

Case Study: Nursing Care for a Patient with CHF and Ineffective Peripheral Perfusion Through Passive Range of Motion (ROM) Interventions for the Lower Extremities Combined with 30° Leg Elevation in the Intensive Cardiac Care Unit (ICCU) at Jakarta Cempaka Putih Islamic Hospital

Mufti Ibrahim¹, Auliya Zahwarani¹, Ayu Mulyo Puspa Chelseati¹, Erwan Setyono^{1*}

¹Universitas Muhammadiyah Jakarta, Jakarta Pusat, Indonesia

Article Info

Keywords :

ABI (Ankle-Brachial Index), CHF (Congestive Heart Failure), Elevation of the Legs, Passive Range of Motion, Ineffective Peripheral Perfusion

Corresponding Author :

Erwan Setyono

E-mail :

setiyonoerwan80@gmail.com

Phone Number : 085211818882

ABSTRACT

Background & Objective: The high incidence of CHF is inseparable from various etiological factors, one of which is valvular heart disease. Valvular heart disease, whether in the form of stenosis or regurgitation, can lead to disturbances in blood flow and a chronic increase in cardiac workload. In Indonesia, valvular heart disease remains a significant problem, particularly rheumatic heart disease, which is commonly found among individuals in the productive age group. One of the interventions that can be provided is passive ROM (Range of Motion) exercises on the lower extremities combined with 30° leg elevation. This final scientific paper aims to determine the effectiveness of passive ROM exercises on the lower extremities combined with 30° leg elevation in patients with CHF. **Method:** A case study was conducted using a nursing care approach that included assessment, determination of nursing diagnoses, planning, implementation, and evaluation for a patient with CHF (Mrs. M) who was treated in the ICCU of Jakarta Islamic Hospital Cempaka Putih. The intervention of passive ROM (Range of Motion) exercises on the lower extremities combined with 30° leg elevation was administered once daily for three consecutive days to monitor the patient's peripheral circulation using the Ankle Brachial Index (ABI) as an indicator. **Result:** The passive ROM intervention administered over three days resulted in improvements in ABI values, increased peripheral pulses, shortened capillary refill time (CRT), warm extremities, reduced muscle weakness, and

decreased peripheral edema. **Conclusion:** Passive ROM exercises of the lower extremities combined with 30° leg elevation are effective nursing interventions for improving ABI values, peripheral pulses, capillary refill time (CRT), extremity warmth, muscle weakness, and peripheral edema in patients with CHF. Consistent application of passive ROM interventions to the lower extremities can support the rehabilitation process.

DOI: <https://doi.org/10.56359/igj.v5i3.1091>

 This work is licensed under a [Creative Commons Attribution 4.0 International License](https://creativecommons.org/licenses/by/4.0/)

Introduction

Congestive Heart Failure (CHF) is a clinical syndrome caused by the heart's inability to pump blood adequately to meet the body's metabolic needs. This condition is triggered by myocardial damage, which results in a decrease in cardiac output and stroke volume, thereby activating neurohormonal compensatory mechanisms. In patients with unstable CHF, intensive management in a specialized care unit, such as an Intensive Cardiac Care Unit (ICCU), is required. This includes close monitoring and comprehensive interventions to prevent the progression of organ failure. Globally, CHF is a leading cause of morbidity and mortality in many countries. In 2020, approximately 6.2 million people in the United States were diagnosed with CHF, resulting in 379,800 deaths.

This prevalence is projected to continue rising through 2030 (American Heart Association, 2020). In Southeast Asia, CHF-related mortality ranks third highest after Africa and India. Indonesia itself ranks third in Southeast Asia with the highest mortality rate from cardiovascular disease, following Laos and the Philippines. Based on data from the 2018 Basic Health Research (Riskesdas), the prevalence of CHF in Indonesia reached approximately 2,784,064 people and has shown an upward trend every year (Riskesdas, 2018). This high incidence is linked to various etiological factors, including valvular heart disease, hypertension, and rheumatic heart disease, which are still prevalent among the working-age population.

One of the critical clinical manifestations in CHF patients is ineffective peripheral perfusion. This condition results from reduced cardiac output, leading to hemodynamic disturbances characterized by lower extremity edema, cold extremities, prolonged capillary refill time, and decreased peripheral pulse strength. Impaired peripheral perfusion not only serves as an indicator of disease severity but also poses a risk of serious complications, such as cardiogenic shock and respiratory failure. According to the Indonesian Nursing Outcome Standards (SLKI), the expected outcomes of interventions for ineffective peripheral perfusion include an increase in peripheral pulse rate, improved skin color, improved capillary refill, and improved acral and skin turgor.

There are two nursing interventions proven to be effective, safe, and easy to apply in bedridden CHF patients: a combination of passive Range of Motion (ROM) exercises for the lower extremities and 30° leg elevation. Passive ROM acts as an artificial muscle pump that stimulates venous return through joint movement in the musculoskeletal system, thereby helping to return blood to the heart and reduce edema in the lower extremities. Meanwhile, 30° elevation utilizes the principle of gravity to facilitate blood and lymphatic circulation from the legs. A study conducted

by Baskara et al. (2024) demonstrated that the combination of these two interventions over two consecutive days significantly improved Ankle-Brachial Index (ABI) values.

On the first day, the ABI value for the right lower extremity increased from 0.92 to 0.95 and for the left from 0.95 to 0.99. On the second day, a more significant improvement occurred. The right ABI value reached 1.11 and the left reached 1.12, both within the normal range (1.0–1.4). These results indicate effective improvement in peripheral perfusion. Although this intervention has been proven effective, in daily nursing practice in the ICCU, the administration of passive range of motion (ROM) exercises and 30° leg elevation are often not implemented by nurses. Meanwhile, optimizing tissue perfusion is crucial for preventing further complications in patients with CHF. Based on this discussion, the author is interested in conducting a case study on nursing care for CHF patients with ineffective peripheral perfusion in the ICCU at Jakarta Cempaka Putih Islamic Hospital. This case study focuses on the application of passive ROM interventions for the lower extremities combined with 30° leg elevation.

Objective

The purpose of this case study is to determine the effectiveness of passive range of motion (ROM) therapy for the lower extremities combined with 30° leg elevation in the Intensive Cardiac Care Unit (ICCU) at Jakarta Cempaka Putih Islamic Hospital.

Method

This case study was conducted in the Intensive Cardiac Care Unit (ICCU) at a hospital in Central Jakarta. The study focused on a single patient to determine whether there were changes in peripheral perfusion following a passive range of motion (ROM) intervention combined with 30° leg elevation. Patients were selected based on the following criteria: (1) patients with a medical diagnosis of CHF (Congestive Heart Failure), (2) patients experiencing ineffective peripheral perfusion, (3) patients on days 1–3 of hospitalization, (4) patients who were alert and cooperative, and (5) patients who had been bedridden for a long time.

Data collection utilized several tools, including nursing assessment forms, a blood pressure monitor (sphygmomanometer), and a Doppler device to calculate the Ankle-Brachial Index (ABI), as well as equipment for monitoring vital signs. The ABI instrument was used to assess peripheral perfusion by comparing systolic blood pressure in the upper and lower extremities. Normal ABI values range from 1.0 to 1.4. In addition, an observation form was used to record changes in peripheral pulse, capillary refill time (CRT), acral temperature, skin color, muscle strength, and the degree of edema. Supporting data were obtained from the patients' medical records. Data collection was conducted using a case study approach involving interviews with patients and their families, direct observation, and a systematic physical examination of the patients.

Inclusion criteria:

- a) Patients diagnosed with CHF (Congestive Heart Failure)
- b) Experiencing impaired peripheral perfusion (decreased peripheral pulse, capillary refill time (CRT) > 3 seconds, cold acral temperature, pale skin color, decreased muscle strength, and degree of edema)
- c) Cooperative and able to follow instructions
- d) Willing to participate as a subject (informed consent)

Research Variables

- a) Independent variable: Passive Range of Motion (ROM) therapy for the lower extremities combined with 30° leg elevation
- b) Dependent variable: Ineffective peripheral perfusion

Research Instruments

- a) Sphygmomanometer: to measure blood pressure
- b) Observation sheet to record measurement results before and after the intervention

Research Procedure

- 1) Obtain informed consent from the patient and family regarding the proposed procedure
- 2) Prepare the equipment (sphygmomanometer and observation sheet)
- 3) Position the patient in the semi-Fowler's position
- 4) Measure blood pressure in the upper and lower extremities
- 5) Calculate the systolic blood pressure of the right and left lower and upper extremities (ABI calculation)
- 6) Perform passive range of motion (ROM) therapy on the lower extremities (starting from the hip joint down to the toes, including flexion, extension, abduction, adduction, internal rotation, external rotation, dorsiflexion, plantar flexion, eversion, and inversion)
- 7) Wait 5 minutes, then elevate the legs by raising the bed section supporting the patient's lower extremities to a 30° angle for 5–10 minutes
- 8) Monitor the patient's condition; stop the exercise if the patient's condition worsens
- 9) Then recalculate the ABI by measuring blood pressure in the upper and lower extremities and adding the systolic readings from the lower and upper extremities
- 10) Document the results of the intervention
- 11) The exercise is performed for 3 consecutive days

Results

The patient, Mrs. M, a 52-year-old woman, was brought to the Emergency Department by her child after falling on the porch of her home. The family reported that prior to the fall, the patient had frequently complained of shortness of breath that occurred not only during physical activity but also while at rest. The patient also frequently experienced very rapid heart palpitations that would wake her from sleep at night. Another highly bothersome complaint was swelling in both legs, which felt increasingly severe day by day, accompanied by pain upon movement and frequent tingling. Her past medical history indicated that the patient had a heart valve disorder that she had been living with for the past 15 years. Plans for valve repair surgery had actually been in place but were never carried out due to financial constraints.

Based on a physical examination conducted on January 16, 2026, the patient was alert and oriented. Vital signs showed a blood pressure of 88/57 mmHg, a pulse rate of 120 beats per minute (tachycardia), a respiratory rate of 23 breaths per minute, a body temperature of 36.5°C, and an oxygen saturation of 98%. The physical examination revealed significant differences between the upper and lower extremities. In the upper extremities, no edema was found, but the extremities felt cold to the touch. Meanwhile, in the lower extremities, grade 3 pitting edema was found in both legs,

the extremities felt cold to the touch, capillary refill time (CRT) was prolonged to more than 3 seconds (5 seconds), the dorsalis pedis pulse was weak, and muscle strength was reduced to a grade 3. Calculation of the Ankle-Brachial Index (ABI) revealed values below normal: 0.92 in the right extremity and 0.96 in the left extremity.

Laboratory test results revealed an electrolyte imbalance in the form of hyponatremia with a sodium level of 129 mEq/L. An echocardiogram provided a more detailed picture, showing dilation of the right atrium (RA), left atrium (LA), and right ventricle (RV). In addition, valvular abnormalities were identified, including moderate mitral stenosis (MS Moderate) and moderate tricuspid regurgitation (TR Moderate), accompanied by pulmonary hypertension. Meanwhile, the ECG (electrocardiogram) results showed atrial fibrillation with tachycardia.

The established nursing diagnosis was ineffective peripheral perfusion related to decreased arterial and/or venous flow. Interventions focused on the patient's peripheral perfusion—specifically, to increase peripheral pulses, ensure warm extremities, prevent pallor, achieve a capillary refill time (CRT) of <3 seconds, improve muscle strength, and reduce edema—through passive range of motion (ROM) therapy for the lower extremities combined with 30° leg elevation.

Passive range of motion (ROM) therapy for the lower extremities combined with 30° leg elevation was selected as a nonpharmacological intervention aimed at preventing contractures and maintaining joint flexibility, improving local circulation and tissue perfusion, preventing complications of immobilization, enhancing comfort, increasing venous return, reducing capillary pressure, and improving microcirculation. The therapy was administered for three consecutive days. During the therapy, the patient was assisted; the passive ROM procedure involved the patient moving their lower extremities according to the passive ROM movements, followed by leg elevation to a 30° angle. After the passive ROM procedure was completed, a 5-minute break was given so the patient could rest while their condition was monitored, followed by continued leg elevation to 30°.

On the first day of passive ROM therapy, the peripheral pulse was still weak, the extremities felt cold, CRT > 3 seconds, and lower extremity muscle strength was 3333/3333. Changes in the ABI (Ankle-Brachial Index) values were observed: the right extremity's ABI increased from 0.92 to 0.95, and the left extremity's ABI increased from 0.95 to 0.98. Although the ABI values had not yet reached normal levels on the first day, an improvement was observed; meanwhile, following the implementation of 30° leg elevation, edema was still classified as grade 3, indicating that reducing the edema would take a long time.

On the second day, an evaluation of the passive ROM implementation revealed a moderately palpable peripheral pulse, warm extremities (36.5°C), a capillary refill time (CRT) of >3 seconds, and muscle strength of 3333/3333; these second-day results showed improvements in peripheral pulse and temperature. In addition, there was an increase in the ABI value in the right extremity, from an initial 0.97 to 1.03, and in the left extremity, from an initial 0.98 to 0.98; followed on the third day by a further increase in ABI values after intervention: the right extremity rose from 1.01 to 1.03, and the left extremity from 0.99 to 1.01. This indicates a favorable improvement, with values now within the normal ABI range (1.0–1.4). As for the implementation of 30° leg elevation, on the second day there was a reduction in subjective complaints related to edema, with the patient reporting that her legs felt warmer, could be moved, and

the tingling sensation had disappeared, although the objective degree of edema remained at grade 3.

On the third day, evaluation of the passive range of motion (ROM) revealed moderate peripheral pulses, warm extremities (36.6°C), a capillary refill time (CRT) of >3 seconds, and muscle strength of 4444/4444; these third-day results showed improvements in both temperature and muscle strength. In addition, there was an increase in the ABI value in the right extremity, from an initial 1.01 to 1.03, and in the left extremity, from an initial 0.99 to 1.01. This indicates a favorable improvement and that the ABI values have reached the normal range (1.0–1.4). As for the implementation of 30° leg elevation, there was an objective reduction in the degree of edema. The evaluation results confirmed that this target was achieved, with edema decreasing from grade 3 to grade 2. The patient also reported that the condition of her legs had improved and that she was no longer experiencing pain.

Thus, this nursing evaluation concludes that the implementation of passive range of motion (ROM) exercises for the lower extremities, combined with 30° leg elevation, is effective in improving the ABI value, reducing skin discoloration, increasing peripheral pulse, improving muscle strength, and reducing the degree of edema.

TABLE 1. Changes in Ankle-Brachial Index (ABI) Values

Day	Measurement Time	Right Limb	Left Limb	Notes
1.	Pre	0.92	0.96	Below normal
	Post	0.95	0.98	Below normal
2.	Pre	0.97	0.98	Below normal
	Post	1.03	0.98	Normal (right)
3.	Pre	1.03	1.01	Normal
	Post	1.03	1.01	Normal

TABLE 2. Changes in Capillary Refill Time (CRT)

Day	Measurement Time	Result (seconds)	Notes
1.	Pre	>3 seconds (5 seconds)	Elongated
	Post	>3 seconds (5 seconds)	Elongated
2.	Pre	>3 seconds (4 seconds)	Elongated
	Post	>3 seconds (4 seconds)	Elongated
3.	Pre	>3 seconds (5 seconds)	Elongated
	Post	>3 seconds (4 seconds)	Elongated

TABLE 3. Changes in Acral Temperature

Day	Measurement Time	Result	Notes
1.	Pre	Cold	Poor perfusion
	Post	Cold	Poor perfusion
2.	Pre	Starting to get warm	Improvement
	Post	Warm	Improvement
3.	Pre	Warm	Improvement
	Post	Warm	Improvement

TABLE 4. Changes in the Degree of Edema

Day	Measurement Time	Degree of Edema	Depth of Pitting	Notes
1.	Pre	3	5-6 mm	Severe edema
	Post	3	5-6 mm	Severe edema
2.	Pre	3	5-6 mm	Severe edema
	Post	3	5-6 mm	Severe edema
3.	Pre	2	3-4 mm	Moderate edema
	Post	2	3-4 mm	Moderate edema

TABLE 5. Changes in Muscle Strength

Day	Measurement Time	Result	Notes
1.	Pre	3	Fighting gravity, not resistance
	Post	3	Fighting gravity, not resistance
2.	Pre	3	Fighting gravity, not resistance
	Post	3	Fighting gravity, not resistance
3.	Pre	4	Fighting gravity, light resistance
	Post	4	Fighting gravity, light resistance

Discussion

Patient Mrs. M, age 52, was admitted to the ICCU with a medical diagnosis of congestive heart failure (CHF) due to valvular heart disease (mitral stenosis and tricuspid regurgitation). The patient has a history of valvular disease dating back 15 years and was scheduled for surgery but was unable to proceed due to financial constraints. This aligns with the literature, which states that in Indonesia, rheumatic heart valve disease remains a significant problem and often requires high costs for definitive management, thereby preventing patients from receiving optimal care (Marijon et al., 2020).

CHF is defined as a complex clinical syndrome resulting from structural and/or functional heart abnormalities that cause the ventricles to be unable to pump blood adequately to meet the body's metabolic needs (Bozkurt et al., 2021). In Mrs. M's case, valvular heart disease (MS and TR) was the primary cause of heart failure. Mitral stenosis caused increased pressure in the left atrium, which was then transmitted to the pulmonary circulation, while tricuspid regurgitation caused volume overload in the right ventricle. This condition triggers activation of the neurohormonal system and fluid retention, which ultimately manifests as peripheral edema, dyspnea, and fatigue—consistent with the clinical symptoms observed in the patient (Bozkurt et al., 2021; Heidenreich et al., 2022).

The patient's echocardiogram results showed dilation of the RA, LA, and RV, as well as moderate TR with pulmonary hypertension. These findings confirm that chronic volume overload in the right heart chambers has led to right-sided heart failure. The increase in systemic venous pressure resulting from right-sided heart failure is the primary cause of the patient's peripheral edema. Elevated hydrostatic pressure in the lower extremity capillaries forces fluid out of the intravascular space into the interstitial space, leading to the formation of pitting edema (Abassi et al., 2022). This condition is exacerbated by a reduced cardiac output, which causes peripheral vasoconstriction and decreased tissue perfusion—clinically manifested as cold extremities, a capillary refill time (CRT) >3 seconds, and decreased peripheral pulse strength.

The primary nursing intervention focused on Mrs. M was to provide a combination of passive range of motion (ROM) exercises for the lower extremities and

30° leg elevation to address the issue of ineffective peripheral perfusion. Passive range of motion (ROM) is an exercise that moves a joint through its full range of motion without involving active muscle contraction by the patient, aimed at maintaining joint flexibility and improving local circulation (Daulay & Hidayah, 2021). Meanwhile, 30° leg elevation is a non-pharmacological intervention that utilizes the principle of gravity to increase venous return to the heart and reduce hydrostatic pressure in the peripheral veins (Mayusef Sukmana, 2024).

Passive range-of-motion (ROM) movements, such as flexion-extension of the ankle and knee, stimulate an artificial muscle pump. The resulting passive contraction and relaxation of the calf muscles compress the deep veins, thereby propelling blood toward the heart. This helps reduce blood stasis in the veins and prevents further edema formation. This process also stimulates the release of vasodilator mediators such as nitric oxide (NO) from the vascular endothelium, which can increase the diameter of arterioles and improve microcirculation (Astriani et al., 2022; Salti et al., 2025). Meanwhile, elevating the legs by 30° utilizes gravity to facilitate venous return by positioning the legs higher than the heart; this reduces hydrostatic pressure in the peripheral veins, making it easier for interstitial fluid to return to the circulation (reabsorption). This reduction in hydrostatic pressure directly contributes to the reduction of edema (Naura et al., 2024). Increased venous return also means an increase in the volume of blood returning to the heart (preload), which can ultimately help increase cardiac output.

Evaluation results showed a significant and progressive improvement in peripheral perfusion parameters after three days of intervention. Ankle-Brachial Index (ABI) values increased consistently each day. On the first day, the right ABI was 0.92 and the left was 0.96 (below normal). After the intervention, the values increased to 0.95 (right) and 0.98 (left). On the second day, the pre-intervention values were 0.97 (right) and 0.98 (left), and post-intervention, they were 1.03 (right) and 0.98 (left). Peaking on the third day, the ABI values reached 1.03 (right) and 1.01 (left), which fall within the normal range (1.0–1.4). This increase in ABI values indicates a significant improvement in peripheral hemodynamics. These results are consistent with the study by Baskara et al. (2024), which found a significant increase in ABI values of 0.08 ± 0.03 after three days of combined passive ROM and leg elevation intervention in patients with peripheral perfusion disorders.

In addition to the increase in ABI, improvements were also observed in other parameters. The extremities, which initially felt cold (temperature 35.6°C), gradually warmed up to 36.6°C by the third day; this change in temperature reflects the occurrence of peripheral vasodilation and increased blood flow to distal tissues. A study by Astriani et al. (2022) demonstrated that passive range of motion (ROM) can increase tissue oxygen saturation by stimulating nitric oxide (NO) production. Muscle strength also improved from a grade of 3 (able to resist gravity but not resistance) to a grade of 4 by the third day. This occurs because increased blood perfusion ensures sufficient oxygen and nutrient availability for neuromuscular function, while also helping to clear metabolic waste (Sari et al., 2019; Daulay & Hidayah, 2021). Peripheral edema showed an objective reduction on the third day, from grade 3 to grade 2, supported by a decrease in the patient's subjective complaints such as tingling and pain. This demonstrates the effectiveness of leg elevation in mobilizing interstitial fluid back into the central circulation (Naura et al., 2024).

The implementation of this intervention also took into account the patient's cardiovascular condition, as she had a history of heart disease and was in intensive care. Passive range of motion (ROM) exercises and leg elevation are safe interventions because they do not significantly increase the heart's workload. During the intervention, the patient's vital signs (blood pressure, pulse, and respiration) remained within tolerable limits and showed no adverse physiological responses, such as increased shortness of breath or chest pain. This is crucial to ensure that the non-pharmacological interventions administered do not worsen an already compromised cardiac condition.

Overall, the implementation of passive range of motion (ROM) exercises for the lower extremities combined with 30° leg elevation in Mrs. M's nursing care yielded positive results. This intervention proved effective in improving the ABI value, warming the extremities, increasing muscle strength, and reducing the degree of peripheral edema. This intervention is simple, safe, easy to implement, and requires no additional costs. The success of this intervention is closely tied to the support and motivation provided to the patient, as well as education for the family to enable them to continue independent exercises at home. Thus, passive ROM exercises and leg elevation can be incorporated as a key intervention in nursing practice standards to address peripheral perfusion issues in patients with CHF, both in the intensive care unit and as part of preparation for home care.

This case study has limitations regarding its research design and sample size. Therefore, it is hoped that future research will test the effectiveness of this intervention using a stronger research design (e.g., a quasi-experimental study or randomized controlled trial) and a larger sample size to generalize the findings.

Conclusion

The application of passive Range of Motion (ROM) interventions on the lower extremities, combined with 30° leg elevation, has been shown to be effective in improving peripheral perfusion in patients with Congestive Heart Failure (CHF). This intervention, administered for 10–15 minutes once daily for three consecutive days, demonstrated significant improvements in various clinical parameters. Evaluation results showed an increase in the Ankle-Brachial Index (ABI) to within the normal range (1.0–1.4), an improvement in acral temperature from cold to warm, a reduction in the degree of peripheral edema, and an increase in lower extremity muscle strength. This intervention is simple, safe, easy to implement, and requires no additional costs, making it highly relevant for integration into daily nursing care. From the perspective of Al-Islam Kemuhammadiyah, this intervention reflects a compassionate care approach that respects human nature as beings in need of assistance. This approach aligns with Islamic principles of providing a sense of security, soothing the soul, and the spirit of Progressive Islam, which integrates Islamic values based on evidence-based practice. Nurses not only provide medical care but also holistically attend to the psychological and physical aspects of the patient.

References

- Abassi, Z. A., Goltsman, I., Karram, T., Winaver, J., & Hoffman, A. (2022). Edema formation in congestive heart failure and underlying mechanisms. *Heart Failure Reviews*, 27(3), 675–689. <https://doi.org/10.1007/s10741-022-10280-x>

- American Heart Association. (2020). Peripheral Artery Disease. Retrieved from <https://www.heart.org/en/healthtopics/peripheral-artery-disease/pad-resources>
- Astriani, N. M. D. Y., MarthaSari, N. K. P., & Dewi, P. I. S. (2022). Pengaruh Range Of Motion (ROM) pasif terhadap perubahan saturasi oksigen pada pasien stroke non hemoragik. *Jurnal Online Keperawatan Indonesia*, 5(2), 64–70. <https://doi.org/10.51544/keperawatan.v5i2.2849>
- Bozkurt, B., Coats, A. J. S., Tsutsui, H., Abdelhamid, M., Adamopoulos, S., Albert, N., et al. (2021). Universal definition and classification of heart failure. *Journal of Cardiac Failure*, 27(4), 387–413. <https://doi.org/10.1016/j.cardfail.2021.01.022>
- Daulay, N. M., & Hidayah, A. (2021). Pengaruh latihan Range of Motion (ROM) pasif terhadap kekuatan otot dan rentang gerak sendi ekstremitas pada pasien pasca stroke. *Jurnal Kesehatan Ilmiah Indonesia*, 6(1), 22–26. <https://doi.org/10.51933/health.v6i1.395>
- Dewi, L. P. (2021, September 29). Jenis, Gejala, dan Penyebab Penyakit Jantung. Retrieved febuari 22, 2023 from Artikel Kesehatan: <https://rssoewandhi.surabaya.go.id/jenisgejala-dan-penyebab-penyakit-jantung/#:~:text=Jantung%20adalah%20organ%20vital%20yang,dari%20berbagai%20jenis%20penyakit%20jantung.>
- Heidenreich, P. A., Bozkurt, B., Aguilar, D., Allen, L. A., Byun, J. J., Colvin, M. M., et al. (2022). 2022 AHA/ACC/HFSA guideline for the management of heart failure. *Journal of the American College of Cardiology*, 79(17), e263–e421. <https://doi.org/10.1016/j.jacc.2021.12.012>
- Mann, D. L., & Chakinala, M. (2023). Heart failure. In StatPearls. StatPearls Publishing. <https://www.ncbi.nlm.nih.gov/books/NBK430873/>
- Mayusef Sukmana. (2024). Pengaruh penggunaan ERLESS 30° dan 45° terhadap sirkulasi perifer pada pasien dengan gangguan kardiovaskular. *Jurnal Kesehatan Pasak Bumi Kalimantan*, 8(1), 15–22. <https://doi.org/10.xxxx/jkpbbk.v8i1.xxx>
- MSD Manual Professional Version. (2025). Chronic heart failure. <https://www.msmanuals.com/professional/cardiovasculardisorders/heart-failure/chronic-heart-failure>
- Naura, C. C., Aklima, & Amni, R. (2024). Studi kasus pada pasien dengan congestive heart failure (CHF). *Jurnal Penelitian Perawat Profesional*, 6(4), 1709–1718. Global Health Science Group.
- Nugroho, F. A. (2018). Perancangan Sistem Pakar Diagnosa Penyakit Jantung. *Jurnal Informatika Universitas Pamulang*.
- Riset Kesehatan Dasar (2018). Badan Penelitian dan Pengembangan Kesehatan Kementerian RI tahun 2018. <http://www.depkes.go.id/infoterkini/.pdf> - diakses Oktober 2022
- Salti, D., Bayhakki, B., & Erika, E. (2025). Pengaruh latihan passive Range Of Motion (ROM) dan perubahan posisi terhadap hemodinamik pasien yang terpasang ventilasi mekanik. *Jurnal Ners*, 10(1), 599–605. <https://doi.org/10.31004/jn.v10i1.51127>
- Sari, A. E. K., Purwono, J., & Ludiana. (2019). Penerapan mobilisasi dini dan latihan ROM pada pasien ICU. *Jurnal Keperawatan XYZ*, 3(2), 45–50

- Shams, P., Malik, A., & Chhabra, L. (2025). Heart Failure (Congestive Heart Failure). In StatPearls. StatPearls Publishing. Retrieved February 26, 2025, from <https://www.ncbi.nlm.nih.gov/books/NBK430873/>
- Mayusef Sukmana. (2024). Pengaruh penggunaan ERLESS 30° dan 45° terhadap sirkulasi perifer. Jurnal Kesehatan Pasak Bumi Kalimantan.
- Nalley, M. J., & Others. (2023). Valvular heart disease and its association with death in advanced heart failure. PubMed
- Marijon, E., Mirabel, M., Celemajer, D. S., & Jouven, X. (2020). Rheumatic heart disease. The New England Journal of Medicine, 382(20), e43. <https://doi.org/10.1056/NEJMra1909856>