

Management of Pseudo Aneurysm, Post AV Access in Upper Limb: A Retrospective Analysis in a Tertiary Centre

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Abstract

Introduction: Pseudo aneurysms occur due to injury to arterial wall. Due to sustained arterial pressure, blood dissects into the tissues around the damaged artery and forms a perfused sac that communicates with the arterial lumen. The perfused sac contains media or adventitia or simply soft tissue structures surrounding the injured vessel.

Material and Methods: We analysed 32 patients who underwent surgical AVF takedown after formation of pseudo aneurysm at our centre over a period of 3 years between September 2018 to September 2021.

Results: 32 patients (26 males and 6 females) underwent takedown of AVF during this 3 years period. 22 (84.62%) had fistula on their left arm as compared to 4 (15.38%) having fistula on their right arm. 21 (80.76%) were brachiocephalic fistulas while the remaining 5 (19.24%) were radio cephalic. 25 (78.12%) presented as pseudo aneurysms with a risk of impending rupture, while 7 (21.88%) presented with aneurysmal rupture.

14 (43.75%) underwent the procedure under axillary block, 18 (56.25%) were operated under local anaesthesia and minimal sedation. Mean operative time was 75.72 ± 24.27 min. 26 (81.25%) underwent excision of aneurysm with ligation of proximal and distal end of arteries while 6 (18.75%) underwent arterial reconstruction with venous interposition grafting. Mean duration of hospital stay was 3.4 days with a maximum of 7.2 days. 6 of our patients had post op wound infection. All patients had good distal pulsations in the postoperative period.

Conclusion: Pseudo aneurysms pose threat to both limb and life. Planning is necessary for properly managing these patients. Though surgical excision of aneurysm with reconstruction

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of vessel has remained definite treatment for impending and ruptured Pseudo aneurysms, however in our experience most of our patients didn't need reconstruction as collaterals had already formed and no patient had post operative ischemia after proximal and distal ligation of artery along with excision of aneurysmal tissue.

Keywords: AVF arterial venous fistula; OT operation theater; $\mu\text{g}/\text{kg}/\text{h}$ = microgram per kilogram per hour.

INTRODUCTION

Pseudoaneurysms form due to injury in the vessel wall resulting from inflammation, trauma, or iatrogenic causes such as surgical procedures¹, percutaneous biopsy, or drainage. Due to sustained arterial pressure, blood dissects into the tissues around the damaged artery and forms a perfused sac that communicates with the arterial lumen.¹⁻³ The perfused sac contains media or adventitia or simply soft tissue structures surrounding the injured vessel.

Haemodialysis remains the mainstay of treatment for patients with chronic renal failure due to the small number of available kidney donors.⁴ To gain access for haemodialysis, many of these patients undergo creation of an arteriovenous fistula (AVF). Repeated punctures for vascular access can lead to pseudoaneurysm formation in such fistulas. These aneurysms and pseudoaneurysms are at risk of impending rupture when they enlarge too much.⁵ Rupture and eventual bleeding is also common in such patients and such patients usually present as a surgical emergency. Therefore, takedown of a surgically created AVF becomes a procedure as important as the creation of the AVF. We present our experience with surgical takedown of such AVF.

MATERIAL AND METHODS

We analysed 32 patients who underwent AVF take down at our centre over a period of 3 years between September 2018 to September 2021. We assessed the profile of the patients with respect to their age, sex, time interval between fistula creation and excision. We could not do a pre-operative ultrasonography in all patients as some of them presented as an emergency. These patients underwent surgery and were analyzed with various parameters related to surgery such as duration of surgery, postoperative complications, and discharge status.

Surgery

For patients who presented to us with bleeding, we tied a tourniquet around the proximal arm to control bleeding and then patients were shifted to OT. Patients underwent surgery under local anesthesia with sedation or under axillary block. The agent used at our center for sedation was fentanyl bolus (0.05–2 µg/kg) with dexmedetomidine infusion (0.2–0.7 µg/kg/h) and for local anesthesia,

we used a combination of bupivacaine diluted to 0.125–0.25% (2–3 mg/kg) and lignocaine 1% (5 mg/kg). The same local anesthetic agents were used to administer axillary block as well. For brachiocephalic fistulas, we gained control over the brachial artery by looping it through a separate incision in the mid arm. Once that control was achieved, we incised at the fistula site. For distal or radiocephalic fistulas, we took control at the elbow over the brachial artery by looping it. Then we proceeded to the dissection of the fistula. In case we encountered any bleeding during dissection, we would tighten the loop or clamp the proximal artery with a bulldog anastomotic clamp. Once the fistula site was well delineated, we would clamp the artery proximally and distally. We checked for peripheral perfusion at the fingers on the affected site through pulse oximetry and hand held Doppler. If saturation was maintained at the peripheries then we ligate the aneurysm and under run the aneurysm at the anastomotic site. The remnant of the aneurysmal sac would be excised and sent for histopathology. In cases where adequate perfusion could not be maintained at the peripheries or simple under running was not possible, after excision of the aneurysm, we had to do an end-to-end anastomosis of the artery through a venous graft interposition to maintain arterial continuity and ensure distal pulsations and adequate perfusion through the artery. Any areas of necrotic skin were also excised. Haemostasis was achieved and skin was sutured with interrupted non-absorbable sutures.

RESULTS

A total of 32 patients underwent takedown of their AVF during this 3 years period. There were 26 males and 6 female patients ranging in age from 25 to 67 years with a mean age of 48.31 ± 13.41 years for males and 39.04 ± 6.11 years for females respectively [$p = 0.1105$]. 22 out of 26 (84.62%) patients had the fistula on their left arm as compared to 4 out of 26 (15.38%) had fistula on their right arm. 21 out of 26 (80.76%) were brachiocephalic fistulas while the remaining 5 out of 26 (19.24%) were radio cephalic fistulas. We found that these fistulas had been created around 6 to 40 months ago with a mean age of 23.13 ± 8.74 months. 25 out of 32 (78.12%) patients with fistulas presented as pseudoaneurysms with a risk of impending rupture, and these were created around 12 to 38 months with a mean of 25.24 ± 8.25 months. 7 out of 32 (21.88%) patients with fistulas presented to us with aneurysmal rupture, had been created around 6 to 40 months ago with a mean of

24.86 ±12.43 months.

14 out of 32 patients (43.75%) underwent the procedure under axillary block while 18 out of 32 patients (56.25%) we reoperated under local anaesthesia and minimal sedation. Mean operative time was 75.72 ± 24.27 min. 26 out of 32 (81.25%) patients underwent excision of aneurysm with ligation of proximal and distal end of arteries while 6 out of 32 (18.75%) patients underwent arterial reconstruction with venous interposition grafting done to maintain arterial continuity. Mean duration of stay in the hospital was 3.4 days with a maximum stay of 7.2 days. 6 of our patients had wound infection as a complication. All patients had good distal pulsations in the postoperative period and were successfully discharged. They were called for follow-up and underwent creation of fistula at a later date. On follow up (1 month - 3 years), all patients were found to have good distal pulsations without any recurrence of an aneurysm.

DISCUSSION

Haemodialysis is the treatment followed nowadays in chronic renal failure patients. For vascular access, these patients undergo creation of an AVF usually at the wrist, i.e. the radiocephalic fistula, or at the elbow, i.e. the brachiocephalic fistula. Such fistulas are associated with their own complications such as aneurysm formation or pseudoaneurysm formation. Usually the venous side of the fistula becomes aneurysmal. The definitive cause of such aneurysms is unknown. A true aneurysm is a vascular dilatation containing all its wall layers intact. Conversely, a pseudoaneurysm is a dilatation with disruption of one or more layers of its wall. A pseudoaneurysm wall typically contains neointima and fibrous tissue and sometimes is lined with thrombus. Repeated punctures for vascular access can lead to thinning of the walls of such aneurysms and may lead to their rupture.^{6,7} Color Doppler ultrasonography is helpful in confirming the diagnosis and choosing the appropriate surgical approach. Other investigations that are of help are magnetic resonance angiography or fistulography with concomitant upper limb angiography. Treatment modalities include manual ligation and compression, endovascular graft implantation, embolization, thrombin injection under ultra sonographic guidance and surgical reconstruction. Traditionally, the treatment of focal venous aneurysms involves resection of the aneurysmal dilatation with or without interposition bypass grafting. Resection with reestablishment of

venous continuity with end-to-end anastomosis has also been performed. Karabay *et al.*⁵ described excision of the aneurysm and the communicating veins with restoration of the arterial patency. Moini *et al.*⁶ described a new technique, after ligation of the AVF, two ends of the aneurysm were cut and released for drainage of the aneurysm. Then the incision was closed in layers. However, these two procedures leave the patient without a functional fistula. Therefore, various conservative techniques have been proposed for the correction of a venous aneurysm. Lo and Tan⁷ and Okten *et al.*⁸ suggested simple plication of the vessel using a running suture. Pierce *et al.*⁹ proposed the use of a surgical stapler to reshape the venous aneurysm. At our centre, we have excised the venous aneurysms and aimed at maintaining arterial continuity. Patients who come to us for fistula creation and dialysis are from a poor socio-economic background and often do not follow up regularly. We have also encountered patients who present with rupture of the fistula and severe bleeding. Due to logistical difficulties, such patients do not reach the hospital on time. Hence, we have formulated such a policy to not try and conserve the fistula. However, all patients get a new access for immediate hemodialysis and are appointed for a new fistula creation on the other arm at the earliest.

CONCLUSION

Pseudoaneurysms pose threat to both limb and life. Planning is necessary for properly managing these patients. Though surgical excision of aneurysm with reconstruction of vessel has remained definite treatment for impending and ruptured Pseudoaneurysms, however in our experience most of our patients didn't need reconstruction as collaterals had already formed and no patient had post operative ischemia after proximal and distal ligation of artery along with excision of aneurysmal tissue.

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