

Comparative Study Between Bilateral Ultrasound-Guided Transversus Abdominis Plane Block and Parenteral Diclofenac for Postoperative Analgesia Following Lower Segment Caesarean Section: A Randomized Comparative Study

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Abstract

Background: Pain after a caesarean section does more than hurt. It keeps mothers from moving, from caring for a newborn, from settling into those first fragile hours of bonding. Bilateral ultrasound-guided transversus abdominis plane (TAP) block has emerged as a genuine alternative, or a useful add-on, to the parenteral analgesics most units still reach for by default. We set out to compare bilateral TAP block against parenteral Diclofenac head-to-head, each used alone as the sole mode of postoperative analgesia, following lower segment caesarean section (LSCS) under spinal anaesthesia. **Material and Methods:** In this prospective, randomized comparative study, we randomized 60 women undergoing elective LSCS under spinal anaesthesia into two equal groups. Group T (n = 30) received bilateral ultrasound-guided TAP block with 20 mL of 0.25% Bupivacaine on each side after wound closure; Group D (n = 30) received intravenous Diclofenac 75 mg as a stat dose, then every 8 hours for 24 hours. We tracked Visual Analogue Scale (VAS) score, duration of analgesia, requirement of rescue analgesia and quality of pain relief for 24 hours. Intravenous Paracetamol 1 g served as first-line rescue; Tramadol 50 mg backed it up as second-line. We analysed the data in SPSS v23.0, taking $p < 0.05$ as significant. **Results:** TAP block bought patients more time: a mean of 6.3 hours of analgesia versus 3.9 hours with Diclofenac. In Group D, 26 of 30 patients needed their first rescue dose within 4 hours, against just 4 of 30 in Group T; most of the TAP block patients — 24 of them — held out until 5–8 hours post-op. Over 24 hours, Group T needed fewer rescue doses overall, 69 versus 86. Pain relief quality came out excellent-to-moderate in 86.7% of Group T patients versus 70% of Group D patients ($p < 0.001$). Neither group saw a single local or systemic complication. **Conclusion:** Bilateral ultrasound-guided TAP block with 0.25% Bupivacaine outperforms parenteral Diclofenac on every measure that matters here: longer analgesia, fewer rescue doses, and better overall pain relief, all without any added safety concern.

Keywords: Caesarean section; Transversus abdominis plane block; Bupivacaine; Diclofenac; Postoperative analgesia; Regional anaesthesia.

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INTRODUCTION

Caesarean section is one of the most commonly performed surgical procedures worldwide, and adequate postoperative analgesia is essential for early mobilization, maternal recovery, breastfeeding, and effective interaction between the mother and newborn. Post-caesarean pain has both somatic and visceral components and therefore requires a multimodal analgesic approach that provides effective pain relief while minimizing opioid-related adverse effects.^[1]

The transversus abdominis plane (TAP) block has emerged as an important regional analgesic technique following caesarean delivery. By depositing local anaesthetic between the internal oblique and transversus abdominis muscles, it blocks the sensory nerves supplying the anterior abdominal wall. Recent evidence has demonstrated that bilateral TAP block with long-acting local anaesthetics can significantly reduce postoperative pain and additional analgesic requirements after caesarean section.^[2,3] Ultrasound guidance further facilitates accurate deposition of local anaesthetic and may improve the reliability and safety of the

block.^[4]

Randomized clinical evidence has shown that bilateral TAP block provides effective postoperative analgesia, particularly when neuraxial opioids are not incorporated into spinal anaesthesia.^[5] However, conventional systemic analgesics remain widely used because of their simplicity, accessibility, and low cost. Diclofenac, a non-steroidal anti-inflammatory drug, is frequently employed after caesarean delivery and has been compared with regional techniques such as TAP and

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ilioinguinal–iliohypogastric nerve blocks.^[6]

Evidence from systematic reviews and meta-analyses supports the analgesic efficacy of TAP block after caesarean section and highlights its potential role as a component of multimodal postoperative pain management.^[7,8] Nevertheless, direct comparisons between ultrasound-guided TAP block and parenteral diclofenac remain relatively limited.

Therefore, the present randomized comparative study was undertaken to compare bilateral ultrasound-guided TAP block with parenteral diclofenac for postoperative analgesia following lower segment caesarean section, with emphasis on postoperative pain scores, duration of analgesia, rescue analgesic requirement, and adverse effects.

MATERIALS AND METHODS

Study design and setting: We ran this prospective, randomized comparative study in the Department of Anaesthesiology, Pain and Critical Care, ESIC Medical College & PGIMS, Rajajinagar, Bangalore, after the Institutional Ethics Committee approved the protocol. Sixty women scheduled for elective LSCS enrolled between December 2018 and June 2020, each after giving written informed consent.

Participants: We included women with ASA physical status I or II, aged over 18, undergoing elective caesarean delivery. We excluded ASA grade III or IV; bleeding disorders or anticoagulant therapy; local infection at the block site; allergy to local anaesthetics or NSAIDs; and concomitant treatment for a co-incidental medical disorder.

Randomization and interventions: We randomly allocated patients into two equal groups of 30 using a computer-generated number table — Group T for TAP block, Group D for Diclofenac. Every patient received spinal anaesthesia with 2 mL of 0.5% hyperbaric Bupivacaine at the L3–L4 interspace, under standard ASA monitoring. At the end of surgery, Group T received bilateral ultrasound-guided TAP

block: 0.25% Bupivacaine, 20 mL per side, delivered with an echogenic needle and a linear (5–10 MHz) ultrasound probe placed in the mid-axillary line between the costal margin and iliac crest, using an in-plane technique. The same investigator performed every block. Group D received intravenous Diclofenac 75 mg in 100 mL normal saline over 15 minutes after wound closure, repeated every 8 hours for 24 hours. We kept a resuscitation cart and 20% intralipid emulsion available in theatre for both groups.

Outcome measures: We assessed postoperative pain on a 0–10 Visual Analogue Scale (VAS) at 1, 2, 4, 6, 12 and 24 hours (VAS ≤ 3: mild; 4–7: moderate; > 7: severe). Duration of analgesia ran from study-drug administration to a VAS score of 4. Intravenous Paracetamol 1 g served as first-line rescue once VAS reached ≥ 4; intravenous Tramadol 50 mg backed it up if Paracetamol didn't hold. We graded analgesia quality as excellent (grade 3, ≤ 2 rescue doses), moderate (grade 2), or poor (grade 1, needed the second-line agent). We also watched for nausea, vomiting, haematoma, and any sign of local anaesthetic systemic toxicity.

Statistical analysis: We calculated sample size from data reported by Srivastava et al.⁽³⁾ on TAP block duration and rescue analgesic consumption, assuming power > 90%, a standard deviation of 4.5, 5% significance, and 10% attrition — this gave us 30 patients per group. We expressed continuous data as mean ± standard deviation, compared with Student's t-test (or the Mann–Whitney U test where data weren't normally distributed). Categorical data came as frequencies and percentages, compared using the chi-square test or Fisher's exact test as appropriate. We set significance at $p < 0.05$ and ran the analysis in SPSS v23.0 (IBM Corp.).

RESULTS

Age and baseline haemodynamics matched up well between the two groups, apart from heart rate, which ran a bit higher in Group D [Table 1 & 2].

Table 1: Distribution of age

Parameter	Group D (n=30) Mean ± SD	Group T (n=30) Mean ± SD	Mean Difference	p value
Age (years)	27.53 ± 4.13	26.87 ± 4.09	0.67	0.533

Table 2: Pre-operative haemodynamic variables

Parameter	Group D Mean ± SD	Group T Mean ± SD	Mean Difference	p value
Heart rate (bpm)	101.63 ± 14.66	88.30 ± 10.56	13.33	<0.001*
SBP (mmHg)	122.00 ± 10.44	125.73 ± 10.11	-3.73	0.165
DBP (mmHg)	84.30 ± 8.96	80.60 ± 9.63	3.70	0.129
MAP (mmHg)	96.30 ± 7.91	95.67 ± 8.03	0.63	0.759

*Significant at 5% level of significance ($p < 0.05$).

VAS scores told a clear story early on: Group D patients hurt more than Group T patients through the first 5 hours (Group T ranged 0.2–3.4 in the first 4 hours, versus 1.5–4.5

in Group D). Past hour 5, that flipped — Group T's VAS climbed above Group D's, right around when the block wore off [Table 3].

Table 3: Mean Visual Analogue Scale (VAS) scores

Time	Group D Mean ± SD	Group T Mean ± SD	Mean Difference	p value
1 hour	1.53 ± 0.73	0.23 ± 0.63	1.30	<0.001
2 hours	2.90 ± 0.84	1.17 ± 1.02	1.73	<0.001
4 hours	4.50 ± 1.43	3.40 ± 1.07	1.10	0.001
6 hours	3.20 ± 0.71	3.83 ± 0.83	-0.63	0.003

12 hours	3.07 ± 1.72	4.13 ± 0.90	-1.07	0.004
24 hours	4.67 ± 0.66	4.53 ± 1.14	0.13	0.581

Time to first rescue dose told the same story from another angle: 3.9 hours in Group D versus 6.3 hours in Group T [Table 4]. Twenty-six of 30 Group D patients needed rescue

analgesia within 4 hours, against just 4 of 30 in Group T; most of Group T — 24 patients — held out until 5 to 8 hours postoperatively [Table 5].

Table 4: Mean time (hours) to administration of successive rescue doses

Rescue dose	Group D Mean ± SD	Group T Mean ± SD	Mean Difference	p value
Rescue 1	3.90 ± 0.61	6.30 ± 1.60	-2.40	<0.001
Rescue 2	11.20 ± 1.00	14.82 ± 3.93	-3.62	<0.001
Rescue 3	19.04 ± 2.38	19.00 ± 2.28	0.04	0.964
Rescue 4	20.00 ± 0.00	23.50 ± 0.71	-3.50	0.154

Table 5: Timing of requirement of first rescue dose

Time of first rescue	Group D, n (%)	Group T, n (%)	Total
Before 4 hours	26 (86.7%)	4 (13.3%)	30
Between 5 and 8 hours	4 (13.3%)	24 (80.0%)	28
After 8 hours	0 (0%)	2 (6.7%)	2
Total	30 (100%)	30 (100%)	60

Group D needed more rescue doses overall too: 86 across the series, against 69 in Group T. Per patient, that worked out to 2.90 ± 0.40 doses in Group D versus 2.37 ± 0.72 in Group T (p = 0.001) (Table 6). Nine Group D patients needed a second-line rescue agent (Tramadol) and counted

as analgesic failures, compared with 4 in Group T — and in each of those Group T cases, the failure came down to technical difficulty locating the TAP plane, not the technique itself.

Table 6: Rescue analgesic dose requirement over 24 hours

Parameter	Group D	Group T	p value
Cumulative rescue doses (whole series)	86	69	—
Mean rescue doses per patient (Mean ± SD)	2.90 ± 0.40	2.37 ± 0.72	0.001
Patients requiring second-line rescue (Tramadol), n	9	4	—

Quality of analgesia followed the same pattern. In Group T, 60% of patients scored excellent and another 26.7% moderate, for 86.7% excellent-to-moderate overall. Group D managed 3.3% excellent and 66.7% moderate, for 70%

excellent-to-moderate (p < 0.001) (Table 7). Neither group saw a single complication — no nausea, vomiting, haematoma, or sign of local anaesthetic systemic toxicity.

Table 7: Quality of postoperative analgesia

Grade	Group D, n (%)	Group T, n (%)
1 – Poor	9 (30.0%)	4 (13.3%)
2 – Moderate	20 (66.7%)	8 (26.7%)
3 – Excellent	1 (3.3%)	18 (60.0%)
Total	30 (100%)	30 (100%)

p < 0.001 (chi-square test).

DISCUSSION

Effective analgesia following caesarean section facilitates early mobilization, maternal–neonatal interaction and recovery while reducing the requirement for systemic analgesics. In the present randomized comparative study, bilateral ultrasound-guided TAP block provided superior early postoperative analgesia compared with parenteral diclofenac, as demonstrated by lower early VAS scores, delayed requirement for rescue analgesia, fewer rescue doses and better overall quality of analgesia.

The present findings are consistent with Bhati et al,^[9] who evaluated TAP block with or without intravenous diclofenac following caesarean section and demonstrated the usefulness of TAP block as part of multimodal postoperative analgesia. Current procedure-specific

recommendations also emphasize multimodal analgesia after caesarean delivery, incorporating non-opioid analgesics and regional techniques when appropriate.^[10]

In the present study, VAS scores were significantly lower in Group T during the early postoperative period. At 1 hour, the mean VAS score was 0.23 ± 0.63 in Group T compared with 1.53 ± 0.73 in Group D (p<0.001), and this significant advantage persisted at 2 and 4 hours. Sultan et al,^[11] in their systematic review and network meta-analysis, similarly demonstrated the analgesic effectiveness of TAP block following caesarean delivery. Qian et al,^[12] also reported effective postoperative analgesia with ultrasound-guided TAP block using a long-acting local anaesthetic.

The duration of effective analgesia was substantially greater with TAP block. The first rescue analgesic was required at 6.30

± 1.60 hours in Group T compared with 3.90 ± 0.61 hours in Group D ($p < 0.001$). Moreover, 86.7% of patients receiving diclofenac required their first rescue analgesic within 4 hours, whereas 80% of TAP-block patients required it between 5 and 8 hours. Pharmacokinetic evidence also supports the ability of long-acting local anaesthetics administered into the TAP to provide sustained postoperative analgesia.^[13] Ultrasound guidance allows direct visualization of the muscular planes and facilitates more accurate local anaesthetic deposition.^[14]

The TAP group also had a significantly lower mean number of rescue doses during 24 hours (2.37 ± 0.72 vs. 2.90 ± 0.40 ; $p = 0.001$). Similar opioid- and analgesic-sparing effects have been demonstrated in randomized studies comparing TAP block with other postoperative analgesic strategies.^[15] Champaneria et al,^[16] in a meta-analysis, also found TAP block to be an effective modality for reducing pain and analgesic requirements after caesarean section.

Our findings are further supported by Mankikar et al,^[17] who demonstrated that ultrasound-guided TAP block provided effective postoperative analgesia following caesarean delivery. Abdallah et al,^[18] in a systematic review and meta-analysis, concluded that TAP block provides clinically useful analgesia after caesarean delivery, particularly when long-acting neuraxial opioids are not used.

The superiority of TAP block was also reflected in the subjective quality of analgesia. Excellent analgesia was reported in 60% of Group T compared with only 3.3% of Group D, while poor analgesia occurred in 13.3% and 30.0%, respectively ($p < 0.001$). These observations are consistent with the randomized study by Belavy et al,^[19] which demonstrated improved post-caesarean analgesia with ultrasound-guided TAP block. Likewise, the landmark randomized trial by McDonnell et al,^[20] demonstrated significant analgesic benefit and reduced postoperative analgesic consumption following TAP block.

No nausea, vomiting, haematoma or features of local anaesthetic systemic toxicity were observed in either group. Four patients in Group T required second-line rescue analgesia because of technical difficulty in identifying the TAP plane, emphasizing that the success of ultrasound-guided TAP block may partly depend on operator experience and accurate identification of the anatomical plane.

Overall, the present findings indicate that bilateral ultrasound-guided TAP block offers a clinically meaningful advantage over parenteral diclofenac for early postoperative analgesia following lower segment caesarean section. Its benefit was most prominent during the first several postoperative hours, after which the difference in pain scores diminished as the block effect gradually subsided.

CONCLUSION

Bilateral ultrasound-guided TAP block provided superior early postoperative analgesia compared with parenteral diclofenac following lower segment caesarean section. It significantly prolonged the time to first rescue analgesia,

reduced overall rescue analgesic requirements, and resulted in better quality of analgesia without additional complications. Ultrasound-guided TAP block can therefore be considered an effective and safe component of multimodal analgesia following caesarean delivery, particularly when neuraxial opioids are not used.

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Conflicts of interest

There are no conflicts of interest.

Authors Contribution

Nischal Molkeri - Study concepts, literature research, clinical studies, data acquisition, data analysis

Balasubramanyam P K - Statistical Analysis

Manjunath V - Manuscript preparation, and editing

Review was done by all three authors and was approved by all three authors for final publication

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