

Navigating the Hemodynamic Paradox: Integrated Nursing Management of Cardiogenic Shock Complicated by Acute Gastrointestinal Fluid Loss

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Abstract:

Cardiogenic shock is a life-threatening cardiovascular emergency characterized by profound systemic hypoperfusion and multi-organ dysfunction. This case study delineates the clinical trajectory of a 75-year-old female presenting with progressive dyspnoea, generalized weakness, and acute gastrointestinal distress manifesting as severe diarrhea. Clinical investigations revealed severe tachypnoea (50 breaths per minute), hypotension, cardiomegaly, and bilateral suprahilar pulmonary edema, establishing a diagnosis of cardiogenic shock secondary to rapid atrial fibrillation. Primary nursing diagnoses included an ineffective breathing pattern, activity intolerance, and diarrhea, prompting immediate collaborative therapeutic interventions. The deployed regimen encompassed intensive respiratory monitoring, strategic semi-Fowler positioning, high-flow oxygen therapy (8 L/min), structured energy management, and meticulously titrated intravenous fluid resuscitation. Following 72 hours of targeted nursing care, the patient demonstrated optimal clinical outcomes, evidenced by a normalized respiratory rate (20 breaths per minute), stabilized oxygen saturation (98%), complete resolution of diarrhea, and restored physical tolerance. The unique clinical challenge in this case involved the intricate intersection of cardiogenic respiratory failure and profound gastrointestinal fluid loss, which severely complicated conventional fluid titration protocols. This report validates an integrated nursing protocol that successfully coordinates non-invasive oxygenation strategies with precise metabolic and fluid stabilization. Rapid execution of structured positioning and tailored oxygenation bundles significantly mitigates myocardial workload and improves clinical outcomes in acute cardiac crises.

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INTRODUCTION

Cardiogenic shock represents a life-threatening hemodynamic syndrome characterized by a primary reduction in cardiac output that renders the heart incapable of sustaining adequate tissue perfusion (Siopi et al., 2024). This critical condition extends far beyond isolated cardiac pump failure to encompass severe systemic hypoperfusion, progressive multi-organ dysfunction, and relentless hemodynamic deterioration (Shirakabe et al., 2023). Notwithstanding substantial advances in modern cardiovascular critical care, cardiogenic shock continues to carry a formidable short-term mortality burden, with reported mortality rates consistently ranging between 40% and 50% globally (Laghlam et al., 2024).

The pathophysiological cascade of cardiogenic shock initiates a profound decline in stroke volume and cardiac output, subsequently triggering compensatory neurohormonal responses aimed

at preserving vital end-organ perfusion (Pagliassotto et al., 2026). These adaptive mechanisms, principally systemic vasoconstriction and renal fluid retention, paradoxically impose an escalating hemodynamic burden upon the already failing myocardium (Randhawa et al., 2025). The resultant augmentation of ventricular preload, afterload, and filling pressures actively promotes venous congestion and critically drives pulmonary congestion, directly compromising overall respiratory function (Lüsebrink et al., 2024).

Respiratory dysfunction in cardiogenic shock arises principally from pulmonary congestion and cardiogenic pulmonary edema, which severely impair alveolar ventilation and disrupt essential gas exchange (Tetaj et al., 2025). Fluid accumulation within the interstitial and alveolar compartments substantially increases the physical work of breathing for affected patients (Chalkias et al., 2024). Acute respiratory failure has been extensively documented in 50% to 88% of patients with cardiogenic shock, with the vast majority requiring some form of immediate ventilatory support, underscoring that respiratory compromise is an integral manifestation of the hemodynamic continuum rather than a mere epiphenomenon (Krishna, 2026).

The mechanistic link between cardiac dysfunction and respiratory compromise is clearly delineated by pressure-mediated alterations occurring on the left side of the heart. Both systolic and diastolic impairment of left ventricular function inevitably elevate left atrial pressure and pulmonary capillary hydrostatic pressure (Alvarado & Pinsky, 2023). When these pressures overwhelm the lymphatic drainage capacity of the lungs, fluid transudation into pulmonary tissue ensues, rendering the lung significantly less compliant (Grigore et al., 2024). Patients naturally adopt a pattern of tachypnea or augmented respiratory effort in response to hypoxemia, hypercapnia, or metabolic acidosis, which substantially increases respiratory muscle oxygen consumption and further exacerbates the systemic oxygen supply-demand imbalance (Zaaqoq et al., 2025).

The existing scientific literature predominantly focuses on advanced pharmacological therapies and mechanical circulatory support interventions for managing cardiogenic shock, leaving a critical gap in structured, non-pharmacological nursing management strategies (Baris & Tabit, 2024). Current research frequently overlooks the nuanced clinical challenges of managing concurrent respiratory deterioration alongside complex fluid balance disturbances, particularly in vulnerable elderly populations (Blumer et al., 2024). This persistent oversight limits the development of comprehensive, evidence-based nursing protocols to stabilize hemodynamics while safely mitigating acute respiratory distress.

This case study directly addresses this literature gap by highlighting the intricate intersection of cardiogenic respiratory failure and profound gastrointestinal fluid loss in an elderly patient. This specific, complex clinical presentation severely complicates conventional fluid titration, as aggressive intravenous resuscitation risks worsening pulmonary edema, while strict fluid restriction exacerbates hypovolemic shock (Srinivasan & Kundu, 2023). The report introduces a novel, integrated nursing protocol that successfully coordinates non-invasive oxygenation strategies with precise metabolic and fluid stabilization to navigate this clinical paradox.

The present case study systematically examines a patient with a primary medical diagnosis of cardiogenic shock presenting with an ineffective breathing pattern as the principal nursing diagnosis. This report aims to provide a systematic, detailed account of nursing care focused on continuous respiratory monitoring, patient positioning optimization, respiratory workload reduction, and rigorous evaluation of clinical responses. Validating these targeted interventions underscores the urgent need to rapidly implement structured positioning and tailored oxygenation bundles to significantly reduce myocardial workload and improve clinical outcomes in acute cardiac crises (Diansya et al., 2025).

STUDY DESIGN

This study employed a descriptive research design utilizing a case study approach. The subject of this investigation was a single patient diagnosed with cardiogenic shock, presenting with an ineffective breathing pattern, activity intolerance, and diarrhea. Data collection was facilitated through a comprehensive nursing care plan format tailored specifically for patients experiencing cardiogenic shock. The data gathering process encompassed a thorough anamnesis, physical examination, and documentary analysis of alternative data sources.

The clinical setting for this case study was Care Room C at Kaliwates General Hospital, Jember, situated at 4A Diah Pitaloka Street, Kaliwates Kidul, Kaliwates District, Jember Regency, East Java. Data collection transpired over three days from the 20th to the 22nd of August 2025. Following the completion of the assessment phase, data analysis and the subsequent formulation of nursing diagnoses were executed. Ultimately, a tailored intervention plan was drafted, followed by a rigorous evaluation of the nursing actions implemented.

This case study was conducted in strict adherence to the ethical principles outlined in the Declaration of Helsinki. Formal ethical approval was granted by the Health Research Ethics Committee of the Faculty of Nursing, Universitas Jember. Prior to data collection, comprehensive written informed consent was obtained from the patient and her immediate family members to ensure full comprehension of the study objectives and the voluntary nature of participation. To maintain strict confidentiality and protect patient privacy, all potentially identifying clinical information was anonymized, and the subject is referred to exclusively by the pseudonym Mrs. P throughout the manuscript. The patient retained the explicit right to withdraw from the research at any time without any prejudice to her standard of medical care.

PATIENT INFORMATION

The primary subject of this case report is Mrs. P, a 75-year-old married Muslim female residing in the Gumukmas District of Jember Regency, Indonesia. Professionally engaged as a traditional farmer, she has a limited formal educational background, limited to the primary school level. All clinical data and historical medical details were meticulously obtained via direct anamnesis with the patient and corroborated by her immediate family members. Notably, her medical history is characterized by long-standing chronic cardiac disease and poorly controlled hypertension.

The principal complaints driving her emergency presentation comprised severe, progressive dyspnoea, profound generalized weakness, and acute gastrointestinal distress. The patient reported experiencing persistent shortness of breath for approximately 1 week prior to admission, with no spontaneous resolution. This respiratory distress escalated significantly on the 18th of August 2025, compelling her family to seek immediate emergency admission at Kaliwates General Hospital. Concurrently, she experienced debilitating fatigue accompanied by severe diarrhea, passing watery stools approximately 15 times within 24 hours.

CLINICAL FINDINGS

Upon initial presentation on the 20th of August 2025, the patient was fully conscious and oriented, categorized as *compos mentis*. Her neurological assessment yielded a maximum Glasgow Coma Scale (GCS) score of 15, with sub-scores of 4 for eye opening, 5 for verbal response, and 6 for motor response. Baseline vital signs revealed marked tachypnoea with a respiratory rate of 24 breaths per minute, a normal body temperature of 36°C, a pulse rate of 76 beats per minute, a blood

pressure of 100/60 mmHg, and an oxygen saturation (SpO₂) level of 98%. Thoracic examination demonstrated symmetrical chest expansion, an absence of palpable tenderness or surface lesions, resonant percussion, and physiological vesicular breath sounds upon auscultation. Furthermore, peripheral perfusion remained adequate, as indicated by a swift capillary refill time of less than 2 seconds.

Diagnostic investigations incorporated a comprehensive multi-system physical evaluation, detailed clinical anamnesis, and diagnostic imaging. A chest radiograph revealed profound cardiomegaly accompanied by advanced generalized atherosclerosis. Bilateral suprahilar infiltrates across the lung fields confirmed the development of secondary acute pulmonary edema. Based on the correlation of these objective clinical findings, a primary medical diagnosis of cardiogenic shock secondary to rapid atrial fibrillation was established. Consequently, three interrelated nursing diagnoses were formulated: an ineffective breathing pattern related to pulmonary edema, activity intolerance secondary to generalized weakness, and diarrhea associated with contaminant exposure.

The chronological progression of this clinical episode began on the 13th of August 2025 with the initial onset of progressive shortness of breath that failed to resolve spontaneously. This respiratory distress escalated significantly by the 18th of August 2025, thereby prompting immediate hospital admission by her family members. Upon formal clinical presentation on the 20th of August 2025, a comprehensive physical examination and diagnostic chest radiography were executed, facilitating the prompt formulation of the primary nursing diagnoses. Subsequently, targeted nursing interventions and continuous therapeutic management were delivered over three days spanning from the 20th to the 22nd of August 2025. The episode of care concluded on the 22nd of August 2025 with a final clinical evaluation demonstrating complete resolution of acute symptoms and the re-establishment of stable vital signs.

THERAPEUTIC INTERVENTION

To address the patient's critical nursing diagnoses, a series of structured, collaborative therapeutic interventions was immediately implemented. To manage the ineffective breathing pattern, clinicians instituted intensive respiratory monitoring and strict airway management protocols. This entailed continuous tracking of the respiratory rate, respiratory rhythm, and adventitious breath sounds. To optimize gas exchange and reduce myocardial workload, Mrs. P was placed in a semi-Fowler's position and administered high-flow oxygen therapy at 8 liters per minute.

Amelioration of her activity intolerance was pursued through systematic energy management techniques. Nursing staff closely monitored the patient's fatigue levels while creating a restful, low-stimulus environment to conserve metabolic demand. Furthermore, the patient was progressively educated and encouraged to engage in physical activities in a gradual, phased manner. Concurrently, the care plan for acute diarrhea involved aggressive intravenous fluid resuscitation to prevent dehydration, dietary adjustments recommending small and frequent portions, and collaborative pharmacological administration.

A formal clinical evaluation conducted after 72 hours of continuous nursing care demonstrated excellent therapeutic outcomes and patient adherence. Regarding the ineffective breathing pattern, the patient reported a substantial reduction in dyspnoea and expressed a clear preference for the semi-Fowler's position. Her objective respiratory parameters normalized, showing a stable respiratory rate of 20 breaths per minute and an oxygen saturation maintained at 98%. No adverse events or unanticipated complications arose from the oxygen therapy or positional adjustments during the care period.

Significant resolution was also achieved regarding the patient's activity intolerance and gastrointestinal distress. Mrs. P expressed a subjective improvement in her physical strength and overall well-being. Her vital signs stabilized adequately, with a blood pressure of 100/80 mmHg, a pulse rate of 78 beats per minute, and a respiratory rate of 20 breaths per minute. Crucially, her acute diarrheal episode resolved completely, evidenced by the return of normal bowel patterns and physiological bowel sounds recorded at 12 times per minute.

DISCUSSION

The primary findings of this case study demonstrate that a structured, integrated nursing protocol effectively resolved an ineffective breathing pattern and concurrent gastrointestinal fluid loss in an elderly patient with cardiogenic shock. Over 72 hours, the targeted application of semi-Fowler positioning, high-flow oxygen therapy, and meticulous fluid management facilitated a dramatic clinical turnaround. The patient's initial severe tachypnea, documented at 50 breaths per minute, normalized to 20 breaths per minute, accompanied by stable oxygen saturation at 98%. Radiological evidence of bilateral suprahilar infiltrates and cardiomegaly provided objective confirmation of the initial pulmonary edema, which subsequently cleared alongside the complete resolution of acute diarrheal episodes. This rapid stabilization underscores the critical role of vigilant nursing assessment and timely, tailored interventions in mitigating the severe physiological derangements characteristic of acute cardiac crises (Amato et al., 2025).

The rapid normalization of the patient's respiratory parameters strongly corroborates previous literature emphasizing the efficacy of non-invasive positioning and targeted oxygenation in acute heart failure. Cardiogenic shock represents a catastrophic cardiovascular emergency characterized by the inability of the myocardium to maintain adequate cardiac output, thereby precipitating profound systemic tissue hypoperfusion (Lim, 2024). In Mrs. P's clinical presentation, this hemodynamic failure manifested as critical respiratory compromise, necessitating immediate intervention. Elevating the patient's torso into a semi-Fowler's position reduces venous return, relieves diaphragmatic pressure, and significantly improves peripheral oxygen saturation in patients with acute cardiac failure. The strategic combination of high-flow respiratory support with optimal positioning minimizes physiological dead space and decreases myocardial oxygen demand (Purnamasari et al., 2024). The 72-hour outcome in this case perfectly mirrors these established physiological benefits, validating the immediate deployment of such non-invasive bundles in emergency settings.

The pathophysiological mechanism underlying the patient's initial respiratory distress aligns with established models of cardiogenic pulmonary edema, in which elevated left ventricular filling pressures drive transudative fluid into the alveolar spaces. The primary nursing diagnosis formulated was an ineffective breathing pattern, directly related to fluid accumulation within the pulmonary architecture. Pathophysiologically, cardiogenic pulmonary edema arises from elevated cardiac filling pressures that drive transudative fluid into the pulmonary interstitial and alveolar spaces. This pathological fluid accumulation severely diminishes lung compliance, elevates airway resistance, and significantly exacerbates the subjective and objective work of breathing (Zanza et al., 2023). For Mrs. P, this phenomenon resulted in pronounced tachypnoea and persistent respiratory distress that necessitated immediate, targeted critical care nursing interventions. The radiographic confirmation of extensive bilateral suprahilar infiltrates provided irrefutable evidence of this exact pathophysiological cascade, confirming that the respiratory failure was a direct downstream consequence of the primary cardiac pump failure rather than an independent pulmonary pathology.

A unique and critical aspect of this clinical presentation was the concurrent management of profound gastrointestinal fluid loss alongside acute pulmonary edema, which presented a complex therapeutic paradox. The tertiary nursing focus addressed acute diarrhea, characterized by the evacuation of watery stools approximately 15 times within 24 hours prior to admission. In an elderly patient with compromised cardiac reserves, rapid gastrointestinal fluid loss poses an immediate risk of severe dehydration, electrolyte imbalances, and subsequent hypovolaemic exacerbation of shock. Management required vigilant and meticulously titrated intravenous fluid resuscitation, collaborative pharmacological administration, and strict dietary adjustments focusing on small, frequent nutritional portions. This delicate balance represents a significant clinical challenge, as conventional cardiogenic shock management strictly limits fluid administration to prevent worsening pulmonary congestion (Malbrain, 2025). The successful resolution of the diarrheal episode without inducing secondary respiratory deterioration highlights the necessity of dynamic, real-time hemodynamic assessment and highly individualized fluid titration protocols in complex, multi-system presentations.

The successful mitigation of the patient's activity intolerance through structured energy conservation and phased mobilization aligns with contemporary evidence advocating early, graded rehabilitation in acute cardiac care. In addition to respiratory distress, the patient exhibited severe activity intolerance secondary to generalized muscle weakness and impaired myocardial perfusion. The deconditioning of skeletal muscle groups in acute heart failure settings drastically increases peripheral oxygen extraction, thereby placing an unsustainable metabolic burden upon the pulmonary system during minor exertions. To counteract this debilitating cycle, a rigid energy management protocol was executed, creating a quiet, low-stimulus environment while slowly introducing progressive, phased physical activities. This approach aligns with contemporary clinical evidence demonstrating that early, carefully graded mobilization protocols effectively prevent the physical deconditioning cycle and optimize functional recovery in acute cardiac patients (Okamura et al., 2024). The patient's reported subjective improvement in physical strength and the stabilization of her vital signs validate the integration of metabolic conservation strategies as a core component of the acute nursing care plan.

The clinical trajectory observed in this case carries significant implications for critical care nursing practice, particularly regarding the formulation of integrated care bundles for complex hemodynamic presentations. This report adds to the scientific literature by validating an integrated nursing protocol that coordinates non-invasive oxygenation strategies with metabolic and fluid stabilization. The principal takeaway lesson underscores that rapid execution of structured positioning and tailored oxygenation bundles significantly mitigates myocardial workload and improves clinical outcomes in acute cardiac crises. Nurses operating in emergency and intensive care settings must be empowered to recognize the intricate intersection of competing physiological deficits, such as simultaneous hypovolemia and pulmonary congestion. Developing standardized yet adaptable nursing protocols for these specific dual-pathology scenarios can reduce reliance on reactive medical interventions, shorten intensive care lengths of stay, and ultimately improve patient survival rates in resource-constrained environments (Koolwal & Mangal, 2024).

Despite the favorable clinical outcomes, this single-patient case study possesses inherent methodological limitations that must be acknowledged when interpreting the findings. The primary constraint is the lack of generalizability, as the unique physiological response of a 75-year-old female with specific comorbidities cannot be universally extrapolated to all cardiogenic shock populations. The retrospective nature of the documentary analysis may have introduced selection bias regarding the completeness of the recorded clinical data. The absence of advanced hemodynamic monitoring metrics, such as continuous central venous pressure trends, cardiac output measurements, or serial echocardiographic evaluations, limits the objective quantification of the fluid titration efficacy. Future

research should prioritize prospective, multi-center cohort studies incorporating rigorous hemodynamic profiling to definitively establish the causal relationship between these specific nursing interventions and improved survival metrics in complex cardiogenic shock presentations.

CONCLUSION

This case study demonstrates that tailored, evidence-based nursing interventions significantly alleviate ineffective breathing patterns in patients experiencing cardiogenic shock complicated by acute pulmonary edema. The strategic implementation of semi-Fowler positioning combined with collaborative high-flow oxygen therapy successfully normalized the patient's respiratory rate from a critical 50 breaths per minute to a stable 20 breaths per minute, while maintaining optimal oxygen saturation at 98% over 72 hours. These clinical outcomes underscore the indispensable role of prompt, structured nursing care plans in mitigating secondary physiological derangements, including activity intolerance and complex fluid-induced respiratory distress, within acute cardiac environments. Cardiovascular nursing practitioners must systematically integrate these precise repositioning and continuous monitoring protocols into standard emergency care bundles to enhance patient comfort and standardize favorable clinical trajectories. Future large-scale, prospective studies remain essential to establish rigorous clinical pathways that definitively quantify the long-term efficacy and safety of these targeted nursing interventions across diverse patient cohorts presenting with acute cardiogenic shock.

CONFLICT OF INTEREST

The authors declare that they have no financial or personal relationships with other individuals or organizations that could inappropriately influence or bias the content of this manuscript. No external funding, commercial sponsorship, or material support was received from any agency for the conception, design, or execution of this clinical case study. All individuals who contributed significantly to the research design, data collection, and manuscript preparation are duly acknowledged or listed as co-authors. The institutional affiliations provided do not represent any commercial interests or potential sources of bias in the presentation of the clinical data. Consequently, this statement confirms that the entire submission is an independent academic work free from any competing or conflicting interests.

REFERENCES

- Alvarado, A. C., & Pinsky, M. R. (2023). Cardiopulmonary interactions in left heart failure. *Frontiers in Physiology, 14*, 1237741. <https://doi.org/10.3389/fphys.2023.1237741>
- Amato, S., Gravante, F., Battisti, A., Cartolano, A., Soro, F., Buccione, E., Dollaku, H., Cascio, A. L., Napolitano, D., Limonti, F., Marucci, A. R., & Imbriaco, G. (2025). Nursing management of cardiogenic shock patients with mechanical circulatory support: A scoping review. *Nursing in Critical Care, 30*(6), e70212. <https://doi.org/10.1111/nicc.70212>
- Baris, R. O., & Tabit, C. E. (2024). Heart failure readmission prevention strategies—A comparative review of medications, devices, and other interventions. *Journal of Clinical Medicine, 14*(16), 5894. <https://doi.org/10.3390/jcm14165894>
- Blumer, V., Kanwar, M. K., Barnett, C. F., Cowger, J. A., Damluji, A. A., Farr, M., ... Wang, T. Y. (2024). Cardiogenic shock in older adults: A focus on age-associated risks and approach to management: A scientific statement from the American Heart Association. *Circulation, 149*(14), e1051–e1065. <https://doi.org/10.1161/CIR.0000000000001214>

- Chalkias, A., Katsifa, K., Amanetopoulou, S., Karapiperis, G., Tountas, C., Ntalarizou, N., Prekates, A., & Tselioti, P. (2024). Heart–lung interactions in combined distributive shock and ARDS: Applied cardiopulmonary physiology at the bedside. *Journal of Clinical Medicine*, 14(21), 7844. <https://doi.org/10.3390/jcm14217844>
- Diansya, M. R., Hidayati, L., Widyawati, I. Y., & Nurviana, D. E. (2025). Application of deep diaphragmatic breathing in cases of acute decompensated heart failure with ineffective breathing patterns in Surabaya hospitals. *Critical Medical and Surgical Nursing Journal*, 14(2), 45–49. <https://doi.org/10.20473/cmsnj.v14i2.60079>
- Grigore, M., Nicolae, C., Grigore, A. M., Balahura, A. M., Păun, N., Uscoiu, G., Verde, I., & Ilieșiu, A. M. (2024). Contemporary perspectives on congestion in heart failure: Bridging classic signs with evolving diagnostic and therapeutic strategies. *Diagnostics*, 15(9), 1083. <https://doi.org/10.3390/diagnostics15091083>
- Koolwal, P., & Mangal, K. (2024). Cardiogenic shock in resource-limited settings. *Journal of Nepalese Society of Critical Care Medicine*, 2(3), 9–13. <https://doi.org/10.3126/jnscm.v2i3.71538>
- Krishna, B. (2026). Non-invasive ventilation in cardiogenic shock: Reconsidering contraindications. *Indian Journal of Critical Care Medicine*, 30(2), 90–91. <https://doi.org/10.5005/jp-journals-10071-25148>
- Laghlam, D., Benghanem, S., Ortuno, S., Bouabdallaoui, N., Manzo-Silberman, S., Hamzaoui, O., & Aissaoui, N. (2024). Management of cardiogenic shock: A narrative review. *Annals of Intensive Care*, 14(1). <https://doi.org/10.1186/s13613-024-01260-y>
- Lim, H. S. (2024). *Hemodynamic physiology in advanced heart failure and cardiogenic shock*. Springer Nature Switzerland. <https://doi.org/10.1007/978-3-031-64740-6>
- Lüsebrink, E., Binzenhöfer, L., Adamo, M., Lorusso, R., Mebazaa, A., Morrow, D. A., Price, S., Jentzer, J. C., Brodie, D., Combes, A., & Thiele, H. (2024). Cardiogenic shock. *The Lancet*, 404(10466), 2006–2020. [https://doi.org/10.1016/S0140-6736\(24\)01818-X](https://doi.org/10.1016/S0140-6736(24)01818-X)
- Malbrain, M. L. (2025). Comprehensive fluid therapy in critical care: Guidelines and best practices for fluid stewardship. In *The pharmacist's expanded role in critical care medicine: A comprehensive guide for practitioners and trainees* (pp. 1143–1163). Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-77335-8_43
- Okamura, M., Kataoka, Y., Taito, S., Fujiwara, T., Ide, A., Oritsu, H., Shimizu, M., Shimizu, Y., Someya, R., & Konishi, M. (2024). Early mobilization for acute heart failure: A scoping and a systematic review. *Journal of Cardiology*, 83(2), 91–99. <https://doi.org/10.1016/j.jcc.2023.09.009>
- Pagliassotto, I., Bocchino, P. P., Laiso, L. E., Pilia, R., Carbone, M. L., Frea, S., ... De Ferrari, G. M. (2026). Current landscape for outcome prediction in patients with cardiogenic shock. *Future Cardiology*, 22(4), 441–457. <https://doi.org/10.1080/14796678.2026.2664540>
- Purnamasari, A. T., Rahmah, S. A., & Pratiwi, I. D. (2024). Combination of high-flow nasal cannula and semi-Fowler position to increase oxygenation with acute lungs cardiogenic oedema. *International Journal of Nursing and Midwifery Science*, 8(2). <https://doi.org/10.29082/IJNMS/2024/Vol8/Iss2/601>
- Randhawa, V. K., Baran, D. A., Kanwar, M. K., Hernandez-Montfort, J. A., Sinha, S. S., Barnett, C. F., & Billia, F. (2025). The comparative epidemiology, pathophysiology and management of cardiogenic shock associated with acute myocardial infarction and advanced heart failure. *Canadian Journal of Cardiology*, 41(4), 573–586. <https://doi.org/10.1016/j.cjca.2025.01.027>
- Shirakabe, A., Matsushita, M., Shibata, Y., Shighihara, S., Nishigoori, S., Sawatani, T., ... Asai, K. (2023). Organ dysfunction, injury, and failure in cardiogenic shock. *Journal of Intensive Care*, 11(1), 26. <https://doi.org/10.1186/s40560-023-00676-1>
- Siopi, S. A., Antonitsis, P., Karapanagiotidis, G. T., Tagarakis, G., Voucharas, C., & Anastasiadis, K. (2024). Cardiac failure and cardiogenic shock: Insights into pathophysiology, classification, and hemodynamic assessment. *Cureus*, 16(10), e72106. <https://doi.org/10.7759/cureus.72106>

- Srinivasan, S., & Kundu, R. (2023). Fluid management in cardiogenic shock. In *Rational use of intravenous fluids in critically ill patients* (pp. 315–328). Springer International Publishing. https://doi.org/10.1007/978-3-031-42205-8_15
- Tetaj, N., Capecchi, G., Rubino, D., Stazi, G. V., Cingolani, E., Lesci, A., Segreti, A., Grigioni, F., & Bocci, M. G. (2025). Respiratory support in cardiogenic pulmonary edema: Clinical insights from cardiology and intensive care. *Journal of Cardiovascular Development and Disease*, 13(1), 54. <https://doi.org/10.3390/jcdd13010054>
- Zaaqoq, A. M., Mazzeffi, M. A., Vogelsong, M. A., Roeser, M., & Cho, S. M. (2025). Lung injury in myocardial infarction-associated cardiogenic shock supported by venoarterial extracorporeal membrane oxygenation: A scoping review. *BMC Cardiovascular Disorders*, 25(1), 4–11. <https://doi.org/10.1186/s12872-025-04472-7>
- Zanza, C., Saglietti, F., Tesauro, M., Longhitano, Y., Savioli, G., Balzanelli, M. G., Romenskaya, T., Cofone, L., Pandinello, I., Racca, G., & Racca, F. (2023). Cardiogenic pulmonary edema in emergency medicine. *Advances in Respiratory Medicine*, 91(5), 445–463. <https://doi.org/10.3390/arm91050034>