

A RANDOMIZED CONTROLLED TRIAL COMPARING ULTRASOUND-GUIDED ERECTOR SPINAE PLANE BLOCK AND OBLIQUE SUBCOSTAL TRANSVERSUS ABDOMINIS PLANE BLOCK FOR POSTOPERATIVE ANALGESIA FOLLOWING LAPAROSCOPIC CHOLECYSTECTOMY



Anaesthesiology

Subu Kobing MD Anaesthesiology, RIMS Imphal.

Dr. Yumnam Arunkumar Singh Associate Professor, Department of Anaesthesiology, RIMS Imphal.

Dr. Andrea Nongsiej Assistant Professor, Department of Anaesthesiology, Shillong Medical College.

Dr. Anellia Dari-I-Ka Massar Post graduate trainee, Department of Anaesthesiology, RIMS Imphal.

ABSTRACT

Background And Aims: Effective postoperative analgesia after laparoscopic cholecystectomy is essential to enhance recovery and reduce opioid-related adverse effects. Ultrasound-guided erector spinae plane block (ESPB) and oblique subcostal transversus abdominis plane block (OSTAPB) are commonly used truncal blocks for upper abdominal surgeries; however, comparative evidence between the two techniques remains limited. This study aimed to compare the analgesic efficacy of ESPB and OSTAPB following laparoscopic cholecystectomy. **Material And Methods:** This prospective, single-blinded, randomized controlled trial included adult patients undergoing elective laparoscopic cholecystectomy under general anesthesia. Patients were randomized to receive either bilateral ultrasound-guided ESPB or bilateral ultrasound-guided OSTAPB using 0.25% levobupivacaine. Postoperative pain was assessed using the numerical rating scale (NRS). Time to first rescue analgesia, total postoperative analgesic consumption within 24 hours, and incidence of postoperative nausea and vomiting (PONV) were recorded. Data were analyzed using appropriate statistical tests. **Results:** Eighty-six patients were analyzed (43 in each group). Demographic variables were comparable between the groups. The time to first rescue analgesia was significantly longer in the ESPB group compared with the OSTAPB group (419.0 ± 89.9 min vs. 288.7 ± 62.1 min; $p < 0.001$). NRS scores were consistently lower in the ESPB group at multiple postoperative time points. Total postoperative analgesic consumption and incidence of PONV were comparable between groups. **Conclusion:** Ultrasound-guided erector spinae plane block provides a longer duration of postoperative analgesia compared with oblique subcostal transversus abdominis plane block following laparoscopic cholecystectomy, with similar analgesic requirements and side-effect profiles.

KEYWORDS

Erector spinae plane block; Oblique subcostal transversus abdominis plane block; Laparoscopic cholecystectomy; Postoperative analgesia; Regional anesthesia

INTRODUCTION

Laparoscopic cholecystectomy is among the most frequently performed minimally invasive abdominal procedures. Despite smaller incisions, patients often experience moderate postoperative pain due to a combination of somatic pain from port-site incisions and visceral pain related to peritoneal irritation and pneumoperitoneum. Inadequately controlled postoperative pain can delay ambulation, impair respiratory function, increase stress response, and prolong hospital stay. Hence, effective postoperative analgesia is a key component of perioperative care following laparoscopic cholecystectomy.

Multimodal analgesia strategies incorporating regional anesthesia techniques have gained popularity because of their opioid-sparing effects and improved recovery profiles. The transversus abdominis plane (TAP) block provides analgesia by blocking the thoracolumbar nerves supplying the anterior abdominal wall. The oblique subcostal approach to the TAP block extends dermatomal coverage to the upper abdomen and has been widely used for analgesia following laparoscopic cholecystectomy.

More recently, the ultrasound-guided erector spinae plane block has emerged as an effective regional analgesic technique for thoracic and abdominal surgeries. Injection of local anesthetic in the fascial plane deep to the erector spinae muscle allows cranio-caudal spread and potential paravertebral extension, thereby providing both somatic and visceral analgesia. Several studies have reported favorable analgesic outcomes with ESPB in abdominal surgeries.

Although both ESPB and OSTAPB are used for postoperative analgesia following laparoscopic cholecystectomy, direct comparisons between these techniques are limited, and available evidence remains inconsistent. Furthermore, data comparing these blocks in the Indian population are scarce. Therefore, this randomized controlled trial was conducted to compare the analgesic efficacy of ultrasound-guided ESPB and OSTAPB in patients undergoing elective laparoscopic cholecystectomy under general anesthesia.

MATERIALS AND METHODS

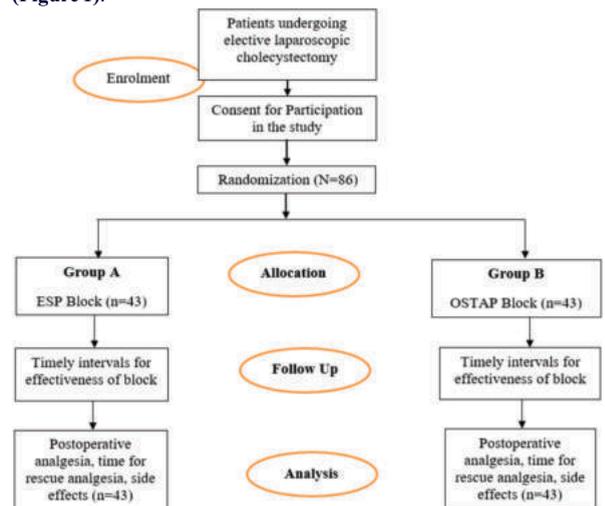
Study Design And Registration

This prospective, single-blinded, randomized controlled trial was conducted in the Department of Anaesthesiology and Critical Care at a tertiary care teaching hospital. The study was prospectively registered with the Clinical Trials Registry of India (CTRI No: [CTRI/2024/07/071473](https://www.clinicaltrials.gov/ct2/show/study?term=CTRI/2024/07/071473)).

Ethical Approval

The study was approved by the Research Ethics Board (REB), Regional Institute of Medical Sciences (RIMS), Imphal (Approval No: A/206/REB-Comm(SP)/RIMS/2015/972/03/2023). Written informed consent was obtained from all participants prior to enrolment.

Patient Enrollment, Randomization, Allocation, Follow-up, And Analysis Are Summarized In The CONSORT Flow Diagram (Figure 1).



Study Population

Adult patients aged 18–65 years, belonging to the American Society of

Anesthesiologists (ASA) physical status I–II, scheduled for elective laparoscopic cholecystectomy under general anesthesia were considered for inclusion. Patients with refusal to participate, allergy to local anesthetics, coagulopathy, infection at the block site, pregnancy, chronic opioid use, or significant cardiopulmonary or neurological disorders were excluded.

Randomization And Blinding

Patients were randomized into two equal groups (ESPB and OSTAPB) using a computer-generated randomization sequence. Allocation concealment was ensured using sealed opaque envelopes. Patients were blinded to group allocation.

Block Technique

After induction of general anesthesia and under strict aseptic precautions, ultrasound-guided bilateral blocks were performed by an experienced anesthesiologist.

- **Group A (ESPB):** Bilateral erector spinae plane block was performed at the T9 vertebral level.
- **Group B (OSTAPB):** Bilateral oblique subcostal transversus abdominis plane block was performed.

Both groups received 20 mL of 0.25% levobupivacaine per side.

Anesthesia and postoperative analgesia

General anesthesia was standardized for all patients. Postoperative analgesia included intravenous paracetamol and intramuscular diclofenac (aqueous), tramadol as per institutional protocol. Rescue analgesia was administered when NRS score exceeded 4.

Outcome Measures

The primary outcome was the time to first rescue analgesia. Secondary outcomes included postoperative NRS scores at predefined intervals (0, 1, 3, 6, 12, 18 and 24 hours)(Figure 2)(Table3), total postoperative analgesic consumption within 24 hours, and incidence of PONV. Postoperative analgesic requirement was analyzed as the proportion of patients requiring rescue analgesia rather than equianalgesic dose conversion due to differing pharmacological profiles of drugs used.

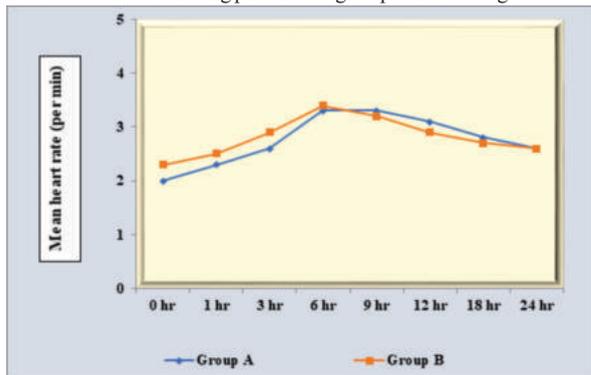


Figure 2. Comparison of mean postoperative Numeric Rating Scale (NRS) pain scores between the ESPB and OSTAPB groups at different postoperative time intervals

Statistical Analysis

Data were analyzed using standard statistical software. Continuous variables were expressed as mean ± standard deviation and categorical variables as numbers and percentages. Intergroup comparisons were performed using Student's *t*-test or Chi-square test as appropriate. A *p*-value <0.05 was considered statistically significant.

RESULTS

A total of 86 patients were enrolled and analyzed, with 43 patients in each group. Demographic characteristics were comparable between the groups (Table 1).

Table 1. Demographic And Baseline Characteristics

Variable	ESPB Group (n = 43)	OSTAPB Group (n = 43)	p-value
Age (years)	44.6 ± 10.7	42.6 ± 11.2	0.395
Sex (M/F)	17 / 26	19 / 24	0.662
Body mass index (kg/m ²)	23.3 (22.1-24.8)	22.5(22.1-23.5)	0.070
ASA physical status II, n (%)	43 (100)	43 (100)	-----
Duration of surgery (min)	52.8 ± 11.2	53.2 ± 10.1	0.864

*Data are presented as mean ± standard deviation or number (percentage). ASA=American Society of Anesthesiologists.

Continuous variables were compared using Student's *t*-test and categorical variables using Chi-square test or Fisher's exact test as appropriate.

Although patients with ASA physical status I–II were eligible, **all enrolled patients belonged to ASA physical status II.**

The time to first rescue analgesia was significantly longer in the ESPB group compared with the OSTAPB group (419.0 ± 89.9 min vs. 288.7 ± 62.1 min; *p* < 0.001). Postoperative NRS scores were lower in the ESPB group at all measured time points (Table 2). However, total postoperative analgesic consumption and incidence of PONV were comparable between the groups (Table 3)

Table 2. Postoperative Pain Scores (Numeric Rating Scale)

Group	Time (hours)								Effect size	p value*	
	N	0	1	3	6	9	12	18			24
Between the groups (mean Numerical Rating Score)											
A	43	2.0	2.3	2.6	3.3	3.3	3.1	2.8	2.6	0.002	0.704
B	43	2.3	2.5	2.9	3.4	3.2	2.9	2.7	2.6		
Within the subjects (mean Numerical Rating Score)											
	N	0	1	3	6	9	12	18	24	Effect size	p value*
	86	2.2	2.4	2.7	3.3	3.2	3.0	2.8	2.6	0.194	<0.001

Table 3. Postoperative Analgesic And Recovery Outcomes

Outcome	ESPB Group (n = 43)	OSTAPB Group (n = 43)	P value
Time to first rescue analgesia (min)	419.0 ± 89.9	288.7 ± 62.1	<0.001
Diclofenac requirement, n (%)	9 (20.9)	16 (37.2)	0.096
Paracetamol requirement, n (%)	5 (11.6)	3 (7.0)	0.713*
Incidence of postoperative nausea and vomiting, n (%)	5	8	0.366

DISCUSSION

This randomized controlled trial demonstrated that ultrasound-guided erector spinae plane block provided a significantly longer duration of postoperative analgesia compared with oblique subcostal transversus abdominis plane block following laparoscopic cholecystectomy. Patients receiving ESPB also had lower postoperative pain scores, while overall analgesic consumption and incidence of PONV were similar between the two groups.

Postoperative pain after laparoscopic cholecystectomy has both somatic and visceral components. While OSTAPB predominantly provides somatic analgesia to the anterior abdominal wall, ESPB may offer broader analgesic coverage through cranio-caudal spread and possible paravertebral diffusion of local anesthetic. This proposed mechanism may explain the prolonged analgesia observed with ESPB in the present study.

The findings of this study are consistent with previous reports demonstrating effective analgesia with ESPB in abdominal surgeries. Although OSTAPB has been shown to provide satisfactory analgesia for laparoscopic cholecystectomy, its limited visceral pain coverage may result in a shorter duration of analgesia. The comparable postoperative analgesic consumption observed in both groups may be attributed to the standardized multimodal analgesia protocol used.

Given its simplicity, favorable safety profile, and prolonged analgesic effect, ESPB may be considered a useful component of multimodal analgesia for laparoscopic cholecystectomy.

Limitations

This study was conducted at a single center, which may limit the generalizability of the results. The spread of local anesthetic was not assessed using imaging techniques, and analgesic outcomes were evaluated only for the first 24 postoperative hours. Larger multicenter studies with longer follow-up are warranted to confirm these findings.

CONCLUSION

Ultrasound-guided erector spinae plane block provides a longer duration of postoperative analgesia compared with oblique subcostal transversus abdominis plane block in patients undergoing

laparoscopic cholecystectomy. Both techniques offer effective analgesia with comparable analgesic requirements and side-effect profiles.

Financial Support And Sponsorship

Nil.

Conflicts Of Interest

There are no conflicts of interest.

REFERENCES:

- Keus F, de Jong JA, Gooszen HG, van Laarhoven CJ. Laparoscopic versus open cholecystectomy for patients with symptomatic cholecystolithiasis. *Cochrane Database Syst Rev*. 2006;(4):CD006231.
- Bisgaard T, Klarskov B, Kristiansen VB, Callesen T, Schulze S, Kehlet H. Multiregional local anesthetic infiltration during laparoscopic cholecystectomy in patients receiving prophylactic multimodal analgesia: A randomized, double-blind, placebo-controlled study. *Anesth Analg*. 1999;89:1017-24.
- Abdelsalam K, Mohamadin OW. Transversus abdominis plane block for perioperative analgesia in upper abdominal surgery: A randomized controlled study. *Saudi J Anaesth*. 2016;10:25-8.
- Wu Y, Liu F, Tang H, Wang Q, Chen L, Wu H, et al. Analgesic efficacy of subcostal transversus abdominis plane block compared with thoracic epidural and intravenous opioid analgesia after radical gastrectomy. *Anesth Analg*. 2013;117:507-13.
- Ekstein P, Szold A, Sagie B, Werbin N, Klausner JM, Weinbroum AA. Laparoscopic surgery may be associated with severe pain and high analgesic requirements in the immediate postoperative period. *Ann Surg*. 2006;243:41-6.
- Elsharkawy H, El-Boghdady K, Barrington M. Quadratus lumborum block: Anatomical concepts, mechanisms, and techniques. *Anesthesiology*. 2019;130:322-35.
- Mitra S, Khandelwal P, Roberts K, Kumar S, Vadivelu N. Pain relief in laparoscopic cholecystectomy: A review of current options. *Pain Pract*. 2012;12:485-96.
- Chin KJ, Adhikary SD, Forero M. Erector spinae plane block: A new paradigm in regional anesthesia and analgesia. *Curr Opin Anaesthesiol*. 2017;30:621-7.
- Kot P, Rodriguez P, Granell M, Cano B, Rovira L, Morales J, et al. The erector spinae plane block: A narrative review. *Korean J Anesthesiol*. 2019;72:209-20.
- Rafi AN. Abdominal field block: A new approach via the lumbar triangle. *Anaesthesia*. 2001;56:1024-6.
- Hebbard P, Fujiwara Y, Shibata Y, Royse C. Ultrasound-guided transversus abdominis plane block. *Anaesth Intensive Care*. 2007;35:616-7.
- Petersen PL, Mathiesen O, Torup H, Dahl JB. The transversus abdominis plane block: A valuable option for postoperative analgesia? *Acta Anaesthesiol Scand*. 2010;54:529-35.
- Forero M, Adhikary SD, Lopez H, Tsui C, Chin KJ. The erector spinae plane block: A novel analgesic technique in thoracic neuropathic pain. *Reg Anesth Pain Med*. 2016;41:621-7.
- Ueshima H, Inagaki M, Toyone T, Otake H. Efficacy of erector spinae plane block for lumbar spinal surgery: A retrospective study. *Asian Spine J*. 2019;13:254-7.
- Tulgar S, Selvi O, Senturk O, Ermis MN, Cubuk R, Ozer Z. Clinical experiences of ultrasound-guided lumbar erector spinae plane block. *J Clin Anesth*. 2018;47:5-6.
- Beh ZY, Lim SM, Lim WL, Sitaram PN. Erector spinae plane block as analgesic adjunct for traumatic rib fractures in ICU. *Indian J Anaesth*. 2020;64:1086-9.
- Jiang M, Peri V, Ou Yang B, Chang J, Hacking D. Erector spinae plane block for acute rib fractures: A scoping review. *Local Reg Anesth*. 2023;16:81-90.
- Altıparmak B, Korkmaz Toker M, Uysal AI, Kuşçu Y, Demirbilek SG. Ultrasound-guided erector spinae plane block versus oblique subcostal transversus abdominis plane block for laparoscopic cholecystectomy. *J Clin Anesth*. 2019;57:31-6.
- Routray SS, Mohanty R, Pradhan K, Pani S. Evaluation of erector spinae plane block and oblique subcostal TAP block in laparoscopic cholecystectomy. *Panacea J Med Sci*. 2020;10:128-34.
- Engineer SR, Devanand A, Kulkarni M. Comparative study of ultrasound-guided erector spinae block and oblique subcostal TAP block. *Ain-Shams J Anesthesiol*. 2022;14:84.
- Ozdemir H, Araz C, Karaca O, Turk E. Comparison of ESPB and subcostal TAP block for postoperative analgesia after laparoscopic cholecystectomy. *J Invest Surg*. 2022;35:870-7.
- Sahu L, Sanjaya B, Ganesh CS, Shlok S, Subhadra P, Rajendra KS. Comparison of analgesic efficacy of ESPB and OSTAP block. *J Clin Diagn Res*. 2021;15:UC09-13.
- Peng K, Ji FH, Liu HY, Wu SR. Ultrasound-guided TAP block for analgesia in laparoscopic cholecystectomy: A systematic review and meta-analysis. *Med Princ Pract*. 2016;25:237-46.
- Liheng L, Siyuan C, Zhen C, Changxue W. ESPB versus TAP block for abdominal surgery: A systematic review and meta-analysis. *J Invest Surg*. 2022;35:1711-22.
- Zewdu D, Tantu T, Eanga S, Tilahun T. ESPB versus TAP block for laparoscopic cholecystectomy: A systematic review and meta-analysis. *Front Med (Lausanne)*. 2024;11:1399253.
- Tulgar S, Kapakli MS, Kose HC, Senturk O, Serifsoy TE, et al. ESPB versus OSTAP block in laparoscopic cholecystectomy. *Anesth Essays Res*. 2019;13:50-6.
- Ibrahim M. Erector spinae plane block in laparoscopic cholecystectomy: A randomized controlled trial. *Anesth Essays Res*. 2020;14:119-26.
- Breazu CM, Ciobanu L, Hadade A, Bartos A, Mitre C, Mircea PA, et al. Efficacy of OSTAP block in laparoscopic cholecystectomy. *Rom J Anaesth Intensive Care*. 2016;23:12-8.
- Yang X, Zhang Y, Chen Y, Xu M, Lei X, Fu Q. Analgesic effect of ESPB in laparoscopic cholecystectomy: A meta-analysis. *BMC Anesthesiol*. 2023;23:7.
- Shaffer EA. Gallstone disease: Epidemiology. *Best Pract Res Clin Gastroenterol*. 2006;20:981-96.