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Research Article

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Necklace Graft for Difficult Hemodialysis Access: Two Case Reports from Saudi Arabia

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ABSTRACT

The incidence of renal failure in Saudi Arabia is increasing. Consequently, the number of required vascular access creation is increasing as well. The creation of multiple vascular accesses after thrombosis and the occlusion of the primary access occur frequently; however, the creation of a new access in the presence of central venous occlusion or arterial insufficiency creates a dilemma. Therefore, the creation of a secondary access may become necessary. The present report demonstrated two patients with multiple failed accesses and occluded subclavian vein at one side, and the unsuitable arteries for access on the other side. Both were treated successfully, the first with an axillary-axillary graft using simple PTFE, and the second with three-layer Flexin PTFE grafts. For three years now, both grafts have been functioning effectively for hemodialysis in both patients with no major complications. Axillary artery to axillary vein PTFE bridge graft is an excellent and durable secondary access strategy when primary access at upper limb is not feasible.

Key words: *Arterio-Venous Fistula, Renal Failure, Vascular Access, Necklace, Graft*

INTRODUCTION

The placement of a well-functioning vascular access point is essential for most patients with end stage renal disease (ESRD). [1] Many surgical techniques and different anatomical sites have been used to provide ideal long-term vascular access for patients who require hemodialysis (HD) treatment. Arteriovenous fistula (AVF), arteriovenous graft (AVG), and central venous catheter (CVC) are the three main types of vascular access procedures performed in HD patients. [2] The selection of the ideal site and vessel have been based primarily on the data available from the vessel mapping studies. [2, 3] Most of the guidelines recommended AVF as the first choice as it has fewer access-related complications. [2] This access has been primarily created at the upper limb, and usually placed in the non-dominant limb to minimize any effect on the patients' quality of life and daily activities; however, this procedure has not been suitable for all patients. [2, 3] Frequently, the primary access is complicated with thrombosis, stenosis, total occlusion or central venous occlusion and sometimes arterial insufficiency which necessitates the creation of another access in the form of fistula or central line. Lower limb is another choice for vascular access, but lower extremity access placement has been discouraged in many centers due to the higher risk of infection and lower limb amputation. [3] To avoid this complication, and because of the presence of central venous occlusion or arterial insufficiency, several complex novel sites have been used for difficult accesses. One of which is the axillary-axillary arterio-venous route (necklace graft). [2, 4] This procedure has been mentioned in the literature, and a few international case reports have been published. However, this approach has not been reported previously in Saudi Arabia. [5-7]

Case Presentation:

Case 1

The first case was 58-year-old Saudi woman with diabetes mellitus (DM), hypertension (HTN) and chronic renal failure (CRF) who has been on HD for 10 years. She had multiple upper limb access failures. Peritoneal dialysis was used for a period of time, but failed because of the recurrent peritonitis. Her last successful access was via a left brachiocephalic AVF which failed due to a complication (infected pseudo-aneurysm) at the site of the anastomoses, and required ligation of the brachial artery. She was assessed for right upper limb access, and found to have total occlusion of the right subclavian vein (SCV). The patient refused lower limb access, and no donor for renal transplant was available; however, she was treated successfully with a polytetrafluoroethylene (PTFE) necklace graft of the right axillary artery to the left axillary vein (Fig 1).

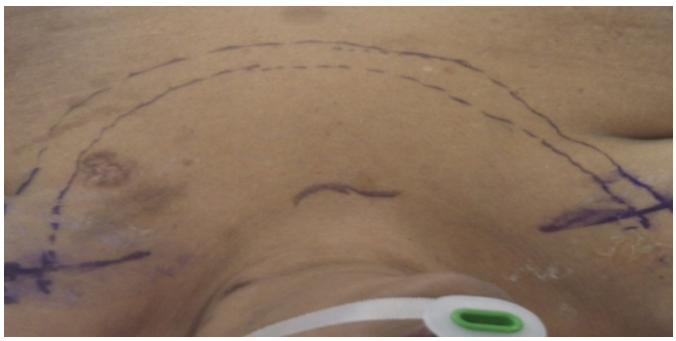

Figure 1. The area of the surgical incision for right axillary artery to left axillary vein; in addition, the area in the graft will be tunneled at subcutaneous tissues below both right and left clavicles, sternal notch and angle.

The surgical approach to the axillar artery and vein was similar to that used for an axillo-bifemoral bypass, with the PTFE graft tunneled through the subcutaneous tissue with a slight downward curve to approximately 5–10 cm below the sternal angle (Fig2, 3)

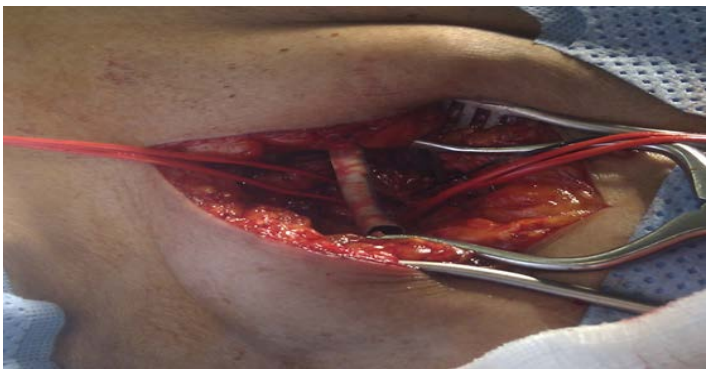

Figure 2. The right surgical wound which shows the right Axillary artery controlled with vascular sling and shows a part of the PTFE graft after tunneling.

Figure 3. The left surgical wound below the left clavicle shows the left Axillary vein with a part of graft already anastomosed with the vein as an end to side.

HD was started 2–3 weeks after the surgery with good flow during dialysis sessions. Three years after the surgery, the patient reported one episode of bleeding due to the multiple punctures at the site of access. This was resolved by applying pressure and did not require any intervention. Another report of a hematoma in the left breast that was secondary to a puncture made at the lower border of the graft subsided spontaneously without the intervention.

Case 2

The second case was a 65-year-old Saudi woman known to have DM, HTN, and CRF who has been on HD for the previous 16 years. The patient referred because of an inefficient left femoral permcath for HD. A venogram through the catheter showed severe subtotal stenosis of the inferior vena cava (IVC). After assessing the patient's upper limbs for potential vascular access points, all routine access sites were exhausted, with occlusion of the right SCV. The usual PTFE grafts were not used because the patient required urgent HD. Therefore, a right axillary artery to left axillary vein grafting was performed with the three-layer Flexin PTFE using a technique similar to the one used to insert the graft in the previously described patient. HD was started after 48 hours using the newly implanted Flexin graft. During the period of two years post-surgery, three incidents of graft thrombosis were recorded, the last of which required refashioning of the venous end transferring the venous anastomosis proximally toward the SCV. One episode of wound infection was treated, and did not affect the graft.

Overall, close follow-up for three years after the insertion showed that both patients had maintained effective successful necklace grafts during HD, with no major complications.

Discussion:

In axillary-axillary arteriovenous access via a necklace graft, the axillary artery was connected with the contralateral axillary vein using a prosthetic graft as a conduit. The axillary vein and artery were exposed through a deep transverse infraclavicular incision to the pectoralis major muscle. [2] The graft was then tunneled in the subcutaneous tissue of the chest with a slight curve below the sternal angle. Both ends of the graft were anastomosed with the artery and vein in a form of end to side anastomosis to establish the flow.

In these two cases, the axillary necklace graft which is a type of secondary access which is used instead of a primary vascular access procedure was considered when no other upper limb option was feasible, and before thigh access could be considered. In other words, axillary-axillary arteriovenous access would be the last upper body option even in case of severe central venous stenosis, obstruction or unilateral upper limb arterial insufficiency. A good three years patency rate was achieved in the two patients as reported. A prospective study conducted by Morsy et al. showed that 18 patients who underwent necklace grafting showed primary patency of 83% and 72.2% at six months and one year; respectively, with five successful surgical revisions performed for graft thrombosis with minimum complications recorded. [8] Another study of the incidence of complications and durability of the grafts showed that the incidence of infection and thrombosis was similar to that associated with the conventional arm AVF procedure. Furthermore, the patency at 3 years was 60%. [9] AV access for HD should be tailored according to the status of the patients' vasculature. Axillary-axillary arteriovenous access has been a reasonable strategy for patients with complex access issues as it carries the lowest risk of complications.

Conclusion:

The placement of a suitable vascular access is essential for chronic HD patients. The axillary artery to axillary vein PTFE bridge graft has been an excellent and durable secondary access strategy. The authors of this paper encourage access surgeons to attempt novel complex access procedures such as axillary-axillary arteriovenous grafting when all the conventional upper extremity access options have been exhausted, and before attempting the lower extremity access.

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