

From the Clinic

Transposition of the cephalic vein in therapeutic rescue of cephalic arch stenosis

Introduction

Autogenous arteriovenous fistulas (AVFs) are considered the most reliable long-term vascular access in patients undergoing haemodialysis. Although AVFs generally require fewer interventions than arteriovenous grafts (AVGs) to maintain patency, some sites of venous stenosis account for a large portion of repeated interventions. A particularly troublesome site within brachiocephalic AVFs is the cephalic arch. Cephalic arch stenosis (CAS) has been implicated in 19–77% of brachiocephalic fistula failures [1]. The cephalic arch has a unique architecture. In addition to containing a high concentration of valves and having a steep angulation, it crosses multiple tissue planes, bridging the superficial and deep venous systems while being tethered to rigid extravascular structures. These factors combine to make the cephalic arch particularly vulnerable to the development of stenotic lesions, as changes in vessel compliance produce turbulent flow. When an anastomosis is created between the brachial artery and the cephalic vein, the flow within the cephalic vein increases and the vessel starts dilating. However, the tissues surrounding the cephalic arch preclude its expansion, so that the cephalic vein narrows as it approaches its junction with the central veins. This sudden reduction in the circumference of a high-flow pathway results in an inflow–outflow mismatch, potentiating turbulence and the increased shear stress associated with it [1, 2]. When a CAS occurs, the management is not easy.

Angioplasty of stenotic lesions involving the cephalic arch has limited effectiveness, which led investigators to seek surgical alternatives to treat these lesions and to preserve current fistula [1]. The option for cephalic vein transposition (CVT), described by Chen *et al.*, involves surgical revision to redirect the blood flow to the adjacent patient veins. The surgical procedure entailed transecting the healthy portion of the cephalic vein distal to the stenotic segment in the arch, transposing and anastomosing it to the upper basilic [2] (Figure 1).

We present the experience of our centre with upper arm CVT procedures in three haemodialysis patients who underwent haemodialysis treatment in the haemodialysis unit of Centro Hospitalar de Setúbal E.P.E. Two of the 3 cases did not have the possibility of endovascular treatment. In these cases CVT to basilic vein made possible the preservation of vascular access. Both accesses are patents to date, 6 and 9 months, respectively. In the other case, the CVT allowed the reduction of percutaneous transluminal angioplasties (PTAs)/access-year in a patient with frequent recurrent CAS (requiring angioplasty in <3-month intervals) and is also patent to date (52 months).

Case reports

Clinical and demographics aspects of the cases are summarized in Table 1.

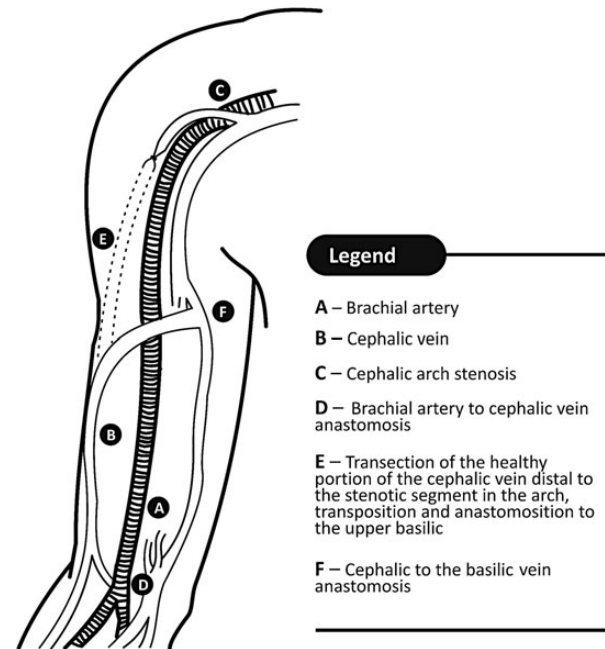


Fig. 1. Illustration of the cephalic vein transposition technique.

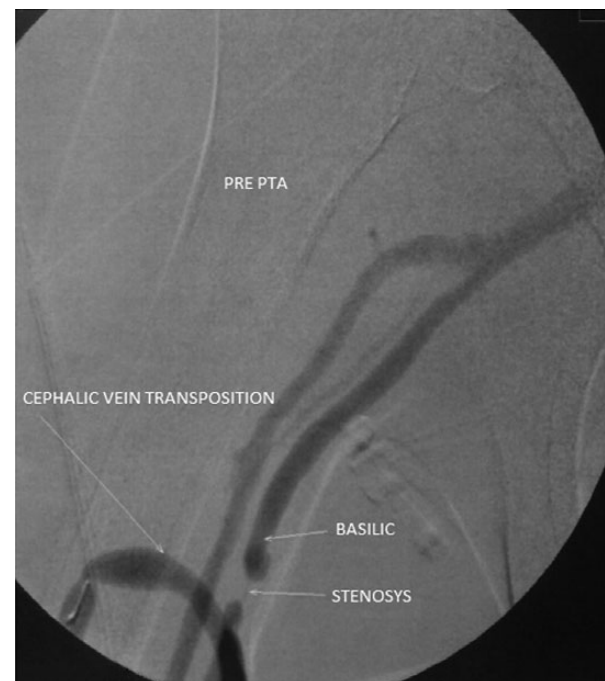


Fig. 2. An occlusive stenosis close to the re-anastomosis, 6 months after surgical revision—cephalic vein transposition (CVT) to basilic vein (case 2). PTA, percutaneous transluminal angioplasties.

Table 1. Patient demographics and baseline characteristics

	Case 1	Case 2	Case 3
Age (years)/gender	41/female	91/male	51/male
Ethnicity	Caucasian	Caucasian	Caucasian
Diabetes mellitus/hypotension	No/no	No/no	Yes/no
Coronary artery disease/antiplatelet therapy	No/no	No/no	Yes/yes
Body mass index (kg/m ²)	<35	<35	>35
Smoking/PVD	No/no	No/yes	No/yes
Cause of ESRD	Chronic lithiasic pyelonephritis	ANCA vasculitis	Diabetic nephropathy
Start of haemodialysis programme	May 2012	February 2002	September 2004
First access/type/creation date	Yes/left arm, BAVF/January 2012	Yes/right arm, BAVF/December 2009	No/left arm, BAVF/April 2004
Time of CAS (since AVF creation)	18 months	36 months	20 months
Endovascular treatment	Not possible • Decide to CVT	Not possible • Decide to CVT	Yes • Dissection of the dilated vein during angioplasty; two stents were necessary • Critical CAS intrastent • Successive PTA • Decide to CVT
CVT surgical complications	No	No	No
Problems-related post-CVT	No	Stenosis at the site of re-anastomosis 6 months after, successfully treated with PTA (Figure 2)	Stenosis of the subclavian vein induced by stent migration; non-significant stenosis in the re-anastomosis
Patency time	Patent to date (6 months)	Patent to the present moment (9 months)	Patent to the present moment (52 months)

PVD, peripheral vascular disease; BAVF, brachiocephalic autogenous arteriovenous fistula; CAS, cephalic arch stenosis; ESRD, end-stage renal disease; CVT, cephalic vein transposition; PTA, percutaneous transluminal angioplasty.

Discussion

When failure of vascular access is imminent, it is important to know all management options in order to be able to choose the best solution for the patient, allowing preservation of the access. Angioplasty of stenotic lesions involving the cephalic arch has limited effectiveness as immediate elastic recoil, venous rupture and rapid regrowth of venous intimal hyperplasia results in a 42% primary patency at 6 months [2, 3]. Limited information is available on the outcomes of stent and stent graft in the management of CAS. Placement of stents improves immediate patency, but no study has yet established the superiority of stents over percutaneous balloon angioplasty for CAS. The curvature of this venous segment and the proximity to the confluence with the subclavian vein can complicate this procedure. The migration of the stent into the clavian vein can cause problems in the creation of an arteriovenous fistula using the basilic system [1, 4]. In many patients, rapid re-stenosis occurs and repeated interventions become necessary to maintain access patency and haemodialysis adequacy. Additionally, some lesions are not amenable to endovascular intervention because of cephalic arch total occlusion. Some studies demonstrate that CVT is an available option for fistula preservation, as showed by the clinical cases presented in this report. Besides, it seems to reduce the number of PTA/access-year in patients with frequently recurrent CAS, as shown in Case 3. In a previous report by Kian *et al.*, patency rates for angioplasty before and after surgical revision were evaluated: primary patency rates for angioplasty before the surgical revision were 23, 8 and 0% at 3, 6 and 12 months, respectively. Following surgical revision, primary patency increased to 92, 69

and 39% at 3, 6 and 12 months, respectively ($P=0.0001$) [3]. Several factors might be responsible for these results: the portion of the cephalic arch that is situated underneath the clavicular head of the pectoralis major muscle and the portion that pierces the clavipectoral fascia might be under extrinsic compression and halt remodelling of this segment of the vein. Additionally, the presence of valves in this portion of the vein might interfere with dilatation of the cephalic arch following fistula creation. A change in the configuration of the access might improve the above-mentioned factors and extend patency rates for subsequent angioplasty procedures [3]. Moreover, CVT approach allows to maintain patency and function of the access immediately after surgical intervention, thus avoiding the need of a central venous catheter; the procedure is safe to perform in outpatient settings under conscious sedation and local anaesthesia and future ipsilateral AVG still possible if the basilic/axillary vein is patent [5].

However, we should note some aspects that might limit this treatment selection. Surgical revision to connect the cephalic vein to the axillary-basilic vein may jeopardize the creation of a proximal basilic vein fistula in the future. Another potential problem, although unusual, is the development of stenosis at the site of re-anastomosis, as occurred in two of our three patients (Figure 2), and the risk of potential complications due to its invasive nature, compared with other non-surgical procedures [3, 5].

Although our experience may be somewhat undersized, our good results support current literature output.

All surgical management options for preserving the current fistula should be evaluated, studied and considered taking into account the particular characteristics of each vascular access and the patient as a whole.

Management of CAS is a demanding task involving the patient, the nephrologist and the surgeon. The purpose of this study is to demonstrate a surgical option for preserving brachiocephalic fistula in cephalic arch occlusive lesions, which is less described and rarely executed. These results might encourage surgeons and nephrologists to consider this strategy as a viable option.

Conflict of interest statement. None declared.

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