Outcome of End to Side Arterio-venous Fistula for Chronic Hemodialysis Patients at Nawaz Sharif Kidney Hospital Swat: A Cross Sectional Study

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ABSTRACT

Background: End stage renal disease (ESRD) is associated with irreversible kidney function decline. Total number of ESRD patients is increasing dramatically and became major public health concern, globally. Arterio venous (AV) fistula for hemodialysis is gold standard for vascular access. A subcutaneous anastomosis of an artery to adjacent vein is termed as AVF.

Objective: To determine outcome of end to side Arterio-venous fistula in terms of AVF functioning, primary patency, maturation and associated complications

Material and Methods: A cross sectional study was conducted in department of urology at Nawaz Sharif Kidney Hospital Swat. Study duration was one year (April 2017- April 2018). Sample size of 195 patients was calculated using WHO calculator with 5% significance, 95% confidence interval, 85% Patency (primary patency). Patients were recruited through non probability consecutive sampling. Ethical approval and consent forms were taken. After pre-operative assessment, radio-cephalic and elbow fistula were created where feasible. Post operatively patients were followed after one month. Data was analyzed using SPSS version 22.0. Chi-square test was applied to observe associations. P value =0.05 was considered significant.

Results: Total 195 patients were included in study. There were 101(51.8%) males and 94(48.2%) females. Mean age of patients was 51 years±12.04 SD. The AVF site was radio-cephalic in 169(86.7%), cubital fossa in 23(11.8%) and Brachio-median cubital AVF in 3(1.5%) patients. AVF functioning was immediate in 116(59.5%), delayed in 51(26.2%) and non-functional in 28(14.4%) patients. Primary patency was low in 85(43.6%) patients, moderate in 58(29.7%) and better in 52(26.7%) patients. AVF maturation was reported in 159(81.5%). Thrombosis was most common complication (25.1%). AVF functioning is significantly associated with gender (p=0.00), early thrombosis (p=0.01), late thrombosis (p=0.01), stenosis (p=0.00) and primary patency (p=0.00).

Conclusion: Arterio-venous fistula (AVF) is gold standard for vascular access with functional rate 47.4%, high degree of maturation and better primary patency. This specialized surgery should be done & referred to those surgeons who are well versed in vascular surgery, knows their limitations & are cognizant of the principles of vascular surgery. Thrombosis is most common complication of subsequent procedure. Further research is required on pathophysiology of thrombosis

Key words: *Arterio-venous fistula, chronic Renal Failure, hemodialysis*

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INTRODUCTION

End stage renal disease (ESRD) is associated with irreversible kidney function decline[1]. Total number of ESRD patients is increasing dramatically and became major public health concern, globally[2]. A high prevalence of ESRD is reported in United States (U.S), Japan and Taiwan (1500 people per million population). Mortality and morbidity due to ESRD is as high as >20% per year[3]. However, in U.S health care cost of 17$ per billion annually is reported. In Pakistan, incidence of ESRD is 16000 people per years[4]. Prevalence of ESRD in India and Pakistan is estimated to be 17.35%. Major risk factors for ESRD in Pakistan are renal calculi 5%, diabetes mellitus 10%, hypertension 12% and glomerulonephritis 37%. Moreover gender, weight, race, age, nocturia, smoking, hyper-uricemia, recreational drugs, poor health education and chronic anemia are indirect risk factors for ESRD[5].

Approximately, one quarter of ESRD patients are receiving kidney transplants, one tenth are getting peritoneal dialysis and one quarter are receiving hemodialysis in Pakistan[6]. Arterio venous (AV) fistula for hemodialysis is gold standard for vascular access. A subcutaneous anastomosis of an artery to adjacent vein is termed as AVF. Anastomosis can be of two types; One is between artery & vein in a side to end fashion and 2nd is between arterial side to side of vein. Common locations of AVF include radiocephalic (wrist), brachiocephalic (elbow), or brachiobasilic transpositions AVF. AV fistula is preferred type of vascular access as compared to double lumen catheters & AV grafts for hemodialysis. Better efficacy of AV fistula as compared to AV graft is associated with low frequency of stenosis, infection and thrombosis. Evidence exists that patients with AV fistula had lower complications rate and longer duration of patency. An AVF created on arm or forearm is considered as superiors to grafts for vascular access[7].

Ahmed et al. reported among all the patients who undergone AVF, 78.1% had radiocephalic AVF, 20.5% cubital fossa and 1.4% had left snuff box AVF. 67.1% had AVF maturation while 9.6% cases did not matured. AVF function failure was reported in 26% patients as a result of thrombosis (20.5%) and aneurysm (5.5%)[8].

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Lok et al. reported that 50% goals set regarding AVF outcome were achieved by acceptable rates of morbidity 7.2%, no operative mortality and better primary patency in 78% patients. Early detection of complications is associated with long term patency rates improvement[9].

Limited data is available on outcome of end to side AV fistula efficacy in Pakistan. The study aims to determine outcome of end to side Arterio-venous fistula in terms of AVF functioning, primary patency, maturation and associated complications.

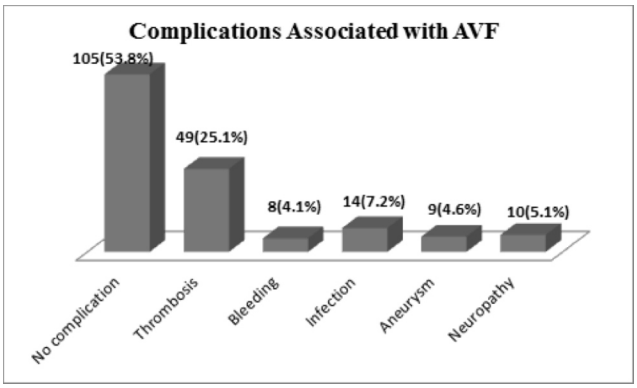
MATERIALAND METHODS

A cross sectional study was conducted in department of urology at Nawaz Sharif Kidney Hospital Swat. Study duration was one year (April 2017- April 2018). Sample size of 195 patients was calculated using WHO calculator with 5% significance, 95% confidence interval, 85% prevalence of adequate patency (primary patency)[10]. Non probability consecutive sampling was used for recruitment of patients. Ethical approval was taken from Ethical review board of Nawaz Sharif kidney hospital, Swat. Consent forms were taken from all participants. Patients of age >18 years, both gender, diagnosed with ESRD, receiving chronic haemodialysis (from last 6 months) were included in the study. Patients with acquired immunodeficiency syndrome, hepatitis C, hepatitis B, local or systemic sepsis, small and deformed limbs with inadequate venous mapping were excluded from study. Preoperative clinical assessment includes blood count, blood urea, serum electrolytes, coagulation profile, serology, antibody and blood grouping. Radio-cephalic and elbow fistula were created where feasible. Post operatively patients were followed after one month. Data was analyzed using SPSS version 22.0. Mean and standard deviation was calculated for quantitative variables. Frequency and percentages were calculated for qualitative variables. Effect modifiers like age, gender, diabetes mellitus and hypertension was controlled by stratification. Post stratification chi-square test was applied. P value =0.05 was considered significant.

RESULTS

Total 195 patients were included in study. There were 101(51.8%) males and 94(48.2%) females. Mean age of patients was 51 years±12.04 SD. There were 106(54.4%) patients with diabetes mellitus while 89(45.6%) did not had diabetes. Total 117(60%) patients had hypertension while 78(40%) did not had hypertension. The AVF site was radio-cephlic in 169(86.7%), cubital fossa Brachio-cephalic in 23(11.8%) and Brachio median cubital AVF in 3(1.5%) patients. Out of all, 30(15.4%) patients had early thrombosis while 165(84.6%) did not had early thrombosis. Total 59(30.3%) had late thrombosis while 136(69.7%) did not had late thrombosis. Among all the patients, 44(22.6%) had stenosis while 151(77.4%) did not had stenosis. Primary patency was low in 85(43.6%) patients, moderate in 58(29.7%) and better in 52(26.7%) patients. AVF maturation was reported in 159(81.5%) while 36(18.5%) did not had AVF maturation. AVF functioning was immediate in 116(59.5%), delayed in 51(26.2%) and non functional in 28(14.4%) patients. No complication was seen in 105(53.8%) patients while 49(25.1%) had thrombosis, 8(4.1%) had bleeding, 14(7.2%) had infection, 9(4.6%) had aneurysm and 10(5.1%) had neuropathy as shown in Figure 1.

Figure 1: Complications Associated with Arterio-Venous Fistula for chronic haemodialysis



Among all the males 101(51.8%), 85(43.6%) had AVF maturation while 16(8.2%) did hot had AVF maturation. Similarly among all females 94(48.2%), 74(37.9%) had AVF maturation while 20(10.3%) did not had AVF maturation (??^{2} =0.955, p=0.36, df =1). Among all the patients 18-40 years, 28(14.4%) had AVF maturation while 6(3.1%) did not had AVF maturation. Similarly among all those in age group >40 years 161(82.6%), 131(67.2%) had AVF maturation while 30(15.4%) did not had AVF maturation (??^{2} =0.18, p=0.55, df =1).. An insignificant association was reported between AVF maturation and DM (P=0.45), HTM (p=0.32) as shown in Table 1.

Table 1: Association between AVF maturation and independent variables

Gender	AVF maturation		Total	P value
	No	Yes		
Male	16(8.2%)	85(43.6%)	101(51.8%)	0.36
Female	20(10.3%)	74(37.9%)	94(48.2%)	
Total	36(18.5%)	159(81.5%)	195(100%)	
Age				
18-40 years	6(3.1%)	28(14.4%)	34(17.4%)	0.556
>40 years	30(15.4%)	131(67.2%)	161(82.6%)	
Total	36(18.5%)	159(81.5%)	195(100%)	
DM				
No	14(7.2%)	75(38.5%)	89(45.6%)	0.45
Yes	22(11.35)	84(43.1%)	106(54.4%)	
	36(18.5%)	159(81.5%)	195(100%)	
HTM				
No	20(10.3%)	58(29.7%)	78(40%)	0.32
Yes	16(8.2%)	101(51.8%)	117(60%)	
Total	36(18.5%)	159(81.5%)	195(100%)	

Table 2: Association between AVF functioning and independent variables

Gender	AVF functioning			Total	P value
	Immediate	Delayed	Non Functional		
Male	48(24.6%)	40(20.5%)	13(6.7%)	101(51.8%)	0.00
Female	68(34.9%)	11(5.6%)	15(7.7%)	94(48.2%)	
Early thrombosis					
Yes	23(11.8%)	4(2.1%)	7(3.6%)	34(17.4%)	0.01
NO	93(47.7%)	47(24.1%)	21(10.8%)	161(82.6%)	
Late thrombosis					
No	72(36.9%)	41(21.0%)	23(11.8%)	136(69.7%)	0.01
Yes	44(22.6%)	10(5.1%)	5(2.6%)	59(30.3%)	
Stenosis					
No	105(53.8%)	26(13.3%)	20(10.3%)	151(77.4%)	0.00
Yes	11(5.6%)	25(12.8%)	8(4.1%)	44(22.6%)	
Primary Patency					
Low	56(28.7%)	6(3.1%)	23(11.8%)	85(43.6%)	0.00
Moderate	19(9.7%)	37(19%)	2(1.0%)	58(29.7%)	
Better	41(21%)	8(4.1%)	3(1.5%)	52(26.7%)	

Among all the males 101(51.8%), 48(24.6%) had immediate AVF functioning, 40(20.5%) had delayed functioning while 13(6.7%) had non functional AVF. Similarly among all females 94(48.2%), 68(34.9%) had immediate, 11(5.6%) had delayed and 15(7.7%) had non functional AVF (??^{2} =19.856, p=0.00, df =2). Among all the patients with early thrombosis 34(17.4%), 23(11.8%) had immediate, 4(2.1%) had delayed and 7(3.6%) had non functional AVF. Similarly among all those who did not had early thrombosis 161(82.6%), 93(47.7%) had immediate, 47(24.1%) had delayed and 21(10.8%) had non functional AVF (??^{2} =8.11, p=0.00, df =2).. Statistically significant association was found between AVF function and late thrombosis (p=0.01), stenosis (0.00) and primary patency (p=0.00) as shown in Table 2.

DISCUSSION

A well functional vascular access is an important indicator of haemodialysis success. AVF is preferred vascular access and considered as gold standard. Complications associated with AVF accounts for 16% to 25% hospital admissions[11].

Present study reported AVF site was radio-cephlic in 169(86.7%), cubital fossa Brachio-cephalic in 23(11.8%) and Brachio-median cubital AVF in 3(1.5%) patients. Ahmed et al has reported that radiocephlic AVF is created in 78.1%, cubital fossa in 20% and snuff box AVF in 1.4% patients[8]. Brescia et al.has reported that radiocephic fistula is most common operative procedure for fistula construction in chronic haemodialysis patients[12].

Our study found out that AVF functioning was immediate in 116(59.5%), delayed in 51(26.2%) and non-functional in 28(14.4%) patients. Mozaffar et al. has reported a total failure rate of AVF of 18.3%. Major reason of failure was thrombosed access veins[13].

Our study reported that primary patency was low in 85(43.6%) patients, moderate in 58(29.7%) and better in 52(26.7%) patients. Kazemzadeh et al. reported that primary patency was 79.5% after 1 month, 70% after 2 months, 65% after 3 months and 60.5% after 4 months[14]. Sahasrabudhe et al reported that patency rate dropped to 53.63% in 2 years and 34.39% in 3 years[15].

This study found out AVF maturation in 159(81.5%) while 36(18.5%) did not had AVF maturation. A similar study reported that AVF maturation was found in 85% cases while 15% cases never matured. Evidence exist that success rate of AVF is associated with AVF maturation in 70% cases[16].

In present study AVF functioning is significantly associated with gender (p=0.00), early thrombosis (p=0.01), late thrombosis (p=0.01), stenosis (p=0.00) and primary patency (p=0.00). Evidence exist that AVF function is associated with AVF site (p=0.01) and low rate of complications (p=0.00)[17].

In present study no complication was seen in 105(53.8%) patients while 49(25.1%) had thrombosis, 8(4.1%) had bleeding, 14(7.2%) had infection, 9(4.6%) had aneurysm and 10(5.1%) had neuropathy. Weiswasser et al. reported aneurysm and thrombosis are most complications of AVF[18].

Limitation: Small sample size and conduction of study at single center limits generlizability of study.Further research will be required to elucidate the exact pathophysiology of thrombosis in AVF in patients of CKD.

The strength of this study is that it provides an insight & emphasis on the importance of end to side vascular anastomosis along with priority of first to go for distal radio-cephalic gold standard AVF.

The study is implicated on Urologists, Transplant surgeons, Vascular Surgeons, General Surgeons & Nephrologists.

CONCLUSION

Arterio-venous fistula (AVF) & the end to-side fashion is the gold standard for vascular access with functional rate 47.4%, high degree of maturation and better primary patency. This specialized surgery should be done & referred to those surgeons who are well versed in vascular surgery, knows their limitations & are cognizant of the principles of vascular surgery.

Thrombosis is most common complication of subsequent procedure. Further research is required on Pathophysiology of AVF thrombosis in patients of CKD. AVF is the most cost effective, durable & natural among all the other means of vascular access for hemodialysis patients. Moreover the priority of site for AVF construction should be the most distal first & end to-side fashion followed by the more proximal sites & not vice versa.

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