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Prevalence of arteriovenous fistula use in hemodialysis patients in Burdur province

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ABSTRACT

Objectives: This study aimed to examine the vascular access routes used by patients undergoing hemodialysis treatment in our province and determine the prevalence of arteriovenous (AV) fistula use.

Methods: Patients who were receiving regular hemodialysis treatment in Burdur province as of April 2024 were included in the study. Data on patients' age, gender, comorbidities, duration of dialysis, type of vascular access, and history of hemodialysis access were retrospectively reviewed and recorded using electronic patient records.

Results: The mean age of 197 patients evaluated in the study was 62.48±14.13 years. Of the patients, 63 (32%) were female and 134 (68%) were male. Hypertension was the most common comorbidity in 61.9% of the cases. The number of patients receiving hemodialysis treatment through an AV fistula was 136 (69%). The mean age of patients receiving treatment via an AV fistula was significantly lower than those receiving treatment via an indwelling hemodialysis catheter (P=0.011). Among the patients treated with an indwelling hemodialysis catheter, 59% had no history of AV fistula surgery. The mean age of patients without a history of AV fistula surgery was statistically significantly higher than those with a history of AV fistula surgery (69.28±14.98 vs. 60.96 ± 13.52, respectively; P=0.001).

Conclusions: This study shows that one out of every two patients undergoing hemodialysis through an indwelling hemodialysis catheter has no history of AV fistula surgery. Reaching these patients and prioritizing AV fistula planning is crucial for achieving long-term success in hemodialysis treatment and reducing complications.

Keywords: Cardiovascular surgery, nephrology, arteriovenous fistula, hemodialysis

It is estimated that approximately 850 million people worldwide have chronic kidney disease [1]. Kidney transplantation is the best treatment option for improving survival rates, reducing complications, and enhancing the quality of life in patients diagnosed with chronic kidney disease. However, only a limited number of patients can benefit from this treatment [2-4]. Most patients undergo chronic hemodialysis therapy requiring effective vascular access. Vascular access options for hemodialysis patients include arteriovenous (AV) fistulas, indwelling hemodialysis catheters, and temporary hemodialysis catheters. Hemodialysis through an AV fistula is generally considered the best option for vascular access

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in hemodialysis patients, as it is associated with lower rates of infection and thrombosis compared to the use of indwelling or temporary hemodialysis catheters. Additionally, increased use of AV fistulas has been associated with longer survival times and reduced healthcare costs [5, 6].

The AV fistula creation technique, first performed by Brescia *et al*. [7] in 1966, has been modified over time in light of various advancements. Today, hemodialysis through an AV fistula is the most preferred access route for hemodialysis due to its long-term durability and lower complication rates [8, 9]. Therefore, the present study aimed to examine the vascular access routes used in the hemodialysis treatment of chronic kidney disease patients across our province and determine the prevalence of AV fistula use.

METHODS

The study was conducted in accordance with the ethical guidelines of the Helsinki Declaration of 1975, with approval from the Non-Interventional Ethics Committee of Süleyman Demirel University Faculty of Medicine (Decision no: 17/377 and date: 29.12.2023).

Patients receiving regular hemodialysis treatment at any of the four centers with hemodialysis units in Burdur province as of April 2024 were included in the study. Hemodialysis patients who died before April 2024 were excluded from the study. Data on patients' age, gender, comorbidities (diabetes mellitus, hypertension, atherosclerotic heart disease, and chronic obstructive pulmonary disease), duration of dialysis, type of vascular access (AV fistula and indwelling hemodialysis catheter), and hemodialysis access history were retrospectively reviewed and recorded using electronic patient records. Comparative analyses were conducted between patients with an AV fistula and those without an AV fistula.

Statistical Analysis

Statistical analysis was performed using SPSS 26.0 (SPSS Inc. Chicago, IL) program. The conformity of the data to normal distribution was evaluated by Kolmogorov–Smirnov test. Parametric tests were used for data with a normal distribution, while non-parametric tests were used for data that did not follow a normal distribution. Descriptive statistics (count, percentage, mean, and standard deviation), t-test, Chi-square test, and logistic regression analysis were used to evaluate the data. A P value of <0.05 was considered statistically significant in all analyses.

RESULTS

The mean age of 197 patients evaluated in the study was 62.48±14.13 years. Of the patients, 63 (32%) were female and 134 (68%) were male. The median age at hemodialysis was 4 years (min: 4 months, max: 30 years). Hypertension was present in 61.9% of the patients, while diabetes mellitus was observed in 42.1% of the patients. The distribution of patient characteristics and demographic variables by groups is shown in Table 1.

Hemodialysis access was provided through the upper extremities in 97.5% of the patients. Conversely, 2.5% of the patients had hemodialysis access through the lower extremities. AV fistulas were used in 136 patients (69%). The number of patients receiving hemodialysis treatment through indwelling hemodialysis catheters was 61 (31%). The age of patients receiving treatment via an AV fistula was significantly lower compared to those without AV fistulas (P=0.011) (Fig. 1). Among the patients treated with an indwelling hemodialysis catheter, 59% had no history of AV fistula surgery. The mean age of patients without a history of AV fistula surgery was statistically significantly higher compared to those with a history of AV fistula surgery (69.28±14.98 vs. 60.96±13.52, respectively; P=0.001) (Fig. 2). Among patients without a history of AV fistula surgery, 24 (66.7%) were male and 12 (33.3%) were female. No statistically significant difference was observed between gender and AV fistula surgery history (P=0.847).

DISCUSSION

Although the AV fistula is reported as the best vascular access method for hemodialysis, temporary and indwelling hemodialysis catheters are still frequently used today. Catheters are associated with both infectious and non-infectious complications, which can lead to increased mortality and morbidity [10]. Acute

Table 1. Distribution of patient characteristics and demographic data by groups

	Total (n=197)	Arteriovenous fistula (+) (n=136)	Arteriovenous fistula (-) (n=61)	P value
Age (years)	62.48±14.13	60.78±13.60	66.28±14.65	**0.011***
Gender, n (%)				0.618#
Male	134 (68)	91 (66.9)	43 (70.5)	
Female	63 (32)	45 (33.1)	18 (29.5)	
Hypertension, n (%)	122 (61.9)	84 (61.8)	38 (62.3)	0.943#
Diabetes mellitus, n (%)	83 (42.1)	57 (41.9)	26 (42.6)	0.926#
CAD, n (%)	69 (35)	21 (34.4)	48 (35.3)	0.906#
COPD, n (%)	7 (3.6)	3 (4.9)	4 (2.9)	0.679#

Data are shown as mean±standard deviation or n (%) where appropriate. CAD=coronary artery disease, COPD=chronic obstructive pulmonary disease.

*T-test, #Chi-square

complications associated with the use of indwelling hemodialysis catheters include hemorrhage, venous perforation, catheter malposition, infection, arterial injury, pneumothorax, and air embolism [11]. A study found that approximately one-third of patients undergoing hemodialysis with an indwelling hemodialysis catheter for 1–2 years experienced complications. Additionally, about 9% of patients developed bacteremia within 1 year, and bacteremia was the most common reason for hospital admissions related to indwelling hemodialysis catheters [12].

Another disadvantage of hemodialysis catheters compared to AV fistulas is recirculation. In order to minimize blood recirculation during hemodialysis treatment, the arterial and venous end holes at the catheter's distal end are separated from each other by 1–3 cm. Despite this design feature, recirculation remains a more frequent problem compared to AV fistulas. For an indwelling hemodialysis catheter with the distal end positioned in the right upper atrium, the average recirculation rate should be <5% [13].

In elderly patients, creating an AV fistula early in the course of dialysis is associated with lower mortality compared to the use of indwelling hemodialysis

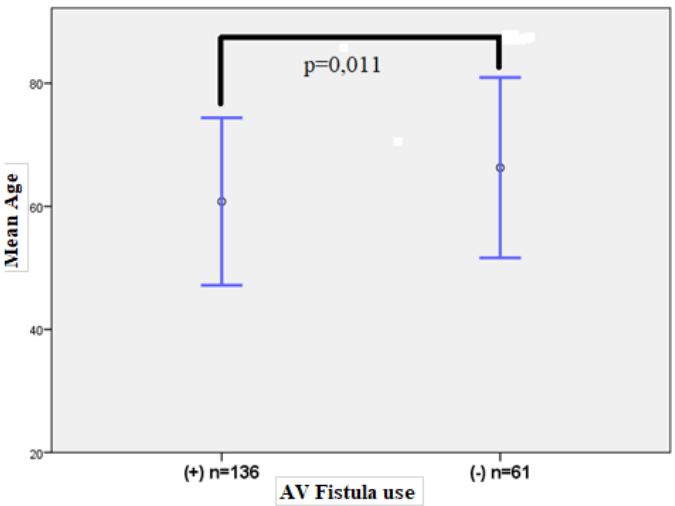

Fig. 1. Standard deviation graph showing the relationship between age and arteriovenous fistula use.

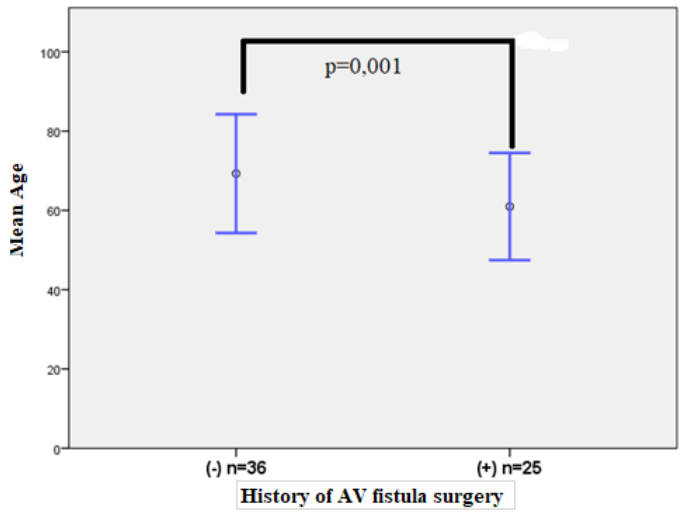

Fig. 2. Standard deviation graph showing the relationship between age and history of arteriovenous fistula surgery.

catheters. It has been observed that receiving hemodialysis treatment through an AV fistula positively affects survival outcomes, even in patients who initially started dialysis with an indwelling hemodialysis catheter [14]. Compared to patients receiving hemodialysis treatment with an indwelling hemodialysis catheter, patients receiving treatment with an AV fistula have significantly reduced length of hospitalization and depression symptoms [15].

To enable hemodialysis and improve patients' quality of life and comfort, AV fistula surgeries are often the first-choice procedure prior to kidney transplantation [16]. However, complications associated with AV fistula use may necessitate the use of alternative vascular access routes [17].

In our province, there are a total of four hemodialysis centers, including one private facility. The highest number of patients was at Burdur State Hospital, which was also the primary center of our study. In the present study evaluating the prevalence of AV fistulas among hemodialysis patients in our province, it was determined that the predominant preferred vascular access route was the AV fistula. A study conducted in Turkey in 2022 reported that indwelling hemodialysis catheters were the most frequently used vascular access route at the start of hemodialysis, accounting for 51.64% of the cases [18]. According to the same study, other vascular access routes included AV fistulas in 28.7% of the cases, temporary hemodialysis catheters in 19.45% of the cases, and AV fistulas made with AV grafts in 0.21% of the cases. In the study, the most commonly used vascular access option for patients undergoing long-term hemodialysis was identified as the AV fistula, with a prevalence of 70.89%. In recent years, there has been a trend of decreasing AV fistula usage rates, with a notable increase in the use of catheters for vascular access.

Although poor outcomes have been reported in the literature for patients over 65 years of age, especially for radiocephalic AV fistulas, AV fistula surgery in the elderly continues to be a matter of debate [19]. This may be the reason why AV fistula use is less preferred in patients over 65 years of age. Contreras-Jimenes *et al* demonstrated that poor AV fistula outcomes in the older age group can be improved with adequate preoperative evaluation [20]. As a result of these new data, the use of AV fistula should be encouraged in patients over the age of 65.

The AV fistula usage rate observed in the present study is consistent with the national prevalence of AV fistula use in Turkey, but it is below the desired level. Another notable finding in the present study is the prevalence of AV fistula history among patients using indwelling hemodialysis catheters. The fact that one out of every two patients undergoing hemodialysis through an indwelling hemodialysis catheter has no history of AV fistula surgery presents a significant barrier to achieving higher AV fistula usage rates. Reaching these patients and prioritizing AV fistula planning is crucial for long-term success in hemodialysis treatment and reducing complications.

CONCLUSION

Increasing the use of AV fistulas can potentially reduce complications and improve patient outcomes in hemodialysis treatment. As healthcare professionals, efforts should be focused on strategies such as early referral for AV fistula creation, patient education, surgical expertise, and multidisciplinary collaboration to improve this process. These approaches could contribute to the wider adoption of AV fistulas and thus achieve better treatment outcomes for patients with chronic kidney failure.

Ethical Statement

The study was conducted in accordance with the ethical guidelines of the Helsinki Declaration of 1975, with approval from the Non-Interventional Ethics Committee of Süleyman Demirel University Faculty of Medicine (Decision no: 17/377 and date: 29.12.2023).

Authors' Contribution

Study Conception: BA, ÖFR, CA; Study Design: BA, ÖFR, CA; Supervision: BA, ÖFR, CA; Funding: BA, ÖFR, CA; Materials: BA, ÖFR, CA; Data Collection and/or Processing: BA, ÖFR, CA; Statistical Analysis and/or Data Interpretation: BA, ÖFR, CA; Literature Review: BA, ÖFR, CA; Manuscript Preparation: BA, ÖFR, CA and Critical Review: BA, ÖFR, CA.

Conflict of interest

The authors disclosed no conflict of interest during the preparation or publication of this manuscript.

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REFERENCES

1. Jager KJ, Kovesdy C, Langham R, Rosenberg M, Jha V, Zoccali C. A single number for advocacy and communication-worldwide more than 850 million individuals have kidney diseases. Kidney Int. 2019;96(5):1048-1050. doi: 10.1016/j.kint.2019.07.012.
2. Laupacis A, Keown P, Pus N, et al. A study of the quality of life and cost-utility of renal transplantation. Kidney Int. 1996;50(1):235-242. doi: 10.1038/ki.1996.307.
3. Wolfe RA, Ashby VB, Milford EL, et al. Comparison of mortality in all patients on dialysis, patients on dialysis awaiting transplantation, and recipients of a first cadaveric transplant. N Engl J Med. 1999;341(23):1725-1730. doi: 10.1056/NEJM199912023412303.
4. Loubeau PR, Loubeau JM, Jantzen R. The economics of kidney transplantation versus hemodialysis. Prog Transplant. 2001;11(4):291-297. doi: 10.1177/152692480101100411.
5. Casserly LF, Dember LM. Thrombosis in end-stage renal disease. Semin Dial. 2003;16(3):245-256. doi: 10.1046/j.1525-139X.2003.16048.x.
6. Roy-Chaudhury P, Kelly BS, Melhem M, et al. Vascular access in hemodialysis: issues, management, and emerging concepts. Cardiol Clin. 2005;23(3):249-273. doi: 10.1016/j.ccl.2005.04.004.
7. Brescia MJ, Cimino JE, Appel K, Hurwich BJ. Chronic hemodialysis using venipuncture and a surgically created arteriovenous fistula. N Engl J Med. 1966;275(20):1089-1092. doi: 10.1056/NEJM196611172752002.
8. Manduz Ş, Katrancıoğlu N, Karahan O, Sapmaz İ, Doğan K. [Results of A-V Fistula Creation Surgeries for Hemodialysis Purposes Performed in Cumhuriyet University, Faculty of Medicine, Department of Cardiovascular Surgery]. Cumhuriyet Med J. 2008;30(1):28-32. [Article in Turkish]
9. Hastaoglu IO, Bilgen F. [Basilic vein transposition performed for hemodialysis access: Mid-term results]. Turk Gogus Kalp Damar Cerrahisi Derg. 2011;19(4):513-517. doi: 10.5606/tgkdc.dergisi.2011.079. [Article in Turkish]
10. Vats HS. Complications of catheters: tunneled and nontunneled. Adv Chronic Kidney Dis. 2012;19(3):188-194. doi: 10.1053/j.ackd.2012.04.004.
11. Bhutta ST, Culp WC. Evaluation and management of central venous access complications. Tech Vasc Interv Radiol. 2011;14(4):217-224. doi: 10.1053/j.tvir.2011.05.003.
12. Poinen K, Quinn RR, Clarke A, et al. Complications From Tunneled Hemodialysis Catheters: A Canadian Observational Cohort Study. Am J Kidney Dis. 2019;73(4):467-475. doi: 10.1053/j.ajkd.2018.10.014.
13. Depner TA. Catheter performance. Semin Dial. 2001;14(6):425-431. doi: 10.1046/j.1525-139x.2001.00106.x.
14. Roldão M, Figueiredo C, Escoli R,et al. Vascular access type and mortality in elderly incident hemodialysis patients. Nefrologia (Engl Ed). 2023;43(4):452-457. doi: 10.1016/j.nefroe.2022.02.011.
15. Kim DH, Park JI, Lee JP, et al. The effects of vascular access types on the survival and quality of life and depression in the incident hemodialysis patients. Ren Fail. 2020;42(1):30-39. doi: 10.1080/0886022X.2019.1702558.
16. Jenkins AM, Buist TA, Glover SD. Medium-term follow-up of forty autogenous vein and forty polytetrafluoroethylene (Gore-Tex) grafts for vascular access. Surgery. 1980;88(5):667-672.
17. Lawson JH, Niklason LE, Roy-Chaudhury P. Challenges and novel therapies for vascular access in haemodialysis. Nat Rev Nephrol. 2020;16(10):586-602. doi: 10.1038/s41581-020-0333-2.
18. Seyahi N, Kocyigit İ, Eren N, et al. Current status of kidney replacement therapy in Türkiye: A summary of 2022 Turkish Society of Nephrology registry report. Turk J Nephrol. 2024;33(2):134-139. doi: 10.5152/turkjnephrol.2024.24722.
19. Asif A, Bakr MM, Levitt M, et al. Best Vascular Access in the Elderly: Time for Innovation? Blood Purif. 2019;47(1-3):236-239. doi: 10.1159/000494591.
20. Contreras-Jimenez E, Lopez-Pena G, Ruben-Castillo C, et al. Analysis of clinical outcomes of arteriovenous fistula for hemodialysis access in a Mexican elderly population. Cir Cir. 2023;91(2):200-203. English. doi: 10.24875/CIRU.22000217.