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RESEARCH ARTICLE
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COMPARISON OF POSTOPERATIVE ANALGESIC EFFICACY BETWEEN ULTRASOUND-GUIDED BILATERAL EXTERNAL OBLIQUE INTERCOSTAL PLANE BLOCK AND BILATERAL TRANSVERSE ABDOMINIS PLANE (TAP) BLOCK IN LAPAROSCOPIC CHOLECYSTECTOMY

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ABSTRACT

Background:
Laparoscopic cholecystectomy is frequently associated with moderate postoperative pain. Regional blocks, such as the transversus abdominis plane (TAP) block, are commonly used to mitigate pain. The external oblique intercostal (EOIC) block is a newer technique targeting upper abdominal wall analgesia.

Objective:
To compare the efficacy of ultrasound-guided bilateral EOIC block versus TAP block in patients undergoing laparoscopic cholecystectomy under general anaesthesia.

Methods:
A double-blind, prospective observational study was conducted on 60 patients (ASA I–II, aged 18–60 years) undergoing laparoscopic cholecystectomy. Patients were randomized to receive either bilateral EOIC block (Group E) or TAP block (Group T) using 30 ml of 0.125% levobupivacaine with 4 mg dexamethasone. VAS scores at rest and movement were recorded at multiple time intervals postoperatively. The time to first rescue analgesia, number of doses, and percentage of patients requiring rescue analgesia were evaluated.

Results:
Group T showed significantly lower VAS scores at rest and movement in the first 4 postoperative hours ($p<0.001$). Group T had a longer duration to first rescue analgesia (10 ± 8.35 hrs vs 7.33 ±

9.40 hrs, p<0.0001) and required fewer rescue doses (0.5 ± 0.68 vs 1.8 ± 1.47, p<0.0001). Fewer patients required rescue analgesia in Group T (40% vs 76.6%, p=0.0051).

Conclusion:

Ultrasound-guided TAP block provided superior postoperative analgesia compared to EOIC block for laparoscopic cholecystectomy.

Keywords: Laparoscopic cholecystectomy, postoperative pain, TAP block, external oblique intercostal block, ultrasound-guided block, regional anaesthesia.

INTRODUCTION

Laparoscopic cholecystectomy is a commonly performed procedure associated with moderate postoperative pain, primarily due to peritoneal irritation and trocar site trauma. Effective multimodal analgesia, including regional nerve blocks, improves patient comfort and recovery.

The EOIC block, a relatively new truncal block, targets the lateral and anterior abdominal wall above the costal margin. In contrast, the TAP block is widely used for infra-umbilical analgesia but has limited coverage in upper abdominal procedures.

This study aims to compare EOIC and TAP blocks for postoperative analgesia following laparoscopic cholecystectomy.

MATERIALS AND METHODS

Study Design and Setting:

Prospective, double-blind, randomized observational study conducted at Narayana Medical College and Hospital, Nellore from January to June 2025.

Ethical Approval:

Obtained from the institutional ethics committee. Informed consent was secured from all participants.

Inclusion Criteria:

- Age 18–60 years
- ASA physical status I or II
- Scheduled for elective laparoscopic cholecystectomy

Exclusion Criteria:

- ASA III or IV
- Local infection at injection site
- Allergy to study drugs
- Patient refusal

General Anaesthesia Protocol:

All patients were premedicated with intravenous midazolam 1–2 mg and glycopyrrolate 0.2 mg. General anaesthesia was induced with propofol 2–2.5 mg/kg and fentanyl 2 µg/kg. Endotracheal intubation was facilitated with Cisatracurium 0.2 mg/kg. Anaesthesia was maintained using sevoflurane (1–1.5%) in a mixture of oxygen and air (50:50) with intermittent boluses of cisatracurium as needed. Paracetamol 1 g IV was administered intraoperatively. Reversal of neuromuscular blockade was done with neostigmine 0.05 mg/kg and glycopyrrolate 0.01 mg/kg.

Technique of EOIC Block:

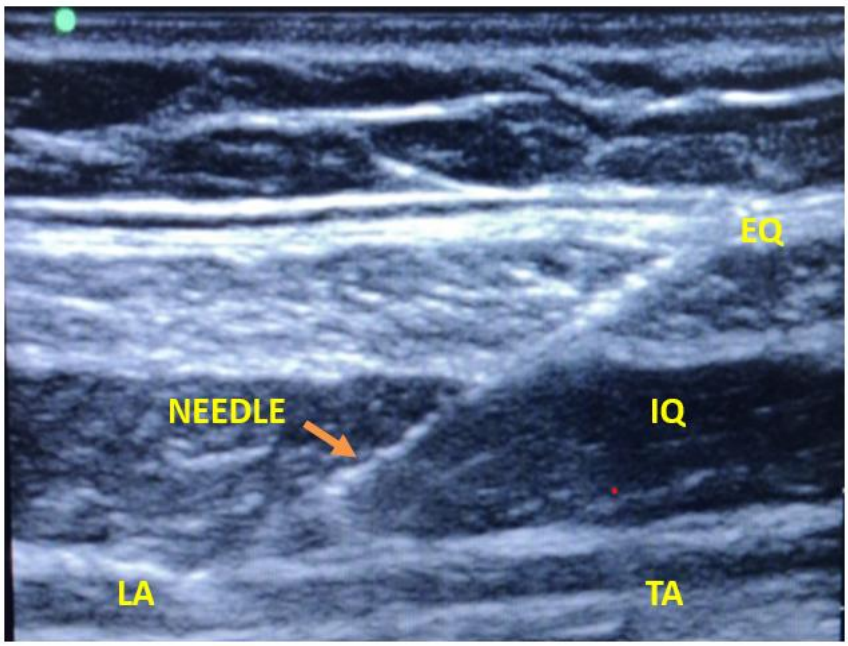
With the patient in a supine position and after induction of anaesthesia, a high-frequency linear ultrasound probe (13–6 MHz, Sonosite M-Turbo) was placed obliquely over the 5th rib in the mid-axillary line to identify the external oblique, internal oblique, and intercostal muscles. The block needle (20G, 80 mm) was inserted in-plane from an anterior to posterior direction targeting the fascial plane between the external oblique and intercostal muscles. After negative aspiration, 30 ml

of 0.125% levobupivacaine with 4 mg dexamethasone was injected bilaterally, confirming spread under real-time ultrasound guidance.

EXTERNAL OBLIQUE INTERCOASTAL (EOIC) BLOCK

Technique of TAP Block:
Following induction of anaesthesia and positioning the patient supine, a high-frequency linear ultrasound probe was placed transversely on the midaxillary line between the iliac crest and the costal margin. The three muscle layers—external oblique, internal oblique, and transversus abdominis—were identified. An in-plane needle approach was used to advance a 20G block needle into the fascial plane between the internal oblique and transversus abdominis muscles. After negative aspiration, 30 ml of 0.125% levobupivacaine with 4 mg dexamethasone was injected on each side with visualization of the spread.

TRANSVERSUS ABDOMINIS PLANE (TAP) BLOCK



Group Allocation:
- **Group E (EOIC block):** 30 ml of 0.125% levobupivacaine + 4 mg dexamethasone
- **Group T (TAP block):** 30 ml of 0.125% levobupivacaine + 4 mg dexamethasone

Outcomes Measured:
- VAS at rest and dynamic at 1, 2, 4, 6, 8, 12, and 24 hours
- Time to first rescue analgesia
- Number and percentage of patients requiring rescue analgesia in 24 hours
- Total number of rescue doses

Statistical Analysis:
Data were analyzed using SPSS v20. Continuous variables were expressed as mean ± SD and compared using Student's t-test. Categorical variables were analyzed with Chi-square test. A p-value < 0.05 was considered statistically significant.

RESULTS

Parameter	Group T (TAP)	Group E (EOIC)	p-value	Significance
Time to 1st rescue analgesia (hr)	10 ± 8.35	7.33 ± 9.40	<0.0001	Significant
No. of rescue doses (24 hrs)	0.5 ± 0.68	1.8 ± 1.47	<0.0001	Significant
% of patients needing rescue	40% (12/30)	76.6% (23/30)	0.0051	Significant

Table 1: VAS Scores at Rest (Mean ± SD)

Time Post-Op	Group T (TAP)	Group E (EOIC)	p-value	Significance
1st hour	0.16 ± 0.46	1.00 ± 1.55	0.0061	Significant
2nd hour	0.43 ± 0.77	2.43 ± 2.29	<0.0001	Significant
4th hour	0.90 ± 1.29	2.60 ± 2.04	0.0003	Significant
6th hour	1.60 ± 1.73	2.13 ± 1.50	0.2099	Not Significant
8th hour	1.80 ± 1.39	1.73 ± 1.18	0.8342	Not Significant
12th hour	1.76 ± 1.27	2.07 ± 1.67	0.4217	Not Significant
24th hour	1.56 ± 0.56	1.67 ± 1.11	0.6298	Not Significant

Table 2: Dynamic VAS Scores (on Movement, Mean ± SD)

Time Post-Op	Group T (TAP)	Group E (EOIC)	p-value	Significance
1st hour	0.30 ± 0.59	2.20 ± 1.80	<0.0001	Significant
2nd hour	0.70 ± 0.98	3.26 ± 2.16	<0.0001	Significant
4th hour	1.46 ± 1.43	3.76 ± 2.06	<0.0001	Significant
6th hour	2.26 ± 1.85	3.10 ± 1.42	0.0533	Borderline
8th hour	2.33 ± 1.64	2.80 ± 1.21	0.2116	Not Significant
12th hour	2.43 ± 1.33	3.10 ± 1.39	0.0614	Borderline
24th hour	2.03 ± 0.40	2.76 ± 0.93	0.0002	Significant

VAS and Dynamic VAS Scores showed significantly lower values in Group T at early postoperative hours (1st, 2nd, and 4th hrs; $p < 0.001$). No significant difference was noted beyond 6 hours

DISCUSSION

The present study reveals that the ultrasound-guided transversus abdominis plane (TAP) block provides significantly better postoperative analgesia than the external oblique intercostal (EOIC) block in patients undergoing laparoscopic cholecystectomy. The early postoperative period is often critical for optimal pain control to promote early mobilization and reduce hospital stay. In this context, our results emphasize that TAP block achieves a longer duration of analgesia, reduces the need for rescue analgesics, and lowers the proportion of patients requiring additional analgesia.

Several mechanisms may account for the superior analgesia provided by the TAP block. The TAP block targets the anterior rami of T6–L1 spinal nerves, providing somatic analgesia to the anterior abdominal wall. The local anaesthetic spreads in the fascial plane between the internal oblique and transversus abdominis muscles, covering a wide dermatomal distribution. In contrast, the EOIC block is a newer technique that anesthetizes the anterior and lateral cutaneous branches of the intercostal nerves. However, its spread may be more limited, especially in surgeries involving deeper visceral pain components.

Our findings are consistent with those of Ke Peng et al., who concluded through a meta-analysis that TAP block significantly reduces postoperative pain scores and opioid consumption after laparoscopic cholecystectomy [1]. Their systematic review also indicated that TAP block is associated with fewer opioid-related side effects and improved patient satisfaction. Likewise, Niraj et al. demonstrated that TAP blocks provided significantly better pain scores and reduced morphine consumption following open appendectomy and gynecological procedures, further supporting its utility in abdominal surgeries [7].

Elsharkawy et al. introduced the EOIC block as a novel method for providing analgesia for upper abdominal wall incisions, highlighting its anatomical plausibility and ease under ultrasound guidance [2]. However, unlike TAP block, there is still limited high-quality evidence for EOIC in randomized trials or meta-analyses. Our findings demonstrate that although EOIC offers a potential alternative, it may not match the effectiveness and consistency of TAP block in terms of coverage and duration.

Charlton et al. emphasized that ultrasound guidance significantly enhances the safety and efficacy of fascial plane blocks, reducing complications and improving block success [6]. Both TAP and EOIC blocks benefit from sonographic precision, but TAP block has the added advantage of a well-defined anatomical plane and reproducibility in various patient populations.

Abdallah et al. further validated the efficacy of TAP blocks, showing its benefit in reducing early postoperative pain scores and opioid requirements after cesarean sections, demonstrating its versatility across different types of abdominal surgeries [3].

Notably, the EOIC block may have a role in select patient populations. Its theoretical advantage lies in its ability to provide upper abdominal wall analgesia while preserving core muscle strength and respiratory function, potentially benefitting patients with compromised pulmonary function [4]. However, given the lack of broader evidence and its more recent introduction, EOIC block should currently be considered supplementary or investigational.

An important strength of our study is the double-blind, prospective randomized design. By standardizing drug concentration and volume and using the same ultrasound guidance technique, we reduced operator-dependent bias. Nevertheless, a few limitations exist. First, the study focused only on a 24-hour postoperative window. The long-term analgesic profiles and late complications were not assessed. Second, all blocks were performed by experienced practitioners; generalizability to less experienced hands may vary. Third, visceral pain components were not evaluated separately, which could provide deeper insights.

From a practical standpoint, both TAP and EOIC blocks are relatively easy to perform under ultrasound guidance. However, the TAP block benefits from wider clinician familiarity, established anatomical landmarks, and stronger evidence for efficacy. Cost-effectiveness, training burden, and institutional resources must be considered when implementing newer blocks like EOIC into routine clinical practice.

Future research should explore combinations of EOIC with other regional techniques to enhance its analgesic efficacy. The role of adjuvants, catheter-based infusion, and continuous block techniques should also be investigated to optimize pain management protocols. Comparative studies involving different types of upper abdominal surgeries may better define the scope of each block.

CONCLUSION

This study confirms the analgesic superiority of the TAP block over EOIC block in the early postoperative period following laparoscopic cholecystectomy. The TAP block remains a reliable, reproducible, and effective technique for achieving optimal analgesia, enhancing recovery, and minimizing opioid-related side effects. While EOIC block holds promise, further studies are necessary to establish its definitive role in clinical practice.

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FIGURES

Figure 1: Comparison of VAS scores at rest over 24 hours between TAP and EOIC blocks.
Figure 2: Comparison of dynamic VAS scores over 24 hours between TAP and EOIC blocks.

TABLES

Table 1: VAS Scores at Rest (Mean ± SD)
Table 2: Dynamic VAS Scores (on Movement, Mean ± SD)