Abstract

**Introduction:** The use of prosthetic arterio-venous grafts (AVGs) is necessary in patients where all autogenous vein options are exhausted. This study assesses the results of PTFE patch plasty at the venous end of the access anastomosis.

**Materials and Methods:** This is a prospective observational single centre study in a tertiary care centre for all patients with prosthetic AV graft venous anastomotic site stenosis between 2012 and 2015.

**Results:** There were 40 patients in the study period. Presenting symptoms were primarily inadequate dialysis from AVG due to thrombosed graft within 14 days duration. The average age was 58.2 years and 70% were male. They underwent thrombectomy and PTFE patch closure at the venous anastomotic site due to AVG graft thrombosis in upper extremity. 38.4% patients had both hypertension, Type II DM while 38.4% patients suffered from triad of hypertension, Type II DM and Hyperlipidemia. Criteria of success was based on immediate post operative bruit and next day heparin free hemodialysis from AVG Graft. 37 patients who underwent the procedure had primary patency rate of 91.89% at 3 months and 59.45% at 6 months. Mean follow-up time was 8 months with average hospital stay of 3 days without post-operative complications.

**Conclusion:** Treatment of AVG thrombosis should be performed urgently. There is no standard approach for AVG graft thrombosis and surgical management must be individualized for each case. As the commonest cause of graft occlusion is at the venous anastomotic site, hence AVG graft thrombectomy with eptfe patch closure can achieve better result compared to thrombectomy with primary closure or stent placement.

**Key Words:** Arteriovenous graft patch plasty, arteriovenous graft salvage, venous anastomotic site stenosis

Introduction

After the introduction of the “fistula first,”[1] autogenous arteriovenous (AV) fistulae are considered primary access for hemodialysis.[2,3] However, the created AV fistulae may fail because of inadequate maturation, poor caliber vessels, and exhaustion of superficial veins after long-term hemodialysis.[4] In those cases, the use of prosthetic AV grafts (AVGs) is mandatory even if these access modalities are associated with greater morbidity and inferior primary and secondary patency rates compared to native AV fistulae.[5]

Stenosis occurred most commonly at the graft venous anastomotic site (50% at 1 year and 67% at 2 years after implantation).[6] Complications are mainly due compliance mismatch between graft wall and vein wall;[4,7] flow disturbance[8,9] and vein wall vibration[10] at vein graft anastomosis are retained as the main causes of neointimal hyperplasia development at that site.

This is a novel study to assess the results of polytetrafluoroethylene (PTFE) patch closure near or on venous anastomotic site of AVG thrombosis associated with venous anastomotic stenosis/occlusion.

**Materials and Methods**

This is a prospective, observational, single-center study in a tertiary care center. Forty patients who suffered with prosthetic AVG venous anastomotic site stenosis between 2012 and 2015 at M. S. Ramaiah Medical College, Bengaluru, were included in the study. All patients were selected based on confirmatory diagnosis by ultrasound duplex to confirm AVG thrombosis/anastomotic site stenosis/occlusion.

Presented symptoms were primarily inadequate dialysis from AVG due to thrombosed graft within 14 days duration.
Forty patients (average age: 58.2, 70% male) underwent thrombectomy and PTFE patch closure at the venous anastomotic site due to AVG thrombosis in the upper extremity.

About 38.4% patients had both hypertension and Type II diabetes mellitus (DM) while 38.4% patients suffered from triad of hypertension, Type II DM, and hyperlipidemia.

Criteria of success were based on immediate postoperative bruit and the next day heparin-free hemodialysis from AVG.

Under local anesthesia, incision was performed at the earlier venous anastomotic site. Venotomy was made at the toes of the earlier anastomotic site after taking control over vein and graft. Around the anastomotic site, neointimal hyperplasia with thrombosis was noted, so proximal and distal thrombectomies were done. Central venous patency was checked through intraoperative angiography. Venotomy was closed with PTFE patch to increase patency of anastomotic site [Figure 1]. Postoperatively, the patient received sulbactam/cefoperazone combination with teicoplanin as an antibiotic prophylaxis for 5 days. Patients were advised to take antiplatelets in renal dose for 3 months.

Recurrence of symptoms was deemed as clinical failure, and the patients were planned for AVG at other sites.

Results

A total of forty patients with AVG venous anastomotic site stenosis requiring intervention were considered. Majority of the patients belonged to age group between 51 and 60 years (42.5%), with mean age of 58.2 ± 5.87 years.

Predominantly, male (70%) population was involved. In patients who underwent access salvage, 61.5% of the patients had failing access while 26.9% had no flow or thrombosed AVG. About 78.2% of patients had organized plaque on thrombectomy while the rest had fresh clots.

Three patients had long segment occlusion of a vein due to proximal narrowing and venous adhesions making it difficult to gain control over vein and graft; hence, procedure could not be performed. No procedure-related complications were noted in the study.

Thirty-seven patients who underwent the procedure had primary patency rate of 91.89% at 3 months and 59.45% at 6 months. Mean follow-up time was 8 months, with an average hospital stay of 3 days without postoperative complications.

Discussion

PTFE is the primary graft material used for AVGs in chronic hemodialysis, but these AVGs are prone to failure by stenosis and occlusion due to intimal hyperplasia associated with distal graft turbulence. The normal blood flow in native arteries is spiral laminar flow. Standard vascular grafts do not produce spiral laminar flow at the distal anastomosis, hence prone for thrombosis.

The National Kidney Foundation-Kidney Disease Outcomes Quality Initiative Guidelines recommend that the re-permeabilization of thrombosed AVGs for hemodialysis must achieve positive results in 40% at 3 months if it is performed by endovascular technique or 50% at 6 months and 40% at 1 year if it is performed by surgical procedure.

This study assesses the results of AVG thrombosis associated with venous anastomotic stenosis. Ideally, the AVG and native veins should be evaluated by using intraprocedural imaging. Methods for monitoring or surveillance of AVG abnormalities that are used to screen for venous stenosis should return to normal after intervention.

Conclusion

Treatment of AVG thrombosis should be performed urgently to minimize the need for a temporary HD catheter. It is also beneficial in dialyzing the patient through the same access as early as possible. There is no single standard approach for AVG thrombosis, and surgical management must be individualized for each case.

As the most common cause of graft occlusion is at the venous anastomotic site, hence AVG thrombectomy with expanded PTFE patch closure at venous anastomotic site can achieve better result as compared to thrombectomy with primary closure or stent placement. Major benefit is that the patient can be dialyzed very early without delay.

In the era of thrombolysis and stenting for AVG/venous anastomotic site stenosis/occlusion, cheaper surgical alternatives with good primary patency serve well for long-term complication-free hemodialysis in chronic kidney disease patient.

This surgical intervention offers the patient good quality of life due to faster cannulation times and cost-effective nature of the procedure with lesser complications of bleeding.
Financial support and sponsorship
Nil.

Conflicts of interest
There are no conflicts of interest.

References
1. Rayner HC, Besarab A, Brown WW, Disney A, Saito A, Pisoni RL. Vascular access results from the Dialysis Outcomes and Practice Patterns Study (DOPPS): Performance against Kidney Disease Outcomes Quality Initiative (K/DOQI) Clinical Practice Guidelines. Am J Kidney Dis 2004;44 5 Suppl 2:22-6.
2. Gessaroli M, Faggioli GL, Freyrie A, Gargiulo M. Regarding “the brachiocephalic elbow fistula: A useful alternative angioaccess for permanent hemodialysis”. J Vasc Surg 1995;22:195-6.
3. Gessaroli M. Renal dialysis: Fistula versus line. In: Davies A, Mitchell A, editors. Vascular and Endovascular Surgery Highlights 2007-2008. Oxford, UK: Health Press Limited; 2008. p. 51-7.
4. Allon M, Robbin ML. Increasing arteriovenous fistulas in hemodialysis patients: Problems and solutions. Kidney Int 2002;62:1109-24.
5. Akoh JA. Prosthetic arteriovenous grafts for hemodialysis. J Vasc Access 2009;10:137-47.
6. Bozof R, Kats M, Barker J, Allon M. Time to symptomatic vascular stenosis at different locations in patients with arteriovenous grafts. Semin Dial 2008;21:285-8.
7. Li L, Terry CM, Shiu YT, Cheung AK. Neointimal hyperplasia associated with synthetic hemodialysis grafts. Kidney Int 2008;74:1247-61.
8. Lee T, Roy-Chaudhury P. Advances and new frontiers in the pathophysiology of venous neointimal hyperplasia and dialysis access stenosis. Adv Chronic Kidney Dis 2009;16:329-38.
9. Manos TA, Sokolis DP, Giagini AT, Davos CH, Kakisis JD, Kritharis EP, et al. Local hemodynamics and intimal hyperplasia at the venous side of a porcine arteriovenous shunt. IEEE Trans Inf Technol Biomed 2010;14:681-90.
10. Lee SW, Fischer PF, Loth F, Royston TJ, Grogan JK, Bassiouny HS. Flow-induced vein-wall vibration in an arteriovenous graft, J Fluids Struct 2005;20:837-52.