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Urology

OUTCOMES OF ARTERIOVENOUS FISTULA CREATION AFTER THE FISTULA FIRST INITIATIVE- AN INSTITUTIONAL STUDY

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ABSTRACT **Background And Objectives:** Although the arteriovenous fistula (AVF) is the recommended hemodialysis access, there is a significant failure rate and infrequent reports of problems after AVF installation. The predictors of AVF patency are not universally agreed upon. This study determined AVF outcomes and patency predictors in patients who underwent AVF creation at Hassan Institute of Medical Sciences, Hassan (HIMS, Hassan). **Methodology:** It is retrospective cohort study of AVF creation at Hassan Institute of Medical Sciences, Hassan from January 2018 to December 2023. We looked at hospitalizations, interventions, complications, and primary and secondary failure rates related to AVF installation. Primary and secondary patency and related variables were identified using Cox proportional hazard models and Kaplan–Meier survival curves. **Results:** AVF creation resulted in complications and hospitalization in 31.2 and 12.3% of patients, respectively; diabetes increased the risk for reduced primary patency , while larger arteries decreased the risk for reduced primary and secondary patency . During this time period, 151 AVFs were placed in patients; the primary failure rate was 37.1% after excluding patients not started on hemodialysis during follow-up (n = 38) or those with an unknown outcome (22 lost to follow-up/dead;). **Conclusions:** After fistula first initiative, primary failure is still a significant problem. Planning for AVF placement requires taking complications into account. Our findings show that the primary predictor of AVF patency is arterial size.

KEYWORDS :

INTRODUCTION

Hemodialysis patients' overall morbidity and mortality, as well as their hospitalization, are significantly influenced by vascular access failure (1–7). Additionally, vascular access dysfunction has a significant financial impact, with annual healthcare expenses exceeding $1 billion.

The arteriovenous fistula (AVF) is the preferred vascular access for patients receiving chronic hemodialysis, according to the Fistula First Initiative. AVFs generally have higher functional longevity, are less likely to become infected, and are linked to lower mortality and expenses. With widespread support from the renal community and the Centers for Medicare and Medicaid Services, Fistula First was a successful campaign, as evidenced by the consistent rise in the proportion of common hemodialysis patients utilizing AVFs following its implementation.

Nevertheless, the results for this suitably favored access are unquestionably subpar. Of the AVFs that do work, 25% will fail after two years, and up to 50% of them are never suitable for hemodialysis. With patency rates of 67% and 58% for central venous catheters and AV grafts after 6 months, respectively, the results for other accesses are likewise subpar.

The severity of the problem of hemodialysis access dysfunction is shown by the fact that the most popular access, the AVF, has failure rates that, ironically, are among the highest for any elective surgical treatment.

Failure of the AVF has serious and wide-ranging effects. First of all, this kind of failure not only prevents patients from having a functional access, but it also limits the number of locations where a later access can be placed.Second, patients are frequently subjected to interventional therapies in addition to AVF formation since these operations are frequently performed to salvage failed AVFs. Third, there is a risk associated with AVF placement; patients may experience permanent consequences that worsen the frustration and patient management setback caused by AVF failure. Therefore, defining the problems that may arise following AVF insertion and identifying individuals at risk for AVF failure are crucial.

MATERIALS AND METHODS

Population of Patients

We conducted a retrospective cohort analysis of AVFs at Hassan Institute of Medical Sciences, Hassan from January 2018 to December 2023.

All the patients who were referred by a Physician/Nephrologist were assessed at our Urology Clinic in the Department of General Surgery. Every patient was evaluated thoroughly with all basic blood investigations, had a preoperative doppler study of the upper limb, a central vein ultrasound. The surgery was performed by the Urologists in the Department.

Study Outcomes

Secondary patency is the interval between the establishment of the AVF and its access abandonment. This was our main outcome. These and other definitions are based on the suggestions made by the American Association for Vascular Surgery and the Society for Vascular Surgery's Committee on Reporting Standards for Arterio-Venous Accesses. While the Society of Interventional Radiology suggests using the time of percutaneous intervention, these recommendations use the time of access creation as a reference point for assessing patency. Since these suggestions are based on the period of AVF development, they not only make it easier to analyze outcomes but also provide a patient-centric understanding and perspective, which is why we choose the former. Additional results included primary failure, secondary failure, hemodialysate suitability, and primary Patency. AVF use with two needles and blood flow maintenance of 300 ml/min for a minimum of eight hemodialysis sessions over a month were prerequisites for hemodialysis suitability. The AVF's irreversible failure prior to hemodialysis appropriateness was the main failure.

Inadequate maturation, thrombosis, unsuccessful initial and recurrent cannulations, and other issues resulting in nonfunctional AVFs are all included in this definition. After the AVF met the requirements for dialysis appropriateness and was subsequently abandoned, secondary failure resulted in irreversible failure. The primary patency was the intervention-free access survival, which was determined by the date of the final patency assessment or the interval between the establishment of the AVF and any interventions to maintain patency.

Hospitalizations and complications related to the installation of an AVF were also noted. To ascertain if a hospitalization was due to AVF, the dismissal diagnoses from every admission following AVF placement at the Institute were examined. Bleeding, thrombosis (non-AVF vessels), infection, arterial steal syndrome, nerve damage, seroma, and subclavian vein stenosis were among the complications. When assessing patency, AVF thrombosis was taken into account and excluded from this list of problems. If medications were recommended, an infection (cellulitis or abscess related to the surgical site) was noted. With the exception of infection, a complication was

only listed if it necessitated surgery or resulted in AVF failure.

Demographic, Clinical, and AVF Characteristics

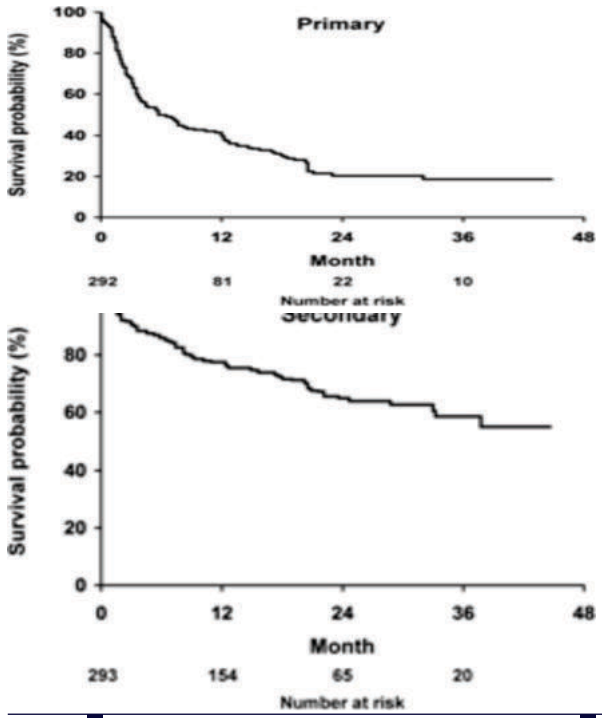
Age, gender, race, etiology of renal illness, duration of hemodialysis, body mass index (BMI), blood pressure, and prior catheter use were among the data obtained at the time of AVF construction. Diabetes, nonskin cancer, coronary artery disease, congestive heart failure, peripheral vascular disease, cerebrovascular disease, and thromboembolic disease were among the disorders that were highlighted if reported. Coronary stenosis, myocardial infarction history, or prior revascularization was considered coronary artery disease. Prior revascularization or amputation due to ischemia or gangrene was used to characterize peripheral vascular disease. Prior pulmonary embolus or deep vein thrombosis was considered thromboembolic illness.

Statistical Analyses

Primary and secondary patency rates were determined using Kaplan-Meier survival analysis, and patency rates were compared using the log-rank test. To check for confounding, Spearman and Pearson correlation coefficients were acquired for each possible predictor variable. Using characteristics deemed pertinent to AVF patency, a univariate analysis was conducted. The multivariate analysis includes all variables with a P value ~< 0.05. Factors linked to decreased AVF patency were identified using multivariate Cox proportional hazards models. Hazard ratios (HR) with 95% CIs were used to display test results, and a two-sided P ~< 0.05 was deemed statistically significant.

Table 1. Baseline characteristics of patients who had AVF placed during study

Baseline Characteristics	*n* 151
Age at AVF placement (mean SD)	65.1
Gender	female 41 male 110
Etiology of renal disease	
Diabetes mellitus	98
Hypertension	35
Glomerulonephritis	9
Neoplasm	4
Body mass index, kg/m2 (mean SD)	29.8
Systolic blood pressure (mean SD)	134.0 23.7Diastolic blood pressure (mean SD) 71.7
Comorbidities	
diabetes 127 coronary artery disease 53	
congestive heart failure 37 peripheral vascular disease 20	
cerebrovascular disease 35	
Fistula site	
brachiocephalic 131 (68.2) radiocephalic 9 brachiobasilic 11	
Artery size, mm (mean SD)	4.4
Vein size, mm (mean SD)	3.5



RESULTS

AVF formation procedures were performed on 151 patients between January 1, 2018, and December 31, 2023. According to Table 1, the patients' mean age was 65.1 +16.8 years (mean + SD), 110 of them were men, and 41 of them were female.

Chronic Kidney Disease leading to diabetic nephropathy is the most prevalent kidney disease, accounting for 64.9%. The brachiocephalic AVF was most commonly performed (68.2%). For the artery and vein, the ultrasound-determined vascular sizes used to create the AVF were 4.4 + 1.2 and 3.5 + 1.3 mm, respectively. 100 of 151 (66%) of the participants received hemodialysis at our institution , 21 of 151 (14%) had hemodialysis elsewhere,

Patients who received dialysis at our institution and elsewhere had comparable results (P ~ 0.08 for main patency and P ~ 0.81 for secondary patency, respectively).

AVF Outcomes

19.8% (30 of 151) of the remaining AVFs were deemed unsuitable for hemodialysis within a reasonable time frame after removing the AVFs that were unused due to death, no hemodialysis initiation during follow-up or loss to follow up. A suitable time was defined as follows: (1) within one month of the start of hemodialysis if the AVF was made more than six months in advance, or (2) within six months of the start of hemodialysis if the AVF was put after the start of hemodialysis (data not shown).

All AVF outcomes at the conclusion of follow-up are displayed in Figure.

Additionally, we looked at AVF outcomes at the conclusion of follow-up for patients who had hemodialysis at some point, survived, or had not received a transplant prior to using AVF (Figure).

AVF Patency Predictors

Following univariate analysis, we discovered that the following factors were linked to primary AVF patency: arterial diameter , diabetes , AVF site (upper versus lower arm), BMI (kg/m2) and prior catheter use.

Age , BMI , history of thromboembolic disease, AVF site (upper versus lower) , artery diameter , and prior catheter use were all linked to secondary patency, according to univariate analysis.

Gender, duration of hemodialysis prior to AVF implantation, atherosclerotic heart disease, congestive heart failure, cerebrovascular illness, systolic or diastolic blood pressure, and vein size were among the factors that were not linked to either primary or secondary patency. The predictor factors did not exhibit any additional clinically significant relationships (data not shown).

A multivariate analysis model for primary patency was constructed that incorporated age, gender, BMI, diabetes, AVF location, artery diameter, and prior catheter use. Only diabetes raised the risk of decreased primary patency. We looked at characteristics related to secondary patency using the same techniques used for initial patency analysis. The only significant factor was artery diameter. Brachiocephalic, brachiobasilic, and radiocephalic AVFs had mean artery diameters of 4.7 ~ 1.0, 4.4 ~ 1.2, and 2.9 ~ 1.2 mm, respectively.

DISCUSSION

Our center's AVF failure rate is in line with earlier research. Nonetheless, we discovered variations in patency predictions. In our group, artery size was the key predictor of primary and secondary patency. Diabetes did not predict secondary patency, but it did predict decreased main patency and intervention-free survival. We found no predicted relationship between AVF patency and age, gender, vascular disease, BMI, catheter use, or time on hemodialysis. Because the average vein size (3.5 mm) was larger than the advised standard (2.5 mm), vein size was likewise not predictive.

There are four possible explanations for this artery size impact. First, tiny changes in size can significantly improve blood flow since it is proportional to the fourth power of the arterial radius. Second, larger arteries may exhibit a stronger vasorelaxant response, hence supporting greater blood flow during AVF maturation. Third, larger arteries may reduce the risk of AVF thrombosis. Interestingly, we also

discovered a potential link between thromboembolic illness and secondary AVF patency. Fourth, the process of making AVFs with bigger arteries might be simpler.

Only a small number of previous studies that looked at access-associated morbidity addressed the issues and hospitalizations linked to AVFs (18). Complications and hospitalization were more common in patients with primary AVF failure in our study, occurring in 21.2% and 12.3% of patients, respectively. Although it is a crucial factor to take into account when planning for and advising patients regarding access placement, the impact of such sequelae is not adequately addressed in the present efforts to expand the number of functional AVFs.

The fact that age was not linked to poor AVF patency may not mean that elderly patients should be treated with AVFs arbitrarily; rather, each patient should be evaluated on an individual basis, taking into account their desired quality of life (38). The risk of death for older patients with chronic kidney disease is comparable to or higher than that for commencing dialysis, and the 1-year mortality rate for octogenarians starting dialysis is almost 50% (39–43). Hemodialysis is therefore necessary whether the patient would require it in the near future or during their lifetime; interestingly, 16.4% of our patients did not begin hemodialysis within the first year.

AVF-salvaging treatments and the installation of unnecessary or non-functional AVFs in elderly individuals may impair their quality of life. Similar problems that other studies in this field have encountered might affect our analyses. The AVF failure rate may be underestimated due to the challenge of identifying AVF failure in patients who were not started on hemodialysis during follow-up.

In conclusion, we discovered that the sole predictor of primary and secondary patency was arterial size. Therefore, based on patency results, additional patient features or comorbidities shouldn't prevent the installation of an AVF provided preoperative Doppler mapping reveals an appropriately sized artery. We further show that problems and hospitalization follow AVF placement in a significant proportion of patients.

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