ANATOMY TEAM

Lecture (2)

Muscles Involved in Respiration

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OBJECTIVES

At the end of the lecture, students should:

- ***Describe the components of the thoracic cage and their articulations.***
- ***Describe in brief the respiratory movements.***
- ***List the muscles involved in inspiration and in expiration.***
- ***Describe the attachments of each muscle to the thoracic cage and its nerve supply.***
- ***Describe the origin, insertion, nerve supply of diaphragm.***

تنويه / هذا العمل لا يعتبر مصدر أساسي للمذاكره وإنما هو للمراجعه فقط والمصدر الاساسي هو السلايدز ، توجد إضافة لدى الأولاد وهي كالتالي :

DIAPHRAGM

- **Convex toward thoracic & concave toward abdominal cavity**
- **Attached to: sternum, costal cartilages,12th rib & lumbar vertebrae**

SUMMARY OF RESPIRATORY MOVEMENTS

Inspiration

- **Quiet Inspiration (active)**

Contraction (Descent) of diaphragm → Increase in **vertical** diameter

Elevation of ribs (external intercostal) → Increase in:
- **anteroposterior** diameter
- **lateral** diameter

- **Forced Inspiration (active)**

Accessory muscles of inspiration:
1. Pectoralis major
2. Scalene muscles

Expiration

- **Quiet Expiration (passive)**

1. Elastic recoil of lung
2. Relaxation of diaphragm & external intercostal

- **Forced Expiration (active):**

Contraction of anterior abdominal wall muscles → Compression of abdominal viscera → Ascent of diaphragm

Depression of ribs (rest of intercostal muscles)

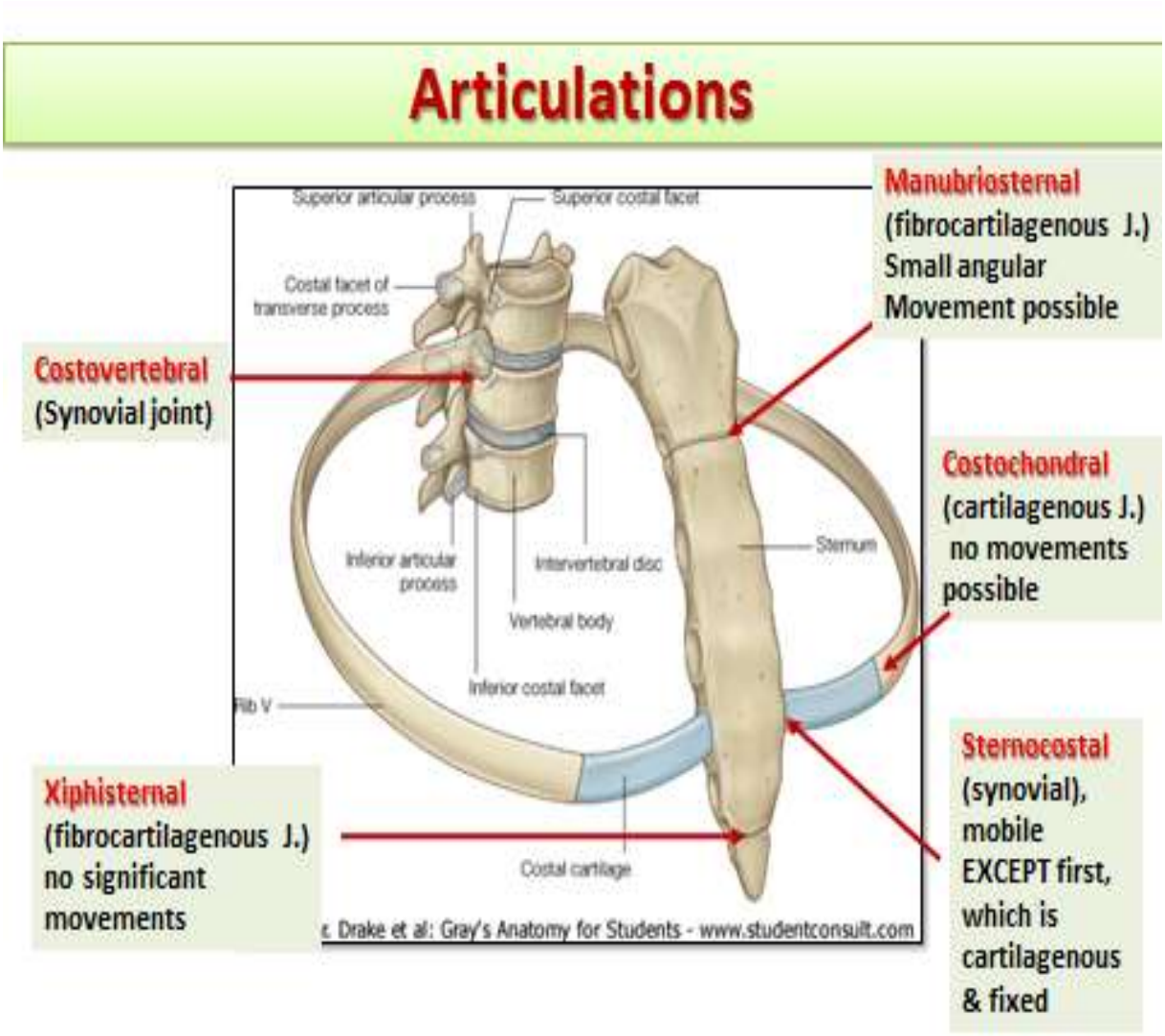
QUESTIONS

- **Are the following muscles have a respiratory role? If yes, what is it?**

1. Levatores costarum.
2. Serratus posterior superior.
3. Serratus posterior inferior.
4. Pectoralis minor.
5. Serratus anterior.
6. Latissimus dorsi.
7. Quadratus lumborum.

- **Why diaphragm is supplied by cervical nerves?**
- **Why right crus of diaphragm is larger than left crus?**

عند البنات فقط :



NOTES

Clinically, the superior opening of the thorax is called “Inlet” not the outlet because they follow the structure from the neck to the Thorax.

Angular movement allow the body of the sternum to move on the manubrium “*Inward and Outward*”

Each costal cartilage has 2 joints: one with the Sternum “**Sternocostal**” and the other with the Rib “**Costochondral**”

All the Sternocostal joints are SYNOVIAL so they are MOBILE Except the first rib which is Fixed and cartilaginous.

The 2 joints are helping in respiration: *Sternocostal and Manubriosternal*.

Diaphragm (most important muscle) in respiration

The normal Expiration needs no muscles

Thickening of the deep fascia is forming the lateral and medial arcuate ligaments.

Some fibers arising from the right and left sides of the lumbar vertebra to form gap for the Aorta passage

Right crus is longer than the left crus and it attach to (L1,2 and 3) while the left crus attach to (L1 and L2).

The aponeurosis of the 3 muscles on both sides fuse in the midline to form linea alba→ يعني الخط الأبيض

REVIEW QUESTIONS:

What form the thoracic cage?

Anteriorly → STERNUM + COSTAL CARTILAGES

Laterally → RIBS

Posteriorly → THORACIC VERTEBREA

What are the differences between the Superior and Inferior openings?

Superior	**Narrow and opened contineusly with the neck**
Inferior	Wider and closed by the diaphragm

Articulations that happened at the Thorax

With the Sternum 3:

Manubriosternal fibrocartilagenous Small angular Movement possible

Xiphisternal fibrocartilagenous no significant movements

Sternocostal (synovial), mobile EXCEPT first, which is cartilagenous & fixed

With the Vertebrae

Costovertebral (Synovial joint)

With the Ribs

Costochondral cartilagenous
No movements possible

Movements of Ribs:

PUMP HANDLE MOVEMENT	**Increase in antero-posterior diameter of thoracic cavity**
BUCKET HANDLE MOVEMENT	**Increase in lateral diameter of thoracic cavity**

Normal **Inspiratory Muscles** are: the Diaphragm and External intercostal muscles

Some of accessory muscles (only used during forced inspiration):

1. Scalene muscles
2. Pectoralis major

Origin of the Diaphragm

1. **Sternal:** xiphoid process of sternum
2. **Costal:** lower 6 costal cartilages & 12th rib
3. From medial & lateral arcuate ligaments
4. **Vertebral:** as right crus from upper 3 lumbar vertebrae & left crus from upper 2 lumbar vertebrae

Insertion: Fibers converge to join the central tendon

Nerve supply: phrenic nerve (C3,4,5)

Action: contraction (descent) of diaphragm increases vertical diameter of thoracic cavity (essential for normal breathing)

MUSCLES	Attachments:	Nerve supply:	Action:
EXTERNAL INTERCOSTAL	from lower border of rib above to upper border of rib below Direction of fibers: downward & medially	intercostal nerves (T1-T11)	rib elevators (inspiratory)
Scalene "Accessory"	**From cervical (5,6,7) vertebrae** **To 1st & 2nd ribs** **5 and 6 to first rib** **7 to second rib**	-	**elevate 1st & 2nd ribs** (inspiratory)
Pectoralis major "Accessory"	**From sternum + costal cartilages** **To the humerus**	-	**increases antero-posterior diameter of thoracic cavity, when arm is fixed (inspiratory)**

Rib depressors:

- **Internal intercostal**
- **Innermost intercostal**
- **Subcostals**
- **Transversus thoracis**

Direction: upward & medially

Nerve supply: intercostal nerves (ventral rami of T1-T11)

Anterior abdominal wall muscles: "forced expiration"

- **External oblique**: downward and medially
- **Internal oblique:** upward and medially
- **Transversus abdominis:** transverse
- **Rectus abdominis:** vertical

Nerve supply: lower intercostal nerves (T7 – T11), subcostal nerve (T12) and first lumbar nerve.

MCQs

1) The shape of the thoracic cage is:

1- Triangle
2- Pyramid
3- Conical

2)The ……..aperture is narrow but the…….. is wide:

1- Superior, inferior

2-anterior, superior

3- inferior, anterior

3)Synovial joints of the thoracic cage:

1- costovertebral and manubriosternal

2- sternocostal and costochondral

3- sternocostal and costovertebral

4)The only Cartilaginous joint is:

1-costochondral

2-sternocostal

3-costovertebral

5) Contraction of the diaphragm will increase.....diameter during.....:

1-Transversal, inspiration

2-vertaical, inspiration

3-vertical, expiration

6) BUCKET HANDLE MOVEMENT will increase.....diameter:

1-Anteroposterior

2-lateral

3-posterior

7)All of these are origin for the diaphragm EXCEPT:

1-upper 6 costal cartilages

2-medial and lateral arcuate ligaments

3-right and left crus

8) Direction of fibers of the External intercostal muscles is:

1-Upward & medially

2- downward & medially

3- downward & laterally

9)Scalene muscles are… in number and inserted in…..ribs:

1- 3, 1st and 2nd

2- 2, 1st and 2nd

3- 3, 4^{th} +5^{th}

10) Action of Pectoralis major is increases …….. diameter of thoracic cavity

1- antero-medially

2-antero-laterally

3- antero-posterior

11) Neurovascular plane in thoracic cavity going between:

1- skain and facia

2- External intercostal and internal intercostal

3-internal intercostal and innermost intercostal

12) Direction of fibers of the Internal intercostal muscles is:

1--Downward& laterally

2- Downward & medially

3- Upward& laterally

The Answers

1	**3**
2	1
3	3
4	1
5	2
6	2
7	1
8	2
9	1
10	3
11	3
12	1