Journal of the
Bahrain Medical Society

Al Agha et al., J Bahrain Med Soc. 2021;33(1):26-30

ORIGINAL RESEARCH

Current State of Vascular Access in Patients on Hemodialysis in Bahrain

Rani Al Agha[1], Asma Al Qaseer[2]*, Amer AlDurazi[3], Ali Al Aradi[4], Abdulraqeeb Taher[4], Salaheldin El Sharkaqi[4], Sharif Khashaba[5], Sughra Alhayki[6], Afrah Aljamri[6]

[1]Consultant Vascular Surgeon, Chairman of Department of Surgery, Salmaniya Medical Complex, Bahrain.
[2]Senior Surgical Resident, Department of Surgery, Salmaniya Medical Complex, Bahrain.
[3]Consultant General Surgery, Salmaniya Medical Complex, Bahrain.
[4]Consultant Nephrology, Department of Nephrology, Salmaniya Medical Complex, Bahrain.
[5]Consultant Vascular Surgeon, Salmaniya Medical Complex, Bahrain.
[6]Special Nursing Specialist, Vascular Access Coordinator, Department of Nephrology, Salmaniya Medical Complex, Bahrain.

***Corresponding author:**
Asma Al Qaseer, Senior Surgical Resident, Department of Surgery, Salmaniya Medical Complex, Bahrain, Tel.: (+973) 39222280; Email: asma.alqaseer@gmail.com

Received date: December 02, 2020; **Accepted date:** January 11, 2021; **Published date:** March 31, 2021

Abstract

Background & Objective: Patients on hemodialysis (HD) require well-functioning vascular access for its initiation and successful transition to dialysis. Arteriovenous fistula is recognized internationally as the first choice of vascular access due to its long lifespan and low incidence of complications in comparison to other methods. Despite this, the rates remain poor. The aim of the study was to document the trend of vascular access currently observed in the hemodialysis centers.

Methodology: This is cross-sectional study in Hemodialysis Centers in Ministry of Health, Kingdom of Bahrain. All patients undergoing regular hemodialysis in May 2020 were included in this study.

Results: A total of 536 patients undergoing regular renal replacement therapy were recruited. Majority of the patients; 478 (89.2%) were on hemodialysis. Of them, 214 (44.8%) patients were on arteriovenous fistula/graft (AVF/ AVG), while the remaining 264 (55.2%) were on tunnel line. Causes of tunnel line hemodialysis were further evaluated. About 137(51.9%) patients were undergoing investigations. This was followed by patient refusal and unfit for surgery among thirty-five (13.3%) and 23 (8.7%) patients, respectively. The remaining patients were either awaiting surgery, or experienced complications post arteriovenous fistula/graft creation.

Conclusion: In this study, a high use of tunnel line vascular access in HD was observed in comparison to AVF. A potential for higher utilization of AVF/AVG up to 60% was observed in this practice. Further studies and strategies to increase the usage of AVF is highly recommended to reach international standards and improve patient care.

Keywords: Arteriovenous fistula; Bahrain; Central venous catheter; Renal Dialysis; Renal Replacement Therapy.

Introduction

Chronic kidney disease (CKD) is a global medical condition that affects more than 10% of the world's population. CKD will eventually develop to end-stage renal disease (ESRD) that requires renal replacement therapy (RRT). [1,2,3] The most commonly used method of RRT is hemodialysis (HD), which requires well-functioning vascular access for its initiation and successful transition to dialysis.[4,5,6] Vascular access can be established by two main ways; native arteriovenous fistula (AVF) or arteriovenous graft (AVG), and central venous catheter (CVC).[6,7] Despite careful patient assessment, the smooth transition to dialysis and the creation of functional vascular access does not always result in permanent access availability because of numerous factors. Maintaining functional vascular access remains a challenge for the vascular access team in dialysis units.[7,8] The role of a dedicated vascular access team is essential in monitoring the cases and improving outcomes.[8]

The authors had observed an increased utilization of tunnel line over AVF/AVG at the HD centers in Ministry of Health. The aim of this study was to evaluate the trends of vascular access currently used at the HD centers and to improve outcomes.

Methodology

All patients undergoing regular hemodialysis in Hemodialysis Centers in the Ministry of Health, Kingdom of Bahrain during May 2020 were included in the study. All patients' demographics and clinical records were collected via a database registry. Patients below the age of 14 years, and patients who were started on hemodialysis as an emergency intervention were excluded from the study.

Results

A total of 536 patients undergoing regular RRT at the dialysis centers in Ministry of Health, Kingdom of Bahrain were observed. Majority of the patients; 478 (89.2%) were on HD, while the remaining 58 (10.8%) patients were on peritoneal dialysis. (Figure 1)

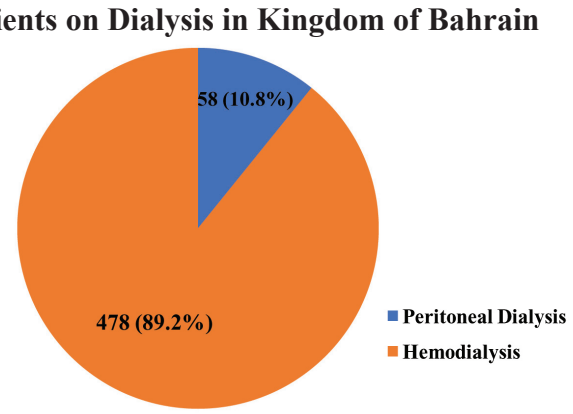

Figure 1: Total number of patients on regular renal replacement therapy in the Kingdom of Bahrain.

A total number of 214 (44.8%) patients on HD were on AVF/AVG, and 264 (55.2%) were on tunnel line. (Figure 2)

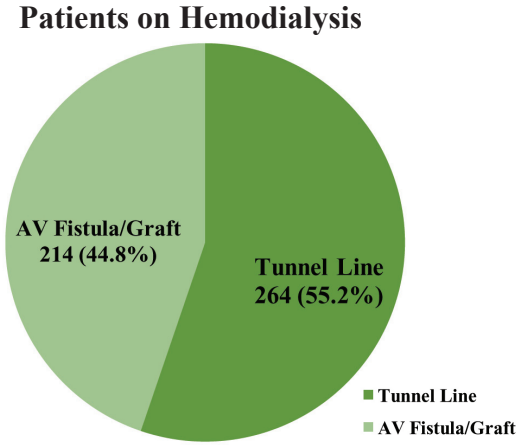

Figure 2: Vascular access in patients on hemodialysis.

Patients on tunnel line HD were further evaluated. Of them, 162 (61.4%) patients were male and the remaining were female. Majority of patients were between 40-60 years of age. (Figure 3)

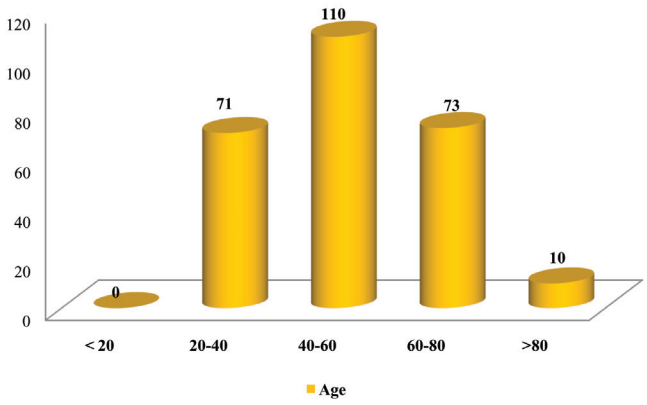

Figure 3: Age distribution of patients on tunnel line.

Evaluation regarding the causes for tunnel line HD showed about 137 (51.9%) patients were undergoing investigations prior to the transfer to vascular team. These investigations included full assessment of the patient's comorbidities, detailed tests such as echocardiogram, and ruling out underlying malignancy or active infection. Further, 35 (13.3%) patients refused surgical creation of AVF/AVG, while 23 (8.7%) patients were unfit to undergo surgery. Furthermore, 22 (8.3%) patients were awaiting their scheduled surgery.

Finally, subsets of patients were placed on tunnel line after undergoing AVF/AVG because they developed complications such as aneurysm in 11(4.2%) patients, steal syndrome in 4 (1.5%) patients, and failed or weak AVF in 31(11.7) patients. One patient (0.4%) remained on tunnel line and was due for kidney transplant. These causes were also categorized into avoidable and unavoidable causes. Avoidable causes included assessment time and surgery schedule, while the unavoidable included patient refusal, unfit for surgery, complications post AVF/AVG creation, and awaiting kidney transplant. About 60.2% were avoidable, and the remaining 39.8% were non-avoidable causes. This indicated that in this practice, there was a possibility for higher utilization of AVF/AVG of up to 60%.

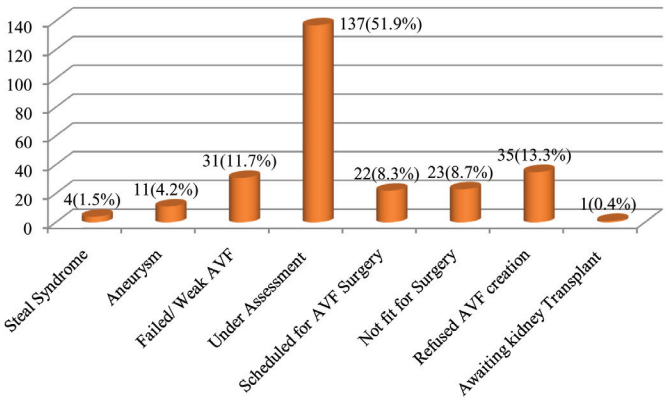

Figure 4: Reasons and characteristics of patients on hemodialysis via Tunnel Line.

Discussion

AVF is recognized internationally as the first choice of vascular access due to its long lifespan and low incidence of complications in comparison to other methods.[1,2,5,9] Where this is not applicable, the use of AVG is recommended as a second choice. This method allows to link two vessels which would not be possible to connect due to their distance using a prosthetic segment that can also be used for the insertion of HD catheters.[7] The prosthetic AVG access has been the most common access for dialysis in the United States.[7] The third and last option is the use of CVC once autogenous options have been exhausted. Although this method is less favored, it has become an important adjunct in maintaining patients on HD, especially when urgent HD is required or when a permanent access becomes dysfunctional.[7]

The most frequent complications related to AVFs are insufficient maturation of the fistula, stenosis, thrombosis, aneurysm, and steal syndrome.[1,2,6,7] As for the AVG, the functional survival is much shorter than with AVF, with higher infection and ischemia rates.[7] CVC carries the highest rate of infection. Infection is responsible for the removal of 30%–60% of HD CVCs. Complications of CVC insertion reaches up to 19%. Other complications include thrombosis, catheter kinking, pneumothorax, and higher hospitalization rates, and therefore is less favored.[4,7,10]

The prevalence of vascular access methods varies greatly between counties. The Kidney Disease Outcomes Quality Initiative (K/DOQI) guideline suggests that AVF should be used in at least 65% of patients on HD, while CVC should be used in less than 10% of patients.[6] Japan leads by example and reports having 1% on CVC. On the contrary CVC use in Belgium and Canada is 42%, and 44% respectively.[7] Similarly in Singapore where the rates range from 44.1% -85.7%.[3] In the United States up to 80% of patients are initiated on HD with a temporary CVC.[3] Despite all efforts, CVC remains the predominant use of vascular access in Ireland.[11] In this study CVC usage reached up to 55.2%. The study results fall in the range of CVC usage in Gulf countries ranging from 29% in Oman to 56% in Kuwait, which is considered high according to the international guidelines.[12]

Despite clear international guidelines for timely initiation of a HD via AVF, the rates remain poor. Several factors attribute to this internationally, both remedial and non- remedial. Delayed AVF placement consumes a large number of resources and contributes to patient comorbidity.[5] Studies have reported higher mortality rates on CVC access

in comparison to AVF reaching up to two folds, as well as higher risks of cardiovascular events.[13,14,15] Early conversion from CVC to AVF/AVG has been shown to improve survival.[14]

Few centers reported lack of formal written policies with regards to patient referral to dialysis education or surgical assessment.[5] These issues could be resolved by maintaining a clear referral checklist and database to monitor patient course, which is the standard operating procedure at the study centre. Despite this, prolonged time for patient assessment prior to referral to vascular unit including up to 51.9% of the patients. Far appointments for some investigations such as echocardiogram, as well as treatment of the underlying active infection or malignancy may contribute to the delay in the referral for timely AVF/AVG creation.

Another important factor is patient-related barriers, which has received lesser attention according to a recent study.[3] Delay in patient clinical pathway such as late referral are important barriers but doesn't fully account for the observed trends.[3] Patient's delay behaviors such as hesitation to discuss dialysis, lack pre dialysis education, denial about the disease, nonattendance appointments, refusal or delay to make decisions related to dialysis or access may all contribute to the delay in initiating the AVF.[3,4,5] In this study, the authors experienced about 13.3% refusal rate to transfer from CVC to AVF/AVG, which is the second cause of high utilization of tunnel line in this center. It is reported that patients who request to wait and see usually end up on unplanned dialysis initiation via temporary CVC.[3] It was also found that patients often express their concerns with the appearance of the fistula, and the fear of undergoing surgery, thus prefer looking for other alternatives.[3] Another factor is unmodifiable patient-associated limitations such as multiple comorbid conditions, limited life expectancy, and generally unfit which increases the likelihood of CVC dialysis rather than AVF.[4,5]

Subset of patients remain on tunnel line after AVF/AVG due to its post-operative complications. Primary AVF/AVG failure is a relatively common complication and ranges from, 8%-62%. In the study about 11.7% weak and failed AVF postoperatively, which is within the acceptable range.[4]

There is a strong evidence that educating the patient influences their preference for dialysis modality and access. Therefore, it is encouraged to improve patient and family engagement, and addressing patient's emotional concerns in order to initiate AVF as the first modality.[3,5]

Conclusion

The study observed a high use of tunnel line vascular access in HD in comparison to AVF. A potential for higher utilization of AVF/AVG up to 60% in this practice was noticed. Further studies and strategies to increase the usage of AVF is highly recommended to reach international standards and improve patient care.

Conflicts of interest

None.

Acknowledgment

None.

References

1. Pounds L, Teodorescu V. Chronic kidney disease and dialysis access in women. *Journal of Vascular Surgery.* 2013;57(4):49S-53S.e1.
2. Al-Agha R, Al-Qaseer A, Shehab M. Arteriovenous Fistula Aneurysm. *Bahrain Medical Bulletin.* 2016;38(3):142-144.
3. Griva K, Seow P, Seow T, Goh Z, Choo J, Foo M et al. Patient-Related Barriers to Timely Dialysis Access Preparation: A Qualitative Study of the Perspectives of Patients, Family Members, and Health Care Providers. *Kidney Medicine.* 2020;2(1):29-41.
4. Moist L, Lok C. Incident Dialysis Access in Patients With End-Stage Kidney Disease: What Needs to Be Improved. *Seminars in Nephrology.* 2017;37(2):151-158.
5. Lopez-Vargas P, Craig J, Gallagher M, Walker R, Snelling P, Pedagogos E et al. Barriers to Timely Arteriovenous Fistula Creation: A Study of Providers and Patients. *American Journal of Kidney Diseases.* 2011;57(6):873-882.
6. Ren C, Chen J, Wang Y, Huang B, Lu W, Cao Y et al. Application of ultrasonography in monitoring the complications of autologous

arteriovenous fistula in hemodialysis patients. *Medicine.* 2018;97(44):e12994.

7. Santoro D, Benedetto F, Mondello P, Spinelli F, Ricciardi C, Cernaro V et al. Vascular access for hemodialysis: current perspectives. *International Journal of Nephrology and Renovascular Disease.* 2014;:281.
8. Raza H, Hashmi M, Dianne V, Hamza M, Hejaili F, A-Sayyari A. Vascular access outcome with a dedicated vascular team based approach. Saudi *Journal of Kidney Diseases and Transplantation.* 2019;30(1):39.
9. Domenick Sridharan N, Fish L, Yu L, Weisbord S, Jhamb M, Makaroun M et al. The associations of hemodialysis access type and access satisfaction with health-related quality of life. *Journal of Vascular Surgery.* 2018;67(1):229-235.
10. Pisoni R, Zepel L, Port F, Robinson B. Trends in US Vascular Access Use, Patient Preferences, and Related Practices: An Update From the US DOPPS Practice Monitor With International Comparisons. *American Journal of Kidney Diseases.* 2015;65(6):905-915.
11. Hussein W, Mohammed H, Browne L, Plant L, Stack A. Prevalence and Correlates of Central Venous Catheter Use Among Haemodialysis Patients in the Irish Health System - A National Study. *Journal of Vascular Surgery: Venous and Lymphatic Disorders.* 2018;6(6):802.
12. AlYousef A, AlGhareeb S, AlWakeel J, et al. Hemodialysis delivery, dialysis dose achievement, and vascular access types in hemodialysis patients from the Gulf Cooperation Council countries enrolled in the dialysis outcomes and practice patterns study phase 5 (2012-2015). *Saudi J Kidney Dos Transpl*. 2016 Nov;27(6 Suppl 1):S42-50.
13. Ravani P, Palmer S, Oliver M, Quinn R, MacRae J, Tai D et al. Associations between Hemodialysis Access Type and Clinical Outcomes: A Systematic Review. *Journal of the American Society of Nephrology.* 2013;24(3):465-473.
14. Raimann J, Chu F, Kalloo S, Zhang H, Maddux F, Wang Y et al. Delayed conversion from central venous catheter to non-catheter hemodialysis access associates with an increased risk of death: A retrospective cohort study based on data from a large dialysis provider. *Hemodialysis International.* 2020; 2020 Jul;24(3):299-308.
15. Arhuidese I, Orandi B, Nejim B, Malas M. Utilization, patency, and complications associated with vascular access for hemodialysis in the United States. *Journal of Vascular Surgery.* 2018;68(4):1166-1174.