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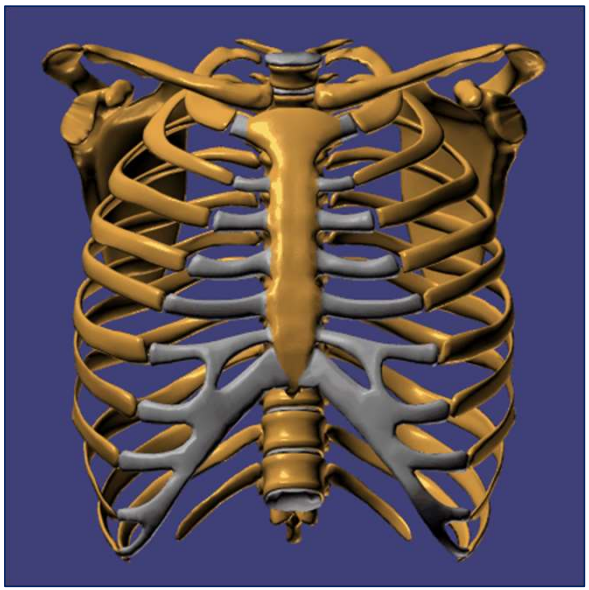
National Center for Osteopathic Principles and Practice Education

Segmental Diagnosis: Rib Cage



Meadow Will, DO

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Meadow Will, DO, is an Assistant Professor of Osteopathic Neuromusculoskeletal Medicine at A.T. Still University's Kirksville College of Osteopathic Medicine (ATSU-KCOM). She earned her Doctor of Osteopathic Medicine degree from the University of Pikeville-Kentucky College of Osteopathic Medicine (UP-KYCOM) where she also did an undergraduate teaching fellowship in Osteopathic Principles and Practices and Anatomy. She completed her residency in osteopathic neuromusculoskeletal medicine at Northeast Regional Medical Center.

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Segmental Diagnosis: Rib Cage

Diagnosis of the Abdominal Diaphragm and Thoracic Inlet

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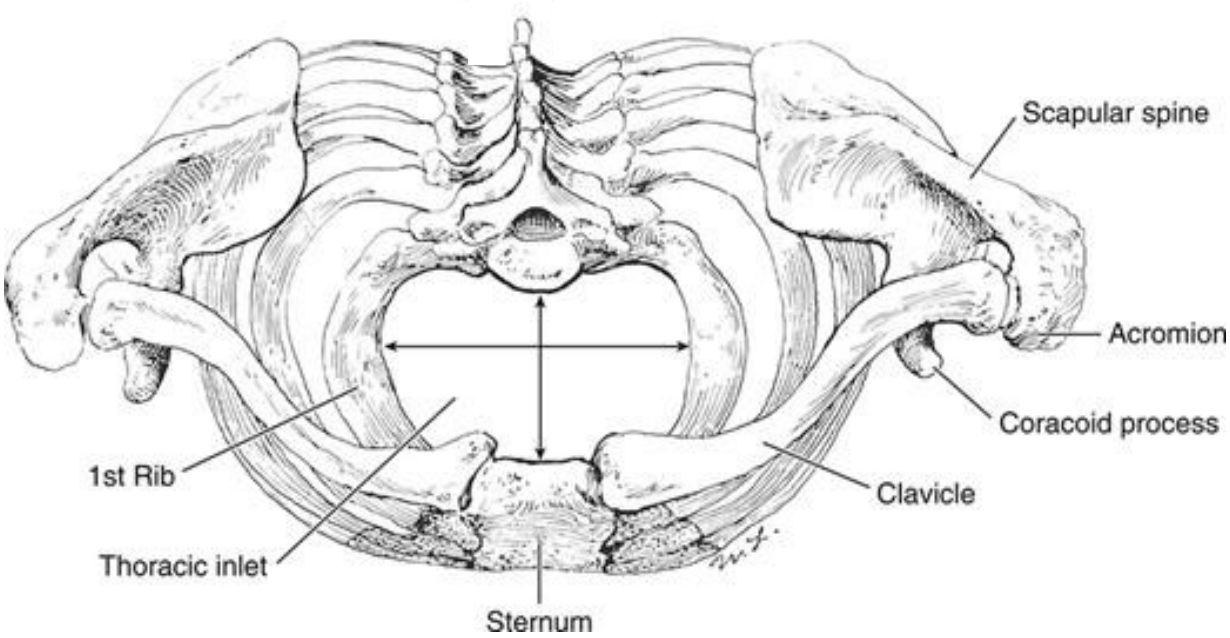
Objectives

- Palpate and diagnose myofascial component of thoracic inlet
- Palpate and diagnose ribs 1-12 bilaterally
- Palpate and diagnose abdominal diaphragm

Thoracic Inlet



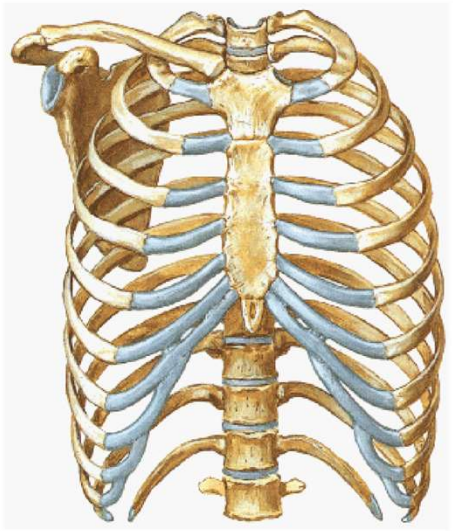
Thoracic Inlet

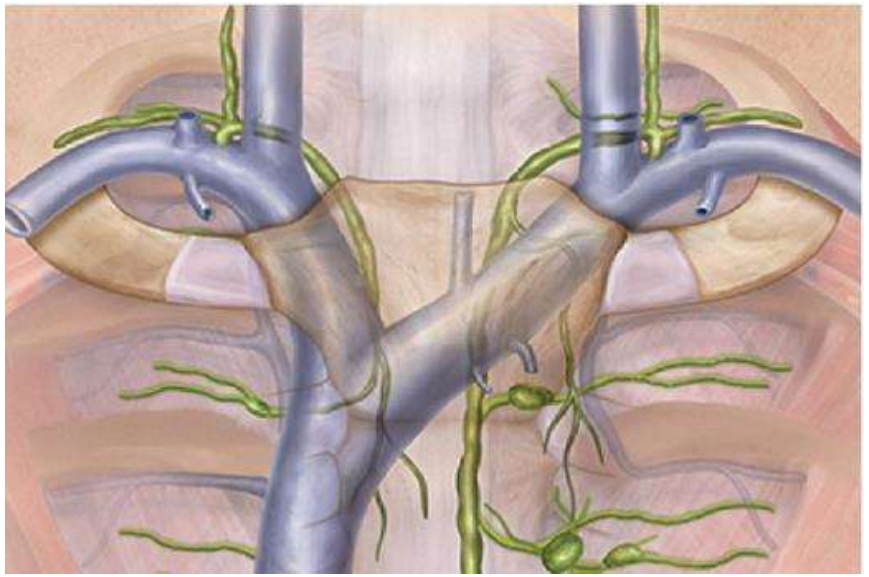
T1, right and left 1st ribs, and manubrium

Treatment can improve overall lymphatic drainage.

Impacted by somatic dysfunction:

- Bony
- Myofascial





Thoracic Inlet Diagnosis

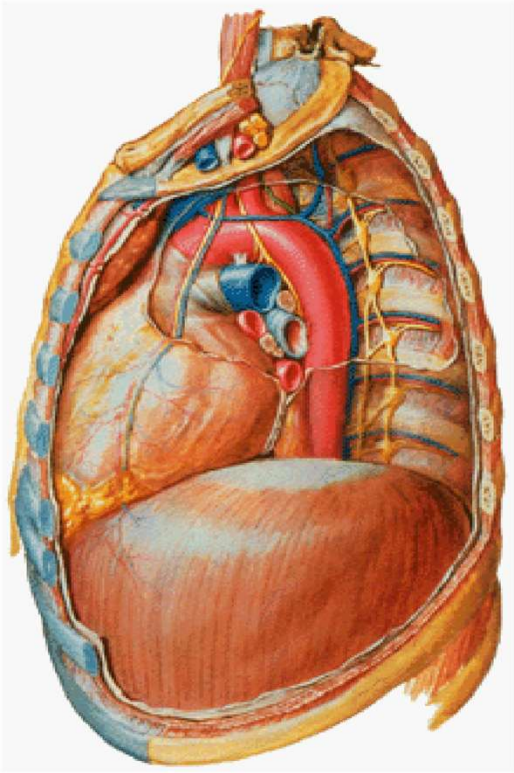
- Thumbs rest on posterior 1st ribs
- Finger pads rest on anterior ribs just inferior to clavicle
- Sequentially evaluate fascial motion preference in all 3 planes
  - Rotation
  - Sidebending left and right
  - Flexion and extension

Lab Exercise: Thoracic Inlet Diagnosis

Rib Cage

Rib Cage

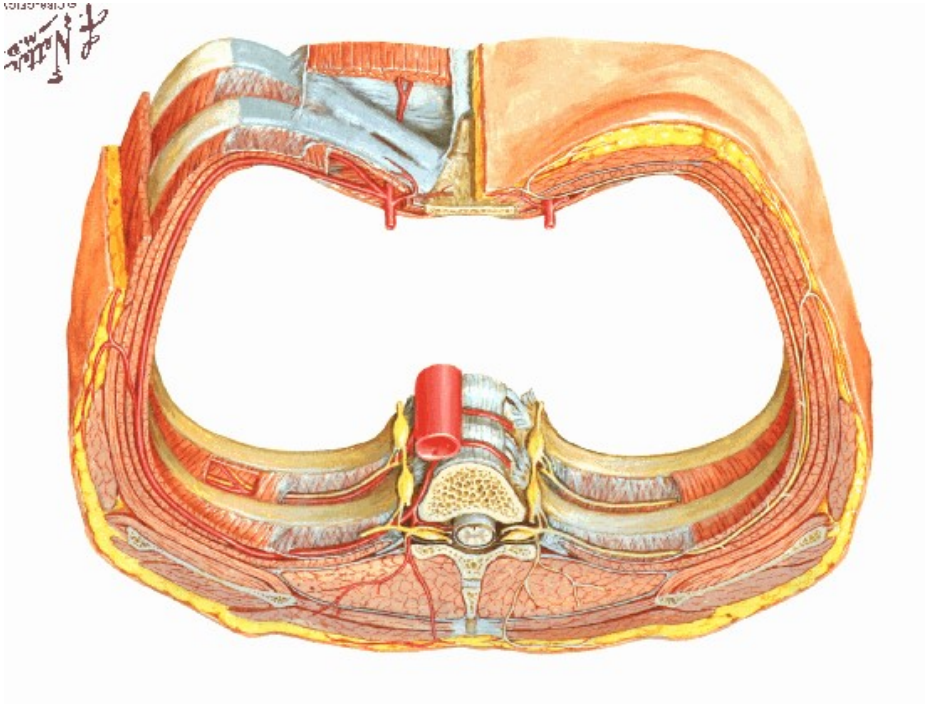
- Bony structure
- Ribs slant downward (inferior) from posterior to anterior
- Superior orifice is covered by suprapleural membrane
  - Thoracic inlet
- Inferior opening is closed by the abdominal diaphragm



Rib Cage

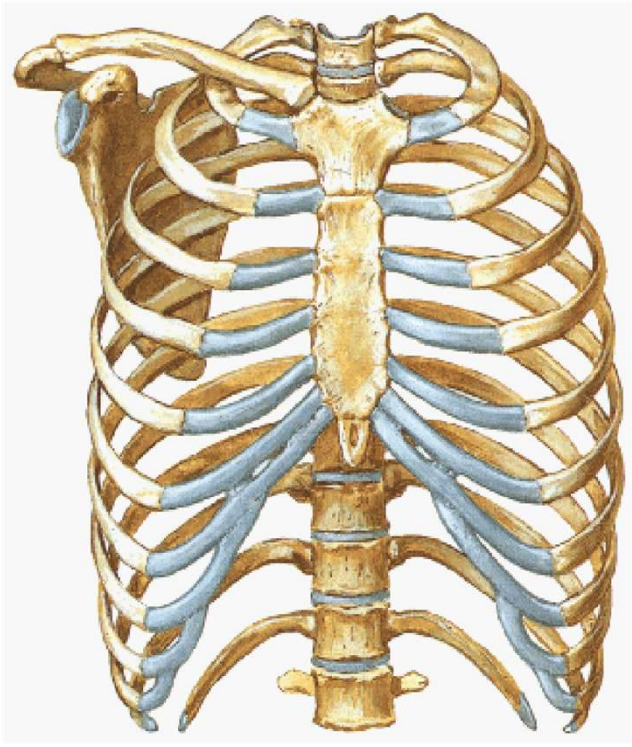
Sympathetic control of Chest Cage organs:

- T1-6 Nerve roots exit from the thoracic spine, synapse in the sympathetic chain ganglia & innervate the heart and lungs
- chain ganglia are just anterior to the rib heads & can be influenced by rib dysfunction



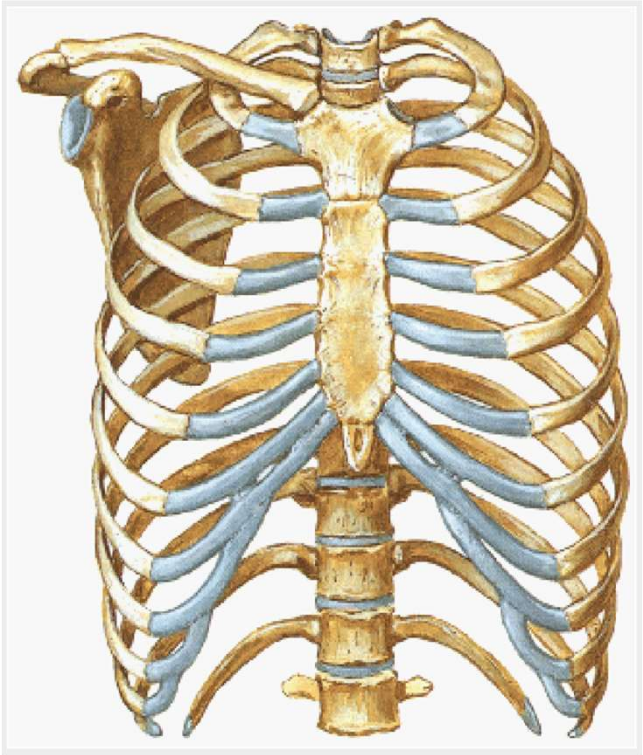
Rib Cage Anatomical Relationships

- Sternal notch at level of T2
- Sternal Angle = T4
- Xiphoid process = T9
- Umbilicus = L3, 4
- Rib 2 attaches at sternal angle
- Rib 8 is just inferior to the tip of the scapula posteriorly
- Rib 7 is the last one to attach directly to sternum



Clinical Indications for Assessment

- Rib pain with breathing, positional changes, or coughing
- History of cough or recent respiratory illness
- History of trauma
  - Car accidents
  - Thoracotomies
  - Non-physical traumas
- Flank pain or upper abdominal pain
- Back pain: Cervical, Thoracic, or Lumbar



Rib Cage Dysfunction Assessment

- Screening
  - Palpate for tissue texture abnormalities at rib angles
  - Springing on ribs to test motion restriction
    - Typically anterior contact for pump handle ribs
    - Typically lateral contact for bucket handle ribs
- Definitive Diagnosis
  - Palpate inhalation and exhalation motion preference

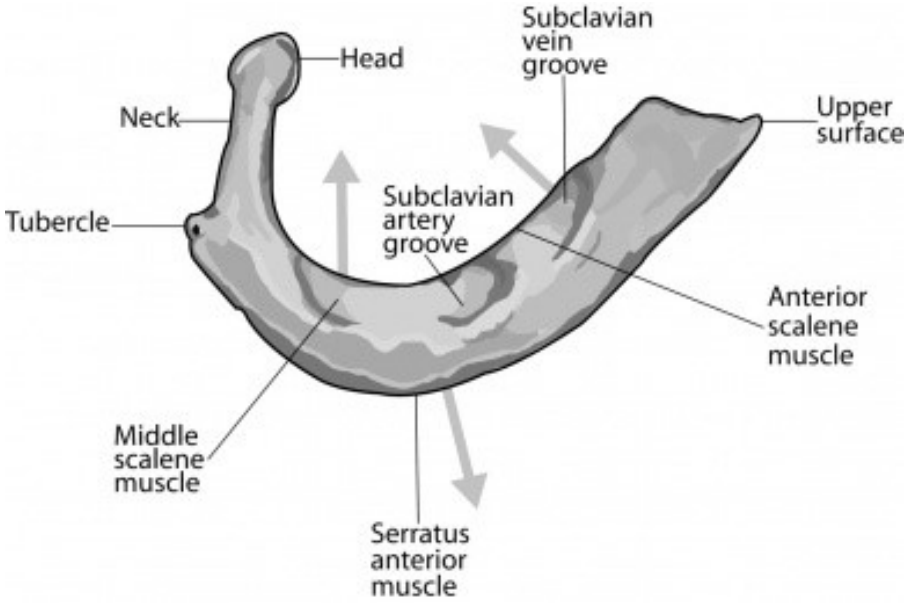
Somatic Dysfunction: Naming – FOM5

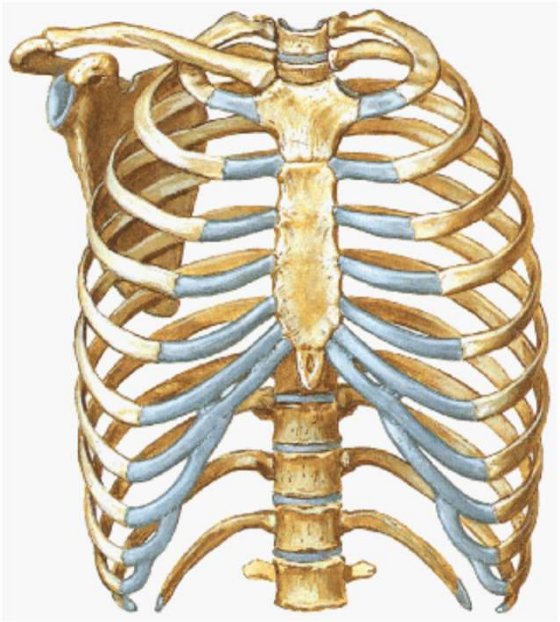
- ***Exhaled rib dysfunction.*** *Somatic dysfunction characterized by a rib being held in a position of exhalation such that motion toward exhalation is more free and motion toward inhalation is restricted. Synonyms: caught in exhalation, exhalation rib dysfunction, inhalation rib restriction, depressed rib.*

- ***Inhaled rib dysfunction.*** *A somatic dysfunction characterized by a rib being held in a position of inhalation such that motion toward inhalation is freer and motion toward exhalation is restricted. Synonyms: caught in inhalation, inhalation rib dysfunction, exhalation rib restriction, elevated rib.*

Atypical Rib 1 Anatomy

- attaches to the T1 posterior and the manubrium anteriorly
- Crosses inferior to clavicle

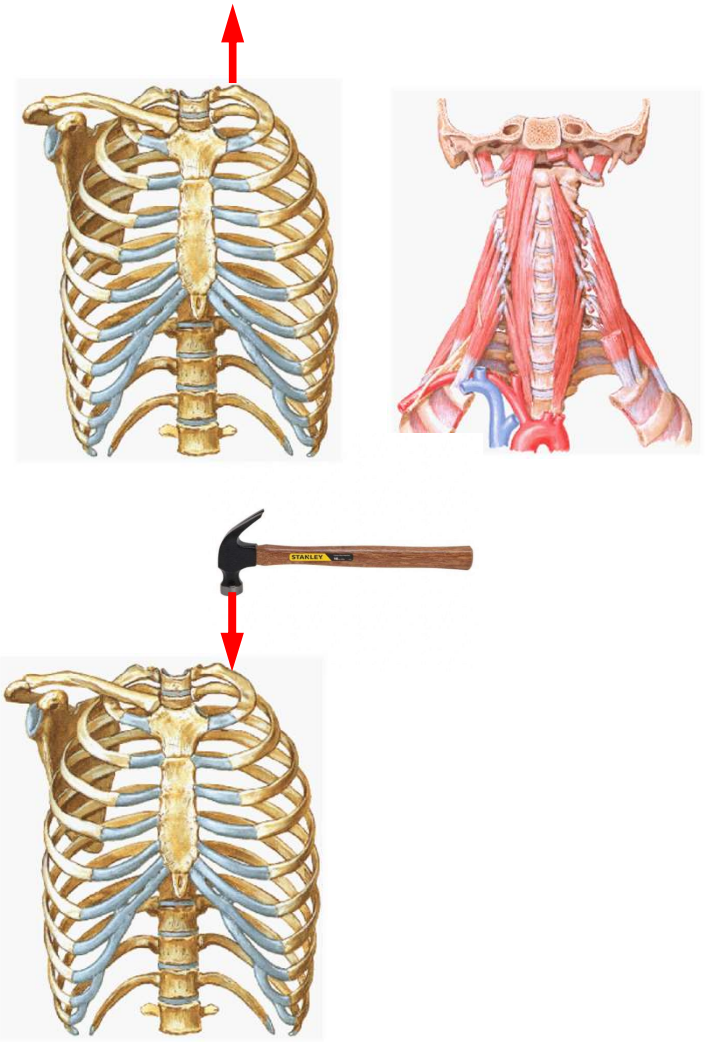




1st Rib Motion & Findings

- Elevates with inhalation; may become elevated (inhaled) from muscle spasm of anterior & middle scalenes

- Depresses with exhalation; may become depressed (exhaled) from trauma



First Rib Diagnosis

1. The patient is seated or supine on the examination table.

2. Make bilateral contact with the posterolateral shafts of the patient's first ribs, immediately lateral to the costotransverse articulation

3. The patient is instructed to inhale and exhale deeply.

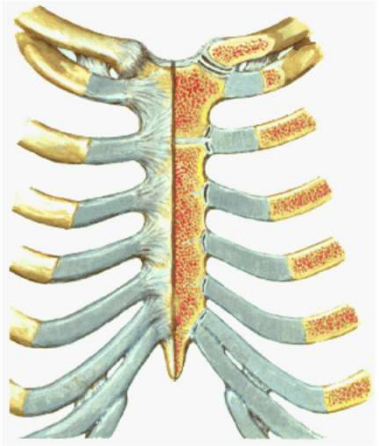
4.Name for the direction of preference

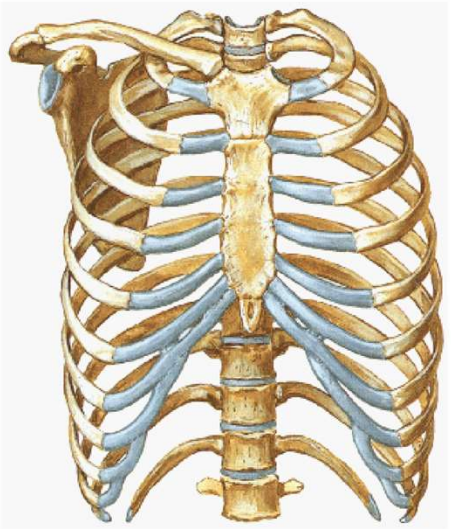
Lab Exercise: First Rib Diagnosis

Typical Ribs: 2-10

- Rib bone joins anteriorly to the costal cartilage→ costochondral joint→ costochondritis (non-synovial)

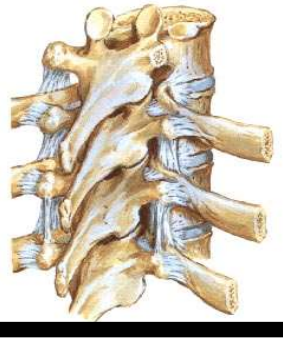
- ribs 8, 9, 10 join the chondral mass via costochondral joints

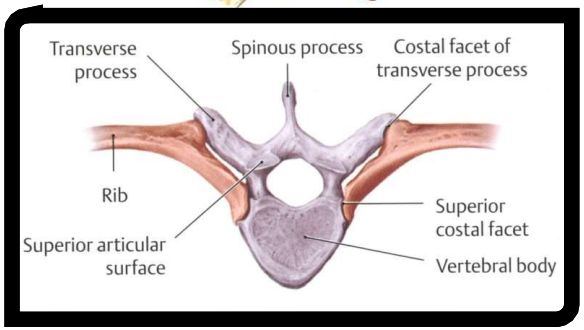


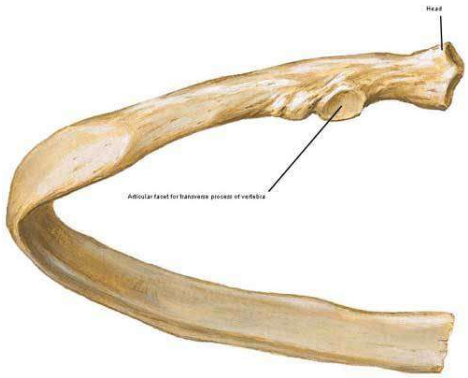


Typical Ribs (cont.)

- All have costotransverse & costovertebral synovial joints
- Rib attaches to vertebral body and transverse process of its number and to vertebral body above via demifacets
- Posterior rib angle is most prominent

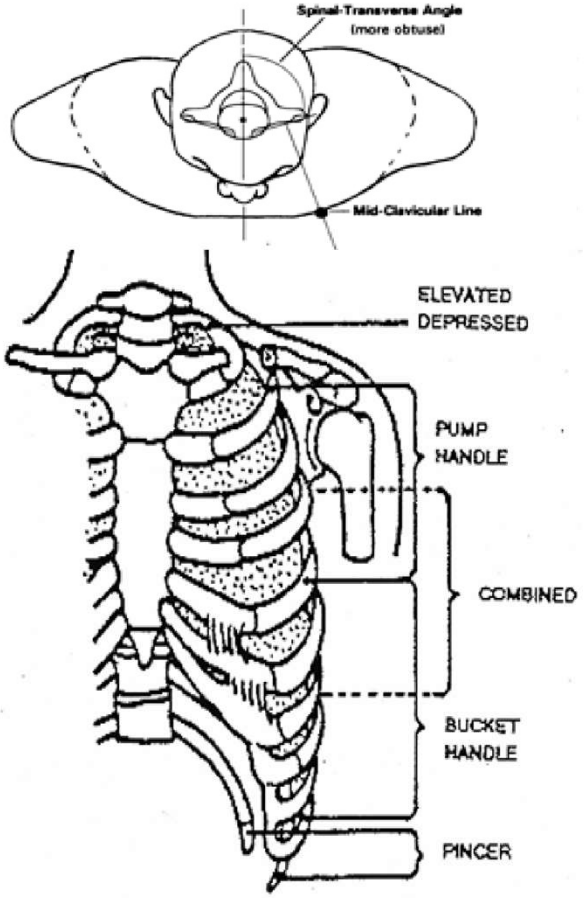






Pump Handle Motion

- Occurs about the transverse axis: pump handle motion best palpated at midclavicular line of ribs 2-5
- In inhalation, anterior end of rib moves superiorly, posterior angle moves inferiorly
- In exhalation, motion is opposite of inhalation

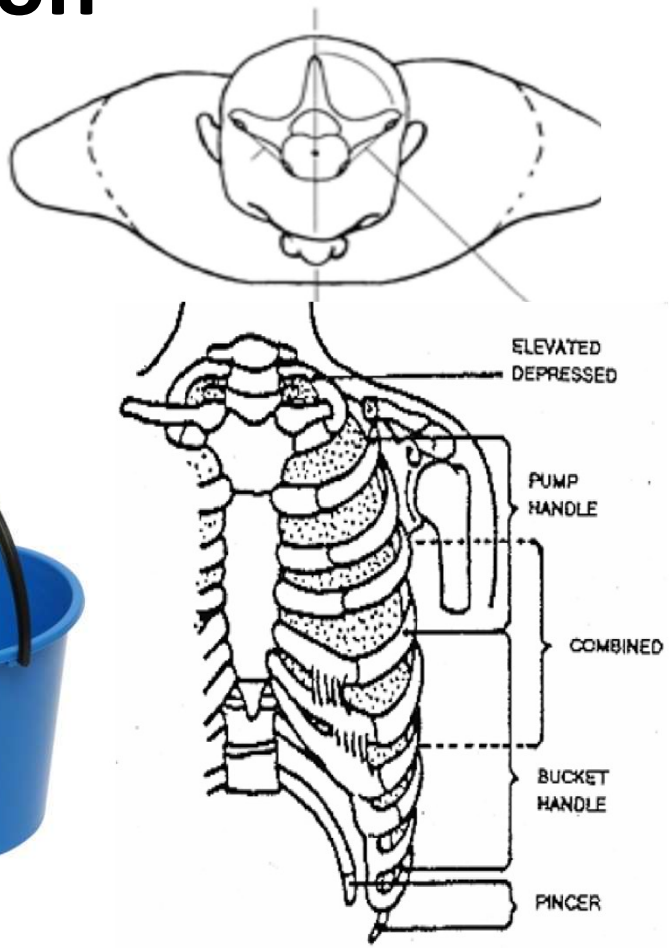


Typical Rib Bucket Handle Motion

•Occurs about the AP axis: bucket handle motion best palpated at midaxillary line of ribs 6-10.

• In inhalation, intercostal space separates as ribs move lateral & superior

•In exhalation, intercostal space narrows



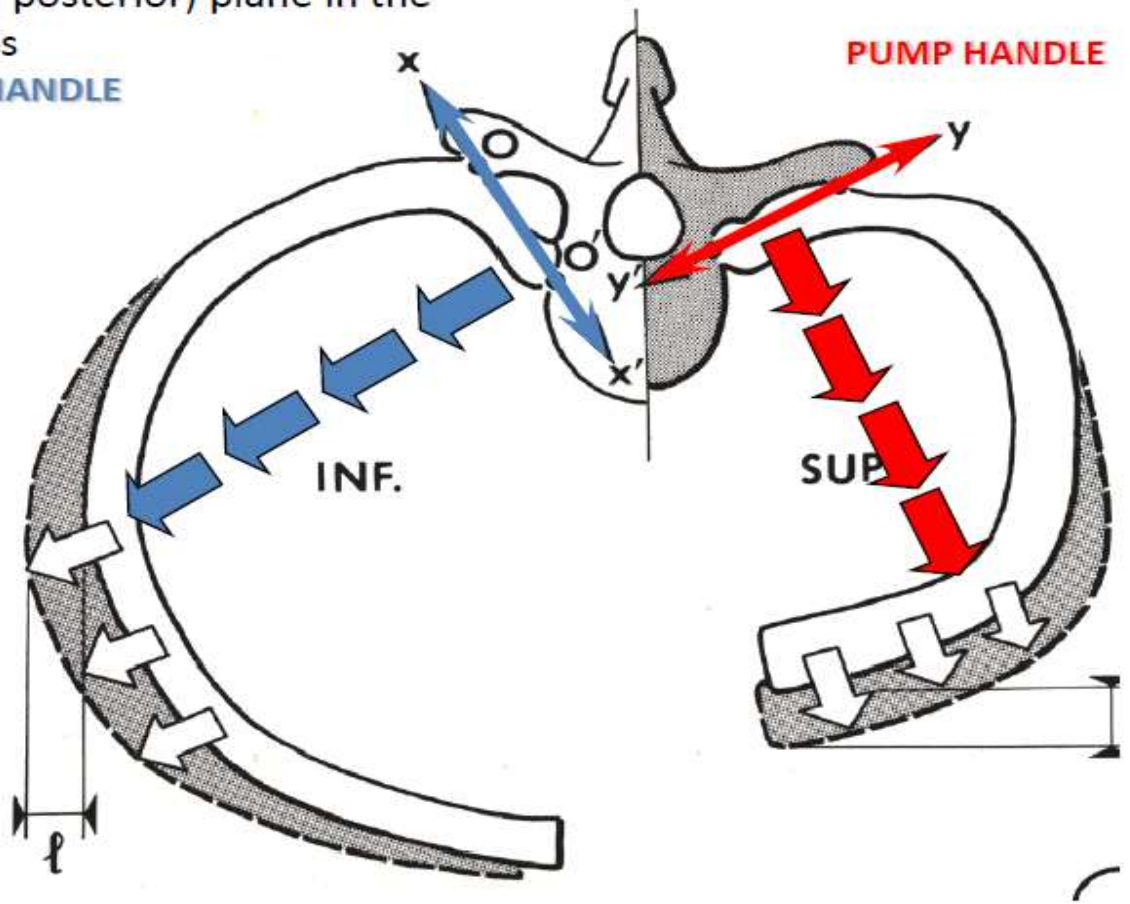
Costo-vertebral to costo-transverse axis

The axis is in a more sagittal (anterior-posterior) plane in the lower ribs

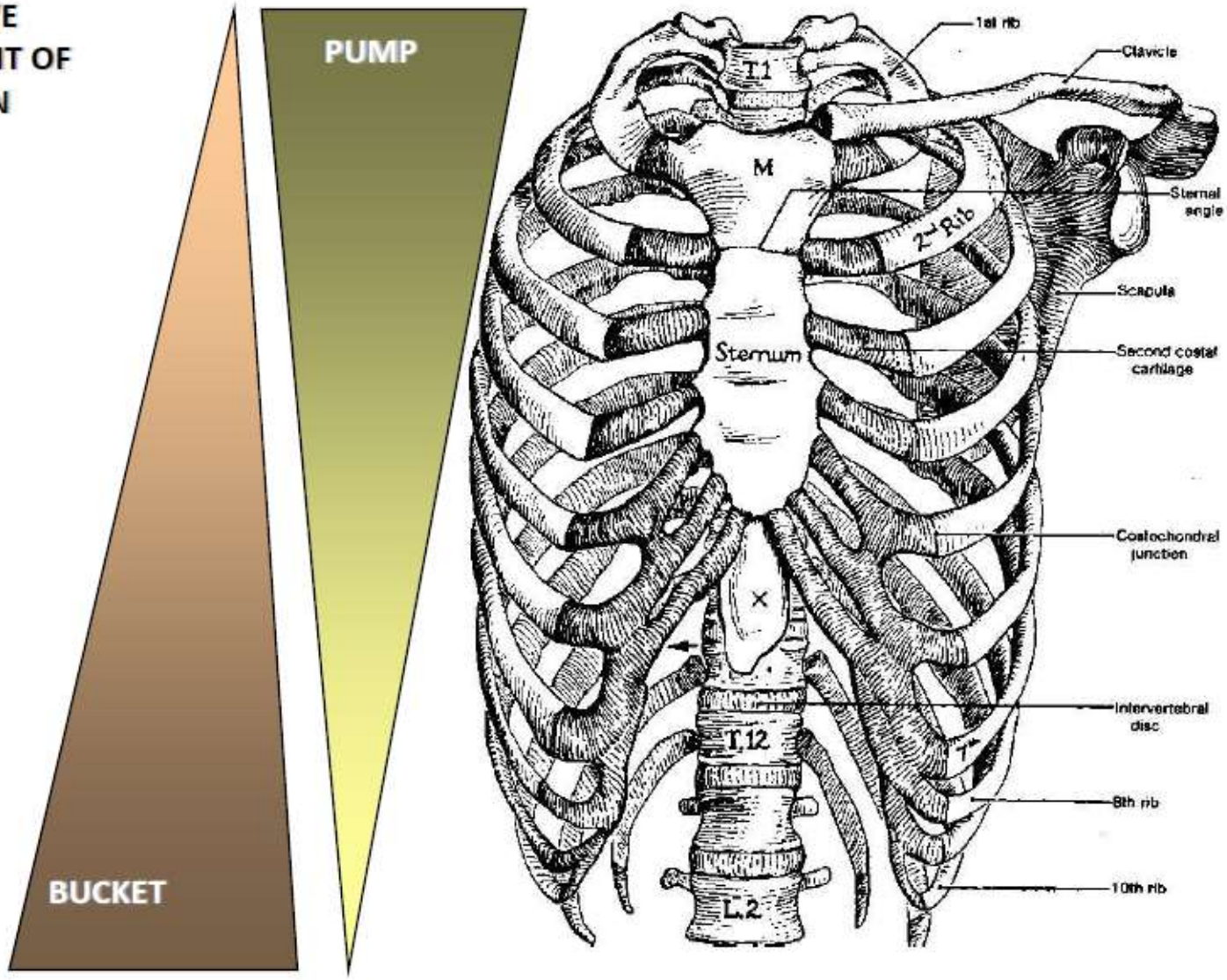
BUCKET HANDLE

The axis is in a more coronal (lateral) plane in the upper ribs

PUMP HANDLE



RELATIVE AMOUNT OF MOTION



Typical Ribs
Inhalation Dysfunction findings

- Diagnostic Findings:
  - TTA or tenderness over costochondral or chondrosternal junctions or posteriorly over rib angles
  - Anterior end elevated
  - Superior edge of posterior angle prominent
  - Anterior end moves cephalad on inhalation
  - Anterior end restricted on exhalation
  - Anterior narrowing of interspace above dysfunctional rib (top of group)
  - Breathing, positional changes, or coughing may cause pain

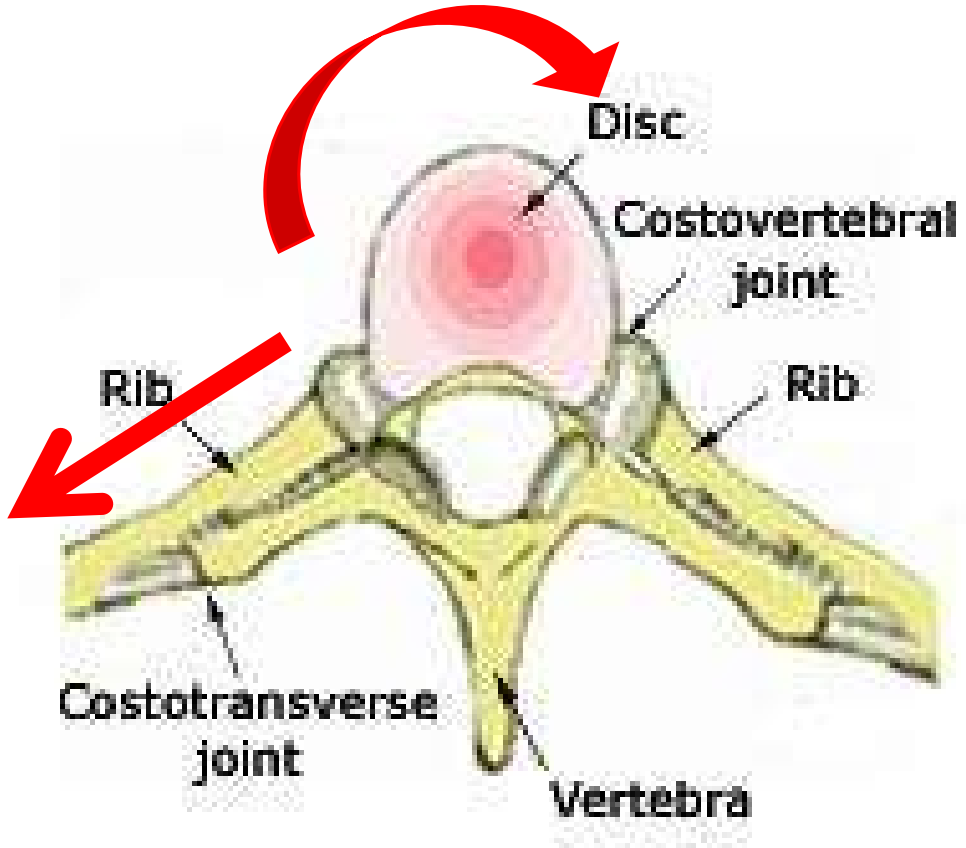
Typical Ribs
Exhalation Dysfunction findings

- Diagnostic Findings:
  - TTA or tenderness over costochondral or chondrosternal junctions or posteriorly over rib angles
  - Anterior end depressed
  - Inferior edge of posterior angle prominent
  - Anterior end moves caudad on exhalation
  - Anterior end restricted on inhalation
  - Anterior narrowing of interspace below dysfunctional rib (bottom of group)
  - Breathing, positional changes, or coughing may cause pain

Influence of Neck Rotation on Rib Articulations

Rotation of neck away from (to contralateral side of) dysfunctional rib

- Gaps costovertebral articulation
- Allows the rib to pivot at the costotransverse articulation
- Most useful closer to c-spine

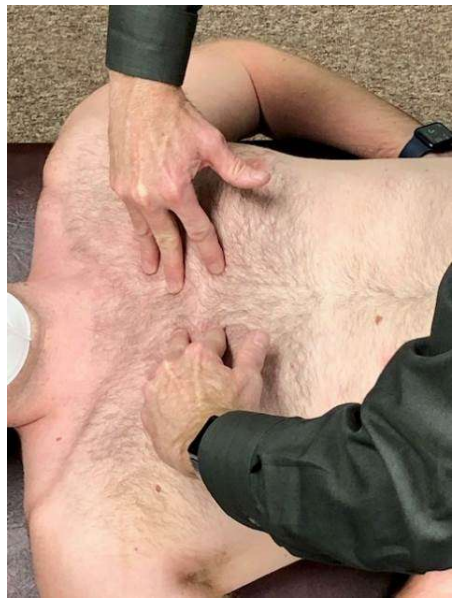


Upper (2-5) Rib Diagnosis

1. Screen by springing ribs anterior to posterior at midclavicular or feeling for global motion with respiration

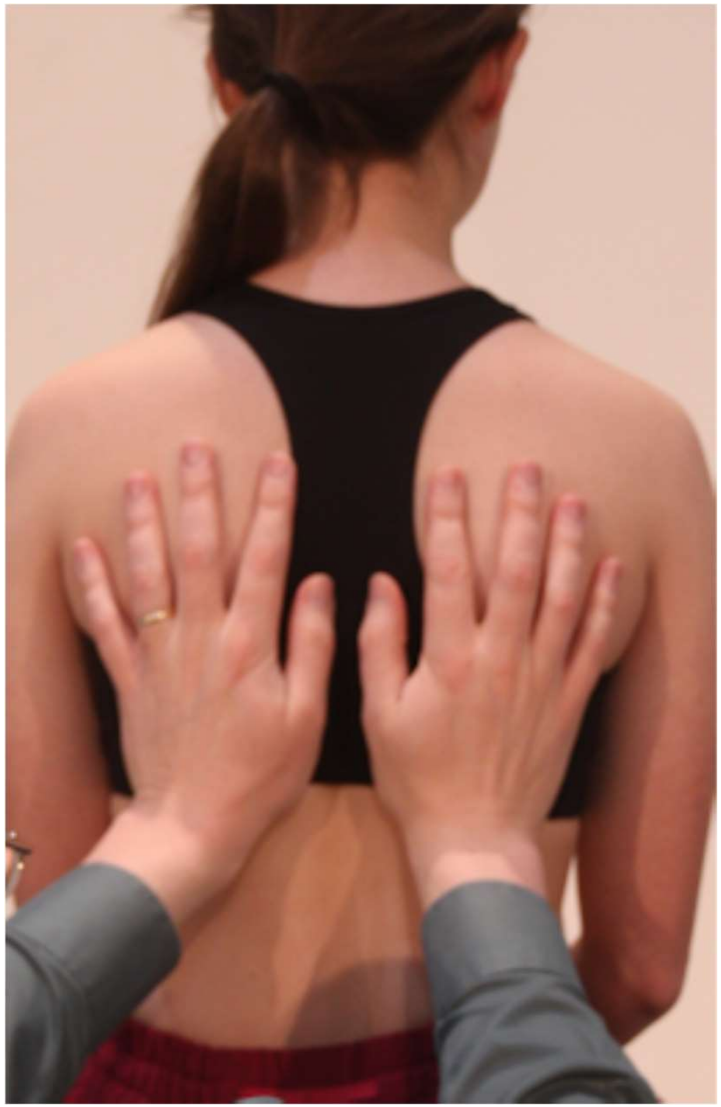
2. With one hand over the restricted rib and the other hand over the contralateral rib, have patient breathe in & out and note the preference of the dysfunctional rib

    *Name dysfunction for way it likes to go

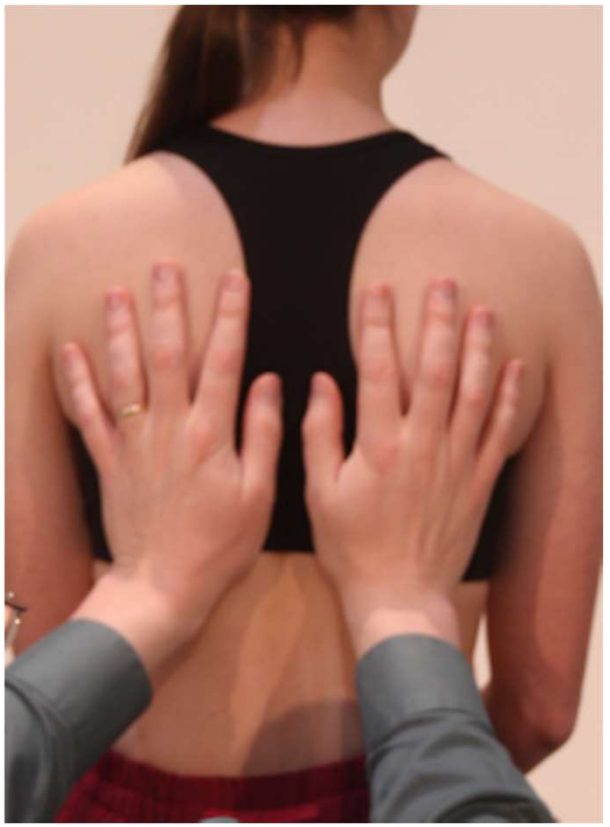


Seated Rib diagnosis

- Place hands over the angles of the ribs bilaterally
- Palpate the reciprocal motion of the ribs
  - On inhalation, the rib angles move inferiorly with breathing



Lab Exercise: Upper Rib Diagnosis



Lower (6-10) Rib Diagnosis

1. Screen by springing ribs lateral to medial at midaxillary line & feeling resistance or feeling for global motion with respiration

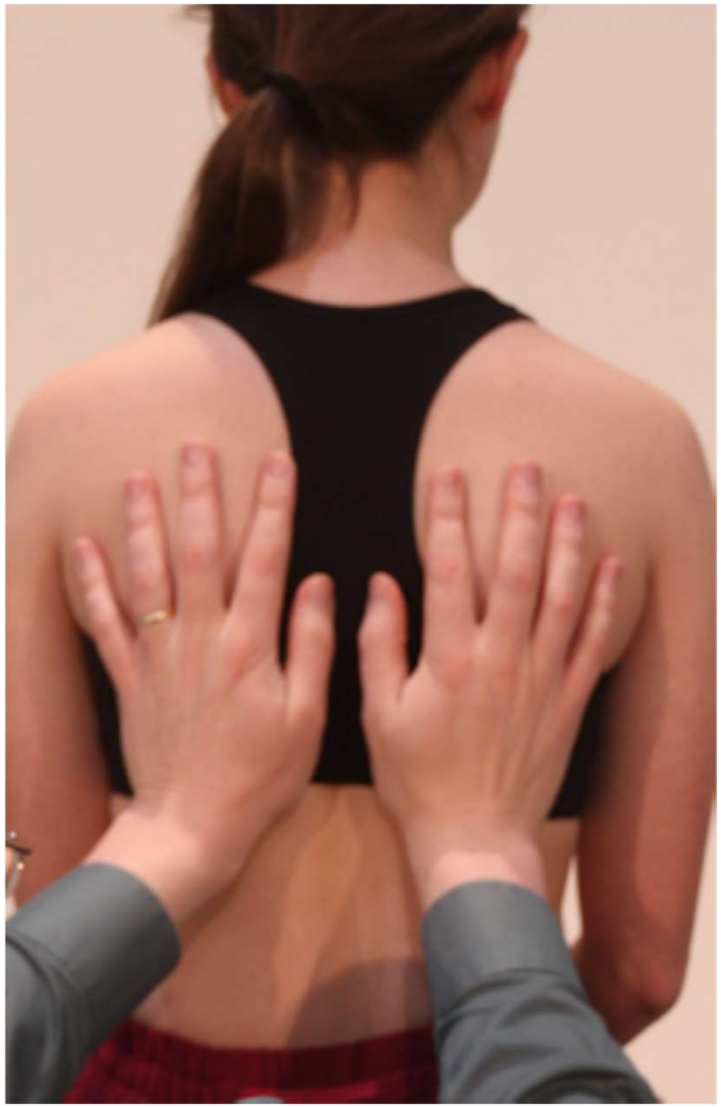
2. With one hand over the restricted rib and the other hand over the contralateral rib, have patient breathe in & out and note the preference of the dysfunctional rib

    *Name dysfunction for way it likes to go

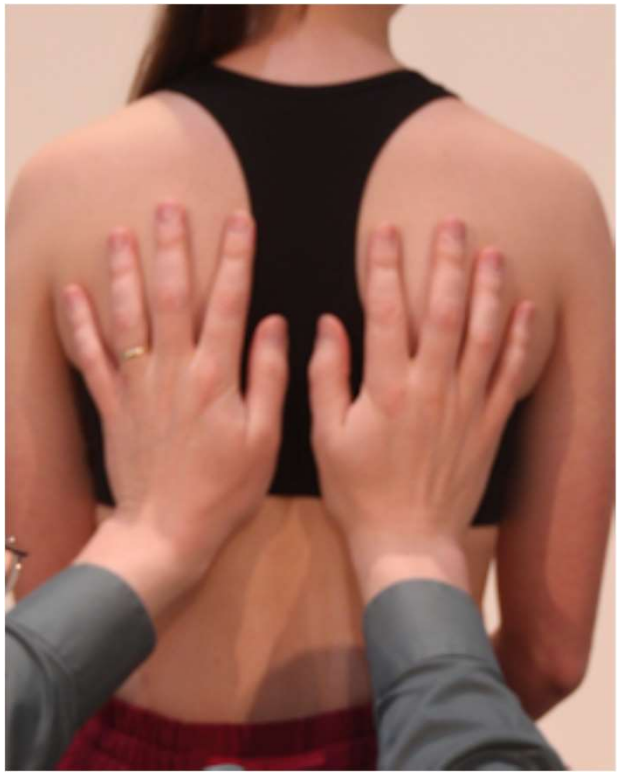
Seated Rib diagnosis

- Place hands over the angles of the ribs bilaterally
- Palpate the reciprocal motion of the ribs

- May wrap hands around lower ribs to feel bucket handle motion

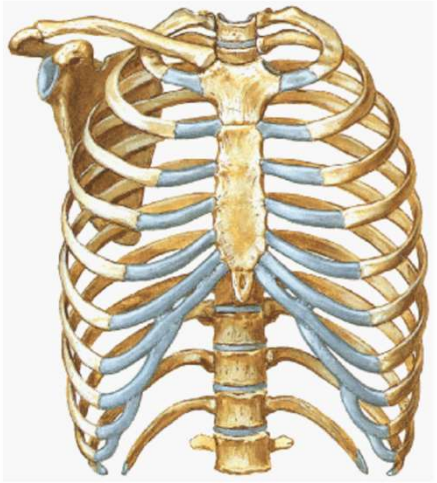


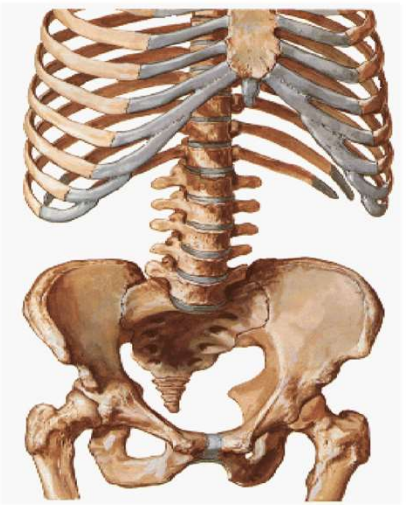
Lab Exercise: Lower Rib Diagnosis



Atypical Ribs 11 and 12

- 11 and 12 are floating ribs; no costochondral or costosternal articulations
- Pincer/Caliper motion– ribs move posteriorly, laterally & slightly superiorly with inhalation and opposite with exhalation)

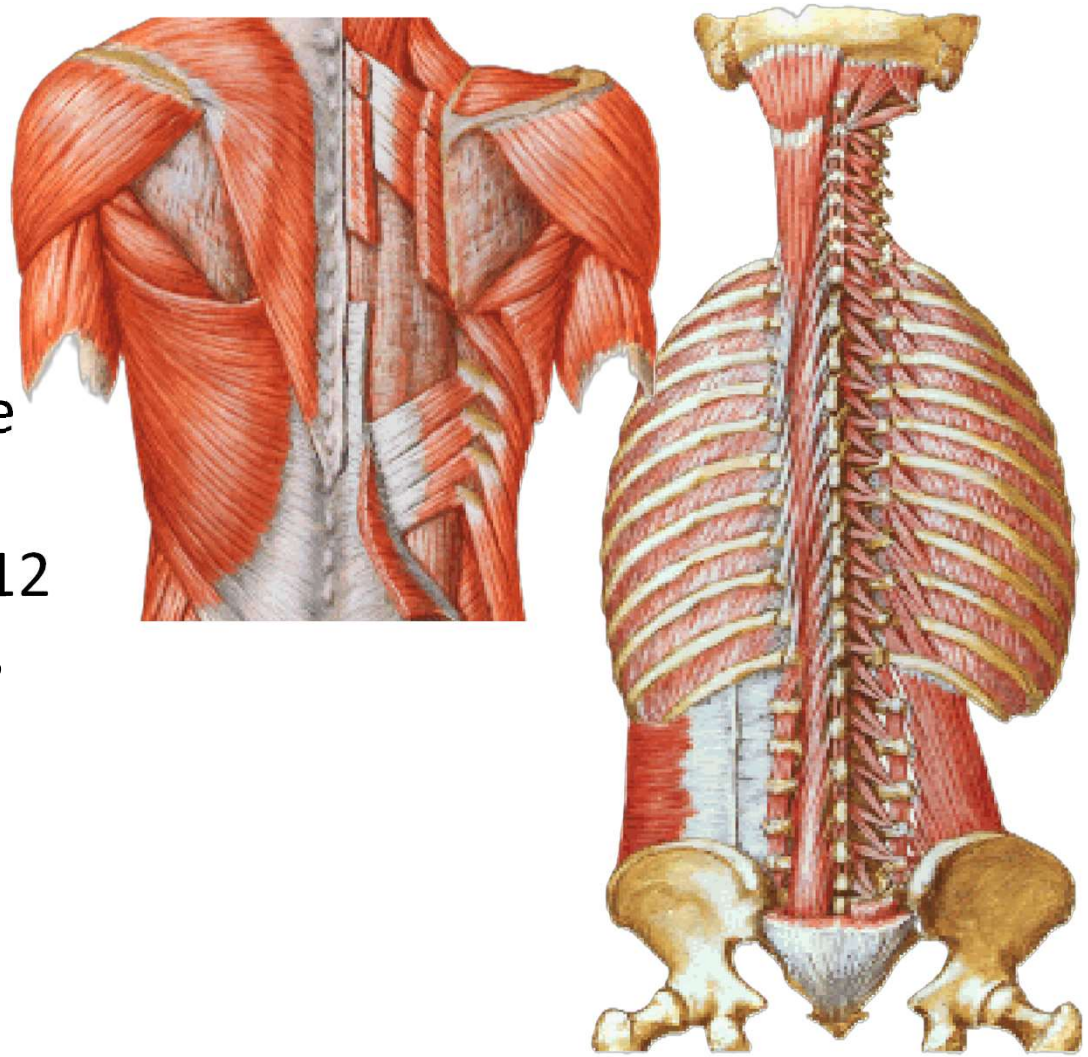




Rib Motion: 11-12

- Latissimus pulls 11 & 12 away from iliac crest & narrows interspaces causing inhalation preference

- Quadratus lumborum pulls 12 down to iliac crest & widens 11 intercostal space causing exhalation preference



Inhalation Dysfunction, Ribs 11-12

- Diagnostic Findings:
  - TTA in intercostal muscles or related musculature
  - Shaft approximates rib above
  - Shaft separates from rib below or the iliac crest
  - Occasionally tip is caught under rib above
  - Tip of rib elevates with inhalation
  - Tip of rib does not fully depress with exhalation
  - Deep aching pain in rib or pain with respiration
  - Tenderness along shaft of rib
    - *Dysfunction may be maintained by intercostal or latissimus dorsi muscle hypertonicity*

Exhalation Dysfunction, Ribs 11-12

- Diagnostic Findings:
  - TTA in intercostal muscles or related musculature
  - Shaft approximates rib below or iliac crest
  - Shaft separates from rib above
  - Occasionally tip is caught under rib below or contacts iliac crest
  - Tip of rib depresses with exhalation
  - Tip of rib does not fully elevate with inhalation
  - Deep aching pain in rib or pain with respiration
  - Tenderness along shaft of rib

- *Dysfunction may be maintained by intercostal or quadratus lumborum muscle hypertonicity*

Atypical Rib 11-12 Diagnosis

- Look for resistance w/ springing anteromedial over ribs 11 & 12 or feel for global motion with respiration
- Feel widths of the 10^{th} & 11^{th} intercostal spaces & direction of tips of the 11^{th} & 12^{th} ribs

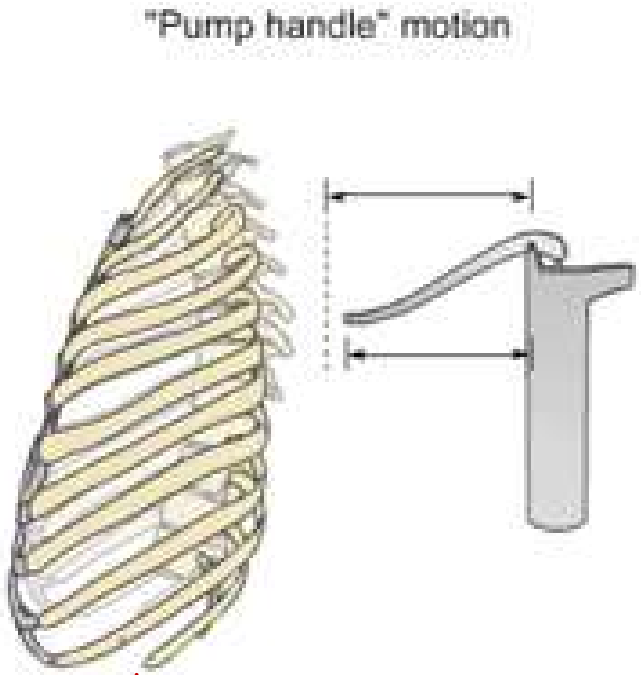
*Naming: For direction of respiratory motion preference.

Seated Rib diagnosis

- Place hands over the atypical ribs bilaterally
- Palpate for motion with respiration.
  - On inhalation, the ribs move posteriorly, laterally & slightly superiorly
  - On exhalation the ribs move anteriorly, medially and slightly inferiorly.

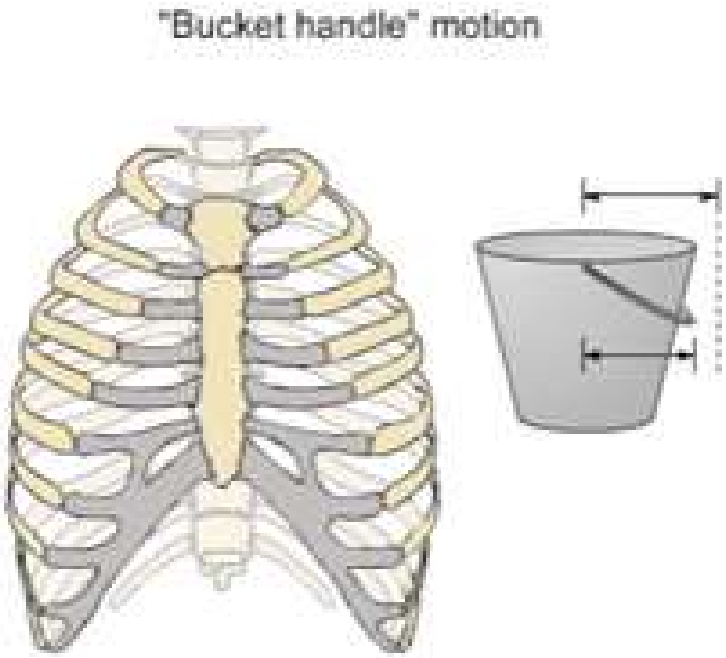
Lab Exercise: Rib 11-12 Diagnosis

Review Pump/Bucket Handle Mechanics



Transverse axis

Increased Anterior Chest Wall Movement via Sternum (upper rib cage)



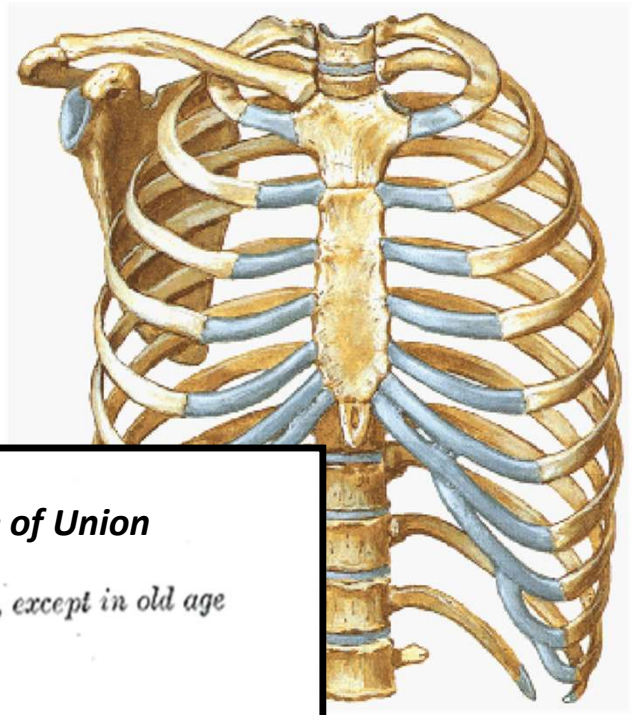
AP axis

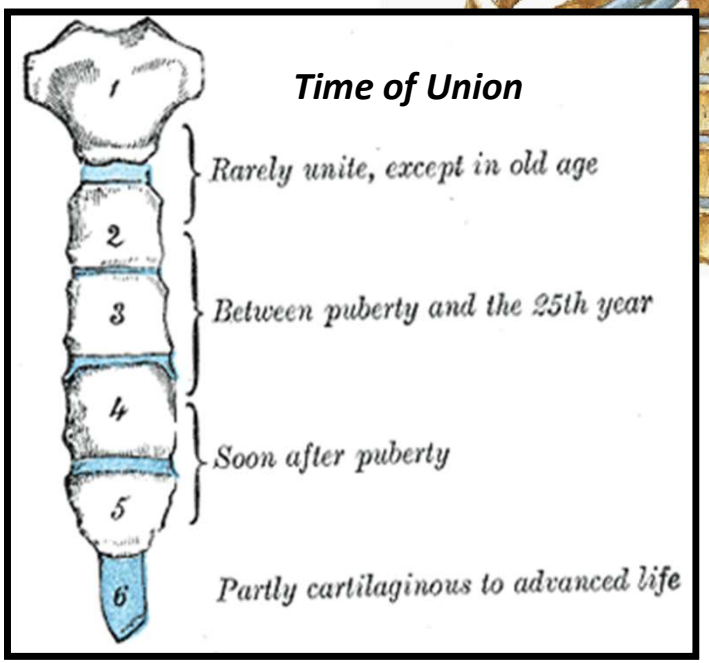
Lateral Chest Wall Movement

More apparent in lower rib cage

Rib Cage Anatomical and Biomechanical Considerations

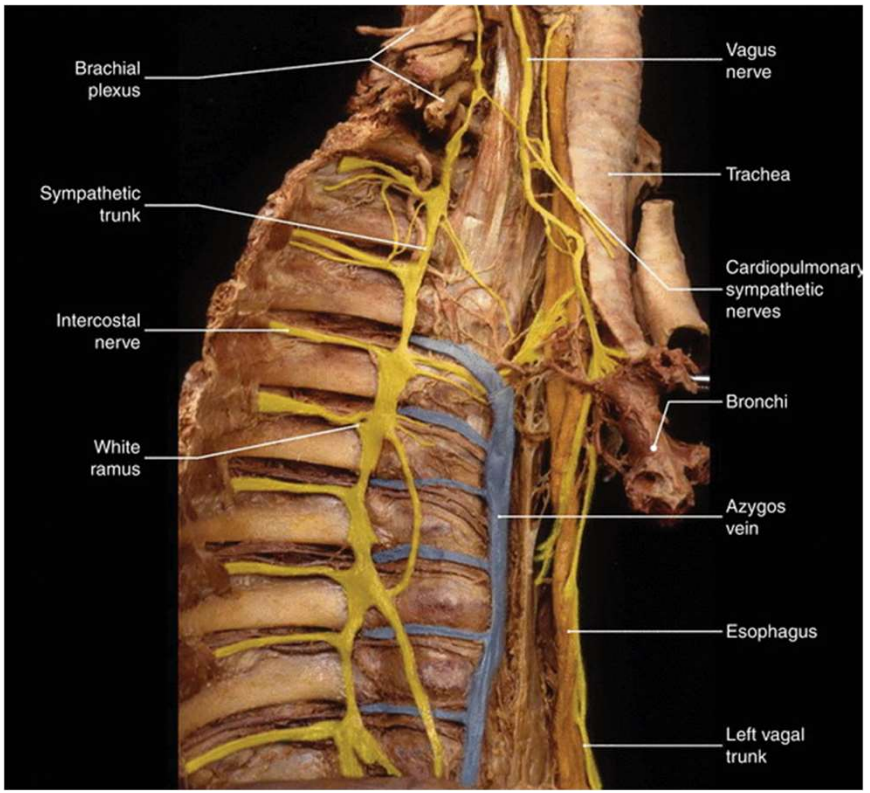
- Anatomy – bone (bendable, twistable), cartilage - costochondral junction
- Foundation of the cervical and upper extremity musculature
- Body position and rib cage shape
- Sternum - The manubriosternal joint tilts approximately 4.4° during the respiratory cycle.





Clinical Significance of Rib Cage SD

- Maximize respiratory efficiency
  - Breathing 16x/min (23,040x/day)
  - Improve ventilation
- Inefficient rib cage mechanics impair lymph drainage (respiratory circulatory model)
- Neurologic consequences
  - Proximity of rib head and sympathetic ganglia
  - Facilitation & altered sympathetic tone



Sympathetic trunk in the upper thoracic region

Abdominal Diaphragm

- Dome shaped thin (2-4mm) musculotendinous structure
  - Sternal attachment – 2 muscle bundles originating from the back of the xiphoid process
  - Costal attachment – Inner surface of the cartilage and adjacent surfaces of lower 6 ribs bilaterally.
  - Lumbar attachment –
    - Medially: body of L1 vertebrae. Laterally: front of TP of L1 vertebrae
    - Right crus attaches to upper three lumbar vertebrae and intervening discs.
    - Left crus attaches to upper two lumbar vertebrae and intervening disc.

Evaluating the Diaphragm

1. Rest hands over lower ribs, thumbs just below the inferior costal margin.
2. Sink through the abdominal wall until the abdominal contents are felt. Press slightly superior to engage the tension of the diaphragm through the upper abdominal organs.
3. Patient inhales and exhales deeply, note:
   - Range and ease of motion in both inhalation and exhalation
   - Right vs left
   - Any paradoxical motion
4. Sequentially evaluate fascial motion in all 3 planes:
   - Rotation
   - Sidebending
   - Flexion/Extension

Abdominal Diaphragm Alternate Handhold

- Posterior hand at T12 & L1
- Anterior hand at inferior sternum, xiphoid process, and contacting inferior anterior rib angles

Lab Exercise – Palpate and Dx the Diaphragm

Remember this, friendly operator, that when this blood leaves the lung it lives and acts as atoms or seeds of life. It has that quality or it could not prove it by its works. Thus the importance of perfect adjustment of every rib, and every vertebra from the head to the coccyx, or the work will fail to show perfection in place, form and function in some part of the body.

A.T.Still, Osteopathy Research and Practice

Grievance Policy

All grievances should be in writing and should specify the nature of the grievance. Initially, all grievances should be directed to MAOPS Executive Director, who will then forward said grievance to the Education & Convention Committee. All grievances will receive an initial response in writing within 30 days of receipt. If the participant does not receive a satisfactory response, then they can then submit a complaint in writing to the Bureau of Osteopathic Education of the AOA at 142 East Ontario Street, Chicago, IL 60611.