ORIGINAL ARTICLE

PROXIMAL ARTERIO VENOUS FISTULA CREATION – A GOLD STANDARD IN CHRONIC RENAL FAILURE PATIENTS WITH MULTIPLE COMORBIDITIES

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Background: Patients with end stage renal disease need an accurate and effective vascular access for haemodialysis. This study was conducted to postulate a hypothesis that proximal arterio venous fistula (AVF) creation should be a gold standard in Chronic Renal Failure (CRF) patients with multiple co morbidities. **Methods**: A total of 230 patients reporting to Vascular Surgery Clinic in Combined Military Hospital Lahore and Peshawar from January 2014 to January 2016 for AVF creation, were included and equally divided into two groups by random draw method. Distal AVF created in Group A and proximal AVFs at elbow in Group B. The data regarding age, gender, atherosclerotic risk factors, body mass index (BMI) was recorded. The groups were compared for functional maturation of AVF and their patency at 6 and 12 months. **Results:** Mean age was 30±SD 6.5 years (31±SD 5.1 in Group A, 30±SD 6.9 in Group B) with a male to female ratio of 5.4:1. In terms of age (*p*-value 0.529), gender (*p*-value 0.716), diabetes (*p*-value 0.682), hypertension (*p*-value 0.659) and BMI; there was no difference between two groups. 85.2% (n=98) AVFs matured in Group B as compared to 44.3% (n=51) AVFs in Group A (*p*-value=0.0045). Furthermore, statistically significant differences between the two groups were found in terms of patency rates at 6 and 12 months (73.9% and 66% in Group B: 26.9% and 16.5% in Group A; *p*-value 0.0039 and 0.0007 respectively). **Conclusion:** Proximal AVF creation in CRF patients with multiple co morbidities should be the gold standard as a primary procedure in terms of better long term primary patency.

Keywords: Co morbidity; Creation; Aold standard; Proximal AVF

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INTRODUCTION

The patients with end stage renal disease need an accurate and effective vascular access for haemodialysis as permanent replacement therapy and according to guide lines of NKF-DOQI, at least 50% of the vascular access should be in the form of an arteriovenous fistula.[1] An AVF can usually be created distally or proximally preferably in a non-dominant upper limb. The distal AVF are created at wrist, mid forearm and upper forearm between radial artery and cephalic vein but proximal AVF are created at elbow between brachial artery and cephalic vein or basilica vein. Radiocephalic AVF creation is the gold standard as it provides long vein area for cannulation with less complication rate.[2,3]

However, various studies are in favour that CRF patients may have less or lost superficial veins around wrist and in the forearm furthermore they may have diseased distal arteries in distal forearm and wrist.[4–7] Hence the failure and patency loss in AVFs created in this area under these circumstances are higher. The diameter of veins and artery at elbow are usually satisfactory so proximal AVF creation provides better results especially when the distal options are exhausted[8]. We postulated in our study that proximal AVF creation should be the gold standard in CRF patients with multiple co morbidities.

MATERIAL AND METHODS

All consecutive patients from January 2014 to January 2016, reporting to Vascular Surgery Clinic in Combined Military Hospital Lahore and Peshawar for AVF creation, were included in this study. All patients underwent clinical evaluation and preoperative Duplex scan to assess the patency of superficial veins. Patients with no major atherosclerotic risk factor (diabetes, hypertension, smoking), bleeding diathesis, oral anticoagulant therapy, Body Mass Index (BMI) <25, inadequate flow and patency of superficial veins on Duplex Scan, previous surgery for AVF at same site, requiring arteriovenous graft (AVG) and unwilling to participate in study were excluded. Patients were randomly assigned into two groups by simple random draw method. All patients in group A underwent distal AVF creation in forearm or wrist. Group B patients had fistula created at elbow.

All patients underwent AVF procedure by a Consultant Vascular Surgeon who had a minimum of

five years of experience of doing such procedure under local anaesthesia. The operating surgeon made a decision to choose the exact type and site of AVF within the assigned group. All patients were given oral antibiotics and analgesia on discharge and provided with written instructions for standard care of the AVF. Regular follow up was done fortnightly for 2 months followed by 6 monthly reviews.

A functionally mature AVF is defined as per Kidney Disease Outcome Quality Initiative (KDOQI) guidelines as one that can be easily cannulated and has at least six successful consecutive dialysis sessions.[3] Fistula was labelled failed if there was no flow or the flow rate was inadequate for continuation of dialysis sessions (Less than 200 ml/min) on Duplex Scan. Cannulation was done by experienced staff in dialysis unit. They followed standard operating protocols for cannulation to prevent AVF failure due to mis-cannulation. Fistula failure rate and other procedure related complications were recorded.

The data was analyzed using SPSS-22. The numerical outcomes e.g., age was calculated as mean and standard deviation. Gender was recorded as frequency and percentage. Group comparison was done using Chi Square test to assess qualitative variables such as failure of fistula and Independent t-test to assess quantitative variables like age. The results were considered statistically significant if the *p*-value was found to be less than or equal to 0.05.

RESULTS

A total of 230 consecutive patients fulfilling the inclusion criteria were included in this study. The minimum age of patients was 22 years and maximum were 45 years with mean age of 30±SD 6.5 years. Out of 230 cases, 84.3% (n=194) were males and 15.7% (n=36) were females. Male to female ratio was 5.4:1.

Patients were divided into two equal groups: Group A (n=115) had all patients who had distal AVF and Group B (n=115) had AVF created proximally at elbow. In terms of age (*p*-value 0.529), gender (*p*-value 0.716), diabetes (*p*-value 0.682) and hypertension (*p*-value 0.659); there was no statistically significant difference in the two groups (Table-1). Furthermore, there was no difference in two groups in terms of BMI.

A total of 64.7% (n=149) AVFs matured. In terms of comparison between the two groups, 85.2% (n=98) AVFs matured in Group B as compared to 44.3% (n=51) AVFs in Group A with a *p*-value of 0.0045. The patency rates show statistically significant difference between the two groups at 6 and 12 months. Patients who had proximal AVFs at elbow show a patency rate of 73.9% and 66% at 6 and 12 months respectively when compared to a patency rate of distal AVFs as 26.9% and 16.5% at 6 and 12 months respectively.

Table-1: Baseline characteristics, risk factors and patency rates.

Variable	Total (n=230)	Group A (n = 115)	Group B (n = 115)	*p*-value
Mean Age (Years±SD)	30±SD 6.5	31±SD 5.1	30±SD 6.9	0.529
Male Gender [n, (%)]	194 (84.3)	93 (80.9)	101 (87.9)	0.716
Atherosclerotic risk factors:				
Diabetes [n, (%)]	180 (78.2)	85 (74)	95 (82.6)	0.682
Hypertension [n, (%)]	130 (56.5)	71 (61.7)	59 (51.3)	0.659
Smoking [n, (%)]	100 (43.4)	62 (53.9)	38 (33)	0.392
All 3 risk factors [n, (%)]	99 (43)	51 (44.3)	48 (41.7)	0.559
Two risk factors [n, (%)]	95 (41.3)	47 (40.8)	48 (41.7)	0.571
Single risk factor [n, (%)]	36 (15.6)	17 (14.7)	19 (16.5)	0.323
BMI 25–30 [n, (%)]	61 (26.5)	30 (26)	31 (26.9)	0.441
BMI 31–35 [n, (%)]	103 (44.7)	54 (46.9)	49 (42.6)	0.397
BMI 36–40 [n, (%)]	54 (23.4)	26 (22.6)	28 (24.3)	0.524
BMI >40 [n, (%)]	12 (5.2)	5 (4.3)	7 (6)	0.671
Maturation rate and patency [n, (%)]:				
Maturation	149 (64.7)	51(44.3)	98 (85.2)	0.0045
Patency (6 months)	116 (50.4)	31 (26.9)	85 (73.9)	0.0039
Patency (12 months)	95 (41.3)	19 (16.5)	76 (66%)	0.0007

DISCUSSION

Accurate and effective vascular access is required for haemodialysis in patients with end stage renal disease. This vascular access can be achieved by a central venous catheter insertion, arteriovenous fistula creation or arteriovenous graft.[1,8,10] Central venous catheters may be acute or temporary (for 1–2 weeks) and chronic or permanent (for more than 2 weeks). These can be inserted in Internal Jugular Vein (IJV), Femoral Vein or Subclavian Vein. The IJV is preferable because of less infectious and

thrombotic complications as compared to femoral and subclavian veins.[11,12] AVF can be created distally at wrist, mid forearm, proximal forearm and proximally at elbow by anastomosing a superficial vein with an artery.[13] ArterioVenous Graft (AVG) is similar to AVF creation but instead of superficial vein a synthetic vascular graft is used as a bridge between an artery and a deep vein.[14]

According to NKF-DOQI, a minimum of 50% of the vascular access should be an AVF and radiocephalic AVF creation at wrist is the gold standard. The internal diameter of vein should be >2 mm whereas arterial diameter >1.6 mm to create a fistula that can deliver a blood flow of 600 ml/min during dialysis.[15,16] But the cephalic vein at the wrist is too small or is thrombosed sometimes as a consequence of previous intravenous therapy.

A meta-analysis study revealed that 15% of the wrist fistulas never matured functionally, and the mean primary patency rate was 63% at 1 year and improved to 66% with secondary procedures.[17] Another meta-analysis showed the primary patency rate of distal radial cephalic vein fistulae in patients below 65 years of age as 57% and 45% at 1 and 2 years respectively and improved by secondary procedures to 66%.[18] In our study we created 115 radiocephalic AVF in CRF patients with multiple comorbidities and the primary patency rate 44.3% which fell down to 26.9% and 16.5% at 06 and 12 months respectively. The same studies suggested that the patency rate at 1 year was quite less (<57%) in patients above 65 years but improved to 82% in patients with proximal AVF creation at elbow.

Age, female gender, diabetes mellitus, cardiovascular diseases and prior catheter use have shown conflicting association in many studies with fistula dysfunction and decreased primary and cumulative primary patency especially in distal AVF.[4–7] But some large studies are in favor that fistula failure or dysfunction and decreased patency rate have strong association with advanced age, female gender and diabetes.[19,20] We do have the similar findings in our study of decreased primary and cumulative primary patency when distal AVF were created as a primary procedure. The patency rate was increased when a proximal fistula was created in all these patients after failure or non- functioning or patency loss of distal fistulae.

Obesity is associated with deeply lying superficial veins especially at wrist and in forearm. So, fistula failure rate is high in these patients. Elderly, female, hypertensive and diabetic patients have diseased blood vessels especially medium and small sized, hence failure of distal AVF is high. Our study augments this argument also by showing a lower patency rates in obese patients with distal AVFs.

CONCLUSIONS

On the basis of our finding we conclude that CRF patients with multiple comorbid conditions has compromised vasculature especially at wrist and in the forearm, so proximal AVF creation as a primary vascular procedure to get an accurate and effective vascular access is better in terms of less negative exploration, less fistula failure rate and higher primary patency.

AUTHORS' CONTRIBUTION

MJ: Study conception, analysis, and investigation. RU: Data collection. Analysis, write-up. KA: Critical review and revision. MJ, RU: Final approval of the article. MJ, RU, KA: Accountability for all aspects of the work.

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