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Translumbar access for hemodialysis. A window to open?

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Abstract

Vascular access failure is a significant cause of mortality in Haemodialysis (HD) patients. We describe the case of a 43-year-old Cape Verdean women with end-stage kidney disease undergoing HD treatment since 2004. Since then, she had one episode of an arteriovenous fistula thrombosis, had been submitted to several tunnelled dialysis catheter replacements and, due to thrombosis or occlusion of upper and lower limb large veins, had undergone HD through collateral posterior thoracoabdominal varicose veins. She was considered ineligible for kidney transplantation due to extensive peripheral vascular disease. A 9-year period of peritoneal dialysis followed, complicated by recurrent peritonitis that eventually led to the removal of Tenckhoff catheter in 2019. A Translumbar Tunnelled Dialysis Catheter (TLDC) was then successfully implanted directly through the Inferior Vena Cava (IVC). Although technically demanding, IVC cannulation with TLDC can be a life-saving option.

Keywords

Dialysis vascular access; terminal kidney disease; peritonitis; vascular access failure; kidney transplant.

Introduction

Advances in nephrological care have led to dialysis patients living longer. Consequently, those deemed ineligible for kidney transplantation or conservative treatment tend to remain on long-term dialysis, mostly Haemodialysis (HD). Vascular access is thus a critical clinical factor for the care and outcome of these patients [1]. During 2018 in Portugal, 12,227 patients were treated with HD. Also, during that year, 73.1% of the prevalent HD patients had an Arteriovenous Fistula (AVF), 17.3% had a Tunnelled Dialysis Catheter (TDC) and 9% an Arteriovenous Graft (AVG) [2]. Due to their greater longevity and lower rates of complications such as thrombosis or infection, AVF are generally preferred over AVG. In addition, AVF need

fewer interventions to maintain patency and are associated with lower overall mortality [3-5]. AVG are, in turn, associated with lower primary failure rates [6,7]. Finally, TDC tend to be the least desirable vascular access, mainly due to higher rates of catheter associated bacteremia, fatal infections and cardiovascular events, inadequate solute clearance and greater all-cause mortality [6].

Vascular Access Failure (VAF) remains one of the greatest challenges in HD care. For End-Stage Kidney Disease (ESKD) patient's ineligible for treatments other than HD, often with poor vasculature and undergoing HD for an extended period of time, VAF presents as a particularly demaning and life-threatening problem. Although not fully understood yet, the complex pathogenesis of VAF includes factors such as neo-intimal hyperplasia, insufficient vasodilation and adverse vascular remodeling leading to stenosis and thrombus formation [6,8]. Several therapeutic strategies have already been proposed in an attempt to counteract these factors, promote maturation and thus improve the outcome of vascular access. Inhibition of the renin-angiotensin-aldosterone system, fatty acid supplementation, the use of antiplatelet agents and statins are examples of such strategies. However, clinical trials have failed to prove their efficacy and there is still insufficient evidence to recommend their routine use [6].

The Translumbar Tunnelled Dialysis Catheter (TDLC) was first described by Lund et al. in 1995 as a valuable alternative for HD in cases which traditional catheter sites have failed [1]. Since then, many authors have supported this procedure as a relatively safe and effective HD vascular access and a potential solution for patients with limited central venous access [2-4].

Case Study

A 43-year-old African Cape Verdean women with chronic hepatitis C infection and ESRD of unknown etiology undergoing Renal Replacement Therapy (RRT) since 2004 was referred to our vascular access consultation in June of 2009. She lived in Cape Verde and was being treated at a local hospital. Until then, a thrombosed AVF and multiple large vein thrombosis and occlusions made it impossible to maintain any functioning vascular access for HD, thus motivating the referral. Until her arrival in Portugal, in January of 2010, the only way to maintain HD treatments had been through cannulation of collateral varicose veins that had developed in the posterior thoracoabdominal and scapular region (Figure 1 & 2). At that point, she was immediately referred for Continuous Ambulatory Peritoneal Dialysis (CAPD) treatment and was able to start it before the end of January 2010. Thoraco-abdominopelvic Computed Tomography Angiography (CTA) revealed an occlusion of the superior vena cava and extensive thrombosis of the common and external iliac veins, as well as the distal portion of the Inferior Vena Cava (IVC). There was an apparent patency of the middle and upper portions of the IVC. A panel of thrombophilia tests was performed and no acquired or hereditary thrombophilia was found. Occlusions and venous thrombosis remained despite an anticoagulation trial (Figure 3). The extension of peripheral vascular disease did not allow any endovascular treatment or even the placement of a kidney, which made transplantation impossible. A year later, CAPD was suspended for 2 months due to a pleuroperitoneal and an abdominal wall leak. During this period, she undergone HD through a catheter that was surgically inserted directly into the right atrium. An uneventful period of 8 years followed, during which she remained stable and free of ESKD symptoms. However,

since the beginning of 2018 she developed relapsing and resisting peritonitis, requiring several antibiotic courses and successive removals and replacements of Tenckhoff catheter. This led to the permanent removal of the Tenckhoff catheter in March of 2018 and surgical cannulation of the IVC with a TLDC. A year after insertion of TLDC she remains on HD treatment, with good arterial rates and without major complications during sessions. Her vascular disease is being revised by our surgical team for the possibility of an orthotopic kidney transplantation.

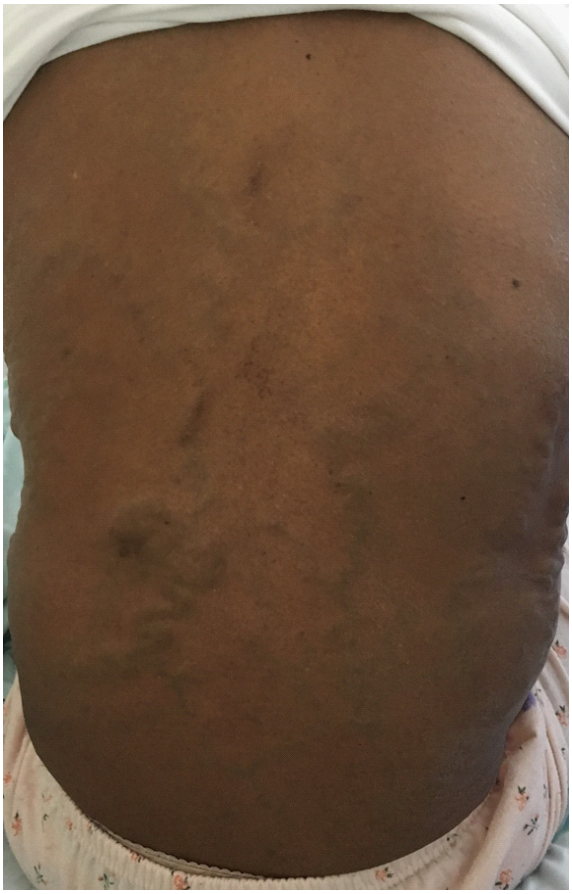

Figure 1: Posterior thoracic wall collateral circulation.

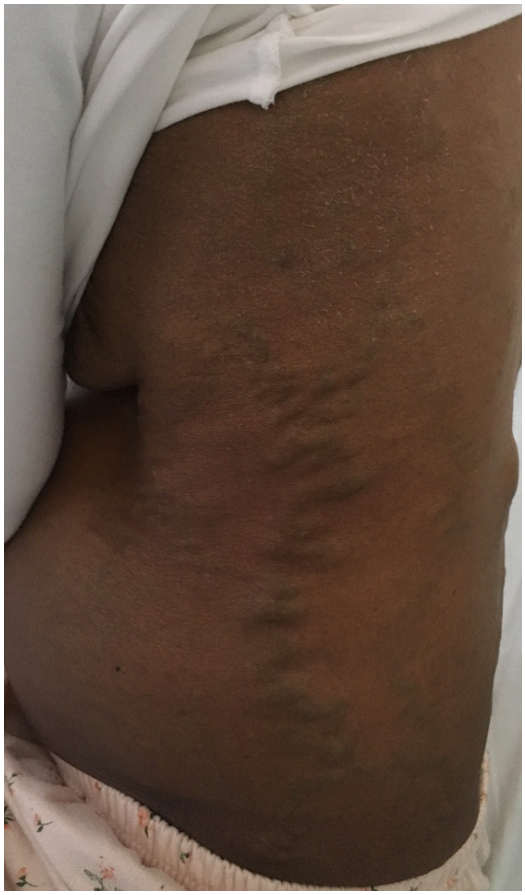

Figure 2: Left thoracic wall collateral circulation.

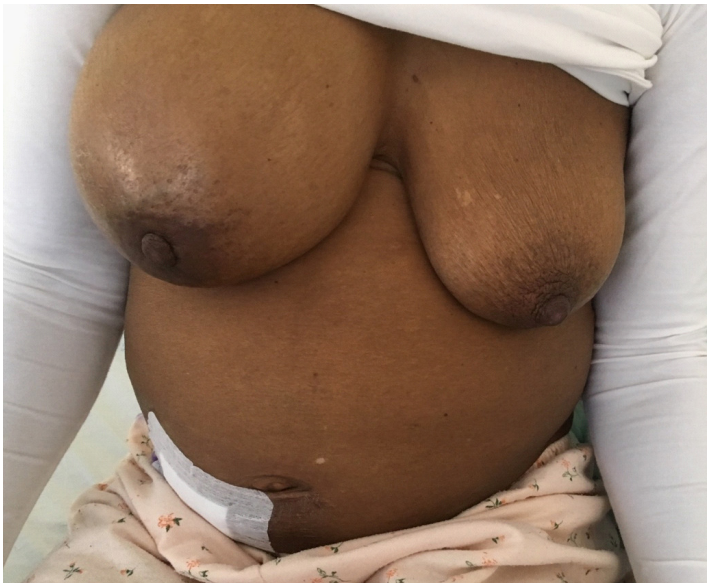

Figure 3: Breast asymmetry secundary to occlusion of the superior vena cava.

Discussion

Patients on long-term dialysis treatment might develop end stage VAF, especially those with peripheral vascular disease and multiple comorbidities [9]. VAF is a major cause of morbidity and even mortality in patients on chronic HD. AVF and AVG are preferred to venous catheters but TDC are frequently required as temporary or permanent solutions. Alternatives for long-term HD patients with VAF include lower limb AVG, haemodialysis reliable outflow (HeRO) device and transfemoral, transhepatic or translumbar tunnelled cannulation through the IVC [1,10,11]. HeRO is a surgically inserted subcutaneous device characterized by a venous outflow component, an arterial graft and a percutaneous accessible cannulation area. [10] Percutaneous IVC catheterization was originally described by Kenney et al in 1985 as an alternative means for long-term parenteral nutrition [5]. Ten years later, Lund et al. and Gupta et al. first reported this technique as a successful alternative for HD treatment in patients with VAF [1,9,12,13]. Translumbar IVC cannulation is generally preferred over transfemoral cannulation since the former allows the iliac and femoral veins to remain available for renal transplantation and vascular access, respectively. The risk of deep vein thrombosis is also higher in the latter. Transhepatic IVC cannulation is associated with higher rates of catheter-related thrombosis and catheter malposition or migration, when compared to translumbar cannulaton [11].

For the insertion of the TDLC, the patient is placed in oblique or prone position and a small incision is made just above the right iliac crest, at the vertebral level of L3. A 15 to 21-gauge needle is then introduced under fluoroscopic guidance through the subcutaneous tissues and the lumbar muscles (spine and psoas) into the IVC, just below the renal veins. The catheter is then placed using the Seldinger technique and its tip inserted into the right atrium. The cuff is dug under the skin and sutured. The catheter outlet should be located externally above the waistline, for example in posterior medial axillary line, for patients' comfort [14]. The best results are achieved by the appropriate positioning of the catheter during insertion, with meticulous confirmation and correction of any kinking and poor positioning. Through the use of fluoroscopy, the correct placement of the catheter should be confirmed, and its curvature evaluated to ensure a smooth and undulating curve. A 10mL syringe is then connected to confirm rapid blood flow.[14] Lund et al. defined as catheter failure a flow rate less than 200 mL/min [15].

Although generally safe and associated with low rates of complications, TLDC still has a higher rate of long-term complications, replacements and removals than traditional TDC [9,11,12]. Among the most reported complications are catheter-related infection and thrombosis [9]. Gregory et al. reported that the main indications for exchange or TLDC removal (n=78) were catheter-related infection (n=39; 50.0%), catheter malposition (n=15;19.2%), catheter malfunction secondary to occlusion (n=10; 12.8%), mature permanent vascular access (n=7; 9.0%), conversion to peritoneal dialysis (n=3; 3.9%), functioning transplant (n=2; 2.6%), malfunction and infection (n=1; 1.3%), and unknown (n=1; 1.3%) [11]. The reported cumulative 12-month catheter patency rates ranged from 7% to 73.2% [9,14]. There are some interventions that may be necessary to evaluate and correct the eventual formation of thrombus and/or inadequate catheter position. Such measures include the use of a trombolytic agent and venography-guided catheter repositioning, respectively [14]. A low-dose (1 mg/ml) of alteplase is effective in restoring function in 72–82.1%

situations of catheter failure [9].

Discussion

With the increase of HD patients' life expectancy and the low availability of kidney donors, maintaining vascular access is critical and often challenging. When performed by a specialized team, fluoroscopy-guided placement of TLDC is a safe procedure. If successful, TLDC can be a life-saving option in patients with VAF, as a bridge to a longer-term solution, as kidney transplantation.

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