

Clinical Characteristics and Outcome of Arteriovenous Fistula among Patients Undergoing Haemodialysis with end Stage Renal Disease

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ABSTRACT

Objective: To determine the clinical characteristics and failure rate of arteriovenous fistula (AVF) among patients undergoing haemodialysis with end stage renal disease.

Methodology: This was a cross-sectional study, done at department of urology at Bilawal Medical College for Boys, Liaquat University of Medical and Health Sciences Jamshoro Pakistan, with time duration of eleven months from April 2021 to February 2022. All the patients with age of more than 20 years, both genders, end stage renal disease and undergoing haemodialysis were included. The optimal site for fistula development was determined after taking blood pressure and completing the Allen test. Vascular diameter, intravascular thrombosis, arterial wall atherosclerosis, and the opening of arterial inflow and venous outflow access were all assessed during the procedure. End- to- side and side-to-side arteriovenous fistula were established if there were no contraindication. The patients were discharged after establishing the fistula's patency and experiencing the thrill. The patient's fistula patency and hemodialysis performance were assessed till six weeks. All the information was documented in the self-made proforma. SPSS version 26 was used for the data analysis.

Results: A total of 100 cases were studied, most of the cases (49.0%) were more than 50 years old and males were most common 71.0%. Out of all, 59(59.0%) cases were diabetics and hypertensive. According to the site of arteriovenous fistulae (AVF), Left radio cephalic AVF was 31.0%, left brachio cephalic AVF was 40.0%, left brachio basilic AVF 24.0%, right radio cephalic AVF 03.0%, right Brachio cephalic AVF 1.0% and right brachio basilic AVF 1.0%. At 6th week follow-up arteriovenous fistula was observed successfully functional in 91.0% cases, while 5.0% arteriovenous fistula were burst and in 3.0% it was failed, while one patient was died during this six-weeks follow-up.

Conclusion: For haemodialysis, the arteriovenous fistula was observed to be the best and preferable option with higher functioning rate, noninvasive and lower complicated.

Keywords: Renal failure, AVF, function, failure

INTRODUCTION

Throughout the last twenty years, chronic kidney disease (CKD) has been on the rise. It is one of the hazardous illnesses, with significant psychosocial and economic consequences.¹ In the current worldwide burden of chronic kidney disease, developing nations, including Pakistan, are facing a silent pandemic of end stage renal disease (ESRD).^{2,3} Haemodialysis, peritoneal dialysis, and kidney transplantation are among the treatments available.¹

Centers of the renal transplantation are limited to the disproportionately increasing ESRD patients. As a result, hemodialysis is still a promising therapeutic approach. Long-term hemodialysis survival is often poor, according to global data.^{2,4} Non-tunneled and tunneled catheters, arteriovenous grafts (AVGs), and arteriovenous fistulas are all used to provide hemodialysis. The introduction of hemodialysis in the mid-twentieth century created a demand for dependable, repeatable circulation access.⁵ In 1966, a seminal paper describing hemodialysis via an autologous arteriovenous fistula (AVF), significantly minimizing the problems of infection and thrombosis that plagued previously known long-term cannulation methods and external shunts.⁵ Autologous AVF has since been widely accepted as the best hemodialysis access method, with lower morbidity and mortality rates and lower maintenance costs.⁵ Despite being the finest dialysis access, the fistula is sensitive to a number of consequences, including lower blood flow, infection, aneurysm, thrombosis, hand edema and ischemia, and cardiac overload.⁶ The use of adequate care can help to avert these consequences. The healthcare team and the chronic renal patients share responsibility for the measures in this procedure, and the chronic kidney patient must be taught in self-care about preparing and creation of a cannulation, as well as administration of his new VA.^{6,7} Age, renal dysfunction pathology, severity of renal dysfunction and likelihood of cure, hydration and blood pressure, comorbid diseases and complications occurrence, arm vessels status, the immediate response of starting dialysis, and average lifespan all play a role in determining the vascular access method

and access site.^{8,9} Surgical procedure types used, hypertension, hand and finger workouts, and selective occlusion of main venous branches are all factors that influence the fistula maturation.⁸ This study has been conducted to assess the clinical characteristics and failure rate of arteriovenous fistula among patients undergoing haemodialysis with end stage renal disease.

MATERIAL AND METHODS

This was a cross-sectional study, which was done at department of urology at Bilawal Medical College for Boys, Liaquat University of Medical and Health Sciences Jamshoro Pakistan. Study was done during a period of eleven months from April 2021 to February 2022. All the patients with age of more than 20 years, both genders, end stage renal disease and undergoing haemodialysis were included. Patients having other severe comorbidities, intensive care unit (ICU) admitted patients, patients who did not come in follow-up, and those who were not agree to participate in the study were excluded. After taking demographic medical history and verbal informed consent, complete clinical examination and all the required laboratory investigations were done. The optimal site for fistula development was determined after taking blood pressure and completing the Allen test. Vascular diameter, intravascular thrombosis, arterial wall atherosclerosis, and the opening of arterial inflow and venous outflow access were all assessed during the procedure. End- to- side and side-to-side arteriovenous fistula was established if there was no contraindication. Any patient who did not match the above criteria was ruled out of the research. Our team completed all operations satisfactorily. The patient was discharged after establishing the fistula's patency and experiencing the thrill. The patient's fistula patency was assessed on the first day, the first week, and hemodialysis performance after the sixth week. All the information regarding age, gender, comorbidities, causes of renal failure, site of arteriovenous Fistulae and outcome of AVFs in terms of success and failure were documented in the self-made proforma. SPSS version 26 was used for the data analysis.

RESULTS

A total of 100 cases were studied, most of the cases (49.0%) were more than 50 years old and remaining, less than 50 years old. Males were most common 71(71.0%) and females were 31(31.0%). Out of all, 59(59.0%) cases were diabetics and hypertensive. As per site of double lumen catheters for hemodialysis, right internal jugular vein 50.0%, right subclavian vein 03.0%, right femoral vein 31.0% and left right femoral vein 16.0%. According to the site of arteriovenous fistulae (AVF), Left radio cephalic AVF was 31.0%, left brachio cephalic AVF was 40.0%, left brachio basilic AVF 24.0%, right radio cephalic AVF 03.0%, right Brachio cephalic AVF 1.0% and right brachio basilic AVF 1.0%. Table.1

At 6th week follow-up, arteriovenous fistula was observed successfully functional in 91.0%, while 5.0% arteriovenous fistula were burst and in 3.0% it was failed, while one patient was died during this six-weeks follow-up. Table.2

Table 1: Descriptive statistics of demographic variables and site of the arteriovenous Fistulae (AVF) n=100

Variables	Statistics	
Age groups	21-30 years	13(13.0%)
	31-40 years	20(20.0%)
	41-50 years	18(18.0%)
	>50 years	49(49.0%)
Gender	Males	71(71.0%)
	Females	31(31.0%)
Cause of End stage renal disease (ESRD)	Diabetes/ Hypertension	59(59.0%)
	Others	41(41.0%)
In situ double lumen catheters for hemodialysis	Right internal jugular vein	50(50.0%)
	Right subclavian vein	03(03.0%)
	Right Femoral vein	31(31.0%)
	Left Femoral vein	16(16.0%)
Site of arteriovenous Fistulae (AVF)	Left Radio cephalic AVF	31(31.0%)
	Left Brachio cephalic AVF	40(40.0%)
	Left Brachio basilic AVF	24(24.0%)
	Right Radio cephalic AVF	03(03.0%)
	Right Brachio cephalic AVF	01(01.0%)
	Right Brachio basilic AVF	01(01.0%)

Table 2: Outcome of arteriovenous Fistulae (AVF) at 6th week follow-up n=100

Outcome	Frequency (%)
AVFs successfully functional	91(91.0%)
Failed AVFs	03(03.0%)
Burst AVFs	05(05.0%)
Death	01(10.0%)
Total	100(100.0%)

DISCUSSION

Patients with chronic renal insufficiency benefited greatly from these fistulas, which had a higher safety characteristic and long-term patency.^{10,11} Patients with chronic renal dysfunction may have veins that are not suited for a native arteriovenous fistula.¹⁰ In this study 100 cases were studied, most of the cases (49.0%) were more than 50 years old and males were most common 71(71.0%), while females were 31(31.0%). Nawaz Sh et al¹⁰ reported that the average age of the study subjects was 63±13 years, and out of all, males were 56% and females were 44%. In another study of Sari F et al⁸ demonstrated that the average age of the cases was 28.4±26.1 years and males were 69.4% and females were 30.6%. In the study of Martinez-Mier G et al¹³ found lower average age of the patients as 36.3 years, while consistently males were in majority 74.4 percent of the study participants. In this study out of all 59(59.0%) cases were diabetes and hypertensive. On other hand Martinez-Mier G et al¹³ reported that there were 61.1% cases were hypertensive, 22.2% cases had dyslipidaemia, 22.2% cases had coronary artery disease, 5.6% cases had history of alcohol and 27.8% had history of smoking consumption. In the favor of this study the Nawaz Sh et al¹⁰ reported that 42.0% cases had diabetes

and 32% cases were hypertensive, while 10% had both diabetes mellitus and hypertensive.

In this study according to the site of the site of arteriovenous fistulae (AVF), Left radio cephalic AVF was 31.0%, left brachio cephalic AVF was 40.0%, left brachio basilic AVF 24.0%, right radio cephalic AVF 03.0%, right Brachio cephalic AVF 1.0% and right brachiorbasilic AVF 1.0%. In the study of Nawaz Sh et al¹⁰ reported that the site of radio cephalic was 62.6%, radial artery with Median antebrachial vein was 5.5%, radial artery with Venacumitant 1.1%, brachial artery with Venacumitant was 0.5%, ante-cubital was 30.2%. A distal AV access site may be limited or eliminated if the venous diameter is acceptable. The formation of an AV fistula should be brachial-cephalic, radial-cephalic and then brachial-basilic transposition, all of which should be done according to the National Kidney Foundation Kidney Disease Outcomes Quality Initiative (NKF-KDOQI) clinical practice standards. The use of native vessels has been shown to achieve higher patency rates with fewer problems from a technical standpoint.

In this study at 6th week follow-up arteriovenous fistula was observed successfully functional in 91.0%, while 5.0% arteriovenous fistula were burst and in 3.0% it was failed, while one patient was died during this six-weeks follow-up. On other hand in the study of Schinstock CA et al¹⁵ demonstrated that around 55.7 percent out of 210 cases of the AVFs remained appropriate for dialysis and did not fail, while 7.1 percent developed secondary failure. In another study of Al-Shameri I et al¹⁶ reported that the primary failure rate within three months was 4.3 percent. Primary patency was 80% after six months. Thrombosis was the most prevalent AVF event during the research period (13 percent). Although in the study of Zhang H et al¹⁷ reported that the AVF participants had an 82 percent and 72 percent cumulative survival rate at 12 and 24 months, respectively, while CVC subjects had a 45 percent 12-month survival rate (P 0.001). AVF individuals who were followed up on at 6, 12, and 24 months had primary patency rates of 58 percent, 39 percent, and 31 percent, respectively. As a result, while older patients have a reduced patency rate and a greater interventions rate than younger patients, AVF is more suited for long-term vascular access for HD than CVC in selected elderly cases, and age should not be an exclusion criterion for AVF surgery.^{17,18}

CONCLUSION

For haemodialysis, the arteriovenous fistula was observed to be the best and preferable option with higher functioning rate, noninvasive and lower complicated among patients of end stage renal disease. Several factors influence the type of surgically implanted fistula. It is common practice to start surgery planning as far away as possible.

REFERENCES

1. Imtiaz S, Alam A. Is haemodialysis the most feasible dialysis modality for Pakistan?. Journal of the Pakistan Medical Association. 2020 Nov 3:1-8.
2. Hamid A, Dhrolia MF, Qureshi R, Imtiaz S, Ahmad A. Clinical characteristics of patients on long-term hemodialysis. Journal of the College of Physicians and Surgeons Pakistan. 2019 Apr 1;29(4):328-32.
3. Jafar TH. The growing burden of chronic kidney disease in Pakistan. N Engl J Med 2006; 354:995-7.
4. Chandrashekar A, Ramakrishnan S, Rangarajan D. Survival analysis of patients on maintenance hemodialysis. Indian J Nephrol 2014; 24:206-13
5. Smith GE, Gohil R, Chetter IC. Factors affecting the patency of arteriovenous fistulas for dialysis access. Journal of vascular surgery. 2012 Mar 1;55(3):849-55.
6. Pessoa NR, Linhares FM. Hemodialysis patients with arteriovenous fistula: knowledge, attitude and practice. Escola Anna Nery. 2015 Jan;19:73-9.
7. Furtado, AM; Lima, FET. Autocuidado dos pacientes portadores de insuficiência renal crônica com a fistula artério-venosa. Rev. gauch. enferm. 2006 dez; 27(4):532-8.

- 8 Sari F, Taşkapan H, Sığırcı A, Akpınar B. Evaluation of risk factors for arteriovenous fistula failure in patients undergoing hemodialysis. *Erciyes Med J* 2016; 38(1): 12-9
- 9 Ahearn DJ, Maher JF. Heart failure as a complication of hemodialysis arteriovenous fistula. *Ann Intern Med* 1972; 77(2): 201-4
- 10 Nawaz Sh, Shahzad I, Baloch MU. Arterio venous fistula experience at a tertiary care hospital in Pakistan. *Pakistan journal of medical sciences*. 2013;29(1):161.
- 11 Ahmed GM, Mansour MO, Elfatih M, Khalid KE, Mohammed AhmedME. Outcomes of arteriovenous fistula for hemodialysis in Sudanese patients: Single-center experience. *Saudi J Kidney Dis Transpl*.2012;23(1):152–157.
- 12 Saran R, Elder SJ, Goodkin DA, Akiba T, Ethier J, Rayner HC, et al. Enhanced training in vascular access creation predicts arteriovenous fistula placement and patency in hemodialysis patients: Results from the Dialysis Outcomes and Practice Patterns Study. *Ann Surg*. 2008;247(5):885–891
- 13 Martinez-Mier G, Camargo-Diaz C, Urbina-Velazquez MA, Avila-Pardo SF. Predictive factors for unsuccessful use of arteriovenous fistula in a population of end-stage renal disease patients in southeastern Mexico. *Annals of Vascular Surgery*.2020;1;62:304-9.
- 14 Segal M, Qaja E. Types of arteriovenous fistulas.2021:<https://www.ncbi.nlm.nih.gov/books/NBK493195/>
- 15 Schinstock CA, Albright RC, Williams AW, Dillon JJ, Bergstralh EJ, Jenson BM, McCarthy JT, Nath KA. Outcomes of arteriovenous fistula creation after the Fistula First Initiative. *Clinical Journal of the American Society of Nephrology*. 2011 Aug 1;6(8):1996-2002.
- 16 Al-Shameri I, KhudaBux G, Al-Ganadi A. Prospective Evaluation of Factors Associated with Arteriovenous Fistula Primary Failure and Complications in Hemodialysis Patients: A Single Center-Study. *Cardiol Vasc Res*. 2021;5(3):1-7.
- 17 Zhang H, Lu H, Li W, Jiang G, Zou H, Expert Group of Nephrology Branch of China Academy of Chronic Disease Urology Nephrology and Blood Purification Commission of China Medical Education Association. Expert consensus on the establishment and maintenance of native arteriovenous fistula. *Chronic diseases and translational medicine*. 2021 Dec 25;7(04):235-53.
- 18 Werner-Gibbings K, Ischia L, Butcher W, Ward-Harvey R, Stewart J, Jackson MJ. Selective placement of autogenous arteriovenous fistulae in an over 80-year-old population. *The Journal of Vascular Access*. 2018 Jan;19(1):40-4.