ISSN- O: 2458 - 868X, ISSN–P: 2458 – 8687
National Library of Medicine - ID: 101731606

International Journal of Medical Science and Innovative Research (IJMSIR)
IJMSIR : A Medical Publication Hub
Available Online at: www.ijmsir.com
Volume – 8, Issue – 4, July – 2023 , Page No. : 91 – 95

Role of Sharp recanalization in endovascular AVF salvage: Case series

[1]Dr. Pathak K, MBBS, MD, DNB., Assistant Professor, Department of Interventional Radiology, G.R. Doshi and K.M. Mehta Institute of Kidney Disease and Research Center (IKDRC & ITS) – Dr H. L. Trivedi Institute of Transplantation Sciences (ITS), Gujarat University of Transplantation Sciences (GUTS), Ahmedabad, Gujarat, India

[2]Dr. Popat NP, MBBS, MD., Assistant Professor, Department of Radiodiagnosis, G.R. Doshi and K.M. Mehta Institute of Kidney Disease and Research Center (IKDRC & ITS) – Dr H. L. Trivedi Institute of Transplantation Sciences (ITS), Ahmedabad, Gujarat, India.

[3]Dr Mishra P, MBBS, MD., Assistant Professor, Department of radiodiagnosis, SCB Medical College, Cuttack, Orissa, India.

[4]Dr Rajput M, MS, DNB., Assistant Professor, Department of Urology, G.R. Doshi and K.M. Mehta Institute of Kidney Disease and Research Center (IKDRC & ITS) – Dr H. L. Trivedi Institute of Transplantation Sciences (ITS), Ahmedabad, Gujarat, India.

[5]Dr Roy Choudhury S, FRCS, FRCR, EBIR, FCIRSE., Director of Interventional Therapies, NH Group of Hospitals, India.

[6]Dr Lingegowda D, DNB, PDCC., Consultant Radiologist, Tata Medical Centre, Kolkata.

Corresponding Author: Dr Mishra P, MBBS, MD., Assistant Professor, Department of radiodiagnosis, SCB Medical College, Cuttack, Orissa, India.

Citation this Article: Dr. Pathak K, Dr. Popat NP, Dr Mishra P, Dr Rajput M, Dr Roy Choudhury S, Dr Lingegowda D, "Role of Sharp recanalization in endovascular AVF salvage: Case series", IJMSIR- July - 2023, Vol – 8, Issue - 4, P. No. 91 – 95.

Type of Publication: Case Report

Conflicts of Interest: Nil

Abstract

This retrospective study was performed on attempted recanalization in 8 patients using the sharp end of hydrophilic guidewire in recanalization of stenosed segments of draining veins in AVF or VFG where the conventional method failed. Using 5 Fr diagnostic catheter and straight end of 0.035" hydrophilic guide wire the stenosis/ occlusion was crossed into IVC. Procedures were completed by catheter placement, angioplasty, or stenting following successful recanalization. Using this novel technique, we demonstrated a technical success rate of 100% (8/8). This study was conducted to evaluate the technical success and safety of using the sharp end of hydrophilic guidewire in recanalization of stenosed segments of draining veins in AVF or VFG where the conventional method failed. The proposed technique is effective and safe for patients who have failed traditional techniques of using the angled tip of hydrophilic guidewire.

Level of evidence: Level VI, Case Series.

Keywords: AV Fistula, Sharp Recanalization, Endovascular AVF salvage.

Introduction

Chronic kidney disease is a worldwide problem with prevalence of >10 % worldwide and 17% in India, affecting all age groups requiring dialysis (1). Both AV fistulas (AVF) and AV grafts (AVG) are considered first line vascular access routes for haemodialysis, the preferred being AV fistulas (2). However the fistulas run a risk of stenosis. Turbulence in the anastomosis and repeated cannulation leads to neointimal hyperplasia, thrombosis, stenosis and finally loss of function (3). Percutaneous transluminal angioplasty (PTA) successfully restores the patency in about 70-80 % cases (4). For the purpose of PTA, the standard procedure being crossing the stenosed segment by the angled tip of the guidewire. In some cases the flexible tip of the guide wire is not able to cross the stenosis due to extensive luminal narrowing causing high grade stenosis/ occlusion. In such cases, an alternative method of sharp recanalization can be attempted which however comes with risk of vessel injury and hematoma which may further compress the already narrowed lumen. In such cases we have attempted to cross the stenosed segment using the sharp end of the wire and successfully completed the angioplasty. Use of straight end of the wire has been attempted at multiple centres worldwide for central venoplasty and for peripheral arterial diseases and is well known to the interventional radiologists (5). But use of straight end of the wire is a novel approach in dialysis fistula angioplasty and we found no medical literature describing such an approach.

Materials & Methods

The present retrospective study was performed on all AVFs created in hemodialysis (HD) population aged 16 to 58 years at the Institute of Kidney Diseases and Research Centre (IKDRC) from 01/07/2021 until the writing of this manuscript.

Patients with AVF failure because of either stenosis/ occlusion and/ or thrombus or non-maturation after 6 weeks of creation were taken for endovascular AVF salvage.

All the procedures were carried out under local anesthesia using fluoroscopy under lithoskop (Siemens, Munich, Germany). Radial artery access was taken under ultrasonography guidance (CX 50, Philips, Amsterdam). Using seldinger technique, 7

Fr vascular sheath was placed in radial artery (GSS Slender, Terumo interventional systems, Japan). Injection nitroglyecerin and injection heparin were given according to weight. Fistulogram was done using the same access and findings were noted. Using 5 Fr diagnostic catheter (Cook Medical, Bloomington, IN, US) and 0.035” hydrophilic guide wire with angled tip (Radifocus, Terumo interventional systems, Japan) combination, the stenosis/ occlusion was crossed into IVC.

In some cases, with very tight stenosis/ occlusion/ chronic thrombus in the AVF draining vein or AVG insertion site, this conventional technique using angled tip of hydrophilic guide wire did not help. In those cases, tip of the catheter was kept just proximal to the stenosis/ occlusion and sharp end of the same hydrophilic guide wire was advanced into the AVF draining vein/ AVG venous insertion site. Then the catheter was advanced over this guidewire and its intraluminal position was confirmed by injecting contrast. After confirming intraluminal position, the stenosis/ occlusion was crossed, using soft tip of hydrophilic guide wire and catheter combination, tip of the catheter was parked in IVC. 0.035” stiff wire (Extra stiff Amplatz, Cook Medical, Bloomington, IN, US) was exchanged with hydrophilic guide wire. Fistula angioplasty was done using non compliant PTA balloon (Mustang PTA balloon

dilatation catheter, Boston Scientific, Marlborough, MA, United States) for 3 minutes. In some patients in whom residual waisting is still there even after inflating the balloon till RBP (Rated Burst Pressure), ultra-non-compliant balloon (Conquest 40, BD, NJ, US) was used. Pressure at which waisting was relieved was recorded. Post angioplasty Fistulogram was done and findings recorded. After successful angioplasty, sheath was removed and compression band (TR Band, Terumo interventional systems, Japan) was applied. In case of extraluminal position/ hematoma formation after sharp end recanalization, further procedure was abandoned and compression applied.

The patient was discharged on the following day on dual anti platelets and was kept on follow up at 1, 3 and 6 months.

Results & Discussion

A total of 8 patients of various age groups were studied in which sharp recanalization was attempted. Mean age of the patients was 37.25 years with youngest patient being 16 years old and eldest patient being 58 years old. 7 of them had AVF and 1 patient had AVG. 4 of the AVF were on the left side and 3 were on right side. The AVG was on the left side. 2 of the fistulae were Radiocephalic, 3 Brachiocephalic and 2 Brachiobasilic fistulae. Mean time from AVF creation to AVF salvage was 2 years with minimum duration being 1 month and maximum being 6 years. The AVF which was 1 month old did not mature and had to undergo balloon assisted maturation. 6 of the AVF had stenosis in the draining vein, 1 had stenosis in the anastomotic site as well as in the draining vein. The AVG had stenosis at the venous anastomotic site. Thrombosis was present in 5 out of 7 AV fistulae of which 2 had chronic calcified walls. No major complications such as vessel perforation, hematoma/ pseusoaneurysm formation noted in this subset of patients.

Sharp recanalization was achieved in all the patients except one who had brachiobasilic AVF on the left side. The occlusion was very tight and could not be crossed either with angled or sharp end of hydrophilic guide wire. No major complications such as vessel perforation, hematoma/ pseusoaneurysm formation noted in this patient.

The waisting was relieved in 85% of the patients (7/8) with the use of semi compliant balloon whereas in one case (1/8) ultra non-compliant balloon was used. Mean pressure at which the waisting was relived was 19.5 mm Hg. This was no different than while using the standard method.

The salvage rates were no different than that while using the standard method. At 6 months follow up patency was maintained in all patients and the rates of patency was similar to study by Abigail Falk in which primary patency rate at 180 days was 69% and secondary patency rate was about 72% (6). According to H.Y. Yap et. al Published series consistently report 40% to 50% six-month unassisted patency rates from PTA (7).

In a study done by Rifkin et al, five patients with rapidly recurrent venous lesions at the graft-vein anastomosis showed an increase in the time to stenosis or thrombosis in the arteriovenous grafts, from a mean of three weeks to more than 16 weeks (8). Gray also presented with results of a primary patency of 57% and 28% at three months and six months, respectively (9).

Conclusion

When facing a challenging stenosis or occlusion that cannot be crossed with conventional catheter and guidewire techniques, one can use the sharp end of a hydrophilic guidewire to break and create an intraluminal channel and cross the stenosis/ occlusion in AVF

draining vein or AVG venous insertion site. This method should not be used in anastomotic (arterial anastomosis in case of AVG) or perianastomotic area due to chances of vessel injury to the arterial end of anastomosis. One thing that needs to be taken care of using sharp end is not to use this method in very tortuous anatomy. When used carefully with this method can significantly increase the success rate of a challenging revascularization attempt with a low to no risk of vascular rupture. The long-term patency rate is similar to the conventional method (10).

Shortcomings of this study are limited sample size, its retrospective nature and non-randomization. There is a need for a large randomized clinical trial to provide more strength to the current study experience.

References

1. Kovesdy CP. Epidemiology of chronic kidney disease: an update 2022. Kidney Int Suppl (2011). 2022 Apr;12(1):7-11. doi: 10.1016/j.kisu.2021.11.003. Epub 2022 Mar 18. PMID: 35529086; PMCID: PMC9073222.
2. Novak M, Matras P, Kavan J, Lambert L, Burgetova A. Angioplasty of Dysfunctional Dialysis Fistula or Graft with Resveratrol-Excipient and Paclitaxel-Coated Balloon Improves Primary Patency Rates Compared to Plain Angioplasty Alone. J Clin Med. 2022 Dec 14;11(24):7405.
3. Roy-Chaudhury P, Lee T, Woodle B, Wadehra D, Campos-Naciff B, Munda R. Balloon-assisted maturation (BAM) of the arteriovenous fistula: the good, the bad, and the ugly. Semin Nephrol. 2012 Nov;32(6):558-63.
4. 3. Al-Jaishi A.A., Oliver M.J., Thomas S.M., Lok C.E., Zhang J.C., Garg A.X., Kosa S.D., Quinn R.R., Moist L.M. Patency Rates of the Arteriovenous Fistula for Hemodialysis: A Systematic Review and Meta-analysis. *Am. J. Kidney Dis.* 2014; 63:464–478.
5. B. Chen et a*l.*Sharp recanalization for treatment of central venous occlusive disease in hemodialysis patients: J Vasc Surg Venous Lymphat Disord(2022)
6. Falk A. Maintenance and salvage of arteriovenous fistulas. J Vasc IntervRadiol. 2006; 17:807–813.
7. Yap HY, Robless PA, Lee JC, Wang SC. Managing venous stenosis in vascular access for haemodialysis. Singapore Med J. 2007 Jan;48(1):6-10; quiz 11. PMID: 17245509.
8. Rifkin BS, Brewster UC, Aruny JE, Perazella MA. Percutaneous balloon cryoplasty: a new therapy for rapidly recurrent anastomotic venous stenoses of hemodialysis grafts? Am J Kidney Dis 2005; 5: e27-32. 23.
9. Gray RJ. Pilot study of cryoplasty using PolarCath Peripheral Balloon Catheter System (BSCI) for dialysis access. 2006 Society of Interventional Radiology 31st Annual Scientific Meeting
10. B. Chen *et al.*Sharp recanalization for treatment of central venous occlusive disease in hemodialysis patients J Vasc Surg Venous Lymphat Disord (2022)

Legends Figures

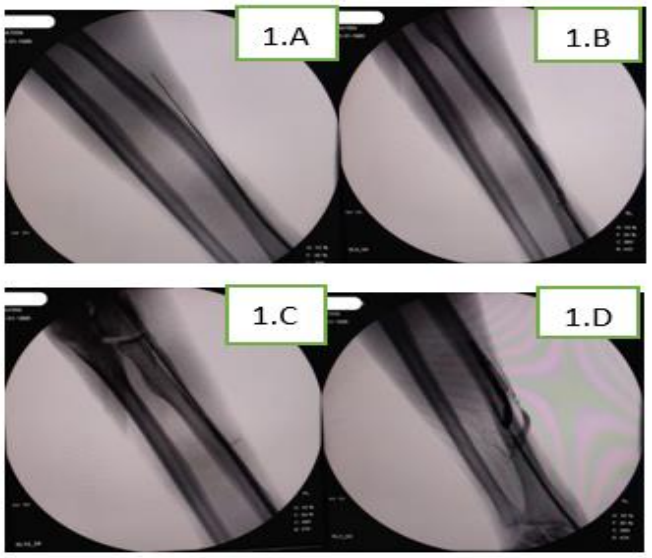

Figure 1: Balloon Assisted Maturation using sharp end of hydrophilic guidewire: This 25 years old patient came to

us with a non-maturing Radio-Cephalic fistula. Fig 1.A On angiogram there was total occlusion in the draining cephalic vein with multiple collaterals. Fig 1.B & 1.C After failing repeated attempts to cross over the stenosis using the angled tip of the hydrophilic guidewire, crossing by the straight end of the wire was attempted successfully. Fig 1.D Flow was established across occlusion post balloon dilatation.

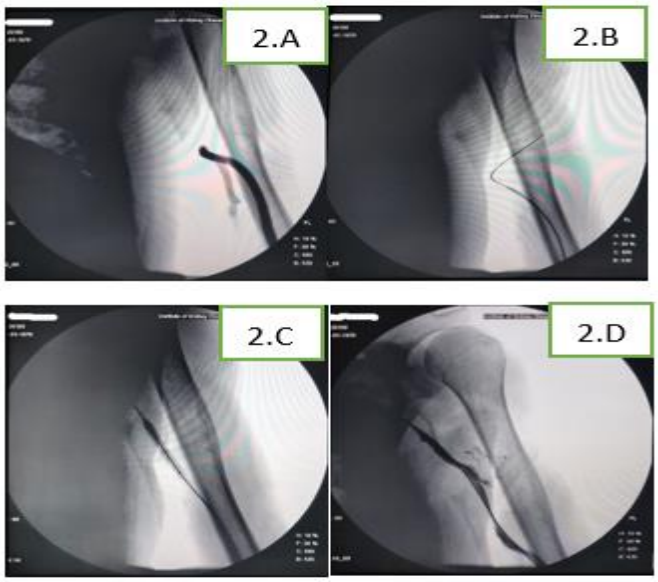

Figure 2.: This 57 years old patient came to us with a nonfunctioning brachio basilic AV graft. Fig 2.A On angiogram there was total occlusion at the venous insertion site of the AV Graft. Fig 2B & 2C After failing repeated attempts to cross over the stenosis using the angled tip of the hydrophilic guidewire, crossing by the straight end of the wire was attempted successfully. Fig 2D Flow was established across occlusion post balloon dilatation.