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Mid-term cumulative patency of fistula and PTFE grafts among hemodialysis patients: A retrospective, single-center study from Palestine

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Abstract

Background: Due to the long waiting time for kidney transplantation, most End-Stage renal disease patients are commenced on either hemodialysis or peritoneal dialysis. Reusable fistulas have the lowest risk for death, cardiovascular events, and infections among all vascular accesses. This study aims to report the outcomes of the arteriovenous fistulas and PTFE grafts and the related predictive clinical and demographic variables.

Methods: This retrospective study reviewed the charts of all hemodialysis patients between January 2017 and January 2021 at the Dialysis Center of An-Najah National University Hospital, Nablus, Palestine. Our outcomes were a primary failure, primary and secondary patency, and the related factors. Survival analysis using the Kaplan-Meier method was conducted, and the log-rank test was used to compare patency rates. The Cox proportional hazards regression model tested factors relevant to primary and secondary patency rates in univariate and multivariate analyses.

Results: A total of 312 procedures were performed during the study period. Primary failure was 7.1% for AVF, 13.9% for arterio-venous graft (AVG) procedures. Peripheral arterial disease and left-sided AVF were associated with more primary failure rates. AVF, primary patency rates at 1, 2, and 3 years were 82%, 69%, and 59%, respectively, while secondary patency rates at 1, 2, and 3 years were 85%, 72%, and 63%, respectively. Factors associated with increased AVF patency in a proportional hazard model were younger age and dual antiplatelet administration.

Conclusion: Our study adds further evidence that autogenous AVF has better results than prosthetic AVG in both primary and secondary patency rates as well as less primary failure rates. Therefore, we encourage further longitudinal studies that assess the benefits of using antiplatelet on AVF outcome versus risks of bleeding, especially with dual agents.

Keywords

End-stage renal disease, arterio-venous fistula, arteriovenous graft, primary patency, secondary patency, primary failure

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Introduction

The incidence of End-Stage renal disease (ESRD) is increasing dramatically over the past two decades, and it is considered a serious medical, social, and economic issue, and it is the ultimate result of chronic kidney disease.[1–3] ESRD patients have a shorter life expectancy compared with their counterparts without kidney disease.[2]

The measured ESRD prevalence in Palestine was 240.3 per million population (PMP),[4,5] which is comparable to nearby countries. In 2018, ESRD prevalence in the Middle East was estimated to be 360 PMP[6] compared with 2160 PMP in 2016 in the United States.[7]

Patients with ESRD need to be informed and educated about various treatment modalities, including kidney transplantation, hemodialysis, or peritoneal dialysis.[8] Kidney replacement is considered the treatment of choice for ESRD[9] since it is associated with a better quality of life and a more favorable cost-effective ratio.[10] Due to the long waiting time for kidney transplantation, most patients are commenced on either hemodialysis or peritoneal dialysis.[8]

Dialysis modalities include hemodialysis and peritoneal dialysis and are used to treat patients who are waiting or not amenable for transplantation. Hemodialysis uses an extracorporeal circulation of the patient's blood to improve the uremic symptoms and accomplish solute balance for acute and chronic kidney failure by restoring the body's fluid balance and correcting electrolyte and acid-base abnormalities.[11,12] The current estimates suggest that about 11% of the global dialysis patients receive peritoneal dialysis and the vast majority receive hemodialysis.[3,13]

Repeated and reliable vascular access to the bloodstream is needed for effective hemodialysis.[14] Vascular accesses include central venous catheters and a surgically-created Arterio-Venous fistula (AVF) or synthetic graft.[14] Among all vascular accesses, reusable fistulas have the lowest risk for death, cardiovascular events, and infections.[14,15] The impact of the central venous catheters on the health system and the patients' health status is dramatic as infection in terms of septicemia is directly linked to the increase in the rates of mortality and morbidity.[16]

AVF is a multidisciplinary effort of Drs. Cimino, Brescia, and Appel in 1962, which is the preferred vascular access for HD nowadays because of its low risk of complications, high longevity, fewer mortality rate, and better patient survival than the other types of vascular access.[15,17]

AVF cannot immediately be used and needs several weeks of maturation (average of 10 weeks) to ensure safe cannulation.[17] Maturation time is defined as the time from the date of creation to the date of the sixth consecutive hemodialysis session using two needles.[17]

Studying the outcomes of dialysis access and their predictors is essential to improve dialysis patients' quality of life and survival. These outcomes can be reflected by terms like primary failure rate, primary and secondary patency rates.[18] The primary failure rate is the proportion of created AVF that thrombosed or failed to mature.[18] Primary Patency is the time between access creation to the time of first intervention to maintain or reestablish patency (surgical or endovascular), or occurrence of access thrombosis, or time of measurement of patency.[18–20] Secondary patency (or cumulative patency) is defined as the time from access creation till access abandonment, reaching a censored event or time of measurement of patency.[18–20] This study aims to report the outcomes of the arteriovenous fistulas and PTFE grafts and the related predictive clinical and demographic variables.

Subjects and methods

Study design, setting, and population

This single-center, retrospective study reviewed the charts of all hemodialysis patients between January 2017 and January 2021 at the Dialysis Center of An-Najah National University Hospital, Nablus, Palestine. This hemodialysis unit is the largest dialysis center in the region (West Bank), with more than 360 patients receiving hemodialysis and peritoneal dialysis therapy. All participants were ESRD patients aged 18 years or older, on regular hemodialysis, three times per week with an average of 4 h per session. All participants provided written informed consent for participation in the study. The Institutional Review Board of An-Najah National University approved the study.

Data collection

Demographic and clinical characteristics were collected from patients and their medical records. These included age, gender, number of years on hemodialysis, patients' comorbidities (diabetes mellitus and its duration, hypertension and its duration, ischemic heart disease (IHD), heart failure (HF), peripheral arterial disease (PAD)), site and side of fistula, date of procedure, smoking, type of the vascular access (native AVF or PTFE graft), and date of any interventional procedure for this access (shunto-plasty, revision, and new access creation). The average time of primary and secondary patency was measured according to the aforementioned definition, and the relation to the clinical and demographic variables was studied.

Primary patency was computed from the time of vascular access creation until the first endpoint. The endpoint was defined as fistula occlusion, inadequate dialysis, or any intervention to maintain blood flow or until reaching a censored event (death, kidney transplant, transfer to peritoneal dialysis, or end of the follow-up period). Secondary or cumulative patency (the duration in which the fistula

was being used for dialysis.) was calculated from the time of vascular access creation until permanent access failure, regardless of the number of procedures required to maintain access patency for dialysis. Finally, access patency was calculated for patients without primary failure. The primary failure rate is the percentage of fistulae created that are thrombosed or failed to mature with the lack of ability to be cannulated and used successfully for dialysis.

Statistical analysis

For descriptive analyses, means with standard deviation (SD) were used to summarize continuous variables and frequencies with percentages for categorical variables. In addition, we tested the difference between the groups using the Chi-squared test for categorical variables and Student's *t*-test for continuous variables. Survival analysis using the Kaplan-Meier method was conducted, and the log-rank test was used to compare patency rates. The Kaplan–Meier survival curve is defined as the probability of surviving for a specific time while time is considered in many small intervals. Factors considered relevant to primary and secondary patency rates were tested in univariate and multivariate analyses using the Cox proportional hazards regression model. Any *p*-value less than 0.05 was considered statistically significant and all analyses were conducted using the Statistical Package for the Social Sciences (SPSS) computer software version 20.0 (IBM Corp., Armonk, NY).

Results

Baseline characteristics of patients

A total of 312 procedures were performed during the study period, 240 AVF and 72 arterio-venous grafts (AVG). The participants' mean age was 59.5 years (SD = 14), and 200 patients (64.1%) were males. About 67.9% ($n = 212$) and 90.1% ($n = 281$) were diabetics and hypertensive, respectively. Patients' baseline demographic and clinical characteristics are summarized in Table 1. Previous access was reported in 22.9% of the AVF patients and in 75% of the AVG patients. Almost 70% of AVF were created on the left side, reflecting the preference for using the non-dominant arm for vascular access. The brachiocephalic fistula was the most common located fistula, 69.6%. The overall causes of secondary patency loss were death 46 (14.7%), access abandonment 72 (23%), turned to peritoneal 7 (2.24%), and end of study 160 (51.2%; Table 1).

Primary failure

Primary failure was observed in 27 of 312 procedures performed (8.7%), 17 AVF procedures (7.1%), and 10 AVG procedures (13.9%). Baseline demographics and comorbid variables of patients who developed primary failure were compared in Table 2. Patients with PAD were significantly more likely to develop primary failure regardless of shunt type ($p < 0.05$). Primary failure was also associated with the insertion site of the AVF (more failure rates on the left; $p < 0.05$); and the location of the AVG as lower limb AVGs were more likely to develop primary failure (50%), compared to upper limb AVGs (Table 2).

Primary and secondary patency with the exclusion of primary failure

For AVF, primary patency rates at 1, 2, and 3 years were 82%, 69%, and 59%, respectively, while secondary patency rates at 1, 2, and 3 years were 85%, 72%, and 63%, respectively. For AVG, primary patency rate at 1, 2, and 3 years were 57%, 43%, and 0%, respectively, while secondary patency rates at 1, 2, and 3 years were 75%, 59%, and 20%, respectively (Figure 1). Thus, both Primary and secondary patencies were significantly better in AVF than AVG.

A log-rank test was run to determine the differences in the primary and secondary patency distribution for AVF and AVG. The probability of primary patency is significantly reduced by 56% with AVG versus AVF at any time over 3 years (HR: 0.447; 95% CI: 0.27–0.74; $p = 0.002$). On the other hand, the probability of secondary patency is significantly reduced by 61% with AVG versus AVF at any time over 3 years (HR: 0.393; 95% CI: 0.24–0.65; $p < 0.001$; Figure 1).

After adjustment for potential confounding variables, multivariate Cox proportional hazard regression analysis showed that older age was significantly associated with a decreased primary (HR: 1.03; 95% CI: 1.02–1.05; $p = 0.037$) and secondary (HR: 1.03; 95% CI: 1.01–1.05; $p = 0.024$) patency (Tables 3 and 4). Moreover, the use of combined, aspirin and Clopidogrel antiplatelet was significantly associated with an increased primary (HR: 0.27; 95% CI: 0.10–0.94; $p = 0.040$) and secondary (HR: 0.21; 95% CI: 0.06–0.73; $p = 0.014$) patency (Tables 3 and 4).

Discussion

This retrospective study aimed to assess the outcomes of AVF and AVG and the related clinical and demographic variables. Successful AVF maturation was achieved in approximately 92.9% of subjects. The AVF primary failure rate in our study was 7.1% which is relatively low and close to the findings of the nearby countries, 12.1% in Jordan.[17] However, there is a wide variation in the primary failure rates in the literature, 22.7%–53.5%.[21–24] We attribute our low primary failure rates of AVF (7.1%) to the routine pre-operative vascular mapping in the vascular department, which agrees with the recommendations of previous studies.[25,26]

Table 1. Baseline demographics and comorbid variables of the patient population.

	Frequency (%)	AVF ($n=240$)	AVG ($n=72$)
Age (Mean ± SD)	59.5 ± 14.1	59 ± 14.2	61 ± 14
Gender			
Female	112 (35.9%)	79 (32.9%)	33 (45.8%)
Male	200 (64.1%)	161 (67.1%)	39 (54.2%)
Smoking			
Yes	81 (26.0%)	68 (28.3%)	13 (18.1%)
No	231 (74.0%)	172 (71.7%)	59 (81.9)
Chronic diseases, yes (%)			
Hypertension	281 (90.1%)	220 (91.7%)	61 (84.7%)
HTN duration in years	11.6 ± 7.6	11.11 ± 7.7	13.8 ± 6.7
Diabetes	212 (67.9%)	169 (70.4%)	43 (59.7%)
DM duration in years	17.6 ± 7.9	17.2 ± 7.7	18.5 ± 8.6
IHD	119 (38.1%)	95 (39.6%)	24 (33.3%)
Heart failure	71 (22.8%)	62 (25.8%)	9 (12.5%)
PAD	30 (9.6%)	22 (9.2%)	8 (11.1%)
Antiplatelet			
None	144 (46.2%)	104 (43.3%)	40 (55.6%)
Aspirin (81 mg) or Clopidogrel (75 mg)	130 (41.6%)	104 (43.3%)	26 (36.1%)
Aspirin and Clopidogrel	38 (12.2%)	32 (13.3%)	6 (8.3%)
Access insertion site			
Left	203 (65.1%)	166 (69.2%)	37 (51.4%)
Right	104 (33.3%)	71 (29.6%)	33 (45.8%)
Missing	5 (1.6%)	3 (1.2%)	2 (2.8%)
Access location			
Brachiocephalic		167 (69.6%)	–
Radiocephalic		44 (18.3%)	–
Brachiobasilic		28 (11.7%)	–
Upper limb		–	64 (88.9)
Lower limb		–	8 (11.1%)
Missing		1 (0.4%)	
Previous access—AVF or AVG			
Yes	109 (34.9%)	55 (22.9%)	54 (75%)
No	203 (65.1%)	185 (77.1%)	18 (25%)
Primary failure			
Yes	27 (8.7%)	17 (7.1%)	10 (13.9)
No	285 (91.3%)	223 (92.9%)	62 (86.1)
Causes of secondary patency loss			
End of study	160 (51.2%)	134 (55.8%)	26 (36.1%)
Death	46 (14.7%)	35 (14.6%)	11 (15.3%)
Turned to peritoneal	7 (2.24%)	5 (2.1%)	2 (2.8%)
Access abandonment	72 (23%)	49 (20.4%)	23 (31.9%)

There was a strong correlation between peripheral arterial disease (for both AVF and AVG) and insertion site (for AVF) with increased primary failure rates. This accords with the findings of a previous study that found a strong relationship between Ankle-Brachial Index (ABI, as a marker of atherosclerosis when <0.9) and vascular access failure. They recommended routine screening for hemodialysis patients for ABI to identify the high-risk groups for access failure.[27] The primary failure rate of AVG was 13.9% which is close to the findings of Lok et al.[28] and Pflederer et al[29] who reported a primary failure rate of 19% and 10.9%, respectively. However, the primary failure rate was higher among AVG than AVF, which differs from previous studies.[25,28,29] We think this might be due to the high percentages of AVG with a history of previous access (75%) and the limited vascular availability for grafts compared with AVF.

For AVF, our primary patency rate at 1, 2, and 3 years was 82%, 69%, and 59%, respectively, and they are better when compared with the findings of a meta-analysis (56%–64% at 1 year and 44%–58% at 2 years).[30,31] The secondary patency rate at 1, 2, and 3 years was 85%, 72%, and 63%,

Table 2. Baseline demographics of patients who developed primary failure.

	AVF primary failure			AVG primary failure		
	Yes ($n=17$)	No ($n=223$)	p-Value	Yes ($n=10$)	No ($n=62$)	p-Value
Age (Mean ± SD)	61.24 ± 17.7	58.8 ± 14	0.500	64.3 ± 5.18	60.3 ± 16.8	0.409
Gender						
Female	4 (5.1%)	75 (94.9%)	0.393	3 (9.1%)	30 (90.9%)	0.279
Male	13 (8.1%)	148 (91.9%		7 (17.9%)	32 (82.1%)	
Smoking	7 (10.3%)	61 (89.7%)	0.223	1 (7.7%)	12 (92.3%)	0.475
Chronic diseases, yes (%)						
Hypertension	15 (6.8%)	205 (93.2%)	0.595	8 (13.1%)	53 (86.9%)	0.655
HTN duration (Mean ± SD)	8.6 ± 7.1	11.2 ± 7.7	0.331	9.8 ± 9	14.2 ± 6.3	0.160
Diabetes	12 (7.1%)	157 (92.9%)	0.987	7 (16.3%)	36 (83.7%)	0.475
DM duration (Mean ± SD)	14.88 ± 8.1	17.3 ± 7.7	0.385	25 ± 10.8	17.7 ± 8.1	0.111
IHD	7 (7.4%)	88 (92.6%)	0.889	3 (12.5%)	21 (87.5)	0.810
Heart failure	5 (8.1%)	57 (91.9%)	0.727	1 (11.1%)	8 (88.9%)	0.797
PAD	4 (18.2%)	18 (81.8%)	0.033	3 (37.5%)	5 (62.5%)	0.041
Antiplatelet						
No	9 (8.7%)	95 (91.3%)	0.557	7 (17.5%)	33 (82.5%)	0.467
Aspirin or Clopidogrel	7 (6.7%)	97 (93.3%)		3 (11.5%)	23 (88.5%)	
Aspirin and Clopidogrel	1 (3.1%)	31 (96.9%)		0 (0%)	6 (100%)	
Accss insertion site						
Left	16 (9.6%)	150 (90.4%)	0.025	4 (10.8%)	33 (89.2%)	0.379
Right	1 (1.4%)	70 (98.6%)		6 (18.2%)	27 (81.8%)	
Access location						
Brachiocephalic	11 (6.6%)	156 (93.4%)	0.731	–	–	0.002
Radiocephalic	3 (6.8%)	41 (93.2%)		–	–	
Brachiobasilic	3 (10.7%)	25 (89.3%)		–	–	
upper limb	–	–		6 (9.4%)	58 (90.6%)	
Lower limb	–	–		4 (50%)	4 (50%)	
Previous access—AVG or AVF						
Yes	3 (5.5%)	52 (94.5%)	0.592	9 (16.7%)	45 (83.3%)	0.238

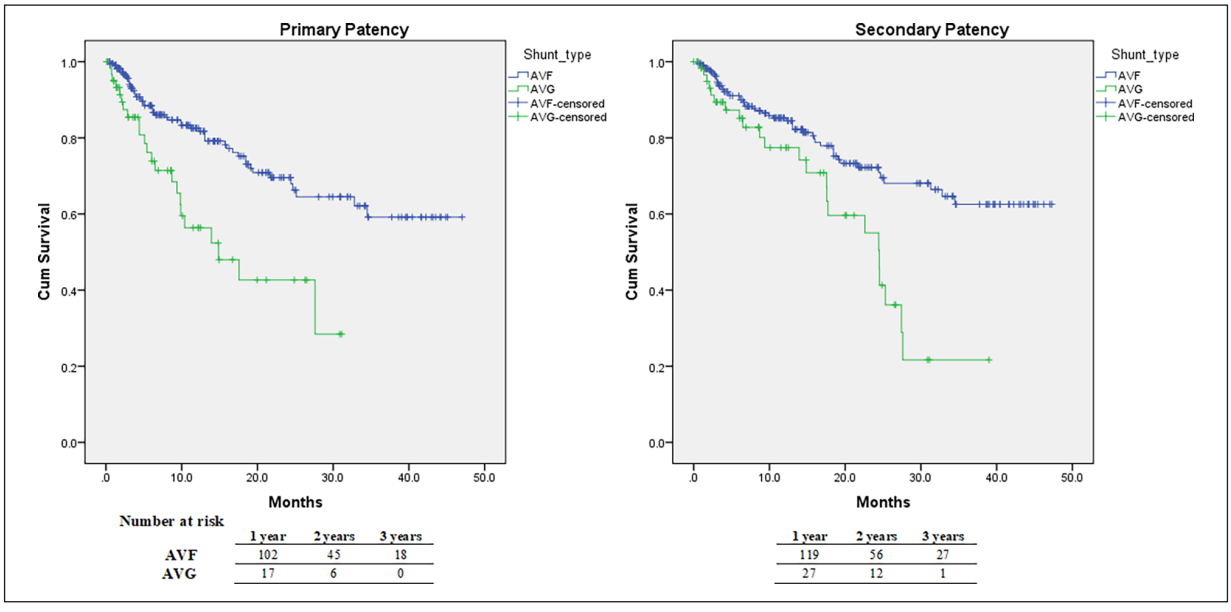

Figure 1. Kaplan–Meier estimates of primary and secondary AVF and AVG patency rates.

Table 3. Factors associated with AVF primary patency in the study population.

	Univariate analysis		Multivariate analysis	
	HR (95% CI)	*p*-Value	HR (95% CI)	*p*-Value
Age	1.02 (0.99–1.1)	0.101	1.03 (1.02–1.05)	0.037
Gender, female	0.92 (0.5–1.6)	0.786	0.76 (0.39–1.5)	0.409
Smoking, yes	1.3 (0.66–2.3)	0.509	0.73 (0.37–1.5)	0.378
Hypertension	046 (0.11–1.8)	0.28	2.4 (0.56–10.4)	0.155
Diabetes	0.84 (0.45–1.5)	0.566	1.1 (0.55–2.1)	0.859
IHD	0.82 (0.47–1.5)	0.499	–	–
Heart failure	0.95 (0.50–1.8)	0.864	–	–
PAD	085 (0.33–2.2)	0.718	–	–
Antiplatelet				
No	1		1	
Aspirin or Clopidogrel	1.1 (06–1.9)	0.775	0.85 (0.47–1.6)	0.601
Aspirin and Clopidogrel	0.41 (0.12–1.4)	0.141	0.27 (0.10–0.94)	0.040
Access insertion site (left)	1.4 (0.8–2.5)	0.278		
Access location				
Brachiocephalic	1			
Radiocephalic	0.56 (0.25–1.3)	0.161	–	–
Brachiobasilic	0.45 (0.14–1.5)	0.181	–	–
Previous access (yes)	0.80 (0.42–1.5)	0.499	1.5 (0.76–3.1)	0.233

Table 4. Factors associated with AVF secondary patency in the study population.

	Univariate analysis		Multivariate analysis	
	HR (95% CI)	*p*-Value	HR (95% CI)	*p*-Value
Age	1.02 (0.99–1.1)	0.098	1.03 (1.01–1.05)	0.024
Gender, female	1.1 (0.59–1.9)	0.850	0.70 (0.36–1.4)	0.292
Smoking, yes	0.86 (0.45–1.6)	0.632	0.72 (0.35–1.5)	0.365
Hypertension	2.3 (0.55–9.3)	0.259	2.40 (0.55–10.3)	0.249
Diabetes	1.3 (0.67–2.3)	0.502	1.20 (0.57–2.2)	0.732
IHD	0.87 (0.49–1.5)	0.625	–	–
Heart failure	0.94 (0.50–1.8)	0.851	–	–
PAD	0.90 (0.35–2.3)	0.815	–	–
Antiplatelet				
No	1	–	1	–
Aspirin or Clopidogrel	1.02 (0.57–1.8)	0.952	0.75 (0.41–1.4)	0.364
Aspirin and Clopidogrel	0.35 (0.10–1.1)	0.083	0.21 (0.06–0.073)	0.014
Access insertion site	1.3 (0.71–2.3)	0.413		
Access location				
Brachiocephalic	1			
Radiocephalic	2.2 (0.68–4.1)	0.184	–	–
Brachiobasilic	1.2 (0.32–4.8)	0.763	–	–
Previous access (yes)	091 (0.48–1.7)	0.769	1.3 (0.65–2.6)	0.462

respectively which is comparable to some studies[32] and better than findings of others.[18,30] However, our better results could be attributed to dialysis patients being younger, as the mean age in our study was 59 ± 14.2 years, which was lower than the mean in most studies.

With regard to AVG, primary patency rates at 1, 2, and 3 years were 57%, 43%, and 0%, respectively, while secondary patency rates at 1, 2, and 3 years were 75%, 59%, and 20%, respectively. The primary patency was better than the findings of other studies[29,33] whereas the secondary patency was comparable to others for the first and second years.[29,33] One meta-analysis included 32 studies showed that primary patency of AVG was 41% and 28% at 1 and 2 years, respectively, while secondary patency were 70% and 54% at 1 and 2 years, respectively.[33]

When comparing AVG and AVF, graft patencies were worse than fistulas' when primary failure was excluded. These findings are consistent with many previous studies[28,29,34,35]

To detect the possible factors affecting patency, multivariate analysis was conducted for age, gender, smoking, diabetes, hypertension, coronary artery disease, history of heart failure, peripheral vascular disease, current use of antiplatelet, access location, and if previous accesses were tried. The risk factor of primary and secondary patencies for AVF was age. In addition, the use of dual anti-platelet therapy (combined use of Aspirin and Clopidogrel) was associated with significantly better primary and secondary patencies for AVF.

Prior studies have shown different findings with respect to the effect of single or double anti-platelet therapy on the patency rates.[36–38] One meta-analysis concluded that Ticlopidine (as adjuvant treatment) may have a beneficial effect on the patency of AVF and AVG in the short term.[36] One more recent study found that the absence of antiplatelet therapy has impaired the secondary patency of AVF.[37] Another earlier meta-analysis had confirmed the beneficial effects of antiplatelet (aspirin alone, Clopidogrel alone, or aspirin and dipyridamole) to increase the patency of AVF and AVG.[38] Although, this finding differs from some previous studies, which showed no significant effect for the anti-platelet on AVF patency (but improved primary patency for AVG)[39] or even negative effect on the AVF patency.[40] Another randomized trial showed that dual therapy with aspirin and Clopidogrel has increased the risk of bleeding in the hemodialysis population and did not affect the frequency of graft thrombosis.[44,45] However, in the last trial, the dose of Aspirin was 325 mg were as in ours, 81 mg which might have led to the increased incidence of bleeding in the aforementioned trial.

The current study found that older age has a negative impact on primary and secondary patencies. Previous studies have demonstrated similar results,[37,41] and they suggested that comorbid diseases in the elderlies such as diabetes, atherosclerosis, and poor veins might interfere with the patency of AVF.[37,42] However, this is not the case for other authors who did not find a significant effect for age on the outcomes of AVF.[18,30]

Concerning the other factors studied in this research, we did not find a significant effect for gender, smoking, hypertension or diabetes, peripheral vascular disease, and type of AVF on the patency rates. We are aware that some reports have found these factors and other factors as significant predictors for AVF patency. However, these findings were not consistent in all rep orts.[18,31,32,37,41,43]

Strengths and limitations

This study included a relatively large number of patients undergoing hemodialysis at An-Najah National University Hospital. This unit's number of hemodialysis patients represents about 20% of all hemodialysis patients in the West Bank, Palestine.[44] So, the demographic, clinical, and biochemical characteristics of included hemodialysis patients are likely to be generalizable to the hemodialysis population in Palestine. This is the first report of the outcomes for vascular access in our nation to the authors' knowledge. I can be used as a framework for similar future studies to build up with and track the progression of our procedure outcomes. This study also included both AVG and AVF and studied the primary failure rates primary and secondary patencies for 3 years, which is fairly enough to get an idea regarding the outcomes of our center and compare the results with their counterparts in the region internationally.

Our study has some limitations that should be taken into consideration when interpreting the study results. Of these limitations is that the number of procedures included in the research does not reflect center's actual number. This is because we did include the procedure that can be followed up over time and not those referred from other centers as they were referred back and lost to follow-up.

Another limitation to mention is the lack of data about the concurrent use of central venous catheters, or if any were inserted at the same side of the failed AVG or AVF, this was because of the lack of sufficient data in the medical records and the non-reliability of the patients to recall for such long period of time. This issue will be taken into consideration in any similar future study.

Conclusion

This study adds further evidence that autogenous AVF has better results than prosthetic AVG in primary and secondary patency rates and less primary failure rates. Thus, our outcomes are heartening in terms of low primary failure rates and comparable primary and secondary patencies for AVF, although there is intent for improvement.

We encourage further longitudinal studies that assess the benefits of using antiplatelet on AVF outcome versus risks of bleeding, especially with dual agents.

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Author contributions

OK, RA, MS, ZH, ZN, OS, and SS designed the study and its protocol. OK, RA, MS, and AH collected the data. ZN performed data analysis. All authors reviewed the manuscript critically for important intellectual content. Finally, all authors read and approved the final manuscript for submission.

Declaration of conflicting interests

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Ethical approval and consent to participate

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

Consent for publication

No images or other personal data that might compromise the anonymity of the patients.

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Availability of data and materials

Data are all contained within the case report. The raw data are available by the corresponding author when requested.

References

1. United States Renal Data System (USRDS). Chapter 5: Mortality, https://www.usrds.org/media/1730/v2_c05_mortality_18_usrds.pdf (2018, accessed 20 September 2019).
2. Gupta R, Mohammed AM, Alenizi EK, et al. Bone mineral density in Kuwaiti patients with end-stage renal disease. *Med Princ Pract* 2011; 20(2): 156–158.
3. Hamdan Z, Tarabeih M, Jebrin K, et al. Peritoneal dialysis in extremely obese patient from Palestine, a case report. *Iran J Kidney Dis* 2020; 14(4): 315–317.
4. Khader MI, Snouber S, Alkhatib A, et al. Prevalence of patients with end-stage renal disease on dialysis in the West Bank, Palestine. *Saudi J Kidney Dis Transpl* 2013; 24(4): 832.
5. Nazzal Z, Khader S, Zawyani H, et al. Bone mineral density in Palestinian patients with end-stage renal disease and the related clinical and biochemical factors: cross-sectional study. *PLoS One* 2020; 15(11): e0241201.
6. Malekmakan L, Tadayon T, Roozbeh J, et al. End-stage renal disease in the Middle East: a systematic review and meta-analysis. *Iran J Kidney Dis* 2018; 12(4): 195.
7. United States Renal Data System. 2018 USRDS annual data report: epidemiology of kidney disease in the United States. National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases, Bethesda, MD, 2018.
8. Thamer M, Hwang W, Fink NE, et al. US nephrologists' recommendation of dialysis modality: results of a national survey. *Am J Kidney Dis* 2000; 36(6): 1155–1165.
9. Suthanthiran M and Strom TB. Renal transplantation. *N Engl J Med* 1994; 331(6): 365–376.
10. Schnuelle P, Lorenz D, Trede M, et al. Impact of renal cadaveric transplantation on survival in end-stage renal failure: evidence for reduced mortality risk compared with hemodialysis during long-term follow-up. *J Am Soc Nephrol* 1998; 9(11): 2135–2141.
11. Ikizler TA and Schulman G. Hemodialysis: techniques and prescription. *Am J Kidney Dis* 2005; 46(5): 976–981.
12. Elliott DA. Hemodialysis. *Clin Tech Small Anim Pract* 2000; 15(3): 136–148.
13. Li PKT, Chow KM, Van de Luijtgaarden MW, et al. Changes in the worldwide epidemiology of peritoneal dialysis. *Nat Rev Nephrol* 2017; 13(2): 90–103.
14. Ravani P, Palmer SC, Oliver MJ, et al. Associations between hemodialysis access type and clinical outcomes: a systematic review. *J Am Soc Nephrol* 2013; 24(3): 465–473.
15. Lok CE and Foley R. Vascular access morbidity and mortality: trends of the last decade. *Clin J Am Soc Nephrol* 2013; 8(7): 1213–1219.
16. Schwab SJ, Buller GL, McCann RL, et al. Prospective evaluation of a Dacron cuffed hemodialysis catheter for prolonged use. *Am J Kidney Dis* 1988; 11(2): 166–169.
17. Wilmink T, Hollingworth L, Powers S, et al. Natural history of common autologous arteriovenous fistulae: consequences for planning of dialysis access. *Eur J Vasc Endovasc Surg* 2016; 51(1): 134–140.
18. Obeidat KA, Saadeh RA, Hammouri HM, et al. Outcomes of arteriovenous fistula creation: a Jordanian experience. *J Vasc Access* 2020; 21(6): 977–982.
19. Sidawy AN, Gray R, Besarab A, et al. Recommended standards for reports dealing with arteriovenous hemodialysis accesses. *J Vasc Surg* 2002; 35(3): 603–610.
20. Lee T, Mokrzycki M, Moist L, et al.; From the North American Vascular Access Consortium (NAVAC). Standardized definitions for hemodialysis vascular access. *Semin Dial* 2011; 24(5): 515–524.
21. Miller PE, Tolwani A, Luscy CP, et al. Predictors of adequacy of arteriovenous fistulas in hemodialysis patients. *Kidney Int* 1999; 56(1): 275–280.
22. Feldman HI, Joffe M, Rosas SE, et al. Predictors of successful arteriovenous fistula maturation. *Am J Kidney Dis* 2003; 42(5): 1000–1012.
23. Huijbregts HJ, Bots ML, Wittens CH, et al. Hemodialysis arteriovenous fistula patency revisited: results of a prospective, multicenter initiative. *Clin J Am Soc Nephrol* 2008; 3(3): 714–719.
24. Akin D, Ozmen S and Kaya R. A novel factor for primary arteriovenous fistula failure: hyperinsulinism. *Ren Fail* 2016; 38(8): 1206–1209.
25. Allon M, Lockhart ME, Lilly RZ, et al. Effect of preoperative sonographic mapping on vascular access outcomes in hemodialysis patients. *Kidney Int* 2001; 60(5): 2013–2020.
26. Wong CS, McNicholas N, Healy D, et al. A systematic review of preoperative duplex ultrasonography and arteriovenous fistula formation. *J Vasc Surg* 2013; 57(4): 1129–1133.
27. Chen SC, Chang JM, Hwang SJ, et al. Significant correlation between ankle-brachial index and vascular access failure in hemodialysis patients. *Clin J Am Soc Nephrol* 2009; 4(1): 128–134.
28. Lok CE, Sontrop JM, Tomlinson G, et al. Cumulative patency of contemporary fistulas versus grafts (2000–2010). *Clin J Am Soc Nephrol* 2013; 8(5): 810–818.

29. Pflederer TA, Kwok S, Ketel BL, et al. A comparison of transposed brachiobasilic fistulae with nontransposed fistulae and grafts in the Fistula First era. *Semin Dial* 2008; 21(4): 357–363.
30. Al-Jaishi AA, Oliver MJ, Thomas SM, et al. Patency rates of the arteriovenous fistula for hemodialysis: a systematic review and meta-analysis. *Am J Kidney Dis* 2014; 63(3): 464–478.
31. Nakata J, Io H, Watanabe T, et al. Impact of preoperative ultrasonography findings on the patency rate of vascular access in Japanese hemodialysis patients. *Springerplus* 2016; 5(1): 1–7.
32. Tsuchida K, Nagai K, Yokota N, et al. Simple surgical method for a native arteriovenous fistula of chronic hemodialysis patients and the patency rate. *J Vasc Access* 2015; 16(Suppl. 10): S13–S17.
33. Halbert RJ, Nicholson G, Nordyke RJ, et al. Patency of ePTFE arteriovenous graft placements in hemodialysis patients: systematic literature review and meta-analysis. *Kidney360* 2020; 1(12): 1437–1446.
34. Maya ID, O'Neal JC, Young CJ, et al. Outcomes of brachiocephalic fistulas, transposed brachiobasilic fistulas, and upper arm grafts. *Clin J Am Soc Nephrol* 2009; 4(1): 86–92.
35. Kim DS, Kim SW, Kim JC, et al. Clinical analysis of hemodialysis vascular access: comparision of autogenous arterioveonus fistula & arteriovenous prosthetic graft. *Korean J Thorac Cardiovasc Surg* 2011; 44(1): 25–31.
36. Tanner NC and Da Silva A. Medical adjuvant treatment to increase patency of arteriovenous fistulae and grafts. *Cochrane Database Syst Rev* 2015; 2015(7): 1–42.
37. Zouaghi MK, Lammouchi MA, Hassan M, et al. Determinants of patency of arteriovenous fistula in hemodialysis patients. *Saudi J Kidney Dis Transpl* 2018; 29(3): 615.
38. Osborn G, Escofet X and Da Silva A. Medical adjuvant treatment to increase patency of arteriovenous fistulae and grafts. *Cochrane Database Syst Rev* 2008; 4: 1–25.
39. Locham S, Beaulieu RJ, Dakour-Aridi H, et al. Role of antiplatelet therapy in the durability of hemodialysis access. *J Nephrol* 2018; 31(4): 603–611.
40. Yevzlin AS, Conley EL, Sanchez RJ, et al. Vascular access outcomes and medication use: a USRDS study. *Semin Dial* 2006; 19(6): 535–539.
41. Smith GE, Gohil R and Chetter IC. Factors affecting the patency of arteriovenous fistulas for dialysis access. *J Vasc Surg* 2012; 55(3): 849–855.
42. Lazarides MK, Georgiadis GS, Antoniou GA, et al. A meta-analysis of dialysis access outcome in elderly patients. *J Vasc Surg* 2007; 45(2): 420–426.
43. Kim JJ, Gifford E, Nguyen V, et al. Increased use of brachiocephalic arteriovenous fistulas improves functional primary patency. *J Vasc Surg* 2015; 62(2): 442–447.
44. Palestinian Health Information Center. *Health annual report: Palestine 2016*. Ramallah: Palestinian Health Information Center, 2017.
45. Kaufman JS, O'Connor TZ, Zhang JH, et al. Randomized controlled trial of clopidogrel plus aspirin to prevent hemodialysis access graft thrombosis. *J Am Soc Nephrol* 2003; 14(9): 2313–2321.