

Case report

## Bi-level erector spinae plane catheters for multiple rib fractures in a high-risk patient

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### Abstract

Rib fractures are associated with significant morbidity and mortality. Most of the morbidity stems from poorly controlled pain and therefore immobility and weak respiratory effort. Moreover, the number of injured ribs correlates with increasing risk of associated morbidity and mortality. We describe the analgesic management of an elderly co-morbid patient on oral anticoagulant therapy presenting with extensive multilevel rib fractures. According to the Western Trauma Association 2017 risk stratification, her mortality was as high as 20%. When a large number of ribs are involved, single level regional blocks may not provide sufficient local anesthetic spread to cover the extensive injury. Therefore, we employed erector spinae plane catheters at two levels. We believe that our therapeutic approach provided comprehensive, reliable and continuous analgesia, leading to a successful outcome in the case of our patient.

**Keywords:** *analgesia; erector spinae block; regional; catheter; multiple rib fractures*

### Introduction

Traumatic rib fractures are common and associated with significant mortality and morbidity [1]. The severe pain experienced from rib fractures impacts on coughing efforts and results in poor ventilation, atelectasis and retained secretions. These lead to hypoxemia and respiratory tract infections. It also results in decreased mobility and increased hospital stay [2]. Risk factors for poor outcomes include patient age, the number of fractures and pre-existing respiratory disease [3].

While standard of care is a thoracic epidural or paravertebral block, the patient cohort at risk of falls often have contraindications to neuraxial blockade. New techniques in peripheral regional analgesia may play an important role

in reducing the health burden of this common presentation.

### Case report

A 93-year-old woman presented to our department due to physical trauma after a fall from standing height at home. Chest computer tomography revealed multiple posterior fractures of the left 3<sup>rd</sup> to 9<sup>th</sup> ribs, associated one-centimeter air rim pneumothorax, small hemothorax and mild subcutaneous emphysema to the left thoracic wall. No other injuries were observed. The patient's comorbidities included stage two chronic kidney disease, insulin-dependent diabetes mellitus and a history of ischemic stroke with residual left sided weakness. She lived at home independently. Her medications included antihypertensives, insulin and clopidogrel.

She was reluctant to take oral morphine, even though she was counselled on the risk/benefit ratio. She accepted paracetamol and codeine. She remained in significant pain

Received: January 2020; Accepted after review: March 2020; Published: April 2020.

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preventing deep inspiration, effective cough or any mobilization. She consistently rated her rest pain and movement-evoked pain as a level 4 on a 4-point verbal pain score. From day two, she was on intravenous paracetamol, buprenorphine patch and "pro re nata"/as needed oxycodone but her pain control was still inadequate. She required nasal oxygen supplementation to achieve peripheral oxygen saturations of 95%. A referral to the regional anesthetic team was made. An erector spinae plane (ESP) block with 20 mL of 0.25% isobaric bupivacaine and a catheter insertion at the level of T5-6 were performed under ultrasound guidance. This improved the patient's pain, allowing her to cough and undergo very gentle physiotherapy. Pain scores fell to 2/4 at rest and 3/4 on movement. An ideal score of 0/4 was not achieved, and this was due to pain at the T8 and T9 levels. This could still not be managed effectively with systemic analgesia, significantly impacting her mobility and rehabilitation. The following day 30 mL of 0.25% bupivacaine were injected via catheter, having no effect on T8 and T9 level, while a repeat dose of 20 mL of 0.25% bupivacaine also failed to spread inferiorly. Therefore, dual-level ESP catheters (at T4 and at T7 level) were placed under ultrasound guidance to allow greater caudal-cranial dispersion of LA. This produced successful anesthesia to all her 7 rib fractures. The patient had a discernible block to cold from T2 to T11 in the left hemithorax.

Her catheters were topped up every 24 hours. Her pain scores became consistently 1/4 at rest and 2/4 on movement. She was fully able to participate in her physiotherapy and no longer required supplemental oxygen as her peripheral oxygen saturations rose to 97% on room air.

On day seven, the patient was able to breathe deeply, cough effectively and independently reposition herself in bed with minimal discomfort after 23 hours since her last catheter loading of LA. The catheters were consequently removed and she was discharged from anesthetic care, while being followed-up by the acute pain team. Four days later she was discharged from hospital, with resolution of her hemopneumothorax on chest radiograph and full mobility regained.

## Discussions

Rib fractures are significant injuries. Age is the most important risk factor for outcomes [4] with the elderly being at far higher risk of mortality and morbidity as compared to their younger counterparts. In the elderly, the odds ratio for mortality increases by 1.19 for each additional rib fracture, twice that of the younger patient cohort [5]. Our patient had other significant comorbidities such as obesity, diabetes and cardiovascular disease. She therefore presented an extremely high risk for respiratory failure, chest sepsis, deep vein thrombosis following immobility and overall mortality. According to the Western Trauma Association 2017 risk stratification, her mortality was as high as 20% [6].

Fascial plane blocks such as ESP have important advantages over central nerve blocks. They generally have a better safety profile and are theoretically safer to deliver to patients with impaired coagulation [7]. This was beneficial in our patient's case as she was on clopidogrel and therefore unsuitable for neuraxial analgesia. The ESP block was first described in the context of thoracic neuropathic pain however increasing evidence has emerged for its beneficial role in rib fracture management. It is shown to improve respiratory function and analgesic outcomes using a catheter technique [8]. The aim of this procedure is to deliver LA deep to the erector spinae muscle. (Figures 1 and 2). This ensures proximity to both the dorsal and ventral ramus of the thoracic spinal nerves, with some evidence of paravertebral spread [9]. The use of ultrasound guidance and the distance from the pleura compared to a conventional paravertebral block mean that the associated risk of pneumothorax is very rare [10].

Unfortunately, the spread obtained from a single fascial plane injection or single catheter infusion is difficult to characterize in terms of a volume, height or weight relationship. It is logical to assume that the effectiveness is dependent on physical spread. In our patient's case, despite large volumes of LA we achieved inadequate caudal spread for the extent of her injuries.



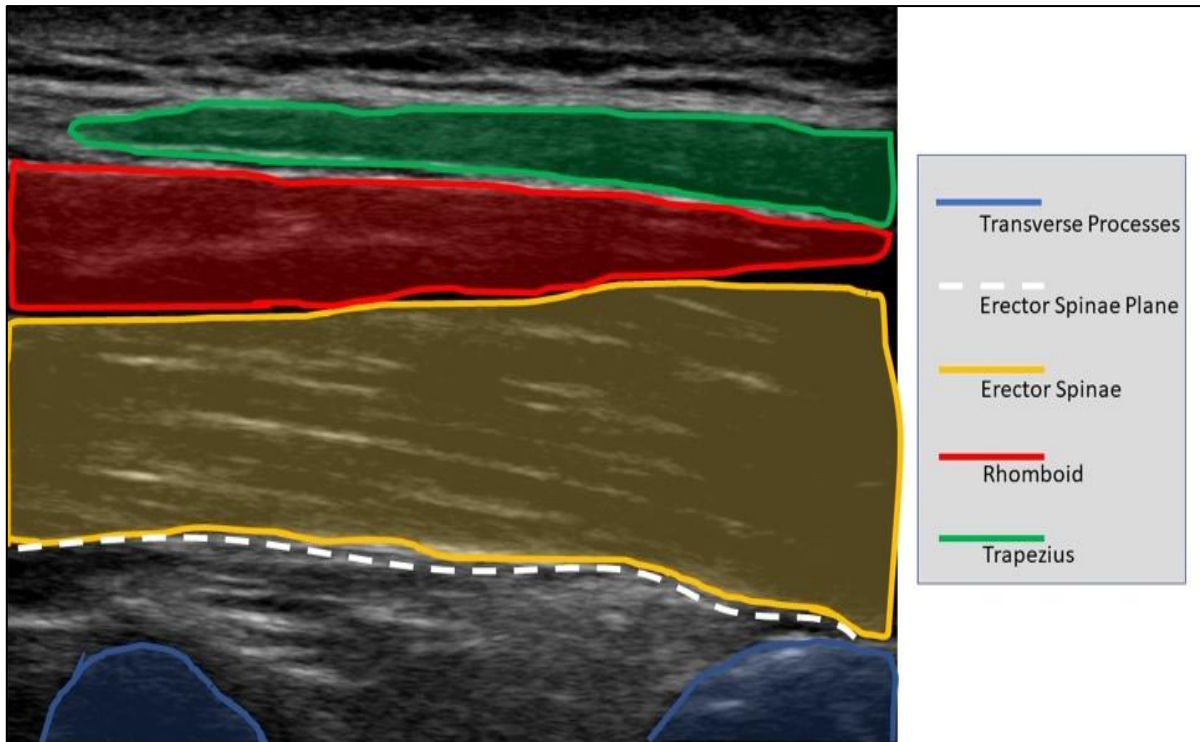


Fig. 1. Ultrasound image for ESP block

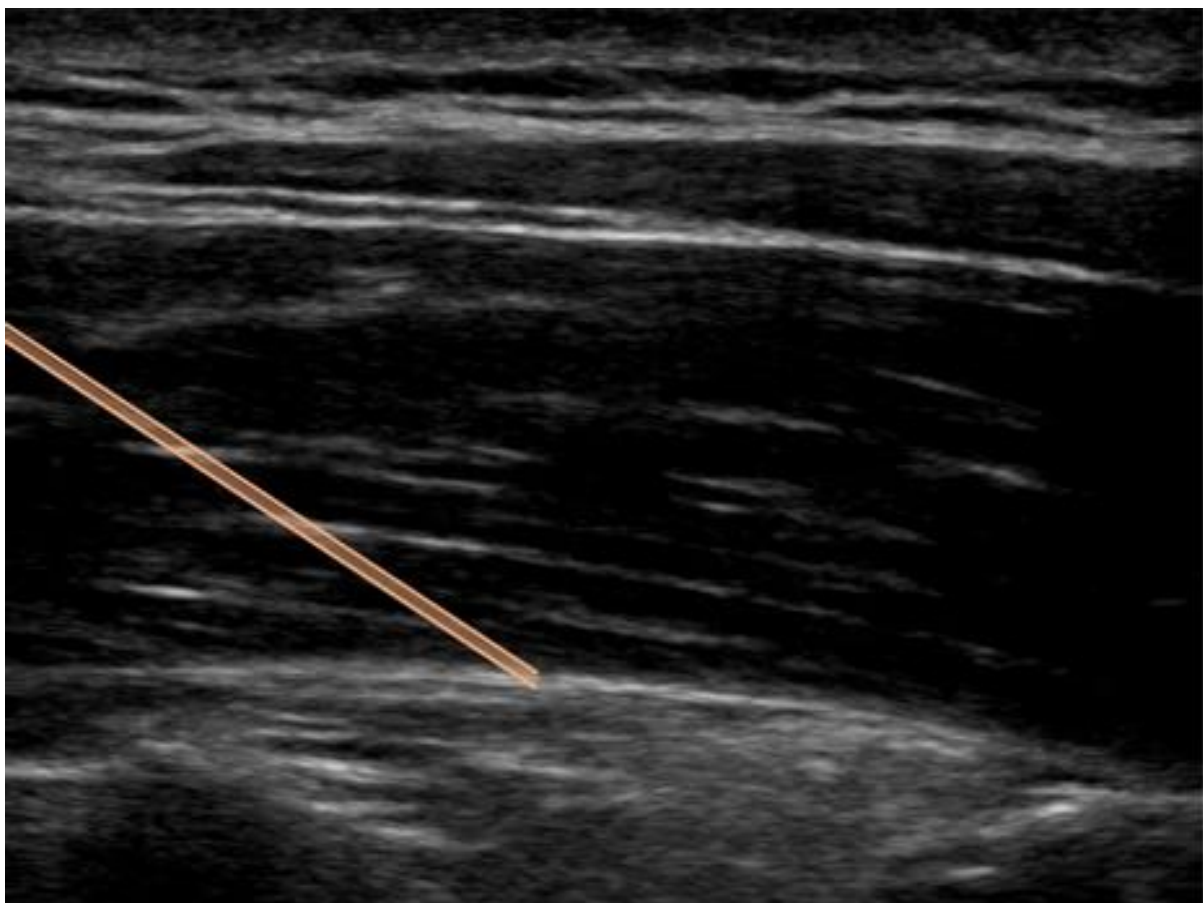


Fig. 2. Needle approach (red line) and needle end point for ESP block

This uncertainty in LA spread has been documented in other fascial plane blocks such as transversus abdominis plane (TAP) blocks [11]. Therefore, using dilute LA at high volumes is not necessarily a reliable standard of care when extensive dermatome coverage is required.

In this case, the use of two catheters gave sufficient caudal-cranial LA spread and resulted in significantly improved analgesia. The patient suffered no complications or adverse effects following our intervention.

### Conclusions

In selected patients with extensive multiple rib fractures, particularly those with contraindications for central neuraxial blockade

or in technically challenging cases, bi-level ESP catheters may provide a superior alternative. In this case report, an extremely high-risk patient had an excellent outcome. Due a good safety profile and relative ease of delivering an ESP block under ultrasound guidance, we encourage our colleagues to consider this technique.

### Consent

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

### Competing interests

The authors declare that they have no competing interests.

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