ORIGINAL ARTICLE

POSTERIOR ANEURYSMORRHAPHY & LATERALIZATION OF ANEURYSMAL FISTULA VEIN: A MODIFICATION OF EXISTING ANEURYSMECTOMY TECHNIQUES

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Background: To present a new modification of aneurysmectomy technique for the management of aneurysmal fistula vein. This cross-sectional study was carried out at Vascular Surgery department, Combined Military Hospital Rawalpindi from 1st October 2014 to 30th December 2018. **Methods:** This modified aneurysmectomy procedure was performed in 20 patients. Massive diffuse venous dilatation of vein, necrosis of overlying skin, reduction in the cannulation area and pain were the indications of surgery. Revision was performed by rotating the mobilized vein to 180°, excising redundant vein, reducing diameter, repairing venotomy posteriorly and placing the vein in a mobilized skin flap over the fascia of biceps muscle away from skin suture line, to facilitate subsequent cannulation and post puncture haemostasis. The rationale of this modification was to prevent damage to the usual anteriorly placed suture line during needle insertion for haemodialysis. The data were analysed by using SPSS version 25.0. **Results:** The mean age of patients was 45.45±14.75 years with a range of 12–65 years. Sixteen patients (80.0%) were having brachiocephalic fistula while 4 patients (20.0%) had radio cephalic fistula. The mean time of reuse of AVF after vein Aneurysmectomy was 24.55±5.3 days with half of the patients having reuse of AVF after 3 weeks. Three (15%) patients developed hematoma while 2 (10%) patients developed skin necrosis. Fifteen (75%) patients had no surgery related complications after procedure. **Conclusion:** Posterior suturing and lateralization of aneurysmal vein under mobilized skin flap is a safe, effective and easy to learn modification of aneurysmectomy procedure for the management of aneurysmal dilatation of fistula vein.

Keywords: Aneurysmectomy; Fistula vein; Skin Flap

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INTRODUCTION

End-stage renal disease (ESRD) is a global public health issue with significant rise in number of the patient's requiring haemodialysis during past few decades. Kidney Disease Outcome Quality Initiative (KDOQI) guidelines recommend autologous radio cephalic or brachiocephalic arterio venous fistula (AVF) as primary method of choice in haemodialysis patients, due to its superiority over artificial grafts and central venous catheters in terms of easier handling, longer patency, lesser complications and cost effectiveness.[1,2]

AVF has its own peculiar complications and one of them is aneurysmal dilatation of fistula vein. It occurs in 5–7% patients, as a result of either pre stenotic dilatation caused by increased pressure or post stenotic dilatation secondary to turbulence of flow.[3] Venous hypertension in the fistula vein in the absence of any stenosis is another cause of aneurysmal dilatation.[4] Woo *et al* identified immunosuppression as another cause of aneurysmal dilatation in renal transplant patients.[5] As a result of this dilatation the vein becomes tortuous, difficult for cannulation during dialysis due to multiple folds, and predisposes the overlying skin to necrosis and infection.

Various surgical, endovascular and hybrid techniques have been adopted and published by the surgeons to manage the aneurysmal vein including conservative aneurysmorrhaphy[6], partial aneurysmectomy[7], long segment plication[8], staple aneurysmorrhaphy[9] and sleeve fistulectomy[10]. Each technique has its pros and cons. To avoid the issues associated with these different techniques we have proposed a modified technique which does not require specialized equipment, easy to perform, versatile, cost effective and can be tailored according to per operative findings. In this modified aneurysmectomy technique, we excise the redundant aneurysmal vein on its posterior aspect and place it under a mobilized lateral flap of healthy skin. It makes the cannulation early and easy post operatively, without additional risks of complications.

The rationale of conducting this study was to introduce a new modification of aneurysmectomy technique for aneurysmal dilatation of fistula vein which would help in ease of cannulation, reduction of compilations by avoiding damage to classical anterior suture line and effective post puncture haemostasis.

MATERIAL AND METHODS

This cross-sectional study was carried out at the Department of Vascular Surgery, Combined Military Hospital Rawalpindi after ethical review committee approval. The study was conducted from 1st October 2014 to 30th December 2018 with prior voluntary informed consent from the patients. The sample size was calculated using the WHO sample size calculator by using confidence interval of 90%, absolute precision required of 0.10 and anticipated population proportion of 7.1% (frequency of hematoma). The sample size came out to be 18 patients.[11] We included a total of 20 patients in our study by using the consecutive non-probability sampling technique.

The sample inclusion criteria included patients of both gender and any age presenting with aneurysmal dilatation of native radiocephalic, brachiocephalic or brachiobasilic fistula vein. The patients with pseudoaneurysms of fistula vein or aneurysms of the feeding artery were excluded from the study. The indications for surgical intervention were massive diffuse venous dilatation of vein, necrosis of overlying skin, reduction in the cannulation area, pain, low venous flow secondary to aneurysm-related stenosis, or high venous flow (>1.5 litters/m) due to multiple aneurysms.

All the patients of aneurysmal fistula vein underwent duplex scan of the AVF and central veins for pre-operative planning of the corrective surgery. Special note was made of any associated stenotic segment or kink. Except children every patient was operated under ultrasound guided brachial plexus block. Children were operated under general anaesthesia. Whole length of the vein was exposed using a longitudinal incision. Vein was dissected all around and slinged. It usually resulted in quite an elongated vein after removing its kinks and curves.

Intravenous injection heparin 80 IU/kg was given to every patient before clamping. After 3 minutes of Heparin injection, clamps were applied on proximal and distal parts of the vein. Both the clamps were rotated at 180° to bring the posterior surface of the vein in front. Longitudinal incision was made in the vein to lay it open. Thrombi and fibrin were removed from the lumen and intimal surface was thoroughly washed with normal saline.

To calibrate the vein size, a 24Fr Foley's catheter (external diameter approximately 8 mm) was placed inside the vein. The redundant wall of the vein was excised longitudinally. Proline 6/0 was used to close the vein over the catheter. When 1.5 cm of the suturing was left, the Foleys catheter was removed. Proximal and distal clamps were also removed after completion of suture line repair. Unclamping automatically brought the posterior surface back to its original position along with suture line. A lateral skin flap over fascia of biceps muscle is raised to accommodate the extra length of refashioned vein.

The vein is placed under raised flap, in a gentle curve, facilitating ease of cannulation during haemodialysis. Thinned out redundant skin was excised. Redivac drain was placed under the skin flap. Skin wounds primarily closed with proline 3/0 in interrupted fashion. In the cases where vein had more than one aneurysmal part or stenotic segment, we took some additional measures. The aneurysm and stenotic segments were resected and the vein was re-sutured with proline 6/0 at right angle to the longitudinal posterior slit. If there was shortening of the vein length due to resection of aneurysm and stenotic segment, medial skin flap was raised and the vein was placed under it.

The haemodialysis needs in the post-operative period till the reuse of fistula vein were fulfilled through temporary dialysis catheter. Patient was followed up in out-patient department for wound and fistula vein patency through clinical examination and office-based ultrasound of fistula vein. Decision of reuse of AVF was based on skin wound healing and fistula flow >600 ml/min in fistula vein.

Demographic details like gender and age of all patients were included in the study. All the data were collected on a pre-designed proforma. Data were entered in and analysed by using SPSS version 25.0. Mean and standard deviation were calculated for quantitative variables including age and mean time of reuse of AVF. Frequencies and percentages were computed for qualitative variables like gender, type of AVF, type of venous anomaly, and complications. Chi-square test was applied after data stratification in terms of age, gender, type of AVF, and type of venous anomaly taking p value of ≤ 0.05 as statistically significant.

RESULTS

A total of 20 patients were included in the study. The mean age of patients included in the study was 45.45±14.75 years with a range of 12–65 years. The mean age of male patients was 47.09±14.03 years while for female patients it was 43.44±16.2 years. There was a slight male gender predominance with 55% (11 patients) being males while 45% (9 patients) were females. Sixteen patients (80.0%) were having brachiocephalic fistula while 4 patients (20.0%) were having radiocephalic fistula. The distribution of

patients according to venous anomaly is given in Table-1. The mean time of reuse of AVF after vein Aneurysmectomy was found to be 24.55±5.3 days with half of the patients having reuse of AVF after 3 weeks. One patient (5%) died on the 14th postoperative day, a 12-year-old boy who passed away while he was under care of nephrology unit. His death was not related to surgical intervention. The frequency of different complications is shown in pie chart below. Data stratification was done for age, gender, type of AVF and type of venous anomaly to determine the frequency of hematoma and skin necrosis shown in Table-2 and 3 respectively.

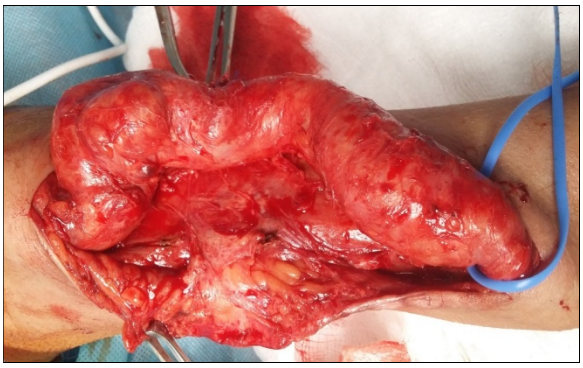

Figure-1: Aneurysmal AVF vein

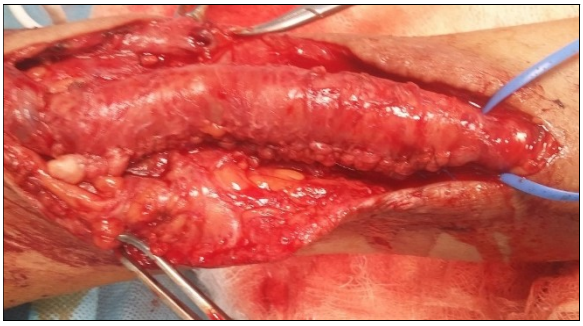

Figure-2: Medial plication of the vein

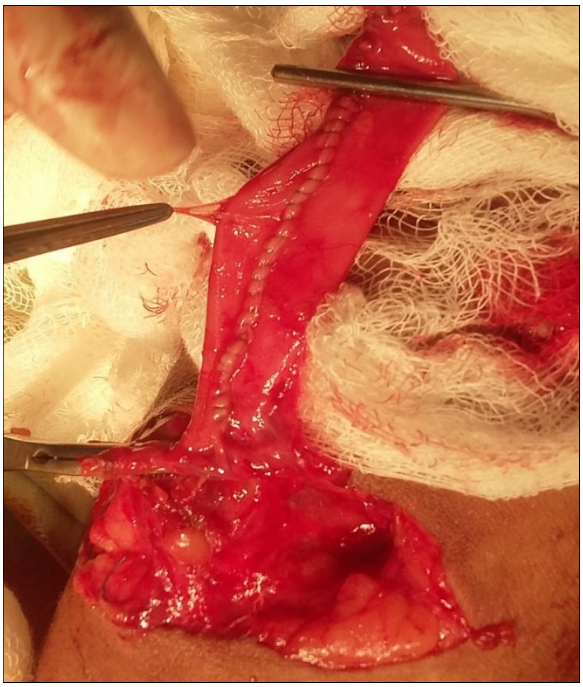

Figure-3: Posterior aneurysmorrhaphy of AVF vein

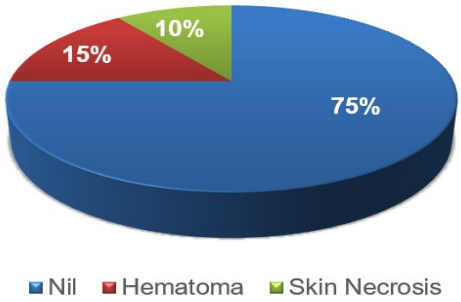

Figure-4: Complications after Vein Aneurysmectomy

Table-1: Distribution of patients according to venous anomaly

Venous Anomaly	Frequency	Percentage
Aneurysmal vein	14	70.0%
Aneurysmal tortuous vein	5	25.0%
Two Aneurysms	1	5.0%
Total	20	100.0%

Table 2: Stratification of frequency of hematoma

Variable	Variable Groups	Hematoma		p value
		Yes	No	
Age Groups	Less than 35 years	1	4	**0.718**
	More than 35 years	2	13	
Gender	Male	2	9	**0.660**
	Female	1	8	
Type of AVF	Brachiocephalic	3	13	**0.348**
	Radiocephalic	0	4	
Venous Anomaly	Aneurysmal vein	1	13	**0.192**
	Aneurysmal tortuous vein	2	3	
	Two Aneurysms	0	1	

Table 3: Stratification of frequency of Skin Necrosis

Variable	Variable Groups	Skin Necrosis		p value
		Yes	No	
Age Groups	Less than 35 years	0	5	**0.389**
	More than 35 years	2	13	
Gender	Male	0	11	**0.099**
	Female	2	7	
Type of AVF	Brachiocephalic	2	14	**0.456**
	Radiocephalic	0	4	
Venous Anomaly	Aneurysmal vein	1	13	**0.672**
	Aneurysmal tortuous vein	1	4	
	Two Aneurysms	0	1	

DISCUSSION

Aneurysmal dilatation of vein is not an infrequent complication of native AVF. It has an incidence of >30% in some studies.[12] Consequences of aneurysmal dilatation in AVF includes skin necrosis, infection, post dialysis poor haemostasis, thrombosis, pain, difficult cannulation due to tortuosity and cosmetic concerns. In addition to that, pain and pressure symptoms can make life miserable in these patients. Due to these reasons, the NKFDOQI guidelines recommend that the aneurysmal segment should not be cannulated and there should be some corrective intervention for the aneurysmal fistula vein[1]. There are many surgical, endovascular and hybrid techniques described in the literature with their pro and cons to correct the aneurysmal vein.[13]

Historically, the most common revision procedure was resection of venous aneurysms with interposition grafts (vein or synthetic).[14] If the synthetic graft is used for revision, it converts the fistula into AVG, with its own demerits in terms of higher risk of infection, lesser patency and lower cost affectivity in comparison to AVF.[15] To avoid the need of graft, Lo *et al* suggested simple plication of the aneurysmal vein using a continuous suture.[16] But they did not cater for the placement of suture line on posterior aspect of the vein, neither had they made the vein lateralized or medialised under the fresh skin flap, as is done in our technique.

In the technique proposed by Nezakatago *et al*[17], the vein is transacted near the arterial anastomosis, plicated, tunnelled medially and re-anastomosed to previous site. This makes the procedure prolonged and more complicated. First, they plicated the vein, then rotated it to place the suture line on posterior aspect, which predisposed the vein for twisting. However, in our technique, the posterior wall of the vein is opened and plicated, so there is no chance of twisting of vein. Another major difference between our techniques is, tunnelling of plicated vein before anastomosis done by Nezakatago *et al*. Tunnelling also predisposes the vein to unseen kinks and bends. Furthermore, if haemorrhage occurs from the plication line in the tunnel after the anastomosis, they have to take down the anastomosis, to bring the vein back in surgical field out of tunnel, for haemostasis, re tunnel the vein and re anastomosis. While in our technique, we just have to open the skin sutures to address the problem in such scenario. Though hematoma observed in our study was in 3 cases (15%), but none required surgical exploration.

Woo *et al*[5] proposed a technique of aneurysmectomy, lateral suturing of vein and fresh tunnelling. This technique is different from our technique in terms of suture line placement and tunnelling. In case of haemorrhage, the tunnelling has similar disadvantages as described for Nezakatago *et al* technique.

Al Musawi *et al* presented their experience of hybrid technique of sleeve fistulectomy using combination of open surgical, laparoscopic and endovascular instruments and techniques to correct the aneurysmal vein in 5 patients. One of their patients developed hematoma as also shown in our study. Another patient developed pseudo aneurysm. In comparison to our technique, it requires specialized instruments, which render its learning curve more prolonged and makes it a costly option for the patients in third world countries.[10]

CONCLUSION

Aneurysmectomy with posterior suture line and lateralization of vein under mobilized skin flap for the management of aneurysmal fistula vein is a new and easy to learn modification of existing aneurysmectomy techniques, with very short learning curve, acceptable complication rate and ease of cannulation for patient and healthcare workers during dialysis.

AUTHORS' CONTRIBUTION

NI: Literature search, concept. HK: Data collection, write-up. WA: Data collection. KA: Proof reading, write-up. FH: Data analysis. AS: Write-up. RAK: Data analysis. PS: Write-up.

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