SCIENTIFIC ARTICLE

A non-pharmacological intraoperative intervention to reduce pain and enhance recovery following laparoscopic cholecystectomy: a randomised controlled trial

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Abstract

Introduction

Non-pharmacological strategies are gaining interest in perioperative care to improve recovery and reduce opioid dependence. This study was designed to evaluate the impact of intraoperative religious chanting on postoperative pain, opioid consumption, and early mobilisation in patients undergoing laparoscopic cholecystectomy.

Methodology

A prospective, double-blinded, randomised controlled trial was conducted involving 60 patients scheduled for elective laparoscopic cholecystectomy at a single tertiary centre. Participants were randomised to receive either religious chanting (n = 30) or silence (control, n = 30) through headphones intraoperatively. The primary outcome was postoperative pain measured using the Visual Analogue Scale (VAS) at 6, 12, and 24 hours. Secondary outcomes included cumulative opioid requirement, early mobilisation (within 6 hours), and incidence of postoperative nausea and vomiting (PONV).

Results

Patients exposed to religious chanting had significantly lower VAS pain scores at 6 hours (3.2 vs 4.7, $p<0.01$), 12 hours (2.7 vs 4.1, $p=0.01$), and 24 hours (1.8 vs 3.2, $p=0.03$). Mean total opioid consumption was reduced by 35% in the chanting group ($p=0.02$). Early mobilisation was achieved in 70% of the chanting group compared to 43% in controls ($p=0.04$). No significant difference was observed in PONV rates.

Conclusion

Intraoperative religious chanting is a safe, low-cost, and effective adjunct to reduce postoperative pain and opioid use, and to enhance early recovery in laparoscopic cholecystectomy. These findings support the integration of culturally appropriate non-pharmacological interventions into multimodal perioperative care protocols.

Sri Lanka clinical trial registry (Reference Number: SLCTR/2024/031)

Introduction

Laparoscopic cholecystectomy remains the gold standard for the management of symptomatic gallstone disease [1]. Its favourable safety profile and reduced postoperative pain have enabled shorter hospital stays, often allowing it to be performed as a day-case procedure [2]. However, some reports indicate that the initial postoperative discomfort may be comparable to, or even greater than, that associated with open surgery [3]. This highlights the need for effective perioperative pain management.

A variety of pharmacological strategies have been employed to mitigate pain, including opioids, port-site infiltration, regional field blocks, and non-steroidal anti-inflammatory drugs (NSAIDs), each with inherent limitations and risks [3]. As a result, non-pharmacological adjuncts have attracted growing interest as complementary approaches. Psychological interventions such as music therapy, prayer recitation, and meditation have shown potential benefits, with several randomised controlled trials reporting reduced postoperative pain and opioid use [4,5]. Nevertheless, findings have been inconsistent, and most investigations have focused on major surgical procedures.

While preliminary evidence suggests that music therapy may offer analgesic benefits for postoperative pain [6,7], religious chanting—an auditory intervention with cultural and spiritual significance—has been evaluated primarily in chronic pain settings [8,9]. Results of these studies on religious chanting

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have been promising. However, its intraoperative role, particularly in laparoscopic cholecystectomy, remains unexplored.

We therefore conducted a randomised controlled trial to investigate whether intraoperative religious chanting could reduce postoperative pain in patients undergoing laparoscopic cholecystectomy.

Methodology

Trial design

This double-blinded randomised clinical trial was conducted to find the impact of religious chanting on postoperative outcomes after laparoscopic cholecystectomy. We included all patients aged over 18 years undergoing elective laparoscopic cholecystectomy for symptomatic gallstone disease or any other non-malignant indication at a tertiary centre. We excluded patients undergoing emergency laparoscopic cholecystectomy and those who had conversion to open surgery. Patients without any religious inclination were excluded, and any patient who did not consent or had impaired hearing and/or was using a hearing aid was also excluded. Patients who were on regular analgesics for chronic pain syndromes and those who had previous upper abdominal surgeries were also excluded. Finally, patients with surgery lasting more than 180 minutes were also excluded. The total sample size was calculated to be 60, assuming 80% power, a 95% significance level, and equal numbers in the intervention and control groups. The trial was approved by the Sri Lanka clinical trial registry (Reference Number: SLCTR/2024/03, URL: https://slctr.lk/trials/6748cd70-1a6b-013d-a8c9-04014debcf01, registration date: 25th September 2024). Ethics approval was obtained from the ethics review committee of the Faculty of Medicine, University of Kelaniya (Reference Number: P/71/06/2024).

Recruitment and randomisation

Recruitment to the study was conducted at the time of surgery booking. Informed written consent was obtained after explaining the objectives, methodology, potential benefits, and any possible adverse effects. The patient was briefed on randomisation and blinding, and the numerical pain rating scale was introduced once they consented to the study. Preoperative data collection included a detailed medical history, any comorbidities, previous surgeries, and the patient's religion, preferences, and the importance of religious chants. Patients were randomised prior to the surgery into intervention and control groups using computer-generated randomisation tables by a trial coordinator who would not take part in the surgery or in the post-operative care.

Surgical procedure and intervention

In the theatre, the patient was positioned supine. General anaesthesia and an orogastric tube were offered routinely. All patients received 100µg of intravenous fentanyl, 1-2mg/kg of propofol, 0.6mg/kg of atracurium for intubation and 0.1mg/kg morphine at the induction. A prophylactic dose of intravenous antibiotics was given. Following cleaning and draping of the operating field, the umbilicus was infiltrated with 3-5ml of bupivacaine in all cases. A 10-mm umbilical port was inserted using the open technique, and a 12-mmHg pneumoperitoneum was achieved. Muscle relaxation was maintained with intravenous atracurium, and anaesthesia was maintained with Isoflurane in a 1:1 ratio of oxygen mixed with air. Isoflurane concentration was adjusted to attain a Minimum Alveolar Concentration (MAC) of 1.0 throughout surgery. During surgery, standard anaesthetic monitoring was performed, including continuous electrocardiography (ECG), non-invasive blood pressure monitoring (NIBP), pulse oximetry, and capnography. Before induction of general anaesthesia, the patient's baseline systolic and diastolic blood pressure and pulse rate were recorded.

Following induction of general anaesthesia and before the skin incision, active noise-cancelling (ANC) headphones connected via Bluetooth were applied to the patient. At the same time, the Bluetooth device played the respective religious chant. This was applied to all patients until wound closure. ANC headphones ensured that ambient noises were effectively eliminated, allowing patients only to hear the designated chant or silence based on their assigned group.

Patients assigned to the intervention group listened to religious-specific chants. These chants were pre-selected by an expert from the Department of Visual Arts & Design and the Performing Arts Unit at the University of Kelaniya, Sri Lanka. The selected chants included the "Maha Piritha" for Buddhists, the "Gayathri Mantra" for Hindus, the "Holy Rosary" for Catholics, the "Book of Psalms" for Christians, and the "Surah Baqara" for Muslims. For the control group, ANC headphones were applied without any audio input.

In both groups, standard laparoscopic cholecystectomy was performed while maintaining similarities in each step, including local anaesthesia, port closure, and skin closure. Intraoperative details, including operative time, difficulty index, complications (blood loss, bile leak), and intraoperative mean blood pressure and mean pulse rate, were recorded. Postoperative care was done in the ward with standard monitoring and analgesia. All patients received paracetamol 1 g 6 hourly, celecoxib 200mg twice daily, and

Ondansetron 8mg 6 hours after surgery. Subcutaneous morphine 0.1mg/kg was administered based on the patient's demand if the pain score is more than 5 or if the patient is demanding further analgesia.

Measures

Medical officers, who were blinded, collected data at 2, 6, 12, 18, 24, and 36 hours after surgery. Patients' pain levels were evaluated using the Numeric Rating Scale (NRS), in which a score of 0 indicated the absence of pain, and a score of 10 signified severe pain. Furthermore, assessments were conducted to evaluate patients' pulse rates, blood pressures, general well-being, postoperative nausea and vomiting, and the duration of immobilisation.

Analysis

In the initial part of the analysis, the demographics and the basic parameters such as median age, gender, mean Body Mass Index (BMI), American Society of Anesthesiologists (ASA) physical status classification system category, indication for the surgery, mean duration of the surgery, mean difficulty index of the surgery, the religion and the religious inclination were compared between the two groups. Following that, the mean pain score, requests for additional opioid doses, postoperative nausea and vomiting, the proportion of patients mobilised at different time points, and the mean heart rate during general anaesthesia (GA) were compared between the intervention and control groups using the chi-squared test and independent-samples t-tests.

Statistical analysis was conducted using SPSS 26, and p-values <0.05 were taken as significant.

Results

The study included 60 patients, with an equal number (n=30) allocated into each intervention and control group. In the per-protocol analysis, 2 patients in the control group and 1 in the test group were excluded post-randomisation for protocol violations, resulting in 28 patients in the test group and 29 in the control group (Figure 1).

In comparison of the two groups, baseline parameters were similar (Table 1). The majority (n=55, 96.4%) of patients had an education level at or above the ordinary level. There were 31 Buddhists (54%) and 13 Catholics (23%), six Christians (11%), four Muslims (7%) and three (5%) Hindus. 54 patients (95%) were engaged in regular listening to religious chants more than a minimum of once a month, while 36 patients (63%) visited places of religious worship or were involved in chanting more than once a week. When the patients were asked about the significance of religious chants in their lives, on a scale of 1-10, both groups reported median values of 8. Biliary colic (n=31, 56%) was the most prevalent indication for surgical intervention, followed by cholecystitis (n=21, 36%). Gallbladder polyps served as the indication in 2 patients (3.5%). The mean operating times for the intervention and control groups were 66 and 63 minutes, respectively. The median hospital stay was 3 days in both groups.

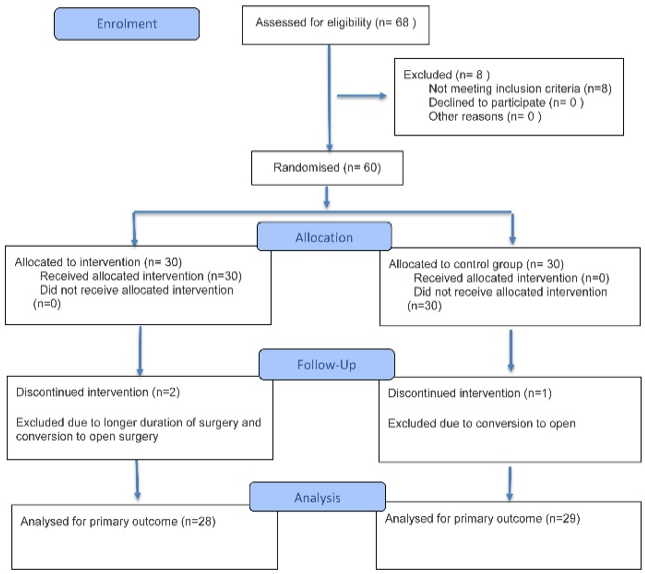

Figure 1: CONSORT 2025 Flow Diagram

Table 1: Baseline characteristics – test and control groups

	Intervention Group (n=29)	Control Group (n=28)	p value
Median age (years)	45	50	0.226
Male: Female	9:20	7:21	0.592
Mean BMI (Kg/m^{-2})	25.38	26.13	0.487
ASA category (1:2)	19:10	17:11	0.887
Indication			
• **Biliary colic (%)**	17 (59)	14 (50)	0.707
• **Cholecystitis (%)**	10 (35)	11 (39)	
• **Other (%)**	2 (7)	3 (11)	
Mean duration of surgery (minutes)	66	63	0.682
Mean difficulty index	4.91	5.00	0.821
Religion			
• **Buddhist (%)**	12 (41)	19 (68)	0.061
• **Catholic (%)**	11 (38)	2 (7)	
• **Christian (%)**	3 (10)	3 (11)	
• **Islam (%)**	1 (3)	3 (11)	
• **Hindu (%)**	2 (7)	1 (3)	
Religious inclination	7.63	7.96	0.519

ASA – American Society of Anesthesiologists, BMI – Body Mass Index

When the pain scores were compared (Figure 2), the intervention group demonstrated significantly lower scores at 6 hours (2.53 vs 4.82, p <0.001), 12 hours (1.34 vs 3.86, p <0.001), 18 hours (1.16 vs 3.32, p <0.001), and 24 hours (0.83 vs 2.48, p <0.001). Patients in the control group demonstrated significantly higher requirements for opioids at 6 (43% vs 14%, p=0.008, 95%CI OR: 1.449 -19.025) and 12 (21% vs 3%, p=0.028, 95%CI OR: 0.950 – 75.27) hours post operatively. The incidence of postoperative nausea and vomiting was similar between the two groups throughout (Table 2).

A difference was observed in patient mobilisation, with the intervention group mobilising earlier. This was statistically significant at 6 (52% vs 0% p=0.001, 95%CI OR: 0.260 – 0.550), 12 (93% vs 43% p=0.001, 95%CI OR: 0.010 – 0.251), and 18 (100% vs 82% p=0.029, 95%CI OR: 1.556 – 2.666) hours.

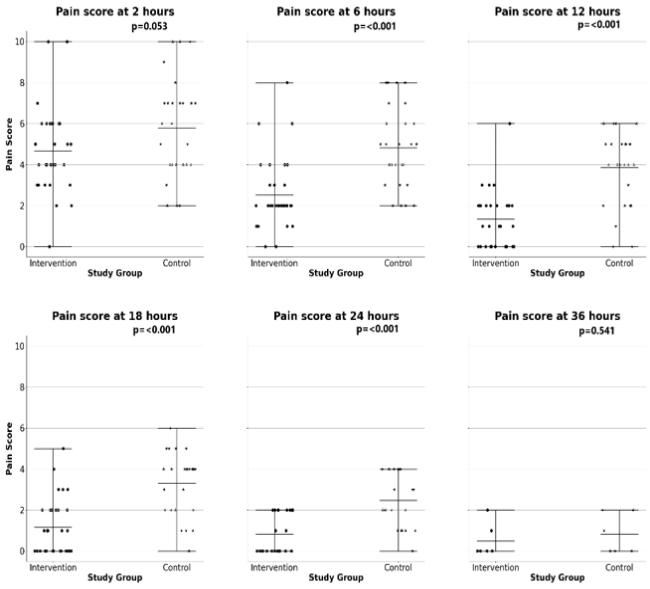

Figure 2: Pain scores at 2, 6, 12, 18, 24, 36 hours

Discussion

In our randomised controlled trial, religious chanting was associated with a significant reduction in pain scores between 6 and 24 hours postoperatively. No difference was observed during the initial 0–6 hours, a likely observation due to the residual effects of anaesthesia and intraoperative analgesics. Similarly, after 24 hours, pain likely subsided naturally, limiting the observable effect of the intervention.

Postoperative pain following laparoscopic cholecystectomy typically peaks within the first 24 hours, making early pain control a crucial component of recovery, especially when it is carried out as a day-case surgery [10]. In addition to standard analgesic protocols, various interventions have been investigated to mitigate this early postoperative pain. These include anterior abdominal wall nerve blocks, corticosteroids, intraperitoneal local anaesthetics, and intravenous magnesium. This adjunct to pharmacological interventions has shown mixed results [11].

Non-pharmacological interventions, such as meditation and music therapy, have also been explored as adjuncts for postoperative pain relief, though results remain inconclusive [12,13]. Some studies suggest that these interventions may contribute more to relaxation and stress reduction rather than directly alleviating pain [14]. However, many of these studies were conducted in the context of complex surgical procedures

Table 2: Mean pain score, requests for additional opioid doses, post-operative nausea and vomiting, and the proportion of patients mobilized at different time points

	Intervention Group (n=29)	Control Group (n=28)	p value
Mean pain score			
- **At 2 hours**	4.66	5.79	0.053
- **At 6 hours**	2.53	4.82	<0.001
- **At 12 hours**	1.34	3.86	<0.001
- **At 18 hours**	1.16	3.32	<0.001
- **At 24 hours**	0.83	2.48	<0.001
- **At 36 hours**	0.50	0.83	0.541
Requests for additional opioid doses			
- **At 2 hours (%)**	5 (17)	10 (36)	0.073
- **At 6 hours (%)**	4 (14)	12 (43)	0.008
- **At 12 hours (%)**	1 (3)	6 (21)	0.028
- **At 18 hours (%)**	1 (3)	0	0.421
- **At 24 hours (%)**	1 (3)	0	0.641
- **At 36 hours (%)**	0	0	-
Post-operative nausea			
- **At 2 hours (%)**	4 (14)	4 (14)	0.633
- **At 6 hours (%)**	4 (14)	4 (14)	0.822
- **At 12 hours (%)**	0	2 (7)	0.124
- **At 18 hours (%)**	1 (3)	0	0.723
- **At 24 hours (%)**	0	0	-
- **At 36 hours (%)**	0	0	-
Post-operative vomiting			
- **At 2 hours (%)**	2 (7)	3 (11)	0.533
- **At 6 hours (%)**	1 (3)	2 (7)	0.469
- **At 12 hours (%)**	1 (3)	1 (4)	0.903
- **At 18 hours (%)**	2 (7)	0	0.357
- **At 24 hours (%)**	0	0	-
- **At 36 hours (%)**	0	0	-
Proportion of patients mobilized from bed			
- **At 2 hours (%)**	2 (7)	0	0.178
- **At 6 hours (%)**	15 (52)	0	<0.001
- **At 12 hours (%)**	27 (93)	12 (43)	<0.001
- **At 18 hours (%)**	29 (100)	23 (82)	0.029
- **At 24 hours (%)**	29 (100)	27 (96)	0.281
- **At 36 hours (%)**	29 (100)	27 (96)	0.346
Median heart rate during GA	77	79	0.467

GA – General anaesthesia

such as oesophagectomy, where the severe and extensive nature of the pain response may limit the perceived benefit of adjunctive therapies. In contrast, laparoscopic cholecystec tomy involves dissection within a limited, well-defined anatomical area in the undersurface of the liver. Therefore, it is reasonable to hypothesise that non-pharmacological adjuncts may have a more measurable impact in this setting. To date, however, the effect of spiritual or religious chanting during laparoscopic cholecystectomy has not been systematically evaluated.

The role of spirituality, repetitive chanting and ritualistic behaviour in pain management remains an underexplored area in medical science. However, its role in human behavioural evolution has been widely discussed in disciplines beyond medicine [15]. Religious chanting, rooted in strong belief systems, may serve as a powerful, repetitive, coalitional stimulus that influences emotional and cognitive processes [16]. A recent study using multimodal electrophysiological and neuroimaging techniques demonstrated that religious chanting significantly reduced neural activity in the posterior cingulate cortex, a region involved in pain perception and self-referential thinking [17]. Additional EEG-based studies have also reported a decreased neuropsychological response to stress during repetitive religious chanting [14].

In a randomised controlled trial conducted by Rahman et al., patients undergoing laparoscopic appendectomy were exposed to either intraoperative music or religious chanting. The study concluded that prayer recitation led to a significantly greater reduction in postoperative pain compared to music [14]. Given that both appendectomy and cholecystectomy involve dissection within a confined anatomical region, religious chanting may offer similar analgesic benefits during the intermediate postoperative period in these types of surgeries.

Consistent with our observations, prior evidence has indicated a positive impact of religious chanting on chronic pain management. However, this study demonstrated the greatest benefit among individuals with higher spiritual or religious tendencies [18]. Although our study protocol included provisions to exclude patients without religious inclination, no such exclusions were necessary. All enrolled participants exhibited a strong spiritual orientation, with a median religiosity score of 8. However, religious inclinations worldwide are dynamic and variable [19]. Therefore, it is important to interpret our findings in light of the religious and cultural context of the study population. Similar outcomes may not be generalisable to populations with different cultural or spiritual backgrounds. Apart from this, our study has a sample of 60 patients, which was the minimum number required to obtain a statistically significant finding given our caseload. This smaller sample size limited us to performing meaningful subgroup analysis on age, gender or baseline anxiety levels, which can have an impact on postoperative pain.

Religious chanting significantly reduced postoperative pain between 6 and 24 hours after laparoscopic cholecystectomy in this Asian cohort. Considering its low cost and simplicity, repetitive religious chanting may serve as an effective adjunct to pharmacological pain management in laparoscopic cholecystectomy. Broader studies are needed to assess its generalizability.

List of abbreviations

VAS - Visual Analogue Scale
PONV - Postoperative nausea and vomiting
NSAIDs - Non-steroidal anti-inflammatory drugs
MAC - Minimum Alveolar Concentration
ECG - Electrocardiography
NIBP - Non-invasive blood pressure monitoring
ANC - Active noise-cancelling
NRS - Numeric Rating Scale
GA - General Anaesthesia
BMI - Body Mass Index
ASA - American Society of Aneasthesiologists

Ethics approval and consent to participate

Ethics approval was obtained from the ethics review committee of the Faculty of Medicine, University of Kelaniya (Reference Number: P/71/06/2024). Informed consent was obtained from all individual participants included in the study

Conflict of interests

The authors declare that they have no conflict of interests

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Consent for publication

Not applicable

Data availability statement

Data will be made available by the authors upon reasonable request

Authors' contributions

RR: Methodology, Investigation, Formal analysis, Writing - original draft, Software, Project administration
MA: Methodology, Data curation, Investigation
ST: Investigation, Methodology, Data curation
LM: Resources, Methodology

PC: Data curation, Investigation, Supervision
SK: Investigation, Data curation, Supervision
BG: Data curation and supervision
MM: Investigation
RCS: Conceptualization, Methodology, Investigation, Supervision, Resources, Writing - review & editing

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