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Incidence and Risk factors for primary AV fistula failure

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Abstract
Introduction: National Kidney foundation KDOQI Vascular access guidelines rank AVF as the best available access for hemodialysis. However a significant number of AVF (28 – 53%) fail to mature adequately to support dialysis therapy. This paper analyses the incidence and risk factors associated with primary fistula failure (PF).
Material and Methods: From Jan 2000 to October 2007, patients who had an A V fistula for hemodialysis were included in the study. Baseline demographic data included age, gender, co morbidities, cause of renal failure and previous catheter use. Access characteristics recorded included access type, anatomic location, dates of creation and failure to mature. Univariate analysis was done to detect the risk factors associated with PF.
Results: 116 AVF were created in 100 patients (M:F = 1.85:1; Mean age = 45.24 ± 20yrs).Co morbidities included Diabetes Mellitus (DM) in 72%, Hypertension in 84%, Coronary Artery Disease (CAD) in 27%, Cerebro Vascular Disease (CVD) in 03%, and Peripheral Vascular Disease (PVD) in 20%. Diabetic nephropathy was the most common cause of CRF (60%). Left side (84%) was most commonly used and Radiocephalic fistulae done in 55% patients. Primary fistula failure was seen in 44 (37%) patients. Risk factors included Distal Fistulae (81% vs 38%), Females (59% vs 19%) and DM (90% vs 61%), CAD (50% vs 13%) and PVD (36% vs 11%).
Conclusions: Primary fistula failure was seen in 38% and Female sex, Radio cephalic fistulas and Diabetes mellitus, CAD and PVD are significant risk factors for PF.

Keywords: Arteriovenous fistula, primary failure, risk factors, vascular access

Introduction
Native Arterio Venous Fistula (AVF) is considered as an ideal vascular access with an excellent long term patency and low thrombosis and infection rates, few interventions and low cost [1, 2, 3, 4, 12]. The current K/DOQI guidelines suggest that AVF should be attempted as the initial vascular access in at least 50% of incident patients and that at least 40% of prevalent HD patients should undergo dialysis with an AVF [4]. Despite these recommendations, AVF is still underused in many centres in India [11]. Besides the cost, this could also be due to high rate of Primary Failure (PF) which has been variously reported by many authors in the range of 20-50% [5, 6, 7, 10, 16, 20, 21]. Identifying patients at risk of PF may help us manage them better and improve the patency rates. Majority of risk factors associated with PF are from developed countries. There has, however been a dearth of studies from the Indian population identifying risk factors for early AVF failure.

Material and Methods
Patients on Maintainence Haemodialysis (MHD) who underwent AVF creation from January 2000 to October 2007 were included in the study. All AVF were created by a single urosurgeon. Site of AVF was dependent on the surgeons preference and experience. A standard protocol was however followed:
AVF was preferentially created in the non dominant arm. If, on physical examination, an "adequate "radial and ulnar artery pulsation was felt at the wrist, then the distal cephalic vein at the wrist was explored. If the vein was of adequate diameter (>3mm), then the radial artery at the wrist was explored.

If the radial artery was of adequate diameter, then an end to side radiocephalic fistula was created. If any of these vessels was too short, then the radiocephalic fistula was abandoned and cephalic vein at the elbow was explored. If cephalic vein of adequate diameter was present, a brachiocephalic fistula was created and if it was not, then a brachiobasilic fistula was created. In case of a mature AVF which was deep seated, superficialization of the arterialised vein was done. Before arterial exploration, 3000-5000 IU of unfractionated Heparin was given. Patients were advised regular fistula exercises on follow up and as a protocol, AVF was not used for 8 weeks following which dialysis was done by 2 needle cannulation. A typical dialysis prescription was for 3 times per week with a duration of 4 hrs at a blood flow rate of 250-350 ml/min and dialysate flow rate of 500-800ml/min.

Baseline patient characteristics recorded at the time of AVF creation included age, gender, co morbidities and etiology of Renal Failure.

Access Characteristics included side of access, access type, anatomic location, date of creation and PF.

Outcome definition

Primary outcome was to determine the rate of PF which was defined as a fistula that was used for Haemodialysis and was unable to provide prescribed dialysis via 2 needle cannulation consistently for 1 month within 6 months of its creation, despite interventions to facilitate maturation. This definition included a) inadequate maturation b) early thrombosis c) failure of 1st cannulation d) other complications [8, 26, 28, 29].

Secondary outcome was to determine the risk factors for PF by comparing patients with and without PF.

Statistical analysis

Data was entered in Microsoft Excel worksheet and analysed using SPSS software version 7.0 for Windows. Students T test was used for discrete variable while Chi square test was used for categorical variables. A univariate analysis was performed to determine the clinical, demographic, co morbid factors and access characteristics associated with PF. P value of < 0.05 was considered to be statistically significant.

Results

A total of 116 AVF were created in 100 patients during the study period. Mean age was 45.24 ± 20 yrs with elderly age group (Age > 60 yrs) comprising 33% of patient population. Male: Female ratio was 1.85: 1. Among the Co morbidities, Diabetes Mellitus (DM) was present in 72%, Hypertension in 84%, Coronary Artery Disease (CAD) in 27%, Cerebro Vascular Disease (CVD) in 03%, and Peripheral Vascular Disease (PVD) in 20%.

Diabetic nephropathy was the most common cause of CRF seen in 60% followed by Chronic Glomerulonephritis in 32%, Chronic interstitial nephritis in 03% and other causes in 05%. Table 1.

AVF was constructed in the non dominant arm in 84%; Radiocephalic fistula in 55%, Brachiocephalic in 40% and Brachiobasilic in 05%. No fistulae were created in the lower limbs. Table 2.

Primary fistula failure was seen in 44 (37%) patients. Risk factors associated with PF included Distal Fistulae (81% vs 38%), Females (59% vs 19%) and DM (90% vs 61%), CAD (50% vs 13%) and PVD (36% vs 11%). Age and Side of the fistula were not associated with increased risk. Table 3.

Discussion

Vascular access continues to be a significant economic, surgical, and logistic problem for CKD patients and their health care providers. Native AVF is the most cost effective and lasting vascular access for haemodialysis [4, 12]. The first radiocephalic fistula was described by Cimino – Brescia in 1966 [13]. Since then, vascular access surgery has changed dramatically in the last 40 yrs. New advances in anastomosis, non invasive access monitoring and percutaneous interventions have been increasingly used to improve fistula patency, minimise complications, and recognise and intervene at the earliest opportunity.

In the present study, 116 AVF were evaluated in 100 patients. The mean age of the patients was 45.24 ± 20 years and 33% (about 1/3rd) of patients were more than 60 years of age. This represents the changing demographics of the current population. In 1966, when the AVF was first described, dialysis population was a select group of young patients but currently there has been a rapid increase in elderly patients on dialysis [27]. Age was not associated with increased risk of PF which is similar to that reported by Lok *et al.* [26] who showed equivalent survival fistula rates in elderly and young individuals.

Males represented 65% of our patient population and this is a reflection of the higher prevalence of CKD in males in the Indian population [11]. Female gender has been associated with an increased risk of PF similar to that reported by other studies [6, 8, 21, 23, 25]. This increased risk could be due to the presence of small diameter of the vessels in females [23].

Comorbid conditions included DM in 72%,Hypertension in 84%, CAD in 27%, PVD in 20% and CVD in 03%.Ernandez *et al.* [8] in his analysis of 151 AVF noted Diabetes Mellitus in 31% and Hypertension in 78% while Wang *et al.* [14] in his analysis of 205 AVF noted DM in 48%,CAD in 41.3%,CVD in 18.3% and PVD in 21.3%.

The most common etiology of ESRF was diabetic nephropathy seen in 60% similar to that reported by Varughese *et al.* [11].

As a rule, nondominant side has been the preferred side of surgery as per the recommendations of K DOQI guidelines and creation of distal fistula (Radiocephalic) as the preferred fistula site [4, 12, 15]. Similar policy is also followed at various other centres as reported by Wang *et al.* [14], Lok *et al* [26], Lok Cairmaine *et al.* [28].

Creation of an AVF at the distal site (Radiocephalic fistula) has been associated with increased risk of primary fistula failure rate. This appears to be contradictory to that advocated by KDOQI guidelines. Distal fistula as an increased risk factor for AVF failure has also been reported in other studies [7, 8, 10, 21, 23, 24]. Increased risk of PF of distal fistula could be due to smaller size [18] and poorer quality of vessel wall due to repeated venous punctures leading to recurrent phlebitis and thrombosis [19].

Presence of DM was associated with an increased risk of PF. There has been conflicting data on this association. Increased risk of PF of AVF in diabetics has been reported by other authors [8, 10, 25]. However, several other studies have reported no influence of diabetes on rate of PF [20]. Increased risk of vascular calcification [24] and presence of PVD [16, 17] makes diabetics prone for PF especially of the distal AVF. Presence of CAD and PVD is also associated with an increased risk of PF of AVF as has been reported by HEMO study [16] and the DOPPS study [17].

Nevertheless there are several limitations in our study. Being a tertiary referral centre, there could have been increased number of sicker population, the results drawn from which may not be applicable to general population of ESRF. Multivariate analysis

was not done in the study.

In summary, a well functioning AVF is the cornerstone of an adequate and effective HD. The side, site and the timing of AVF should be meticulously planned allowing enough time for it to mature. Identifying the subset of patients at increased risk of PF helps plan a pre operative vascular mapping of the blood vessels. AVF in such patients should preferably be performed by an experienced surgeon.

Conflicts of Interest: None

Table 1: Baseline Patient Characteristics

Characteristics		**N= 100**
Age (yrs)	< 60	67(67%)
	> 60	33(33%)
Sex	Males	65(65%)
	Females	35(35%)
Co morbidities	DM	72(72%)
	HTN	84(84%)
	CAD	27(27%)
	PVD	20(20%)
	CVD	03(03%)
Etiology	Diab Nephropathy	60%
	CGN	32%
	CIN	03%
	Others	05%

Table 2: Access Characteristics

	Characteristic	N=116
Side	Right	18(16%)
	Left	98(84%)
Site	Radiocephalic	64(55%)
	Brachiocephalic	46(40%)
	Brachiobasilic	6(05%)

Table 3: Risk factors

Variable	**No PF (N= 72)**	**PF (N=44)**	**P value**
Mean Age	40.26 ± 20.08	48.42 ± 24.44	P=NS
Females	14(19%)	26 (59%)	P<0.05
Side			
Rt Side	08(11%)	10(22%)	P=NS
Lt Side	64(88%)	34(77%)	P=NS
Site			
Radiocephalic	28(38%)	36(81%)	P<0.05
Brachiocephalic	38(52%)	08(18%)	P=NS
Brachiobasilic	06(08%)	00	P=NS
Co Morbidities			
Diabetes Mellitus	44(61%)	40 (90%)	P<0.05
HTN	58(80%)	40 (90%)	P=NS
CAD	10 (13%)	22 (50%)	P<0.05
PVD	08 (11%)	16 (36%)	P<0.05
Aetiology			
Diab Nephropathy	40(55%)	30(68%)	P=NS
CGN	26 (36%)	10 (22%)	P=NS
CIN	04(05%)	00	P=NS
Others	04 (05%)	02 (04%)	P = NS

Disclosure: None

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