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Short Communication

Percutaneous intervention for restoration of patency of occluded lower limb arteriovenous dialysis access

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ABSTRACT

Background: Arteriovenous (AV) fistula thrombosis is a serious complication in patients undergoing hemodialysis, often presenting with symptoms of venous hypertension, failure to dialysis and uremic symptoms. Treatment is aimed to provide symptomatic relief and to maintain hemodialysis access site patency.

Aim: To describe our initial experience in the endovascular treatment of lower limb AV dialysis access (AV fistula) thrombosis and/or obstruction in patients undergoing hemodialysis.

Settings and design: This was a retrospective study carried out in a tertiary care center. Study duration was 24 months. Follow-up was variable.

Materials and methods: Two patients with chronic kidney disease with stage 5 renal failure undergoing hemodialysis presented with lower limb arteriovenous dialysis access (arteriovenous fistula) failure between July 2014 and September 2016. Both the patients underwent endovascular treatment and were analyzed retrospectively.

Results and conclusion: Both the patient underwent successful endovascular treatment for the failure of the lower limb AV dialysis access thrombosis and/or obstruction. One patient had minimal dye extravasation during manipulation of the guide wire, which ceased spontaneously. On follow-up, both patients maintained patency of the dialysis access and are undergoing successful hemodialysis. One patient had a recurrence of the thrombosis of the fistula at 9th month of the follow-up. Endovascular treatment was tried but we could not succeed. However, we found endovascular treatment safe and effective in treating AV fistula failures.

1. Introduction

As the life expectancy of patients with end stage renal disease has improved dramatically in recent years, maintenance of patency of dialysis access has become a challenging task. Lower limb arteriovenous (AV) fistula is constructed as a last resort when upper limb fistulas are obstructed, hence it very important and technically challenging to salvage this fistula once they are obstructed.

2. Materials and methods

This was a retrospective study approved by the departmental ethical committee. Informed written consent was obtained from both the patients. Two patients with occluded lower limb arterial-venous fistulas underwent endovascular treatment in the department of cardiology. Both the patients were on hemodialysis for chronic kidney disease (CKD) with stage 5 renal failure under the renal transplant surgery department of our institute. Mean duration of dialysis before the intervention was 2.5 years. Both the patients had autogenous AV fistula for dialysis access.

Indications for treatment were excessive swelling in the lower limb, decreasing flow during a dialysis session, and pronged bleeding after cannulation.

Both had a history of multiple AV fistula failures of both the upper limb. When patients presented to us they had symptoms of fluid overload and uremia and had skipped hemodialysis for two to three cycles. There was no bruit over the AV fistula. Their lab investigations revealed high serum creatinine and hyperkalemia. After a clinical diagnosis of access failure, patients were referred for angiography and possible intervention to our department. Immediate dialysis was undertaken through the placement of a

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temporary dialysis catheter and taken for intervention. Pre-procedure Doppler study of the AV fistulas was done in both the cases to confirm the acute thrombosis in the outflow of the fistulas. A preliminary diagnostic venography was performed. Location, length, and extent of thrombosis/obstruction were assessed. Endovascular interventions were performed in the same sitting

The first case was a 31-year-old male on once weekly maintenance dialysis who came with a history of persistent vomiting, anasarca, and breathlessness of 2 days duration and not able to undergo dialysis since 1 week. He had a saphenofemoral loop AV fistula on the left lower limb. Left femoral artery puncture was taken by an anterograde technique (Fig. 1) and 7 F arterial sheath (Cordis) was inserted. Fistulography was done using a 6F Judkins right catheter (Cordis). It showed multiple stenoses in the outflow venous loop (saphenous vein) with normal arterial inflow segment (Fig. 2). A 0.014-inch floppy tip hydrophilic coronary guide wire, Sion Blue (Asahi Intecc Co. Ltd.) was used to cross the obstruction and wired through the entire venous loop of the fistula. The entire loop with obstruction was sequentially dilated with non-compliant balloons of size 2.5 × 10 millimeters (mm) Sprinter Legend balloon (Medtronic, Inc.), 3 × 20 mm Pantera balloon (Biotronic AG) and 4 × 12 mm Pantera Leo balloon (Biotronic AG) respectively. Finally, the obstructed segment was serially dilated with 5 × 25 mm non-compliant Prostar stent balloon (Vascular Concepts) at high pressures of 16 ATM (Fig. 3). Post procedure angiogram showed good opening of the proximal saphenous venous loop (Fig. 4) with good distal outflow. The patient was started back on hemodialysis on the same day from the left lower limb saphenofemoral fistula with the good flow during the dialysis.

The second case was a 31-year-old female with CKD on maintenance dialysis twice weekly with uremic symptoms from the past 3 days. She had a saphenofemoral loop AV fistula on the right lower limb. Left femoral arterial access was taken and 7 F arterial sheath (Cordis) was inserted. Fistulography was done with 6F Judkins right catheter (Cordis) after crossing over to the right superficial femoral artery (Fig. 5). It showed complete occlusion of the venous outflow with normal arterial inflow segment (Fig. 6). The fistula was hooked with 3.5 F Judkins right (Cordis) catheter and 0.35 inch Terumo J tipped wire was used to cross the obstruction (Fig. 7). It was exchanged with 0.35-inch Amplatz stiff wire (Cook International) with the help of Slipcath (Cook International). The entire venous loop with the obstruction was sequentially dilated with 5 × 20 mm Bard balloon (Bard Corp.) and 6 × 60 mm Admiral Balloon (Medtronic-Invatec) at 20 to 22 ATM. (Figs. 8). Post procedure angiogram showed good opening of the proximal saphenous venous loop with good distal outflow (Fig. 9).

Technical success was defined as a procedure without significant residual stenosis or without complications. Technical failure was defined as the inability to cross/dilate the lesion or significant

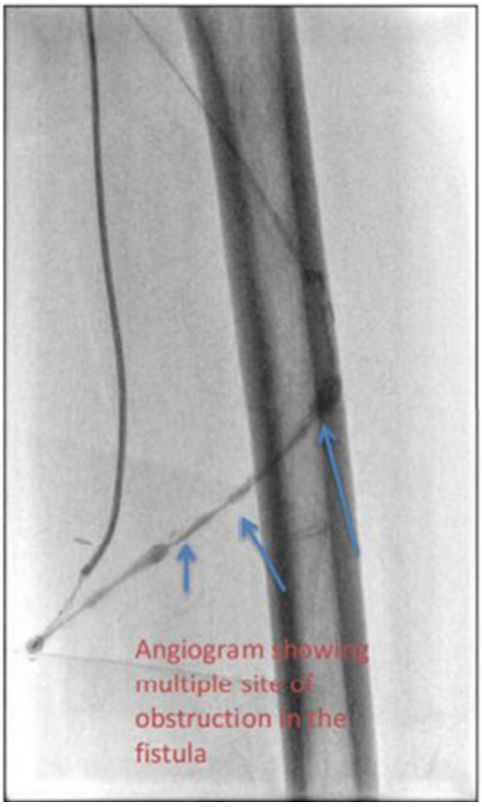

Fig. 2. Fistulogram with 6F Judkins right catheter showing multiple stenoses in the outflow saphenous venous loop in the first patient.

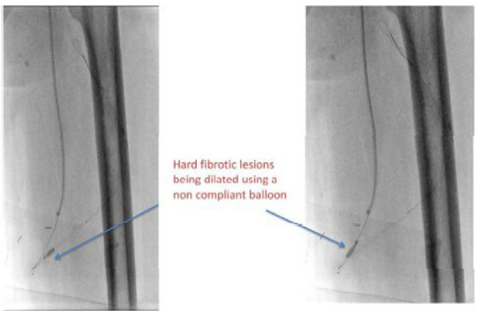

Fig. 3. Fistulogram showing serial dilatation of the stenotic segments with the high-pressure noncompliant balloon in the first patient.

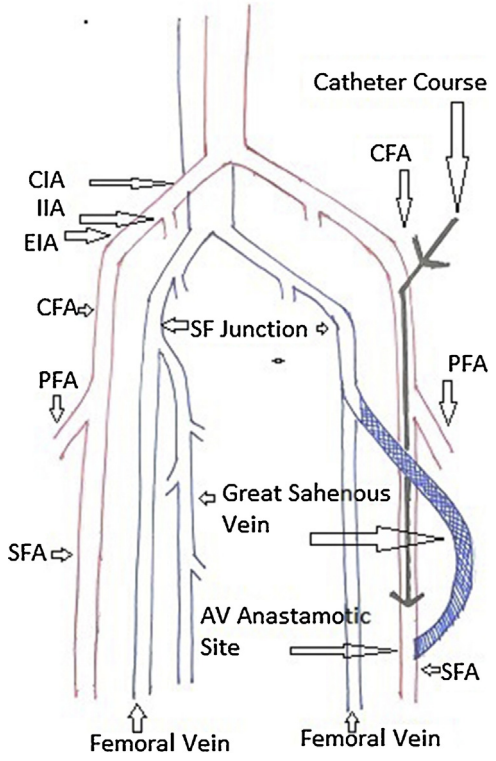

Fig. 1. Diagram showing the Saphenofemoral loop arteriovenous fistula of left lower limb and the catheter course in the first patient. The black arrow indicates the catheter course. CIA- common iliac artery, IIA-internal iliac artery, EIA-external iliac artery, CFA-common femoral artery, SFA-superficial femoral artery, PFA- profunda femoral artery, SF junction- saphenofemoral junction, AV- arteriovenous.

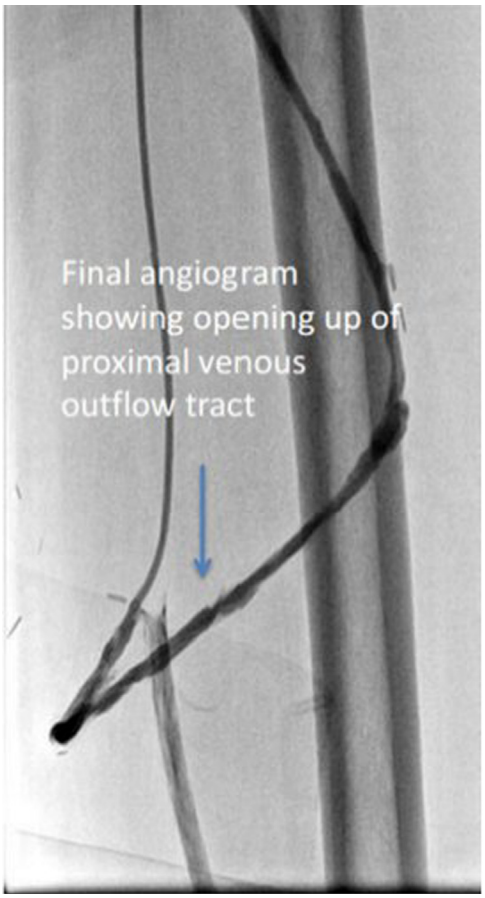

Fig. 4. Final post procedure fistulogram showing good opening of the proximal saphenous venous loop with the good distal flow in the first patient.

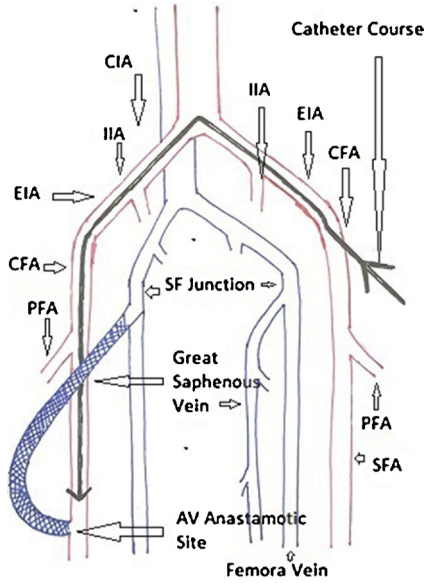

Fig. 5. Diagram showing the Saphenofemoral loop arteriovenous fistula of right lower limb and the catheter course in the second patient. The black arrow indicates the catheter course. CIA- common iliac artery, IIA-internal iliac artery, EIA-external iliac artery, CFA-common femoral artery, SFA-superficial femoral artery, PFA-profunda femoral artery, SF junction- saphenofemoral junction, AV-arteriovenous.

residual stenosis (>30%). A complication was defined as any event which is not routinely observed after the procedure, requiring treatment with endovascular or surgical intervention.

3. Results

Both the patients were on Dialysis with mean duration 2.5 years. The access site was saphenofemoral fistula in both the patients, one on the right side and the other on the left side with mean duration 9 months. Mean duration of fistula failure was 5 days.

Technical success was achieved in both cases. Both the patients underwent successful percutaneous angioplasty with balloon dilatation with no immediate complications observed. Both the patients underwent successful dialysis from the same fistula immediately.

Immediate complication observed was extravasation of dye to subcutaneous tissues during manipulation of the guide wire in the second patient. However, the fistula was crossed successfully and dilated with balloons. Post balloon dilations venograms showed a spontaneous cessation of the dye extravasation, which precluded any further intervention to stop bleeding.

At 6th month follow-up, both patients continued to have maintenance hemodialysis through the lower limb saphenofemoral fistula with no further complications.

However, the second patient presented with delayed complication, namely re-occlusion at 9th month with subsequent failure to undergo dialysis (Fig. 10). She was taken up for repeat intervention which failed possibly due to localized tear/dissection while negotiating the guidewire through the occluded segment (Fig. 11).

4. Discussion

In recent times survival of the patients with end stage renal disease has improved significantly. With this, there is a requirement for long term maintenance of patency of the dialysis access. According to some reports, only about 50% of all hemodialysis accesses remain patent for 3 years.[1]

Thrombosis is the most frequent complication of AV fistulas which results in loss of access for hemodialysis. Most episodes of thrombosis also coincide with the development of stenosis (in more than 85% of cases), which are generally located in the venous segment proximal to the arteriovenous anastomosis.[2]

Lower limb AV fistulas are constructed only as a last resort after exhaustion of all upper limb options because it is surgically more complex, and higher chances of ischemic and infective. Saphenous or superficial femoral veins are commonly used venous outflow whereas arterial inflow is usually provided by either common femoral or superficial femoral arteries. The saphenous vein is mostly used either straight or in a loop fashion after ligating all its branches to make AV fistula.

In published series of saphenofemoral loop AV fistula by Pierre-Paul et al,[3] concluded a mean primary patency of 7 months, primary-assisted patency of 15 months and secondary patency of 16 months. The functionality of the access for dialysis was maintained in 71.4% of patients and almost all patients developed stenosis within the saphenous vein loop. According to available data suggest that saphenous vein grafts have higher complication rate and straight transposition of the vein has better outcomes compared with loop configuration.[3,4] The superficial femoral vein has also been used as venous outflow, has higher patency rates but has higher ischemia complication.[5]

Our patients had a saphenofemoral AV fistula in a loop fashion and had an obstruction in the venous loop, which is the most common site of obstruction. Obstructed fistulas have been

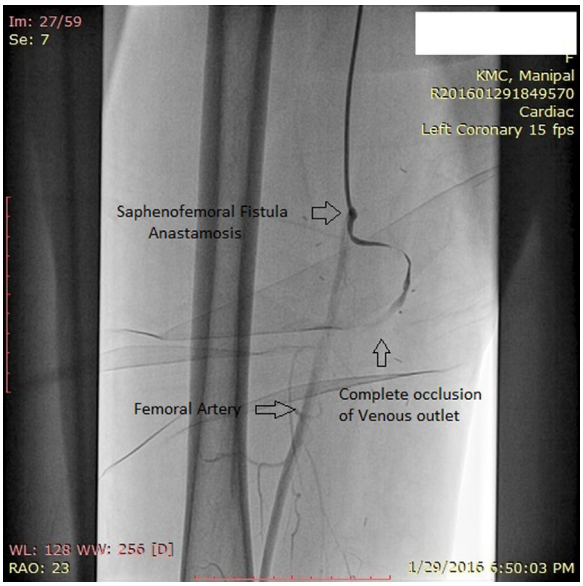

Fig. 6. Fistulogram with 6F Judkins right catheter showing complete occlusion of the venous outflow from the femoral artery in the second patient.

Fig. 8. Fistulogram showing serial dilatation of the stenotic segments with the high-pressure noncompliant balloon in the second patient.

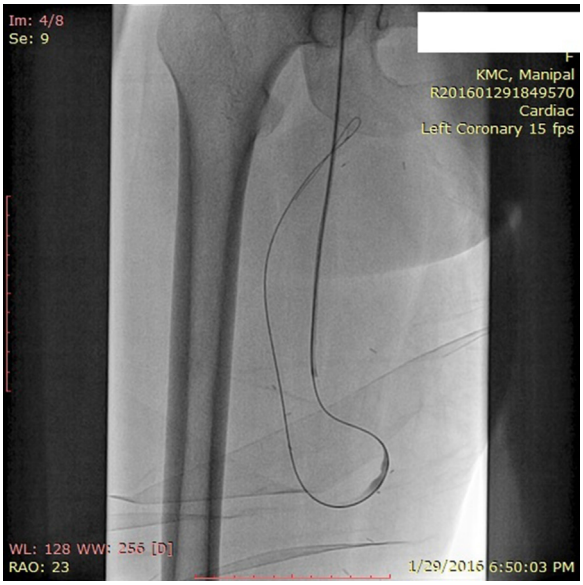

Fig. 7. Fistula hooked with 3.5 F Judkins right (Cordis) catheter and 0.35 inch Terumo J tipped wire used to cross the obstruction in the second patient.

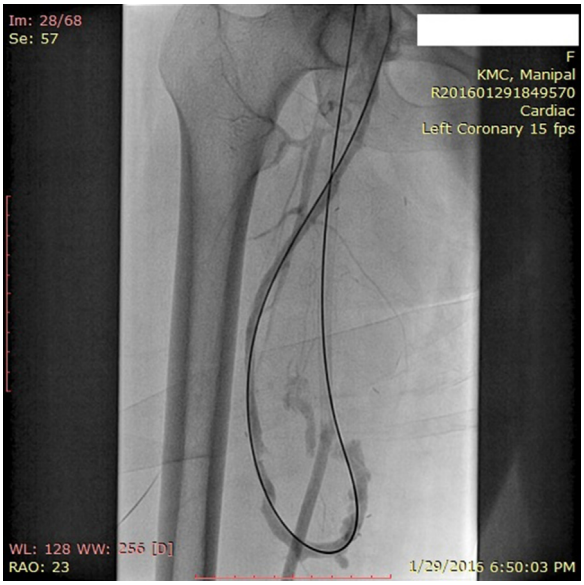

Fig. 9. Final post procedure fistulogram showing good opening of the proximal saphenous venous loop with the good distal flow in the second patient.

traditionally corrected surgically but this minimizes future vascular access sites. Trans-catheter techniques have, in recent years, made it possible to treat these lesions percutaneously with more than 80% success rate and replaced surgical revision as the treatment of choice for failing or thrombosed fistulas and grafts.[6]

Although there has been no direct comparison between percutaneous transluminal angioplasty (PTA) and surgical revision, uncontrolled studies have reported a 95% success rates of PTA.[7] The long term primary patency rates are 84% at 3 months, 57 to 67% at 6 months and 35 to 51% at 1 year. This success rate combined with superior convenience, lower chance of infection, sparing the patients vein, less morbidity and enabling immediate dialysis without the need for a temporary central venous catheter has resulted in PTA is the treatment of choice for these lesions.[8] Stenosis in the venous segments is extremely fibrous requiring very high-pressure dilation, sometimes requiring cutting balloon dilatation. Stenting is usually reserved only for severe recoil, perforations and surgically inaccessible sites only

We did not try the local thrombolysis and thrombosuction. As the interventions were done after a mean duration of 5 days of the fistula failure, we assumed that the thrombus would be organized and may not yield to suction. Also, the chronic renal failure patients have a high risk of bleeding complications and thus we deferred the local thrombolysis. Studies with a larger number of patients are needed to determine if thrombosuction and local thrombolysis would be beneficial in such patients.

Our study had certain limitations. Firstly, it was a nonrandomized retrospective study. Secondly, the number of patients was very less. The lower limb AV fistulas are extremely rare and thus our encounter with them is very less. However, we have reported only our initial experience and further studies for longer time duration and with a larger sample size will be needed to assess

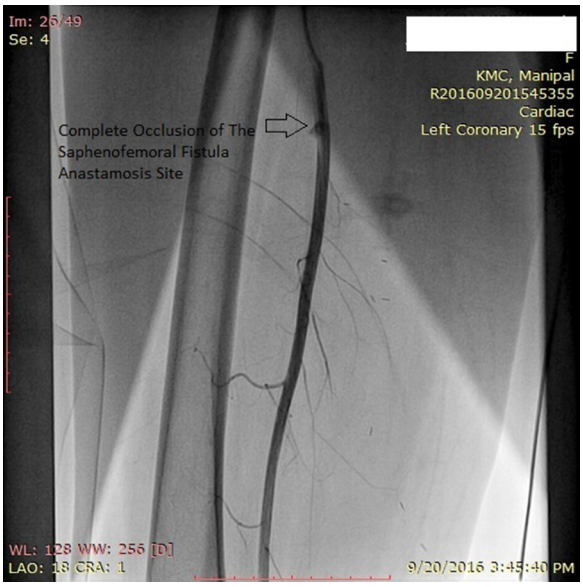

Fig. 10. Fistulogram with 6F Judkins right catheter showing recurrent complete occlusion in the outflow saphenous venous loop in the second patient.

Fig. 11. Fistulogram with 6F Judkins right catheter dissection and failure to obtain a distal outflow in the second patient.

long-term outcomes in the Indian population. However, these procedures could be done at the cost of peripheral angioplasties, which are very much affordable to the patients already overburdened by the expenses of hemodialysis.

5. Conclusion

In recent times survival of the patients with end stage renal disease has improved significantly. With this, there is a requirement for long term maintenance of patent of the dialysis access. Though most common upper limb AV fistulas are constructed as the dialysis access, rarely we do encounter lower limb AV fistulas, especially when upper limb AV fistulas are exhausted. Lower limb AV fistulas have higher complications rates and obstructions may be frequently encountered. The endovascular treatment is an effective and safe method for treatment of occluded AV fistulas in patients undergoing hemodialysis. It has a high technical success rate without significant morbidity or mortality

Source of finding

Nil.

Conflict of interest

Nil.

Acknowledgment

Nil.

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