

TOPIC OULINE 6 – THE THORACIC CAGE.

Introduction.

The thoracic cage is made up of twelve pairs of ribs, the sternum, twelve thoracic vertebrae and their intervertebral discs.

The main function of the thoracic cage is protection. Anterior protection to the heart and lungs are provided by the sternum and ribs. Posterior protection is provided again to the lungs and heart by the thoracic kyphosis and ribs.

The thoracic cage is also responsible for respiration. Along with both primary and secondary muscles of respiration the ribs play an important role in allowing full inspiration and expiration.

As the main function of the thoracic cage is protection, this area of the body is relevantly immobile, but the body's adaptation for respiration lies in the mobility of the ribs.

The thoracic cage is a common area in which patients complain of pain, therefore a full understanding of the anatomy and biomechanics is essential in formulation a diagnosis.

Initial Regional Inspection.

Observation of this area should include,

- Gait, Antalgic posture
- Aysmmetry, it is not uncommon for the patients dominant side to be more developed.
- Discolouration
- Rashes, Herpes Zooster (Shingles)
- Chest Deformities, Barrel chest, Pigeon chest
- Winging of the scapulae, serratus anterior dysfunction
- Scoliosis/ kyphosis
- Scars, surgical or traumatic.

SCARS.

The thoracic cage is a common site for surgical scars,

- lungs – these scars tend to be crescent shaped extending under the shoulder. (pneumothorax repair, lung cancer etc...)
- Heart – these tend to be in the mid-line and anterior, often accompanied with a scar on the inside of the leg for a bypass operation. Childhood cardiac scars may not be as evident and chest hair can hide scars.
- Breast – Biopsy or mastectomy are the most common visible scars.
- Moles – the most common cause of surgical scars on the body.

Ref (Passor – Musculoskeletal Physical Examination Competencies Lists 2000 – 2001)

Once a regional initial inspection has been carried out, palpation of the bony structures is carried out.

Palpation of Anterior Bony Landmarks

This palpation is carried out with the patient seated and the practitioner positioned behind them.

1. Suprasternal notch
2. Sternoclavicular joints
3. Clavicles
4. Sternal angle
5. Costal cartilage Rib2
6. Sternochondral joint of Rib2
7. Costosternal joint of Rib2
8. 2nd Intercostal space
9. Rib2 to angle
10. Remaining Ribs, costochondral & sternochondral joints and intercostal spaces
11. Angle of the costal cartilage
12. Common costal cartilage
13. Xiphoid

The palpation begins by locating the medial aspect of the clavicles. From this point, “drop” into the suprasternal notch. Swelling could be indicative of sternoclavicular displacement or mediastinal shift. The palpation of the suprasternal notch ends with assessing the movements of the sternoclavicular joints by the patient elevating and depressing their shoulders. Assess for pain and crepitation.

The clavicles are next to be palpated. Assess for symmetry of shape, lack of continuity (fracture), tenderness or calluses formed by previous fractures.

The palpation is continued laterally to the tip of the shoulder, marked by the acromion of the scapula. This landmark articulates with the lateral aspect of the clavicle at the acromioclavicular joint. To assess this joint, the patient is asked to flex and extend their arm. Assess for pain and crepitation which may indicate degenerative changes.

The suprasternal notch is re-visited, and palpate inferiorly along the manubrium to the anteriorly angled sternal angle (angle of Louis) which reflects the site of the manubriosternal joint.

From the angle of Louis, palpate laterally to assess the junction of the 2nd costal cartilage. Assess for symmetry and tenderness.

The body of the sternum is palpated, assessing for irregularities. The palpation returns to the manubriosternal joint, and the 2nd rib. Palpate inferiorly to the rib to find the intercostal space, then the 3rd rib.

The process is repeated for ribs 2 to 7 from their attachment at the sternum to their angles.

The sternal body is re- contacted. Palpate inferiorly to the xiphoid process. The xiphoid process is often tender, therefore care must be taken when palpating this structure.

Continue palpating inferolaterally along the common costal cartilage to the lateral angulation in the cartilage. This is normally level with the 9th rib, and is an important anatomical landmark for the following structures:

- Posteriorly it is level with the head of 12th rib
- Posteriorly it is level with the SP of L1
- Level with the pylorus of the stomach
- It is the site where the rectus abdominus crosses the costal margin
- On the right, it is roughly over the fundus of the gall bladder.

The palpation is continued along the common costal cartilage, assessing for symmetry, lack of continuity and tenderness until rib 10.

The Floating Ribs

Palpation of the floating ribs is best carried out in 3 stages.

1. The joint between rib 10 and the costal cartilage is located.
2. Palpate from this point inferiorly and posteriorly (with pressure directed posteromedially). At this point rib 11 should be palpated.
3. Palpate slightly inferiorly and repeat to locate rib 12.

The First Rib

The Supraclavicular fossa is contacted. The upper fibres of trapezius are drawn back posteromedially. The head of the first rib should become palpable.

The rib is assessed for tenderness, size and the distance it moves during a cycle of respiration.

If the patient has a cervical rib, the palpation will normally reveal a marked difference from one side to the other assuming the anomaly is unilateral.

Palpation of the Posterior Bony Landmarks

The palpation of the posterior rib cage can be conducted sitting or prone and contains the following landmarks:

1. Thoracic SPs
2. Thoracic TPs
3. Costovertebral Joints
4. Rib Angles

5. Rib 11
6. Rib 12
7. Rib 1

Sitting

The palpation begins by assessing the SP's of the thoracic spine, beginning at C7 and palpate inferiorly one at a time until T12. Assess the alignment (AP and lateral) and for tenderness. The SP's of C7 and T1 are the most prominent.

Note the change in the size and shape of the SP's, from being cervically orientated to more "hatchet" shaped moving to the lumbar.

As a rough guide, T3 is level with the spine of the scapula, and T7 with the inferior lateral angle of the scapula.

Prone

The patient is prone and the SP's of the thoracic vertebra are palpated once again.

Approximately 2cm either side of the SP's a line of smaller tubercles should be palpated. These smaller tubercles are located on the posterior aspect of the TP's and correspond to the costotransverse joints. Tenderness could indicate a joint dysfunction or muscular injury.

Palpating laterally from the tubercles the thoracic TP's are assessed. The TP's pass superiorly and laterally, and those of the typical thoracic vertebrae are in line with the upper part of the body of the corresponding vertebrae. The SP's pass inferiorly and posteriorly.

Just beyond the TP's, the shaft of each rib can be felt passing inferiorly and laterally around the chest wall. The angles of the ribs are the first landmarks to be palpated clearly, particularly if the scapula is drawn anteriorly.

Orthopaedic Examination.

The thoracic cage is considered both a midline structure (vertebrae) as well as a bilateral structure (ribs). For an accurate clinical examination as with any spinal examination pure movements must be carried out. Assessment of the ribs must be carried out with the asymptomatic side first, assessing for ease, quality and range of movement and also as a comparison for the symptomatic side.

Normal Range of Movement.

Thoracic cage mobility will alter with age and trauma, normal average range of movements are suggested as

- Flexion – 50 °
- Extension – 10°
- Rotation – 30°
- Side bending – 20° – 40°

Ref: The Physiology of the Joints, I.A.Kapandji Volume 3 The Trunk and Vertebral Column.

Active Movements.

Testing will include:-

STANDING.

- Flexion
- Extension
- Rotation
- Side bending

SITTING

- as above with assessment of rib function.

Passive Movements.

SITTING

- Flexion
- Extension
- Rotation
- Side bending
- Rib assessment.

Special Tests.

The special tests for this topic include spinal/rib fracture tests.

The thoracic spine is susceptible to two main causes of fractures, pathological or traumatic.

Pathological fractures would include vertebral crush fractures caused by, most commonly Osteoporosis or secondary metastasis from the thoracic/abdominal viscera. Other causes would include:- Tuberculosis (TB).

Traumatic fractures usually affect the ribs but if the trauma is severe the vertebrae can also be affected.

Pathological conditions would also affect the ribs, most commonly osteoporosis/ secondary metastasis. A complication of rib fractures is a

Pneumothorax. This is when the fractured rib pierces the plural cavity, altering the controlled thoracic pressure.

As a general rule, dependent of presenting symptoms, a fracture above T4 is considered to be due to secondary metastasis, below T8 is considered to be osteoporotic.

The symptoms the patient will present with include:-

- Acute pain. Localised for a rib, Deep spinal/central for the vertebra
- Shortness of breath
- Difficulty on movement
- Localised inflammation
- Muscle spasm/guarding
- Antalgic posture

SPINAL VIBRATION TEST.

Using a tuning fork, assessing for reproduction of pain. The tuning fork is placed on the spinous processes of either a couple of vertebra above or below the suspected fracture site.

If the patient has a fracture, a “welling” pain should be reproduced the closer the vibration reaches the fractured vertebra.

A “welling” pain is described as a sharp local pain gradually becoming generalised, lasting longer than ten seconds. (Like ripples in a pond)

The vibration test can be used to assess rib fractures.

SPINAL PERCUSSION TEST.

As with the vibration test, the same principles apply.

The percussion is carried out using the practitioner’s fingers.

In accordance with the ‘Chartered Society of Physiotherapists’ the spinal percussion test is only 25 % reliable as an acute rib lesion or somatic dysfunction will mimic either a vertebral/rib fracture.

STERNAL COMPRESSION TEST.

This test is only considered if both vibration and percussion tests are negative. It is considered acceptable to apply this test in assessing for a hairline fracture of the ribs. An anterior/posterior contact is taken with the patient sitting up straight. A sternal contact and a T3/4 contact is taken and a gentle compression is applied. The intensity of the compression is increased until either acute pain is felt or no symptoms are reported.

The compression will put a stress on the most common area for a rib fracture, from the rib angle to the mid – axillary line.

In accordance with the ‘Chartered Society of Physiotherapists’ this test like the percussion test is unreliable as rib lesions, intercostal muscle spasms will mimic a hairline fracture.

It has also been suggested that a sternal compression may result in a pneumothorax.

As with all orthopaedic tests once pain is reported the test is terminated. If a patient reports “welling” pain on the vibration test, **NO FURTHER TESTS ARE NECESSARY.**

The tests above will allow you to confirm your suspicions of a fracture, but are not always accurate. The most accurate diagnostic tool available for a fracture is an x-ray.

Your clinical findings should be recorded as your observations.