

# Efficacy of Ultrasound-Guided Transversus Abdominis Plane Block for Postoperative Analgesia in Women Undergoing Lower Segment Caesarean Section

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## Abstract

**Background:** Effective postoperative analgesia after lower segment caesarean section (LSCS) is a critical component of maternal well-being. The contemporary method of ultrasound-guided transversus abdominis plane (TAP) block has become one of the potential solutions to decrease the postoperative pain and opioid use. The current study aimed to determine the effectiveness of the TAP block with ultrasound in postoperative analgesia in women undergoing elective LSCS. **Material and Methods:** A prospective observational study was done on n=60 patients having elective LSCS done under spinal anesthesia. The patients were separated into two groups: Group T (n=30) actually underwent ultrasound-guided TAP block, and Group C (n=30) actually underwent the standard postoperative analgesia. The measure of pain was done using the Visual Analog Scale (VAS) at 2, 4, 6, 12, and 24 hours. Time to first rescue analgesia, total consumption of tramadol, the number of adverse effects, and patient satisfaction were measured. **Results:** Group T had lower VAS scores in all periods of time ( $p < 0.001$ ). Time to first rescue analgesia was significantly prolonged in Group T ( $385.6 \pm 45.8$  min vs  $125.4 \pm 28.6$  min,  $p < 0.001$ ). Total tramadol consumption was significantly reduced ( $42.5 \pm 18.6$  mg vs  $142.8 \pm 32.4$  mg,  $p < 0.001$ ). Group T had a significantly lower incidence of nausea, vomiting, and sedation ( $p < 0.05$ ). Patient satisfaction scores were significantly higher in the TAP group ( $4.6 \pm 0.5$  vs  $3.2 \pm 0.8$ ,  $p < 0.001$ ). **Conclusion:** TAP block is a successful analgesic method in the postoperative period, decreases the amount of opioid needed, has fewer adverse events, and enhances patient satisfaction with LSCS. It is an important ingredient of multimodal analgesia during caesarean section.

**Keywords:** TAP block, caesarean section, Postoperative Analgesia, Ultrasound-Guided Block, Visual Analogue Scale (VAS) score.

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## INTRODUCTION

Lower-segment cesarean section is a commonly performed surgical procedure across the world. Postoperative analgesia is an essential part of maternal comfort, early ambulation, and successful initiation of breastfeeding.<sup>[1]</sup> Poor pain control following cesarean section may lead to increased risk of thromboembolic events, delayed recovery, and impaired maternal-infant bonding, along with increased duration of hospital stay.<sup>[2]</sup> Routinely, systemic opioids and neuraxial analgesia have been used for postoperative pain management. However, use of opioids is associated with adverse events such as nausea, vomiting, pruritus, sedation, and respiratory depression, and negatively affects maternal recovery.<sup>[3]</sup> Therefore, in recent years, new modalities of treatment have been devised that can minimize opioid consumption and improve postoperative outcomes.<sup>[4]</sup> Among the new techniques are the transversus abdominis plane (TAP) block, which involves deposition of local anesthetic in the fascial plane between the internal oblique and transversus abdominis muscles, which blocks the sensory nerves supplying the anterior abdominal wall.<sup>[5]</sup> With recent advancements and the use of ultrasound guidance, the accuracy, safety, and efficacy of the TAP block have

significantly improved, and it is now one of the most widely used modalities of postoperative analgesia in abdominal surgeries, including LSCS.<sup>[6]</sup> Ultrasound-guided TAP block by targeting thoracolumbar nerves (T6-L1) provides somatic analgesia, which is responsible for incisional pain following cesarean section. Studies have shown that TAP block significantly decreased postoperative pain scores and opioid requirements compared to placebo or systemic analgesia alone.<sup>[7]</sup> Since it decreases opioid requirements postoperatively, it also decreases opioid-related side effects, thereby enhancing overall recovery in patients.<sup>[3]</sup> Research studies have shown that TAP block prolongs the time for first analgesic request and improves the overall quality of postoperative analgesia when used as a part of a multimodal

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regimen.<sup>[6]</sup> One similar study done prospectively demonstrated a significant reduction in postoperative analgesic consumption and lower pain scores in cesarean section patients, which highlights the role of TAP block for pain management.<sup>[8]</sup>

However, despite its advantages, the efficacy of the TAP block is a subject of ongoing research because of the varied efficacy reported in previous studies.<sup>[4]</sup> While few studies have found its benefits may be limited to when intrathecal opioids are used as a part of spinal anaesthesia, because these provide substantial visceral analgesia, TAP block alone independently does not produce the same effects.<sup>[8]</sup> TAP block tends to provide pain relief for surgical incisions; however, its effectiveness varies depending on the technique, local anesthetic dose, and time of administration.<sup>[5]</sup> Reviews and meta-analyses evaluating the role of ultrasound-guided TAP block in cesarean section have found decreased opioid consumption; however, the pain scores vary. Nonetheless, it was found to be beneficial where neuraxial opioids are contraindicated or not used.<sup>[1]</sup> Since there is increasing emphasis given recently in opioid sparing techniques and enhanced recovery protocols, the ultrasound-guided TAP block has become a reassuring modality for postoperative pain management in cesarean section. The current study aimed to evaluate the efficacy of ultrasound-guided transversus abdominis plane block for postoperative analgesia in women undergoing lower-segment cesarean section.

**MATERIALS AND METHODS**

This prospective analytical study was conducted in the Department of Anesthesiology, Kamineni Institute of Medical Sciences, Narkatpally, Nalgonda, Telangana. Institutional Ethical approval was obtained for the study as per protocol for human research. Written consent was obtained from all the participants of the study after explaining the nature of the study in the vernacular language.

**Inclusion criteria**

1. Parturient aged 19 – 35 years
2. American Society of Anesthesiologists (ASA) physical status I and II
3. Patients undergoing elective cesarean section under spinal anesthesia
4. Signed the informed consent

**Exclusion Criteria**

1. Emergency cesarean sections
2. Allergy to local anesthetics
3. ASA III or IV categories
4. Bleeding diathesis
5. Infection at the site of injection

Based on the inclusion and exclusion criteria, a total of n=60

cases were included in the study, and the sample collection was done by a convenience sampling method. The selected cases were randomly allotted into two equal groups of n=30 each. Group T (TAP Block Group): Patients receiving ultrasound-guided TAP block. Group C (Control Group): Patients receiving standard postoperative analgesia without TAP block. The postoperative pain assessment was done by the observer who was blinded to group allocation.

Anaesthetic Technique in brief: All patients received spinal anesthesia with 0.5% hyperbaric bupivacaine (dose was adjusted according to body weight) and injected into the L3-L4 interspace under aseptic precautions. Routine intraoperative monitoring of heart rate, blood pressure, oxygen saturation, and ECG was applied in all cases. At the end of the surgery, the patients in Group T received an ultrasound-guided bilateral TAP block. A high-frequency linear probe of an ultrasound machine was placed in the mid-axillary line between the costal margin and iliac crest. The fascial plane between the internal oblique and transversus abdominis muscles was identified, and 20 mL of 0.25% bupivacaine was injected bilaterally under aseptic precautions. Patients in Group C did not receive a TAP block and were subjected to routine postoperative analgesic care.

Postoperative Analgesia: Intravenous paracetamol (1g every 8 hours) was routinely administered to all patients. Tramadol (50 mg IV) was given for rescue analgesia when the Visual Analog Scale (VAS) pain score was ≥4. The postoperative pain intensity was assessed using VAS at the 2, 4, 6, 12, and 24 hours postoperatively, and secondary outcomes were analyzed by time to first rescue analgesia, total analgesic consumption in 24 hours, incidence of adverse effects such as vomiting, nausea, pruritus, and sedation, patients' satisfaction scores and complications related to TAP block if any.

Statistical Analysis: All the available data were refined, segregated, and uploaded to an MS Excel spreadsheet and analyzed by SPSS version 26 in Windows format. The continuous variables were represented as mean, standard deviation, frequency, and percentage. The categorical variables were calculated by the chi-square test for differences between two groups, and the values of p (<0.05) were considered statistically significant.

**RESULTS**

The demographic and baseline characteristics of the cohort included in the study are depicted in Table 1. Analysis of the table shows that most of the characteristics between the two groups were found to match, and no statistically significant differences between the two groups. This showed that randomization of the participants was achieved and groups were well matched. The differences in postoperative outcomes in the two groups will be related to the intervention rather than confounding factors.

**Table 1: Baseline Demographic and Clinical Characteristics**

Characteristic	Group T (TAP Block) (n=30)	Group C (Control) (n=30)	p-value
Age (Years)	26.5 ± 3.2	27.1 ± 3.5	0.482
Weight (kg)	64.2 ± 7.5	63.8 ± 8.1	0.842
Height (cm)	157.5 ± 5.2	158.1 ± 4.9	0.641
Gestational Age (Weeks)	38.1 ± 0.9	38.3 ± 0.8	0.354
ASA Status (I: II)	24:06	22:08	0.542
Duration of Surgery (min)	48.5 ± 8.2	47.2 ± 9.1	0.561

Postoperative pain scores at different intervals determined by the Visual Analog Scale (VAS) are depicted in Table 2. A critical analysis of the table showed that Group T cases recorded significantly lower VAS scores at all the time intervals, as compared to Group C; the values were statistically significant. The maximum differences in VAS

scores between the two groups were found to be present at 6 hours, where the mean difference was -2.3. The pain scores were found to be gradually increasing in the first 24 hours; however, Group T demonstrated better analgesia in the 24-hour duration, which showed that ultrasound-guided TAP block provides effective sustained postoperative pain relief.

**Table 2: Postoperative Pain Scores (Visual Analog Scale VAS) at Rest and different intervals**

Time Point	Group T (TAP Block) (n=30)	Group C (Control) (n=30)	Mean Difference (95% CI)	p-value
2 hours	1.8 ± 0.8	3.5 ± 1.2	-1.7 (-2.2 to -1.2)	<0.001*
4 hours	2.2 ± 0.9	4.2 ± 1.4	-2.0 (-2.6 to -1.4)	<0.001*
6 hours	2.5 ± 1.0	4.8 ± 1.5	-2.3 (-2.9 to -1.7)	<0.001*
12 hours	3.0 ± 1.1	5.2 ± 1.6	-2.2 (-2.9 to -1.5)	<0.001*
24 hours	3.2 ± 1.2	4.5 ± 1.4	-1.3 (-2.0 to -0.6)	<0.001*

\*Significant; VAS scale: 0 = no pain, 10 = worst imaginable pain. Confidence Interval (CI)

[Table 3] shows the postoperative analgesic consumption and rescue analgesia comparison between the two groups. Critical analysis of the table showed that the TAP group showed significantly prolonged time for the first rescue analgesic. The total tramadol consumption was found to be lower in Group T. The number of rescue analgesic doses

received by the cases was lower in the TAP group, and 60% of the patients in Group T required rescue analgesia compared to 100% in the control group. These results indicate that Group T cases with the TAP block were able to decrease postoperative analgesic requirements.

**Table 3: Postoperative Analgesic Consumption and Rescue Analgesia Requirements**

Parameter	Group T (TAP Block) (n=30)	Group C (Control) (n=30)	p-value
Time to First Request for Rescue Analgesia (min)	385.6 ± 45.8	125.4 ± 28.6	<0.001*
Total Tramadol Consumption in 24 hours (mg)	42.5 ± 18.6	142.8 ± 32.4	<0.001*
Number of Rescue Analgesic Doses in 24 hours	0.8 ± 0.4	2.9 ± 0.7	<0.001*
Patients Requiring Rescue Analgesia, n (%)	18 (60%)	30 (100%)	<0.001*

\*Significant

[Table 4] presents the adverse effects and patient satisfaction scores in the two groups of the study. Analysis of the table showed that the overall incidence of side effects such as nausea, vomiting, and sedation was significantly lower in the TAP group because of lower opioid usage. In addition, no local complications such as hematoma or infection were

observed in both groups, delineating the safety of the procedure in this study. The patient satisfaction scores were higher in the TAP block group as compared to the control group (4.6 ± 0.5 vs 3.2 ± 0.8, p < 0.001), indicating better overall postoperative experience and comfort.

**Table 4: Incidence of Adverse Effects and Patient Satisfaction**

Parameter	Group T (TAP Block) (n=30)	Group C (Control) (n=30)	p-value
Nausea, n (%)	4 (13.3%)	12 (40.0%)	0.022*
Vomiting, n (%)	2 (6.7%)	8 (26.7%)	0.038*
Sedation (Ramsay Score >2), (%)	6 (20.0%)	14 (46.7%)	0.028*
Patient Satisfaction Score (1-5 scale)	4.6 ± 0.5	3.2 ± 0.8	<0.001*
Local Complications (Hematoma/infection)	0 (0%)	0 (0%)	-

\*Significant; Patient satisfaction score: 1 = very dissatisfied, 5 = very satisfied.

Overall findings of this study show that ultrasound-guided TAP block is highly effective in providing postoperative analgesia following LSCS. It not only reduces pain scores and opioid requirements but also minimizes opioid-related side effects and enhances patient satisfaction.

## DISCUSSION

Postoperative analgesia is the critical aspect of LSCS that affects recovery, maternal comfort, and neonatal care. The current study was done to demonstrate the efficacy of ultrasound-guided transversus abdominis plane (TAP) block in elective LSCS cases. The participants were divided into two groups of n=30 each, with one group receiving ultrasound-guided transversus abdominis plane (TAP) block postoperatively, and the other group was a control. [Table 1] showed that there were no differences in groups based on demographic profile, which indicates effective

randomization. The overall differences in the groups will be attributed to the intervention, not the confounding factors. This distribution is consistent with previous randomized controlled trials and has shown the efficacy of the TAP block in similar population groups.<sup>[6,7]</sup> The results of our study showed that the TAP group had much lower Visual Analog Scale (VAS) scores at all postoperative periods, demonstrating the efficacy of TAP block in the management of somatic pain after LSCS [Table 2]. The results are consistent with the previous research that has shown that TAP block lowers pain scores, especially during the initial hours after surgery.<sup>[1,7,9]</sup>

The highest analgesic effect was noted during the early postoperative period, particularly at the interval of 6 hours. Similar results have been reported in previous studies, in which the TAP block considerably enhanced early postoperative pain relief.<sup>[8,9]</sup> The fact that the pain scores also decreased during the entire 24 hours further supports the effectiveness of the TAP

block as an effective part of multimodal analgesia.<sup>[4]</sup> An important observation of this research is that the time to first rescue analgesia was longer in the TAP group. TAP block patients took a significant amount of time to be administered rescue analgesics as compared to the control group. These results showed that the analgesic effect was long-lasting in the TAP group. These observations are in line with previous research conducted by McDonnell et al,<sup>[2]</sup> and Baaj et al,<sup>[6]</sup> who found delayed analgesic requirement among patients who received a TAP block. Moreover, the overall use of tramadol decreased by about 70% in the TAP group, indicating a massive opioid-sparing effect. This has clinical significance because the reduction of opioid consumption helps in minimizing adverse effects and improving the recovery.<sup>[3,10]</sup> This decrease in opioid consumption was indicated by the decreased number of opioid side effects (nausea, vomiting, and sedation) in the TAP group. Our results are in agreement with the existing literature that has reported a reduction in postoperative nausea and vomiting with a reduction in opioid consumption with the use of TAP block.<sup>[3,11]</sup> The absence of local complications such as hematoma or infection also proves the safety of ultrasound-guided TAP block, as it was also reported in previous literature.<sup>[5,12]</sup> The other notable observation in this research is the much higher patient satisfaction scores that are recorded in the TAP group compared to the control group. Patient satisfaction is an essential component in contemporary perioperative care since effective pain relief will lead to fewer side effects and increased overall comfort, which leads to a higher score of satisfaction. Cases of similar improvement in patient satisfaction score have been reported in previous studies assessing TAP block in analgesia after caesarean section.<sup>[6,13]</sup>

Although these are beneficial results, it is worthwhile to mention that the TAP block is mainly used to offer somatic analgesia and might offer insufficient coverage for visceral pain. Certain studies have indicated that the advantage of the TAP block could be limited in cases where intrathecal opioids are used, which have better visceral analgesia.<sup>[8,14]</sup> Nevertheless, the TAP block is a valid alternative in the environment where intrathecal opioids are contraindicated or to be avoided.<sup>[14,15]</sup> The results of the research are also evidenced by systematic reviews and meta-analyses that have shown TAP block to be an effective way of reducing opioid use after surgery and enhancing analgesic effects in patients undergoing a caesarean section.<sup>[1,16]</sup> Moreover, the role of TAP block in the enhanced recovery after surgery (ERAS) guidelines has been highlighted by the recent literature, which has indicated its role in improving the outcome after surgery and shortening the length of stay.<sup>[17,18]</sup>

## CONCLUSION

In conclusion, within the limitations of the current study, we found ultrasound-guided TAP block is an effective, safe, and opioid-sparing technique for postoperative analgesia in LSCS. The results of the study showed that there were reduced VAS scores, decreased requirements for rescue

analgesia, decreased opioid consumption along with improved patient satisfaction in patients receiving TAP block as compared to the control group. These findings showed that incorporation of TAP block with routine multimodal analgesia protocols for caesarean section will improve overall maternal outcomes.

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## Conflicts of interest

There are no conflicts of interest.

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