

Thoracic epidural analgesia vs. IV lidocaine infusion for management of acute, traumatic rib fracture

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INTRODUCTION

Traumatic rib fractures occur in approximately 10% of trauma patients and are associated with significant morbidity and mortality. While thoracic epidural analgesia (TEA) has been recommended as a gold standard for rib fracture pain management, absolute and relative contraindications frequently limit its use. Intravenous (IV) lidocaine infusion has emerged as a potential alternative with fewer contraindications and a favorable safety profile. We hypothesized that IV lidocaine provides comparable pain control and opioid reduction compared to TEA in patients with traumatic rib fractures.

AIM

To identify whether IV lidocaine infusion provides comparable pain control and opioid reduction compared to to thoracic epdirual analgesia in patients with traumatic rib fractures.

METHOD

This retrospective cohort study included adult patients (≥18 years) admitted to the University of Chicago Medical Center with traumatic rib fractures treated with either IV lidocaine infusion or TEA between July 2017 and June 2024. Patients were excluded if intubated, pregnant, received ketamine infusions, or had treatment initiated at an outside hospital. The primary outcome was pain intensity measured by numeric rating scale (NRS, 0-10) at 24, 48, and 72 hours after treatment initiation. Secondary outcomes included systemic opioid consumption (morphine milligram equivalents [MME]) at 0-24, 24-48, and 48-72 hours; total opioid consumption including neuraxial opioids; hospital length of stay; and adverse events. Linear mixed-effects models evaluated pain trajectories adjusting for baseline pain, demographics, injury severity, comorbidities, and multimodal analgesic use. Multivariable linear regression models assessed opioid consumption with log-transformation for skewed data. Adverse events were summarized descriptively due to low event frequency.

RESULTS

A total of 129 patients were included: 75 (58.1%) received IV lidocaine and 54 (41.9%) received TEA.

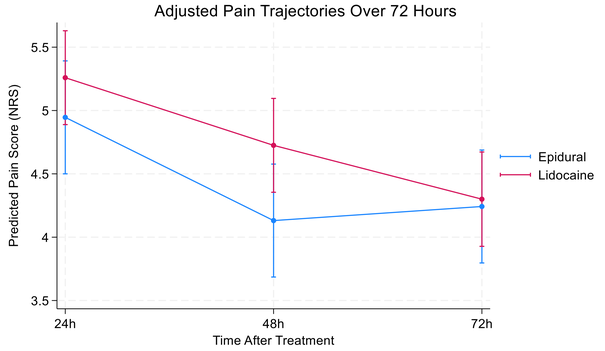
Unadjusted pain scores were similar at 24 hours (median 5.0 vs 5.0, p=0.121) and 24-48 hours (4.4±1.6 vs 4.5±1.7, p=0.680), but significantly lower in the lidocaine group at 48-72 hours (4.0±1.6 vs 4.6±1.5, p=0.016). In adjusted mixed-effects models, there was no significant difference in pain trajectories between groups over 72 hours (β=0.31 at 24 hours; 95% CI -0.33 to 0.95; p=0.339), with both groups showing significant pain improvement over time.

Systemic (IV/PO) opioid consumption tended to be higher in the lidocaine group at all intervals, though differences were not statistically significant: 0-24 hours (75.0 vs 47.0 MME, p=0.495), 24-48 hours (74.6 vs 36.0 MME, p=0.192), and 48-72 hours (58.8 vs 32.0 MME, p=0.703). However, total opioid exposure including neuraxial opioids was significantly higher in the TEA group at all time points (p≤0.003), with median total consumption at 0-24 hours of 125.5 MME (TEA) versus 75.0 MME (lidocaine).

Adverse events were rare, occurring in 4 lidocaine patients (5.3%) and none in the TEA group (p=0.085). Events included sedation (n=3) and sinus tachycardia (n=1), with no neurologic or cardiac toxicity observed.

	Epidural	Lidocaine	p-value
N	54 (41.9%)	75 (58.1%)	
Pain Scores			
Average pain score (NRS) 0-24 hours	5.0 [4.0 7.0]	5.0 [4.0 6.0]	0.121
Average pain score (NRS) 24-48 hours	4.5 ± 1.7	4.4 ± 1.6	0.680
Average pain score (NRS) 48-72 hours	4.6 ± 1.5	4.0 ± 1.6	0.016
Systemic opioid MME 0–24 hours	47.0 [20.0 94.0]	75.0 [40.0 136.7]	0.495
Systemic opioid MME 24–48 hours	36.0 [4.0 95.0]	74.6 [37.5 120.0]	0.192
Systemic opioid MME 48–72 hours	32.0 [12.0 60.0]	58.8 [21.2 105.4]	0.703
Systemic opioid MME 0–72 hours	142.1 [67.5 291.0]	215.0 [114.6 355.8]	0.384
Total opioid consumption (MME) 0-24 hours	125.5 [61.0 216.0]	75.0 [40.0 136.7]	0.003
Total opioid consumption (MME) 24-48 hours	127.2 [52.0 255.0]	74.6 [37.5 120.0]	0.001
Total opioid consumption (MME) 48-72 hours	144.0 [58.0 246.0]	58.8 [21.2 105.4]	<0.001

Values are presented as median [IQR] or mean ± SD, as appropriate. Pain scores represent average numeric rating scale (NRS) values for each 24-hour interval following treatment initiation. Systemic opioid consumption includes all non-neuraxial opioid administration converted to oral morphine milligram equivalents (MME). Total opioid consumption includes both systemic and neuraxial opioid doses. Comparisons between groups were performed using Wilcoxon rank-sum tests for non-normally distributed variables and t-tests for normally distributed variables. A two-sided p-value < 0.05 was considered statistically significant.



Predicted mean pain scores were generated from a linear mixed-effects model including fixed effects for treatment group, time (24, 48, 72 hours), and their interaction, as well as baseline pain score, age, sex, race, number of rib fractures, chest tube placement, supplemental oxygen use, hepatic disease, renal disease, chronic pain history, substance use disorder, time from admission to treatment initiation, and use of non-opioid analgesics. A random intercept accounted for within-patient correlation. Points represent adjusted mean numeric rating scale (NRS) pain scores at each time point, and lines represent estimated trajectories for epidural and lidocaine groups. Error bars (if displayed) represent 95% confidence intervals.

CONCLUSIONS

IV lidocaine infusion provides comparable pain control to TEA for traumatic rib fracture management over 72 hours, with similar adjusted pain trajectories. Although lidocaine patients required numerically higher IV/PO opioid supplementation, total opioid exposure was significantly lower compared to TEA when neuraxial opioids were included. The favorable safety profile and minimal contraindications of IV lidocaine make it a viable alternative to TEA, particularly in patients with contraindications to neuraxial procedures. These findings support the incorporation of IV lidocaine into multimodal analgesic protocols for traumatic rib fractures. Prospective randomized trials are warranted to confirm these findings and evaluate long-term outcomes.

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