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Origianl Research Article

Evaluating the Role of Erector Spinae Plane Block in Alleviating Postoperative Pain in Laminectomy and Discectomy Procedure: A Prospective Randomized Study

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Abstract: ***Background:*** Patient`s having lumbar and thoracic laminectomy surgery have substantial postoperative pain. This study investigates the effectiveness of ultrasound-guided erector spinae plane block (ESPB) in treating these patient`s post-operative pain. ***Objective:*** To compare mean pain score, 1hour, 6 hour 24hour, frequency of patients requiring rescue analgesia and opioids in patients receiving erector spinae plane block versus control group. ***Design:*** Randomized Control Trial. ***Setting:*** This research was performed at the Department of Anaesthesiology and Pain Management at Shifa International Hospital in Islamabad from August 2025 to November 2025. ***Methods:*** There were 72 patients scheduled for elective surgery, including lumbar and thoracic laminectomy and discectomy. Thirty-six patients were randomly assigned to the control group, whereas 36 patients got ESPB at random. The postoperative anesthesia care unit (PACU) documented the NRS pain score, rescue analgesia, total opioid intake, operation time, and duration of hospital stay. ***Results:*** The study examined at 72 individuals (mean age 44.51 years), including 32 males (44.4%) and 40 females (55.6%). ESPB had considerably lower rescue analgesia (16.7%) compared to the control group (69.4%, $p < 0.005$). Patient receiving ESPB had significantly lower pain score at, 1hour, 6 hours, and 24 hours versus the control group along with lower requirement of rescue analgesia ($p<0.005$). ***Conclusion:*** The USG ESPB significantly reduced postoperative pain, and the need for rescue analgesics in patients following laminectomy and discectomy procedures.

Keywords: Lumbar spine, Thoracic spine, Laminectomy, Discectomy, ESPB, Ultrasound-guided regional anesthesia.

INTRODUCTION

Post-surgical pain is frequently severe in patients undergoing lumbar and thoracic Laminectomy surgery. [1-2] Patients' recovery is hampered by their unwillingness to get out of bed early due to postoperative pain. [3,4] Numerous strategies, such as certain drugs and nerve blocks, have been put out to lower the use of analgesics following surgery. However, adverse effects connected to opioids are common in patient-controlled analgesia. Adverse outcomes such as hematomas and infections are linked to epidural injections.

The erector spinae plane block (ESPB) is an ultrasound-guided block illustrated for the administration of thoracic and abdominal pain. ESPB was first used by Forero et al. [4] to manage thoracic pain. It quickly gained popularity as a substitute technique for postoperative pain management in variety of conditions, including post-thoracotomy, major abdominal surgery, and different kinds of acute or chronic pain in laparoscopy, thoracic, abdominal, shoulder, femur, and spine surgery. [5-12] ESPB is safe, low-risk, and simple technique to manage postoperative pain. ESPB acts by inhibits the posterior roots of the spinal nerve and creates a para-spinal block through drug release, although the precise mechanism remains uncertain. [13] Furthermore, recent study has shown that the use of ESPB reduces the need for analgesics after bariatric and breast surgeries, which usually require large doses of opioids for postoperative analgesia. According to Stewart JW, ESPBs had considerably lower opioid requirements at 24 hours than controls (difference = -29.3 mg). At 48 hours, the ESPBs had significantly lower mean pain scores (mean = 3.5; SD = 1.7) than the No block group (mean = 4.8; SD = 1.7). [14]

The postoperative pain management in patients undergoing lumbar and thoracic Laminectomy surgery is still controversial low-middle income countries. Due to a shortage of good quality opioids, equipment, and personnel with expertise, there is a need to find ways to improve the quality of analgesia in patients experiencing thoracic and lumbar Laminectomy and Discectomy surgery. Therefore, the purpose of this study is to evaluate the effectiveness of erector spinae plane block in relieving postoperative pain in laminectomy and discectomy surgeries to controls.

METHODOLOGY

This randomized control trial was carried out at the Shifa International Hospital's Department of Anesthesiology and Pain Management in Islamabad, from from August 2025 to November 2025. The ERC committee granted ethical approval before the study's start [IRB #:274-24]. After obtaining informed consent, adult patients aged 18 to 60 who had elective lumbar and thoracic laminectomy procedures were enrolled. Patients with a history of spine surgery, an allergy to local anesthetics, an infection at the puncture site, and long-term opioid use were excluded.

A preoperative anesthesia assessment was performed in the preoperative anesthesia clinic, before surgery. Patient were randomly allocated into two groups using computer-generated random numbers. Group A: Patients received Erector Spinae Plane Block plus intravenous analgesia. Group B: Patients in the control group received intravenous analgesia only.

A statistician kept the computer-generated random numbers that made up the allocation sequence hidden in opaque, sealed envelopes until the patient gave their assent. The anesthesiologist performed the ESPB technique, and the patients and staff provided postoperative care. Patient demographic, pain score, total opioid consumption, and information regarding the side effects were noted in a predesigned proforma.

All patients received general anesthesia initiated with injection midazolam [2mg] propofol [2mg/kg], nalbuphine [0.1 mg/kg], and atracurium [0.5 mg/kg]. Anesthesia was maintained with sevoflurane [MAC 2%] with fresh gas mixture of air and oxygen and atracurium boluses as needed. Intraoperatively, dexamethasone [8mg] and ondansetron [8mg] were administered for prevention of postoperative Nausea and vomiting and infusion paracetamol 1 gram before extubation. Postoperative assessments included NRS pain scores, nausea, vomiting, and complications in the PACU.

The ESPB involved using a high-frequency linear array ultrasound probe and a 100mm needle inserted in-plane in a cephalad to caudal orientation. After identifying bone contact with the transverse process of the target vertebrae, slight needle retraction and hydro-dissection with normal saline were performed to confirm the correct needle placement. A 10ml dose of bupivacaine (0.5%) diluted in 30ml of normal saline (0.125% in 40ml), 20ml was injected bilaterally in the prone position after induction and before surgery began. Pain was assessed using a numeric rating scale (NRS) from 0 to 10 postoperatively at 1 hour, 6 hours, and 24hours.Rescue analgesia was administered in the form of intravenous nalbuphine 3 mg when the patient reported a pain score ≥4 on the NRS.

Data analyses were conducted using SPSS-23 software. For numeric variables, means ± SD or medians (interquartile range, 25%-75% percentiles) were reported for age, weight, height, BMI, surgical pain duration, and total analgesic consumption within 24 hours after surgery. Proportions and percentages were reported. Continuous data were analyzed using the t-test for mean pain score and analgesic consumption. A p value ≤ 0.05 was considered statistically significant.

RESULTS

Seventy-two patients were planned for elective surgery, lumbar and thoracic laminectomy, and discectomy. The mean age of the patients was 44.51±10.61 years. Of the 72 patients 32(44.4%) male and 40(55.6%) female. Baseline characteristics of the patients are not statistically significant Table 1.

Postoperatively, the mean pain score was higher in Group B as compared to Group A at 1h (p = 0.002), at 6h (p = 0.001), and at 24h (0.001), the difference was even more pronounced, with mean pain scores in Group B than Group A (4.53±2.53 vs. 1.06±1.74; p = 0.0005) as reported in Table 2.

Patients in Group A had significantly lower total rescue analgesia requirements compared to Group B (16.7% vs

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69.4%, p = 0.0005). Although Group A used fewer opioids overall than Group B, there was no discernible difference (p = 0.202). Surgery time was significantly shorter in Group A (2.47 ± 1.22h) compared to Group B (3.13 ± 1.38 h) (p = 0.037). Mean duration of hospital stay was also insignificant between groups (2.5 ± 1.29 vs 2.97 ± 2.67 days, p = 0.343) shown in table 3.

Table 1: Comparisons between the demographic parameters were described as mean and ± SD and its statistical significance was determined by student t tests. A p value ≤ 0.05 was considered statistically significant.

Variables	**ESPB-Group A (n=36)**	**Control -Group B (n=36)**	**P-Value**
Age (Years)	45.83±10.71	43.19±10.49	0.295
Weight (kg)	80.33±11.23	80.44±15.06	0.973
Height (cm)	163.46±11.65	162.92±9.93	0.832
BMI (kg/m^2)	30.37±5.18	30.42±6.04	0.972
Gender			
Male	14(38.9%)	18(50%)	0.343
Female	22(61.1%)	18(50%)	
ASA Status			
I	9(25%)	6(16.7%)	0.654
II	19(52.8%)	20(55.6%)	
III	8(22.2%)	10(27.8%)	

Table 2: Comparisons between the NRS pain score at 1 hour ,6 hours and 24 hours were described as mean and ± SD and its statistical significance was determined by student t tests. A p value ≤ 0.05 was considered statistically significant.

Variables	**Statistics**	**ESPB-Group A (n=36)**	**Control -Group B (n=36)**	**P-Value**
Pain at 1hour	Mean ±SD Median (IQR) [Min-Max]	1.39±1.93 0(2) [0-7]	3.25±2.96 2(5) [0-9]	0.003
Pain at 6hours	Mean ±SD Median (IQR) [Min-Max]	1.19±1.6 1(2) [0-7]	3.0 ±2.65 2(6) [0-8]	0.003
Pain at 24hour	Mean ±SD Median (IQR) [Min-Max]	1.06±1.74 0(2) [0-8]	4.53±2.53 5(4) [0-9]	<0.001

Table 3: Comparison of rescue analgesia and opioid consumption with respect to the time point at 1 hour ,6 hours and 24 hours were described as mean and ± SD and its statistical significance was determined by student t tests. A p value ≤ 0.05 was considered statistically significant.

Variables	**ESPB-Group A (n=36)**	**Control -Group B (n=36)**	**P-Value**
Rescue Analgesia			
At 1hour	5(13.9%)	14(38.9%)	0.016
At 6hours	2(5.6%)	14(38.9%)	0.001
At 24 hours	2(5.6%)	24(%)	0.0005
Opioid Consumption			
1 **hour**	5.0 ± 3.08 (n=5)	4.5±1.78 (n=14)	0.964
6 **hours**	3.0 ± 0 (n=2)	3.71±0.99 (n=14)	0.50
24 **hours**	3.0 ± 0 (n=2)	4.47±2.31 (n=24)	0.280

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Table 4: Comparison of total rescue analgesia , opioid consumption, surgery time and duration of hospital stay were described as mean and ± SD and its statistical significance was determined by student t tests. A p value ≤ 0.05 was considered statistically significant.

Outcomes	ESPB-Group A (n=36)	Control -Group B (n=36)	P-Value
Total Rescue Analgesia	6(16.7%)	25(69.4%)	0.0005*
Total Opioid Consumption	6.17±4.66	9.68±6.14	0.202
Surgery Time	2.47±1.22	3.13±1.38	0.037
Duration of Hospital Stay	2.5±1.29	2.97±2.67	0.343

DISCUSSION

After spine procedures such as discectomies and spinal decompressions, the need to improve postoperative healing and reduce discomfort has motivated the search for efficient pain treatment techniques [2, 15-16]. During the first twenty-four hours following surgery, about 1/3 of patients with spinal stenosis and fourteen percent with disc herniation experience poorly managed pain. [2, 17] The ESPB is a pretty simple technique to learn and apply for post-operative pain control, which is why it is increasingly being investigated in patients after spine surgery. [18] Physiologically, the block relies on the spread of anesthetic to desensitize the primary rami of the spinal nerves. Because this technique intercepts the complex sensory network of spinal architecture and adjacent soft tissues, it results in an extensive area of anesthesia suitable for various surgical procedures. [19]

Our findings reveal the effectiveness of the erector spinal plane block in reducing postoperative pain after a laminectomy and discectomy procedure. According to our research, erector spinal plane block (ESPB) significantly decreases postoperative pain and improves recovery, which corresponds with the increasing amount of evidence indicating the positive outcomes of regional anesthetic methods in spine surgery. [20-24].

In our study, postoperatively, the mean pain score was lower in the ESPB group compared to the control group at 1, 6h, and 24h. These findings are consistent with previous research, Azizi et al. [25], who similarly noted significant improvements in postoperative pain at 6, 12, and 24 hours in patients receiving ESB. This clinical benefit was further evidenced by a significant decrease in the length of hospitalization. Akhlagh et al. also demonstrated that bilateral lumbar ESPB provides effective pain relief for patients undergoing lumbar laminectomy. [20] Van den Broek et al. reported comparable improvements in recovery outcomes following laminectomy and discectomy through the application of the erector spinae plane block. [26]

The ESPB group in our study showed a marked reduction in the need for rescue analgesia compared to controls (16.7% vs 69.4%). A similar reduction was observed in total opioid consumption, though it remained statistically non-significant (p = 0.202). Three additional randomized controlled trials (RCTs) demonstrated that the ESPB significantly lowers postoperative pain scores, shortens hospital stays, and reduces opioid consumption in patients undergoing lumbar decompression, laminectomy, or surgery for prolapsed intervertebral discs. [27-29].

Moreover, a study by Daniele et al. on the use of ESB in thoracic surgery presented similar conclusions regarding pain management. They found a significant reduction in the need for postoperative opioids in the ESP block group compared to the control group. Similar to our study, they observed that ESPB is an effective regional anesthesia technique for minimizing postoperative pain and analgesic consumption. [30]

In a meta-analysis, Huda et al. found that ESB significantly reduces opioid usage (p=0.02) and postoperative pain levels (p<0.05) in the first 24 hours after hip surgery. [31] However in this study there was no statistically significant reduction in opioid consumption. This disparity could be explained by variations in surgical techniques, patient demographics, analgesic regimens, or the larger pooled sample size included in the meta-analysis.

A systematic review conducted by Liu et al. [32] corroborated these findings, reporting that ESPB significantly decreased postoperative pain scores, and total opioid intake among patients undergoing lumbar spinal procedures [32]. Total rescue analgesia requests were fewer in ESPB than in the control (p = 0.0005). However, the mean total opioid consumption was not statistically significant. These results closely match our findings that the ESPB group had better pain control and needed fewer rescue analgesics. Variations in the type of surgery and the intensity of postoperative pain may be linked to the higher opioid-sparing effect seen in their review.

Our findings also support with the study by Patel et al., according to their study [33], both block groups consumed considerably less opioids overall in the first 24 hours (P <.001). Similar to their study, our results indicate that ESPB contributes to enhanced postoperative recovery through improved analgesia and reduced dependence on additional medications. The ESP block may also facilitate earlier mobilization, which can contribute to lower pain scores and decreased analgesic requirements.

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Our study demonstrated that the ESPB exhibited shorter operative durations than the control group (p = 0.037), while the length of hospital stay was similar for both groups (p = 0.343). This result was in contrast to Azizi et al study [25] and van den Broek et al [26], Both studies indicated that the ESB group experienced a significantly shorter hospital stay (p=0.001). Differences in institutional discharge protocols, surgical procedures, postoperative rehabilitation practices, and patient characteristics may explain the variation between studies. Despite the lack of significant reduction in hospital stay in our study, the improved analgesic profile observed with ESPB still supports its role as an effective component of multimodal postoperative pain management.

In contrast, the use of ESB as an opioid-sparing method confronts limitations of conventional opioid-based pain administration, including the potential for addiction and adverse effects such as constipation and respiratory depression. [15, 30, 34] According to Kaye et al., the practice of multimodal analgesia highlights the significance of integrating methods like ESB to improve patient outcomes and recovery processes. [35]

This study focus on a relatively understudied aspect of post-surgery pain management and its addition to the body of knowledge regarding the advantages of ESB in spine procedures are its strongest points. Additionally, the methods and statistical analysis of the study offer strong evidence in favor of the use of ESB as a secure and successful pain administration strategy.

Although this study had limitations, including a small sample size and the inability to differentiate between pain at rest and during movement, it highlighted risks of performance bias due to the non-blinded anesthesiologist. Upcoming research should focus on larger, blinded RCTs to explore the long-term effects of ESB on postoperative recovery and pain management.

CONCLUSION

In conclusion, the US-guided ESPB significantly reduced postoperative pain and decreased the requirement for rescue analgesia postoperatively in patients undergoing laminectomy and discectomy surgery.

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