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The Effectiveness of Lemon Aromatherapy with Guided Imagery on Pain Levels in Post-Surgery Patients with Fracture

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ABSTRACT

A fracture is a break of complete cartilage or continuity of bone. Patients may experience pain sensations even before they are fully conscious as anesthesia wears off, causing postoperative pain to increase. Lemon aromatherapy stimulates the limbic system, increasing endorphins and producing a calming effect. Guided imagery reduces pain by imagining pleasant things. Objective: To determine the effectiveness of lemon aromatherapy combined with guided imagery on pain levels in postoperative fracture patients. Methods: A case study was conducted using a descriptive method design. The therapy used was lemon aromatherapy combined with guided imagery, given to 2 respondents with postoperative clavicle fracture, administered once a day for 2 days, with a duration of 30 minutes per session. Results: After receiving lemon aromatherapy and guided imagery, pain levels in both respondents decreased significantly, from a severe scale before the intervention to a moderate scale after therapy. Conclusions: The combination of lemon aromatherapy and guided imagery was effective in reducing pain in postoperative fracture patients.

Keywords: post fracture surgery; lemon aromatherapy; guided imagery; pain management; nonpharmacological therapy

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INTRODUCTION

Surgery is an invasive medical procedure that incises the part of the body experiencing a health problem and then performs repair and wound closure. There are three phases in surgery: preoperative, intraoperative, and postoperative. Diagnosis, curative, reparative, reconstructive, and palliative are some reasons why surgeries are performed. Surgery always requires an incision on the body, which can cause trauma and complaints (1). Pain is one of the most common problems experienced by patients after surgery. Although postoperative pain is physiological, patients fear it most. Patients can experience pain sensations even before they are fully conscious as anesthesia wears off, causing postoperative pain to increase (2).

The World Health Organization (WHO) states there are 178 million new fracture cases globally, an increase of 33.4% in the absolute number of new fracture cases since 1990. This

is partly driven by population growth and aging. There are 455 million prevalence cases of acute or long-term symptoms resulting from fractures. In the 2019–2024 period, a 70.1% increase in absolute prevalence has occurred since 1990. Globally, fractures have caused 25.8 million individuals to live with disabilities, a 65.3% increase from the absolute number of disabled individuals since 1990 (3).

Extremity fractures are common occurrences in Indonesia, mostly caused by accidents and associated with long hospitalization and surgery (1). The incidence of femur fractures in Indonesia is the highest at 39%, followed by humerus fractures (15%), tibia and fibula fractures (11%). The most common causes are traffic accidents involving motorcycles and cars (62.6%) and falls (37.3%). The majority are male (63.8%), with peak fracture distribution at 15–34 years old and the elderly above 70 years (4).

In Central Java Province, approximately 2,700 individuals experience fractures; 56% suffer physical disability, 24% die, and 5% experience psychological disorders or depression as a result of fracture accidents (5). Patients who experience fractures typically develop pain, difficulty sleeping, inability to perform activities, risk of infection and swelling, and various other problems (6). Postoperative fracture patients frequently face impaired physical mobility that requires structured nursing care and rehabilitation to restore function (21). Acute pain management is a central challenge in fracture care, as uncontrolled pain negatively impacts recovery outcomes and prolongs hospitalization (8). Fractures cause pain through nociceptors stimulated by biochemical substances such as bradykinin, histamine, serotonin, and potassium ions released during tissue trauma, inflammation, and ischemia (7).

Non-pharmacological pain management includes techniques such as aromatherapy, relaxation techniques, hypnotherapy, guided imagery, music therapy, and acupressure (10). Deep breathing relaxation has been demonstrated to reduce pain intensity in postoperative fracture patients by activating the parasympathetic nervous system and promoting physical relaxation (9). Lemon aromatherapy is an additional treatment method that uses essential oils as a therapeutic agent. The olfactory receptors inhale the lemon aroma, which then sends signals to the limbic system in the brain, releasing serotonin and endorphins that cause comfort and pain reduction (13). Research shows that guided imagery is effective in reducing pain by focusing the patient's attention on pleasant imaginations that release endorphins and prevent pain from spreading (11).

Several studies have examined lemon aromatherapy and guided imagery as separate interventions for pain management (13,14). However, evidence regarding their combined application specifically in postoperative clavicle fracture patients remains limited, with most existing research focusing on extremity fractures in general (11). The novelty of this study lies in the implementation of a combined lemon aromatherapy and guided imagery protocol applied to postoperative clavicle fracture patients within a tertiary referral hospital setting. Unlike previous studies that examined these therapies independently or in heterogeneous fracture populations (14,19), this study presents an integrated dual-mechanism intervention targeting both physiological (endorphin and serotonin release via olfaction) and psychological (parasympathetic activation via sensory imagery) pathways simultaneously. Furthermore, this study contributes a structured nursing case study model that can be directly adopted as an independent nursing intervention protocol, addressing a practical gap in bedside pain management at the ward level (20).

Based on a preliminary study at Flamboyan 5 Ward, RSUD Dr. Moewardi, Central Java Province, the number of patients in the last month reached 970, with 68 fracture patients.

Interviews with patients confirmed postoperative pain. Non-pharmacological therapy currently applied was limited to deep breathing exercises, and lemon aromatherapy with guided imagery had never been implemented. This study aimed to determine the effectiveness of lemon aromatherapy combined with guided imagery in reducing pain in postoperative fracture patients.

METHODS

This study used a case study design with a descriptive method. The therapy implemented was lemon aromatherapy combined with guided imagery for reducing pain scale in fracture patients in Flamboyan 5 Ward, RSUD Dr. Moewardi, Central Java Province. The case study was conducted using a nursing process approach on 2 respondents, starting from assessment, nursing diagnosis, planning, implementation, and evaluation. The study focused on the independent nursing action of providing lemon aromatherapy and guided imagery.

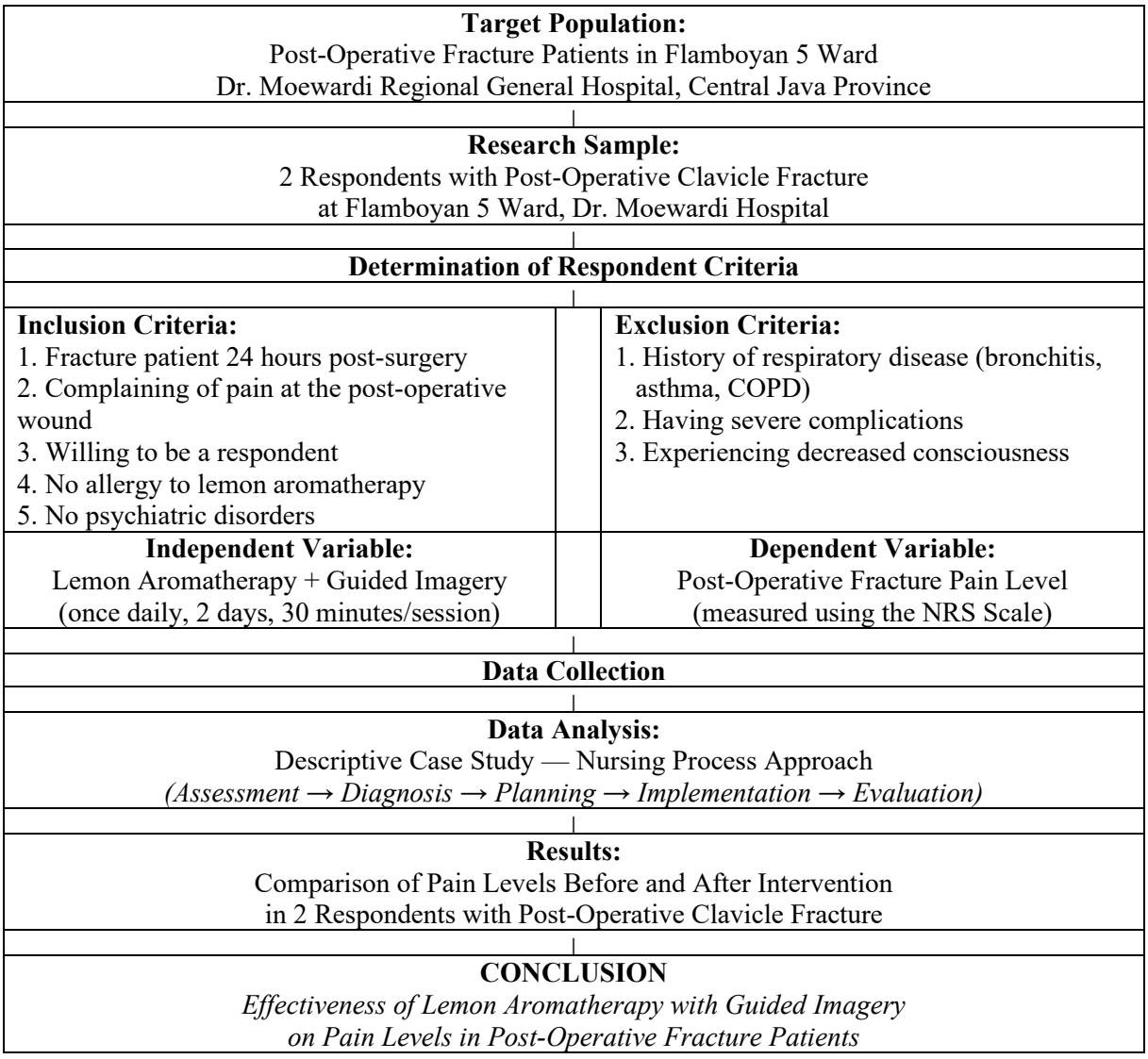


Figure 1. Research Stages Flowchart

The study was conducted in Flamboyan 5 Ward, RSUD Dr. Moewardi, Central Java Province, in January 2026. Subjects were 2 fracture patients meeting the following inclusion criteria: 24-hour post-operative fracture patients, complaining of pain at the postoperative fracture wound, willing to be respondents, no history of lemon aromatherapy allergy, and no psychiatric disorders. Exclusion criteria included patients with a history of respiratory diseases (bronchitis, asthma, COPD), severe complications, or decreased consciousness.

Lemon aromatherapy was prepared by placing 50 ml of warm water in a basin and adding 5 drops of lemon aromatherapy oil. Respondents inhaled the lemon-infused air with deep breaths for 30 minutes. Guided imagery was delivered via earphone containing instrumental music and natural sounds for 15 minutes while the patient performed deep breathing relaxation (Simamora et al., 2025). Pain was measured before and after each session using the Numeric Rating Scale (NRS). Therapy was given once daily for 2 consecutive days. Data analysis used descriptive statistical analysis, comparing pain scale changes between respondents before and after intervention. The research stages flowchart is presented below:

RESULTS

This study was conducted at RSUD Dr. Moewardi, Central Java Province – a Type A hospital owned by the Central Java Provincial Government, located in Jebres, Surakarta. It serves as the highest referral center in western Central Java and as an academic hospital for the Faculty of Medicine, Universitas Sebelas Maret. With over 850 beds and more than 220 specialist/subspecialist doctors, the hospital excels in integrated cancer and cardiac services. The study was carried out in Flamboyan 5 Ward, a surgical ward with 8 rooms (4 beds each), serving patients with various surgical procedures including postoperative fracture, laparotomy, and colonoscopy patients. In the last month, 68 fracture patients were treated in this ward.

The intervention was applied to two respondents: Mr. M (24 years old) and Mr. L (34 years old). Both underwent clavicle fracture surgery on January 26, 2026. Therapy was administered on January 27–28, 2026 in the afternoon. Before each session, pain scale was measured using NRS, after which lemon aromatherapy and *guided imagery* were administered for approximately 30 minutes. Post-intervention pain scale was then reassessed.

Table 1. Pain Scale Before Lemon Aromatherapy and Guided Imagery Intervention (January 27, 2026)

Respondent Name	Pain Scale
Mr. M	8
Mr. L	7

Source: Primary Data 2026

Based on Table 1, the pain scale of both respondents before receiving lemon aromatherapy and *guided imagery* was in the severe category: Mr. M scored 8 and Mr. L scored 7 on the first day.

Table 2. Pain Scale After Lemon Aromatherapy and Guided Imagery Intervention (January 28, 2026)

Respondent Name	Pain Scale
Mr. M	5
Mr. L	5

Source: Primary Data 2026

Based on Table 2, after receiving lemon aromatherapy and *guided imagery*, pain scales of both respondents were in the moderate category: Mr. M scored 5 and Mr. L scored 5.

Table 3. Pain Level Development Before and After Lemon Aromatherapy and Guided Imagery Intervention

Respondent Name	Pain Scale Before (Jan 27, 2026)	Pain Scale After (Jan 28, 2026)
Mr. M	8	5
Mr. L	7	5

Source: Primary Data 2026

Table 4. Comparison of Final Results of Pain Scale Before and After Lemon Aromatherapy and Guided Imagery Intervention

Respondent	Pain Scale Before	Pain Scale After	Difference
Mr. M	8	5	3
Mr. L	7	5	2

Source: Primary Data 2026

Based on Table 4, the administration of lemon aromatherapy and *guided imagery* reduced pain scales in postoperative fracture patients. After 2 consecutive days of intervention, pain scale in Mr. M decreased by 3 points, while in Mr. L it decreased by 2 points.

DISCUSSION

Before intervention, both respondents experienced severe pain: Mr. M (scale 8) and Mr. L (scale 7). This is consistent with research indicating that 80% of patients experience pain after surgery, with 86% reporting moderate to severe pain (12). Fracture-related pain is acute and causes frustration, anxiety, and psychological depression in patients. Elevated blood pressure and rapid heart rate can reduce the immune system, as fracture pain patients experience stress and anxiety (13). Adequate acute pain assessment and management in postoperative fracture patients is therefore a critical nursing priority to prevent escalation of physiological and psychological complications (8).

After the combination intervention of lemon aromatherapy and guided imagery, both respondents' pain scales decreased to 5 (moderate category). This is consistent with the study

by Alves et al.,11 which showed that the majority of patients experienced a reduction in pain to mild pain: 34 respondents (55.7%) experienced mild pain and 27 respondents (44.3%) experienced moderate pain after intervention. Astaris & Afni (14) also found that guided imagery and lemon aromatherapy are effective methods for reducing patient pain, providing comfort, reducing muscle tension, relieving pain, managing anxiety, and stabilizing the nervous system. Simamora et al. (10) found a significant difference in mean pain scores before and after the combined lemon aromatherapy and guided imagery intervention, with p-value 0.005.

The pain reduction occurred because lemon aromatherapy provides a relaxation effect through stimulation of the limbic system that triggers endorphin release. The linalool content in lemon calms and stabilizes nerves, while limonene (>70%) inhibits prostaglandin activity, reducing pain (15,13). The mechanism of lemon aromatherapy works through air circulation and olfaction; the inhaled aroma is associated with mood regulation through connections between olfactory receptors and the brain (10). Comparative studies on aromatherapy modalities suggest that lemon essential oil demonstrates superior analgesic properties compared to other single-agent aromatherapy interventions (19).

Guided imagery helps patients become calmer and more relaxed by utilizing sensory tools visual, touch, hearing, taste, and smell to activate the parasympathetic nervous system, which is responsible for reducing pain and anxiety (10). Tiyonggo et al.(17) found this technique effectively reduces pain from severe to mild, or from moderate to mild. Its mechanism involves processing imaginary stimuli in the brain, including the brainstem, thalamus, amygdala, and hippocampus, triggering positive responses and muscle relaxation. Benson relaxation, another technique sharing the parasympathetic activation mechanism, has similarly demonstrated effectiveness in reducing fracture pain scores (16).

The combination of lemon aromatherapy and guided imagery is more effective than some other therapies because it works simultaneously on physiological and psychological aspects, producing a more comprehensive analgesic effect (18). Cold compress combination therapies have also shown efficacy in reducing pain intensity among closed fracture patients, suggesting that multimodal non-pharmacological approaches consistently outperform single-modality interventions (20). The non-pharmacological approach is also safer, has fewer side effects, and can be applied independently by patients and families. Deep breathing relaxation, which is currently the standard non-pharmacological intervention in this ward, can be meaningfully enhanced by incorporating lemon aromatherapy and guided imagery as adjunct therapies (9). Relaxation techniques including Benson relaxation have also been documented to reduce fracture pain effectively, further supporting the adoption of multimodal non-pharmacological strategies (16).

CONCLUSION

The administration of lemon aromatherapy combined with guided imagery for 2 consecutive days with 30-minute sessions per day effectively reduced pain in postoperative fracture patients at Flamboyan 5 Ward, RSUD Dr. Moewardi, Central Java Province. Before intervention, both respondents experienced severe pain (Mr. M: scale 8, Mr. L: scale 7); after intervention, pain decreased to moderate level (scale 5) in both respondents, with a reduction of 3 points for Mr. M and 2 points for Mr. L. The combination therapy works by stimulating the limbic system through lemon aromatherapy to release endorphins, while guided imagery helps patients relax and redirect attention away from pain. Limitations of this study include

variation in patients' clinical conditions, time constraints, and inability to monitor pain scales outside intervention hours. This therapy is recommended as an independent nursing intervention that can be applied to postoperative fracture patients, and further research with larger samples and randomized controlled designs is suggested to strengthen the evidence base.

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