

Bilateral Parasternal Catheters Provide Unparalleled Pain Relief in Displaced Sternal Fracture following Blunt Force Chest Trauma

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Background

- Sternal fractures are a common injury after deceleration accidents or blunt anterior chest trauma.
- Uncomplicated non-displaced fractures are managed and observed, followed early hospital discharge as long as the patient has a negative cardiac workup including EKG and cardiac enzymes.
- Displaced fractures causing more significant discomfort may require operative management.
- Uncontrolled pain from sternal fractures may result in impaired ventilation causing devastating pulmonary complications.
- We present a case report of a patient with a displaced sternal fracture who had complete resolution of pain following placement of bilateral parasternal nerve block catheters (PNBC).

Location	Medication	Dose
Nerve Block #1	2% Lidocaine	3 mL
	0.25% Bupivacaine with 1:400000 Epinephrine	30 mL
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	Fentanyl	100 mcg
	Midazolam	2 mg
Nerve Block #2	0.25% Bupivacaine	30 mL
BPC Continuous	0.2% Ropivacaine	8 mL/ hour
BPC Daily Bolus	0.2% Ropivacaine	20 mL daily per catheter
Additional Multimodal Pain Regimen	Acetaminophen	975 mg q6hrs
	Gabapentin	300 mg TID
	Ketorolac	15 mg q6h
	Methocarbamol	500 mg TID
	Oxycodone	5/10 mg q3hrs prn

Table 1. Patient's pain regime during in-hospital stay.

Methods

The patient gave consent to publication. As the case report is devoid of patient identifiable information, it is exempt from IRB review requirements as per Hartford Healthcare policy.

Case Report

A 69 year old woman with a past medical history of hypertension, asthma, and anxiety initially presented to Hartford Hospital Emergency Department following a motor vehicle vs. tree accident without loss of consciousness. A CT scan revealed a displaced sternal fracture and retrosternal hematoma.

The patient presented in intractable pain and the acute pain service was consulted for procedural intervention. The patient appeared profoundly uncomfortable and in respiratory distress with increased work of breathing and audible wheezing heard from the bedside. She was offered single shot nerve blocks to improve pain and respiratory mechanics.

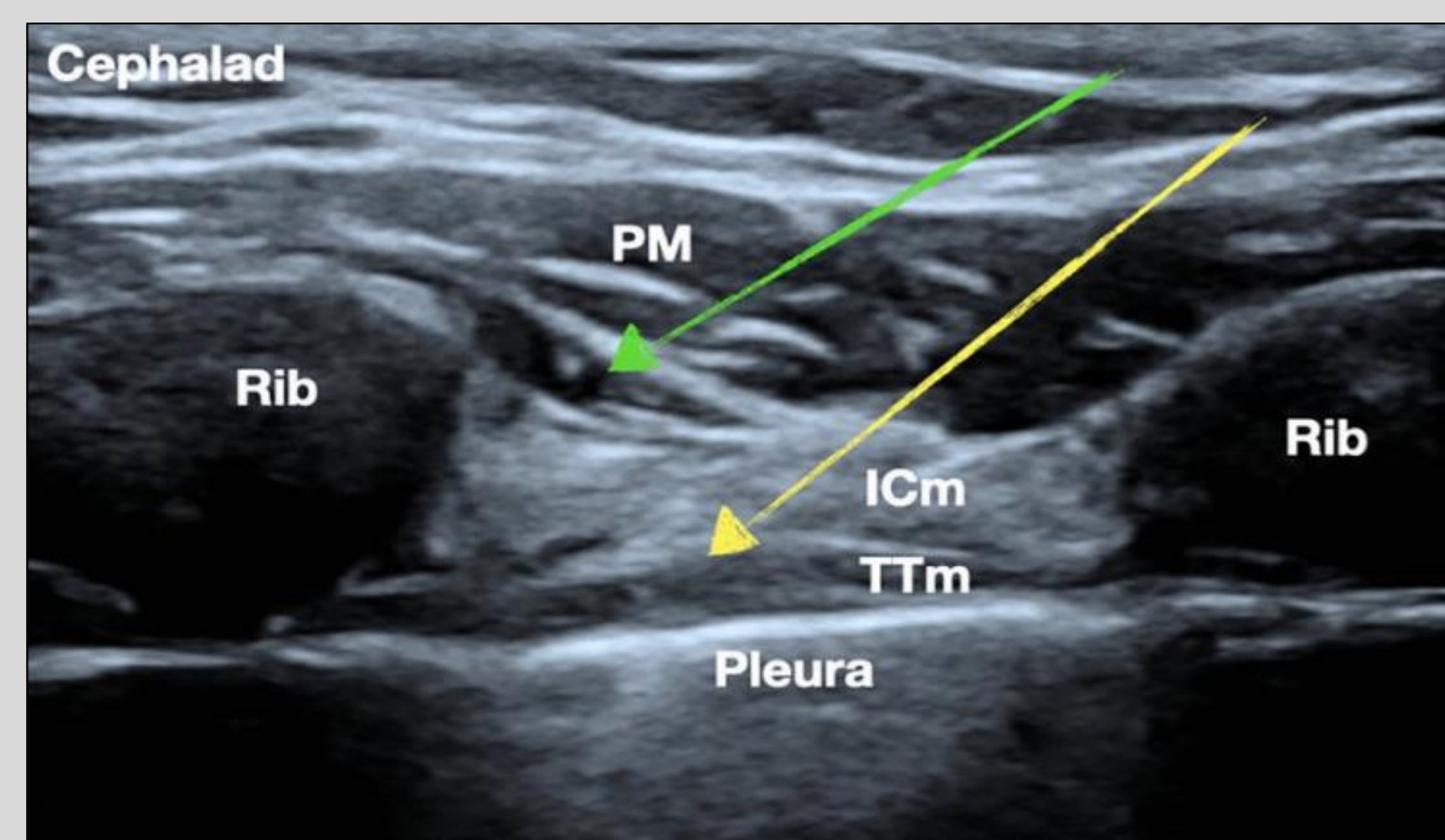


Figure 1. PM; pectoralis major muscle, ICm: intercostal muscle, TTm: transversus thoracis muscle

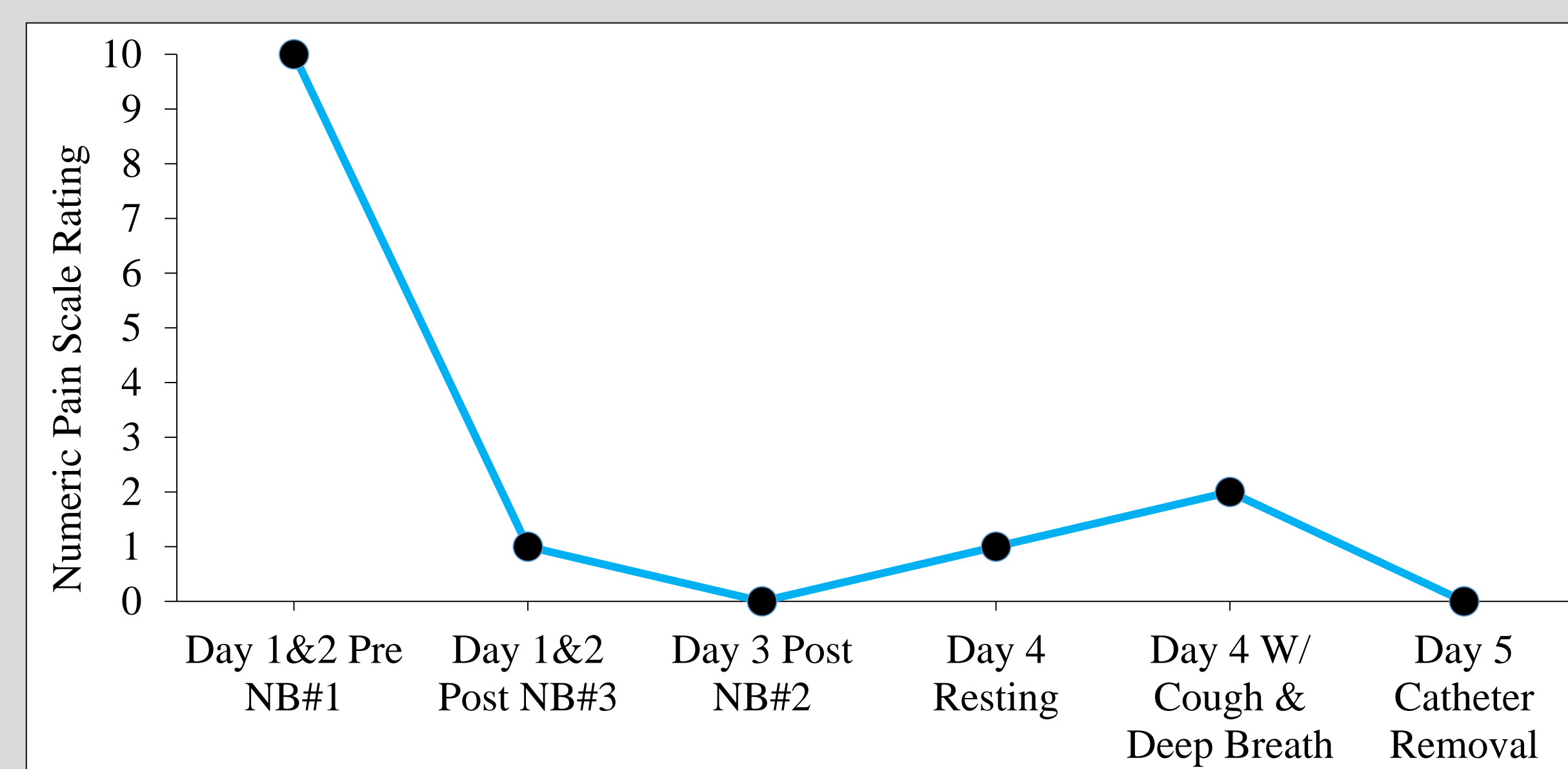


Figure 2. Patient's perceived pain throughout in-hospital stay, NB = Nerve Block

On hospital day 3, after single shot nerve blocks had presumably worn off, the acute pain service was again consulted for another nerve block. The patient wished to have another sternal block but requested a longer duration, and a nerve catheter was offered. The patient was placed supine and sedated with 100 mcg fentanyl and 2 mg midazolam. A linear transducer was placed on the sternal bone and moved laterally to identify the edge of the sternum. A Pajunk needle (E-cath PLUS, over the needle catheter system, 18g, 83mm) was inserted in-plane in a caudal to cranial direction. The tip of the needle was advanced until it was positioned in the interfascial plane between the pectoralis major and internal intercostal muscle. Catheters were each loaded with 30mL of 0.25% bupivacaine.

She also had improvement in respiratory mechanics and the ability to perform pulmonary hygiene. On hospital day 5, the patient was taken to the operating room for ORIF sternum. Catheters were within the surgical field and removed. Postoperatively the patient was comfortable with re-approximation of sternum and was deemed stable for discharge the following day on PO pain regimen.

Summary

- Sternal fractures, particularly those with displacement, can cause severe pain, impaired ventilation, and pulmonary complications, resulting in a need for non-invasive or invasive ventilation.
- Adequate analgesia and pulmonary hygiene are critical to improve outcomes and decrease morbidity of sternal fractures. Opioids are the first line of care, however, they carry a risk for respiratory depression. Thoracic epidurals and paravertebral catheters are also used, but these procedures are invasive and associated with more patient risks.
- The sternum is innervated via the anterior divisions of the intercostal nerves which come off the spinal nerve and pass between the parietal pleura and the endothoracic fascia. It then enters the plane between the innermost and inner intercostal muscles, and as it approaches the sternum passes between the transversus thoracis muscle and inner intercostal muscle. These nerves then pass anterior to the internal mammary vessels and end by piercing the internal intercostal muscles, external intercostal membranes between the costal cartilages, and the pectoralis major muscle, to become anterior cutaneous branches.
- Bilateral PNBCs were placed where the anterior cutaneous branches of the intercostal nerve emerge next to the internal mammary vessels, just deep to the pectoralis major muscle and lateral to the sternum. Using ultrasound greatly reduces the major risks of pneumothorax, pericardial injury, or intravascular injection.
- The anatomy of sternal innervation explains the success of these nerve catheters and should be considered for pain management of sternal fractures cause impaired ventilation and significant pulmonary complications.**

References

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