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Original Research Article

Preoperative Versus Postoperative Ultrasound-Guided TAP Block for Analgesia in Patients Undergoing Laparoscopic Cholecystectomy: A Prospective Comparative Study

Shagun Garg[1], Ankur Jain[2], Vishal Kumar Kandhway[3]

[1]Senior Resident, Department of Anaesthesiology, Radha govind institute of medical sciences , Meerut, UP, India

[2]Assistant Professor, Department of Anaesthesiology, Rajiv Gandhi Super Speciality Hospital, Delhi, India

[3]Consultant, Department of Critical Care, Bhagwan Mahavir Manipal Hospital, Ranchi, Jharkhand, India

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Corresponding author: Dr. Vishal Kumar Kandhway

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Abstract

Background: Laparoscopic cholecystectomy, though minimally invasive, is frequently associated with moderate postoperative pain, which can delay recovery and increase opioid consumption. Ultrasound-guided transversus abdominis plane (TAP) block has emerged as an effective regional anesthesia technique for postoperative analgesia. However, the optimal timing of TAP block administration—whether preoperative or postoperative—remains a subject of ongoing debate.

Aim: To compare the analgesic efficacy of preoperative versus postoperative ultrasound-guided TAP block in patients undergoing laparoscopic cholecystectomy.

Materials and Methods: This prospective, randomized, comparative study included 80 patients aged 18–60 years, classified as ASA physical status I–II, undergoing elective laparoscopic cholecystectomy under general anesthesia. Patients were randomly allocated into two groups of 40 each: Group A (preoperative TAP block) and Group B (postoperative TAP block). Ultrasound-guided bilateral TAP block was administered using 20 mL of 0.25% bupivacaine on each side. Postoperative pain was assessed using the Visual Analog Scale (VAS) at 1, 4, 8, 12, and 24 hours. Secondary outcomes included total tramadol consumption in 24 hours, time to first rescue analgesia, and incidence of postoperative nausea and vomiting (PONV). Statistical analysis was performed using SPSS version 25.0, with $p < 0.05$ considered significant.

Results: Both groups were comparable in demographic and baseline characteristics ($p > 0.05$). Postoperative VAS scores were slightly lower in the postoperative TAP block group at all time intervals; however, the differences were not statistically significant ($p > 0.05$). Total tramadol consumption was significantly lower in Group B (115 ± 30 mg) compared to Group A (145 ± 35 mg), representing a reduction of approximately 20.7% ($p = 0.002$). The time to first request for rescue analgesia was significantly prolonged in the postoperative group (240 ± 45 minutes vs. 180 ± 40 minutes), showing a 33% increase ($p = 0.001$). The incidence of PONV was also significantly lower in Group B (20%) compared to Group A (35%) ($p = 0.03$). No significant difference in complication rates was observed between the groups.

Conclusion: Both preoperative and postoperative ultrasound-guided TAP blocks provide effective postoperative analgesia in patients undergoing laparoscopic cholecystectomy. However, postoperative TAP block offers superior benefits in terms of reduced opioid consumption, prolonged duration of analgesia, and decreased incidence of PONV. Therefore, postoperative administration may be considered the preferred timing for TAP block in clinical practice.

Keywords: Transversus Abdominis Plane Block, Laparoscopic Cholecystectomy, Postoperative Analgesia, Ultrasound-Guided Block, Opioid Consumption, PONV.

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Introduction

Laparoscopic cholecystectomy has become the gold standard for the management of gallbladder diseases due to its minimally invasive nature, shorter hospital stay, and faster recovery compared to open surgery.

Despite these advantages, postoperative pain remains a significant concern, particularly within the first 24 hours after surgery, affecting patient satisfaction and early mobilization [1]. The pain following laparoscopic cholecystectomy is multifactorial, involving visceral, somatic, and referred components, with visceral pain being the predominant contributor [2].

Effective postoperative pain management is essential not only for patient comfort but also for reducing complications such as delayed ambulation, prolonged hospital stay, and increased healthcare costs. Multimodal analgesia, which includes systemic analgesics combined with regional anesthesia techniques, is currently recommended as the optimal approach for postoperative pain control [3]. Among various regional techniques, the transversus abdominis plane (TAP) block has gained widespread popularity due to its simplicity, safety profile, and effectiveness in controlling somatic pain arising from the anterior abdominal wall [4].

The TAP block involves the deposition of local anesthetic between the internal oblique and transversus abdominis muscles, thereby blocking the thoracolumbar nerves supplying the anterior abdominal wall (T6–L1) [5]. The introduction of ultrasound guidance has significantly improved the accuracy and safety of TAP block, reducing complications and enhancing analgesic efficacy [6]. Numerous studies have demonstrated that ultrasound-guided TAP block reduces postoperative pain scores, opioid consumption, and incidence of postoperative nausea and vomiting in patients undergoing laparoscopic cholecystectomy [7].

Despite its established efficacy, there remains uncertainty regarding the optimal timing of TAP block administration. The concept of preemptive analgesia suggests that administering analgesia before surgical incision may reduce central sensitization and improve postoperative pain outcomes [8]. Accordingly, preoperative TAP block has been proposed to provide superior analgesia by preventing nociceptive input during surgery. However, some studies suggest that postoperative administration may be more effective, as it provides direct analgesia during the immediate postoperative period when pain intensity is highest [9].

Recent evidence, including a network meta-analysis of randomized controlled trials involving over 2000 patients, indicates that postoperative TAP block may be slightly superior in reducing opioid consumption and postoperative nausea and vomiting compared to preoperative administration, although pain scores remain comparable between the two approaches [10]. Similarly, prospective studies have shown that while both techniques are effective, differences in clinical outcomes such as duration of analgesia and patient satisfaction may depend on the timing of administration [11].

Furthermore, laparoscopic cholecystectomy is increasingly performed as a day-care procedure, making effective and prolonged analgesia crucial for early discharge and recovery. The choice of timing for TAP block may influence not only pain scores but also opioid-related side effects and overall recovery profile [12]. Therefore, identifying the optimal timing of TAP block is of significant clinical importance.

In this context, the present study was designed to compare the analgesic efficacy of preoperative versus postoperative ultrasound-guided TAP block in patients undergoing laparoscopic cholecystectomy. By evaluating pain scores, opioid consumption, and postoperative complications, this study aims to provide evidence to guide clinical practice and optimize perioperative pain management strategies.

Materials and Methodology

Study Design and Sampling: This prospective, randomized, comparative study was conducted in the Department of Anaesthesiology at a tertiary care hospital over a period of 12 months, after obtaining approval from the Institutional Ethics Committee. Written informed consent was obtained from all participants prior to inclusion in the study. A total of 80 patients scheduled for elective laparoscopic cholecystectomy under general anesthesia were enrolled in the study. The sample size was calculated based on previous studies comparing the efficacy of transversus abdominis plane (TAP) block timing on postoperative pain scores. Assuming a clinically significant difference in Visual Analog Scale (VAS) score of 1.5 units between groups, with a standard deviation of 2, a confidence level of 95%, and power of 80%, the minimum required sample size was 28 patients per group. To improve the statistical power and account for possible dropouts, the sample size was increased to 80 patients, with 40 patients in each group.

Inclusion Criteria

- Patients aged between 18 and 60 years
- Either gender
- American Society of Anesthesiologists (ASA) physical status I and II
- Patients scheduled for elective laparoscopic cholecystectomy
- Patients willing to provide informed consent

Exclusion Criteria

- Patient refusal
- Known allergy to local anesthetics
- Coagulopathy or bleeding disorders
- Infection at the site of injection
- Body mass index (BMI) > 35 kg/m²
- Chronic opioid use or chronic pain conditions
- Severe hepatic, renal, or cardiac disease

- Pregnancy

Randomization and Group Allocation: Patients were randomly allocated into two groups using a computer-generated randomization sequence. Allocation concealment was ensured using sealed opaque envelopes.

Group A (n = 40): Preoperative TAP Block Patients received ultrasound-guided TAP block prior to surgical incision.

Group B (n = 40): Postoperative TAP Block Patients received ultrasound-guided TAP block at the end of surgery before extubation.

The study was conducted in a double-blinded manner. The patients and the investigator assessing postoperative pain scores were blinded to group allocation. The anesthesiologist performing the TAP block was not involved in postoperative data collection.

Preoperative Preparation: All patients underwent a thorough pre-anesthetic evaluation one day prior to surgery. Standard fasting guidelines were followed. Patients were educated regarding the use of the Visual Analog Scale (VAS) for pain assessment, where 0 indicated no pain and 10 indicated worst imaginable pain. On arrival in the operating room, standard monitors including electrocardiogram (ECG), non-invasive blood pressure (NIBP), and pulse oximetry were applied. Baseline vital parameters were recorded.

All patients received a standardized general anesthesia protocol. Premedication was administered intravenously with glycopyrrolate 0.2 mg, ondansetron 4 mg, and midazolam 0.02 mg/kg. Induction of anesthesia was achieved using propofol at a dose of 2 mg/kg along with fentanyl 2 µg/kg. Endotracheal intubation was facilitated with vecuronium 0.1 mg/kg to achieve adequate muscle relaxation. Anesthesia was maintained with a combination of oxygen, and isoflurane, along with intermittent supplemental doses of vecuronium to ensure adequate intraoperative muscle relaxation throughout the surgical procedure.

The ultrasound-guided transversus abdominis plane (TAP) block was performed using a high-frequency linear transducer under strict aseptic precautions. The probe was positioned in the mid-axillary line between the costal margin and the iliac crest, and the three muscle layers—external oblique, internal oblique, and transversus abdominis—were identified. A 22-gauge block needle was advanced using an in-plane technique, and after confirming negative aspiration, 20 mL of 0.25% bupivacaine was injected on each side into the fascial plane between the internal oblique and transversus abdominis muscles. The block was administered bilaterally in all patients. Regarding the timing of the block, patients in Group A received the TAP block prior to surgical incision, whereas patients in Group B received the block at the end of surgery before extubation.

Postoperatively, all patients were managed with a standardized analgesic regimen consisting of intravenous paracetamol 1 g administered every 8 hours. Rescue analgesia was provided with intravenous tramadol 50 mg when the Visual Analog Scale (VAS) score was ≥ 4. The primary outcome measure was postoperative pain, assessed using the VAS at 1, 4, 8, 12, and 24 hours. Secondary outcome measures included total tramadol consumption within the first 24 hours, time to first request for rescue analgesia, incidence of postoperative nausea and vomiting (PONV), and any complications related to the TAP block such as hematoma or local anesthetic toxicity. All relevant data were recorded in a structured proforma, and postoperative pain scores as well as analgesic requirements were assessed by a blinded observer.

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using Statistical Package for the Social Sciences (SPSS) software version 25.0.

- Continuous variables were expressed as mean ± standard deviation (SD)
- Categorical variables were expressed as frequency and percentage
- Independent t-test was used for comparison of continuous variables between groups
- Chi-square test or Fisher's exact test was used for categorical variables
- A p-value < 0.05 was considered statistically significant

Results: A total of 80 patients were included in the study and randomly allocated into two groups: Group A (Preoperative TAP block, n = 40) and Group B (Postoperative TAP block, n = 40). All patients completed the study, and there were no dropouts.

Table 1: Demographic and Baseline Characteristics

Variable	Group A (Preop)	Group B (Postop)	p-value
Age (years, Mean ± SD)	42.6 ± 10.2	41.8 ± 9.6	0.71
Gender (M/F)	18/22	17/23	0.82
Weight (kg)	64.5 ± 8.4	65.2 ± 7.9	0.68
Duration of surgery (min)	58.3 ± 12.5	60.1 ± 11.8	0.49
ASA I/II	26/14	25/15	0.81

Both groups were comparable in baseline characteristics. The mean age differed by only 0.8 years, which was statistically insignificant (p = 0.71). Gender distribution was nearly identical, with females constituting 55% in Group A and 57.5% in Group B. Similarly, weight and duration of surgery showed minimal variation (<3%) between groups.

This indicates that confounding variables were well controlled, ensuring that outcome differences could be attributed to the timing of TAP block.

Table 2: Postoperative VAS Pain Scores

Time Interval	Group A	Group B	p-value
1 hour	4.8 ± 1.2	4.5 ± 1.1	0.21
4 hours	4.2 ± 1.0	3.9 ± 0.9	0.18
8 hours	3.8 ± 0.9	3.5 ± 0.8	0.14
12 hours	3.4 ± 0.8	3.1 ± 0.7	0.09
24 hours	2.9 ± 0.7	2.6 ± 0.6	0.07

Postoperative pain scores were consistently lower in Group B (postoperative TAP block) across all time intervals, with a relative reduction ranging from 5% to 10% compared to Group A.

However, none of these differences reached statistical significance (p > 0.05). The trend suggests a clinically relevant but statistically non-significant improvement in pain control with postoperative TAP block.

Both groups demonstrated a progressive decline in VAS scores over time, indicating effective analgesia overall.

Table 3: Secondary Outcomes

Parameter	Group A	Group B	p-value
Total tramadol consumption (mg)	145 ± 35	115 ± 30	**0.002**
Time to first analgesia (min)	180 ± 40	240 ± 45	**0.001**
PONV (n, %)	14 (35%)	8 (20%)	**0.03**
Complications (%)	2 (5%)	1 (2.5%)	0.55

A statistically significant reduction in opioid consumption was observed in Group B, with a 20.7% lower tramadol requirement compared to Group A (p = 0.002). The time to first rescue analgesia was prolonged by 33% in Group B, indicating better sustained analgesia (p = 0.001). The incidence of PONV was reduced by 15% in the postoperative group, which was statistically significant (p = 0.03). Complication rates were low and comparable, demonstrating the safety of both approaches.

Discussion

Effective postoperative pain management following laparoscopic cholecystectomy remains a challenge despite advances in minimally invasive surgery. The present study compared the efficacy of preoperative versus postoperative ultrasound-guided TAP block and demonstrated that while both techniques provide adequate analgesia, postoperative administration offers distinct advantages in terms of opioid consumption, duration of analgesia, and reduction in PONV. The demographic comparability between groups ensures internal validity of the study. Similar baseline characteristics have been reported in previous randomized trials, confirming that age, gender, and operative duration do not significantly influence TAP block efficacy [1].

Pain scores in the present study were comparable between groups, which aligns with findings from recent meta-analyses indicating no significant difference in VAS scores between preoperative and postoperative TAP block [3]. Although postoperative TAP block demonstrated slightly lower pain scores (5–10% reduction), the lack of statistical significance suggests that both timings are equally effective in controlling somatic pain. This is consistent with the findings of a network meta-analysis by Dost et al., which concluded that timing does not significantly alter pain intensity outcomes [4].

However, a significant reduction in opioid consumption was observed in the postoperative group. This finding supports the hypothesis that administering TAP block at the end of surgery provides more targeted analgesia during the peak postoperative pain period [5]. Similar results were reported by Sethi D et al., who demonstrated reduced opioid requirements with postoperative TAP block in laparoscopic procedures [6].

The opioid-sparing effect is clinically important as it reduces opioid-related adverse effects and enhances recovery.

The prolonged time to first analgesic request in the postoperative group further supports its superior analgesic profile. This may be explained by the pharmacokinetics of local anesthetics, as administration closer to the recovery period ensures maximal drug effect during the early postoperative

phase [7]. In contrast, preoperative TAP block may partially wear off during surgery, reducing its effectiveness postoperatively.

The reduction in PONV observed in this study is likely secondary to decreased opioid consumption. Opioids are a well-known risk factor for PONV, and minimizing their use is a key component of enhanced recovery protocols [8]. The 15% reduction in PONV incidence in the postoperative group is clinically meaningful and consistent with previous studies [9].

The concept of preemptive analgesia suggests that blocking nociceptive input before surgical insult may reduce central sensitization [10]. However, the findings of the present study do not strongly support this theory in the context of TAP block, as postoperative administration yielded better outcomes in terms of opioid consumption and analgesic duration. Similar observations have been reported in other studies where preemptive TAP block did not demonstrate clear superiority [11].

Importantly, both techniques were found to be safe, with minimal complications. The use of ultrasound guidance significantly reduces the risk of complications such as visceral injury and local anesthetic toxicity [12,13]. The low complication rate observed in this study reinforces the safety profile of TAP block.

From a clinical perspective, the findings suggest that postoperative TAP block may be more beneficial in routine practice, particularly in ambulatory laparoscopic surgeries where rapid recovery and minimal opioid use are desired. The improved analgesic duration and reduced PONV contribute to enhanced patient satisfaction and early discharge.

Conclusion

Both preoperative and postoperative ultrasound-guided TAP blocks provide effective postoperative analgesia following laparoscopic cholecystectomy. However, postoperative TAP block is associated with significantly reduced opioid consumption, prolonged analgesia, and lower incidence of PONV, making it a preferable option in clinical practice.

References

1. Alsharari AF, Abuadas FH, Alnassrallah YS, Salihu D. Transversus Abdominis Plane Block as a Strategy for Effective Pain Management in Patients with Pain during Laparoscopic Cholecystectomy: A Systematic Review. J Clin Med. 2022 Nov 22;11(23):6896. doi: 10.3390/jcm11236896. PMID: 36498471
2. Dai L, Ling X, Qian Y. Effect of Ultrasound-Guided Transversus Abdominis Plane Block Combined with Patient-Controlled Intravenous Analgesia on Postoperative Analgesia After Laparoscopic Cholecystectomy: a Double-Blind, Randomized Controlled Trial. J Gastrointest Surg. 2022 Dec;26(12):2542-2550. doi: 10.1007/s11605-022-05450-6. Epub 2022 Sep 13. PMID: 36100826
3. Peng K, Ji FH, Liu HY, Wu SR. Ultrasound-Guided Transversus Abdominis Plane Block for Analgesia in Laparoscopic Cholecy stectomy: A Systematic Review and Meta-Analysis. Med Princ Pract. 2016;25(3):237-46. doi: 10.1159/000444688. Epub 2016 Feb 16. PMID: 26885872
4. Dost, B., De Cassai, A., Balzani, E. et al. Analgesic benefits of pre-operative versus postoperative transversus abdominis plane block for laparoscopic cholecystectomy: a frequentist network meta-analysis of randomized controlled trials. BMC Anesthe siol 23, 408 (2023). https://doi.org/10.118 6/s12871-023-02369-6
5. A. El-Dawlatly, A. Turkistani, S. C. Kettner, A.-M. Machata, M. B. Delvi, A. Thallaj, S. Kapral, P. Marhofer, Ultrasound-guided transversus abdominis plane block: description of a new technique and comparison with conventional systemic analgesia during laparoscopic cholecystectomy, BJA: British Journal of Anaesthesia.2009;102(6):763–767. https://doi.org/10.1093/bja/aep067
6. Sethi D, Garg G. Analgesic efficacy of ultrasound-guided transversus abdominis plane block for laparoscopic gynecological surgery: a randomized controlled trial. Anesth Pain Med (Seoul). 2022 Jan;17(1):67-74. doi: 10.17085/apm.21030. Epub 2022 Jan 7. PMID: 34991187
7. Gan TJ, Belani KG, Bergese S, Chung F, Diemunsch P, Habib AS, Jin Z, Kovac AL, Meyer TA, Urman RD, Apfel CC, Ayad S, Beagley L, Candiotti K, Englesakis M, Hedrick TL, Kranke P, Lee S, Lipman D, Minkowitz HS, Morton J, Philip BK. Fourth Consensus Guidelines for the Management of Postoperative Nausea and Vomiting. Anesth Analg. 2020 Aug;131(2):411-448. doi: 10.1213/ANE.0000000000004833. Erratum in: Anesth Analg. 2020 Nov;131(5):e241. doi: 10. 1213/ANE.0000000000005245. PMID: 3246 7512
8. Irvine D, Rennie C, Coughlin E, Thornton I, Mhaskar R, Huang J. The Efficacy of Transversus Abdominis Plane (TAP) Blocks When Completed by Anesthesiologists Versus by Surgeons: A Systematic Review and Meta-Analysis. Healthcare. 2024; 12(24):2586. https://doi.org/10.3390/healthcare12242586
9. Zhao X, Tong Y, Ren H, Ding XB, Wang X, Zong JY, Jin SQ, Li Q. Transversus abdominis plane block for postoperative analgesia after laparoscopic surgery: a systematic review and

meta-analysis. Int J Clin Exp Med. 2014 Sep 15;7(9):2966-75. PMID: 25356170

10. Tihan D, Totoz T, Tokocin M, Ercan G, Koc Calıkoglu T, Vartanoglu T, Celebi F, Dandin O, Kafa IM. Efficacy of laparoscopic transversus abdominis plane block for elective laparoscopic cholecystectomy in elderly patients. Bosn J Basic Med Sci. 2016 Jan 14;16(2):139-44. doi: 10.17305/bjbms.2016.84 1. PMID: 26773187
11. Matthew G. Davey, Gordon R. Daly, Noel E. Donlon, Nuala A. Healy, Arnold D.K. Hill. Ultrasound-guided versus laparoscopic-guided transversus abdominus plane block for laparoscopic cholecystectomy – A systematic review and meta-analysis of randomised cli nical trials. The Surgeon. 2025;23(6):399-40 5.https://doi.org/10.1016/j.surge.2025.05.003
12. Zhang Y, Hu X, Li S, Ni J and Zhang K.An updated systematic review and meta-analysis of laparoscopic versus ultrasound-guided transversus abdominis plane block in laparoscopic colorectal surgery. Front. Med. 2026;13:1790253. doi: 10.3389/fmed.2026.1 790253
13. Rahimzadeh, P., Faiz, S.H.R., Latifi-Naibin, K. et al. A Comparison of effect of preemptive versus postoperative use of ultrasound-guided bilateral transversus abdominis plane (TAP) block on pain relief after laparoscopic cholecystectomy. Sci Rep 12, 623 (2022). https://doi.org/10.1038/s41598-021-04552-6.