Original Article

Arteriovenous Fistula (AVF) Formation: Comparison of End-to-Side and Side-to-Side Techniques in End Stage Renal Disease.

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ABSTRACT

Objective: To compare the success and complications of the side-to-side and end-to-side techniques of AV fistula formation. **Study Design:** A prospective randomized comparative analysis of 344 cases. **Place and Duration of Study**: The study was carried out from February 2006 to July 2010 in the Department of Urology, Punjab Medical College and Al-Noor Hospital Faisalabad. **Subjects and Methods:** A total number of 344 patients with end stage renal disease (ESRD) were included in the study for AV. fistula formation for Hemodialysis access. 304 patients completed their follow up. AV fistula was made by end-to-side and side-to-side techniques. Patients were followed after 24 Hours, 1 week, 1 month and 6 months after the operation. **Results:** These 304 patients were divided into 2 groups. Group 1 comprises of 154 patients and group 2 comprises of 150 patients. AV fistula worked successfully in 88.3%, 70.78%, 68.18% and 61.04% of 154 group 1 patients after 24 hours, one week, one month and six months followup respectively. AV fistula worked successfully in 76%, 65.33%, 63.33% and 58% of 150 group 2 patients after 24 hours, one followup respectively.

Hemorrhage from fistula site was among 9.09%patients in group 1 and in 7.33% in group 2 patients after 24 hours of surgery while it was 2.6 % and 1.33% patients in group 1 and group 2 patients respectively after one moth follow up. Aneurysm was seen in 1.3% patients at one month and six months follow up respectively in group 1. It was seen in 0.67 and 1.33% patients at one month and six months follow up in group 2 patients. Ischemia was seen among 1.3% patients in group 1 and 8% in group 2 patients. No limb edema was present upto 1 week in any group. Odema was in 9.74% and 13% patients of group 1 patients at one month and six months follow up and 14.67% and 17.33% of group 2 patients at one month and six months follow up respectively. **Conclusion:** Both operative techniques for AV fistula formation are equally good for Hemodialysis access but complication rate with end-to-side technique is lower as compared to side-to-side technique. **Key Words:** Artriovenous Fistula (AVF), End Stage Renal Disease (ESRD), Side-to-side, End-to-side, Hemodialysis,

INTRODUCTION

Patients are dialyzed mostly for renal failure. Peritoneal dialysis and Hemodialysis are its two types having their own indications. Hemodialysis may be emergency therapy or planned in renal failure. End Stage Renal Disease (ESRD) is managed by either Peritoneal Dialysis or maintenance Hemodialysis or and ultimately by Renal Transplantation. Hemodialysis is method of removing waste products such as urea, cretenine excessive electrolytes as potassium and free water from the blood with a Hemodialysis machine. During Hemodialysis, blood continuously flows at certain flow rate from the vein having arterial blood through AV fistula to the Hemodialysis machine and then back to the vein. It may be done on Outpatient or Indoor basis. Less frequently it is done at home [1]. Thamor Graham developed dialysis for the treatment of renal failure across semi permeable membrane in 1854 [2]. Artificial kidney was first developed by Abd Rountee and Turnor in 1913 [3]. First Hemodialysis in human being was by Hass [4]. Artificial kidney was developed by Koff in 1943 [5]. An optimum blood flow from limb vessel is attained towards and from the Hemodialysis machine by three primary methods. These include an intravenous catheter, artriovenous fistula and synthetic graft. All three types need surgery to create access for

Hemodialysis[6]. AV fistula is the most commonly preferred method to gain access for Hemodialysis. End-to-side and side-to-side are the two types of operation to develop a fistula between artery and vein. Most often this procedure is preferred between radial artery and cephalic vein near the wrist on the non dominant upper limb. We planned this randomized prospective study to compare end-to-side and side-to-side AVF formation procedures with respect to success and complications.

PATIENT AND METHODS

This prospective study was conducted at the Department of Urology and Renal Transplantation, Punjab Medical College, Allied Hospital and Al-Noor Hospital Faisalabad from February 2006 to July 2010. All the patients from Outpatient Department, Emergency, Nephrology and other Medical units coming for AV fistula formation for Hemodialysis were included in this study. Patients with bad vascular status at planned site of AV fistula formation as well as previous fistula failure or vascular abnormality below the elbow joint in both upper limbs were excluded from the study. Blood pressure was properly controlled in hypertensive patients prior to this procedure. Hand exercises were advised to the patients in cases of weak radial artery pulsations and also for small veins in that area.

Patients were divided randomly into two groups and were operated under local anesthesia. End-to-side fistula close to wrist was made between side of radial artery and one end of vein in group 1 and side-to-side AV fistula close to wrist was made between radial artery and nearby vein in the other group 2. Other end of cephalic vein was ligated in group 1. Prolene No. 6/0 suture was used for vascular anastmosis. Pressure free bandage was applied on the wound after the completion of the procedure. AV fistula formation was declared successful by palpating the bruit and by auscultating the murmur at the site of AV fistula. It was declared as failure in case of the absence of above signs confirming the flow of high pressure blood from artery to the vein through the fistula.

Patients in the both groups were followed after 24 hours, one week, one month and six months after the operation to see the function of the fistula and to see complications like bleeding, wound infection, aneurysm, limb ischemia sign and limb edema. Patients who could not come due to any reason according to follow up schedule were dropped from the study. Data was analysed by chi-square test.

RESULTS

A total number of 344 patients were included in this study. Among them 210(60.9%) were male patients and remaining 134(39.1%) were female patients. Age of the patients in this study was in range of 11-68 years and mean age was 43 years. There were 172(50%) patients in end- to- side AV fistula group 1 and there were 172(50%) patients in side-to-side AV fistula group 2. Total 40(11.62%) including Eighteen patients from group 1 and 22 patients from group 2 were dropped from the study because they could not come according to the follow up schedule. So finally 304 total patients with 154 from group 1 and 150 from group 2 respectively completed the study by fulfilling the study protocol. AV fistula worked successfully in 136(88.3%) of 154 group 1 patients and 114(76%) of group 2 patients respectively at 24 hours after the procedure. This difference was significant (p value 0.0025). The success was 109(70.78%), 105(68.18%) and 94(61.04%) at one week, one month and six months respectively in group 1 and it was 98(65.33%) , 95(63.33%) and 87(58%) at one week, one month and six months follow up respectively in group 2 patients. This difference was not significant P value >0.05 at one week, one month and six months follow up.

Hemorrhage from fistula site was among 14(9.09%) patients in group 1 and in 11(7.33%) in group 2 patients after 24 hours of surgery while it was 4(2.6%) and 2(1.33%) patients in group 1 and group 2 patients respectively after one month follow up. There was no bleeding from fistula site in any patient from both groups at six months follow up.

Table 1:
Success Rate of Different Techniques

Duration	End-to-side Anastmosis	Side-to-side Anastmosis
24 Hours	136/88.31%	114/76%
1 Week	109/70.78%	98/65.33 %
1 Month	105/68.18%	95/63.33 %
6Months	94/61.04%	87/58%

Table 2:
Complications of End-to-Side Anastmosis

Complication	24 Hours	1Week	1Month	6Month
Hemorrhag	14/9.09%	--	4/2.6%	--
Aneurysm	--	--	2/1.3%	2/1.3%
Ischemia	--	--	--	2/1.3%
Oedema	--	--	15/9.74%	20/13%

No Aneurysm was seen at 24 hours and one week follows up in both groups. It was seen in 2(1.3%) and 1(0.67%) patients in group I and group 2 patients respectively at one month. Aneurysm was seen in 2(1.3%) and 2(1.33%) patients at six months follow up in group 1 and 2 respectively. No limb ischaemia was seen in any patient at 24 hours, one week and one month follow up in both the groups. It was seen among 2(1.3%) patients in group 1 and 12(8%) in group 2 patients. No limb edema was seen at 24 hour and one week follows up in both group patients. While it was present in 15(9.74.4%) and 20(13%) patients of group 1 patients at one month and six month follow up and 22(14.67%) and 26(17.33%) of group 2 patients at one month and six months follow up respectively.

Table 3:
Complications of Side-to-Side Anastmosis

Complication	24 Hours	1Week	1Month	6Month
Hemorrhag	11/7.33%	--	2/1.33%	--
Aneurysm	--	--	1/.67%	2/1.3%
Ischemia	--	--	--	12/8%
Oedema	--	--	22/14.67 %	26/17.33%

DISCUSSION

Hemodialysis is done by double lumen catheter, AVF and synthetic shunts. Artriovenous fistula is made at different sites. Most frequently used AVF is snuff box (Bresia Cimino) fistula with which all other fistulae are compared[7, 8]. We conducted our study to compare the results of snuff box AVF by the different techniques. Selection of the best site is achieved by good evaluation of the vascular status, adequate colletrals from ulnar artery to minimize problems of hand ischemia [9]. It is inaccordance to our study. We achieved all this by good physical examination associated the Allen test. Distal upper limb AV fistula are more common because of superficial venous system and less complications in comparison with proximal fistula[10].Our study has proved the same. There are multiple factors responsible for AVF failure but falling blood pressure, post operative hemorrhage and vascular injury during surgery are major factors[11]. Hemorrhage was seen in 15% of end-to-side and 18% of side-to-side AVF. It is similar to our study. Abdul Hussain Talaiezadih et al found failure of AVF due to fall of blood pressure in 22(73%) patients, thrombosis in 30% of patients. In some patients Hemorrhage and hematoma was seen after repeated punctures[12]. Upper limbs are gold standard for AV fistula formation.

Suchwab SJ et al evaluated that distal limb ischemia was low in lower than upper extremity AVF. In our study distal limbs ischemia was seen more in side-to-side AV fistula [13]. Sdwab SJ, Olvers MJ et al used different type fistula as a first choice [14]. It is as seen in our study. Feldman HI et al performed study regarding evaluation of predictor of successful artriovenous fistula maturation with success rate 55%. [15] Wedgwood Kr et al compared side-to-side AV fistula with end-to-side AV fistula and obtained 79.2% success rate of side-to-side anastomosis while 78.6% success rate of end-to-side anastmosis[16]. Our success rate was 58% by side-to-side techniques and 61% by end-to-side technique. Aneurysm was found in 1.3% of patients by end-to-side and 1.33% of patients by side-to-side AV fistula. Hand ischemia was seen in 1.3% patients of end-to-side and 8% of side-to-side AV fistula. High dose administration of heparin during surgery, checking proximal patency by flusing with Heparinized solution and appropriate techniques are responsible for good results. Success rate of AV fistula was lower in children as compared to adults. Stable blood pressure during and after surgery is necessary to minimize complications. Raised blood pressure may

lead to problems like bleeding and aneurysm formation. Hypotension leads to thrombus and failure of AV fistula [17]. In our study thrombosis was seen in 10% of end-to-side and 14% of side-to-side AV fistula. We performed thrombectomy and reanastomosis if thrombosis was diagnosed within 24 hours and success rate after such procedure was 40% by end-to-side and 56% by side-to-side anastomosis. Azam Ates et al evaluated results of radiocephalic AV fistula, brachiocephalic and AVF created by plytetrafleothylene graft and concluded that radiocephalic was superior to all[18].

CONCLUSION

Both operative techniques for AV fistula formation are equally good for Hemodialysis for access but complication rate with end-to-side techniques is lower as compared to side-to-side technique.

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