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Ultrasound-Guided Radiofrequency Ablation of the Intercostal Nerve for Traumatic Rib Fracture Pain: A Case Report

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Background: Pain arising from traumatic rib fracture contributes to significant patient morbidity and mortality.

Case Report: A 68-year-old man with multiple comorbidities presented to the emergency department with a left-sided multiple rib fracture (ribs 6-8) and altered mental status after an unwitnessed fall. The patient was started on a standard of care oral analgesic regime, but continued to deteriorate because of inadequate pain relief in his pulmonary function. Given his altered mental status and insufficient pain control, to facilitate pulmonary physiotherapy, we performed an early (day 5) thermal radiofrequency ablation (RFA) of intercostal nerves at 80 °C for 90 seconds each level. Significant pain relief was noted on the same day of the procedure (pain score - 1/10).

Conclusions: This case report demonstrates the feasibility and efficacy of early thermal RFA of intercostal nerves in a frail elderly patient with multiple rib fractures and delirium in the acute pain setting.

Key words: Rib fracture, radiofrequency, denervation, intercostal nerve, acute pain

BACKGROUND

A traumatic rib fracture is associated with significant patient morbidity and mortality (1,2). The all-cause mortality rate associated with a single rib fracture is 5.8% and for every additional rib fracture, the risk increases by 19%, according to the National Trauma Data Bank review (1). The risk is exponentially high in the elderly population. Although the overall recovery in these patients often depends on multiple factors, such as age, comorbidities, other associated major injuries, an aggressive strategy to alleviate the pain arising from rib fractures is of paramount importance. Current evidence suggests that multimodal analgesia, including regional anesthetic techniques, as an integral part of the gold standard in treating acute pain associated with rib fractures (4). Including regional blocks in any form has shown to provide better analgesia with lesser demand for opioid medications.

Available regional techniques for acute pain related to rib fractures include traditional methods, such as epidural, paravertebral, and intercostal analgesia, and recently introduced interfascial plane blocks. Noteworthy are the erector spinae and serratus plane blocks for their ease of performance and being away from the neuraxial structures, thereby avoiding rare yet major complications associated with epidural and paravertebral techniques. Nevertheless, these regional anesthetic procedures require the placement of catheters to provide continuous analgesia owing to the relatively short duration of action of local anesthetics. Also, it comes with the added disadvantage, such as the need for catheter maintenance and its related complications.

Radiofrequency ablation (RFA) techniques are single-shot procedures commonly used in chronic pain syndromes wherein the target nerves are ablated using

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various modalities. In this case report, we describe the use of early RFA as a long-term analgesic modality and its efficacy in the acute pain setting in an elderly patient who presented with a traumatic multiple rib fracture. We believe this case first report describing the clinical feasibility of such a technique in acute pain management. This case report is written following the Cooperative for Assistance and Relief Everywhere guidelines.

CASE REPORT

A 68-year-old man presented to the emergency department after an unwitnessed fall with altered mental status. He had a past medical history of diabetes mellitus, paroxysmal atrial fibrillation (AF) on aspirin, and previous pulmonary tuberculosis. The patient had a history of recent stroke for which he was on follow-up. A chest X-ray revealed minimally displaced anterior left sixth to eighth rib fractures. A 12-lead electrocardiogram was unremarkable apart from his known history of AF. No other traumatic injuries were found on examination as per advanced traumatic life-support guidelines. He was planned for conservative management with adequate analgesia for his rib fracture.

His rib fracture pain limited his participation in physiotherapy and limiting his ambulation. Objectively, he could generate a tidal volume of 200-300 mL in incentive spirometry and range of motion of his left shoulder was limited to 90° due to pain. A diagnosis of multifactorial delirium was made contributed by his recent stroke as well as severe, acute rib fracture pain. He was started on oral analgesics (paracetamol, nonsteroidal anti-inflammatory drugs, and opioids) with suboptimal effect. He didn't receive parenteral analgesics. Pain severity was assessed using the Numeric Pain Scale (Table 1). However, there was no much change in pain severity and there was a restriction in rehabilitative therapy participation despite increasing his 24-hour morphine dose from 3 mg to 6 mg over 3 days.

Though there was an overall improving trend in the patient's reported pain score with increasing opioid usage, activity participation was still limited. The decision was taken to provide pain relief by thermal RFA of left sixth to eighth intercostal nerves after the patient's pain assessment by the Acute Pain Services team on day 5.

The patient was scheduled for RFA in the operation theatre under sterile precaution. He was placed in the right lateral position and ultrasonography (USG) was used for locating the lateral branches of intercostal nerves at the anterior axillary line on the left side at each level of the rib fracture with high-frequency linear USG probe. A 22G NeuroTherm™ RFA needle of 50 mm with 5 mm active tip was used for RFA. Sensory stimulation was used to confirm position of the RFA needle. A total volume of 10 mL mixture of 0.5% bupivacaine with 4 mg triamcinolone was given to the RFA sites to reduce the development of neuritis following RFA. RFA was done at 80 ºC for 90 seconds at each site after confirming the position by impedance and sensory stimulation. No complications were noted during and after the nerve ablation. Significant pain relief noted on the same day of the procedure. (Pain score - 1/10)

On post-procedure day 1, he generated 500-600 mL tidal volume for his incentive spirometry and ambulated with a walking frame. Regular morphine was switched to only breakthrough doses, for which he required 3 mg each day. From post-procedure day 3, his analgesic requirement was reduced to only paracetamol with ketoprofen patch and he didn't require opioids. Charted pain scores were significantly reduced to 1/10-2/10 for the rest of his admission. Notably, there was an improvement in his sensorium post-procedure. By post-procedure day 4, he was able to ambulate with minimal assistance.

DISCUSSION

In this case report, we describe the clinical feasibility and efficacy of early thermal RFA in treating acute pain following traumatic multiple rib fractures in an elderly patient.

Multimodal analgesia (4) with regional anesthetic techniques should be the treatment choice for acute pain management in cases of multiple rib fractures. The primary goal would be to provide quality analgesia which helps in better chest physiotherapy, pulmonary toileting, and deep breathing exercises, thereby achieving early ambulation and discharge. It is important to achieve a forced vital capacity of a minimum of 15 mL/kg if the patient has no other internal injuries like lung contusion or pneumothorax and haemothorax. Adding regional anesthetic techniques have been shown to offer better pain scores at rest and movement (cough), with a reduction in the overall requirement for opioids and consequently reduced the mechanical ventilation days and the length of intensive care unit (ICU) and hospital stay. It has also shown to be associated with an overall improved respiratory mechanics, oxygenation status, and thus reduced pulmonary complications, such as pneumonia (3).

Table 1. Patient analgesic consumption and pain score.

Admission Day	Analgesia (Oral)	Doses (Cumulative)	Pain Score (NPS)
1	Paracetamol Tramadol Diclofenac	2 g 25 mg 50 mg	5/10
2	Paracetamol Tramadol Diclofenac	3 g 50 mg 75 mg	5/10
3	Paracetamol Diclofenac Morphine Ketoprofen (Patch)	3 g 25 mg 3 mg 30 mg	10/10
4	Paracetamol Morphine Ketoprofen (Patch)	3 g 6 mg 60 mg	7/10
5	Paracetamol Morphine Ketoprofen (Patch)	4 g 6mg 30 mg	6/10

Abbreviation: NPS, Numeric Pain Scale

Various regional anesthetic techniques, such as epidural, paravertebral, erector spinae, midpoint transverse process to pleura, retrolaminar, subrhomboid, serratus anterior plane, and intercostal blocks, have been tried in the setting of acute pain following multiple rib fractures. Although there is a steady increase in randomized trials comparing these techniques with encouraging results, it is imperative to remember that these are single-shot modalities unless one considers placing a catheter. Current evidence suggests that epidural or paravertebral catheter techniques are commonly employed in these circumstances. However, they can be associated with catheter-related and neuraxial complications, especially in patients who are admitted to ICUs and increase the hospital stay.

RFA is an attractive alternative in this particular scenario as it provides long-term analgesia and is performed away from the neuraxial structures. Early RFA in a frail elderly patient with multiple rib fractures and delirium, as in our case, proved to be beneficial in the acute pain setting where traditional oral analgesics have failed to achieve the desired goal. Furthermore, active and aggressive management of acute pain will reduce the risk of central sensitization and, therefore, the development of chronic pain and overall outcome (4,5). With the increasing use of ultrasound assistance in the field of regional anesthesia, RFA can be performed using USG guidance, while needle placement thereby further increasing its safety. role, efficacy, and safety in such scenarios.

CONCLUSIONS

We believe this report would draw attention to the feasibility of early RFA in acute pain management following multiple rib fractures and future research is warranted to explore its potential RFA of the intercostal nerves in patients with conservative management of rib fracture can improve the overall clinical outcome when performed early.

Informed Consent

The authors declare that informed consent has been obtained from the patient and his family for their participation in this case report.

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