EMERGENCY CARE IN SPORTS 2023: THORACIC TRAUMA

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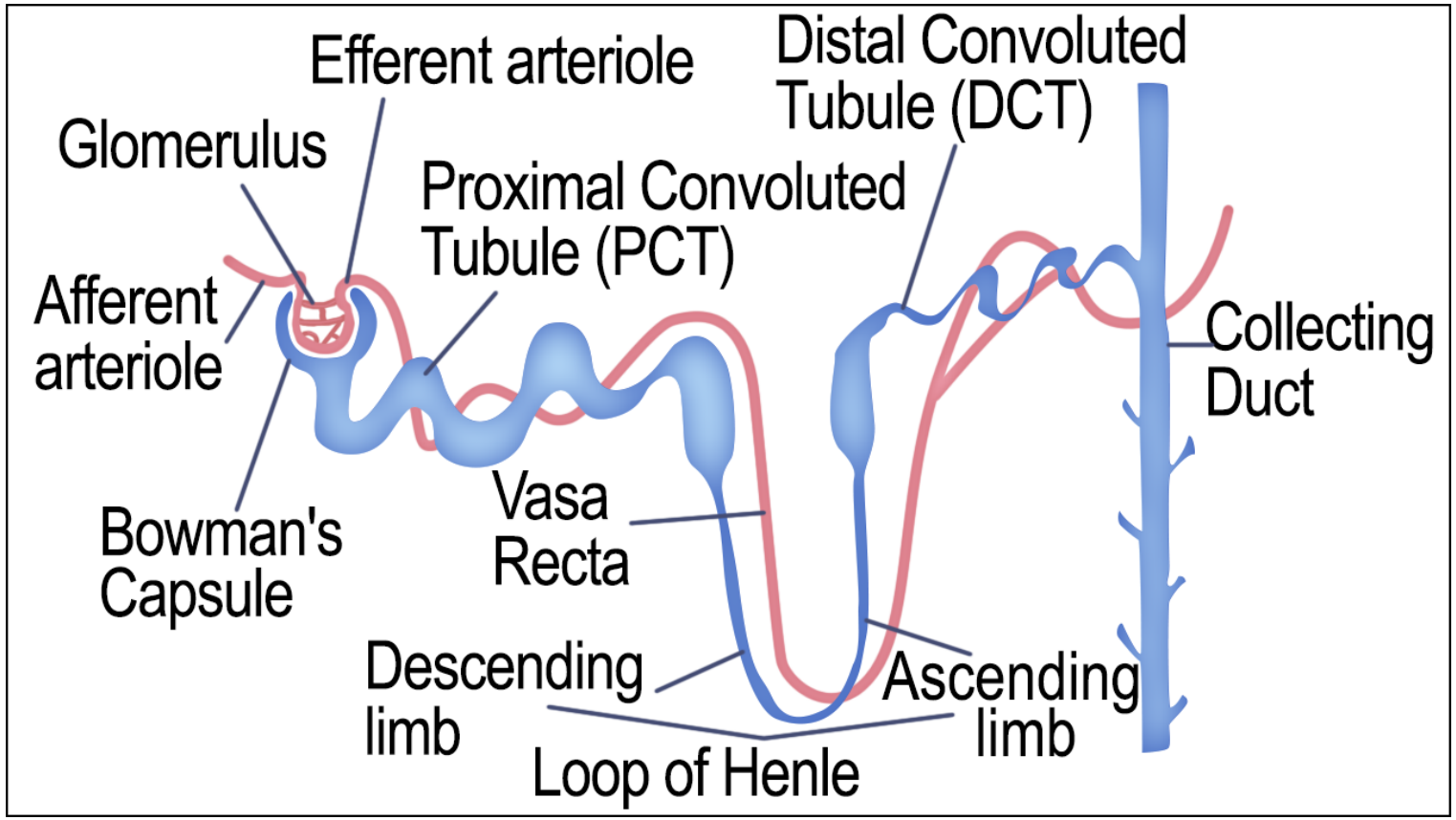
INTRODUCTION

- Diplomate of the Board of Internal Medicine
- Nephrologist, Metrolina Nephrology Associates
- Division Chief of Nephrology, Atrium Health
- CAQ Sports Medicine
- Head Team Physician, Carolina Panthers
- Vice Chair of NFL Medical Committee
- Task Force Lead, Chest and Abdominal Injuries

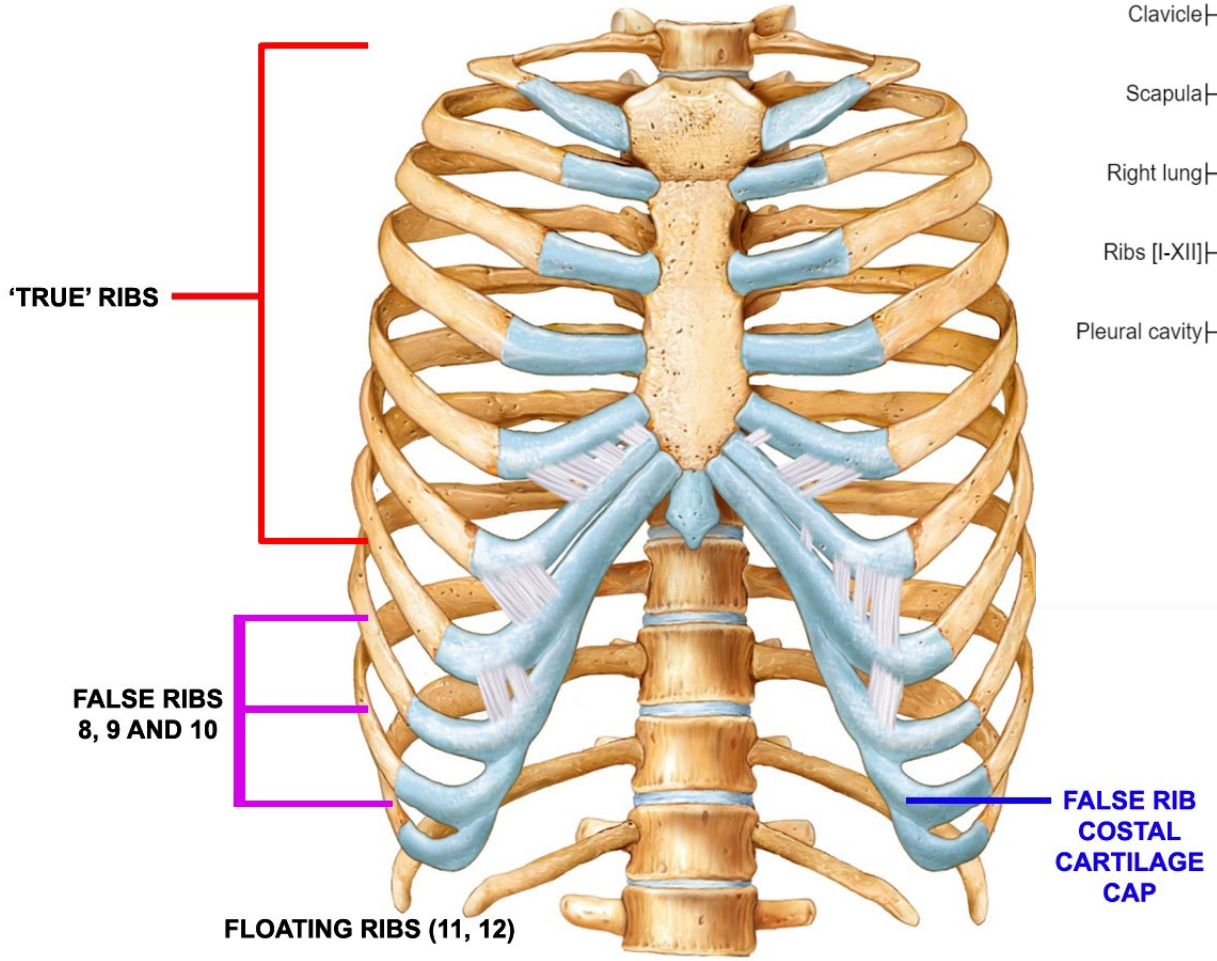
NFL Physicians Society (NFLPS)
https://nflps.org

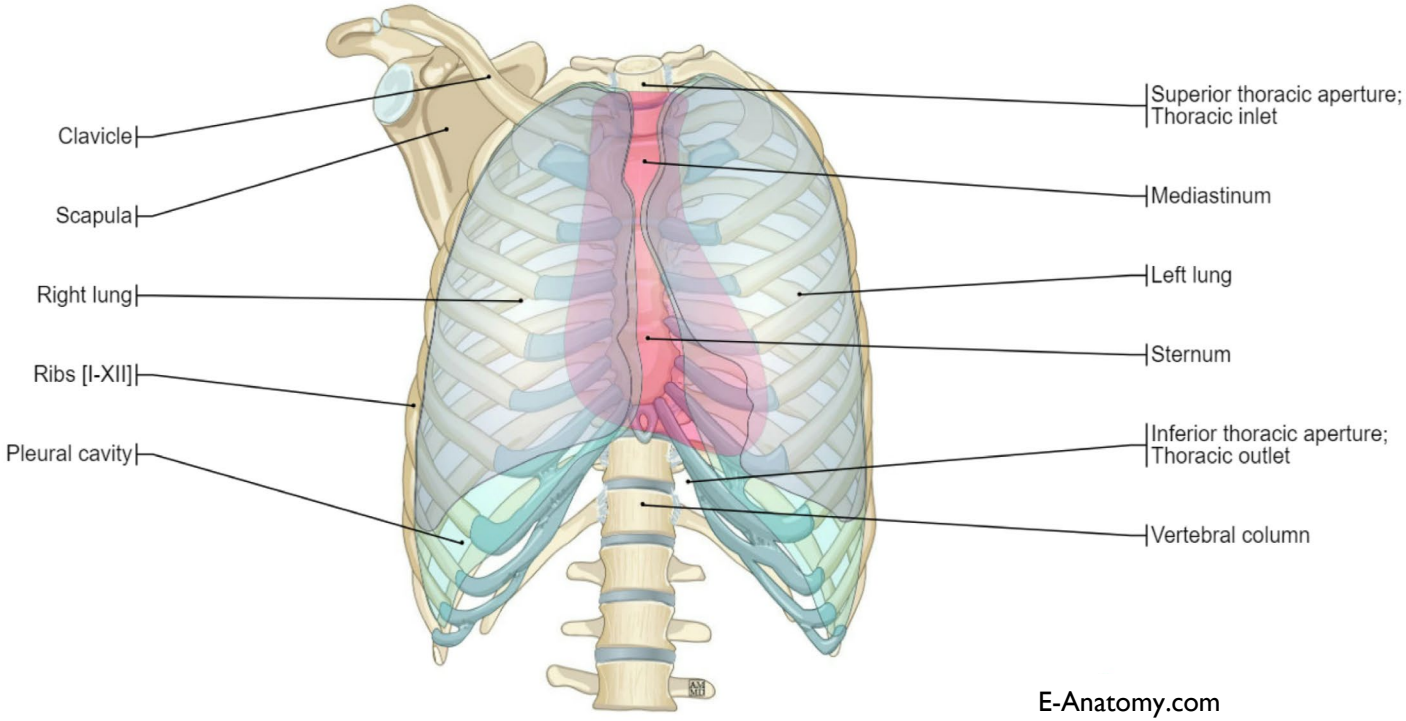
NO FINANCIAL DISCLOSURES…BUT ONE APOLOGY



OBJECTIVES

- Anatomy
- Evaluation and Assessment
  - Life-threatening Injury
- Spectrum of Injuries
- Acute Care and Management
- Adjunctive Evaluation

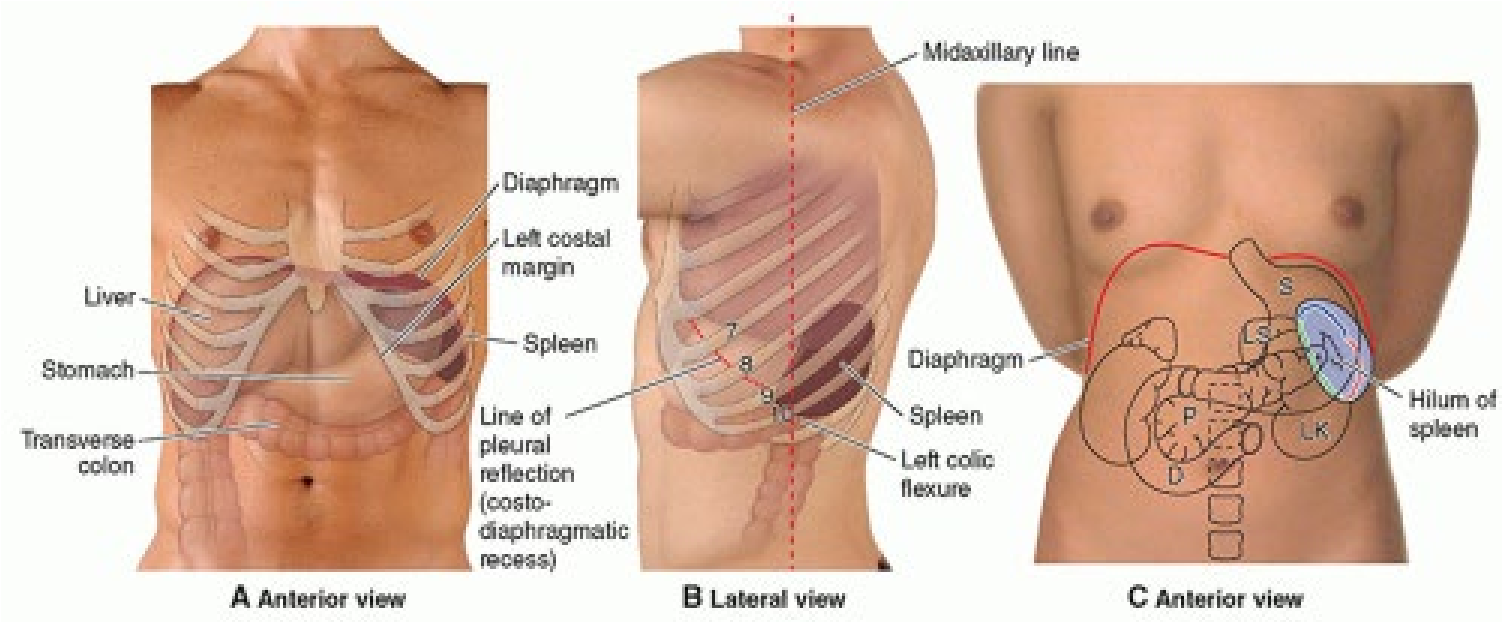


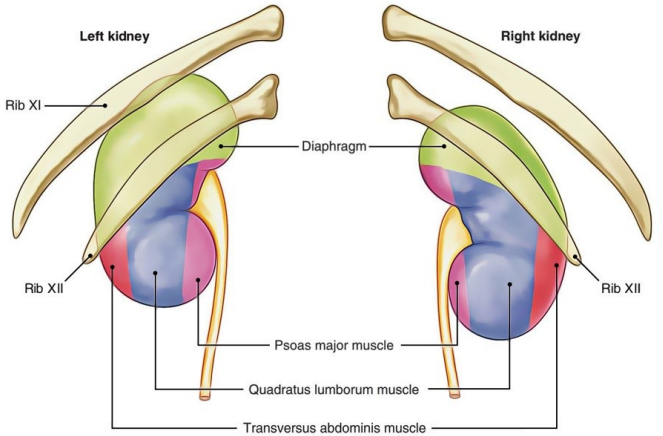


E-Anatomy.com

THORACIC ANATOMY

NEARBY VISCERA, INTERNAL ORGANS, STRUCTURES





https://basicmedicalkey.com/anatomy

BACKGROUND

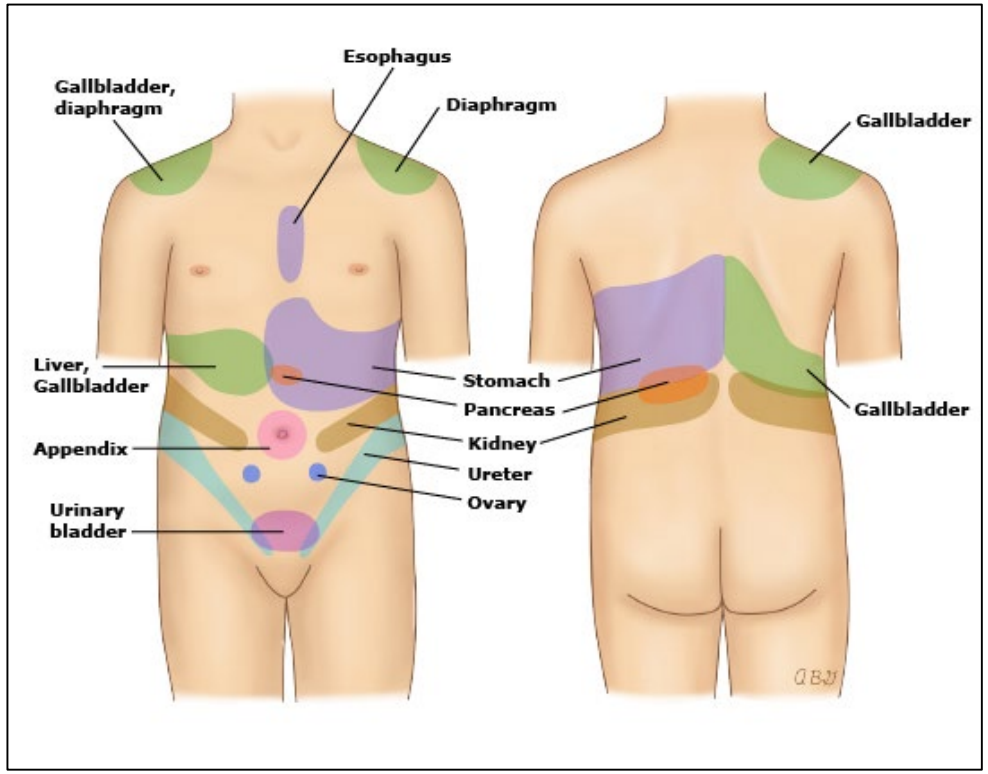
https://blog.purehockey.com

- Emergent sports-related thoracic trauma is relatively rare
- Injuries can be serious, potentially life-threatening
- Rapid evaluation, awareness of spectrum of injuries, treatment, and triage are critical
- Rapid deceleration and direct impact predominant mechanisms of injury
- Secondary tissue hypoxia (⇩FIO_2, ⇩IVV, V/Q mismatch, ⇩CO)
- Primary and Secondary survey detection of injury

Phillips NR, Kunz DE. Chest trauma in athletic medicine. *Curr Sports Med Rep.* 2018;17:90-96.

EVALUATION AND ASSESSMENT

- ABCDE or CABDE
- Symptoms: Shortness of breath, chest pain, ⇧ WOB, referred pain pattern (Kehr's sign diaphragm / spleen)
- Signs: Shock (hemorrhagic or obstructive), hemoptysis, cyanosis, open wound, chest wall contusion, flail chest, distended neck veins, tracheal deviation, or subcutaneous emphysema
- Concomitant injuries often present
- Portable ultrasound FAST examination, sonography for trauma, field-side use evolution



EVALUATION: LIFE THREATS FIRST

- **A** Airway Patency
  - Jaw thrust, airway adjuncts
  - Assume spinal injury in unconscious down athlete
- **B** Breathing
  - Inspect (listen and feel), RR, RQ, paradoxical movement, auscultate, accessory signs
  - Comfort and control; oxygen therapy
- **C** Circulation (Hemorrhagic or ***Obstructive*** Shock)
  - Pulse presence/quality, 80/70/60 Rule, HR, BP, skin (e.g., cold / clammy), capillary refill, SpO_2
  - Rule of 100 (SBP, HR/Temperature)
  - **AED**
- **D** Disability
  - Neurologic status, GCS, sensory and motor
- **E** Exposure
  - Head to toe, secondary survey, life-threats
  - Concomitant injuries

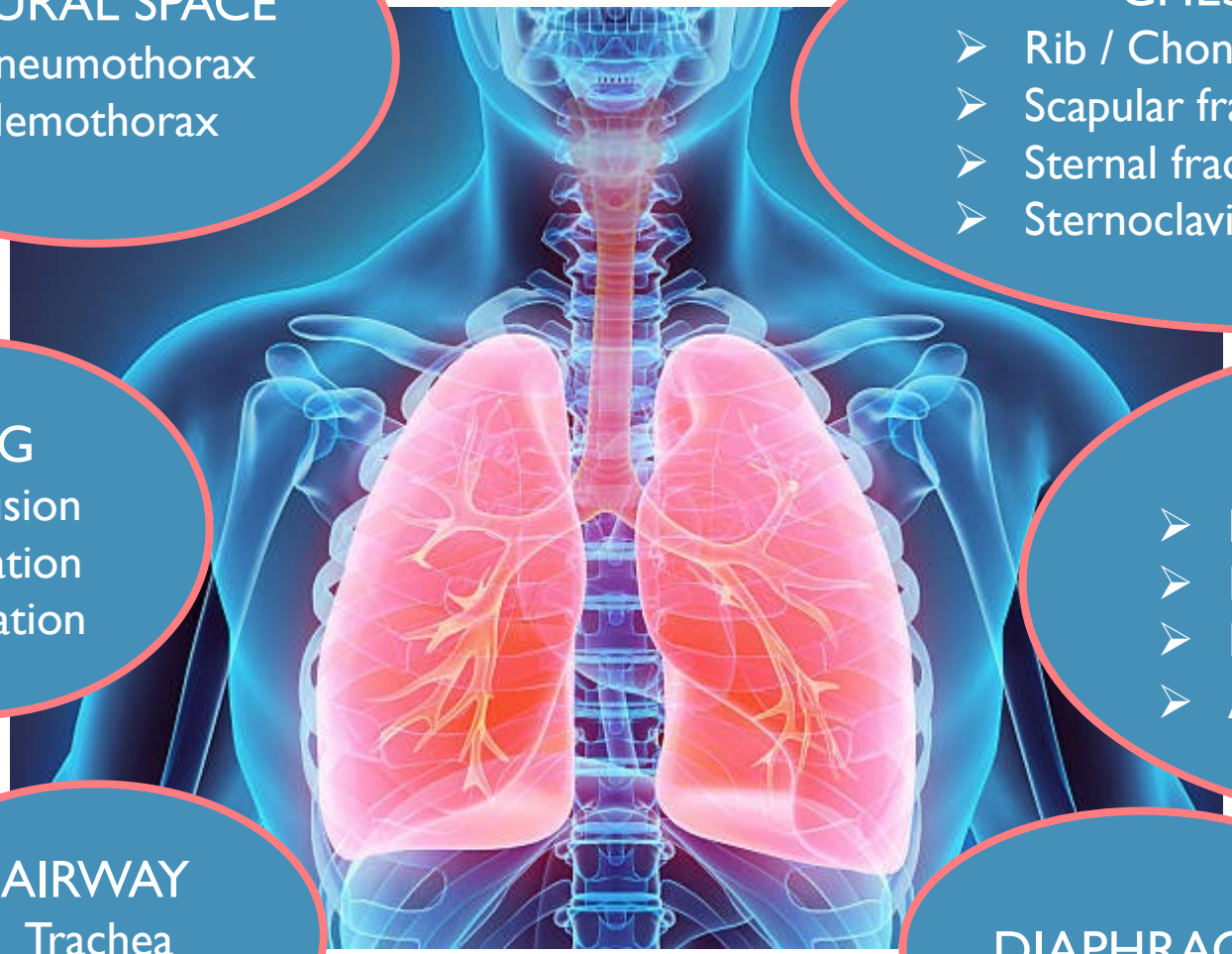
https://spectrumlocalnews.com/

PLEURAL SPACE

- Pneumothorax
- Hemothorax

CHEST WALL

- Rib / Chondral fracture
- Scapular fracture
- Sternal fracture
- Sternoclavicular Dislocation



LUNG

- Contusion
- Laceration
- Herniation

MEDIASTINUM

- Pneumomediastinum
- Esophagus
- Heart
- Aorta/Great Vessels

AIRWAY

- Trachea
- Bronchi

DIAPHRAGM

SPECTRUM OF THORACIC INJURIES

Acute Life-Threatening Emergencies

- Pneumothorax
- Tension Pneumothorax
- Hemothorax
- Flail Chest
- Sternoclavicular dislocation
- Mediastinum (Heart, Esophagus, Aorta/Great vessels)
- Airway, tracheal or bronchial tree
- Diaphragmatic Tear

Urgent / Subacute Injuries

- Lung Contusion or Laceration
- Rib / Chondral Fractures
- Sternal Fracture / Contusion
- Cardiac Contusion

PNEUMOTHORAX / TENSION PNEUMOTHORAX

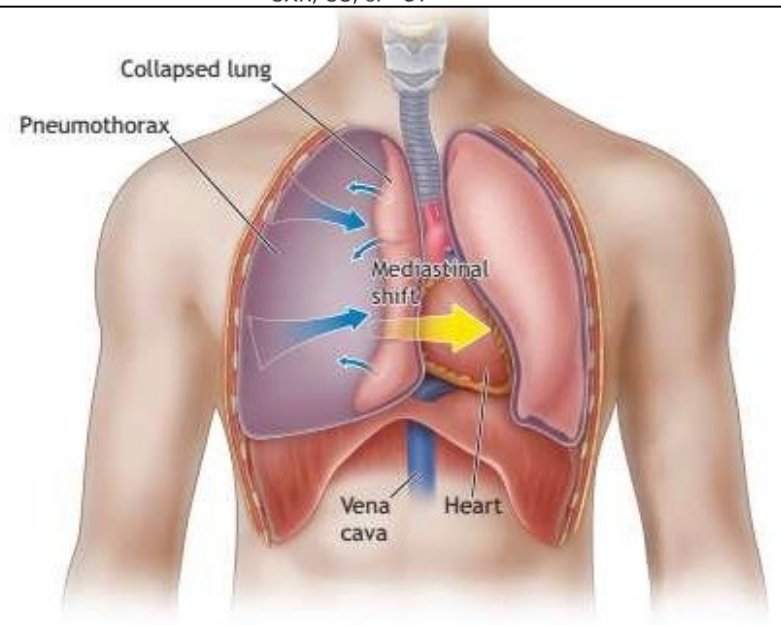
Pneumothorax

- Air trapped between visceral pleura of lung and chest
- Spontaneous or direct blow to chest
- Associated rib fractures
- Sx: Chest pain, neck/shoulder/back pain, cough, SOB
- Exam: Decreased BS, change in fremitus, or hyper-resonant to percussion, ⇧RR/HR, anxious
- POC US, lack of normal lung sliding
- CXR when available, CT scan (gold standard). ✈~14d

Tension pneumothorax

- Air in thoracic cavity without means of escape
- Displaces mediastinum / alternate lung, ⇩venous return and CO
- Needle decompression, 2nd ICS, midclavicular line*

Emergent Injury	Mechanism	Diagnosis	Treatment	RTP
Pneumothorax	Spontaneous or Posttraumatic where air is trapped between visceral pleura of lung and parietal pleura of chest wall	Clinical Chest pain, SOB, and decreased breath sounds or hyper-resonant lung fields with percussion may be present. Tension: deviated trachea away from injury, distended neck veins Imaging CXR, US, or *CT	Stable Observation if <20% & Serial CXR Unstable Needle decompression (if tension) at 2nd Intercostal space, mid-clavicular line, side of injury Chest Tube	Resolution on CXR Avoid flying for 2 wk after resolution

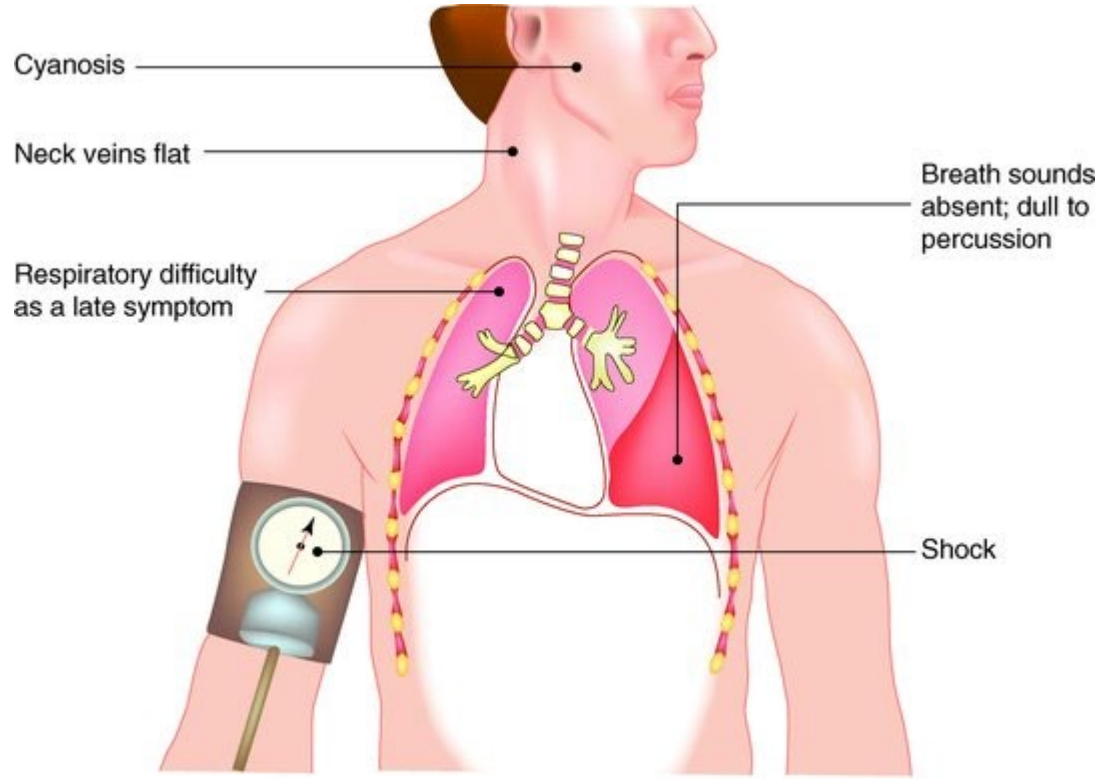


Thomas, RD, De Luigi, AJ. Chest trauma in athletes; Current Sports Medicine Reports 2018:17(8): 251-252.

HEMOTHORAX

Hemothorax

- Blood in pleural space, disrupted pulmonary or systemic vessel
- Penetrating or blunt trauma
- If enough blood, massive > 1500 ml, shifts mediastinum, compress IVC/SVC and opposite lung, hypoxemia and mixed shock
- Sx: Hypovolemic / obstructive shock, difficulty breathing, anxiety, confusion
- Exam: Shock, neck veins flat (vs. pericardial effusion with tamponade), BS decreased, percussion dull, fremitus increased
- EMS activation, prepare for transport, O_2

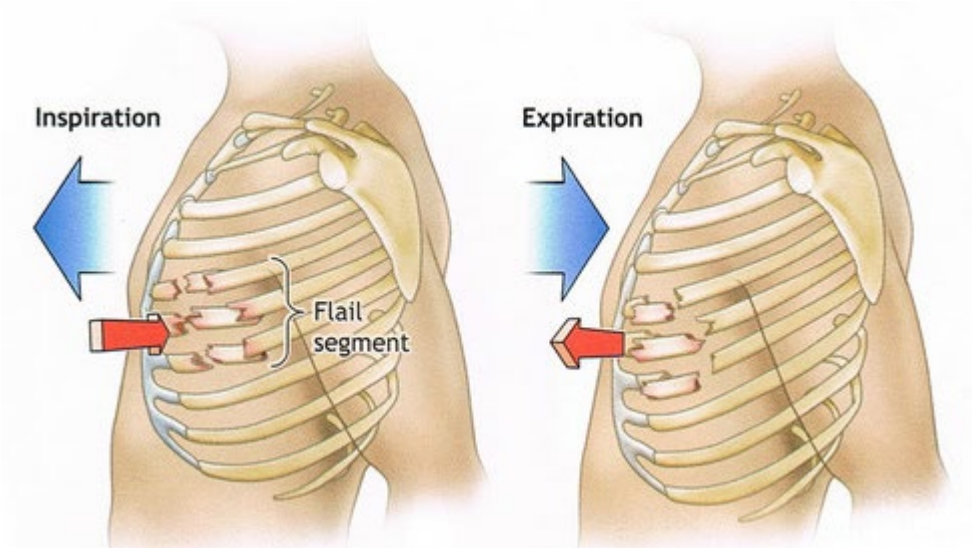


FLAIL CHEST

Flail Chest

- Unstable portion of the chest wall in discontinuity with chest wall, due to multiple rib fractures in at least two locations of the same rib and at least 3 consecutive ribs
- Blunt trauma or severe torsion, rare in sports
- Flail segment falls during inspiration expansion, rises during expiration decompression
- Associated lung contusion, risk of hypoxia, risk of PTX / HTX
- Sx: Pain, difficulty breathing, pain and paradoxical motion, associated lung contusion
- Exam: Crepitus, paradoxical motion, ⇧RR, ⇩SpO_2
- Stabilize flail segment (hand, dressing, pillow), assess for PTX/HTX, prepare for transport

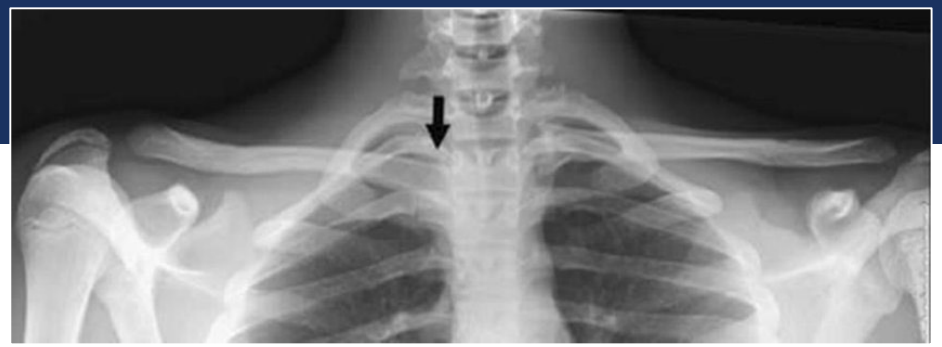
Emergent Injury	Mechanism	Diagnosis	Treatment	RTP
Flail chest	Segmental rib fractures (at least 2 locations on same rib) of at least 3 ribs	Clinical Paradoxical breathing Imaging CXR	Aggressive pain control May require ventilation Surgery is considered	Healed fractures w/o any respiratory compromise



Thomas, RD, De Luigi, AJ. Chest trauma in athletes; Current Sports Medicine Reports 2018:17(8): 251-252.

HTTP://WATILEARNED2DAY.BLOGSPOT.CA/2013/08/QUESTION-OF-DAY-FLAIL-CHEST.HTML

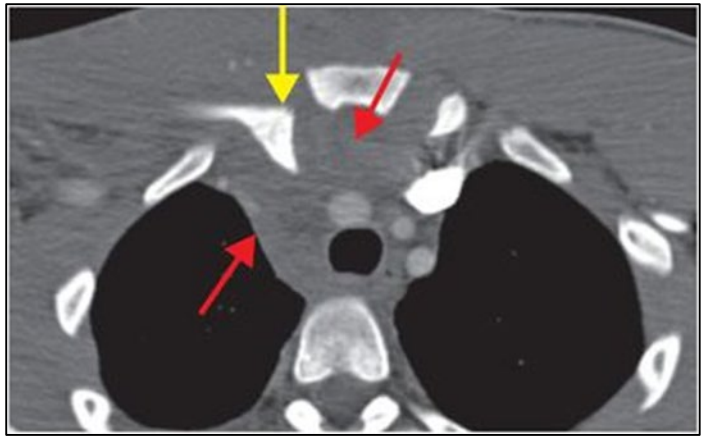
STERNOCLAVICULAR DISLOCATION



Sternoclavicular Dislocation

- True dislocation rare, anterior > posterior
- Posterior with risk to nearby mediastinal structures
- Blunt direct impact to chest / medial clavicle or indirect after lateral compression on shoulder
- Sx: Localized pain, dyspnea or dysphagia, stridor
- Exam: Deformity, swelling, pain on palpation (head-turn relief), asymmetry (paresthesia, pulseless)
- Xray Serendipity view (40° cranially); CT scan
- Field-side closed reduction not advised, bolster between shoulder blades, towel clip traction

Emergent Injury	Mechanism	Diagnosis	Treatment	RTP
Sternoclavicular (SC) dislocation	Dislocation of SC joint in an anterior or posterior direction following blunt force	Clinical Localized pain and swelling Imaging CXR **CT*	Anterior Reduction Immobilization × 4–6 wk w/clavicular strap Posterior Reduction under general anesthesia ASAP Immobilization w/figure of 8 strap × 4–6 wk	Full course of immobilization and no continued evidence of instability



https://radiologykey,com

Thomas, RD, De Luigi, AJ. Chest trauma in athletes; *Current Sports Medicine Reports.* 2018; 17(8):251-252.

Alent J, Narducci D, Moran B, Coris E. Sternal Injuries in Sport: A Review of the Literature. *Sports Medicine.* 2018; 48:1-10.

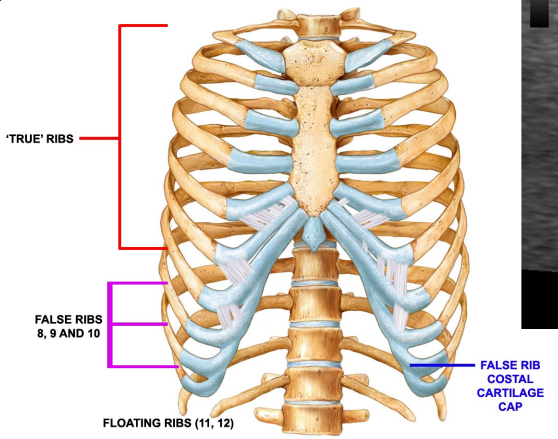
RIB FRACTURE / COSTAL CARTILAGE INJURY

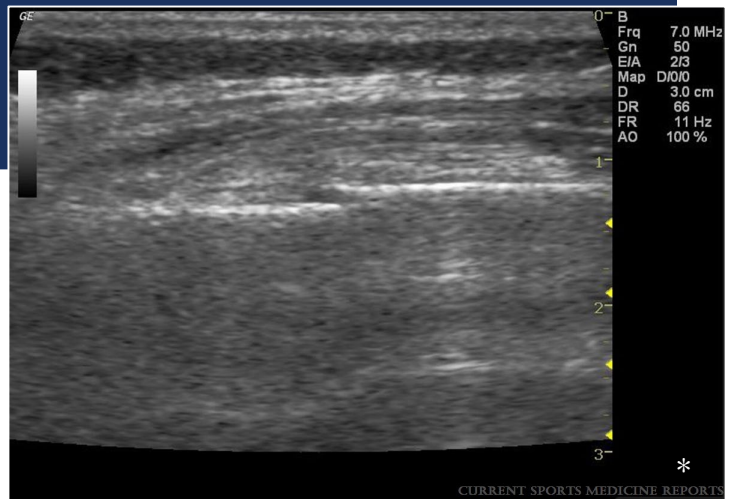
Rib Fracture

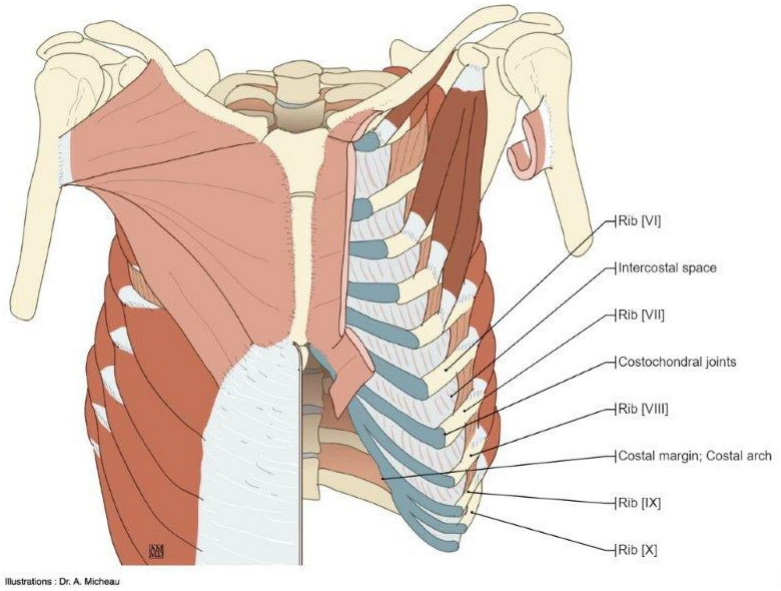
- Common, not life-threatening by itself; 5-7 common ribs
- Concomitant injuries must be considered; 3 or more ribs
- Collision sports, direct blow, or repetitive movements
- Sx: Pain, worse with cough / deep breath / laugh, SOB
- Exam: Focal tenderness, pain with rib cage compression, crepitus, ⇧RR, RQ, anxious
- POC US, irregular cortex, accurate and sensitive/specific*
- CXR, rib series, CT scan (if associated injury concern)

Costochondral Injury

- Direct blow, or sudden twist, "fall on ball"
- Similar symptoms / signs to rib fracture, pain locale differs (anatomy), "clicking"; Coexistent injuries
- CXR to exclude PTX/rib fracture, but misses CC injury; CT or MRI







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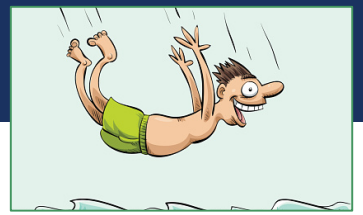
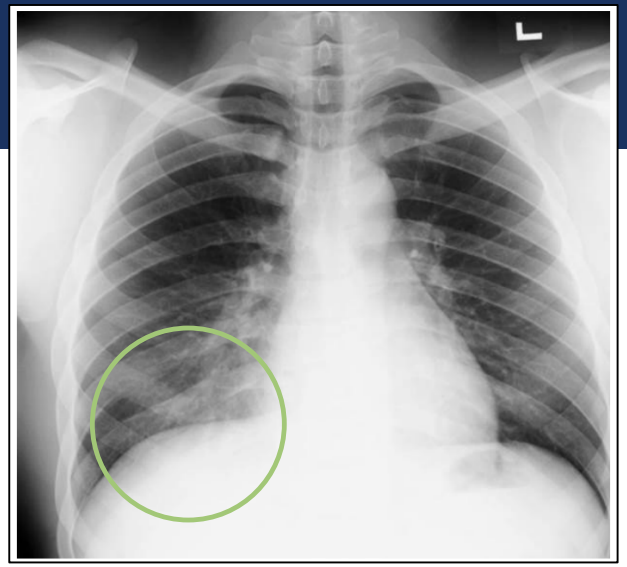
Gilbertson J, et al. Test Characteristics of chest ultrasonography for rib fractures following blunt chest trauma: A systematic review and meta-analysis. *Ann of Emergency Medicine.* 2022; 79:529-539

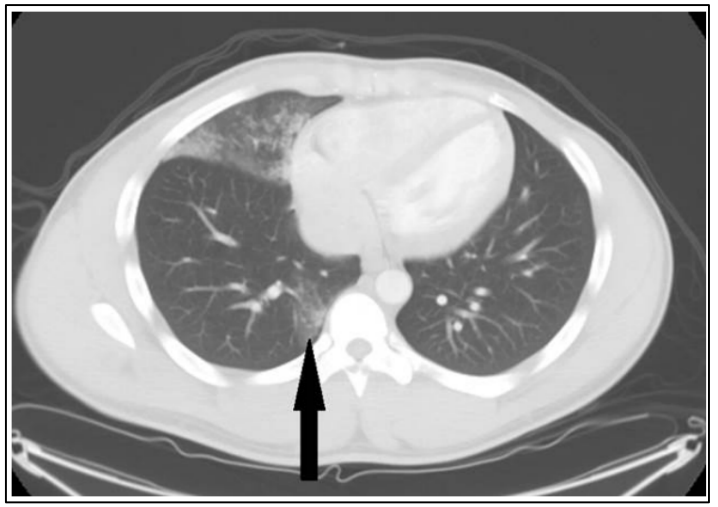
LUNG CONTUSION





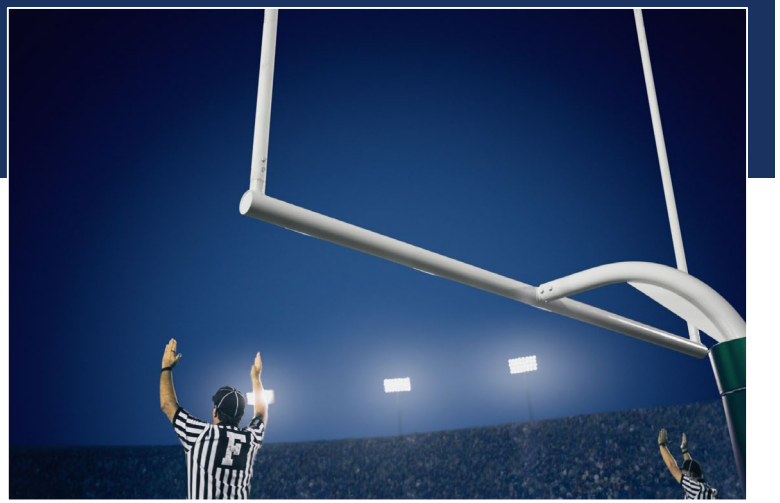
Lung Contusion

- Injury to lung parenchyma "bruising", fluid in alveoli
- Blunt trauma, high velocity transmission e.g., Diver
- Associated chest contusion, rib /chondral fracture
- Sx: Chest pain, SOB, hemoptysis (can be delayed)
- Exam: Wheeze or crackles or normal, ⇧RR, ⇩SpO_2
- CXR normal initially, peripheral infiltrates, 4 – 48 hours. CT gold standard
- Supportive care, oxygen, pulmonary toilet



Phy, M. Multiple pulmonary contusions in a collegiate football player. *The Southwest Respiratory and Critical Care Chronicles*; 2014: 2(8)54-58.

CONCLUSION: TAKE-HOME POINTS



- Recognize spectrum of sports-related thoracic injuries
  - Life-threatening emergencies ⇔ Urgent / subacute injuries
- Appreciate mechanism of injury as clue to the differential diagnosis
- Identify clinical signs and symptoms, especially the critical vital signs and their evolution
- Understand the initial assessment and prompt management
- Be aware of risk of concomitant injury, as that 2nd associated injury could be the emergency
- Stimulate further individual study (e.g., post injury management, return to train, return to participation)

CONCLUSION: EMPOWER THE TEAM

If you fail to plan, you are planning to fail!

BENJAMIN FRANKLIN

- **E** Emergency Action Plan
- **M** Medical Knowledge
- **P** Practice and Drill
- **W** Walk-Through Scenarios
- **R** Readiness and Roles


AtriumHealth

REFERENCES

- Rehberg, RS. *Sports Emergency Care: A Team Approach*, 2nd Edition, 2013.
- Moussa M, Shaar BA, El-Karim GA, Almalki Y. Costal cartilage fracture: A commonly missed thoracic injury in trauma patients. *Radiology Case Reports*. 2022; 17:95-98.
- Phillips NR, Kunz DE. Chest trauma in athletic medicine. *Current Sports Medicine Reports*. 2018; 17(3):90-96.
- Thomas, RD, De Luigi, AJ. Chest trauma in athletes; *Current Sports Medicine Reports*. 2018; 17(8): 251-252.
- Alent J, Narducci D, Moran B, Coris E. Sternal Injuries in Sport: A Review of the Literature. *Sports Medicine*. 2018; 48:1-10.
- Fitch RW, Williams J. Evaluation and Management of Traumatic Conditions in the Athlete. Clin Sports Med. 2019; 38:513-535.
- Feden JP. Closed Lung Trauma. *Clin Sports Med*. 2013; 32:255-265.
- Phy, M. Multiple pulmonary contusions in a collegiate football player. *The Southwest Respiratory and Critical Care Chronicles*. 2014; 2(8)54-58.
- Gilbertson J, et al. Test Characteristics of chest ultrasonography for rib fractures following blunt chest trauma: A systematic review and meta-analysis. *Ann of Emergency Medicine*. 2022; 79:529-539.