

Knee Pain in Patients with End-Stage Renal Disease: A Preliminary Study in the Hemodialysis Unit of Universitas Airlangga Hospital

Aisyah Syafaanurani Nadia¹, Abdurachman^{2*},
Satriyo Dwi Suryantoro³, Yunus⁴

¹Medical Program, Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia

²Department of Anatomy, Histology, and Pharmacology,
Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia

³Department of Internal Medicine, Faculty of Medicine,
Universitas Airlangga, Surabaya, Indonesia

⁴Department of Orthopaedics and Traumatology,
Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia

E-mail: aisyah.syafaanurani.nadia-2022@fk.unair.ac.id; abdurachman@fk.unair.ac.id;
satriyo.dwi.suryantoro@fk.unair.ac.id; yunus@fk.unair.ac.id

*Corresponding author: Abdurachman; abdurachman@fk.unair.ac.id

ABSTRACT

Knee pain is a common musculoskeletal complaint among patients with end-stage renal disease (ESRD) undergoing hemodialysis and may negatively affect mobility and quality of life. This prospective cross-sectional study aimed to describe knee pain characteristics and explore the association between knee pain severity and clinical as well as laboratory parameters in ESRD patients undergoing hemodialysis. A total of 64 patients were included, with knee pain severity assessed using structured questionnaires and clinical-laboratory data obtained from medical records. Descriptive analysis and Spearman's correlation test were performed. Most patients were male, with a mean age of 52.39 years, and the majority experienced mild to moderate knee pain. No statistically significant associations were found between knee pain severity and most clinical or laboratory parameters; however, a tendency toward a negative correlation was observed between the duration of hemodialysis and knee pain scores, indicating greater pain severity with longer hemodialysis duration. These findings suggest that knee pain in ESRD patients undergoing hemodialysis is common and multifactorial, warranting further investigation with larger samples and more comprehensive assessments.

Keywords: knee pain; hemodialysis; end-stage renal disease; ureum; creatinine; calcium; phosphor; hemoglobin; electrolyte

INTRODUCTION

Chronic kidney disease (CKD) is a progressive condition that constitutes a major global health burden and may ultimately lead to end-stage renal disease (ESRD), a stage requiring renal replacement therapy such as hemodialysis [1,2]. Globally, CKD contributes substantially to morbidity and mortality, and its burden continues to increase across regions [3,4]. In Indonesia, the prevalence of CKD and the number of patients undergoing hemodialysis have also shown a rising trend, resulting in significant healthcare utilization and economic impact [5–7].

Patients with ESRD frequently experience a wide range of systemic complications related to metabolic disturbances and disease progression [8,9]. Pain is

one of the most commonly reported symptoms among patients undergoing maintenance hemodialysis, with musculoskeletal pain representing a major component of this symptom burden [10,11]. Such pain may impair physical function, daily activities, and overall quality of life.

Knee pain is a common manifestation of musculoskeletal disorders and has been widely reported in both general and clinical populations [12,13]. In patients with ESRD, knee pain may be influenced by dialysis-related factors, reduced physical activity, and chronic metabolic alterations [9,11]. However, evidence regarding the relationship between routine clinical or laboratory parameters and knee pain severity remains inconsistent [14,15].

Given the limited data focusing specifically on knee pain among ESRD patients in the Indonesian setting, this preliminary study aimed to describe knee pain characteristics and explore the tendency of association between knee pain severity and selected clinical and laboratory parameters in patients with ESRD undergoing hemodialysis.

METHODS

Study Design and Setting

This study employed a prospective cross-sectional design and was conducted in the Hemodialysis Unit of Universitas Airlangga Hospital. The study population consisted of patients with end-stage renal disease (ESRD) undergoing maintenance hemodialysis as renal replacement therapy.

Participants

Eligible participants were adult patients diagnosed with ESRD who were receiving routine hemodialysis at the study site during the data collection period. Patients with incomplete clinical records or those unable to complete the knee pain assessment questionnaire were excluded. Demographic and clinical characteristics were obtained from medical records.

Assessment of Knee Pain

Knee pain severity was assessed using a structured knee pain score questionnaire. In this study, lower knee pain scores represented greater pain severity. The assessment focused on overall knee pain symptoms rather than diagnostic classification.

Clinical and Laboratory Data

Clinical variables included age, sex, and duration of hemodialysis. Laboratory parameters were retrieved from medical records and included hemoglobin, albumin, calcium, phosphate, creatinine, blood urea nitrogen, sodium, potassium, and chloride, when available. Due to variations in laboratory examination schedules, not all participants had complete laboratory data for every parameter.

Statistical Analysis

Descriptive statistical analysis was performed to summarize patient characteristics and knee pain scores. An exploratory correlation analysis was conducted using Spearman's correlation test to evaluate the tendency of association between knee pain severity and selected clinical and laboratory parameters. Pairwise analysis was applied for variables with missing data. Statistical analyses were performed using IBM SPSS software, with a significance level set at $p < 0.05$.

RESULTS

A total of 64 patients with end-stage renal disease (ESRD) undergoing maintenance hemodialysis were included in this study. Most participants were male, with a mean age of 52.39 years. The majority of patients had been receiving hemodialysis for approximately three years, reflecting a population with prolonged exposure to dialysis therapy.

Assessment using the knee pain score questionnaire demonstrated that most patients experienced mild to moderate knee pain. A smaller proportion of patients reported lower knee pain scores, indicating greater pain severity. These findings suggest that knee pain is a prevalent musculoskeletal complaint among patients undergoing hemodialysis.

Exploratory correlation analysis revealed no statistically significant associations between knee pain scores and most clinical or laboratory parameters. However, a tendency toward a negative correlation was observed between the duration of hemodialysis and knee pain scores, indicating that longer hemodialysis duration was associated with greater knee pain severity. No meaningful correlations were identified between knee pain scores and electrolyte parameters, including sodium, potassium, and chloride.

DISCUSSION

This preliminary study demonstrates that knee pain is a common musculoskeletal complaint among patients with end-stage renal disease (ESRD) undergoing maintenance hemodialysis. Most patients experienced mild to moderate knee pain, a finding consistent with previous reports indicating a high burden of musculoskeletal symptoms in hemodialysis populations [11,15]. Musculoskeletal pain has been recognized as one of the most frequently reported symptoms in patients with chronic kidney disease, particularly in advanced stages requiring dialysis [10].

The predominance of mild to moderate knee pain observed in this study may reflect the multifactorial nature of pain perception in ESRD patients. Chronic metabolic disturbances, alterations in bone and mineral metabolism, and cumulative dialysis-related stress may contribute to musculoskeletal discomfort without necessarily producing severe or disabling pain in all patients [8,16]. Additionally, reduced physical activity and functional limitation commonly observed in hemodialysis patients may further influence symptom presentation [15,17].

In this study, no statistically significant associations were identified between knee pain severity and most routine clinical or laboratory parameters. This finding supports previous observations suggesting that musculoskeletal pain in hemodialysis patients cannot be adequately explained by isolated laboratory markers alone [11,17]. Pain in ESRD is likely influenced by a complex interplay of biological, mechanical, and psychosocial factors, which may not be fully captured through routine laboratory assessments [10,18].

Notably, an exploratory tendency toward greater knee pain severity with longer duration of hemodialysis was observed. Although this association did not reach statistical significance, similar trends have been reported in descriptive and imaging-based studies, where longer dialysis duration was associated with increased musculoskeletal abnormalities and joint involvement [15,12].

Prolonged exposure to dialysis-related factors, including chronic inflammation and cumulative metabolic stress, may contribute to progressive musculoskeletal changes over time [8,16].

The absence of a significant association between knee pain severity and electrolyte parameters, such as sodium, potassium, and chloride, aligns with previous studies reporting limited direct influence of electrolyte levels on joint pain and functional outcomes [14]. These findings further emphasize that knee pain in ESRD patients is unlikely to be driven by single biochemical abnormalities.

Given the exploratory nature of this study, the findings should be interpreted with caution. The relatively small sample size, incomplete laboratory data for certain parameters, and the cross-sectional design limit causal inference. Nevertheless, as a preliminary study, these results provide important descriptive insights into knee pain characteristics among ESRD patients undergoing hemodialysis and highlight the need for further research incorporating larger cohorts, longitudinal designs, and additional clinical assessments, such as imaging and inflammatory biomarkers [10,12].

CONCLUSIONS

This preliminary study demonstrates that knee pain is a common musculoskeletal complaint among patients with end-stage renal disease undergoing maintenance hemodialysis. Most patients experienced mild to moderate knee pain, and no statistically significant associations were identified between knee pain severity and routine clinical or laboratory parameters. An exploratory tendency toward greater knee pain severity with longer hemodialysis duration was observed. These findings suggest that knee pain in ESRD patients is multifactorial and highlight the need for further studies with larger sample sizes, longitudinal designs, and more comprehensive clinical and laboratory assessments.

ACKNOWLEDGMENT

The authors wish to express their sincere gratitude to all researchers and institutions whose published work provided the scientific foundation for this study. We gratefully acknowledge the contributions of previous epidemiological and clinical studies focusing on chronic kidney disease, end-stage renal disease, hemodialysis, and musculoskeletal pain, which have been essential in shaping the context and interpretation of the present preliminary investigation. The authors also thank the Hemodialysis Unit of Universitas Airlangga Hospital for their support and cooperation during data collection, as well as all patients who voluntarily participated in this study.

REFERENCES

[1] Vaidya, S.R. and Aeddula, N.R. (2022). What Is Chronic Kidney Disease? | NIDDK. National Institute Diabetes and Digestive and Kidney Diseases.

- [2] Ammirati, A.L., (2020). Chronic Kidney Disease. *Revista da Associação Médica Brasileira*, 66(suppl 1), pp.s03–s09. <https://doi.org/10.1590/1806-9282.66.s1.3>.
- [3] World Health Organization (2020). The top 10 causes of death. [online] Who.int. Available at: <https://www.who.int/news-room/fact-sheets/detail/the-top-10-causes-of-death> [Accessed 1 May 2024].
- [4] Ying, M., Shao, X., Qin, H., Yin, P., Lin, Y., Wu, J., Ren, J., and Zheng, Y., 2024. Disease Burden and Epidemiological Trends of Chronic Kidney Disease at the Global, Regional, and National Levels from 1990 to 2019. *Nephron*, 148(2), pp.113–123. <https://doi.org/10.1159/000534071>.
- [5] Badan Kebijakan Pembangunan Kesehatan | BKKPK Kemenkes. (2024). SKI 2023 Dalam Angka - Badan Kebijakan Pembangunan Kesehatan | BKKPK Kemenkes. [online] Available at: <https://www.badankebijakan.kemkes.go.id/ski-2023-dalam-angka/>.
- [6] Perhimpunan Nefrologi Indonesia (PERNEFRI), 2020. 3rd ANNUAL REPORT OF INDONESIAN RENAL REGISTRY 2020.
- [7] Kristina, S., Endarti, D., Andayani, T., and Aditama, H., 2020. Cost of illness of hemodialysis in Indonesia: A survey from eight hospitals in Indonesia. *International Journal of Pharmaceutical Research*, 13. <https://doi.org/10.31838/ijpr/2021.13.01.375>.
- [8] Agarwal, A. and Nath, K.A. (2020). Pathophysiology of Chronic Kidney Disease Progression: Organ and Cellular Considerations. In: *Chronic Renal Disease*. Elsevier. pp.263–278. <https://doi.org/10.1016/B978-0-12-815876-0.00018-8>.
- [9] Hashmi, M.F., Benjamin, O., and Lappin, S.L. (2023). End-Stage Renal Disease. [online] Nih.gov. <https://www.ncbi.nlm.nih.gov/books/NBK499861/>.
- [10] Mizher, A., Hammoudi, H., Hamed, F., Sholi, A., AbuTaha, A., Abdalla, M.A., Jaber, M.M., Hassan, M., Koni, A.A., and Zyoud, S.H. (2023). Prevalence of chronic pain in hemodialysis patients and its correlation with C-reactive protein: a cross-sectional study. *Scientific Reports*, [online] 13(1). doi: <https://doi.org/10.1038/s41598-023-32648-8>.
- [11] Ranaei, H., Raeesi, V., Salmani, F., Khojasteh-Kaffash, S., and Saremi, Z., 2024. Musculoskeletal disorders in hemodialysis patients: prevalence, clinical symptoms, and associated factors. *Journal of Nephro pharmacology*, 13(1), p.e10605. <https://doi.org/10.34172/npj.2023.11656>.

- [12] Farha, N., Spencer, A., and McGervey, M. (2021). Outpatient Evaluation of Knee Pain. *Medical Clinics of North America*, [online] 105(1), pp.117–136.
doi:<https://doi.org/10.1016/j.mcna.2020.08.017>.
- [13] Ginnerup-Nielsen, E., Christensen, R., Heitmann, B.L., Altman, R.D., March, L., Woolf, A., Bliddal, H. and Henriksen, M. (2021). Estimating the Prevalence of Knee Pain and the Association between Illness Perception Profiles and Self-Management Strategies in the Frederiksberg Cohort of Elderly Individuals with Knee Pain: A Cross-Sectional Study. *Journal of Clinical Medicine*, 10(4), p.668.
<https://doi.org/10.3390/jcm10040668>.
- [14] Achmad, A, Suharjono, , Soeroso, J, Suprapti, B, Siswandono, , Pristianty, L, Rahmadi, M, Nugraha, J, Nugroho, CW, Surya, Y, Isma, SPP, Rahadiansyah, E, Huwae, TECJ & Suryana, BPP (2023), 'The sodium does not affect joint pain and functional activity of knee osteoarthritis patients', *Journal of Public Health in Africa*, vol. 14, no. S1, 2494.
<https://doi.org/10.4081/jphia.2023.2494>.
- [15] Tharwat, S., Saleh, M., Elrefaey, R., Nassar, M.K. and Nassar, M.K. (2025). Clinical and ultrasonographic features of 104 knee joints in hemodialysis patients: impact of age, gender, and hemodialysis duration: a descriptive cross-sectional study. *BMC Musculoskeletal Disorders*, [online] 26(1).
doi: <https://doi.org/10.1186/s12891-025-08447-9>.
- [16] Mallamaci, F. and Tripepi, G., 2024. Risk Factors of Chronic Kidney Disease Progression: Between Old and New Concepts. *Journal of Clinical Medicine*,
<https://doi.org/10.3390/jcm13030678>.
- [17] Abdurachman., Subadi, I., Hamdan, M., Andira, L.H. and Andira, D. (2024) Mudah Bebas dari Nyeri Lutut. Unair.ac.id. Available at: <https://doi.org/10.20473/aup.1130>.
- [18] Molus, L. and Kansal, A. (2022). Visceral pain. *Anaesthesia & intensive care medicine*, [online] 23(9), pp.535–539.
doi: <https://doi.org/10.1016/j.mpaic.2022.04.017>.
- [19] Abdulrasheed, M., Armiyau, M. B., Abdullahi, Y. N., & Nuhu, M. K. (2025). Demographic and Clinical Profile of Haemodialysis Patients with End-Stage Renal Disease in a Northern Nigerian Hospital: A Retrospective Analysis of Patterns and Outcomes. *Nigerian medical journal: journal of the Nigeria Medical Association*, 66(1), 165–173. <https://doi.org/10.71480/nmj.v66i1.660>.
- [20] Ricardo AC, Yang W, Sha D, Appel LJ, Chen J, Krousel-Wood M, Manoharan A, Steigerwalt S, Wright J, Rahman M, Rosas SE, Saunders M, Sharma K, Daviglius ML, Lash JP; CRIC Investigators. Sex-Related Disparities in CKD Progression. *J Am Soc Nephrol*. 2019 Jan;30(1):137-146.
doi: 10.1681/ASN.2018030296. Epub 2018 Dec 3. PMID: 30510134; PMCID: PMC6317604.
- [21] Sunariyanti, E., Andayani, T.M., Endarti, D., and Puspandari, D.A., 2023. Cost Analysis of Chronic Kidney Disease Patients in Indonesia. *ClinicoEconomics and outcomes research: CEOR*, 15, pp.621–629.
<https://doi.org/10.2147/CEOR.S388547>.
- [22] Zhang, Y., Chen, T., Luo, P., Li, S., Zhu, J., Xue, S., Cao, P., Zhu, Z., Li, J., Wang, X., Wluka, A. E., Cicuttini, F., Ruan, G., & Ding, C. (2022). Associations of Dietary Macroelements with Knee Joint Structures, Symptoms, Quality of Life, and Comorbid Conditions in People with Symptomatic Knee Osteoarthritis. *Nutrients*, 14(17), 3576.
<https://doi.org/10.3390/nu14173576>.