Division of Acute Care Surgery Clinical Practice Policies, Guidelines, and Algorithms:
Management of Multiple Rib Fractures
Clinical Practice Policy

Original Date: 12/2013

Purpose: To standardize treatment of multiple rib fractures or flail chest.

Definitions:
- Multiple rib fractures – four or more rib fractures on a single side
- Flail chest – three or more consecutive ribs with two or more fractures in each rib

Previously Stated Policies:
- Trauma patients being admitted to SIMU or with ≥2 rib fractures should be admitted to trauma service.

Indications for Admission to IMU:
- Age > 45 with multiple rib fractures and/or flail chest.¹
- Any age with multiple rib fractures and/or flail chest and:
  - Poor pain control, or
  - Incentive spirometer (IS) volumes ≤15cc/kg IBW, or
  - Oxygen requirement ≥ 5L/min nasal cannula
  - Volume expansion protocol (VEP) desired every 2-3 hours (every 4 hours can be done on floor; <2 hours should be done in STICU)
- When the above indications are no longer met, the patient may be transferred to floor.

Indications for Admission to ICU:
- Mechanical ventilation
- VEP < q2 hours
- When the above indications are no longer met, the patient may be transferred to a lower level of care.

Conservative Management:
- Multimodal pain therapy (per Acute Trauma Pain Management guideline) starting in Emergency Department, including:
  - IV/PO acetaminophen (central prostaglandin inhibitor)
  - PO Celebrex (NSAID)
  - PO Lyrica (gabapentinoid)
  - PO tramadol
  - PO opioid (hydrocodone/oxycodone/methadone)
- Volume expansion protocol (VEP):
  - Order in Care4: Respiratory Therapy Consult
  - Stepwise progression of therapy employed in the VEP:
    - IS in alert and cooperative patients. If goal IS is not achieved, positive expiratory pressure (PEP) is initiated
    - PEP (EZPAP®, MetaNeb®) is performed if patient is: unable to perform IS, not meeting IS goal, has persistent or severe atelectasis, or has poor oxygenation
    - Induced deep breathing in patients with a tracheostomy
Indications and frequency in the VEP – the RT will assess patient and assign them a RT Triage Score. The frequency of VEP is based on the RT Triage Score:

<table>
<thead>
<tr>
<th>RT Triage Score</th>
<th>VEP Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>22-32</td>
<td>q4 hours and q2 hours prn</td>
</tr>
<tr>
<td>15-21</td>
<td>QID and q4 hour prn</td>
</tr>
<tr>
<td>8-14</td>
<td>TID and q4 hour prn</td>
</tr>
<tr>
<td>0-7</td>
<td>BID and q4 hour prn</td>
</tr>
<tr>
<td>Tracheotomies</td>
<td>q4 hour and q2 hour prn</td>
</tr>
</tbody>
</table>

Patients who meet IS goals are discharged from the VEP.

Patients with ≥2 rib fractures, a pulmonary contusion, a chest tube, or abdominal/thoracic surgery who meet IS goals are seen q shift if STICU/SIMU status and q 48 hours if floor status.

If you think patient with adequate IS requires more frequent therapy than the VEP calls for, you may order “VEP q __ hour despite IS for ___ hours duration.”

- VEP can be done q4 on the floor at the most frequent. A patient requiring more frequent treatments should be moved to SIMU or STICU.

- Physical activity:
  - If able, patient should be out of bed for majority of day (in chair and ambulating).
  - For patients who cannot get out of bed, the stationary hand bike may be used.
    - Bike therapy should be used q4 hours during day time.

- Patients should, at a minimum, have a repeat chest radiograph (CXR) at 24.

**Retained Hemothorax:**

- Patients with multiple rib fractures and/or flail chest who remain hospitalized, a CXR should be performed at a minimum 72 hours after admission.
- If the 72 hour CXR shows any opacity concerning for a hemothorax, a non-contrast CT chest should immediately be obtained.
- Clinical judgment should guide the decision to go for video assisted thoracoscopic surgery (VATS) and evacuation of hemothorax. Ideally, the VATS would occur on hospital day 3 or 4.
- If the hemothorax is estimated to be less than 500 cc, observation is an option.

**Failure of Conservative Management:**

- Persistent incentive spirometer volumes < 15 cc/kg 2-3 days post admission
- Progression from spontaneous breathing to invasive mechanical ventilation or non-invasive positive pressure ventilation (NIPPV) within 48 hours of admission
- Inability to wean from mechanical ventilation within 48 hours
- Persistent pain score > 6 requiring continued IV opioids and/or IMU status 2-3 days post admission.
Strategies for Failure of Conservative Management

- **Pain Management Strategies:**
  - Local analgesia (e.g. intercostal nerve block)
  - Acute Pain Management consult
    - Regional analgesia (e.g. epidural catheter or spinal analgesia)

- **Operative Rib Fracture Fixation:**
  - **Indications:**
    - Acute setting (2-3 days post admission):
      - Four or more consecutive rib fractures,\(^1,3\)
      - Flail chest (3 consecutive ribs fractured in 2 or more places),\(^4,5\) or
      - Displaced, symptomatic sternal fracture
      - Respiratory failure or compromise despite adequate multimodal pain therapy and conservative management.
    - Delayed setting (> 3 days after admission):
      - Persistent pain score > 6 requiring plus consecutive rib fractures or flail as described above
      - Indication for VATS or thoracotomy (non-empyema diagnosis), especially if fractures preclude chest closure
    - Post-discharge, out-patient setting:
      - Rib fracture non-union after 3 months
  - **Exclusion criteria:**
    - Age < 16 or > 80 years
    - Spine injury which precludes the lateral decubitus position
    - Open rib fractures with soiling or infection
    - Empyema or concern for infected pleural space
    - Severe TBI with active ICP management
    - Uncorrected coagulopathy
    - Significant pulmonary contusion or underlying pulmonary pathology as a major driver for respiratory failure
    - Significant skin trauma (abrasions, burns, etc...) that might predispose to increased surgical site infection

If considering rib fracture fixation, obtain 3D reconstruction of most recent CT chest.
References:


