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Renal Data from the Arab World

Vascular Access Mortality and Hospitalization among Hemodialysis Patients in Palestine

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ABSTRACT. Vascular access complications are common in patients with end-stage kidney disease who are receiving maintenance hemodialysis (HD) and are responsible for an enormous burden of morbidity and mortality among these patients. Differences in the all-cause mortality rate and hospitalization between dialysis catheter use and arteriovenous (AV) vascular access use have not been documented in our HD population. We performed a 12-month prospective analysis of our HD patients from four dialysis centers. We examined all-cause mortality and hospitalization in patients being dialyzed through HD catheters as compared to patients with AV access. A total of 382 patients were included in the study. Of these, 88 had catheters and 294 had AV accesses. Seventy-eight percent of all catheters were temporary nontunneled dialysis catheters. The overall gross mortality rate for all patients was 14.7%. Gross mortality was significantly lower among AV access group compared to the catheter group (12.2% vs. 22.7%; $P = 0.015$). Catheter use was associated with a relative hazard ratio (HR) of 1.85 [95% confidence interval (CI), 1.13–3.03] compared with use of an AV access. Hospitalization rate was also significantly lower among patients with AV access versus patients who used catheters (27.6% vs. 46.6%; $P = 0.006$). The risk of hospitalization was also higher in catheter users with a relative HR of 1.69 (95% CI, 1.26–2.26) compared with use of AV access. In our HD population where the majority of catheters were temporary nontunneled catheters, dialysis catheter use was associated with higher mortality and increased hospitalization rates compared with AV access. These results emphasize the urgent need to minimize the use of dialysis catheters, in order to reduce mortality and hospitalization rates among HD patients.

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Introduction

Vascular access problems are the leading cause of mortality and hospitalization among hemodialysis (HD) patients and are also associated with high economic burden on the health-care system.[1-3] In contrast to arterio-

venous (AV) accesses, dialysis catheter use is associated with higher risk for infections,[4-6] thrombosis,[7] and short access survival.[8] Moreover, catheter use is associated with a higher risk for mortality when compared with AV accesses.[4,9] Therefore, the National Kidney Foundation Kidney Disease Outcome Quality Initiative guidelines recommended the use of noncatheter AV access (fistula or graft) to avoid catheter use.[1] Despite this recommendation, about two-thirds of HD patients begin dialysis with venous catheter, and 15% of the patients use AV fistula (AVF) at the initiation.[1]

Materials and Methods

Study design and population

This study is a prospective multicenter cohort study in which all adults with end-stage kidney disease (ESKD) from four dialysis centers in Palestine were included in the study. All patients gave informed consent and the local medical ethics committee approved the study. We followed patients for one year until death, transfer to nonparticipating dialysis center, transplantation, and withdrawal from the study or end of the follow-up period. Eligibility included all HD patients with ESKD who are >18 years of age and who were initiated on dialysis in one of our four dialysis centers.

Demographic characteristics (age and sex), dialysis vintage, underlying cause of the ESKD, and vascular access type were collected at the beginning of the study from patients and/or their relatives as well as from review of their medical records. Dialysis accesses included catheters (both tunneled and nontunneled catheters) and AV accesses (AV fistulas and grafts). Patients were categorized according to age group. Patients above 65 years and less than 65 years old and according to dialysis vintage (1–3 years, 3–5 years, 5–10 years, and >10 years). All data were recorded monthly using data master flow sheets, discharge summaries, dialysis clinic progress notes, and dialysis flow sheets. Vital status was verified actively from the dialysis centers and death certificate.

Statistical Analyses

Continuous variables are presented as mean ± standard deviation and categorical variables are presented as numbers with valid percentage. Chi-square test was used for categorical variable. P <0.05 was considered statistically significant. Mortality rates and hospitalization rate were calculated for each category of HD patients. Relative hazards (RHs) for mortality and hospitalization in patients with catheter compared with AV access were calculated using the Statistical Package for the Social Sciences (SPSS) for Windows version 16.0 (SPSS Inc., Chicago, IL, USA).

Results

Patient characteristics

All HD patients who met the inclusion criteria were included in this study. A total of 399 patients were included and 17 patients dropped out (15 patients transferred and 2 underwent kidney transplantation). Of the remaining 382 participants, 223 patients were males (58.4%) and 159 patients were females (41.6%). The mean age was 55.17 ± 14.86. The cause of ESKD was diabetes mellitus (DM) in 51.8% of all the patients. The majority of patients were on dialysis for <5 years, 1–3 years (39.8%), and 3–5 years (39.5%) (Table 1).

Table 1. Participant's demographic data (n = 382).

Variable	Number (%)
Gender	
Male	223 (58.4)
Female	159 (41.6)
DM	198 (51.8)
CVD	62 (16.2)
Age	
<65 years	254 (66.5)
>65 years	128 (33.5)
Duration on dialysis	
1–3 years	152 (39.8)
3–5 years	151 (39.5)
5–10 years	59 (15.4)
>10 years	20 (5.2)

DM: Diabetes mellitus, CVD: Cardiovascular disease.

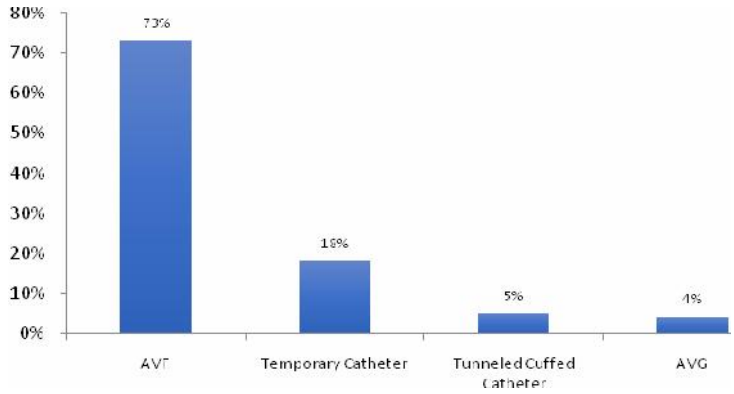

Figure 1. Dialysis access distribution.
AVF: Arteriovenous fistula, AVG: Arteriovenous graft.

Access characteristics

The majority of patients had an AVF (73%) followed by temporary dialysis catheters (18%). AV graft and cuffed tunneled catheters (CTC) were present in only 5% of the patients (Figure 1). Catheters were most commonly inserted into the subclavian vein (68%) followed by the internal jugular (28%) and femoral veins (4%), respectively.

Mortality rate

There were a total of 56 deaths among the 382 patients followed during the 12-month study period. The overall mortality rate was 14.6%. The mortality was lower among AV access type compared to catheters (12.2 vs. 22.7; P = 0.015) (Figure 2). The gross mortality rate was significantly higher in patients >65 years of age compared to those <65 years (55.2 vs. 17.5; P = 0.001) and in patients with DM than without DM (20.2 vs. 8.7; P = 0.001). Mortality rates did not differ significantly by gender or duration of dialysis (Table 2). The most common cause of death was cardiovascular (9.4%) followed by infection (2.9%) and other causes (2.4%) (Table 3).

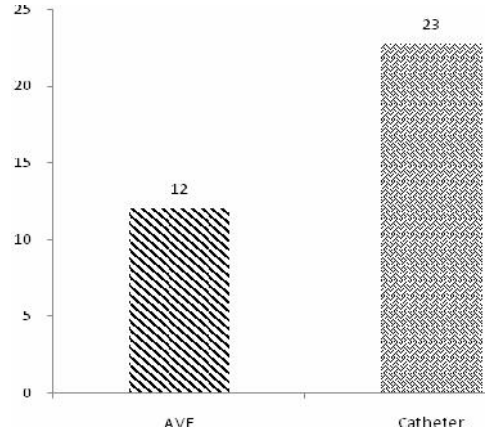

Figure 2. Gross mortality.
AVF: Arteriovenous fistula.

Table 2. Relation of mortality to other variables.

Variable	Death, *n* (%)	*P*
Age		
<65 years	23 (17.5)	0.001
>65 years	33 (55.2)	
DM		
Nondiabetic	16 (8.7)	0.001
Diabetic	40 (20.2)	
Access type		
Arteriovenous	36 (12.2)	0.015
Catheter	20 (22.7)	
Gender		
Male	32 (14.3)	0.839
Female	24 (15.1)	
Duration of dialysis		
1–3 years	19 (12.5)	0.660
3–5 years	25 (16.6)	
5–10 years	10 (16.9)	
>10 years	2 (10)	

DM: Diabetes mellitus.

Table 3. Mortality and causes of death.

	Frequency	Gross mortality
Mortality	56	14.6
Causes of death		
CVD	36	9.4
Infection	11	2.9
Others	9	2.4

CVD: Cardiovascular disease.

In an unadjusted Cox proportional hazards regression model, catheter use was associated with a RH of 1.85 (95% CI, 1.13 to 3.03) compared with use of an AV access.

Hospitalization rate

Of the 382 patients, 122 (31.9%) were hospitalized over the 12-month period, with an average of 1.73 hospitalizations per patient. The hospitalization rate was lower among AV access group compared with the catheter use group (27.6 vs. 46.6; $P = 0.001$) (Table 4). Hospitalization did not differ significantly by age, gender, DM, or duration of dialysis (Table 4). The average length of stay (LOS) for hospitalized patients was 2.085 days (LOS = 2.11 for patient with catheter and 2.07 for patient with AV access).

In an unadjusted Cox proportional hazards regression model, catheter use was associated with a RH of 1.69 (95% CI, 1.26 to 2.26) compared with use of an AV access.

Discussion

In this study, we showed that catheter use was associated with an increased 1-year all-cause mortality rate as compared to AV access use. The overall mortality rate was 14.66%. Participants who were using a catheter for HD were at approximately 50% higher risk for mortality and RH of 1.85 (95% CI, 1.13–3.03) compared with those patients with an AVF for HD access. Several mechanisms have been proposed such as access infection[5] and septicemia.[10,11] Catheters provide a lower blood flow, which may lead to a lower dialysis dose[9] and more frequent hospitalization.[12]

To our knowledge, this is the first study that evaluated mortality and hospitalization in a

Table 4. Relation of hospitalization to other variables.

Variable	Hospitalization *n* (%)	*P*
Age		
>65 years	83 (64)	0.69
<65 years	39 (54.1)	
Gender		
Male	69 (30.9)	0.621
Female	53 (33.3)	
Duration of dialysis		
1–3 years	57 (37.5)	
3–5 years	43 (28.5)	0.304
5–10 years	17 (28.3)	
>10 years	5 (26.3)	
DM		
Nondiabetic	58 (31.5)	0.867
Diabetic	64 (32.3)	
Access type		
Arteriovenous	41 (46.6)	0.001
Catheter	81 (27.6)	

DM: Diabetes mellitus.

cohort of dialysis patient population in which temporary dialysis catheter was the main type of catheter used. The majority of dialysis centers in our cohort relay on temporary dialysis catheters as the main type of catheter for HD. Tunneled cuffed dialysis catheters are the recommended type of dialysis catheter,[13] and the internal jugular vein is the preferred site of catheter insertion. Due to limited financial resources and a small number of sufficiently trained personnel for the placement of tunneled cuffed dialysis catheters, temporary dialysis catheters remain the most commonly used catheter access. Moreover, the most used anatomical position for the placement of catheters in our cohort was the subclavian vein (68%); this is likely due to practice preference and also the ease of catheter position on the chest wall for long-term use.

The mortality rate was higher in patients >65 years compared to those <65 years; these findings are comparable to the increased risk found in other cohorts.[9] Similar to other studies,[14,15] mortality also was found to be higher in patients with DM than without DM (20.2% vs. 8.7%). Mortality rates did not differ significantly by gender or duration of dialysis.

Our study confirms that catheters continue to be the access type with the greatest associated hospitalization rate as other studies have shown.[16-18] Nearly 31.9% of all the patients were hospitalized within the year averaging 1.73 episodes per patient compared to study done in North America where 59% of patients were hospitalized within a year averaging 1.5 episodes per patient.[16] In our study, lower rates may due to small sample size. Compared with AV access, catheters were associated with a higher risk of overall hospitalization, RH = 1.69 (95% CI, 1.26–2.26) similar to RH = 1.30 in North America study.[16]

The reason why catheters are associated with higher hospitalization may be due to direct results of catheter-related bloodstream infections, access site infections,[19,20] thrombosis, bleeding and hematoma,[21,22] and catheter dysfunction.[22] Vascular access type did not influence the length of hospital stay as other study also shows.[23]

We did not account for the change of access during the one-year study period, which may have changed the mortality and hospitalization rates. Other studies have shown that after adjusting for change in access, there continued to be a significant increase in mortality.[1]

Conclusion

In this study, HD patients using a venous dialysis catheter were at a higher risk for death and hospitalization compared with patients with an AV access. These results add to the existing data, suggesting that the use of venous catheters should be minimized in order to reduce the frequency of access complications, patient's hospitalization and to improve patient survival.

Conflict of interest: None declared.

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