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Renal Data from the Arab World

Vascular Access Types in Hemodialysis Patients in Palestine and Factors Affecting Their Distribution: A Cross-Sectional Study

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ABSTRACT. The incidence of end-stage renal disease (ESRD) patients is increasing considerably worldwide, and most of the patients start their therapy by hemodialysis (HD). Arteriovenous fistula (AVF) is the best type of vascular access due to its decreased rate of complications followed by arteriovenous graft (AVG) and finally, central venous catheters which are associated with increased mortality and morbidity. In this study, we aim to find out the proportion of each vascular access type used in HD patients and to evaluate the epidemiology of HD access in Palestine. Six hundred and fifty-eight patients were enrolled in this study from 10 dialysis units distributed in Palestine. The patients were divided into incident patients or prevalent patients. Data were collected by the researchers by regular visits to the units. AVFs were the most common access type (69.3%), catheters came second (27.8%) finally, AVGs (2.9%). Temporary catheters composed 59% of all catheters, followed by the permanent catheters. The subclavian vein was the most common insertion site (68.3%), internal jugular vein (26.8%), and femoral vein (4.9%). Temporary catheters were most commonly used among incident patients (41.5%) and AVFs were the most common in the prevalent patients (75%). There was no statistically significant association between the type of dialysis access use with gender, body mass index, or diabetic status. We recommend close follow-up and early AVF creation when the patients are expected to need HD. We also highly recommend decreasing the duration of temporary catheters. Finally, further prospective studies to follow-up and evaluate the progression in the vascular access status in Palestine are needed.

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Introduction

The incidence of end-stage renal disease (ESRD) is increasing considerably in the past few years, the incidence in 2008 in the US was 112,476 compared to 120,435 in 2014. However, more than 87% of the incident patients

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start their therapy with hemodialysis (HD).[1,2] Vascular access type is one of the most important factors that affect health outcomes of HD patients. Central venous catheters (CVC), arteriovenous fistulas (AVF), and arteriovenous grafts (AVG) are different types of accesses that can be used for HD. However, many factors will influence the location and the type of access that will be used, for example, patient's arterial, venous and cardiorespiratory systems, other clinical and socioeconomic factors and duration on HD.[3,4] Among the different types of vascular access AVFs are considered to be the best in terms of less infection, and less thrombotic events and hospitalization episodes. In addition, AVFs are associated with increased patient survival.[3,5-8] AVGs are considered the second best choice as HD access.[9] They are made of prosthetic material that connects two vessels that are far away to be linked through fistula.[10] The use of central venous catheter as dialysis access has been associated with worse mortality, morbidity, and economic burden.[3] Vascular access complications such as infection, thrombosis, and narrowing of central veins are major causes of morbidity and mortality in HD patients.[11-13]

In the literature, there is a wide variation among worldwide countries regarding the types of accesses being used for ESRD patients on HD. In Europe, 66% of new patients start their HD through AVF compared to 15% in the US, whereas catheters are more widely used in the US among newly diagnosed ESRD patients with a percentage of 60% versus 31% in Europe.[14] Moreover, there is a considerable variation among patients' preferences regarding the use of catheters as dialysis access.[15] Unfortunately, up to authors' knowledge, no one study has been performed to describe such data among HD patients in West Bank, Palestine.

In this study, we aim to find out the proportion of each access type used in HD patients and to evaluate the epidemiology of HD access in the West Bank, Palestine. We also aim to find possible factors associated with the distribution of vascular access. Finally, we aspire that this study will become a baseline for further studies that are required to follow-up and evaluate the progression in the vascular access status in West Bank.

Methods

Study design, population, and setting

The study is a cross-sectional one, conducted in 10 HD centers distributed within the West Bank, Palestine in the period between July 2013 and June 2014. The Institutional Review Board of College of Medicine and Health Sciences at An-Najah National University granted ethical approval for this study. All patients signed informed consent for partici-pation in the study. Patients had to meet the following eligibility criteria for inclusion in the study: patient known to have ESRD on regular HD in any of the included centers, age ≥18 years old. Patients who did not meet the inclusion criteria or those who refused to participate were excluded from the study. All patients were on regular HD, twice or thrice weekly.

Treatment groups

Incident patients were defined as patients who started HD <150 days (5 months) before 1/10/2013, whereas prevalent patients were defined as patients who started HD 150 days (5 months) or more before 1/10/2013. Given that the average time for maturation of AV fistula is about 6–8 weeks, 150 days was chosen as the time to establish permanent access for HD. This period was used to allow logistic time for the surgical procedures and for possible interventions.

Data collection

The type of vascular access was recorded as AVF, AVG, temporary CVC, tunneled cuffed CVC, and CVC with maturing AVF or AVG. Each patient was interviewed to obtain the relevant data and patient's medical records were reviewed. Vascular access type data were collected with specific data relating to the anatomical location of vascular access, and duration of access use. Other data such as gender, body mass index (BMI), diabetes types

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(I or II), and location of dialysis units were collected. To avoid the possibility of confusing dialysis access types, physical examination of each patient was done to assure the proper vascular access was recorded. The investigating team collected all data. BMI was calculated after measuring the height and weight of each patient. The dry weight was used in the calculation of the BMI. Obesity was defined as BMI >30, overweight as BMI between 25 and 29, normal weight as BMI between 18 and 24 and BMI <18 as under-weight.[16]

Statistical Analysis

Variables and data were collected manually from patients in each dialysis unit using paper master sheets and then were computerized and encoded. Analytical cross-tabulations were used to present the relationship between each independent variable (gender, age, vascular access timing, diabetic status, BMI, duration on dialysis, and dialysis unit) and the dependent variable (vascular access type). Chi-square test was used to assess these relations as appropriate. All statistical analyses were conducted using the Social Package of Statistical Sciences (SPSS) software version 17.0 (IBM Corp. Armonk, NY, USA).

Results

Baseline characteristics of patients

Six hundred and fifty-eight patients were enrolled in the study. Most of the participants were male (59.3%), and the mean age of the patients was 52.9 ± 15.69 years. The participants were distributed in 10 dialysis centers of the West Bank with the highest number of participants were in the northern district of the West Bank of Palestine. Regarding diabetic status and BMI, the highest proportion of the patients were nondiabetic (58.7%) and with normal BMI (44.7%). The baseline demographic and other characteristics of patients are presented in Table 1.

Vascular access characteristics

Most of the enrolled patients were prevalent ones, 576 patients, accounting for 87.5% of all patients, whereas 82 patients were incidents and accounting 12.5%. AVF was the most common access type (69.3%) among all patients followed by temporary dialysis catheters only (16.4%), tunneled cuffed dialysis catheters represented (6.4%), catheters with maturing fistulas were (5%) and the least used access type was AVGs with (2.9%). Vascular access types and their proportions are presented in

Table 1. Patient characteristics.

Characteristics	Frequency (%)
Gender	
Male	390 (59.3)
Female	268 (40.7)
Age (SD)	52.9 (15.69)
Dialysis center	
Northern district	330 (50.2)
Central district	141 (21.4)
Southern district	187 (28.4)
Diabetic status	
Non-diabetic	386 (58.7)
Type 2 DM	228 (34.7)
Type 1 DM	44 (6.7)
BMI	
Underweight	60 (9.1)
Normal	294 (44.7)
Overweight	181 (27.5)
Overweight	123 (18.7)

SD: Standard deviation, DM: Diabetes mellitus, BMI: Body mass index.

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Table 2 and Figure 1.

Catheters were furthermore grouped based on type and site of insertion. There were two types of catheters used as dialysis access; temporary catheters that were the most common type (59% of all catheters), permanent catheters (23% of all catheters) and catheters with immature fistula (18% of all catheters) (Table 3).

Dialysis catheter insertion site

Regarding catheter insertion site, the most common site was subclavian vein (68.3%) followed by internal jugular vein (26.2%), femoral vein (4.9%) and transhepatic catheter, respectively. The catheter insertion site is significantly related to the type of catheter (P <0.001). The subclavian vein was the most common site in temporary catheters and catheters with maturing fistula, whereas the internal jugular was the most common site for permanent catheter (Table 4). The most common site for temporary dialysis catheter insertion was the subclavian vein followed by the

Table 2. Vascular access types and their distribution.

Characteristics	Frequency (%)
Duration of dialysis	
Incident patients	82 (12.5)
Prevalent patients	576 (87.5)
Vascular access type	
AVF	456 (69.3)
Total catheters	183 (27.8)
Temporary catheter	108 (16.4)
Permanent catheter	42 (6.4)
Catheter with immature fistula	33 (5)
Graft	19 (2.9)

AVF: Arteriovenous fistula.

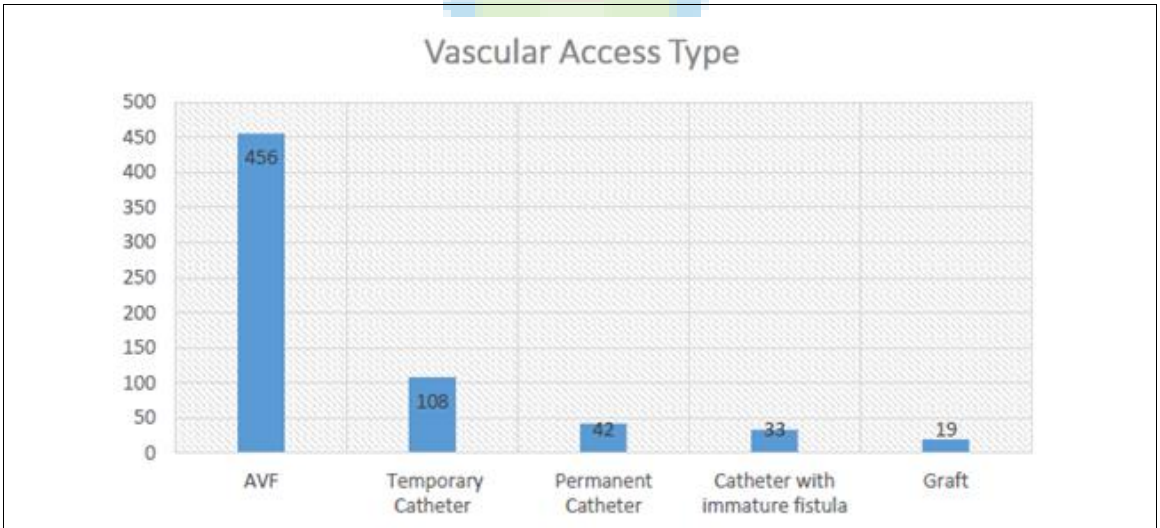

Figure 1. Vascular access type among all patients.

Table 3. Catheter types and their distribution.

Catheter type	Frequency (%)
Temporary catheter	108 (59)
Permanent catheter	42 (23)
Catheter with immature fistula	33 (18)

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Table 4. Distribution of catheter insertion types.

Site of catheters	Frequency (%)
Subclavian	125 (68.3)
Internal jugular vein	48 (26.2)
Femoral vein	9 (4.9)
Transhepatic vein	1 (0.5)
Total	183 (100)

femoral vein. The internal jugular vein was not used for as a site of insertion of temporary dialysis catheters.

Duration of dialysis and access type

When dividing the patients into the incident (<5 months) and prevalent (more or equals 5 months) we found that the type of access varies significantly. For incident patients, the temporary catheters are the most common access type (41.5%), whereas in prevalent patients, the AVF is the most common one (75%) (Table 5).

Factors affecting dialysis access types

There was a significant relationship between dialysis center and access type (P = 0.0002) with variation in access types proportions among the different ten centers as shown in Table 6. AVFs are considered as the most common vascular access type being used among all centers with the highest being the northern ones with percentage of about (72.1%). Temporary catheters proportion was significantly low in the northern centers (7.9%). On the other hand, it was relatively higher in the middle centers (29.8%). Permanent catheters proportion was as twice in the northern centers (8.2%) as middle (4.3%) or southern (4.8%) centers. Catheters with immature fistula were significantly higher in the northern centers (7.3%) but significantly low in the middle centers (0.7%). Finally, grafts proportion was significantly higher in the northern centers also (4.5%) (Table 6). There was no statistically significant association between the type of dialysis access use with gender, BMI, or diabetic status (Table 7).

Discussion

The aim of this cross-sectional study is to find out the different types of vascular accesses used for HD in ESRD patients being

Table 5. Types of access according to the duration of dialysis.

Types of access	Incident patients	Prevalent patients
AVF	24 (29.3)	432 (75)
Temporary catheter	34 (41.5)	74 (12.8)
Permanent catheter	7 (8.5)	35 (6.1)
Catheter with immature fistula	16 (19.5)	17 (3)
Graft	1 (1.2)	18 (3.1)
Total	82 (100)	576 (100)

AVF: Arteriovenous fistula.

Table 6. Vascular access according to dialysis center.

Types of access	Dialysis Center		
	Northern	Middle	Southern
AVF	238 (72.1)	89 (63.1)	129 (69)
Temporary catheter	26 (7.9)	42 (29.8)	40 (21.4)
Permanent catheter	27 (8.2)	6 (4.3)	9 (4.8)
Catheter with immature fistula	24 (7.3)	1 (0.7)	8 (4.3)
Graft	15 (4.5)	3 (2.1)	1 (0.5)
Total	300 (100)	141 (100)	187 (100)

AVF: Arteriovenous fistula.

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Table 7. Distribution of access types according to patient BMI and DM.

Character	AVF	Temporary catheter	Permanent catheter	Catheter with immature fistula	Graft	*P*
Gender						
Male	266 (68.2)	66 (16.9)	28 (7.2)	22 (5.6)	8 (2.1)	0.36
Female	190 (70.9)	42 (15.7)	14 (5.2)	11 (4.1)	11 (4.1)	
BMI						
Underweight	42 (70)	5 (8.3)	9 (15)	2 (3.3)	2 (3.3)	0.123
Normal	206 (70.1)	52 (17.7)	16 (5.4)	13 (4.4)	7 (2.4)	
Overweight	124 (68.5)	32 (17.7)	13 (7.2)	8 (4.4)	4 (2.2)	
Obese	84 (68.3)	19 (15.4)	4 (3.3)	10 (8.1)	6 (4.9)	
DM						
Non-diabetic	269 (69.7)	64 (16.6)	21 (5.4)	18 (4.7)	14 (3.6)	0.682
Type 2	153 (67.1)	40 (17.5)	18 (7.9)	13 (5.7)	4 (1.8)	
Type 1	34 (77.3)	4 (9.1)	3 (6.8)	2 (40.5)	1 (2.3)	

AVF: Arteriovenous fistula, BMI: Body mass index, DM: Diabetes mellitus.

used in our country and the proportion of each and to compare our findings with those of the other parts of the world. We also aim to put a framework for future follow-up studies to be able to track the improvement in this field in the forthcoming years.

As the results of the study showed, the most common vascular access type over all the included 658 patients in this study was the AVF, which was present in 69.3% of the patients. Compared to other studies in other countries, AVF proportion was lower in West Bank than in other countries such as Germany (84%), France (77%), and Italy (90%).[14] AVF proportion in the United Kingdom (67%)[14] and Egypt (67.3%)[17] were close to that in the West Bank.[14] In the USA, the proportion of AVF there among prevalent patients is (63.4%) in 2014 and this is also close to our findings in Palestine, (75% among prevalent patients, Table 5).[1,18] In both Saudi Arabia and north Jordan, proportion of AVF was about 56% for each which is lower than in the West Bank.[19,20] Our findings, 75% of prevalent patients are using AVF, are close to those of an Australian study which revealed that the AVF accounts for 77% of all prevalent patients.[21]

Catheters represented the second most common access type in the West Bank, 27.8% of the patients. Temporary catheters formed 59% of all catheters and 16.4% of all access types. Proportions of catheters were lower in countries such as France (6%), Germany (4%), Spain (7%),[18] and USA (15%)[22] compared to that proportion in the West Bank (27.8%).

Regarding grafts, they were the least common access type used in the West Bank (2.9% for all and 3.1% for prevalent patients). In the USA, the percentage decreased dramatically between the years 2003–2014 from 40% to 18%.[1] About 5% of patients had fistula creation, but AVF was still immature and hence, they were using catheters temporarily until the fistula are mature.

Compared to developed countries, the West Bank has generally the lower proportion of AVF and a higher proportion of catheters, especially temporary non-tunneled catheters. This means that access type status needs more improvement by increasing the proportion of patients with AVF as it is the best vascular access type,[3,6,7,18] and by decreasing proportion of patients with catheters (mainly temporary catheters) and other venous catheters as they are associated with decreased patients' survival and their association with more frequent access complications[8,11,23] and increased risk of hospitalizations if the catheters are used as a baseline dialysis access.[24] Improvement in this field will affect health outcomes of dialysis patients by decreasing mortality and morbidity with better economic outcomes by decreasing costs and expenses on expected complications.[18] In addition to that, early and persistent

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AVF creation has been associated with a better feeling of improved health and quality of life in dialysis patients.[25] However, compared to the neighboring countries, results in West Bank were close and even sometimes better.[17,19,20] This also inspires us to set up future plans for dialysis access in patients expected to start their HD and introduce methods to reduce the complications associated with catheter use mainly temporary ones.[26,27]

In the present study, we found a significant correlation between the used vascular access type and the duration of dialysis. Prevalent patients used more AVF (75%) and grafts (3.1%) compared to incident patients (29.3% of access types were AVF and 1% were grafts). On the other hand, incident patients had a higher percentage of temporary catheters (41.5%), permanent catheters (8.5%) and catheters with immature fistulas (19.5%) compared to prevalent patients in whom 12.8% of access types were temporary catheters, 6.1% were permanent catheters and only 3% were catheters with immature fistula (Table 5). When we compare these findings with the US data, we find that the AVFs are used in 16.9% of incident patients compared with 29.3% in West Bank. Catheters, catheters with maturing graft or fistula and AVG were found in 61.6%, 18.7%, and 2.9%, respectively, among incident patients in the US.[1] This wide variation might be explained by noting that AVF prevalence of 60% or more is achieved at about one year on HD in the US.[1]

The high percentage of prevalent patients with temporary catheters (12.8%), is likely due to failure of previous AVF or other reasons such as the delay in referral to the vascular surgery centers. However, this problem seems to be universal as many European and American countries have not achieved a satisfied reduction in the percentage of catheter use.[28]

Regarding catheter insertion sites the vast majority of temporary catheters and catheters with immature fistula (94.4% and 69.7%, respectively) were inserted in the subclavian vein whereas the majority of permanent catheters (92.9%) were inserted in the internal jugular vein, making the subclavian vein the mostly used vein (68.3%) followed by internal jugular vein (26.2%) (Tables 4 and 8). In Europe, 57% of temporary catheters are inserted in the internal jugular vein, but in the US, both subclavian and internal jugular veins are used equally as insertion sites for temporary catheters (46% for each).[14] The aforementioned findings urges us to re-evaluate the distribution of temporary catheter insertion sites away from the subclavian vein due to the high risk of complications that are associated with its use, mainly central venous stenosis.[29,30]

Regarding dialysis center districts, the results showed that it has a significant variation in the distribution of vascular access types. The highest proportion of temporary catheters (29.8%) was in the middle centers, whereas the lowest was in northern centers (7.9%). On the other hand, the highest proportion of AVF was in northern centers (72.1%) and the percentages of the other two centers were in the same range (63.1% and 69%), (Table 6). After testing the relationship between vascular access type and gender, BMI and diabetes mellitus status, results showed that there was no significant association and so those factors did not affect the type of vascular access type. This study has emphasized the main vascular access being used at the different dialysis centers in the West Bank, Palestine and it establishes a base for future studies to evaluate the progression in this field toward the world-

Table 8. Insertion site of each catheter type.

Type of catheters	Subclavian vein	Internal jugular vein	Femoral vein	Transhepatic
Temporary catheter	102 (94.4)	0	6 (5.6)	0
Permanent catheter	0	39 (92.9)	2 (4.8)	1 (2.4)
Catheter with immature fistula	23 (69.7)	9 (27.3)	1 (3)	0
Total	23 (69.7)	9 (27.3)	1 (3%)	0

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wide recommendations taking into consideration that the prevalence of ESRD in West Bank, Palestine is high in comparison to the industrialized countries.[31]

Strengths and Limitations

This study included relatively a large number of patients undertaking HD in the West Bank. The number of the included patients in this study represents more than 82% of all HD patients' population in West Bank, Palestine.[32] Hence, the demographic characteristics of enrolled patients are very likely to be representative of the HD population in West Bank, Palestine. This study is the first of its type in our country and this might help establishing a national database for the ESRD patient and will be baseline for future follow-up studies.

Conclusion and Recommendations

This study showed that there is a high proportion of HD patients with catheters especially temporary catheters in the West Bank, Palestine, and this may increase morbidity, mortality, and increased health care costs. However, proportion of AVF seems to be acceptable when compared with the neighboring countries but still needs more improvement to increase their use, especially at the beginning of HD. According to this, we recommend close follow-up of chronic renal failure patients for early AVF creation when they are expected to need HD and increase number of physicians who are well trained in tunneled catheters insertion. Reducing the catheter time use is essential to reduce the risks associated with dialysis catheters. Early referral and prompt creation of AVF or AVG needs to be implemented. Subclavian vein site insertion for HD catheters needs to be avoided.

Ethical approval

The study was approved by the Institutional Review Board of An-Najah National University. Full verbal and written consent has been obtained from patient's family.

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Conflict of interest: None declared.

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