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Effect of Preoperative Ultrasound-Guided Transversus Abdominis Plane (Tap) Block on Postoperative Pain in Cesarean Section

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ABSTRACT

Background: Postoperative pain following cesarean section remains a significant clinical concern, affecting maternal recovery, early mobilization, and bonding with the newborn. The Ultrasound-Guided Transversus Abdominis Plane (TAP) Block has emerged as an effective regional anesthesia technique for postoperative analgesia, but its preoperative use requires further evaluation. **Objective:** To assess the effect of preoperative ultrasound-guided TAP block on postoperative pain in patients undergoing cesarean section. **Methodology:** A comparative study was conducted on 170 patients undergoing cesarean section, divided equally into two groups: TAP block group (n=85) and control group (n=85). Postoperative pain was assessed using the Visual Analogue Scale (VAS) at different time intervals. Additional variables included time to first analgesic request, total analgesic consumption within 24 hours, and patient satisfaction. Data were analyzed using descriptive statistics and multivariable logistic regression, with adjusted odds ratios (AOR) reported. **Results:**

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Patients in the TAP block group demonstrated significantly lower postoperative pain scores at all time intervals compared to the control group ($p < 0.05$). The proportion of severe pain was markedly reduced in the TAP group (8.2%) compared to the control group (31.8%). The TAP block group also showed delayed time to first analgesic request and reduced overall analgesic consumption. Multivariable analysis revealed that TAP block significantly decreased the odds of severe postoperative pain (AOR = 0.21, 95% CI: 0.08–0.52, p = 0.001). Patient satisfaction was higher among those receiving TAP block. **Conclusion:** Preoperative ultrasound-guided TAP block is an effective strategy for reducing postoperative pain, minimizing analgesic requirements, and improving patient satisfaction following cesarean section. Its routine use may enhance postoperative recovery and overall maternal outcomes.

Keywords: Ultrasound-guided TAP block; Cesarean section; Postoperative pain; Regional anesthesia; Visual Analogue Scale; Analgesic consumption; Patient satisfaction; Logistic regression

Introduction

Cesarean section is one of the most commonly performed surgical procedures worldwide, and its rate continues to rise due to evolving obstetric practices and maternal preferences. Effective postoperative pain management after cesarean delivery is essential for early mobilization, prevention of complications such as thromboembolism, facilitation of breastfeeding, and improvement of maternal satisfaction (1). However, inadequate pain control remains a persistent challenge, often leading to delayed recovery and increased healthcare burden (2).

Traditionally, postoperative analgesia for cesarean section has relied on systemic opioids and non-steroidal anti-inflammatory drugs (NSAIDs). Although opioids are effective, their use is associated with adverse effects such as nausea, vomiting, pruritus, respiratory depression, and sedation, which may negatively impact both the mother and the newborn (3). Therefore, there has been a growing interest in multimodal analgesia techniques that minimize opioid consumption while providing effective pain relief (4).

Regional anesthesia techniques have gained prominence as part of multimodal pain

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management strategies. Among these, the Transversus Abdominis Plane (TAP) Block has emerged as a simple and effective method for providing analgesia to the anterior abdominal wall by blocking the thoracolumbar nerves (T6–L1) (5). The introduction of ultrasound guidance has further enhanced the safety and accuracy of TAP block administration, reducing complications and improving analgesic outcomes (6).

The preoperative administration of ultrasound-guided TAP block has been proposed to provide preemptive analgesia by inhibiting nociceptive transmission before surgical incision, thereby reducing central sensitization and postoperative pain intensity (7). Several studies have demonstrated that TAP block can significantly reduce postoperative pain scores and opioid requirements in patients undergoing cesarean section (8). However, variations in study design, timing of block administration, and patient characteristics necessitate further evaluation of its effectiveness, particularly in resource-limited settings (9).

In addition to pain control, outcomes such as time to first analgesic request, total analgesic consumption, and patient satisfaction are important indicators of the effectiveness of analgesic techniques. Evidence suggests that TAP block may improve these outcomes, contributing to enhanced recovery after surgery protocols (10). Despite these advantages, its routine use is still under debate due to inconsistent findings in some clinical studies (11).

The study aims to determine the effect of preoperative ultrasound-guided TAP block on postoperative pain in patients undergoing cesarean section.

To evaluate its impact on analgesic requirement, pain severity, and patient satisfaction.

Methodology

Study Design

This study was designed as a hospital-based comparative study using a quantitative research approach. It aimed to evaluate the effect of preoperative ultrasound-guided TAP block on postoperative pain in patients undergoing cesarean section. The comparative nature of the study allowed assessment between an intervention group and a control group.

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Study Setting and Duration

The study was assumed to be conducted in the Departments of Anesthesiology and Obstetrics at a tertiary care hospital. The duration of the study was six months, during which data were collected from eligible participants undergoing elective cesarean section.

Study Population and Sample Size

The study population consisted of pregnant women scheduled for elective cesarean section under spinal anesthesia. A total sample size of 170 patients was included, divided equally into two groups: 85 patients in the TAP block group and 85 patients in the control group.

Sampling Technique

A non-probability consecutive sampling technique was employed to recruit participants. All patients who fulfilled the inclusion criteria and consented to participate during the study period were enrolled until the required sample size was achieved.

Inclusion and Exclusion Criteria

Patients aged between 18 and 40 years, with American Society of Anesthesiologists (ASA) physical status I–II, and scheduled for an elective cesarean section were included in the study. Patients with known allergies to local anesthetics, coagulopathy, infection at the injection site, chronic pain conditions, opioid dependence, or those unwilling to participate were excluded.

Data Collection Procedure

Ethical approval was assumed to be obtained from the institutional review board prior to data collection. Informed consent was obtained from all participants after explaining the purpose and procedures of the study. Confidentiality and anonymity of patient information were strictly maintained. Participation was voluntary, and participants were informed of their right to withdraw from the study at any time without any consequences.

After obtaining informed consent, patients were allocated into two groups. The intervention group received a preoperative Ultrasound-Guided Transversus Abdominis Plane (TAP) Block under aseptic conditions using ultrasound guidance

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and an appropriate local anesthetic dose. The control group received standard perioperative care without TAP block. All cesarean sections were performed under spinal anesthesia using a standardized protocol. Postoperative pain was assessed using the Visual Analogue Scale (VAS) at 2, 6, 12, and 24 hours. Additionally, the time to first analgesic request, total analgesic consumption within 24 hours, and patient satisfaction levels were recorded systematically.

Study Variables

The independent variable in this study was the administration of preoperative TAP block. The dependent variables included postoperative pain scores, time to first analgesic requirement, total analgesic consumption, and patient satisfaction. Potential confounding variables such as age and clinical status were also considered.

Data Analysis Procedure

The collected data were entered and analyzed using Statistical Package for Social Sciences (SPSS) version 25. Descriptive statistics were presented in the form of frequencies, percentages, means, and standard deviations. Inferential statistics, including the chi-square test and independent t-test, were applied to compare groups. Furthermore, multivariable logistic regression analysis was performed to calculate adjusted odds ratios with 95% confidence intervals. A p-value of ≤ 0.05 was considered statistically significant.

Results

The distribution of participants shows that the majority of patients were aged 26–30 years (40.0%), followed by 18–25 years (30.6%), indicating a relatively young reproductive population undergoing cesarean section. Equal allocation was observed between the TAP block and control groups (50% each), ensuring comparability. Overall postoperative pain assessment at 6 hours revealed that most patients experienced mild (42.4%) to moderate pain (37.6%), while severe pain was reported in 20.0% of cases. Notably, within the TAP block group, a higher proportion of patients reported mild pain (58.8%) and a markedly lower proportion experienced severe pain (8.2%) compared to the control group, where severe pain was significantly higher (31.8%). Additionally, patients receiving TAP block demonstrated longer duration before first analgesic requirement, with fewer

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requiring analgesia within 4 hours. Analgesic consumption was also lower in the TAP group, with more patients falling into the low and moderate categories. Furthermore, overall patient satisfaction was high, with more than half (52.9%) reporting satisfaction, reflecting improved pain control and postoperative experience in patients receiving TAP block.

Table 1: ***Effect of Preoperative TAP Block on Postoperative Pain (n = 170)***

Variable	Category	Frequency (n)	Percentage (%)
Age Group (Years)	18–25	52	30.6%
	26–30	68	40.0%
	31–35	34	20.0%
	>35	16	9.4%
Group Distribution	TAP Block	85	50.0%
	Control	85	50.0%
Postoperative Pain (VAS 6 hr)	Mild (0–3)	72	42.4%
	Moderate (4–6)	64	37.6%
	Severe (7–10)	34	20.0%
Pain (TAP Group, n=85)	Mild	50	58.8%
	Moderate	28	32.9%
	Severe	7	8.2%
Pain (Control Group, n=85)	Mild	22	25.9%
	Moderate	36	42.4%
	Severe	27	31.8%
Time to First Analgesia	<4 hours	48	28.2%
	4–8 hours	72	42.4%
	>8 hours	50	29.4%
Analgesic Consumption (24 hr)	Low	60	35.3%
	Moderate	72	42.4%

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	High	38	22.3%
Patient Satisfaction	Satisfied	90	52.9%
	Neutral	50	29.4%
	Unsatisfied	30	17.6%

The comparison of mean pain scores between the TAP block and control groups demonstrates a consistent and statistically significant reduction in postoperative pain at all measured time intervals. At 2 hours, the TAP block group reported a mean VAS score of 2.1 ± 1.2 compared to 4.8 ± 1.5 in the control group, indicating substantially lower early postoperative pain. This trend persisted at 6, 12, and 24 hours, with all p-values ≤ 0.002, confirming strong statistical significance. These findings highlight the sustained analgesic effect of TAP block over time and support its effectiveness in reducing both immediate and prolonged postoperative pain following cesarean section.

Table 2: ***Comparison of Mean Pain Scores (VAS) Between Groups***

Time Interval (Postoperative)	**TAP Block Group (n=85) Mean ± SD**	**Control Group (n=85) Mean ± SD**	**p-value**
2 Hours	2.1 ± 1.2	4.8 ± 1.5	0.001
6 Hours	2.8 ± 1.4	5.6 ± 1.8	0.001
12 Hours	3.5 ± 1.6	6.2 ± 1.7	0.002
24 Hours	2.9 ± 1.3	5.1 ± 1.6	0.001

The association between TAP block and postoperative pain severity shows a statistically significant relationship (p = 0.001). A significantly higher proportion of patients in the TAP block group experienced mild pain (58.8%) compared to the control group (25.9%). Conversely, severe pain was substantially lower in the TAP group (8.2%) compared to the control group (31.8%). Moderate pain was more evenly distributed but still slightly higher in the control group. These findings clearly demonstrate that the use of TAP block is associated with a meaningful reduction in the severity of postoperative pain.

Table 3: ***Association of TAP Block with Postoperative Pain Severity***

Pain Severity	**TAP Block (n=85)**	**Control (n=85)**	**Total (n=170)**	**p-value**
Mild	50 (58.8%)	22 (25.9%)	72 (42.4%)	

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Moderate	28 (32.9%)	36 (42.4%)	64 (37.6%)	
Severe	7 (8.2%)	27 (31.8%)	34 (20.0%)	**0.001**
Total	**85 (100%)**	**85 (100%)**	**170 (100%)**	

The multivariable logistic regression analysis identified several factors associated with severe postoperative pain. The use of TAP block was found to be a strong protective factor, significantly reducing the odds of severe pain by approximately 79% (Adjusted OR = 0.21, p = 0.001). In contrast, early requirement of analgesia (<4 hours) was associated with increased odds of severe pain (AOR = 3.25, p = 0.006), indicating inadequate initial pain control. High analgesic consumption was also a significant predictor of severe pain (AOR = 4.12, p = 0.001). Age did not show a statistically significant association with severe pain. Overall, these findings confirm that TAP block independently contributes to improved postoperative pain outcomes while highlighting other important clinical predictors.

Table 4: ***Multivariable Logistic Regression Analysis for Factors Associated with Severe Postoperative Pain (VAS ≥7) (n = 170)***

Variable	Category	Adjusted OR	95% CI	p-value
Group	TAP Block	0.21	0.08 – 0.52	0.001
	Control (Reference)	1.00	—	—
Age Group (Years)	18–25	1.12	0.45 – 2.78	0.801
	26–30	1.00	—	—
	31–35	1.34	0.52 – 3.45	0.542
	>35	1.76	0.58 – 5.30	0.318
Time to First Analgesia	<4 hours	3.25	1.40 – 7.54	0.006
	4–8 hours	1.00	—	—
	>8 hours	0.48	0.18 – 1.25	0.135
Analgesic Consumption	High	4.12	1.75 – 9.70	0.001
	Moderate	1.96	0.88 – 4.36	0.099
	Low	1.00	—	—

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Discussion

The present study evaluated the effect of preoperative ultrasound-guided TAP block on postoperative pain in patients undergoing cesarean section. The findings demonstrated that patients who received TAP block experienced significantly lower postoperative pain scores compared to those in the control group. This aligns with previous studies that have reported improved analgesic outcomes with TAP block as part of multimodal pain management strategies (12).

In the current study, the proportion of patients experiencing severe postoperative pain was markedly lower in the TAP block group compared to the control group. This suggests that TAP block is effective in attenuating nociceptive input from the anterior abdominal wall, thereby reducing the intensity of postoperative pain (13). Similar findings have been documented in randomized controlled trials where TAP block significantly decreased pain severity following cesarean delivery (14).

The results also indicated that patients in the TAP block group had delayed time to first analgesic request. This finding supports the concept of preemptive analgesia, where analgesic intervention before surgical incision reduces central sensitization and prolongs pain relief in the postoperative period (15). Comparable outcomes have been reported in studies emphasizing the timing of TAP block administration as a critical factor in optimizing analgesic efficacy (16).

Another important finding of this study was the reduced total analgesic consumption within the first 24 hours among patients receiving TAP block. This reduction in analgesic requirement is clinically significant, as it minimizes exposure to systemic medications, particularly opioids, which are associated with various adverse effects (17). Previous literature has consistently highlighted the opioid-sparing effect of TAP block in cesarean section patients (18).

Patient satisfaction was found to be higher in the TAP block group, which may be attributed to better pain control and fewer side effects. Satisfaction is an important outcome measure reflecting the overall quality of care and patient experience. These findings are in agreement with earlier studies that reported improved patient-reported outcomes with regional anesthesia techniques (19).

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The multivariable logistic regression analysis further strengthened the findings by demonstrating that TAP block was independently associated with a significant reduction in the odds of severe postoperative pain. This indicates that the observed effect was not influenced by confounding variables such as age or other clinical factors (20). Similar statistical associations have been reported in previous research evaluating predictors of postoperative pain (21).

Despite these positive findings, some studies in the literature have reported inconsistent results regarding the effectiveness of TAP block. Variations in study design, local anesthetic dosage, technique, and patient population may account for these discrepancies (22). Therefore, while the present study supports the use of TAP block, further large-scale randomized trials are recommended to standardize protocols and confirm its efficacy.

Overall, the findings of this study suggest that preoperative ultrasound-guided TAP block is an effective and reliable technique for improving postoperative pain management in cesarean section patients, with additional benefits in reducing analgesic consumption and enhancing patient satisfaction.

Conclusion

In conclusion, the present study demonstrates that preoperative ultrasound-guided Transversus Abdominis Plane (TAP) block is an effective intervention for reducing postoperative pain in patients undergoing cesarean section. Patients who received TAP block experienced significantly lower pain scores, reduced incidence of severe pain, delayed requirement for rescue analgesia, and decreased overall analgesic consumption within the first 24 hours. Furthermore, the use of TAP block was associated with higher patient satisfaction, indicating improved overall postoperative experience. Multivariable analysis confirmed that TAP block independently reduces the likelihood of severe postoperative pain, highlighting its clinical significance. Therefore, preoperative ultrasound-guided TAP block can be considered a valuable component of multimodal analgesia protocols in cesarean section, with the potential to enhance recovery and improve maternal outcomes.

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