# Postoperative Analgesia in Laparoscopic Cholecystectomy: A Comparison of Posterior and Subcostal TAP Block Approaches

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## Abstract

**Objective:** To compare the efficacy of subcostal transversus abdominis plane block with posterior transversus abdominis plane block for postoperative analgesia in patients undergoing laparoscopic cholecystectomy.

**Material and Methods:** This randomized control trial was performed in the Department of Anaesthesia of King Edward Medical University, Lahore. After approval from the Institutional Review Board and obtaining consent from the patients, the patients meeting the set criteria were randomly divided into two groups, namely S and P. After surgery, an ultrasound-guided subcostal TAP block was performed in group S, and a posterior TAP block was performed in group P. The severity of pain was assessed using Visual Analogue Score (VAS) at time 0 and then every 2 hours for 12 hours from each patient in the postoperative period

**Results:** Both subcostal and posterior TAP blocks controlled the postoperative pain. The efficacy of both techniques was comparable in the initial hours post-operatively; however, at four hours and onwards, the postoperative pain scores were significantly lower in patients of Group S as compared to those in Group P.

**Conclusion:** Subcostal TAP block is more effective than posterior TAP block for post-procedural pain relief in patients after laparoscopic cholecystectomy.


**Keywords:** Laparoscopic Cholecystectomy, TAP block, Subcostal TAP block, Posterior TAP block, VAS score, Post-operative analgesia.

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## Introduction

Laparoscopic cholecystectomy (LC) is a commonly performed procedure for the removal of the gallbladder. It has many advantages, including faster recovery and shorter stay at the hospital compared to an open cholecystectomy. Despite being a minimally invasive procedure, it is not uncommon for patients to experience postoperative pain after laparoscopic cholecystectomy, particularly in the first 24 hours.[1,2] Adequate analgesia after laparoscopic cholecystectomy is of paramount importance because most of the laparoscopic procedures are done as day-care surgeries.

Regional anesthesia in the form of an epidural has been used for a very long time for adequate pain relief after LC to reduce opioid consumption. Recently, some other regional blocks have been introduced to manage postoperative pain. One such technique used efficiently for most abdominal surgeries is the transversus abdominis plane (TAP) block. First

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described by Rafi, the block is performed by injecting local anaesthetic in the plane between the internal oblique and transversus abdominis muscles to obtund the nerve supply of the anterolateral abdominal wall.[3,4] This block has been used successfully for post-operative analgesia thereby reducing the amount of opioids required and, their undesirable effects, such as sedation, nausea, and vomiting.[5]

Over a period of time, the conventional blind technique of TAP blocks is gradually being replaced by ultrasound-guided techniques. With ultrasound guidance, the block can be done in a more targeted manner since the plane of injection can be precisely located, thereby minimizing the risk of poor pain relief.[6] Also, it minimizes the complications that come with blind techniques. Regional anesthesia through ultrasound, mainly in the setting of laparoscopy, has been established as the gold standard because of its ease of use, safety, and efficacy. Various approaches for TAP block administration have been defined. These include oblique subcostal, subcostal, upper subcostal, posterior, and lateral approaches. In the posterior approach, the TAP block is administered using the classical landmark of the Petit Triangle. It can be reached by placing an ultrasound probe on the iliac crest in the midaxillary line. The other approach is the subcostal TAP (S-TAP) block, introduced by Hebbard which can be performed by placing an ultrasound probe immediately below the costal margin. Subcostal TAP blocks have provided efficient pain relief in surgeries involving supra-umbilical incisions.[6-8] Dual TAP block helps to alleviate pain in both supra-umbilical and the infra-umbilical regions like post-operative pain in patients undergoing extensive procedures like laparotomies.[9] Dual TAP block is comprised of two separate blocks: subcostal TAP block and lateral/posterior TAP block. This technique was first described by Borglum et al who originally described it as the four-point technique Later on, Niraj and colleagues named it the "four-quadrant" TAP block approach.[10] The continuous TAP block technique involves the insertion of a catheter through the needle using any of the above-mentioned approaches. After the first dose, additional boluses of local anaesthetic can be given as required, or a continuous infusion of local anaesthetic can be given using infusion pumps; thus, achieving prolonged analgesia with a lesser requirement of systemic analgesics.[11]

McDonnell et al. demonstrated that ultrasound-guided TAP block was effective in work done on 16 laparotomies with a midline incision and stated that the application significantly reduced opioids compared to patients without regional blocks.[8] Although studies have been conducted on different TAP blocks separately, the literature comparing the efficacy of two techniques, posterior and subcostal, is scant. By comparing the two TAP blocks, we will find out which TAP block is superior in terms of pain control in patients after laparoscopic cholecystectomy. It will help us to keep the patients pain-free for longer period, less use of analgesic drugs, and early mobilization and discharge of patients.

## Material and Methods

After approval from the institutional review board (IRB) and hospital ethics committee (No. 516/RC/KEMU; dated 29-07/2020), this randomized controlled trial was carried out in the Department of Anesthesia, in the operation theatres of general surgery, at King Edward Medical University, Lahore. A sample size of 66 patients was estimated by using a 5% level of significance,90% power of test with expected mean value of pain score of posterior TAP Group P 3.0±2.6 and subcostal TAP Group S 1.4±1.8(6). Patients aged 25-60 years, belonging to ASA class I and II who were scheduled to undergo laparoscopic cholecystectomy were included in the study. Patients having allergies to local anesthetics, uncontrolled hypertension, ischemic heart disease, uncontrolled diabetes, epilepsy, bleeding diathesis, chronic liver disease, or chronic kidney disease were excluded from the study. Each patient was briefed about the procedure and informed consent was taken.

Patients were randomly split into two groups (Groups S and P) using the lottery method. After securing the intravenous line and attaching the cardiac monitor

Injection Nalbuphine 0.1mg/kg and Injection Dexamethasone were administered to every patient. Injection Propofol 2 mg/kg and Atracurium 0.5 mg/kg were used to induce general anesthesia. The patient was ventilated for three minutes with Isoflurane (1-1.5 MAC). After 3 minutes, the patient was intubated, endotracheal tube (ETT) was fixed and confirmed by auscultating the chest. General anesthesia was maintained on IPPV (intermittent positive pressure ventilation) with oxygen and isoflurane and boluses of Atracurium 0.1mg/kg. At the completion of the operation, a TAP block was performed; a Subcostal TAP block was performed for Group S and a posterior TAP block for Group P. Using a 5% povidine iodine solution and sterile drapes, the skin of the abdomen was prepared for the blocks. Ultrasound (Honda HS-2600) with linear ultrasonic probe with a high frequency (5-15 MHz) was put on the front of the abdomen wall just below the costal margins for a subcostal block. The Transversus abdominis muscle was recognized as being behind the rectus muscle. While keeping the needle in the same plane as the ultrasound beam, a 23-gauge (G) spinal needle was entered from an anterior medial position to an inferolateral position, and adjacent to the edge of the costal margin. After that, 30ml of 0.125% Bupivacaine was injected into the plane between the rectus and transversus abdominis muscles of the abdominal region on each side. To locate the external oblique, internal oblique, and transversus abdominis muscles for a posterior TAP block, an ultrasound probe was positioned transversely along the anterolateral abdominal wall in the midaxillary line, between the iliac crest and subcostal border. Inserting a 23-gauge spinal needle anteriorly in the ultrasound beam's field of view, aiming it at the neural plane, 30ml of Bupivacaine 0.125 percent infiltrated on each side. After a TAP block, any remaining neuromuscular blockage was reversed using 0.05mg/kg of Injection Neostigmine. The ETT was taken out as soon as patients opened their eyes and began to breathe. Before being transferred to a care unit, the patient was kept in anesthesia recovery ward (PACU). 12 hours of VAS (0-10) pain scores were recorded from each patient every two hours in the resting state. Patients with 0-4 VAS were considered to have mild pain, from 5-7 as moderate pain and 8-10 as severe pain. Patients in both groups were given Nalbuphine 1–2 mg as rescue analgesia if their VAS score was above 4.

Data was entered and analyzed using the statistical package for social sciences (SPSS26). Quantitative variables like pain score and age were presented as mean ± standard deviation. Qualitative variables like gender and, histories of hypertension and diabetes mellitus were presented as frequency and percentages. In our study, a comparison of mean VAS pain scores in both groups (subcostal and posterior) was done by applying repeated measure ANOVA. Chi-square test was applied to compare the frequencies. p-value≤0.05 was considered significant

## Results

Both groups were comparable in terms of their demographic data and histories as shown in **Table-1**. Pain was well controlled in the post-operative period in both groups. The efficacy of both techniques was comparable up to 4 hours (p = 0.3 and 0.1). After that, the subcostal TAP block showed superior efficacy than the posterior approach in controlling post-operative pain at rest in patients with LC with a p-value < 0.05 as shown in **Table 2**.

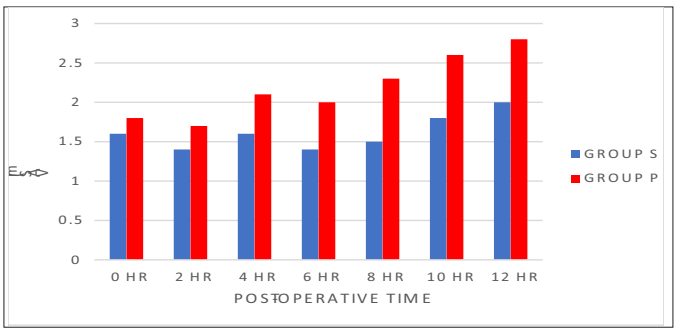
**Table 1:** *Comparison of demographic data and clinical parameters*

| VARIABLES | GROUP S (subcostal TAP Block) N=33 | GROUP P (Posterior TAP Block) N= 33 | P VALUE |
|---|---|---|---|
| Age in years (mean ± SD) | 42 ± 8.5 | 46 ± 10.1 | 0.08 |
| Gender | M= 36.36% (12) | M= 18.18% (6) | 0.09 |
| | F= 63.63%. (21) | F= 81.81% (27) | 0.09 |
| HTN (controlled) | 30.3% (10) | 24.2% (8) | 0.5 |
| Diabetes Mellitus (controlled) | 15.1% (5) | 21.2 % (7) | 0.5 |

**Figure-1:** *Graphical representation of comparison of postoperative pain scores of study groups*

**Table 2:** *Comparison of post-operative pain scores at rest*

| Time Interval | Group S (Subcoastal Tap Block) | Group P (Posterior Tap Block) | P value |
|---|---|---|---|
| VAS score 0 hour (Mean ± SD) | 1.6 ± 0.8 | 1.8 ± 1 | 0.373 |
| VAS score 2 hours | 1.4 ± 0.7 | 1.7 ± 1.1 | 0.192 |
| VAS score 4 hours | 1.6 ± 0.7 | 2.1 ± 1.2 | 0.044 |
| VAS score 6 hours | 1.4 ± 0.9 | 2.0 ± 1.4 | 0.043 |
| VAS score 8 hours | 1.5 ± 1.0 | 2.3 ± 2.0 | 0.045 |
| VAS score 10 hours | 1.8 ± 1.3 | 2.6 ± 1.8 | 0.043 |
| VAS score 12 hours | 2.0 ± 1.3 | 2.8 ± 1.5 | 0.024 |




## Discussion

Laparoscopic cholecystectomy (LC) has become a common procedure for the removal of diseased gall bladder and is being increasingly performed as a daycare surgery.[12] However, it is often associated with pain, particularly in the first twenty-four hours[13,14] and administration of opioids for pain relief brings along unwanted symptoms like nausea and vomiting that hamper the discharge of the patients on the day of surgery.[15] Therefore, effective pain management is very crucial in the recovery and discharge of the patients. In our study, we tried to keep the patients pain-free by infiltrating them with TAP blocks and rescue analgesia in case the VAS score was equal to or exceeded 4.

Takeli recruited a total of 515 patients in their study and their results showed that post-operative VAS pain scores till 6 hours of surgery and the need for rescue analgesia were significantly lower in patients who received TAP block in Petit triangle as compared to patients who received intravenous analgesics.[16] In contrast, the patients in our study remained effectively pain-controlled till 12 hours post-operatively.

Tolchard et al also concluded in their study that subcostal TAP block provides better analgesia, and reduces post-operative opioid requirement after LC, thereby effectively reducing the time to discharge.[17]

Weheba et al also showed in their study the efficacy of subcostal TAP block for effective analgesia and reduction in the opioid requirement in the first twenty-four hours of LC.[18]

Results of a study done by Vrsajkov et al revealed significantly reduced postoperative pain scores in patients getting S-TAP block compared to intravenous analgesia with injectionTramadol in the postoperative period.[19]

In contrast, the results of the study conducted by Adame-Coronel et al showed no difference in the pain score of patients receiving S-TAP block compared to those receiving ketorolac intravenously. However, the use of rescue analgesia in the S-TAP group was lower as compared to the control group ($p = 0.035$).[20]

Suseela compared the TAP block with port-site infiltration of local anesthetic. They concluded that bilateral subcostal TAP block provides statistically significant better postoperative analgesia as compared to port-site infiltration in patients undergoing LC.[21]

Various techniques for the administration of TAP block are known. However, there seems to be very little evidence comparing the efficacy of one technique over the other.[14] So, considering the paucity of data, we conducted this study and our results showed that both posterior and subcostal approaches are equally effective in pain control during the first four hours of LC. However, after four hours, the subcostal approach showed significantly better pain control as compared to the posterior approach ($p \leq 0.05$). It is possible that a subcostal TAP block, as opposed to a posterior approach, is more effective in relieving the pain that patients experience after surgery by blocking the nerves in the supra-umbilical region where the port incisions are made.[22]

The results of our study were comparable with the one conducted by Bhatia et al. Their results also showed the superiority of the subcostal approach over the posterior approach for effective pain control after LC both at rest and with movement after four hours of surgery.[23] However, they used 15 ml of 0.375% Ropivacain in contrast to our study in which we had used 30 ml of inj Bupivacain 0.125% on each side.

We found another study conducted by Khan et al in

which they compared the efficacy of S-TAP with P-TAP block. Their results showed that S-TAP was statistically superior to P-TAP block even at 2nd post-operative hour as compared to the fourth hour postoperatively in our study. However, this significance was seen only at rest while the two groups did not show any statistically significant difference in the pain control upon movement. Moreover, they had used 20 ml of 0.375% bupivacaine on each side in contrast to 30 ml of 0.125% bupivacaine used in our study.[24]

The limitation of our study is that we did not compare the pain scores between the two groups on movement. Also, we did not compare the total need of rescue analgesia needed by patients in each group.

## Conclusion

We can conclude that the subcostal approach of ultrasound-guided TAP block is superior to the posterior approach for effective pain control after laparoscopic cholecystectomy.

**Conflict of Interest:** *None*

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## Authors Contribution

**RI, LRB, MZ, SK:** Conceptualization of Project
**RI, LRB, MZ, SK:** Data Collection
**MA, AA:** Literature Search
**RI, LRB, MZ, SK:** Statistical Analysis
**RI, LRB, MZ, SK**: Drafting, Revision
**MA, AA:** Writing of Manuscript