

Original Article

Comparative Study: Preemptive vs. Postoperative Intraperitoneal Local Anesthetic in Managing Postoperative Pain After Elective Laparoscopic Cholecystectomy in Adults

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ABSTRACT:

Background: Laparoscopic removal has become the preferred surgical approach for cholecystectomy. This study was undertaken to assess the effectiveness of preemptive versus post-surgery intraperitoneal local anesthetic (IPLA) in managing postoperative pain following elective laparoscopic cholecystectomy in adult patients. **Methods:** In the current study, a total of 252 patients, all of whom were slated for laparoscopic cholecystectomy, were included. The primary objective of the study was to assess postoperative pain intensity using the Visual Analogue Scale (VAS) score at various time points: 30 minutes, 1, 2, 4, 6, and 24 hours following the surgery. Secondary objectives included examining the rate of analgesic requests within the 24-hour postoperative period, evaluating the length of hospital stay, and determining the time it took for patients to return to their normal daily activities. **Results:** The patients in this study were divided into three groups. Group I (Control) received 30 ml of normal saline both at the beginning and the end of the surgery. Group II (preemptive) received 30 ml of 0.5% bupivacaine at the start of the surgery and 30 ml of saline at the conclusion of the surgery. Group III (post-surgery) received 30 ml of saline initially and 30 ml of 0.5% bupivacaine at the end of the surgery. The Visual Analogue Scale (VAS) scores were used to evaluate pain levels at different time intervals. After 6 hours, the VAS score was 3.2 in group I, 2.6 in group II, and 2.8 in group III. After 24 hours, the VAS score was 4.5 in group I, 3.5 in group II, and 3.9 in group III. The observed differences were found to be statistically significant ($P < 0.05$). **Conclusion:** The authors of the study discovered that the use of pre-emptive intraperitoneal local anesthetic instillation led to reduced pain intensity and diminished shoulder pain in patients who underwent laparoscopic cholecystectomy (LC).

Keywords: Local anaesthetic, Intraperitoneal, laparoscopic cholecystectomy

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INTRODUCTION

Cholecystectomy, the surgical removal of the gallbladder, has become the most common intraabdominal surgical procedure in contemporary medical practice. Laparoscopic cholecystectomy (LC) has emerged as the preferred method when gallbladder removal is necessary^{1,2}. Nevertheless, there are ongoing investigations into newer, less invasive techniques, such as natural orifice transluminal endoscopic surgery (NOTES) and single incision laparoscopic cholecystectomy (SILC), as potential alternatives to the traditional 4-port laparoscopic approach. However, there is a notable lack of comprehensive safety data and conclusive evidence regarding the advantages of these minimally invasive procedures.

Approximately two decades ago, LC quickly supplanted open cholecystectomy (OC) as the preferred surgical technique for gallbladder removal.

Given the substantial disparities in terms of pain, hospital stay duration, and postoperative recovery between the two procedures, only a limited number of randomized trials have been conducted to compare LC to OC.³

Certain investigators believed that it would be morally inappropriate to randomly assign patients to undergo open cholecystectomy (OC) in clinical trials, given the evident advantages of laparoscopic cholecystectomy (LC) as seen in practice⁴.

The source of pain after laparoscopic cholecystectomy is complex, stemming from multiple factors, including pain originating from incision sites (somatic pain), pain arising from the gallbladder bed (visceral pain), and referred pain to the shoulder. Peritoneal distension and visceral irritation caused by the creation of capnoperitoneum (carbon dioxide insufflation) and surgical manipulation are the most plausible explanations for visceral and shoulder pain in this

context⁵.The intraperitoneal administration of local anesthetic agents, either on its own or in conjunction with opioids, has proven to be an effective method for significantly reducing postoperative pain and the need for pain-relief medications after laparoscopic cholecystectomy. Recent advancements in this field suggest that initiating an afferent block before the introduction of nociceptive input can help in preventing or minimizing the development of central neural hypersensitivity. This, in turn, can lead to a substantial reduction in both the intensity and duration of pain, as well as a delay in its onset.

The primary goal of the current study was to compare the effectiveness of preemptive intraperitoneal local anesthetic instillation (IPLA) with post-surgery IPLA in managing postoperative pain among adult patients undergoing elective laparoscopic cholecystectomy⁶.

MATERIALS AND METHODS

The present study was carried out in the departments of General Surgery and Anesthesiology and involved a total of 252 patients with physical statuses ranging from I to III, encompassing both genders. Patient information, including details such as name, age, and

gender, was duly recorded. The patients were categorized into three groups for the study.

- Group I (Control): Patients in this group received 30 ml of normal saline at the start of the surgery and at its conclusion.
- Group II (Preemptive): Patients in this group were administered 30 ml of 0.5% bupivacaine at the beginning of the surgery and 30 ml of saline at the end of the procedure.
- Group III (Post-surgery): Patients in this group were given 30 ml of saline at the commencement of the surgery and 30 ml of 0.5% bupivacaine at the end of the surgery.

The primary outcome of the study was to evaluate the postoperative pain intensity using the Visual Analogue Scale (VAS) score at various time intervals: 30 minutes, 1 hour, 2 hours, 4 hours, 6 hours, and 24 hours after the surgery⁷. Secondary outcomes included assessing the rate of analgesic requests within the 24-hour postoperative period, determining the duration of hospital stay, and establishing the time it took for patients to return to their normal daily activities.

The collected results were then subjected to statistical analysis, where a p-value less than 0.05 was considered statistically significant.

RESULTS

Table I: Distribution of patients

Groups	Group I(Control)	Group II(Pre-emptive)	Group III (Post surgical)
Agent	30ml saline	30 ml 0.5% bupivacaine, 30 ml of saline	30 ml of saline, 30 ml of 0.5% bupivacaine
Number	84	84	84

Table I illustrates the treatment regimens for each group in the study:

- Group I (Control): These patients received 30 ml of normal saline both at the start and the end of the surgical procedure. This group comprised 84 patients.
- Group II (Preemptive): Patients in this group were administered 30 ml of 0.5% bupivacaine at

the commencement of the surgery and 30 ml of saline at the conclusion of the surgery. This group also consisted of 84 patients.

- Group III (Post-surgery): Patients in this group received 30 ml of saline at the beginning of the surgery and 30 ml of 0.5% bupivacaine at the end of the surgery. Similar to the other groups, this group included 84 patients.

Table 2: Assessment of primary outcome

Parameters	Groups	GroupI	GroupII	GroupIII
VASat30 th min	0	0	0	0
2 hours	0	0	0	0
6 hours	3.2	2.6	2.8	0.04
24hours	4.5	3.5	3.9	0.01

Fig 1: Assessment of primary outcome

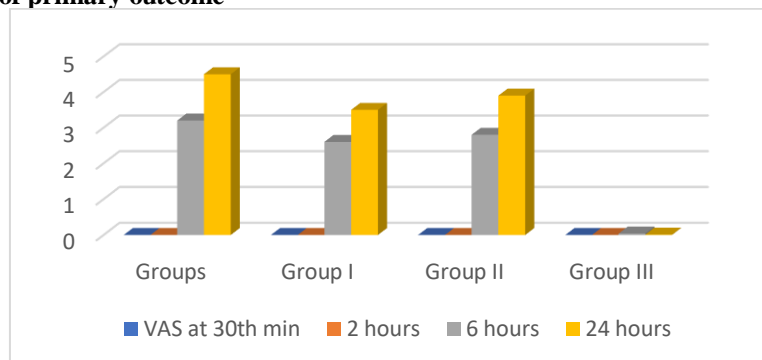


Table II provide a clear depiction of the Visual Analogue Scale (VAS) scores at two key time points for the three groups in the study. After 6 hours, Group II, which received preemptive intraperitoneal local anesthetic (IPLA), had the lowest VAS score at 2.6, indicating less postoperative pain. In comparison, Group I (control) recorded a VAS score of 3.2, and Group III (post-surgery IPLA) had a VAS score of 2.8. Similarly, after 24 hours, Group II maintained the lowest VAS score at 3.5, Group III had a VAS score of 3.9, and Group I reported the highest score at 4.5. These findings revealed a statistically significant difference ($P < 0.05$) between the groups, underscoring the effectiveness of preemptive intraperitoneal local anesthesia in managing postoperative pain following laparoscopic cholecystectomy, compared to both the control group and the post-surgery IPLA group.

DISCUSSION

In the realm of gallbladder removal, novel techniques are continually emerging, including natural orifice transluminal endoscopic surgery (NOTES) and single incision laparoscopic cholecystectomy (SILC). These methods serve as alternatives to the conventional 4-port laparoscopic cholecystectomy (LC)⁸. While neither NOTES nor SILC has yet gained widespread adoption, there is a growing interest in SILC, even though there is currently limited data demonstrating a distinct advantage over the traditional laparoscopic approach. Additionally, it remains unclear how the increased use of SILC might impact the traditionally low complication rate associated with LC, particularly in terms of bile duct injury.

One significant distinction between the 4-port laparoscopic cholecystectomy and its less invasive counterparts, NOTES and SILC, lies in the approach to accessing the peritoneal cavity⁹. In the traditional 4-port technique, access to the peritoneal cavity can be achieved using either a closed or open method. One of the noteworthy complications associated with the initial trocar insertion during laparoscopic procedures is the risk of vascular and intestinal injury, although the reported rate of such injuries in extensive series ranges from 0% to 0.20%. To address this, the present study aimed to compare the efficacy of pre-emptive versus post-surgery intraperitoneal local anesthetic (IPLA) administration in controlling postoperative pain among adult patients undergoing elective laparoscopic cholecystectomy. In this study, patients in Group I (control) were provided with 30 ml of normal saline at the beginning and end of the surgery. Group II (preemptive) patients received 30 ml of 0.5% bupivacaine at the start of the surgery and 30 ml of saline at its conclusion, while Group III (post-surgery) patients were administered 30 ml of saline initially and 30 ml of 0.5% bupivacaine at the end of the surgery. Each of the three groups consisted of 84 patients.

Palmes et al¹⁰. conducted a study involving 50 patients classified as belonging to the American Society of Anesthesiologists physical status I or II. These patients were randomly assigned to receive intraperitoneal local anesthetic instillation (IPLAI) with either 30 ml of normal saline (group C) or 30 ml of 0.5% bupivacaine, either at the beginning of the surgery (group PE) or at the end of the surgery (group PS). This allocation was done using a double-dummy technique to maintain blinding.

The primary outcome of the study was to assess pain levels at various time points, specifically at 30 minutes, 1 hour, 2 hours, 4 hours, 6 hours, and 24 hours after the surgery. The time taken for the first request for analgesia was also recorded. Secondary outcomes included evaluating the rate of analgesic requests within the first 24 hours, the duration of hospital stay, and the time it took for patients to return to their normal activities.

The study findings indicated that for all predefined time points, the Visual Analogue Scale (VAS) scores in group PE (preemptive group) were significantly lower than those in group C (control), with a statistically significant difference ($P < 0.05$). The time to the first request for analgesia was shortest in group C (238.0 ± 103.2 minutes) compared to the intervention groups (PE, 408.2 ± 115.5 minutes; PS, 327.5 ± 97.5 minutes), with a significant difference ($P < 0.001$). However, the time required to meet the criteria for discharge from the hospital did not exhibit a statistically significant difference among the groups. In our study, the need for rescue anesthesia was observed in 15 patients in group I, 3 in group II, and 8 in group III. Shoulder pain was reported in 42 patients in group I, 8 in group II, and 14 in group III. The time required for patients to return to their normal activities was 1024 minutes in group I, 1126 in group II, and 1168 in group III. In terms of paracetamol doses, group I required 3.1 doses, while group II needed 2.4 doses, and group III required 2.7 doses. These differences were statistically significant ($P < 0.05$).

In a review by Karaaslan et al., 1000 consecutive patients who underwent cholecystectomies were analyzed. The laparoscopic approach was attempted in nearly all cases, with a success rate of 94.1%. The conversion rate to open surgery was higher for patients with acute cholecystitis compared to other forms of biliary tract disease. Successful cholangiography was achieved in over 97% of the patients. The review identified nineteen complications directly related to the surgical procedure, including one case of bile duct injury.

CONCLUSION

The authors of the study concluded that the use of pre-emptive intraperitoneal local anesthetic instillation resulted in reduced pain intensity and decreased shoulder pain in patients who underwent laparoscopic cholecystectomy (LC).

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