

Sequential use of erector spinae plane block and thoracic epidural analgesia as multimodal regional analgesia in bilateral rib fractures: a case report

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ABSTRACT

Effective pain management is a cornerstone in the treatment of patients with multiple rib fractures, as inadequate analgesia can impair ventilation and increase the risk of pulmonary complications. Bilateral rib fractures, in particular, can significantly compromise respiratory mechanics, leading to hypoventilation, atelectasis, and hypoxemia. Regional analgesic techniques play a crucial role in improving respiratory function while reducing reliance on opioids and their associated adverse effects. We report the case of a patient with multiple bilateral rib fractures following thoracic trauma who presented with severe pain and compromised respiratory function. Initial management with systemic analgesic proved inadequate. Multimodal regional analgesia was therefore initiated with a bilateral erector spinae plane (ESP) block, resulting in rapid pain relief and improved oxygenation. Given the limited duration of analgesia provided by a single-shot ESP block, thoracic epidural analgesia (TEA) was subsequently established via epidural catheter. Continuous low-dose epidural local anesthetic infusion ensured sustained analgesia, prevented pain recurrence, and supported ongoing improvement in respiratory function throughout the clinical course. This case highlights that a multimodal regional analgesic approach, combining an ESP block followed by TEA, may represent an effective and feasible strategy for optimizing pain control and respiratory outcomes in patients with bilateral rib fractures. Such an approach may also reduce the need for systemic opioid therapy while optimizing clinical outcomes and minimizing associated risks.

Keywords: Erector spinae plane block; multimodal regional analgesia; rib fractures; thoracic epidural analgesia; thoracic trauma.

INTRODUCTION

Thoracic trauma is frequently associated with severe pain that directly impairs respiratory mechanics and adversely affects clinical outcomes. Effective pain management in thoracic trauma is therefore essential, given its direct impact on clinical outcomes. Rib fractures, particularly when bilateral and occurring in the setting of multitrauma, can significantly compromise respiratory mechanics and ventilatory function. Pain induced by thoracic wall expansion during inspiration limits deep breathing, impairs effective coughing and secretion clearance, and results in reduced tidal volume, hypoxemia,

atelectasis, and an increased risk of pulmonary infections and other respiratory complications.

Optimal analgesic management is therefore a cornerstone in the care of patients with rib fractures. Although systemic administration of opioids and non-opioid analgesics is commonly employed, it may provide inadequate pain relief and is often associated with dose-dependent adverse effects. Thoracic epidural analgesia (TEA) is widely regarded as the gold standard for postoperative pain control in thoracic conditions and has been shown to improve respiratory outcomes.^[1,2] It remains a well-established technique for both thoracic sur-

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gery and trauma.^[3,4] However, the invasive nature, technical challenges, and potential complications of central neuraxial blocks have led to the exploration of less invasive regional techniques.

The erector spinae plane (ESP) block is a relatively novel regional analgesia technique that has gained increasing traction in thoracic surgery and trauma due to its technical simplicity and favorable safety profile.^[5,6]

In this report, we describe a patient with bilateral rib fractures whose pain was inadequately controlled with conventional systemic analgesia, and demonstrate how a planned sequential regional analgesia strategy, consisting of an initial ESP block followed by TEA, provided effective and sustained pain relief.

CASE REPORT

A 58-year-old male patient was brought to the emergency department after a fall from approximately 10 meters. On initial evaluation, he was hemodynamically stable, with a heart rate of 105 beats per minute, blood pressure of 135/78 mmHg, and a Glasgow Coma Scale score of 15. He reported severe chest pain, along with mild headache and abdominal discomfort. His medical history was significant for hypertension, for which he was receiving antihypertensive therapy.

Thoracic computed tomography (CT) revealed multiple rib fractures: the right 1st and 7th through 12th ribs, and the left 6th and 7th ribs, accompanied by a minimal right-sided pneumothorax. Additional imaging identified minor fractures of the L1 and L2 vertebrae, as well as small perineal and perihaptic hematomas. No other life-threatening injuries requiring surgical intervention were detected.

The patient was admitted to the thoracic surgery ward and initially managed with systemic analgesia, including intravenous paracetamol (1 g four times daily) and ibuprofen (400 mg three times daily). Despite this regimen, he continued to experience severe chest pain and shallow, guarded breathing. On examination, the respiratory rate was 22 breaths per minute, and peripheral oxygen saturation was 88% on room air. Pain intensity, assessed using the Numeric Rating

Scale (NRS; 0=no pain, 10=worst pain), was 8/10 (Table 1). Supplemental oxygen was administered via face mask at 4 L/min, and intravenous tramadol (50 mg three times daily) was added. Nevertheless, adequate pain control and clinical improvement were not achieved, and the patient continued to exhibit impaired respiratory mechanics secondary to pain. Chest radiography demonstrated bilateral atelectasis, more pronounced on the right, with reduced lung volumes (Fig. 1).

In light of inadequate pain control and worsening respiratory status, a multimodal regional analgesic approach was adopted. Following standard monitoring in the operating room, procedural sedation and analgesia were achieved with intravenous midazolam (1 mg) and fentanyl (50 µg), with the patient in the sitting position.

An ultrasound-guided bilateral ESP block was then performed. Using a high-frequency ultrasound probe, the relevant muscle layers were identified approximately 3 cm lateral to the transverse processes. The block was first administered on the right hemithorax at the T7 level, followed by the left hemithorax at the T6 level. A 23-gauge needle was advanced under ultrasound guidance, and correct placement was confirmed by hydrodissection with 2 mL of normal saline. After negative aspiration, 20 mL of 0.375% bupivacaine was incrementally injected on each side.

Approximately 30 minutes after the bilateral ESP block, peripheral oxygen saturation increased to 93% on room air, and the NRS score decreased to 3 (Table 1). Thoracic epidural catheterization was subsequently performed at the T6 level under local anesthesia using 2 mL of 2% lidocaine. The patient was then continuously monitored on the ward, where peripheral oxygen saturation further improved to 96% approximately 3 hours after the ESP block.

Although the NRS score initially remained below 3, pain intensity gradually increased to 5–6 after approximately 10 hours. Following administration of a standard epidural test dose, a continuous epidural infusion of 0.125% bupivacaine was initiated at a rate of 5 mL/h via the epidural catheter. Two hours later, the NRS score decreased to 2. The epidural infusion was maintained for 72 hours. Oral diclofenac was initiated twice daily, and previously administered paracetamol,

Table 1. Respiratory and pain parameters before and after analgesia

Time point	Respiratory rate (breaths/min)	SpO ₂ (%)	NRS
Pre-ESP block	22	88	8
30 minutes after ESP block	16	93	3
10 hours after ESP block	18	91	5-6
2 hours after initiation of TEA infusion	15	96	2

NRS: Numeric Rating Scale; ESP: Erector spinae plane block; TEA: Thoracic epidural analgesia.

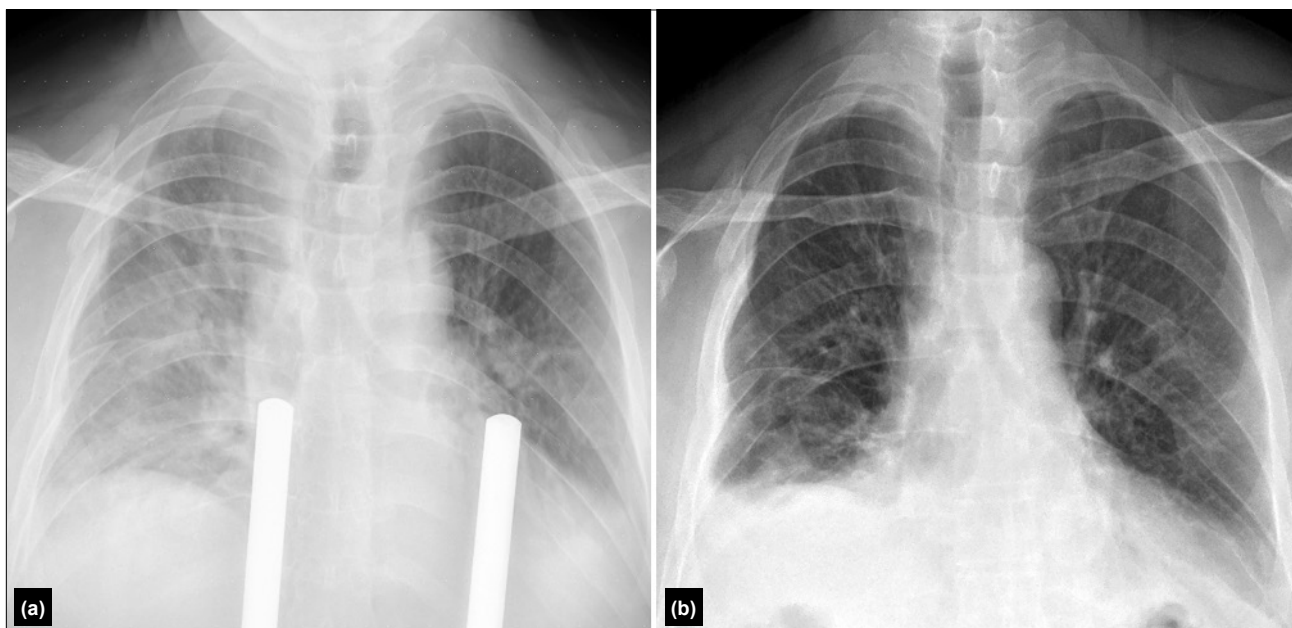


Figure 1. (a) Pre-procedural posteroanterior chest radiograph. (b) Post-procedural posteroanterior chest radiograph.

ibuprofen, and tramadol were discontinued. Follow-up imaging demonstrated significant resolution of the previously observed atelectasis (Fig. 1). No adverse events related to tramadol or other analgesic administration were observed. Five days later, the patient was discharged from the hospital with satisfactory respiratory and overall clinical outcomes.

Ethical Considerations

Written informed consent was obtained from the patient for publication of this case report and the accompanying images.

DISCUSSION

This case report underscores the pivotal role of effective analgesia in patients with rib fractures following thoracic trauma, particularly in relation to respiratory function. Inadequate pain control in this population may lead to shallow breathing, reduced tidal volumes, impaired cough, and an increased risk of pulmonary complications. Consequently, multimodal regional analgesia strategies have gained prominence, as they can improve respiratory mechanics, enhance patient comfort, and favorably influence clinical outcomes in patients with chest trauma.^[7]

In the present case, severe pain limited the patient's ability to achieve adequate tidal volume, resulting in hypoxemia and clinical deterioration. The implementation of an ESP block followed by TEA provided effective pain relief, improved respiratory mechanics, as reflected by oxygenation parameters, and led to overall clinical improvement.

In patients with bilateral multiple rib fractures, systemic analgesics such as non-steroidal anti-inflammatory drugs and paracetamol are often insufficient. Although escalation to

high-dose opioid therapy may enhance analgesia, it is frequently associated with respiratory depression, sedation, and other opioid-related adverse effects. Consequently, regional analgesic techniques that provide effective pain control without compromising respiratory function are increasingly favored in this population.

The ESP block has emerged as a valuable regional analgesia technique with a favorable safety profile. The use of ultrasound guidance reduces the risk of serious procedure-related complications. Since its initial description in 2016, the ESP block has been widely adopted in thoracic trauma and surgical settings, with multiple studies demonstrating effective analgesia and improved respiratory parameters.^[5,8] In the present case, the ESP block resulted in a rapid reduction in NRS scores from 8 to below 3, accompanied by an improvement in oxygen saturation from 88% to 93%, and subsequently to 96% on room air.

Thoracic epidural analgesia remains one of the most extensively studied regional techniques in thoracic trauma. Evidence from clinical studies, meta-analyses, and case reports indicates that TEA is associated with improved respiratory function and favorable clinical outcomes in patients undergoing thoracic surgery or sustaining chest trauma.^[4,9,10] In line with these findings, initiation of epidural infusion approximately 10 hours after the ESP block in this case provided sustained analgesia and contributed to a favorable clinical course.

Comparative studies evaluating neuraxial and regional analgesic techniques in patients with rib fractures have yielded important insights. Two randomized controlled trials comparing TEA and ESP block in thoracic trauma reported comparable outcomes in terms of pain scores, opioid consumption, and oxygenation parameters, suggesting that both techniques are

effective when appropriately applied.^[11,12]

Nevertheless, each technique has inherent limitations. A commonly cited limitation of the ESP block is the relatively short duration of analgesia when administered as a single-shot technique, typically not exceeding 10-12 hours. Although catheter placement may prolong its effect, bilateral thoracic catheterization can be technically challenging due to respiratory movement, insertion difficulties, and issues with catheter fixation. Additionally, variability in local anesthetic spread may result in inconsistent analgesia over time.^[13] In contrast, TEA, as a central neuraxial technique, carries a risk of adverse effects, most notably hypotension, particularly with high-dose bolus administration.^[12]

Adopting a patient-centered and risk-conscious approach, we prioritized analgesic techniques with proven efficacy while minimizing potential adverse effects. Initial analgesia was achieved with an ESP block to avoid the hemodynamic consequences associated with epidural bolus dosing. Anticipating the limited duration of ESP block analgesia and recognizing the challenges of bilateral ESP catheter placement, a thoracic epidural catheter was inserted during the same session. As the analgesic effect of the ESP block diminished after approximately 10-12 hours, a low-dose continuous epidural infusion was initiated, ensuring uninterrupted pain control, preventing pain recurrence, and supporting sustained clinical improvement.

CONCLUSION

This case illustrates that multimodal regional analgesia, using the sequential application of an erector spinae plane block followed by thoracic epidural analgesia, may provide effective pain control and support respiratory function in patients with bilateral rib fractures. Further prospective studies are needed to confirm these findings and to determine the optimal multimodal analgesic strategy in thoracic trauma.

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OLGU SUNUMU - ÖZ

Bilateral kosta fraktürlerinde multimodal rejyonal analjezi olarak erektor spina plan bloğu ve torasik epidural analjezinin ardışık kullanımı: Bir olgu sunumu

Yetersiz analjezinin ventilasyonu bozarak pulmoner komplikasyon riskini artırabilmesi nedeniyle, multipl kosta fraktürü olan hastalarda etkin ağrı yönetimi tedavinin temel taşlarından biridir. Özellikle bilateral kosta fraktürleri, solunum mekaniğini belirgin şekilde etkileyerek hipoventilasyon, atelettazi ve hipoksemiye yol açabilmektedir. Rejyonal analjezik teknikler, opioid ilişkili yan etkileri en aza indirirken solunum fonksiyonunun iyileştirilmesinde önemli rol oynamaktadır. Toraks travması sonrası bilateral multipl kosta fraktürleri bulunan bir hasta, şiddetli ağrı ve bozulmuş solunum fonksiyonu ile başvurdu. Sistemik ilaçlarla uygulanan başlangıç analjezi yetersiz kaldı. Bunun üzerine bilateral erektor spina plan (ESP) bloğu uygulanarak multimodal rejyonal analjezi sağlandı ve hızlı ağrı kontrolü ile oksijenasyonda iyileşme elde edildi. Tek doz ESP bloğunun analjezi süresinin sınırlı olması nedeniyle, epidural kateter aracılığıyla torasik epidural analjezi (TEA) başlatıldı. Düşük doz sürekli epidural lokal anestetik infüzyonu, sürdürülebilir analjezi sağlayarak ağrının tekrarını önledi ve klinik seyir boyunca solunum fonksiyonundaki iyileşmeyi destekledi. Bu olgu, ESP bloğunu takiben TEA'nın ardışık kullanımını içeren multimodal rejyonal analjezi yaklaşımının, bilateral kosta fraktürü olan hastalarda ağrı kontrolü ve solunum desteği açısından etkili ve uygulanabilir bir strateji olabileceğini göstermektedir. Bu yaklaşım, sistemik opioid tedavisi ile ilişkili riskleri en aza indirirken klinik sonuçların optimize edilmesine olumlu katkılar sağlayabilir.

Anahtar sözcükler: Erektör spina plan bloğu; kosta fraktürleri; multimodal rejyonal analjezi; torasik epidural analjezi; toraks travması.

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