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Case Report

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Ultrasound-Guided Continuous Erector Spinae Plane Block in a Patient with Multiple Rib Fractures

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Abstract

The invention of new modalities in regional anaesthesia has included a number of important fascial plane blocks. We here describe a case of a successful erector spinae plane block using a continuous catheter technique for pain relief in a patient with multiple rib fractures.

Keywords: Analgesia, erector spinae plane block, rib fractures

Introduction

Rib fractures account for 10% of all trauma cases, secondary to road traffic accidents (1). Rib fractures can be at a single or multiple level. They can lead to complications ranging from pain, atelectasis, pneumonia, consolidation and respiratory failure. These complications are directly proportional to the number of ribs involved and the age of patient. Increased morbidity leads to frequent intensive care unit admissions and mortality as high as 33% (2).

Case presentation

A 39-year-old male patient was admitted to the emergency department of our institute with a history of a motor vehicle accident. He had sustained an injury on the right side of the thorax, along with a fracture of the left mandible. Chest X-ray confirmed the fracture of the 2nd through 8th right ribs and pneumothorax (Figure 1). Due to fractured ribs, the patient complained of severe pain in the back and lateral part on the right side of the thoracic cage. He had severe pain with the visual analogue scale (VAS) score of 8/10 at rest.

Immediately, intravenous diclofenac sodium 75 mg and paracetamol 1000 mg were administered for analgesia. Six hours later, the patient again complained of severe pain on the right side of the chest, and he was unable to take a deep breath; the VAS score at this time was 9/10.

In view of increased severity of pain, we decided to apply a regional block in the form of a continuous erector spinae plane (ESP) block in this patient. The patient was transferred to the operation theatre after obtaining informed written consent. The procedure was performed with patient in the sitting position with all American Society of Anesthesiologists (ASA) monitoring attached to the patient. The ultrasound (USG)-guided in-plane continous ESP block was applied with the help of a high-frequency (8-15 MHz) linear ultrasound transducer (LOGIQe, GE Healthcare, China). The transducer was placed oblique parasagittally 3 cm laterally to the T4 spinous process with the orientation marker facing the cephalad, and all the three back muscles, trapezius, rhomboid major and erector spinae,

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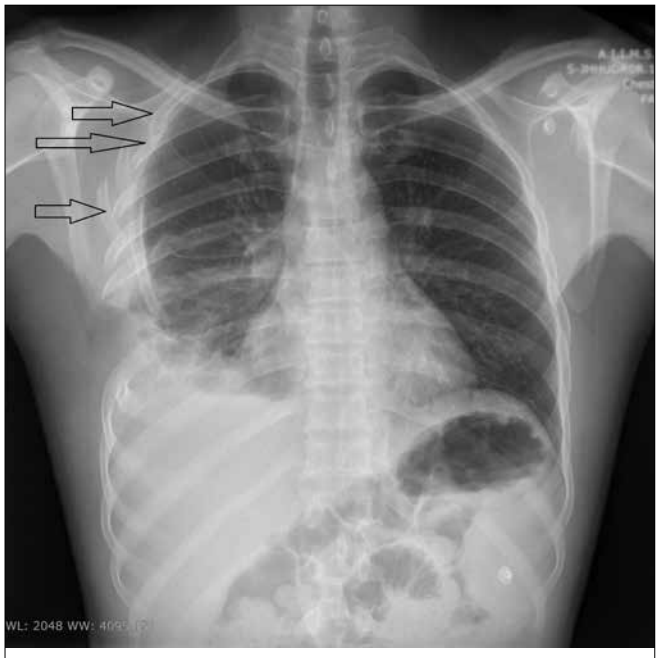

Figure 1. Chest X-ray showing multiple rib fractures

were identified. After skin infiltration with 2% xylocaine, a 10 cm long block needle (contiplex, B BRAUN) was inserted in-plane in cranial-to-caudal direction until the tip of the needle touched the transverse process of T4 vertebra. The location of the needle tip was confirmed by lifting the erector spinae muscle after the injection of 3 mL of normal saline. A total of 15 mL of 0.375% ropivacaine in 5 ml aliquot were injected deep into the erector muscle and superficially to the transervese process, followed by insertion of an indwelling catheter through the needle. After 30 minutes, the patient was completely relived from pain with the VAS score dropping from 8/10 to 1/10. A continous infusion of 0.20% of ropivacaine was administered for 4 days at the rate of 5 mL $hour^{-1}$.

Discussion

The factors responsible for morbidity and mortality associated with rib fractures are hypoventilation due to pain, impaired gas exchange in damaged lung underlying the fractures, altered breathing mechanics (3), the number of ribs fractured and the age of patients (4, 5). The number of ribs involved is directly correlated with mortality. When seven or more ribs are fractured, the mortality spikes up to 29% (6). The presence of a flail chest alone has a reported mortality rate of 33% due to the paradoxical chest movement that inhibits effective ventilation.

Elderly patients are particularly susceptible to rib fractures due to osteoporosis, cartilage degeneration and reduced elasticity, along with physiological changes with age, which lead to an impaired gas exchange with a poor respiratory reserve. All these alterations along with other co-morbidities make elderly patients more susceptible to rib fractures and associated morbidity such as pneumonia at the rate as high as 31% (7).

Various clinical and radiographic scoring systems have been developed for the risk assessment in patients with rib fractures such as RibScore by Chapman and colleagues, and the PIC scoring tool developed by the Wellspan York Hospital, York, Pennsylvania, USA, which serially evaluate and monitor patients based on pain, inspiratory capacity and cough (8).

Paramount importance should be given to adequate analgesia administration in patients, even with simple rib fractures. A good pain relief can help to prevent secondary pulmonary complications by improving patients' functional capacity by reducing splinting and improving pulmonary function.

Various systemic and regional block techniques have been used for analgesia in patients with rib fractures. Oral and systemic nonsteroidal anti-inflammatory drugs (NSAIDs) (e.g. diclofenac, ibupropfen, ketorolac) are useful for mild-to-moderate pain as they do not depress the cardiovascular and central nervous systems. The side effect of NSAIDs include peptic irritation, platelet inhibition and renal injury. Opioids are depressants, and they suppress cough and may promote respiratory complications, in addition to interfering with the assessment of head and abdominal injuries in trauma victims.

Epidural analgesia (EA) using local anaesthetic agents, opioids or a combination of both has been successfully used to manage pain in patients with rib fractures. EA improves patient's condition by increasing *functional residual capacity* (FRC), dynamic lung compliance and vital capacity; by decreasing the airway resistance; and by significantly increasing PaO_2 (9). EA is technically challenging having a failure rate of approximately 15%. In patients with multiple injuries, it can mask intra-abdominal injuries and be associated with the loss of bilateral sympathetic tone causing hypotension. In addition, it can result in cardiovascular collapse and cardiac arrest in an inadequately resuscitated patient.

A thoracic paravertebral block (TPVB) is simple and easier to perform, and it produces a multidermatomal ipsilateral somatic and sympathetic nerve blockade in contiguous thoracic dermatomes. The incidence of complications with TPVB are hypotension (4.6%), vascular puncture (3.8%), pleural puncture (1.1%) and pneumothorax (0.5%) (9).

We used a USG-guided ESP block in this patient because it is simple to perform and less time consuming. It is safer because no structures are visible in the immediate vicinity of the needle. The ESP muscles are arranged in a columnar fashion and encased in fascia called thoracolumbarfascia, which extends

from the base of the skull to sacrum. Local anaesthetic drugs injected into the ESP plane have an extensive cranio-caudal spread and cover multiple dermatomes, as described in the cadaver model in which a single injection applied at the T5 level showed spreading of the dye up to T2-T9 (10). In comparison to the ESP block, a thoracic epidural block has spread of a local anaesthetic two dermatome cranially and one in the caudal direction only (11).

Conclusion

The ESP block can provide adequate pain relief as one of the regional anaesthetic techniques and may become a new modality of analgesia in patients with multiple rib fractures.

Informed Consent: Written informed consent was obtained from patient who participated in this case.

Peer-review: Externally peer-reviewed.

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Conflict of Interest: The authors have no conflicts of interest to declare.

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