CASE REPORT

Subclavian vein angioplasty during arteriovenous fistula surgery: case report and literature review

Angioplastia de veia subclávia no intraoperatório de fístula arteriovenosa: relato de caso e revisão de literatura

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Abstract

Patients with chronic kidney disease stage 5 are generally treated by hemodialysis, preferentially performed via an arteriovenous fistula (AVF). We report the case of a 58-year-old male patient with diabetes mellitus, hypertension and end-stage renal disease in whom hemodialysis was conducted via a long-term catheter. His medical record described numerous central venous cannulations and several AVF creations. The patient developed subclinical subclavian stenosis that required creation of a new vascular access route. The purpose of this case report is to describe treatment of subclavian vein stenosis during AVF creation.

Keywords: renal insufficiency, chronic; arteriovenous fistula; angioplasty.

Resumo

Pacientes portadores de Insuficiência Renal Crônica (IRC) estágio V são geralmente tratados por hemodiálise (HD), preferencialmente por fístula arteriovenosa (FAV). Descrevemos um relato de caso de um paciente de 58 anos, masculino, portador de *diabetes mellitus*, hipertensão arterial sistêmica e IRC terminal. Seus antecedentes demonstram múltiplos acessos para implante de cateter de hemodiálise, assim como tentativas prévias de realização de FAV. Esse paciente desenvolveu estenose subclínica da veia subclávia, limitando a HD pelo membro superior. O propósito deste relato foi descrever o tratamento endovascular de estenose de veia subclávia, concomitante à realização de uma nova FAV.

Palavras-chave: insuficiência renal crônica; fístula arteriovenosa; angioplastia.

Introduction

Hemodialysis is the main treatment in end-stage renal disease (ESRD). When possible, this treatment should be administered via an arteriovenous fistula (AVF), which offers the best vascular access[1]. Compared with other options of kidney replacement therapy, this modality of treatment is associated with reduction in infection complications and less morbidity and mortality[2].

In the United States, approximately 300,000 patients are treated by hemodialysis, and vascular access is the leading cause of hospitalization[3]. In Brazil, approximately 80,000 patients use hemodialysis treatment[4].

Nearly 40% of patients who have previously received a subclavian vein hemodialysis catheter develop stenoses[5]. Unless these lesions are corrected, creation of an upper extremity AVF is limited[6]. Endovascular treatment has a high initial technical success, but it is associated with low primary patency and high failure rate with its consequences (e.g. development of upper limb edema)[7,8].

The purpose of this case report was to describe subclavian vein angioplasty during AVF creation.

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Case report

A 58-year-old patient with diabetes mellitus, hypertension and chronic kidney disease (stage 5) had been treated by hemodialysis via a long-term catheter inserted in the right femoral vein. His past medical history included many central venous cannulations (right internal jugular, left internal jugular, right subclavian, left subclavian, right femoral and left femoral veins). The patient had had a previous left femoral deep venous thrombosis (DVT), and creation of an upper extremity AVF was attempted three times (radiocephalic and brachiocephalic in the right arm, and brachiobasilic in the left arm) without success.

A color Doppler study performed to investigate the cervical and upper extremity veins revealed the absence of arm veins suitable for new surgery and detected signs of previous axillary vein thrombosis. Upper extremity phlebography performed prior to attempting to create a new AVF showed left axillary vein occlusion and stenosis of the proximal right subclavian vein.

Surgery was then performed, by right axillary vein and ipsilateral brachial artery dissection. A loop subcutaneous tunnel was created in the anterior arm and a terminal-lateral nonringed polytetrafluoroethylene (PTFE) 6.0 mm anastomosis was performed with the vein. The prosthesis was then punctured and a 10 F sheath was introduced (Figure 1). Intraoperative phlebography was obtained (Figure 2) and a hydrophilic 0.035" guide wire (Roadrunner® 260 cm; Cook) was passed beyond the subclavian lesion to reach the inferior vena cava. The diameter of the vein was estimated as 12 mm; after infusion of 5000 UI of intravenous heparin, subclavian vein angioplasty was performed using a 14×40 mm vascular balloon (XXL®; Boston Scientific) inflated to 10 atm for 3 minutes. Recoil was noted following a second angiography, and a self-expanding stent (16x40 mm Wallstent®; Boston Scientific) was satisfactorily deployed, preserving the right internal jugular ostium (Figure 3).

The PTFE graft was passed through the tunnel, and brachial anastomosis was performed. Lastly, the sheath was removed and the prosthesis closed with Prolene sutures. A thrill was identified at the axillary vein, and evolution of AVF and the patient was satisfactory. Clopidogrel and Aspirin were initiated on the first day after surgery.

Color Doppler study surveillance performed four weeks after surgery showed AVF patency, signs of PTFE integration and a flow rate of 640 mL/minute. Hemodialysis via the AVF was satisfactorily initiated six weeks after surgery.

Figure 1. PTFE puncture with 10 F sheath.

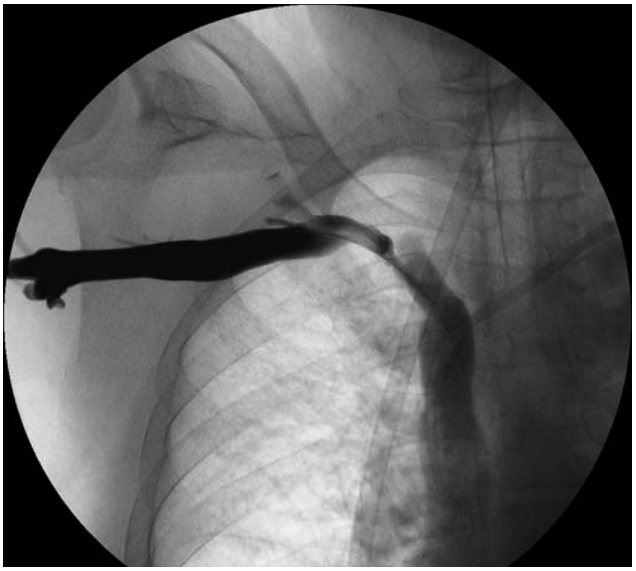

Figure 2. Intraoperative phlebography.

Figure 3. Final image.

Discussion

Many guidelines recommend that kidney replacement treatment should preferably be performed by an autogenous AVF[3,5]. Until 2002 in the United States, access was created using prosthesis in approximately 80% of cases for reasons of accessibility, early cannulation and thrombectomy treatment in cases of occlusion[9]. Cumulative patency, infection rate and survival analysis have shown better results with autogenous conduits; however, these findings were derived from low-evidence reports[10].

Central venous stenoses are common in central vein cannulation, especially in subclavian vein hemodialysis catheters. Almost 50% of patients with these catheters have stenoses or occlusions[11], which are a major impediment to upper extremity access[8]. After obtaining arteriovenous access, central venous stenoses sometimes lead to swelling of the arm; after obtaining prosthetic vascular access, attempts to treat these lesions can result in an arm hematoma and related complications. We could find no previous reports regarding central venous angioplasty during AVF creation.

Central venous lesions are short and have fibrotic features[12]. This condition makes endovascular treatment a favorable approach that has high initial technical success (approximately 90%)[13]. The 1-year primary patency rate for balloon angioplasty is approximately 30%, but the feasibility of performing repeat angioplasty makes this treatment a feasible option[8]. Treatment by primary stenting has been studied previously, but is not associated with an increase in primary patency, and thus it should be used selectively[8,14]. Stent placement is recommended in situations of recoil or failure, which is identified when a symptomatic patient returns for treatment (e.g. development of arm swelling, unsuccessful hemodialysis)[14]. The primary assisted program may require multiple angioplasties to achieve a 1-year cumulative patency (CP) result of 70%[8,13,15].

Preservation of the ostium of the internal jugular vein is important during stent placement to ensure that the possibility of future central venous cannulation is retained. Similarly, preservation of the ostium is also beneficial in stenting of the contralateral innominate vein[16].

Wallstent® self-expanding stents are generally used in treatment of central venous stenosis[7,8,13-16]; the use of Nitinol stents is also reported for this purpose[17]. Both types produced similar results regarding primary patency and freedom from symptoms, but, in the United States, Nitinol stent placement is an off-label procedure for central veins. Considerations in stent selection are that elgiloy alloy (Wallstent®) has better resistance to external compression, but that Nitinol has greater radial strength and conforms better to the wall of the vein.

Recently, Haskal et al. conducted a multi center study, in which dysfunctional access were randomized to receive balloon angioplasty or stent graft (Bard Flair stent®). At six months follow-up, stent graft group had better results of freedom from reintervention and patency (51x23%; $p<0.001$)[18].

Creation of lower extremity arteriovenous access is an alternative treatment in patients with upper extremity vein outflow obstruction. Saphenous vein tight transposition has 1-year cumulative patency of 93%, but sometimes the use of this conduit is not possible because of previous usage or the presence of peripheral arterial disease. Otherwise, there is the possibility of prosthetic vascular access, which has a rate of complications from infection of 20%[19].

Surveillance of arteriovenous hemodialysis access remains controversial[20]. Some types of surveillance are potentially beneficial: in particular, measurement of volume flow rate can detect early dysfunction of vascular access, and detection should be encouraged as a method of increasing vascular patency. This approach is reported as a method of reducing costs, hospitalization, morbidity and mortality. A flow rate of less than 600 mL/minute or a 20% reduction in flow rate over 1 month are predictive signs of arteriovenous occlusion[5,21].

Conclusion

The present case report describes an alternative treatment of subclavian stenosis that was performed via the axillary vein. This approach enabled treatment without another vein puncture and with the advantage of performing the angioplasty under favorable conditions (absence of arm swelling and hematoma development after prosthesis puncture). In the present patient, previous deep venous thrombosis of the lower extremity limited access through the inferior vena cava. The present procedure was successful. Previous reports regarding angioplasty and stenting favor endovascular treatment.

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