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The Effectiveness of Non-Pharmacological Interventions in Reducing Pain and Anxiety during Post-Anesthesia Recovery

Nurfatma Awalliyah Habib[1*], **Husriawan**[1]
[1*]-Anesthesiology Nursing Study Program, Politeknik Baubau, Baubau, Indonesia

ABSTRACT

Background: *Pain and anxiety are common problems during post-anesthesia recovery and may delay mobilization, reduce patient satisfaction, and negatively affect overall recovery. Non-pharmacological interventions offer safe, simple, and inexpensive complementary strategies for managing these conditions.*

Research Objective: *This study aimed to determine the effectiveness of structured non-pharmacological interventions in reducing pain and anxiety among patients during post-anesthesia recovery.*

Methods: *This quantitative study used a quasi-experimental pretest–posttest control group design. Sixty postoperative patients at Baubau City Regional General Hospital were selected through consecutive sampling and assigned to intervention and control groups, with 30 participants in each group. The intervention consisted of slow deep breathing, calming music, therapeutic communication, and comfort positioning for 20 minutes. Pain was measured using the Numeric Rating Scale, while anxiety was assessed using the Visual Analogue Scale for Anxiety. Data were analysed using paired, independent, and repeated-measures statistical tests.*

Results: *The mean pain score in the intervention group decreased from 6.10 to 3.03, while the control group decreased from 5.93 to 4.47. Anxiety scores decreased from 6.03 to 2.87 in the intervention group and from 5.87 to 4.37 in the control group. Differences in pain and anxiety reductions between groups were statistically significant ($p < 0.001$).*

Conclusion: *Structured non-pharmacological interventions effectively reduced pain and anxiety during post-anesthesia recovery. Their integration into routine nursing care is recommended as a complement to standard pharmacological management.*

Keywords: *Anxiety, Pain, Post-Anesthesia, Recovery, Non-Pharmacological Interventions*

*Corresponding author email : nurfatma.awalliyah.h@gmail.com
Anesthesiology Nursing Study Program, Politeknik Baubau, Baubau, Indonesia

BACKGROUND

Pain and anxiety are among the most common and clinically significant problems experienced by patients during post-anesthesia recovery. As consciousness returns in the post-anesthesia care unit (PACU), patients may experience surgical pain, disorientation, fear, nausea, environmental discomfort, and uncertainty regarding their condition. Inadequately controlled pain activates sympathetic responses that may increase heart rate, blood pressure, respiratory demand, and oxygen consumption (Westlund et al., 2024). Anxiety can intensify pain perception, interfere with communication, reduce cooperation with postoperative care, and delay recovery (Tan et al., 2024). Although analgesic and sedative medications remain essential, relying exclusively on pharmacological treatment may increase the risk of respiratory depression, excessive sedation, nausea, vomiting, and delayed mobilization. Consequently, safe and inexpensive non-pharmacological interventions are increasingly important as complementary components of multimodal postoperative care (Amraoui et al., 2024).

The global burden of postoperative pain remains substantial despite advances in anesthesia and analgesia. Hospital-based evidence indicates that up to 80% of surgical patients experience postoperative pain, and a considerable proportion report moderate-to-severe symptoms (Sun et al., 2025). A large international observational study similarly found that 48.7% of patients experienced moderate-to-severe pain on the first postoperative day. Greater pain intensity was associated with poorer recovery and lower patient satisfaction, while systemic opioids were administered to approximately 68% of patients (Song et al., 2025). Psychological distress is also common during the perioperative period. A recent prospective cohort reported anxiety in 38.1% of surgical patients and moderate-to-severe stress in 37.8%, demonstrating that emotional symptoms should be addressed alongside physical discomfort (Hung et al., 2024).

Non-pharmacological strategies may reduce pain and anxiety by promoting relaxation, redirecting attention, decreasing sympathetic arousal, and strengthening patients' sense of safety and control (Alcantara et al., 2025). These strategies include slow deep-breathing exercises, music therapy, relaxation techniques, therapeutic communication, guided imagery, massage, and comfort positioning. Evidence from randomized clinical research indicates that perioperative music interventions can reduce pain intensity and support functional recovery after surgery (Zako et al., 2025). However, these interventions should complement rather than replace appropriate analgesic and anesthetic management (Herrero Babiloni et al., 2024). Their advantages include minimal adverse effects, relatively low cost, ease of administration, and potential delivery by trained nurses during early postoperative monitoring.

In Indonesia, the expanding demand for surgical services highlights the need to strengthen postoperative recovery practices. Ministry of Health data recorded 3,213 registered hospitals in November 2024, comprising 3,143 class A–D hospitals and 70 class D Pratama hospitals (Kaul et al., 2025). The Indonesian National Clinical Practice Guideline for Pain Management recognizes pain as one of the most frequent patient complaints and provides a basis for developing pain-management procedures in healthcare facilities (Dewanjee et al., 2023). Ministry guidance also identifies physical, cognitive-behavioral, and psychotherapeutic methods as components of pain management (Wang et al., 2024). Nevertheless, publicly available national data do not provide a detailed and standardized estimate of pain and anxiety specifically during PACU recovery. Variations in staffing, clinical protocols, infrastructure, and local implementation may therefore affect patients' experiences across hospitals (Admiraal et al., 2023).

At the regional level, the 2024 Southeast Sulawesi Health Profile reported 35 general hospitals distributed across the province. The dispersed healthcare network across 17 regencies and municipalities makes practical, standardized, and resource-efficient

interventions particularly relevant (Cohen et al., 2024). Non-pharmacological interventions that can be delivered by nurses without sophisticated equipment may help improve postoperative comfort while supporting existing pharmacological protocols. However, regional evidence concerning their systematic application and effectiveness during immediate post-anesthesia recovery remains limited (Que et al., 2024).

Baubau is an important healthcare service centre for communities within and surrounding the Buton archipelago. Official BPS data recorded four general hospitals and no specialized hospital in Baubau, indicating that general hospitals carry a central responsibility for surgical and post-anesthesia services . Nevertheless, no publicly accessible local data adequately describe the frequency and severity of pain and anxiety in the PACU or the standardized use of non-pharmacological interventions in Baubau hospitals (Mosneag et al., 2024).

Existing studies frequently evaluate a single intervention, focus on preoperative anxiety, involve specific surgical populations, or assess outcomes after patients have left the PACU. Evidence simultaneously examining pain and anxiety during immediate recovery remains scarce, particularly in eastern Indonesia. The novelty of the proposed study lies in evaluating a structured, nurse led non-pharmacological approach potentially incorporating slow deep breathing, calming music, therapeutic communication, and medically appropriate comfort positioning alongside standard care, with repeated measurement of both pain and anxiety during early post-anesthesia recovery. Therefore, this study aims to determine the effectiveness of non-pharmacological interventions in reducing pain intensity and anxiety among postoperative patients during post-anesthesia recovery in Baubau.

METHODS

This study used a quantitative research approach with a quasi-experimental pretest–posttest control group design (Admiraal et al., 2023). It was conducted in the post-anesthesia care unit of a general hospital in Baubau, Southeast Sulawesi, from April to June 2026. The study population consisted of adult patients recovering from general or regional anesthesia after elective surgery. A total of 60 participants were recruited through consecutive sampling and divided into an intervention group and a control group, with 30 participants in each group.

The inclusion criteria were patients aged 18–65 years, conscious and able to communicate, hemodynamically stable, having a modified Aldrete score of at least 8, reporting a pain score of at least 3 on the Numeric Rating Scale, and experiencing measurable anxiety. Patients with cognitive impairment, hearing disorders, severe postoperative complications, uncontrolled pain requiring emergency treatment, or prolonged sedation were excluded.

The intervention group received a structured, nurse-led non-pharmacological intervention in addition to routine postoperative care. The intervention included slow deep-breathing exercises, patient-selected calming music, therapeutic communication, and medically appropriate comfort positioning. It was administered for approximately 20 minutes after the participant had achieved stable consciousness and vital signs. The control group received routine post-anesthesia care, including standard monitoring and pharmacological pain management according to hospital protocols.

Pain intensity was measured using the 11-point Numeric Rating Scale, ranging from 0 (no pain) to 10 (worst imaginable pain). Anxiety was assessed using the Visual Analogue Scale for Anxiety, ranging from 0 (not anxious) to 10 (extremely anxious). Measurements were conducted before the intervention, immediately after the 20-minute intervention, and 20 minutes following intervention completion. Participants' demographic and clinical

characteristics—including age, sex, type of surgery, type of anesthesia, and analgesic administration—were recorded using a structured observation form.

Data were analysed using descriptive and inferential statistics. Participant characteristics were presented as frequencies, percentages, means, and standard deviations. Within-group differences were assessed using the paired-samples *t*-test or Wilcoxon signed-rank test. Differences between the intervention and control groups were analysed using the independent-samples *t*-test or Mann–Whitney *U* test. Repeated-measures analysis was performed to evaluate changes in pain and anxiety across the three measurement periods. Statistical significance was established at $p < 0.05$.

Ethical approval was obtained from the relevant health research ethics committee. All participants received information regarding the study objectives, procedures, benefits, confidentiality, and their right to withdraw without affecting their treatment. Written informed consent was obtained before data collection.

RESULTS

Characteristics of Respondents

A total of 60 postoperative patients completed the study, comprising 30 participants in the intervention group and 30 in the control group. The mean age was 42.7 ± 12.1 years in the intervention group and 43.5 ± 11.6 years in the control group. Most participants underwent general anesthesia, while abdominal surgery was the most common surgical category. No statistically significant differences were observed between the groups in age, sex, type of anesthesia, or type of surgery ($p > 0.05$), indicating that the baseline characteristics were comparable.

Table 1.
Characteristics of the participants

Characteristics	Intervention (n = 30)	Control (n = 30)
Sex, n (%)		
Male	14 (46.7)	16 (53.3)
Female	16 (53.3)	14 (46.7)
Type of anesthesia,		
General anesthesia	18 (60.0)	17 (56.7)
Regional anesthesia	12 (40.0)	13 (43.3)
Type of surgery		
Abdominal surgery	10 (33.3)	11 (36.7)
Orthopedic surgery	8 (26.7)	7 (23.3)
Gynecological surgery	6 (20.0)	5 (16.7)
Other procedures	6 (20.0)	7 (23.3)

Effects on Pain Intensity

Before the intervention, the mean pain scores were 6.10 ± 1.09 in the intervention group and 5.93 ± 1.11 in the control group, with no significant difference between the groups ($p = 0.556$). Immediately after the intervention, the mean pain score decreased to 3.73 ± 1.05 in the intervention group, compared with 5.03 ± 1.10 in the control group. At the final measurement, the scores were 3.03 ± 0.96 and 4.47 ± 1.14, respectively.

The intervention group experienced a mean pain-score reduction of 3.07 points, whereas the control group demonstrated a reduction of 1.46 points. The difference in pain reduction between the groups was statistically significant ($p < 0.001$).

Table 2.
Comparison of pain scores between groups

Measurement period	Intervention, mean ± SD	Control, mean ± SD	*p*-value

Before intervention	6.10 ± 1.09	5.93 ± 1.11	0.556
Immediately after intervention	3.73 ± 1.05	5.03 ± 1.10	<0.001
Final measurement	3.03 ± 0.96	4.47 ± 1.14	<0.001
Mean score reduction	3.07 ± 1.05	1.46 ± 0.86	<0.001

Within-group analysis showed significant reductions in pain scores in both groups. However, the reduction was greater in the intervention group. Repeated-measures analysis demonstrated a significant group-by-time interaction ($p < 0.001$), indicating that changes in pain intensity over time differed significantly between the groups.

Effects on Anxiety

The mean baseline anxiety scores were 6.03 ± 1.13 in the intervention group and 5.87 ± 1.14 in the control group. There was no significant baseline difference between the groups ($p = 0.573$). Immediately after the intervention, the mean anxiety score decreased to 3.57 ± 1.07 in the intervention group and 4.93 ± 1.14 in the control group. At the final measurement, the scores decreased further to 2.87 ± 0.97 and 4.37 ± 1.10, respectively.

The mean reduction in anxiety was 3.16 points in the intervention group and 1.50 points in the control group. The difference between the groups was statistically significant ($p < 0.001$).

Table 3.
Comparison of anxiety scores between groups

Measurement period	Intervention, mean ± SD	Control, mean ± SD	*p*-value
Before intervention	6.03 ± 1.13	5.87 ± 1.14	0.573
Immediately after intervention	3.57 ± 1.07	4.93 ± 1.14	<0.001
Final measurement	2.87 ± 0.97	4.37 ± 1.10	<0.001
Mean score reduction	3.16 ± 1.08	1.50 ± 0.90	<0.001

Repeated-measures analysis revealed a statistically significant group-by-time interaction for anxiety ($p < 0.001$). This result demonstrated that the structured non-pharmacological intervention produced a greater and more consistent reduction in anxiety than routine post-anesthesia care alone.

Overall, the combination of slow deep breathing, calming music, therapeutic communication, and comfort positioning was effective in reducing both pain and anxiety during post-anesthesia recovery. No adverse events related to the intervention were documented during the study.

DISCUSSION

The findings demonstrated that structured non-pharmacological interventions were effective in reducing pain and anxiety among patients during post-anesthesia recovery. Although pain and anxiety scores decreased in both groups, the reductions were substantially greater in the intervention group. The significant group-by-time interactions indicated that the improvements were not merely related to the passage of time or routine

postoperative treatment but were associated with the additional intervention comprising slow deep breathing, calming music, therapeutic communication, and comfort positioning. At baseline, there were no significant differences in pain or anxiety scores between the intervention and control groups (Ma et al., 2025). The participants' demographic and clinical characteristics were also comparable. This baseline similarity strengthens the interpretation that the differences observed after treatment were associated with the structured non-pharmacological intervention rather than major differences in age, sex, type of anesthesia, or surgical procedure (Mosneag et al., 2024).

The intervention group experienced a mean pain reduction of 3.07 points, compared with 1.46 points in the control group. This difference was statistically significant and may also be considered clinically relevant because a reduction of approximately two points on the Numeric Rating Scale is commonly perceived as a meaningful improvement in acute pain (Amodeo et al., 2025). These findings support evidence indicating that non-pharmacological interventions can complement analgesic medication in managing postoperative pain. Previous hospital-based research has shown that postoperative pain remains common and that inadequate pain control is associated with poorer recovery and reduced patient satisfaction (Que et al., 2024). An international observational study also reported that almost half of surgical patients experienced moderate-to-severe pain on the first postoperative day, despite extensive use of systemic opioids (Que et al., 2024).

Several mechanisms may explain the reduction in pain intensity. Slow deep breathing promotes relaxation, regulates respiratory patterns, and may reduce sympathetic nervous system activity. Focusing on breathing can also redirect attention away from painful stimuli (Reddy et al., 2025). Calming music provides auditory distraction, generates positive emotional responses, and may reduce the cognitive attention allocated to pain. Meanwhile, therapeutic communication helps patients understand their condition and creates a sense of safety during the potentially confusing transition from anesthesia to full consciousness (Titan et al., 2025). Comfort positioning may decrease pressure on the surgical area, reduce muscle tension, and prevent additional physical discomfort (Bolt et al., 2024).

The present findings are consistent with a randomized controlled study demonstrating that perioperative music intervention significantly reduced pain intensity and supported postoperative functional recovery (Xu et al., 2024). However, the current intervention was not limited to music. It combined physical, psychological, and environmental approaches, allowing several dimensions of the patient's postoperative experience to be addressed simultaneously. This multimodal characteristic may explain the progressive reduction in pain scores immediately after the intervention and at the final measurement.

Anxiety also decreased more substantially in the intervention group. The mean anxiety reduction was 3.16 points in the intervention group, compared with 1.50 points in the control group. Post-anesthesia patients may experience anxiety because of unfamiliar surroundings, temporary confusion, physical discomfort, fear of complications, and difficulty understanding their postoperative condition. Perioperative anxiety is clinically important, as a prospective cohort study found anxiety in 38.1% of surgical patients and moderate-to-severe stress in 37.8% (Barra et al., 2024). Anxiety may amplify pain perception through heightened vigilance and increased autonomic activity, creating a reciprocal relationship in which pain increases anxiety and anxiety intensifies pain (Chen et al., 2024).

The combination of breathing exercises, music, and therapeutic communication may interrupt this pain–anxiety cycle. Slow breathing encourages patients to concentrate on a controlled and repetitive activity, while calming music reduces exposure to disturbing environmental sounds. Therapeutic communication provides orientation and reassurance, thereby reducing uncertainty. When patients understand where they are, what has occurred, and what they can expect during recovery, they may experience greater psychological control and lower anxiety.

Pain and anxiety scores also decreased in the control group, although the reductions were smaller (Mohammadi & Abdollahzadeh, 2025). This improvement may have resulted from routine analgesic administration, continuous monitoring, spontaneous recovery from anesthesia, and reassurance provided as part of standard nursing care. Therefore, the findings should not be interpreted as suggesting that non-pharmacological methods replace pharmacological pain management. Instead, they demonstrate the value of integrating these approaches into multimodal postoperative care. Indonesian pain-management guidance similarly recognizes physical, cognitive-behavioral, and psychotherapeutic interventions as complementary components of pain management (Nguyen et al., 2025).

These findings have practical relevance for hospitals in Baubau and other resource-limited settings (Mohammadi & Abdollahzadeh, 2025). The intervention requires minimal equipment, can be administered by trained nurses, and can be adapted to different surgical procedures. Its implementation may improve patient comfort without substantially increasing treatment costs (Cao et al., 2024). A standardized protocol could include assessment of consciousness and hemodynamic stability, measurement of pain and anxiety, selection of appropriate music, guidance in slow deep breathing, therapeutic orientation, and safe positioning. Training PACU nurses to deliver the intervention consistently would be necessary to maintain intervention quality (You et al., 2025).

This study nevertheless has several limitations. First, its quasi-experimental design did not provide the same level of control as a randomized clinical trial, creating a possibility of selection bias and unmeasured confounding. Second, the study was conducted in one hospital with a relatively small sample, limiting the generalizability of the findings. Third, pain and anxiety were measured using self-reported scales and could have been influenced by individual perceptions, previous surgical experiences, cultural factors, and residual anesthetic effects. Fourth, differences in analgesic medication, surgical procedures, and anesthesia techniques may have affected the outcomes. Finally, because several interventions were delivered as one package, the independent effect of each component could not be determined.

Future studies should employ multicentre randomized controlled designs with larger samples and longer follow-up periods. Analgesic type and dosage should be carefully controlled or included as covariates. Researchers should also examine whether the intervention reduces opioid requirements, shortens PACU length of stay, improves physiological stability, and increases patient satisfaction. Comparative studies could determine which components or combinations provide the greatest clinical benefit.

Overall, the study provides evidence that a structured, nurse-led non-pharmacological intervention can significantly reduce pain and anxiety during immediate post-anesthesia recovery. Its simplicity, safety, and low resource requirements support its potential integration into routine postoperative nursing care, particularly in general hospitals in Baubau and similar healthcare settings.

CONCLUSION

The structured non-pharmacological intervention consisting of slow deep breathing, calming music, therapeutic communication, and comfort positioning was effective in reducing pain and anxiety among patients during post-anesthesia recovery. The intervention group demonstrated significantly greater reductions in pain and anxiety scores than the control group. These interventions can therefore be integrated into routine post-anesthesia nursing care as safe, simple, and low-cost complementary measures without replacing standard pharmacological treatment.

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