

Anatomy

LEC : 1-6

صدقتا عن روح نزيلنا عمر عطية
ادعوا له بالرحمة والمغفرة

LEC-1

Anatomy of the nose and paranasal sinuses

★ The pathway of air after entering the nose:

Nose → Pharynx → Larynx → Trachea → Right/Left main bronchi → Secondary
Alveolar duct ← Respiratory bronchi ← Terminal bronchi ← Tertiary bronchi ← bronchi
↳ Atrium → Alveolar Sac → Alveoli

★ The bronchi contain cartilage

★ The pathway after the bronchi there are the bronchioles

No cartilage

Classified as Conducting or Respiratory
for passage of air only Gas exchange

★ Each lung is made of billions of alveoli

★ Each alveolus is surrounded by a network of capillaries

★ The largest capillaries in the body are those surrounding the Alveoli.

Function of the Respiratory System

① Gas exchange

② Regulate blood pH (O_2/CO_2 balance).

↳ When doing a blood test to check the Gas content → we must take a sample of arterial blood, not venous blood.

③ Filterate the inspired air.

The anterior opening of the nose

↳ first filtration occurs in the vestibule directly after the nostrile

This vestibule contains vibrissae (thick hair) → that filterate air.

it's covered by stratified squamous keratinized (like skin).

↳ filtration also occurs by the secretions released by the glands and they trap the foreign bodies and dust.

④ Receptor for Smell Sensation

↳ The roof of the nose contain **bipolar cells** responsible of smell sensation. ↳ **Olfactory region** ↳ attached to filaments of the Olfactory nerve.

⑤ Phonation

↳ In the larynx there are true vocal cords responsible of phonation by their vibration.

⑥ Excretion of small amounts of water and heat

☆ The submucosa contain plexus of veins that heats air. If air that enters is very cold and didn't get warmed it may injure the brain cells.

NOSE

☆ Made of External Nose and Nasal Cavity.

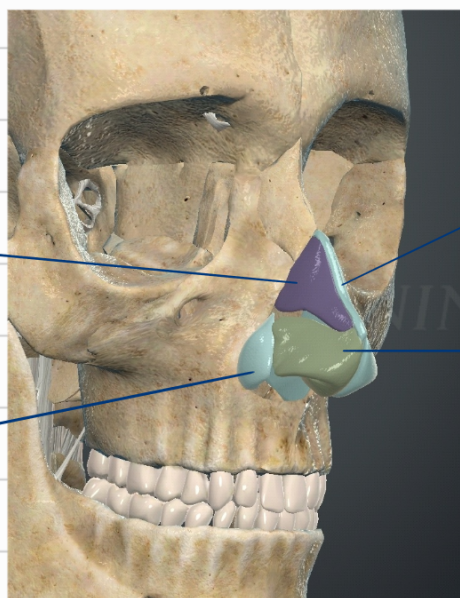
↳ 2 nasal cavities separated by a Septum

External Nose

Hyaline

Superior lateral
Nasal cartilage

Alar Nasal
cartilage



Cartilaginous part
of nasal septum

Inferior lateral
Nasal Cartilage

↳ The Ala of the Nose is the bulge on the lateral side contain: Cartilage + fat + muscle (dilator and compressor)

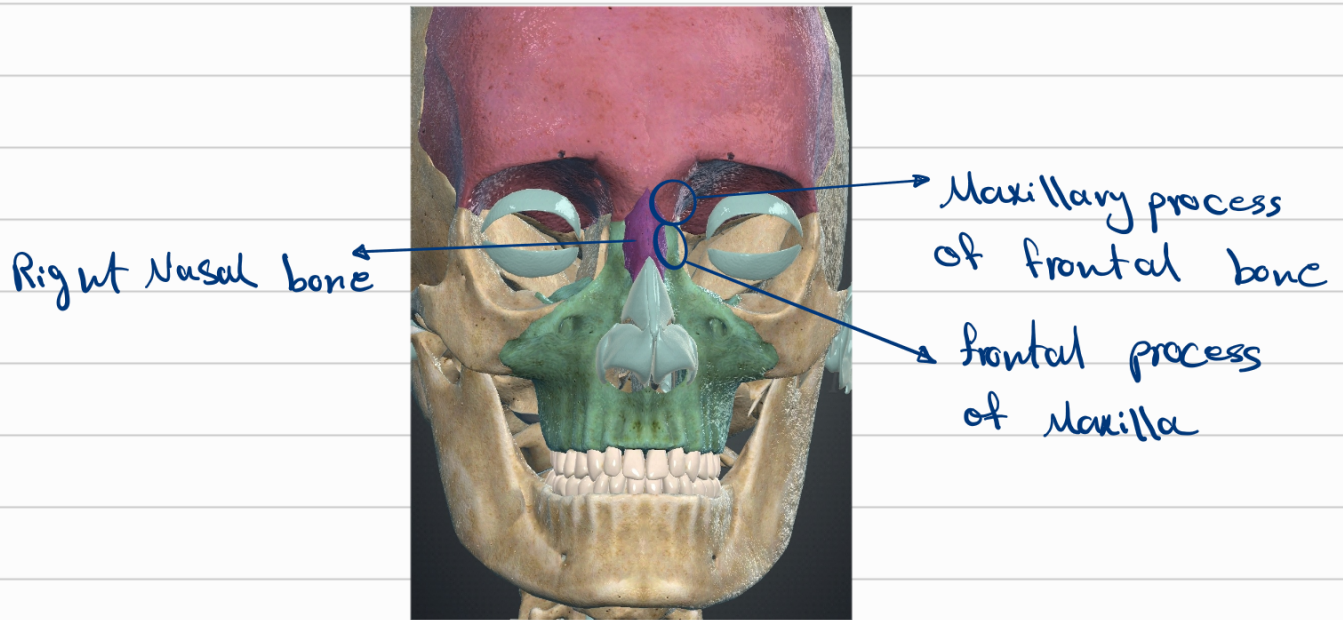
★ The anterior part of external nose is made of Cartilage while the roots are made of two nasal bones separated by a septum.

★ There are two processes beside the nasal bones.

① Frontal process of maxilla

② Maxillary process of frontal bone.

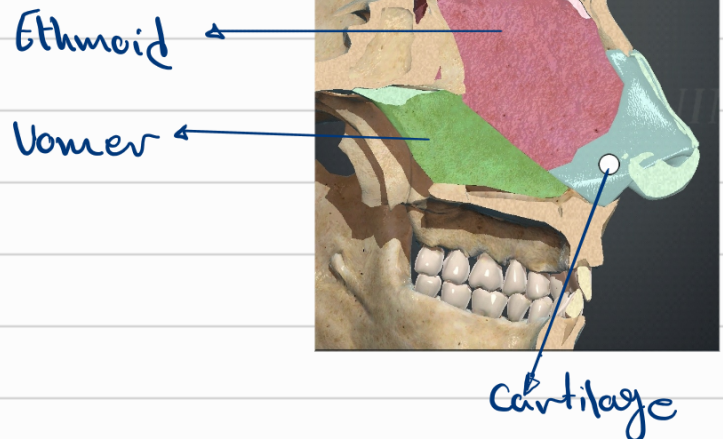
★ They support the bones of the nose.



Nasal Septum

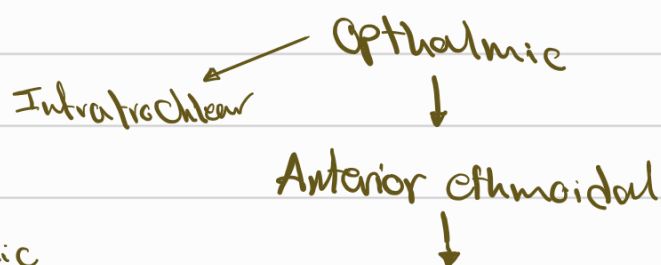
↳ Make the medial wall of the two nasal cavities and it's made of three parts:

- Cartilage Anteriorly
- perpendicular (vertical) plate of ethmoid
- vomer



☆ Blood Supply of external nose

- ① Ophthalmic artery (branch of internal carotid artery)
- ② Maxillary (end branch of external carotid artery)
- ③ Facial artery (branch of external carotid)
 - ↳ Gives labial and nasal for upper lip



☆ Nerve Supply of external nose:

- ① Intraorbital branch of ophthalmic
- ② External nasal branch of ophthalmic nerve
- ③ Infraorbital branch of Maxillary
 - ↳ Infraorbital foramen the passage of the terminal part of maxillary artery and the terminal part of maxillary nerve (Infraorbital)



Nasal Cavity

2 nasal Cavities separated by a septum and have

- * medial wall
- * lateral wall
- * floor
- * Roof

- The **Nares** (anterior nasal opening) is the entry of air.
- followed by a vestibule (we discussed it before)
- above the vestibule there is the **Antrum (Atrium)**.
- The lateral wall contains **3 Meatuses + 3 Conchi + 1 Recess**

Functions of nasal Cavity

- ① Respiratory
- ② Olfactory
- ③ Resonance of voice

↳ everyone has a different voice and the paranasal sinuses ^{contain air.} are the main player for these differences. these paranasal sinuses have ducts that open in the lateral wall of the nasal cavity

- ④ draining lacrimal fluid.

↳ tears secreted by lacrimal gland (in the roof of orbital cavity) these tears are collected in the medial end of eye in the lacrimal sac from this sac the nasolacrimal duct arise and opens in the inferior meatus.

- Some babies are born with a blocked nasolacrimal duct, so all tears exit from the eye and it will irritate the skin under the eye → Rash and Redness.
treated by drainage by opening the nasolacrimal duct.

- ⑤ protective

↳ by sneezing + filtration + secretion of enzymes from glands + warming and moistening of air.

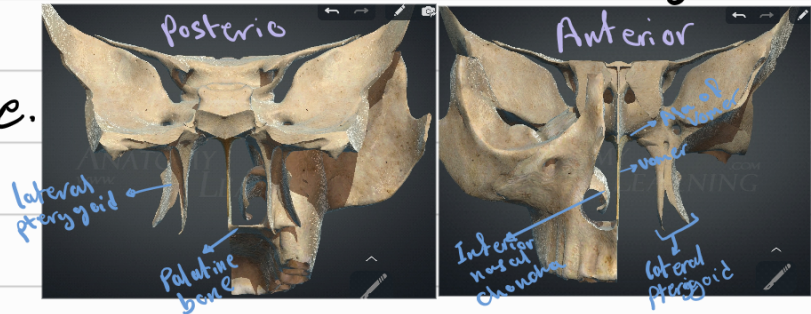
- ☆ The lining epithelium is **pseudostratified ciliated columnar**
- ☆ The submucosa contain plexus of veins for warming air → become congested in case of rhinitis → may block the nasal cavity (treated by decongestants)

Nares

is the anterior opening of nose

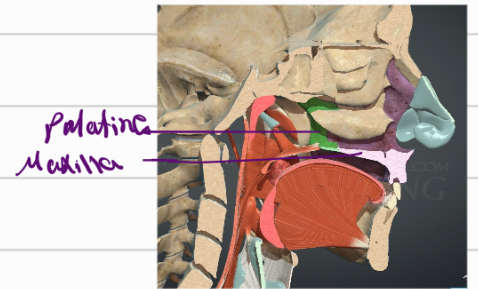
Choanae

- is the posterior opening of nose
- The septum in the middle of the Choanae is made of the vomer. and superiorly there is the ala of vomer.
- On the lateral sides there are the medial pterygoid plates of sphenoid bone
- The base the palatine bone.



Floor of Nasal Cavity

- Hard palate anteriorly → made of Maxilla and palatine



Roof of Nasal cavity

Cribriform plate of ethmoid

→ penetrated by filaments of olfactory nerve.

- ☆ There are anterior sloping part and posterior sloping part.
 - mainly frontal bone and nasal bone
 - mainly from body of sphenoid + Ala of Vomer

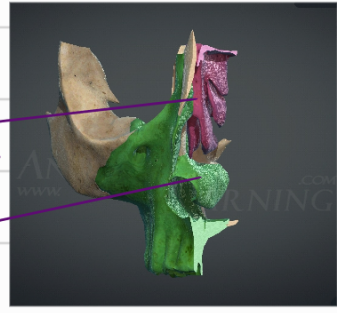
Medial wall

- Septal nasal cartilage anteriorly
- Vomer and perpendicular plate of ethmoid

Lateral wall

- 3 Concha:

Superior } from ethmoidal bone
Middle }
Inferior → from Maxilla

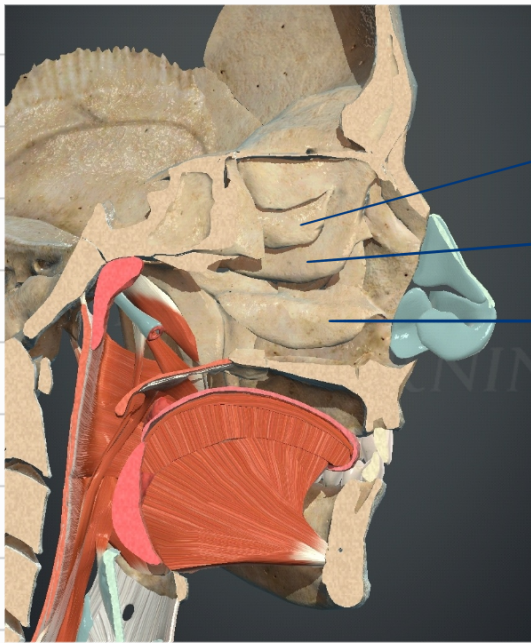


☆ The Concha are process of bone covered by Mucosa

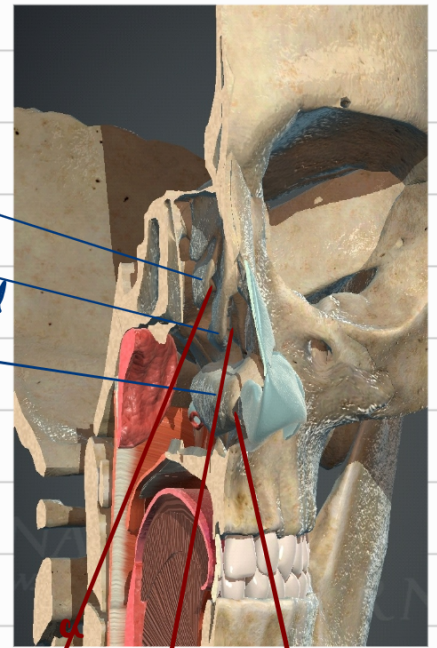
↳ function: increases the surface area of lateral wall.

☆ The meatus is a groove under the concha.

↳ function: receives paranasal ducts.



Superior
Middle
Inferior nasal
concha



Superior meatus
Middle meatus
Inferior nasal meatus

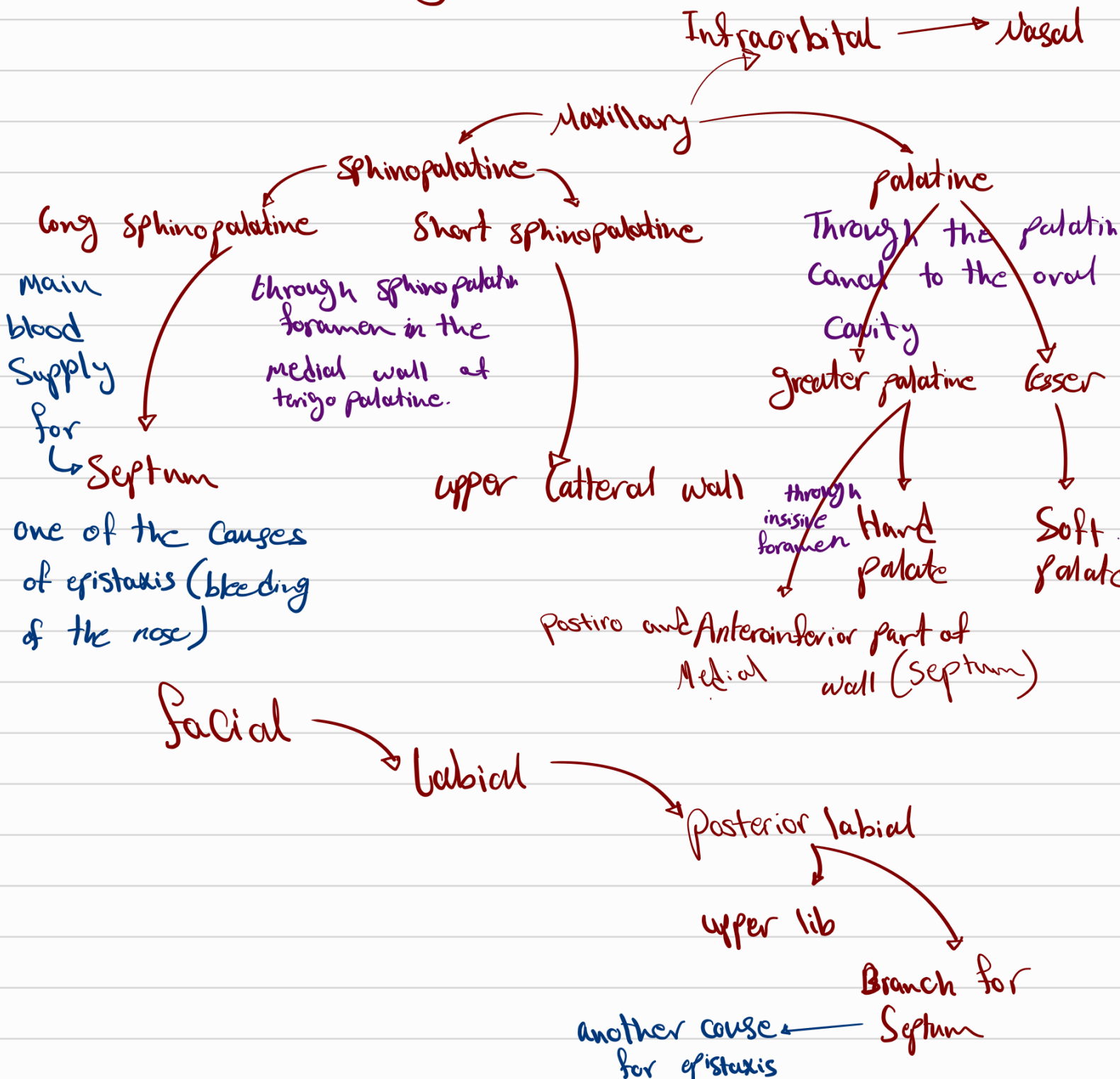
paranasal sinuses and their openings in the meatus

middle meatus → polla ethmoidalis
↳ Middle Ethmoidal Sinus
↳ Anteriorly: Anterior Ethmoidal Sinus
↳ Posteriorly: Maxillary Air Sinus
Middle infundibulum — frontonasal duct — Frontal Air Sinus

☆ Superior meatus ← posterior Ethmoidal

☆ Sphenothmoidal recess ← sphenoidal Eor sinus.

☆ Blood Supply of Nasal Cavity:
mostly from Maxillary artery In the trigopalatine fossa.



Internal Carotid

↓ Ophthalmic artery

Anterior Ethmoidal

Anterior Cranial fossa
then enters the anterior
ethmoidal foramen and

gives :

Septum

Lateral wall

(Supra-orbitally)

Terminates as External
nasal Artery for
External nose.

Posterior Ethmoidal

Through posterior foramen
then posteriorly to the

upper part of the medial
and lateral wall

Epistaxis : bleeding through the nose

The area of epistaxis is located on the septum
known as Kisselbach's area.

→ Area of Anastomosis

→ Located between upper $\frac{2}{3}$ and
lower $\frac{1}{3}$.

→ Arteries : Long sphenopalatine
and posterior labial
branch of facial.

★ Venous drainage:

Anterior part → facial → Common facial → Internal jugular
posterior and upper part → ptergoid plexus → Maxillary vein
↳ around the lateral ptergoid muscle

☆ Lymphatic drainage:

Anterior → Submandibular lymph nodes

posterior and upper → Retropharyngeal or deep cervical lymph nodes

Then all lymphatic drainage go to deep cervical lymph nodes.

☆ Innervation:

- Sensory

Maxillary and ophthalmic

Just like Arteries

↳ But it's not

Spinothalamic Nerve X

it's Trigeminal Nerve ✓

- Smell Sensation

Olfactory

Starts from bipolar cells from the roof of the nose

then through cribriform plate as filaments of olfactory nerve then terminates in Center of Smell.

- Parasympathetic

Secretomotor for the nasal glands
facial → Greater petrosal

↳ trigeminal fossa in the ganglion

↳ Glands

para nasal Sinuses

Frontal air
Sinus

Maxillary air
Sinus

Sphenoidal air
Sinus

Ethmoidal Air : Anterior + Middle + posterior
Sinuses

★ These sinuses are made of a cavity covered by thin mucosa
contains air.

★ have duct that open in the lateral wall of nasal cavity.

☆ At delivery they're small in size then they will grow with the growth
of the bones of the face.

Functions:

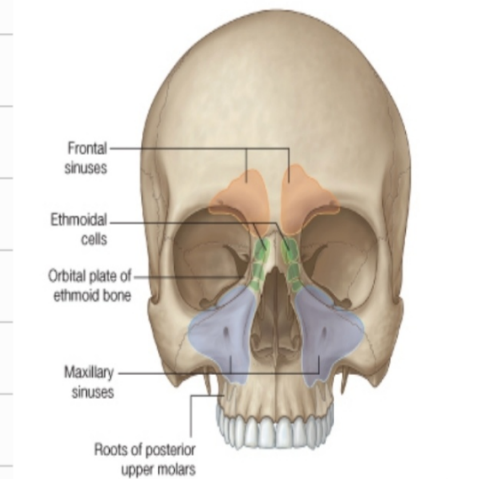
- ① Resonance of voice
- ② decrease the weight of skull
- ③ protection.

Frontal Sinus:

★ In the frontal bone

★ Drainage : from above downward to the Infundibulum of middle meatus

★ Nerve supply: Supraorbital nerve branch of ophthalmic.



ier. Drake et al: Gray's Anatomy for Students - www.studentconsult.com

Ethmoidal 3 Sinuses on each side

- Small sinuses each is made of 1 or 2 air cells
- Very thin mucosa.
- Drainage : Anterior → Anterior part of Hiatus semilunaris
Middle → polyaethmoidals
posterior → Superior hiatus.
- Nerve : Anterior and posterior ethmoidal.

Maxillary the most important one.

- large, pyramidal

- The duct opens upward

Bad taste and
Smell → must be
treated rapidly.

→ bad drainage, In case of chronic infection pus
will form in it → fistula may be formed → Oral cavity.
→ If someone Extracted one of the 2 molars a fistula may form.

☆ Relations : - Above : orbit = below : roots of the
upper molars
= behind : Infratemporal fossa
- Medially : lower part of nasal cavity

Nerve : Infraorbital from maxillary

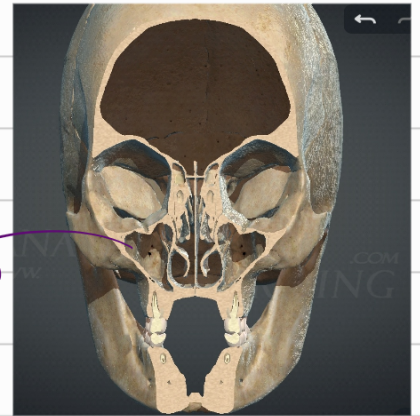
Sphenoidal Sinuses

* In body of sphenoid

* opens in the Sphenothmoidal recess.

* Related Superiorly to the pituitary gland.

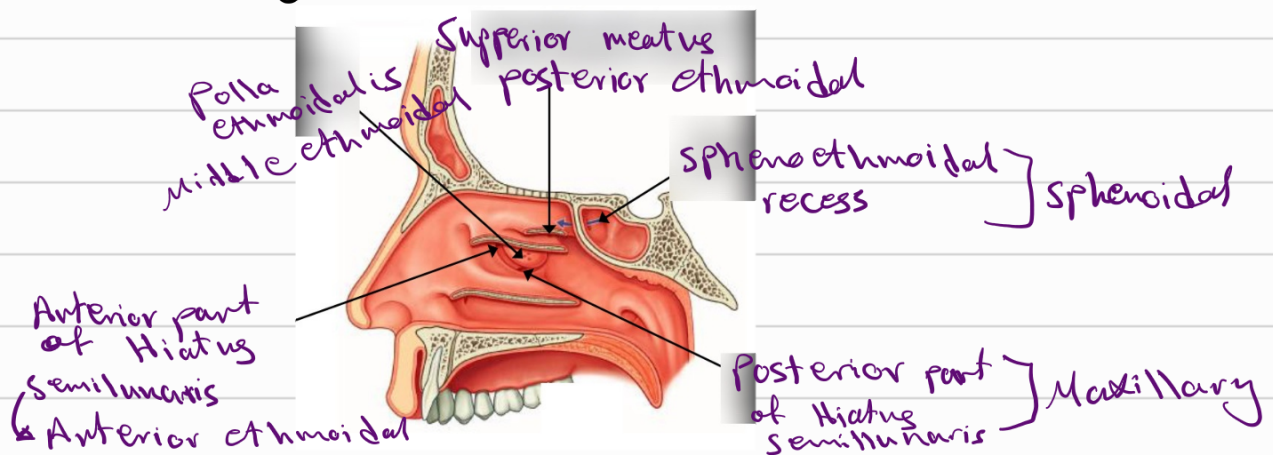
Maxillary
air
sinus



→ A tumor in the pituitary gland if invasive can penetrate the sphenoidal
air sinuses → can be seen in the X-Ray.

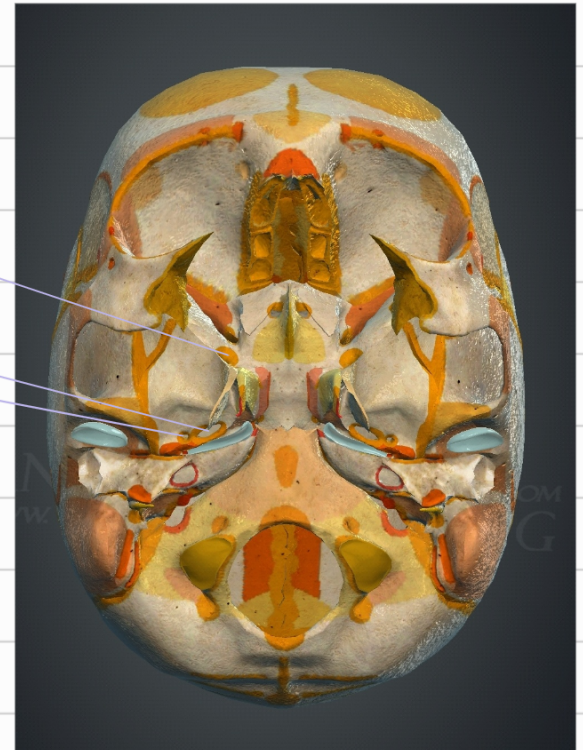
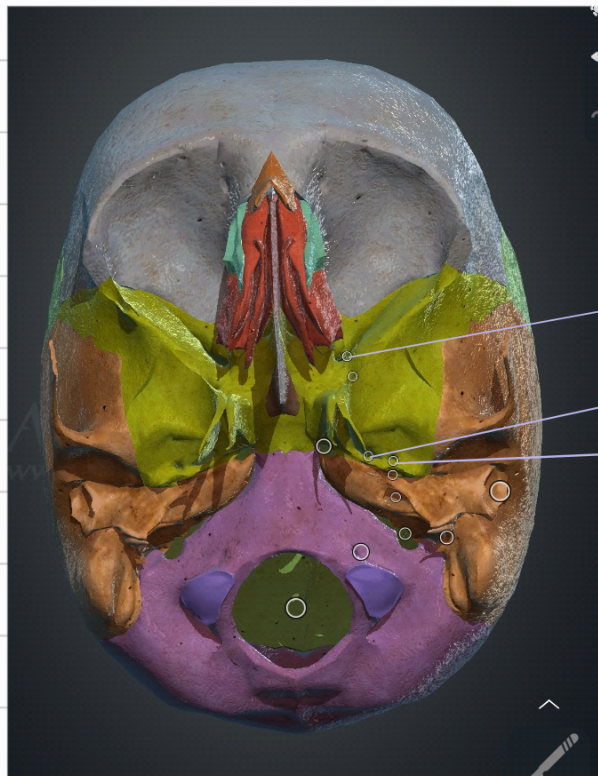
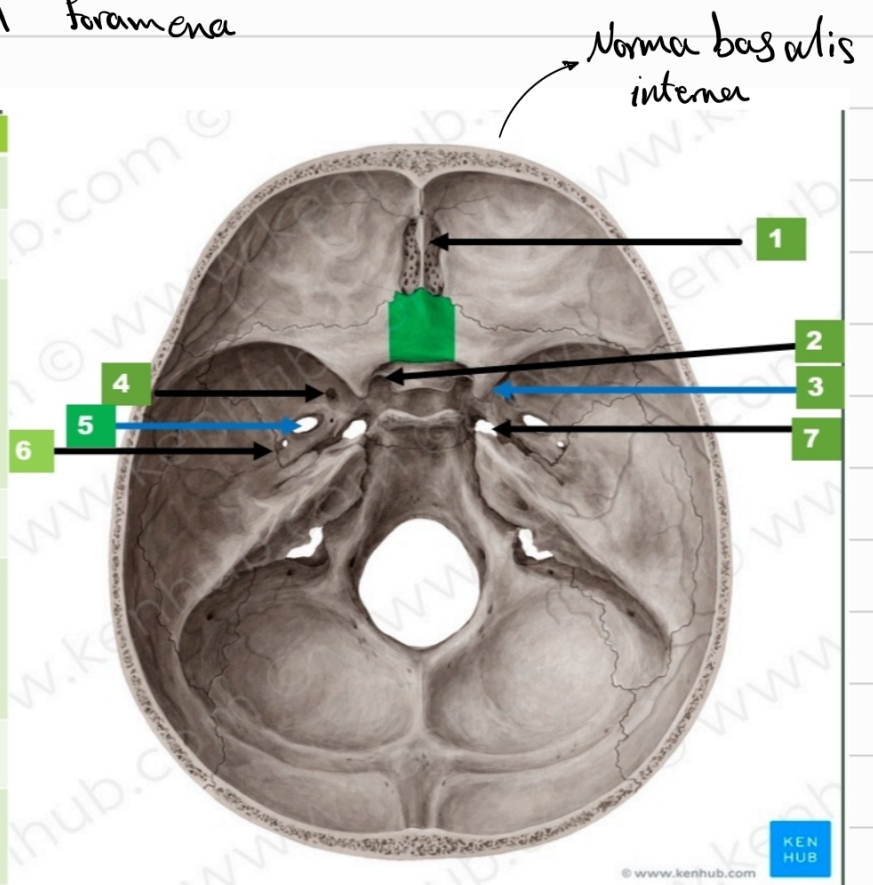
* Nerve : posterior ethmoidal branch of ophthalmic
Orbital branch of maxillary.

Relations : - Above : pituitary gland
- laterally : cavernous sinuses.



Revision of Skull Foramina

Foramina	Contents
1-Cribriform Plate	Olfactory N (I)
2-Optic canal	Optic nerve (II) and ophthalmic artery
3-Superior orbital fissure	Oculomotor (III), Trochlear (IV), Abducence (VI) and (lacrimal, frontal and nasociliary) branches of ophthalmic nerves (V1)
4-Foramen Rotundum	Maxillary nerve
5-Foramen Ovale	MALE Mandibular nerve V3 Accessory meningeal A Lesser petrosal nerve Emissary vein
6-Foramen spinosum	Middle meningeal artery
7-Foramen Lacerum	Nerve and Artery of pterygoid canal and emissary vein



Norma basalis externa

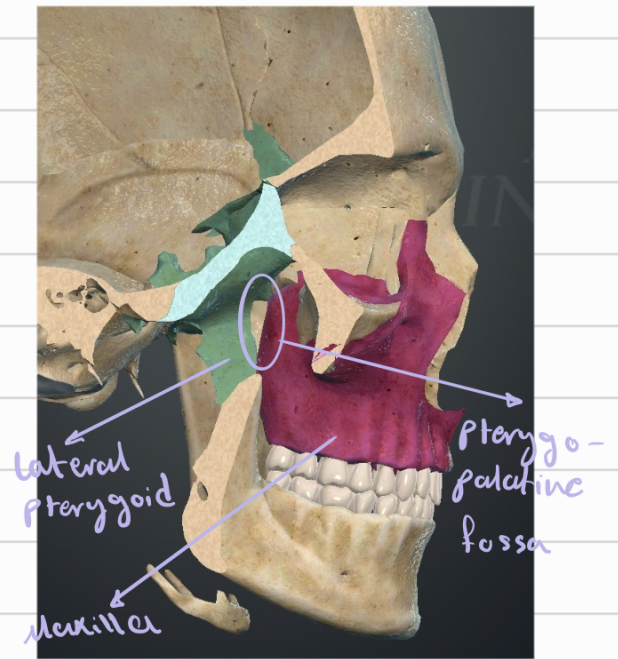
LEC-2

Pterygopalatine Fossa

★ Tear drop shaped space

Between bones on lateral side of the skull immediately posterior to maxilla.

Between lateral pterygoid plate and Maxilla and



★ Importance:

1- Connection with surrounding organs.

↳ Orbit + Nasopharynx + Oral cavity + Nose + Midcranial fossa + Intra temporal fossa.
 through sphenopalatine foramen.

★ This connection is for delivering blood supply or nerve supply.

Skeletal framework

- the walls of pterygopalatine fossa are formed by:

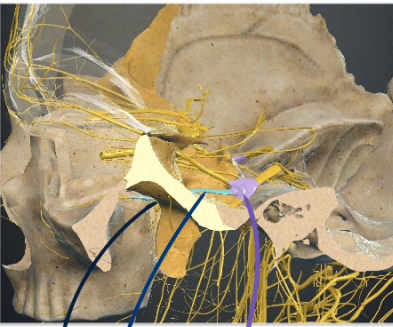
- 1- Anterior surface by Maxilla.
- 2- Medial wall by palatine bone. (contain an important foramen which is the sphenopalatine)
- 3- Posterior surface by sphenoid bone.

4- Roof by sphenoid bone

- Lateral Relation : space connected to intra temporal fossa. through pterigo maxillary fissure for the passage of Maxillary Artery

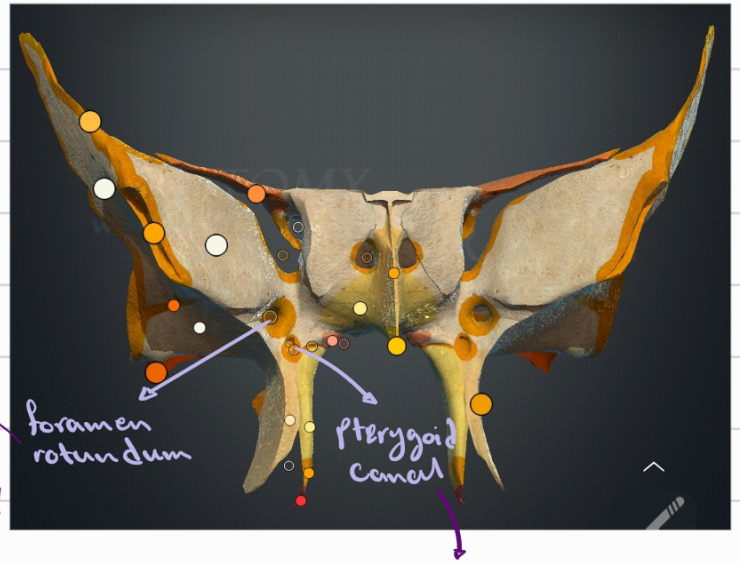
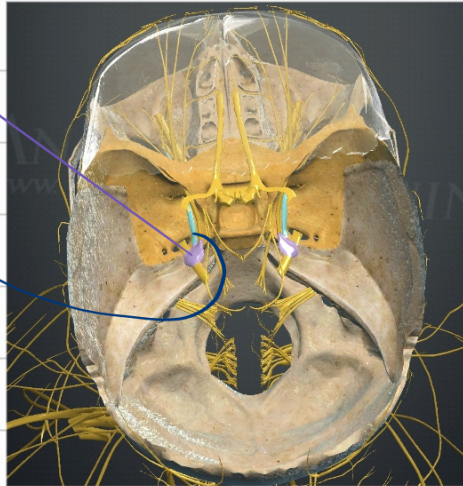
Sphenoid bone

These two openings connect the Middle cranial fossa with the Pterygopalatine fossa.



Rotundum
Trigeminal Ganglion
Maxillary nerve

for passage
of maxillary nerve
branch of trigeminal



for passage at pterygoid canal

nerve. **Vidian Nerve**

Carry sympathetic fibers
and parasympathetic fibers

Synaps in the ganglia in the
fossa

This ^{preganglionic} parasympathetic fiber
is the **Greater petrosal nerve**
which is a branch from facial.

The one that carry the
Sympathetic fibers is the
Deep petrosal
Post ganglionic.

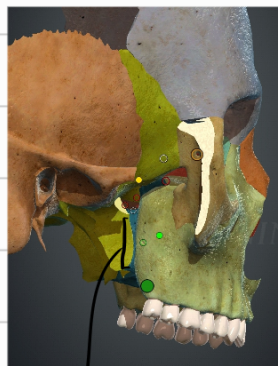
☆ Discussed later.

Gateways

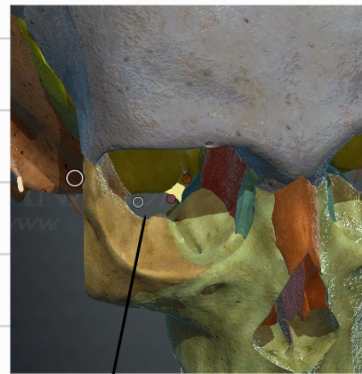
- **foramen rotundum** : passage of **Maxillary Nerve**
- **opalatovaginal Canal** : Deliver **vein and blood supply** for **nasopharynx**
- **opalatine canal** : For passage of **palatine artery**.
- **Sphenopalatine foramen** : On **medial wall of pterygopalatine** for passage of **Sphenopalatine artery and Nasopalatine Nerve to Nasal Cavity** → palatine bon
- **pterygomaxillary fissure** : Connect **pterygopalatine fossa** with the **infra temporal** for **Maxillary Nerve and Maxillary artery**.
exiting the fossa. entering the fossa.
- **Inferior Orbital fissure** : Between **pterygopalatine fossa** and **Orbital Cavity** for passage of **terminal ends of Maxillary Artery and Maxillary Nerve**.



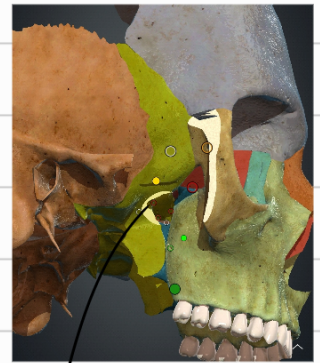
foramen Rotundum



Pterygomaxillary fissure



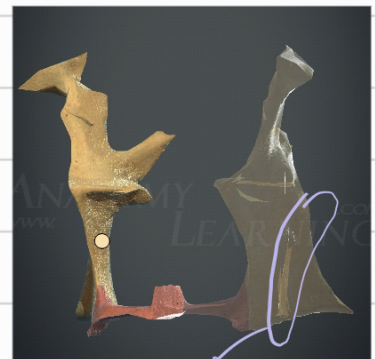
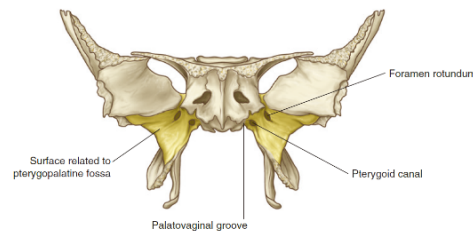
Inferior Orbital fissure



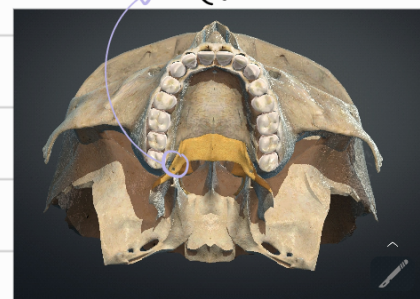
Rotundum

Contents

- 1- Maxillary Nerve
- 2- Terminal part of Maxillary artery
- 3- Nerve of pterygoid canal
- 4- pterygopalatine ganglion (parasympathetic).
- 5- Veins and lymphatics.



Palatine canal



Nerves

☆ Nerve of Pterygoid Canal

↳ Parasympathetic:

↳ Greater petrosal nerve pass in the canal then reach the ganglia and synapse

(preganglionic parasympathetic).

After synapsing → postganglionic parasympathetic

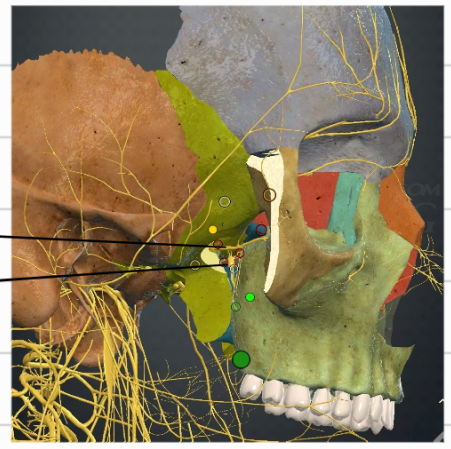
are distributed with branches of Maxillary nerve and artery.

Great petrosal : preganglionic parasympathetic

Deep petrosal : postganglionic sympathetic

Glands in Nose + palate + lacrimal

Maxillary
Ganglion



↳ Sympathetic:

↳ from Superior Sympathetic ganglion in the neck

↳ gives postganglionic sympathetic that pass to pterygopalatine fossa and do not synapse → distributed with the maxillary artery and nerve

Pterygopalatine ganglion

☆ The pterygopalatine ganglion receives sensory nerves from maxillary 2 branches

- Gives branches to

Orbital cavity + Temporal bones + Nose + pharynx (mainly nasopharynx)

↳ Distributed with maxillary nerve and artery branches.

- Orbital branches

- * pass through the inferior orbital fissure.
- * Supply the
 - ① Orbital wall (periosteum)
 - ② Lacrimal Gland
 - ③ Sphenoidal and Ethmoidal air sinuses.

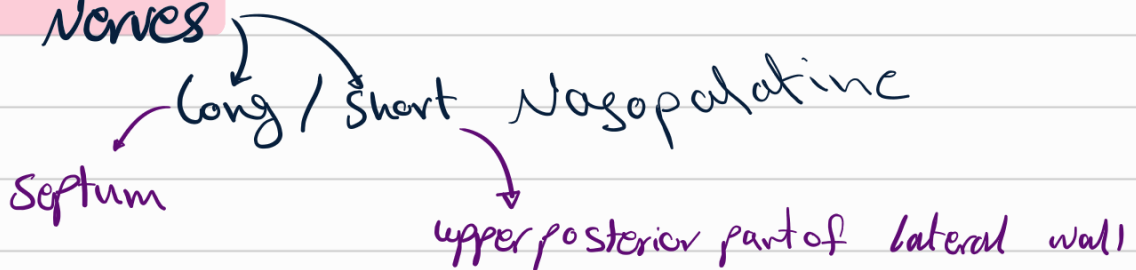
Pharyngeal Nerve

- posteriorly from the pterygopalatine ganglion
- Leaves the fossa through the palatovaginal canal.
- Supply the mucosa and glands of the nasopharynx

Greater and lesser palatine nerves

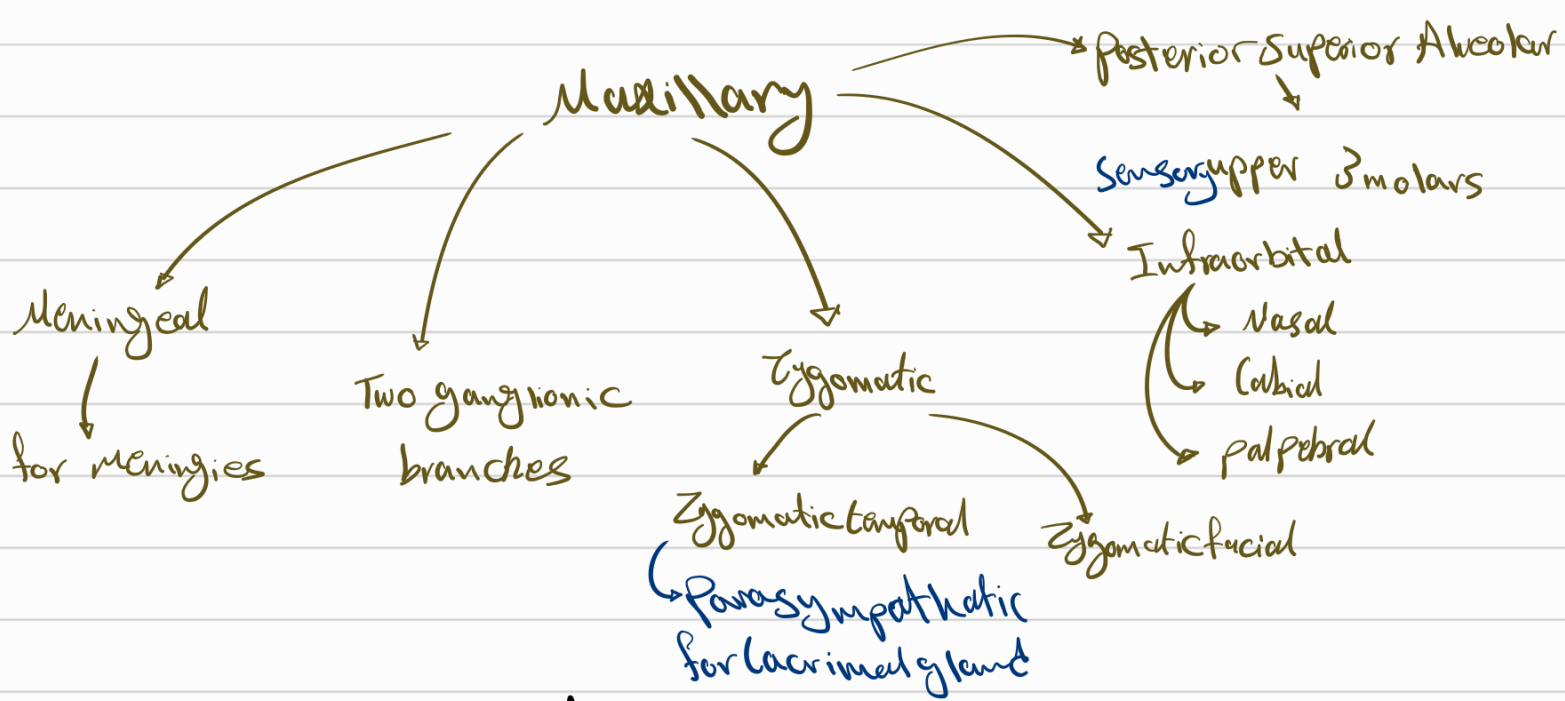
- ↳ Hard palate
- ↳ Soft palate
- ↳ Then through incisive foramen to the nasal cavity.

Nasal Nerves



Maxillary Nerve

- Branch of trigeminal in the mid cranial fossa.
- pure Sensory
- Firstly enters the foramen rotundum then enters the ganglion (Sensory nerves for ganglion) → branches in Pterygopalatine fossa.
- Terminates in intraorbital foramen
 - Palpebral → lower eyelid
 - Nasal → External nose
 - Labial → upper lip



Maxillary Artery

- Major branch of External carotid.
- originate at the level of the neck of mandible within the parotid gland.
- Enters the pterygopalatine fossa through the pterygomaxillary fissure (The third part)

☆ Divided into 3 parts by the lateral pterygoid muscle.
 usually posterior but sometimes anterior to the Artery

1st part: before the muscle

2nd part: related to the muscle (Anterior or posterior)

3rd part: after the muscle (from infratemporal fossa through pterygomaxillary fissure to pterygopalatine fossa)

First part

Gives 5 branches that all pass through a foramina.

1- Inferior Alveolar → Mandibular foramen

2- Middle meningeal Artery → Foramen Spinosum → Cranial fossa.

3- Accessory meningeal → Foramen ovale

4- Deep auricular and 5- Anterior tympanic → auricle

Second part

5 muscular branches for muscles of mastication.

Temporalis + masseter + medial and lateral pterygoid + buccal muscles.

Third part

branches distributed with branches of maxillary nerve.

1- Sphenopalatine : long + short

2- palatine : greater + lesser

3- Orbital → Infraorbital

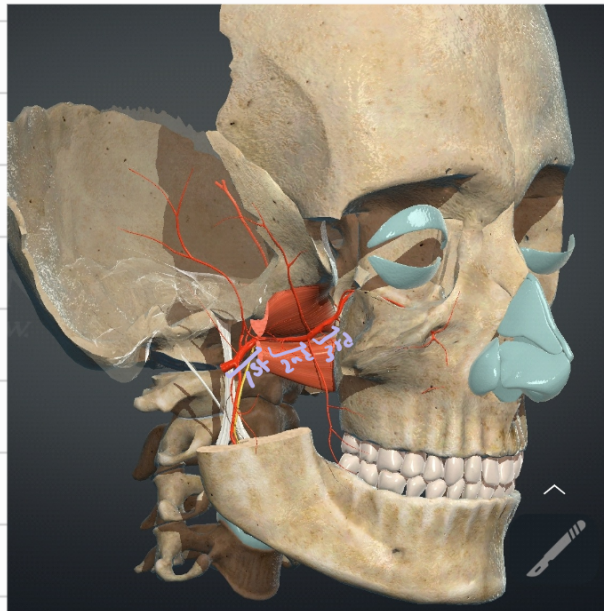
→ Nasal
→ Labial
→ Palpebral

Firstly it enters the orbital canal → Orbital groove → exits from the ^{foramen}
gives
Anterior Superior Alveolar Middle Superior Alveolar

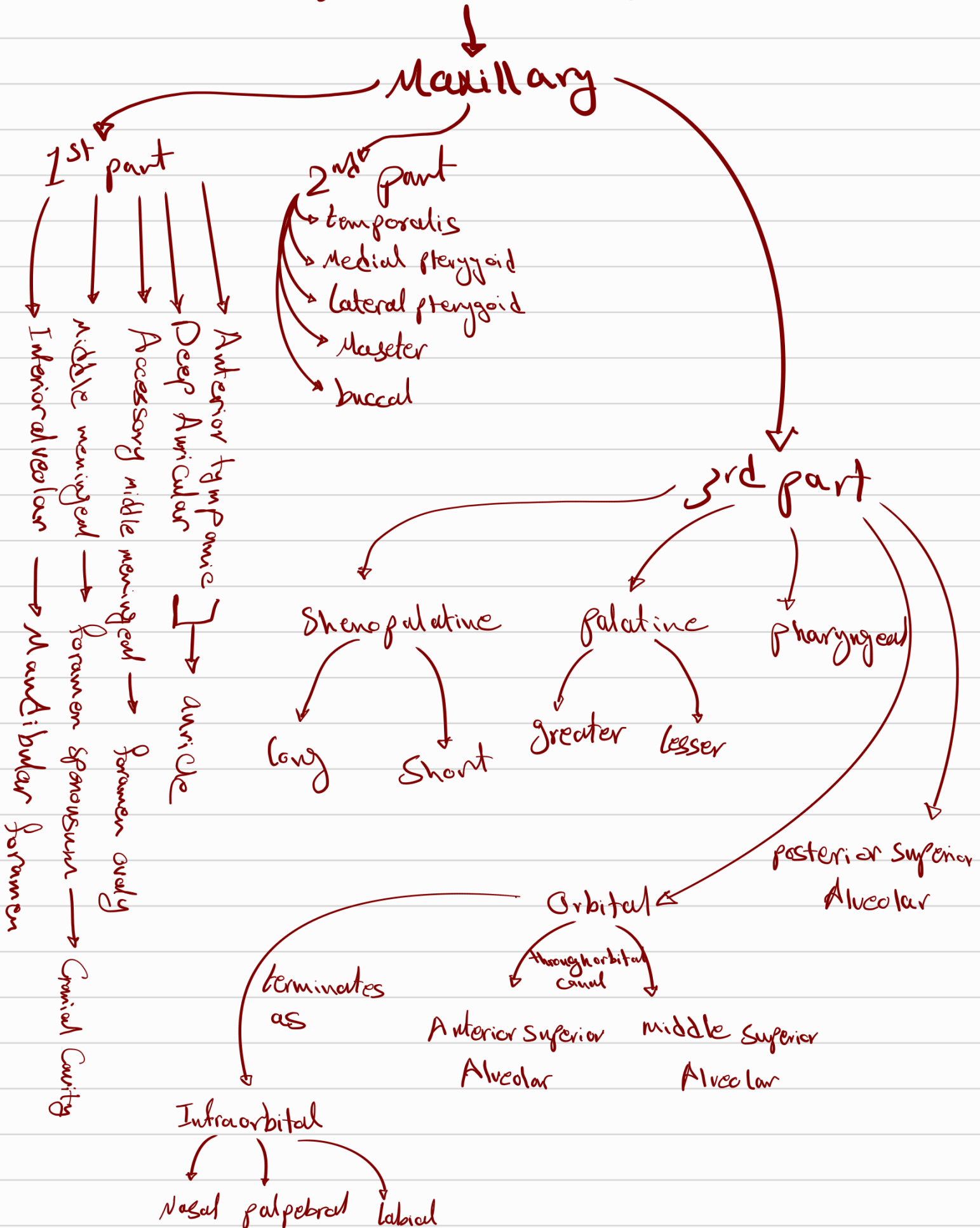
4- Pharyngeal

5- posterior superior alveolar → Molars + premolars + gingiva + Maxillary Sinus.

6- Artery of pterygoid canal : through the pterygoid canal and supplies its structures → terminates in the mucosa of nasopharynx



External Carotid



Veins

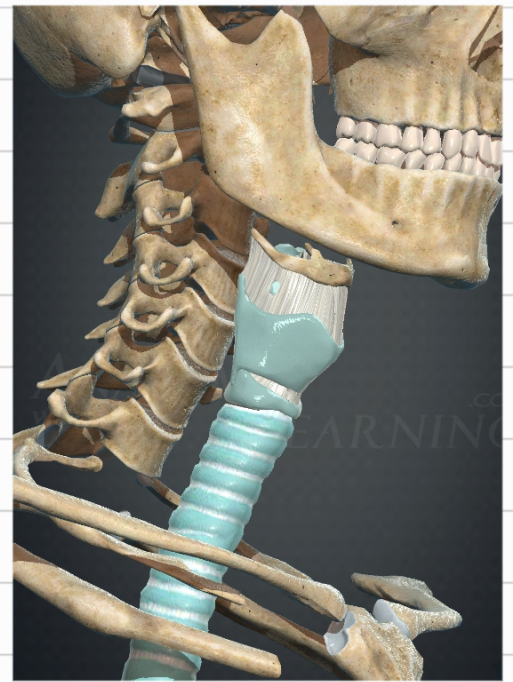
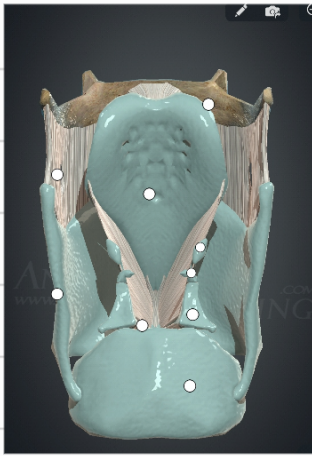
- Drain areas supplied by the arteries
- Then they all go to posterior of pterygoid plexus of veins.
 - ↳ Around lateral pterygoid muscle.

* The plexus will form the maxillary vein → in the parotid
Joins the superficial temporal to form retromandibular vein

* Some veins may go to intraorbital vein → Cavernous Sinus.

* Pterygoid plexus is connected with Cavernous Sinus by emissary veins through foramen spinosum and foramen ovale.

LEC 3 LARYNX



☆ Extends from the middle of C3 vertebra till the level of the lower border of C6.

☆ Upper boundary: hyoid bone. (Not included in the skeleton of larynx)

☆ Formed of many cartilages:

- Single:

- ① Epiglottis
- ② Thyroid cartilage
- ③ Cricoid cartilage (the larynx extends to the lower border of cricoid)

- Paired

- ① Arytenoid
- ② Cuneiform
- ③ Corniculate

☆ Lining Epithelium: (Respiratory mucosa) pseudostratified columnar ciliated.
↳ Except for true vocal cords.

☆ Between Cartilages there are Membranes and Ligaments
↳ to connect the cartilages

Ex: Thyrohyoid membrane, connects hyoid and thyroid cartilage
↳ Thickening in midline.
↳ On lateral sides it becomes a ligament

☆ There are also muscles in the larynx (intrinsic muscles of Larynx).

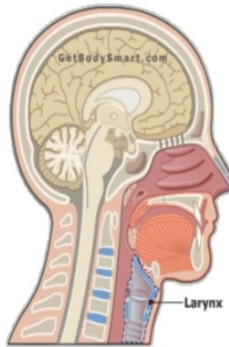
☆ Outside the larynx there is a connective tissue.

- Layers of larynx:

- ① Mucosa
- ② Cartilage
- ③ Ligaments and membranes and muscles
- ④ Connective tissue.

Functions

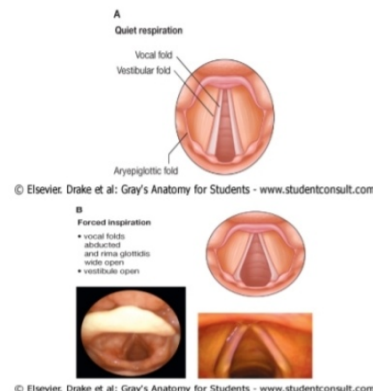
- 1. acts as an **open valve in respiration**
- 2. Acts as a **closed valve in deglutition**
- 3. Acts as a **partially closed valve in the production of voice**
- 4. During cough it is first closed and then open suddenly to release compressed air



Functions

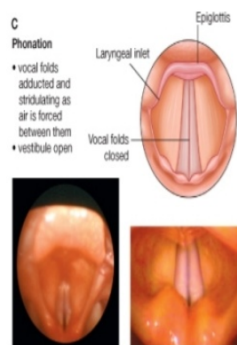
Respiration

- During quiet respiration, the laryngeal inlet, vestibule, rima vestibuli, and rima glottidis are **open**
- During forced inspiration the arytenoid cartilages are **rotated laterally**, mainly by the action of the **posterior crico-arytenoid muscles**.
- As a result, the vocal folds are **abducted**, and the **rima glottidis widens** into a rhomboid shape, effectively **increases the diameter of the laryngeal airway**.



Phonation

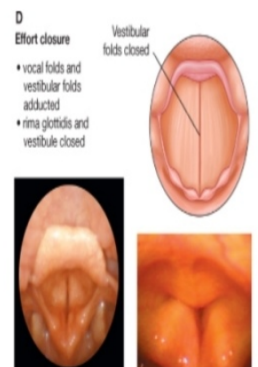
- When phonating, the arytenoid cartilages and vocal folds are **adducted** and air is forced through the **closed rima glottidis**
- This action causes the vocal folds to **vibrate** against each other and produce sounds
- Can then be modified by the upper parts of the airway and oral cavity
- **Tension** in the vocal folds can be adjusted by the **vocalis and cricothyroid muscles**.



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Effort closure

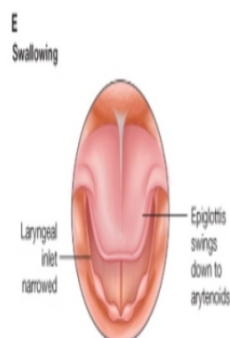
- Effort closure of the larynx occurs when air is retained in the thoracic cavity to **stabilize the trunk**
- For example during heavy lifting, or as part of the mechanism for increasing intra-abdominal pressure
- The rima glottidis is **completely closed**, as is the rima vestibuli and lower parts of the vestibule
- The result is to completely and **forcefully shut the airway**.



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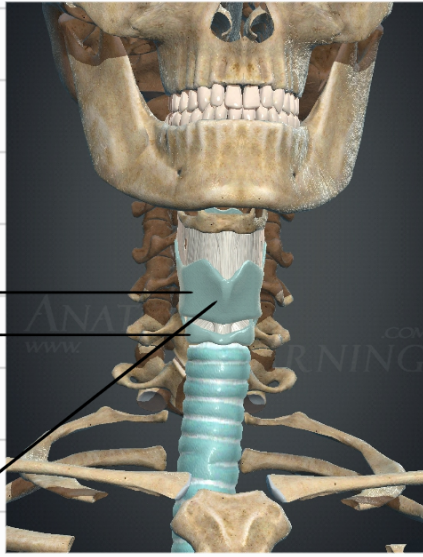
Swallowing

- During swallowing, the rima glottidis, the rima vestibuli, and vestibule are **closed** and the **laryngeal inlet is narrowed**
- The larynx moves **up and forward**
- This action causes the **epiglottis** to swing **downward** to effectively **narrow or close the laryngeal inlet**
- The up and forward movement of the larynx also **opens the esophagus**
- All these actions together **prevent solids and liquids from entry into the airway**



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Cartilage



Single

① Epiglottis

② Thyroid

③ Cricoid

Adam's Apple 🍏

epiglottis

pairs

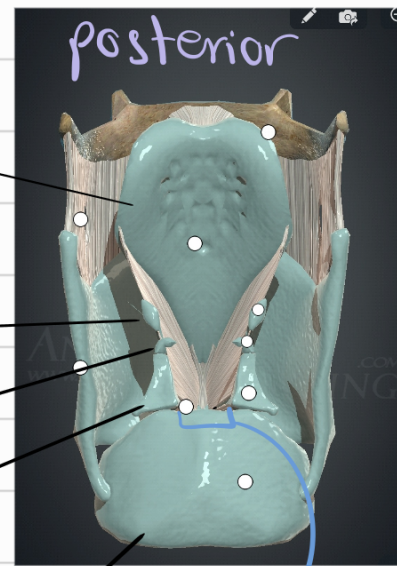
① Cuneiform

② Corniculate

③ Arytenoid

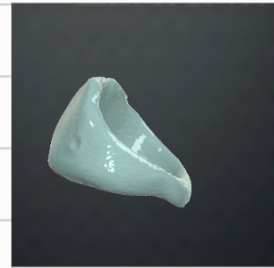
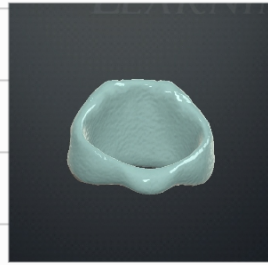
Cricoid cartilage

Aryepiglottic fold

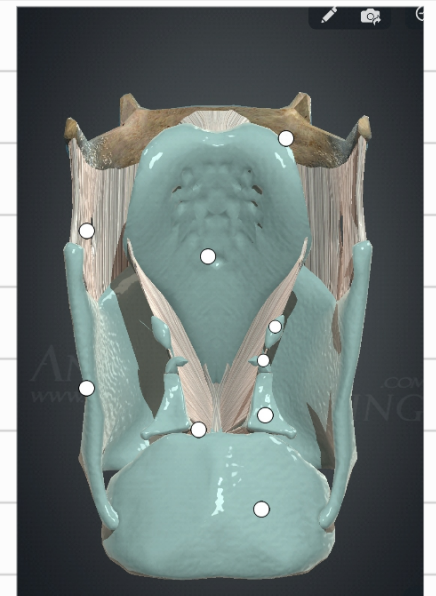


posterior

Cricoid Cartilage



Signet Ring appearance



* Cricoid cartilage from → Anterior : arch
→ posterior : lamina

* On the lamina

① laterally a facet for articulation with inferior thyroid horn (of thyroid cartilage).



② upper border: 2 facets for articulation with Arytenoid.



③ Ridge: Attached to a ligament connecting the cricoid and esophagus.

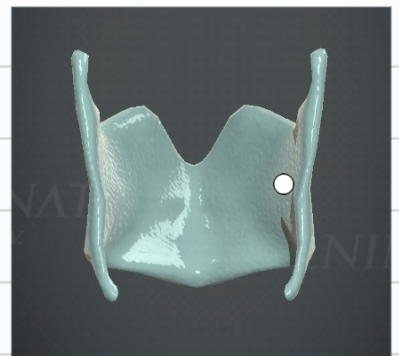
→ The esophagus is posterior to trachea and is fixed in place through this ligament.

④ Two depression on the sides of the ridge: attached to a muscle **posterior Cricarytenoid**
→ Abduction of true vocal cord.

⑤ On lateral sides **Lateral Cricarytenoid**
→ Adduction of true vocal cords

Origin: Cricoid
Insertion: Arytenoid
Nerve: Recurrent laryngeal

Thyroid Cartilage



* Two lamina laterally

* Connected together anteriorly forming angle (Thyroid angle)

Superiorly
Laryngeal prominence
Adam's apple

Inferiorly
Inferior thyroid notch

* The angle anteriorly attached to the true vocal cords.
↳ Vocal cords are attached to the vocal process of Arytenoid.

* The two lamina are opened posteriorly.

↳ And form Superior and Inferior horns

Articulate with greater
horn of hyoid bone

↳ Articulate with lamina
of cricoid

- each horn has articulation facet

Laryngeal prominence (Adam's apple)

↳ The angle is acute in males / obtuse in females

↳ Due to hormonal causes.

In males: After puberty → Testosterone is released →

Heavy bones + Bulky strong muscles → acute angle

So the vocal cords are lax → low pitch of voice

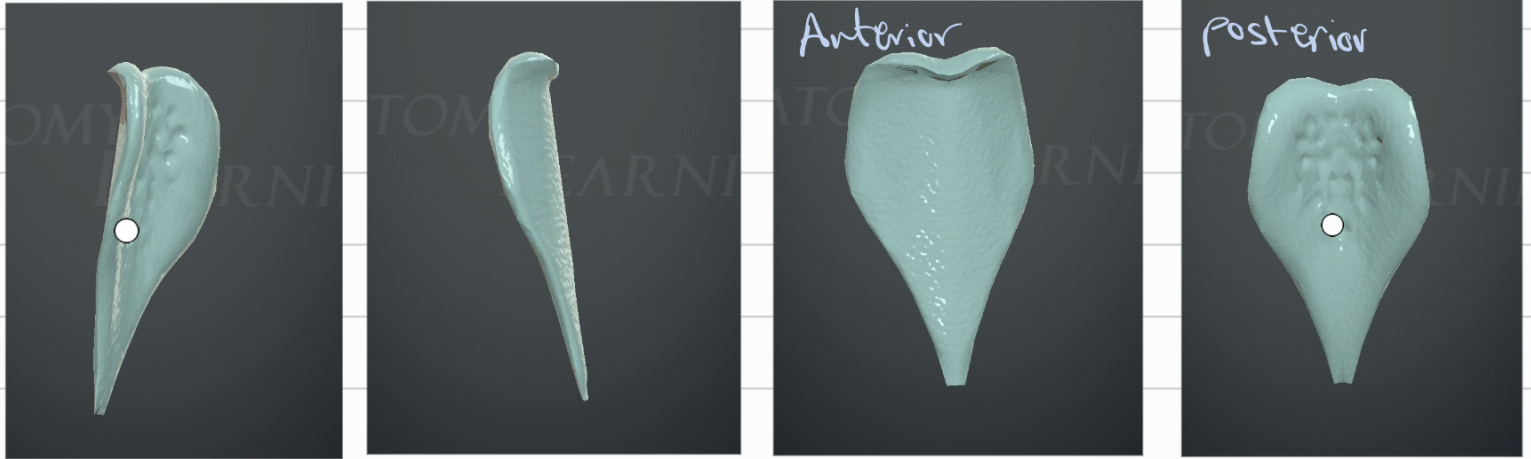
In females: Estrogen and progesterone are released →

light bones + smooth muscles → obtuse angle

So the vocal cords are taut → high pitch of voice

- ★ On lamina → Oblique line (muscular line)
 - ↳ attached to infrahyoid muscles
 - like: Sternohyoid + Thyrohyoid (Extrinsic muscles)

Epiglottis



- ★ upper free edge
- ★ Apex attached to the angle of thyroid.
- ★ 2 Surfaces: ① Superoanterior
 - ② posteroinferior (contains tubercles)

★ Epithelium:

↳ Anterior surface

↳ Stratified Squamous Non-keratinized

↳ Because it's connected with tongue

↳ Other parts

↳ pseudostratified ciliated columnar with goblet cells

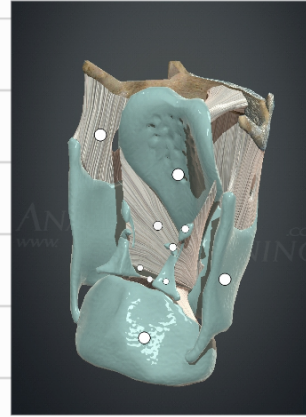
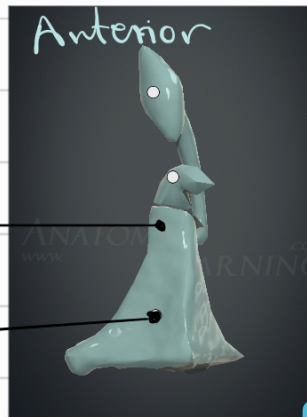
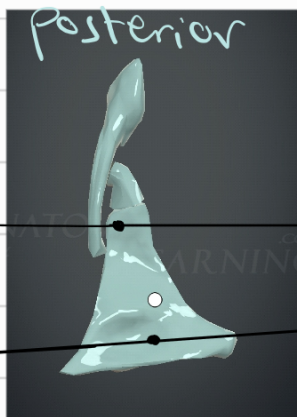
- ★ edge of epiglottis has a fold → Connected with Arytenoid
 - ↳ Aryepiglottic fold (boundary of inlet of larynx)
 - ↳ contain uniforn and cuneiform cartilages.

Arytenoid

Base
Apex
2 Surfaces
2 Processes

Apex ←

Base ←



- Base Articulate with Cricoid.
- Apex Articulate with Corniculate through alligament.

☆ 2 Surfaces : Lateral and medial → Smooth



have ridge separation Superior depression
Attached to vocalis muscles.

from inferior depression
→ vestibular ligament
that forms vestibular fold.

- ☆ 2 processes : (1) Anterior : Vocal process → Attached to true vocal cord.
- (2) Posterior & Muscular process

Corniculate and Cuneiform

Both are in the Aryepiglottic fold.



Corniculate

* Too small Conical cartilages articulates with apex of Arytenoid



Ligaments

* Extrinsic ligaments:

① Thyrohyoid

From thyroid cartilage to hyoid bone enters inside the hyoid and attach its upper border.

* Contain opening for passage of nerves and arteries

* Internal laryngeal v.

↳ branch of vagus
↳ Sensory to larynx above true vocal cords.

* Superior laryngeal A.

Branch of Superior thyroid.

② Cricotracheal

Between cricoid and first tracheal ring.

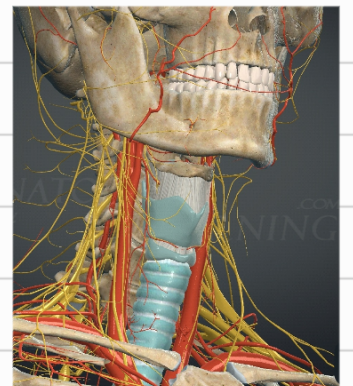
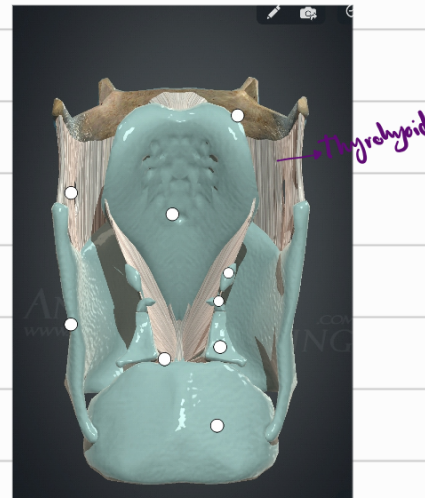
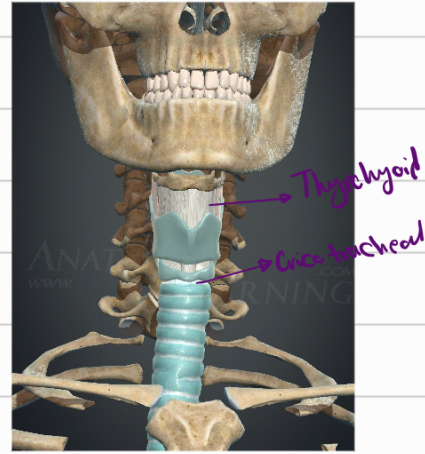
Tracheostomy: Important in emergencies in cases of the block in respiration.

→ Make opening in the Suprasternal notch → the trachea is directly behind it.

→ Rush of air.

Also done during some operations like in case of Thyroidectomy → may induce a cut in the recurrent laryngeal on both sides → Adduction of true vocal cords → Suffocation
↳ The opening must be below vocal cords.

③ Hyopiglottic



* Intrinsic ligaments.

* More important than extrinsic.

* Fibroelastic

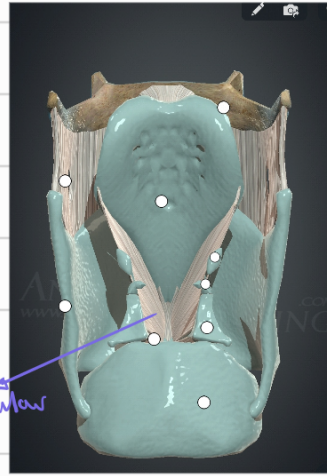
In the midline

Cricothyroid ligament: Originate inner surface of Cricoid then ascends up toward Thyroid but don't attach to it → It will form upper free edge → Vocal ligament.

* Vocal ligament attached to vocal process of Arytenoid and Angle of thyroid.

- Also known as Cricovocal.
- Surgeons name it as conuselasticus.

Quadrangular



Quadrangular membrane

- Start from edge of epiglottis → then descends toward thyroid.
- Have lower free edge forms vestibular ligament (false vocal cords)

Joints

- All are synovial joints. → Rotatory movement.

Cricothyroid joint

- Between cricoid and inferior horn of thyroid.
- Tense of true vocal cords by cricothyroid muscle.
 - ↳ Moves forward then inward movement (Rotatory movement internal)

Crico-arytenoid joint

Rotatory movement by two muscles: 1- posterior crico-arytenoid. Abduction
2- lateral crico-arytenoid. Adduction

Cavity of larynx

Divided into 3 compartments.

① Vestibule

↳ between inlet to false vocal cords

② Glottic compartment

↳ Between false and true vocal cords

③ Intraglottic compartment

↳ Between true vocal cord and trachea

Beside the Glottic (middle) compartment there is a ventricle forming a sacule. The sacule moves upward and filled with Glands to secrete Seromucous secretions for lubrication for true vocal cords.

Inlet

- Endotracheal tube from oral cavity → Inlet of larynx → between the two vocal cords → trachea
↳ to make sure that air is entering even in case of adduction of the true vocal cords.

Muscles in inlet:

① Aryepiglottic muscle

↳ In the Aryepiglottic fold
↳ for opening the inlet

② Oblique Arytenoid muscle

↳ Closure of inlet (posterior part mainly)

③ Transversus Arytenoid

↳ Closure of inlet (posterior part mainly)

Closure of inlet by muscles occurs mainly in the posterior part. While the anterior closes by epiglottis that descends downward and larynx moves upward

Vocal folds

- * Vocal cords are formed of vocal ligament + vocalis muscle + mucosa
- * Stratified squamous non-keratinized → for rapid regeneration.
- * No Submucosa
- * No Blood vessels → white in color.
- * No lymphatics
- * longer in males than in females

Vestibular folds → above true

- No action in articulation
- vascularized → Red color
- Mucosa: Respiratory mucosa.
- Rima Vestibuli: space between False Vocal cords.
- Rima glottidis: space between True Vocal cords. narrower than Rima Vestibuli.
 - narrow by adduction and wide by abduction of true vocal cords.

Muscles of Larynx (Intrinsic)

group 1 Inlet muscles

- ① Aryepiglotticus: for opening
- ② Oblique Arytenoid: Closure
- ③ Transversus Arytenoid: Closure

Vocal cord muscles

group 2 tense/relaxation

- ① Cricothyroid: tense
- ② Thyroarytenoid: relaxation
 - Vocalis muscle.

group 2 Adduction/Abduction

- ① Adduction: lateral Cricoarytenoid
- ② Abduction: posterior Cricoarytenoid.

All Supplied by recurrent laryngeal N. Except the Cricothyroid Supplied by External laryngeal N.

- Vagus → Superior laryngeal

- Internal: sensory
- External: motor

☆ Cricothyroid is made of two parts Oblique and Strate.
from Cricoid → thyroid.

☆ Transvers Arytenoid: Origin: posterior Surface of arytenoid
Insertion: The other Arytenoid

☆ Oblique Arytenoid : Origin: Aryepiglottic fold.
Insertion: Apex of Arytenoid

Extrinsic

Elevators

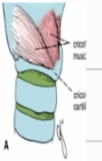
- ① Digastric
 - ② Stylohyoid
 - ③ Mylohyoid
 - ④ Geniohyoid
- The larynx moves up during swallowing by these muscles.

Depressors:

- ① Sternothyroid
- ② Sternohyoid
- ③ Omohyoid

The students should know the Intrinsic muscles (origin/insertion/nerve supply/action):

	origin/	insertion/	nerve supply/	action):
1. Cricothyroid muscles	anterolateral surf. of Cricoid	thyroid cartilage	External laryngeal	tense vocal cords
2. Posterior crico-arytenoid muscles	Back of cricoid	muscular process of Arytenoid	Recurrent laryngeal	Abducts vocal cords
3. Lateral crico-arytenoid muscles	upper border of Cricoid	muscular process of Arytenoid	Recurrent laryngeal	Adducts vocal cords
4. Transverse arytenoid	Back and medial surf. of Arytenoid	Back and medial surf. of the opposite Arytenoid	Recurrent laryngeal	Closes posterior part of Rima Glottidis
5. Thyroarytenoid (vocalis)	Inner surface of Thyroid	Arytenoid	Recurrent laryngeal	Relaxes vocal cords
6. Oblique arytenoid	muscular process of Arytenoid	Apex of opposite Arytenoid.	Recurrent laryngeal	Narrows the inlet (closes posterior part)
7. Thyroepiglottic (aryepiglottic muscles)	lateral surf. of Thyroid	lateral margin of epiglottis and aryepiglottic fold.	Recurrent laryngeal	widens the inlet



LEC-4

Blood Supply

passes with Internal laryngeal v.

- External Carotid → Superior thyroid → Superior laryngeal Artery
- Sub Clavian → Thyrocervical trunk → Inferior thyroid → Inferior laryngeal Artery
↳ with Recurrent laryngeal v.

Veins

Superior laryngeal Veins → Superior thyroid → Internal jugular
Inferior laryngeal Veins → Inferior thyroid → Left Brachiocephalic

Lymphatic

Above true Vocal Cords → Deep cervical lymph nodes
Below true vocal cords → paratracheal lymph nodes

Nerves

Sensory for mucosa above true vocal

Inferior laryngeal ganglia → Superior laryngeal → Internal laryngeal → Sensory for mucosa above true vocal
→ External laryngeal → Motor for Cricothyroid muscle.

Sensory

Above true Vocal cord → Internal laryngeal

Below true vocal Cords → Recurrent laryngeal

On left side it hooks under the aortic arch

On Right side hooks below right subclavian.

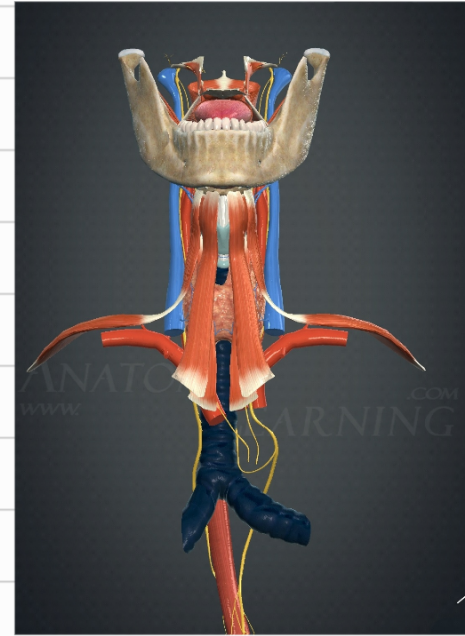
Left is longer than Right

Motor : All muscles are supplied by recurrent laryngeal N. except for Cricothyroid by External laryngeal N.

Relations

On each side :

Carotid sheath : Contains : Nerve + Vein + Artery.



Clinical notes

Thyroidectomy : Read from Dis slides

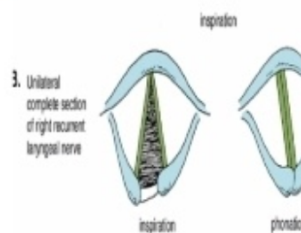
Thyroidectomy

- Sectioning of the **external laryngeal** nerve might happen in thyroidectomy
- Due to the close relationship between the external laryngeal nerve and the superior thyroid artery.
- Produces **weakness in voice** since the vocal cords cannot be tensed (cricothyroid M.).

Section of the Recurrent laryngeal nerve

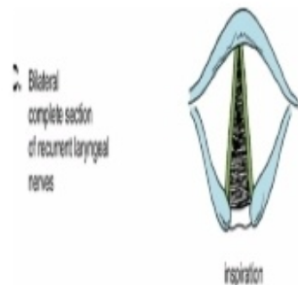
1. Unilateral complete section:

- One vocal fold (on the affected side) in the position midway between abducted and adducted
- Speech not greatly affected as the other vocal cord compensates for the action.



2. Bilateral complete section:

- Both vocal folds in position midway between abducted and adducted
- Breathing is impaired since the rima glottis is partially close and speech is lost



3. Unilateral partial section :

- This results in a greater degree of paralysis of the abductor muscles than of the adductor .
- Therefore the affected cord is in the adducted midline position
- Hoarseness of the voice (the other vocal fold compensates the action)

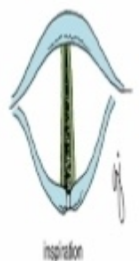
1. Unilateral partial section of right recurrent laryngeal nerve



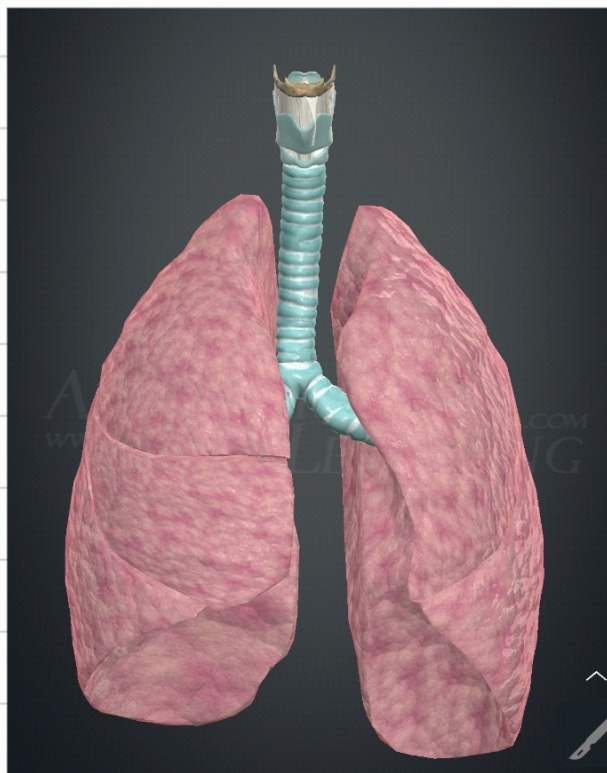
4. Bilateral partial section:

- This results in bilateral paralysis of the abductor muscles
- Therefore the vocal folds are adducted together in the midline
- Acute breathlessness (Dyspnea) and stridor follow
- Lead to suffocation so tracheostomy is necessary

2. Bilateral partial section of recurrent laryngeal nerves



LUNGS



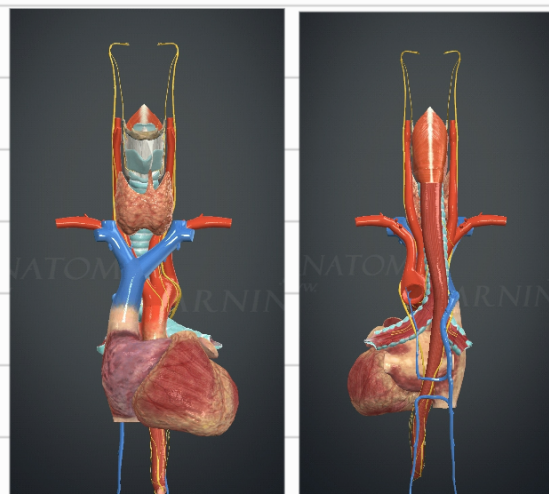
Trachea

- Starts at the level of C6 and End at the level of the disc between T4 and T5.
- 5 inches long.
- Diameter equal to diameter of index finger (Adult)
- Very narrow equal to diameter of a pencil (Children).
- Contain 16-20 C-shaped hyaline cartilage. That's absent posteriorly and replaced by trachealis muscle. (Smooth muscle).

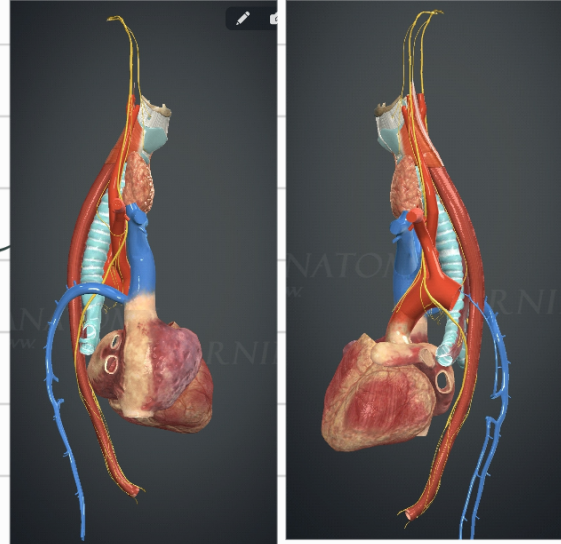
* Relations:

- posteriorly:
 - ① Esophagus
 - ② left recurrent laryngeal Nerve
 - ③ Thoracic duct.
- Anteriorly:
 - ① Aortic Arch
 - ② Thyroid (remains)
 - ③ Smooth of thyroid In front of 2nd, 3rd & 4th tracheal rings
 - ④ Origin of brachiocephalic artery
 - ⑤ Manubrium Sterni
- Right:
 - ① Right pleura and lung
 - ② Azygous Arch.
 - ③ brachiocephalic Artery.
 - ④ Right vagus and phrenic
 - ⑤ Right main bronchus

The Right one branches at the root of the neck while the left in the chest



- left ① left pleura and lung
- ② Arch of Aorta
- ③ left Subclavian and Common carotid
- ④ left main bronchus
- ⑤ left Vagus and phrenic
Posterior Anterior to lung hilum



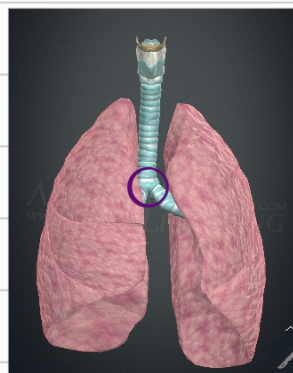
Carina

- Cartilaginous ridge covered by mucosa.

* Very Sensitive → If any thing touch it it will lead to cough.

↳ When using bronchoscope must be careful not to touch the carina.

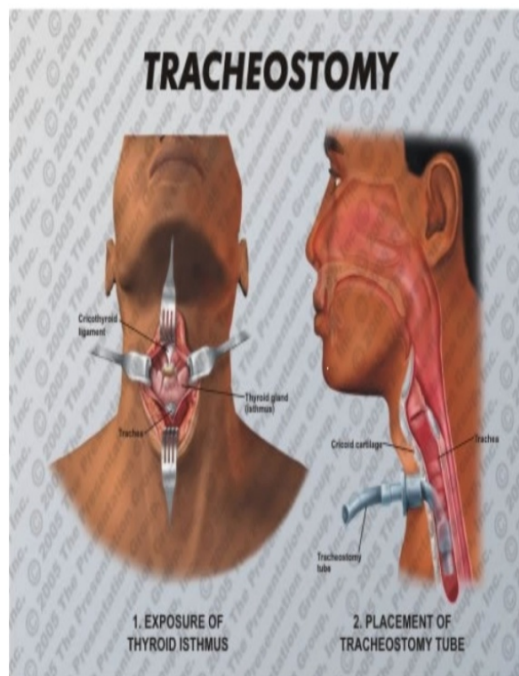
* With deep inspiration it descends to T₆.

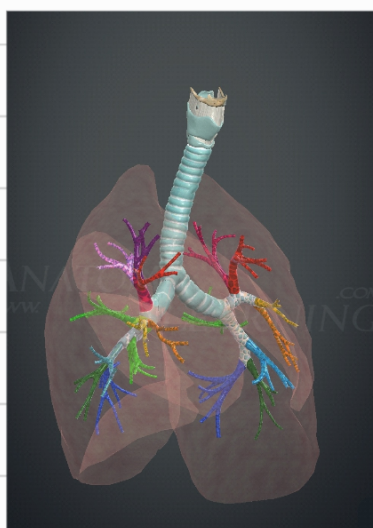


Tracheotomy and Intubation

Tracheotomy and intubations

- Used to reestablish airflow past a tracheal obstruction.
- If the obstruction is superior to the larynx a tracheotomy may be performed
- A longitudinal incision below the cricoid cartilage
- The patient can breathe through a metal or plastic tube.
- in intubation the tube is inserted through the mouth or nose and push aside any flexible obstruction
- Any mucous clogging can be suctioned through the tube





Main Bronchi (primary)

- Trachea terminate as right and left main bronchus at level of T₄ and T₅.
- * The **Right** is ^{1 inch} shorter, wider and more vertical.
- * The **left** is ^{2-3 inch} longer, narrower and horizontal.
- foreign bodies can enter the right side easier

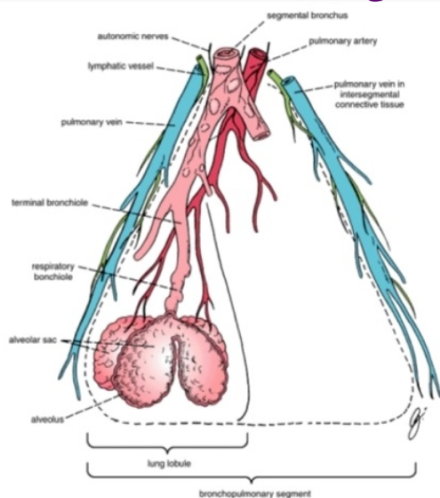
Secondary Bronchi (lobar Bronchi) (Secondary)

- In Right : 3 secondary bronchi
- In left : 2 secondary bronchi

Bronchopulmonary Segment

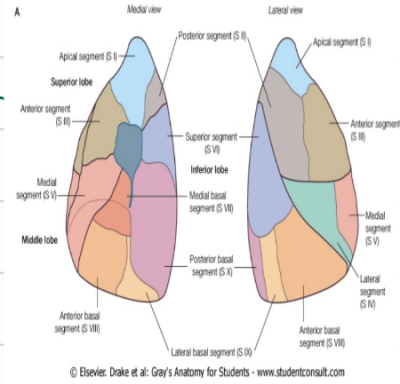
- 10 in each lung.

- Pyramidal in shape with an apex near the hilum of the lung and a base on the surface of the lung.
- On its two sides there is a connective tissue and pulmonary vein



★ Inside the segment there are : ① Bronchi ② Bronchioles ③ Alveoli
 ↳ Veins in the periphery. ④ Pulmonary Artery ⑤ Lymphatic vessel
 ⑥ Nerve.

Right lung : upper lobe : ① Apical ② Anterior ③ posterior
 middle lobe : ④ Medial ⑤ lateral
 Basal lobe : ⑥ Apicobasal ⑦ Anterior ⑧ Medial
 ⑨ lateral ⑩ posterior



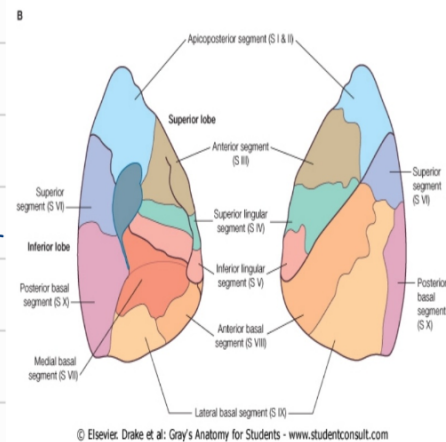
* If a foreign body enters the lung → bronchopulmonary segments, commonly it will go basally

- But If a tooth slips from the dentist's hand and is aspirated while the patient is lying supine, it will most likely enter the apicobasal segment.

- If a child aspirates a small object sitting uprite during play, it is most likely to enter the posterior basal.

Left lung : upper lobe : ① Apical ② posterior
 ③ Anterior ④ Sup. lingual
 ⑤ Inf. lingual

↳ Basal lobe : ① Apical (Apicobasal)
 ↳ just like the ② Anterior ③ Medial
 basal lobe in right lung ④ lateral ⑤ posterior



- Before birth : Rt. Lung 10 Segments

Lt. Lung 8 Segments

↳ upper lobe have : Apicoposterior → Apical
 ↳ Posterior
 ↳ Basal lobe have : Anteromedial → Anterior
 ↳ Medial

Clinical importance of pulmonary segments

- Surgery: very important in case of a tumor we make segmentectomy
Not lobectomy.
- Infection: kept localized in the segment *may spread in progressive cases, because there is no barrier.*
- No barrier
- Bronchoscopy: for removal of foreign bodies + take biopsy - - - -
- postural drainage.

Lungs

Right:

3 lobes: upper + middle + lower

2 fissures: horizontal + oblique

Left

2 lobes: upper + lower

1 fissure: oblique

** lingula found in*

left lung and not in the right.

★ Right Oblique fissure starts posteriorly 4cm away from T₄ Ant. then pass in the 5th intercostal space and meet the 6th rib.

★ Right horizontal fissure starts anteriorly at the level of 4th costal cartilage and descends to the 5th intercostal space and meet the 6th rib.

Impressions in Right lung

★ Anterior to hilum related to deoxygenated blood:

① Right atrium ② SVC ③ IVC

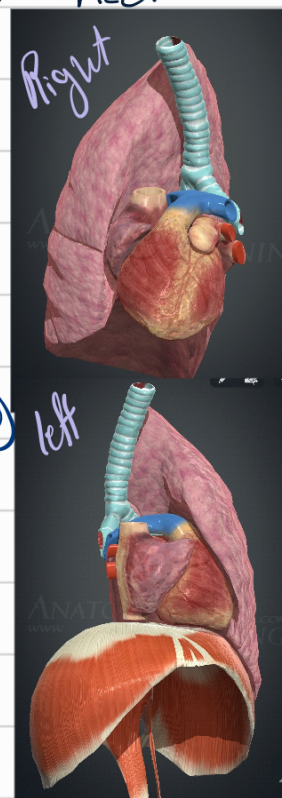
★ posterior to hilum: ① esophagus (starting from Apex)
② Trachea (*deviated to the right*)

Impressions in left

★ Related to oxygenated blood:

① Left ventricle ② Aortic arch and its branches.

③ Descending thoracic Aorta ④ esophagus (*only lower part behind the hilum*)



Left Ant. border differs than the right due to the presence of the cardiac notch. → semicircular notch with a radius of 1 cm.
→ between 4th rib and 6th rib.

Posterior border: From 7th Cervical to 10th Thoracic Vertebra

Base: ① The intersection between the mid clavicular line and 6th rib
② The intersection between the Midaxillary line and the 8th rib
③ Dorsal vertebral line with the 10th thoracic vertebra.

*Surface anatomy of pleura:

- Apex is similar to the lung.
- Ant. border similar to the lung. (the lung reaches the 6th while the pleura reaches the 7th).
- post. border is different:

it reaches the 12th thoracic vertebra not the 10th.

- Base: Midclavicular — 8th (not 6th)
Midaxillary — 10th (not 8th)
Vertebral — 12th (not 10th)

→ why the pleural base descends 2 spaces?

Because when the lung is inflated it descends 2 spaces.

- In case of collection of air, pus, blood accumulate in the space between lung and pleura.

- For suction, must put the syringe in the space between lung and pleura.

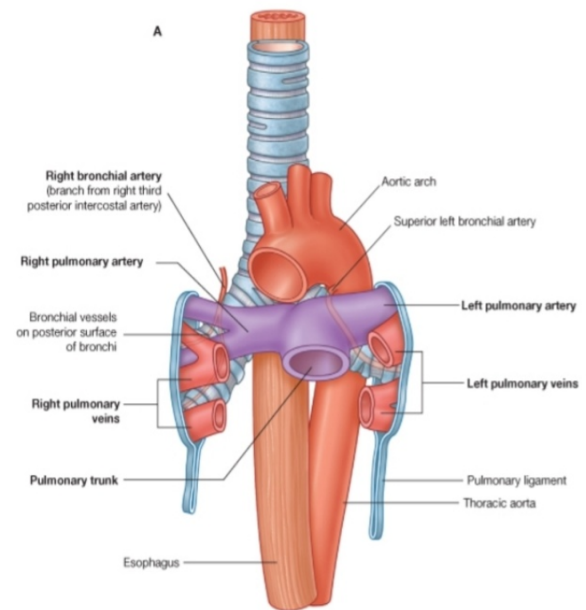
- Midaxillary — 9th intercostal space.
- Midclavicular — 7th intercostal space.

Pulmonary Arteries

- Pulmonary trunk arise from the right ventricle
- Ascends upward to the level of T₅ and divides to right and left pulmonary arteries.
 - The bifurcation of the pulmonary trunk occurs to the left of the midline just inferior to vertebral level T₄, and anteroinferiorly to the left of the bifurcation of the trachea.
- The Right is longer.
- Enter the hilum.
- The Right in the right hilum divides into two one above and one below.
- While the left remains one.

Relations:

- The **right pulmonary artery** is longer than the left and passes horizontally across the mediastinum. It passes:
 - anteriorly and slightly inferiorly to the tracheal bifurcation and anteriorly to the right main bronchus;
 - posteriorly to the ascending aorta, superior vena cava, and upper right pulmonary vein.
- The **left pulmonary artery** is shorter than the right and lies anterior to the descending aorta and posterior to the superior pulmonary vein.



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Pulmonary Veins

- 2 from right and 2 from left.
- One superior and one inferior in the lower part of hilum.

Bronchial Arteries and Veins

- Blood Supply for lung tissue.
 - oxygenated blood to lungs.
 - On Right side: from 3rd posterior intercostal artery.
 - On left side: from 2nd + 3rd posterior intercostal artery.
 - Enters from hilum.
- from Descending thoracic Aorta.

Veins:

- Opens in left atrium.
- or to Azygos vein.

Innervation

- pulmonary plexus of Nerves

↳ Anterior: Anterior to end of trachea.
↳ posterior: posterior to end of trachea

- Parasympathetic, from Vagus bronchoconstriction.
- Sympathetic: from cervical sympathetic ganglia bronchodilation

Lymphatic drainage

- All go to hilum → paratracheal → bronchomediastinal
- In left → thoracic duct
In right → Right lymphatic duct.

LEC-6

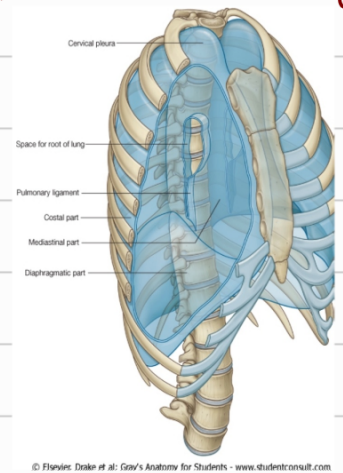
PLEURA

- * Two cavities each containing a lung.
 - * Two membranes: ① visceral: Adherent to lungs.
② parietal: lining the thoracic cage.
- Separated by potential space
- In case something accumulated between them they will be ^{separated}

* Functions:

- ① protection
- ② produce fluid for lubrication

- If the fluid decrease $\rightarrow$ friction $\rightarrow$ pleuritis $\rightarrow$ painful breathing.
- pneumothorax: Accumulation of air in the pleural sac.
- pleural effusion: Accumulation of fluid.
- Empyema: Accumulation of pus.
- haemothorax: Accumulation of blood.



Pleura is made of four parts:

Cervical Pleura

Related to the apex of lung 1 inch above the medial $\frac{1}{3}$ of Clavicle.

- Clinical Note: When inserting a cannula into the Subclavian vein, it's essential to have clear understanding of its anatomy. Because the venous cannulation via the Subclavian is commonly performed, Clinicians must be thoroughly familiar with the anatomical relation to avoid accidental puncture of the pleura which can lead to pneumothorax and lung collapse.

The cervical extension of lung is covered by 3 layers:

- ① Suprapleural membrane
 - ② parietal pleura
 - ③ visceral pleura
- Adherent to deep fascia in the neck (Sibson's fascia)
- Sibson's fascia investing deep fascia in the neck descends downward and blends with suprapleural membrane.
- Sealing to the thoracic cavity to maintain intrathoracic pressure.

Diaphragmatic pleura

- Base of lung above the diaphragm.

Mediastinal pleura

- Covering the mediastinal surface of lungs.
- The visceral and parietal are adherent to each other and surround the hilum then become the pulmonary ligament.
- Between T5 and T7 is the site of hilum of lung
- parietal and visceral pleura adhere together and surround the hilum.

Costal pleura

- Between ribs and costal cartilage and lungs.

Reflection of pleura and pleural Recesses

- Costomediastinal recess between costal and mediastinal.
- Costodiaphragmatic recess between costal pleura and diaphragmatic.
 - When the lung inflates it will descend downward in this recess.
 - Clinically important: common site for accumulation of fluid, air or pus.
 - 1 inch in the midclavicular line.
 - 2 inch in the Scapular line.
 - 3 inch in the midaxillary line.

- Pleural space normally contain 5-10 ml of clear fluid.

→ If increased to 300 ml → pleural effusion.

→ due to Infection or injury

→ Clinical manifestation:

- ① Decrease in lung expansion
- ② Decreased lung sound
- ③ pain
- ④ Cough
- ⑤ In percussion - Dullness

Clinical note

- Aspiration of fluid (pneumothorax) from the pleural cavity by putting a needle through the 7th intercostal space in the midclavicular line or in any other recesses
- The needle is put in the lower border of the space.



Clinical percussion is a physical exam technique where a clinician taps body parts to assess underlying structures (organs, fluid, air) by the sounds produced, helping determine size, borders, and consistency.

Surface Anatomy

* Discussed in the previous lecture.

Suprapleural membrane

* Fibrous sheath.

* laterally attached to the medial border of first rib and costal cartilage

* Medially blends with Sibson's fascia.

* Apex attached to the transverse process of the 7th Cervical vertebrae.

→ these attachments are for sealing of thoracic cavity

+ protection for cervical pleura and lung.

Visceral pleura

* Adherent to the lung and enters the fissures (between lobes).

Nerve Supply

- Visceral: same as lung → Sensitive to stretch

→ Insensitive to pain, temp or touch.

→ from pulmonary plexus sympathetic and parasymp.

Parietal : Sensitive to pain, touch and temp.

☆ Costal pleura takes from intercostal nerves segmentally

At level of X^{th}
Costal cartilage it's
supplied by X^{th} intercostal
nerve.

☆ Mediastinal and diaphragmatic pleura are innervated by phrenic nerve.

- Phrenic nerve is motor to diaphragm and sensory to the pleura.

Arterial Supply of pleura

☆ Visceral : bronchial arteries (same as lung).

☆ Parietal : Intercostal arteries (Ant. and post.)

Internal mammary

or internal thoracic

Continue as musculophrenic

↳ descending thoracic

Veins

Right side → Azygos

Anteriorly → Internal thoracic and Subclavian.

Lymphatic drainage

☆ Parietal pleura

- Mediastinal by:

① mediastinal nodes

② Tracheobronchial nodes

③ Intercostal nodes

→ Then all drain :

- Left : to thoracic duct

- Right : to Right thoracic
(lymphatic duct).

- Diaphragmatic pleura

① parasternal nodes

② posterior mediastinal nodes

- Visceral : Along bronchial
arteries → bronchopulmonary nodes.