

Original Research

Complications Requiring Reoperation After Radio-Cephalic Arteriovenous Fistula Formation Surgery For Hemodialysis: Our Experience

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ABSTRACT

Background: Arterio-venous fistula is the preferred type of vascular access in patients requiring hemodialysis. (1-3) They have longer patency with low complication rates as compared to grafts. Still arteriovenous fistulas surgery can give rise to various complications

Objectives: this study was done to evaluate the various complications, early as well as late, arising from the arteriovenous fistula surgery.

Materials and Methods: This study was conducted over a span of 3 years from October 2019 to October 2022 comprising of 284 patients of chronic kidney disease who were on regular hemodialysis underwent surgery to create end to side radio-cephalic arteriovenous fistula formation for vascular access.

Results: out of 284 patients 22(7.74%) patients required reoperation. Thrombosis with failure of AV fistula requiring reoperation was seen in 19(6.69%) patients. Reoperation for bleeding, Aneurysm and ischemic steal syndrome was seen in 1 patient each.

Conclusion: Thrombosis with loss of AV fistula is the most common complication requiring reoperation after Radio-cephalic arteriovenous fistula surgery for vascular access in patients on hemodialysis.

Keywords: av fistula, hemodialysis, radiocephalic, complication, reoperation, failure.

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INTRODUCTION

Although over the years medical science has made tremendous advances in the field of renal replacement therapy yet hemodialysis remains the mainstay of treatment in most of the patients with chronic renal failure. A reliable and well-functioning vascular access remains the cornerstone of hemodialysis treatment. Despite the emergence of synthetic grafts and double lumen catheters, native arteriovenous fistula still remains the preferred vascular access due to its superior patency rates and low complication rates.(1-5)

Although Arteriovenous fistulae can be formed at different sites yet upper limb is preferred because of low complication rate.it can be either radio-cephalic AV fistula of brachiocephalic or brachio-basilic AV fistula in the cubital fossa. The radio-cephalic Av fistula formed in the distal one third of the forearm is the preferred site. The arterio-venous anastomosis can be done in a side-to-side or end-to-side fashion.

The outcome of AV fistula surgery is affected by various factors like age, general condition of the patient, condition of native vessel wall, surgical skill, coagulation profile, endothelial injury and technique of puncture etc.

Complications associated with radio-cephalic AVF formation include local edema, wound infection, local hematoma, thrombosis, bleeding, aneurysm and ischemic steal syndrome. Complications requiring re-operation include thrombosis, Ischemic steal syndrome, aneurysm, and excessive bleeding.

MATERIALS & METHODS

From October 2019 to October 2022, 284 patients underwent radio-cephalic AV fistula formation surgery in our department. All the patients underwent end-to-side radio-cephalic arteriovenous anastomosis with overlay venous patch technique using 6-0 double arm polypropylene suture under local anesthesia.

All the patients underwent in-depth history and physical examination. Local examination of upper limb was done in detail to ascertain the condition of radial artery and cephalic vein. All the patients underwent detailed duplex ultrasonography with doppler of the target upper limb. A cephalic vein diameter of atleast 2mm without any evidence of clot or thrombosis was a pre-requisite. Radial artery was scanned for diameter, flow, condition of arterial wall and any evidence of atherosclerosis or calcifications. An extensively calcified Radial artery with low or monophasic flow was an exclusion criterion. Other exclusion criteria included arterial diameter less than 2mm and incomplete palmer arch. Non-dominant arm was chosen in majority of the cases except when the lack of optimal vascular characteristics forced the procedure to be done on dominant arm.

After obtaining an informed consent, all the surgeries were performed under local anesthesia. A standard linear incision over the distal one third of forearm was made and radial artery and cephalic vein were dissected. After achieving proximal and distal controls on both artery and vein, injection Heparin 5000IU were injected intravenously and cephalic vein was transected at the distal end. After 3 minutes of the injection bulldog clamps were applied in the both ends of the radial artery and an around 1.5 to 2cm arteriotomy was performed. The proximal cephalic vein was anastomosed with the artery in end to side fashion by on-lay patch technique using continuous 6-0 polypropylene sutures.

On table confirmation of successful surgery was described as a good thrill and incase of absence of thrill a revision of the anastomosis was promptly done. All the patients were examined on day 1, 1 week, 2 weeks and monthly for the next 6 months. Patency of fistula and maturation were checked by palpation for thrill, auscultation to look for machinery murmur and in case of maturation failure duplex ultrasonography was done to delineate the cause of failure.

All the patients with complications were carefully assessed and decision for reoperation was taken after doppler ultrasonography. All the patients requiring reoperation were counselled and surgery done under local anesthesia.

RESULTS

The study included 284 patients suffering from end-stage renal disease requiring hemodialysis who underwent Radio-cephalic AV fistula formation surgery. Out of these 113 (39.7%) were females and 171(60.2%) were males (Table 1).

Table1: Sex Ratio of the Patients

Sex	No. of Patients	% Age
Male	171	60.21%
Female	113	39.78%

Mean age was 45.3 years with youngest patient being 10 years and eldest was 81 years. Medical history of the patients revealed hypertension in 198(69.71%) and type 2 diabetes in 176(61.97%) patients. Hepatitis B and C infection was detected in 20(7.04%) and 12(4.22%) patients respectively. Two patients (0.70%) were HIV positive.(Table 2)

Table 2: Various Comorbidities and Their Distribution among Patients

S.no.	Comorbidity	No. of Patients	% Age
1	Hypertension	198	69.71%
2	Type 2 diabetes	176	61.97%
3	Hepatitis B	20	7.04%
4	Hepatitis C	12	4.22%
5	HIV	2	0.70%

Table 3: Complications seen after AV fistula formation

S. No	Complication	No. of Patients	% Age
1	Thrombosis with AVF failure	19	6.69%
2	Local edema	19	6.69%
3	Wound infection	10	3.52%
4	Local hematoma	8	2.81%
5	Excessive bleeding	1	0.35%
6	Aneurysm	1	0.35%
7	Ischemic steal syndrome	1	0.35%

Table 4: distribution of various Types of Procedures done in reoperation

S. no	Type of Procedure	No. of Procedure
1	Creation of proximal radio-cephalic AVF	9
2	Creation of radio-cephalic AVF in contralateral forearm	8
3	Creation of brachio-cephalic AVF	4
4	Take down/closure of AVF	2
5	Ligation of bleeder vein	1

Common post-operative complications recorded included local edema in 19(6.69%), wound infection in 10(3.52%) and local hematoma in 8(2.81%). Out of 284 patients 22 (7.74%) required re-operation for various complications. These complications included thrombosis with AVF failure in 19(6.69%), bleeding in 1(0.35%), aneurysm in 1 patient (0.35%). One(0.35%) patient had features of ischemic steal syndrome that included blanching and severe ischemic pain in distal forearm and hand confirmed by doppler ultrasonography.

All the reoperations were done under local anesthesia. All the cases with thrombosis with failure of AV fistula were operated and a proximal radiocephalic or brachio-cephalic fistula was formed with acceptable results.

In the case of patient with aneurysm, the AV fistula was taken down/closed and aneurysmal part of cephalic vein was resected. A brachio-cephalic fistula in the anti-cubital fossa was formed without any complications. In the patient with excessive post operative bleeding, re-

exploration was promptly done and the bleeding venous branch ligated thus achieving complete hemostasis without the need to take down the anastomosis.

In the case of ischemic steal syndrome, intra-operative pressure on the fistula lead to relief of symptoms with perfusion of the affected hand thus confirming the diagnosis. The AV fistula was taken down and a radio-cephalic AV fistula formed on the contralateral forearm with no complications.

DISCUSSION

Although renal replacement therapy has evolved over the years yet hemodialysis still remains the mainstay for most end stage renal disease patients and also serves as a bridge therapy for patients planned for renal transplant. A good reliable vascular access remains the cornerstone in patients on regular hemodialysis. Although there are various options available like double lumen catheters, grafts etc. yet native arteriovenous fistula still remains the preferred vascular access due to longer patency rates, less chances of infection and low costs.

Various sites usually used for native arterio-venous fistula are Radio-cephalic at the wrist, Brachio-cephalic and Brachio-basilic at the cubital fossa. Radio-cephalic fistula at the wrist is the most preferred site because of ease of access and low complication rates

This study done over a span of 3 years from October 2019 to October 2022. A total of 284 patients of end-stage renal disease on regular hemodialysis underwent surgery for radio-cephalic arteriovenous fistula formation. All the patients were operated as a day care procedure under local anesthesia. There was no intra-operative mortality and all the patients were discharged after 4 hours of procedure. All the patients were followed up in OPD clinic regularly and all the complications noted.

Mean time for the complete maturation of the fistula to allow use for dialysis was 28 ± 5.2 days

Minor complications like immediate post-operative edema(6.69%), wound sepsis(3.52%) and local hematoma(2.81%) resolved with symptomatic treatment and antiseptic dressings.

Major complications that required re-operation were thrombosis with failure of fistula in 19(6.69%) patients, excessive bleeding in 1(0.35%) patient, aneurysm of distal cephalic vein due to weakness in venous wall in 1(0.35%) patient and ischemic steal syndrome in 1(0.35%) patients.

Out of the 19 patients with thrombosis with failure of av fistula 9 (47.36%) were treated by creation of a radio-cephalic fistula proximal to the previous site, 7(36.84%) patients underwent radio-cephalic fistula formation on contralateral forearm and 3(15.78%) patients needed a brachio-cephalic fistula formation. All the patients had patent av fistulae at the end of reoperation.

The patient with excessive bleeding was promptly re-explored and a bleeding branch of cephalic vein was found to be the culprit which was ligated and complete hemostasis achieved without taking down the AV fistula.

In case of aneurysm at the distal end of cephalic vein, the AV fistula was taken down and a brachio-cephalic fistula at cubital fossa was formed.

The patient who developed ischemic steal syndrome, underwent surgery to take down the fistula and in the same session a radio-cephalic fistula at the contralateral wrist was formed without any complication.

A review of the literature reveals primary failure rate of 23% (95% confidence interval, 18%-28%) of created fistulas. In our study, the failure rate was only 6.69% (19 patients) which is very low as compared to reported failure rates. The probable reasons for such low failure

rates are rigorous pre-operative selection, end to side venous onlay patch technique and a single operating surgeon.

All other complications in our study were also very low probably due to the reasons already mentioned above.

CONCLUSION

Radio-cephalic fistula is the most preferred vascular site access with high patency and low complication rates. Thrombosis with failure of av fistula is the most common complication that requires reoperation and results of reoperation are excellent.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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