



A RANDOMIZED CONTROLLED TRIAL COMPARING POSTOPERATIVE PAIN INTENSITY USING VISUAL ANALOGUE SCALE FOLLOWING ULTRASOUND-GUIDED ERECTOR SPINAE PLANE AND TRANSVERSUS ABDOMINIS PLANE BLOCKS IN ELECTIVE CESAREAN SECTION

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ABSTRACT

Post-caesarean pain can interfere with maternal comfort, mobility and recovery. Ultrasound-guided fascial plane blocks are used as components of multimodal analgesia. This randomized controlled study compared postoperative pain intensity following bilateral erector spinae plane (ESP) and transversus abdominis plane (TAP) blocks in women undergoing elective cesarean section. Sixty ASA II women aged 21–39 years with gestational age ≥ 37 weeks were randomized equally into ESP and TAP groups at SNR District Hospital, Kolar. All underwent spinal anesthesia followed by ultrasound-guided bilateral blocks using bupivacaine. Pain intensity was assessed using a 10-cm Visual Analogue Scale (VAS) during the first 24 hours. Mean VAS scores were lower in the ESP group at most assessments. At 2 hours, VAS was 4.2 ± 0.91 versus 5.0 ± 0.86 ($p=0.001$); at 6 hours, 3.2 ± 0.89 versus 4.0 ± 0.66 ($p=0.03$); at 8 hours, 3.1 ± 0.80 versus 3.7 ± 0.87 ($p=0.01$); and at 12 hours, 2.5 ± 0.90 versus 3.37 ± 0.85 ($p=0.008$). VAS decreased significantly from 2 to 24 hours in both groups. ESP block provided lower postoperative pain intensity than TAP block at most assessed intervals.

KEYWORDS : Erector Spinae Plane Block; Transversus Abdominis Plane Block; Cesarean Section; Postoperative Pain; Visual Analogue Scale

INTRODUCTION

Cesarean section is associated with acute postoperative pain arising from the abdominal incision and deeper visceral structures. Inadequate analgesia can limit mobility and maternal comfort and may interfere with breastfeeding and recovery. Multimodal analgesia therefore combines systemic drugs with regional techniques to improve pain control while reducing reliance on systemic opioids.^{1,2}

The transversus abdominis plane (TAP) block deposits local anesthetic between the internal oblique and transversus abdominis muscles and primarily provides somatic analgesia of the anterior abdominal wall.^{3,4} McDonnell et al. (2007) demonstrated spread to the anterior rami of lower thoracic nerves and L1, providing an anatomical basis for its use in lower abdominal surgery.⁵ The erector spinae plane (ESP) block is performed deep to the erector spinae muscle and superficial to the transverse process. It was initially described for thoracic neuropathic pain and has subsequently been used for abdominal and obstetric procedures.⁶ Its potential cranio-caudal and paravertebral spread may provide broader analgesia.^{7,8}

Comparative studies have reported favorable postoperative pain scores with ESP block after cesarean delivery. Malawat et al. (2020)⁴ reported superior postoperative analgesia with ESP block, while Boules et al. (2020)² found lower pain scores during the early postoperative period. Balata et al. (2023)¹ also reported lower pain scores during the first 24 hours after cesarean delivery. The present study was undertaken to compare postoperative analgesic intensity between ultrasound-guided bilateral ESP and TAP blocks using VAS score in elective cesarean section under spinal anesthesia.

Objective

1. To compare postoperative analgesic intensity between ultrasound-guided bilateral ESP and TAP blocks using VAS score in elective cesarean section under spinal anesthesia.

Methodology

A randomized controlled study was conducted in the Department of Anaesthesiology, SNR District Hospital, Kolar,

Karnataka, over 18 months. Institutional Ethics Committee approval and written informed consent were obtained.

Participants were women aged 21–39 years, BMI 19–29.9 kg/m², ASA physical status II, gestational age ≥ 37 weeks and scheduled for elective cesarean section. Exclusion criteria included local infection or anatomical abnormality at the regional anesthesia site, contraindication to regional anesthesia, allergy to local anesthetics or study drugs, emergency cesarean section, major cardiac, hepatic, renal, coagulation or neurological disease, cognitive impairment and anemia during pregnancy.

The calculated minimum sample size was 25 per group by taking the reference of the study conducted by Malawat et al.⁴. Sixty participants were ultimately enrolled and randomized equally into two groups of 30 using simple randomization and sealed allocation envelopes. Baseline demographic and clinical data were recorded. Patients were familiarized with a 10-cm VAS. Spinal anesthesia was administered at L3–L4 using 10 mg (2.0 mL) hyperbaric bupivacaine, with standard monitoring.

After surgery, Group E received ultrasound-guided bilateral ESP block in the lateral position at T10. A 23-G needle was advanced in-plane to the plane deep to the erector spinae muscle and superficial to the transverse process, followed by administration of 20 mL of 0.25% bupivacaine on each side. Group T received ultrasound-guided bilateral TAP block in the supine position after the surgery. The needle was positioned in the plane between the internal oblique and transversus abdominis muscles and 20 mL of 0.25% bupivacaine on each side was administered according to the study protocol.

Postoperative VAS was recorded during the first 24 hours at 0, 2, 4, 6, 8, 12 and 24 hours. The primary outcome was mean VAS score at each assessment. Data were entered in Microsoft Excel and analyzed using SPSS version 20. Continuous variables were expressed as mean $\pm$ standard deviation. Independent t-test was used for between-group comparisons and paired t-test for within-group comparisons. $p < 0.05$ was considered statistically significant.

RESULTS

Sixty participants were analyzed, with 30 in each group. Baseline characteristics were comparable. Mean age was 24.9 ± 3.37 years in the ESP group and 26.7 ± 3.5 years in the TAP group; mean BMI was 25.5 ± 2.1 and 25.4 ± 2.7 kg/m², respectively. Mean duration of surgery was 75.5 ± 15.8 minutes in the ESP group and 68.5 ± 13.3 minutes in the TAP group ($p=0.069$).

Mean VAS scores were consistently lower in the ESP group. At 0 hour, scores were 0.0 ± 0.01 and 0.1 ± 0.02 in the ESP and TAP groups, respectively, with no significant difference ($p=0.12$). At 2 hours, VAS was 4.2 ± 0.91 versus 5.0 ± 0.86 ($p=0.001$). At 4 hours, scores were 3.5 ± 0.86 versus 4.3 ± 0.85 ($p=0.05$). At 6 hours, they were 3.2 ± 0.89 versus 4.0 ± 0.66 ($p=0.03$). At 8 hours, scores were 3.1 ± 0.80 versus 3.7 ± 0.87 ($p=0.01$). At 12 hours, scores were 2.5 ± 0.90 versus 3.37 ± 0.85 ($p=0.008$). At 24 hours, scores were 2.2 ± 0.82 versus 2.9 ± 0.84 ($p=0.05$).

Within-group analysis showed significant reduction in VAS from 2 to 24 hours in both groups. In the ESP group, VAS decreased from 4.2 ± 0.91 to 2.2 ± 0.82 ($p=0.001$). In the TAP group, it decreased from 5.0 ± 0.86 to 2.9 ± 0.84 ($p=0.003$). Thus, both blocks provided postoperative analgesia, while lower pain scores were observed with ESP block at most measured intervals.

Table 1. Comparison of Postoperative VAS Scores Between ESP and TAP Groups

Postoperative time	ESP block (n=30), Mean $\pm$ SD	TAP block (n=30), Mean $\pm$ SD	p-value
0 hour	0.0 ± 0.01	0.1 ± 0.02	0.12
2 hours	4.2 ± 0.91	5.0 ± 0.86	0.001
4 hours	3.5 ± 0.86	4.3 ± 0.85	0.05
6 hours	3.2 ± 0.89	4.0 ± 0.66	0.03
8 hours	3.1 ± 0.80	3.7 ± 0.87	0.01
12 hours	2.5 ± 0.90	3.37 ± 0.85	0.008
24 hours	2.2 ± 0.82	2.9 ± 0.84	0.05

DISCUSSION

The principal finding was that bilateral ESP block produced lower postoperative VAS scores than bilateral TAP block following elective cesarean section. The difference was evident at 2 hours and remained significant at 6, 8 and 12 hours. At 4 and 24 hours, the difference was at the threshold of statistical significance. Immediately after surgery, there was no significant difference, suggesting that the comparative benefit of ESP became more evident as the effect of spinal anesthesia diminished.

Both groups showed significant reduction in VAS between 2 and 24 hours. The lower scores in the ESP group across follow-up indicate comparatively better pain control rather than absence of analgesic efficacy with TAP block. TAP remains an effective technique for abdominal wall pain, whereas the results suggest that ESP may provide a broader analgesic effect in this setting.

The findings are consistent with previous comparative evidence. Malawat et al. (2020) reported better postoperative analgesia with ESP block than TAP block in cesarean patients. Boules et al. (2020) similarly found lower VAS scores at rest and on movement during the early postoperative period after elective cesarean section. Balata et al. (2023) reported lower pain scores during the first 24 hours with ESP block compared with TAP block. Agreement across these studies supports the observed analgesic advantage of ESP.

The difference may be explained by the anatomical distribution of local anesthetic. TAP block deposits drug within the fascial plane containing nerves supplying the abdominal wall and therefore mainly addresses somatic incisional pain. ESP block is performed adjacent to the transverse process,

where local anesthetic may spread across several levels and toward paravertebral structures. Such spread may permit wider somatic coverage and influence visceral nociceptive pathways.

A strength of the present study was its randomized comparative design with standardized elective cesarean patients and ultrasound guidance for both blocks. The groups were comparable in baseline characteristics, supporting a reliable comparison of postoperative pain scores. Repeated VAS assessment over 24 hours also allowed comparison of the pattern of analgesia over time.

The study has limitations. It was conducted at a single center and included only 60 selected ASA II women undergoing elective cesarean section, limiting generalizability. Several comorbid conditions were excluded.

Overall, both techniques provided postoperative analgesia, but ESP block was associated with lower VAS scores at most postoperative assessment points. The advantage was most evident during the early and intermediate postoperative period, supporting ESP block as an effective regional technique for pain management after elective cesarean delivery.

These findings support ESP block as a useful option for postoperative pain control after cesarean delivery.

CONCLUSION

Ultrasound-guided bilateral ESP block provided lower postoperative VAS scores than bilateral TAP block at most assessed intervals following elective cesarean section. Both techniques significantly reduced pain intensity over the first 24 hours. ESP block may therefore be considered an effective regional analgesic option for postoperative pain management after cesarean delivery.

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