TITLE: CHEST TRAUMA

PURPOSE:
Provides a standardized treatment algorithm for patients with chest trauma

PROCESS:

I. INITIAL ASSESSMENT OF THORACIC TRAUMA
A. Penetrating Thoracic Trauma
   1. Hemodynamically Unstable –
      a. ED thoracotomy – should be reserved to patients sustaining penetrating thoracic injuries who arrive to the emergency department with loss of signs of life:
         (a) In emergency department OR
         (b) Less than 15 minutes prior to arrival.
      b. Operative Intervention – choice of approach should be based on suspected site of injury. In general, a clam-shell anterior thoracotomy is the most versatile approach to undefined thoracic penetrating trauma.
   2. Hemodynamically Stable - All penetrating thoracic trauma should be evaluated with CT Chest.
      (1) INCLUDES wounds “outside the box”
      (2) EXCLUDES wounds clearly determined to be a superficial injury (not violating chest wall muscle fascia) by local wound exploration.
      (3) Indications for operative management
         (a) Cardiac tamponade – requires pericardial window or median sternotomy.
Guidelines and Protocols

(b) Tube thoracostomy output – Initial chest tube output > 1500 mL of blood or ongoing bleeding at a rate of 200 to 300 mL/hour

(c) Major tracheobronchial injury with massive air leak.

B. Blunt Thoracic Trauma

1. *Hemodynamically Unstable* –
   
   a. ED thoracotomy
   
   (1) Reserved to patients sustaining blunt thoracic injuries who arrive to the emergency department and:
   
   (a) Lose signs of life in ED and appear to have no obvious nonsurvivable injury.
   
   OR
   
   (b) Have cardiac tamponade (rapidly assessed with ultrasound) and no obvious nonsurvivable injury.
   
   (2) Contraindicated in:
   
   (a) Patient with > 15 minutes CPR
   
   (b) Patients with nonsurvivable injuries.

   b. Operative Intervention – choice of approach should be based on suspected site of injury. In general, a clam-shell anterior thoracotomy is the most versatile approach to undefined thoracic blunt trauma.

2. *Hemodynamically Stable* –

   a. Radiologic Assessment

   (1) Chest radiograph – Should be performed on all patients with blunt thoracic trauma.
(2) Ultrasound - All blunt thoracic trauma patients should be evaluated with a FAST exam

(3) Chest CT – based on risk assessment.

b Indications for operative management

(1) Cardiac tamponade – requires pericardial window or median sternotomy.

(2) Tube thoracostomy output – Initial chest tube output > 1500 mL of blood or ongoing bleeding at a rate of 200 to 300 mL/hour

(3) Major tracheobronchial injury with massive air leak.

II. RIB FRACTURES

A. Indications for Admission to Telemetry:
   1. Age > 45 with multiple rib fractures and/or flail chest
   2. Any age with multiple rib fractures and/or flail chest and:
      a. Poor pain control, or
      b. Incentive spirometer (IS) volumes ≤15cc/kg IBW, or
      c. Oxygen requirement ≥ 5L/min nasal cannula
      d. Volume expansion protocol (VEP) desired every 2-3 hours (every 4 hours can be done on floor; <2 hours should be done in ICU)

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

B. Indications for Admission to ICU:
   1. Mechanical ventilation
   2. Volume expansion protocol < q2 hours

When the above indications are no longer met, the patient may be transferred to a lower level of care.
Guidelines and Protocols

C. Initial Management:

1. Multimodal pain therapy starting in Emergency Department, including:
   a. IV/PO acetaminophen (central prostaglandin inhibitor)
   b. NSAID (unless contraindicated)
   c. Gabapentinoid
   d. Tramadol
   e. PO opioid (hydrocodone/oxycodone/methadone)

2. Volume expansion protocol (VEP):
   a. Respiratory Therapy Consult
   b. Stepwise progression of therapy employed in the VEP:
      (1) Incentive spirometry (IS) in alert and cooperative patients. If goal IS (15 ml/kg IBW) is not achieved, positive expiratory pressure (PEP) is initiated
      (2) 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
      (3) Induced deep breathing in patients with a tracheostomy

3. Physical activity
   a. If able, patient should be out of bed for majority of day (in chair and ambulating).
   b. For patients who cannot get out of bed, physical therapy should be consulted.

4. Patients should, at a minimum, have a repeat chest radiograph (CXR) at 24 hours.
III. RETAINED HEMOTHORAX $^2$
   A. Patients with multiple rib fractures and/or flail chest who remain hospitalized, a CXR should be performed at a minimum 72 hours after admission.
   B. If the 72 hour CXR shows any opacity concerning for a hemothorax, a non-contrast CT chest should immediately be obtained.
   C. Clinical judgment should guide the decision to perform a video assisted thoracoscopic surgery (VATS) and evacuation of hemothorax. Ideally, the VATS would occur on hospital day 3 or 4.
   D. If the hemothorax is estimated to be less than 500 cc, observation is an option.

IV. FAILURE OF INITIAL MANAGEMENT (DEFINITION):
   A. Persistent incentive spirometer volumes < 15 cc/kg 2-3 days post admission
   B. Progression from spontaneous breathing to invasive mechanical ventilation or non-invasive positive pressure ventilation (NIPPV) within 48 hours of admission
   C. Inability to wean from mechanical ventilation within 48 hours
   D. Persistent pain score > 6 requiring continued IV opioids and/or telemetry status 2-3 days post admission.

V. STRATEGIES FOR FAILURE OF INITIAL MANAGEMENT
   A. Adjunct Pain Management Strategies:
      1. Local analgesia (e.g. intercostal nerve block)
      2. Anesthesia (pain management) consult
         a. Regional analgesia (e.g. epidural catheter or spinal analgesia)
B. Operative Rib Fracture Fixation:
   1. Indications:
      a. Acute setting (2-3 days post admission): *Respiratory failure or compromise despite adequate multimodal pain therapy and conservative management AND*
         (1) Four or more consecutive rib fractures,1,3
         (2) Flail chest (3 consecutive ribs fractured in 2 or more places),4,5 or
         (3) Displaced, symptomatic sternal fracture
      b. Delayed setting (> 3 days after admission):
         (1) Persistent pain score > 6 requiring plus consecutive rib fractures or flail as described above
         (2) Indication for VATS or thoracotomy (non-empyema diagnosis), especially if fractures preclude chest closure
      c. Post-discharge, out-patient setting:
         (1) Rib fracture non-union after 3 months
   C. If considering rib fracture fixation, obtain 3D reconstruction of most recent CT chest.
      1. Exclusion criteria:
         a. Age < 16 or > 80 years
         b. Spine injury which precludes the lateral decubitus position
         c. Open rib fractures with soiling or infection
         d. Empyema or concern for infected pleural space
         e. Severe TBI with active ICP management
         f. Uncorrected coagulopathy
         g. Significant pulmonary contusion or underlying pulmonary pathology as a major driver for respiratory failure
h Significant skin trauma (abrasions, burns, etc...) that might predispose to increased surgical site infection

REFERENCE / BIBLIOGRAPHY:


OFFICE OF PRIMARY RESPONSIBILITY:

LYNDON B. JOHNSON HOSPITAL TRAUMA SERVICES

REVIEW / REVISION HISTORY

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