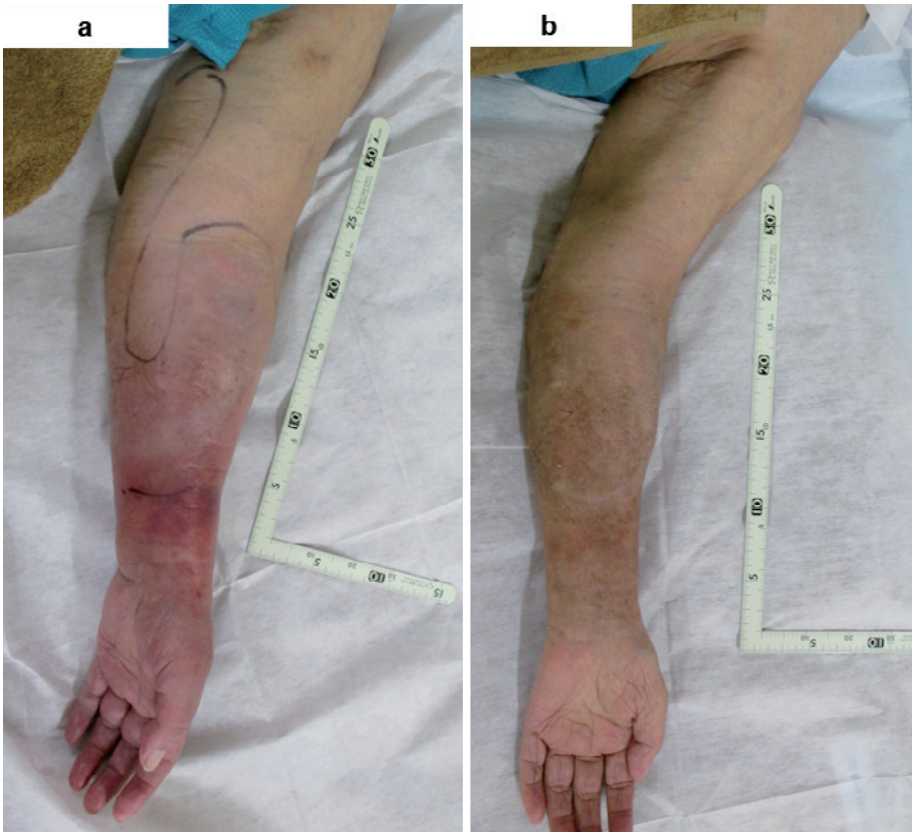

Fig. 1 (a) Symptoms of venous hypertension, including redness, swelling, and pain in the left forearm. (b) No symptom of venous hypertension was observed on the day after PTA and stent graft placement.

treatment, in an elderly adult undergoing HD.

Case Description

An 86-year-old woman underwent HD for diabetic nephropathy 7 years before the present treatment. An AVF was created with the radial artery and radial basilic vein in her left arm at another hospital. This AVF failed 3 years previously, and she underwent an AVG procedure with the brachial artery and brachiocephalic vein in her left arm for maintenance HD at the same hospital. Later, a PTA was performed, and a vascular stent was inserted for outflow stenosis. However, another AVG was created with the brachial artery and brachiobasilic vein because of AVG occlusion 1 year previously. She was referred to our hospital 10 months previously and underwent PTA for juxta-graft-venous junction (GVJ) stenosis. She eventually required four PTAs within a period of 9 months because of stenosis recurrence at the juxta-GVJ. Two weeks after the most recent PTA (6 weeks previously), venous pressure was 140-160 mm Hg (quantity of blood flow: 180 mL/min). One month after the most recent PTA (1 month previously), the patient developed redness, swelling, and pain in her left forearm (**Fig. 1(a)**). Laboratory data showed a C-reactive protein level of 0.10 mg/dL, an albumin level of 3.8 g/dL, and a negative blood culture result. A chest radiograph showed a cardiothoracic ratio of 65%. Ultrasonography showed a flow volume of 524 mL/min and a resistance index of 0.77 in her left brachial artery. Three-dimensional CT scanning and angiography showed regurgitation to the periphery of the basilic vein and juxta-GVJ stenosis (**Fig. 2(a), 3(a)**), and venous hypertension was diagnosed. The stenosis was adequately expanded with a 7-mm balloon (Mustang; Boston Scientific Corp, Massachusetts, USA), and a 7-mm stent graft (Gore Viabahn; W. L. Gore & Associates Inc., Arizona, USA) was inserted into the stenosis site (**Fig. 2(b)**). After successful treatment, ultrasonography showed a flow volume of 1,465 mL/min and resistance index of 0.58 in her left brachial artery, with no regurgitation to the periphery of the basilic vein (**Fig. 2(c), 3(b)**), and no symptoms (**Fig. 1(b)**). Venous pressure was 40-70 mm Hg (blood flow volume: 150 mL/min) after PTA, and she underwent HD without any treatment for 5 months. Written informed consent was obtained from the patient for publication of the present report and images.

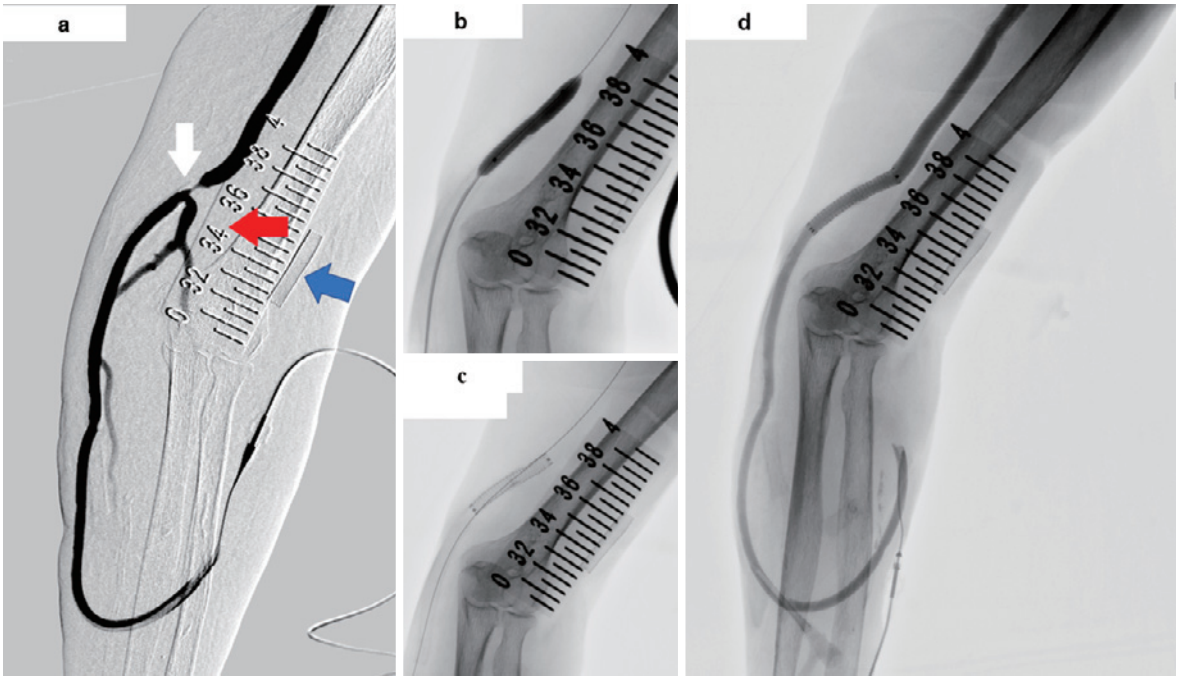

Fig. 2 (a) Angiogram showing arteriovenous outflow stenosis (white arrow), regurgitation to the peripheral vein (red arrow), and a non-functional vascular stent (blue arrow). (b) Angiogram showing that the stenosis was adequately expanded with a 7-mm balloon (Mustang; Boston Scientific Corp, Massachusetts, USA). (c) Angiogram showing a 7-mm stent graft (Gore Viabahn; W. L. Gore & Associates Inc, Arizona, USA) inserted into the stenosis site. (d) Angiogram showing blocked regurgitation to the peripheral vein by stent graft placement.

Discussion

In the present case, venous hypertension improved, and regurgitation to the peripheral veins was blocked by stent graft placement. The main complication of an AVG is stenosis, and 58% of stenoses occur at the juxta-GVJ or GVJ[4]. PTA is the standard treatment for stenosis; however, it has been reported that the restenosis rate at 12 months after successful PTA was 60%[1]. Moreover, the 29.2% primary patency at the target lesion at 6 months after PTA was lower than the value of 43.9% without PTA[2], as vascular damage of the target lesion with PTA accelerates restenosis[5]. The present target lesion also caused restenosis with PTA, because the stenosis was expanded by high-pressure and non-compliant balloons. In fact, the present patient required four PTAs over a period of 9 months. In Japan, stent graft placement for graft outflow stenosis has been approved since 2019. Stent grafting may be an option for PTA treatment. Yang et al[3] reported that the post-intervention restenosis rate was significantly lower for a stent graft placement group than for a balloon angioplasty alone group (9% vs. 69% at 3 months and 29% vs. 72% at 6 months, P <.0001) in a prospective randomized study of 98 patients. Studies reported that primary patency after stent graft placement was 25-63%[6–8]. Therefore, the present patient may require intervention within 6 months after stent graft placement. However, long-term patency is expected after treatment because a previous study found that the secondary patency of failing HD grafts after stent graft placement was 82.1% at 18, 24, and 36 months[9]. In the present patient, AVG outflow stenosis and regurgitation to the peripheral vein resulted in venous hypertension. In general, prevention of blood backflow requires that peripheral veins be cut off from the anastomosis when an AVG is created (the AVG in our patient was created at another hospital). It is impossible to treat regurgitation to the peripheral vein with PTA; therefore, surgical revisions such as cutting a peripheral vein and replacing the graft may be needed. However, it was difficult for the patient to maintain her position during surgery, as she was elderly, had dementia, and was almost bedridden. In such cases, stent graft placement might be the optimal treatment because it is easier, shorter, and less invasive than surgical revision, for both physicians and patients. Follow-up is essential for this patient, as restenosis of AVG outflow is frequent, even if regurgitation to the peripheral vein is blocked by the stent graft.

This report has some limitations. First, we were not re-

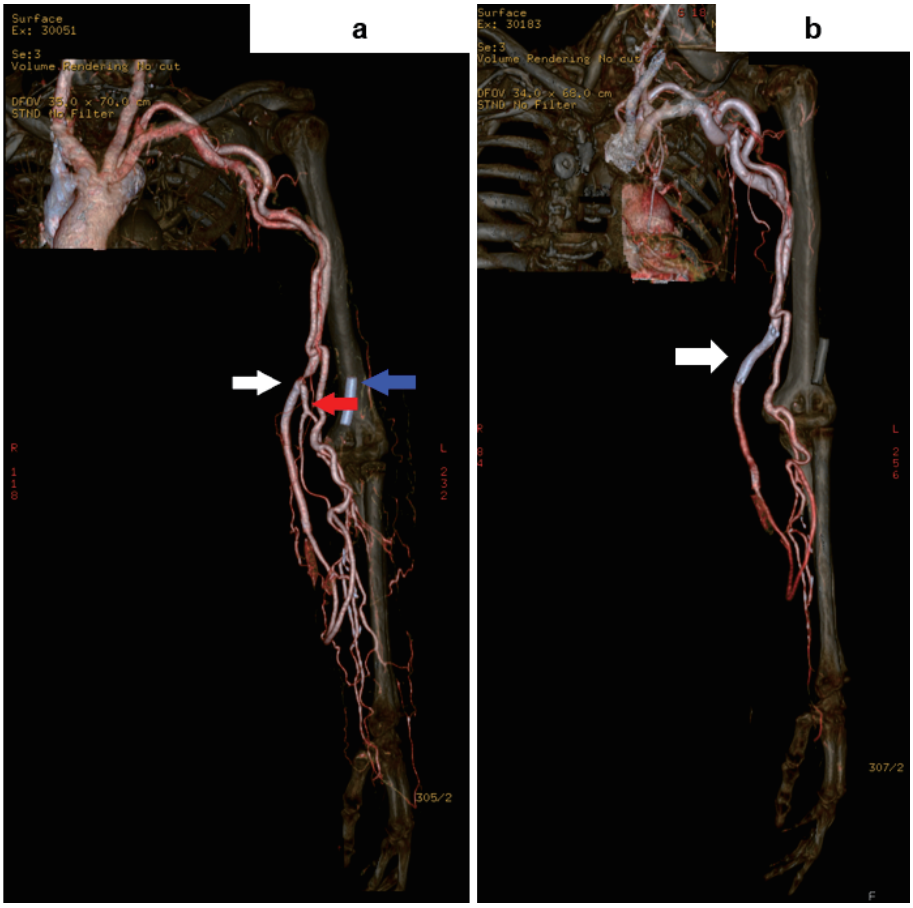

Fig. 3 (a) Three-dimensional CT scan showing arteriovenous outflow stenosis (white arrow), regurgitation to the peripheral vein (red arrow), and a non-functional vascular stent (blue arrow). (b) Three-dimensional CT scan showing stent graft placement (white arrow).

sponsible for initial management of vascular access, and the patient might not have developed symptoms if her peripheral vein had been cut off at AVG creation. Second, venous hypertension might have been caused by AVG outflow stenosis, as well as by regurgitation to the peripheral vein. Therefore, her symptoms might have resolved with a PTA only. To prove this, large studies should evaluate the incidence of venous hypertension when peripheral veins are not cut during AVG creation.

In conclusion, in an elderly patient undergoing HD, venous hypertension improved with a stent graft blocking regurgitation to the periphery of the basilic vein. This complication should be considered when an AVG is created, because cutting off peripheral veins might prevent venous hypertension; moreover, clinicians should perform regular postoperative monitoring.

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