

Surgical Management and Outcome of Juxta-Anastomotic Aneurysms of Native Arteriovenous Fistulae in Patients on Haemodialysis for Chronic Renal Failure

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Abstract

Aim: To study the outcome and therapeutic validity of surgical management of juxta-anastomotic aneurysms in native arterio-venous fistulae in chronic kidney disease patients on hemodialysis. **Material and Methods:** We included fifty patients of Chronic kidney disease who were on maintenance haemodialysis in the Department of Nephrology and had developed arteriovenous aneurysmal swellings during the course of repeated vessel puncture and cannulations. The morpho-volumetric quantification of the aneurysms and blood flow pattern studies were made. After proper medical optimization, patients were taken up for surgical exploration of the aneurysmal fistulae. **Results:** The group included 22 males and 28 females with a mean age of 47 (+/-7) years. The mean period of aneurysm formation was 22 (+/-8) months. The mean size of the aneurysmal sac was 42 (+/-7) mm in the largest dimension. The true venous aneurysms included 34 while as 3 were arterial. Remaining 13 were mixed type. The mean operating time was 88 (+/-17) minutes. The mean post operative stay was two days. There was no hospital mortality. **Conclusion:** Un-natural anatomical vascular alterations inflicted during arteriovenous fistula creation have unpredictable healing and adaptation behaviour. Aneurysms are among the late unwanted complications. This poses great threat to patients limb and life both. Timely evaluation and liberal surgical address alleviates these risks and additionally provides a long lasting vascular access pathway with low complication and high patency rates.

Keywords: Chronic Renal Failure (CVF); Vascular access; Native arteriovenous fistula; Aneurysm; Reconstruction

Introduction

A good functional vascular access is a mainstay to perform a repeated and efficient hemodialysis in kidney disease patients. There are three main types of vascular access: An autogenous arteriovenous fistula, prosthetic arteriovenous graft, and a central venous based catheter. Arteriovenous fistula first described by Brescia and Cimino, remains the first choice for chronic hemodialysis^[1].

Native or autogenous arteriovenous fistula is considered the best form of vascular access for hemodialysis, delivering superior patency and durability with relatively lower morbidity, hospitalization and expenses as compared to prosthetic grafts and indwelling hemodialysis catheters^[2].

However native arteriovenous fistula are not free from complications. ^[3]The most frequent complications seen are thrombosis, aneurysm formation, anastomotic stenosis, arterial steal syndrome, distal limb ischemia, infection, dermal necrosis, wound site haematoma, venous hypertension and limb odema. Among these, aneurysmal dilatation of arteriovenous fistulae represents a challenging complication with serious morbidity and mortality.

Considering a wide spectrum of morbidity and mortality due

to vessel aneurysms, it is imperative to anticipate, diagnose and manage this complication efficiently. Therefore, an early diagnosis and appropriate treatment is essential to improve the quality of life in these patients with life consuming diseases^[4,5].

The most frequent late complication of arteriovenous fistulas is aneurysm formation, which carries the risk of spontaneous rupture and torrential haemorrhage. ^[6]These aneurysms present as both painless and painful swellings, infection, skin necrosis, bleeding and limb ischemia. This complication can be dealt with by several operative techniques such as ligation and resection, placement of stent and perivascular metal meshes. Open surgical resection and reconstruction has been validated as a durable modality of treatment.

We employed regional operative exploration under local and regional anaesthesia to reconstruct the aneurysmal fistulae. We studied and analysed the operative outcome in terms of

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fistula and limb salvage, durability of AV fistulae for long term maintenance haemodialysis and long term patency rates.

Material and Methods

We included fifty patients of Chronic kidney disease who were on maintenance haemodialysis in the Department of Nephrology and had developed arteriovenousaneurysmal swellings during the course of repeated vessel puncture and cannulations. All the patients had undergone multiple sessions of hemodialysis through the native AV fistulae before the development of aneurysms. The affected extremities were examined clinically as well as by Colour Doppler Ultrasonography. The morphovolumetric quantification of the aneurysms and blood flow pattern studies were made. After proper medical optimization, patients were taken up for surgical exploration of the aneurysmal fistulae.

We used locoregional anaesthetic infiltration as well as brachial block, depending upon the size and extent of aneurysm and the patient demand.

The operative technique involved exploration of the fistula site through the previous scar/wound and a separate incision in cases of dermal necrosis. 44 (88%) patients were operated in elective setting., 4(8%) in semi-elective whereas 2 (4%) patients were explored on emergency basis. A meticulous dissection was carried out to expose the fistulae and reveal anastomosis and aneurysmal sac. Systemic heparin was given in all patients to prevent thrombosis due to clamping during aneurysmectomy and anastomotic repair.

Depending upon the severity of the aneurysm formation and extent of the vessels involved, various procedures undertaken were aneurysmectomy with primary repair, excision of aneurysmal vein with takedown of fistula and reconstruction in another limb, segmental resection and interposition vein graft reconstructions. All these patients were kept under close observation for few days before final assessment and discharge.

Results

The group included 22 males and 28 females within the age range of 28 to 76 years with a mean age of 47 (+/-7) years. The mean period of aneurysm formation was 22(+/-8) months with a range of 14 to 34 months. The anatomical distribution was 39 brachiocephalic and 11 radiocephalic based fistulae. Out of 39 brachiocephalic fistulae, 25 were true venous aneurysms, 3 were true arterial and remaining 11 were mixed type. Of the radiocephalic fistula group 5 were pure venous, 4 pure arterial and 2 were mixed type. The mean size of the aneurysmal sac was 42 (+/-7) mm in the largest dimension with a range of 35 mm to 55 mm. 11 patients had associated dermal necrosis and wound sepsis while 6 patients had leaking aneurysms with normal distal flow. 44 (88%) patients were operated in elective setting whereas 6 (12%) patients were explored on emergency basis.

The operating time ranged from 40-110 minutes with a mean of 82 (+/-17) minutes. Using 30x30 cm gauze for mopping and visual analogue scale for estimation of blood loss,the intraoperative blood loss ranged from 50–140 ml with a mean of (85+/-10) ml. (Table 1). Aneurysmectomy and primary reconstruction was done in 21 pure venous and 2 pure arterial aneurysms ,

Table 1: Profile, presentation and management of patients studied.

Gender Distribution (n=50)	Males		Females	
	22(44%)	Range	Mean	
Age (years)	28-76	47 (+/- 7)		
Time of aneurysm formation (month)	14-34	22 (+/- 8)		
Aneurysmal sac size (mm)	35-55	42 (+/- 7)		
Anatomical distribution (n=50)	Brachiocephalic	Radiocephalic		
	39 (78%)	11 (22%)		
Aneurysmal type	Venous	Arterial	Mixed	
	30 (60%)	7 (14%)	13 (26%)	
a. Brachiocephalic	25(64%)	3(8%)	11(28%)	
b. Radiocephalic	5(46%)	4(36%)	2(18%)	
Clinical Presentation	Intact	Leaking		
	44(88%)	6(12%)		
Operation	Elective	Emergency		
	44 (88%)	12 (24%)		
	Range	Mean		
Per-operative blood loss (ml)	50-140	55(+/-10)		
Post-operative stay (days)	4-11	6(+/-1)		
Operating time (minutes)	40-110	82(+/- 17)		

aneurysmectomy with interposition graft fistula was done in 9 pure venous and 5 pure arterial fistulae. In 13 mixed type, the fistulae were taken down,veins ligated and artery reconstructed by primary repair or interposition vein graft.

The post operative stay ranged from 3–11 days with a mean of 6(+/-1) days. There was no hospital mortality.

No thrombosis or distal ischemia was noted in early postoperative period. Two patients had bleeding in the early postoperative period requiring re-exploration, takedown of fistula and artery ligation. All patients were given haemodialysis through femoral route for two weeks till the native fistula was again ready for use.

Discussion

Aneurysm formation is one of the late complications of the arteriovenous fistulae for hemodialysis, with a reported incidence of 5% to 6%. These are generally a mixture of true and pseudoaneurysms and occur as a result of puncture techniques used. [6]Repeated and failed cannulation attempts inflict vessel trauma and trigger diverse pathological responses, resulting in vessel distortion and aneurysm dilatations. [7]Risk factors for vascular access aneurysmal formation are diverse. These are more frequently seen in patients with adult polycystic kidney disease than other renal pathological entities.

Vascular dysfunction may arise within the feeding artery or draining vein and has been attributed to factors such as patients age, complication status of diabetes, associated hypertensive vessel diseases, uremia, tobacco use, and inflammation. [8] Anastomosisrelated problems are considered mainly to be due to surgical techniques employed. increased blood flow, increased vessel wall shear traction and stress and turbulence and generalised immunosuppression nutritional debilitation may accelerate the aneurysmal formation process. [9,10]The majority of aneurysms present with an obvious pulsatile swelling, thinning and ulceration of the overlying skin.

The rate of AV fistula aneurysmal formation is high with a significant rate of morbidity and mortality if left untreated. Therefore, timely and appropriate evaluation and surgical intervention are crucial^[10].

Autologous surgical reconstruction is feasible in the majority of AV Fistula aneurysms. It preserves fistula function with low complication and high patency rates^[8,10].

Conclusion

Un-natural anatomical vascular alterations inflicted during arteriovenous fistula creation have unpredictable healing and adaptation behaviour. Whereas as some shunts behave benign as expected, serving as the desired durable access for long term maintenance hemodialysis, others go unpredictably wrong. These may manifest as many complications warranting interventions. Aneurysms are among the late unwanted complications. This poses great threat to patients limb and life both. Timely evaluation and liberal surgical address alleviates these risks and additionally provides a long lasting vascular access pathway with low complication and high patency rates.

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