Rib fracture audit

Paravertebral / erector spinae plane / serratus anterior plane block, single injection or catheter. One sheet per patient.

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PATIENT AND INJURY

Audit no. _____ Date _____ Age _____ **Sex** ☐ F ☐ M **ASA** ☐ 1 ☐ 2 ☐ 3 ☐ 4 Weight (kg) _____ Height (cm) _____

Ribs fractured _____ **Side** ☐ L ☐ R ☐ Both **Flail segment** ☐ Yes ☐ No **Lung disease** ☐ Yes ☐ No

Predicted peak flow (L/min) _____

BLOCK

Block ☐ Paravertebral ☐ Erector spinae plane ☐ Serratus anterior plane ☐ Other ☐ Single injection ☐ Catheter

Level _____ Operator grade _____ **Prep, Stop, Block** ☐ Yes ☐ No

Loading dose: drug and concentration (%) _____ Volume (mL) _____ Dose (mg) _____ mg/kg _____

Regimen ☐ Programmed intermittent bolus ☐ Continuous infusion ☐ Manual top-ups Drug and % _____

mL per bolus or mL/h _____ Interval (h) _____ Dose in 24 h (mg) _____

MEASUREMENTS: BEFORE THE BLOCK, 10 MINUTES AFTER, THEN 2-HOURLY TO 8 H AND 4-HOURLY TO 24 H

	Before block	10 min	2 h	4 h	6 h	8 h	12 h	16 h	20 h	24 h
Clock time										
Pain at rest (0-10)										
Pain on deep breath (0-10)										
Pain on cough (0-10)										
Peak flow, best of 3 (L/min)										
Peak flow: % change										
Spirometry (mL), optional										
Deep breath: full / limited / no										
Cough: strong / weak / absent										
Respiratory rate (/min)										
SpO_2 (%) / oxygen (L/min)										
Opioid since last entry (mg)										
Catheter bolus given (mL)										

IS THE BLOCK WORKING? RESPONSE AT 10 MINUTES

Peak flow before (L/min)	Peak flow at 10 min (L/min)	% change = (after − before) ÷ before × 100	Pain on cough: before → after	Cough effort: before → after	Responder by local definition
					Yes / No

DAY 2 AND DAY 3 (BEST VALUES OF THE DAY)

	Pain on cough	Peak flow (L/min)	% change from baseline	Cough effort	Resp. rate	Opioid in 24 h (mg)	Catheter in situ
Day 2							
Day 3							

OUTCOMES AND COMPLICATIONS

Pneumonia ☐ Yes ☐ No **Non-invasive ventilation** ☐ Yes ☐ No **Intubation** ☐ Yes ☐ No **Critical care** ☐ Yes ☐ No

Stay (days) _____

Catheter ☐ Dislodged ☐ Leaking ☐ Blocked ☐ Infection ☐ None **Toxicity** ☐ Yes ☐ No **Pneumothorax** ☐ Yes ☐ No

Catheter days _____

Rib fracture audit: notes and standards

How to use the sheet, suggested standards and references.

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HOW TO TAKE THE MEASUREMENTS

- **Timing.** Record every measure before the block, 10 minutes after the loading dose, then every 2 hours for the first 8 hours and every 4 hours up to 24 hours. Measure before the next catheter bolus where possible.
- **Peak expiratory flow** is the main measure, because a peak flow meter is available in the emergency department and in theatre when an incentive spirometer is not. Sitting upright, the same meter each time, best of three blows.
- **Percentage change.** (Peak flow after − peak flow before) ÷ peak flow before × 100. Example: 150 L/min rising to 210 L/min is a 40% improvement.
- **Incentive spirometry** is optional: best of three slow maximal breaths in, in mL.
- **Cough effort.** Ask for one voluntary cough: strong (clears secretions), weak, or absent (unable or will not cough because of pain).

SUGGESTED STANDARDS (SET LOCALLY)

Standard	Target
Baseline and 10-minute measurements recorded	100%
Loading dose and 24-hour dose within the maximum for the dosing weight	100%
Peak flow rises from baseline at 10 minutes	Report median % change and responder rate
Pain on cough falls by 2 points or more at 10 minutes	Report the proportion
Peak flow improvement is maintained at 24 h	Report median % change
Catheter complications recorded daily	100%

WHAT THE EVIDENCE SAYS

- After erector spinae plane block in 79 patients (77% with catheters), spirometry volume rose from a mean of 784 mL to 1375 mL in 24 hours and pain fell from 7.7 to 4.7 in three hours.[1]
- Peak expiratory flow rose significantly straight after intercostal nerve block in 21 patients with rib fractures,[2] and 30 minutes after paravertebral block in 15 patients, an improvement that was held for the four days of the infusion.[3] In a randomised trial peak flow improved with both epidural and paravertebral infusions.[4]
- These studies used intercostal and paravertebral blocks. Applying peak flow to erector spinae plane and serratus anterior plane blocks is a reasonable extension, since the aim (pain relief that lets the patient breathe and cough) is the same, but it has not been tested directly.
- No published percentage rise in peak flow defines a working block. Agree a local figure after the first audit cycle and write it on the sheet.
- Peak flow shows the response to the block; it did not predict respiratory failure in 99 patients with rib fractures, whereas an admission spirometry volume below 1000 mL did.[5] Do not use peak flow alone to decide the level of care.
- The SCARF score (spirometry below 50% of predicted, respiratory rate above 20, pain 5 or more, inadequate cough) predicted pneumonia and longer intensive care stay.[6]
- A joint guideline conditionally recommends epidural and multimodal analgesia for blunt thoracic trauma;[7] a UK expert panel has since agreed 28 statements on choosing regional techniques for rib fractures.[8]

REFERENCES

1. Adhikary SD, Liu WM, Fuller E, et al. The effect of erector spinae plane block on respiratory and analgesic outcomes in multiple rib fractures: a retrospective cohort study. Anaesthesia 2019; 74: 585-93. https://doi.org/10.1111/anae.14579
2. Osinowo OA, Zahrani M, Softah A. Effect of intercostal nerve block with 0.5% bupivacaine on peak expiratory flow rate and arterial oxygen saturation in rib fractures. J Trauma 2004; 56: 345-7. https://doi.org/10.1097/01.TA.0000046257.70194.2D
3. Karmakar MK, Critchley LA, Ho AM, et al. Continuous thoracic paravertebral infusion of bupivacaine for pain management in patients with multiple fractured ribs. Chest 2003; 123: 424-31. https://doi.org/10.1378/chest.123.2.424
4. Mohta M, Verma P, Saxena AK, et al. Prospective, randomized comparison of continuous thoracic epidural and thoracic paravertebral infusion in patients with unilateral multiple fractured ribs: a pilot study. J Trauma 2009; 66: 1096-101. https://doi.org/10.1097/TA.0b013e318166d76d
5. Butts CA, Brady JJ 3rd, Wilhelm S, et al. Do simple beside lung function tests predict morbidity after rib fractures? Am J Surg 2017; 213: 473-7. https://doi.org/10.1016/j.amjsurg.2016.11.026
6. Hardin KS, Leasia KN, Haenel J, et al. The Sequential Clinical Assessment of Respiratory Function (SCARF) score: a dynamic pulmonary physiologic score that predicts adverse outcomes in critically ill rib fracture patients. J Trauma Acute Care Surg 2019; 87: 1260-8. https://doi.org/10.1097/TA.0000000000002480
7. Galvagno SM Jr, Smith CE, Varon AJ, et al. Pain management for blunt thoracic trauma: a joint practice management guideline from the Eastern Association for the Surgery of Trauma and Trauma Anesthesiology Society. J Trauma Acute Care Surg 2016; 81: 936-51. https://doi.org/10.1097/TA.0000000000001209
8. Strachan D, Baker E. Building consensus on the selection criteria used when providing regional anaesthesia for rib fractures. An e-Delphi study amongst a UK-wide expert panel. Injury 2024; 55: 110967. https://doi.org/10.1016/j.injury.2023.110967