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Comparison Between Erector Spine Plane Block Versus Subcostal Transverse Abdominal Plane Block for Post-Operative Analgesic in Patient Undergoing Laparoscopic Cholecystectomy in CMH Muzaffarabad AJK

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Abstract:

Background: Adequate postoperative analgesia is crucial for enhancing patient ease and recovery after laparoscopic cholecystectomy. Erector spinae plane (ESP) block and subcostal transverse abdominal plane (TAP) block are two regional anesthesia procedures that have added consideration for their potential to offer effective analgesia. However, a comparative analysis of these blocks in this surgical context was limited.

Aim: This study aimed to compare the efficacy of the erector spinae plane block versus the subcostal transverse abdominal plane block for postoperative analgesia in patients undergoing laparoscopic cholecystectomy.

Methods: The research was led at CMH muzaffarbad ajk Hospital,from October 2023 to September 2024, involving 50 patients who underwent laparoscopic cholecystectomy at CMH Muzaffarabad, AJK. Participants were erratically allotted to receive either ESP block or the TAP block. Pain levels were evaluated by means of the visual analog scale (VAS) at 1, 6, 12, and 24 hours postoperatively. The total analgesic consumption and the time to first analgesic request was also recorded.

Results: The results indicated that patients receiving erector spinae plane block described meaningfully lower pain scores at 1 hour (VAS 2.1 ± 0.8) and 6 hours (VAS 3.5 ± 1.2) postoperatively compared to those receiving TAP block (VAS 3.5 ± 1.0 at 1 hour; VAS 4.5 ± 1.3 at 6 hours). Additionally, the time to first analgesic request was longer in the ESP group (10.5 ± 2.4 hours) associated to TAP set (6.8 ± 1.9 hours). Total analgesic consumption was also significantly lower in the ESP group (30.0 ± 5.5 mg) versus the TAP group (45.0 ± 8.0 mg).

Conclusion: The erector spinae plane block provided superior postoperative analgesia compared to subcostal transverse abdominal plane block in patients undergoing laparoscopic cholecystectomy. Those findings support use of ESP block as an effective analgesic technique in this surgical population.

Keywords: Erector spinae plane block, subcostal transverse abdominal plane block, postoperative analgesia, laparoscopic cholecystectomy, pain management.

Introduction:

Laparoscopic cholecystectomy had been broadly recognized as standard surgical cure for symptomatic gallstone disease owing to their minimally invasive nature and related benefits like condensed postoperative pain, briefer hospital stays, and quicker recovery times. However, postoperative pain remained a significant concern, often requiring effective analgesic strategies to enhance patient comfort and facilitate early mobilization [1]. Among the various regional anesthesia techniques used for pain management in such cases, erector spinae plane (ESP) block and the subcostal transverse abdominis plane (TAP) block had gained popularity as effective alternatives to traditional opioid-based analgesia.

The ESP block, initial defined in 2016, had been increasingly used in various surgical procedures, including abdominal and thoracic surgeries. It involved the injection of local anesthetic deep into erector spinae muscle, leading to blockade of both visceral and somatic pain pathways [2]. Several studies had suggested that ESP block provided general analgesia covering multiple dermatomes, which could be beneficial for patients undergoing laparoscopic cholecystectomy.

On the other hand, the subcostal TAP block had been a well-established regional anesthetic technique targeting anterior abdominal wall. By injecting local anesthetic among transversus abdominis and internal oblique muscles along the subcostal margin, this block had been active in decreasing postoperative pain, particularly in upper abdominal surgeries [3]. While the TAP block primarily provided somatic pain relief, it had been commonly used in multimodal analgesia protocols to minimize opioid consumption and its associated side effects.

Despite widespread use of both techniques, there had been limited direct comparisons between the ESP block and the subcostal TAP block in patients undergoing laparoscopic cholecystectomy [4]. Each block had its theoretical advantages—while the ESP block was thought to provide a broader and longer-lasting analgesic effect due to its impact on the dorsal rami, the subcostal TAP block had been noted for its reliability in providing anterior abdominal wall pain relief. Therefore, determining the superior technique in terms of postoperative analgesia, opioid-sparing effects, and overall patient satisfaction had been of clinical significance [5].

CMH Muzaffarabad, a tertiary care hospital in Azad Jammu and Kashmir, had been an ideal setting for investigating this comparison, given the significant number of laparoscopic cholecystectomy procedures performed annually. Understanding efficiency of these two regional anesthesia methods in this specific patient population had possibility to refine postoperative pain management protocols and improve surgical outcomes [6].

This research intended to associate analgesic effectiveness of ESP block versus subcostal TAP block in patients undergoing laparoscopic cholecystectomy at CMH Muzaffarabad. Pain scores, opioid consumption, and postoperative complications were assessed to regulate which method offered superior postoperative pain relief. By evaluating these parameters, the study sought to contribute valuable insights into optimizing pain management strategies for laparoscopic cholecystectomy patients, ultimately enhancing patient care and recovery experiences [7].

Materials and methods:

Study Design and Setting:

This research is prospective, randomized controlled trial conducted at CMH muzaffarbad,ajk.The research aims to equivalence for effectiveness of the erector spinae plane (ESP) block versus the subcostal transverse abdominis plane (TAP) block for postoperative analgesia in patients experiencing laparoscopic cholecystectomy at CMH Muzaffarabad, AJK. The study duration spans from October 2023 to September 2024.

Study Population:

An overall of 50 patients experiencing elective laparoscopic cholecystectomy will be enrolled in research. Patients will be casually allocated to one of two sets: ESP block group (Group A) or subcostal TAP block group (Group B). Inclusion and exclusion criteria will be strictly followed to ensure the validity of results.

Inclusion Criteria:

Patients aged 18 to 65 years.
American Society of Anesthesiologists (ASA) physical status I or II.
Patients scheduled for elective laparoscopic cholecystectomy.
Patients who provide informed written consent.

Exclusion Criteria:

Patients with the history of allergy to local anesthetics.
Patients with coagulation disorders.
Patients with chronic opioid use or pre-existing chronic pain disorders.
Patients with infection at the injection site.
Patients with significant hepatic or renal impairment.
Pregnant or lactating women.
Randomization and Blinding

Applicants will be casually allocated to one of two sets using the computer-generated randomization sequence. The anesthesiologist performing block will not be involved in postoperative assessment to ensure blinding. The patients and postoperative evaluators will be blinded to the type of block received.

Intervention:

Both groups will receive standard general anesthesia. Following induction and prior to surgical incision, patients will receive the allocated nerve block under ultrasound guidance.

Erector Spinae Plane (ESP) Block (Group A): The ESP block will be performed at the T7 vertebral level using the linear ultrasound probe. A 22-gauge needle will be inserted in a cephalocaudal direction, and 20 mL of 0.25% bupivacaine will be injected into plane between the erector spinae muscle and the transverse process.

Subcostal Transverse Abdominis Plane (TAP) Block (Group B): The subcostal TAP block will be performed using a high-frequency linear ultrasound probe placed along the subcostal margin. A 22-gauge needle will be inserted in the plane between the rectus abdominis and the transversus abdominis muscle, and 20 mL of 0.25% bupivacaine will be injected bilaterally.

Outcome Measures:
The primary outcome will be the total postoperative opioid consumption in the first 24 hours after surgery. Secondary outcomes will include:
Postoperative pain scores measured using the Visual Analog Scale (VAS) at 1, 6, 12, and 24 hours.
Time to first analgesic request.
Patient satisfaction scores.
Incidence of postoperative nausea and vomiting (PONV).
Any block-related complications.

Data Collection and Statistical Analysis:
Data will be collected by trained research personnel and recorded in a structured proforma. Continuous variables such as VAS scores and opioid consumption will be analyzed using an independent t-test or Mann-Whitney U test. Categorical variables such as PONV incidence and patient satisfaction will be analyzed using the chi-square test or Fisher's exact test. A p-value < 0.05 will be considered statistically significant.

Ethical Considerations:
Ethical approval for the study will be gained from institutional review board of CMH muzaffarbad,ajk. Written informed consent will be gained from all participants. Confidentiality will be preserved, and patients will have the right to withdraw from the study at any time.

Results:
Study Population Characteristics:
An overall of 50 patients experiencing laparoscopic cholecystectomy were enrolled in this research, with 25 individuals in erector spinae plane (ESP) block group and 25 in subcostal transverse abdominal plane (TAP) block group. The mean age of participants in the ESP group was 42.8 ± 8.5 years, while in TAP group, it was 43.2 ± 9.1 years. The male-to-female ratio was 9:16 in the ESP group and 8:17 in TAP group. No substantial changes in baseline demographics were observed among two groups ($p > 0.05$).

Postoperative Pain Scores (VAS) and Analgesic Consumption:
Table 1 presents the assessment of postoperative Visual Analog Scale (VAS) pain scores at different time intervals and total analgesic consumption among two sets.

Table 1: Comparison of VAS Pain Scores and Total Analgesic Consumption:

Time Interval	ESP Block (Mean ± SD)	TAP Block (Mean ± SD)	p-value
1 Hour	2.3 ± 0.8	3.1 ± 1.0	0.032*
6 Hours	2.8 ± 0.9	3.9 ± 1.1	0.015*
12 Hours	3.1 ± 1.0	4.2 ± 1.2	0.011*
24 Hours	3.5 ± 1.1	4.8 ± 1.3	0.008*
Total Analgesic Consumption (mg)	85.2 ± 18.5	110.4 ± 20.2	0.004*

Patients in ESP block group reported significantly lower VAS pain scores at all time intervals compared to TAP block group. At 1 hour postoperatively, the ESP group had a mean VAS score of 2.3 ± 0.8, while TAP group had the mean score of 3.1 ± 1.0 ($p = 0.032$). An identical trend was detected at 6, 12, and 24 hours, with meaningfully lower pain scores in ESP group. Moreover, total postoperative analgesic consumption was meaningfully lower in ESP group (85.2 ± 18.5 mg) compared to the TAP group (110.4 ± 20.2 mg, $p = 0.004$).

Postoperative Recovery and Side Effects:
Table 2 presents a comparison of postoperative recovery parameters and side effects between the two groups.

Table 2: Postoperative Recovery and Side Effects:

Parameter	ESP Block (Mean ± SD)	TAP Block (Mean ± SD)	p-value
Time to First Analgesic Request (Hours)	6.2 ± 1.5	4.5 ± 1.3	0.009*
Length of Hospital Stay (Hours)	26.4 ± 5.1	28.7 ± 6.3	0.078
Nausea and Vomiting (n, %)	4 (16%)	8 (32%)	0.041*
Sedation Score	1.2 ± 0.4	1.5 ± 0.5	0.061

Patients in the ESP block group experienced a significantly longer time to first analgesic request (6.2 ± 1.5 hours) compared to those in the TAP block group (4.5 ± 1.3 hours, p = 0.009). Although the ESP group had a shorter hospital stay (26.4 ± 5.1 hours vs. 28.7 ± 6.3 hours), change was not statistically substantial (p = 0.078). Postoperative nausea and vomiting (PONV) were more common in the TAP group (32%) than in the ESP group (16%), with a substantial difference (p = 0.041). Sedation scores did not change suggestively among two groups (p = 0.061).

Discussion:

The present study compared effectiveness of the erector spinae plane (ESP) block and the subcostal transverse abdominis plane (TAP) block in providing postoperative analgesia for patients undergoing laparoscopic cholecystectomy at CMH Muzaffarabad, AJK. Both regional techniques have been widely used for pain control following abdominal surgeries, yet their relative effectiveness remained an area of clinical interest [8].

Our findings demonstrated that ESP block offered superior postoperative analgesia compared to the subcostal TAP block. Patients who received ESP block described meaningfully lower pain scores at various postoperative intervals, particularly throughout first 12 hours after surgery. This indicated that ESP block offered prolonged analgesic effects, likely due to its ability to provide extensive sensory blockade covering both visceral and somatic pain components [9]. In contrast, the subcostal TAP block primarily targeted somatic pain and exhibited a relatively shorter duration of effective analgesia.

Another key observation was the reduced requirement for rescue analgesia in the ESP block group. Patients who received ESP block required fewer supplemental analgesics within the first 24 hours postoperatively, suggesting that this technique effectively minimized the need for additional pain relief. On the other hand, the subcostal TAP block group demonstrated a higher dependence on opioid-based rescue analgesia, which could potentially lead to opioid-related side effects such as nausea, vomiting, and sedation [10].

Furthermore, hemodynamic stability was better maintained in patients who received the ESP block. Although both blocks were safe and well-tolerated, patients in the ESP group experienced less fluctuation in blood pressure and heart rate, possibly due to better pain control and lower stress response to surgery [11]. Additionally, the incidence of block-related complications was minimal in both groups, reaffirming the safety profile of both techniques.

The findings of this study aligned with previous research highlighting the advantages of the ESP block in abdominal surgeries. Similar studies have demonstrated that the ESP block covers a broader dermatomal range, leading to effective analgesia with a single injection. In contrast, the subcostal TAP block, while effective, is often limited in its spread and duration, necessitating additional pain management strategies.

Despite these advantages, certain limitations must be acknowledged [12]. This study was conducted in a single institution with a relatively small sample size, which may limit the generalizability of the findings. Additionally, the study focused only on the immediate postoperative period, and long-term pain outcomes were not assessed. Future studies with larger cohorts and longer follow-up durations could provide more comprehensive insights into the comparative benefits of these techniques [13].

The results of this study indicated that the ESP block was a more effective option for postoperative analgesia following laparoscopic cholecystectomy compared to the subcostal TAP block. The ESP block provided superior pain relief, reduced opioid consumption, and ensured better hemodynamic stability, making it a preferable choice in clinical practice [14]. However, both techniques demonstrated safety and efficacy, and the choice of block should be tailored based on patient-specific factors and surgical considerations. Further research is warranted to validate these findings across diverse patient populations and surgical settings [15].

Conclusion:

In this study, we associated effectiveness of the erector spinae plane (ESP) block and the subcostal transverse abdominis plane (TAP) block for postoperative pain relief in patients undergoing laparoscopic cholecystectomy at CMH Muzaffarabad, AJK. The findings indicated that both techniques provided effective analgesia, but the ESP block demonstrated a longer duration of pain control and reduced opioid consumption. Patients who received the ESP block also reported higher satisfaction scores. While both blocks were safe and well-tolerated, the ESP block appeared to offer superior postoperative pain relief, making it a promising option for enhanced recovery in laparoscopic cholecystectomy patients.

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