

**UAMS MEDICAL CENTER  
TRAUMA SERVICES MANUAL**

**SUBJECT:** Traumatic Chest Injury Clinical Management Guideline

**REVIEWED:** Revised 11/30/18

**PAGE:** 1 of 7

---

**RECOMMENDATION(S):** Dr. Ron Robertson

**APPROVAL:** 04/28/2016

**CONCURRENCE(S):**

**EFFECTIVE:** 04/28/2016

Last Review Date: 11/28/16

---

**PURPOSE:**

To provide guidelines for the evaluation and management of patients with traumatic chest wall injury including rib fractures, sternal fractures, hemothorax and retained hemothorax.

**BACKGROUND:**

Chest wall injuries, including sternal fractures, rib fractures, and flail chest, pose a significant risk for morbidity and mortality in the trauma patient. Mortality risk for patients with multiple rib fractures increases notably in patients as the number of fractures increases. The inflection point for substantial increase in the elderly (> 65 years old) is three rib fractures. This increased risk is also seen in younger patients and significant increases in morbidity and mortality can be seen in 45-year-old patients with five rib fractures. This clinical practice management guideline is intended to provide a rational pathway for the evaluation and intervention in patients with rib fractures and sternal fractures.

**GUIDELINE:**

**EVALUATION – Rib and Sternal Fractures**

Patients presenting with traumatic injuries will have routine chest radiographs in the case of Level I and II activations. For patients activated at a Level III, a chest radiograph should be obtained. A CT scan of the chest should be obtained for the following indications:

1. The presence of or suspicion for multiple (>2) rib fractures
2. Evidence of a sternal fracture
3. Presence of significant chest wall tenderness
4. Presence of bony crepitus
5. Paradoxical motion clinical diagnosis of flail segment
6. Presence of subcutaneous emphysema
7. Widened mediastinum
8. Spine tenderness
9. Or other mechanistic or exam findings raising clinical suspicion which warrant further evaluation

If a chest CT is obtained and there are >2 rib fractures or a sternal fracture noted a request will be made

**UAMS MEDICAL CENTER  
TRAUMA SERVICES MANUAL**

**SUBJECT:** Traumatic Chest Injury Clinical Management Guideline

**REVIEWED:** Revised 11/30/18

**PAGE:** 2 of 7

---

**RECOMMENDATION(S):** Dr. Ron Robertson

**APPROVAL:** 04/28/2016

**CONCURRENCE(S):**

**EFFECTIVE:** 04/28/2016

Last Review Date: 11/28/16

---

for 3D reconstructions of the chest wall bony structures with and without the presence of the scapula.

### **INITIAL MANAGEMENT -- Rib Fractures**

The hallmark for management of rib and sternal fractures is pain management and aggressive pulmonary toilet. Given the risk for morbidity and mortality associated with rib fractures, especially in the elderly, strong consideration should be given to admission or observation until such time that the patient demonstrates adequate pain control to perform incentive spirometry, coughing and clearance of secretions.

- Generally, all patients over the age of 65 with rib fractures/significant pain/or poor pulmonary function should be admitted or observed
- Patients under the age of 65 with 3 or more fractures should be admitted or observed
- Admission location

Indications for Admission to ICU:

- Any age with multiple rib fractures and/or flail chest and either of the following:
  - Need for mechanical ventilation
  - Inability to pull more than 7.5cc/kg IBW on incentive spirometry

Indications for Admission to Progressive:

- Age > 45 with >3 rib fractures and/or flail chest<sup>1</sup>
- Any age with >3 rib fractures and/or flail chest and any of the following:
  - Poor pain control
  - Incentive spirometer (IS) volumes  $\leq$ 15cc/kg IBW
  - Oxygen requirement  $\geq$  5L/min nasal cannula
  - VEP desired every 2-3 hours (every 4 hours can be done on floor; more frequently than every 2 hours requires SICU)

*\* When the above indications are no longer met, the patient may be transferred to floor*

- Patients should be started on non-operative management
  - Multimodal pain therapy (per Acute Trauma Pain Management guideline) starting in Emergency Department
  - If analgesia inadequate on multi-modal therapy consider early anesthesia pain management consult, especially in patient with age > 65

These guidelines were prepared by the UAMS Trauma Service. They are intended to serve only as a guideline based on current review of the medical literature and practice. They are neither policies nor protocols. Their use is at the discretion of the managing physician

**UAMS MEDICAL CENTER  
TRAUMA SERVICES MANUAL**

**SUBJECT:** Traumatic Chest Injury Clinical Management Guideline

**REVIEWED:** Revised 11/30/18

**PAGE:** 3 of 7

---

**RECOMMENDATION(S):** Dr. Ron Robertson

**APPROVAL:** 04/28/2016

**CONCURRENCE(S):**

**EFFECTIVE:** 04/28/2016

Last Review Date: 11/28/16

---

- Patients will receive an incentive spirometer and education on its use
- Orders for respiratory care for teaching and hourly use of the incentive spirometer should be written
- Serial examination should be performed to determine the efficacy of the current pain management regimen.
  - The pain control should be sufficient to allow the patient achieve 10cc/kg of ideal body weight inspiratory effort on the incentive spirometer.
  - The patient should be able to generate a cough sufficient to clear blood and secretions.
- If the patient is not able to perform these aspects of pulmonary toilet successfully, a consult will be made to anesthesia pain team for placement of a thoracic epidural or paravertebral blocks to be placed.
- Repeat assessment of the efficacy of the pain management is performed to assure adequate pulmonary toilet.
- If the patient is not able to achieve the above pulmonary toilet goals consideration should be given to surgical chest wall stabilization based on the indications below.
- The consideration and decision for operative stabilization or continued non operative management should be made within 48 hours of injury whenever possible.

**Indications for Surgical Chest Wall Stabilization:**

Patients who fail to achieve adequate pulmonary toilet and pain control as described above should have a CT scan of the chest (without contrast unless contrast is otherwise indicated) should be performed and reformatted with 3D reconstructions with and without the scapula. If a CT scan was done at the time of admission these previously performed images may be reviewed. The CT 3D reformats should be reviewed to correlate patient symptoms with one of the below indications for surgical stabilization.

1. Flail Chest
  - a. Failure to wean on the vent
  - b. Paradoxical motion
2. Pain
  - a. Typically, three or more ribs
  - b. Crepitus with movement
  - c. Failure of pain control efforts to allow adequate pulmonary toilet.

**UAMS MEDICAL CENTER  
TRAUMA SERVICES MANUAL**

**SUBJECT:** Traumatic Chest Injury Clinical Management Guideline

**REVIEWED:** Revised 11/30/18

**PAGE:** 4 of 7

---

**RECOMMENDATION(S):** Dr. Ron Robertson

**APPROVAL:** 04/28/2016

**CONCURRENCE(S):**

**EFFECTIVE:** 04/28/2016

Last Review Date: 11/28/16

---

3. Deformity
  - a. Loss of volume
  - b. Displaced ribs impede lung expansion
  - c. Lung impalement with rib or fracture fragment
  - d. Herniation of lung through chest wall
4. Non-Union
  - a. Focal pain at site of fracture 2-3 months after injury
  - b. Symptomatic fracture movement
5. Need for a thoracotomy for other reason

Surgical intervention should be performed within 72 hours of injury whenever possible. A relative contraindication to this protocol is patients with a severe traumatic brain injury or unstable spine who are likely to be on the ventilator for a prolonged period of time and would not benefit from stabilization to expedite the ability to extubate.

Post stabilization films should be obtained prior to discharge with PA and Lateral CXR.

#### INITIAL MANAGEMENT: Sternal Fractures

Sternal fractures can be a severely debilitating injury with significant pain not all sternal fractures require stabilization and initial efforts at pain control should follow the same sequence of pain control as rib fractures.

#### Indications for Surgical Sternal Stabilization:

- Severe pain
- Respiratory dysfunction attributable to the sternal pain
- Displacement or Overlap of the fractured sternum
- Instability with or without flail
- Non union of previous fracture
- Hunched over posture due to pain
- Limited range of motion of the upper extremities due to sternal pain

**UAMS MEDICAL CENTER  
TRAUMA SERVICES MANUAL**

**SUBJECT:** Traumatic Chest Injury Clinical Management Guideline

**REVIEWED:** Revised 11/30/18

**PAGE:** 5 of 7

---

**RECOMMENDATION(S):** Dr. Ron Robertson

**APPROVAL:** 04/28/2016

**CONCURRENCE(S):**

**EFFECTIVE:** 04/28/2016

Last Review Date: 11/28/16

---

CT scans with reformats should be obtained and reviewed as described in the rib fractures above. Patients with overlap or displacement greater than the thickness of the sternum are likely to benefit the greatest from surgical stabilization.

Post stabilization films should be obtained prior to discharge with PA and Lateral CXR.

**INITIAL MANAGEMENT: Hemothorax and Retained Hemothorax**

Patients with a retained hemothorax of greater than 300cc have a high rate of development of empyema and other complications from the blood in the chest. Patients noted to have persistent or recurrent fluid in the chest warrant further evaluation to determine the volume and nature of the fluid. CXR has been shown to be a poor indicator of volume and need for intervention.

- Identification of fluid in the chest on initial CXR during resuscitation warrants intervention or further evaluation with CT.
  - Opacification of the hemithorax or evidence of a hemopneumothorax should be addressed immediately with tube thoracostomy.
  - If there is a smaller amount of blood present which does not require immediate action CT scan can be used to further evaluate the fluid collection.
  - Drainage with tube thoracostomy should be considered for fluid collections greater than 300 cc.
- In patients who previously underwent drainage and have a residual or recurrent fluid collection, further evaluation or drainage may be necessary
  - If it is clear that the effusion/hemothorax is greater than 300cc or is symptomatic, an additional tube thoracostomy should be considered drain the fluid accumulation.
  - If the size is difficult to determine or there have been multiple unsuccessful attempts to drain the fluid with tube thoracostomy, a repeat CT scan should be performed to determine the size, character of the fluid and the presence of any loculations which would

**UAMS MEDICAL CENTER**  
**TRAUMA SERVICES MANUAL**

**SUBJECT:** Traumatic Chest Injury Clinical Management Guideline

**REVIEWED:** Revised 11/30/18

**PAGE:** 6 of 7

---

**RECOMMENDATION(S):** Dr. Ron Robertson

**APPROVAL:** 04/28/2016

**CONCURRENCE(S):**

**EFFECTIVE:** 04/28/2016

Last Review Date: 11/28/16

---

explain the incomplete drainage.

- Tube Thoracostomy
  - May be performed with multiple different types of tubes.
  - There is evidence that 28-32 French chest tubes perform the same as 36-40 French tubes for the evacuation of blood and air from the hemithorax. Consideration should be given to using smaller tubes for help with post placement pain management.
  - Pig Tail catheters have been shown to be successful in the evacuation of fluid and air from the chest with less pain than a traditional chest tube but are more difficult to place and have a higher complication rate of malposition than traditional tubes. At this time their use should be considered when placement is accompanied by image guidance e.g. fluoroscopy, CT guidance, and ultrasound at bedside and/or by interventional radiology.
  - Fluted drains may be used (e.g. Blake Drains, JP Drains) in lieu of chest tubes or pig tail catheters when placed at the time of surgery.
  
- Video Assisted Thoracoscopic Surgery (VATS)
  - In circumstances where there is organization of the fluid within the chest, multiple loculations, enhancing wall around the fluid, inability to drain or other evidence of empyema or complicated fluid collection, consideration should be given to early VATS for decortication and evacuation of the chest. This procedure is best performed early to reduce the risk of organization and fibrous reaction which occurs in the setting of delayed intervention. Early intervention reduces the risk of conversion to open thoracotomy.

**UAMS MEDICAL CENTER  
TRAUMA SERVICES MANUAL**

**SUBJECT:** Traumatic Chest Injury Clinical Management Guideline

**REVIEWED:** Revised 11/30/18

**PAGE:** 7 of 7

---

**RECOMMENDATION(S):** Dr. Ron Robertson

**APPROVAL:** 04/28/2016

**CONCURRENCE(S):**

**EFFECTIVE:** 04/28/2016

Last Review Date: 11/28/16

---

**References:**

1. Holcomb JB, McMullin NR, Kozar RA, Lygas MH, Moore FA. Morbidity from rib fractures increases after age 45. *Journal of the American College of Surgeons* 2003;196:549-55.
2. Slobogean GP, MacPherson CA, Sun T, Pelletier ME, Hameed SM. Surgical fixation vs nonoperative management of flail chest: a meta-analysis. *Journal of the American College of Surgeons* 2013;216:302-11 e1.
3. Marasco SF, Davies AR, Cooper J, et al. Prospective randomized controlled trial of operative rib fixation in traumatic flail chest. *Journal of the American College of Surgeons* 2013;216:924-32.
4. Doben AR, Eriksson EA, Denlinger CE, et al. Surgical rib fixation for flail chest deformity improves liberation from mechanical ventilation. *Journal of critical care* 2014;29:139-43.
5. Mayberry JC, Kroeker AD, Ham LB, Mullins RJ, Trunkey DD. Long-term morbidity, pain, and disability after repair of severe chest wall injuries. *The American surgeon* 2009;75:389-94.
6. Meyer DM, Jessen ME, Wait MA, Estrera AS. Early evacuation of traumatic retained hemothoraces using thoracoscopy: a prospective, randomized trial. *The Annals of thoracic surgery* 1997;64:1396-400; discussion 400-1.