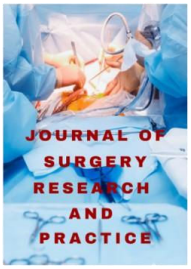

e-ISSN: 3068-3742
Journal of Surgery Research and Practice

ATHENAEUM SCIENTIFIC PUBLISHERS

Case Report

Analgesic Effect of Bilateral Bi-Level Erector Spine Planae Block in Adolescents for Surgical Treatment of Adolescent Idiopathic Scoliosis: Two Case Reports

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Citation: Stevanovska MT, et al. Analgesic Effect of Bilateral Bi-Level Erector Spine Planae Block in Adolescents for Surgical Treatment of Adolescent Idiopathic Scoliosis: Two Case Reports. J Surg Res Prac. 2025;6(2):1-7.

https://doi.org/10.46889/JSRP.2025.6208

Received Date: 29-05-2025

Accepted Date: 16-06-2025

Published Date: 24-06-2025

Abstract

Surgical intervention for Adolescent Idiopathic Scoliosis (AIS) involves three-dimensional correction of the defect and also resection of the entire thoracolumbar segment. Therefore, it causes severe pain in the postoperative period. Ultrasound guided Erector Spine Plane Block (ESP) performed bilaterally at two levels in combination with opioid and non-opioid analgesics can provide good postoperative analgesia as well as a reduction in the amount of opioid analgesic consumption. In this study, the ESP block was performed in two patients aged 14 and 18. After the performed anesthesiological examination and obtaining informed consent, the patients were scheduled for surgical treatment with open Posterior Spinal Fusion (PSF). The ESP block was performed after standard induction of anesthesia, in the prone position. In the postoperative period, continuous fentanyl infusion was also used in the patients. Pain was recorded at multiple time intervals in the first 48 hours according to the numeric pain rating scale NPRS. At all time intervals, the patients did not experience pain greater than 4 according to the NPRS. ESP block applied bilaterally at two levels is a reliable procedure for pain reduction in adolescents with PSF due to AIS.

Keywords: Erector Spine Plane Block; Scoliosis; Multimodal Analgesia; Local Anesthetic

Introduction

Scoliosis is a complex three-dimensional deformity of the spine, characterized by a lateral deviation of at least 10 degrees, with rotation of the vertebrae and usually associated with a reduction of the normal kyphosis curvature of the spine (hypokyphosis) [1,2]. Adolescent Idiopathic Scoliosis (AIS) occurs most frequently in adolescents (10-19 years) and is more common in females 9: 1 than in males [1].

The main options for the treatment of scoliosis with curves greater than 40 degrees are operative treatment [2]. Surgical treatment for AIS consists of Posterior Spinal Fusion (PSF), which is a three-dimensional correction of the deformity that simultaneously covers a large segment of the spine (Fig. 1).

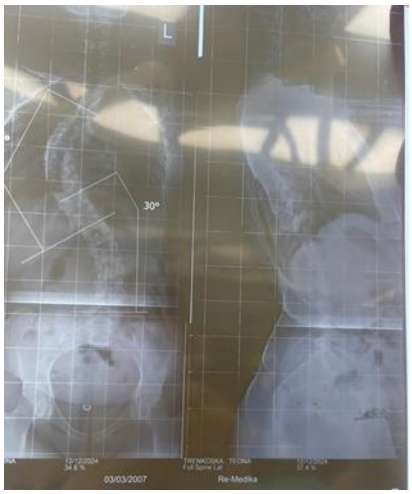

Figure 1: Surgical treatment for AIS consists of Posterior Spinal Fusion (PSF).

Therefore, PSF is one of the most invasive surgical interventions, which, in adolescents, especially in the early postoperative period, causes severe pain [3]. Opioid analgesics have traditionally been the mainstay of postoperative pain management in patients after PSF. Although they are effective in the treatment of pain, they also cause more adverse effects such as somnolence, respiratory depression, nausea, vomiting, pruritus and urinary retention [4,5]. Multimodal analgesia involves the use of non-opioid analgesics such as nonsteroidal anti-inflammatory drugs, acetaminophen, metamizole, gabapentin, ketamine, neuraxial blocks and local anesthesia, which provide more successful analgesia, accelerate recovery time, reduce the incidence of adverse events and reduce the dose of total opioid consumption [6,7]. This multimodal approach for pain management also reduces the occurrence of opioid-induced hyperalgesia, referred as a lowered pain threshold [7].

One of the procedures, which contribute the multimodal approach of analgesia, is Erector Spine Plane Block (ESP). It is performed by applying a local anesthetic in the plane between the deep fascia of the erector spine muscle and the transverse process of the spine, extending 4 segments cranially and 4 caudally and blocks the dorsal branches of the spinal nerves, thereby providing extensive sensory block on the ipsilateral side of the spine [8-12,14]. Performing the block bilaterally and at two different levels of the spine, this block can provide analgesia of 10 to 15 spine segments [10,11]. The use of ultrasound provides easier identification of the structures and a simpler and safer performance of the block [8-12]. As a relatively simple and safe technique, the ESP block has been successfully used in spinal surgery in adult patients [8]. However, in adolescents with spinal deformity, the use of this technique is challenging. ESP block, as a technique used in a multimodal approach to the treatment of pain after corrective scoliosis surgery performed bilaterally and bi-level, may contribute to pain relief and opioid consumption reduction as well as to the reduction of the inflammatory response to stress caused by the extent of the intervention and the use of neuromonitoring [8-13]. The performance of ESP block does not interfere with the use of neuromonitoring [13].

Case Reports

Two Case Reports

Two female patients, 14 and 18 years old and weight 40 and 50 kg, respectively, were admitted to the Clinic of Orthopedics and Orthopedic Diseases at different times with thoracolumbar AIS for the purpose of posterior spinal fusion. After the anesthesiological examination, it was determined that apart from the previously diagnosed AIS, the patients had no other medical comorbidities. The patients were American Society of Anesthesiology classes 1. After obtaining informed consent, the patients were scheduled for surgical treatment with open Posterior Spinal correction and Fusion (PSF). The surgical intervention was performed under general anesthesia. Standard monitoring was established: ECG, pulse oximetry, NIBP, capnography, diuresis. After induction of anesthesia with midazolam 1 mg, fentanyl 0.1 mg, propofol 150 mg and esmeron 30 mg, both patients underwent ESP block bilaterally and bi-level at Th4 and Th10 level. The block was performed after positioning the patients in the prone position. The technique of performing the block consisted of placing the flat probe paravertebral in the thoracic spine, 4-5 cm lateral to the midline of the spine (spinous processes), first identifying the first rib and then lowering the probe to the fourth rib (Fig. 2). After identifying the ribs with ultrasound, the probe was gradually moved closer to the midline of the spine until the transverse processes of the thoracic vertebrae were identified (Fig. 3).

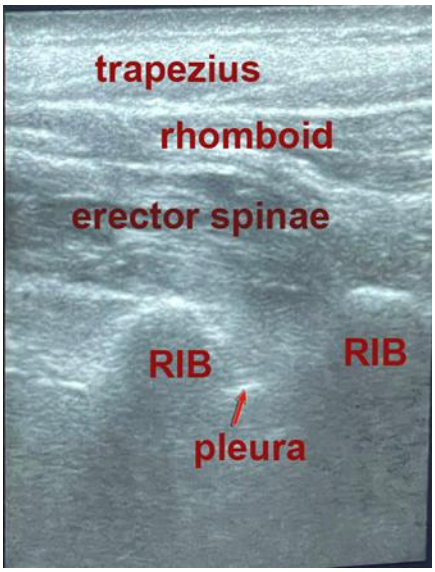

Figure 2: Identifying the first rib and then lowering the probe to the fourth rib.

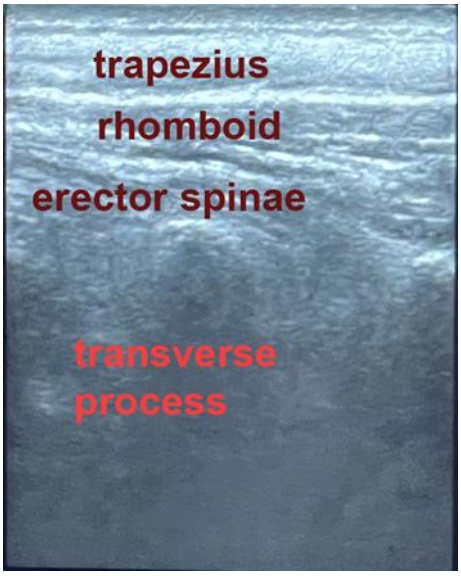

Figure 3: Thoracic vertebrae were identified.

After identifying the fourth / tenth transverse process, the block was performed with strict observance of sterility conditions. A 22 G Stimuplex needle, 100 mm long, was used, placed with an in-plane technique caudo-cranially, directed towards the identified transverse process of the fourth thoracic vertebra. The needle was passed through the three muscles that cover the spine, from back to front: trapezius, rhomboid and erector spine. When the needle touches the transverse process, 1 ml of saline was applied. If the fascia rises, this was a sign that the needle is correctly placed and the entire amount of local anesthetic was applied, with regular aspirations (Fig. 4). The procedure was performed in the same way on the opposite side of the fourth thoracic vertebra and bilaterally at the level of the tenth transverse process. 12 ml of bupivacaine 0.25% and 3 ml of lidocaine 1% were applied on each side, not exceeding the maximum permissible dose per kilo in the patients. In both cases, dexasone 4 mg was given as an adjuvant to the local anesthetic administered intravenously, 30 min before performing the block.

The surgical intervention involved 13 spinal segments in the first patient and 12 in the second patient (Fig. 5). Anesthesia during the surgical intervention was administered with a continuous infusion of remifentanil 0.25-0.5 mcg/kg/min and propofol 50-100 mcg/kg/min. The first surgical intervention lasted 8 hours while the second lasted 5 hours. Neuromonitoring was used during both interventions as the gold standard for the prevention of neurological deficit. During the surgical intervention, acetaminophen 15 mg/kg and metamizole 15 mg/kg were administered as a part of a multimodal approach to analgesia and a

continuous infusion of fentanyl 0.4 mcg/kg/h was started at the very end of the intervention, which continued continuously for the next 48 hours. During the surgical intervention, both patients were hemodynamically stable. After awakening, both patients were calm and did not feel pain. Pain was controlled after 30 min, 1h, 4h, 8h, 12h, 24h and 48h using the numerical pain rating scale NPRS, where 0 indicates no pain, while 10 means unbearable pain. During the first 24 hours, the patients did not experience pain stronger than 4 in the 8th hour and 2-3 in the other time intervals according to the NPRS scale. Acetaminophen 1 g and niflam 50 mg were used as additional pain treatment. In both patients, there was no need for rescue analgesia during the first 24 hours. In the postoperative period of 48 hours, the patients described the pain as 3-4 according to the NPRS and the fentanyl infusion was reduced to 0.2 mcg/kg/h during the same period. No opioid-related adverse events were recorded, except for vomiting on one occasion in the first patient and on two occasions in the second patient. By the end of the second postoperative day, opioid analgesia was discontinued and non-opioid pain treatment was continued. On the second postoperative day the patients were mobilized without any special problems.

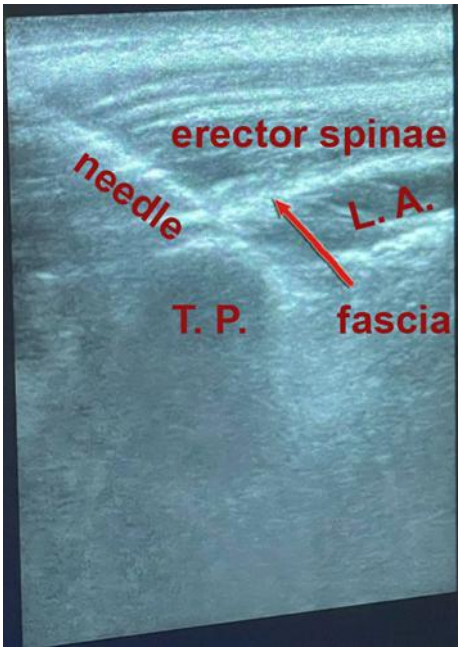

Figure 4: Thoracic vertebrae with regular aspirations.

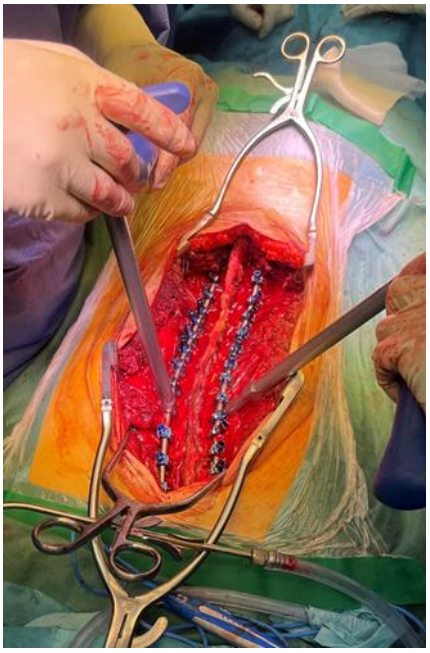

Figure 5: Surgical intervention involved 13 spinal segments.

Discussion

The ESP block is a relatively new technique described in 2016 [8]. Since then, this technique has attracted great interest for the analgesia of patients with rib fractures, thoracic and abdominal surgery, breast surgery and spinal surgery [8,12,14]. In our study, the ESP block was used as an additional technique for more effective postoperative analgesia in two adolescent girls undergone PSF surgery, due to AIS, as a part of a multimodal approach to pain relief. Acetaminophen, metamizole and NSAIDs were used as non-opioid analgesics during the surgical intervention and in the postoperative period as rescue analgesia.

Sagar, et al., in their review study and Collis, et al., in a retrospective cohort study analyzed a multimodal approach to pain management in children undergoing corrective spinal surgery for AIS and found that the multimodal approach provided superior postoperative pain management and faster recovery compared to the traditional opioid pain protocol [5,6]. Eli, et al., in their comparative study standardized the use of nonopioid agents, either orally or intravenously, in addition to opioids as a Rapid Recovery Pathway (RRP) that was superior to opioid analgesia alone [7]. Collis, et al. and Eli, et al., concluded that patients receiving greater amounts of nonopioid intraoperative medications utilized 20% fewer postoperative morphine milligram equivalents, were discharged earlier and had earlier recorded evidence of mobility [5,7].

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In our case report, low-dose fentanyl was used as a continuous postoperative opioid infusion, in contrast to other studies that used morphine. Cadavid-Puentes, et al., in their randomized, double blind, clinical trial first compared the effect on pain and the incidence of adverse effects of fentanyl versus morphine for severe postoperative pain management [4]. They found no difference between these two opioids on the degree of pain or the time to residual analgesia, adverse side effects such as nausea, vomiting, dizziness or the incidence of postoperative complications and hospital stay [4].

In the above-referenced study, the ESP block was used as the main adjunctive technique for more effective postoperative analgesia. The block was performed bilaterally at two levels, the Th4 and Th10. These two levels for performing the block were determined based on the research of Schwartzmann, et al., according to which, local anesthetic in the thoracic region applied in the space between the transversal process and the fascia of the erector spine muscle spreads craniocaudal 9 (5-9) levels [14]. In this way, it was considered that all spinal levels involved in the surgical treatment are covered. Schwartzmann, et al., in their study used Magnetic Resonance Imaging (MRI) to evaluate the spread of local anesthetic injectate following ESP blocks in six patients with pain [14]. They also followed the spread into the intercostal space and neural foramina in all six patients. The obtained results showed that the extent of cephalocaudal spread was variable, with a median spread of 9 (5-11) and 3 (2-6) levels for the intercostal space and neural foramina, respectively. The injectate also spread extensively within the erector spine muscles. Spread to the epidural space was seen in two patients. Sensory block was achieved in both ventral and dorsal dermatomes in all patients, though the extent was variable [14].

Domagalska, et al., in a study investigating the effect of ESP block in a series of 6 children undergoing corrective surgery for AIS, referred the blockade at the dorsal rami of multiple spinal nerves above and below the injection site when the local anesthetic is injected below the fascia of the erector spine muscle [9]. The ventral rami are blocked inconsistently and could be involved in the analgesic effects of ESPB without extension to the paravertebral zone. The presence of the thoracolumbar fascia facilitates the local anesthetic spread in the caudal and cranial directions [9].

In our study, effective analgesia was achieved in both patients during the first 24 hours. The patients did not experience pain greater than 4 at 8 hours and 2-3 at other time intervals according to the NPRS scale. These results are consistent with the results obtained in the review study by Sun, et al., on the effect of ESP block in spinal surgery and the controlled comparative double-blind study by Domagalska, et al., on the efficacy of bilateral and bi-level ESP block in children with corrective treatment of scoliosis [8,10]. Based on their research, they concluded that ESP block is effective for postoperative analgesia, can reduce opioid consumption in patients undergoing scoliosis surgery and reduces the stress response to surgery. Domagalska, et al., also concluded that ESP block does not interfere with neuromonitoring [10]. Kamel, et al., in their comparative study, in addition to the intraoperative analgesic effect of ESP block, they also examined the influence of somatosensory SSEPs and motor evoked potentials MEPs [13]. They found that patients with ESP block had lower fentanyl and propofol consumption intraoperatively and that ESP block can be safely used without interfering with the monitoring of the somatosensory SSEPs and motor evoked potentials MEPs during complex spinal surgery [13]. These results are in agreement with our practical experience with the use of neuromonitoring.

In contrast to these studies, Purnama, et al., used an intraoperative wake-up test in a case report, which is a simple method to assess spinal cord or nerve root injuries [11]. They believe that adequate analgesia is required to prevent the risk of failure and obtain a quality wake-up test. Erector spine plane block and administration of intravenous dexmedetomidine can provide optimal intraoperative analgesia and facilitate the success of the wake-up test, so it can be an alternative to opioids with a risk of causing opioid-induced hyperalgesia [11].

Dubilet, et al., in a comparative study investigated the effect of ESP block in patients after oncological surgery that suffers from severe pain [12]. They found that the main analgesic effect of the ESP block lasted until 12 hours after surgery. At 24 hours after surgery, patients with ESP block felt severe pain and needed increased opioid consumption. They believe that a reasonable explanation for this result might be related to the phenomenon of "rebound pain". Rebound pain has been defined as an extremely severe pain that occurs after a peripheral nerve block resolution when sensitivity returns. The authors believe that this phenomenon can be overcome by timely initiation of treatment with non-opioid analgesics [12].

In our study, the patients did not experienced severe pain throughout the entire 48-hour of postoperative period. Based on this result, we cannot reliably determine the duration of the block.

Conclusion

ESP block applied bilaterally and bi-level represents a reliable and safe procedure as part of a multimodal approach to analgesia in adolescents for PSF due to AIS, which provides a reduction in the NPRS value, provides a reduced use of opioid analgesia and early mobilization of the patients.

Conflict of Interest

The authors declare that there is no conflict of interest.

Funding

None.

References

1. Boos N, Aebi M. Spinal disorders: Fundamentals of diagnosis and treatment. Germany: Springer. 2008.
2. Choudhry MN, Ahmad Z, Verma R. Adolescent Idiopathic Scoliosis. ICH GCP. 2023.
3. Fusco C, Donzelli S, Lusini M, Salvatore M, Zaina F, Negrini S. Low rate of surgery in juvenile idiopathic scoliosis treated with a complete and tailored conservative approach: End-growth results from a retrospective cohort. Scoliosis. 2014;9:12.
4. Cadavid-Puentes A, Bermúdez-Guerrero FJ, Giraldo-Salazar O, et al. Comparison of the effectiveness of fentanyl versus morphine for severe postoperative pain management. A randomized, double blind, clinical trial. Colomb J Anesthesiol. 2017;45(2):100-7.
5. Collis RW, Dry T, Ray H, Herman E, Grundlingh N, Chan G, et al. Evidence for a multimodal pain management regimen in reduction of postoperative opioid use in pediatric patients receiving posterior spinal fusion for adolescent idiopathic scoliosis. Spine. 2023;48(21):1486-91.
6. Sagar A, Guidry R, Heffernan MJ. Current trends in pediatric spine deformity surgery: Multimodal pain management and rapid recovery. Glob Spine J. 2019;10(3).
7. Eli AS, Juston F, Afshin A. Rapid recovery pathway for postoperative treatment of adolescent idiopathic scoliosis. JAAOS Glob Res Rev. 2021;5(3):e20.
8. Sun O, Zhang C, Liu S, et al. Efficacy of erector spine plane block for postoperative analgesia lumbar surgery: A systematic review and meta-analysis. BMC Anesthesiol. 2023;23(54):70-8.
9. Domagalska M, Ciftsi B, Kolasinski J. Bilateral bi-level erector spinae plane blocks as a part of opioid-sparing multimodal analgesia in scoliosis surgery: A case series of six pediatric patients. Medicina. 2023;59:8.
10. Domagalska M, Ciftsi B, Janusz P. Effectiveness of the bilateral and bilevel Erector Spine Plane Block (ESPB) in pediatric idiopathic scoliosis surgery: a randomized, double-blinded, controlled trial. J Pediatr Orthop. 2024;44(7):634-40.
11. Purnama MA, Arie U, Elizeus H. Application of erector spinae plane block and intravenous dexmedetomidine as analgesia modalities for wake-up test in scoliosis correction surgery: a case report. Bali J Anesthesiol. 2024;8(1):57-9.
12. Dubilet M, Gruenbaum BF, Semyonov M, Ishay SY, Osyntsov A, Friger M, et al. Erector Spinae Plane (ESP) block for

postoperative pain management after open oncologic abdominal surgery. Pain Res Manag. 2023.
13. Kamel WJ, Sami A, Abdelrazik RA. The impact of erector spine plane (ESP) block on neurophysiological monitoring in patients undergoing scoliosis repair. Egypt J Anesth. 2024:383-9.
14. Schwartzmann A, Peng P, Maciel MA, Alcarraz P. A magnetic resonance imaging study of local anesthetic spread in patients receiving an erector spine plane block. Springer Nat. 2020;67:942-8.