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ORIGINAL ARTICLE

Effectiveness of Deep Breathing Relaxation Technique in Reducing Postoperative Nausea and Vomiting Among Patients Receiving Spinal Anesthesia: A One-Group Pretest–Posttest Study

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ABSTRACT

Background: Postoperative nausea and vomiting (PONV) is a common complication after surgery, including among patients receiving spinal anesthesia. PONV may reduce patient comfort, delay recovery, and increase the need for additional postoperative management. Deep breathing relaxation is a simple nonpharmacological intervention that may help reduce nausea and vomiting by promoting relaxation and parasympathetic activity.

Objectives: This study aimed to evaluate the effectiveness of deep breathing relaxation technique in reducing PONV among postoperative patients receiving spinal anesthesia.

Methods: This study used a pre-experimental design with a one-group pretest–posttest approach. A total of 60 postoperative patients receiving spinal anesthesia were selected using purposive sampling. PONV severity was measured before and after the intervention using the Rhodes Index of Nausea, Vomiting, and Retching (RINVR). Data were analyzed using the Wilcoxon signed-rank test.

Results: Before the intervention, most respondents experienced moderate PONV (56.7%) and severe PONV (40.0%). After deep breathing relaxation, most respondents experienced mild PONV (91.7%), while 8.3% experienced moderate PONV. The Wilcoxon test showed a significant reduction in PONV severity after the intervention ($Z = -6.915$; $p < 0.001$).

Conclusions: Deep breathing relaxation was effective in reducing PONV among postoperative patients receiving spinal anesthesia. This technique may be used as a safe, simple, and feasible supportive intervention in postoperative care.

Introduction

Surgical care is an essential component of modern health systems because it supports diagnosis, treatment, palliation, and recovery across a wide range of conditions. Global estimates show that more than 300 million surgical procedures are performed annually, making the prevention of postoperative complications a major priority in perioperative care (Weiser et al., 2016). As surgical volume remains high, patient-centred recovery has become increasingly focused on reducing avoidable discomfort, shortening post-anesthesia recovery, and improving postoperative safety (Gan et al., 2020; Gress et al., 2020). One complication that continues to affect postoperative comfort and recovery is postoperative nausea and vomiting (PONV), which is often considered one of the most distressing outcomes after anesthesia and surgery (Gan et al., 2020; Rajan & Joshi, 2021).

Postoperative nausea and vomiting refers to nausea, vomiting, and retching that occur after anesthesia and surgery, commonly within the first 24 hours after the procedure. A systematic review and meta-analysis reported that the global prevalence of PONV was 27.7%, while nausea and vomiting occurred in 31.4% and 16.8% of patients, respectively (Amirshahi et al., 2020). In high-risk patients, the incidence may be substantially higher, which makes early identification and preventive management clinically important (Gan et al., 2020; Schlesinger et al., 2023). PONV may delay oral intake, ambulation, and discharge, increase patient dissatisfaction, require rescue medication, and raise healthcare costs (Gress et al., 2020; Jin et al., 2020).

The pathophysiology of PONV is multifactorial and involves complex interactions between peripheral and central emetic pathways. Emetic stimuli may arise from gastrointestinal irritation, vestibular inputs, pain, anxiety, anesthetic agents, opioids, and surgical manipulation, which are integrated through the vomiting centre, area postrema, nucleus tractus solitarius, and vagal afferent pathways (Stoops & Kovac, 2020; Zhong et al., 2021). Several neurotransmitter systems, including serotonin, dopamine, histamine, acetylcholine, neurokinin-1, and opioid receptors, contribute to nausea and vomiting responses (Jin et al., 2020; Kovac, 2025). Because multiple pathways are involved, PONV management often requires multimodal strategies that combine risk reduction, pharmacological prophylaxis, rescue therapy, and supportive nonpharmacological approaches (Gan et al., 2020; Rajan & Joshi, 2021).

Although PONV is frequently associated with general anesthesia, it can also occur in patients receiving spinal anesthesia. In spinal anesthesia, sympathetic blockade may cause hypotension, increased vagal tone, and gastrointestinal hypoperfusion, which can contribute to nausea and vomiting (Huh, 2023; Stoops & Kovac, 2020). The use of intrathecal opioids or postoperative opioids may further increase emetic risk among patients undergoing surgery with spinal anesthesia (Moraitis et al., 2020; Kovac, 2025). Therefore, postoperative patients receiving spinal anesthesia still require active monitoring and supportive interventions to reduce PONV and promote recovery (Gan et al., 2020; Huh, 2023).

Several risk factors for PONV have been identified, including female sex, nonsmoking status, previous PONV or motion sickness, younger age, perioperative opioid use, anesthetic technique, type of surgery, duration of anesthesia, and postoperative pain. Current evidence also emphasizes that PONV risk is not determined by a single factor but by the interaction of patient-related, anesthesia-related, and surgery-related factors (Schlesinger et al., 2023; Stoops & Kovac, 2020). These risk factors are clinically relevant because they can guide anesthetists and perioperative nurses in selecting preventive and therapeutic strategies before symptoms become severe (Gan et al., 2020; Jin et al., 2020). In patients with spinal anesthesia, recognizing individual risk factors remains important because nausea and vomiting may still appear during early recovery even without exposure to volatile anesthetics (Huh, 2023; Moraitis et al., 2020).

Current PONV guidelines recommend risk assessment, baseline risk reduction, multimodal antiemetic prophylaxis, and rescue treatment when symptoms occur. Pharmacological interventions remain central to PONV management, but they may be limited by cost, availability, contraindications, adverse effects, or incomplete symptom relief in some patients (Gan et al., 2020; Rajan & Joshi, 2021). For this reason, nonpharmacological interventions have gained

increasing attention as supportive strategies because they are generally simple, inexpensive, safe, and feasible to integrate into perioperative nursing and anesthesia care (Jin et al., 2020; Wang et al., 2024). Evidence from complementary approaches, such as aromatherapy and acupressure, suggests that nonpharmacological interventions may help reduce nausea and vomiting and improve patient comfort after surgery (Kilinç & Karaman Özlü, 2024; Tsai et al., 2025; Wang et al., 2024).

Deep breathing relaxation is a nonpharmacological technique that involves slow, controlled, and rhythmic breathing to produce physiological and psychological relaxation. The proposed mechanisms include stimulation of pulmonary afferent pathways, baroreflex modulation, increased vagal activity, improved respiratory sinus arrhythmia, reduced sympathetic arousal, and activation of parasympathetic responses (Gholamrezaei et al., 2021; Noble & Hochman, 2019). Recent studies and meta-analyses indicate that structured breathing practices may reduce stress, anxiety, physiological arousal, and acute clinical pain, which are factors that may indirectly influence nausea and vomiting responses (Balban et al., 2023; Fincham et al., 2023; Joseph et al., 2022). Because anxiety, discomfort, and autonomic imbalance can intensify postoperative symptoms, deep breathing relaxation may be a relevant supportive intervention for patients experiencing PONV (Bentley et al., 2023; Noble & Hochman, 2019).

Several clinical studies have begun to examine breathing-based interventions for perioperative symptoms, including nausea, vomiting, retching, pain, and anxiety. Diaphragmatic breathing exercise has been reported to reduce postoperative nausea, vomiting, and retching among orthopedic surgery patients, suggesting that controlled breathing may have practical benefits in postoperative recovery (Ibrahim et al., 2020). Other nonpharmacological strategies, including acupressure and aromatherapy, have also been tested in surgical patients, supporting the broader value of simple adjunctive approaches for PONV management (Kilinç & Karaman Özlü, 2024; Tsai et al., 2025; Wang et al., 2024). However, compared with pharmacological prophylaxis, aromatherapy, and acupressure, evidence on deep breathing relaxation specifically for PONV among patients receiving spinal anesthesia remains limited and requires further clinical investigation (Gan et al., 2020; Jin et al., 2020; Wang et al., 2024).

Deep breathing relaxation is particularly relevant for postoperative care because it can be taught quickly, performed at the bedside, and practiced independently by patients without special equipment. This makes the technique suitable as a supportive intervention in recovery rooms and surgical wards, especially when nurses and nurse anesthetists need practical strategies to improve comfort while maintaining patient safety (Bentley et al., 2023; Joseph et al., 2022). Despite its feasibility, the effectiveness of deep breathing relaxation for reducing PONV after spinal anesthesia has not been sufficiently established in pretest–posttest clinical studies. Therefore, this study aimed to evaluate the effectiveness of deep breathing relaxation technique in reducing postoperative nausea and vomiting among patients receiving spinal anesthesia.

Methods

This study used a quantitative pre-experimental design with a one-group pretest–posttest approach. This design was used to evaluate changes in postoperative nausea and vomiting before and after the implementation of the deep breathing relaxation technique in patients receiving spinal quantitative pre-experimental design with a one-group pretest–posttest approach. This design was used to evaluate changes in postoperative nausea anesthesia. The pretest was conducted to assess the level of postoperative nausea and vomiting before the intervention, while the posttest was conducted after the intervention to identify changes in symptom severity.

The study was conducted in the postoperative care setting of PKU Muhammadiyah Gamping Hospital, Yogyakarta, Indonesia. The study population consisted of patients who underwent elective surgery with spinal anesthesia. The sample size was determined from a population of 151 patients using the Slovin formula, resulting in 60 respondents. Participants were selected using purposive sampling based on predetermined eligibility criteria.

The inclusion criteria were patients with compos mentis consciousness, aged 18–65 years, not under the influence of antiemetic or sedative drugs, in stable hemodynamic condition, and willing to participate in the study. The exclusion criteria were patients with infectious diseases, severe systemic disease, gastrointestinal disease, emergency surgery, and patients who refused to participate. All eligible patients were approached after surgery, provided with an explanation of the study objectives and procedures, and asked to sign informed consent before participation.

The independent variable was the deep breathing relaxation technique. This intervention consisted of slow and controlled breathing through the nose, holding the breath for several seconds, and exhaling slowly through the mouth. Patients were guided to perform the technique in a comfortable position after surgery. The intervention was conducted in the early postoperative period after the patient was transferred to the recovery room or postoperative ward and was clinically stable.

The dependent variable was postoperative nausea and vomiting. PONV was measured using the Rhodes Index of Nausea, Vomiting, and Retching (RINVR). This instrument consists of eight items assessing nausea, vomiting, and retching. Each item is scored using a scale of 0 to 4, with a total score ranging from 0 to 32. The total score was categorized as no nausea and vomiting = 0, mild nausea and vomiting = 1–8, moderate nausea and vomiting = 9–16, severe nausea and vomiting = 17–24, and very severe nausea and vomiting = 25–32.

Data collection was carried out after ethical approval and research permission had been obtained. The researcher identified patients who underwent surgery with spinal anesthesia based on the surgical schedule and medical records. After the operation, eligible patients were assessed within the early postoperative period. The pretest was conducted by assessing the level of PONV using the RINVR questionnaire before the deep breathing relaxation technique was given. After that, patients were guided to perform the deep breathing relaxation technique according to the procedure. The posttest was then conducted using the same instrument to evaluate changes in PONV severity after the intervention.

Data were processed through editing, coding, data entry, tabulation, and cleaning. Descriptive statistics were used to describe respondent characteristics, including age, sex, and smoking status, as well as the distribution of PONV severity before and after the intervention. Frequencies and percentages were used for categorical variables. The normality assumption was not applied because the PONV score was ordinal and measured before and after intervention in the same respondents.

The difference in PONV severity before and after the deep breathing relaxation technique was analyzed using the Wilcoxon signed-rank test. This test was selected because the data were paired and ordinal, and the study aimed to examine differences between pretest and posttest scores within the same group. Statistical significance was set at $p < 0.05$. The analysis was conducted using statistical software.

This study was conducted according to ethical principles, including respect for autonomy, beneficence, non-maleficence, justice, anonymity, and confidentiality. Ethical approval was obtained from the Ethics Committee of PKU Muhammadiyah Gamping Hospital with approval number 064/KEP-PKU/III/2026. Research permission was also obtained before data collection. All respondents received information about the study and provided written informed consent before participation. Respondents were informed that their participation was voluntary and that they could withdraw from the study at any time without any consequences for their care.

Results

A total of 60 postoperative patients receiving spinal anesthesia were included in this study. Based on age, most respondents were aged 47–65 years, with 28 respondents (46.7%), followed by those aged 18–31 years, with 18 respondents (30.0%), and those aged 32–46 years, with 14 respondents (23.3%). Based on sex, most respondents were female, with 33 respondents (55.0%), while 27 respondents (45.0%) were male. Regarding smoking status, most respondents were non-smokers, with 37 respondents (61.7%), while 23 respondents (38.3%) were smokers.

Table 1: Characteristics of participants

Characteristics	Frequency (n)	Percentage (%)
Age		
18–31 years	18	30.0
32–46 years	14	23.3
47–65 years	28	46.7
Sex		
Male	27	45.0
Female	33	55.0
Smoking status		
Yes	23	38.3
No	37	61.7

Before the intervention, most respondents experienced moderate PONV, with 34 respondents (56.7%), followed by severe PONV, with 24 respondents (40.0%). Only 2 respondents (3.3%) experienced mild PONV before the intervention. After the deep breathing relaxation technique was given, most respondents experienced mild PONV, with 55 respondents (91.7%), while 5 respondents (8.3%) experienced moderate PONV. No respondents experienced severe PONV after the intervention.

Table 2: Distribution of PONV severity before and after deep breathing relaxation technique

PONV severity	Pre-test		Post-test	
	n	%	n	%
Mild	2	3.3	55	91.7
Moderate	34	56.7	5	8.3
Severe	24	40.0	0	0.0
Total	60	100.0	60	100.0

The Wilcoxon signed-rank test showed that 58 respondents had lower PONV scores after the intervention, 2 respondents had no change, and no respondents had higher PONV scores after the intervention. The mean rank of negative ranks was 29.50, with a sum of ranks of 1711.00. The test showed a statistically significant difference in PONV severity before and after the deep breathing relaxation technique ($Z = -6.915$; $p < 0.001$).

Table 3: Effect of deep breathing relaxation technique on PONV among postoperative patients receiving spinal anesthesia

Analysis	n	Mean rank	Sum of ranks	Z	p-value
Negative ranks	58	29.50	1711.00	-6.915	<0.001
Positive ranks	0	0.00	0.00		
Ties	2				
Total	**60**				

Note. Negative ranks indicate lower PONV scores after the intervention compared with before the intervention. The analysis was performed using the Wilcoxon signed-rank test.

These results indicate that the deep breathing relaxation technique significantly reduced PONV severity among postoperative patients receiving spinal anesthesia. Most respondents shifted from moderate and severe PONV before the intervention to mild PONV after the intervention.

Discussion

This study found that the deep breathing relaxation technique significantly reduced postoperative nausea and vomiting among patients receiving spinal anesthesia. Before the intervention, most respondents experienced moderate and severe PONV, whereas after the intervention, most respondents shifted to mild PONV. The Wilcoxon signed-rank test showed a significant difference between pretest and posttest PONV severity, indicating that deep breathing relaxation was effective in reducing PONV symptoms. This finding supports the use of deep breathing relaxation as a simple and feasible nonpharmacological intervention in postoperative care.

The high proportion of moderate and severe PONV before the intervention indicates that nausea and vomiting remain important clinical problems among postoperative patients receiving spinal anesthesia. Although PONV is often associated with general anesthesia, patients receiving

spinal anesthesia may also experience nausea and vomiting due to sympathetic blockade, hypotension, increased vagal tone, anxiety, pain, and the use of perioperative opioids. These mechanisms can stimulate central and peripheral emetic pathways, including the vomiting centre, area postrema, nucleus tractus solitarius, and vagal afferent pathways. Therefore, active monitoring and early management of PONV are still needed in patients undergoing surgery with spinal anesthesia (Gan et al., 2020; Huh, 2023; Stoops & Kovac, 2020; Zhong et al., 2021).

After the deep breathing relaxation technique was given, most respondents experienced only mild PONV. This improvement suggests that controlled breathing may help reduce nausea and vomiting by promoting physiological relaxation and reducing autonomic arousal. Deep breathing can stimulate parasympathetic activity, improve vagal modulation, reduce sympathetic responses, and create a calmer physiological state. These mechanisms may decrease discomfort, anxiety, and nausea-related sensations during the early postoperative period (Gholamrezaei et al., 2021; Noble & Hochman, 2019).

The findings of this study are consistent with previous evidence showing that breathing-based interventions may provide clinical benefits for postoperative symptoms. Ibrahim et al. (2020) reported that diaphragmatic breathing exercise reduced postoperative nausea, vomiting, and retching among orthopedic surgery patients. A systematic review also showed that slow deep breathing may reduce acute clinical pain in adults, while other studies have shown that structured breathing practices can reduce stress and physiological arousal (Balban et al., 2023; Fincham et al., 2023; Joseph et al., 2022). These findings support the assumption that deep breathing relaxation may reduce PONV not only through direct relaxation effects but also by decreasing stress, anxiety, and discomfort that deep breathing relaxation may reduce PONV not only through direct relaxation that can worsen nausea and vomiting.

The significant reduction in PONV severity in this study also supports the broader role of nonpharmacological interventions in perioperative care. Although antiemetic drugs remain the main strategy for preventing and treating PONV, nonpharmacological approaches can be useful as supportive interventions because they are safe, low-cost, easy to teach, and do not require special equipment. Recent evidence on complementary approaches, such as aromatherapy and acupressure, also suggests that nonpharmacological interventions may help reduce postoperative nausea and vomiting and improve patient comfort (Kilinç & Karaman Özlü, 2024; Tsai et al., 2025; Wang et al., 2024). Therefore, deep breathing relaxation may be considered as an additional supportive intervention alongside standard pharmacological management.

The effectiveness of deep breathing relaxation in this study may also be related to its ability to improve patients' sense of control during the postoperative recovery period. PONV can cause discomfort, fear, and distress, especially when patients feel unable to control nausea or the urge to vomit. Guided breathing provides patients with an active coping strategy that can be performed independently and repeatedly. This self-directed component may improve comfort, reduce anxiety, and support recovery after surgery.

However, two respondents in this study did not experience a change in PONV severity after the intervention. This finding indicates that PONV is multifactorial and may not be fully controlled by a single nonpharmacological intervention. Patient-related factors, such as sex, age, smoking status, history of motion sickness, previous PONV, anxiety, and individual sensitivity to anesthesia, may influence the response to intervention. Anesthesia-related and surgery-related factors, including opioid use, duration of surgery, type of surgery, and postoperative pain, may also contribute to persistent PONV (Gan et al., 2020; Jin et al., 2020; Schlesinger et al., 2023).

From a clinical perspective, the findings suggest that deep breathing relaxation can be integrated into postoperative nursing and anesthesia care for patients receiving spinal anesthesia. Nurses and nurse anesthetists can teach patients slow and controlled breathing during the early postoperative period when the patient is conscious, stable, and able to follow instructions. This intervention may be especially useful in recovery rooms and surgical wards as a supportive measure to reduce nausea, vomiting, discomfort, and anxiety. Because the technique is simple and does not require equipment, it can be implemented in various hospital settings with minimal cost.

Despite its positive findings, this study has several limitations. The one-group pretest–posttest design does not include a control group, so the reduction in PONV cannot be attributed solely to the intervention without considering natural recovery, time effects, or other clinical management. The study was conducted in one hospital with purposive sampling, which may limit the generalizability of the findings. In addition, several confounding factors, such as history of motion sickness, type and duration of surgery, opioid use, postoperative pain, and antiemetic administration, were not fully controlled.

Overall, this study demonstrates that the deep breathing relaxation technique was effective in reducing PONV severity among postoperative patients receiving spinal anesthesia. The findings support the use of deep breathing relaxation as a safe, simple, and practical supportive intervention in postoperative care. Future studies should use randomized controlled designs, larger samples, control groups, and better control of confounding variables to confirm the effectiveness of this intervention. Further research may also compare deep breathing relaxation with other nonpharmacological interventions or combine it with standard antiemetic therapy to optimize PONV management.

Implication and limitation

The findings of this study imply that deep breathing relaxation can be used as a simple, safe, low-cost, and feasible supportive intervention to reduce postoperative nausea and vomiting among patients receiving spinal anesthesia. Nurses and nurse anesthetists may integrate this technique into postoperative care, particularly in the recovery room or surgical ward, after patients are conscious, hemodynamically stable, and able to follow instructions. This intervention may help improve patient comfort, reduce nausea-related distress, and support early postoperative recovery alongside standard pharmacological management. However, this study has several limitations. The one-group pretest–posttest design did not include a control group, so the reduction in PONV cannot be attributed solely to the intervention because natural recovery, time effects, or standard postoperative management may also influence the results. The study was conducted in a single hospital with purposive sampling, which may limit generalizability. In addition, several confounding factors, such as history of motion sickness, type and duration of surgery, opioid use, postoperative pain, and antiemetic administration, were not fully controlled. Future studies should use randomized controlled designs, larger samples, control groups, and better control of confounding variables to confirm the effectiveness of deep breathing relaxation in reducing PONV.

Relevance for Practice

The findings of this study are relevant for postoperative nursing and anesthesia care because deep breathing relaxation can be used as a supportive nonpharmacological intervention to reduce postoperative nausea and vomiting among patients receiving spinal anesthesia. Nurses and nurse anesthetists can teach and guide patients to perform slow, controlled breathing after surgery when patients are conscious, stable, and able to follow instructions. This technique is simple, safe, low-cost, and does not require special equipment, making it feasible for use in recovery rooms and surgical wards. In practice, deep breathing relaxation may help improve patient comfort, reduce nausea-related distress, support early recovery, and complement standard pharmacological management for PONV.

Conclusion

This study found that deep breathing relaxation was effective in reducing postoperative nausea and vomiting among patients receiving spinal anesthesia. Before the intervention, most respondents experienced moderate and severe PONV, whereas after the intervention, most respondents experienced only mild PONV. The Wilcoxon signed-rank test showed a significant difference in PONV severity before and after the intervention. These findings indicate that deep breathing relaxation can be used as a simple, safe, and feasible supportive intervention to improve patient comfort and reduce nausea-related distress during the early postoperative recovery

period. However, further studies with randomized controlled designs and better control of confounding factors are needed to confirm its effectiveness.

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Author Contribution

Najwa Zajida Latifah contributed to conceptualization, study design, literature review, data collection, data organization, data analysis, interpretation of findings, and drafting of the original manuscript. Joko Murdiyanto contributed to study supervision, methodology refinement, clinical interpretation, critical review of the manuscript, and intellectual input related to anesthesia practice. Aisyah Nur Azizah contributed to study supervision, data interpretation, manuscript review, academic guidance, and final editing. All authors read and approved the final version of the manuscript and agreed to be accountable for all aspects of the work.

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Declaration of Conflicting Interest

The authors declare no conflict of interest.

Declaration of Use of AI in Scientific Writing

The authors declare that generative AI and AI-assisted technologies were used to support language editing and grammatical refinement of the manuscript.

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