

Original Articles

A-V Fistula Blood Flow and Complications: A One Year Survey

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Abstract

Background: Worldwide haemodialysis(HD) is the mostly used method of renal replacement therapy. Arterio-venous fistula use is on rise due to Fistula First Initiative due to least complications of fistulae than catheters. But they are also subjected to many complications. Thereby appropriate surveillance of the fistulae is important.

Objectives: To measure the blood flow as well as fistula related complications in study population.

Materials and Methods: This was a cross sectional study, conducted in the department of Nephrology, Dhaka Medical College Hospital during September 2010 to December 2011. Total 118 subjects were included in the study. Besides visualization technique colour Doppler ultrasonogram of fistula and echocardiography were performed for each patients.

Results: Most of the patients had adequate fistula flow. Aneurysm was most common complication. Many subjects were suffered from primary and secondary fistula failure.

Conclusion: Arterio-Venous fistula is subjected to many complications and appropriate surveillance should be launched to detect complications and to prevent fistula failure.

Keywords: A.V fistula, haemodialysis

Introduction:

A mature, functional arterio-venous (AV) access is the lifeline for a hemodialysis (HD) patient, as an access for dialysis. Chronic kidney Disease (CKD) and end-stage renal disease (ESRD) population is expanding day by day and due to relative shortage of donor kidney HD is the choice of treatment worldwide. Many guide lines recommend increased A-V fistula construction because of the many hazardous complications of dialysis catheters. National Kidney Foundation's Kidney Disease Outcomes Quality Initiative (KDOQI, 2006) and Fistula First Initiative have developed guidelines in attempts to increase use of Arterio-Venous Fistula (AVF) due to least complications.¹ There by accelerated placement AV accesses and use of it for HD is

increasing. Though the fistulas are superior to catheters, AV accesses are also subjected to many complications. Therefore appropriate surveillance of the fistula are important.² All these permanent access are subject to complications associated low flow, failure of maturation, venous stenosis and thrombosis. On the other hand, states of high flow can result in high output heart failure So, appropriate surveillance for the vascular access becomes essential.² Because of the projected increase in placement and use of permanent AV accesses, a successful surveillance system for common complications of the access is essential.³

Objectives:

To measure the blood flow through fistula as well as to observe the fistula related complications.

Materials and Methods:

Study design: This study was a cross sectional study.

Place of study: This study was carried out in the Department of Nephrology, Dhaka Medical College and Hospital, Dhaka.

Period of study: September 2010 to December 2011.

Study population: Patients with End Stage Renal Disease (ESRD) who were getting haemodialysis through arterio venous fistula for more than three months.

Sample size: The study was a cross-sectional study. Therefore, we considered every available ESRD patient on haemodialysis through A-V fistula at the Department of Nephrology, Dhaka Medical College. Since there was no

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past record of similar study in Bangladesh sample size was determined as:

Sample size was determined by following formula:

$$n = \frac{Z^2pq}{d^2}$$

Total 118 subjects were included in the study.

Selection criteria:

Inclusion criteria: Patients undergoing haemodialysis by arterio venous fistula for more than three months, age: more than 18 yrs,sex: both sex andthose who gave consent.

Exclusion criteria: Patients who were getting dialysis for less than 3 months, age less than 18 years, in presence of any other acute condition which were a contraindication for HD.

Variables: Age, sex, type of fistula (Radio-cephalic/ bracio-cephalic), cause of end stage renal Disease (ESRD), duration of use of fistula, primary fistula failure(failure to mature fistula after creation),blood flow through the fistula, peak systolic flow (PSF), end diastolic flow (EDF), diameter of fistula, aneurysm, haematoma, stenosis, thrombosis, secondary fistula failure (failure of a functioning fistula), infection in fistula, heart failure, pain in hand, dizziness during dialysis and cyanosis of affected hand were also recorded.

Methods of data collection:

All patients with ESRD on maintenance Haemodialysis (HD) through fistula for 3 months or more from September 2010 to December 2011 were invited to participate. In our centre, no patient had A-V graft. Selections of patients were done as per inclusion and exclusion criteria. Total 118 patients were included in our study. Prior to any procedure, informed written consent was taken from all subjects. All of the participants had the autonomy to refuse the study. At the onset of study a standardized questioner were prepared regarding age, sex, type of fistula, duration of useof fistula, history of failure of fistula maturation. Line infection were recorded by pain, redness, tenderness in fistula site, fever or culture positivity, pain and dizziness during dialysis, cyanosis of hand were recorded. A-V fistula Colour Doppler Ultrasound was performed by an expert vascular sonologist for the blood flow through the fistula, PSF, EDF in cm/m²and diameter of fistula were recorded as milimeter from the Centre for Nuclear Medicine & Ultrasound, Bangladesh Atomic Energy Commission, Dhaka Medical College Hospital Campus, Dhaka- 1000.Colour Duplex Ultrasonography was performed by high frequency (7.5 MHZ) linear probe with the USG unit using Toshiba Nemio-30, Japan using B flow mode of duplex study. All fistula were examined for the

presence of aneurysm, haematoma formation, Stenosis, thrombosis in vessels. For each patients echo cardiography was performed for the presence of heart failure. During the whole study period number of secondary fistula failure was also noted.

Results

A total 118 patients were included in the study. Mean age 43.58±12.49 with age ranging 18-75 years. Majority of the patients were in between 41 -50 years. Male were found 92(78% and female 26(22%). Male female ratio was 2.5:1. Among the causes of renal failure DM 52(44.2%), GN 35(29.7%), Hypertension 9(4.2%), Obstructive nephropathy 5(4.2%), ADPKD 5(4.2%), and unknown were 12 (10.2%).Radio cephalic were found 94(79.7%), Brachiocephalic werefound 24(20.3%).Mean left ventricular ejection fraction were 57.24±6.95,with a range 40- 70%.Mean blood flow through fistula was 1174.1±554.8 with a range 456 to 2893 ml/min. Duration of use were 9.89±6.48 months with a range 53 to 27 months.

Table-I

Arterio Venous fistula blood flow. (N=118)

A-V Fistula Parameters	Mean±SD	Range (Min-Max)
Blood flow (ml/sec)	1207.11±588.56	(456-2893)
PSF(cm/sce)	151.69±55.27	(80-344)
EDF(cm/sce)	92.90±23.76	(41-153)
Diameter(mm)	4.81±1.16	(3.2-7.4)

Table-II

Arterio- venous fistula complications. (N=118)

Complications	Frequency	Percentage
Aneurysm	33	28.45
Hematoma	4	3.8
Primary fistula failure	19	16.10
Thrombosis	2	2.3
Stenosis	0	0
Secondary fistula failure	22	18.64
H/o fistula infection	7	5.9
Dizziness during dialysis	18	15.25
Pain and swelling in limbs	15	12.71
Cyanosis	4	3.38

Discussion

Beladiet .al. found in his study majority of the study patients were in the age-group of 41-60 years and there was a male

preponderance (56.7%). The mean duration from the time AVF surgery was performed was 26 ± 29.8 months, the mean duration of ESRD was 48.1 ± 45.52 months and the mean duration on dialysis was 28.6 ± 30.81 months.⁴ Mean duration of dialysis in our patients were much less than their study that might be due to the facts most of the patients receive 8 hours dialysis per week rather than required 12 hours/weeks, that might affect their overall survival. Our study also found male preponderance that might due to the fact that male are the most privileged group to achieve high medical care especially like most of poor countries. Beladi et. al. found blood flow through AV fistula was 400-500ml/min in 4 patients, 500-1000ml/min in 72 patients, 1000-1600ml/min in 19 patients, more than 1600ml/min in 5 patients. No Stenosis and obstruction due to thrombosis were observed.⁴ Lopot F et al. found in their study that blood flow as low as 200ml/min to 2 l/min. They also stated that the lower values were observed in females and diabetic patients.⁵ Nidham A et. al. found the means of flow rate 950 ± 215 ml/min at 0 day and 3113 ± 307 ml/min at 28 days.⁸ Nidham A et. al. observed in a study, 31(72%) patients have a fistula flow rate over 1300 mL/min, 12 (28%) patients have a flow rates within 1000 ± 300 mL/min, and none has a fistula flow rate less than 700 mL/min. In our patients most of the patients have adequate blood flow which supports that study. Tessitore et. al. observed Stenosis detected by flow monitoring of a fistula flow less than 350 ml/min, were treated either angioplasty (72%) or by surgical repair (28%) and this pre-emptive repair group experienced a higher thrombosis free survival.⁶ Mahesh K et. al. found, the mean diameters 4.9 ± 0.53 mm at 2 days vs. 7.3 ± 0.68 mm at 28 days.⁷

Fokoe et. al. found aneurysms, failure to mature, and thrombosis were the most frequent complications occurring in 26.54%, 14.69%, and 12.79% of cases, respectively. The management options for the complications included the creation of a new access in 36.96%, a temporary catheter before a new AVF in 10.52%, and nonoperative management in 43.12%. That study also found no adverse effect of comorbid factors such as diabetes mellitus ($\chi^2 = 3.58$, $P > 0.05$) or HIV-positive status ($\chi^2 = 0.64$, $P > 0.05$) on the complication rate.⁹ Yu Q et. al. found the most frequent complications seen in their patients were thrombosis (13.86%), aneurysm (12.23%), anastomotic stenosis (2.17%); arterial steal syndrome (1.63%); infection (0.54%); and venous hypertension (0.27%). Aneurysm was more common in the elbow group (66.67%) than in the wrist group (9.43%) ($p < 0.01$). There were no differences in other complications, patency rate during 1-3 years or Kt/V between the 2 groups. They did not find high-output cardiac failure related to NAVFs

(Native AV Fistula) in their patients. We also did not find high-output cardiac failure related to NAVFs in our patients.¹⁰ Derakhshafar A et. al. found most of the patients (75.6%) had undergone AVF surgery only once and in the majority (61.1%), the fistula was in the left arm. The most frequent complication seen in our patients was aneurysm (51%), followed by venous hyper-tension (16.7%), infection (4.4%), thrombosis (3.3%) and arterial steal syndrome (1.1%).¹¹ In our patients 18.64 % patients had history of secondary fistula failure. Nidham A et. al. found, with optimum blood flow three (25%) patients develop dizziness during hemodialysis; three (25%) have numbness in their fistula corresponding hand during hemodialysis; two (17%) have weaker radial pulse in their fistula corresponding limb compared to the other limb; three (25%) have peripheral cyanosis in their fistula corresponding hand compared to the other limb.⁸

Limitation

It was a single centre study, stenosis could not be ruled out as this study did not include venography.

Conclusion

The complications of Arterio Venous fistula (AVF) is high, and greater attention should be paid to the prevention of these complications. Care should be taken for early diagnosis and management of complications related to AVFs, to prevent loss of valuable vascular access.

Conflict of Interest: None

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