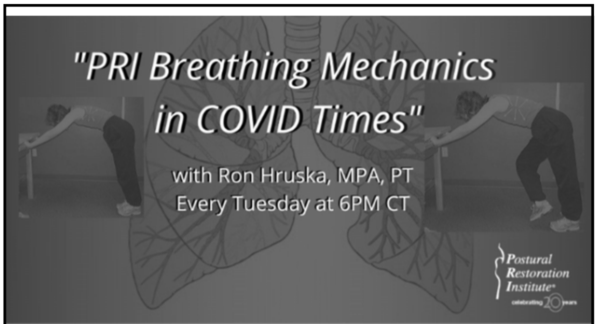

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This week, I am going to review how we can maximize our lung function by centering our trachea, providing compression to the lungs dead space during inspiration, and how to begin repositioning the chest wall for "reportioning" of associated respiratory bronchioles of respiratory zones.

RESPIRATORY TRACT

Upper Airway

- Nose
- Nasal passages
- Paranasal sinuses
- Pharynx
- And the portion of the larynx above the vocal folds or vocal cords

RESPIRATORY TRACT

Lower Airway

- Larynx
- Trachea
- Bronchi (primary, secondary and tertiary)
- Bronchioles
- Lungs (alveoli)

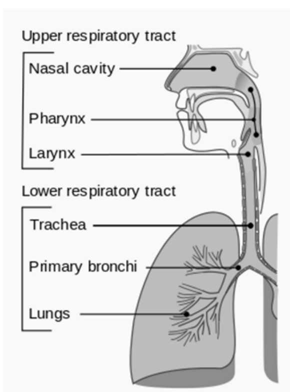


Image from: https://en.wikipedia.org/wiki/Upper_respiratory_tract_infection

TRACHEA, ROOTS (HILUS), AND MAIN STEM BRONCHI

The lungs are connected to the upper airways by the trachea and the main stem bronchi.

The root or the hilus of the lungs lies in front of the fifth, sixth and seventh thoracic vertebrae.

The part or cavity inside our chest wall, that houses the heart, thymus gland, portions of the esophagus and the trachea, as well as other structures, is the mediastinum.

For clinical purposes, the mediastinum is traditionally divided into the anterior, middle, posterior and superior regions.

At the mediastinum's apex is the hilum, the point at which the bronchi, pulmonary arteries and veins, lymphatic vessels, and nerves enter the lung.

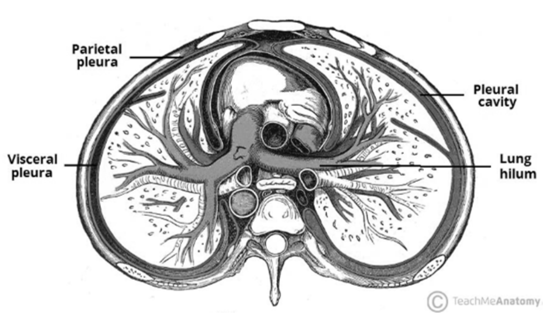


Image from: https://teachmeanatomy.info/wp-content/uploads/The-Parietal-and-Visceral-Pleura-and-Pleural-Cavity.jpg

TRACHEA

The trachea is a flexible, cartilaginous tube. It lies in front of our esophagus, descending with a slight inclination to the right. It travels behind the sternum into the thorax to the sternal angle where it divides to form the right and left main stem bronchi.

The trachea wall is strengthened by 16 to 20 horseshoe-shaped cartilaginous rings, that reinforce it from collapsing when the chest wall flexes (cough), extends (reach up), or during rotation and lateral flexing from one side to the other. It is lengthened when the head and neck extends or moves back on the chest wall, during swallowing (which raises the trachea), and during inspiration when the lungs expand and the trachea is pulled downward.

Fig 1–12. – Tracheobronchial tree (a three-quarters view, rotated toward the right side).

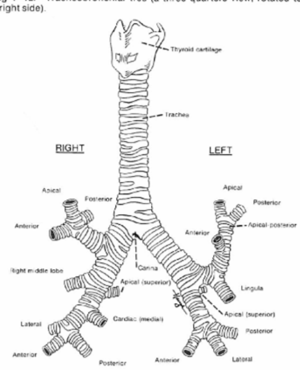


Figure from: Frownfelter DL. Chest physical therapy and pulmonary rehabilitation: An interdisciplinary approach (1978). Year Book Medical Publishers, Inc. Chicago.

The top and the bottom of the trachea is secured, protected, guided and shielded by sternum and thyroid cartilage.

Its relationship to the center or the middle of the body, depends on chest wall orientation, patterns of habitual lung pressure, cervical or neck placement and position, and asymmetrical alveolar dead space.

The trachea connects the upper airway with the lower airway.

Air comes in and goes out through bellows that are pushed and pulled.

Our alveoli are pushed and pulled by our chest wall movement from top to bottom, bottom to top and from side to side.

Image from: https://en.wikipedia.org/wiki/Accordion

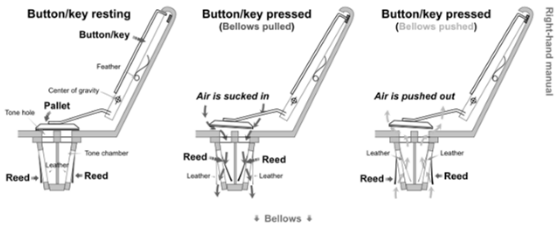


Image from: https://en.wikipedia.org/wiki/Accordion

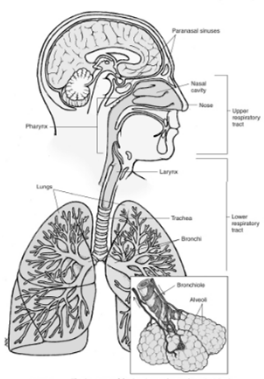


Image from: https://www.brainkart.com/article/Upper-Respiratory-Tract---Anatomy-of-the-Respiratory-System_21113/

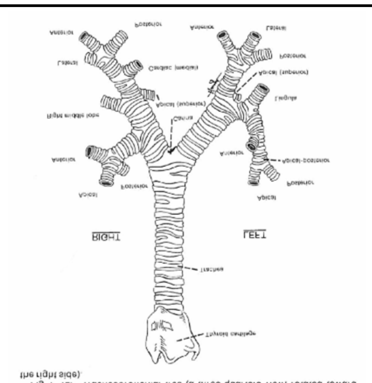


Figure from: Frownfelter DL. Chest physical therapy and pulmonary rehabilitation: An interdisciplinary approach (1978). Year Book Medical Publishers, Inc. Chicago.
**(Figure 1-12 upside down)*

The movement of air through the lung and the trachea is dependent on the position our lungs are placed in and the accompanying size of trachea, root and main stem bronchi.

Humans have a strong tendency to follow the rightward orientation of the right main stem bronchus and the right upper lobe bronchus.

The right upper lobe divides into three segmental bronchi; apical, posterior and anterior.

The apical bronchus runs almost vertically toward the apex of the lung.

This course of flow compliments the right main stem bronchus which is more vertical than the left main stem bronchus.

The right main stem bronchus appears to be an extension of the trachea, and being wider than the left, makes it easier to breathe when our bodies are oriented to the right.

Fig 1–12.—Tracheobronchial tree (a three-quarters view, rotated toward the right side).

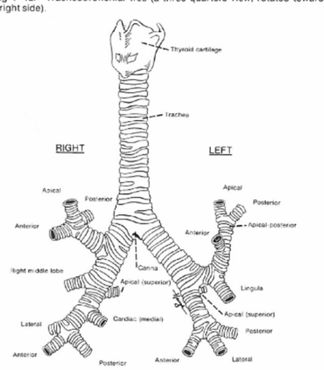


Figure from: Frownfelter DL. Chest physical therapy and pulmonary rehabilitation: An interdisciplinary approach (1978). Year Book Medical Publishers, Inc. Chicago.

Our left main stem bronchi is narrower and runs more horizontally than the right.

The overall bronchus division, diameter and distance from the center of the bronchial tree makes physical and physiological movement of the lung to the left somewhat more of a challenge.

And our physical performance, noted through postural analysis, reflects this anatomical arrangement.

Therefore, any way we can assist opening up our chest wall cavities at the right upper anterior region and at the left lower posterior region to aid in the expansion of the right apical lung [Zone 1] and the left posterior lung [Zone 3], will help increase the overall diameter of the tracheobronchial tree and decrease the fluid accumulation in this possible lung dead space (alveolar ducts and sacs).

PHYSIOLOGICAL DEAD SPACE

Lung dead space is the volume of air that is inhaled that does not take part in the gas exchange, because it:

1. Remains in the conducting airways and never is pushed out,
2. Reaches alveoli that are not perfused or poorly perfused, possibly because of fluid accumulation, or
3. Retains the shape of the alveolar sac that has alveolar walls that are twisted into shapes that can not untwist or open.

Dead space can be increased and possibly better envisioned by imagining breathing through a long tube, such as a snorkel.

Even though one end of the snorkel is open to the air, when the wearer breathes in, they inhale a significant quantity of air that remained in the snorkel from the previous exhalation.

A snorkel increases the person's dead space by adding even more "airway" that doesn't participate in gas exchange.

The total dead space or physiological dead space, is the sum of the anatomical dead space (bronchus tubes like snorkels that don't open because of torsional diameter limitations), plus the alveolar dead space (alveolar ducts and sacs that don't open because of torsional compression limitations).

There is however, a good ratio we all have for good to bad amounts of dead space.

We retain needed carbon dioxide, warm up air as it is brought in, trap particles of matter with mucus that lines the airways, and humidify dry air which improves the quality of airway mucus.

About 1/3 of every resting breath we take has no change in O_2 and CO_2 levels. (Usually in the range of 150 mL.)

Limitation of chest wall movement and associated expansion of any or all of the portions of lung tissue will increase this range and decrease the dead space to "live" space ratio.

Studies have shown that individuals with scoliosis have general associated restrictive lung disease and decreased lung volume as manifested by a decrease in total lung capacity (TLC).

However, scoliosis "impedes the movement of ribs and affects the mechanics of the respiratory muscles. Scoliosis decreases the chest wall as well as the lung compliance and results in increased work of breathing at rest, during exercise and sleep".

Tsiligiannis T & Gravis T. *Pulmonary function in children with idiopathic scoliosis*. Scoliosis, 7 (2012). http://www.scoliosisjournal.com/content/7/1/7

Ventilation to perfusion inequalities, at the alveolar level (alveolar dead space) secondary to alveolar malposition, and associated chest wall malposition, may also be increased by smoking, bronchitis, emphysema, asthma, pulmonary tension, viruses, and pulmonary emboli.

Acute respiratory distress syndrome (ARDS) occurs when fluid builds up in the alveoli.
**A future topic of this Webinar series.*

LUNG MOVEMENT

The shape of our lungs, the portions (lobes) in our lungs, the surfaces of our lungs from nearby organs, and the fissures of our lungs, all provide one message to the anatomist.

They were meant to MOVE under integrated guidance, compression, oscillation and segmentally.

For an example, the right lung has an upper horizontal fissure that separates the upper from the middle lobe.

The horizontal fissure arises from the right oblique fissure and follows the fourth intercostal space from the sternum until it meets the oblique fissure as it crosses the right fifth rib.

It compliments segmental action of the apical chest walls, associated portions of lung that are large or small under these chest walls, and cervical orientation related to the brachial tissue overlying this fissure. (*PRI Right Superior T4 Syndrome*)

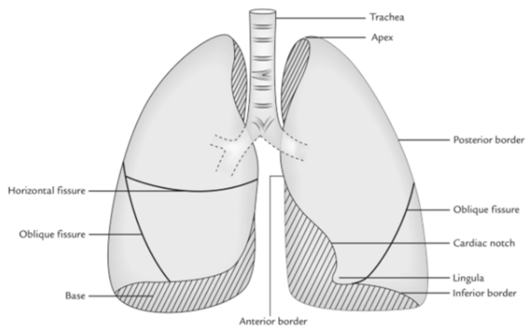


Image from: https://www.memorangapp.com/flashcards/264923/Gross+Anatomy%3A+Lungs+and+Superior+Mediastinum/

The “portion” of the lungs that need to move the most, especially on the left side, is the posterior basal portion of the lung and the posterior lateral regions of the chest and abdomen.

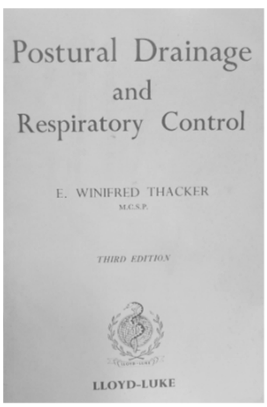
Our lungs are portioned for a reason.

The pleural sacs, pleural fluid, inner and outer walls of the lobes, allow the lungs to slide over each other during arm and leg raise, and reach.

For you to reach forward or back with an arm, obligatory chest wall rotation should occur.

Our power, endurance, composure, development and behavior, reflects how we compliment hemi-chest raising, reaching and rotation with the other side.

By performing chest wall repositioning and lung lobe “reportioning” activities to enhance our lack of movement at the lower posterior base of our lungs, drainage of stagnant lung fluid in these portions of the lungs, and compliance of the lower rib cage and mid back, the overall ratio of dead space to live space will improve.



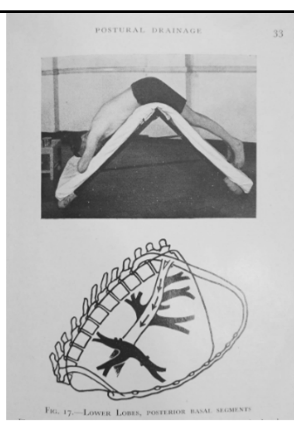


Figure from: Thacker EW. Postural drainage and respiratory control, 3rd Ed. (1971)

CORONAVIRUS

‘It’s one thing to survive the infection, but what’s next?’ Some COVID-19 patients need rehab to walk, talk and problem solve

By LISA SCHENCKER
CHICAGO TRIBUNE | MAY 08, 2020 | 12:06 PM

https://www.chicagotribune.com/coronavirus/ct-coronavirus-covid-patients-rehabilitation-recovery-illinois-20200508-umnznrdvifc47izvjzcyy5nf4u-story.html

STANDING SUPPORTED LEFT GLUTE PUSH

This “standing” technique requires wearing shoes that provide good heel counter support, arch support and a toe box that will allow the toes and forefoot to easily spread out in the shoe.

You will also need to push a table next to a wall to prevent it from moving forward as you push it forward with your hands (or you could use a kitchen or bathroom counter in your home).

This PRI technique is designed to place one in a Valsalva-like maneuver position between the exhalation and the inhalation phases, without blowing up a balloon and holding the expelled air or while pinching off the nose.

In this technique, the force applied by the table and floor allow the tongue and mouth to close off the airway and properly use the abdominal muscles and the diaphragm to exhale and inhale without engaging the neck or back under moderate pressure created by closing off the pharynx with the pharyngeal muscle and the larynx/trachea with the tongue muscle.

This voluntary control of the abdomen is maintained during the entire technique, without having to think about how to “hold” the contraction of the abdominals during both phases of the respiration cycle.

It is a wonderful way to teach someone how to inhale with good opposition to the diaphragm so that its effectiveness on opening up the mid and lower chest wall is maximized, as the subconscious effort of maintaining abdominal stabilization is minimized.

The “support” of the upper extremities, offered by the stable table or counter, also allows one to lift the right leg up and the right foot off the floor as the left glutes "push” the body forward to further stabilize the lower trunk and pelvis as the right hip is raised up.

This activity co-activates more integrative assistance from the right hip flexors, the right lower trapezius and long head of the triceps and left abdominal wall.

When all said and done, the tension and internal pressure created by the lengthened anterior shoulder and hip flexors enables one to breathe with the diaphragm under high compliance and forgiveness of lateral and posterior chest wall tension.

This technique is, therefore, a good technique because the lateral, posterior, apical and base surfaces of both lungs can expand easily upon diaphragmatic contraction, secondary to chest wall compliance and the gravitational force displaced on the abdominal contents.

The internal organs fall anteriorly and off the front of the thoracic and lumbar spine.

It is also an excellent postural drainage technique for the posterior lobes of the mid to lower lungs, preceding the standing positional induced coughing that more than likely will follow with those who are experiencing difficulty breathing because of fluid-filled aveolar sacs.

Standing Supported Left Glute Push

For additional comments about the steps that follow the title and pictorial example, along with reasoning for the procedural steps, please refer to last week's blog on our website (link below).

https://www.posturalrestoration.com/community/post/6074/pri-breathing-mechanics-in-covid-times-webinar-recording-and-third-chest-wall-technique-reasoning?id=6074