



A COMPARATIVE STUDY OF SERRATUS ANTERIOR PLANE BLOCK VERSUS TRAMADOL FOR ACUTE PAIN IN RIB FRACTURE PATIENTS, IN A TERTIARY CARE HOSPITAL, PUDUCHERRY

Emergency Medicine

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ABSTRACT

Background: Trauma is leading cause of death, with thoracic injuries being a significant contributor. Blunt chest trauma, predominantly caused by motor vehicle accidents, account for 70% of chest injuries. Rib fractures, although generally non-fatal, lead to complications such as pneumothorax and pulmonary contusions, necessitating effective pain management. This study compares the efficacy of ultrasound guided Serratus anterior plane block (SAPB) using Bupivacaine versus IV Tramadol in managing severe pain in patients with isolated unilateral rib fractures. **Methods:** This prospective randomized controlled trial was conducted at a tertiary care hospital from November 2022 to November 2024. A total of 60 adult patients with isolated unilateral rib fractures and severe pain (≥ 7 on Universal Pain Assessment Tool) were randomized into two groups: Group A received Ultrasound guided Serratus Anterior Plane Block (SAPB) with 0.25% Bupivacaine, while Group B received IV tramadol (1mg/kg, max 100mg). Pain scores were recorded at baseline and at 15 minutes, 1 hour, 3 hours, 5 hours post intervention. Data were analyzed using a two-sample t test assuming unequal variance. **Results:** The baseline pain scores showed no significant difference between the groups ($P=0.15$). At all post intervention time points, Group A demonstrated significantly lower pain score compared to Group B. At 15 minutes, the mean pain score for SAPB was 3.46 compared to 8.15 for Tramadol ($P<0.001$). The trend continued at 1 hour (2.03 vs 3.62, $P<0.001$), 3 hours (3.12 vs 4.4, $P<0.001$) and 5 hours (4.3 and 6.7, $P<0.001$). **Conclusion:** Ultrasound guided Serratus Anterior Plane Block with Bupivacaine provides significantly faster and more effective pain relief compared to IV tramadol in managing acute pain associated with isolated unilateral rib fracture. The findings support the use of SAPB as a superior analgesic approach in such cases.

KEYWORDS

Blunt chest trauma, rib fracture, Serratus Anterior Plane Block, Ultrasound guided block, Bupivacaine, IV Tramadol, acute pain management.

INTRODUCTION:

Trauma is a leading global cause of death with India accounting for over 20% trauma related fatalities worldwide. Injuries have emerged as a significant preventable public health concern in the country with one in four patients succumbing to thoracic injury or its complications. [1] Notably 70% of all chest trauma results from blunt injuries caused by motor vehicle accidents, crush injuries and falls [2]. Among these chest wall injuries including ribs, sternum and clavicle fractures account for 36.1% of chest trauma injuries with an associated mortality rate of 4% [3]. Although isolated rib fractures are generally not fatal, they are accompanied by complications such as pneumothorax, hemothorax, pulmonary contusions, parenchymal lacerations. Midzone ribs are particularly vulnerable to blunt leading to serious complications. The number of ribs fractured and the age of patients are crucial indicators of mortality and morbidity.

Effective pain management in patients with rib fractures is critical as it directly impacts hypoventilation due to pain, impaired gas exchange from parenchymal damage and altered breathing mechanics. These factors are central in managing blunt chest trauma. This study focuses on patients with unilateral isolated rib fractures accompanied by severe pain, aiming to address hypoventilation caused by pain.

Traditionally Intravenous IV tramadol a systemic opioid analgesic has been the drug of choice for managing pain in such cases. However, recent advances have highlighted the benefits of ultrasound guided Serratus anterior plane block using bupivacaine a local anesthetic, which has shown promising results due to its rapid onset of action. [4]. This prospective Randomized control trial RCT compares the efficacy of ultra sound guided serratus anterior plane block using Bupivacaine against IV tramadol in reducing the pain at various time intervals. The goal is to assess which provides better pain relief.[5]

Methodology:

A Prospective Randomized Controlled Trial comparing the efficacy of Ultrasound guided Serratus anterior plane block using Bupivacaine versus IV Tramadol for severe acute pain in patients with Unilateral rib fractures.

Study Setting:

The study was conducted in the Emergency Department and Trauma care Unit of a tertiary care hospital, Sri Lakshmi Naryana institute of medical sciences, puducherry enrolling participants from Nov 2022 to Nov 2024

Study Population

Inclusion Criteria:

- Adult patients aged 18- 55 years
- Diagnosed with isolated unilateral rib fracture.
- Experiencing severe acute pain (Pain score ≥ 7 on Universal Pain Assessment Tool)
- Hemodynamically stable

Exclusion Criteria:

- Polytrauma patients or those with bilateral rib fractures
- Pre existing chronic pain conditions or Opioid dependency
- Allergies to Bupivacaine or tramadol
- Patients with coagulopathy, infection at the injection site.
- Underlying lung conditions like COPD

Sample Size

- A total of 60 patients were randomized into two groups, with 30 patients in each group.

Randomization And Blinding

- Participants were randomized into two groups.
- Group A received ultrasound-guided serratus anterior plane block (SAPB) with 0.25% bupivacaine after passing test dose.
- Group B received IV tramadol (1 mg/kg, maximum dose 100 mg).
- The data analyst was blinded to the group allocation

Intervention

Group A(Serratus Anterior Plane Block)

The block was performed using a linear ultra sound probe. After skin preparation, the probe was placed in the mid-axillary line at the level of the fifth rib. A 22- gauge needle was advanced under ultrasound guidance and 20ml of 0.25% bupivacaine was injected into serratus anterior plane.

Group B (IV Tramadol)

Tramadol was administered as a single IV dose over 15 minutes.

Outcome Measure

- Pain score as per Universal pain assessment tool after 15 minutes, at first hour, third hour and the fifth hour.

Data Collection And Analysis

- Pain scores were recorded at baseline before intervention in both the test and the control group.
- Pain scores were recorded at 15 minutes, 1 hour, 3 hours and 5 hours post intervention in both the groups.
- Statistical analysis was performed using Excel using two-sample t test assuming unequal variance.

Ethical Consideration

- The study was approved by the Institutional ethics committee [ICE]
- Informed consent was obtained from all the participants or their family member.
- The study adhered to GCP Good Clinical Practice Guidelines.

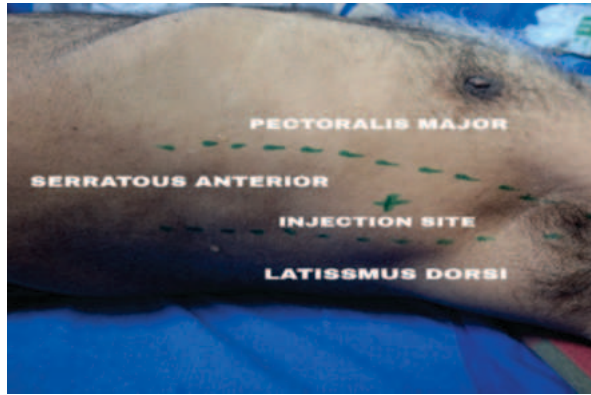


Figure 1 . Surgical Landmark for Serratus Anterior Plane Block

RESULTS:

During the study period a total of 60 patients with isolated unilateral rib fracture (n=60) were included in the study. The male : female ratio was 4:1 with the majority of patients aged between 20 and 40 years. The mechanism of thoracic injury was 100% Road Traffic Accidents (RTA). Among these 80% were 2 wheeler accidents, 15% involved 4 wheelers accidents and 5% were pedestrians of hit and run injury patterns.

Baseline pain scores for all the patients were recorded using Universal Pain Assessment tool. The Test group showed a mean pain score of 8.6, while the control group showed a mean pain score of 8.1. A t test ($t = 1.4$ and $P = 0.15$) showed no statistically significant difference in the baseline between the two groups.

Following the administration of the test dose 50% of the patients (n=30) received high frequency ultra sound guided serratus anterior plane block (SAPB) with Bupivacaine and the remaining 50% (n=30) received a single of Tramadol IV.

Post – Treatment Pain Score Analysis:

1. At 15 Minutes Post Treatment

- The mean pain score in the test group (SAPB) was 3.46, significantly lower than the control group (IV Tramadol) 8.15 .
- The t-test revealed a statistically significant difference ($t = -24$, $df = 58$, $P < 0.001$) indicating that the Ultra sound guided SAPB provided faster and more effective pain relief compared to IV tramadol.

2. At 1 Hour Post Treatment

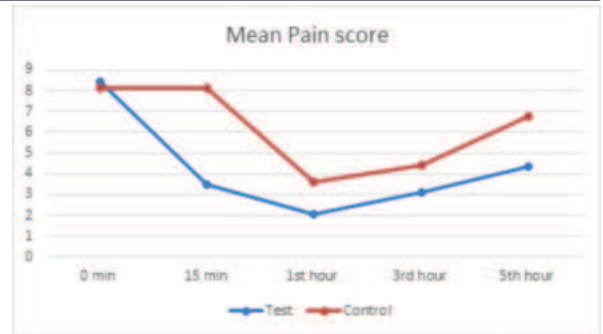
- The test group had a mean pain score 2.03, significantly lower than the control group score of 3.62 .
- The t test demonstrated a statistically significant difference ($t = -9.6$, $P < 0.001$) indicating SAPB achieved lower pain score faster than IV tramadol

3. At 3 Hours Post Treatment:

- The mean pain score in test group remained superior at 3.14, compared to 4.4 in the control group.
- The t test confirmed the difference was statistically significant ($t = -7.1$, $P < 0.001$)

4. At 5 Hours Post Treatment:

- The test group maintained superior outcome with a mean score of 4.3 compared to the control group's score of 6.7
- The t test showed a highly significant difference ($t = -14.9$, $P < 0.001$) demonstrating the sustained efficacy of SAPB over IV tramadol.



Duration	t Stat	P(T<=t) two-tail	Remarks
0 min	1.447935024	0.153019525	No statistically significant difference between two groups
15 min	-24.8973813	1.18329E-32	Highly significant difference in Test Group
1st hour	-9.609205677	1.42378E-12	Highly significant difference in Test Group
3rd hour	-7.179913308	1.46136E-09	Highly significant difference in Test Group
5th hour	-14.98482061	1.33129E-21	Highly significant difference in Test Group

CONCLUSION:

The results indicate the ultrasound guided Serratus Anterior Plane Block with Bupivacaine provides significantly faster and more effective pain relief compared to IV Tramadol at all recorded time intervals. This underscored the superior efficacy of SAPB in managing acute pain associated with isolated unilateral rib fracture.

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