International Journal of Science and Research (IJSR)
ISSN: 2319-7064
Impact Factor 2025: 7.089

Analgesic Efficacy of Ultrasound Guided Erector Spinae Plane Block on Lumbar Spine Surgeries

Dr. Riya Sarkar[1], Dr. Geeta Karki[2]

[1]Junior Resident, Department of Anaesthesia, SRMS IMS, Bareilly, India
Email: *rsarkar3105[at]gmail.com*

[2]Professor and Head, Department of Anaesthesia, SRMS IMS, Bareilly, India

Abstract: **Background:** ***Pain is multifactorial, involving nociceptive (surgical site), neuropathic (nerve irritation) and inflammatory components. Postoperative pain can adversely affect recovery phase, prolong hospital stays, and reduce overall quality of life. Effective postoperative pain management is critical for enhancing recovery outcomes and patient satisfaction. ESPB is a new interfacial block that provides broad analgesia by block dorsal and ventral rami of spinal nerves, reducing opioid consumption both perioperatively and postoperatively.*** ***Objective: This study's primary objective is to determine the effectiveness of ultrasound-guided ESPB for post-operative analgesia in lumbar spine surgeries.*** ***Methods: In a tertiary care hospital, a prospective, randomized controlled study was carried out. Seventy patients posted for lumbar spine surgeries were randomized into control group (n=35) who received general anesthesia without any nerve block and intervention group (n=35), who received ultrasound guided bilateral ESP block at the level of spinal surgery with 0.25% bupivacaine 20 mL after standard general anesthesia. Total intraoperative fentanyl consumption, total rescue analgesia, VAS score and OBAS to evaluate pain, overall patient satisfaction and any side effects were compared at 24 hours.*** ***Results: Intraoperative heart rate, systolic, diastolic and mean blood pressure was significantly lower in intervention group compared to control group($p<0.001$). Intraoperative fentanyl consumption is significantly lower in intervention group (5.7 %) versus control group (100%). ($p<0.001$). Postoperative VAS scores were significantly decreased in intervention group compared to control group ($p<0.001$). Patient satisfaction scores were more favorable in intervention group (4.2 ± 1.4 versus (7.8 ± 2.6).*** ***Conclusion: Ultrasound guided ESP block significantly reduces postoperative opioid consumption and improves analgesia and patient satisfaction without adverse events undergoing surgeries.***

Keywords: Analgesia; Bupivacaine; ESPB; Fentanyl; Visual analog scale, Lumbar spine surgery

1. Introduction

Postoperative pain remains a major clinical challenge in lumbar spine surgery. Although "nociceptive signalling is essential for protecting tissues from injury, insufficient pain control after surgery can negatively influence recovery. Patients undergoing lumbar decompression, fusion, or instrumentation frequently experience intense postoperative pain, which is often multifactorial in origin and tends to peak during the first 48 hours after surgery.[1] Inadequate postoperative analgesia affects more than comfort, as it can delay mobilization, heighten sympathetic and metabolic stress, impair respiratory and gastrointestinal function, and increase the risk of venous thromboembolism.[2]

Postoperative pain after lumbar spine surgery can make patients more vulnerable to chronic pain and extended opioid use. Traditional opioids and epidurals are helpful but may cause side effects. Using a multimodal approach with various medications and regional techniques improves pain control while reducing risks and aiding quicker recovery.[3] Ultrasound-guided fascial plane blocks have expanded regional anesthesia in spine surgery. The erector spinae plane block is valued for its simplicity, safety, and clear ultrasound landmarks. By depositing local anesthetic beneath the erector spinae muscle, it provides multilevel analgesia and is well suited to lumbar procedures.[4]

Clinical evidence supporting ESPB in lumbar spine surgery has grown steadily. Meta-analyses report reductions in postoperative pain scores, opioid consumption, and opioid-related adverse effects, along with lower rates of postoperative nausea and vomiting.[5] Comparative studies suggest that ESPB may provide longer-lasting analgesia and greater opioid sparing than wound infiltration.[6] Additionally, emerging data indicate potential benefits beyond analgesia, including earlier ambulation, faster return of bowel function, and shorter hospital stay, likely related to reduced opioid exposure and attenuation of the perioperative stress response.[7] Overall, ESPB appears to be a valuable component of multimodal analgesia for lumbar spine surgery, although further high-quality studies are needed to optimize its application and clarify its impact on longer-term recovery.

This study aims to determine the effectiveness of ultrasound-guided erector spinae plane block for post-operative analgesia in lumbar spine surgeries. Despite encouraging results, questions remain regarding optimal injection levels, consistency of effect across patients, and the overall impact on functional recovery. Therefore, continued research is essential to strengthen evidence-based practice, validate its advantages and also determine the procedure specific effectiveness in its role in multimodal analgesia.

2. Objectives

1) To compare hemodynamic stability intra-operatively between group given erector spinae block and group with conventional analgesia
2) To compare the pain scores in 2,4,6,12 and 24 hours post-operatively
3) To compare first rescue analgesia time
4) To compare the total analgesic requirement in 24 hours.
5) To compare the patient satisfaction and compliance to the block
6) To compare adverse effects.

3. Materials and Methods

3.1 Study Design

The study is randomized, prospective, parallel-arm clinical study carried out on patients of either sex fulfilling the inclusion and exclusion criteria, conducted in the Department of Anaesthesia, Sri Ram Murti Smarak Institute of Medical Sciences, Bareilly

3.2 Study Duration

Study was conducted over a period of 18 months. (April 2024-September 2025).

3.3 Sample Size

Assuming a pooled standard deviation (SD) of 3.5 units, the study would require a sample size of 31 per group (i.e., a total of 62 subjects assuming equal group sizes) to achieve a power of 80 % and a two-sided level of significance of 5 %, for detecting a true difference in means between the test and reference groups of –2.5 units (i.e., 3.5 – 6). Considering a 10 % non-response rate, the final total sample size is adjusted to 70 patients (35 in each group)[8].

3.4 Sample Selection

a) Inclusion Criteria:
- Patients aged 18–60 years.
- Either sex.
- ASA physical status I, II, III
- Patients scheduled for elective lumbar surgeries under general anesthesia.

b) Exclusion Criteria
- ASA Grade IV.
- Unwillingness to participate in the study.
- Allergy to local anaesthetic drugs used in the study.
- Age < 18 years or > 60 years.
- Body Mass Index > 30 kg/m².
- Local infection at the injection site.
- Previous lumbar surgery.
- Major psychiatric illness or cognitive impairment.
- Substance abuse or opioid dependence.
- Uncontrolled diabetes mellitus or hypertension.
- Hemodynamic instability.
- Pregnancy.
- Coagulopathy.

3.5 Study Tools

Eligible patients were randomly allocated into two equal groups (n = 35 each) using a computer - generated randomization table:
- **Group C (Control):** Patients received general anesthesia without any block.
- **Group T (Test):** Patients received general anesthesia followed by bilateral ultrasound-guided erector spinae plane block (ESPB) with 20 mL of 0.25 % bupivacaine hydrochloride on each side.

3.6 Study Methods

All patients underwent detailed pre-operative assessment one day before surgery, including routine investigations and anaesthetic evaluation. The study protocol and block procedure was clearly explained, and written informed consent obtained. On the day of surgery, standard fasting guidelines followed. All patients receive ASA-standard monitoring (electrocardiogram, non-invasive blood pressure, pulse oximetry, and capnography). Intravenous access secured before induction.

Anaesthetic Technique: General anesthesia with endotracheal intubation induced using:
- Propofol 1.5–2.5 mg/kg,
- Fentanyl 2 µg/kg, and
- Atracurium 0.5 mg/kg for muscle relaxation.

After intubation, anesthesia was maintained with Isoflurane (1–4 %) in 60 % oxygen. Additional Atracurium 0.5 mg/kg was administered as required at the discretion of the anesthesiologist.

Interventions:
- Group C (Control Group): received general anesthesia alone, with no pre-incision regional block.
- Group T (Test Group): After induction, patients were placed in the prone position, and an ultrasound-guided bilateral erector spinae plane block was performed at the appropriate lumbar level using 20 mL of 0.25 % bupivacaine on each side, injected with intermittent negative aspiration to avoid intravascular spread.

Intraoperative hemodynamic parameters- heart rate, non-invasive blood pressure, oxygen saturation, and end-tidal CO_2 - was continuously monitored. In the control group, if surgery exceeded two hours, Fentanyl 50 µg IV was administered intraoperatively. In both groups, if hemodynamic parameters rose > 20 % above baseline, Fentanyl 50 µg IV was repeated.

Postoperative Management:
At the end of surgery and before extubating the patients who have not received ESPB received:
- Paracetamol 1 g IV 6 hourly and
- Diclofenac 75 mg 12 hourly IM.

All patients were monitored for 24 hours postoperatively**.** Pain intensity was evaluated using the Visual Analog Scale (VAS) at 2, 4, 6, 12, and 24 hours after surgery.
Rescue analgesia was provided with Tramadol 100 mg IV in 100 mL normal saline infused over 20 minutes whenever VAS ≥ 4 or on patient demand. The frequency of rescue analgesia and total 24-hour opioid consumption was recorded. Patient satisfaction regarding pain management was assessed using The Objective Pain Assessment Score (OBAS) at 24 hours postoperatively. Adverse effects such as nausea, vomiting, dizziness, and sedation were recorded.

3.7 Technique of Block

Patients after induction were placed based on surgery type-lateral with abdominal surgery and prostrate with lumbar spine surgery. A high-frequency linear ultrasound probe was

applied after aseptic skin preparation to locate the area of erector spinae muscle over the desired level of the lumbar region of the transverse process. The tip of the needle was then inserted under real time ultrasound guidance using an 18-G Tuohy needle until the tip of the needle touched the anterior fascia of the erector spinae muscle. The proper positioning was verified through hydro-dissection using saline. It was then followed with a single injection of 20 mL of 0.25 percent bupivacaine bilaterally injected in small aliquots with negative aspirations between each injection.

3.8 Study Parameters

- Hemodynamic variables - Heart rate, mean arterial pressure, and oxygen saturation recorded at baseline, before incision, after incision, 60 minutes after block, and at every 30-minute interval until the end of surgery.
- VAS Pain Scores - Recorded at 2, 4, 6, 12, and 24 hours postoperatively.
- Total rescue analgesic consumption - Cumulative requirement of tramadol within 24 hours.
- Number of rescue analgesic demands - Frequency of requests within 24 hours.
- OBAS Score**:** Assessed at 24 hours to evaluate patient satisfaction.
- Intra-operative and post-operative complications - Hypotension, bradycardia, local anaesthetic toxicity, nausea, vomiting, dizziness, or block-related events.

3.9 Data Collection and Analysis

The data was prospectively obtained. The vital signs, age, sex, ASA grade and the BMI were taken before the surgery. The intra-operative data were recorded at the beginning of anesthesia, once the block had been performed (in case of Group T), and at an hourly rate until the end of the procedure. The post-operative data were collected once the patients had been transferred to the recovery room. Pain score data was gathered by the nursing staff with the help of the Visual Analogue Scale, rescue analgesia administration, time and sum dose of tramadol received. Adverse effects were recorded during the 24 hours follow up postoperatively. Patients were measured on the level of satisfaction 24 hours after the course of surgery using the scale of OBAS.

All data was recorded on case report forms and input into the database of the study in a manner that could preserve the anonymity of the participants and data sheet was developed.

Once we completed the processes of validating the data in terms of integrity and accuracy, the data was logged in SPSS version 26.0 and calculated the descriptive statistics to create a summary of the demographic information for each group. VAS scores, rescue analgesic consumption, and other hemodynamic and OBAS scores as continuous metrics were recorded as means and standard deviations.

4. Results

No statistically significant differences between two studied groups regarding patient's characteristics in form of age, BMI, gender, ASA and duration of surgery. [Table 1]

Table 1: Demographic Profile and duration of surgery

Demographic variables	Group C	Group T	P - value
Age (years)	43.3 ± 9.2	42.1 ± 9.8	0.440
BMI	22.97 ± 3.0	23.95 ± 3.91	0.225
Gender	n (%)	n (%)	0.068
Male (n=49)	21 (60%)	28 (80%)	
Female (n=21)	14 (40%)	7 (20%)	
Duration of Surgery (min)	176.77 ± 35.89	175.14 ± 30.91	0.853

The baseline and pre-incision heart rates were comparable between the two groups ($p > 0.05$). However, a statistically significant difference was observed after incision at 60, 90, 120 minutes, and at the end of surgery with Group T (ESPB) demonstrating consistently lower heart rates compared to Group C (Control), indicating better hemodynamic stability and attenuation of stress response during surgery. [Table2/Figure 1]

Table 2: Intraoperative Heart Rate Changes in Both Studied Groups

HR	Group C (n = 35)	Group T (n = 35)	p-value
Baseline	72.89 ± 10.24	73.66 ± 9.84	0.360
Before incision	69.40 ± 6.41	70.54 ± 8.07	0.541
After incision	84.89 ± 7.81	78.71 ± 6.58	0.002
60 minutes	85.97 ± 7.07	75.77 ± 9.85	<0.001
90 minutes	88.43 ± 7.18	76.37 ± 7.00	<0.001
120 minutes	87.51 ± 7.20	77.20 ± 5.65	<0.001
End of surgery	88.43 ± 7.18	74.37 ± 7.01	<0.001

*Independent t-test.

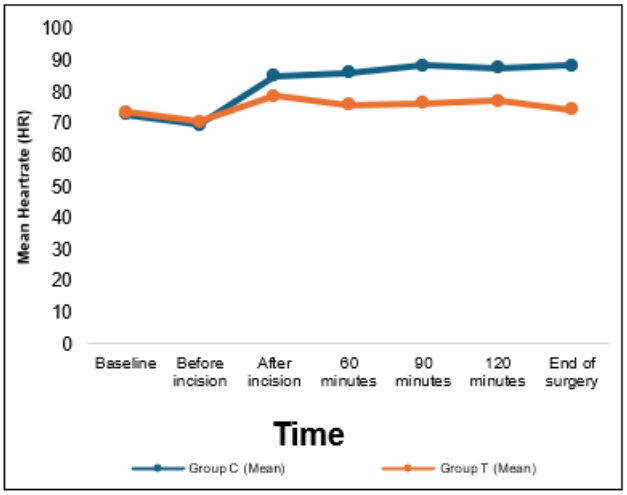

Figure 1: Intraoperative Heart Rate Changes in both Groups

No statistically significant MAP difference at baseline between both groups ($p = 0.062$). After incision, there was a significant decrease in MAP in Group T compared to Group C which was 102.03 ± 7.39 mmHg in Group C and 95.77 ± 5.44 mmHg in Group T ($p < 0.001$). This difference persisted at 60 minutes (98.77 ± 6.66 vs. 92.43 ± 4.95 mmHg, $p < 0.001$), 90 minutes (96.22 ± 5.31 vs. 91.02 ± 4.88 mmHg, $p < 0.001$), and 120 minutes (95.07 ± 5.32 vs. 90.44 ± 5.00 mmHg, $p < 0.001$). [Table 3 / Figure 2]

Table 3: Intraoperative Mean Arterial Pressure (MAP) in Both Groups

MAP	Group C Mean ± SD	Group T Mean ± SD	p-value
Baseline	92.57 ± 6.10	95.43 ± 6.21	0.062
Before Incision	98.80 ± 9.11	97.34 ± 6.01	0.160
After Incision	102.03 ± 7.39	95.77 ± 5.44	< 0.001
60 Minutes	98.77 ± 6.66	92.43 ± 4.95	< 0.001
90 minutes	96.22 ± 5.31	91.02 ± 4.88	< 0.001
120 minutes	95.07 ± 5.32	90.44 ± 5.00	< 0.001
End of Surgery	94.43 ± 5.31	90.33 ± 5.26	0.017

**Unpaired t-test.*

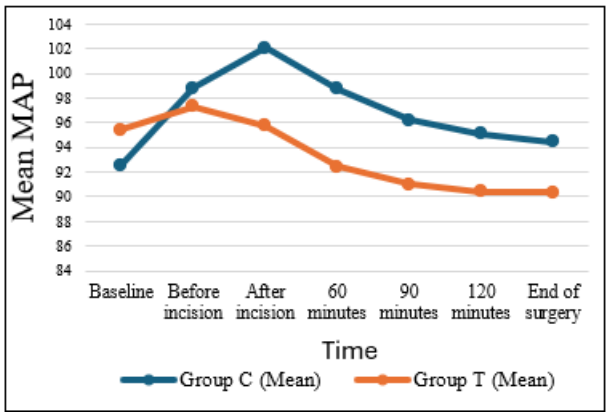

Figure 2: Intraoperative Mean Arterial Pressure (MAP) in Both Groups

The difference between the two groups was highly statistically significant ($p < 0.001$), showing marked reduction in intraoperative opioid requirement among patients receiving erector spinae plane block (ESPB) clearly demonstrates its superior intraoperative analgesic efficacy. [Table 4]

Table 4: Intraoperative Fentanyl Use in study group

Intra operative Fentanyl Requirement	Group C (Control)	Group T (ESPB)	Total	P value
Yes	35 (100.0%)	2 (5.7%)	37 (52.9%)	<0.001
No	0 (0.0%)	33 (94.3%)	33 (47.1%)	
Total	35 (100.0%)	35 (100.0%)	70 (100.0%)	

*Chi-Square Test

There was statistically significant difference at 2, 4, 6, 12 and 24 hours between both groups. This indicate that patients who received the erector spinae plane block experienced significantly lower pain intensity in the early and intermediate postoperative periods compared to those who did not receive the block. [Table 5 / Figure 3]

Table 5: Postoperative Pain Scores (VAS) in Both Groups

Time Point (Postoperative)	Group C (Control) Mean ± SD	Group T (ESPB) Mean ± SD	p-value
2 hours	3.23 ± 1.48	1.14 ± 0.88	0.004
4 hours	4.97 ± 1.12	1.97 ± 0.89	<0.001
6 hours	6.00 ± 1.50	2.83 ± 1.51	<0.001
12 hours	6.40 ± 1.14	4.26 ± 1.44	<0.001
24 hours	6.80 ± 1.18	5.94 ± 1.35	0.006

*Independent t-test.

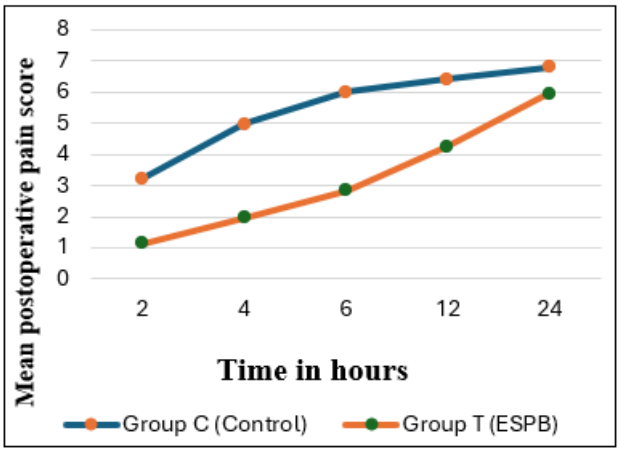

Figure 3: Postoperative Pain Scores (VAS) in Both Groups

The statistically difference between the two groups was highly statistically significant ($p < 0.00$), clearly indicating that patients ESPB had markedly reduced postoperative analgesic requirements. [Table 6]

Table 6: Rescue Analgesia (Inj. Tramadol 100 mg) in 24 Hours

Tramadol 100mg	Group C (Control)	Group T (ESPB)	Total (n = 70)	p value
0	0 (0.0%)	11 (31.4%)	11 (15.7%)	<0.001
1	5 (14.3%)	14 (40.0%)	19 (27.1%)	
2	15 (42.9%)	10 (28.6%)	25 (35.7%)	
3	12 (34.3%)	0 (0.0%)	12 (17.1%)	
4	3 (8.6%)	0 (0.0%)	3 (4.3%)	
Total	35 (100.0%)	35 (100.0%)	70 (100.0%)	

*Chi-Square test

The difference between the two groups was highly statistically significant ($p = 0.0012$), indicating that patients who received the ESPB had a marked reduction in postoperative opioid requirement compared to those managed with conventional analgesia alone. [Table 7]

Table 7: Total Tramadol Consumption (mg) in study participants

Total Tramadol (mg)	Group C (Control)	Group T (ESPB)	Total (n = 70)	p value
0 mg	0 (0.0%)	11 (31.4%)	11 (15.7%)	0.0012
100 mg	5 (14.3%)	15 (42.9%)	20 (28.6%)	
200 mg	16 (45.7%)	9 (25.7%)	25 (35.7%)	
300 mg	11 (31.4%)	0 (0.0%)	11 (15.7%)	
400 mg	3 (8.6%)	0 (0.0%)	3 (4.3%)	
Total	35 (100%)	35 (100%)	70 (100%)	

*Chi square test.

The incidence of adverse effects was significantly lower in the ESPB group (Group T) compared to the Control group (Group C). The most common adverse effect observed in the control group was nausea and vomiting ($p = 0.005$). Dizziness was also markedly higher in the control group compared to the ESPB group ($p = 0.003$). Hypotension occurred in Group C, but was absent in Group T ($p = 0.026$). Other minor complications as pain at the block site, muscle weakness, not statistically significant between groups ($p > 0.05$). [Table 8]

Table 8: Adverse Effects in both groups

Adverse Effect	Group C (Control)	Group T (ESPB)	p-value
Nausea/ Vomiting	25 (71.4%)	2 (5.7%)	0.005
Dizziness	10 (28.6%)	1 (2.9%)	0.003
Hypotension	6 (17.1%)	0 (0.0%)	0.026
Pain at block site	0 (0.0%)	1 (2.9%)	0.313
Muscle weakness	3 (8.6%)	0 (0.0%)	0.079

*Chi-Square test

Comparison of Overall Benefit of Analgesia Score (OBAS) between the two study groups at 24 hours postoperatively. was highly statistically significant ($p = 0.0002$), indicating that patients who received ESPB experienced greater overall satisfaction with pain control and fewer side effects compared to those receiving conventional analgesia. [Table 9]

Table 9: OBAS Score at 24 Hours

Variable	Group T (n = 35)	Group C (n = 35)	P-value
OBAS Score	4.2 ± 1.4	7.8 ± 2.6	0.0002

*Independent t-test.

5. Discussion

One of the most important issues in anesthetic problems is perioperative pain management in lumbar spine surgery due to the great amount of tissue dissection, duration of surgery, and the intensity of postoperative nociceptive input. The ultrasound-guided erector spinae plane (ESP) block belongs to the potential elements of multimodal analgesia in previous years, which ensures not only effective pain management but also minimizes the negative consequences of opioid use. The present study involved comparative analgesic efficacy, hemodynamic stability, opioid-sparing effect, post-operative pain, and safety profile of ESP blocks against conventional analgesic management of the lumbar spine surgery patients. The findings of this study are constantly consistent to suggest that the ESP block is superior in intraoperative and postoperative analgesia accompanied with an improved hemodynamic stability and a favorable safety profile. Interestingly, the results are very consistent with numerous randomized controlled studies and systematic reviews which were reported in recent literature.[1]

The lack of statistically significant differences between both groups were similar in the current study in terms of demographic and baseline clinical profiles, such as age, height, weight, and body mass index (BMI) and ASA physical status ($p > 0.05$), demonstrates successful randomization and guarantees that the observed differences in outcomes can be accredited almost solely to the analgesic method and that these differences are not caused by the confounding factors of patients. Also, the surgical time took the same amount of time in the two groups, which ruled out the factor of operative time affecting the postoperative pain scores or analgesic intake.[9] These results are comparable to reports by MR El Ghamry et al ($p< 0.199$) who also did not find any significant differences when it comes to the duration of operative hours between ESP and control groups.[10]

Patients in the current research were found to have much stable HR, and MAP after surgical incision and during intraoperative period when administered with ESP block (Group T) when compared to those who were exposed to conventional analgesia (Group C). These results indicate that the sympathetic responses of ESP block group were significantly attenuated. The heart rate measures in Group T were found to be comparatively lower consistently, with not much differences to baseline readings. In another study, Siam et al., it compared heart rate of group I which was given ESP block and group II under multimodal analgesia. For group I the mean HR was 79.20±12.49 and 74.0±8.79 beats/min after stimulus of incision and first-time interval respectively. While group II, mean HR were 88.07±10.22, 81.00±8.03 beats/min at the same intervals. Therefore, statistically, significant difference seen between two groups.[11]

The trends of mean arterial pressure in the study also indicate the better analgesic effect of ESP block as the lower the MAP the more the autonomic stability. All these hemodynamic results support the idea that ESP block helps to keep intraoperative physiological stability in order to relieve the conditions and decrease the anaesthetic interventions.

In another study, Siam et al. compared heart rate of group I which was given ESP block and group II under multimodal analgesia. For group I the mean HR was 79.20±12.49 and 74.0±8.79 beats/min after stimulus of incision and first-time interval respectively. While group II, mean HR were 88.07±10.22, 81.00±8.03 beats/min at the same intervals. In the same study, for group I, MBP values were 84.73±7.12 mm Hg after stimulus and while for Group II, MBP values were 92.53±11.56 mmHg. There was statistically significant change seen between the groups in HR and MBP. [11]

The parameters including the heart rate, systolic blood pressure, and diastolic blood pressure and mean arterial pressure were found to be more stable during the intraoperative period in the ESPB group especially after surgical incision and long surgical period. Such stability is an indicator of a good attenuation of nociceptive and sympathetic responses, which means that anaesthetic adjustments and rescue administration of opioids are reduced. Better hemodynamic management also helps to enhance safer anaesthetic management particularly in patients that have less physiological reserve or greater ASA grades.

Effect on Opioid consumption

An important and clinically significant opioid-sparing effect was noted in the patients who were given ESPB. The significant decrease in the occurrence of intraoperative and postoperative opioid demands emphasizes the effectiveness of ESPB in the provision of long-term analgesia and reduction of opioid exposure. This observation especially applies to the contemporary clinical environment, where the incidence of adverse effects caused by opioids and the probability of opioid-dependent syndrome are key issues. Less opioid use in the ESPB group was linked with fewer side effects of opioid consumption including nausea, vomiting, dizziness, and hypotension, hence improving patient comfort and recovery. Group T also demonstrated significant lessening of intraoperative fentanyl need, as the percentage of Group T receiving intraoperatively opioid supplementation was 5.7 that of Group C which used conventional analgesia universally. This large decrease is well consistent with the

findings of systematic reviews and meta-analyses that Viderman et al[1] Fu et al.[2], and Wilson et al.[12] conducted, which all showed a considerably lower intraoperative and postoperative opioid use among patients that received ESP block.

The opioid-sparing effect of ESP block is of some interest to the enhanced recovery protocols and opioid stewardship programs. Minimal exposure to opioids limits the occurrence of the side effects of opioids like nausea, vomiting, dizziness, respiratory depression, and slow mobilization. Similar results were also shown by Siam et al, intraoperatively administered drugs group I (ESP) patients (six patients 40%) received statistically significant higher mean ephedrine dose 5.33±6.94 mg, compared to group II (MMA) patients ($p< 0.007$). Also, fentanyl consumption was statistically lower in Group I (ESP) patients.[13]

Akhlagh et al. who noted that fentanyl and morphine requirement in ESP block groups was significantly lower than in conventional analgesia. Patients in the ESP block group requested analgesic medication for the first time later than the control group (45 min vs. 22.5 min, $P < 0.001$). PCA consumption in the ward (mg), additional morphine consumption in the ward (mg), morphine consumed in recovery (mg), and total morphine consumption (mg) were lower in the ESP block group than in the control group. Also, the number of patients who requested additional morphine in the ward was significantly higher in the control group relative to the ESP block group (57.6% vs. 20.8%, $P = 0.008$). The current evidence also enhances this fact and shows that the rate of intraoperative opioid supplementation avoidance is almost 100 percent in the ESP group.[14]

Post-operative pain (VAS) and Rescue analgesia

The management of pain after surgery is a major factor that dictates the level of patient satisfaction, early ambulation, and recovery after spinal surgery. Patients that received ESP block in the current study also were found to report significantly visual analog scale (VAS) pain scores at each of the measured postoperative time intervals up to 24 hours. The prolonged analgesic effect of the Group T may be evidence of sustained blockage of nociceptive pathways, probably because of constant diffusion of local anaesthetic in the paraspinal fascial planes. The analgesic superiority of ESPB was also strengthened by the assessment of postoperative pain. The long-lasting nature of analgesia is an indication of successful diffusion of local anaesthetic in the erector spinae fascial plane that causes long-term blockade of both dorsal and ventral rami of the nociceptive pathways. The decreased use of rescue analgesics and decreased consumption of opioids in total postoperative further establish the prolonged analgesic effect of ESPB.

In Zhang et al, studies 60 patients undergoing open postoperative lumbar surgery, compared to the control group, patients in ESP block group (T12) needed less intraoperative sufentanil and post-operative morphine, had earlier ambulation times, and had higher modified observer assessment of alertness/sedation score.[4]

The comparative evaluation between Group T and Group C demonstrated clear and consistent differences across demographic, intraoperative, and postoperative parameters. Both groups were largely comparable in baseline physical characteristics, including age, weight, height, and BMI, confirming that the study groups were well matched. Although Group T had a higher proportion of male participants, and Group C had slightly more ASA III patients, these variations did not significantly influence the clinical outcomes. However, surgical duration was notably longer in Group C, which may have contributed to greater postoperative analgesic needs.

Hemodynamic analysis revealed pronounced differences beginning immediately after incision. Group T maintained significantly more stable heart rate, SBP, DBP, and MAP values throughout surgery, indicating superior analgesic depth and reduced sympathetic activation. Conversely, Group C showed more fluctuating hemodynamic parameters, reflecting heightened nociceptive response and reduced intraoperative analgesic control.

These physiological findings translated directly into analgesic outcomes. Intraoperative fentanyl requirement was drastically different, with nearly all patients in Group C requiring supplemental opioid analgesia, compared with only a small minority in Group T. This highly significant disparity underscores the robust intraoperative analgesic efficacy provided in Group T.

Postoperatively, the benefits of Group T continued. Pain scores were consistently and significantly lower at all time intervals, demonstrating sustained analgesic action. Consequently, Group C required significantly more rescue analgesia, including approximately three times more tramadol over 24 hours, further confirming poorer postoperative pain control. OBAS scores supported these findings, with Group T showing excellent patient satisfaction and comfort compared with the markedly poorer scores in Group C.

The safety profile also favored Group T. Adverse effects were minimal, whereas Group C exhibited a higher incidence of opioid-related complications such as nausea, dizziness, and hypotension, likely linked to greater intraoperative and postoperative opioid consumption.

Group T demonstrated superior analgesic efficacy, better hemodynamic stability, lower opioid requirements, fewer adverse effects, and higher patient satisfaction compared with Group C. These results collectively suggest that the intervention used in Group T provides a more effective and safer analgesic strategy both intraoperatively and postoperatively.

6. Limitations

Despite the strong results, the study was characterized with a few limitations:

1) Single-center design has a disadvantage of generalizability.
2) The scoring of pain can be subjective, thus becoming variable.
3) The results of follow-up were assessed after 24 hours only; a more extended follow-up period might be used to increase its comprehensiveness.

4) Surgeon and anesthetists practice with ESP block technique could have an impact.

These limitations could be overcome by future large-scale randomized, multicenter studies.

7. Conclusion

The effective pain management of the lumbar spine surgery remains among the pillars of successful surgery, and it directly affects the stability of the patient during the surgical period, post operative phase and the patient satisfaction and the overall outcome of surgery. The study results are a clear message that, when compared to the patients treated only with the standard analgesic regimens, patients treated with ESPB were more stable during the intraoperative period.

The ESPB group had significant improvements in patient-centered outcomes, including overall satisfaction and the sense of comfort and better safety profile and also offers an input to the enhanced compliance with the postoperative rehabilitation, early mobility, and potentially reduced hospitalization. Block-related complications were not significant in their issues, and the prevalence of adverse effects was minimal. ESPB helps in enhancing the intraoperative hemodynamic stability, better and longer postoperative analgesia.

Finally, we conclude that this research has shown that, in comparison to traditional analgesia, ultrasound-guided ESP block offers better analgesia, intraoperative hemodynamic stable, less opioid intake, better postoperative outcomes, and fewer side effects in surgeries on the lumbar spine. The ESP block is an opioid-sparing, safe, and effective treatment method that should be regarded as a useful part of the multimodal analgesia plan in spine surgery.

Conflict of interest: - NONE

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