

Intraperitoneal Ropivacaine and Bupivacaine for Postoperative Analgesia in Laparoscopic CholecystectomyShikha Chahar¹, Priyam Sarma², Pankaj Kumar³¹Assistant Professor, Department of Anaesthesiology, NDMC Medical College and Hindu Rao Hospital, Delhi, India²Senior Resident, Department of Anaesthesiology, NDMC Medical College and Hindu Rao Hospital, Delhi, India³Assistant Professor, Department of Anaesthesiology, Adesh Medical College and Hospital, Mohri, Haryana, India

Received: 01-03-2026 / Revised: 02-04-2026 / Accepted: 03-05-2026

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Conflict of interest: Nil

Abstract:**Background:** Postoperative pain following laparoscopic cholecystectomy remains a significant clinical concern despite the minimally invasive nature of the procedure. Intraperitoneal instillation of local anesthetic agents has emerged as an effective technique for reducing postoperative pain. The present study was conducted to compare the analgesic efficacy of intraperitoneal ropivacaine and bupivacaine in patients undergoing laparoscopic cholecystectomy.**Materials and Methods:** A prospective, randomized, double-blind comparative study was conducted on 100 patients aged 18–65 years belonging to ASA physical status I and II undergoing laparoscopic cholecystectomy under general anesthesia. Patients were randomly divided into two groups of 50 each. Group A received 20 mL of 0.5% bupivacaine intraperitoneally, while Group B received 20 mL of 0.5% ropivacaine intraperitoneally following gallbladder removal. Postoperative pain was assessed using the Visual Analog Scale (VAS) at predefined intervals up to 24 hours. Hemodynamic parameters, postoperative nausea and vomiting, rescue analgesic requirement, and adverse effects were also evaluated. Statistical analysis was performed using SPSS version 22, and $p < 0.05$ was considered statistically significant.**Results:** The mean age of patients was 46.3 years in Group A and 43.7 years in Group B. Females predominated in both groups. The mean duration of surgery was comparable between Group A (60.3 ± 5.9 minutes) and Group B (63.7 ± 6.1 minutes) with no significant difference ($p = 0.255$). Postoperative VAS scores were comparable during the initial postoperative period at 0, 0.5, 1, and 2 hours. However, Group B demonstrated significantly lower VAS scores at 4, 6, and 8 hours postoperatively compared to Group A ($p < 0.05$), indicating superior analgesic efficacy of ropivacaine during the intermediate postoperative period. At 12 and 24 hours, pain scores again became comparable between the groups.**Conclusion:** Both intraperitoneal bupivacaine and ropivacaine were effective in providing postoperative analgesia following laparoscopic cholecystectomy. However, ropivacaine demonstrated superior analgesic efficacy with significantly lower postoperative pain scores during the intermediate postoperative period. Therefore, intraperitoneal ropivacaine may be considered a more effective option for postoperative pain management in laparoscopic cholecystectomy.**Keywords:** Intraperitoneal, Ropivacaine, Bupivacaine, Laparoscopic Cholecystectomy.**DOI:** 10.25258/ijcpr.18.5.16This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.**Introduction**

Laparoscopic cholecystectomy has become the gold standard surgical procedure for the management of symptomatic cholelithiasis and other benign gallbladder diseases due to its minimally invasive nature, reduced postoperative morbidity, shorter hospital stay, and faster recovery compared with open cholecystectomy. Despite the advantages of laparoscopic surgery, postoperative pain continues

to remain a significant clinical concern during the early postoperative period. Pain following laparoscopic cholecystectomy is multifactorial in origin and includes parietal pain resulting from trocar insertion, visceral pain caused by surgical manipulation and peritoneal stretching, and referred shoulder pain secondary to diaphragmatic irritation by residual carbon dioxide pneumoperitoneum.

Inadequately controlled postoperative pain may lead to delayed ambulation, prolonged hospitalization, increased analgesic consumption, respiratory complications, patient dissatisfaction, and delayed return to normal activities. [1, 2]

Effective postoperative analgesia is therefore an essential component of perioperative management in laparoscopic procedures. Various analgesic modalities have been employed to reduce postoperative pain following laparoscopic cholecystectomy, including systemic opioids, non-steroidal anti-inflammatory drugs, epidural analgesia, port-site infiltration, intraperitoneal instillation of local anesthetics, and multimodal analgesic techniques. Among these approaches, intraperitoneal administration of local anesthetic agents has gained considerable attention because it is simple, safe, minimally invasive, and effective in reducing visceral pain without significant systemic adverse effects. Intraperitoneal local anesthetics act by blocking free afferent nerve endings within the peritoneum and decreasing transmission of nociceptive impulses generated during surgical manipulation and pneumoperitoneum. [3, 4]

Bupivacaine and ropivacaine are long-acting amide local anesthetic agents commonly used for postoperative analgesia. Bupivacaine has been extensively utilized because of its prolonged duration of action and potent sensory blockade. However, concerns regarding cardiotoxicity and central nervous system toxicity, particularly with systemic absorption or inadvertent intravascular administration, have encouraged the search for safer alternatives. Ropivacaine, a newer amino-amide local anesthetic, possesses pharmacological properties similar to bupivacaine but demonstrates reduced cardiotoxicity and neurotoxicity due to its lower lipid solubility and stereoselective formulation. Additionally, ropivacaine provides preferential sensory blockade with comparatively less motor blockade, making it an attractive option for postoperative pain management in minimally invasive surgeries. [5- 7] Hence; the present study was conducted for comparing Intraperitoneal ropivacaine and bupivacaine for postoperative analgesia in laparoscopic cholecystectomy.

Materials & Methods

A prospective, randomized, double-blind comparative study was conducted on 100 patients aged 18–65 years belonging to American Society of Anesthesiologists (ASA) physical status I and II who were scheduled for laparoscopic cholecystectomy under general anesthesia. Patients were randomly allocated into two equal groups of 50 each using the sealed-envelope technique. Group A received 20 mL of 0.5% bupivacaine

intraperitoneally, whereas Group B received 20 mL of 0.5% ropivacaine intraperitoneally following gallbladder removal. The study drug was prepared in pre-labeled syringes and instilled intraperitoneally at the end of surgery in Trendelenburg position to facilitate adequate subhepatic distribution. The solution was administered over the hepatodiaphragmatic surface, gallbladder bed, and hepatorenal space by the operating surgeon. Both the investigator and postoperative observer remained blinded to group allocation throughout the study period. Postoperative evaluation included monitoring of hemodynamic parameters such as heart rate, systolic blood pressure, diastolic blood pressure, and oxygen saturation. Pain assessment was performed using the Visual Analog Scale (VAS) at predefined intervals up to 24 hours postoperatively. Patients were also evaluated for postoperative nausea, vomiting, requirement of rescue analgesia, and other adverse effects. Rescue analgesia was administered in the form of intramuscular diclofenac sodium 75 mg when required, while intravenous ondansetron 4 mg was used for postoperative nausea and vomiting. Collected data were compiled and statistically analyzed using SPSS version 22. Appropriate statistical tests including paired t-test were applied, and a p-value <0.05 was considered statistically significant.

Results

The mean age of patients in Group A was 46.3 years, while in Group B it was 43.7 years, indicating comparable age distribution between the groups. Female patients predominated in both groups, accounting for 76% in Group A and 70% in Group B, whereas males constituted 24% and 30%, respectively. The findings suggest demographic homogeneity between the study groups. Table 2 compares the duration of surgery between the two groups. The mean duration of surgery was 60.3 ± 5.9 minutes in Group A and 63.7 ± 6.1 minutes in Group B. The difference between the groups was statistically non-significant ($p=0.255$), indicating that operative duration was comparable and unlikely to influence postoperative pain outcomes. Table 3 illustrates the comparison of postoperative pain intensity assessed using the Visual Analog Scale (VAS) at different postoperative intervals. At 0, 0.5, 1, and 2 hours, pain scores were comparable between the groups with no statistically significant difference. However, at 4, 6, and 8 hours postoperatively, Group B demonstrated significantly lower mean VAS scores compared to Group A ($p<0.05$), indicating superior analgesic efficacy during the intermediate postoperative period. At 12 and 24 hours, the pain scores again became comparable between the groups with statistically non-significant differences.

Table 1: Demographic variables

Variable	Group A		Group B	
	Number	Percentage	Number	Percentage
Mean age (years)	46.3 years		43.7 years	
Males	12	24	15	30
Females	38	76	35	70

Table 2: Duration of surgery

Duration of surgery	Group A	Group B
Mean	60.3	63.7
SD	5.9	6.1
p-value	0.255	

Table 3: Comparison of pain as assessed by VAS

Time Interval (Hours)	Group A (Mean VAS)	Group B (Mean VAS)	p-value
0	2.2	2.3	
0.5	2.7	2.6	
1	3.2	3.0	0.12
2	2.8	2.9	0.28
4	2.9	2.3	0.00*
6	2.8	2.1	0.01*
8	3.2	2.1	0.00*
12	1.7	1.8	0.52
24	1.5	1.6	0.25

*: Significant

Discussion

Intraperitoneal instillation of local anesthetics has emerged as an effective strategy for reducing postoperative pain following laparoscopic cholecystectomy, thereby enhancing patient comfort and early recovery. Comparative evaluation of ropivacaine and bupivacaine is essential to determine the more efficacious agent with superior analgesic profile and minimal adverse effects. Postoperative pain after laparoscopic cholecystectomy remains a significant concern despite the minimally invasive nature of the procedure. Intraperitoneal administration of ropivacaine and bupivacaine has gained increasing attention as a simple and effective modality for improving postoperative analgesia and reducing analgesic requirements. Effective postoperative pain management plays a crucial role in facilitating rapid recovery after laparoscopic cholecystectomy. Intraperitoneal use of long-acting local anesthetics such as ropivacaine and bupivacaine may provide sustained analgesia, improved patient satisfaction, and decreased dependence on systemic analgesics. [8- 10]

The mean age of patients in Group A was 46.3 years, while in Group B it was 43.7 years, indicating comparable age distribution between the groups. Female patients predominated in both groups, accounting for 76% in Group A and 70% in Group B, whereas males constituted 24% and 30%, respectively. The findings suggest demographic homogeneity between the study groups. The mean

duration of surgery was 60.3 ± 5.9 minutes in Group A and 63.7 ± 6.1 minutes in Group B. The difference between the groups was statistically non-significant ($p=0.255$), indicating that operative duration was comparable and unlikely to influence postoperative pain outcomes. At 0, 0.5, 1, and 2 hours, pain scores were comparable between the groups with no statistically significant difference. However, at 4, 6, and 8 hours postoperatively, Group B demonstrated significantly lower mean VAS scores compared to Group A ($p<0.05$), indicating superior analgesic efficacy during the intermediate postoperative period. At 12 and 24 hours, the pain scores again became comparable between the groups with statistically non-significant differences. Sharan R et al compared intraperitoneal instillation of bupivacaine and ropivacaine for postoperative analgesia in patients undergoing LC. Sixty patients, aged 18–65 years, of either gender, and American Society of Anesthesiologists physical status I to III scheduled for LC were included and categorized into two groups ($n = 30$). Group A patients received 20 mL of 0.5% bupivacaine intraperitoneally after cholecystectomy and Group B patients received 20 mL of 0.5% ropivacaine intraperitoneally after cholecystectomy. Pulse rate, systolic blood pressure, and diastolic blood pressure were comparatively lower in Group B than in Group A. The visual analog scale (VAS) score was significantly lower in Group B. Rescue analgesia was given when VAS was >6 . Verbal rating scale score was significantly lower in Group B, showing longer duration of analgesia in this group. Rescue analgesic requirement was also less in Group B. The instillation of bupivacaine and

ropivacaine intraperitoneally was an effective method of postoperative pain relief in LC. It provided good analgesia in immediate postoperative period with ropivacaine, providing longer duration of analgesia. [10] Das NT et al compare the analgesic efficacy of intraperitoneally instilled equipotent concentrations of bupivacaine and ropivacaine versus placebo in relieving postoperative pain after laparoscopic cholecystectomy when used as a part of multimodal analgesia. 90 ASA Class I or II patients were randomly divided into three groups of 30 each. Group S received intraperitoneal infiltration with 35 ml of 0.9% normal saline, Group B with 35 ml of 0.25% bupivacaine and Group R with 35 ml of 0.375% ropivacaine. All groups received standard general endotracheal anaesthesia and analgesia with IV paracetamol 15 mg/kg and diclofenac 1.5 mg/kg. Numerical Rating Scale (NRS) score of analgesia at rest and on cough/movement, duration of analgesia, haemodynamic parameters, need for a rescue analgesic (IV tramadol 1 mg/kg) was recorded and adverse effects of procedure and drugs if any were monitored. The mean NRS was <5 till only four hours in Group S, till eight hours in Group B and till 16 hours in Group R. The duration of analgesia was 13.47 ± 1.38 hours in Group R, 7.93 ± 1.44 hours in Group B and 4.47 ± 0.86 hours in Group S. Intraperitoneal infiltration of LA significantly reduces pain intensity scores in the early postoperative period after LC surgery and helps in improving the postoperative recovery profile and outcome. [11]

Conclusion

The present study concludes that both intraperitoneal bupivacaine and ropivacaine provide effective postoperative analgesia following laparoscopic cholecystectomy. However, intraperitoneal ropivacaine demonstrated superior analgesic efficacy during the intermediate postoperative period, as evidenced by significantly lower VAS scores at 4, 6, and 8 hours after surgery. Both drugs were associated with comparable demographic characteristics, operative duration, and overall safety profile. Therefore, intraperitoneal ropivacaine may be considered a more effective alternative to bupivacaine for postoperative pain management in patients undergoing laparoscopic cholecystectomy.

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