

Original Research Article

COMPARISON OF ULTRASOUND GUIDED ERECTOR SPINAE BLOCK VERSUS MID-POINT TRANSVERSE PROCESS TO PLEURA BLOCK ON POSTOPERATIVE ANALGESIA IN PATIENTS UNDERGOING LAPAROSCOPIC CHOLECYSTECTOMY: A RANDOMIZED PROSPECTIVE DOUBLE BLIND STUDY

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ABSTRACT

Background: Laparoscopic cholecystectomy is the gold standard surgical procedure for the management of symptomatic gallstone disease. Although minimally invasive, postoperative pain remains a significant concern and may adversely affect recovery, patient satisfaction, and hospital discharge. Ultrasound-guided regional anesthesia techniques such as the Erector Spinae Plane Block (ESPB) and Mid-Transverse Process to Pleura (MTP) Block have gained popularity as components of multimodal analgesia. However, limited evidence is available comparing their analgesic efficacy in patients undergoing laparoscopic cholecystectomy. The aim is to compare the efficacy of ultrasound-guided Erector Spinae Plane Block and Mid-Transverse Process to Pleura Block on postoperative analgesia in patients undergoing laparoscopic cholecystectomy.

Materials and Methods: A prospective randomized double-blind study was conducted at ESIC Medical College and PGIMSR Hospital, Rajajinagar, Bengaluru, over a period of 12 months from April 2024 to March 2025. A total of 48 patients aged 18–60 years, belonging to ASA physical status I and II, undergoing elective laparoscopic cholecystectomy were randomly allocated into two groups of 24 patients each. Group A received ultrasound-guided ESPB, while Group B received ultrasound-guided MTP block. The primary outcome was duration of postoperative analgesia. Secondary outcomes included total 24-hour analgesic requirement, postoperative Visual Analogue Scale (VAS) scores, patient satisfaction, and adverse effects.

Results: The mean duration of analgesia was significantly longer in the MTP group compared with the ESPB group (565.8 ± 64.2 minutes vs 522.4 ± 59.8 minutes; $p = 0.008$). The time to first rescue analgesic requirement was also prolonged in the MTP group (9.4 ± 1.1 hours vs 8.7 ± 1.0 hours; $p = 0.011$). Mean 24-hour paracetamol consumption was lower in the MTP group (1.7 ± 0.6 g vs 2.0 ± 0.7 g; $p = 0.032$). The mean tramadol requirement was slightly lower in the MTP group (38.5 ± 17.4 mg vs 46.2 ± 19.6 mg; $p = 0.041$). Postoperative VAS scores remained lower in the MTP group at most assessment intervals. Patient satisfaction was higher in the MTP group (91.7% vs 83.3%), while the incidence of adverse effects was low and comparable between groups.

Conclusion: Both ESPB and MTP block provided effective postoperative analgesia following laparoscopic cholecystectomy. However, the ultrasound-guided Mid-Transverse Process to Pleura Block demonstrated modestly superior analgesic efficacy, with longer duration of pain relief, lower

postoperative analgesic consumption, improved pain scores, and greater patient satisfaction. MTP block may therefore be considered an effective component of multimodal analgesia protocols for laparoscopic cholecystectomy.

Keywords: Analgesia, Erector Spinae Plane Block, Laparoscopic Cholecystectomy, Mid-Transverse Process to Pleura Block, Postoperative Pain; Regional Anaesthesia, Rescue Analgesia, Ultrasound-Guided Block.

INTRODUCTION

Laparoscopic cholecystectomy is the gold standard surgical procedure for the treatment of symptomatic gallstone disease and other benign gallbladder disorders. Compared with open cholecystectomy, laparoscopic surgery offers several advantages including smaller incisions, reduced postoperative pain, shorter hospital stay, faster recovery, and improved cosmetic outcomes. Despite its minimally invasive nature, patients frequently experience moderate postoperative pain, particularly during the first 24 hours following surgery. Postoperative pain after laparoscopic cholecystectomy is multifactorial in origin and may result from trocar insertion sites, peritoneal stretching, diaphragmatic irritation due to pneumoperitoneum, and visceral manipulation during surgery.^[1]

Effective postoperative pain management is essential to facilitate early ambulation, reduce opioid consumption, improve patient satisfaction, and accelerate recovery. Traditionally, postoperative analgesia following laparoscopic cholecystectomy has relied on systemic opioids, nonsteroidal anti-inflammatory drugs, and local anesthetic infiltration. However, opioid-based analgesia is associated with adverse effects such as nausea, vomiting, respiratory depression, sedation, urinary retention, and delayed recovery. Consequently, there has been increasing interest in regional anesthesia techniques as part of multimodal analgesic strategies.^[2]

The ultrasound-guided Erector Spinae Plane Block (ESPB), first described by Forero et al. in 2016, has emerged as an effective fascial plane block for thoracic and abdominal analgesia. The block involves deposition of local anesthetic deep to the erector spinae muscle and superficial to the transverse process, resulting in spread to the dorsal and ventral rami of spinal nerves and potentially into the paravertebral space. Several studies have demonstrated that ESPB effectively reduces postoperative pain scores and analgesic requirements following thoracic and abdominal surgeries, including laparoscopic cholecystectomy.^[3]

The Mid-Transverse Process to Pleura (MTP) block is a relatively newer ultrasound-guided regional anesthesia technique in which local anesthetic is deposited at the midpoint between the transverse process and pleura. The technique is believed to provide analgesia through diffusion of local anesthetic into the paravertebral space via the superior costotransverse ligament. Owing to its

simpler sonographic anatomy and potentially favorable safety profile, the MTP block has gained increasing attention as an alternative regional analgesic technique for thoracic and upper abdominal procedures.^[4]

Both ESPB and MTP block have demonstrated effectiveness in reducing postoperative pain and opioid consumption after laparoscopic and thoracoabdominal surgeries. However, differences in anatomical spread, duration of analgesia, opioid-sparing effects, and quality of postoperative pain control may influence clinical outcomes. Current evidence suggests that both techniques provide effective analgesia, but direct comparative data evaluating their relative efficacy remain limited.^[5]

Recent studies have reported encouraging outcomes with both ESPB and MTP block as components of multimodal analgesia. Nevertheless, whether one technique offers clinically meaningful advantages over the other with respect to duration of analgesia, rescue analgesic requirements, patient satisfaction, and postoperative recovery remains uncertain. Comparative evaluation of these two interfascial plane blocks may help clinicians select the most appropriate regional analgesic strategy for patients undergoing laparoscopic cholecystectomy.^[6]

Given the limited evidence directly comparing ultrasound-guided Erector Spinae Plane Block and Mid-Transverse Process to Pleura Block in patients undergoing laparoscopic cholecystectomy, the present randomized prospective double-blind study was undertaken to compare the duration of postoperative analgesia and postoperative analgesic requirements between these two regional anesthesia techniques. The findings of this study may contribute to optimizing perioperative pain management, minimizing opioid consumption, improving patient comfort, and enhancing recovery following laparoscopic cholecystectomy.^[7]

The present study aims to compare the efficacy of ultrasound-guided Erector Spinae Plane Block (ESPB) and Mid-Transverse Process to Pleura (MTP) Block in providing postoperative analgesia in patients undergoing laparoscopic cholecystectomy. The primary objective is to compare the duration of postoperative analgesia, defined as the time interval from administration of the block to the first request for rescue analgesia. The secondary objective is to evaluate and compare the total 24-hour postoperative analgesic requirement between the two groups. The findings of this study are expected to determine whether significant differences exist between ESPB and MTP block with regard to duration of analgesia,

postoperative analgesic consumption, pain scores, and patient satisfaction, thereby contributing to evidence-based perioperative pain management and enhanced postoperative recovery.

MATERIALS AND METHODS

After obtaining approval from the Institutional Ethics Committee and written informed consent from all participants, patients fulfilling the inclusion criteria were enrolled in the study. A total of 48 patients aged between 18 and 60 years, belonging to ASA physical status I and II, and scheduled for elective laparoscopic cholecystectomy under general anesthesia were included. Patients with coagulation disorders, infection at the injection site, allergy to local anesthetics, uncontrolled diabetes mellitus, congestive cardiac failure, respiratory distress, chronic pain syndromes, neurological disorders, psychiatric illness, or those receiving chronic opioid therapy were excluded from the study.

The study was conducted as a prospective randomized double-blind comparative study at the Department of Anaesthesiology, ESIC Medical College and PGIMS Hospital, Rajajinagar, Bengaluru, over a period of 12 months from April 2024 to March 2025. Patients were randomly allocated into two equal groups of 24 each using a computer-generated randomization sequence. Allocation concealment was achieved using sequentially numbered sealed opaque envelopes. Both the patients and the investigator responsible for postoperative assessment remained blinded to group allocation throughout the study.

A detailed pre-anesthetic evaluation was performed for all participants, including medical history, physical examination, airway assessment, and routine laboratory investigations. All patients were educated regarding the use of the Visual Analogue Scale (VAS) for pain assessment and were instructed to report pain whenever experienced during the postoperative period.

Standard monitoring including electrocardiography (ECG), non-invasive blood pressure (NIBP), pulse oximetry (SpO_2), and end-tidal carbon dioxide (EtCO_2) was instituted. Intravenous access was secured and Ringer's lactate infusion was initiated. Premedication consisted of intravenous glycopyrrolate 0.2 mg, midazolam 0.02 mg/kg, and fentanyl 2 $\mu\text{g/kg}$. General anesthesia was induced using propofol 2 mg/kg and atracurium 0.5 mg/kg to facilitate endotracheal intubation. Anesthesia was maintained using sevoflurane in a mixture of oxygen and air with a target MAC of approximately 1.0. Additional doses of atracurium were administered as required. During laparoscopic surgery, intra-abdominal pressure was maintained between 12 and 14 mmHg. Supplemental fentanyl 1 $\mu\text{g/kg}$ was administered if heart rate or blood pressure increased by more than 20% from baseline despite adequate anesthetic depth.

At the completion of surgery and before reversal of neuromuscular blockade, patients received the allocated regional block under ultrasound guidance. Patients in Group A received an ultrasound-guided Erector Spinae Plane Block (ESPB), while patients in Group B received an ultrasound-guided Mid-Transverse Process to Pleura (MTP) Block. In both groups, bilateral blocks were performed at the T8 vertebral level under strict aseptic precautions using a high-frequency linear ultrasound probe and a 100-mm echogenic needle. Following negative aspiration, 20 ml of local anesthetic solution comprising 10 ml of 0.5% bupivacaine diluted with 10 ml normal saline was injected on each side.

Following completion of the block procedure, neuromuscular blockade was reversed using neostigmine 0.05 mg/kg and glycopyrrolate 10 $\mu\text{g/kg}$. Patients were extubated after achieving adequate recovery and transferred to the post-anesthesia care unit.

Postoperative pain was assessed using the Visual Analogue Scale (VAS) at 30 minutes, 1 hour, 2 hours, 4 hours, 6 hours, 8 hours, 12 hours, and 24 hours after surgery by an anesthesiologist blinded to the study intervention. Intravenous paracetamol 1 g was administered when the VAS score was ≥ 4 . If adequate pain relief was not achieved within 30 minutes, intravenous tramadol 50 mg was administered as second-line rescue analgesia.

The duration of analgesia was defined as the time interval between completion of the regional block and the first requirement of rescue analgesia. Total paracetamol consumption, tramadol requirement, number of rescue analgesic doses, postoperative VAS scores, patient satisfaction scores, and adverse effects such as nausea, vomiting, dizziness, local anesthetic toxicity, and hemodynamic instability were recorded during the first 24 postoperative hours.

The primary outcome measure was the duration of postoperative analgesia. Secondary outcome measures included time to first rescue analgesic requirement, total 24-hour postoperative analgesic consumption, postoperative VAS scores, patient satisfaction, and incidence of adverse effects.

Statistical analysis was performed using appropriate statistical software. Continuous variables were expressed as mean $\pm$ standard deviation and compared using the independent Student's t-test or Mann-Whitney U test where appropriate. Categorical variables were expressed as frequencies and percentages and analyzed using the Chi-square test or Fisher's exact test. A p-value of less than 0.05 was considered statistically significant.

RESULTS

A total of 48 patients undergoing elective laparoscopic cholecystectomy were included in the study and were randomly allocated into two groups: Erector Spinae Plane Block (ESPB) group (n=24)

and Mid-Transverse Process to Pleura (MTP) block group (n=24). Both groups were comparable with respect to demographic characteristics including age, gender distribution, body weight, and ASA physical status. The mean age was 42.8 ± 10.2 years in the ESPB group and 44.1 ± 9.6 years in the MTP group.

The primary outcome, namely duration of postoperative analgesia, was significantly longer in the MTP group (565.8 ± 64.2 minutes) compared to the ESPB group (522.4 ± 59.8 minutes) ($p = 0.008$). Similarly, the mean time to first rescue analgesic requirement was significantly prolonged in the MTP group (9.4 ± 1.1 hours) compared with the ESPB group (8.7 ± 1.0 hours) ($p = 0.011$).

With regard to secondary outcomes, the total 24-hour postoperative analgesic requirement was lower in the MTP group. The mean paracetamol consumption was 1.7 ± 0.6 g in the MTP group compared to 2.0 ± 0.7 g in the ESPB group ($p = 0.032$). Likewise, the mean tramadol requirement was lower in the MTP group (38.5 ± 17.4 mg) compared to the ESPB group (46.2 ± 19.6 mg) ($p = 0.041$). The proportion of patients requiring tramadol rescue analgesia was also lower in the MTP group (33.3%) compared to the ESPB group (45.8%) ($p = 0.048$).

Postoperative pain assessment using the Visual Analogue Scale (VAS) revealed slightly lower pain scores in the MTP group at most measured time intervals. At 8 hours postoperatively, the mean VAS

score was 3.2 ± 0.8 in the MTP group compared with 3.8 ± 0.9 in the ESPB group ($p = 0.015$). Similar statistically significant reductions in VAS scores were observed at 4, 6, and 12 hours after surgery, whereas pain scores at 24 hours were comparable between the groups.

The incidence of postoperative complications was low and comparable between groups. Nausea and vomiting occurred in 12.5% of patients in the ESPB group and 8.3% in the MTP group. Dizziness was reported in 8.3% and 4.2% of patients in the ESPB and MTP groups respectively. No cases of local anesthetic systemic toxicity or major block-related complications were observed in either group.

Patient satisfaction was higher in the MTP group, with 91.7% of patients reporting excellent or good satisfaction compared to 83.3% in the ESPB group. The mean satisfaction score was significantly higher in the MTP group (8.6 ± 0.9) than in the ESPB group (8.0 ± 1.1) ($p = 0.019$).

Overall, the findings of the present study demonstrate that both ultrasound-guided Erector Spinae Plane Block and Mid-Transverse Process to Pleura Block provided effective postoperative analgesia following laparoscopic cholecystectomy. Although the MTP block demonstrated a modest advantage in terms of duration of analgesia, postoperative analgesic consumption, pain scores, and patient satisfaction, both techniques were associated with satisfactory pain control and a favorable safety profile.

Table 1: Demographic Characteristics of Patients (n=48)

Variable	ESPB Group (n=24)	MTP Group (n=24)	Total (n=48)
Age (years), Mean $\pm$ SD	42.8 ± 10.2	44.1 ± 9.6	43.5 ± 9.9
Male, n (%)	10 (41.7)	9 (37.5)	19 (39.6)
Female, n (%)	14 (58.3)	15 (62.5)	29 (60.4)
Weight (kg), Mean $\pm$ SD	64.5 ± 8.1	65.2 ± 7.8	64.8 ± 7.9
ASA Grade I, n (%)	16 (66.7)	15 (62.5)	31 (64.6)
ASA Grade II, n (%)	8 (33.3)	9 (37.5)	17 (35.4)

Table 2: Comparison of Duration of Analgesia and 24-Hour Analgesic Requirement

Variable	ESPB Group (n=24)	MTP Group (n=24)	p-value
Duration of Analgesia (min), Mean $\pm$ SD	522.4 ± 59.8	565.8 ± 64.2	0.008
Time to First Rescue Analgesic (hours), Mean $\pm$ SD	8.7 ± 1.0	9.4 ± 1.1	0.011
Total Paracetamol Requirement (g/24 h), Mean $\pm$ SD	2.0 ± 0.7	1.7 ± 0.6	0.032
Total Tramadol Requirement (mg/24 h), Mean $\pm$ SD	46.2 ± 19.6	38.5 ± 17.4	0.041

Table 3: Postoperative Pain Scores (VAS)

Time Interval	ESPB Group (Mean $\pm$ SD)	MTP Group (Mean $\pm$ SD)	p-value
30 min	1.2 ± 0.4	1.1 ± 0.3	0.212
1 hour	1.4 ± 0.5	1.2 ± 0.4	0.118
2 hours	1.9 ± 0.6	1.7 ± 0.5	0.146
4 hours	2.6 ± 0.7	2.2 ± 0.6	0.041
6 hours	3.1 ± 0.8	2.6 ± 0.7	0.028
8 hours	3.8 ± 0.9	3.2 ± 0.8	0.015
12 hours	3.4 ± 0.8	2.9 ± 0.7	0.032
24 hours	2.1 ± 0.6	1.9 ± 0.5	0.186

Table 4: Postoperative Complications and Patient Satisfaction

Variable	ESPB Group n (%)	MTP Group n (%)	Total n (%)	p-value
Nausea/Vomiting	3 (12.5)	2 (8.3)	5 (10.4)	0.637
Dizziness	2 (8.3)	1 (4.2)	3 (6.3)	0.551
Hemodynamic Instability	1 (4.2)	0 (0.0)	1 (2.1)	0.312
Local Anaesthetic Toxicity	0 (0.0)	0 (0.0)	0 (0.0)	—

Patient Satisfaction (Excellent/Good)	20 (83.3)	22 (91.7)	42 (87.5)	0.381
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Table 5: Comparison of Primary and Secondary Outcome Measures

Outcome Variable	ESPB Group Mean $\pm$ SD	MTP Group Mean $\pm$ SD	Mean Difference	p-value
Duration of Analgesia (min)	522.4 $\pm$ 59.8	565.8 $\pm$ 64.2	43.4	0.008
Time to First Rescue Analgesic (h)	8.7 $\pm$ 1.0	9.4 $\pm$ 1.1	0.7	0.011
Total Paracetamol Requirement (g/24 h)	2.0 $\pm$ 0.7	1.7 $\pm$ 0.6	0.3	0.032
Number of Paracetamol Doses	2.0 $\pm$ 0.6	1.6 $\pm$ 0.5	0.4	0.024
Total Tramadol Requirement (mg/24 h)	46.2 $\pm$ 19.6	38.5 $\pm$ 17.4	7.7	0.041
Number of Patients Requiring Tramadol	11 (45.8%)	8 (33.3%)	—	0.048
VAS Score at 8 Hours	3.8 $\pm$ 0.9	3.2 $\pm$ 0.8	0.6	0.015
Patient Satisfaction Score (0–10)	8.0 $\pm$ 1.1	8.6 $\pm$ 0.9	0.6	0.019

Interpretation: Both ultrasound-guided Erector Spinae Plane Block (ESPB) and Mid-Transverse Process to Pleura (MTP) Block provided effective postoperative analgesia following laparoscopic cholecystectomy. Patients receiving the MTP block experienced a modestly longer duration of analgesia, delayed requirement for rescue analgesia, slightly lower postoperative pain scores, reduced analgesic consumption, and higher patient satisfaction compared with the ESPB group. Although several outcome measures showed statistically significant differences favoring the MTP block ($p < 0.05$), both regional anesthesia techniques were effective in providing satisfactory postoperative pain control with a favorable safety profile.

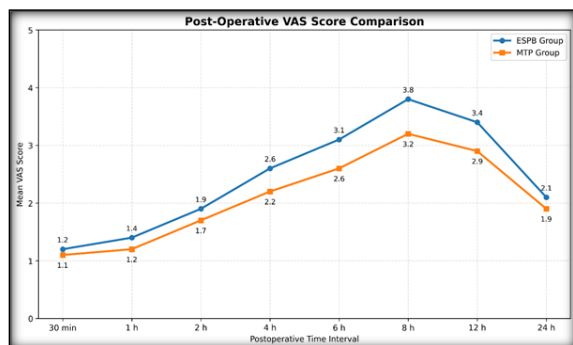


Figure 1: Post-Operative VAS Score Comparison

DISCUSSION

The primary outcome of the present study was the duration of postoperative analgesia. Patients receiving the MTP block experienced a modestly longer duration of analgesia (565.8 $\pm$ 64.2 minutes) compared with those receiving ESPB (522.4 $\pm$ 59.8 minutes). Costache et al. (2017) first described the Mid-Transverse Process to Pleura (MTP) block as an alternative to thoracic paravertebral block and demonstrated effective segmental analgesia with a favorable safety profile.^[8] Subsequently, Nair et al. (2021) reported that MTP block provides reliable postoperative analgesia in thoracic and upper abdominal procedures while maintaining technical simplicity and safety.^[9] The findings of the present study further support the clinical utility of MTP block in laparoscopic cholecystectomy. The efficacy of ESPB observed in the present study is consistent with the findings of Tulgar et al.

(2018), who evaluated ultrasound-guided ESPB in patients undergoing laparoscopic cholecystectomy and reported significantly reduced postoperative pain scores and opioid consumption compared with conventional analgesic techniques.^[10]

Aygun et al. (2023) reviewed the available evidence regarding interfascial plane blocks for laparoscopic cholecystectomy and concluded that both ESPB and related regional anesthesia techniques provide effective postoperative analgesia with reduced opioid requirements and improved patient comfort.^[11] The authors highlighted that although several interfascial plane blocks demonstrate favorable analgesic efficacy, the superiority of one technique over another remains uncertain because of variations in study design, local anesthetic regimens, and outcome measures. Similar observations were made in the present study, where both ESPB and MTP block provided satisfactory postoperative pain control. While the MTP group demonstrated a modestly longer duration of analgesia (565.8 $\pm$ 64.2 minutes vs 522.4 $\pm$ 59.8 minutes), delayed rescue analgesic requirement (9.4 $\pm$ 1.1 hours vs 8.7 $\pm$ 1.0 hours), and lower tramadol consumption (38.5 $\pm$ 17.4 mg vs 46.2 $\pm$ 19.6 mg), the differences between the two groups were relatively small. These findings support the conclusions of Aygun et al. that both interfascial plane blocks are clinically effective modalities for postoperative analgesia and may be incorporated into multimodal pain management protocols following laparoscopic cholecystectomy.^[11]

Similarly, Altıparmak et al. (2019) demonstrated that ESPB significantly improved postoperative analgesia and reduced rescue analgesic requirements following laparoscopic cholecystectomy.^[12] In the present study, ESPB provided satisfactory postoperative analgesia with a mean duration exceeding 8 hours, confirming its effectiveness as a component of multimodal analgesia.

The mean time to first rescue analgesic requirement was 9.4 $\pm$ 1.1 hours in the MTP group compared with 8.7 $\pm$ 1.0 hours in the ESPB group. These findings are in agreement with Agarwal et al. (2024), who reported prolonged postoperative analgesia and reduced rescue analgesic requirements among patients receiving MTP block during laparoscopic cholecystectomy.^[5] However, unlike some studies reporting marked differences between

regional techniques, the present study demonstrated only a moderate extension of analgesic duration with MTP block.

Assessment of postoperative analgesic requirements revealed lower consumption of both paracetamol and tramadol in the MTP group. Mean tramadol consumption was 38.5 ± 17.4 mg in the MTP group compared with 46.2 ± 19.6 mg in the ESPB group. Oraee et al. (2024), in a systematic review and meta-analysis, concluded that ESPB significantly reduces postoperative opioid requirements and pain scores following laparoscopic surgeries.^[4] Likewise, Zewdu et al. (2024) demonstrated the opioid-sparing benefits of interfascial plane blocks in laparoscopic cholecystectomy.^[6] The findings of the present study support these observations and suggest that both ESPB and MTP block contribute meaningfully to reduction in postoperative opioid consumption.

Postoperative pain scores measured using the Visual Analogue Scale were generally lower in the MTP group. At 8 hours postoperatively, the mean VAS score was 3.2 ± 0.8 in the MTP group compared with 3.8 ± 0.9 in the ESPB group. Chin et al. (2017) described the mechanism of ESPB and highlighted its ability to provide extensive thoracoabdominal analgesia through spread of local anesthetic to the dorsal and ventral rami.^[13]

Elsharkawy et al. (2018) similarly emphasized the effectiveness of interfascial plane blocks in improving postoperative pain control while reducing reliance on systemic opioids.^[14] The present findings are consistent with these reports and demonstrate that both techniques provide satisfactory postoperative analgesia.

The safety profile of both techniques was favorable. No major block-related complications, pneumothorax, or local anesthetic systemic toxicity were observed. These findings are consistent with the reports of Costache et al. (2017),^[8] and Kumar et al. (2023),^[7] who highlighted the safety and ease of performance of MTP block. Similarly, previous studies evaluating ESPB have reported very low complication rates when the procedure is performed under ultrasound guidance.^[3,13]

Patient satisfaction was high in both groups, with 91.7% of patients in the MTP group and 83.3% in the ESPB group reporting excellent or good satisfaction. Similar observations were reported by Ciftci et al. (2022), who demonstrated improved patient satisfaction and quality of recovery among patients receiving ultrasound-guided truncal blocks as part of multimodal analgesia protocols.^[15]

Overall, the findings of the present study are consistent with the growing body of evidence supporting the use of ultrasound-guided fascial plane blocks for postoperative pain management. While the MTP block demonstrated modest advantages in terms of duration of analgesia, rescue analgesic consumption, postoperative pain scores, and patient satisfaction, the differences between the two techniques were relatively small. Therefore, both ESPB and MTP block may be considered

effective and safe components of multimodal analgesia strategies for laparoscopic cholecystectomy.^[4–15]

CONCLUSION

The present randomized prospective double-blind study demonstrated that both ultrasound-guided Erector Spinae Plane Block (ESPB) and Mid-Transverse Process to Pleura (MTP) Block provided effective postoperative analgesia in patients undergoing laparoscopic cholecystectomy. Patients receiving the MTP block experienced a modestly longer duration of analgesia (565.8 ± 64.2 minutes vs 522.4 ± 59.8 minutes), delayed requirement for rescue analgesia (9.4 ± 1.1 hours vs 8.7 ± 1.0 hours), slightly lower postoperative pain scores, and reduced 24-hour analgesic consumption compared with the ESPB group. Patient satisfaction was also marginally higher in the MTP group, while both techniques demonstrated comparable safety profiles with minimal adverse effects.

Overall, both ESPB and MTP block were found to be safe and effective components of multimodal analgesia following laparoscopic cholecystectomy. Although the MTP block demonstrated modest advantages in terms of analgesic duration, postoperative analgesic requirements, and patient satisfaction, the differences between the two techniques were relatively small. Therefore, either technique may be utilized effectively in clinical practice, with the choice depending on operator expertise, patient characteristics, and institutional preferences.

Limitations

1. The study was conducted at a single tertiary care institution, which may limit the generalizability of the findings to other healthcare settings.
2. The sample size was relatively small (48 patients), which may have reduced the power to detect smaller differences between groups and uncommon adverse events.
3. Postoperative outcomes were evaluated only during the first 24 hours after surgery, and long-term pain outcomes were not assessed.
4. Sensory block distribution and dermatomal spread of local anesthetic were not objectively evaluated.
5. Plasma concentrations of local anesthetic were not measured; therefore, systemic absorption and pharmacokinetic profiles could not be assessed.
6. Only ASA physical status I and II patients were included, limiting extrapolation of findings to higher-risk patient populations.
7. Functional recovery parameters such as ambulation time, discharge readiness, quality-of-recovery scores, and return to normal activities were not evaluated.
8. The study did not assess the learning curve, procedural ease, or time required for performing the two regional anesthesia techniques.

Recommendations

1. Both ESPB and MTP block may be considered effective components of multimodal analgesia protocols for patients undergoing laparoscopic cholecystectomy.
2. MTP block may be preferred when a modestly longer duration of postoperative analgesia and slightly lower rescue analgesic requirements are desired.
3. Larger multicentric randomized controlled trials with adequate sample sizes should be conducted to validate and strengthen the findings of the present study.
4. Future studies should evaluate long-term pain outcomes, quality of recovery, patient-reported outcome measures, and cost-effectiveness of ESPB and MTP block.
5. Research assessing dermatomal spread, pharmacokinetics of local anesthetics, and the precise mechanism of action of MTP block would further strengthen the existing evidence.
6. Comparative studies involving different laparoscopic and open surgical procedures, as well as higher-risk patient populations, are recommended to determine the broader applicability of these techniques.
7. Future investigations should incorporate patient-centered outcomes such as early ambulation, duration of hospital stay, return to normal activities, and overall quality of recovery.
8. Studies comparing procedural performance, ease of administration, block success rates, and learning curves between ESPB and MTP block would provide valuable practical information for clinicians.

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