



The Effects of Deep Breathing Relaxation Techniques on Pain Intensity in Patients After a Cesarean Section: A Case Study

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Abstract

Acute pain is a common postoperative problem following cesarean section and may interfere with maternal mobility, rest, comfort, and daily caregiving activities. Deep breathing relaxation is a simple, low-cost non-pharmacological intervention that can be integrated into nursing care to support postoperative pain management. This study aimed to describe the application of deep breathing relaxation and changes in pain intensity among patients following cesarean section. An empirical descriptive case-study design was applied to five postpartum women who had undergone cesarean section and received inpatient care at four hospitals in Batang and Pekalongan, Indonesia. Pain intensity was measured using the Numeric Rating Scale before and after the intervention, which was administered once to twice daily for 10–15 minutes per session throughout a 3 × 24-hour hospitalization period. All participants demonstrated decreased pain intensity, with individual pre-intervention scores of 5, 3, 8, 6, and 6 and a mean score of 5.6, which decreased to post-intervention scores of 2, 2, 3, 2, and 3 with a mean of 2.4. The mean reduction was 3.2 points, and all participants reached the mild-pain category at final assessment, indicating that deep breathing relaxation may serve as a feasible complementary nursing intervention for post-cesarean pain management. The findings remain descriptive because standard postoperative care, including analgesic therapy, continued and no control group was included, limiting causal interpretation of the observed changes.

Keywords: Acute Pain, Cesarean Section, Deep Breathing Relaxation, Maternal Nursing, Numeric Rating Scale.



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INTRODUCTION

Section caesarea (SC) is a surgical procedure for delivering a baby through an incision in the abdominal wall and uterus, and its utilization has increased substantially across countries, with global and regional projections indicating that the proportion of births delivered by SC will continue to rise toward 2030 (Betran et al., 2021). This epidemiological shift has important implications for modern maternal healthcare because the growing volume of surgical births inevitably increases the number of women requiring structured postoperative recovery and pain management. Acute postoperative pain remains one of the most clinically relevant concerns following SC, with evidence from a systematic review and meta-analysis demonstrating that postoperative acute pain continues to affect a considerable proportion of women after cesarean delivery and is influenced by multiple maternal and perioperative factors (Demilew et al., 2024). The clinical significance of this problem extends beyond the subjective experience of discomfort because severe postoperative pain may interfere with mobility, sleep, respiratory activity, emotional well-being, and the performance of daily activities during the early postpartum period (Emrich et al., 2023). Persistent or poorly controlled pain can also complicate maternal recovery at a time when women must simultaneously adapt to the physical and psychological demands of caring for a newborn. The contemporary challenge is therefore not merely to reduce pain scores, but to establish approaches that can be integrated into comprehensive, safe, and patient-centered postoperative care.

Pain management following SC is increasingly conceptualized as a multimodal process in which pharmacological analgesia is complemented by appropriate regional techniques and supportive nonpharmacological interventions (Roofthoof et al., 2021). Although analgesic therapy remains fundamental, dependence on pharmacological strategies alone may not adequately address the

cognitive, emotional, autonomic, and behavioral dimensions involved in postoperative pain perception. Anxiety is particularly relevant because maternal psychological states may interact with pain perception and postoperative analgesic requirements, indicating that pain following cesarean delivery cannot be understood exclusively as a consequence of tissue injury (Poehlmann et al., 2022). Nonpharmacological interventions consequently have gained attention as accessible adjuncts that can be administered within routine nursing care without requiring complex equipment or substantial additional resources. Deep breathing relaxation is one such intervention because it can be taught relatively easily, performed repeatedly by patients, and incorporated into postoperative nursing activities. Evidence from studies of cesarean patients indicates that deep breathing relaxation may also have value before surgery by reducing preoperative anxiety, suggesting a broader psychophysiological role beyond direct pain modulation (Karim & Sulistiyah, 2025). The relevance of this approach becomes particularly pronounced in settings where nurses require simple, low-cost interventions that can complement standard analgesic management without replacing clinically indicated medical treatment.

Deep breathing relaxation involves controlled inspiration and expiration performed slowly and rhythmically, creating a physiological condition that may influence autonomic regulation and the patient's perception of discomfort. A systematic review and meta-analysis found that voluntary slow breathing can increase heart rate variability and modify cardiovascular autonomic activity, supporting the plausibility of autonomic regulation as one pathway through which breathing-based interventions may influence recovery (Laborde et al., 2022). However, the assumption that autonomic changes automatically translate into analgesic effects remains theoretically and empirically uncertain. Experimental evidence indicates that controlled breathing can alter cardiovascular autonomic responses while respiratory rate and inspiratory loading do not necessarily produce corresponding changes in pain intensity, suggesting that the relationship between breathing, autonomic modulation, and pain is more complex than a simple physiological pathway (Gholamrezaei et al., 2021). Attention regulation, emotional responses, perceived control, and relaxation may therefore operate alongside autonomic mechanisms in shaping the patient's experience of pain. Broader evidence supports the potential analgesic value of slow deep breathing, as a systematic review and meta-analysis of randomized controlled trials reported lower acute clinical pain following the intervention, although the certainty of evidence was limited and substantial heterogeneity remained across studies (Joseph et al., 2022). These findings position deep breathing relaxation as a promising intervention while simultaneously indicating the need for context-specific investigation rather than assuming uniform effects across different pain populations.

Evidence from maternal and obstetric populations provides further support for breathing-based and relaxation-oriented interventions, yet the existing literature remains methodologically heterogeneous. A systematic review and meta-analysis has shown that breathing exercises can influence outcomes related to labor duration, illustrating the broader application of breathing-based techniques within maternity care (Issac et al., 2023). However, evidence concerning labor pain cannot be directly equated with evidence concerning postoperative pain because the physiological mechanisms, tissue injury, movement limitations, and analgesic context differ substantially between vaginal labor and recovery following abdominal surgery. Studies specifically involving post-SC patients have reported reductions in pain following slow deep breathing therapy, indicating that the intervention may have practical relevance in the postoperative setting (Idris, 2023). Similar reductions have been documented in case-based applications of deep breathing relaxation among post-SC clients, supporting its feasibility as a nursing intervention while providing only limited evidence regarding generalizability (Roslianti et al., 2022). Other relaxation modalities, including Benson relaxation, have also demonstrated reductions in post-cesarean pain, suggesting that relaxation-induced changes in attention and emotional arousal may contribute to analgesic outcomes across different intervention formats (Mostafa Mohammed et al., 2023). Case-based evidence combining deep breathing relaxation with Quran recitation has likewise reported improvements in acute pain among post-SC patients, although the combined nature of the intervention makes the specific contribution of deep breathing difficult to isolate (Musviro et al., 2024). The literature therefore supports the feasibility and potential effectiveness of relaxation-based interventions while leaving unresolved the extent to which deep breathing itself contributes to changes in postoperative pain intensity.

A more focused examination of the literature reveals several empirical and conceptual gaps that justify further investigation of deep breathing relaxation after SC. Recent case studies have reported

decreased pain following deep breathing relaxation in post-SC patients, including women undergoing cesarean delivery for preeclampsia, but these findings remain primarily descriptive and provide limited control over contextual factors that may influence pain trajectories (Dwiarto et al., 2025). Comparable evidence from Benson relaxation studies demonstrates that relaxation interventions can reduce post-cesarean pain, yet the physiological and behavioral components of Benson relaxation differ from those of isolated deep breathing, limiting direct attribution of effects to respiratory regulation (Nisa & Haniyah, 2024). Other interventions have combined deep breathing with guided imagery and music, producing favorable pain outcomes but simultaneously introducing multiple active components that obscure the independent contribution of deep breathing (Purnamasari et al., 2025). Recent work combining deep breathing relaxation with guided imagery within a Comfort Theory framework further illustrates the growing sophistication of nonpharmacological pain management while reinforcing the methodological difficulty of distinguishing the effect of breathing from co-interventions (Priyantini et al., 2026). Case-based research has also explored Benson relaxation together with other physical relaxation approaches, reflecting an expanding but fragmented evidence base in postoperative maternal care (Talukdar & Chumthang, 2025). Similar findings from labor-phase research suggest that deep breathing techniques can influence maternal pain, but differences between labor pain and post-surgical pain prevent straightforward extrapolation to women recovering from SC (Tandondo et al., 2025). The unresolved issue is therefore not whether relaxation interventions can be beneficial in general, but how an isolated, simple, and clinically feasible deep breathing technique is associated with changes in pain intensity specifically during postoperative SC recovery.

This study is positioned within this gap by focusing specifically on the application of deep breathing relaxation as a nursing-based nonpharmacological intervention for pain following SC, while interpreting changes in pain intensity within the broader physiological and psychological context of postoperative recovery. A case study approach is particularly relevant for examining the clinical application of a simple intervention in an authentic care environment because it permits close observation of changes in pain intensity alongside the patient's response to the intervention. The approach does not seek to replace evidence generated through randomized trials, but rather to provide clinically grounded evidence that can contribute to the refinement of hypotheses concerning breathing-based pain management. The study also responds to the need for interventions that are inexpensive, minimally invasive, easy to teach, and potentially applicable alongside standard postoperative analgesia. Its analytical position recognizes that changes in pain intensity may reflect not only the direct effects of breathing regulation but also relaxation, attentional shifts, emotional responses, and individual characteristics of postoperative patients. This perspective enables the intervention to be examined as a practical component of contemporary maternal nursing care rather than as an isolated physiological technique. The study aims to describe changes in pain intensity following the application of deep breathing relaxation techniques in a patient after cesarean section and to interpret these changes in relation to the potential physiological and psychosocial mechanisms underlying postoperative pain. The study contributes theoretically by strengthening the conceptual understanding of breathing-based relaxation as a multidimensional approach to pain modulation and contributes methodologically by providing a clinically contextualized case-based examination of an easily implementable nonpharmacological intervention in post-cesarean care.

RESEARCH METHODS

This study employed an empirical, descriptive case-study design to examine changes in pain intensity following the application of deep breathing relaxation techniques in postpartum women after cesarean section. The study involved five postpartum patients who had undergone cesarean section and were receiving inpatient care at RS QIM Batang, RSUD Limpung Batang, RSU ARO Pekalongan, and RSUD Kraton Pekalongan. Participants were recruited based on the inclusion criteria of being postpartum women after cesarean section, experiencing postoperative pain, receiving inpatient care during the study period, and providing voluntary consent to participate. Patients were excluded when they had other medical complications or clinical conditions that could substantially interfere with pain assessment or participation in the intervention. The use of a case-study design was considered appropriate for documenting the clinical application of a simple nonpharmacological intervention in an actual postoperative setting, particularly because previous case-based studies have similarly examined deep breathing relaxation among patients recovering from cesarean section (Roslianti et al., 2022). The

intervention consisted of slow and controlled breathing, in which participants were instructed to inhale gradually through the nose, hold the breath for approximately three seconds, and exhale slowly through the mouth. This breathing pattern was selected because voluntary slow breathing has been associated with changes in cardiovascular autonomic regulation that may accompany relaxation responses (Laborde et al., 2022).

Pain intensity was assessed using the Numeric Rating Scale (NRS) ranging from 0 to 10, with scores of 1–3 interpreted as mild pain, 4–6 as moderate pain, and 7–10 as severe pain. The deep breathing relaxation intervention was administered once to twice daily, with each session lasting approximately 10–15 minutes throughout the 3×24 -hour hospitalization period. Pain intensity was measured before the intervention and reassessed during the final evaluation to identify changes in individual pain scores and the overall pattern observed across participants. The intervention procedure was implemented consistently across participants while allowing the patients to perform the breathing exercise in a comfortable position according to their postoperative condition. Previous evidence from randomized controlled trials has indicated that slow deep breathing may reduce acute clinical pain, although the certainty and consistency of the available evidence remain limited (Joseph et al., 2022). Data were analyzed descriptively by comparing pre-intervention and post-intervention pain scores for each participant and calculating the corresponding mean pain score across the five cases, without applying inferential statistical testing because of the small sample size and absence of a control group. The study was conducted in accordance with ethical principles of nursing research, including obtaining informed consent, maintaining participant confidentiality, protecting personal identities through anonymization, and ensuring that participants retained the right to refuse or discontinue participation at any stage without consequences for their care.

RESULTS AND DISCUSSION

Changes in Pain Intensity Following Deep Breathing Relaxation

The five respondents included in this case study demonstrated a consistent reduction in pain intensity following the implementation of deep breathing relaxation during the 3×24 -hour postoperative care period. As presented in Table 1, the initial pain scores ranged from 3 to 8, with a mean score of 5.6, indicating that the overall pain experience was within the moderate category before the intervention. After the intervention period, pain scores decreased to a range of 2–3, producing a mean score of 2.4 and a mean reduction of 3.2 points. This pattern indicates a clinically observable shift from predominantly moderate-to-severe pain toward mild pain among the five cases. The magnitude of change was not uniform, suggesting that individual postoperative characteristics may influence responsiveness to relaxation-based pain management. The descriptive nature of the study requires these findings to be interpreted as an observed clinical pattern rather than as definitive evidence of a causal treatment effect.

Table 1. Pain Intensity Before and After the Application of Deep Breathing Relaxation

No.	Respondent	Age (years)	Indication for CS	Pre-test	Post-test	Reduction
1	Mrs. S	27	Cephalopelvic disproportion (CPD)	5	2	3
2	Mrs. H	41	Umbilical cord entanglement	3	2	1
3	Mrs. S	30	Breech presentation	8	3	5
4	Mrs. L	29	Premature rupture of membranes	6	2	4
5	Mrs. Y	38	Breech presentation	6	3	3
Mean				5.6	2.4	3.2

The distribution shown in Table 1 indicates that all five respondents experienced a reduction in NRS scores, corresponding to a 100% proportion of cases showing improvement during the observation period. The largest reduction occurred in Respondent 3, whose score decreased from 8 to 3, representing a five-point change and a transition from severe to mild pain. Respondent 4 demonstrated the second-

largest reduction, from 6 to 2, while Respondents 1 and 5 each experienced a three-point decrease. The smallest reduction occurred in Respondent 2, whose initial score was already relatively low at 3 and decreased to 2. This variation is clinically meaningful because patients entering postoperative recovery with different baseline pain intensities may have different opportunities for observable improvement. The findings also suggest that the intervention was feasible across patients with different indications for cesarean section, although the present design cannot determine whether the indication itself influenced responsiveness.

The reduction from a mean NRS score of 5.6 to 2.4 represents a 3.2-point absolute decrease and places the post-intervention mean within the mild-pain category. From a clinical perspective, this shift is relevant because postoperative pain intensity is closely associated with the patient's ability to engage in movement, rest, respiratory activity, and other aspects of early recovery. Slow deep breathing has previously been investigated as a nonpharmacological approach for acute pain, with a systematic review and meta-analysis reporting significantly lower post-intervention pain scores among participants receiving slow deep breathing compared with controls, although substantial heterogeneity and very low certainty of evidence limited the strength of the conclusion (Joseph et al., 2022). The present findings are directionally consistent with that broader evidence because pain decreased following repeated exposure to a controlled breathing technique. The difference between the present findings and stronger experimental evidence lies in the absence of a control group and the small number of participants, which prevents estimation of an independent intervention effect. The observed reduction is therefore best interpreted as evidence of clinical feasibility and a potentially beneficial pain-management pattern requiring confirmation through controlled studies.

The findings are also consistent with case-based evidence from post-cesarean populations, in which deep breathing relaxation has been reported to accompany reductions in postoperative pain intensity. Roslianti et al. (2022) documented the application of deep breathing relaxation as an intervention for pain in a post-cesarean client, supporting the feasibility of incorporating the technique into nursing care. A more recent case report by Dwiarto et al. (2025) similarly described reduced pain following deep breathing relaxation in post-cesarean patients with preeclampsia. The convergence of these observations with the present five cases strengthens the clinical plausibility of the intervention while not resolving the question of causality. Case-based evidence is particularly useful for demonstrating how an intervention can be delivered under routine care conditions, but its capacity to distinguish intervention effects from spontaneous postoperative recovery remains limited. The present study contributes to this evidence base by documenting the pattern across five patients treated in different hospital settings rather than relying on a single clinical observation.

The temporal pattern of the findings also requires consideration because postoperative pain naturally changes as tissue injury begins to recover and patients progress through the early postpartum period. The intervention was administered repeatedly during hospitalization, meaning that the final pain scores reflect cumulative exposure to deep breathing relaxation together with physiological recovery, analgesic treatment, rest, nursing care, and other routine postoperative processes. This distinction is important because the systematic review by Joseph et al. (2022) found that effects of slow deep breathing varied according to pain etiology, with the pooled postoperative subgroup not demonstrating a statistically significant difference despite an overall favorable effect across acute pain studies. The present decrease in pain therefore should not be interpreted as confirmation that deep breathing produces the same analgesic effect across all postoperative populations. Instead, the results indicate that the technique may function as a practical adjunct within a broader recovery process. This interpretation is particularly appropriate for a case-study design in which the purpose is to characterize clinical change rather than establish treatment efficacy through hypothesis testing.

The clinical meaning of the observed change becomes stronger when the numerical reduction is considered alongside the categorical movement from moderate or severe pain toward mild pain. Before the intervention, three respondents reported moderate pain, one reported severe pain, and one reported mild pain, whereas the post-intervention assessment placed all five respondents within the mild-pain category. Such a distributional shift suggests that the intervention was associated with an improvement that was not restricted to patients with a particular initial pain level. Nevertheless, the magnitude of improvement differed substantially between respondents, indicating that pain response should be understood as an individualized phenomenon rather than a fixed consequence of the intervention. Previous research has similarly emphasized that pain after cesarean delivery is influenced

by multiple clinical and psychological determinants, reinforcing the need to interpret postoperative pain changes within the broader context of patient characteristics and perioperative management (Demilew et al., 2024). The present findings consequently support deep breathing relaxation as a potentially useful adjunct to postoperative nursing care while retaining appropriate caution regarding attribution and generalizability.

Physiological and Psychophysiological Mechanisms Underlying Pain Reduction

The reduction in pain intensity observed in the five respondents can be interpreted through a physiological and psychophysiological framework in which controlled breathing may influence autonomic regulation, attentional processes, and emotional responses associated with postoperative pain. Surgical tissue injury after cesarean section activates nociceptive pathways and inflammatory responses that generate pain sensations, while the accompanying stress response may increase muscular tension and heighten attention toward painful stimuli. Deep breathing relaxation introduces a slower and more controlled respiratory pattern that may modify the patient's physiological state during periods of discomfort. This process is relevant because pain perception is not determined exclusively by the intensity of peripheral tissue injury but is also shaped by central processing, emotional state, attention, and autonomic activity. The mean reduction from 5.6 to 2.4 in the present cases may therefore reflect an interaction between physiological relaxation and changes in how patients perceived and responded to postoperative discomfort. Such an interpretation remains consistent with the case-study design because the observed outcome represents a multidimensional response rather than an isolated physiological measurement.

One of the most established physiological responses associated with slow breathing is alteration of cardiovascular autonomic regulation. Voluntary slow breathing has been shown to increase heart rate variability, particularly indices associated with vagally mediated cardiac regulation, during and following breathing exercises (Laborde et al., 2022). Increased heart rate variability is generally interpreted as an indicator of greater flexibility in autonomic regulation and may accompany a state characterized by reduced physiological arousal. In the context of postoperative pain, a shift toward a more regulated autonomic state may reduce the physiological tension that accompanies painful experiences. The controlled inhalation and prolonged exhalation used in the present intervention may have facilitated this relaxation response by providing a repetitive respiratory rhythm that patients could consciously regulate. The potential relevance of this mechanism is illustrated in Table 2, which summarizes the principal physiological and psychological processes that may contribute to changes in pain perception. These mechanisms should be regarded as complementary pathways rather than independent explanations because relaxation, autonomic regulation, and attentional control can occur simultaneously during deep breathing.

Table 2. Potential Mechanisms Associated With Deep Breathing Relaxation and Pain Modulation

Mechanism	Physiological or psychological process	Potential relevance to postoperative pain
Slow Respiratory Pattern	Reduction and stabilization of respiratory rate	Promotes a controlled physiological state during pain episodes
Parasympathetic Modulation	Increased vagally mediated cardiovascular regulation	May support relaxation and autonomic stabilization
Heart Rate Variability	Increased HRV during voluntary slow breathing	Reflects changes in autonomic regulation
Attentional Regulation	Focus shifts from surgical pain toward breathing activity	May reduce excessive attention to pain sensations
Emotional Relaxation	Reduction of tension and distress during controlled breathing	May influence subjective pain perception
Perceived Control	Patient actively participates in pain-management process	May improve coping with postoperative discomfort

The mechanisms summarized in Table 2 also indicate why autonomic regulation alone cannot adequately explain the reduction in pain observed in this study. Experimental research has demonstrated that controlled breathing can modify cardiovascular autonomic responses without necessarily producing a corresponding reduction in experimentally induced pain, indicating that changes in autonomic activity and analgesia are not obligatorily coupled (Gholamrezaei et al., 2021). This distinction is important when interpreting the present findings because an improvement in NRS scores cannot be attributed solely to increased parasympathetic activity. Deep breathing may instead influence several interconnected processes, including reduction of physiological arousal, redirection of attention, emotional regulation, and enhanced perceived control over discomfort. The act of concentrating on inhalation and exhalation provides patients with a structured behavioral task that can compete with excessive attention to surgical pain. A reduction in pain-related attention may subsequently alter the subjective intensity assigned to nociceptive sensations without eliminating the underlying tissue injury. The mechanism is therefore more appropriately conceptualized as modulation of pain perception and coping rather than direct elimination of the biological source of pain.

Attentional regulation may represent an important component of the intervention because postoperative pain is experienced within a continuous stream of sensory and emotional information. During deep breathing, patients are instructed to consciously attend to the rhythm of inhalation, breath holding, and exhalation, creating a focal task that may reduce excessive monitoring of the surgical wound. This attentional shift may be particularly relevant during episodes in which anxiety or anticipatory concern amplifies the salience of pain. Evidence from maternal populations indicates that psychological factors can contribute to postoperative pain experiences, suggesting that interventions capable of promoting emotional regulation may have relevance beyond their direct physiological effects. In the present cases, the absence of a standardized measure of anxiety prevents direct determination of whether psychological relaxation mediated the observed reduction. Nevertheless, the consistent decline in NRS scores across the five respondents provides a clinically relevant basis for considering attentional and emotional mechanisms as possible contributors. Future investigations incorporating validated anxiety and distress measures could clarify whether patients who demonstrate greater psychological relaxation also experience greater reductions in postoperative pain.

The relationship between breathing and pain can also be understood through the concept of perceived control, in which active participation in a self-management technique may change how patients respond to an unpleasant sensory experience. Unlike passive receipt of medication, deep breathing requires patients to perform a deliberate behavioral action that can be repeated when discomfort becomes noticeable. This characteristic may increase patients' sense of agency during postoperative recovery, particularly when movement and other activities are temporarily restricted by surgical discomfort. Previous evidence concerning breathing-based interventions in maternity care indicates that controlled breathing techniques have been explored as strategies for managing maternal discomfort, although evidence from labor cannot be directly generalized to postoperative cesarean pain (Issac et al., 2023). The present intervention differs from breathing exercises designed to facilitate labor because it was implemented after surgical delivery and targeted postoperative pain rather than uterine contractions. This distinction supports a more specific interpretation in which deep breathing is considered a postoperative coping and relaxation strategy. The ability to perform the intervention without equipment also makes perceived control a potentially relevant practical component of its clinical value.

The physiological and psychophysiological interpretation of the findings should remain cautious because the present study did not directly measure heart rate variability, respiratory rate, cortisol, anxiety, or other biomarkers of relaxation. The proposed mechanisms are therefore theoretical interpretations supported by previous physiological and clinical literature rather than variables demonstrated empirically in the five respondents. This limitation does not diminish the observed clinical pattern but establishes an important boundary between the measured outcome and the mechanisms proposed to explain it. The reduction in mean pain intensity from 5.6 to 2.4 may reflect the combined influence of autonomic regulation, attentional redirection, emotional relaxation, perceived control, natural postoperative recovery, and concurrent clinical management. The broader evidence suggests that slow deep breathing has potential for acute pain modulation, while also indicating variability in the strength and consistency of its effects across populations and experimental conditions (Joseph et al., 2022). A mechanistic understanding of the intervention should therefore treat deep breathing relaxation

as a multidimensional behavioral intervention rather than as a single autonomic stimulus. This perspective provides a more scientifically defensible explanation for the pain reduction observed in the present case study and establishes a basis for subsequent investigation using physiological and psychological outcome measures.

Clinical and Patient-Related Factors Influencing Post-Cesarean Pain

The reduction in pain intensity observed in the present cases should be interpreted within the broader clinical context of postoperative cesarean care because pain is influenced by pharmacological, psychological, surgical, and behavioral factors. Although all five respondents received the same deep breathing relaxation protocol, their baseline pain scores differed from 3 to 8, indicating substantial individual variation in postoperative pain experience. Such variation is expected because acute pain following cesarean section is determined by multiple interacting factors rather than by tissue injury alone. A systematic review and meta-analysis identified several maternal and perioperative characteristics associated with postoperative acute pain after cesarean delivery, reinforcing the multifactorial nature of this clinical outcome (Demilew et al., 2024). The different indications for cesarean section among the respondents further illustrate that the clinical circumstances preceding surgery were not identical. Consequently, the reduction in NRS scores should be understood as occurring within individualized postoperative trajectories rather than as a uniform response attributable exclusively to the breathing intervention.

Pharmacological management represents an important factor that may have contributed to the observed decline in pain intensity because the respondents continued to receive standard postoperative care during the study period. Current procedure-specific recommendations for cesarean delivery emphasize multimodal analgesia, in which appropriate systemic analgesics and regional techniques are integrated to achieve effective postoperative pain control (Roofthoof et al., 2021). Deep breathing relaxation in this context should therefore be positioned as a complementary nursing intervention rather than a substitute for clinically indicated analgesic therapy. The interaction between pharmacological and nonpharmacological approaches is particularly important in interpreting the mean reduction from 5.6 to 2.4 because the study design did not isolate the contribution of each component of postoperative management. Table 3 summarizes the principal patient-related and clinical factors that may have influenced the pain trajectories observed among the five respondents. The table also demonstrates why the same relaxation procedure can produce different numerical changes between patients even when the intervention itself is delivered according to the same general protocol.

Table 3. Factors Potentially Influencing Pain Intensity in Post-Cesarean Patients

Factor	Possible influence on pain	Relevance to the present cases
Analgesic Therapy	Direct pharmacological reduction of postoperative pain	May contribute to pain reduction alongside deep breathing
Preoperative Anxiety	May increase pain perception and analgesic requirements	Can contribute to individual differences in pain response
Surgical Indication	Different clinical conditions may produce different postoperative experiences	The five respondents had different indications for CS
Mobility	Movement may temporarily increase wound-related discomfort but progressive mobilization supports recovery	May influence pain scores during hospitalization
Attention and Distraction	Redirection of attention may reduce perceived pain	Breathing exercise provides a structured attentional focus
Sleep and Rest	Adequate rest may improve coping with postoperative discomfort	Hospital environment and newborn care may affect recovery
Individual Pain Sensitivity	Pain perception varies between patients	Explains differences between pre-test and post-test changes

Psychological factors represent another important dimension of the postoperative pain experience, particularly anxiety and emotional distress. Anxiety may increase vigilance toward bodily sensations and intensify the subjective interpretation of painful stimuli, creating a feedback relationship between emotional arousal and pain perception. A retrospective cohort study of women undergoing cesarean delivery found that preexisting maternal anxiety was associated with greater postoperative pain and opioid use, demonstrating the clinical relevance of psychological status in postoperative pain management (Poehlmann et al., 2022). This evidence provides a plausible explanation for why patients with comparable surgical procedures may report different pain intensities. The present study did not use a standardized anxiety scale, so the contribution of anxiety cannot be quantified for individual respondents. Nevertheless, the controlled breathing procedure may have provided an opportunity for patients to regulate emotional arousal while simultaneously directing attention toward a structured activity. This potential psychological pathway is relevant when interpreting deep breathing relaxation as a multidimensional nursing intervention rather than merely a respiratory exercise.

Surgical characteristics and the circumstances surrounding cesarean delivery may also contribute to differences in postoperative pain. The five respondents presented with different indications, including cephalopelvic disproportion, umbilical cord entanglement, breech presentation, and premature rupture of membranes, indicating variation in the clinical circumstances preceding surgery. Differences in surgical and anesthetic factors can influence postoperative pain, and evidence indicates that several perioperative characteristics are associated with the occurrence of acute pain after cesarean delivery (Demilew et al., 2024). The initial pain score of 8 in Respondent 3, for example, was substantially higher than the score of 3 recorded for Respondent 2, despite both patients being evaluated after cesarean delivery. This contrast illustrates the importance of avoiding assumptions that postoperative pain intensity is determined solely by the type of surgical procedure. Individual pain sensitivity, timing of assessment, surgical experience, and perioperative management may all contribute to the baseline score recorded at the beginning of an intervention period. The five-case dataset therefore provides evidence of variability that should be preserved rather than averaged away when interpreting the clinical response.

Patient activity and behavioral responses during postoperative recovery may further modify pain intensity. Mobilization can temporarily increase discomfort around the surgical wound, yet progressive movement is also an essential component of recovery and may influence subsequent functional status. A large prospective multicenter study involving 11,932 patients found that factors related to daily activities and postoperative experiences were associated with severe pain and impairment following cesarean section (Emrich et al., 2023). This relationship is relevant because pain assessment does not occur in isolation from the patient's activities, rest, interactions, and recovery demands. Deep breathing may provide a structured attentional activity that patients can perform during periods of discomfort without requiring physical movement around the surgical site. At the same time, differences in mobility, sleep, newborn-care demands, and hospital routines could contribute to variations in pain scores between respondents. These factors reinforce the importance of viewing the observed 3.2-point mean reduction as a clinical change occurring within a complex postoperative environment.

The clinical interpretation of the findings is strengthened by recognizing that pain management after cesarean section requires integration of multiple complementary strategies rather than reliance on a single intervention. Deep breathing relaxation may be particularly valuable because it is inexpensive, requires no specialized equipment, can be performed repeatedly, and allows patients to participate actively in their own pain-management process. Evidence from post-cesarean studies has reported beneficial changes following relaxation-based interventions, including approaches that incorporate breathing, although the specific contribution of each intervention component varies across studies. A case study involving deep breathing relaxation and Quran recitation, for instance, reported reduced acute pain among post-cesarean patients, but the combined intervention makes it difficult to distinguish the independent effect of breathing (Musviro et al., 2024). Similar methodological considerations apply to interventions combining deep breathing with guided imagery or music, in which multiple therapeutic components may contribute to the final outcome. The present study is more narrowly focused on deep breathing relaxation, which provides a clearer clinical description of the intervention but still cannot eliminate the influence of concurrent analgesia and natural postoperative recovery. This distinction is

important for interpreting the findings responsibly and for designing subsequent controlled research that can separate the effects of breathing relaxation from other determinants of postoperative pain.

Comparison with Previous Evidence, Clinical Implications, and Study Limitations

The findings of the present case study are broadly consistent with the growing evidence that relaxation-based interventions can contribute to the management of pain following cesarean section, although the strength of evidence varies according to intervention design and methodological rigor. The reduction in mean pain intensity from 5.6 to 2.4 observed across the five respondents is compatible with previous reports describing lower postoperative pain following relaxation-oriented nursing interventions. Benson relaxation, for example, has been associated with reductions in post-cesarean pain among postpartum women, indicating that interventions capable of promoting relaxation may influence subjective pain experiences (Mostafa Mohammed et al., 2023). Similar findings have been reported in post-cesarean case studies using Benson relaxation as part of nursing care, further supporting the relevance of nonpharmacological approaches in postoperative maternal care (Rahadiani & Daniati, 2023). The consistency across these studies suggests that relaxation may represent a clinically meaningful component of pain management, although the specific mechanisms and magnitude of effect may differ between techniques. The present study adds to this literature by focusing specifically on controlled deep breathing rather than a broader relaxation protocol.

Evidence involving Benson relaxation also provides a useful comparison for understanding the specificity of the intervention examined in this study. Studies conducted among post-cesarean patients have reported significant reductions in pain following Benson relaxation, indicating that structured relaxation can influence the subjective experience of postoperative discomfort (Nisa & Haniyah, 2024). However, Benson relaxation incorporates cognitive and attentional elements that differ from the respiratory sequence used in the present intervention. This distinction prevents direct equivalence between the two approaches even when both are classified broadly as relaxation techniques. A study conducted among postoperative cesarean patients similarly reported beneficial effects of Benson relaxation on pain reduction, reinforcing the potential value of relaxation-based nursing interventions while demonstrating that multiple techniques may achieve comparable clinical objectives (Retni et al., 2024). The present findings therefore support the broader relaxation literature without suggesting that deep breathing and Benson relaxation operate through identical pathways. Such differentiation is important for developing intervention protocols that can be reproduced and evaluated independently in future clinical research.

Recent research has increasingly examined combinations of relaxation techniques, providing further context for the present findings. Deep breathing combined with guided imagery and music has been associated with reduced pain intensity among patients after cesarean section, suggesting that simultaneous modulation of attention and sensory experience may strengthen nonpharmacological pain management (Purnamasari et al., 2025). A more recent intervention integrating deep breathing relaxation with guided imagery within a Comfort Theory framework also reported improvements in pain intensity and vital signs among post-cesarean patients (Priyantini et al., 2026). These studies demonstrate the expanding scope of behavioral and complementary approaches in postoperative maternal care, but their combined-intervention designs make it difficult to determine how much of the observed effect is attributable specifically to deep breathing. The present case study addresses this issue at a descriptive level by examining deep breathing relaxation as the central intervention without deliberately adding music or guided imagery. Table 4 presents a synthesis of these intervention approaches and clarifies the position of the present study within the broader relaxation-based pain-management literature.

Table 4. Comparison of Relaxation-Based Interventions for Post-Cesarean Pain Management

Intervention Approach	Main characteristic	Interpretation for the present study
Deep Breathing Relaxation	Controlled slow inspiration and expiration	Directly corresponds to the intervention examined
Benson Relaxation	Structured relaxation involving cognitive focus	Supports the broader role of relaxation in pain management

Deep Breathing + Guided Imagery	Breathing combined with mental imagery	Suggests potential benefit of multimodal nonpharmacological approaches
Deep Breathing + Music	Breathing combined with auditory distraction	Demonstrates the possible contribution of attentional modulation
Deep Breathing + Other Relaxation Approaches	Combined behavioral or physical techniques	Highlights the need to distinguish isolated and combined intervention effects

The broader maternity literature also supports the potential value of breathing techniques as accessible nonpharmacological strategies, although evidence from labor should be distinguished from evidence involving postoperative pain. A systematic review and meta-analysis of breathing exercises during labor found effects on labor-related outcomes, demonstrating that breathing-based approaches have an established place within maternity-focused nonpharmacological care (Issac et al., 2023). Evidence from labor pain cannot be transferred directly to post-cesarean pain because the latter involves surgical tissue injury, postoperative inflammation, mobility restrictions, and pharmacological analgesia. A case study of deep breathing relaxation in women experiencing labor pain likewise illustrates the feasibility of teaching controlled breathing as a self-regulation technique but does not establish its specific effectiveness after abdominal surgery (Hertati, 2024). Research involving active-phase labor has similarly reported beneficial pain-related outcomes following deep breathing relaxation, although the underlying pain mechanisms differ from those present after cesarean delivery (Tandondo et al., 2025). These distinctions reinforce the importance of evaluating breathing interventions within the clinical population in which they are intended to be applied. The present study contributes population-specific evidence by examining women during postoperative recovery after cesarean delivery rather than extrapolating findings from labor populations.

The clinical implications of the present findings concern the feasibility of integrating deep breathing relaxation into routine nursing care as an adjunctive intervention. The technique requires minimal resources, can be administered at the bedside, and can subsequently be practiced independently by patients once adequate instruction has been provided. Its potential value is particularly relevant in contemporary maternal healthcare, where effective postoperative recovery involves not only pharmacological pain control but also interventions that promote patient participation and comfort. A recent case-based study combining pelvic floor exercise with Benson relaxation for post-cesarean pain and stress further illustrates the potential for structured relaxation strategies to be incorporated into broader recovery-oriented care (Talukdar & Chumthang, 2025). The present findings suggest that a simpler respiratory intervention may offer a practical starting point for nursing education because it does not require specialized equipment or complex preparation. However, implementation should remain complementary to prescribed analgesic management and individualized clinical assessment rather than being presented as an alternative to medical treatment. The clinical contribution of deep breathing relaxation therefore lies primarily in its accessibility, low resource requirements, and potential to strengthen multimodal postoperative care.

Several methodological limitations constrain the interpretation and generalizability of these findings. The study involved only five respondents, which is appropriate for a descriptive case study but insufficient for estimating population-level effectiveness or establishing statistically reliable treatment effects. The absence of a control group also means that the observed decrease in pain cannot be separated from natural postoperative recovery, analgesic treatment, rest, mobilization, or other aspects of routine hospital care. The study further relied on NRS scores as the primary outcome and did not simultaneously measure anxiety, autonomic activity, sleep quality, medication consumption, or functional recovery, limiting the ability to test the proposed psychophysiological mechanisms directly. These limitations are particularly important because previous evidence on slow deep breathing has demonstrated variability in effect magnitude and certainty across clinical pain conditions (Joseph et al., 2022). Future research should therefore employ larger samples, controlled or randomized designs, standardized intervention schedules, and repeated pain assessments at defined postoperative intervals. Incorporating measures of analgesic consumption, anxiety, autonomic regulation, and functional recovery would also enable researchers to determine whether deep breathing relaxation produces benefits beyond changes in subjective pain intensity.

CONCLUSION

The application of deep breathing relaxation to five post-cesarean section patients was accompanied by a reduction in pain intensity across all respondents. The mean pain score decreased from 5.6 before the intervention to 2.4 after the intervention, representing an average reduction of 3.2 points. This change indicates a shift from predominantly moderate pain toward mild pain during the postoperative observation period. The potential mechanisms underlying this improvement include the development of a more relaxed physiological state, modulation of autonomic activity, attentional redirection, and improved emotional regulation. The observed reduction should also be interpreted within the context of other factors that may influence postoperative pain, including analgesic therapy, anxiety, surgical characteristics, mobility, distraction, and rest. Because the study used a descriptive case-study design involving only five patients without a control group, the findings cannot establish a definitive causal relationship between deep breathing relaxation and pain reduction. The findings support the use of deep breathing relaxation as a feasible complementary intervention within postoperative nursing care, while its effectiveness should be interpreted cautiously within the limitations of the case-study design.

Future research should involve larger and more diverse samples to improve the generalizability of findings across different postoperative maternal populations. Controlled or randomized experimental designs are recommended to distinguish the effects of deep breathing relaxation from natural postoperative recovery and concurrent clinical treatment. Subsequent studies should standardize the timing and dosage of analgesic administration to reduce potential confounding in the assessment of intervention effects. Repeated pain assessments at clearly defined postoperative intervals may also provide a more accurate representation of changes in pain intensity over time. Additional assessment of anxiety, mobility, sleep quality, functional recovery, and analgesic consumption could provide a more comprehensive understanding of factors associated with postoperative pain. From a clinical perspective, nurses may integrate deep breathing relaxation into individualized multimodal pain-management strategies because the technique is simple, inexpensive, and does not require specialized equipment. Further empirical investigation is needed to establish the magnitude, durability, and clinical significance of its effects and to determine how the intervention can be optimally incorporated into evidence-based post-cesarean care.

REFERENCES

- Betran, A. P., Ye, J., Moller, A. B., Souza, J. P., & Zhang, J. (2021). Trends and projections of caesarean section rates: Global and regional estimates. *BMJ Global Health*, 6(6), e005671. <https://doi.org/10.1136/bmjgh-2021-005671>
- Demilew, B. C., Zurbachew, N., Getachew, N., Mekete, G., & Lema, D. T. (2024). Prevalence and associated factors of postoperative acute pain for mothers who gave birth with cesarean section: A systematic review and meta-analysis. *Pain Management Nursing*, 25(6), e452–e464. <https://doi.org/10.1016/j.pmn.2024.05.010>
- Dwiarto, M. F., Rilyani, R., & Wardiyah, A. (2025). Pemberian teknik relaksasi nafas dalam untuk menurunkan nyeri pada pasien post operasi sectio caesarea dengan indikasi pre-eklampsia. *Journal of Public Health Concerns*, 5(9), 556–562. <https://doi.org/10.56922/phc.v5i9.1585>
- Emrich, N. L. A., Tascón Padrón, L., Komann, M., Arnold, C., Dreiling, J., Meißner, W., Strizek, B., Gembruch, U., & Jiménez Cruz, J. (2023). Risk factors for severe pain and impairment of daily life activities after cesarean section—A prospective multi-center study of 11,932 patients. *Journal of Clinical Medicine*, 12(22), 6999. <https://doi.org/10.3390/jcm12226999>
- Gholamrezaei, A., Van Diest, I., Aziz, Q., Vlaeyen, J. W. S., & Van Oudenhove, L. (2021). Controlled breathing and pain: Respiratory rate and inspiratory loading modulate cardiovascular autonomic responses, but not pain. *Psychophysiology*, 58(10), e13895. <https://doi.org/10.1111/psyp.13895>
- Hertati, D. (2024). Case Study Of Labor Pain In Parturient Mothers With Non-Pharmacological Therapy Using Deep Breathing Relaxation Techniques In The Palangka Raya River Basin 2024. *Proceedings OPTIMAL*. <https://doi.org/10.5281/zenodo.15952964>
- Idris, S. (2023). The Effect Of Slow Deep Breathing Therapy On Reducing Post Sectio Patient Intensity Caesarea In General Hospital Mom Kartini Kisaran Year 2023. *Jurnal eduhealth*, 14(02), 776-781. <https://ejournal.seaninstitute.or.id/index.php/health/article/view/2131>

- Issac, A., Nayak, S. G., Balakrishnan, D., Halemani, K., Mishra, P., Vr, V., ... & Stephen, S. (2023). Effectiveness of breathing exercise on the duration of labour: A systematic review and meta-analysis. *Journal of global health*, 13, 04023. <https://doi.org/10.7189/jogh.13.04023>
- Joseph, A. E., Moman, R. N., Barman, R. A., Kleppel, D. J., Eberhart, N. D., Gerberi, D. J., Murad, M. H., & Hooten, W. M. (2022). 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*, 27, 2515690X221078006. <https://doi.org/10.1177/2515690X221078006>
- Karim, N. S., & Sulistiyah, S. (2025). The Effect of Deep Breathing Relaxation on Reducing Preoperative Anxiety in C-Section Patients. *Jurnal Siti Rufaidah*, 3(3), 319-327. <https://doi.org/10.57214/jasira.v3i3.315>
- Laborde, S., Allen, M. S., Borges, U., Dosseville, F., Hosang, T. J., Iskra, M., Mosley, E., Salvotti, C., Spolverato, L., Zammit, N., & Javelle, F. (2022). Effects of voluntary slow breathing on heart rate and heart rate variability: A systematic review and a meta-analysis. *Neuroscience & Biobehavioral Reviews*, 138, 104711. <https://doi.org/10.1016/j.neubiorev.2022.104711>
- Mostafa Mohammed, F., Ahmed Hassan, A., Abdallah El Sayed Afifi, H., & Mahmoud Hassan, M. (2023). Effect of Benson Relaxation Technique on Intensity of Post Cesarean Section Pain among Primipara Women. *Journal of Nursing Science Benha University*, 4(2), 878-893. <https://doi.org/10.21608/jnsbu.2023.310630>
- Musviro, M., Fitriyah, A. S., Hayati, N., Azizah, L. N., & Astuti, A. (2024). The Implementation of Deep Breathing Relaxation and Al-Quran Recitation in Reducing Acute Pain in Post-Op Sectio Caesarea Patients: A Study Case. *Health and Technology Journal (HTechJ)*, 2(6), 655-660. <https://doi.org/10.53713/htechj.v2i6.297>
- Nisa, N. K., & Haniyah, S. (2024). Implementation of Benson relaxation technique to reduce acute pain post-caesarean section. *Viva Medika: Jurnal Kesehatan, Kebidanan dan Keperawatan*, 17(2), 348-354. <https://doi.org/10.35960/vm.v17i2.1435>
- Poehlmann, J. R., Stowe, Z. N., Godecker, A., Xiong, P. T., Broman, A. T., & Antony, K. M. (2022). The impact of preexisting maternal anxiety on pain and opioid use following cesarean delivery: A retrospective cohort study. *American Journal of Obstetrics & Gynecology MFM*, 4(3), 100576. <https://doi.org/10.1016/j.ajogmf.2022.100576>
- Priyantini, D., Ayatulloh, D., & Nursalam, N. (2026). Deep breathing relaxation with guided imagery on pain intensity and vital signs of post-caesarean section patients with a Comfort Theory approach. *Journal of Obstetrics & Gynecology Science*, 34(1), 1-8. <https://doi.org/10.20473/mog.V34I12026.1-8>
- Purnamasari, I., Sumarliyah, E., Aisyah, S., Firman, F., & Nasrullah, D. (2025). Effectiveness of Deep Breathing Relaxation Combined Guided Imagery with Music on Pain Scale in Patients After Cesarean Section. *EMBRIO: Jurnal Kebidanan*, 17(2), 89-97. <https://doi.org/10.36456/embrio.v17i2.10738>
- Rahadianti, S. D. P., & Daniati, E. (2023). Analysis Of Post Sectio Caesarea Nursing Care Using Benson's Relaxation Technique to Reduce Pain: Case Study. *Nursing Case Insight Journal*, 1(01), 20-23. <https://doi.org/10.63166/zyxq7h62>
- Retni, A., Lihu, F. A., & Yunus, I. D. (2024). The Effect Of Benson's Relaxation Technique On Pain Reduction In Post-Operative Cesarean Section Patients In The Postpartum Care Room At RSUD Dr. MM Dunda. *Jurnal EduHealth*, 15(04), 609-620. <https://ejournal.seaninstitute.or.id/index.php/health/article/view/5748>
- Roofthoof, E., Joshi, G. P., Rawal, N., & Van de Velde, M. (2021). PROSPECT guideline for elective caesarean section: Updated systematic review and procedure-specific postoperative pain management recommendations. *Anaesthesia*, 76(5), 665–680. <https://doi.org/10.1111/anae.15339>
- Roslianti, E. ., Azmi, A. ., Permatasari, W., Hidayat, N., & Lismayanti, L. . (2022). Case Study: Deep Breathing Relaxation Intervention to Reduce Pain in Post Sectio Caesarea Client. *Genius Journal*, 3(2), 166–173. <https://doi.org/10.56359/gj.v3i2.127>
- Talukdar, D., & Chumthang, N. V. (2025). Pelvic Floor “Drop” Proprioceptive Neuromuscular Facilitation Exercise and Benson’s Relaxation Technique for Post-Cesarean Pain and Stress Relief: A Case Study. *International Journal of Obstetrics, Perinatal and Neonatal Nursing*, 11(1), 20-28p. <https://journalspub.com/publication/ijopnn/article=15248/>

Tandondo, H. S., Yulianti, Y., & Irmayanti, I. (2025). The Effect of Deep Breath Relaxation Techniques on Pain of Labor Phase 1 Active Phase in Mothers Mability at Kolonodale Hospital North Morowali Regency. *Health Science & Biomedical Journal*, 1(1), 20-27.