

Research Article

Erector Spinae Plane Block for Control of Stress Response in Multiple Rib Fractures



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Abstract

Background : Rib fractures are seen in more than 50% of patients presenting with blunt chest trauma and are associated with significant morbidity, long-term disability and mortality. More recently, ultrasound-guided fascial plane block techniques, such as the erector spinae plane block and serratus anterior plane block, have emerged as alternatives that are purported to provide excellent analgesia while being simpler and theoretically safer to perform. **Aims**: Our study is designed to evaluate the effect of ultrasound guided erector spinae plane block with bupivacaine for control of stress response in multiple rib fractures. **Patients and Methods**: the patients will be allocated into two groups: Group C (control group). Patients of this group received intravenous paracetamol 1gm/8h plus liometacin amp/12h and Group E (ESPB group) were undergone erector spinae plane block. **Results**; marked reduction in pain score, prolonged time to 1st analgesic request, lowest rescue fentanyl consumption, decrease cortisol level with better hemodynamic stability , patient satisfaction and less top up doses of fentanyl without any complications related to block technique when compared with patients received normal analgesics. **Conclusion**: that ultrasound guided continuous erector spinae plane block with bupivacaine (15 ml) resulted in more effective analgesia for multiple ribs fracture with control of stress response.

Keywords: fracture ribs, erector spinae, cortisol .

Introduction

Rib fractures are seen in more than 50% of patients presenting with blunt chest trauma and are associated with significant morbidity, long-term disability and mortality^[1]. Many of these adverse consequences are a result of inadequately controlled pain which hinders respiration leading to atelectasis, pneumonia and respiratory failure^[2]. The early provision of adequate analgesia is therefore paramount in the management of these patients^[3]. The cornerstones of analgesic management are oral and intravenous medications such as paracetamol, nonsteroidal anti-inflammatory drugs (NSAIDs) and opioids^[4]. Nevertheless, in patients with more significant injuries or

comorbidities, interventional procedures are often needed to provide adequate analgesia and avoid opioid-related adverse effects^[5].

Thoracic epidural and paravertebral blocks have traditionally been employed but they are technically complex, are associated with adverse effects and are often not feasible in the presence of conditions such as coagulopathy, hemodynamic instability and vertebral fractures^[6]. More recently, ultrasound-guided fascial plane block techniques, such as the erector spinae plane block and serratus anterior plane block, have emerged as alternatives that are purported to provide excellent analgesia while being simpler and theoretically safer to perform^[7,8].

For these reasons, the erector spinae plane block has become the first-line interventional analgesic technique for rib fractures in our institution. At present, however, the published evidence for the efficacy of erector spinae plane blocks in this setting is limited to isolated case reports [9,10]. Our study is designed to evaluate the effect of ultrasound guided erector spinae plane block with bupivacaine for control of stress response in multiple rib fractures .

Patients and methods

After obtaining Institutional Ethical Committee approval and written informed consent ,this prospective randomized controlled study will be conducted on adult patients aged 21-65years presented to emergency department with multiple fractures of ribs.

Inclusion criteria:

1. Age: 18-65
2. Both genders.
3. Unilateral multiple fracture ribs.

Exclusion criteria:

1. Drug allergy.
 2. Morbid obesity (BMI>40kg/m2).
 3. Psychiatric disorders.
 4. Opioid dependence.
 5. Local site infection.
 6. Poly trauma patients that need other routs of analgesia.
 7. Patient refusal to give informed consent.
- According to the used technique ,the patients will be allocated into two groups:

Group C (control group)

Patients of this group will receive intravenous paracetamol 1gm/8h plus liometacin amp/12h.

Group E (ESPB group)

Will undergo erector spinae plane block as following:

Landmark-guided ESPB can be performed with the patient in prone, lateral, or sitting position. The sitting position allows easy identification of landmarks and greater comfort to the patient. Our aim is to deposit local anaesthetic (LA) into the fascial plane deep to erector spinae muscle which blocks the dorsal and ventral rami of the spinal nerve depending on the level of injection and the amount of local anesthetic injected . The spinous process of the vertebra and a point 3 cm lateral to it are marked at the appropriate level before performing the block.

Under aseptic precautions, the needle (22-gauge, 8–10cm short, bevelled needle or a Tuohy needle) is inserted and advanced perpendicular to the skin in all planes to contact the transverse process of the vertebra.

The transverse process of the thoracic vertebra lies at a variable depth of 2–4 cm from the skin depending on the build of the individual. At this point, the needle tip lies between the erector spinae muscle and transverse process. After negative aspiration, local anesthetic is injected in 3–5 ml of normal saline. A volume of 10 ml of 0.25% bupivacaine injected. The drug injected in this plane spreads in the longitudinal axis to both cephalad and caudal direction over several levels as the erector spinae fascia extends from nuchal fascia to the sacrum.

Through the needle, a 19 G multi-orifice catheter was inserted and placed in the fascial plane and its position was confirmed by injecting 5 ml of 0.25% bupivacaine then the catheters were fixed in position and secured

Parameters will be assessed:

1. Cortisone level (before block,1st and 3rd day of study at 5.00 am)
2. Hemodynamics parameters including blood Patients of both groups will receive fentanyl by PCA as backup drug in case of failure (VAS>3). pressure and heart rate measured at 0 ,15,30,60 min,2h,4h then every 4 hours
- 3.VAS at 0,1h,2h,4h then every 4h at rest and during coughing (static and dynamic VAS)
- 4.Respiratory rate ,arterial oxygen saturation (SaO₂) and arterial blood gases (PaCO₂).
5. Time of first analgesic request:
6. Total analgesic consumption.
7. Incidence of any side effects.

Primary outcome:

Total opioid consumption.

Secondary outcome:

Changes of Visual analogue score (VAS) during time of study (3 days).
 1Changes of cortisone level (before block,1st and 3rd day of study at 5.00 am)
 Time of first analgesic request.
 Length of stay in hospital or ICU.
 Incidence of any side effects.

Incidence of respiratory complications or ventilation needed.

Statistical analysis

Our results will be statistically analyzed and expressed as tables and figures.

Results

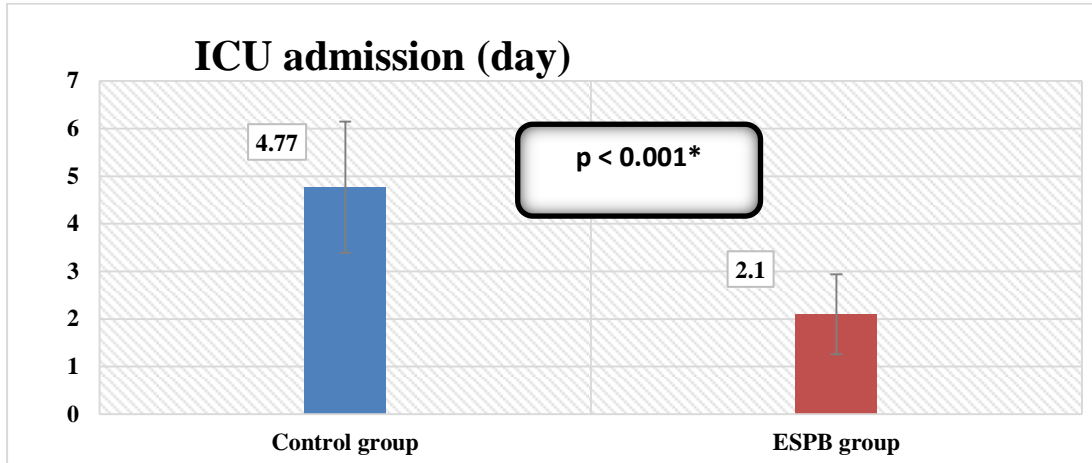


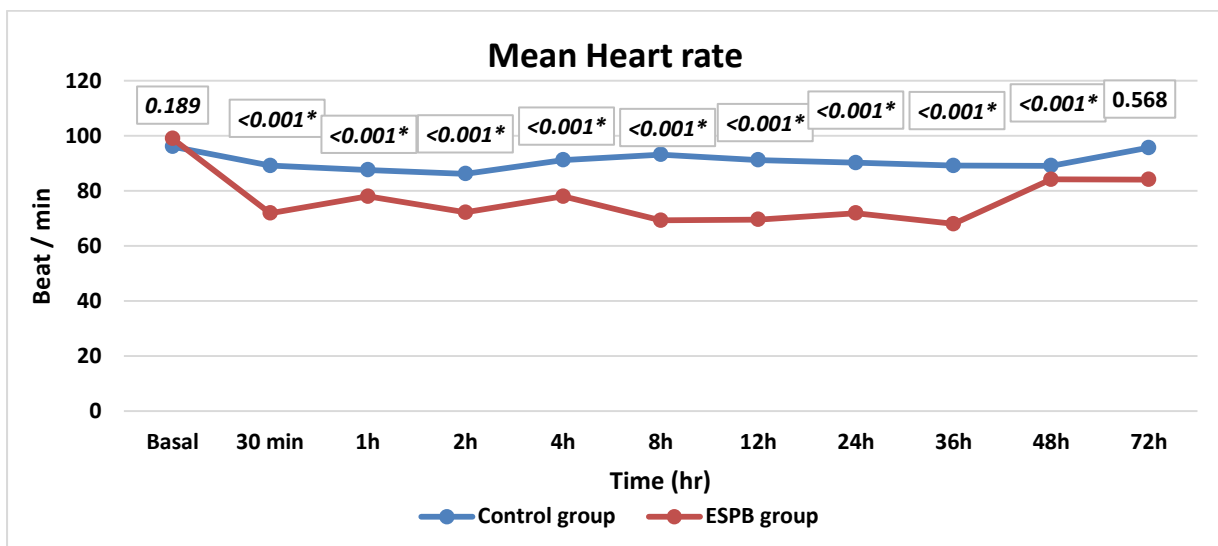
Figure: Comparison between the two studied groups according to ICU admission (day)

Hemodynamics

Table and figure clarified mean value of heart rate (beats/min.) at basal value in ESPB group was 99 ± 7 which was significantly decreased at all time intervals but in control group was 96.1 ± 7.1 which was significantly decreased at

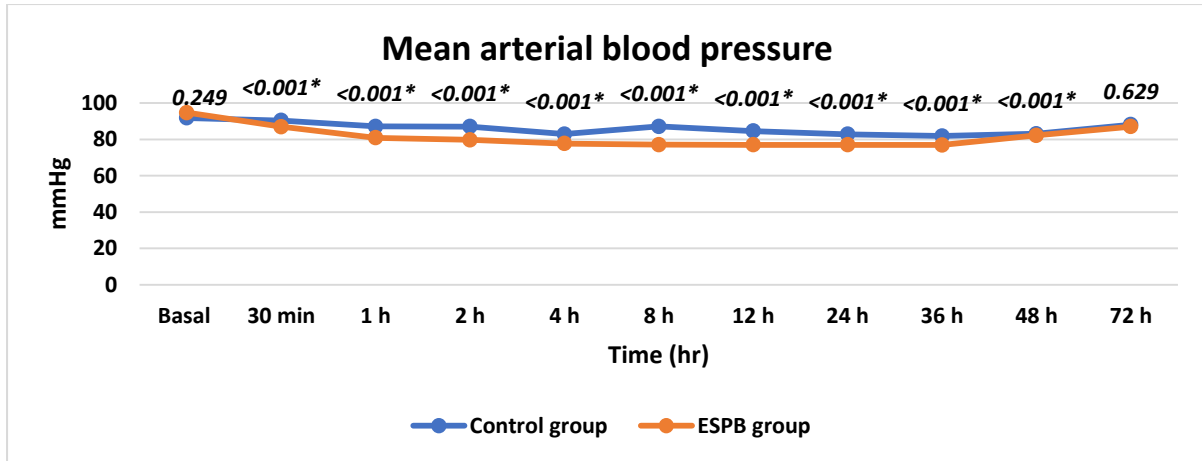
all time interval except at 8h .

Regarding inter-group HR comparison, ESPB group showed significantly decrease in mean HR when compared to control group at all time intervals except at 48h and 72h .



As seen in table & figure the mean value of mean arterial blood pressure (mmHg) at basal value in control group was 91.8 ± 8.2 which was significantly decreased at all time intervals

except at 30 min and 72h. while in ESPB group was 94.7 ± 7.9 which was significantly decreased at all time intervals of the study.



Respecting inter-group MAP comparison, ESPB group showed significantly decrease in mean arterial pressure (mmHg) at all time intervals except at 72h.

Time of first analgesic request and total fentanyl requirement:

The mean time to 1st analgesic request was significantly longer in ESPB group than control group. While the mean cumulative fentanyl

consumption during the first 72 h was significantly lower in ESPB group in comparison with the control group as illustrated in table .

	Control Group (n = 40)		ESPB Group (n = 40)		p value
	Mean ± SD	Range	Mean ± SD	Range	
Time of 1st analgesic	3.325 ± 1.802	1 - 7	6.95 ± 2.037	3 - 12	<0.001*
Opioid consumption (mic) (median)	513.7 ± 134.9 (500)	300 - 800	62.5 ± 51.57 (50)	0 - 200	<0.001*

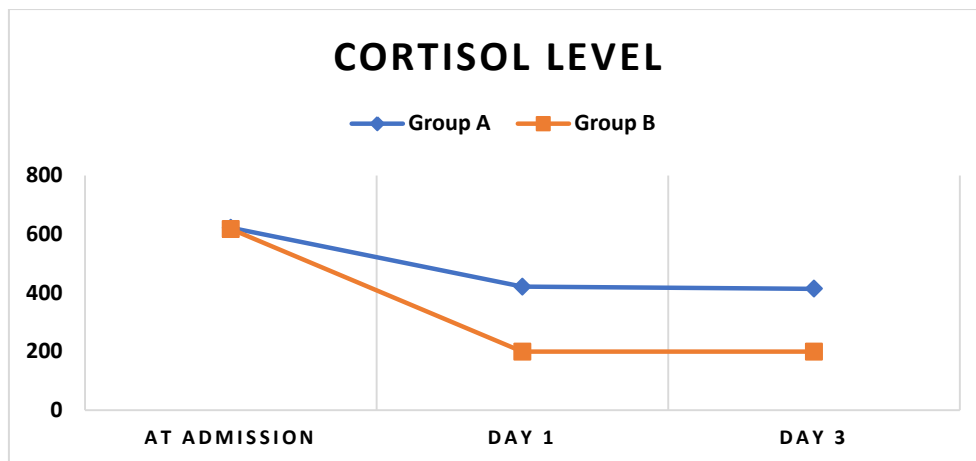
As regards Cortisol level (nmol/l) at 5.00 a.m.

As seen in table & figure there was significant difference in between two groups. which lower in ESPB group than control group at day 1 and day 3.

In control group median was 622 which

decreased to 421 and 414 in day 1 and 3 respectively with no significant difference.

While in ESPB group median was 617.5 which decreased to 200 and 200 in day 1 and 3 respectively with significant difference.



Discussion

Optimal pain management following rib fracture is of paramount importance^[3]. Pain hinders coughing and ventilatory efforts, which in turn predisposes to atelectasis, retention of secretions and respiratory failure^[5, 7,8]. Although systemic analgesic medications, including opioids, remain the mainstay of therapy, they are not always completely effective and are associated with significant adverse effects. Opioids, in particular, may cause somnolence and respiratory depression, negating any analgesic benefit^[5].

More importantly, it appears that erector spinae plane blocks can be used safely in settings where thoracic epidural and paravertebral techniques might be contraindicated, including anticoagulated patients^[5, 7,8, 9]. As with both of the latter techniques, the erector spinae plane block generally provides sensory blockade of multiple dermatomes from a single injection site, and analgesic duration may be extended by inserting a standard epidural or nerve^[8]. For all of the above reasons, the erector spinae plane block has become the first-line intervention for regional analgesia of rib fractures in our institution. The findings of our study support our clinical impression that the erector spinae plane block is associated with hemodynamic stability and an immediate and significant improvement in inspiratory volumes. The accompanying reductions in both pain scores and opioid requirements were more modest and, arguably, of limited clinical significance catheter.

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