Thoracic Cage Respiratory Mobility Deficits

ICD-9-CM:  733.6  costochondritis (Tietze's Disease)

ICF codes:  
Activities and Participation Domain code:  d498  Mobility, other specified  
(Expansion of the ribcage during forceful respiratory movements such as deep breathing, coughing, sneezing or laughing)

Body Structure code:  s4302  Thoracic cage

Body Functions code:  b4402  Depth of respiration  (Functions related to the volume of expansion of the lungs during breathing)

Common Historical Findings:
  Lateral or anterior chest wall pain
  Pain worsens with respiratory movements - especially a deep breath or cough
  Blunt trauma to thorax

Common Impairment Findings - Related to the Reported Activity Limitation or Participation Restrictions:
  Asymmetrical position of rib - anterior/posterior or superior/inferior
  Limited and painful rib mobility with either anterior-to-posterior (AP) glides or posterior-to-anterior (PA) glides of the involved rib
  Tender iliocostalis insertion, and/or intercostal myofascia

Physical Examination Procedures:

Rib Positional Assessment
(Anterior Rib Asymmetry)

Rib Positional Assessment
(Superior Rib Asymmetry)
Performance Cues:
For anterior-posterior symmetry assessment palpate near costochondral junction anteriorly and rib angle posteriorly
For superior-inferior symmetry assessment palpate width of intercostal spaces
Palpate for tenderness and symptom reproduction/provocation in conjunction with palpating for asymmetries

Rib AP Pressures

Rib PA Pressures

Performance Cues:
For AP pressures - stand at side of patient, use gentle pressure, keep fingers in area of xiphoid and clavicular areas
For PA pressures - stand on opposite side of the rib to be assessed, use hypothenar eminence, thumb down - ok to use "dummy thumb" under hypothenar eminence in scapular area
Assess mobility, restriction to movement, and symptom response to pressures
Thoracic Cage Respiratory Mobility Deficits: Description, Etiology, Stages, and Intervention Strategies

The below description is consistent with descriptions of clinical patterns associated with the vernacular term “Rib Dysfunction”

**Description:** Rib dysfunctions involve the ribs and their associated articulations to the vertebral bodies (costovertebral joints), cartilage (costochondral joints), transverse processes of the vertebra (costotransverse joints) or sternum (sternocostal joints). A change in the position or alignment of a rib can put pressure on the soft tissues around where the rib attaches or along edges of the rib where muscles of the thorax attach (sternum) in front or along the side of the spine in back.

With a Stage I disability, the patient may experience inability to perform functional activities, such as overhead work and computer keyboard activity/operation. Patient may be experiencing moderate headaches, changes in breathing patterns secondary to pain, upper limb pain or symptoms suggestive of thoracic outlet syndrome and vague, visceral complaints.

With a Stage II dysfunction, the patient reports less severe symptoms or primary postural-related symptoms. Deficits may be noted in body mechanics and work site positions. With a Stage III dysfunction, the patient’s symptoms are reproduced with activity or work. The primary goal is to improve tolerance to perform occupational or recreational tasks.

**Etiology:** The cause of rib dysfunction is most commonly due to a significant trauma to the chest or sternum from a fall, surgery, or contact sport related injury. This may cause pain with abnormal mobility of the ribs and their joints, poor postural alignment, sprain, costochondral injury, costochondritis or inflammation, dislocation, subluxation, arthritis or infection. Tietze’s syndrome is characterized by benign, localized, and painful swelling of an upper costochondral area, without any evidence of overlying disease.

Slipping rib syndrome is an infrequent cause of thoracic and upper abdominal pain and is thought to arise from the inadequacy or rupture of the interchondral fibrous attachments of the anterior ribs. This disruption allows the costal cartilage tips to sublux, impinging on the intercostals nerves. In most cases it is attributed to luxation of the costal cartilage at the eight, ninth or tenth ribs.

After serious cardiac disease and gastrointestinal problems are ruled out, most non-traumatic chest pain is usually diagnosed as costochondritis or Tietze’s syndrome. Yet non-traumatic causes may be serious diagnoses such as Hodgkins lymphoma and viral/bacterial/yeast infection seen in drug abusers. More attention needs to be focused on the atraumatic diagnoses examination to rule out ones that need to be referred back to the physician.

**Acute Stage / Severe Condition:** Physical Examinations Findings (Key Impairments)

**ICF Body Functions code:** b4402.3 SEVERE impairment of respiratory mobility, (e.g., severely impaired depth of respiration)

- Pain with cough, sneeze, deep breathing, and/or trunk movements
- Pain with rectus abdominus contraction (slipping rib syndrome)
- Pain noted during respiration at the extremes of inhalation and exhalation
• Limited and painful rib mobility with either anterior-to-posterior or posterior-to-anterior glides to the involved rib(s). Painful hypermobility of a rib may be present following some types of traumas or surgical procedures.
• Muscle guarding, tenderness of the intercostal muscles associated with the involved ribs - palpation may reproduce the reported pain with its referral pattern along the costal border.
• Tenderness at the costochondral junction of the involve rib
• Tender iliocostalis insertion and/or intercostals myofascia
• Palpable asymmetrical position of a rib – anterior/posterior or superior/inferior
• Localized tender spot that corresponds to the site of injury
• Pain limited mobility of the thorax and shoulder girdle may be present

**Sub Acute Stage / Moderate Condition:** Physical Examinations Findings (Key Impairments)

*ICF Body Functions code: b4402.2* MODERATE impairment of respiratory mobility (e.g., moderately impaired depth of respiration)

• As above with the following differences
• Pain replication at end of range of one particular movement with or without overpressure; pain at resistance
• A decrease in tenderness and motion restrictions of the involved segment commonly is associated with a reduction in symptoms

**Settled Stage / Mild Condition** Physical Examinations Findings (Key Impairments)

*ICF Body Functions code: b4402.1* MILD impairment of respiratory mobility (e.g., mildly impaired depth of respiration)

• As above with the following differences
• The patient’s unilateral symptoms are reproduced only with end range overpressures in either a combined extension and sidebending motion or a combined flexion and sidebending motion

**Intervention Approaches / Strategies**

**Acute Stage / Severe Condition**

Goals: Decrease pain and inflammation
• Restore normal rib movement
• Restore rib alignment and symmetry

• Physical Agents
  - Cold application, ice or ice pack
  - Electrical stimulation, combined with ice
  - Ultrasound
• External Devices (Taping/Splinting/Orthotics)
  Consider taping procedures for hypermobile rib (placing tape along the rib attachment to temporarily keep it from moving, helps to hold the rib still while giving the soft tissue around the rib a chance to heal)
  May use a direct pressure pad over costochondral joint. A rib belt or strapping may be used to hold the pad in place. Union of acute costochondral separation occurs slowly, typically ~ 6-8 weeks

• Manual Therapy
  Soft tissue mobilization to restricted intercostal myofascia
  Joint mobilization to restricted rib movement to restore normal symmetry and mobility – including isometric mobilizations
  Joint mobilization to thoracic spine segmental motions associated with rib dysfunction(s)

• Therapeutic Exercises
  Segmental breathing exercises maintain and enhance gain in mobility from soft tissue and joint mobility
  Thorax extension and flexion and rotation exercises
  Shoulder girdle and upper extremity mobility exercises
  Normal breathing pattern retraining with Pursed Lip Breathing, which takes less excursion and same amount of oxygen than closed mouth breathing.

• Re-Injury Prevention Instruction
  Limit contact sports for 3-4 weeks

Sub Acute Stage / Moderate Condition

Goal: Reduce deficits in posture, strength, flexibility, coordination, and body mechanics

• Approaches / Strategies listed above – focus on promoting/maintaining rib symmetry, normal respiration, and normal trunk mobility

• Physical Agents
  Heat application alternating with cold

• Manual Therapy
  Passive treatments should be used cautiously and only to rapidly facilitate a patient into an active rehabilitation program

• External Devices (Taping/Splinting/Orthotics)
  If the symptoms have resolved, the athlete may return to sports participation in 7-10 days with lower chest strapping
• Therapeutic Exercises

Add progressive resistive exercises, stabilization and postural exercise. These should be designed to improve the movement restriction and re-educate or stretch the appropriate muscle groups that assist in normal movement in postural alignment.

Settled Stage / Mild Condition

Goal: Improve tolerance to perform occupational or recreational tasks.

• Approaches / Strategies listed above – focus on long-term strategies for good posture, ergonomics, prevention, and exercises

• Therapeutic Exercises
  Maintain and increase general fitness through low-stress aerobic and general conditioning exercises

• Ergonomic Instruction
  Perform work site evaluation and intervention if indicated

• Re-injury Prevention Instruction
  Teach bracing techniques to athletes

Intervention for High Performance / High Demand Functioning in Workers or Athletes

Goal: Return to desired occupation or leisure time activities

• Approaches / Strategies listed above – focus on long-term strategies for good posture, ergonomics, prevention, and exercises

• Therapeutic Exercises
  Encourage participation in regular low stress aerobic activities as a means to improve fitness, muscle strength and prevent recurrences
  Incorporate a regulated program to allow the athlete to return to their sport without re-injury
Selected References


RIB PHYSICAL EXAMINATION

*Structure*: Symmetry of Rib Contours:
- Anterior/Posterior
- Superior/Inferior
- Intercostal Spaces

*Active Movements*: Inhalation, Exhalation:
- Lateral/Medial Motion
- Anterior/Posterior Motion
- Superior/Inferior Motion

*Passive Movements*:
- AP Glides (supine)
- PA Glides (prone)
- Lateral Glides (sidelying)
- Inferior Glide of 1st Rib

*Palpation*:
- Rib Angle/Iliocostalis
- Intercostal Myofascia
- Costocondral Articulation

RIB MANUAL TREATMENT

*Patient Problem: Limited 1st Rib Inferior Glide*

ST MOB: Scalene Myofascia

JNT MOB: Inferior Glide (sitting and supine)
- Inferior Glide combined with contralateral scalene contraction

RE-ED: Ipsilateral scapular posterior depression

*Patient Problem: Limited Rib Posterior Glide*

ST MOB: Intercostal Myofascia

JNT MOB: Posterior Glide (supine)
- Posterior Glide combined with ipsilateral serratus anterior contraction

RE-ED: Lateral Expansion

*Patient Problem: Limited Rib Anterior Glide*

ST MOB: Intercostal Myofascia

JNT MOB: Anterior Glide (prone)
- Anterior Glide combined with ipsilateral pectoralis major contraction

RE-ED: Anterior-Posterior Expansion
Impairments: Positional Rib Asymmetry  
Limited Rib Posterior Translation

Rib Posterior Glide with Isometric Mobilization

Cues:  Passively glide the involved rib and its costal cartilage posteriorly  
Elicit serratus anterior contraction to provide additional posterior glide mobilization  
Be precise with your manual resistance to ensure that pectoralis major is not facilitated  
(i.e., contact only the posterior surface)
Impairments: Positional Rib Asymmetry
Limited Rib Anterior Translation

Rib Anterior Glide with Isometric Mobilization

Cues: Passively Glide the involved rib anteriorly
Elicit pectoralis major contraction to provide additional anterior glide mobilization
The anterior passive force is countered with the pectoralis major resistance force
(This keeps the patient balanced on his/her ischial tuberosities).
Impairment: Positional Asymmetry of the 1st Rib
Limited Left 1st Rib Inferior Glide

Cues: Sidebend head slightly to the left to lessen tension on the left upper trapezius and scalene myofascia
Contacting the 1st Rib with the index finger metacarpal head using a “flat palm” (slightly supinated and extended wrist) is usually the most comfortable for the patient
Swinging your stool a bit to the right may help line up your forearm to allow a more “connected” weight shift
Elicit a sustained contraction of the right scalenes to reciprocally inhibit the left scalenes during the mobilization
Consider using a sitting 1st rib inferior glide if a stronger mobilizing force is indicated

The following reference provides additional information regarding these procedures: