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OUTCOME OF NATIVE ARTERIO-VENOUS FISTULA FOR HAEMODYNAMICS: A SINGLE CENTRE EXPERIENCE

Urology

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ABSTRACT

Aim: To review our experience of arterio-venous fistula(AVF) creation and to assess the success rate and common complications.

Materials and methods: A prospective study was conducted in a tertiary health care institute over a period of 18 months. Inclusion criteria included patients with chronic kidney disease/End stage renal disease referred by the nephrologist for AV fistula creation. Preoperative work up included clinical and Doppler assessment of the vessel, laboratory investigations, operative procedure, confirmation of fistula function follow up on table, 6 weeks, 8 to 12 weeks and after 12 weeks.

Results: Side to side anastomosis was done in 94.6% and end to side anastomosis in 5.4% cases. 80% of our AVFs started to immediately function after operation, a majority(65.3%) in less than 6 weeks. 10.6% cases of AVF developed thrombosis, 5.3% cases bled, 9.4% got infected and 4% developed an AV aneurysm. 69 out of 75 patients survived towards the end of our study period.

Conclusion: Distal AVFs are associated with less complications. The success rate of AVF creation can be improved by proper case selection with use of Doppler ultrasound preoperatively and the use of proper technique of anastomosis .

KEYWORDS

Arterio-venous fistula, Complications, Doppler ultrasound, Haemodialysis

Introduction

A native arteriovenous fistula(AVF) distally created is the gold standard for vascular access for haemodialysis(HD)treatment .[1] .An AVF is closest to the ideal model of vascular access .[2] Morbidity related to vascular access is the leading cause of hospitalisation for chronic HD patients. [3] The quality of vascular access for HD should be suitable for repeated puncture and allow a high blood flow rate for high efficiency dialysis with minimal complications .[2] The morbidity rates and delays in achieving satisfactory patent arterio-venous(AV) access are high .[4] Keeping this in mind, several retrospective studies have been done on this topic .[4] We have a lot of chronic HD patients coming to our nephrology department and hence have a number of cases for AVF creation. With this background, we decided to conduct a prospective study to review our experience of AVF creation and to assess the success rate and common complications associated with the same.

Methods

Our hospital ethical committee approval was obtained for the prospective study which was conducted on 75 patients at our institute which is a tertiary medical college hospital for a period of 18 months. Informed consent was obtained from the patients participating in the study. Based on the power of study being 80% and confidence interval of 95%, considering a clinically significant difference of 0.5 and standard deviation of 1, the sample size was 62. We included 75 patients in our study keeping in mind the possibility of drop outs. The inclusion criteria included chronic kidney disease/ end stage renal disease patients referred by the nephrologist to us for AVF creation. The exclusion criteria included patients with artery and vein not suitable for fistula on clinical and Doppler study (A<2mm, V<3mm), negative Allen's test, hemiplegic/deformed limbs, patients in sepsis and patients with uraemia associated with uncorrected bleeding tendency. The preoperative work up included clinical assessments followed by doppler ultrasonography (USG). The clinical assessment included i) vein calibre, course and patency ii) artery palpation iii) hand exam-Allen's test. Doppler USG was done in selected patients to assess the diameter of the artery and vein, the flow rate, calcification of vessels, presence of thrombosis and plaque in the vessels. The selected patients for AVF construction were advised hand exercises and local application of heparin ointment. This was followed by laboratory investigations which included complete haemogram, blood urea and serum creatinine levels, HIV, HbsAg, HCV status, blood group and Rh type, serum electrolytes, coagulation profile including prothrombin time, partial thromboplastin time, international normalized ratio and liver function tests. Preoperatively antibiotics were administered. Vein mapping was done with doppler ultrasound. Local anaesthesia was infiltrated at the site of proposed creation of AVF with 1% plain lignocaine. The incision was taken. The vein was explored and mobilised by artery forceps. A water-tight anastomosis was performed with 6-0/7-0 prolene. The anastomosis was end to side/ side to side. We took care to avoid major alterations in vein configuration and torsion. The functioning of anastomosis was confirmed by the presence of thrill and murmur. The patient was discharged on the first postoperative day. Oral amoxicillin-clavulinic acid and tramadol were administered for 7-10 days at appropriate doses. The hand was kept elevated and crepe bandage was applied on the third and seventh day. The sutures were removed on the 14th day. The functioning of fistula was assessed on table, at 6 weeks, 8-12 weeks and after 12 weeks. Successful maturation of fistula at 6 weeks was assessed by the presence of criteria like presence of easily palpable superficial and relatively straight vein, fistula with adequate diameter (3-4 mm) and adequate length (>10 cm), presence of uniform thrill on palpation and presence of blood flow of 250-300 ml per minute. The patients were followed up regularly and the patency of fistula and complications therein were assessed and classified as early (<12 weeks) and later (>12 weeks).

RESULTS

Our patients were in the age ranging from 16 to 72 years with a mean age of 44 years.76% of our patients were males and 24% were females [Table 1].

TABLE-1 PATIENT DEMOGRAPHICS

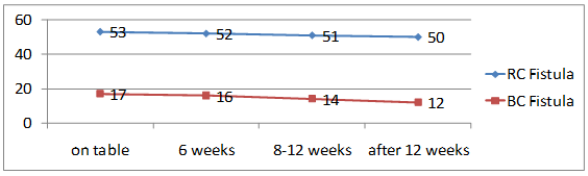
AGE(years)	MALE	FEMALE
10-19	2(2.6%)	1(1.3%)
20-29	2(2.6%)	1(1.3%)
30-39	10(13.3%)	0
40-49	8(10.6%)	3(4%)
50-59	17(22.6%)	7(9.3%)
60 0r more	18(24%)	6(8%)
TOTAL	57(76%)	18(24%)

92% of our patients had temporary venous access before creation of AVF; out of these 87% had jugular venous access and 5.3% had subclavian venous access. The AVF site chosen was radiocephalic in 77% of cases. Doppler ultrasound was done in 21 patients (28%) preoperatively out of the 75 cases. The average length of the distal anastomosis was 7 to 10 mm and proximal anastomosis was 5 to 7 mm. End to side anastomosis was done in most of cases viz 71 out of 75(94.6%). The fistulae were found to be functioning quite well (Table 2) ;(fig1).

TABLE- 2 FUNCTIONING OF FISTUL

	On table	6 weeks	8 -12 weeks	After 12 weeks
RC fistula	53/58	52	51	50 (1 aneurysm)
BC fistula	17/17	16 (1 thrombosis)	14 (4 bleed, 2 saved)	12 (2 aneurysm)

FIGURE-1 FUNCTIONING OF FISTULA



Most of AVFs (80%) almost immediately started functioning after surgery while 17.3% AV fistulas did not function after operation (Table 3).

TABLE-3 TIME NEEDED FOR MATURATION

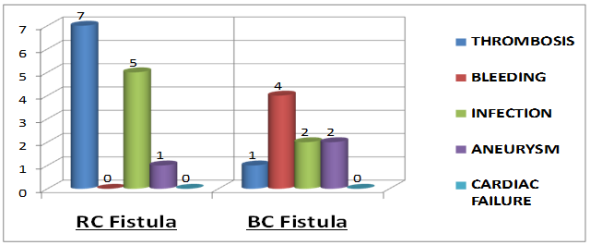
STATE OF AVF after operation	Time needed for maturation/week (%)				TOTAL
	6	6-8	>8	NONE	
IMMEDIATE FUNCTION	49(65.3%)	7(9.3%)	4(5.3%)	0	60(80.0)
DELAYED FUNCTION	0	0	2(100)	0	2(2.7)
NONE	0	0	0	13(100)	13(17.3)

10.6% cases developed thrombosis in the AVF, 4% developed bleeding, 7% developed infection and 3%cases an AV aneurysm was formed (Table 4. Fig 2).

TABLE-4 POST- PROCEDURE COMPLICATIONS

Site of avf	Early (<12 weeks)			Late (>12 weeks)	
	Thrombosis	Bleeding	Infection	Aneurysm	Cardiac failure
R-C AVF N=58(77.3)	7(9.3%)	0	5(6.7)	1(1.3)	-
B-C AVF N=17(22.7)	1(1.3)	4(5.3)	2(2.7)	2(2.7)	-
Total	8(10.6)	4(5.3)	7(9.4)	3(4.0)	-

FIGURE-2 COMPLICATIONS OF AVF



Further follow up of the cases showed promising results(table 5)

TABLE 5- FOLLOW UP OF AVFs

Period of surgery	No.of cases	Surviving patients	Functioning AVFs	Renal transplant
1st 6 months (with 2 Yr. F/U)	30	26	20 (76.9%)	2
6-12 months (with 1 Yr. F/U)	35	33	28 (84.8%)	1
12-18 months (with 3 months. F/U)	10	10	8 (80%)	0
Total	75	69	56(81.15%)	3

DISCUSSION

The native AVF with radiocephalic fistula is the most commonly created fistula in our centre (77%) and most of the patients with brachiocephalic fistulas are either previously failed distal fistulas or those with inadequate vessels. Side-to-side anastomosis is technically easier and can be done if the blood vessels are close to each other; however, this type of anastomosis may lead to the development of venous hypertension. Currently, the most acceptable option is end-to-side anastomosis.[5] In our study population,too, end to side anastomosis was done in most of the cases viz 71 out of 75(94.6%). In our study, the AVF was successful in 62 cases (82.7%) and a failure in 13 cases(17.3%). This correlates with literature data of 10-30%. Thrombosis of the AVF was the most common complication in our study followed by infection and bleeding. The failed cases in our study population may have been due to unsuitable veins despite clinical selection (3/54 cases) and Doppler selection(2/21 cases); the measures taken to control bleeding on table(extra sutures placed in 4 cases and pressure applied in 2 cases), and associated co-morbidities in 2 cases. Doppler USG is the only imaging modality that furnishes both morphological and functional data on native vascular access and it is the only imaging tool that can be used directly by the surgeon. Preoperative use of Doppler USG helps in the identification of vessels that are suitable for fistula construction .[6] Some studies have demonstrated that routine pre-operative sonographic vascular mapping results in a dramatic increase in successful native fistula construction.[7] In our study Doppler USG was used in 21 out of 75 cases. Doppler USG also helps in postoperative surveillance by the early detection of postoperative complications and thus helps native AVF survival .[6] The patency rate of AVFs was 82.6% in our study. It was thus more than the patency rate reported by Ahmed et al and Huber et al in their studies. 10% of our cases developed thrombosis. This was similar to the rate of thrombosis observed by Ahmed[8] and co-researchers(10%) . Dember[9] and co researchers have reported the development of fistula thrombosis in 19.5% cases; Grontoft et al [10]have reported the development of fistula thrombosis in 195 case at 6 weeks postoperatively. Thrombosis is the most common complication in 90% of AVFs.4% of our AVFs developed aneurysms. This correlates with the findings of Ahmed et al who observed aneurysms in 5.5% cases. Some authors have observed that at the initiation of haemodialysis treatment, 68% of patients use a dialysis catheter and 32% have vascular access .[11] 92% of our patients had temporary venous access before creation of the AVF.

Our study had some limitations. The duration of HD session, body mass index, serum albumin , presence of co-morbid conditions like diabetes mellitus , intake of anti platelet agents are some factors which can determine the outcome of the AVF. We did not analyse these in our study . Also, ours was a single centre study. We recommend multi - centre studies on this topic in the near future.

CONCLUSION

Native AVF is the optimal vascular access for HD. Distal AVFs are most preferred due to their less complication rate and more segment of the superficial vein. The success rate can be improved by proper case selection (with Doppler in selected patients), proper technique of anastomosis(minimal alteration in vein configuration and torsion) .

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