Alaska Native Medical Center

Trauma Services

Guideline: Management of Rib Fractures

Introduction:

Rib Fractures (RF) is a common injury sustained after chest trauma. RF is most commonly seen in blunt trauma and is also possible in penetrating chest trauma. As many as one in five patients admitted for trauma will have RF. Those patients who are elderly, frail or with severe rib fractures are at particularly high risk of morbidity and mortality. Early intervention in rib fracture management with appropriate triaging to higher levels of care is key to preventing clinical decompensation.

Purpose: To establish evidenced based guidelines for the multidisciplinary management of rib fractures, including triaging, hospital admission and disposition, analgesia, optimal bedside nursing and respiratory therapy interventions, surgical stabilization of rib fractures (SSRF), and discharge criteria.

Patient Type/Population at Risk: Patients with the following clinical variables are at higher risk for complications such as pneumonia, respiratory failure, and death

- Geriatric Age, defined as 60 years or older
- Frailty (see assessment tools)
- Three or more rib fractures
- Flail chest
- Pre-existing pulmonary disease such as COPD on home oxygen, asthma, interstitial fibrosis, cystic fibrosis, and bronchiectasis, heart failure
- Incentive spirometry of < 1000 ml or < 15 ml/kg
- Rib fractures in the setting of polytrauma

Assessment tools:

Initial Imaging and workup

Chest x-rays are an initial screening test for those presenting with signs of chest trauma or in any significant blunt trauma such as falls or motor vehicle collisions. In those with RF noted on chest x-ray, strong consideration should be made for obtaining a chest CT as x-rays have low sensitivity for delineating the total number and type of rib fractures. Most patients who present as trauma activations will likely have blunt trauma protocol imaging including a CT angiogram of the chest. If there are more than three rib fractures with bi-cortical displacement, obtaining 3-dimensional reconstructions of the CT images can provide useful information in evaluating candidacy and potential benefit from surgical stabilization of rib fractures (SSRF).

Severity of rib fractures can be defined by the RibScore.[1] This score assigns one point to each of (a) six or more ribs fractured, (b) bilateral fractures, (c) flail chest, (d) three or more bi-cortically displaced fractures, (e) first rib fracture, (f) at least one fracture in each of three anatomic areas (anterior, lateral, and posterior). A RibScore of three or more is associated with increased complications, particularly in the elderly.[2]

Criteria for Discharge from the Emergency Department

On initial assessment in the Emergency Department, discharge to home with early (<72 hour) clinic follow up may be considered in young patients with well-controlled pain on oral analgesia only, incentive spirometer (IS) volumes greater than 1500 ml, and no need for supplemental oxygen. Patients with bi-cortically displaced RF should be admitted for observation and multimodal analgesia, even if they have preserved pulmonary function and respiratory mechanics on initial assessment.

Age

Geriatric patients are at high-risk of mortality from RF. Age greater than 65 is an independent predictor of increased RF mortality.[3] Each additional year of age, beyond age 65, is associated with up to 4% increase in mortality. Admission to a higher level of care (intermediate or critical care) is strongly encouraged in those patients with three or more RF and an age greater than 60.[4]

Frailty

Frailty has been shown to be stronger predictor of trauma mortality than age.[5] Frailty can be assessed by several validated bedside screening matrices. The goal is to recognize early those patients at heightened risk for physiologic decline, independent of their age. The "Simple Frail" model relies on five bedside questions.[6-7] A score three or greater is consistent with frailty. Admission to a higher level of care (intermediate or critical care) is strongly encouraged for patients with frailty and additional risk factors for clinical deterioration, such as three or more rib fractures or underlying systemic diseases.

Simple Frail Score (1 point for each YES answer):

- Fatigue: "Do you feel fatigue on a daily basis?"
- Resistance: "Are you unable to climb one flight of stairs?"
- Aerobic: "Are you unable to walk one block?"
- Illnesses: "Do you have five or more chronic illnesses?"
- Loss of weight: "Have you lost more than 5% of your weight in the last six months?"

Respiratory Mechanics

Patients in the ED should have incentive spirometry (IS) measured on their initial evaluation. Admission to a higher level of care (intermediate or critical care) is strongly encouraged for those patients with an IS of less than 1000 ml or less than 15 ml/kg.

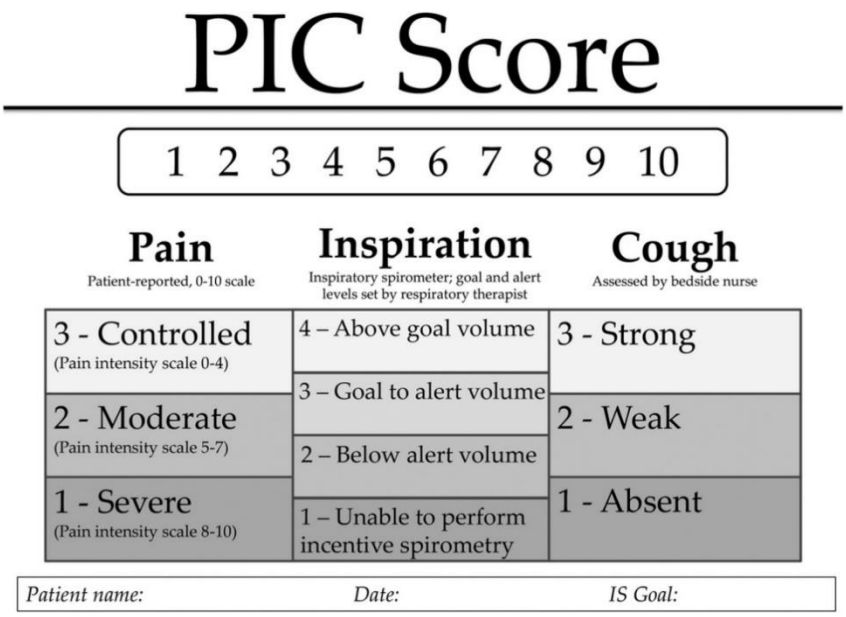
An additional way to assess respiratory mechanics is via the *Pain, Inspiratory & Cough (PIC) scoring tool*

The PIC Score assesses three areas:

1. The patient will be asked to rate their pain on a scale of 1-10
2. The Respiratory therapist will determine the patient's goal based the inspiratory volume, height, and age
3. The patient will be asked to cough as strong as possible and the cough will be rated as absent, weak or strong

The total score of the three parameters should be documented it the patients' medical record and written on the patient's communication board. This score serves as a standardized tool to serially assess

the patient each shift. A PIC score of 4 or score of 1 in any category requires admission to a higher level of care (intermediate or critical care). A decrease of PIC score by 3 or greater over a 24-hour period must be communicated to the primary team and escalation of care at that time may be warranted.



Additional Information:

Analgesia

All patients should have multimodal analgesia with scheduled acetaminophen and a NSAID. Gabapentin and muscle relaxers may be used. Appropriate reductions in dosages for NSAIDs, gabapentin and muscle relaxers should be made, accounting for age and renal function. Oral narcotics should be used as needed for moderate pain. IV narcotics should be used as needed in those patients with severe pain despite multimodal analgesia including oral opioids; these can be administered by either a patient-controlled analgesic pump or intermittent IV push.

Anesthesiology consultation for a loco-regional or neuraxial analgesic should be obtained within the first 12-24 hours in those patients at high risk for respiratory failure including the elderly or frail, those with clinical or radiographic flail chest, 3 or more bi-cortically displaced rib fractures, >30% chest volume loss or other need for thoracotomy. Additionally, patients with chronic pain, chronic opioid use, or actively enrolled in opioid treatment therapy may also benefit from early consultation with anesthesia as well as the Pain service. Prompt consultation with anesthesiology will prevent delays in obtaining optimal analgesia and initiation of venous thromboembolism prophylaxis. The specific type of loco-regional or neuraxial analgesia will depend on the injury pattern and anesthesiologist preference.

Ketamine infusions may be initiated in conjunction with the Pain service in those patients with difficult to control pain from RF or in patients with pre-existing chronic narcotic use. Use in these RF population has not been extensively studied. A single randomized controlled trial evaluating low dose ketamine infusion in RF patients did not demonstrate an overall decrease in opioid use or pain scores. However, in

more severely injured patients ketamine may decrease opioid use.[8] Initiation of ketamine infusion will require admission to a higher level of care (intermediate or critical care).

Respiratory Therapy and Nursing Assessments

The "Imminent Pneumonia Power Plan" should be initiated on all rib fracture patients. Respiratory Therapy (RT) should evaluate the patient every day, and more frequently if they have high-risk rib fractures. All patients should have an incentive spirometer with instructions to use ten times per hour when awake. Maximal volumes should be recorded as part of the PIC assessment. Chest Physiotherapy with a flutter valve should be routinely ordered and used on high-risk patients. In patients at high risk for clinical decline or those with declining PIC score, use of continuous positive expiratory pressure (CPEP) combined with continuous high-frequency oscillation therapy (CHFO) via the Metaneb™ system should be considered. This is a bedside intervention that can be performed by respiratory therapy to treat or prevent atelectasis and improve mobilization of secretions. Nursing staff should frequently remind patients to use IS and flutter valve devices. Patients should be encouraged to spend as much time in bedside chairs as possible, elevate the head of bed to 30 degrees or more, and ambulate a minimum of three times daily, so long as there are no injuries precluding these practices.

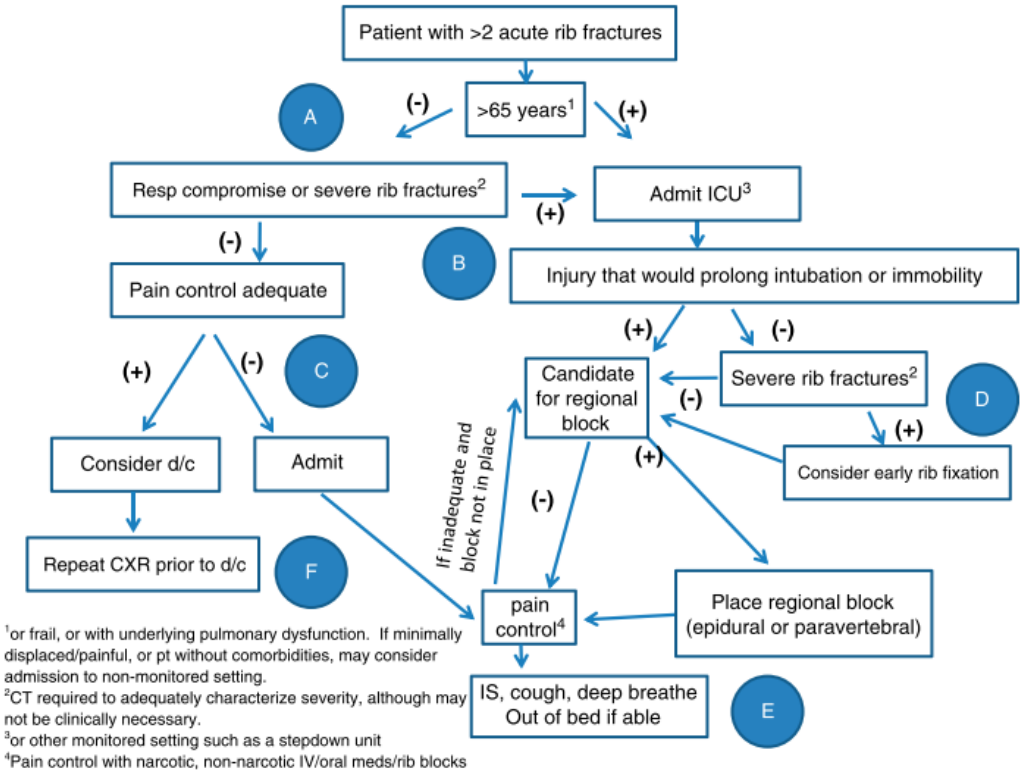
Surgical Stabilization of Rib Fractures (SSRF)

Patients should be screened by the trauma surgery service for potential surgical stabilization of rib fractures on admission. Three dimensional reconstructions of the chest CT is helpful for operative planning. SSRF should be strongly considered in those patients with clinical flail chest. Relative indications for SSRF include three or more bi-cortically displaced rib fractures, radiographic flail chest, >30% hemi-thorax volume loss and those patients with rib fractures undergoing a thoracotomy for a separate indication. In patients with relative indications for SSRF, an initial attempt at non-operative management may be appropriate. However, early and aggressive multi-modal analgesia, respiratory therapy interventions and close monitoring for respiratory decline is essential. Criteria for failure of non-operative management include uncontrollable pain (pain score >5) despite loco-regional and neuraxial analgesia, IS <50% predicted, poor cough (determined by RT), tachypnea (RR >20), and progressive atelectasis on chest imaging. In patients who show signs of failure of non-operative management, evaluation for SSRF should be obtained. If SSRF is considered, the greatest potential benefit is likely obtained with intervention in the first 24 to 72 hours after injury. Further delay beyond this time, particularly in elderly or frail patients decreases the benefit of SSRF.

Use of SSRF in flail chest may be associated with an improvement in mortality, however data is conflicting on this. Multiple meta-analyses and a Cochrane review suggest improvements in ICU length of stay, duration of mechanical ventilation, incidence of pneumonia, and need for tracheostomy for patients with flail chest. There may be a similar benefit for patients with relative indications for SSRF. Additionally, there may be an improvement in pain scores and narcotic use in patients with non-flail chest RF who undergo SSRF.[9]

Appendix:

Appendix A: Western Trauma Association Critical Decisions in Trauma: Management of rib fractures algorithm *Note: ANMC uses age 60 for higher risk requiring ICU admission.



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