Jurnal Kesehatan Akimal
e-ISSN: 2963-3338
Volume 5 No. 2 Edisi Oktober 2026
https://jurnal.akimal.ac.id/index.php/jka

The Relationship Between Vascular Access Complications and Intradialytic Emergencies in Patients with Chronic Kidney Disease Undergoing Hemodialysis

Resmi Pangaribuan[1], Nina Fentiana[2], Nita Mayrani[3], Yulinar Sianipar[4], Khairunnisa Batubara[5], Indah Dwi Handayani [6]
[1,2,3,4] Stikes Kesdam I/Bukit Barisan, Prodi D III Keperawatan Medan
[5]Akper Gita Matura Abadi Kisaran
[6]Rumah Sakit TK. II Putri Hijau Medan
Email :resmi.offficial18@gmail.com

ARTICLE INFO

Received 09 Sept 2026
Accepted 19 Sept 2026
Published 31 Oct 2026

Keywords:

Vascular access ; Hemodialysis; Chronic Kidney Disease; Intradialytic emergencies.

ABSTRACT

*Background: Chronic kidney disease (CKD) patients undergoing hemodialysis are at risk of vascular access complications that may be associated with intradialytic emergencies. This study aimed to analyze the relationship between vascular access complications and intradialytic emergencies in CKD patients undergoing hemodialysis. Methods: This analytic observational study used a cross-sectional design and secondary data from medical records at the Hemodialysis Unit of Putri Hijau Level II Hospital, Medan. A total of 40 patients were selected using total sampling. Data were analyzed using univariate analysis and Fisher's Exact test, with an alpha level of 0.05. The association was measured using the odds ratio (OR) and 95% confidence interval (CI). Results:Most respondents were aged 66–80 years (32.5%) and male (52.5%). An arteriovenous fistula was used by 77.5% of respondents. Vascular access complications occurred in 45% of patients, while 25% experienced intradialytic emergencies. Fisher's Exact test showed a significant relationship between vascular access complications and intradialytic emergencies (*p* = 0.025). Patients with vascular access complications had higher odds of experiencing intradialytic emergencies (OR = 8.00; 95% CI: 1.42–44.92). Conclusion: Vascular access complications were significantly associated with intradialytic emergencies. Regular vascular access assessment, early complication detection, and appropriate monitoring are essential to support patient safety during hemodialysis.*

How to cite: Resmi, R. P., Nina Fentiana, Nita Mayrani, Yulinar Sianipar, Khairunnisa Batubara, & Indah Dwi Handayani. (2026). The Relationship Between Vascular Access Complications and Intradialytic Emergencies in Patients with Chronic Kidney Disease Undergoing Hemodialysis. *Jurnal Kesehatan Akimal*, *5*(2), 75–84. Retrieved from https://jurnal.akimal.ac.id/index.php/jka/article/view/274

This is an open-access article distributed under a Creative Commons Attribution-ShareAlike 4.0 International License, that allows others to share the work with an acknowledgement of the work's authorship and initial publication in this journal.

* *Corresponding author: resmi.offficial18@gmail.com*

INTRODUCTION

Chronic Kidney Disease (CKD) is a health condition characterized by progressive loss of kidney function and may require renal replacement therapy, such as hemodialysis, in advanced stages. Hypertension and diabetes mellitus are major risk factors contributing to CKD progression and an increased risk of complications (Boss et al., 2023; Hallan et al., 2025). In patients undergoing hemodialysis, treatment effectiveness depends not only on dialysis adequacy but also on the availability and functionality of adequate vascular access. Vascular access, including an arteriovenous (AV) fistula and a central venous catheter, provides the pathway for blood circulation during hemodialysis. However, vascular access may be associated with complications such as infection, thrombosis, stenosis, bleeding, and access dysfunction, which can disrupt treatment continuity.

Vascular access complications may affect not only access function and the smooth delivery of hemodialysis but also the occurrence of intradialytic emergencies. These emergencies are acute conditions arising during hemodialysis that require immediate intervention and may threaten patient safety. Clinically significant events include bleeding from vascular access, severe infection, hemodynamic instability, and intradialytic hypotension. A study in Indonesia reported vascular access complications ranging from hematoma to acute bleeding caused by pseudoaneurysm, which may require emergency surgical intervention in certain circumstances (Djajakusumah, 2024). Another study found that infections associated with temporary vascular access occurred in 39.3% of patients and were related to factors such as diabetes mellitus and catheter duration (Susilo et al., 2022). Meanwhile, research on vascular access emergencies at the Provincial General Hospital of West Nusa Tenggara primarily examined double-lumen catheter use, emergency characteristics, and the need for catheter-related interventions. Although these findings highlight the importance of vascular access management, they do not specifically establish the relationship between vascular access complications and emergencies occurring during hemodialysis sessions across different types of vascular access.

In nursing practice, preventing vascular access complications also requires clinical monitoring and supporting patients' self-care abilities. Dorothea Orem's Self-Care Deficit Nursing Theory explains that nursing support is needed when individuals cannot adequately meet their health-related self-care requirements. For patients undergoing hemodialysis, this approach includes education on vascular access care, infection prevention, recognition of complication signs, and adherence to recommended care practices. Through a supportive-educative nursing system, nurses can strengthen patients' knowledge and self-care abilities while monitoring their condition for early signs of complications (Pangaribuan et al., 2026). Furthermore, the Kidney Disease Outcomes Quality Initiative (KDOQI) guidelines emphasize the importance of monitoring and managing vascular

access complications, including stenosis, thrombosis, infection, aneurysms, and catheter-related complications (Lok et al., 2019).

Although previous studies have examined vascular access complications, infection risk factors, cannulation-related complications, and the management of specific emergencies, further evidence is needed regarding the relationship between vascular access complications and intradialytic emergencies. This gap warrants attention because vascular access complications may disrupt treatment and potentially increase the need for immediate clinical intervention during hemodialysis (Franchin et al., 2023). Therefore, the present study specifically examines the association between vascular access complications and intradialytic emergencies across the types of vascular access used by patients. The study was conducted at the Hemodialysis Unit of Putri Hijau Level II Hospital, Medan, using patient medical records. The findings are expected to provide empirical evidence to support nursing practice, particularly vascular access monitoring, early complication detection, and improved patient safety during hemodialysis. Accordingly, this study aimed to analyze the relationship between vascular access complications and intradialytic emergencies among patients with CKD undergoing hemodialysis.

METHOD

This study used a quantitative, analytical observational design with a retrospective cross-sectional approach. It was conducted at the Hemodialysis Unit of Putri Hijau Level II Hospital, Medan, Indonesia, using medical records from November 2025 to April 2026. The study included 40 patients with chronic kidney disease (CKD) selected through total sampling. Eligible participants were patients undergoing routine hemodialysis using an arteriovenous (AV) fistula or central venous catheter (CVC), with complete records of vascular access conditions and events during hemodialysis. Records were excluded if essential data were incomplete or if an emergency had occurred before hemodialysis began.

Data were collected retrospectively using a researcher-developed observation form. The collected information included patient characteristics, vascular access type, vascular access complications, intradialytic emergencies, and documented interventions. Vascular access complications and intradialytic emergencies were classified according to predefined operational definitions. The researchers reviewed and cross-checked the records to ensure consistent data extraction. Data were analyzed using univariate and bivariate analyses. Frequencies and percentages were used to describe patient characteristics and study variables. Fisher's exact test was used to examine the relationship between vascular access complications and intradialytic emergencies. Statistical significance was set at $p < 0.05$. The strength of the association was assessed using the odds ratio (OR) and 95% confidence interval (CI).

Ethical approval was obtained from the Research Ethics Committee of STIKes Kesdam I/Bukit Barisan Medan (No. 012/Kep/Pen/III/2026).

Permission was also obtained from Putri Hijau Level II Hospital. Patient information was kept confidential and used solely for research purposes.

RESULT AND DISCUSSION

Table 1. Respondent Characteristics by Age and Sex

Characteristics of Age	Frequency (n)	Percentage (%)
Age		
16–25 Years Old	2	5,0
36–45 Years Old	5	12,5
46–55 Years Old	9	22,5
56–65 Years Old	11	27,5
66–80 Years Old	13	32,5
Sex		
Male	21	52,5
Female	19	47,5

Table 2. Distribution of Vascular Access Types Among Hemodialysis Patients

Kinds og Vascular Access	Frequency (n)	Percentage (%)
AV Fistula	31	77,5
Kateter vena sentral (CVC)	9	22,5
Total	40	100

Table 3. Distribution of Vascular Access Complications Among Hemodialysis Patients

Vascular Access Complications	Frequency (n)	Percentage (%)
Complications Present	18	45
No Complications	22	55
Total	40	100

Table 4. Distribution of Intradialytic Emergencies Among Hemodialysis Patients

Intradialytic Emergencies	Frequency (n)	Percentage (%)
Yes	10	25
No	30	75
Total	40	100

Table 5. Relationship Between Vascular Access Complications and Intradialytic Emergencies Among Patients with Chronic Kidney Disease Undergoing Hemodialysis

Vascular Access Complications	Emergency	Total	OR (95% CI)	*p*-value
	Ya n (%)	Tidak n (%)	n (%)	
Complications Present	8 (44,4)	10 (55,6)	18 (100)	8,00 (1,42–44,92)
No Complications	2 (9,1)	20 (90,9)	22 (100)	1,00 (ref.)
Total	10 (25,0)	30 (75,0)	40 (100)	
Vascular Access Complications	Intradialytic Emergencies	Total	OR (95% CI)	*p*-value
	Yes n (%)	No n (%)	n (%)	
Complications Present	8 (44,4)	10 (55,6)	18 (100)	8,00 (1,42–44,92)

As presented in Table 1, the largest age group was 66–80 years, comprising 13 respondents (32.5%). Regarding sex, 21 respondents (52.5%) were male and 19 (47.5%) were female. Table 2 shows that most respondents used an arteriovenous (AV) fistula (31; 77.5%), while nine respondents (22.5%) used a central venous catheter (CVC).In Table 3, vascular access complications were identified in 18 respondents (45%), whereas 22 respondents (55%) had no documented complications. Table 4 shows that 10 respondents (25%) experienced intradialytic emergencies, while 30 respondents (75%) did not experience emergencies during hemodialysis. And Table 5, among the 18 respondents with vascular access complications, eight (44.4%) experienced intradialytic emergencies, while 10 (55.6%) did not. Among the 22 respondents without vascular access complications, two (9.1%) experienced intradialytic emergencies, whereas 20 (90.9%) did not.

The two-sided Fisher's exact test showed a statistically significant relationship between vascular access complications and intradialytic emergencies ($p = 0.025$). The odds ratio (OR) was 8.00 (95% confidence interval [CI]: 1.42–44.92), indicating that respondents with vascular access complications had eight times the odds of experiencing intradialytic emergencies compared with those without complications. However, the wide confidence interval indicates uncertainty in the magnitude of this association.

*Respondent Characteristics and Vascular Access Type*s

A total of 40 patients with chronic kidney disease (CKD) undergoing hemodialysis were included in this study. The largest age group was 66–80 years, comprising 13 respondents (32.5%). Male respondents

accounted for 21 (52.5%), while female respondents accounted for 19 (47.5%). Regarding vascular access, most respondents used an arteriovenous (AV) fistula (31; 77.5%), whereas nine (22.5%) used a central venous catheter (CVC).

The predominance of older patients may reflect the progressive decline in kidney function associated with aging and the higher prevalence of comorbidities, including hypertension and diabetes mellitus. Age-related physiological changes may also affect fluid balance and hemodynamic stability during hemodialysis (Chou & Chen, 2021). The proportion of male respondents was slightly higher than that of females, consistent with findings reported by Nerbass et al. (2024), in which males accounted for 59.1% of dialysis patients. However, age and sex were described only as respondent characteristics and were not analyzed as factors associated with intradialytic emergencies in this study.

The high proportion of AV fistula use indicates that this was the predominant vascular access type among the study participants. AV fistulas generally offer better long-term patency and a lower risk of infection than CVCs, although they remain susceptible to stenosis, thrombosis, bleeding, and dysfunction. CVCs, meanwhile, are particularly vulnerable to infection and catheter dysfunction. These differences highlight the importance of regular vascular access assessment, regardless of access type (Lok et al., 2025).

Vascular Access Complications and Intradialytic Emergencies

Vascular access complications were identified in 18 respondents (45%), while 22 (55%) had no documented complications. Intradialytic emergencies occurred in 10 respondents (25%), whereas 30 (75%) did not experience such events during hemodialysis. The finding that 45% of respondents experienced vascular access complications indicates that access-related problems remain an important concern in hemodialysis care. Complications may include infection, thrombosis, stenosis, bleeding, hematoma, and impaired blood flow. These conditions can compromise access function, interrupt dialysis, and potentially require immediate intervention. Previous research has similarly highlighted the impact of vascular access complications on access function and dialysis adequacy (Murniati et al., 2025; Hidalgo-Blanco et al., 2023).

Although most respondents did not experience intradialytic emergencies, the occurrence of such events in one-quarter of the sample highlights the need for continuous clinical monitoring. Intradialytic emergencies may arise from changes in fluid volume, blood pressure, electrolyte balance, cardiovascular status, or vascular access function. Rapid changes in fluid balance and blood pressure during ultrafiltration may contribute to intradialytic hypotension, while other patient-related and treatment-related factors may affect hemodynamic stability (Hamrahian et al., 2023). Therefore, nurses should monitor vital signs, assess patients' clinical conditions, and evaluate vascular access function throughout the hemodialysis procedure.

Relationship Between Vascular Access Complications and Intradialytic Emergencies

The bivariate analysis showed that eight of the 18 respondents with vascular access complications (44.4%) experienced intradialytic emergencies, compared with two of the 22 respondents without complications (9.1%). Fisher's exact test demonstrated a statistically significant relationship between vascular access complications and intradialytic emergencies ($p = 0.025$).

The odds ratio (OR) was 8.00, with a 95% confidence interval (CI) of 1.42–44.92. This indicates that patients with vascular access complications had eight times the odds of experiencing an intradialytic emergency compared with patients without such complications. However, the wide confidence interval indicates considerable uncertainty in the estimated magnitude of the association, which should be considered given the relatively small sample size.

Clinically, this association may be explained by the essential role of vascular access in maintaining blood circulation during hemodialysis. Access-related bleeding may contribute to intravascular volume loss and hemodynamic instability. Similarly, thrombosis or stenosis may impair blood flow and disrupt the dialysis procedure, potentially requiring immediate clinical intervention. Infection may also lead to serious complications, depending on its severity and clinical progression. These mechanisms provide plausible explanations for the observed association, although the specific types of complications and emergencies were not analyzed separately in this study. The findings are consistent with Murniati et al. (2025), who highlighted the potential for vascular access complications to impair access function and disrupt hemodialysis treatment. Vascular access management guidelines also emphasize the importance of monitoring and early detection of stenosis, thrombosis, infection, and access dysfunction to maintain access function and support patient safety.

Nevertheless, the observed association does not establish a causal relationship. The retrospective cross-sectional design does not establish the temporal sequence between vascular access complications and intradialytic emergencies. Furthermore, emergencies may be influenced by other factors, including age, comorbidities, cardiovascular status, fluid balance, ultrafiltration volume, and dialysis-related characteristics, which were not examined in this study. These factors should be considered in future research. From a nursing perspective, the findings emphasize the importance of assessing vascular access before dialysis, observing the access during cannulation and treatment, monitoring vital signs, and recognizing early signs of complications. Timely identification and appropriate intervention may help reduce the risk of clinical deterioration during hemodialysis (Lok et al., 2025).

Nursing Implications Based on Orem's Self-Care Theory

Orem's Self-Care Deficit Nursing Theory provides a useful conceptual framework for understanding nursing support in patients undergoing hemodialysis. The theory emphasizes the role of nursing in supporting individuals whose self-care abilities are insufficient to meet their health needs. In this context, self-care includes maintaining access hygiene, recognizing signs of complications, and promptly reporting changes in vascular access conditions to healthcare personnel.

Through a supportive-educative nursing system, nurses can provide health education, guidance, and ongoing support to strengthen patients' self-care abilities. Previous literature has discussed the role of nursing support in promoting self-care among hemodialysis patients (Simmons, 2009) and the importance of education in improving vascular access self-management (Wembenyui et al., 2024). These approaches may complement clinical monitoring and early complication detection. However, Orem's theory serves as a conceptual basis for the nursing implications of this study rather than a variable directly tested in the analysis (Orem et al., 2001; Hudson & Macdonald, 2010).

CONCLUSION

This study demonstrated a significant association between vascular access complications and intradialytic emergencies among patients with chronic kidney disease (CKD) undergoing hemodialysis. Patients with vascular access complications had higher odds of experiencing emergencies during hemodialysis than those without complications. These findings highlight the importance of vascular access monitoring and early complication detection in promoting patient safety.

In clinical practice, hemodialysis nurses should assess vascular access before each session, identify early signs of complications, and maintain clinical vigilance throughout the procedure. These measures may facilitate timely recognition of potential problems and appropriate interventions, thereby supporting patient safety during hemodialysis.

ACKNOWLEGMENT

The authors would like to express their sincere gratitude to the management and healthcare staff of Putri Hijau Level II Hospital, Medan, particularly the Hemodialysis Unit, for their support and assistance during the research process. The authors also thank all parties who contributed to facilitating access to the medical records and the completion of this study. Their cooperation is greatly appreciated.

REFERENCES

Arriyani, F., & Wahyono, T. Y. M. (2023). Faktor Risiko Penyakit Ginjal Kronis pada Kelompok Usia Dewasa : Literature Review. *Media*

Publikasi Promosi Kesehatan Indonesia (MPPKI), *6*(5), 788–797. https://doi.org/10.56338/mppki.v6i5.3239

Boss, K., Stolpe, S., Müller, A., Wagner, B., Wichert, M., Assert, R., Volbracht, L., Stang, A., Kowall, B., & Kribben, A. (2023). Effect of serum creatinine difference between the Jaffe and the enzymatic method on kidney disease detection and staging. *Clinical Kidney Journal*, *16*(11), 2147–2155. https://doi.org/10.1093/ckj/sfad178

Chou, Y., & Chen, Y. (2021). *Aging and Renal Disease : Old Questions for New Challenges*. *12*(2), 515–528.

Djajakusumah, T. M. (2024). *Characteristics of Vascular Access Cannulation Complications in End Stage Kidney Disease Patients in West Java from 2018 to 2022 : A Retrospective Observational Study*. *February*, 47–58.

Franchin, M., Tadiello, M., Guzzetti, L., Gattuso, A., Mauri, F., Cervarolo, M. C., Giovanni, M., Oria, G. D., & Tozzi, M. (2023). *Acute problems of hemodialysis access : Thrombosis , aneurysms , symptomatic high-flow fistulas , and complications related to central lines*.

Hallan, S. I., Øvrehus, M. A., Shlipak, M. G., Potok, O. A., Romundstad, S., Aspvik, N. P., Wisløff, U., Ix, J. H., Stensvold, D., & Langlo, K. A. (2025). Long-Term Physical Exercise for Preventing CKD in Older Adults: A Randomized Controlled Trial. *Journal of the American Society of Nephrology : JASN*, 1–11. https://doi.org/10.1681/ASN.0000000636

Hamrahian, S. M., Vilayet, S., Herberth, J., & Fülöp, T. (2023). *Prevention of Intradialytic Hypotension in Hemodialysis Patients : Current Challenges and Future Prospects*. *July*, 173–181.

Hidalgo-blanco, M. Á., Moreno-arroyo, M. C., & Sánchez-, M. A. (2023). Análisis de las complicaciones del acceso vascular en hemodiálisis . Una revisión sistemática. *Enfermeria Nefrologika*.

Lok, C. E., Huber, T. S., Lee, T., Shenoy, S., Yevzlin, A. S., Abreo, K., Allon, M., Asif, A., Astor, B. C., Glickman, M. H., Graham, J., Moist, L. M., & Rajan, D. K. (2019). KDOQI Clinical Practice Guideline for Vascular Access: 2019 Update. *American Journal of Kidney Diseases*, *75*(4), S1–S164. https://doi.org/10.1053/j.ajkd.2019.12.001

Lok, C. E., Yuo, T., Lee, T., Hoenig, M., Brewster, U. C., Choi, M. J., & Young, B. (2025). Hemodialysis Vascular Access : Core Curriculum 2025. *American Journal of Kidney Diseases*, *85*(2), 236–252. https://doi.org/10.1053/j.ajkd.2024.05.021

Murniati, M., Umar, W., & Padaallah, A. P. (2025). *Hubungan Tingkat Pengetahuan Pasien Hemodialisa terhadap Kemampuan Perawatan Cimino secara Mandiri di Rumah Sakit Sentra Medika Cikarang*. *5*.

Pangaribuan, R., Girsang, E., & Anggeria, E. (2026). Pengalaman Keluarga dalam membantu Aktivitas Fisik pasien Chronic Kidney Disease (CKD) yang menjalani Hemodialisis. *Uinsu*, *11*(1), 60–72. https://doi.org/10.30829/jumantik.v11i1.27409

Simmons, L. (2009). *Dorthea Orem's self care theory as related to nursing practice in hemodialysis*.

Susilo, A., Suryana, K. D., Nugroho, P., & Muhadi, M. (2022). Risk Factors for Temporary Vascular Access Infection in Patients with End- Stage Renal Disease Undergoing Hemodialysis in Cipto Mangunkusumo Hospital. *Acta Med Indones - Indones J Intern Med*, *54*(3), 356–364.

Wembenyui, C., Marsh, N., & Larsen, E. (2024). *Educational or Behavioural Interventions to Improve Long - Term Haemodialysis Vascular Access Self - Management : A Systematic Review*. https://doi.org/10.1111/jorc.70005