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Case Report

Balloon assisted stent deployment in the cephalic arch (BASCA)☆,☆☆

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ABSTRACT

Cephalic arch stenosis causes repeated dysfunction and failure of arteriovenous access. Outcomes following balloon angioplasty alone in this location are unsatisfactory. Stent grafts have very good patency rates in this location. However, stent graft placement is technically challenging in this location due to the adverse angles and vectors of the cephalic arch. Stent graft deployment in this location is associated with a real risk of jailing the axillary vein, thereby precluding the use of that arm for future accesses and/or predisposes to venous edema. We describe a technique that was used to safely and effectively deploy a stent graft in the cephalic arch of a 65-year-old male patient.

Introduction

Vascular accesses include arteriovenous fistula (AVF), arteriovenous grafts, and central venous catheters. They are critical for the survival of patients with chronic kidney disease undergoing dialysis. AVF is the preferred vascular access for dialysis, owing to better patient survival rates and fewer complications associated with it [1,2]. In fact, Kidney Disease Outcomes Quality Initiative (KDOQI) recommends a minimum target AVF prevalence rate of 65% in patients on dialysis. According to the KDOQI guidelines the brachiocephalic fistula in the arm is the second most preferred fistula access after the radiocephalic fistula at the wrist [3,4]. The cephalic arch (CA) is the most common site of stenosis in the brachiocephalic fistulas and in 15% of dysfunctional AVFs overall [4,5]. When considering endovascular options to treat these lesions, stent grafts (SG) have significantly higher patency rates compared to bare metal stents or just balloon angioplasty [6–10].

Optimal deployment of SG to treat CA stenosis (CAS), in patients with dialysis fistulas is technically challenging due to the angles and forces associated with the CA. When treating a lesion at the confluence of the CA and the axillary vein it is recommended that the SG protrude at least 3 mm into the adjacent axillary vein to ensure optimal coverage of the stenosis [11,12]. Unfortunately, while doing this there is a real risk of jailing the axillary vein, thereby precluding the use of that arm for future accesses and/or predisposes to venous edema. In this case report, we describe a technique used to safely and effectively deploy a SG in the CA of a 65-year-old male patient.

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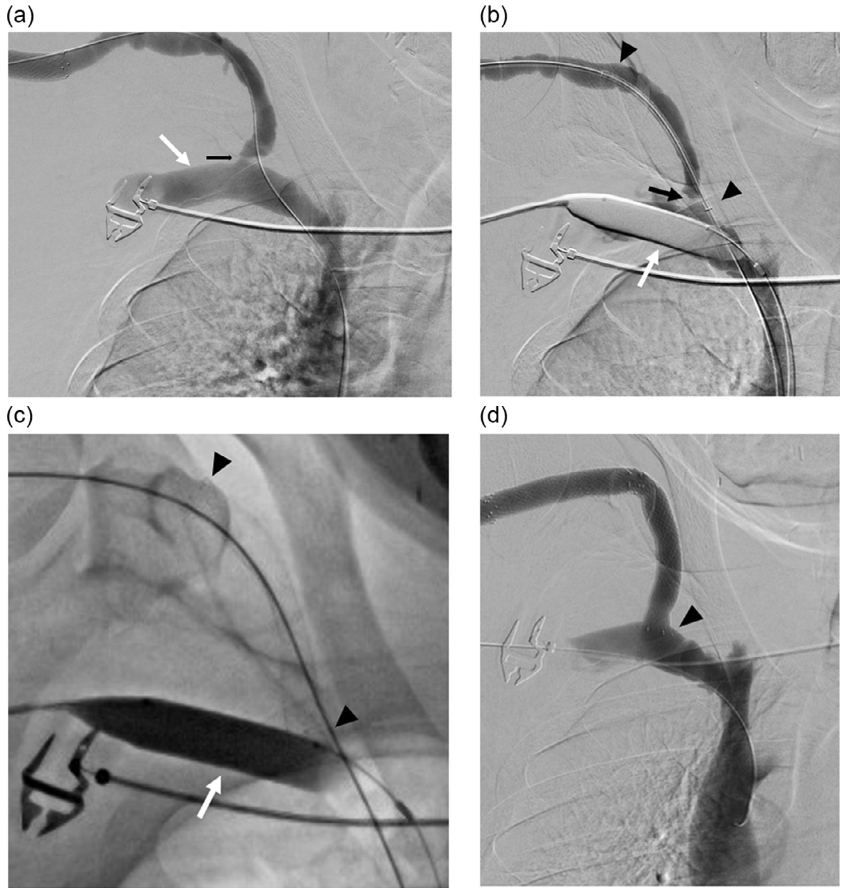

Fig. 1 – Fistulagram of a right brachiocephalic fistula in a 65-year-old male showing high-grade stenosis of the cephalic arch (black arrow) as it drains into the axillary vein (white arrow). Fistulagram (b) in the same patient showing the undersized balloon in the axillary/subclavian veins. Appropriately positioned stent graft (black arrowheads) in the cephalic vein, just past the stenosis (black arrow). Fluoroscpic image in the same patient (c) after Stent graft deployment (black arrowheads). Note the balloon (white arrow) opposes the distal stent edge thus preventing its migration. Fistulagram of the right arm (d) in the same patient following stent graft deployment with acceptable protrusion into the axillary vein (black arrowhead) and complete resolution of the stenosis.

Case report

A 65-year-old male presented with history of prolonged bleeding, recirculation and pain following dialysis through his right arm brachiocephalic fistula. His symptoms were progressively getting worse over the course of several weeks. Clinical examination demonstrated a very tense outflow vein with a pulsatile fistula indicating outflow stenosis. After obtaining the required consent, the patient was placed in a spine position on the angiographic table and the right arm was sterilely prepped and draped in the normal routine fashion. Antegrade access is obtained into the brachiocephalic fistula with ultrasound guidance. A fistulagram was performed through a sheath that was placed in the outflow vein. This demonstrated a very tight narrowing at the confluence of the right cephalic and the axillary veins, with moderate areas of stenosis of the remainder of the CA (Fig. 1). At this point a decision is made to place a SG in the CA. The stenosis was crossed with a hydrophillic wire and was subsequently exchanged for a stiffer wire. An additional access is obtained in the brachial vein of the same arm followed by placement of an 8 French sheath. Through the sheath in the brachial vein, an Atlas balloon (BD BARD, Tempe, AZ), 2 mm smaller than the ipsilateral axillary/subclavian vein was advanced, positioned and inflated across the CA drainage site (Fig. 1). A 10× 80 mm Covera SG (BD BARD, Tempe AZ) was positioned appropriately in the CA and deployed (Fig. 1). Once the SG was deployed the balloon was deflated and withdrawn. The SG was post dilated with a 10 × 40 mm Conquest balloon (BD BARD, Tempe AZ). The position of the SG and flow across was confirmed by a completion fistulagram (Fig. 1) which showed significant improvement in the appearance of the CA with complete resolution of the stenosis. The 2-mm balloon-vein size discrepancy not only allowed for sufficient protrusion of the SG into the axillary vein to ensure coverage of the stenosis but also protected the axillary vein from being jailed inadvertently (Fig. 1). Balloon assisted stent placement in the CA ensures optimal stenting of the CA and also protects the underlying axillary vein.

Fig. 2 – Fistulagram in of a left brachiocephalic fistula in a 75-year-old male, following stent graft deployment in the cephalic arch without balloon support, demonstrates significant protrusion of the stent (black arrows) into the axillary vein (white arrows) potentially limiting future venous access or predispose to venous edema in that upper extremity.

Discussion

The brachiocephalic fistula is a very common type of access in patients undergoing dialysis [4]. The CA is a common site for failure of the brachiocephalic fistula and to a lesser extent other types of dialysis accesses in the arm. If not diagnosed and treated early in its course, it results in dialysis dysfunction and ultimately thrombosis of the access [4,13]. The pathophysiology of CAS has been attributed to various factors. Physical factors such as venous valves in the CA, the course of the CA through the deltopectoral groove and the CA angle as it enters the axillary vein has been associated with increased shear stress and turbulent flow within the CA, promoting intimal hyperplasia and hypertrophic remodeling [14–17]. The treatment options available for management CAS includes angioplasty, stent placement, cutting balloon angioplasty, inflow reduction, and surgeries such as cephalic vein transposition, patch angioplasty, or bypass [6]. Angioplasty with a high-pressure balloon in this location has very low patency rates with a high rate of rupture with the need for placement of a SG [9,18,19]. Additionally, studies comparing angioplasty to SGs favor higher patency rates for SGs [6,8,18,20]. Based on this, many operators favor primary SG placement in the CA. However, SG placement may be technically challenging given the adverse angles and vectors of the CA. SG deployment in this location carries the real risk of extreme stent advancement into the axillary vein thereby jeopardizing future access placements in that arm or even worse can cause swelling of the treated arm due to venous obstruction (Fig. 2). Based on this, some of the papers do not even consider SG placement as a definite and safe treatment of CAS and have recommend surgical treatment for this type of stenosis [21,22].

Conclusion

CAS is a frequent site of failure of a brachiocephalic fistula and does not respond well to balloon angioplasty. Although SGs have shown better patency in the CA, their placement is technically challenging and may result in untoward consequences offsetting the benefits of stenting. Hopefully, using our technique interventionalists feel more comfortable to safely and effectively stent CAS, thereby obviating the need for surgery.

Contributorship statement

Study conception (WB, AB), Data collection (WB, AB), Manuscript writing (WB,AB), Final approval (WB, AB).

Data sharing

Data used in this study are not shared publicly.

Patient consent statement

Informed consent was obtained at the time of the procedure about the possibility of publication in peer reviewed journals.

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