

Deep-Breathing Relaxation as an Adjunct to Acute Pain Management in Patients with Acute Myocardial Infarction: A Two-Patient Case Study in an Intensive Cardiac Care Unit

Dilla Illiyin Saffanatul Hikmih¹, Endah Suprihatin¹, Purwanti Nurfita Sari¹, Dwi Adji Norontoko¹, Zarinah Binti Abdul Aziz²

¹Department of Nursing, Poltekkes Kemenkes Surabaya, Surabaya, Indonesia

²Diploma in Nursing Program, City University Malaysia, Selangor, Malaysia

Corresponding author: Dilla Illiyin Saffanatul Hikmih (e-mail: dillailyn@gmail.com)

ABSTRACT Acute myocardial infarction (AMI) is a cardiovascular emergency frequently accompanied by severe acute chest pain, discomfort, and psychological distress, requiring timely and comprehensive management. Although pharmacological therapy remains central to acute pain management, non-pharmacological interventions may provide complementary support during nursing care. However, evidence describing the practical integration of deep-breathing relaxation into comprehensive pain management for patients with AMI in Indonesian intensive cardiac care settings remains limited. This study aimed to describe the implementation of deep-breathing relaxation as an adjunct to comprehensive pain management and to describe changes in pain intensity and patient comfort among patients with AMI admitted to an Intensive Cardiac Care Unit (ICCU). A descriptive prospective two-patient case study was conducted in the ICCU of Dr. Moh. Soewandhie Regional General Hospital, Surabaya. Two purposively selected patients with AMI and acute pain received routine nursing care, physician-prescribed pharmacological treatment, and deep-breathing relaxation for approximately 10 minutes per session, three times daily for three consecutive days when clinically and hemodynamically stable. Data were collected using the Numeric Rating Scale, nursing assessments, clinical observations, interviews, physical examinations, and medical-record reviews. Both patients demonstrated progressive reductions in pain intensity, with NRS scores decreasing from 9 to 3 in Patient 1 and from 9 to 2 in Patient 2. Reduced nonverbal pain behaviours and improved comfort were also observed. Nevertheless, because the intervention was delivered concurrently with pharmacological therapy and other comprehensive care and no control group was used, the observed improvement cannot be attributed specifically to deep-breathing relaxation. Deep-breathing relaxation may therefore be considered a feasible adjunct to comprehensive pain management in clinically stable patients with AMI. Larger controlled studies with standardized intervention protocols and detailed monitoring of concurrent treatments are required to establish its independent effectiveness and safety.

INDEX TERMS Acute Myocardial Infarction, Acute Pain, Deep-Breathing Relaxation, Nursing Care, Intensive Cardiac Care Unit

I. INTRODUCTION

Cardiovascular diseases remain the leading cause of mortality worldwide, with substantial health and socioeconomic consequences, particularly in low- and middle-income countries [1]. Acute myocardial infarction (AMI) represents one of the most clinically significant manifestations of coronary artery disease and requires rapid diagnosis, risk stratification, and treatment to limit myocardial injury and prevent adverse outcomes [2]–[5]. Recent evidence indicates that myocardial infarction continues to impose a considerable global burden, with prevalence increasing substantially among older populations [6]. Contemporary guidelines emphasize timely assessment, evidence-based pharmacological therapy, revascularization when indicated, and patient-centred care

throughout the acute coronary syndrome (ACS) pathway [4], [5], [7]. Chest pain is one of the principal clinical manifestations requiring systematic assessment because its severity may contribute to physical discomfort, anxiety, sympathetic activation, and increased physiological stress [8], [9]. Therefore, effective pain management represents an important component of comprehensive nursing care for patients with AMI.

Current AMI management primarily relies on pharmacological and interventional approaches; however, complementary non-pharmacological strategies may support symptom management and patient comfort [4], [5]. Deep-breathing relaxation has received increasing attention because it is simple, non-invasive, inexpensive, and does not require

specialized equipment. Previous experimental research has suggested that slow and deep breathing may influence pain perception through psychophysiological mechanisms, including changes in autonomic regulation, cardiovascular responses, and attentional processes [10]–[13]. A systematic review and meta-analysis of randomized controlled trials reported that slow deep breathing was associated with lower acute pain intensity, although the certainty of evidence remained low and substantial heterogeneity was observed between studies [14]. Other systematic reviews have demonstrated that voluntary slow breathing can increase vagally mediated heart-rate variability and may influence cardiovascular autonomic regulation [15]. Evidence concerning physiological responses has also indicated potential reductions in blood pressure and heart rate following breathing-based interventions [16], [17]. These findings provide a scientific rationale for considering breathing relaxation as a complementary component of nursing care rather than as a replacement for definitive medical treatment.

The clinical relevance of non-pharmacological interventions is further supported by evidence that psychological distress frequently accompanies myocardial infarction and may adversely affect recovery and quality of life [18], [19]. Systematic evidence has reported that psychological interventions, including relaxation-based approaches, may reduce anxiety following myocardial infarction, although intervention protocols and outcomes vary considerably [18]. Similarly, recent research has highlighted the broader relationship between psychological factors and cardiovascular outcomes [19], while contemporary AMI management emphasizes patient-centred care and attention to symptoms beyond the underlying coronary pathology [4], [5]. Nevertheless, the existing literature predominantly consists of experimental studies, systematic reviews, or interventions conducted in populations and settings different from intensive cardiac nursing care. Furthermore, breathing interventions differ in frequency, duration, breathing pattern, supervision, and outcome assessment, limiting direct comparability across studies [14]–[17].

A specific gap therefore remains regarding the practical integration of standardized deep-breathing relaxation into comprehensive nursing care for patients with AMI in Indonesian ICCU settings. Case-based evidence that simultaneously documents the nursing assessment, intervention implementation, patient response, and clinical progression remains limited. The present study consequently aimed to describe the implementation of deep-breathing relaxation as an adjunct to comprehensive pain management and to describe changes in pain intensity and patient comfort among patients with AMI admitted to an ICCU. The contributions of this study are threefold: (1) providing a clinical description of the integration of deep-breathing relaxation into routine nursing care for AMI patients; (2) documenting patient-specific changes in pain intensity, physiological parameters, and comfort during a three-day care period; and (3) identifying practical considerations and methodological limitations that can inform the development of future controlled studies.

The remainder of this article is organized as follows. Section II describes the study design, setting, participants, intervention procedure, data collection, analysis, and ethical

considerations. Section III presents the clinical characteristics and outcomes of the two patients. Section IV discusses the observed findings in relation to previous evidence, study limitations, and implications for nursing practice. Section V concludes the study and identifies directions for future research.

II. METHOD

A. STUDY DESIGN AND SETTING

This study employed a descriptive prospective two-patient case study design conducted in the Intensive Cardiac Care Unit (ICCU) of Dr. Moh. Soewandhie Regional General Hospital, Surabaya. A prospective case-study approach was selected to document patient-specific clinical conditions, nursing care processes, and changes in pain and comfort during hospitalization. Case-study methodology is appropriate for examining clinical processes within their real-world context, particularly when the number of cases is limited and detailed patient-level observation is required [21], [22]. The study was not designed to determine the independent efficacy of deep-breathing relaxation. Therefore, no randomization, comparator group, or blinding procedure was applied. Each participant was followed prospectively from the initial assessment through three consecutive days of comprehensive nursing care.

B. PARTICIPANTS AND SAMPLING

The study population consisted of patients diagnosed with acute myocardial infarction (AMI) and admitted to the ICCU with acute pain identified as the primary nursing diagnosis. Two patients were selected using purposive sampling according to predefined eligibility criteria. The inclusion criteria were: (1) confirmed diagnosis of AMI; (2) presence of acute pain; (3) admission to the ICCU; (4) ability to communicate effectively; (5) ability and willingness to perform the breathing procedure; and (6) provision of written informed consent. Patients with impaired consciousness, defined in this study as a Glasgow Coma Scale score below 13, were excluded. The selection procedure was intended to identify cases that could provide complete clinical information throughout the three-day observation period. Because the study was a descriptive case study involving two patients, participants were not randomly allocated and no control group was established [21], [22].

C. INTERVENTION PROCEDURE

Deep-breathing relaxation was administered as an adjunct to routine nursing care and physician-prescribed pharmacological treatment. The intervention was performed three times per day for approximately 10 min per session over three consecutive days. Before each session, the patient's clinical condition was assessed to determine whether the patient was sufficiently stable to perform the breathing exercise. The intervention was postponed or adjusted when the patient's condition or tolerance did not permit its performance.

For each session, the patient was positioned comfortably and instructed to perform slow, controlled breathing. The patient inhaled slowly through the nose for approximately 3–5 s, held the breath for approximately 2–3 s, and then exhaled slowly through the mouth. The sequence was repeated during the approximately 10-min session according to the patient's

tolerance. The procedure was supervised by the nurse to ensure that the breathing sequence was performed correctly. Deep-breathing exercises were used only as an adjunct and did not replace prescribed medical therapy, oxygen therapy, monitoring, or other routine nursing interventions. Previous evidence indicates that slow deep breathing may be associated with reduced acute pain, although the certainty of evidence and heterogeneity between protocols should be considered [24]. Breathing exercises have also been reported to influence physiological parameters such as heart rate and blood pressure [25], supporting their use as a complementary rather than replacement intervention.

D. MATERIALS AND DATA COLLECTION

The materials and instruments used in the study consisted of a standardized deep-breathing relaxation Standard Operating Procedure (SOP), Numeric Rating Scale (NRS), nursing assessment form, observation sheet, physical examination procedure, interview guide, and patient medical records. The NRS was used to quantify pain intensity on an 11-point scale from 0 to 10, where 0 represented no pain and 10 represented the most severe pain. The NRS was selected because it is a practical patient-reported measure for quantifying pain intensity and has been evaluated for its measurement properties in clinical populations [23].

Data collection was performed at baseline and during the three-day observation period. Pain intensity was recorded using the NRS, while additional clinical information included pain characteristics, facial expression and other nonverbal pain responses, respiratory rate, heart rate, oxygen saturation when available, comfort level, and the patient's ability to perform the breathing procedure. Direct observation was conducted during and after each intervention session. Interviews were used to obtain subjective information regarding pain and perceived comfort. Physical examination and medical-record review were used to document the patient's diagnosis, prescribed treatment, oxygen therapy, clinical status, and relevant changes during hospitalization. The 2023 European Society of Cardiology guideline emphasizes systematic clinical assessment, including symptom characterization, vital signs, and physical examination, in patients with acute coronary syndrome [26].

E. DATA ANALYSIS

Data were analyzed descriptively at the individual-patient level. Information obtained from the NRS, nursing assessments, observations, interviews, physical examinations, and medical records was organized chronologically for each participant. Changes in pain intensity were compared between the initial assessment and subsequent observations over the three-day care period. Observed changes in comfort, nonverbal pain responses, respiratory status, and other available clinical parameters were also described. Findings were presented in narrative and tabular forms to facilitate comparison between the two cases.

No inferential statistical test was performed because only two patients were included and the study did not contain randomization or a control group. In addition, both participants received concurrent pharmacological treatment and routine ICCU care. Therefore, reductions in pain or

changes in physiological parameters were interpreted as observations occurring during comprehensive care that included deep-breathing relaxation rather than as evidence of an independent causal effect of the intervention. This analytical approach was consistent with the descriptive purpose of the case study and the limitations inherent in causal interpretation from uncontrolled case-based evidence [22].

F. ETHICAL CONSIDERATIONS

The study obtained written informed consent from each participant before data collection. Participant confidentiality was maintained by limiting identifiable information in the research records and manuscript. Participation was voluntary, and participants retained the right to refuse or discontinue participation without affecting the healthcare services they received. Ethical approval was reported as having been obtained from the Health Research Ethics Committee of Poltekkes Kemenkes Surabaya under Approval No. EA/4427/KEPK-Poltekkes_Sby/V/2026. The approval documentation, approval date, and data-collection period should be verified against the official institutional records before final manuscript submission.

III. RESULTS

Two patients with AMI and acute pain received comprehensive nursing care that included deep-breathing relaxation, physiological monitoring, patient education, and physician-prescribed pharmacological treatment [26].

TABLE 1
Patient Characteristics

Variable	Patient 1	Patient 2
Age	64	51
Diagnosis	Anterior STEMI	Inferior STEMI
Initial pain score (NRS)	9	9
Chief complaint	Chest pain	Chest Pain

According to the information in [TABLE 1](#), shows the demographic and clinical characteristics of the two patients. Both patients were diagnosed with acute myocardial infarction and acute pain and met the study inclusion criteria. During three days of comprehensive care that included deep-breathing relaxation and pharmacological treatment, NRS scores decreased from 9 to 3 in Patient 1 and from 9 to 2 in Patient 2. Both patients demonstrated reduced nonverbal pain behaviours and reported greater comfort. These findings describe observed changes during the care period and do not establish that deep-breathing relaxation independently caused the reduction.

The original manuscript does not provide sufficient longitudinal data for heart rate, blood pressure, respiratory rate, or oxygen saturation at standardized pre- and post-session time points. These physiological data should be added from the clinical observation sheets/medical records if available. Similarly, the complete medication list, dose, administration time, and temporal relationship to NRS measurements should be added before resubmission.

According to the information presented in [TABLE 2](#), both patients experienced a reduction in pain intensity after receiving the deep breathing relaxation interv both patients demonstrated a gradual reduction in pain intensity during the three-day period of comprehensive care. Patient 1's NRS score

TABLE 2
Clinical Outcomes After Deep Breathing Relaxation

Patient 1 Day	NRS	HR	RR	SPO2	Response
1	9	121x/minute	25x/minute	99% NRM	Severe chest pain; patient appeared uncomfortable and demonstrated pain-related nonverbal behaviour.
2	7	111x/minute	25x/minute	99% NRM	Chest pain decreased but was still present; patient remained uncomfortable.
3	3	107x/minute	23x/minute	99% NRM	Chest pain decreased; patient appeared more comfortable and relaxed.
Patient 2 Day	NRS	HR	RR	SPO2	Response
1	9	114	24	99% NRM	Severe chest pain; patient appeared uncomfortable and demonstrated pain-related nonverbal behaviour.
2	6	98	23	99% SM	Chest pain decreased but was still present; patient tolerated the intervention.
3	2	74	22	99% NC	Minimal chest pain reported; patient appeared more comfortable and relaxed.

decreased from 9 on Day 1 to 7 on Day 2 and 3 on Day 3, while Patient 2's score decreased from 9 to 6 and 2, respectively. Changes in physiological parameters were also observed during the care period. In Patient 1, heart rate decreased from 121 to 107 bpm and respiratory rate decreased from 25 to 23 breaths/min, while oxygen saturation remained at 99% with a non-rebreather mask (NRM). In Patient 2, heart rate changed from 114 to 98 and then 74 bpm, while respiratory rate decreased from 24 to 22 breaths/min and oxygen saturation remained at 99%, with oxygen support changing from NRM on Day 1 to a simple mask on Day 2 and nasal cannula on Day 3. Both patients reported decreased chest pain and demonstrated improved comfort by Day 3. These changes were observed during comprehensive care that included deep-breathing relaxation, pharmacological treatment, physiological monitoring, and patient education. Therefore, the observed reduction in pain intensity cannot be attributed specifically to deep-breathing relaxation. The

findings describe the clinical changes observed during the three-day care period and support the feasibility of incorporating deep-breathing relaxation as an adjunct to comprehensive pain management in patients with AMI [27].

Throughout the intervention period, both patients were able to perform the deep breathing relaxation technique appropriately and demonstrated positive responses, including a more relaxed facial expression, decreased chest pain complaints, and improved comfort levels. These observations support the feasibility of incorporating deep-breathing relaxation as an adjunctive non-pharmacological intervention within comprehensive nursing care [28].

IV. DISCUSSION

A. INTERPRETATION OF PAIN REDUCTION AND CLINICAL RESPONSE

This two-patient case study demonstrated a progressive reduction in acute chest pain during three days of comprehensive nursing care that included deep-breathing relaxation, physiological monitoring, patient education, and physician-prescribed pharmacological treatment. Both patients initially reported severe pain with an NRS score of 9. Patient 1 demonstrated a reduction from NRS 9 on Day 1 to 7 on Day 2 and 3 on Day 3, whereas Patient 2 decreased from NRS 9 to 6 and subsequently to 2. In parallel with the reduction in reported pain, both patients showed fewer nonverbal pain behaviours and appeared more comfortable and relaxed by Day 3. These observations indicate that the overall pain-management process was accompanied by clinically meaningful improvement in patient-reported pain and observable comfort.

The observed pattern is compatible with previous evidence concerning breathing-based interventions and pain perception. Joseph et al. reported in a systematic review and meta-analysis of randomized controlled trials that slow deep breathing was associated with a reduction in acute clinical pain, although the certainty of evidence was limited by heterogeneity among the included studies [27]. Experimental evidence has similarly demonstrated that controlled breathing can reduce pain perception, with the effect varying according to breathing pattern and duration [28]. Gholamrezaei et al. also found that slow, deep breathing reduced visceral pain intensity compared with uncontrolled breathing, although the reduction was not specifically attributable to the slow breathing frequency itself [29]. These findings provide a plausible basis for considering controlled breathing as a complementary component of pain management, but they do not establish that the decrease observed in the present cases was produced solely by the breathing intervention.

The physiological observations also provide contextual support for the clinical changes. In Patient 1, heart rate decreased from 121 to 107 beats/min and respiratory rate decreased from 25 to 23 breaths/min, while oxygen saturation remained at 99% with a non-rebreather mask. In Patient 2, heart rate decreased from 114 to 98 and then 74 beats/min, respiratory rate decreased from 24 to 22 breaths/min, and oxygen saturation remained at 99%, while oxygen support progressed from a non-rebreather mask to a simple mask and subsequently to a nasal cannula. These changes occurred

concurrently with clinical stabilization and therefore should not be interpreted as direct physiological effects of deep breathing.

Nevertheless, the findings are consistent with broader evidence concerning the physiological effects of controlled breathing. Laborde et al. reported that voluntary slow breathing was associated with increased vagally mediated heart-rate variability during breathing, immediately after a session, and following multi-session interventions [30]. Similarly, a systematic review and meta-analysis by Garg et al. found that breathing exercises were associated with modest reductions in systolic blood pressure, diastolic blood pressure, and heart rate [31]. These physiological responses may be relevant to relaxation and cardiovascular regulation; however, the present study did not measure heart-rate variability or autonomic activity. Therefore, any autonomic mechanism remains a hypothesis rather than a demonstrated mechanism in these patients.

An additional consideration is the psychological component of acute myocardial infarction. Pain and hospitalization in an ICCU may be accompanied by anxiety and emotional distress, which can influence subjective pain perception and comfort. A systematic review by Ryan et al. found that psychological interventions following myocardial infarction produced mixed but generally supportive evidence for reducing anxiety, with relaxation-based approaches included among the interventions evaluated [32]. More recent evidence also indicates that depression, anxiety, and post-traumatic stress symptoms remain clinically relevant following AMI [33]. The improved facial expression, relaxation, and comfort observed in the present cases may therefore reflect an interaction between pain relief, reduced distress, attention, and the broader therapeutic environment rather than a purely analgesic effect.

B. COMPARISON WITH PREVIOUS STUDIES AND CLINICAL IMPLICATIONS

The magnitude and direction of pain reduction in the present cases are broadly consistent with studies investigating breathing-based interventions in cardiovascular patients, although the study populations and intervention protocols differ. Mostafa et al. reported that deep-breathing exercises were associated with reduced pain severity among patients undergoing coronary artery bypass grafting, supporting the potential role of breathing exercises as a complementary nursing intervention [34]. Similarly, Babamohamadi et al. conducted a randomized controlled trial involving patients after coronary artery bypass grafting and found that rhythmic breathing was associated with lower postoperative sternotomy pain compared with routine care [35]. Jarrah et al. also reported reduced pain following slow deep-breathing relaxation in patients undergoing chest-tube removal after coronary artery bypass grafting [36]. These studies provide a degree of consistency with the present observations because all involve cardiovascular patients and pain outcomes.

However, important differences must be recognized. Previous controlled studies generally included larger samples and, in several cases, randomized intervention and control groups. For example, Babamohamadi et al. randomized 60

post-CABG patients to rhythmic breathing or control conditions, while Jarrah et al. randomized 50 post-CABG patients to slow deep-breathing relaxation or conventional care [35], [36]. The present study involved only two patients with AMI and did not include a comparator group. Consequently, the present findings should be interpreted as clinical observations rather than evidence of intervention efficacy.

The difference in clinical population is also important. Postoperative CABG pain is primarily related to surgical tissue injury, sternotomy, chest tubes, and postoperative inflammation, whereas the pain experienced by the present patients was associated with acute myocardial infarction. The underlying mechanisms, clinical trajectories, pharmacological management, and physiological risks are therefore different. Although evidence from postoperative cardiovascular populations can support the plausibility and feasibility of breathing-based pain management, it cannot be directly assumed that the same magnitude of effect occurs in patients with acute myocardial ischemia.

The intervention protocol used in this study also differs from protocols reported in previous research. The present intervention consisted of approximately 10 minutes per session, three times daily for three days, with inhalation through the nose for approximately 3–5 seconds, a 2–3-second breath hold, and slow exhalation through the mouth. Previous studies have used different breathing frequencies, session durations, and intervention schedules. The systematic review by Joseph et al. highlighted substantial heterogeneity in slow deep-breathing protocols across studies [27]. Gholamrezaei et al. likewise demonstrated that the effect on pain was not necessarily specific to slow breathing frequency [29]. Therefore, the present protocol should be regarded as one feasible implementation rather than an established optimal protocol for AMI.

From a nursing perspective, the findings support the potential feasibility of deep-breathing relaxation as an adjunctive intervention when the patient's clinical condition permits. The technique requires no specialized equipment, can be taught relatively easily, and may allow patients to participate actively in symptom management. This is particularly relevant in an ICCU, where nurses routinely assess pain, respiratory status, comfort, and hemodynamic condition. However, implementation must remain subordinate to definitive AMI treatment. Deep-breathing relaxation should not delay emergency assessment, pharmacological treatment, reperfusion-related management, oxygen therapy when clinically indicated, or continuous monitoring.

The intervention may also have value beyond pain intensity alone. The observed reduction in facial tension and improved comfort suggests that patient-centred outcomes should be included in future research. Pain intensity measured with the NRS provides a useful quantitative outcome, but it does not fully represent anxiety, distress, perceived control, relaxation, or overall comfort. Future studies could therefore combine NRS with validated anxiety and comfort measures, physiological monitoring, and standardized assessment of respiratory and cardiovascular parameters. This would provide a more comprehensive evaluation of whether

breathing relaxation contributes to symptom management in AMI.

C. LIMITATIONS, IMPLICATIONS, AND FUTURE RESEARCH

Several limitations restrict the interpretation and generalizability of the findings. First, the study involved only two purposively selected patients. The small sample prevents estimation of population-level effects and limits transferability to the broader AMI population. Second, no control or comparison group was included. Both patients received pharmacological therapy, monitoring, education, routine nursing care, and other aspects of hospital treatment. The manuscript also does not provide a sufficiently detailed longitudinal record of medication names, doses, administration times, and their exact temporal relationship with each NRS assessment. Consequently, the reduction in pain cannot be attributed independently to deep-breathing relaxation.

Third, the observation period was limited to three days. This period was sufficient to document short-term clinical changes but did not allow assessment of sustained adherence, recurrence of pain, post-discharge use of the technique, or long-term effects on quality of life. Fourth, physiological variables were not consistently measured at standardized pre- and post-intervention time points. The available values therefore describe overall clinical progression rather than intervention-specific physiological responses. Fifth, the two patients had different infarct locations, with Patient 1 diagnosed with anterior STEMI and Patient 2 with inferior STEMI. Differences in infarct location, disease severity, treatment response, and individual pain perception may have contributed to the different trajectories of pain reduction.

Despite these limitations, the study has practical implications for nursing care. The ability of both patients to perform the intervention appropriately and the observed improvement in comfort indicate that deep-breathing relaxation was feasible within the ICCU care process. Nurses may consider incorporating a standardized breathing-relaxation procedure into comprehensive non-pharmacological pain-management protocols, provided that eligibility, hemodynamic stability, and patient tolerance are assessed before each session. The intervention should remain complementary to definitive medical management rather than being presented as an alternative to pharmacological or emergency treatment.

Future research should use a larger sample and a controlled or randomized design to determine the independent contribution of deep-breathing relaxation to pain reduction. Medication type, dose, administration time, and timing of pain assessment should be systematically recorded to reduce confounding. Future studies should also standardize intervention frequency, session duration, breathing rate, inspiratory and expiratory duration, and supervision procedures. Repeated pre- and post-session measurements of NRS, heart rate, respiratory rate, blood pressure, oxygen saturation, and, where feasible, heart-rate variability would allow researchers to examine both clinical and physiological responses. Such studies could determine whether the observed

reduction in pain represents a reproducible intervention effect and establish a more appropriate protocol for integrating breathing relaxation into nursing care for patients with AMI.

V. CONCLUSION

This study aimed to describe the implementation of deep-breathing relaxation as an adjunctive non-pharmacological intervention for acute pain management in patients with acute myocardial infarction admitted to an intensive cardiac care unit. In two purposively selected patients, both initially reported severe chest pain with an NRS score of 9. Following three days of comprehensive nursing care incorporating deep-breathing relaxation approximately three times daily for 10 minutes per session, together with physiological monitoring, patient education, and prescribed pharmacological treatment, Patient 1 demonstrated a progressive reduction in pain from NRS 9 on Day 1 to 7 on Day 2 and 3 on Day 3, while Patient 2 decreased from NRS 9 to 6 and subsequently to 2. The observed reductions corresponded to decreases of 6 points in Patient 1 and 7 points in Patient 2 from baseline. Improvements in nonverbal pain behaviours and perceived comfort were also observed in both patients. Patient 1 showed a decrease in heart rate from 121 to 107 beats/min and respiratory rate from 25 to 23 breaths/min, whereas Patient 2 showed a decrease in heart rate from 114 to 74 beats/min and respiratory rate from 24 to 22 breaths/min, with oxygen saturation maintained at 99% during the documented observations. These findings indicate that deep-breathing relaxation was feasible to implement as part of comprehensive nursing care and was accompanied by short-term improvement in pain and comfort. However, because the study involved only two patients, had no control group, and included concurrent pharmacological and medical treatment, the observed reductions cannot be attributed independently to deep-breathing relaxation. The findings should therefore be interpreted as clinical observations supporting feasibility rather than evidence of definitive analgesic efficacy. Future research should involve larger samples and controlled or randomized designs, apply a standardized breathing protocol, record medication type, dosage, and administration timing, and obtain repeated pre- and post-intervention measurements of pain and physiological parameters. Longer follow-up should also be considered to determine whether the intervention produces sustained benefits after the acute hospitalization period. Such research would provide stronger evidence regarding the independent effectiveness, safety, optimal frequency, and appropriate clinical integration of deep-breathing relaxation for pain management in patients with acute myocardial infarction.

ACKNOWLEDGEMENTS

The authors would like to express their sincere gratitude to Dr. Moh. Soewandhie Regional General Hospital, Surabaya, particularly the Intensive Cardiac Care Unit staff, for their support during the implementation of this study. Appreciation is also extended to the patients and their families for their participation, cooperation, and trust throughout the data-collection process. The authors are grateful to the academic supervisors and colleagues who provided guidance, constructive feedback, and support during the preparation and completion of this manuscript.

FUNDING

This study received no specific grant or financial support from any governmental, commercial, or non-profit funding agency.

DATA AVAILABILITY

The data supporting the findings of this study are available from the corresponding author upon reasonable request, subject to applicable ethical requirements and participant confidentiality. Individual patient-level data are not publicly available because they contain confidential clinical information.

AUTHOR CONTRIBUTION

The author was responsible for the conceptualization and design of the study, literature review, nursing assessment, data collection, implementation of the deep-breathing relaxation intervention, data organization, analysis and interpretation of clinical findings, and preparation of the manuscript. The academic supervisor provided academic guidance, methodological supervision, critical evaluation of the study process and findings, and assistance with manuscript revision. Both parties reviewed the final manuscript and approved its submission. The author accepts responsibility for the accuracy, integrity, and completeness of the work.

DECLARATIONS**ETHICAL APPROVAL**

Ethical approval was obtained from the Health Research Ethics Committee of Poltekkes Kemenkes Surabaya under Approval No. EA/4427/KEPK-Poltekkes_Sby/V/2026. The approval number and approval date should be verified against the official institutional ethics documentation before final submission.

CONSENT FOR PUBLICATION PARTICIPANTS

Written informed consent was obtained from all participants before the implementation of the nursing intervention and collection of clinical data. Participants were informed about the study procedures and their voluntary right to participate.

COMPETING INTERESTS

The author declares that there are no competing interests associated with this study or its publication.

REFERENCES

- [1] M. Di Cesare, P. Perel, S. Taylor, C. Kabudula, H. Bixby, T. A. Gaziano, D. V. McGhie, J. Mwangi, B. Pervan, J. Narula, D. Pineiro, and F. J. Pinto, "The heart of the world," *Global Heart*, vol. 19, no. 1, Art. no. 11, 2024, doi: 10.5334/gh.1288.
- [2] N. Salari, F. Morddaranjogh, A. Abdolmaleki, S. Rasoulpoor, A. A. Khaleghi, L. Afshar Hezarkhani, S. Shohaimi, and M. Mohammadi, "The global prevalence of myocardial infarction: A systematic review and meta-analysis," *BMC Cardiovascular Disorders*, vol. 23, Art. no. 206, 2023, doi: 10.1186/s12872-023-03231-w.
- [3] S. Rao et al., "2025 ACC/AHA/ACEP/NAEMSP/SCAI guideline for the management of patients with acute coronary syndromes," *Circulation*, vol. 151, no. 13, pp. e771–e862, 2025, doi: 10.1161/CIR.0000000000001309.
- [4] R. A. Byrne et al., "2023 ESC Guidelines for the management of acute coronary syndromes," *European Heart Journal*, vol. 44, no. 38, pp. 3720–3826, 2023, doi: 10.1093/eurheartj/ehad191.
- [5] M. Buske, H.-J. Feistritz, A. Jobs, and H. Thiele, "Management of acute coronary syndrome: ESC guidelines 2023," *Herz*, vol. 49, no. 1, pp. 5–14, 2024, doi: 10.1007/s00059-023-05222-1.
- [6] H. Goh et al., "The epidemiology and burden of cardiovascular diseases in countries of the Association of Southeast Asian Nations, 1990–2021: Findings from the Global Burden of Disease Study 2021," *The Lancet Public Health*, vol. 10, no. 6, pp. e467–e479, 2025, doi: 10.1016/S2468-2667(25)00087-8.
- [7] M. Domienik-Karłowicz et al., "Fourth universal definition of myocardial infarction: Selected messages from the European Society of Cardiology document and lessons learned from the new guidelines on ST-segment elevation myocardial infarction and non-ST-segment elevation acute coronary syndrome," *Cardiology Journal*, vol. 28, no. 2, pp. 195–201, 2022, doi: 10.5603/CJ.a2021.0036.
- [8] M. Gulati et al., "2021 AHA/ACC/ASE/CHEST/SAEM/SCCT/SCMR guideline for the evaluation and diagnosis of chest pain," *Circulation*, vol. 144, no. 22, pp. e368–e454, 2021, doi: 10.1161/CIR.0000000000001029.
- [9] Y. Sandoval, F. S. Apple, S. A. Mahler, R. Body, P. O. Collinson, and A. S. Jaffe, "High-sensitivity cardiac troponin and the 2021 AHA/ACC/ASE/CHEST/SAEM/SCCT/SCMR guidelines for the evaluation and diagnosis of acute chest pain," *Circulation*, vol. 146, no. 7, pp. 569–581, 2022, doi: 10.1161/CIRCULATIONAHA.122.059678.
- [10] H. Jafari et al., "Can slow deep breathing reduce pain? An experimental study exploring mechanisms," *Journal of Pain*, vol. 21, no. 9–10, pp. 1018–1030, 2021, doi: 10.1016/j.jpain.2019.12.010.
- [11] A. Gholamrezaei, I. Van Diest, Q. Aziz, A. Pauwels, J. Tack, J. W. S. Vlaeyen, and L. Van Oudenhove, "Effect of slow, deep breathing on visceral pain perception and its underlying psychophysiological mechanisms," *Neurogastroenterology & Motility*, vol. 34, no. 4, Art. no. e14242, 2022, doi: 10.1111/nmo.14242.
- [12] A. E. Joseph et al., "Effects of slow deep breathing on acute clinical pain in adults: A systematic review and meta-analysis of randomized controlled trials," *Journal of Evidence-Based Integrative Medicine*, vol. 27, Art. no. 2515690X221078006, 2022, doi: 10.1177/2515690X221078006.
- [13] S. Laborde et al., "Effects of voluntary slow breathing on heart rate and heart rate variability: A systematic review and a meta-analysis," *Neuroscience & Biobehavioral Reviews*, vol. 138, Art. no. 104711, 2022, doi: 10.1016/j.neubiorev.2022.104711.
- [14] P. Garg et al., "Effect of breathing exercises on blood pressure and heart rate: A systematic review and meta-analysis," *International Journal of Cardiology: Cardiovascular Risk and Prevention*, vol. 19, Art. no. 200232, 2023, doi: 10.1016/j.ijcrp.2023.200232.
- [15] S. Chaiduang, T. Klinsofphon, and J. Wattanapanyawech, "The effect of breathing exercise on hemodynamics and heart rate variability parameters in hypertensive patients: A systematic review," *Journal of Bodywork and Movement Therapies*, vol. 40, pp. 42–52, 2024, doi: 10.1016/j.jbmt.2024.03.043.
- [16] R. A. A. Rania, "Deep breathing exercise application: Its effect on physiological parameters among patients with acute coronary syndrome," *Egyptian Journal of Health Care*, vol. 15, no. 2, pp. 52–62, 2024, doi: 10.21608/ejhc.2024.350649.
- [17] H. A. Mostafa, M. S. Abdelhady, and L. M. Ismail, "Efficacy of deep breathing exercise on pain perception among coronary artery bypass grafting patients," *World Journal of Nursing Sciences*, vol. 7, no. 1, pp. 1–12, 2021.
- [18] E. M. Ryan, A.-M. Creaven, E. Ní Néill, and P. S. O'Súilleabháin, "Anxiety following myocardial infarction: A systematic review of psychological interventions," *Health Psychology*, vol. 41, no. 9, pp. 599–610, 2022, doi: 10.1037/hea0001216.
- [19] R. J. Chong et al., "Prevalence of depression, anxiety and post-traumatic stress disorder (PTSD) after acute myocardial infarction: A systematic review and meta-analysis," *Journal of Clinical Medicine*, vol. 14, no. 6, Art. no. 1786, 2025, doi: 10.3390/jcm14061786.
- [20] L. Gopichandran et al., "Effectiveness of progressive muscle relaxation and deep breathing exercise on pain, disability, and sleep among patients with chronic tension-type headache: A randomized control trial," *Holistic Nursing Practice*, vol. 38, no. 5, pp. 285–296, 2024, doi: 10.1097/HNP.0000000000000460.
- [21] S. L. Sibbald, S. Paciocco, M. Fournie, R. Van Asseldonk, and T. Scurr, "Continuing to enhance the quality of case study methodology in health services research," *Healthcare Management Forum*, vol. 34, no. 5, pp. 291–296, 2021, doi: 10.1177/08404704211028857.
- [22] J. Green, B. Hanckel, M. Petticrew, S. Paparini, and S. Shaw, "Case study research and causal inference," *BMC Medical Research Methodology*, vol. 22, art. no. 307, 2022, doi: 10.1186/s12874-022-01790-8.
- [23] S. Modarresi, M. Lukacs, M. Ghodrati, S. Salim, J. MacDermid, and D. M. Walton, "A systematic review and synthesis of psychometric

- properties of the Numeric Pain Rating Scale and the Visual Analog Scale for use in people with neck pain.” *Clinical Journal of Pain*, vol. 38, no. 2, pp. 132–148, 2022, doi: 10.1097/AJP.0000000000000999.
- [24] A. E. Joseph, R. N. Moman, R. A. Barman, D. J. Kleppel, N. D. Eberhart, D. J. Gerberi, M. H. Murad, and W. M. Hooten, “Effects of slow deep breathing on acute clinical pain in adults: A systematic review and meta-analysis of randomized controlled trials,” *Journal of Evidence-Based Integrative Medicine*, vol. 27, 2022, doi: 10.1177/2515690X221078006.
- [25] P. Garg, A. Mendiratta, A. Banga, A. C. F. Bucharles, M. V. F. Piccoli, B. Kamaraj, R. K. Qasba, V. Bansal, J. Thimmapuram, R. Pargament, and R. Kashyap, “Effect of breathing exercises on blood pressure and heart rate: A systematic review and meta-analysis,” *International Journal of Cardiology Cardiovascular Risk and Prevention*, vol. 20, art. no. 200232, 2024, doi: 10.1016/j.ijcrp.2023.200232.
- [26] R. A. Byrne et al., “2023 ESC Guidelines for the management of acute coronary syndromes,” *European Heart Journal*, vol. 44, no. 38, pp. 3720–3826, 2023, doi: 10.1093/eurheartj/ehad191.
- [27] A. E. Joseph, R. N. Moman, R. A. Barman, D. J. Kleppel, N. D. Eberhart, D. J. Gerberi, M. H. Murad, and W. M. Hooten, “Effects of slow deep breathing on acute clinical pain in adults: A systematic review and meta-analysis of randomized controlled trials,” *Journal of Evidence-Based Integrative Medicine*, vol. 27, 2022, doi: 10.1177/2515690X221078006.
- [28] H. Jafari, A. Gholamrezaei, M. Franssen, L. Van Oudenhove, Q. Aziz, O. Van den Bergh, J. W. S. Vlaeyen, and I. Van Diest, “Can slow deep breathing reduce pain? An experimental study exploring mechanisms,” *The Journal of Pain*, vol. 21, no. 9–10, pp. 1018–1030, 2020, doi: 10.1016/j.jpain.2019.12.010.
- [29] A. Gholamrezaei, I. Van Diest, Q. Aziz, A. Pauwels, J. Tack, J. W. S. Vlaeyen, and L. Van Oudenhove, “Effect of slow, deep breathing on visceral pain perception and its underlying psychophysiological mechanisms,” *Neurogastroenterology & Motility*, vol. 34, no. 4, e14242, 2022, doi: 10.1111/nmo.14242.
- [30] S. Laborde, M. S. Allen, U. Borges, F. Dosseville, T. J. Hosang, M. Iskra, E. Mosley, C. Salvotti, L. Spolverato, N. Zammit, and F. Javelle, “Effects of voluntary slow breathing on heart rate and heart rate variability: A systematic review and a meta-analysis,” *Neuroscience & Biobehavioral Reviews*, vol. 138, art. no. 104711, 2022, doi: 10.1016/j.neubiorev.2022.104711.
- [31] P. Garg, A. Mendiratta, A. Banga, A. C. F. Bucharles, M. V. F. Piccoli, B. Kamaraj, R. K. Qasba, V. Bansal, and R. Kashyap, “Effect of breathing exercises on blood pressure and heart rate: A systematic review and meta-analysis,” *International Journal of Cardiology: Cardiovascular Risk and Prevention*, vol. 20, art. no. 200232, 2024, doi: 10.1016/j.ijcrp.2023.200232.
- [32] E. M. Ryan, A.-M. Creaven, E. Ní Néill, and P. S. O’Súilleabháin, “Anxiety following myocardial infarction: A systematic review of psychological interventions,” *Health Psychology*, vol. 41, no. 9, pp. 599–610, 2022, doi: 10.1037/hea0001216.
- [33] R. J. Chong, Y. Hao, E. W. Q. Tan, G. J. L. Mok, C.-H. Sia, J. S. Y. Ho, M. Y. Y. Chan, and A. F. W. Ho, “Prevalence of depression, anxiety and post-traumatic stress disorder (PTSD) after acute myocardial infarction: A systematic review and meta-analysis,” *Journal of Clinical Medicine*, vol. 14, no. 6, art. no. 1786, 2025, doi: 10.3390/jcm14061786.
- [34] H. A. Mostafa, M. S. Abdelhady, and L. M. Ismail, “Efficacy of deep breathing exercise on pain perception among coronary artery bypass grafting patients,” *World Journal of Nursing Sciences*, vol. 7, no. 1, pp. 1–12, 2021, doi: 10.5829/idosi.wjns.2021.01.12.
- [35] H. Babamohamadi, M. Karkeabadi, and A. Ebrahimian, “The effect of rhythmic breathing on the severity of sternotomy pain after coronary artery bypass graft surgery: A randomized controlled clinical trial,” *Evidence-Based Complementary and Alternative Medicine*, vol. 2021, art. no. 9933876, 2021, doi: 10.1155/2021/9933876.
- [36] M. I. Jarrah, I. M. Hweidi, S. A. Al-Dolat, H. N. Alhawtmeh, S. M. Al-Obeisat, L. I. Hweidi, A. I. Hweidi, and O. A. Alkouri, “The effect of slow deep breathing relaxation exercise on pain levels during and post chest tube removal after coronary artery bypass graft surgery,” *International Journal of Nursing Sciences*, vol. 9, no. 2, pp. 155–161, 2022, doi: 10.1016/j.ijnss.2022.03.001.