

Continuous Erector Spinae Plane Block for Unilateral Multiple Rib Fracture- A Case Report

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Abstract

Patients with chest trauma have high morbidity due to rib fractures, lung contusion, hemo/pneumothorax leading to prolonged hospital stay. Adequate pain relief is the key for early recovery following rib fracture. Pain due rib fracture can cause lung atelectasis, flail chest, hypoventilation leading to hypoxia, respiratory failure and further pulmonary complications. Erector spinae plane (ESP) block is an inter-fascial plane block which has been proposed as a regional anaesthesia technique in acute pain management for multiple rib fractures (MRF's).

Keywords: Multiple rib fracture, Chest trauma, Erector spinae plane block.

Introduction

Rib fractures following chest trauma leads to pulmonary complications like pneumothorax, lung atelectasis, hypoventilation, secondary infections- pneumonia causing prolonged hospital stay and increased morbidity and mortality [1]. Erector spinae plane block helps in acute pain management, aiding in alveolar recruitment by spirometry, deep breathing exercises and preventing further lung complications like pneumonia. Early mobilization is the key factor for fast recovery and reduced hospital stay.

We present the continuous ESP block using multipored catheter in a patient with unilateral multiple rib fracture admitted in Intensive Care Unit (ICU).

Case Report

A 75-year-old female with no significant medical history, presented with a history of road traffic accident, was admitted in the ICU with chest trauma, complained of left sided chest pain and breathlessness. On examination: Heart rate (HR)- 120 bpm, Blood pressure (BP)- 140/90 mmhg, Saturation (SPO₂)- 86% in room air, Respiratory rate (RR)- 30/minute. On

evaluation, Electrocardiogram showed no acute changes; HRCT chest showed left sided multiple- 3rd to 6th postero-lateral rib fracture with hemopneumothorax and lung contusion (Fig. 1). Arterial blood gas (ABG) analysis revealed hypoxia of PO₂- 40; PCO₂- 50 requiring oxygen support. CT brain and other lab investigations were within normal limits.

Initial resuscitation, oxygen supplementation and intravenous analgesics like acetaminophen, NSAID's were administered. Under all aseptic precautions left sided intercostal drain (ICD) was placed. In view of severe pain (NRS- 8-9/10), fentanyl infusion was initiated to mitigate tachypnoea and low saturation (SPO₂- 88-90% with 4 L oxygen support via Hudson face mask). Despite opioid infusion, patient had Numerical Rating Scale (NRS)- 7/10, tachypnoeic; hence regional anaesthesia technique was planned on day 2.

After explaining the procedure and obtaining consent, with utmost care the patient was made to sit and the Ultrasound (USG) machine placed facing the patient and the performer standing behind the patient. Oxygen support was continued via Hudson mask and vitals were

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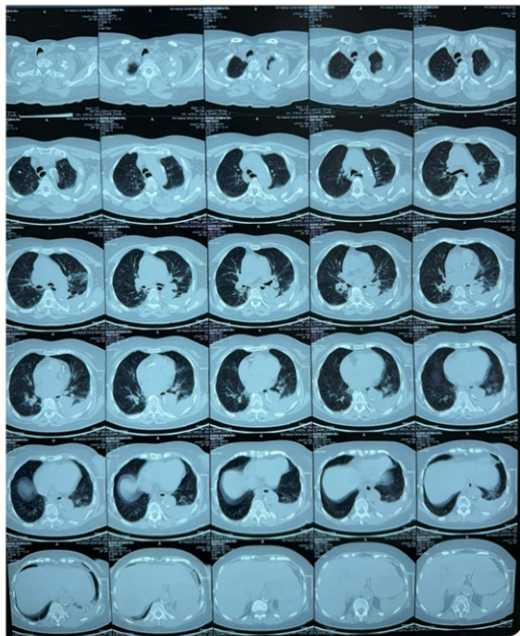


Figure 1: HRCT Thorax- Features suggestive of left hemopneumothorax with lung contusion, multiple 3rd to 6th postero-lateral rib fracture.



Figure 2: Erector Spinae Plane Block with subcutaneous catheter tunnelling



Figure 3: Intercostal Drain in situ.



Figure 4: Virtual Reality CT scan of contrast spread via multiport catheter in Erector spinae plane block.

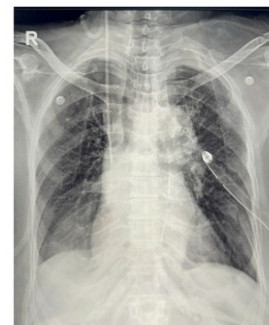


Figure 5: Lung expansion after continuous erector spinae plane block.

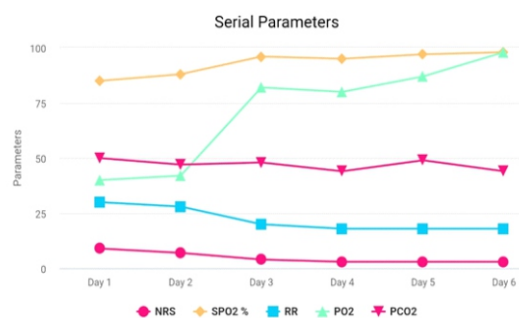


Figure 6: Pain scores and Arterial blood gas analysis graph representing the improving trend in respiratory parameters after continuous erector spinae plane block after Day 2.

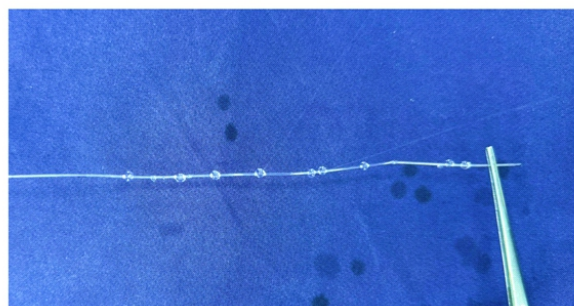


Figure 7: Multipored catheter showing the drug exiting through multiple pores.

monitored throughout the procedure. Under all aseptic precautions, parts painted and draped; using a high frequency linear probe of 6-13 Mhz, kept in parasagittal orientation at the level of 3rd rib, the inter-fascial plane identified deep to the erector spinae muscle (ESM) and superficial to transverse process. After local infiltration with 2% lidocaine, 18 Gauge Tuohy needle was inserted in cephalad to caudal direction with in-plane approach, until the tip is beneath the Erector spine muscle. Under USG guidance, after negative aspiration to blood and air, 10ml of local anaesthetic- Ropivacaine 0.2% was injected to dissect the plane and a multipored catheter introduced via the Tuohy needle and fixed at a depth of 10cm from the needle tip. Catheter tunnelled and fixed to avoid displacement of catheter and sterile dressing was done (Fig. 2). Another bolus of 10 ml of ropivacaine 0.2% injected through the catheter after negative aspiration and a continuous infusion of ropivacaine 0.1% started at 8 ml/hr.

After 30 minutes, patient was comfortable with NRS- 4/10; able to do deep inspiration without pain. Hemodynamic parameters improved: HR-90 bpm, BP-120/84 mmhg, SpO₂-94% with 4l/min O₂, RR- 20/min. On day 3, repeat ABG showed improvement in PO₂- 82. Multimodal analgesia- Acetaminophen, NSAID's and opioids were continued. Fentanyl infusion was tapered and stopped on day 3 in view of NRS- 4/10. After stopping fentanyl, patient was comfortable, able to do incentive spirometry, respiratory and physical therapies. Serial ABG's, respiratory parameters and pain management has been depicted in the Table 1. The line graph (Fig. 6) illustrates the reduction in NRS score and concomitant improvement in respiratory parameters from day 3.

Serial chest x-rays done, showed improvement in lung expansion (Fig. 3, 5). Ropivacaine infusion was continued @8 ml/hr for 6 days; Patient was well mobilized, and saturation was maintaining 96-97% in room air. After obtaining consent, 2 ml contrast (Iohexol 300 mg I/ml) injected along with 20 ml of ropivacaine 0.2% and CT chest

	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
NRS	8-9/10	7/10	4/10	3/10	3/10	3-4/10
Intervention	HRCT Thorax ICD insertion	-	-	-	-	Repeat CT chest ICD removed
Pain management	IV analgesics Fentanyl infusion	ESP block planned Bolus + infusion Fentanyl infusion tapered	Continuous catheter Infusion 8ml/hour Fentanyl infusion stopped	Continuous catheter Infusion 8ml/hour	Continuous catheter Infusion 8ml/hour	Catheter removed
RR	30	28	20	18	18	18
SPO₂	85%	88%	96%	95%	97%	98%
PH	7.336	7.50	7.48	7.521	7.485	7.501
PO₂	40	42	82	80	87.4	98.3
PCO₂	50	47	48	44	49.2	44.1
HCO₃	26	36.8	36.7	36.8	37	34.4

Table 1: Analgesic intervention and ABG interpretation from day 1 to day 6, showing the improvement in respiratory parameters following continuous Erector spinae plane block.

done, which showed the real time spread of contrast via the multipored catheter (Fig. 4). After which, ICD was removed in view of minimal drain and continuous catheter was removed on Day 6, intravenous analgesics (Acetaminophen and NSAID's) were continued. Patient was observed and then shifted out of ICU on day 7.

Discussion

Stumbl score is used to predicts the morbidity in patients with blunt chest wall trauma. Rib fracture score (RFS) helps in step wise management of pain following chest trauma and the need for regional anaesthesia technique if: RFS>15, patient unable to take deep breath, cough or mobilise. Regional anaesthesia (RA) helps in reducing the pain and improving respiratory parameters [2]. Various RA techniques like Thoracic epidural, Thoracic paravertebral block, ESP block, Serratus anterior plane block and intercostal nerve block can be used in managing pain following MRF's.

Epidural and paravertebral block (PVB) have been commonly used for relieving acute or chronic pain for cervical, thoracic, or abdominal surgeries [3]. Intercostal nerve block must be performed at multiple levels for adequate analgesia in MRF's. The ESP block is a novel technique which can be performed either superficial (between Trapezius/rhomboids and ESM) or deep (between ESM and Transverse process).

Based on US-guided dye injections in formalin-based cadavers, it was postulated that the probable mechanism of action of thoracic erector spinae blockade at the level of T4-T5 is through paravertebral and epidural blockade, thus blocking the ventral and dorsal rami of the spinal nerves [4].

ESP block gives a multi-dermatomal sensory blockade for acute pain management; also helps in reducing the opioid consumption and its related complications like respiratory depression, cough suppression, delirium, constipation and pruritis [5]. ESP block can be used successfully in patients, appropriately selecting the level of intervention, and opioid-sparing analgesia can be effectively delivered [6]. Unilateral ESP block helps in managing pain in multiple unilateral injuries [7]. Epidural and PVB is contraindicated in anticoagulated patients, patient with coagulopathy; and positioning of the patient is difficult with multiple rib fractures; and risk of pleura injury with PVB and CSF/blood tap during epidural. Hence ESP block is technically easier to perform with the transverse process acting as the shield, preventing pleural injury.

In continuous ESP block, where the catheter is inserted after an initial bolus of local anaesthetic in the paraspinal plane and continuous infusion maintains or enhances the block effectiveness. The advantages of multi-orifice catheters are wider anaesthetic distribution, reduced mechanical obstruction, hence more effective analgesia when compared to single-hole catheters [2] (Fig. 7). The injected drug spreads through multiple holes in the distal 10cm of the catheter, which helps in wider spread of the drug and wider

analgesia. CT chest following contrast showed cranio-caudal and medial spread of the drug and spread to paravertebral space. The local action of the local anaesthetic in the periosteum at the site of rib fracture helps in better analgesia along with the nerve blockade. The local anaesthetic around the periosteum of fractured ribs blocks the nerve signals, preventing the sensation of pain [8]. ESP block offers deep truncal analgesia and requires only a single site injection for providing unilateral analgesia and avoids the risks associated with opioids and more invasive traditional RA techniques [9].

Conclusion

Pain management in multiple rib fractures is essential for faster recovery, early mobilization, reduced ICU stay and prevention of pulmonary complications. ESP block is advantageous as it is simple, effective, no risk of bleeding and less complications, hence considered as an alternative to paravertebral, intercostal, epidural or other regional techniques. All inter-fascial plane blocks depend on the volume and spread of the local anaesthetics. The only disadvantage being positioning the patient either in sitting or lateral, when the patient is on mechanical ventilation.

References

1. Kuo K, Kim AM. Rib Fracture. [Updated 2023 Aug 8]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 Jan-. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK541020/>
2. Thoracic Paravertebral Analgesia Through a New Multiple-Hole Catheter- 2016/04/01. doi: 10.1053/j.jvca.2015.09.016. DO - 10.1053/j.jvca.2015.09.016. Journal of Cardiothoracic and Vascular Anesthesia
3. Kumar G, Kumar Bhoi S, Sinha TP, Paul S. Erector spinae plane block for multiple rib fracture done by an Emergency Physician: A case series. Australas J Ultrasound Med. 2020 Aug 30;24(1):58-62. doi: 10.1002/ajum.12225. PMID: 34760612; PMCID: PMC8412024.
4. Diwan S, Garud R, Nair A. Thoracic paravertebral and erector spinae plane block: A cadaveric study demonstrating different site of injections and similar destinations. Saudi J Anaesth. 2019 Oct-Dec;13(4):399-401. doi: 10.4103/sja.SJA_339_19. PMID: 31572102; PMCID: PMC6753759.
5. L May, C Hillermann, S Patil, Rib fracture management, BJA Education, Volume 16, Issue 1, 2016,
6. Diwan, S., Nair, A., Adhye, B. et al. Dual erector spinae plane block for complex traumas of upper and lower limb: an opioid reduction strategy—a case series. Ain-Shams J Anesthesiol 15, 81 (2023). <https://doi.org/10.1186/s42077-023-00380-0>
7. Diwan, Sandeep; Nair, Abhijit1. Unilateral erector spinae plane block for managing acute pain arising from multiple unilateral injuries: A case report. Indian Journal of Anaesthesia 64(1):p 79-80, January 2020. |DOI: 10.4103/ija.IJA_609_19
8. Periosteal Infusion of Local Anesthetics as an Alternative to Bilateral Subpectoral Interfascial Plane Catheters in Patients with Sternal Fractures, Regional Anesthesia & Pain Medicine. Paul, Barry. 2017/05/01.
9. Rashmi Syal, Sadik Mohammed, Rakesh Kumar, Nidhi Jain, Pradeep Bhatia, Continuous erector spinae plane block for analgesia and better pulmonary functions in patients with multiple rib fractures: a prospective descriptive study, Brazilian Journal of Anesthesiology (English Edition), Volume 74, Issue 1, 2024.

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given his/her consent for his/her images and other clinical information to be reported in the Journal. The patient understands that his/her name and initials will not be published, and due efforts will be made to conceal his/her identity, but anonymity cannot be guaranteed.

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