

Metro MN Regional Trauma Advisory Committee (MMRTAC)

Management of Rib Fractures in Adults at level III and IV Trauma Centers Practice Management Guideline

Purpose

To address the evaluation and treatment of trauma patients with known or suspected rib fractures.

Definitions

1. Adult trauma patient: any patient age fifteen (15) or older suffering an injury. For the purposes of this guideline the definition is any injured patient who may be at risk for rib fractures.
2. Flail chest: Fractures of three or more adjacent ribs in two or more places.
3. Negative Inspiratory Force (NIF): Strength measured by measuring the negative pressure produced by having the patient try to inhale through a blocked mouthpiece after a full exhalation. The patient's NIF/MIP should be at least -20 cm H₂O. Values less than -20 cm H₂O may be indicative of respiratory failure.
4. Forced Vital Capacity (FVC) [or Vital Capacity, VC]: The maximum volume of air that a person can exhale after maximum inhalation. Acceptable/predicted vital capacity volumes are based on age and height. Measured values $< 30\%$ predicted value may indicate worsening respiratory status and require additional/modified interventions.

Policy Statements

1. Rib fractures occur in $\sim 75\%$ of blunt chest trauma cases. Rib fractures may not be evident on routine radiographic studies. The incidence of rib fractures increases with age.
2. Patients > 65 y/o have markedly increased morbidity from isolated rib fractures.
3. In patients with rib fractures, adequate pain control allows for the patient to effectively cough and deep breathe.
 - a. Patients who do not demonstrate effective cough and deep breathing do not have adequate pain control.
4. Ground level falls commonly result in rib fractures, particularly in patients who have osteopenia, arthritis, or decreased mobility of the chest wall.
5. Fractures of ribs #1-3 require a high energy mechanism. Injuries to the great vessels, lungs, and myocardium should be suspected.
6. Ribs #9-12 surround the upper abdominal viscera. Fractures of these ribs may be associated with underlying organs such as the liver and spleen.
7. Flail chest is associated with significant respiratory compromise, due to

underlying pulmonary contusion and impaired respiratory mechanics.

8. Rib belts/binders or maneuvers to wrap the chest are not recommended as they can worsen hypoventilation, atelectasis and pneumonia.

Procedure Statements

1. Care in ED
 - i. Cardiac monitoring
 - ii. Pulse oximetry
 - iii. Treat pneumo/hemothorax with chest tube/tube thoracostomy as needed
 - iv. Incentive spirometer, bi-pap and c-pap as needed
 - v. Manage airway and resuscitate as needed
 - vi. Obtain imaging as appropriate
 - vii. Strongly consider Chest CT if patient meets any of the following criteria
 - a. Fall greater than 20 feet
 - b. MVC at greater than 40 mph
 - c. Chest pain or tenderness not adequately explained by x-ray findings
 - d. Intoxication
 - e. GCS<15
 - f. Distracting painful injury
 - g. Age > 65
 - viii. Pain management: Isolated rib fractures without associated injuries may be managed on an outpatient basis with oral analgesics. Start with NSAIDS, if not contraindicated, and progress to narcotics as needed. Respiratory treatment with an incentive spirometer should be considered.
 - ix. Consider discharge from ED if:
 - a. No underlying pulmonary injury
 - b. No significant comorbidities (COPD, neuromuscular disease, etc)
2. Consider admission if:
 - i. Inability to readily control pain with minimal oral pain meds (ie. 10 mg oxycodone) within 4 hours since last IV narcotic dose
 - ii. Compromised pulmonary function (NIF less than -20 cm H₂O or FVC/VC < 30% predicted) or Incentive Spirometer (IS) <750 ml
 - iii. Age ≥ 65 years old
 - iv. Obtain trauma consult if available for patients with >3 rib fractures before considering admission.
3. Consider ICU admission if:
 - i. Low Tidal Volume in ED
 - ii. Patients >65 years of age and 3 or more rib fractures
 - iii. Requiring IV narcotics to control pain
 - iv. Respiratory rate (RR) >30
 - v. IS <750 ml

- vi. Change in mentation
4. Consider transfer to tertiary trauma care facility for the following high-risk patients if the facility does not have resources for ICU, Bipap, humidified high flow oxygen, CT scan to rule out associated injuries, or ability for neuraxial blockade Fracture of ribs 1-3
- i. Flail chest
 - ii. Pneumothorax, pneumomediastinum or pulmonary contusion,
 - iii. Patients \geq 65 years
 - iv. Fractures of \geq 3 ribs
 - v. Patients on anticoagulation therapy (increased risk of delayed hemothorax)
- Note: above patients may benefit from rib stabilization surgery**

5. Multimodal Analgesic Strategy for Inpatient Pain control

- i. Consider Pain Team consult
- ii. Scheduled Acetaminophen- 1000 mg PO every 8 hrs unless contraindicated)
- iii. Scheduled NSAID – Ibuprofen 600mg PO every 6 hours, or ketorolac IV - 15-30mg every 6 hours, unless contraindicated (NOTE: Age \geq 65 y/o - 400mg every 6 hrs, or ketorolac - 7.5-15mg every 6 hours, unless contraindicated
- iv. Lidocaine (Lidoderm®) 5% patches (1-3) over and/or medial to fracture site(s)
- v. Narcotic analgesics – patient controlled analgesia (PCA) vs PRN IV vs PO with PRN IV for breakthrough pain based on success of pain management with aforementioned non-narcotic analgesia
 - a. Initial treatment to include PRN IV hydromorphone (Dilaudid®) 0.4mg to 0.8mg every 2 hrs, and PRN oxycodone - 5mg to 10mg every 4hrs, with dosing adjusted for patient age and weight, unless contraindicated
 - b. Age \geq 65 y/o, opioid-naïve, and low body mass - PRN IV hydromorphone (Dilaudid®) - 0.2mg to 0.4mg every 2-4 hrs, and PRN oxycodone – 2.5mg to 5mg every 4hrs, unless contraindicated
 - c. If pain inadequately controlled, based on patient report and provider assessment, with above analgesics, PCA pump to be ordered with appropriate dosing and likely discontinuation of other narcotic analgesics based on provider assessment
- vi. Muscle relaxants - cyclobenzaprine 5-10 mg PO every 8hrs as needed or methocarbamol 500-1000mg PO every 6 hrs as needed or 500-1000mg IV every 8 hrs (not to exceed 3-day course), unless contraindicated and based on provider discretion
- vii. Consider other pharmacologic modalities such as pregabalin or gabapentin and/or hydroxyzine (Vistaril®)
- viii. Ketamine infusion – 0.1mg/kg/hr (5-20mg/h) to be used as opioid adjunct for poorly controlled pain or at provider discretion.
- ix. Epidural catheter
- x. Paravertebral block

xi. On Q pain balls

6. Multidisciplinary Orders Inpatient Care

i. Respiratory Therapy (RT)

- a. Incentive Spirometry (IS) - Ten or more times every hour while awake with coaching by RN. Goal of >15mL/kg volumes written on communication board. If patient failing to meet IS goal, EZ-PAP® to be initiated.
- b. EZ-PAP®- three times daily if failing to meet IS goal, if increasing oxygen demands from baseline, or at provider discretion.
- c. Consider pulmonary function tests (PFT) via RT consultation, including VC and NIF/MIP- twice daily, if evidence of failure to progress or worsening IS volumes
- d. Consider Bipap or high flow nasal cannula if patient shows signs of splinting, RR >30 or IS <750 ml

ii. Physical Therapy: Early mobilization, daily ambulation (as allowed by weight-bearing status, activity orders, and/or clinical status), up in chair multiple times daily (as allowed by weight-bearing status, activity orders, and/or clinical status)

iii. Repeat imaging

- a. Repeat chest x-ray and/or CT chest should be completed if concern for worsening pulmonary function and/or at provider discretion

7. Follow up:

- i. If discharged from the ED, the patient should have follow up with PCP within one week with repeat chest X-ray.
- ii. Send home with IS and multimodal pain management
- iii. ED patient discharge instructions should include the need to seek medical treatment if patient has any of the following physical signs:
 - a. Fever
 - b. Productive cough
 - c. Worsening pain
 - d. Shortness of breath

Disclaimer: This is a general guideline and is not intended as a substitute for clinical judgment or as a protocol for the management of all trauma patients.