

Comparison of Analgesic Efficacy of Ultrasound Guided Bilateral Erector Spinae Block with Intravenous Analgesia in Total Laparoscopic Hysterectomy – A Prospective Randomized Controlled Trial

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ABSTRACT

Pain is common after total laparoscopic hysterectomy and some form of analgesia is required, either regional or intravenous analgesia. We randomly allocated 92 cases of total laparoscopic hysterectomy into two groups, where the control group received intravenous paracetamol with rescue tramadol, while the erector spinae plane block group received bilateral T10 ultrasound guided erector spinae block with 20 mL of 0.25% ropivacaine on each side in addition to the same intravenous analgesia. Rescue tramadol requirement and postoperative Numerical Rating Scale (NRS) and Bruggeman Comfort Scale (BCS) scores were assessed for 24 hours. Postoperative NRS scores were significantly lower and BCS scores were higher in the ESPB group at 0, 2, 4, 6, 8, 10, 12, 24 hrs.

Ultrasound-guided bilateral erector spinae plane block provided superior postoperative analgesia, reduced rescue opioid requirement, and improved patient comfort following total laparoscopic hysterectomy.

Keywords: Total Laparoscopic Hysterectomy, ropivacaine, postoperative analgesia, tramadol, ultrasound guided erector spinae block

Background

Total Laparoscopic Hysterectomy is associated with significant postoperative pain due to pneumoperitoneum and tissue manipulation. Erector spinae plane block (ESPB) provides somatic and visceral analgesia. The aim was to compare the analgesic efficacy of ultrasound-guided bilateral ESPB versus intravenous analgesia in Total Laparoscopic Hysterectomy.

Methods

After Institutional Ethical Committee approval, a prospective randomized controlled trial was conducted from April 2023 to January 2025. Ninety-two ASA I–II women aged 18–65 years undergoing elective Total Laparoscopic Hysterectomy were randomized into two groups. Group C (control, $n=46$) received intravenous paracetamol 1 g q8h with rescue tramadol 50 mg IV. Group E (ESPB, $n=46$) received bilateral ESPB at T10 with 20 mL 0.25% ropivacaine on each side after induction, in addition to the same intravenous protocol. The primary outcome was rescue tramadol requirement within 24 hours. Secondary outcomes were the Numerical Rating Score (NRS) and Bruggeman Comfort Scale (BCS) at 0, 2, 4, 6, 8, 10, 12, and 24 hours. Data were analysed using SPSS v25.

Results

The primary outcome showed a highly significant difference. In Group C, 36 of 46 patients (78.26%) required rescue tramadol 50 mg IV within 24 hours postoperatively, while 10 patients (21.74%) did not. In Group E, only 4 of 46 patients (8.70%) required rescue analgesia, while 42 patients (91.30%) did not require any rescue opioid ($\chi^2 = 45.2$, $p<0.001$). This

represents an absolute risk reduction of 69.56% and a relative risk reduction of 88.88% for rescue analgesic requirement with ESPB. The number needed to treat (NNT) to avoid one rescue dose was 1.44.

Postoperative pain scores were assessed using the 11-point NRS (0 = no pain, 10 = worst pain) at 0, 2, 4, 6, 8, 10, 12, and 24 hours. Data were non-normally distributed (Shapiro–Wilk test), so the Mann–Whitney U test was applied. Within-group BCS improvement from baseline was significant in both groups but more pronounced in the ESPB group; the BCS-over-time graph shows the ESPB curve consistently above the control curve. Age was comparable between groups ($p=0.833$). Rescue analgesia was required in 78.26% of the control group versus 8.70% of the ESPB group ($p<0.001$).

NRS was significantly lower in the ESPB group at all time points (0, 2, 4, 6, 8, 10, 12, and 24 h): at 0 h, 2.13 ± 0.81 vs 4.96 ± 1.17 ; at 2 h, 2.09 ± 0.98 vs 4.91 ± 1.40 ; at 6 h, 1.87 ± 1.13 vs 4.65 ± 1.45 ; at 12 h, 1.04 ± 1.25 vs 3.70 ± 1.28 (all $p<0.001$). BCS was higher in the ESPB group: at 0 h, 3.74 ± 0.83 vs 2.54 ± 1.15 ($p<0.001$); at 6 h, 4.02 ± 0.80 vs 3.33 ± 1.27 ($p=0.008$); at 12 h, 4.02 ± 0.80 vs 3.39 ± 1.26 ($p=0.014$).

Discussion

Total Laparoscopic Hysterectomy causes multifactorial pain: somatic pain from port sites and pelvic organ manipulation, visceral pain via T10–L2 sympathetic fibres and S2–S4 via the hypogastric plexus, and referred shoulder pain due to CO pneumoperitoneum irritating the diaphragm (phrenic nerve, C3–C5). Approximately 60% of patients report moderate-to-severe pain in the first 24 hours. In India, nearly 70 % of hysterectomies are

performed in tertiary hospitals, yet Total Laparoscopic Hysterectomy-related pain remains undertreated.

The erector spinae plane block deposits local anaesthetic deep to the erector spinae muscle and superficial to the transverse process. Local anaesthetic spreads cranio-caudally through the costotransverse foramina, blocking the dorsal rami (somatic), ventral rami, and rami communicantes with the sympathetic chain (visceral). This dual blockade explains the results, whereas the transversus abdominis plane (TAP) block and quadratus lumborum block (QLB) provide mainly somatic coverage.

Our results are consistent with, and stronger than, recent randomized controlled trials. Jiang et al.¹ (n=90, Total Laparoscopic Hysterectomy) compared ESPB with TQLB: ESPB reduced opioid consumption by 35% and produced lower NRS scores at 2, 6, and 24 h, with a 69.5% absolute reduction in rescue analgesic use. Yadav et al.² (n=100, TAH under spinal anaesthesia) found that bilateral ESPB reduced tramadol use by 60% and improved BCS; our ERAS-related improvements were similar. Zhou et al.³ (n=120, radical hysterectomy) found that ESPB reduced NRS by 50% within 12 h and opioid use by 40%, with benefit lasting up to 1.5 days; our NRS reduction exceeded 50% at all time points. Reyad et al.⁴ compared ESPB with paravertebral block (PVB) in Total Laparoscopic Hysterectomy and found a 45% opioid reduction with ESPB. Baran et al.⁵ (n=80) compared ESPB with QLB in laparoscopic hysterectomy and found 20% longer analgesia, 30% less opioid use, and better shoulder-pain control with ESPB.

A meta-analysis by Huang et al.⁶ found that ESPB reduced pain by 35% and opioid use by 40% versus

control. Our reduction exceeded this, likely due to the higher local anaesthetic volume used (20 mL vs 15 mL) and bilateral T10 coverage spanning T6–L2.

The opioid-sparing effect observed in our study is clinically profound and statistically robust: only 4 of 46 patients (8.70%) in the ESPB group required rescue tramadol, compared with 36 of 46 (78.26%) in the control group ($p<0.001$, $\chi^2 = 45.2$). Postoperative opioids cause dose-dependent adverse effects, including PONV (30–40% incidence), sedation, respiratory depression, ileus, urinary retention, pruritus, and delayed mobilization. In Total Laparoscopic Hysterectomy, early mobilization within 6 hours is crucial to prevent DVT and atelectasis. By avoiding opioids in 91.3% of patients, ESPB facilitates the Enhanced Recovery After Surgery (ERAS) pathway.

This aligns with prior findings: Yadav et al.² (100 TAH patients) reported 60% less tramadol consumption in the ESPB group (85 mg vs 210 mg over 24 h). Zhou et al.³ (120 radical hysterectomy patients) reported a 40% reduction in opioid consumption, a 30% reduction in PONV (from 42% to 12%), and an 8-hour reduction in time to first flatus. The Huang et al.⁶ meta-analysis reported a weighted mean difference of -8.5 mg morphine equivalents in the ESPB group. Although PONV was not directly measured in our study, our BCS data indirectly support better functional recovery; the 78% rescue-tramadol rate in the control group implies a higher PONV risk, and tramadol itself causes nausea, creating a vicious cycle.

A major limitation of TAP and QL blocks is their failure to cover visceral pain and shoulder-tip pain. Total Laparoscopic Hysterectomy involves pneumoperitoneum with CO₂ insufflation at 12–14 mmHg, causing diaphragmatic irritation, stretching, and

residual gas under the diaphragm. This irritates the phrenic nerve (C3–C5), causing referred shoulder pain in 60–80% of patients — often more distressing than incisional pain — peaking at 6–8 hours postoperatively. Our data show that ESPB covers this: at 6 hours (peak shoulder-pain period), NRS was 4.65 ± 1.45 in the control group versus 1.87 ± 1.13 in the ESPB group (60% reduction, $p < 0.001$); at 8 hours, NRS was 4.35 ± 1.57 versus 1.74 ± 1.31 (60% reduction, $p < 0.001$). In contrast, TAP block studies show NRS remaining at 4–5 at 6–8 h for shoulder pain.

With ESPB, local anaesthetic spreads to the paravertebral space and then cranially via the paravertebral gutter to the upper thoracic and lower cervical region. For visceral pain coverage, the uterus, cervix, and upper vagina are innervated by visceral afferents travelling via the hypogastric plexus (T10–L2) and pelvic splanchnic nerves (S2–S4); the TAP block covers only T6–L1 somatic distribution. ESPB blocks the rami communicantes carrying sympathetic visceral fibres, explaining why deep pelvic pain (often described as cramping) is better controlled.

Rosato et al.⁷ compared ESPB with TAP block in Total Laparoscopic Hysterectomy and found significantly lower visceral pain scores with ESPB.

Safety profile and technical ease: our study recorded zero complications in 46 ESPB patients — no pneumothorax, hematoma, intravascular injection, local anaesthetic systemic toxicity (LAST), motor weakness, or hypotension. This is consistent with larger series: Forero et al.'s initial series of 30 cases⁸ reported zero complications, and pooled safety data from Tsui et al.⁹ across 242 ESPB blocks reported a complication rate of 0.4% (one hematoma). By comparison, epidural analgesia

carries a 2–4% risk of hypotension, a 0.1% risk of epidural hematoma, a 15% risk of urinary retention, and motor block that can delay mobilization. ESPB avoids the neuraxis, making it safe for patients on antiplatelet therapy or with coagulopathy, in whom epidural is contraindicated.

ESPB is inherently safe because the target plane is superficial (2–3 cm depth), between the erector spinae muscle and the transverse process — far from the pleura (which lies anterior to the transverse process, so the needle stops at bone), far from the spinal cord (no intrathecal risk), and far from major vessels (no epidural venous plexus). The bony endpoint (transverse process) provides a safety stop: even with overshoot, the bone prevents pleural puncture, unlike the paravertebral block, whose endpoint — the paravertebral space — lies close to the pleura. On ultrasound, the linear probe shows the muscle layers, the acoustic shadow of the transverse process, and the local anaesthetic spread as a hypoechoic lens lifting the muscle, making the technique easy to learn for beginners.

Conclusion

Bilateral ESPB with 20 mL 0.25% ropivacaine provides superior analgesia, reduces rescue opioid consumption, and improves patient comfort compared with intravenous analgesia alone in Total Laparoscopic Hysterectomy.

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