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Postoperative Analgesic Efficacy of Ultrasound-Guided Bilateral External Oblique Intercostal Plane Block in Laparoscopic Cholecystectomy: A Prospective Study

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Abstract

Background: Laparoscopic cholecystectomy (LC) is commonly performed for gallbladder diseases but is often associated with significant postoperative pain. Conventional analgesic techniques, including opioids and NSAIDs, have limitations and potential side effects.

Objectives: This study aimed to evaluate the postoperative analgesic efficacy of ultrasound-guided bilateral External Oblique Intercostal Plane Block (EOIPB) in LC patients, focusing on pain relief, opioid consumption, and recovery quality.

Methods: A prospective observational study was conducted on 70 adult patients undergoing elective LC. Participants were divided into two groups: Control (general anaesthesia only) and EOIPB group (general anaesthesia with bilateral EOIPB). Pain scores, fentanyl consumption, and Quality of Recovery (QoR-15) were assessed postoperatively.

Results: The EOIPB group showed significantly lower pain scores at rest and during movement ($p<0.001$) and reduced fentanyl requirements. QoR-15 scores were higher in the EOIPB group, indicating better recovery.

Conclusion: EOIPB provides effective, safe, and opioid-sparing analgesia in LC patients.

Keywords: Laparoscopic Cholecystectomy; EOIPB; Ultrasound-guided Block; Postoperative Pain; Analgesia

Introduction

Laparoscopic cholecystectomy (LC) is now the preferred surgical approach for gallbladder diseases due to reduced postoperative complications and shorter hospital stays. However, significant postoperative pain remains a concern, with 17% to 41% of patients reporting inadequate pain relief, which delays recovery and increases opioid use [1,2]. Postoperative pain in LC primarily arises from incision sites, pneumoperitoneum, and visceral handling, with incisional pain contributing up to 70% [3]. Conventional analgesia, including opioids and NSAIDs, is often insufficient and associated with side effects like nausea, vomiting, sedation, and respiratory depression [4]. Ultrasound-guided fascial plane blocks have gained popularity as a safe, effective component of multimodal analgesia [5]. The External Oblique Intercostal Plane Block (EOIPB) is a novel technique targeting the lateral cutaneous branches of the thoracoabdominal nerves (T6-T10), providing effective somatic analgesia for the upper abdominal wall [2,6]. Its supine application, minimal motor blockade, and opioid-sparing potential make it suitable for LC.

Despite promising results, clinical evidence on EOIPB for LC remains limited, especially in the Indian population. This study aimed to evaluate the postoperative analgesic efficacy of ultrasound-guided bilateral EOIPB in LC, focusing on pain scores, opioid consumption, and quality of recovery.

Materials and Methods

This prospective observational study was conducted in the Department of Anaesthesiology and Critical Care Medicine, Nehru Hospital, B.R.D. Medical College, Gorakhpur, equipped with advanced ultrasound imaging facilities. The study was carried out over a period of 18 months.

Sample Size Calculation

Based on a medium effect size, significance level of 0.05, and power of 80%, the required sample size was 64. To account for potential dropouts, a total of 70 patients were included, with 35 patients in each group.

Selection Criteria

Inclusion Criteria

- Patients aged 18 to 65 years.
- Either sex.
- ASA physical status I or II.
- Elective laparoscopic cholecystectomy under general anaesthesia.

Exclusion Criteria

- Refusal to participate.
- Bleeding disorders or anticoagulant therapy.
- Pregnancy.
- Uncontrolled systemic illnesses (e.g., hypertension, cardiac, cerebrovascular, renal, or hepatic disease).
- Malignancy.

Study Protocol

After obtaining informed consent, eligible patients were randomized into two groups:

- **Group NB (Control Group):** Received general anaesthesia only.

- **Group EB (Study Group):** Received general anaesthesia along with bilateral EOIPB using 20 ml of 0.2% ropivacaine per side.

Pre-anaesthetic assessment included a detailed history, physical examination, and routine investigations. Standard fasting guidelines were followed. General anaesthesia was induced with intravenous propofol (1.5 mg/kg), fentanyl (2 µg/kg), and vecuronium (0.1 mg/kg), with maintenance as per institutional protocol.

EOIPB was performed under aseptic conditions using a Sonosite Edge II portable ultrasound machine with a high-frequency linear probe. The probe was positioned at the sixth rib level, identifying the plane between the external oblique and intercostal muscles. A 21/22G insulated needle was inserted in-plane, and 20 ml of 0.2% ropivacaine was injected incrementally on each side.

Postoperative pain was assessed using the Numeric Rating Scale (NRS) at rest and during movement at immediate, 2, 6, 12, and 24 hours. Fentanyl consumption, Quality of Recovery (QoR-15) score, side effects, and block-related complications were recorded. Rescue analgesia with intravenous fentanyl (1 µg/kg) was administered if NRS exceeded 4.

Statistical Analysis

Data were analyzed using SPSS v28. Continuous variables were expressed as mean ± SD, and categorical variables as frequency and percentages. Appropriate statistical tests were applied. A p-value <0.05 was considered statistically significant.

Ethical Considerations

The study was approved by the Institutional Ethics Committee. Written informed consent was obtained from all participants. Confidentiality was maintained, and patients were free to withdraw at any stage without affecting their medical care.

Results

The study assessed the effectiveness of ultrasound-guided bilateral External Oblique Intercostal Plane Block (EOIPB) in providing postoperative pain relief, minimizing opioid use, and enhancing recovery outcomes in patients undergoing laparoscopic cholecystectomy.

Table 1: Postoperative Pain Scores (NRS) at Rest and movement

Time Point	At Rest			At Movement		
	Group NB (Control) (n=35)	Group EB (EOIPB) (n=35)	p-value	Group NB (Control) (n=35)	Group EB (EOIPB) (n=35)	p-value
Immediate Postoperative	6.397 ± 0.675	2.634 ± 0.634	0.001	7.65 ± 0.466	2.93 ± 0.626	0.001
2 Hours	5.289 ± 0.577	2.254 ± 0.543	0.001	6.35 ± 0.728	2.75 ± 0.663	0.001
6 Hours	4.143 ± 0.733	1.640 ± 0.696	0.001	4.74 ± 0.611	2.34 ± 0.591	0.001
12 Hours	3.314 ± 0.583	1.734 ± 0.851	0.001	3.60 ± 0.497	2.57 ± 1.420	0.001
24 Hours	2.963 ± 0.652	0.500 ± 0.628	0.001	3.46 ± 0.561	1.18 ± 0.506	0.001

Highly statistically significant: 0.001

Table 2: Total Fentanyl Consumption in First 24 Hours and post-operative Fentanyl consumption

Variable	Group NB (Control) (n=35)	Group EB (EOIPB) (n=35)	p-value
Total Fentanyl (µg)	325 ± 40.1	132 ± 19.6	0.001
No of Dose			
0	0	31 (0)	-
1	0	4 (64.5 ± 7.55)	-
2	12 (144.7 ± 17.73)	0	-
3	22 (206.8 ± 27.96)	0	-
4	1 (240)	0	-

Highly statistically significant: 0.001

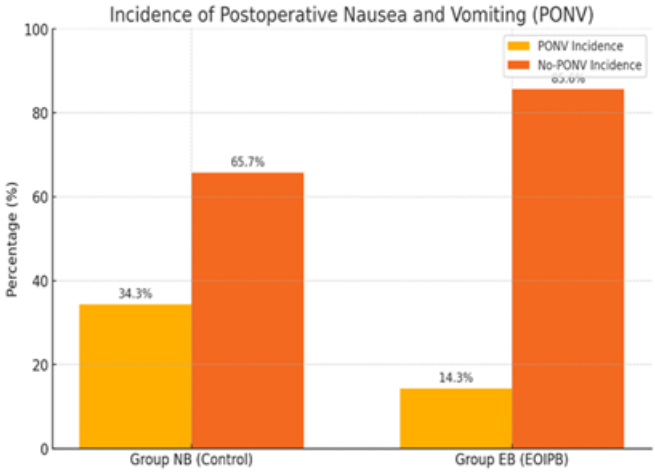

Figure 1: Incidence of Postoperative Nausea and Vomiting (PONV)

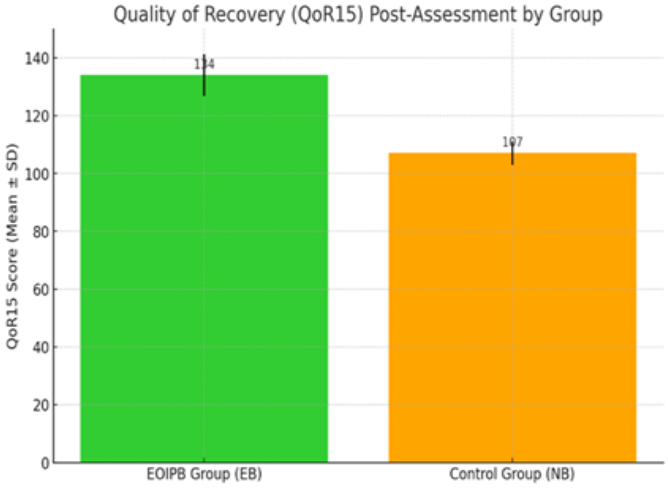

Figure 2: Quality of Recovery (QoR15) Post-Assessment by Group

Discussion

The present study demonstrated that ultrasound-guided bilateral external oblique intercostal plane block (EOIPB) significantly enhances postoperative pain control and recovery in patients undergoing laparoscopic cholecystectomy (LC). The two groups were comparable in sociodemographic characteristics, including age, gender, education, and socioeconomic status ($p>0.05$), ensuring that outcome differences were attributable to the EOIPB intervention. This aligns with the findings of Korkusuz et al. (2023)[7] who emphasized the importance of baseline comparability to preserve study validity, unlike Hamilton et al. (2018)[8] who reported compromised results due to poor demographic control.

Baseline characteristics, including BMI and ASA status, were similar across groups, supporting reliable interpretation of postoperative outcomes. Leigh et al. (2022)[9] highlighted the role of uniform comorbidity distribution in enhancing the reliability of regional anesthesia research, consistent with the present study.

Intraoperatively, although fentanyl consumption was slightly lower and mean arterial pressure marginally higher in the EOIPB group, these differences were not statistically significant ($p>0.05$), consistent with findings from Korkusuz et al. (2023)[7] and Korkusuz et al.

(2022)[10], confirming the hemodynamic stability and safety of EOIPB.

Postoperatively, EOIPB provided significantly lower pain scores both at rest and during movement across all time points (p=0.001), reinforcing the analgesic efficacy of EOIPB reported by Korkusuz et al. (2023)[7]. Reduced fentanyl consumption in the EOIPB group further highlights its opioid-sparing effect, in line with the opioid reduction benefits described by Korkusuz et al. (2022)[10].

Although the incidence of postoperative nausea and vomiting (PONV) was lower in the EOIPB group (14.3% vs. 34.3%), this difference was not statistically significant, warranting further investigation.

Importantly, Quality of Recovery (QoR-15) scores were significantly higher in the EOIPB group (134 ± 7.20) compared to the control group (107 ± 4.01), consistent with improved recovery outcomes reported by Korkusuz et al. (2023)[7] and Liotiri et al. (2023)[11], who demonstrated that EOIPB promotes early mobilization, reduced opioid use, and enhanced patient satisfaction.

Limitations: The limitations of the study include a small sample size, single-centre design, short follow-up period, and exclusion of high-risk patients, which may limit the generalizability of the findings.

Strength: The strengths of the study include a well-defined methodology, comparable baseline characteristics, objective pain assessment using NRS, and evaluation of both pain scores and opioid requirements, enhancing the study's clinical relevance.

Conclusion

We concluded that ultrasound-guided bilateral EOIPB significantly improves postoperative pain control, reduces opioid consumption, and enhances recovery quality in laparoscopic cholecystectomy patients, making it a safe and effective analgesic technique.

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