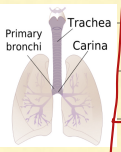
* Trachea & Lung :-

Remember! End of larynx : lower border of cricoid cartilage at C6 ⇒ then: trachea

Trachea: flexible tube, that extends below the larynx (C6)

Then extends downwards to the level of T4 & T5 ⇒ the end of trachea and is called: carina (very sensetive area)

carina descends from (T4) to (T6) in deep inspiration

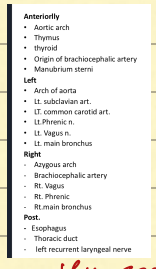


- C-shaped hyaline cartilage (16 - 20 in #)
  - WHY ??
    - bcz we have the esophagus posterior to the trachea
    - so: the cartilage is replaced by trachealis muscle posteriorly (smooth m.)
- Length = 12 cm ≈ 5 inches
- Diameter: almost the same as the index of a person (Extra: almost 1 inch)
  - * very narrow in children (almost the diameter of a pencil) → so tracheostomy is hard in children

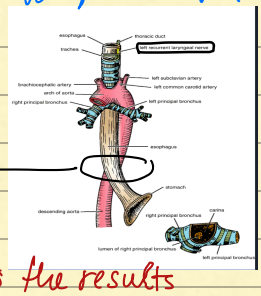
- Relations:

- **Ant**: Arch of aorta (Ant then to the left) / thyroid gland (the ismuth) * Ant. to 2nd+3rd+4th tracheal rings / remnants of the thymus (radiments in adults) / manubrium sterni (First part of the sternum) / beginning of the brachiocephalic artery (Ant then to the rt)

- **Left**: Arch of aorta / Left CC + left subclavian / phrenic / vagus / lt main bronchus
  - Phrenic + Vagus: in the right + left sides
  - Phrenic: Ant. to the lung hilum
  - Vagus: Post. to lung hilum
- **Right**: azygous arch / brachiocephalic artery / rt main bronchus / phrenic / vagus
  - azygous arch → venous drainage of the rt side of the chest → Drains eventually at the SVC → rt atrium
  - phrenic: Ant. to hilum
  - vagus: Post. to hilum
- **Posterior**: esophagus / left recurrent laryngeal nerve / thoracic duct
  - left recurrent laryngeal nerve: Between trachea + esophagus: → NOT the right
    - bcz the rt recurrent laryngeal appears only in the neck (rt + lt)
    - but here on the chest only the left is present
  - thoracic duct (begins from cisterna chyli at the rt side of the opening of abdominal aorta) ascends to the right of esophagus crosses to be post. to both esophagus + trachea then ascends to the left to open at the beginning of left brachiocephalic vein



* the esophagus + descending thoracic aorta → cross each others
- esophagus: opens 1 inch to the left in the stomach through esophageal orifice
- descending...: Goes to the midline at the level of T12



the crossing ←

* Carina: cartilagenous ridge covered by mucosa (from inside of tracheal tube)
  - → very sensetive area causing reflex cough in bronchoscopy ⇒ that affects the results

* Tracheostomy = tracheotomy: Opening through the trachea by a sharp object
  - in emergency: suprasternal → 5th, 6th, 7th rings can be felt by hands
    - → the most dangerous → bcz we have BVs there (veins: inf. thyroid + ant. jugular)
      - But still bleeding isn't that big issue ← (arteries: thyroid ima) → ONLY if present!

usually during surgeries
- cricothyroid ligament → opening in the infraglottic space → still below the vocal cords ✓
- cricotracheal (between the lower border of cricoid & the 1st tracheal ring)
- Between 1st + 2nd tracheal rings ⇒ But not between 2 & 3 & 4 → we have the ismuth ✗

in thyrohyoid membrane? No, bcz it's above the true vocal cords ✗

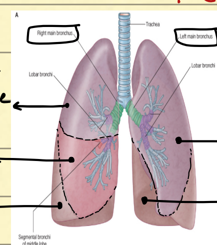
ملاحظة: الهواء أول ما تنفتح الفتحة
بال trachea يدخل على طول تلقائي
عليها ← ليه؟
Due to the -ve pressure in the chest

* Intubation → from oral cavity to trachea / from the nose to the trachea
  - → endo-tracheal tube should be put during surgeries to prevent sudden adduction of vocal cords
    after anasthesia → tube from oral cavity → larynx inlet → between true vocal cords → trachea
  - → could be used in cases of larynx cancer → damage of larynx ⟹ Permenant tube

* Primary bronchi = extrapulmonary (right & left main bronchi):-
  - → ① right bronchus: more vertical with trachea, wider & shorter than the left (1 inch in length)
  - ② Left bronchus: more horizontal, narrower & longer (2-3 inches)
  - *So: if the baby swallows a foreign body → most likely goes to the rt bronchus
  - → Type of cartilage: Hyaline → in the form of pieces/plates (not C-shaped like trachea)

* Secondary bronchi (lobar bronchi) → intrapulmonary (بيكون حوالين lung tissue)
  - → 3 lobes in the rt lung & 2 on the left lung
    - ↓ Upper, middle, lower ↓ Appear at the lung hilum
    - ↓ Upper & lower ↓ 1° bronchus doesn't divide into 2° bronchi in the lung hilum (divides inside the lung)
  - → Less plates of cartilage than 1° bronchi

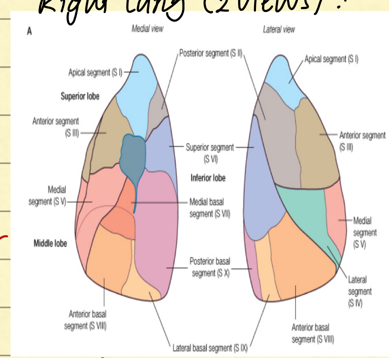
right
Upper lobe
middle lobe
Lower lobe



Left
upper lobe
Lower lobe

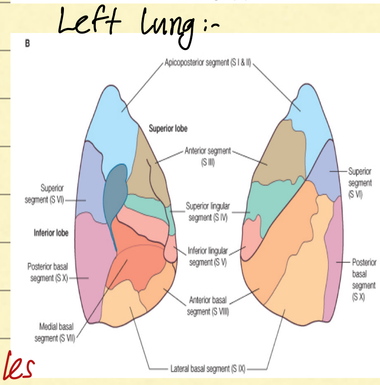
in green: 1° bronchi
purple: 2°

Right lung (2 views):-



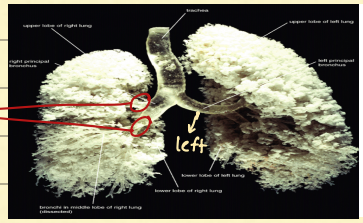
* Tertiary bronchi (bronchopulmonary segments):-
  - → 10 on each side (rt & lt)
  - → Right lung lobes: Upper, middle, lower / Left lung: upper, lower
    - # of segments: 3, 2, 5 / 5, 5
  - → Have cartilage but only 1-3 pieces
  - → Each one gives 5-7 bronchioles

Left lung:-

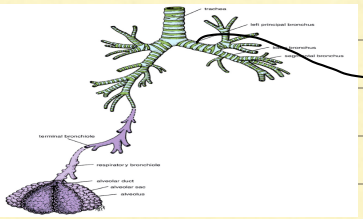


* Bronchioles
  - ① → conducting (terminal)
    - No cartilage
    - Simple columnar / cuboidal ciliated
    - Excess of smooth m. cells (spiral) حوس كل ال lumen
    - Glands & Goblet cells gradually disappear
    - Much fewer clara cells than respiratory bronchioles
  - ② → Respiratory
    - the simple cuboidal ciliated ✗ (تصير) → non ciliated ✓ (clara cells) ⟹ بأعداد أكبر بكثير
      - → then it becomes simple squamous ✓
    - smooth m. become in the shape of knobs (not spiral) → & fewer in #

* the changes are gradual not abrupt
↓
مافي حد فاصل
بين كل جزء بال lung
كله متداخل
(نادر: ما في بس أبيض وأسود!)



2° bronchi



→ left bronchus: ↑ horizontal + narrower + longer

* Bronchopulmonary segments:-

↳ Nowadays we perform segmentomy instead of lobectomy

*each segment has:-

↳ Base + Apex

↳ Base: on the lung surface

↳ Apex: also called segmental bronchus → Terminal bronchioles → respiratory ... alveoli

* On each segment:-

↳ ① Pulmonary artery, ② Lymphatic vessel, ③ nerves (sym + parasym)

④ connective tissue on the 2 edges (lateral) → (contains pulmonary veins - 2 veins)

↳ The landmark that surgeons have to defect to perform segmentomy

↳ they search for the pulmonary veins (boundaries of the segment)

* In the right lung:-

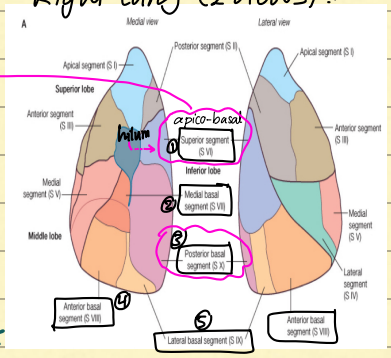
↳ 3 in the upper lobe (apical, post., ant.) + 2 segments in the middle lobe (medial, lateral)

in the direction of: apex, post. border, Ant. border; medial surface, lateral surface

5 in the Basal lobe (apico-basal, ant., post., lateral, medial)

superior

Right lung (2 views):-



Foreign bodies lodgement: in: ① Erect position ② lying down

lower lobe segments:

* In the left lung:-

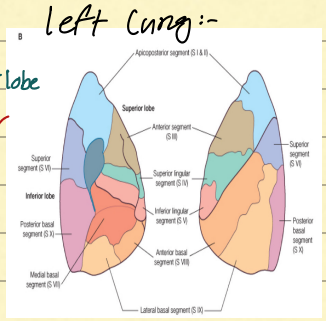
↳ Differs from the right: that it has sup. & inf. lingular segments that go to the lingula (Formed in the left lung by cardiac notch during development of the ♡ → pushes the left lung) → its segments: in upper lobe

① Upper lobe → Apical, post., ant., sup. lingular, inf. lingular

② Basal lobe → Apico-basal, medial, lateral, ant., post.

↳ just like the right lung

left lung:-



*Imp. of the previous info:-

* Foreign bodies usually enter the right bronchus → lobar bronchus → segment

↳ * if the child was playing in erect position → Foreign bodies go to the base → post. segment

Here the lodgement usually happens (just like)

↳ * if he goes to the dentist → and the extracted tooth fell down accidentally (the child is lying down)

↳ Foreign bodies go to apico-basal segment

Extra: in the lying down position: the apico-basal segment is considered posterior to the hilum of the lung

Supine position

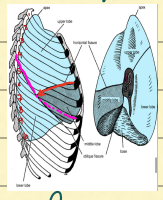
* in both cases: we perform bronchoscopy to extract the foreign body ⟹ after a specific detection of the exact location of this body

* Before birth (During the segments formation)
  - → left lung → 8 segments
    - ① → apico-posterior 1 segment after delivery → apical + post. (2)
    - ② → Antero-medial 1 segment (in the base) → anterior + medial (2)
  - → right → 10 segments → so no changes happen after delivery of the baby

* Importance of bronchopulmonary segments:-
  - → in infections → start in the segment (but they have no barrier around them) ↓ So: they can spread to the surrounding segments
  - → in surgeries → segmentectomy

Lungs:- ⟹ have: apex & base / ant & post borders / mediastinal & costal surfaces

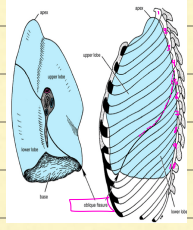
* Right lung: ⟹ shorter + wider (bcz the liver pushes the diaphragm upwards pressing on the right lung)
  - → 3 lobes
  - → 2 fissures → oblique + horizontal
    - → Surface anatomy:-


Oblique fissure
Horizontal fissure

Oblique: Backwards 4cm away from the dorsal spine of (T3) / (T4) → crossing the 5th intercostal space → passing along with the 6th rib

Horizontal: Starting anteriorly from 4th intercostal space then → Passing with the 5th rib → then: crossing the 6th rib to meet the oblique fissure

* Left lung: ⟹ Longer + narrower
  - → 2 lobes
  - → 1 oblique fissure → (separates between the 2 lobes) | Starts 4cm from the dorsal spine of (T3)/(T4) backwards, then descends to the back in 5th intercostal space, ending with the 6th rib anteriorly



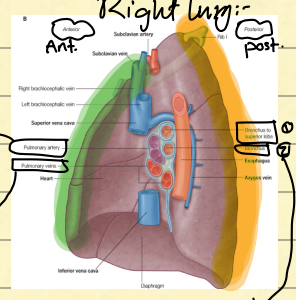
* Lung weight = 600 - 800 gm (for each lung) → 90% air ⟹ inside the alveoli
  → 10% lung tissue ⟹ (elastic + reticular fibers of CT)

+ Lung has ① apex
  - * at the root of the neck
  - * 1 inch above the medial 1/3rd of clavicle

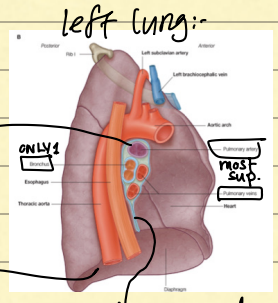
② base = Diaphragmatic surface
  - * over the cupula of diaphragm
  - * has a sharp edge downwards → the doctor referred to it also as inf. border

-* Lung has 2 surfaces → ① mediastinal (Has the hilum) ② Costal (Relating to costal cartilages)

* Lung has 2 borders
  - ① Ant: Sharp + shorter →
  - ② Post: rounded + longer →



⇉ Lung hilum :-
- Right lung: * 2 bronchi → one above the pulmonary artery + one is posterior
  - called: Eparterial bronchus / Hyparterial bronchus
- In left lung → * one ONLY bronchus in the hilum → then : divides



* then most sup. structure → pulmonary artery
  - Then: superior & inferior pulmonary veins

* Lung is surrounded by pleura
  - ① Parietal (lining thoracic cavity)
  - ② Visceral (adherent to the lung)

⟹ Joined together around the hilum of the lung (one layer around the hilum)

↓

And below the hilum, they form the pulmonary ligament

* Surface anatomy of the lung (apex, Ant border, Post border, base)
  - → The same as the surface anatomy of visceral pleura ⟹ But for parietal pleura it's different

① Apex → one inch above the medial 1/3rd of the clavicle // same: 3-4 cm above the first costal cartilage

② Ant border → We draw a line from apex to mid of the sternal angle

* But then : The left lung differs from the right *

Right : completes its descending to reach the 6th costal cartilage (on midline)

Left : We have the cardiac notch → between 4th & 6th costal cartilages

1 cm to the left

Remember!

In cases of cardiac tamponade (fluid accumulation in the pericardium)

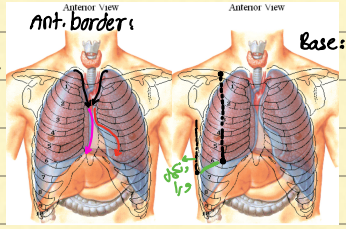
Aspiration is performed through the cardiac notch

(Here : No lung + No pleura)

The common course of (rt + lt) ant. borders

Right lung

Left lung



③ Base (we must detect 3 points) :-
- 1st point : intersection of the midclavicular line → with the 6th rib
- 2nd point : intersection of the midaxillary line → with the 8th rib
- 3rd point : intersection of the scapular line / paravertebral line → with the 10th thoracic vertebra

(scapular line is 4 cm away from the dorsal spine of the 10th thoracic vertebra)

From the inferior angle of the scapula (posteriorly)

④ Post. border → From the apex posteriorly towards the 10th thoracic vertebra

* most important surface anatomy is that of the base ⟹ WHY? For comparison with the pleura!
(lung والـ visceral عكس ⟸ parietal of course)

* Surface anatomy of parietal pleura :-

① Apex → The same as the lung
② Ant. border
③ Post. border
④ Base (Different from the lung!) →
- midclavicular line to: 8th rib (instead of 6th) — in lung :-
- midaxillary line to: 10th (instead of 8th)
- posteriorly to: 12th (instead of 10th)

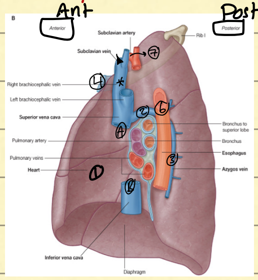
WHY there's a difference of 2 spaces?! For the inflation of the lung (expands downwards in 2 spaces)

* Root & hilum

→ ① 1 artery / ② 2 veins / ③ Bronchi → 2 in the right; 1 in the left
④ Bronchial vessels (blood supply of the lung tissue)
⑤ Nerves (sym. + parasym.)
⑥ Lymphatics (LNs + Lymph vessels)

We have the pulmonary ligament inferiorly (From the 2 pleural layers)

* Impressions on the right lung :-



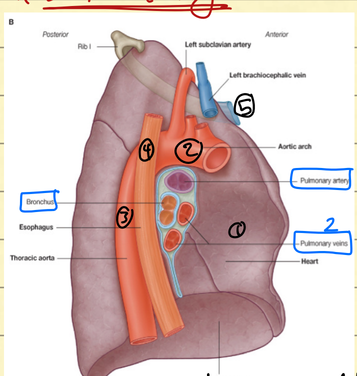
① For the right atrium → Ant. to the hilum
From the RA:
- Ⓐ SVC → above → * right brachiocephalic; ▲ subclavian
- Ⓑ IVC → below

② Arch of azygous → sup. to the hilum
③ Azygous vein

(① – ③ → veins)

④ First rib → impression on the ant. border of right lung
⑤ Trachea → on the apex of right lung
ONLY in the right
NOT in the left ⟹ bcz trachea is slightly deviated to the right
⑥ Esophagus → on the apex of the 2 lungs (right & left) → bcz it's on the midline (unlike the trachea)
→ then: post. to the hilum of the right lung
⑦ Subclavian artery

* Left lung : جزئها ⟹ Has the lingula (لسان) → Formed by the cardiac notch



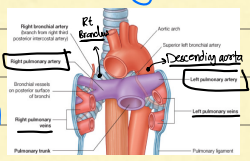
Left lung: related to oxygenated blood

- in its hilum → most superiorly : pulmonary artery (pulmonary artery + 2 veins + bronchus)

No trachea!

- Impressions :
① Heart (left ventricle) → covered by pericardium → Ant. to the hilum
→ Dealing with oxygenated blood
(بيفصل الـ diaphragm بين الـ left و الـ stomach)
② Arch of aorta (Gives 3 branches)
③ Descending thoracic aorta → post. to the hilum
④ Esophagus → apex ⟹ then: in the lower part : Ant. to thoracic aorta
⑤ First rib → on costal surface + Ant. border

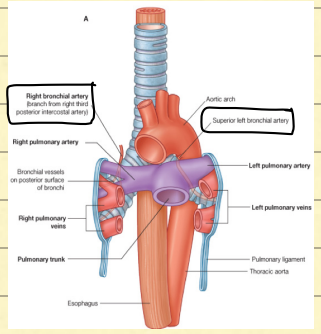
* Pulmonary arteries: ⟹ originating from the pulmonary trunk
  * pulmonary trunk divides at (T4) to: right & left pulmonary arteries to: rt lt lungs
    - From the right ventricle (from pulmonary valve)
    - Ascends upwards to the left
  - Are present on the hilum (the right & left pulmonary arteries)
  - Different relations:
    - On the right: Ant. to the bronchus + post. to the pulmonary veins (between them)
    - On the left: Ant. to the descending thoracic aorta + post. to the lt pulmonary veins
  - Right → Longer
    Left → Shorter → & passes through the root of the hilum
    - bcz the pulmonary trunk is deviated to the left
  - Carry deoxygenated blood to the lungs (enter at the hilum)



* Pulmonary veins (4 in #) ⟹ Carry oxygenated blood to the left atrium
  - Superior & inferior pulmonary veins in each hilum

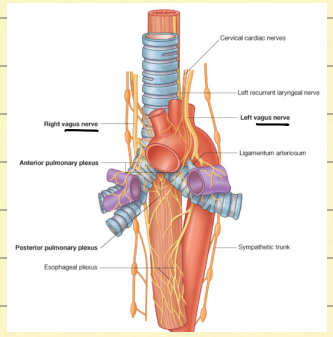
* Brief summary:-
- In each hilum: pulmonary artery / 2 pulmonary veins / bronchi
- Left hilum: the artery is the most superior → then: sup. pulmonary vein → inf. pulmonary vein → Bronchus
- Left pulmonary is shorter than the right
  - Relations: post. → descending aorta
    Ant. → Superior pulmonary vein

* Bronchial arteries: Main blood supply to the lungs + visceral pleura
  - They deliver oxygenated + full of nutrients blood
  - ① Right side: single (1) right bronchial artery
    - comes from the 3rd posterior intercostal artery
  - ② Left side: sup + inf bronchial arteries (2 in #)
    - origin: from the descending thoracic aorta
  - Small in size → enter the hilum & then are distributed to the lung tissue + visceral pleura



* Bronchial veins: venous drainage of the lung (Deoxygenated blood)
  - ① Right side: To azygous vein
    ② Left side: To hemi-azygous
    → then: to arch of azygous → to: SVC
  - But sometimes they go with the pulmonary veins ⇓ to left atrium
    They carry oxygenated blood (and here it's deoxygenated)
    But it's OK → their percentage is small

* Innervation
  → Plexus of nerves → Ant. + Post. to the end of the trachea



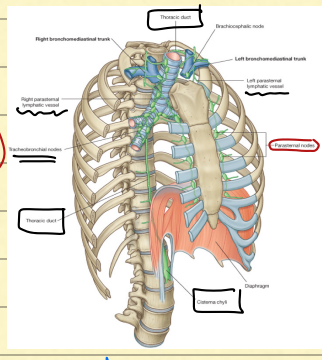
- Sympathetic ⇓ From: Sympathetic chain
  - ① Bronchodilation
  - ② Vasoconstriction (on BVs)
    - → opposite effect to that on the bronchi
- Parasym ⇓ From: Vagus ↓ Go to the bronchi in the lung ↓ Bronchoconstriction

* Adrenaline → Sympathetic
  - → Given in asthmatic attacks (at the emergency department)
    - ⇓ Bronchodilatation

* Lymphatic drainage → 3 plexuses

1- Superficial 2- Subpleural (below the visceral pleura)

3- Deep in lung tissue



All collect the lymph at the hilum → in the hilum it's called:
* tracheobronchial nodes *
(between trachea + bronchi in the hilum)

* Lymphatics :-
  - then:
    1- Para-sternal (parallel to the sternum)
    2- Paratracheal (parallel to trachea)
    3- Mediastinal
  - → They all go to the thoracic duct at the end ⇓ ON the left side of chest + Right lymphatic on the rt side

* Thoracic duct begins from the cisterna chyli at aortic orifice (on the right side of aorta)
  - → ascends upwards → crossing esophagus + trachea posteriorly
    - ↓ Ending at the beginning of left brachiocephalic vein
* While the right lymphatic duct → rt brachiocephalic vein
  - → (They both end & empty in the venous blood)