Annals of Case Reports
Murithi JK, et al. Ann Case Rep: 8: 1362
www.doi.org/10.29011/2574-7754.101362
www.gavinpublishers.com

Case Report

Axillary Vein to Superior Vena Cava Bypass: Femoral Vein Conduit Vs Synthetic Graft: Effective Treatment Options in a Low Resource Setting

John Kinyua Murithi*, Jason Faulds, Peter Aseyo Sore

Coast General Teaching and Referral Hospital, P.O. Box 90062-80100, Mombasa, Kenya

***Corresponding author**: John Kinyua Murithi, Coast General Teaching and Referral Hospital, P.O. Box 90062-80100, Mombasa, Kenya

Citation: Murithi JK, Faulds J, Aseyo P (2023) Axillary Vein to Superior Vena Cava Bypass: Femoral Vein Conduit Vs Synthetic Graft: Effective Treatment Options in a Low Resource Setting. Ann Case Report. 8: 1362. DOI:10.29011/2574-7754.101362

Received: 30 June 2023, **Accepted:** 04 July 2023, **Published:** 06 July 2023

Abstract

Introduction: Central vein stenosis is a challenging problem faced by hemodialysis patients. Significant arm swelling, facial plethora, skin breakdown and loss of dialysis access are potential complications, which limit both the quality of life and life expectancy of these patients. Amongst dialysis patients in Mombasa County, the incidence of subclavian catheter utilization is common, leading to a higher-than-expected incidence of symptomatic central vein stenosis.

Methodology: The goal of this paper is to describe the definitive surgical cure for a dialysis patient with symptomatic subclavian vein occlusion. Two methods are highlighted. Open bypass from the axillary vein to the superior vena cava using reversed deep femoral vein and bypass using a synthetic conduit. The cases are of particular value to low resource sites without access to complex endovascular treatment.

Results: Both cases presented demonstrated excellent recovery from the methods used. Neither patient had residual symptoms after the bypass graft. Furthermore, arteriovenous fistulas, which could not be utilized for dialysis before the procedure, could now be successfully used.

Conclusion: Open bypass using a reversed femoral vein bypass or a synthetic vessel graft as a conduit can successfully be used to manage patients with central vein stenosis.

Introduction

Central vein stenosis is defined as the narrowing or occlusion of the major veins that return blood to the heart from the extremities; that is: the brachiocephalic, subclavian, internal jugular veins and the superior vena cava [1]. It is a challenging problem that faces hemodialysis patients as the most common etiology of the condition is prolonged cannulation of the vessels. Significant arm swelling, facial plethora, skin breakdown and loss of dialysis access are potential complications, which limit both the quality of life and life expectancy of the patients. The true incidence of central vein stenosis is unknown. Reported incidence of central vein stenosis worldwide ranges from 3 percent in some centres to as high as 60 percent in others [2]. Central vein stenosis is diagnosed as an incidental finding during routine venography in some patients while a significant number are diagnosed based on presence of signs and symptoms hence the cause of the discrepancy in incidence [3]. Placement of dialysis catheters in the subclavian vein has been shown to increase the rate of stenosis of this vein [3]. This could be due to venous wall thickening, endoluminal

obstruction and extrinsic compression [4]. In patients undergoing hemodialysis in Mombasa County an increased utilization of the subclavian vein as a primary access has been noted, which could be the potential cause for the higher than expected incidence of symptomatic central vein stenosis. Patients with central vein stenosis present with ipsilateral arm edema, which is progressive in nature with gradually increasing severity [5]. As these progresses, swelling of the adjacent areas i.e. the face, neck, shoulder and breast begins [5]. This severe edema causes extreme patient discomfort. Furthermore, it increases the risk of the patient developing skin ulceration and infection [6]. As it worsens, access to the AV fistula for dialysis becomes more difficult to the point of loss of dialysis access [7]. There are several options for managing central vein stenosis but they are only instituted when stenosis exceeds 50 percent and is associated with clinico-pathological abnormalities [8]. Modalities include angioplasty with 70 to 90 percent success rates, stenting; balloon assisted banding and venous bypass surgery [9]. These modalities however have a severe cost implication with the average cost of angioplasty in Kenya estimated to be at 2000 dollars. We therefore sought to identify an effective and affordable treatment option for the rising number of patients with central vein stenosis in our region. We present two patients managed at our institution for central vein stenosis. Both underwent axillary vein to superior vena cava bypass. For one patient a femoral vein conduit was utilised and for the second an artificial vein graft was used. Both patients demonstrated significant symptomatic and clinical improvement. The modalities are therefore shown to be suitable for adoption for management of the condition in our setup.

Case Presentation 1

A sixty-one-year-old male patient presented with severe left upper limb edema for 12 months. He had developed end stage kidney failure five years previously due to uncontrolled primary hypertension. At initial presentation, he had come in in hypertensive crisis and had been initiated on dialysis emergently. Venous access for dialysis had been obtained through temporary left subclavian catherization. After 6 months, flow rates through the catheter were noted to be inadequate to sustain dialysis. The catheter was removed and a left internal jugular vein catheter inserted which also became obstructed within 4 weeks. A right jugular tunneled catheter was inserted which he used for several years. Two years prior to the current presentation, a left cephalic vein to brachial artery arteriovenous fistula was fashioned. The AVF matured well and dialysis was commenced through the fistula with acceptable blood flows. After one year of use, the left forearm was noted to be progressively enlarging with overt edema. Conservative management such as limb elevation was unsuccessful in relieving the edema. The patient was subsequently referred to the vascular clinic. At presentation the patient had significant discrepancy in size between the left and right upper limbs with upper limb circumference of 36cm in the right arm and 92 cm in the left upper limb. The left limb was edematous and the patient had substantial difficulty performing any form of self-care due to the size and weight of the limb. A contrast venogram was performed on the limb to assess patency of the patient's central veins. Access was obtained though catheterization of the AV fistula. Contrast was observed to flow to the distal end of the innominate vein only. There was no flow of contrast to the left jugular vein or the proximal end of the innominate vein. This signified severe stenosis of the left jugular vein and the proximal innominate vein. Attempts to pass a guide wire into the superior venacava were also unsuccessful. The right femoral vein was cannulated and an attempt made to pass a guide wire into the left innominate vein via the superior venacava. This was also unsuccessful. The patient was then counselled on surgical bypass of the innominate vein, which he consented to. Surgery was performed through a median sternotomy and left infraclavicular incision. After sternotomy, the pericardium was opened and both the intra pericardial and extra pericardial segments of the superior vena cava dissected and isolated. Via the infraclavicular, incision the left cephalic, axillary and subclavian veins were isolated as well. The exposed veins were noted to be arterialized due to prolonged exposure to high pressures. There was complete cut off from the superior venacava with the veins draining through multiple collaterals. The left superficial femoral vein was then dissected free through skip incisions in the left thigh. We took care to preserve the profunda femoris vein and the saphenous vein in order to preserve venous drainage from the leg. The harvested femoral vein was then used to create a reverse vein bypass graft between the axillary vein and the extra pericardial segment of the superior vena cava. The harvested vein was tunneled between the first and second rib. Good flow was noted in the venous graft. The sternotomy was repaired using steel wires after leaving a pericardial drain and the soft tissue incisions repaired procedurally repaired (Figures 1&2).

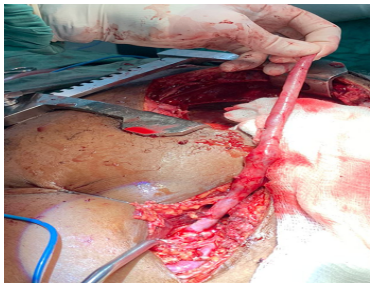

Figure 1: Showing the femoral vein conduit anastomosed to the left subclavian vein.

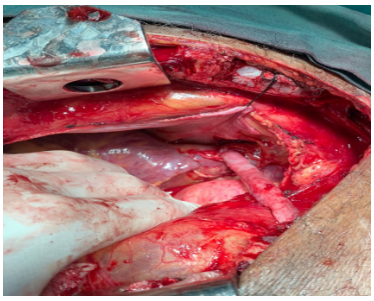

Figure 2: Showing the femoral vein conduit anastomosed to the subclavian vein and the superior vena cava.

The patient recovered in the intensive care unit for two days before being stepped down to the regular ward. His subsequent recovery from surgery was uneventful. Left upper limb edema began subsiding immediately post operatively. The dialysis fistula which prior to surgery was difficult to discern now became more prominent. Two weeks post operatively the left upper limb had significantly reduced in size with a circumference of 54cm representing a 43% reduction in size. Redundant skin around the left upper limb has been observed but the patient has declined further reconstructive procedures. Minimal edema of the left lower limb was noted post operatively, which resolved over 2 weeks. The patient currently has regained full use of the arm and is on follow up monthly at the vascular clinic. Dialysis access currently is though the cephalic-brachial artery AV fistula (Figure 3).

Figure 3: Showing the arm reduction 2 weeks after surgery.

Case Presentation 2

A 65 year old male patient presented to the vascular clinic with a severely edematous right arm. The patient had been diagnosed with end stage renal disease ten years previously. He had been using a right internal jugular vein indwelling catheter for dialysis since diagnosis. Two years previously, a cephalic vein to brachial artery fistula had been fashioned in the right arm, which he had been using successfully. However, since right arm edema had begun the AV fistula had become impossible to cannulate. The patient also complained of significant arm discomfort and inability to utilize the arm for self-care. At the time of presentation, the left internal jugular had been cannulated and was being used for dialysis access. A diagnosis of central vein stenosis was made. The patient was taken to the catheterization lab and a venogram was done. It was noted that he had complete stenosis of the proximal right innominate vein as well as of the right jugular vein. The patient however had a patent left innominate vein. Attempt was made to pass a stiff wire through the right innominate vein but this was unsuccessful. He was counseled on open right subclavian vein to superior vena cava bypass, which he consented to. The patient's superficial femoral veins were assessed using Doppler ultrasonography but the caliber was deemed too narrow to sufficiently drain the right arm. A synthetic graft (Impra © ePTFE beaded 10mm graft) was therefore sourced. The patient underwent a right infraclavicular dissection to isolate the right axillary vein. The vein was noted to be arterialized with thickened walls and a caliber of 18mm. A sternotomy was done; the intra and extra pericardial segments of the superior vena cava were dissected out. The synthetic graft was tunneled between the first and second rib ensuring no point of compression was present. The graft was then anastomosed to the right axillary vein and the extra pericardial segment of the superior vena cava. The incisions were then procedurally repaired. The patient had an uneventful hospital recovery course and was discharge in good general condition on day seven. Significant arm reduction was documented over the course of 6 weeks with reduction of forearm circumference from an initial size of 93 cm to the current size of 46cm. This represented a 50.5cm reduction in size. The AV fistula is currently aneurysmal but can be safely used for dialysis and has been successfully cannulated twice since the procedure. The patient's arms arm currently of equal size and he is capable of continuing his daily routine without any hindrance (Figures 4&5).

Figure 4: Before surgery.

Figure 5: After surgery.

Discussion

Subclavian vein catheterization for dialysis access is an independent risk factor for central vein stenosis. Proposed mechanisms include intimal injury with a secondary fibrotic reaction, compression from hematoma or reactive fibroplasia related to intraluminal vibration of the catheter from the cardiac cycle [7]. Patients such as ours with a functioning AV fistula ipsilateral to the subclavian vein stenosis are more susceptible to symptomatic arm swelling [7]. In our first patient, haemodialysis was initiated emergently through a left subclavian catheter, which subsequently occluded. Left internal jugular and right subclavian catheters were then required to maintain AV access. With three separate central catheters required over a period of years, it is not surprising that symptomatic central vein stenosis developed. Clearly, a strategy aimed at early identification of patients at risk for dialysis and subsequent fistula creation is warranted. In addition, our cases highlight the risk of subclavian vein catheterization in the development of symptomatic central vein stenosis. The prevalence of central vein stenosis amongst haemodialysis access patients is estimated to be below 2%, however this increases to nearly 30% with a prior history of central catheterization [8,10]. In our hemodialysis population, subclavian catheterization remains a common modality for long-term hemodialysis access with an incidence of symptomatic central vein stenosis higher than expected. In centres with limited access to endovascular treatment, the initial treatment modality for patients with central vein stenosis is often ligation of the fistula to reduce the arm swelling. Unfortunately, this leaves patients with limited options for hemodialysis. In our institution, patients with symptomatic central vein stenosis have a guarded prognosis with 9 of 11 patients we identified over the last year dying before definitive therapy. This has led to increased interest in the treatment for this group of patients at our institution. Endovascular balloon venoplasty with stenting is a minimally invasive treatment strategy, which can improve patient symptoms. The durability of this approach is unclear with recurrent symptoms common. The patency of surgical bypass was found to be higher than that of endovascular treatment, with patency rates of 75% compared to 63% reported [9]. More modern series using covered stent grafts have challenged the limited patency of endovenous treatment for central vein stenosis. In addition, endovenous treatment requires access to costly equipment and disposables, which may not be readily available in low resource settings. Symptom relief following open surgical bypass is common with 95% of patients achieving symptom improvement in a review by Selvanathan et al [7]. In our dialysis population, patients may not have adequate insurance or be able to afford repeated endovascular interventions. In light of this, our interest in definitive surgical treatment has increased. Lack of adequate size vein and concern about compression of venous conduits has led some authors to advocate for PTFE conduits for central vein reconstruction as demonstrated in our second patient [11]. The cost of prosthetic conduits can be prohibitive, with patients often responsible for this additional cost. In the second patient, the National Hospital Insurance Fund (NHIF) was able to cater for the cost of the PTFE graft thus availing it for the patient who might otherwise have been unable to meet the cost. In addition, risks of prosthetic graft infection are negated by using autogenous vein. Femoral vein conduits are well described, and can be used with minimal morbidity at the harvest site. In our approach, care is taken to preserve the profunda femoris vein and the saphenous vein where possible. In addition, we do not extend our dissection into the popliteal fossa in order to preserve venous collaterals of the popliteal vein. Our first patient recovered well from the femoral vein harvest with no added morbidity. There was no immediate or delayed leg swelling and wound healing was not an issue. In our case, the vein graft was tunneled directly through the chest wall using the second intercostal space. This reduces the chance of graft compression during closure of the chest as one can see when the graft is tunnelled anatomically.

Conclusion

These cases highlight the difficulty in managing hemodialysis patients with symptomatic central vein stenosis. While numerous treatment options exist, our approaches using open surgical bypass with autogenous vein conduits or affordable synthetic grafts present a safe and definitive treatment option. Purported improved patency rates over endovascular treatment and reduced cost as compared to endovascular options are potential benefits of these approaches. In addition, further resources should be aimed at reducing the incidence of central vein stenosis amongst the hemodialysis population.

References

1. Gerald AB, Ingemar D, Steve JS (2021) Central vein obstruction associated with upper extremity hemodialysis access.

2. Korzets A, Chagnac A, Ori Y, Katz M, Zevin D (1991) Subclavian vein stenosis, permanent cardiac pacemakers and the haemodialysed patient. Nephron 58: 103-105.

3. Sticherling C, Chough SP, Baker RL, Wasmer K, Oral H, et al (2001) Prevalence of central venous occlusion in patients with chronic defibrillator leads. Am Heart J 141: 813.

4. Saad TF, Vesely TM (2004) Venous access for patients with chronic kidney disease. J Vasc IntervRadiol 15: 1041.

5. Trerotola S, McLean G, Burke D, Meranze S (1986) Treatment of subclavian venous stenoses by percutaneous transluminal angioplasty. J Vac Interv Radiol 1: 15.

6. Beathard GA (1994) The treatment of vascular access graft dysfunction: a nephrologist's view and experience. Adv Ren Replace Ther 1: 131.

7. Selvanathan KS, Ariffin Azizi Z (2017) Extra-anatomical veno-venous surgical bypass for central vein occlusion in patients with ipsilateral arterio-venous fistula (AVF) for haemodialysis - A single center experience Med J Malaysia. 72: 1-6.

8. Bouffard Y, Bouletreau P, Motin J (1985) Deep venous thrombosis with clinical signs after catheterization of the superior vena cava system. Acta Anaesthesiol Scand Suppl 81: 65-66.

9. Haage P, Vorwerk D, Piroth W, Schuermann K, Guenther RW (1999) Treatment of Hemodialysis-related Central Venous Stenosis or Occlusion: Results of Primary Wallstent Placement and Follow-up in 50 Patients 1. Radiology 212: 175-180.

10. Dammers R, De Haan MW, Planken NR, Van der Sande FM, Tordoir JH (2003) Central vein obstruction in hemodialysis patients: results of radiological and surgical intervention. Eur J Vasc Endovasc Surg 26: 317-21.

11. Anaya-Anaya J, Bellows P, Ismail N, Cheema Z, Naoum J, et al (2011)Surgical Management of Hemodialysis-Related Central Venous Occlusive Disease: A Treatment Algorithm. Annals of Vascular Surgery. 25: 117-129.