Journal of Case Reports and Clinical Insights in Health
Volume 1 Issue 1, May 2026, pp 13-20
https://ebsina.or.id/journals/index.php/jcrcih
eISSN 0000-0000

JCRCIH
CASE REPORT OPEN ACCESS

Application of Ankle Pump Exercise and 30° Leg Elevation in Chronic Kidney Disease Patients with Hipervolemia (Peripheral Edema) in the Anturium of Dr. Soebandi Jember

Azzahra Ganandya Nurul Firdaus[1], Rondhianto[2], Lutfiasih Rahmawati[2], Mustakim[2]
[1]Faculty of Nursing, Jember University, Indonesia
[2]Holistic Care in Medical Surgical Nursing, Faculty of Nursing, Jember University, Indonesia
[2]Dr. Soebandi General Hospital, Jember, Indonesia

Correspondence: Rondhianto
Faculty of Nursing, Jember University, Indonesia (rondhianto83@gmail.com)

Received: 20 January 2026 | **Revised:** 18 February 2026 | **Accepted:** 17 March 2026

ABSTRACT

Chronic Kidney Disease (CKD) is a condition in which the kidneys are damaged and cannot filter blood optimally, where one of the clinical manifestations of this condition is peripheral edema. Based on previous research, 59% of CKD patients experienced peripheral edema (83 respondents), followed by other problems: 51.1% were pale, 26.5% had ascites, and 28.9% had pleural effusion. The purpose of this study was to determine the results of the application of ankle pump exercises and 30° leg elevation in CKD patients with hypervolemia (peripheral edema) at the Anturium of Dr. Soebandi Regional Hospital, Jember. After applying ankle pump exercises and 30° leg elevation 3 times a day for 20 minutes for 3 days, the results showed a decrease in edema depth and return time from the first to the third day. The degree of edema on the first day was grade 3; on the second day, grade 2; and on the third day, grade 1, with a depth of 1.1 mm and a return time of 6 seconds. In addition, the results showed improved capillary refill time (< 2 seconds), increased skin turgor in areas outside the edema, a thirst distress score of 13, and moist mucous membranes after the intervention from the first to the third day, with the interpretation that fluid circulation improved. It can be concluded that ankle pump exercises and 30° leg elevation can reduce edema and improve blood circulation in CKD patients with hypervolemia and treatment challenges.

KEYWORDS

Ankle pump exercises; 30-degree leg elevation; Hypervolemia; Peripheral edema; Chronic Kidney Disease

How to cite

Firdaus, A. G. N., Rondhianto, Rahmawati, L., & Mustakim. (2026). Application of Ankle Pump Exercise and 30° Leg Elevation in Chronic Kidney Disease Patients with Hipervolemia (Peripheral Edema) in the Anturium of Dr. Soebandi Jember. Journal of Case Reports and Clinical Insights in Health, 1(1), 13–20. https://doi.org/10.58545/jcrcih.v1i1.638

1 | Background

Chronic Kidney Disease (CKD) is defined as a persistent disorder of kidney structure or function, characterized by a glomerular filtration rate (GFR) below 60 mL/min/1.73 m² or the presence of albuminuria ≥30 mg per 24 hours, lasting for more than three months (Ortiz et al., 2022). Clinically, CKD represents irreversible kidney damage that impairs optimal blood filtration, with peripheral edema being one of the most prominent manifestations (National Kidney Foundation, 2023).

The development of peripheral edema in CKD patients is primarily driven by compensatory activation of the renin-angiotensin-aldosterone system (RAAS). Vascular disorders and impaired glomerular perfusion lead the kidneys to misinterpret reduced blood flow as hypovolemia, triggering RAAS activation (Goyal et al., 2025). This cascade results in angiotensin II-mediated vasoconstriction and increased aldosterone secretion, promoting excessive sodium and water reabsorption. The consequent expansion of intravascular volume, combined with gravitational forces when patients are upright,

elevates hydrostatic pressure in the lower extremity capillaries, forcing fluid into the interstitial space (Sawdon & Kirkman, 2023).

Peripheral edema is a highly prevalent complication among CKD patients, serving as a primary clinical indicator of renal impairment. Research indicates that 59% of CKD patients experience peripheral edema, often accompanied by pallor (51.1%), pleural effusion (28.9%), and ascites (26.5%) (Nazim & Nazim, 2024). Similarly, a multicenter study in Ethiopia reported that 99.4% of CKD patients developed edema, with severity distributed as grade 1 (6.47%), grade 2 (40.6%), grade 3 (51.8%), and grade 4 (0.6%) (Garedow et al., 2024). These findings underscore the critical need for effective, non-invasive edema management strategies in this population.

Non-pharmacological interventions offer a safe and practical approach to managing peripheral edema, particularly in patients with limited mobility and fatigue. Ankle pump exercises and standardized 30° leg elevation enhance peripheral circulation through complementary mechanical mechanisms. Ankle pumps promote venous return via rhythmic contraction of the calf muscles, while leg elevation utilizes gravity to facilitate fluid redistribution from the lower extremities. Evidence supports their efficacy: a study of 61 patients with leg edema found that 90.2% experienced improvement following ankle pump exercises (Gul et al., 2021). Furthermore, interventions combining leg elevation with other modalities have demonstrated significant reductions in edema severity, whereas the absence of such positioning has been associated with edema progression up to grade 4 (Asadi et al., 2023; Liu et al., 2025). These interventions are particularly suitable for CKD patients as they improve hemodynamics without imposing excessive physical demand.

Despite the established benefits of these techniques, limited research has specifically evaluated their combined application in CKD patients with hypervolemia. Therefore, this case report aims to evaluate the effectiveness of ankle pump exercises combined with 30° leg elevation in reducing peripheral edema and improving fluid circulation in a CKD patient with hypervolemia in the Anturium Room of Dr. Soebandi Jember Hospital.

2 | Methods

This study employed a descriptive case report design, using a pretest-posttest approach, to evaluate the clinical effectiveness of non-pharmacological interventions for managing peripheral edema among patients with chronic kidney disease. The intervention was conducted in the Anturium Room (Internal Medicine Care Unit) at Dr. Soebandi Hospital, Jember, Indonesia, over three days from June 5 to 7, 2025. Prior to implementation, written informed consent was obtained from the patient, ensuring full comprehension of the study's purpose, procedures, potential benefits, and the right to withdraw without affecting clinical care. Patient confidentiality was strictly maintained throughout data collection, documentation, and reporting, with all identifiable information anonymized in accordance with institutional ethical guidelines and international standards for case report publications.

The participant was selected using purposive sampling based on predefined clinical criteria. Inclusion criteria encompassed adult patients diagnosed with Chronic Kidney Disease (CKD) stage 5 undergoing maintenance hemodialysis, presenting with hypervolemia characterized by bilateral peripheral pitting edema (grade 2 or higher), hemodynamic stability, and voluntary willingness to participate. Exclusion criteria included the presence of deep vein thrombosis, lower extremity trauma or fractures, severe cardiopulmonary instability requiring intensive monitoring, and cognitive impairment that would hinder active cooperation with the intervention. Baseline data were collected through comprehensive nursing assessments, systematic physical examinations, and medical record review, focusing on demographic characteristics, clinical history, laboratory parameters, and baseline indicators of edema and peripheral fluid circulation.

The Nursing intervention protocol consisted of combined ankle pump exercises and 30° leg elevation administered three times daily for 20 minutes per session over three consecutive days. The ankle pump exercise involved active, rhythmic plantar flexion and dorsiflexion of the ankle joint, performed every 3 to 4 seconds, specifically designed to engage the calf muscle pump and promote venous return. Concurrently, the patient's lower extremities were elevated to 30° (approximately 20–30 cm above heart level)

using standardized pillows to facilitate gravitational drainage of interstitial fluid and reduce capillary hydrostatic pressure. The intervention was continuously monitored and temporarily suspended if the patient exhibited respiratory distress requiring semi-Fowler positioning or any signs of hemodynamic instability. All procedures were implemented by trained nursing personnel to ensure procedural consistency, patient safety, and adherence to the standardized protocol.

Outcome measurements were systematically recorded immediately before and after each intervention session, with comprehensive daily evaluations focusing on both structural and functional indicators of fluid circulation. Peripheral edema was assessed using the standard pitting edema grading scale, with precise measurements of indentation depth (in millimeters) and skin return time (in seconds). Additional circulatory and hydration parameters included capillary refill time, skin turgor in non-edematous areas, mucous membrane moisture, and thirst distress scores. Vital signs, daily body weight, strict intake-output balance, and relevant laboratory values were extracted from clinical records to monitor overall physiological response. Data were analyzed descriptively by comparing pre- and post-intervention measurements across the three-day observation period, allowing for clear visualization of clinical trends and intervention effectiveness without inferential statistical testing, consistent with the methodological standards for single-case clinical reports.

3 | Case Presentation

3.1 Assessment

A 59-year-old male patient presented to the internal medicine clinic at Dr. Soebandi Hospital on June 5, 2025, at 08:00 PM with complaints of shortness of breath, productive cough, and discomfort due to edema of the feet for 1 day. After that, the patient underwent laboratory tests (Table 1).

Table 1. Complete Blood Count results

Component	Result	Normal	Interpretation
Hemoglobin	5,9	13.5 – 17.5	Low
Hematocrit	16,6	41 – 53	Low
Erythrocytes	2,03	4,7 – 6,1	Low
Leukocytes	5,4	4.5 – 11	Normal
Platelets	179	150 – 450	Normal

The patient was immediately referred to the Anturium Room with the doctor's approval. The researcher's initial assessment was conducted on June 5, 2025, at 08.25 PM. The patient's general condition was weak, glasgow coma scale score E4V5M6, respiratory rate 24 x/minute, oxygen saturation 99% with nasal cannula 3 lpm, pulse 64 x/minute, Blood Pressure 169/78 mmHg, temperature 36.90C, warm extremities, capillary refill time > 2 seconds, decreased skin turgor (back fold > 2 seconds), there was grade 3 pitting edema on both legs and Catheter Double Lumen was placed on the neck. The patient was placed in a semi-Fowler position, which is more effective in improving respiratory parameters in patients with respiratory disorders (Prajapati et al., 2024). The patient stated that he had been hospitalized previously for kidney stones and had undergone surgery in 2018. He was also diagnosed with Chronic Kidney Disease and hypertension 9 months ago and underwent regular hemodialysis every Tuesday and Friday. Prior to his CKD diagnosis, his lifestyle included daily energy drinks, salty foods, infrequent exercise, and smoking. He stated that he took candesartan, but only when symptoms of hypertension appeared. The patient's weight increased by 2 kg from her previous weight of 71 kg, with a BMI of 24.6 kg/m2 (overweight) due to excess fluid accumulation in his legs. His family helped regulate his activity patterns, and he was found to have urinated 300 cc on the first day of treatment.

3.2 Nursing Diagnoses

Researchers determined 3 main diagnoses: ineffective breathing patterns related to obstruction of respiratory efforts; the patient complained of shortness of breath; tachypnea; respiratory rate 24x/minute. The patient's shortness of breath is most likely due to low hemoglobin and erythrocyte levels (5.9 g/dL and 2.03 million/mL). There is a decrease in erythropoietin production in CKD patients due to

damage to the renal cortex, leading to decreased stimulation of red blood cell formation in the bone marrow17. The second diagnosis is hypervolemia related to impaired regulatory mechanisms. The patient complained of swelling in both legs; there was grade 3 edema in both legs. The patient's previous body weight was 69 kg; it is now 71 kg. The fluid balance was 455 cc, and the hemoglobin level was 5.9 g/dL. The third diagnosis is the risk of ineffective renal perfusion caused of renal dysfunction, where the data obtained is the patient said that he had CKD stage 5 since 9 months ago and had hemodialysis schedule on Tuesday and Friday, the patient complained of weakness caused by hemoglobin level of 5.9 g / dL, hematocrit level of 16.6%, blood pressure of 169/78 mmHg and pulse 64 x/minute, the patient also experienced grade 3 edema in both legs. The ankle pump exercise intervention and 30° leg elevation were performed in 3 sessions, each lasting 20 minutes a day, and were evaluated once a day to assess the degree of edema reduction.

3.3 Nursing interventions and implementation

Nursing interventions carried out are airway management, due to the patient complaining about shortness of breath, so nurses can monitor the breath pattern, providing a semi-Fowler or Fowler position, and administering oxygen for 2 days, which is very helpful in reducing the patient's shortness of breath and helps to reduce the patient's respiratory rate to the range of 12 to 20x/minute. Nursing interventions for hypervolemia include management and positioning, given grade 3 edema in both legs, a weight increase of 2 kg from before, and a positive fluid balance of 455 cc. In addition, positioning the lower extremities above heart level and providing active ROM (ankle pump exercises) for 3 days are very helpful in reducing peripheral edema, lowering blood pressure, and increasing skin turgor in areas outside the edema and mucous membranes in the patient. Nursing interventions to reduce the risk of ineffective renal perfusion include blood transfusions. This is caused by the patient's low hemoglobin and hematocrit levels, which can decrease the circulation of oxygen and nutrients throughout the body. Therefore, blood transfusions are expected to increase hemoglobin and hematocrit levels, thereby improving the circulation of oxygen and nutrients throughout the body.

3.4 Evaluation

This study used edema pitting to assess edema severity in CKD patients with hypervolemia-related treatment problems, measuring edema depth and return time (Table 2). Based on the study results, the degree of peripheral edema in patients on the first day before the intervention was grade 3, with a depth of 6 mm and a return time of 1 minute. Meanwhile, the results after the intervention remained the same in degree, but with reduced depth and return time. The skin over the edematous area in patients was smooth, firm, and shiny. Skin turgor was quite decreased (fold back 2 seconds) outside the edema area; capillary refill time was 3 seconds; dry, pale lip mucous membranes; and the thirst distress score was 24, indicating that the patient's fluid circulation had not improved. Ankle pump exercises and 30° leg elevation will be postponed if the patient has shortness of breath, as the patient receives semi-Fowler position therapy to reduce shortness of breath, and the leg elevation position can reduce the patient's comfort level. This is consistent with research showing that the semi-Fowler's position significantly improved RR, oxygen saturation, FVC, and FEV, thereby making the airways more open and allowing air to move more easily in and out of the lungs (Patel & Shah, 2021). According to the researchers' assumption, although some studies have shown that leg elevation can be performed in patients with ARDS, the focus of this intervention is on improving blood flow to the heart rather than on addressing the patient's shortness of breath.

On the second day, the patient received a blood transfusion during hemodialysis to maintain hemoglobin levels and remove metabolic waste products that cannot be excreted by the kidneys. After hemodialysis, the patient's peripheral edema remained at grade 2, with a depth of 3.2 mm and a return time of 15 seconds. Meanwhile, after the intervention, the patient's edema remained at grade 2, but with a reduction in depth of 2.4 mm and a return time of 11 seconds. The skin condition in the patient's edematous area remained shiny and firm, but the skin surface began to appear textured. Increased skin turgor (folds back in 1 second) outside the edema area, capillary refill time 1 second, moist mucous membranes, and the thirst distress score is 20, indicating that the patient's fluid circulation had improved significantly, as seen from the following indicators, showing the difference between the first and second days. According to the

researcher's assumption, the peripheral edema remaining at grade 2 is due to an ultrafiltration rate of 1 during hemodialysis, as the patient experienced 2 kg weight gain and was relatively safe. According to another study, aggressive fluid removal during hemodialysis can cause cardiovascular stress and organ damage (Murdeshwar et al., 2023). According to another study, the ultrafiltration process in hemodialysis can reduce body weight, with an average increase in body weight before hemodialysis of 4.39 kg and a decrease of 3.71 kg after hemodialysis, depending on the ultrafiltration rate (UFR) (Ali et al., 2023). In addition, during and after hemodialysis, there is a plasma refill phase, namely the phase of withdrawing fluid from the interstitium into the intravascular space after ultrafiltration by the dialysis machine (Wang et al., 2023). During hemodialysis, excess fluid is removed from the blood vessels, and during this time, the plasma refill phase occurs. This process takes time even after hemodialysis. According to another study, the plasma refill rate can be normal if it is balanced with the ultrafiltration rate (Wang et al., 2023). In addition, CKD patients generally have a high thirst distress score during or several hours after hemodialysis because this fluid filtration process can cause discomfort and lead to excessive fluid intake19.

On the third day, the patient's edema level before the intervention was grade 2, with a depth of 2 mm and a return time of 10 seconds. Meanwhile, the results after the intervention were grade 1, with a depth of 1.1 mm and a return time of 6 seconds. The edema area in the patient improved significantly, as evidenced by its color and texture. Skin turgor increased (folds returned in 1 second) outside the edema area; capillary refill time 1 second; moist mucous membranes; and a thirst distress score of 13, indicating the patient's fluid circulation began to improve.

Table 2. Monitoring of Clinical Parameters of Patient Fluid Status and Edema During 3 Days of Treatment

Variables	1st day		2nd day		3rd day	
	Before	After	Before	After	Before	After
Edema	Grade 3	Grade 3	Grade 2	Grade 2	Grade 2	Grade 1
Depth	6 mm	5,5 mm	3,2 mm	2,4 mm	2 mm	1,1 mm
Time	1 minute	54 seconds	15 seconds	11 seconds	10 seconds	6 seconds
Fluid circulation						
Skin turgor	Skin turgor increases in the area of edema, the skin appears smooth, firm, and shiny. Skin turgor outside the area of edema returns in >2 seconds.	Skin turgor increases in the area of edema, the skin appears smooth, firm, and shiny. Skin turgor outside the area of edema returns in >2 seconds	Skin turgor increases in the area of edema, the skin appears shiny, firm, and textured. Skin turgor outside the area of edema returns in 2 seconds.	Skin turgor increases in the area of edema, the skin appears shiny, firm, and textured. Skin turgor outside the area of edema returns in 1 seconds	Skin turgor in the area was normal. Skin turgor outside the area of edema returns in 1 seconds	Skin turgor in the area was normal. Skin turgor outside the area of edema returns in 1 seconds
Mucosal membrane	Dry and pale	Dry	Dry	Moist	Moist	Moist
Thirst	Thirst distress score 26	Thirst distress score 24	Thirst distress score 24	Thirst distress score 20	Thirst distress score 14	Thirst distress score 13
Capillary refill time	3 seconds	3 seconds	2 seconds	1 seconds	1 seconds	1 seconds

4 | Discussion

Results showed a decrease in edema after the intervention from the first to the third day. Prior to therapy on June 5, 2025, the patient's edema was at grade 3. His mucosa membrane was dry and pale, his skin turgor was decreased (folding back > 2 seconds), his thirst distress score was 26, and his capillary refill time was 3 seconds (outside the edema area). A skin examination of the edema area revealed increased skin turgor, smooth, firm, and shiny skin. After three consecutive days of therapy and re-evaluation, the patient's edema decreased to grade 1, with a depth of 1.1 mm and a return time of 6 seconds. The patient's skin condition significantly improved, as evidenced by the edema's color and skin surface texture. In the area outside the edema, skin turgor was increased (folding back in 1 second), his capillary refill time was 1 second, his mucous membrane was moist, and his thirst score was 13. This is consistent with research that found a decrease in edema after ankle pump intervention (Liu et al., 2025). Plantar flexion of

the ankle joint activates the calf muscle pump (gastrocnemius and soleus muscles), generating mechanical pressure that increases venous return. Essentially, fluid in the capillaries exerts hydrostatic pressure that forces fluid out of the capillaries and back in, thereby increasing venous return to the heart and reducing intravascular hydrostatic pressure (Bihari et al., 2022; Sawdon & Kirkman, 2023). The results of this study align with those of previous studies that found that alternating plantar flexion and dorsiflexion movements every 3-4 seconds for 5-20 minutes, 3 times daily, can improve lower extremity hemodynamics and enhance patient comfort during ankle pump exercises (Li, 2022; Asadi, 2023). This improvement in hemodynamics leads to increased venous return and decreased capillary hydrostatic pressure, thus ankle pump exercises can reduce peripheral edema.

The results of this study showed that combining ankle pump exercise with leg elevation also reduced edema severity, from grade 3 to grade 1. This study is consistent with research showing a decrease in edema severity after leg elevation compared with the control group. According to this study, elevating the leg 20 to 30 cm above the ground helps position the feet higher than the heart, aiding venous blood flow back to the heart and improving blood circulation and peripheral edema (Asadi, 2023). In patients with peripheral edema, excess fluid accumulates in the lower extremities due to gravity, especially when a person is in a standing or sitting position. Although there is a leg muscle pump that helps venous blood flow, this pump does not work as well as the heart (Ielapi et al., 2022). Therefore, when the legs are raised above the level of the heart, gravity helps support venous blood flow in the legs and can improve blood circulation from the lower extremities to the heart.

Other studies show that edema levels decreased and circulation improved after ankle pump exercises for 5-20 minutes, three times a day, and leg elevation in CKD patients with a nursing diagnosis of hypervolemia (Gul et al., 2021; Li et al., 2022; Wang et al., 2023. This study concluded that ankle pump exercises and 30° leg elevation significantly reduced edema in post-hemodialysis patients compared with pre-hemodialysis patients. However, the application of ankle pump exercises and 30° leg elevation in CKD patients with hypervolemia may help reduce edema, improve fluid circulation more quickly, and reduce hospitalization time.

Based on the ankle pump exercise and 30° leg elevation results in patients with peripheral edema, confounding factors were identified that could have influenced this study's results. On the second day, the patient underwent hemodialysis, which could have reduced the patient's peripheral edema. However, the ankle pump exercise and 30° leg elevation were still possible because the patient's peripheral edema remained grade 2. Furthermore, another confounding factor was the administration of a diuretic, namely furosemide 40 mg, which was taken at 4:00 PM. Furosemide inhibits sodium and chloride reabsorption in the proximal and distal tubules and the ascending limb of Henle by inhibiting the sodium-chloride cotransport system, resulting in excessive excretion of water along with sodium and other electrolytes (Khan et al., 2023). Therefore, the administration of furosemide as a diuretic reduces peripheral edema in CKD patients.

Limitations

Based on the researchers' experience in this study, several limitations were identified that need to be considered in future research, including blood transfusions during hemodialysis and diuretic administration, which were confounding factors. Future research should compare interventions administered before and after hemodialysis, both with and without diuretics.

5 | Conclusions

Based on the study results, the depth and return time of edema decreased from the first to the third day. The results of the degree of edema on the first day were grade 3; on the second day, grade 2; and on the third day, grade 1, with a depth of 1.1 mm and a return time of 6 seconds. In addition, capillary refill time, skin turgor, thirst distress scores, and mucous membrane scores were obtained from the first to the third day, with the interpretation that fluid circulation improved. Based on the discussion, ankle pump exercises and 30° leg elevation can reduce edema and improve fluid circulation in CKD patients with hypervolemia when performed 3 times a day for 20 minutes.

6 | References

Ali, A., Yaqoob, A., Peter, N., Hayat, U., Asif, A., & Karim, K. (2023). Effect Of Ultrafiltration Rate On Dialysis Clinical Indicators Among A Hemodialysis Patients. Journal of Xi'an Shiyou University, Natural Science Edition, 19(5), 453–457. http://xisdxjxsu.asia

Asadi, F., Simbar, M., Zahrani, S. T., & Nasiri, M. (2023). An investigation and comparison of the effects of self-care education with effleurage massage of feet, hydrotherapy, and leg elevation on the physiological status of the feet in pregnant women: A Randomized Clinical Trial. https://doi.org/10.21203/rs.3.rs-3187216/v1

Bihari, I., Guex, J.-J., Jawien, A., & Szolnoky, G. (2022). Clinical Perspectives and Management of Edema in Chronic Venous Disease—What about Ruscus? Medicines, 9(8), 41. https://doi.org/10.3390/medicines9080041

Garedow, A. W., Tesfaye, G. T., Tefera, G. M., & Yizengaw, M. A. (2024). SM Journal of Nephrology and Kidney Diseases agement Outcome and Associated Factors among Patients with Chronic Kidney Disease at Selected Tertiary Hospitals in Ethiopia: A Multi-Center Prospective Observational Study Management Outcome and Associated Factors among Patients with Chronic Kidney Disease at Selected Tertiary Hospitals in Ethiopia: A Multi-Center Prospective Observational Study. J Nephrol Kidney Dis, 5(1), 17.

Goyal, A., Singh, B., & Afzal, M. (2025). Peripheral Edema. National Library of Medicine

Gul, H., Fatima, A., Ahmad, A., & Gilani, S. A. (2021). Effects of Ankle Pumping Exercises on Limb Edema in Critically ill Patients with Acute Respiratory Distress Syndrome. THE THERAPIST (Journal of Therapies & Rehabilitation Sciences), 15–18. https://doi.org/10.54393/tt.v2i2.26

Ielapi, N., Andreucci, M., Bracale, U. M., Costa, D., Bevacqua, E., Giannotta, N., Bevacqua, M. G., Serraino, G. F., Mastroroberto, P., Provenzano, M., & Serra, R. (2022). Elevate to Alleviate – Evidence Based Vascular Nursing Study. Nursing: Research and Reviews, Volume 12, 39–45. https://doi.org/10.2147/nrr.s345076

Khan, T. M., Patel, R., & Siddiqui, A. H. (2023). Furosemide. National Library of Medicine.

Li, H., Zhang, W., Lu, Q., Wang, J., Zhi, Y., Zhang, L., & Zhou, L. (2022). Which Frequency of Ankle Pump Exercise Should Be Chosen for the Prophylaxis of Deep Vein Thrombosis? Inquiry. 59. https://doi.org/10.1177/00469580221105989

Liu, X., Hu, H., Jin, L., Lin, Q., Liu, P., Li, N., & Chen, Z. (2025). Effect of postoperative ankle pump exercises on the prevention of deep vein thrombosis and venous hemodynamics following lower limb orthopedic surgery: a meta-analysis of randomized controlled trials. Journal of Orthopaedic Surgery and Research, 20(1). https://doi.org/10.1186/s13018-025-06236-7

Murdeshwar, H. N., Agarwal, A., & Anjum, F. (2023). Hemodialysis. National Library of Medicine.

National Kidney Foundation. (2023). Chronic Kidney Disease . National Kidney Foundation.

Nazim, R., & Nazim, R. (2024). Clinical and etiological profile of chronic kidney disease patients: A study in a tertiary care hospital in Bangladesh. International Journal of Nephrology Research, 6(1), 42–46. https://doi.org/10.33545/26646692.2024.v6.i1a.15

Ortiz, A., Mattace-Raso, F., Soler, M. J., & Fouque, D. (2022). Ageing meets kidney disease. In Clinical Kidney Journal (Vol. 15, Issue 10, pp. 1793–1796). Oxford University Press. https://doi.org/10.1093/ckj/sfac151

Patel, P., & Shah, S. (2021). A Comparison of Effect of Semi Fowler's and Side Lying Position on Pulmonary Functions and Oxygen Saturation in Bedridden Patients. International Journal of Health Sciences and Research, 11(5), 53–57. https://doi.org/10.52403/ijhsr.20210507

Prajapati, A., Kushwaha, P., & Mishra, P. S. (2024). Assessing the Effectiveness of Lateral and Semi Fowler's Position on Selected Patients Admitted with Respiratory Problems in Different Hospitals. Nursing & Healthcare International Journal, 8(1). https://doi.org/10.23880/nhij-16000301

Sabhan, S. I., & Al-Jawadi, Z. A. M. (2025). Assessment of erythropoietin deficiency and its biochemical correlates in chronic kidney disease in Iraqi patients. Health Biotechnology and Biopharma, 9(3), 99–109. https://doi.org/10.22034/HBB.2025.31

Sawdon, M., & Kirkman, E. (2023). Capillary dynamics and the interstitial fluid–lymphatic system. In Anaesthesia and Intensive Care Medicine (Vol. 24, Issue 5, pp. 291–297). Elsevier Ltd. https://doi.org/10.1016/j.mpaic.2023.01.008

Teuwafeu, D. G., Fonyuy, V. F., Bandolo, N. V., Mahamat, M., Nkoke, C., Fouda Menye, H., & Halle, M. P. (2025). Prevalence and determinants of thirst distress amongst patients on maintenance haemodialysis. BMC Nephrology, 26(1). https://doi.org/10.1186/s12882-025-04369-9

Wang, C. H., Negoianu, D., Zhang, H., Casper, S., Hsu, J. Y., Kotanko, P., Raimann, J., & Dember, L. M. (2023). Dynamics of Plasma Refill Rate and Intradialytic Hypotension during Hemodialysis: Retrospective Cohort Study with Causal Methodology. Kidney360, 4(4), E505–E514. https://doi.org/10.34067/KID.0000000000000082

Wang, X., Tang, R., Zhang, H., Li, F., Wang, J., & Li, B. (2023). What Frequency of Ankle Pump Exercise is Optimal to Improve Lower Limb Hemodynamics? A Systematic Review and Network Meta-analysis. In Asian Nursing Research (Vol. 17, Issue 2, pp. 53–60). Korean Society of Nursing Science. https://doi.org/10.1016/j.anr.2023.03.001

Author Contributions

AGNF: conducted the case study, collected and analyzed the data, and drafted the initial manuscript. **RR:** supervised the research process, contributed to the study design, provided critical revisions, and reviewed the manuscript for intellectual content. **LL & MM:** contributed to data interpretation, clinical nursing perspectives, and manuscript refinement. All authors read and approved the final version of the manuscript.

Acknowledgments

The authors would like to thank Dr. Soebandi Hospital, Jember, Indonesia and the elderly participants for their cooperation in this study, as well as the Faculty of Nursing, University of Jember, for its academic support.

Ethics Statement

This case report was conducted in accordance with ethical standards and the principles of the Declaration of Helsinki. Written informed consent was obtained from the patient prior to data collection and for the publication of this case report. The patient was informed about the purpose, procedures, potential benefits, and confidentiality of the study. No identifying personal information is disclosed in this report.

Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this case report.

Data Availability Statement

All data generated or analysed during this study are included within this published article. Further details are available from the corresponding author upon reasonable request, subject to patient confidentiality considerations.