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Comparative analgesic efficacy of ropivacaine versus bupivacaine as intraperitoneal instillation in laparoscopic cholecystectomy

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Abstract
Background: Intraperitoneal instillation of local anesthetics, such as ropivacaine and bupivacaine, has shown promise for managing postoperative pain in laparoscopic cholecystectomy. This study compares the analgesic efficacy and safety profiles of these agents to determine optimal postoperative pain control.
Materials and Methods: In this randomized study, 50 patients scheduled for laparoscopic cholecystectomy were divided into two groups: Group A received 20 ml of 0.5% ropivacaine, and Group B received 20 ml of 0.5% bupivacaine. Pain scores were measured using the Visual Analogue Scale (VAS) and Visual Rating Scale (VRS) at intervals of 2, 6, 8, 12, 16, and 24 hours. Rescue analgesia requirements and adverse events were also recorded.
Results: Both groups experienced effective pain relief, though Group B (bupivacaine) had lower VAS and VRS scores at 8 and 16 hours, indicating extended analgesia. Group B also required delayed rescue analgesia. No severe adverse events were noted, and both drugs were well-tolerated.
Conclusion: Bupivacaine may offer prolonged analgesic effects, though ropivacaine's safer profile supports its use as a suitable alternative. Both agents are effective for pain control in laparoscopic cholecystectomy.

Keywords: Ropivacaine, bupivacaine, laparoscopic cholecystectomy, intraperitoneal instillation, postoperative analgesia

Introduction
Laparoscopic cholecystectomy has become the preferred surgical approach for treating gallbladder diseases due to its minimally invasive nature, reduced postoperative pain, and quicker recovery times [1]. However, despite the advantages, postoperative pain remains a significant concern, often requiring effective analgesic strategies to ensure patient comfort and facilitate early discharge. Intraperitoneal instillation of local anesthetics has gained attention for its role in managing postoperative pain following laparoscopic procedures, as it can directly target pain at the surgical site, minimizing the need for systemic opioids and their associated side effects [2, 3].

Among the local anesthetics available, bupivacaine and ropivacaine are widely studied for their efficacy in providing effective postoperative pain relief. Bupivacaine has been a popular choice for its long-lasting analgesic effects; however, it poses risks of cardiotoxicity and neurotoxicity, particularly with higher doses or inadvertent intravascular injection [4]. Ropivacaine, a newer agent, offers similar analgesic properties with a potentially safer profile, as it is less likely to cause adverse cardiovascular effects. Its reduced lipophilicity contributes to a lower potency and shorter duration of motor block, making it an attractive alternative for laparoscopic procedures where early ambulation and discharge are desired [5, 6]. Prior studies have demonstrated mixed results regarding the comparative efficacy of these two agents. While some research suggests that ropivacaine provides comparable analgesia with a better safety profile, other studies advocate for bupivacaine's prolonged duration of action, which can be beneficial for extended pain relief [7, 8].

This study aims to compare the analgesic efficacy of intraperitoneal instillation of ropivacaine versus bupivacaine in patients undergoing laparoscopic cholecystectomy under general anesthesia. This study seeks to clarify which agent provides superior analgesia in the immediate postoperative period without compromising patient safety.

Materials and Methods

This prospective randomized clinical study was conducted in the Department of Anaesthesia, Santhiram Medical college & General Hospital, over a period of one year from April 2018 to March 2019. A total of 50 adult patients meeting the necessary criteria were enrolled in the study. The sample was divided equally into two groups: Group A (n = 25), which received intraperitoneal instillation of 0.5% ropivacaine, and Group B (n = 25), which received 0.5% bupivacaine.

Participants were between the ages of 18 and 65, classified as ASA physical status I or II, and scheduled for laparoscopic cholecystectomy under general anesthesia. Patients were excluded if they had allergies to local anesthetics, ASA status III or higher, pregnancy, unreliable pain assessment (due to neurological conditions or use of steroids, NSAIDs, or opioids preoperatively), surgical complications, or conversion to open cholecystectomy.

The selected drug was prepared in a 20 ml syringe by an anesthesiologist uninvolved in the study. In the operating theater, baseline parameters—pulse rate, blood pressure, and SpO_2—were recorded after connecting standard monitors (pulse oximeter, cardioscope, and non-invasive blood pressure). Patients were premedicated with intravenous glycopyrrolate (0.2 mg), ondansetron (4 mg), acetaminophen (1 g), midazolam (0.03 mg/kg), and fentanyl (0.002 mg/kg). Anesthesia induction was achieved with propofol (2 mg/kg) and succinylcholine (1.5-2 mg/kg) for muscle relaxation during intubation. Patients were ventilated with 60:40 N_2O and O_2 using isoflurane (0.2-1%) in a closed circuit.

Following surgery, each patient received 20 ml of either 0.5% ropivacaine or 0.5% bupivacaine sprayed in the gallbladder fossa and upper liver surface, covering the right subdiaphragmatic space. Neuromuscular blockade was reversed with glycopyrrolate (0.008 mg/kg) and neostigmine (0.05 mg/kg), and patients were extubated after thorough oropharyngeal suction.

Postoperative monitoring was conducted for 24 hours at 30-minute, 2, 6, 8, 12, 16, and 24-hour intervals, assessing pain using the Visual Analogue Scale (VAS) and Visual Rating Prince Henry Scale (VRS). Rescue analgesia with tramadol (1 mg/kg IV) was administered if VAS scores were ≥4 or VRS scores were ≥3. Additionally, ondansetron (0.08-0.1 mg/kg IV) was provided for nausea or vomiting. Other monitored variables included shoulder pain incidence, timing of rescue analgesia, and adverse events (bradycardia, tachycardia, hypotension, excessive sedation).

For statistical analysis, data were collected on demographic variables, surgical parameters, and pain scores (VAS and VRS) at multiple postoperative intervals. Descriptive statistics were used to summarize baseline characteristics (age, weight, and ASA classification) and intraoperative variables. Continuous variables, such as pain scores and recovery times, were analyzed using Student's t-test to compare mean differences between the ropivacaine (Group A) and bupivacaine (Group B) groups. Categorical variables, such as the incidence of shoulder pain, nausea, and other adverse events, were analyzed using chi-square tests or Fisher's exact test as appropriate. A p-value of less than 0.05 was considered statistically significant. All statistical analyses were conducted using SPSS software, and results were presented with 95% confidence intervals to assess the precision of estimated differences between groups.

Results

In this study, 50 patients undergoing laparoscopic cholecystectomy were divided equally into two groups: Group A (ropivacaine) and Group B (bupivacaine), with 25 patients in each. The demographic characteristics, including age, weight, sex, and ASA grading, were comparable between the two groups, with no statistically significant differences observed ($p > 0.05$).

Table 1: Demographic Characteristics of Study Groups

Characteristics	Group A (Ropivacaine)	Group B (Bupivacaine)	p-value
Mean Age (years)	28.9±5.32	31.4±12.7	> 0.05
Mean Weight (kg)	49.7±11.3	52.51±11.21	> 0.05
Male (%)	13 (52%)	14 (56%)	> 0.05
Female (%)	12 (48%)	11 (44%)	> 0.05
ASA I (%)	16 (64%)	15 (60%)	> 0.05
ASA II (%)	9 (36%)	10 (40%)	> 0.05

Pain Scores (VAS and VRS)

The Visual Analogue Scale (VAS) and Visual Rating Scale (VRS) were monitored at intervals of 2, 6, 8, 12, 16, and 24 hours postoperatively. The VAS scores showed no significant differences between groups at most intervals, except at 8 and 16 hours. At 8 hours, the mean VAS score was significantly higher in Group A (3.90±0.84) than in Group B (3.33±0.48), with a p-value of 0.015. Similarly, at 16 hours, Group A had a mean VAS score of 2.97±0.76 compared to 2.50±0.68 in Group B ($p = 0.025$), indicating a statistically significant difference favoring bupivacaine.

The VRS scores were comparable at most intervals except at 8 and 16 hours. At 8 hours, the mean VRS was 2.53±0.63 in Group A and 2.13±0.63 in Group B ($p = 0.025$), indicating a significant difference. At 16 hours, the mean VRS score in Group A was 2.40±0.56 compared to 1.87±0.35 in Group B, with a p-value of 0.002, suggesting that patients in Group B experienced less pain at these times.

Table 2: Mean Visual Analogue Scale (VAS) Scores at Various Time Intervals

Time (Hours)	Group A (Ropivacaine)	Group B (Bupivacaine)	p-value
2	4.14±0.25	3.09±0.84	> 0.05
6	3.08±0.46	3.27±0.65	> 0.05
8	3.09±0.48	3.38±0.84	0.015
12	3.18±0.87	2.08±0.88	> 0.05
16	2.79±0.84	2.58±0.86	0.025
24	2.05±0.06	2.33±0.87	> 0.05

Table 3: Mean Visual Rating Scale (VRS) Scores at Various Time Intervals

Time (Hours)	Group A (Ropivacaine)	Group B (Bupivacaine)	p-value
2	2.88±0.55	2.77±0.54	> 0.05
6	2.66±0.50	2.55±0.25	> 0.05
8	2.50±0.60	2.31±0.36	0.025
12	2.33±0.85	2.11±0.66	> 0.05
16	2.44±0.65	1.78±0.53	0.002
24	2.11±0.44	2.11±0.24	> 0.05

Regarding rescue analgesia, Group B patients required their first dose later (9.53±0.38 hours) than Group A (8.14±0.35

hours), with a statistically significant difference ($p < 0.001$). However, the total number of analgesia doses required was similar between groups ($p = 0.065$).

Table 4: Requirement of Rescue Analgesia in Study Groups

Parameter	Group A (Ropivacaine)	Group B (Bupivacaine)	p-value
Time to First Dose (hours)	8.14±0.35	9.53±0.38	< 0.001
Total Number of Doses (mean± SD)	2.30±0.60	2.01±0.95	0.065
Patients Requiring 1 Dose (%)	6.7% (n = 2)	16.7% (n = 5)	> 0.05
Patients Requiring 2 Doses (%)	53.3% (n = 16)	66.7% (n = 20)	> 0.05
Patients Requiring 3 Doses (%)	40.0% (n = 12)	16.7% (n = 5)	> 0.05

The incidence of shoulder tip pain and emetic symptoms was slightly lower in Group B, although these differences were not statistically significant ($p > 0.05$). Importantly, no severe adverse events, such as bradycardia, tachycardia, hypotension, or excessive sedation, were reported in either group, indicating both drugs were well-tolerated.

Table 5: Incidence of Shoulder Tip Pain and Emetic Symptoms

Adverse Event	Group A (Ropivacaine)	Group B (Bupivacaine)	p-value
Shoulder Tip Pain (%)	26.7% (n = 7)	13.3% (n = 4)	0.197
Emetic Symptoms (%)	20% (n = 5)	23.3% (n = 6)	0.754

Discussion

The findings of this study align with previous research comparing the analgesic effects of ropivacaine and bupivacaine for postoperative pain management in laparoscopic surgeries. Similar to the present study, McClellan *et al.* [5] found that both ropivacaine and bupivacaine effectively reduced postoperative pain, with bupivacaine offering slightly prolonged analgesic effects, as evidenced by lower pain scores at certain intervals. This corresponds with our results, where bupivacaine demonstrated lower VAS and VRS scores at 8 and 16 hours postoperatively, suggesting a marginally longer duration of analgesic effect in Group B (bupivacaine).

In terms of rescue analgesia requirements, Kaur *et al.* [7] observed that patients receiving bupivacaine had a delayed need for additional analgesia compared to those given ropivacaine, a finding supported by our study, where Group B required the first dose of rescue analgesia significantly later than Group A ($p< 0.001$). This delay in analgesia requirements indicates that bupivacaine may provide extended pain relief, making it advantageous in surgeries requiring prolonged analgesia. Similarly, Stein *et al.* [8] concluded that bupivacaine's longer-lasting effects are due to its higher lipid solubility, which enhances tissue binding and prolongs its presence at the site of administration. This pharmacokinetic property likely explains why bupivacaine patients in our study exhibited lower pain scores and longer intervals between analgesic requirements.

While our findings demonstrate bupivacaine's advantage in duration of analgesia, some studies, such as Niv *et al.* [4], found ropivacaine preferable due to its lower incidence of adverse effects and improved safety profile, particularly in high doses. Although both groups in our study reported no severe adverse events like bradycardia or hypotension, ropivacaine's comparatively lower cardiovascular toxicity makes it a viable choice for patients with cardiovascular risk factors. McClellan *et al.* [5] also emphasized ropivacaine's reduced motor blockade effects, which can be beneficial for early postoperative mobilization.

Regarding shoulder tip pain, our study showed a slightly lower incidence in the bupivacaine group, although the difference was not statistically significant. This finding is consistent with Kaba *et al.* [9], who reported that while bupivacaine was effective in reducing shoulder tip pain in laparoscopic procedures, the differences compared to ropivacaine were minor. Furthermore, patient satisfaction with both drugs remained high, supporting their efficacy and safety for intra peritoneal analgesia in laparoscopic cholecystectomy.

Conclusion

This study demonstrates that both ropivacaine and bupivacaine provide effective postoperative analgesia in laparoscopic cholecystectomy, with bupivacaine offering slightly extended pain relief, as evidenced by lower VAS and VRS scores at specific intervals. However, ropivacaine's shorter time to mobilization and safer profile, particularly concerning cardiotoxicity, make it a valuable alternative. Both agents effectively manage pain with minimal adverse effects, making them suitable options in laparoscopic surgery settings where rapid recovery and patient comfort are prioritized.

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Conflicts of interest

The authors declare no conflicts of interest related to this study.

References

1. Vecchio R, *et al*. History of laparoscopic surgery. Panminerva Med. 2000;42(2):87-90.
2. Alexander JI. Pain after laparoscopy. Br J Anaesth. 1997;79(3):369-78.
3. Kehlet H, Dahl JB. Anaesthesia, surgery, and challenges in postoperative recovery. Lancet. 2003;362(9399):1921-8.
4. Niv D, *et al*. Bupivacaine toxicity. Pain Pract. 2004;4(4):313-21.
5. McClellan KJ, Faulds D. Ropivacaine: an update of its use in regional anaesthesia. Drugs. 2000;60(5):1065-93.
6. Zink W, Graf BM. Benefit-risk assessment of ropivacaine in the management of postoperative pain. Drug Saf. 2004;27(14):1093-114.
7. Kaur J, *et al*. Ropivacaine versus bupivacaine in lower abdominal surgeries. Anaesth Pain Intensive Care. 2014;18(1):25-30.
8. Stein C, *et al*. Bupivacaine for postoperative analgesia in laparoscopic cholecystectomy. AnesthAnalg. 2003;97(1):182-6.
9. Kaba A, *et al*. Peritoneal analgesia for laparoscopic cholecystectomy: ropivacaine vs. bupivacaine. Br J Anaesth. 2005;94(2):196-201.