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COMPARISON OF EFFECTIVENESS OF PRE-EMPTIVE AND POST-OPERATIVE TAP BLOCK FOR POST-OPERATIVE ANALGESIA IN PATIENTS UNDERGOING CHOLECYSTECTOMY

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ABSTRACT

Objective: To compare the post-operative analgesic efficacy of pre-emptive versus post-operative administered TAP block in patients undergoing cholecystectomy.
Study Design and Duration of Study: Randomized controlled trial. Department of Anesthesia, Fauji Foundation Hospital, Rawalpindi, from Dec-2025 to Feb-2026.
Method: A total of 80 patients aged 18–60 years scheduled for elective laparoscopic cholecystectomy were included and randomly allocated to two equal groups (n=40 each). Patients in Group pre-em received TAP block before the surgical incision, just after the induction of general anesthesia, while patients in Group post-op received this block after completion of surgery just before extubation. Assessment of the post-operative pain was done using the Visual Analog Scale (VAS). The primary outcome was set as the time to require first rescue analgesia and the number of rescue analgesia doses (IV Diclofenac sodium 75 mg) administered within the first 24 hours (when VAS $\geq$4). Secondary outcomes included the pain scores at 6 and 12 hours post-operatively. These outcomes were compared by applying independent t-test considering $p \leq 0.05$ as significant.
Results: The results of primary outcomes showed that the time to first rescue analgesia was longer (5.95±0.75 hours vs 4.88±1.51 hours; $p<0.001$) and the number of rescue analgesia doses was lower in Group post-op compared to Group pre-em (2.13±0.72 vs 2.83±0.90; $p<0.001$). Similarly, the pain scores were significantly lower at 6 hours and 12 hours in Group post-op than Group pre-em (4.18±1.55 vs 5.35±1.17; $p<0.001$ and 3.08±1.19 vs 3.73±0.93; $p=0.01$, respectively).
Conclusion: Post-operative block is more effective than the pre-emptive TAP block in providing postoperative analgesia in patients undergoing laparoscopic cholecystectomy.

KEYWORDS: Analgesia, Cholecystectomy, Postoperative Pain, Transversus Abdominis Plane Block.

1.INTRODUCTION

Postoperative pain (POP) management has a major role in early recovery, patient satisfaction and overall success of a surgical procedure. Laparoscopic cholecystectomy (LC) is replacing the conventional open cholecystectomy due to its minimally invasive nature, shorter hospital stay, and faster recovery.[1] Despite reduced trauma to the abdominal tissues, POP remains a significant clinical concern after LC and may increase analgesic consumption, limit ambulation and cause prolonged hospitalization in inadequately managed cases.[1,2]

POP following LC is multifactorial, comprising visceral, somatic, and referred shoulder pain components. Visceral pain arises mainly from peritoneal irritation and gallbladder bed manipulation and is found to be the primary source of discomfort after surgery. Whereas somatic or parietal pain is less severe due to the small abdominal incisions resulting in minimal damage to the abdominal wall; however, addressing this pain is a crucial part of a multimodal analgesic approach. Effective POP management therefore improves respiratory function, reduces stress responses, and facilitates early patient ambulation.[3,4]

The use of opioids and non-steroidal anti-inflammatory drugs (NSAIDs) has traditionally been the mainstay in POP management. The efficacy of opioids is, however associated with adverse effects including respiratory depression, postoperative nausea and vomiting (PONV), ileus and sedation. This complicates determining a suitable dosage and maintenance of a consistent therapeutic concentration. The problem has directed the attention of anesthesiologists towards regional anesthesia techniques that minimize opioid requirements while providing the adequate analgesia.[5,6]

Various techniques like port site infiltration and fascial plane blocks have been utilized to enhance the efficacy of pain control after LC. The efficacy of Transversus abdominis plane (TAP) block for POP management has been reported across various surgical procedures.[7] By targeting the sensory nerves of the anterior abdominal wall located between the internal oblique and transversus abdominis muscles, TAP block is able to provide somatic analgesia without significant motor blockade for abdominal surgeries. With ultrasound (US) guidance, the safety and accuracy of this technique are further improved making it a widely used modality in cases of LC.[8,9]

With this wide acceptability of TAP blocks, timing of administration remains a topic of consideration. TAP block, when given pre-emptively (pre-em) may help to prevent central sensitization and reduces the somatic POP intensity by blocking nociceptive input before surgical incision. On the other hand, post-operative (post-op) administration may provide prolonged analgesic coverage and help in managing peak POP intensity in the post-op phase. There is conflicting evidence regarding the exact timing of TAP block to find the optimal post-op analgesic efficacy after LC.[10]

This study was therefore designed to compare the analgesic efficacy of pre-em and post-op US guided TAP block in patients undergoing LC. The findings of this study will add to the evidence regarding this ongoing debate and will help the anesthesiologists to adopt the procedures well-tailored to our patient population and improve the patient outcomes.

2.METHODOLOGY

2.1 Design of the Study

This randomized controlled trial was conducted at the Department of Anesthesia, Fauji Foundation Hospital, Rawalpindi, from 5th Nov 2025 to 13 May-2026 over a period of 3 months. The approval of conducting the study was taken from the ethical review board of the hospital.

2.2 Sample

Sample size was calculated using WHO calculator. Time to FRA in pre-emptive group was taken as 2.22±1.2 hours, while this was 5.80±2.68 hours in post-op group.11 By taking alpha =5% (two-sided) and power=90%, the estimated sample size was 16, (8 patients in each group), however, to increase the precision, we included 80 patients in this study (40 in each group). A total of 80 patients aged between 18 and 60 years, belonging to American Society of Anesthesiologists (ASA) status I or II and scheduled for elective LC were included in this study using consecutive sampling. Patients were then randomly allocated to two equal groups, Group pre-em or Group post-op (40 patients each) using a computer-generated randomization.

2.3 Exclusion Criteria

The exclusion criteria consisted of patients with a history of chronic opioid use, having body mass index (BMI)> 35 kg/m² or those suffering from coagulopathy. Patients requiring emergency LC were also excluded.

2.4 Procedure

A written informed consent was taken from each patient at the time of enrollment. All the related demographical details and clinical characteristics were taken and recorded for each patient. Standardized protocols and monitoring were followed for performing general anesthesia (GA) in all patients including ECG, non-invasive blood pressure (BP), pulse oximetry, and capnography. All the surgical procedures were performed by experienced LC surgeons. The fascial plane between internal oblique and transversus abdominis muscles was identified under the guidance of US (using a high frequency linear probe) and local anesthetic was deposited by employing an in-plane technique while ensuring aseptic conditions. In Group pre-em, US guided TAP block was performed after induction of GA but before the surgical incision, while in Group post-op, the TAP block was administered after completion of surgical procedure but prior to extubation.

POP was assessed by using the Visual Analog Scale (VAS) ranging from 0-10 (0= no pain, while 10= worst pain).

Time to FRA was calculated from completion of surgery to the time when FRA was administered (when pain score at VAS was ≥4). Diclofenac sodium 75 mg given intravenously (IV) was used as the rescue analgesia when VAS score reached 4 or higher.

The mean pain score was assessed at post-op 6 and 12 hours.

The primary outcome was set as the time to FRA and the number of rescue analgesia doses required during first 24 hours after surgery, while the POP scores assessed at 6 and 12 hours were set as secondary outcomes.

Data were analyzed using SPSS version 26. Quantitative variables were expressed as mean ± standard deviation (SD), while qualitative variables were presented as frequencies and percentages. Normality of data was assessed using the Shapiro–Wilk test. Comparison of continuous variables between the two groups was done by applying Independent t-test, whereas Chi-square test was used for categorical variables keeping a p-value ≤0.05 as statistically significant.

3. Results

The mean age of patients was 46.86±6.28 years (ranging from 35 to 56 Years). Number of females was higher (60%) than the males (40%) in overall study population. The group wise demographic details and clinical characteristics are shown in Table.1

Table 1: Demographic details and clinical characteristics n= 80

Demographic details and clinical characteristics		Group Pre-em (n=40)	Group Post-op (n=40)
Age (Mean± SD) years		46.25±6.61	47.48±5.97
Gender	Male n (%)	15 (37.5)	17 (42.5)
	Female n (%)	25 (62.5)	23 (57.5)
ASA	I n (%)	23 (57.5)	20 (50)
	II n (%)	17 (42.5)	20 (50)
BMI (Mean± SD) Kg/m^2		27.60±3.69	27.10±3.80
Duration of surgery (Mean± SD) minutes		49.88±5.51	49.08±5.03

Table 1 presents that the mean age was comparable between the pre-emptive and post-operative groups (46.25 ± 6.61 vs 47.48 ± 5.97 years), with similar BMI values (27.60 ± 3.69 vs 27.10 ± 3.80 kg/m²). Male participants were 37.5% and 42.5%, while females were 62.5% and 57.5% in the respective groups. ASA-I patients were 57.5% vs 50%, and the mean duration of surgery was also similar (49.88 ± 5.51 vs 49.08 ± 5.03 minutes).

Table 2: Comparison of analgesic efficacy between the two groups n= 80

Primary outcomes			
Study variables	Group Pre-em (n=40)	Group Post-op (n=40)	p-value
Time to FRA* (Mean± SD) hours	4.88±1.51	5.95±0.75	< 0.001
Number of rescue analgesia doses (Mean± SD)	2.83±0.90	2.13±0.72	< 0.001
Secondary outcomes			
Pain score at 6 hours (Mean± SD)	5.35±1.17	4.18±1.55	< 0.001
Pain score at 12 hours (Mean± SD)	3.73±0.93	3.08±1.19	0.01

First rescue analgesia*

Table 2 shows results of the primary outcomes which demonstrated that Group post-op has significantly longer time required for the FRA (p< 0.001) and lower number of rescue analgesia doses during the first 24 hours, compared to the Group pre-em (p< 0.001). Similarly, the secondary outcomes showed lesser pain scores at 6 and 12 hours (p< 0.001 and p=0.01, respectively) in Group post-op compared to Group pre-em.

4. DISCUSSION

The results of primary outcomes of our study showed that the time to FRA was significantly longer and the number of rescue analgesia doses was significantly lower in Group post-op compared to Group pre-em (5.95±0.75 hours vs 4.88±1.51 hours p<0.001 and 2.13±0.72 vs 2.83±0.90; p<0.001, respectively). Similarly, lower POP scores at 6 hours and 12 hours were observed in Group post-op compared to Group pre-em (4.18±1.55 vs 5.35±1.17; p<0.001 and 3.08±1.19 vs 3.73±0.93; p=0.01). These findings demonstrated that administration of TAP block in the post-op period provides superior analgesic outcomes compared with pre-emptive administration. The impact of TAP block timing on post-op analgesia following LC has been explored in some previous studies, where consistent clinical evidence has favored the post-op approach.

Rohit S et al., in their randomized controlled study compared these two TAP blocks timings in LC and reported a significantly reduced POP scores at 6 (3.05 ± 1.15 vs 6.6±0.49; p<0.001) and 12 hours (3.2±1.01 vs 3.8± 0.40;p<0.001), with reduced 24-hour analgesic requirements (p<0.001). While pre-em TAP block better attenuated intraoperative hemodynamic responses, the overall superiority of post-op TAP block was well established.12 Rahimzadeh P et al. compared pre-em and post-op US-guided TAP block for the management of POP after LC. The results showed a longer time to FRA (5.80±2.68 hours vs 2.22±1.2 hours) and fewer rescue analgesic doses in the post-op group compared with the pre-em group. Similarly, the post-op group showed significantly reduced pain scores at rest and during coughing, particularly at 8 and 12 hours (p≤0.05), higher patient satisfaction and reduced incidence of PONV.[11]

Similar findings have been shared in a recently published study by Palijo MK et al. while comparing the pre-em and post-op TAP block after LC. Post-op block demonstrated significantly lower POP scores at 8 and 12 hours, and therefore prolonged time to FRA compared with the pre-em approach (678.10±34.17 vs 408.36±52.03; p< 0.001). The technique also demonstrated better safety profile with reduced PONV leading to higher patient satisfaction.[13]

Evidence supporting the post-op administration is not only limited to cholecystectomy but also observed in other abdominal procedures. Kalu R et al. retrospectively compared post-op 0.25% bupivacaine TAP block with pre-em approach in colorectal surgery. Post-op TAP block significantly reduced the post-op analgesic requirement (p=0.012) during hospital stay and opioid use recommendations at the time of hospital discharge (6.4% vs. 16.9%, p<0.01). The overall opioid use was also reduced with this approach (32.0 vs. 84.5 mg, p=0.047).[14] Wei M et al. compared pre-em and post-op TAP blocks for analgesia in women undergoing laparoscopic gynecological procedures. Among 120 patients included in this study, overall analgesic outcomes were comparable between groups; however, in surgeries that lasted >180 minutes, post-op TAP block resulted in lower pain scores, reduced analgesic consumption, and greater patient satisfaction proving the superiority of post-op administration in prolonged procedures.[15]

The above evidence was further strengthened in a meta-analysis by Dost B et al., including 34 RCTs (2317 patients), where post-op TAP block significantly reduced 24-hour opioid consumption compared to pre-em approach after LC procedures (p<0.001). POP scores were comparable between groups; however, a lower incidence of PONV was reported in post-op

administration. The analysis mentioned an overall superiority in favor of post-op timings of administration.[16]
The sustained peripheral nociceptive blockade during the peak inflammatory phase following tissue injury may be the reason of this superior analgesia observed with post-op TAP block approach; whereas pre-em blockade may be diminished before the maximal post-op nociceptive input actually occurs.
There are, however, some contrasting findings in some studies where pre-em strategies may offer partial advantages over post-op practices.
The meta-analysis by Xuan C et al. exclusively worked on evaluating the efficacy of pre-em analgesia regimens for POP control. This analysis including 188 studies reported that pre-em approach showed significant improvement in all POP outcomes including reduced pain scores (up to −21.99 points), opioid consumption (up to −2.27 mg morphine equivalents), delayed rescue analgesia by up to 7.35 hours, and decreased PONV incidence (OR 0.22–0.59).[17]
Liu M et al. worked on a meta-analysis of eight RCTs (630 patients) to evaluate the efficacy of TAP block after abdominal surgery, in preventing chronic pain over long term in the postsurgical period. This analysis also reported reduced pain scores at 3, 6, and 12 month follow ups. Subgroup analysis suggested greater benefit when block was administered pre-em administration, while post-op TAP block did not show comparable effects.[18]
Findings of our study and the studies discussed above highlight that the optimization of the timing of regional anesthesia block administration may help in better understanding of POP management after LC and serves as an important part of multimodal analgesic approach. The available evidence; however, support the post-op timing of TAP block for optimization of early post-op analgesic effects following LC.
This was a single center study, and the follow-up period was limited to the early post-op phase. Future studies with long-term pain outcomes may add to these useful data related to the better management of POP after LC.

5 CONCLUSION

Our results demonstrate the importance of the timing of TAP block in providing the post-op analgesic efficacy following LC. Administration of this block after completion of surgery appears to provide more effective pain relief and reduces post-op analgesic requirements compared to the pre-em approach. Therefore, post-op administration may facilitate smoother recovery and enhance patient comfort in our local hospital settings.

Disclaimer:
No.
Conflict of interest:
No.

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