



Evaluation of risk factors affecting the lifespan and efficiency of dialysis accesses installed in dialysis patients referred to Ahvaz therapeutic centers in a two-year cohort study

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ABSTRACT

Introduction: It is crucial in order to provide optimal hemodialysis to patients with end-stage renal disease (ESRD) to establish venous access with the least amount of complications.

Objectives: In this study, we examined the risk factors that affect the efficiency and longevity of dialysis access for patients receiving dialysis in Ahvaz medical centers.

Patients and Methods: In our retrospective study, 180 hemodialysis patients were referred to the Golestan educational and medical center in Ahvaz, Iran. An arteriovenous fistula (AVF) or catheter was conducted to provide them with vascular access. Detailed demographic information about the patient was collected, including age, gender, height, weight, body mass index (BMI), cause of ESRD, duration of renal failure, duration of dialysis, and comorbidities. There were instances of access inefficiency as a result of infection, stenosis, closure, thrombosis, bleeding, and pseudoaneurysms. The data was analyzed using Mann-Whitney U, *t* test, and chi-square tests with SPSS version 22. Statistics were considered significant at a *P* value of 0.05.

Results: The mean age of the patients was 50.08 ± 12.213 years, and the mean BMI was 27.90 ± 9.112 kg/m². Among dialysis patients, there was a significant relationship between male gender, clopidogrel administration, diabetes history, hypertension and access failure. It is estimated that 36.7% of vascular access failures are caused by thrombosis, while 32.8% are due to access stenosis or closure.

Conclusion: Our study showed that male gender, clopidogrel administration, and a history of diabetes and hypertension were risk factors affecting dialysis access quality and efficiency. According to our study, it may be possible to develop a more appropriate approach for determining the type and location of dialysis access.

Implication for health policy/practice/research/medical education:

In this study, risk factors affecting access to dialysis in patients with end-stage renal disease were evaluated. The results of our study of 180 patients found a significant association between male gender, clopidogrel drug use, diabetes, hypertension, with access failures. As a result of these findings, it will be possible to determine the appropriate type of access and location, which will ultimately increase patient survival and efficiency.

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Introduction

It has been widely recognized since the 1990s that non-communicable diseases are the primary cause of disability, morbidity, and mortality in the world (1-3).

One of the most prevalent chronic diseases is chronic kidney disease (CKD), which is rapidly increasing as a result of an increase in etiological causes as well as the

aging of the population (4).

If renal replacement therapy, such as dialysis or kidney transplantation, is not administered, this process can lead to end-stage renal disease (ESRD), a potentially life-threatening condition (5).

In the United States, 600 000 people receive hemodialysis. As a result, the healthcare system in this country incurs a

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cost of 33 billion dollars (6).

Access to hemodialysis, as well as the quality and cost of hemodialysis, are factors that directly affect the patient's health (7-11).

A suitable vascular access is required for optimal hemodialysis, and currently available permanent accesses include arteriovenous fistulas (AVFs), arteriovenous grafts (AVGs), and central venous catheters (12). Previously, Brescia et al first proposed the AVF in 1966 as a technique with a low infection risk and improved patient outcomes (13).

The results of their research led to the development of AVG in 1976 after a number of nephrologists and surgeons began using prosthetic grafts (14).

The type of venous access, however, may also affect the results, and consequently, the choice of method. The catheter site, diabetes, and aging are some of these factors. Vascular walls, especially veins, are affected by these factors, leading to increased complications.

As a result, the best method of establishing venous access for this group of patients with ESRD remains a matter of debate (15-17).

Despite the efforts made to improve vascular access methods, it is still important to evaluate the short- and long-term failures of these catheters. This risk factor has been evaluated in a number of studies to date. There are several factors that can potentially impact the longevity of all types of access, including age, gender, underlying cause of ESRD, type of access used for hemodialysis, and access site (18-20). It remains unclear, however, which type of access is most appropriate for different patients.

Objectives

In the light of the above issues, the present study was designed to investigate the factors influencing the longevity and efficiency of hemodialysis access types. We assessed and compared the outcomes of AVF and catheter access methods in ESRD patients undergoing hemodialysis for vascular access. In addition, risk factors affecting the lifetime and efficiency of dialysis access were evaluated. The focus was on factors that contribute to failure and inefficiency. Optimal selection of the most appropriate vascular access method for each patient was the primary objective, with the aim of minimizing complications and enhancing overall hemodialysis treatment efficiency and quality.

Patients and Methods

Study design

The purpose of our retrospective study was to evaluate 180 patients who received hemodialysis at Golestan educational and medical center in Ahvaz between 2018 and 2020, using an AVF or an AVG, or through catheters. The checklist included demographic information about patients, including age, gender, height, weight, body mass index (BMI), cause of ESRD, duration of

renal failure, duration of dialysis, and comorbidities. In addition, infection, stenosis, thrombosis, bleeding, and pseudoaneurysms were recorded as underlying causes of inefficient access.

A number of causes of ESRD have been identified, including diabetes, hypertension, glomerulonephritis, autosomal dominant polycystic kidney disease, congenital kidney disease, recurrent urinary tract infections, and renal vascular disease.

A failure duration is defined as the interval between the time at which the estimated glomerular filtration rate was less than 30 till the current time. Additionally, the patient's experience with dialysis through vascular or peritoneal access was considered as the duration of dialysis.

Furthermore, comorbid diseases were listed under headings such as hypertension, diabetes, ischemic heart disease, stroke history, peripheral vascular disease history, and chronic obstructive pulmonary disease. An assessment of access findings includes type of access (AVF or AVG), site of access (radial, brachial, or femoral), presence of primary access failures, secondary access failures, duration of access (survival of access), need for other interventions, and side effects.

Dialysis failure due to primary access is defined as the failure of dialysis on the first attempt without a prior history of dialysis use. A secondary access failure occurs when a dialysis procedure fails despite the access having a history of successful dialysis.

Likewise, survival access refers to the duration of successful use of an access without the necessity of replacing or installing another access.

Setting and patients

Inclusion and exclusion criteria

The study included patients aged 18 years and above who underwent hemodialysis through AVF, AVG, or vascular access. Patients who declined to participate were excluded from the study.

Sample size

During the study period (2018-2020), all patients referred to the vascular surgery clinic at Golestan Ahvaz medical education center with complaints of access failure or inefficiency. The sample size was not determined because the sampling was census-based.

Statistical analysis

The collected data were statistically analyzed using SPSS software version 22. We reported descriptive data as mean (median), standard deviation, absolute frequency, and frequency percentage.

The chi-square *t* test, and Mann-Whitney U tests were conducted for analytical data, while logistic regression was conducted for parametric data. The significance level was defined as a *P* value less than 0.05.

Results

Patients' demographics and clinical characteristics are shown in Table 1. The mean age of patients was 50.08 ± 12.213 years, since the majority were males (55%) at the time of the study. Among dialysis patients, there was a significant relationship between male gender, clopidogrel administration, diabetes history, hypertension and access failure. Our study showed, thrombosis (36.7%) and access stenosis and closure (32.8%) were the most common causes of vascular access failure (Table 2).

The risk factors associated with dialysis failure with primary access suggested that male gender, clopidogrel administration, access grafts, hypertension, and history of ERDS-related diabetes are all risk factors influencing dialysis access longevity and efficiency ($P > 0.05$; Table 3).

The relationship between the variables and secondary access failure in patients with dysfunctional access who previously had successful dialysis was evaluated. It was determined that ERDS-related hypertension affects the longevity and efficiency of dialysis access ($P > 0.05$; Table 4).

Discussion

Given the increasing number of dialysis patients and the importance of identifying the factors causing complications and dysfunction of vascular accesses, this study investigated the risk factors affecting the longevity and efficiency of dialysis accesses. Among the factors

affecting the quality and efficiency of dialysis access were male gender, the administration of clopidogrel, access grafts, and a history of diabetes and hypertension.

It is extremely important to take care of the vascular access path of hemodialysis patients. As a result, if vascular access failure reduces dialysis adequacy, the patient's health will suffer. According to studies, approximately 50% of hemodialysis readmissions are caused by problems with vascular access (21).

According to the study by Wen et al, who evaluated AVF performance and factors affecting it in 100 patients, 27% of patients had inappropriate AVF performance after

Table 3. Determining the correlation of the studied parameters with primary access failure in patients with dysfunctional access

Variable	Frequency		P value
	Negative	Positive	
Gender			0.042
Male	24	75	
Female	10	11	
Consumable drugs			0.05
Aspirin	5	38	
Clopidogrel	19	49	
Anticoagulant	10	59	
Access type			0.037
AVF	9	59	
AVG	20	51	
Catheter	5	36	
Access location			0.414
Radial	14	48	
Brachial	15	63	
Femoral	1	18	
Jugular	4	17	
Underlying diseases			0.37
Diabetes	13	41	
Hypertension	17	68	
Ischemic heart disease	2	25	
History of stroke	2	8	
History of peripheral vascular diseases	0	4	
The underlying cause of the need for dialysis			0.02
Diabetes	13	44	
Hypertension	6	60	
Glomerulonephritis	12	28	
ADPKD	2	9	
Repeated UTI	1	0	
Renal vascular diseases	0	5	
Causes of access failure			0.02
Infection	2	20	
Access narrowing and closure	15	44	
Thrombosis	9	57	
Bleeding	6	14	
Pseudoaneurysm	2	11	

Abbreviations: ADPKD, Autosomal dominant polycystic kidney disease; UTI, Urinary tract infection.

Table 1. Demographic information of patients

Variable	Number	%
Gender		
Male	99	55
Female	81	45
Consumable drugs		
Aspirin	43	23.9
Clopidogrel	68	37.8
Anticoagulant	69	38.3
Access type		
AVF	68	37.8
AVG	71	39.4
Catheter	41	22.2
Access location		
Radial	62	34.4
Brachial	78	43.3
Femoral	19	10.3
Jugular	21	11.7

Table 2. Determining the frequency of the underlying cause of failure in vascular access

Causes of failure	Number	%
Infection	22	2.12
Access narrowing and closure (stenosis)	59	32.8
Thrombosis	66	36.7
Bleeding	20	1.1
Pseudoaneurysm	13	2.7

Table 4. Determining the relationship between the examined variables and secondary access failure in patients with dysfunctional access

Variable	Frequency		P value
	Negative	Positive	
Gender			0.260
Male	43	56	
Female	42	39	
Consumable drugs			0.604
Aspirin	18	25	
Clopidogrel	35	33	
Anticoagulant	32	37	
Access type			0.733
AVF	30	38	
AVG	36	35	
Catheter	19	22	
Access location			0.972
Radial	30	32	
Brachial	37	41	
Femoral	8	11	
Jugular	10	11	
Underlying diseases			0.478
Diabetes	26	28	
Hypertension	35	50	
Ischemic heart disease	16	11	
History of stroke	6	4	
History of peripheral vascular diseases	2	2	
The underlying cause of the need for dialysis			0.03
Diabetes	25	32	
Hypertension	26	40	
Glomerulonephritis	22	18	
ADPKD	10	1	
Repeated UTI	0	1	
Renal vascular diseases	2	3	
Causes of access failure			0.746
Infection	9	13	
Access narrowing and closure	26	33	
Thrombosis	262	34	
Bleeding	12	8	
Pseudoaneurysm	6	7	

Abbreviations: ADPKD, Autosomal dominant polycystic kidney disease; UTI, Urinary tract infection.

two years. The following factors contributed to the failure of AVF; age, gender, anemia, number of platelets, and temporary extension of the retention catheter (22).

The study conducted by Valerianova et al concluded that coronary artery disease and high cholesterol levels contribute significantly to the longevity of grafts. Contrary to this, factors such as the location of the vascular graft, the level of triglycerides, heart failure, diabetes, smoking, and hypertension had no impact on the failure of the AVG (23).

In the study of Poinen et al in Canada, the risk factors

for catheter failure were reported as the age of 70 years, obesity, the need for dialysis as a result of another etiological disease during hospitalization, and gender. Heart disease, diabetes, and cancer did not play a role in catheter failure (24).

As opposed to our study, Hernandez et al observed the growth of a distal fistula in 119 patients undergoing AVF implantation. Fistula ineffectiveness is also associated with female gender, surgical expertise, and diabetes mellitus (25).

Vanholder underscored the importance of regular monitoring of the vascular access site and medical measures (e.g., regular Doppler ultrasound to monitor blood flow, and the use of specific drugs to prevent or treat thrombosis) (26).

As a result of the findings of the present study, the type of vein and nursing care provided at the site of vascular access have not been considered. There is a need for nurses working with dialysis patients to receive more scientific training.

We found that hypertension and diabetes histories were significantly associated with treatment effectiveness in our study. Other studies, however, contradict the findings of the present study. However, other studies indicate that diabetic patients have a lower level of fistula efficiency (27).

A vital aspect of any type of vascular access method is its longevity and efficiency as a means of accessing dialysis. Patients undergoing hemodialysis may experience a decrease in treatment efficiency, quality of life, and treatment process due to inadequate vascular access.

Conclusion

Based on the results of this study, male gender, the administration of clopidogrel, as well as a history of diabetes and hypertension were found to be risk factors influencing the quality and efficiency of dialysis access. A more appropriate approach can be developed based on the findings of this study to determine the type and location of dialysis access needed by dialysis patients according to their demographic characteristics and clinical conditions, resulting in improved survival rates as well as more efficient access for dialysis patients.

Limitations of the study

There are a number of limitations to this study, including, first, that it is a retrospective study; second, that it is not a randomized study, and that biases may exist.

Authors' contribution

Conceptualization: Iraj Nazari.

Data curation: Seyed Masood Mousavi, Hossain Minaee, Afshin Bighamian.

Formal analysis: Afshin Bighamian.

Funding acquisition: Iraj Nazari.

Investigation: Afshin Bighamian, Seyed Masood Mousavi, Hossain Minaee.

Methodology: Seyed Masood Mousavi.

Project administration: Iraj Nazari, Afshin Bighamian.

Resources: Iraj Nazari, Afshin Bighamian.

Supervision: Iraj Nazari, Afshin Bighamian.

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Writing—original draft: Afshin Bighamian.

Writing—review and editing: Afshin Bighamian, Hossain Minaee.

Conflicts of interest

The authors declare that they have no competing interests.

Ethical issues

The research adhered to the principles of the Declaration of Helsinki. Approval for the study was obtained from the Ethics Committee of Golestan Hospital (Ethical code #IR.AJUMS.HGOLESTAN.REC.1401.174). Prior to any intervention, written informed consent was obtained from all participants. This study is based on the M.D thesis of Afshin Bighamian at Ahvaz Jundishapur University of Medical Sciences (Thesis #U-01286). The authors have fully addressed ethical concerns, including plagiarism, data fabrication, and double publication.

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