

A Comparative Study After Infiltration of Ropivacaine at Port Site Versus Systemic Analgesia in Reduction of Post-Operative Pain After Laparoscopic Cholecystectomy

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Abstract

Background: Postoperative pain control after laparoscopic cholecystectomy is essential for recovery. This study evaluates ropivacaine port site infiltration as an alternative to systemic analgesia by assessing pain relief, analgesic requirement, side effects, and early mobilization outcomes. The aim is to compare the effectiveness of port site infiltration of ropivacaine versus systemic analgesia in reducing postoperative pain following laparoscopic cholecystectomy. The study also assesses the requirement for systemic analgesics, early ambulation, and postoperative recovery parameters. **Material and Methods:** This hospital-based comparative study was conducted at Nil Ratan Sircar Medical College & Hospital, Kolkata, over an 18-month period. A total of 80 patients undergoing laparoscopic cholecystectomy were included and divided into two groups: one receiving ropivacaine infiltration at the port site and the other managed with systemic analgesia. Pain scores, systemic analgesic consumption, early ambulation, and associated postoperative complications were recorded and analyzed using statistical methods in SPSS software. **Results:** The study showed that ropivacaine port site infiltration significantly reduced postoperative pain, decreased systemic analgesic requirements, promoted early ambulation, and reduced nausea and vomiting. It suggests that local infiltration is an effective and safer analgesic approach after laparoscopic cholecystectomy. **Conclusion:** Laparoscopic cholecystectomy is a widely performed surgery evolving with technological advances. Port site infiltration with ropivacaine provides effective postoperative analgesia, reduces systemic analgesic requirement, promotes early mobilization, and improves recovery outcomes. However, larger studies are needed for validation.

Keywords: Laparoscopic Cholecystectomy, Ropivacaine, Postoperative Pain, Port Site Infiltration, Systemic Analgesia, Early Ambulation.

Received: 25 July 2026

Revised: 10 August 2026

Accepted: 25 August 2026

Published: 03 October 2026

INTRODUCTION

Gall stones are most common biliary pathology. It affects around 10-15% of the total population.¹ Gall stones are asymptomatic in majority of cases (>80%).^[1] Approximately 12%/Year will develop symptoms requiring surgery, mainly cholecystectomy one of the most common operations performed. Laparoscopic cholecystectomy is a minimally invasive procedure used for removal of a diseased gall bladder. Since 1990, this procedure has largely replaced the open techniques for cholecystectomies. Laparoscopic cholecystectomy is currently indicated for the treatment of acute or chronic cholecystitis, acalculous cholecystitis, symptomatic cholelithiasis, gall stone pancreatitis, biliary dyskinesia & gall bladder masses or polyps. Since 1987, the standard procedure for the treatment of gall bladder stones is laparoscopic cholecystectomy (LC). The major benefit of using laparoscopy for upper gastrointestinal (GI) surgery is that it avoids an upper abdominal incision. Such upper abdominal incisions otherwise can hinder postoperative pulmonary rehabilitation, cause surgical wound pain, and increase the total medical cost. Pain after LC is less intense and lasts a shorter time as compared to pain after open cholecystectomy.^[2] Pain intensity usually peaks during the

first postoperative period and usually declines over the following two to three days. The postoperative pain seen after laparoscopic procedures has two components: visceral and somatic. The visceral component is due to the handling of tissues during the surgery, which causes tissue injury and the stretching of nerve endings. The somatic component of pain is due to the incision made in the abdomen for the entry of the trocar. Postoperative pain management is a major challenge after laparoscopic surgeries. Various methods have been introduced to control postoperative pain after LC such as the use of local anesthetics (LAs),^[3] intraperitoneal infiltration of LA, preoperative administration of non-steroidal antiinflammatory drugs (NSAIDs), combined use of NSAIDs and opioids, etc. The

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DOI:
10.21276/amit.2026.v13.i3.1093

How to cite this article: Maity B, Maiti S, Roy P, Goswami A. A Comparative Study After Infiltration of Ropivacaine at Port Site Versus Systemic Analgesia in Reduction of Post-Operative Pain After Laparoscopic Cholecystectomy. Acta Med Int. 2026;13(3):479-482.

intraperitoneal instillation of LAs has been proposed to minimize postoperative pain after laparoscopic surgery. The variable analgesic effects of periportal infiltration of local anaesthetics, intraperitoneal spraying above the gall bladder, and instillation into the subdiaphragmatic space and into the subhepatic space covering the area of the hepatoduodenal ligament have been reported.^[4] Despite some studies, the role of local anaesthetic agents during laparoscopic cholecystectomy is still not established. It is an exciting proposition that just the addition of a small maneuver during an already established operative procedure can decrease postoperative pain and morbidity.^[5] If its efficacy and safety can be proven it can become routine practice. Pain management is integral part of post operative care. Pain can be managed by local or systemic drugs. Local drug usage reduces the use of systemic analgesics thus reduces their side effects & improves patient outcome.^[6] Local anesthesia for post-surgical site infiltration is a technique used to manage pain following surgery. After the procedure, a local anesthetic is injected directly into the tissues surrounding the surgical site, providing targeted pain relief.^[7] This method works by temporarily blocking the nerves in the area, preventing them from sending pain signals to the brain.^[8] It is commonly employed after various types of surgeries, such as orthopedic, dental, and abdominal procedures. One of the main advantages of post-site infiltration is its ability to provide effective, localized pain management without affecting the entire body, as seen with systemic pain medications.^[9] This reduces the risk of side effects like nausea or drowsiness. In addition, it can be used in combination with other pain relief methods, such as oral medications or nerve blocks, to ensure comprehensive pain control. Overall, post-site infiltration enhances patient comfort, promotes faster recovery, and minimizes reliance on opioids. The duration of pain relief varies depending on the anesthetic agent used. Short-acting anesthetics like lidocaine can provide relief for 2–4 hours, while longer-acting agents like bupivacaine can last 6–12 hours, depending on the dose and site of administration. This duration is typically sufficient to help the patient through the initial post-surgical pain phase, which can be intense but short-lived. Additionally, post-surgical site infiltration reduces the need for opioids, which have a higher potential for side effects and dependency. By minimizing opioid use, it not only reduces the risk of opioid-related complications but also helps in promoting a quicker recovery. In conclusion, local anesthesia for post-surgical site infiltration is a valuable technique in modern pain management. It offers effective, targeted pain relief with fewer systemic side effects, reduces the need for opioids, and can significantly enhance the patient's recovery experience by making the postoperative period more comfortable and manageable.^[10]

RESULTS

Table 1: Comparison According to Gender)

		Frequency	Percent
Gender	Female	66	82.5
	Male	14	17.5
	Total	80	100

MATERIALS AND METHODS

Study design: This is a population-based descriptive comparative interventional study.

Place of study: The study used data from Department of General Surgery, NRSMCH, located in Sealdah, Kolkata.

Duration of study: 18-month period.

Study Population: The present study was conducted among patients aged 12–80 years admitted to the Department of General Surgery, NRSMCH, over a period of 18 months. Patients presenting with symptomatic gallstone disease through the General Surgery OPD and Emergency Department constituted the study population.

Sample size: 80 Patients

Inclusion Criteria:

1. Adult patients aged 18–65 years undergoing elective laparoscopic cholecystectomy for symptomatic cholelithiasis or chronic calculous cholecystitis.
2. Patients classified as ASA physical status I or II who were willing to participate in the study and provided written informed consent.

Exclusion criteria:

The analysis was restricted to

1. any adverse reaction due to ropivacaine.
2. Patient not giving consent.
3. Patient was on any previous analgesic.
4. Any chronic health problem leading to decreased pain perception.

The patients were divided into 2 groups: (a) One group of patients will undergo infiltration of ropivacaine (20ml of 0.5%, 5ml at each port) at port site post operatively and (b) other group systemic analgesic is given (1000mg paracetamol infusion, 8hourly).

Study Variable:

1. Ropivacaine infiltration vs systemic analgesia
2. Postoperative pain score (VAS)
3. Rescue analgesic requirement
4. Early ambulation and recovery
5. Postoperative complications & hospital stay

Statistical Analysis: For statistical analysis, data were initially entered into a Microsoft Excel spreadsheet and then analysed using SPSS (version 27.0; SPSS Inc., Chicago, IL, USA) and GraphPad Prism (version 5). Numerical variables were summarized using means and standard deviations, while Data were entered into Excel and analyzed using SPSS and GraphPad Prism. Numerical variables were summarized using means and standard deviations, while categorical variables were described with counts and percentages. Two-sample t-tests were used to compare independent groups, while paired t-tests accounted for correlations in paired data. Chi-square tests (including Fisher's exact test for small sample sizes) were used for categorical data comparisons. P-values ≤ 0.05 were considered statistically significant.

Table 2: Clinical History and Previous Medical Details of Study Participants (N=80)

Variables	Category	Frequency (n)	Percent (%)
History of Acute Attack	No	53	66.3
	Yes	27	33.8
Any Previous History of Co-morbidities	No	54	67.5
	Asthma	3	3.8
	Type 2 DM	11	13.8
	HTN	12	15.0
Any Previous History of ERCP	No	65	81.3
	Yes	15	18.8
Total		80	100.0

Table 3: Group Statistics

	Analgesia Group	N	Mean (in hours)	Std. Deviation
1st ANALGESIA REQUIREMENT (In hours)	1 (Ropi)	40	7.9	1.0573
	2 (PCM)	40	0.575	0.3111

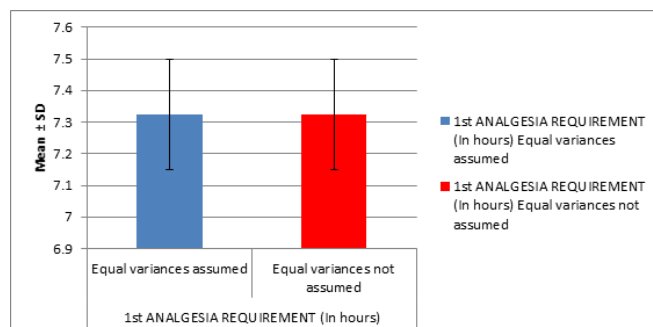


Figure 1: Determination of p value

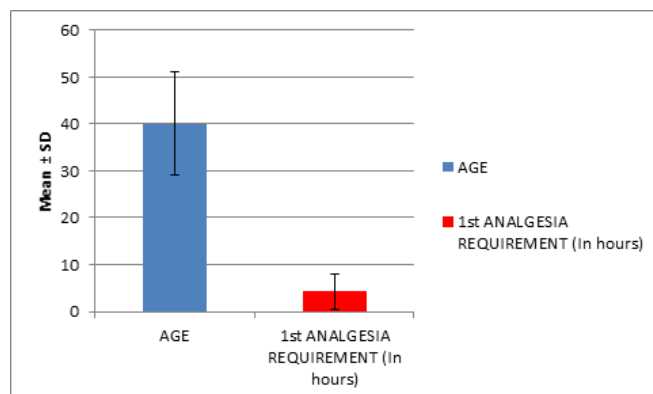


Figure 2: Descriptive Statistics

The gender distribution between the study subjects. Total 80 population were studied, of which 66 subjects (82%) were female and 14 were (18%) male. There is no significant difference between the two groups ($p = 0.612$).

The study included a total of 80 participants. Regarding the history of acute attack, 53 (66.3%) patients had no previous history of acute attack, while 27 (33.8%) patients reported a history of acute attack. Assessment of previous co-morbidities showed that the majority of patients had no associated co-morbid condition (54, 67.5%). Among those with co-morbidities, hypertension was present in 12 (15.0%) patients, Type 2 diabetes mellitus in 11 (13.8%) patients, and asthma in 3 (3.8%) patients. Regarding previous history of ERCP, 65 (81.3%) patients had no history of ERCP, whereas 15 (18.8%) patients had undergone ERCP previously.

The comparison of 1st analgesia requirement (in hours)

between the two analgesia groups showed that patients in Group 1 (Ropi) had a mean analgesia requirement of 7.9 ± 1.0573 hours, whereas patients in Group 2 (PCM) had a mean analgesia requirement of 0.575 ± 0.3111 hours.

By statistical calculation, we can find that degree of freedom is 23.079, p value is 0.0001 which is statistically significant. Mean difference is 7.325, the lower limit of 95% confidence interval of the difference is 6.9781 & upper limit is 7.671.

The descriptive analysis of the study population showed that the mean age of the 80 participants was 40.1 ± 11 years, with ages ranging from 17 to 68 years. The mean requirement of 1st analgesia was 4.237 ± 3.7 hours, with a minimum requirement of 0 hours and a maximum requirement of 10 hours.

DISCUSSION

Peters JH, et al,^[11] reported that laparoscopic cholecystectomy is a safe and effective surgical procedure with reduced postoperative morbidity and faster recovery. In the present study, 80 participants were evaluated, with a predominance of female patients (82%) compared to male patients (18%). The mean age of the study population was 40.1 ± 11 years, ranging from 17 to 68 years, showing that the procedure was commonly performed among middle-aged patients.

Al-Taher S, et al,^[12] demonstrated that ropivacaine infiltration at port sites significantly decreases postoperative pain and prolongs analgesic duration after laparoscopic cholecystectomy. Similarly, in the present study, the Ropi group showed a higher mean time for first analgesia requirement (7.9 ± 1.0573 hours) compared to the PCM group (0.575 ± 0.3111 hours), with a statistically significant difference ($p=0.0001$).

Shankar V, et al,^[13] emphasized the importance of multimodal analgesia in postoperative pain management following laparoscopic cholecystectomy. Their findings support the use of effective analgesic strategies to reduce pain intensity and improve patient recovery, which correlates with the improved analgesic duration observed in the present study.

Ahmed S, et al,^[14] reported that local anesthetic techniques provide superior postoperative pain control compared with systemic analgesia after laparoscopic procedures. The significant delay in requirement of rescue analgesia in the Ropi group in the present study supports the effectiveness of local anesthetic infiltration.

Antoni B, et al,^[15] described the historical development of

cholecystectomy and highlighted the evolution of surgical techniques that improved patient outcomes. The transition from open to laparoscopic approaches has contributed to reduced postoperative complications and enhanced recovery. Spaner SJ, et al,^[16] reviewed the development of endoscopy, laparoscopy, and laparoscopic surgery and described how minimally invasive techniques have revolutionized modern surgical practice by reducing postoperative pain, hospital stay, and recovery time.

CONCLUSION

Laparoscopic cholecystectomy is one of the most commonly performed surgical procedures worldwide and continues to evolve with technological advancements aimed at improving safety, affordability, and cosmetic outcomes. Initially performed mainly for chronic cholecystitis, it is now widely accepted for both acute and chronic cholecystitis, although surgery in acute cases may be challenging due to inflammation, adhesions, and difficult dissection. The present study demonstrated that port-site infiltration with ropivacaine as a local anesthetic effectively reduced postoperative pain, decreased the requirement for systemic analgesics, and promoted early mobilization after surgery. The analgesic benefits were observed irrespective of age, sex, previous history of acute attack, ERCP, or associated comorbidities, contributing to improved postoperative recovery and better surgical outcomes. The reduction in systemic analgesic consumption also suggests that ropivacaine infiltration can be a valuable component of multimodal pain management following laparoscopic cholecystectomy. However, the study had certain limitations, including a shorter study duration and a relatively small sample size, which may restrict the applicability of the findings on a larger population. Additionally, challenges were faced while explaining the procedure and obtaining informed consent from some patient attendants due to limited medical awareness. Overall, port-site infiltration with ropivacaine can be considered a safe and effective method for postoperative analgesia in laparoscopic cholecystectomy, providing prolonged pain relief and facilitating enhanced recovery.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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