Jurnal Ilmiah Ners Indonesia
https://doi.org/10.22437/jini.v7i1.53137
Volume 7, Issue 1, May 2026, p. 11-18

p-ISSN: 2722-922x
e-ISSN: 2722-9211

Application of Combined Ankle Pump Exercise and 30° Leg Elevation in Nursing Care to Reduce Leg Edema in a Patient with Chronic Kidney Disease : Case Report

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Received: 28 January 2026; Revised: 23 May 2026; Accepted: 30 May 2026

Abstract

Chronic kidney disease (CKD) is a global health problem with multifactorial etiologies that may clinically manifest as leg edema, affecting patient comfort and mobility. Although pharmacological and non-pharmacological therapies can be administered simultaneously, evidence regarding the application of combined ankle pump exercise and 30° leg elevation in nursing care for edema reduction in CKD patients remains limited. To analyze nursing care through the application of combined ankle pump exercise and 30° leg elevation therapy to reduce leg edema in a patient with CKD. This study employed a case report design involving a CKD patient with bilateral leg edema. Nursing interventions consisted of a combination of ankle pump exercise and 30° leg elevation administered twice daily for 8 minutes per session, accompanied by furosemide therapy. Edema was assessed through daily observation of edema grading. A reduction in edema level was observed, with the left leg showing improvement on the third day and the right leg on the fourth day, decreasing from grade II to grade I edema. The application of combined ankle pump exercise and 30° leg elevation, accompanied by furosemide administration, demonstrated a reduction in the degree of leg edema in a patient with CKD. However, further studies using larger samples and controlled study designs are needed to confirm the effectiveness and generalizability of this intervention in clinical nursing practice.

Keywords: *Ankle pump exercise; Chronic kidney disease; Edema; 30° leg elevation*

Background

Chronic Kidney Disease (CKD) is a global health problem caused by abnormalities in the structure or function of the kidneys in maintaining metabolism and fluid and electrolyte balance (Gutierrez & Yau, 2025). This causes a disturbance in the glomerular filtration rate (GFR) or a decline in kidney function, which prevents the kidneys from removing metabolic waste products and disrupts endocrine, electrolyte, and acid-base metabolic functions. Chronic Kidney Disease (CKD) is a global problem with an increasing prevalence. According to Global Burden of Disease Study, the the prevalence of CKD in 2023 was 788 million cases. This represents an increase of 161 million cases compared to 2013 (Mark et al., 2025). According to the Vaidya & Aeddula (2025), CKD is the 10th leading cause of death worldwide, with a total of 55.4 million cases globally

CKD has various multifactorial etiologies that are interrelated and can manifest clinically as edema in various parts of the patient's body (Takase et al., 2022). Edema is a medical term that means swelling due to fluid trapped in body tissues or interstitial spaces (Sitanggang et al., 2024). Edema can be caused by exudate or infection and transudate or non-infection edema. Edema is one of the most common clinical manifestations of other clinical manifestations in patients with advanced CKD (Guo et al., 2023). These clinical manifestations can cause discomfort that can affect the quality of life of CKD patients (Maulidiyah et al., 2024).

Edema is classified into 4 types, namely grade I edema with a depth of 1-3 mm and a return time of 3 seconds, grade II edema with a depth of 3-5 mm and a return time of < 15 seconds, grade III edema with a depth of 5-7 mm and a return time of 15-60 seconds, and grade IV edema with a depth of 7-8 mm and a return time of 2-5 minutes (Dina et al., 2024).

The management of CKD patients consists of pharmacological and non-pharmacological therapies that can be carried out simultaneously (Ballegaard et al., 2024). The combination of ankle pump exercise and 30° leg elevation has been found to be effective in reducing edema (Nursanti et al., 2024). Ankle pump exercise is an exercise that involves flexion and extension movements of the legs to increase blood circulation (Kartikasari et al., 2024). This is an effort to reduce edema in the lower extremities due to the pumping effect of the muscles. The movements in this exercise force extracellular fluid into the blood vessels, making it easier for it to return to the heart. When the muscles contract strongly, the veins are compressed, pushing the edema fluid into the circulatory system (Noor et al., 2023). A 30° leg elevation is a movement that raises the legs using gravity to increase venous return and reduce pressure on the blood vessels. The purpose of leg elevation is to reduce pressure on the veins and increase return flow, which is expected to reduce edema during leg elevation (Sari & Rahmania, 2025).

However, despite growing evidence regarding the effectiveness of ankle pump exercise and leg elevation in managing edema, studies specifically examining the combined application of these interventions in patients with CKD remain limited, particularly within the context of nursing care. Existing studies have predominantly focused on single interventions or different patient populations, leaving insufficient evidence regarding the clinical application and potential benefits of combining ankle pump exercise with 30° leg elevation in CKD-related edema management. Therefore, this case report aims to describe the application of a combination of ankle pump exercise and 30° leg elevation as part of nursing care to reduce leg edema in a patient with CKD.

Methods

Study Design and Case Selection

This study employed a case report design, focusing on a single case to provide an in-depth analysis of the nursing intervention. The patient was selected based on a set of predetermined inclusion and exclusion criteria. The inclusion criteria required that the patient be hospitalized in the medical ward, be an adult diagnosed with CKD with or without other comorbid conditions, and remain conscious to follow the prescribed interventions. Additionally, the patient had to present with lower extremity edema and be on prolonged bed rest or immobilization. The exclusion criteria included the presence of pain in both lower

extremities or diabetic ulcers on both lower extremities. Only patients who met all inclusion criteria and none of the exclusion criteria were enrolled in this case report.

Data Collection

Data collection was obtained from two sources: primary data (direct observation, physical examination, and interviews with the patient) and secondary data (medical records and nursing documentation). Data were collected before and after the intervention period.

Intervention Procedure

The intervention was carried out in accordance with the Standard Operating Procedure (SOP) for ankle pump exercises combined with 30° leg elevation. The intervention was administered over five consecutive days, with a frequency of twice per day. Each session lasted 8 minutes, consisting of 3 minutes of leg elevation, followed by 2 minutes of rest, and then another 3 minutes of leg elevation. During the ankle pump exercise, the patient performed dorsiflexion and plantar flexion techniques, holding each movement for 3–4 seconds per cycle.

Instrumentation

The instrument used to assess the degree of edema was a pitting edema observation sheet. Edema severity was graded according to the standard pitting edema scale (grade 1–4).

Data Analysis

The collected data were analyzed quantitatively using univariate analysis. This analysis was conducted descriptively to characterize the variables under study and to determine the demographic and clinical characteristics of the research subject, including changes in edema grade before and after the intervention.

Ethical Considerations

Prior to data collection, the patient was provided with a detailed explanation of the study's purpose, procedures, potential benefits, and risks. Written informed consent was obtained from the patient voluntarily before any intervention was initiated. The patient was assured of the right to withdraw from the study at any time without any consequence to their medical care. Confidentiality of the patient's medical information and personal data was strictly maintained throughout the study.

Result

Case Description

This study is based on the case of Mr. M, a 60-year-old patient with a medical diagnosis of Stage V Chronic Kidney Disease (CKD), hypertension, and heart failure. During the assessment conducted on March 24, 2025, the following clinical findings were obtained: blood pressure 160/90 mmHg, heart rate 122 beats per minute (weak pulse), respiratory rate 22 breaths per minute, SpO2 99% on a simple mask at 8 L/minute, body temperature 37.6°C, cold extremities, decreased skin turgor, capillary refill time (CRT) > 2 seconds, and oliguria (100 cc/24 hours). The patient reported shortness of breath, a sensation of fullness in the stomach, and swelling in both lower extremities, which felt heavy upon movement. Physical

examination revealed pitting edema graded as 2 (3–5 mm). Total fluid input derived from intravenous therapy (infusion and injection), oral intake, and metabolic water was 1640 cc/24 hours, while total output from urine, feces, and insensible water loss (IWL) was 1120 cc/24 hours, resulting in a positive fluid balance of +520 cc/24 hours. The primary nursing diagnosis established was hypervolemia due to impaired regulatory mechanisms, as evidenced by dyspnea, peripheral edema, grade 2 pitting edema, decreased skin turgor (CRT > 2 seconds), decreased hemoglobin levels, oliguria, and positive fluid balance. Accordingly, nursing interventions were developed based on this diagnosis, specifically hypervolemia management combined with ankle pump exercises.

Application of a Combination of Ankle Pump Exercise and 30° Leg Elevation

The intervention, consisting of ankle pump exercises combined with 30° leg elevation, was administered twice daily over five consecutive days. The degree of pitting edema was assessed bilaterally before and after each session using three parameters: edema grade (I–IV), return time (seconds), and depth (millimeters). Data collected from the right leg are presented in Table 1, while data from the left leg are presented in Table 2.

As shown in Table 1 (right leg) and Table 2 (left leg), on the first day of intervention (March 24, 2025), both legs exhibited grade II edema with a depth of 5 mm and a return time of approximately 13–14 seconds pre-intervention. Following the initial intervention sessions, minimal changes were observed, with return time decreasing slightly to 12–13 seconds, while depth remained at 5 mm on both legs. By the second day (March 25, 2025), a gradual reduction in return time began to appear bilaterally. Specifically, Table 1 shows that post-intervention return time on the right leg decreased to 11–12 seconds, while Table 2 indicates that the left leg demonstrated a depth reduction to 4 mm in the afternoon session.

Notable improvements became evident from the third day onward. On March 26, 2025, as detailed in Table 1 and Table 2, both legs showed a reduction in edema depth from 4 mm to 3 mm post-intervention, accompanied by a decrease in return time to 10–11 seconds. By March 27, 2025, Table 1 demonstrates that the right leg improved from grade II to grade I edema in the afternoon session, with return time dropping to 9–11 seconds and depth reducing to 2–3 mm. Similarly, Table 2 reveals that the left leg also progressed from grade II to grade I following the afternoon session. On the final day (March 28, 2025), both Table 1 and Table 2 consistently show grade I edema on both legs, with return times ranging from 6 to 7 seconds and a stable depth of 2 mm. These findings indicate a progressive reduction in pitting edema severity bilaterally over the five-day intervention period, suggesting that the combined ankle pump exercise and leg elevation protocol may be effective in managing lower extremity edema in patients with hypervolemia secondary to CKD and heart failure.

Table 1. The change of the Degree of Edema on The Right Leg

Date	Time	Pre-Intervention application			Post-Intervention application		
		Degree	Return Time	Depth	Degree	Return Time	Depth

24/3/25	10.00 13.00	II II	14 second 13 second	5 mm 5 mm	II II	13 second 12 second	5 mm 5 mm
25/3/25	10.00 13.00	II II	13 second 12 second	5 mm 5 mm	II II	12 second 11 second	5 mm 4 mm
26/3/25	10.00 13.00	II II	12 second 11 second	4 mm 4 mm	II II	11 second 10 second	3 mm 3 mm
27/3/25	15.00 19.00	II I	11 second 9 second	3 mm 2 mm	I I	9 second 8 second	2 mm 2 mm
28/3/25	15.00 19.00	I I	8 second 6 second	2 mm 2 mm	I I	7 second 6 second	2 mm 2 mm

Table 2. The Change of the Degree of Edema on The Left Leg

Date	Time	Pre-Intervention application			Post-Intervention application		
		Degree	Return Time	Depth	Degree	Return Time	Depth
24/3/25	10.00 13.00	II II	14 second 13 second	5 mm 5 mm	II II	13 second 12 second	5 mm 5 mm
25/3/25	10.00 13.00	II II	13 second 12 second	5 mm 5 mm	II II	12 second 11 second	5 mm 4 mm
26/3/25	10.00 13.00	II II	12 second 11 second	4 mm 3 mm	II I	11 second 9 second	3 mm 2 mm
27/3/25	15.00 19.00	I I	9 second 8 second	2 mm 2 mm	I I	8 second 7 second	2 mm 2 mm
28/3/25	15.00 19.00	I I	7 second 7 second	2 mm 2 mm	I I	6 second 5 second	2 mm 2 mm

Discussion

The combination of ankle pump exercise and 30° elevation therapy is considered simple and easy for patients to implement. This therapy was administered to Mr. M for 5 days, twice daily for 8 minutes per session (3 minutes of combined therapy, 2 minutes of rest, 3 minutes of combined therapy) using the dorsiflexion and plantar flexion technique for 3-4 seconds per cycle (Mardova et al., 2025; Wang et al., 2023). The combination of ankle pump exercise and 30° leg elevation reduces capillary hydrostatic pressure, thereby improving venous and lymphatic blood flow (Gusty et al., 2025).

The implementation of this combined therapy on Mr. M showed different progression patterns between the right and left legs. Specifically, edema in the left leg decreased earlier than in the right leg. According to Gasparis et al. (2020), the difference in the degree or asymmetry of edema is related to differences in vascular conditions and lymphatic structure in each right and left leg. This is also in line with Kasron & Susilawati (2024), who state that asymmetrical edema between the right

and left legs is associated with blood vessels in the distal area. Their article further notes that the non-dominant limb (left) tends to experience a more rapid reduction in edema because its blood vessels dilate more easily during leg elevation.

The intervention was continued for 5 consecutive days. The final results showed a decrease in edema in the right leg from grade II to grade I with a depth of 2 mm and a return time of 6 seconds. Meanwhile, the degree of edema in the left leg decreased to grade I with a depth of 2 mm and a return time of 5 seconds. These results were observed or monitored 30 minutes before and after implementation. This is in accordance with the study by Arynanda et al. (2025), who reported that the effects of combined ankle pump exercise and 30° leg elevation therapy can be measured at least 30 minutes after administration.

It is important to note that Mr. M received pharmacological and non-pharmacological therapies simultaneously. In addition to the combined intervention of ankle pump exercise and 30° leg elevation therapy, Mr. M also received diuretic therapy, namely furosemide 3 × 20 mg intravenously. Furosemide works by reducing sodium (Na^+) reabsorption in the renal tubules, thereby increasing sodium and water excretion in the urine (Oh & Han, 2015). Intravenous furosemide acts rapidly to promote sodium excretion, with a maximum effect occurring during the first 1–2 hours, followed by a gradual decline. Furosemide therapy represents a confounding factor in this study because the observed reduction in edema may have been partially attributable to its pharmacological effects, introducing potential bias as the outcomes were not solely due to ankle pump exercise and 30° leg elevation therapy.

The results of this case report are consistent with previous findings. A case study by Gusty et al. (2025) on CKD patients regarding the combination of ankle pump exercise and 30° leg elevation therapy, which showed that this combination of therapies was effective in reducing the degree of edema in CKD patients from grade III to grade II. Research by Arynanda et al. (2025), also supports that this combined therapy provides effective results in reducing edema among CKD patients, with the majority experiencing a two-grade reduction. A similar study by Mardova et al. (2025) concluded that the combination of ankle pump exercise and 30° leg elevation therapy conducted for three days with a duration of 8 minutes per session is effective in reducing leg edema in CKD patients. However, the optimal effectiveness of the intervention may be influenced by age and history of comorbid conditions.

This study has several strengths, including a standardized intervention protocol (8 minutes twice daily for five days, dorsiflexion/plantar flexion, 30° leg elevation), systematic bilateral data collection, and a non-invasive, low-cost approach suitable for resource-limited settings. However, limitations include the single-case design, which limits generalizability; the concurrent use of intravenous furosemide as a confounding variable; the absence of a control group and long-term follow-up; reliance on the subjective pitting edema scale without objective measurements; and the lack of formal assessment of patient compliance or discomfort. Despite these limitations, the methodological transparency supports future replication studies with larger samples and controlled designs.

Conclusion

In summary, Mr. M, a patient with Chronic Kidney Disease (CKD), presented with hypervolemia, which necessitated the development of hypervolemia management interventions combined with ankle pump exercise and 30° leg elevation therapy. The implementation of this evidence-based nursing intervention, supported by furosemide therapy, resulted in a reduction in edema from grade II to grade I. Nevertheless, further studies employing larger sample sizes and controlled study designs are required to confirm the effectiveness and generalizability of this intervention in clinical nursing practice.

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