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Original Research Article

USG Guided Transverse Plain Abdominal Block Vs Standard Analgesics for Post-Operative Pain Relief Following Abdominal Surgeries

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Abstract

Background: Effective postoperative pain management is essential for early recovery following lower abdominal surgeries. Ultrasound-guided transversus abdominis plane (TAP) block has emerged as an effective regional analgesic technique that may reduce postoperative pain and systemic analgesic requirements.

Objectives: To compare the analgesic efficacy of ultrasound-guided TAP block with conventional systemic analgesics for postoperative pain relief following lower abdominal surgeries.

Methods: This prospective comparative study included 60 patients undergoing elective or emergency lower abdominal surgeries under spinal or general anaesthesia. Patients were allocated into two groups: Group T (n=30) received an ultrasound-guided TAP block, while Group C (n=30) received conventional postoperative analgesia. Postoperative pain scores (VAS), time to first rescue analgesia, rescue analgesic consumption, adverse effects, patient satisfaction, ambulation time, and hospital stay were compared.

Results: Baseline demographic and perioperative characteristics were comparable between the groups. Group T demonstrated significantly lower postoperative VAS scores at all assessment intervals ($p<0.001$), longer time to first rescue analgesia (8.6 ± 2.4 vs. 3.9 ± 1.5 hours; $p<0.001$), and significantly lower diclofenac and tramadol consumption during the first 24 hours ($p<0.001$). Patients receiving TAP block also reported higher satisfaction, earlier ambulation, shorter hospital stay, and fewer postoperative adverse effects.

Conclusion: Ultrasound-guided TAP block provided superior postoperative analgesia, reduced rescue analgesic requirements, improved recovery, and enhanced patient satisfaction compared with conventional systemic analgesia. It is a safe and effective component of multimodal analgesia for lower abdominal surgeries.

Keywords: Transversus Abdominis Plane Block; Ultrasound-Guided TAP Block; Postoperative Pain; Regional Anaesthesia; Lower Abdominal Surgery; Multimodal Analgesia.

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Introduction

Postoperative pain remains a major challenge following abdominal surgery despite advances in surgical techniques, anaesthesia, and perioperative care. Effective pain control is essential for early mobilization, improved respiratory function, reduced postoperative complications, enhanced patient satisfaction, and shorter hospital stay [1].

However, inadequate analgesia may impair deep breathing and coughing, delay ambulation, prolong recovery, and increase the risk of chronic postsurgical pain. Consequently, optimal postoperative analgesia has become a cornerstone of Enhanced Recovery After Surgery (ERAS) protocols [2].Pain after abdominal surgery comprises both somatic pain arising from skin, muscle, and fascial incisions and visceral pain caused by peritoneal irritation and manipulation of intra-abdominal organs [3]. Conventional postoperative pain management relies mainly on systemic analgesics, including opioids, non-steroidal anti-inflammatory drugs (NSAIDs), and paracetamol. Although opioids provide effective analgesia, they are associated with adverse effects such as nausea, vomiting, sedation, pruritus, urinary retention, ileus, and respiratory depression.

Similarly, NSAIDs may increase the risk of gastrointestinal bleeding, renal dysfunction, and platelet inhibition. These limitations have promoted the adoption of multimodal analgesic strategies that combine systemic medications with regional anaesthetic techniques to improve pain relief while minimizing drug-related adverse effects

[2].Ultrasound-guided regional anaesthetic techniques have become an important component of multimodal analgesia because they enable accurate deposition of local anaesthetic, improve block success, and reduce complications through real-time visualization of anatomical structures [4,5]. Among these, the ultrasound-guided transversus abdominis plane (TAP) block is widely used for postoperative analgesia after abdominal surgery. The TAP block involves injection of local anaesthetic into the fascial plane between the internal oblique and transversus abdominis muscles, blocking the thoracolumbar nerves (T6–L1) supplying the anterolateral abdominal wall and providing effective somatic analgesia [6,7].

Several randomized controlled trials and systematic reviews have demonstrated that ultrasound-guided TAP block significantly reduces postoperative pain scores, prolongs the duration of analgesia, decreases opioid and rescue analgesic requirements, and improves patient satisfaction following various abdominal procedures, including laparoscopic cholecystectomy, appendicectomy, colorectal, gynaecological, urological, and hernia surgeries, as well as caesarean delivery [9,10].

However, postoperative pain management in many centres still depends predominantly on systemic analgesics or local wound infiltration. Comparative studies suggest that TAP block offers superior analgesia and opioid-sparing benefits compared with conventional analgesic techniques in selected abdominal surgeries [11,12]. In view of the increasing emphasis on opioid-sparing analgesia and ERAS pathways, identifying effective regional analgesic techniques is of considerable clinical importance. Therefore, the present study was undertaken to compare ultrasound-guided transversus abdominis plane block with standard systemic analgesics for postoperative pain relief following abdominal surgeries.

Materials and Methods

The present study was conducted as a prospective comparative study to evaluate the efficacy of ultrasound-guided transversus abdominis plane (TAP) block versus conventional systemic analgesics for postoperative pain relief following lower abdominal surgeries.

The study was conducted in the Department of Anaesthesiology at Basaveshwara Teaching and General Hospital attached to Mahadevappa Rampure Medical College, Kalaburagi. Ethical clearance number was - IEC Reg. No.: EC/NEW/INST/2022/KV/0194

Study Population: The study included adult patients undergoing elective or emergency lower abdominal surgeries under spinal anaesthesia or general anaesthesia.

Sample Size: A total of 60 patients were included in the study. The patients were divided into two groups, with 30 patients in each group.

- **Group T (TAP Block Group):** Patients who received an ultrasound-guided transversus abdominis plane block using a local anaesthetic.
- **Group C (Conventional Analgesia Group):** Patients who received conventional postoperative analgesia using intravenous NSAIDs and opioids according to the institutional protocol.

Sampling Technique: Eligible patients who satisfied the inclusion criteria were selected using a systematic random sampling method until the required sample size was achieved.

Inclusion Criteria

Patients fulfilling the following criteria were included in the study:

1. Age between 18 and 60 years.
2. American Society of Anesthesiologists (ASA) physical status I–III.
3. Patients undergoing elective or emergency lower abdominal surgeries under spinal anaesthesia or general anaesthesia.
4. Patients willing to provide written informed consent.

Exclusion Criteria

Patients meeting any of the following criteria were excluded from the study:

1. Refusal to participate in the study.
2. Infection at the proposed TAP block injection site.
3. Known allergy to local anaesthetic drugs.
4. Coagulopathy or anticoagulant therapy.
5. Cognitive impairment or inability to understand the Visual Analogue Scale (VAS).
6. Severe hepatic or renal dysfunction.
7. Hemodynamic instability.

Ethical Considerations: Institutional Ethics Committee approval was obtained before commencement of the study. Written informed consent was obtained from all participants in their own vernacular language after explaining the nature and purpose of the study. Confidentiality of patient information was maintained throughout the study.

Preoperative Assessment: A detailed pre-anaesthetic evaluation was performed in all patients. Demographic data including age, sex, body weight, body mass index (BMI), ASA physical status, associated comorbidities, type of surgery, and type of anaesthesia were recorded. Routine preoperative investigations were reviewed,

and patients were kept nil per oral according to institutional protocol.

Anaesthetic Technique: On arrival in the operating room, standard monitors including electrocardiography (ECG), non-invasive blood pressure (NIBP), pulse rate, respiratory rate and peripheral oxygen saturation (SpO_2) were attached. Intravenous access was secured using an 18-gauge cannula, and Ringer's lactate infusion was commenced. All patients underwent surgery under either spinal anaesthesia or general anaesthesia according to the surgical requirement and institutional practice.

Ultrasound-Guided TAP Block Technique: At the completion of surgery, patients in Group T received an ultrasound-guided transversus abdominis plane block under strict aseptic precautions. The anterolateral abdominal wall was prepared with 2% chlorhexidine solution, and sterile ultrasound gel was applied.

A high-frequency linear ultrasound probe (10 MHz) was placed transversely between the iliac crest and the subcostal margin. The external oblique, internal oblique and transversus abdominis muscles, along with the peritoneum, were identified.

After identification of the fascial plane between the internal oblique and transversus abdominis muscles, a 23-gauge, 60-mm block needle was introduced using the in-plane technique under continuous ultrasound guidance. Following negative aspiration, 20 mL of local anaesthetic solution was injected into the transversus abdominis plane. Correct needle placement was confirmed by visualization of the spread of the local anaesthetic within the fascial plane.

Conventional Analgesia: Patients in Group C received conventional postoperative analgesia consisting of intravenous NSAIDs and opioids according to the institutional postoperative analgesic protocol. The type, dose and timing of analgesic administration were recorded.

Postoperative Assessment: Patients were monitored in the postoperative period for pulse rate, blood pressure, respiratory rate and oxygen saturation. Pain intensity was assessed using the Visual Analogue Scale (VAS), where 0 represented no pain and 10 represented the worst imaginable pain. VAS scores were recorded at predefined postoperative intervals. The duration of analgesia, defined as the interval between administration of the TAP block or completion of surgery and the first request for rescue analgesia, was documented. The time to first rescue analgesic requirement, total rescue analgesic consumption during the first 24 postoperative hours and any adverse events including nausea, vomiting, sedation, hypotension, respiratory depression or local anaesthetic-related complications were recorded.

Rescue Analgesia: Rescue analgesia was administered whenever the Visual Analogue Scale score was ≥4. Injection diclofenac sodium 75 mg was administered as the first-line rescue analgesic. If adequate pain relief was not achieved within 30 minutes, injection tramadol 50 mg intravenously was administered as second-line rescue analgesia. The total number of rescue analgesic doses administered during the first 24 hours was documented.

Outcome Measures

Primary Outcome

- Postoperative pain intensity assessed using the Visual Analogue Scale.

Secondary Outcomes

- Time to first rescue analgesic.
- Duration of postoperative analgesia.
- Total rescue analgesic consumption during the first 24 hours.
- Incidence of postoperative adverse effects.

Data Collection: All clinical observations were recorded in a predesigned case record form. The collected data were entered into Microsoft Excel and verified for completeness before statistical analysis.

Statistical Analysis: The collected data were analysed using Statistical Package for the Social Sciences (SPSS) version 25.0.Continuous variables were expressed as mean ± standard deviation, whereas categorical variables were expressed as frequencies and percentages. Normality of data was assessed using the Shapiro–Wilk test.

The independent samples t-test was used to compare continuous variables between the two groups for normally distributed data, while the Mann–Whitney U test was used for non-normally distributed data. Categorical variables were compared using the Chi-square test or Fisher's exact test, wherever appropriate. A p-value of less than 0.05 was considered statistically significant.

Results

A total of 60 patients undergoing lower abdominal surgeries were included in the study. Thirty patients received an ultrasound-guided transversus abdominis plane (TAP) block (Group T), while 30 patients received conventional postoperative analgesia (Group C). All enrolled patients completed the study and were included in the final analysis. The baseline demographic and clinical characteristics were comparable between the two groups. The mean age was 42.3 ± 11.8 years in Group T and 43.7 ± 12.1 years in Group C

(p=0.651). Male patients constituted 60.0% of Group T and 56.7% of Group C. Body mass index, ASA physical status, and duration of surgery were also similar between the groups, indicating good baseline comparability (Table 1).Postoperative pain scores assessed using the Visual Analogue Scale (VAS) were significantly lower in the TAP block group at all postoperative time points. Group T demonstrated significantly lower VAS scores at 1, 2, 4, 6, 12 and 24 hours compared with Group C (all $p<0.001$), indicating superior postoperative analgesia with ultrasound-guided TAP block (Table 2, Figure 1).Patients in the TAP block group experienced a significantly longer duration before requiring rescue analgesia (8.6 ± 2.4 vs. 3.9 ± 1.5 hours; $p<0.001$). Furthermore, both diclofenac and tramadol consumption during the first 24 postoperative hours were significantly lower in Group T than in Group C ($p<0.001$ for both), demonstrating a substantial opioid- and NSAID-sparing effect (Table 3, Figure 2).The pattern of rescue analgesic requirement also differed significantly between the groups. No rescue analgesia was required in 30.0% of patients in Group T compared with only 6.7% in Group C. Conversely, the requirement for two or more rescue analgesic doses was considerably higher in the conventional analgesia group (60.0% vs. 16.7%; p=0.018) (Table 4, Figure 3).Postoperative adverse effects were generally less frequent in patients receiving TAP block. Although the incidences of nausea, vomiting, sedation, respiratory depression and pruritus were numerically lower in Group T, these individual differences did not reach statistical significance. However, a significantly greater proportion of patients in Group T experienced no adverse effects compared with Group C (80.0% vs. 46.7%; p=0.007) (Table 5).Overall postoperative recovery was significantly better in the TAP block group. Patients receiving TAP block reported higher satisfaction scores (8.9 ± 0.9 vs. 7.1 ± 1.2; $p<0.001$), achieved earlier ambulation (8.8 ± 1.9 vs. 11.2 ± 2.5 hours; $p<0.001$), and had a shorter duration of hospital stay (3.4 ± 0.8 vs. 4.2 ± 1.0 days; p=0.001) compared with the conventional analgesia group (Table 6).

Table 1: Baseline Demographic and Clinical Characteristics

Variable	Group T (n=30)	Group C (n=30)	p-value
Age (years), Mean ± SD	42.3 ± 11.8	43.7 ± 12.1	0.651
Male, n (%)	18 (60.0)	17 (56.7)	0.793
Female, n (%)	12 (40.0)	13 (43.3)	
BMI (kg/m²), Mean ± SD	24.7 ± 2.9	25.1 ± 3.2	0.612
ASA I, n (%)	15 (50.0)	14 (46.7)	0.796
ASA II, n (%)	12 (40.0)	13 (43.3)	
ASA III, n (%)	3 (10.0)	3 (10.0)	
Duration of surgery (min), Mean ± SD	78.5 ± 18.3	80.2 ± 17.6	0.709

Table 2: Postoperative Pain Scores (VAS)

Time	Group T	Group C	p-value
1 hour	1.8 ± 0.8	3.4 ± 1.0	<0.001
2 hours	2.1 ± 0.9	3.8 ± 1.1	<0.001
4 hours	2.5 ± 0.9	4.4 ± 1.2	<0.001
6 hours	2.8 ± 1.0	4.8 ± 1.3	<0.001
12 hours	3.3 ± 1.1	4.6 ± 1.2	<0.001
24 hours	2.7 ± 0.9	3.8 ± 1.1	<0.001

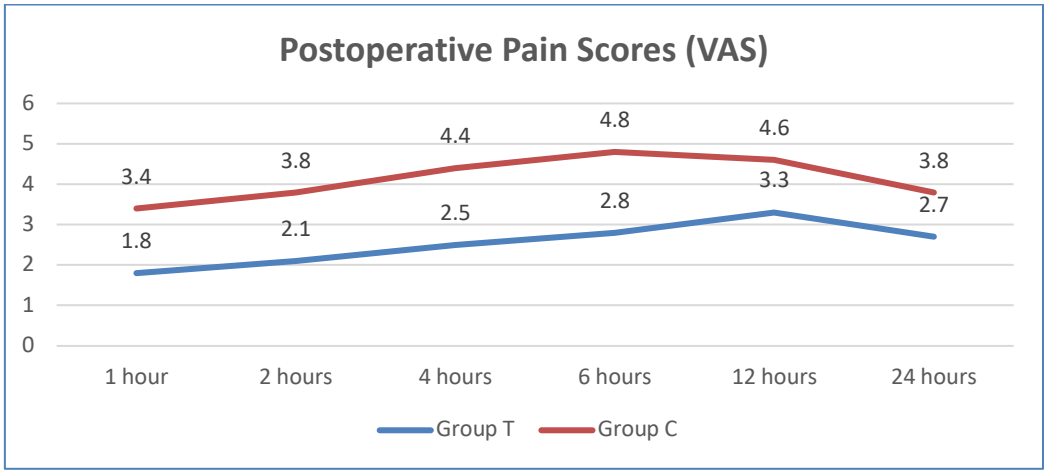

Figure 1: Postoperative Pain Scores (VAS)

Table 3: Rescue Analgesia Requirement

Variable	Group T	Group C	p-value
Time to first rescue analgesia (hours), Mean ± SD	8.6 ± 2.4	3.9 ± 1.5	<0.001
Total diclofenac consumption (mg/24 h), Mean ± SD	78.5 ± 26.8	132.4 ± 38.6	<0.001
Total tramadol consumption (mg/24 h), Mean ± SD	42.5 ± 31.4	94.2 ± 40.7	<0.001

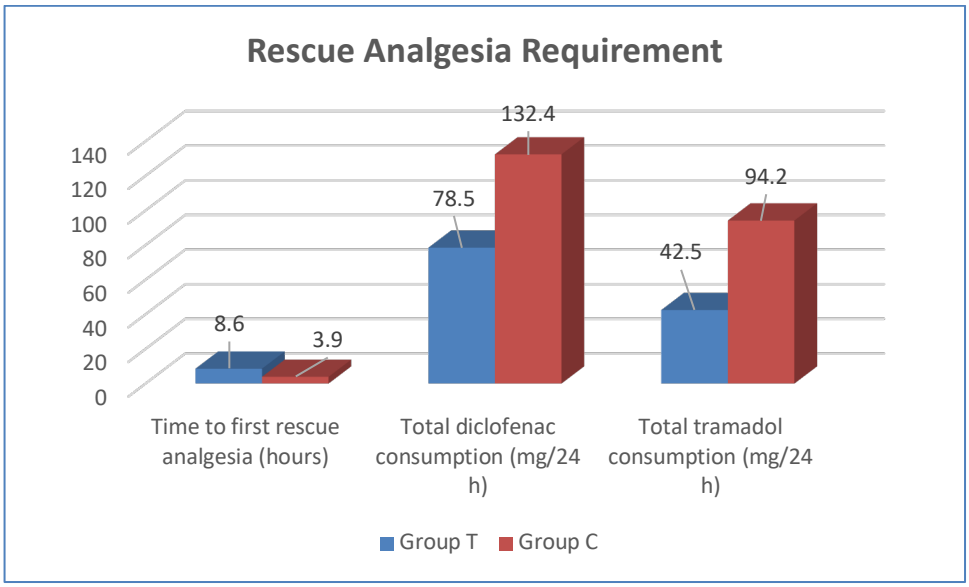

Figure 2: Rescue Analgesia Requirement

Table 4: Rescue Analgesic Requirement Pattern

Variable	Group T n (%)	Group C n (%)	p-value
No rescue analgesia	9 (30.0)	2 (6.7)	0.018
One rescue dose	16 (53.3)	10 (33.3)	
Two or more rescue doses	5 (16.7)	18 (60.0)	

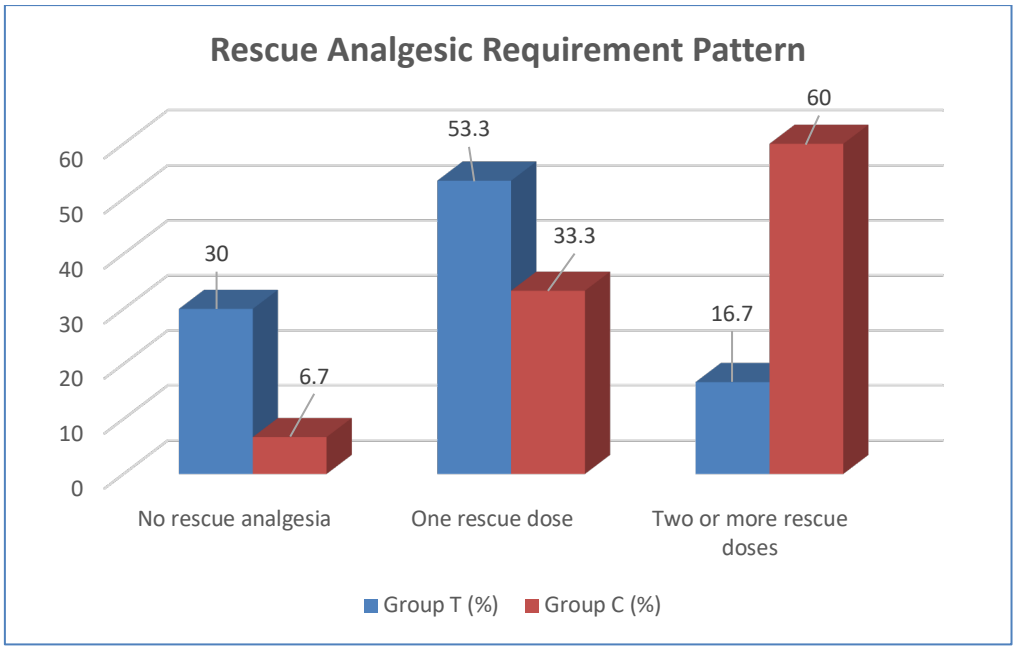

Figure 3: Rescue Analgesic Requirement Pattern

Table 5: Postoperative Adverse Effects

Adverse Effect	Group T n (%)	Group C n (%)	p-value
Nausea	3 (10.0)	9 (30.0)	0.053
Vomiting	2 (6.7)	6 (20.0)	0.129
Sedation	1 (3.3)	5 (16.7)	0.085
Respiratory depression	0	1 (3.3)	0.313
Pruritus	0	2 (6.7)	0.150
Local anaesthetic toxicity	0	0	—
No adverse effects	24 (80.0)	14 (46.7)	0.007

Table 6: Overall Postoperative Outcome

Variable	Group T	Group C	p-value
Patient satisfaction score (1–10), Mean ± SD	8.9 ± 0.9	7.1 ± 1.2	<0.001
Time to ambulation (hours), Mean ± SD	8.8 ± 1.9	11.2 ± 2.5	<0.001
Length of hospital stay (days), Mean ± SD	3.4 ± 0.8	4.2 ± 1.0	0.001

Discussion

The baseline demographic and perioperative characteristics were comparable between the two groups. The mean age was 42.3 ± 11.8 years in Group T and 43.7 ± 12.1 years in Group C (p=0.651). Similarly, BMI, ASA physical status and duration of surgery were comparable, indicating that postoperative outcomes were attributable to the analgesic intervention rather than baseline differences (Table 1). Similar baseline comparability has been reported by Krupali D. Patel and Shashankkumar B. Patel [13] in their randomized controlled trial evaluating ultrasound-guided TAP block after laparoscopic abdominal surgery.

The most important finding of the present study was the significant reduction in postoperative pain scores among patients receiving TAP block. The mean VAS score at 1 hour was 1.8 ± 0.8 in Group T compared with 3.4 ± 1.0 in Group C, while at 6 hours the corresponding scores were 2.8 ± 1.0 and 4.8 ± 1.3, respectively (p<0.001). Even at 24 hours, pain scores remained significantly lower in the TAP block group (2.7 ± 0.9 vs. 3.8 ± 1.1; p<0.001) (Table 2, Figure 1). Similar findings were reported by Krupali D. Patel et al.[13], who observed significantly lower VAS scores at 2, 6, 12 and 24 hours in patients receiving ultrasound-guided bilateral TAP block compared with intravenous morphine-based analgesia (p<0.001). Another important finding of our study was the significantly prolonged duration of postoperative analgesia. The mean time to first rescue analgesia was 8.6 ± 2.4 hours in Group T compared with 3.9 ± 1.5 hours in Group C (p<0.001) (Table 3, Figure 2). A comparable observation was reported by Krupali D. Patel et al.[13], who found that the time to first analgesic request was significantly longer in the TAP block group (342 ± 67 minutes) than in the intravenous analgesia group (48 ± 22 minutes, p<0.001). The present study also demonstrated a marked reduction in postoperative rescue analgesic consumption. Mean diclofenac consumption during the first 24 hours was 78.5 ± 26.8 mg in Group T compared with 132.4 ± 38.6 mg in Group C, while tramadol consumption was 42.5 ± 31.4 mg versus 94.2 ± 40.7 mg, respectively (p<0.001). Furthermore, 30.0% of patients in Group T required no rescue analgesia compared with only 6.7% in Group C, whereas repeated rescue analgesic requirements were significantly higher in Group C (60.0% vs. 16.7%; p=0.018) (Table 3, Table 4, Figure 3). Similarly, Krupali D. Patel et al.[13] reported significantly lower 24-hour morphine consumption (4.2 ± 1.8 mg vs. 12.7 ± 3.4 mg; p<0.001) in the TAP block group. Our study also demonstrated fewer postoperative adverse effects among patients receiving TAP block. Although the incidences of nausea, vomiting and sedation were lower in Group T, these differences were not individually significant.

However, significantly more patients remained free from adverse effects in Group T (80.0% vs. 46.7%; p=0.007) (Table 5). Similarly, Krupali D. Patel et al.[13] reported a significantly lower incidence of postoperative nausea and vomiting in the TAP block group (15.0%) compared with the intravenous analgesia group (38.3%, p=0.005). The present study further demonstrated superior postoperative recovery in patients receiving TAP block. Patient satisfaction scores were significantly higher (8.9 ± 0.9 vs. 7.1 ± 1.2), ambulation occurred earlier (8.8 ± 1.9 vs. 11.2 ± 2.5 hours) and hospital stay was shorter (3.4 ± 0.8 vs. 4.2 ± 1.0 days) in Group T compared with Group C (Table 6). Comparable findings were reported by Krupali D. Patel et al.[13], who observed significantly earlier hospital discharge (22.4 ± 4.1 hours vs. 27.8 ± 5.3 hours, p<0.001) following ultrasound-guided TAP block. Overall, the findings of the present study are in agreement with those of Krupali D. Patel et al.[13], who demonstrated that ultrasound-guided TAP block provides superior postoperative analgesia, prolongs the duration of analgesia, reduces opioid consumption and postoperative

nausea and vomiting, and facilitates earlier recovery compared with conventional intravenous analgesia.

Conclusion

The present study demonstrated that ultrasound-guided transversus abdominis plane (TAP) block provided superior postoperative analgesia compared with conventional systemic analgesics following lower abdominal surgeries.

Patients receiving TAP block had significantly lower postoperative pain scores, prolonged duration of analgesia, reduced rescue analgesic consumption, and fewer analgesia-related adverse effects. TAP block also resulted in higher patient satisfaction, earlier ambulation, and shorter hospital stay. Therefore, ultrasound-guided TAP block is a safe and effective component of multimodal postoperative pain management and can be recommended for patients undergoing lower abdominal surgeries.

Limitations

The present study was conducted at a single tertiary care centre with a relatively small sample size, which may limit the generalizability of the findings. The postoperative outcomes were assessed only during the first 24 hours, and long-term analgesic efficacy was not evaluated. Additionally, different types of lower abdominal surgeries were included, which may have influenced postoperative pain perception and analgesic requirements.

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