11- NOSE I

Objectives:

- Anatomy of the external nose, nasal cavity and paranasal sinuses.
- Physiology and function of the nose and paranasal sinuses.
- Blood and nerve supply of the external nose, nose, nasal cavity and paranasal sinuses.
- Congenital anomalies (choanal atresia)

Resources: Team 435, Slides, Dr. notes.

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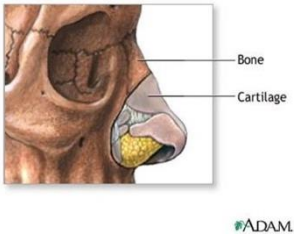
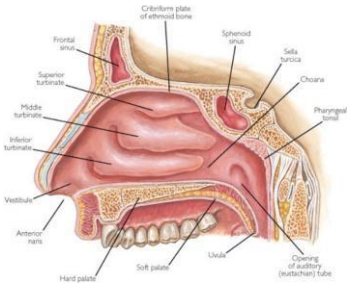
[Color index: Important | Notes | Extra] Editing File

Introduction:

[highly recommend video]

- The nose is made up of a framework of **bone** and **cartilage**, lined with skin on the outside and with mucosa on the inside.
- The nasal mucosa is lined for the most part with ciliated columnar epithelium except for a small area of highly specialized olfactory mucosa, which is receptive to scents and odours and communicates with the olfactory nerve.
- The largest of the cartilages that makes up the nose is the **septal cartilage**, dividing the nasal cavity in two (right and left).
- The **anterior** part of the nose is termed the nasal **vestibule** لخدملا, the **posterior** nasal apertures are the **choanae**. choanae is important in pediatric because of choanal atresia, and it opens in the nasopharynx.
- These open to the upper part of the pharynx – the nasopharynx.
- The lateral wall of the nose is contoured with three bony swellings (above each other), covered with mucosa, projecting into the nasal cavity. These are the **turbinates**, which can become engorged and swollen when inflamed - **'rhinitis'.**



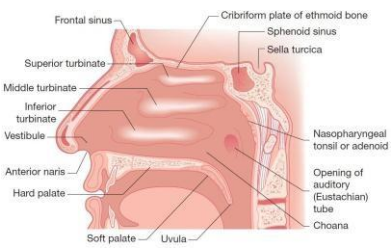


The nose :

- The nose consists of the external nose and the nasal cavity.
- Both are divided by a septum into right and left halves.
  - Functions of the nose:
  1. Respiratory channel
  2. Warming and humedifying inspired air (as soon as air inters the nose no matter how cold/hot it's it will be 37 degree)
  3. Cleaning and filtering inspired air
  4. olfaction

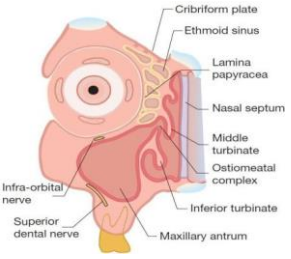
ι The sinuses:

- The paranasal sinuses are a series of air-filled cavities that communicate directly with the nose.
- They are lined with **nasal mucosa** and are subject to the same diseases as the nose itself – notably inflammatory processes. Hence the term 'rhinosinusitis' is more accurate than 'sinusitis'
- The maxillary sinus or 'antrum' is the largest of the sinuses with a capacity in the adult of approximately 15 mL. The orbit lies above.
- Medially the antrum
- is separated from the nose by the lateral nasal wall made up of the middle and inferior turbinate bones, each with a corresponding recess or 'meatus' below it (check the figure below).
- The ethmoidal sinuses form a honeycomb of air cells between the 'lamina papyracea' or thin bone at the medial wall of the orbit and the upper part of the nose. An upward extension forms the



fronto-nasal duct draining the **frontal sinus.**

- The frontal sinus is within the frontal bone in the forehead and the sphenoidal sinus is in the midline within the sphenoid bone behind the nose.
- The openings of the sinuses under the middle turbinate form the **ostiomeatal complex**. It is now recognized that abnormality of this area leads to failure of sinus drainage and thence to sinusitis.



- Abnormalities may be structural, as with a
- large aerated cell blocking
- the ostial openings. Functional anomalies such as oedema, allergy or polyp formation can also obstruct the ostiomeatal complex.

Postnatal development of the nose

- **Chronology:**
  - **At birth:** Frontal sinus furrows appear, only two to three ethmoidal turbinates remain, Craniofacial ratio 8:1.
  - **Six months:** Nares double their birth diameter.

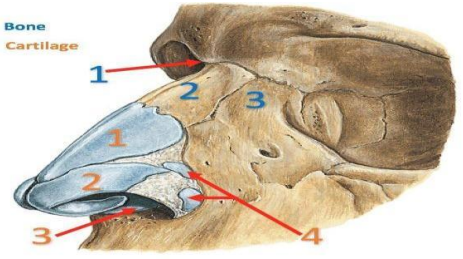
Lateral Bony Wall

- **In neonate:**
  - The nasal and orbital floors are located at the same level.
  - Lateral nasal wall serves as the medial orbital wall.
  - Maxilla contributes minimally in fetus and neonate.
- **In adult:**
  - Only the upper half of the lateral nasal wall forms the medial orbital wall
  - The nasal floor is at a lower level than the orbital floor

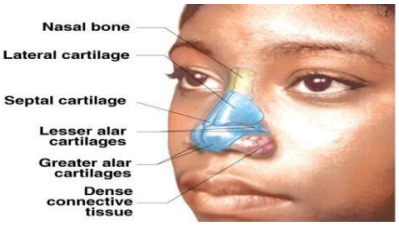
The nasal Pyramid:[1]

[1]you know that nose has functional and cosmetic components, in external nose there is no pathology same much as cosmetic issues but inside we have a lots of pathology .

- **Bony constituents:** the upper part of the nose, it's important to know the bony parts in your life. because they commonly get fractures.
  - Support the **upper** part of the external nose:
  1. Nasal processes of the **frontal** bones.
  2. **Nasal bones.** the major nasal bones in the external nose. the most common bones to get fractures in the nose.
  3. Ascending processes of the **maxillae.** frontal process of the maxillary bone.



- **Cartilaginous constituents:** the lower part of the nose which is usually flexible and rare to get a fracture there unlike the bony part.
  - Support the **lower** part of the external nose:



1. Upper lateral cartilages. between the nasal bones and the lower lateral cartilage.

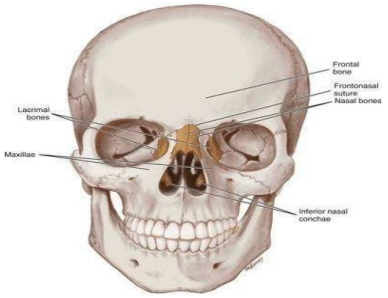
[1] Surface anatomy is important

2. Lower nasal cartilages. like U shape. it has 2 crus medially making the columella and laterally making the Major Alar cartilage.
3. Quadrilateral cartilages of nasal septum medially. only part of the septum is cartilage.
4. Minor Alar cartilages. (sesamoid small cartilages) حبوب تشبه صغيرات السمسم

- The cartilages are connected with each other and with the bones by continuous perichondrium and periosteum.

(Important to know where is the dorsum and the caudal part of the nose)

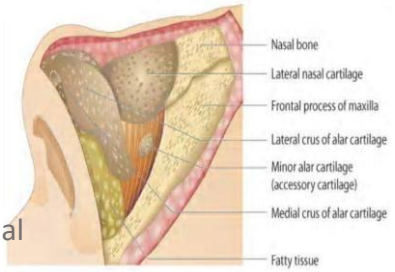
➔ The Piriform Aperture (Anterior Nasal Aperture):



- It is a heart-shaped opening in the skull that is bounded by:
  - Inferior borders of the **nasal bones** superiorly.
  - Nasal surfaces of the **maxilla** laterally.
  - The **anterior nasal spine** inferiorly.

External nose:

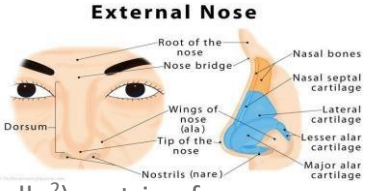
- The framework of the external nose is made up above by the nasal bones, the frontal processes of the maxillae, and the nasal part of the frontal bone.
- Below, the framework is formed of plates of hyaline cartilage.



Note that the nasal septum is very common to be asked about.

➢ Is pyramidal in shape, its shape is maintained by skeletal framework. The external nose has 3 main components, the skin, muscles and osteocartilaginous framework.

➢ **skin:** Thin mobile skin over the upper part of the nose with no hair or sebaceous glands, and thicker very adherent of the overlying tissue over the lower cartilaginous part, where it contains large sebaceous glands and hair follicles.

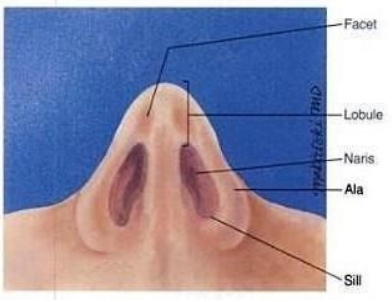


➢ **Anterior nares (Nostrils):**

- Situated in the base of the nose and open downwards, they are separated by (columella[2]), a strip of skin, connective tissue and medial crura of the lower lateral cartilage.
- Inside the aperture of the nostril is a slight dilatation, **the vestibule**. It is lined by skin containing hairs (Vibrissae[3]) and sebaceous glands, and extends as a small recess toward the apex of the nose.
  - the anatomy of the external nose is composed of 3 things in the middle (dorsum, nasal tip and the columella) and 3 things laterally in both sides (sidewall, ala, sil "between the ala and the columella" which you will never hear of it in your life maybe).
- In facial nerve palsy > affect part of the nose compared to the unaffected side. Due to paralysis of external muscles of the nose.
- Nasal flaring: in respiratory distress to aid in respiration. (video)

[2] The **columella** is the bridge of tissue that separates the nostrils at the **nasal** base

➢ **Muscles of external nose: the muscles are not important**



- The nose has number of muscles which in man has vestigial importance.
- The elevator muscle group: procerus, levator labii superioris alaeque nasi.
- The depressor muscle group: alar nasalis, depressor septi nasi.
- The compressor muscle group: transverse nasalis.
- The dilator muscle group: dilator naris anterior and posterior.

❖ **Nerve Supply of the External Nose**: The infratrochlear and external nasal branches of the ophthalmic nerve
(CN V) and the infraorbital branch of the maxillary nerve (CN V).

❖ **Blood Supply of the External Nose:** The skin of the **external nose** is supplied by branches of the ophthalmic (branch of internal carotid artery)and the maxillary arteries (branch of external carotid artery).
The skin of the **ala** and the **lower part of the septum** are supplied by branches from the facial artery (branch of external carotid artery).

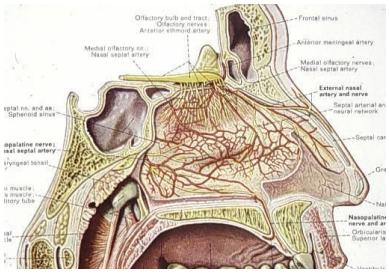
❖ **Venous drainage:** through facial and ophthalmic veins they drain to cavernous sinus.

❖ **Lymphatic drainage:** either follows anterior facial vein and opens in to submandibular nodes, or drains to preauricular lymph nodes

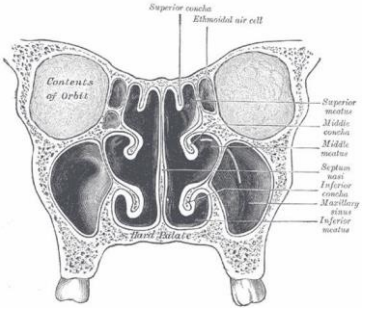
❖ **The Lobule**: Alae - Lower lateral cartilages that form the medial and lateral crura.

Nasal fossa (nasal cavity):

➢ **Nasal Vestibule**



➢ **Nasal Cavity Proper**



The nasal cavity has :
- A floor
- A roof
- A lateral wall
- A medial or septal wall

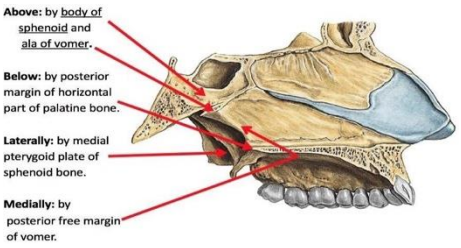
- The nasal cavity extends from the nostrils anteriorly to the choanae posteriorly.
- The right and left nasal fossae (cavities) are separated by the nasal septum.
- The nasal fossae are lined with mucous membranes.
- Each fossa communicates with:
    1. **The paranasal sinuses**, through their Ostia.
    2. **The nasopharynx**, through the posterior 3. choanae.

❖ Boundaries of posterior choanae (Posterior Nasal Apertu

➢ **Boundaries of nasal fossa:**

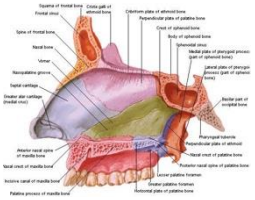
➢ **Floor:** Hard &

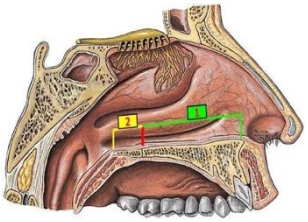
➢ soft palate



1. Palatine process of maxilla in the anterior three quarters.
2. Horizontal part of palatine bone in posterior one quart

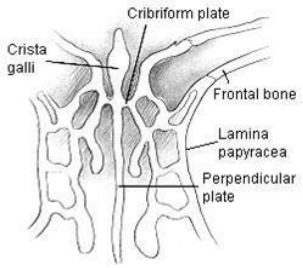
➢ **Roof** (very narrow)**:** it's very important because it is separate the nasal cavity from cranial cavity

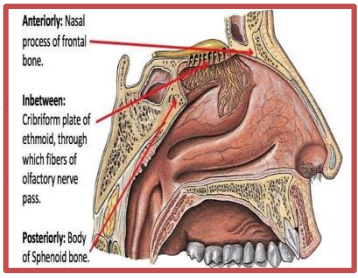




➢ *Maxilla bone and palatine bone set on the floor of the hard palate

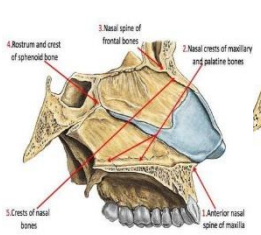
➢ *Olfactory epithelium is in the upper part of the nose. When removing polyps on the upper part you have to be cautious not to injure the olfactory epithelium.

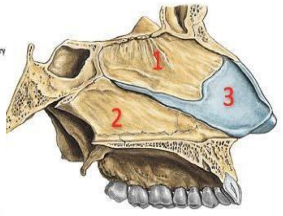




➢ **Medial wall (Nasal septum): Important**

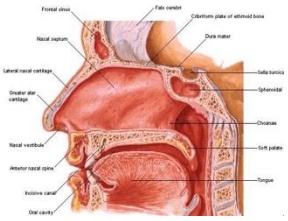
it gives support to the nasal dorsum and the nasal tip. makes a partition between the two sides of the nasal cavities.

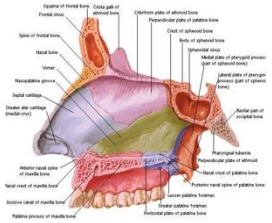




- The three main constituents are:

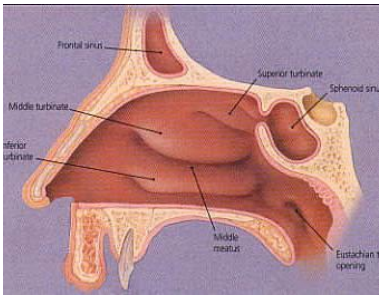
1. **Perpendicular plate of ethmoid**, superior (above and behind).
2. **Vomer,** inferior (below and behind).
3. **Quadrilateral (septal) cartilage,** anterior (in the angle between first and second).





- Other bones which contribute to the formation of the septum:

➢ **Lateral wall:**



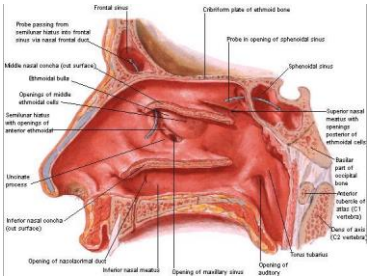
1. Medial wall of maxilla.
2. Lateral mass of ethmoid and lacrimal bone.

- Other contributions are derived from:

❀ Ascending process of maxilla (anteriorly).

❀ Perpendicular part of palatine bone and behind it, medial pterygoid process of sphenoid posteriorly.

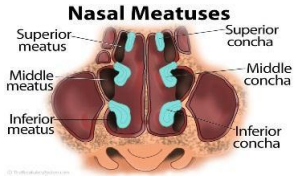
- **The main features of lateral wall are:**
  - Superior concha
  - Middle concha
  - Inferior concha



- **Turbinates (conchae)** زي القرنيات رياتسلا**:** three bony elevations covered by mucus membranes;
superior, middle, and inferior turbinates. They divide the nasal cavity into **4** groove-like air passages.

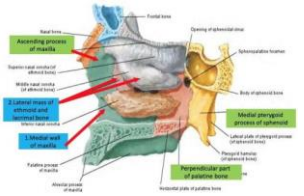
they warm, humidify the air and protect the sinuses.

- the space below each concha is called a meatus and each meatus receive the opening of a paranasal sinuses



- **Nasal Meatus:** Meatus means opening

3 in number, named after the turbinates, each lies below and lateral to the corresponding turbinate. some people have extra meatus called supreme meatus. where
the sinus drain is common to be ask about.

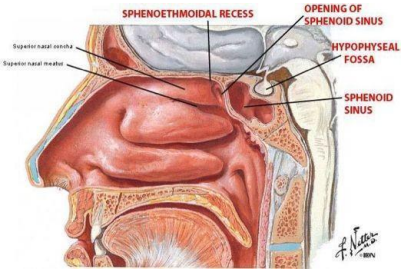


Sphenoethmoidal recess:

- Lies above the superior turbinate and receives the ostium of sphenoid sinus.

➢ **Superior Meatus:** the smallest

- Space below the superior concha.
- Superior concha is a process of ethmoid bone
- Smallest of all meatus
- Posterior ethmoidal sinuses open into it.
- Sphenoethmoidal recess is space above superior concha
- sphenoidal sinus opens into it.



  - Occupies the posterior third of the lateral wall.
  - Contains the ostia of posterior ethmoidal cells.

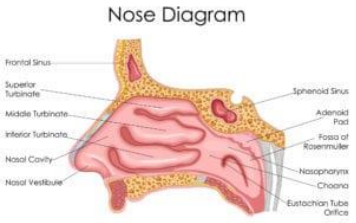
2. Middle meatus:

- Space below middle concha.
- Middle concha is the medial process of ethmoidal labrynith
- Hiatus semilunaris (curved opening)
  - Lateral and maxillary sinuses
- Bulla ethmoidalis (rounded opening) not important
  - Middle ethmoidalis air cells.

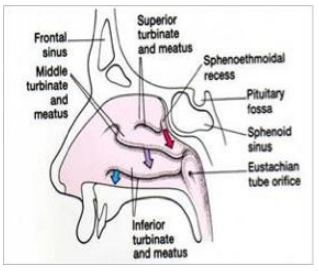
- Occupies the posterior two thirds of the lateral wall, it is the most complex and by far the most important.

- The ostia of **maxillary**, **anterior** & **middle** **ethmoidal**, and **frontal** sinuses open into it drain the 3 anterior sinuses.

- The **atrium** is forward continuation of middle meatus
- The agger nasi is curved ridge lying above the atrium
- The bulla ethmoidalis is a smooth rounded mass formed by anterior ethmoidal cells, the ostia of these cells open on to the bulla.
- The hiatus semilunaris lies below and in front of bulla. It is bounded below by **uncinate process** of ethmoid. The anterior end of the hiatus leads to a funnel-shaped channel called the **infundibulum**, which is continuous with the frontal sinus



- The maxillary sinus opens through the hiatus semilunaris.
- Agger nasi is the most anterior cell in the anterior ethmoid. When agger nasi enlarge they cause obstruction leading to sinusitis.
- Bulla ethmoidalis is the largest cell of the anterior ethmoid. It is adjacent to the maxillary sinus. and one of the good landmarks during surgeries.



3.Inferior meatus:

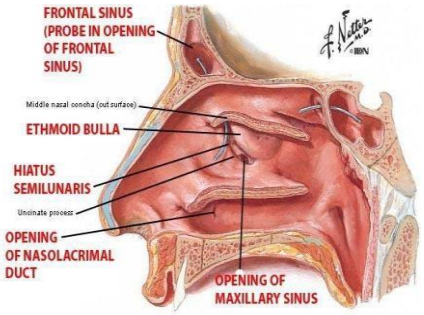
- Largest of the meatuses
- Space below the inferior concha
- Inferior concha is thin, curved independent bone
- Naso lacrimal duct opens.
- The inferior meatus runs the length of the lateral wall.

عشلن كذا لمن البنات يحطون كحل بالعين يطلع مع المخاط أحيانا

some patients go to the ophthalmologist and they put Fluorescein dye into their eye. the patient will complain from yellow secretions from their nose.

❖ **Ostiomeatal Complex:**

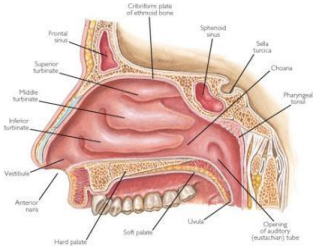
- A common channel that links the frontal sinus, anterior and middle ethmoid sinuses and the maxillary sinus to the middle meatus that allows air flow and mucociliary drainage.
- Composed of the following structures: **Uncinate process, Ethmoid bulla, Middle turbinate,** and the spaces between these structures (**ethmoidal infundibulum, middle meatus, and hiatus semilunaris**).



MUCOUS MEMBRANE

❖ **Mucosal Lining of the nasal cavity:**lining depends of the function

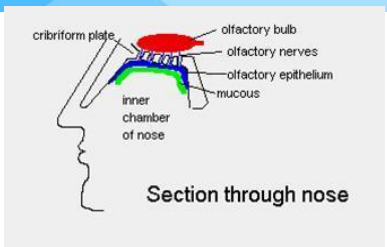
- Upper 1\3 rd -olfactory region, mucous membrane- more delica and yellowish.
- Lower 2\3 rd – respiratory region, lined by pseudo stratified ciliated columnar epithelium with goblet cells, mucoperiosteum –thick, spongy, highly vascular with numerous mucous glands.mucous is important for smelling, if the nose is dry we can't smell.



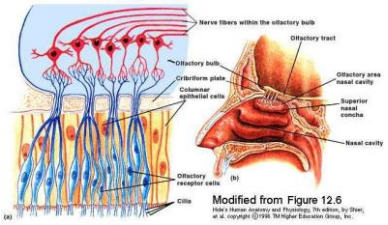
- Mucous membrane covering vestibule of nose carries stiff hairs \ vibrissae.
- Contain arteriovenous anastomosis sinusoidal blood vessels تكبر في الهواء البارد وتصغر في الهواء الحار

- warms the air passing through it.

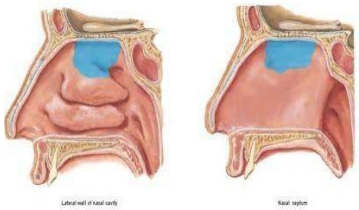
- **Modified Skin:** Keratinized stratified squamous epithelium covering the estibule. It contains sebaceous glands, sweat glands, and short, curved hair called virissae



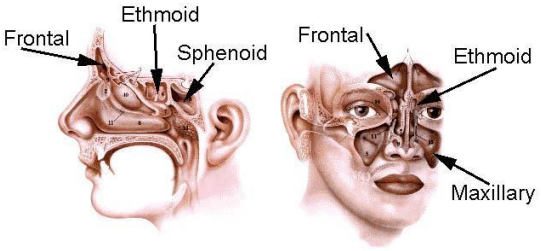
● **Olfactory:** Specialized olfactory epithelium. Present in the olfactory cleft, which occupies the area between the superior turbinate, cribriform plate[4] and the corresponding area of the septum. contains neuroepithelium, a special type of epithelium with contains receptors for the olfactory function



● **Respiratory mucosa:** Ciliated pseudostratified columnar epithelium with goblet cells. It lines the lower two-thirds of the nasal septum, the lateral wall of the nose below the superior turbinate, and the floor of the nasal cavity. It extends into the sinuses

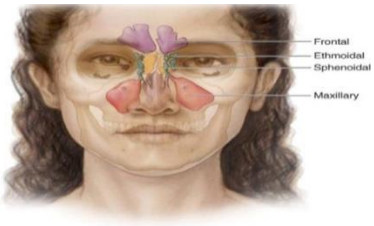


Paranasal sinuses



● These are air spaces within certain bones of the skull.

●They are lined with a mucous membrane continuous with that of the corresponding nasal fossa through their ostia.



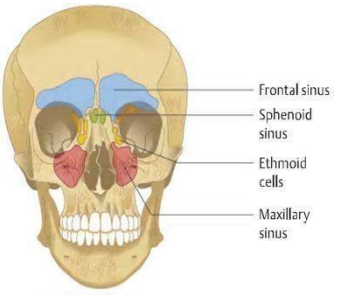
● The sinuses develop as outgrowths from the nasal cavity; hence they all drain directly or indirectly into the nose[5].

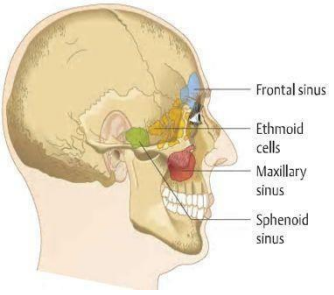
● The lining of the sinuses (mucoperisteum) is continuous with the nasal mucosa[6].

●The sinuses develop mostly after birth, and their degree of development varies greatly.

● Their functions are:

1. Resonators of the voice
2. They also reduce the skulls weight
3. Help wam and moisten inhaled air
4. Act as shock absorbers in trauma
5. When the apertures of the sinuses are blocked or they become filled with fluid, the quality of the voice is markedly changed





- Blood supply: branches from external and internal carotid
- Nerve supply: branches from trigeminal

- Drainage of mucous:

- The mucus produced by the mucous membrane is moved into the nose by ciliary action of the columnar cells.
- Drainage of the mucus is also achieved by the siphon action created during the blowing of the nose.

● Facial growth center is present in paranasal sinus.

● Maxillary sinus is the first to develop.

● Frontal sinus is the last sinus to develop during puberty.

● Most dangerous sinus during surgery is sphenoidal due to its relation with cavernous sinus contents, mainly carotid > massive bleeding if injured.

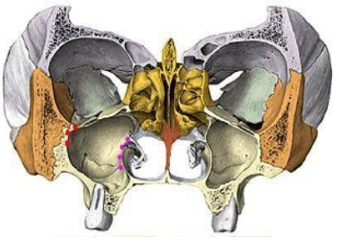
---

[4] contains nerve fibers of nasal cavity and is the closest part of the brain. so what's the most common cranial nerve the gets traumatized? the olfactory nerve. abducens nerve is common in surgery كأنها منخل

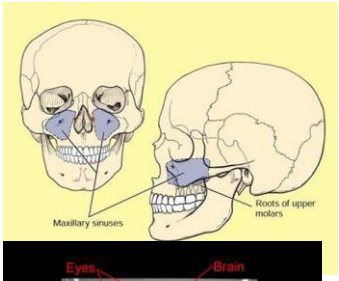
[5] they communicate with the nasal cavity through relatively a small apperatus

[6] The nasal and paranasal sinuses are lined with respiratory mucosa composed of pseudostratified ciliated columnar epithelium with goblet cells

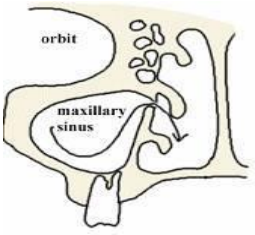
1- Maxillary Sinuses[7]:

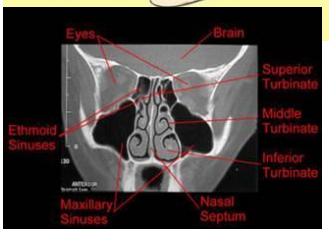


It is the **largest** of the sinuses, with an average capacity of 15 ml in the adult. It is **pyramidal in shape** [8]and occupies the body of maxilla. The **base** lies medially, the **apex** is in the zygomatic portion of the maxilla. Medial wall is the wall between the sinus and the nasal fossa. because of its position (up) it is liable for infection.

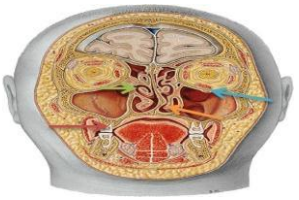


- sinus ostium located in the middle meaus
- The maxillary sinus drains into the middle meatus by means of the semilunar hiatus. The **floor** is formed by **the alveolar process** and **hard palate**.
- **In children**, the floor lies at or above the level of the floor of the nasal fossa. **In adults**, it lies about 1.25 cm below the floor of the fossa.





- The roots of several teeth may project into, or even perforate, the floor (sometimes the maxillary sinus gets penetrated during dental surgery).
- Antrum of Highmore



Relations of maxillary sinus:

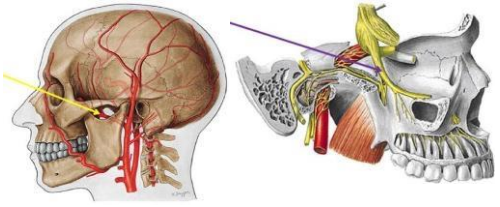
A. **Orbit:** Separated from the antrum by the thin roof of the sinus, which contains the infraorbital nerve (blue arrow). the roof of the maxillary sinus is the floor of the orbit.

B. **Teeth** (red arrow): May produce elevations in the floor of the sinus and the number of related teeth depends on the size of the antrum. The second premolar and first molar are usually related.

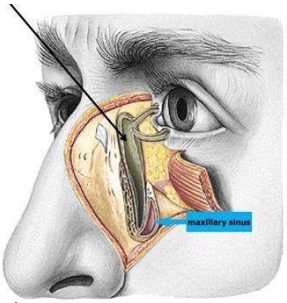
C. **Middle meatus of the nose** (green arrow): related to the upper part of the antrum.

D. **Inferior meatus of the nose** (orange arrow): Separated from the middle part of its medial wall by bone, which is usually thick in front and below but thinner above and behind.

E. **Maxillary artery** (yellow arrow): Related to the posterior wall, where it occupies the pterygopalatine fossa. It may be approached through the antrum for ligature.



F. Maxillary division of the 5th cranial nerve (purple arrow): also traverses the pterygopalatine fossa.



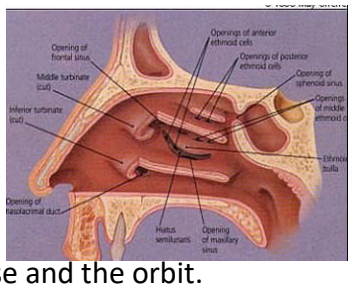
G. **Nasolacrimal duct** (black arrow): Passes downwards, medial to the antrum, to open into the inferior meatus.

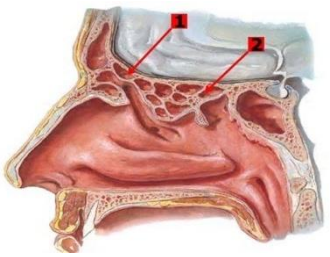
- Infraorbital nerve (sensation of anterior part of the cheek) is a continuation of the maxillary nerve. When a patient has paraesthesia in the cheek suspect mass around the infraorbital nerve, common in RTA also when there is fracture of the floor.
- Lacrimal canaliculi > lacrimal sac > lacrimal duct > lacrimal open in the inferior meatus

[7] First one to develop
[8] paired and symmetric.

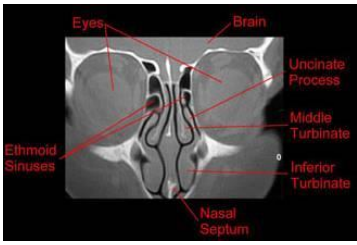
2. Ethmoidal Sinuses[9]

(Labyrinths): the word ethmoid means small rooms





- They are anterior, middle and posterior.
- They are contained within the ethmoid bone, between the nose and the orbit.
- Anterior & middle drains into middle nasal meatus
- Posterior drain into superior nasal meatus
- Consists of a number (approximately 7-15) thin-walled cavities within the lateral masses of the ethmoid bones, in the agger nasi, and middle turbinate.



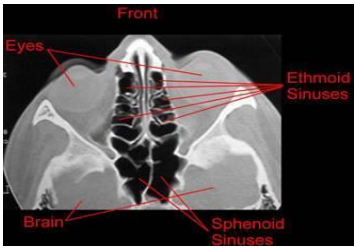
The cells may invade any of the surrounding bones, including the frontal, sphenoid, and maxillary bones. There are two groups of cells:

1.Anterior: Usually small and numerous. They open into the upper part of the hiatus semilunaris or above the bulla ethmoidalis, ultimately **draining into the middle meatus**

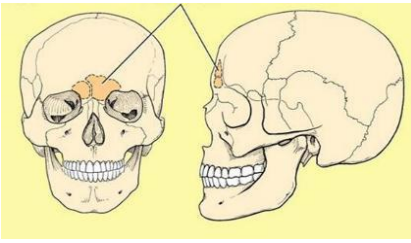
2.Nasal septum divides the right and left ethmoid. The anterior and posterior groups of ethmoid are separated by

the basal lamella (3rd part of the middle turbinates).

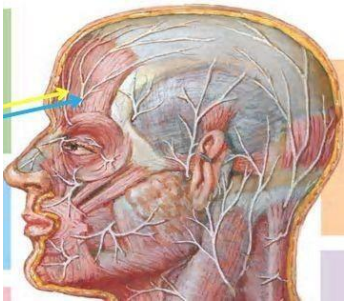
Posterior: Usually large and few, they **open into the superior meatus**



3- Frontal Sinuses[10]:



- Rarely present at birth; usually not visible until age 2
- Great variability in size; congenitally absent in 5% (in 5% of people it could be present at one side and absent at the other and that is normal)
- Second largest sinuses 2 – 2.5 cm
- Contained in frontal bone.
- Each sinus is roughly triangular.
- Extending upward above the medial end of the eyebrow and backward into the medial part of the roof of the orbit.
- Should be regarded as an upward extension of an anterior ethmoidal cell that has invaded the frontal bone postnatally. It occupies a very variable extent of the frontal bone and may be partly loculated. Its average capacity is about 7 ml in the adult.
- The right and left sinuses are often asymmetrical. They are separated by a thin bony septum that is usually deviated to one side. The bony septum may be deficient in part. In the floor of frontal sinus there is agger nasi.

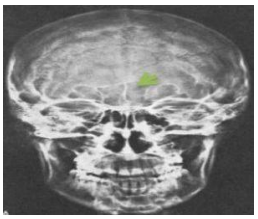


- open into the middle meatus.
- **The frontonasal duct:**
  - It passes through the anterior part of the ethmoidal labyrinth.
  - Its length and curvature vary considerably.
  - Its lower end (ostium) usually opens in to the infundibulum, less often independently above this level.

[9] It's a sensitive area because of its relation to the orbit it could causes orbital complications. The orbit lies laterally to the sinus and the turbinates are medially between the nose and the septum

[10] we usually have 2 frontal sinuses but some people only have one. sometimes both are hypoplastic or aplastic. not necessarily symmetrical (rarely symmetrical), the only paranasal sinuses that are absent at birth

➔ **Relations of frontal sinuses:**

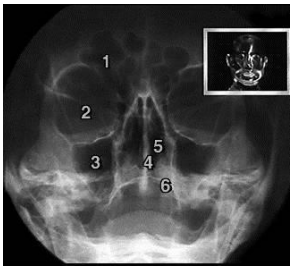


Extending upward above the medial end of the eyebrow and backward into the medial part of the roof of the orbit.

a. **Anterior cranial fossa:** Separated from the sinus by the compact bone of the posterior wall.

b. **Orbit:** Lies below the floor of the sinus. This is also compact bone, which may rarely be deficient.

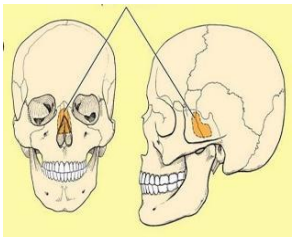
c. **Skin and periosteum of forehead:** Cover the anterior wall, which is of diploic bone and is related to **supratrochlear (yellow arrow)** and **supraorbital** nerves.



●In frontal sinus, if infection extend posteriorly towards the brain it will cause meningitis.

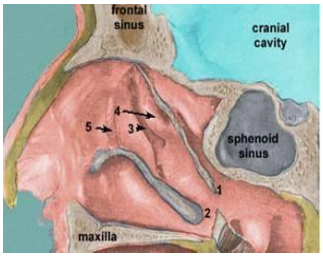
●And if infection extend anteriorly it will cause osteomyelitis (Pott's puffy tumor is osteomyelitis of the anterior bone of the frontal sinus) e.g. patient with two weeks history of frontal swelling and redness, CT shows some collection and abscess and inflammation, the patient has Pott's puffy tumor

4-Sphenoidal Sinuses:

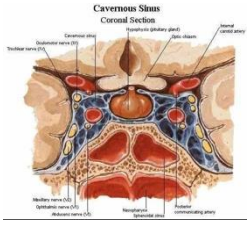


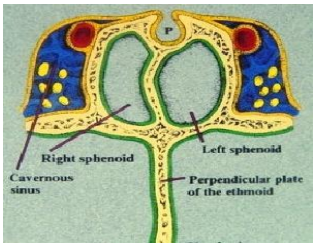
●Lies behind the upper part of the nasal fossa. It occupies the body, and sometimes the wings and pterygoid processes of the sphenoid bone[11].

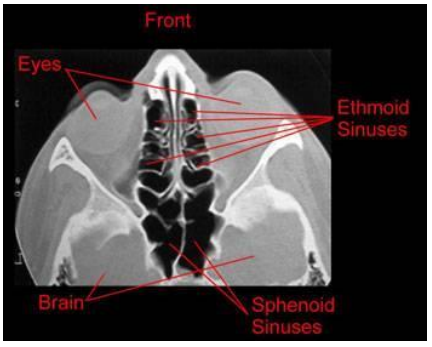
- The average capacity is about 7ml in adult.
- Below Sella turcica (extends between dorsum sellae and post clinoid processes)



- They are separated by a septum (green arrow), which may be deficient in part and is often oblique.
- The ostium (blue arrow) of sphenoid sinus is situated in the upper part of the anterior wall of the sinus.
- It communicates with the superior meatus indirectly through the sphenoethmoidal recess.



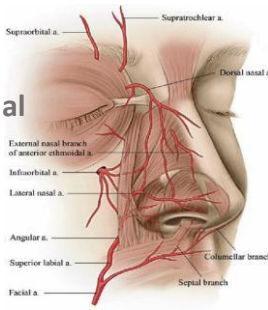




[11] lies within the body of sphenoid , below the sella tunica

Blood supply of nose, nasal cavity and paranasal sinuses:

(موجود مطلوب تعرفوا تفاصيل small blood vessels & nerves وكذا) Blood supply is important



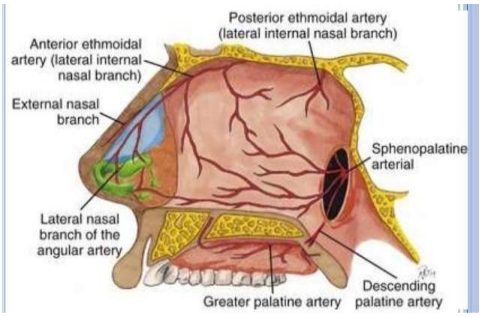
❖ **Arterial supply:**

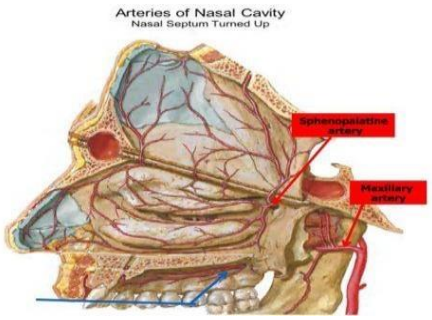
- The nasal fossae and paranasal sinuses are supplied by branches of the **external and internal carotid arteries:**

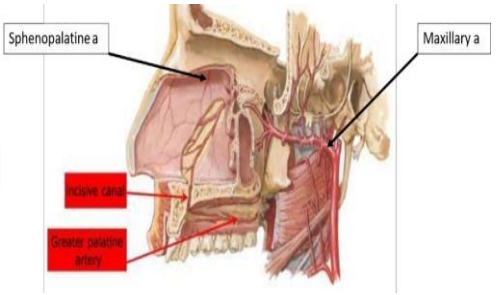
A) Derivatives of external carotid artery: has 2 branches (facial – maxillary)

1. Sphenopalatine artery (the artery of epistaxis): from maxillary artery

via the **maxillary artery** supplies the turbinates and meatus of the nose and most of the septum. It passes through the sphenopalatine foramen. (Important to know the 3 segments of the maxillary artery).





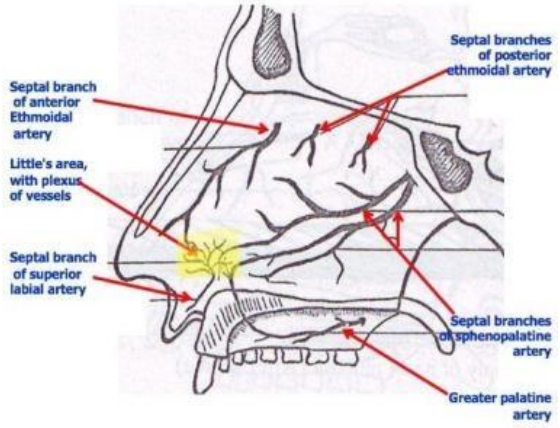


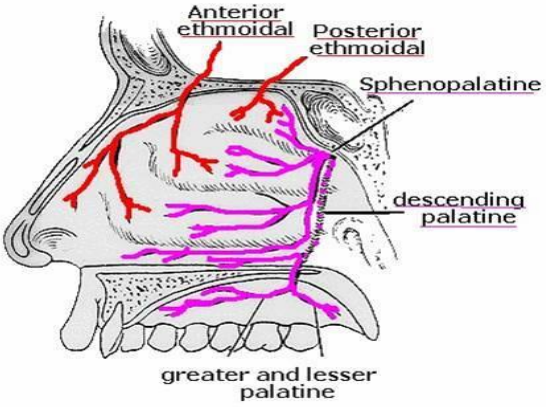
2. Greater palatine artery:

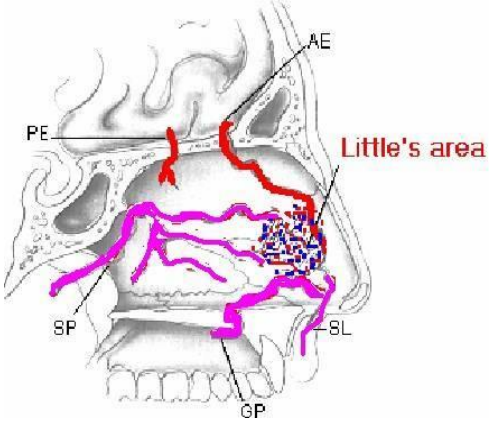
- a branch of the maxillary artery contributes branches to the lateral nasal wall and (via the incisive canal) to the anterior part of the septum.

3. Superior labial artery:

- A branch of the facial artery. It sends branches to the tip of the septum and the alae nasi.
- Its anastomosis with a branch of the spheno- palatine artery and the greater palatine artery forms.







KESSELBACHS PLEXUS[12] (Little's area) the commonest area of epistaxis[13]

- These arteries are (mnemonic – LEGS)
  - Superior labial from facial artery
  - Anterior ethmoidal from internal carotid
  - Greater from maxillary artery
  - Sphenopalatine from maxillary

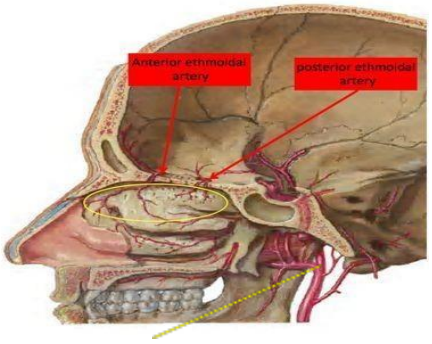
- Little's area is a region in the anteroinferior part of the nasal septum, where there is confluence of 4 arteries forming this plexus.

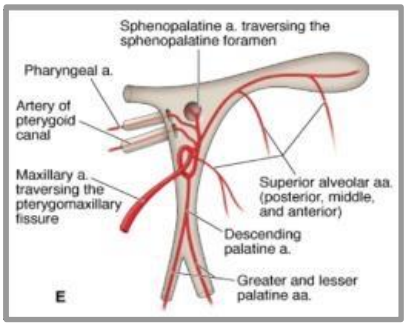
(posterior ethmoidal is not part of KESSELBACHS plexus)

B) Branches of internal carotid artery: has one branch (ophthalmic)

➔ Anterior and posterior ethmoidal arteries:

- Branches of the **ophthalmic artery**.
- They supply the roof of the nose, anterior parts of the septum and lateral wall of the nose, and the ethmoidal and frontal sinuses.
- Bleeding from these vessels is seen above the level of the middle turbinate.
- The skin of the external nose is supplied by branches of the ophthalmic and the maxillary arteries.





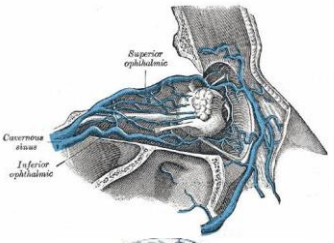
431 Team:

- Frontal Sinus: Supraorbital and supratrochlear divisions of ophthalmic artery.
- Ethmoid Sinus: Sphenopaltine and anterior and posterior ethmoidal arteries.
- Sphenoid Sinus: Posterior ethmoidal and sphenopalatine arteries.
- Maxillary Sinus: Superior alveolar and infraorbital arteries (divisions of maxillary).

[12] very rich in blood supply to warm up the inspired air هي منطقة زي الي بين أربع شوارع

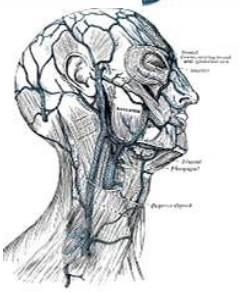
[13] management? apply pressure, pressure, pressure. and put your head down. when you put your head down, you're doing two things 1- compressing the internal jugular and carotid arteries a little bit to avoid loss of consciousness. 2- preventing choking by blood. and YOU DON'T blow your nose to prevent opening of blood vessels again- most common cause of epistaxis is nasal dryness

❖**Venous drainage:**



- The veins form a cavernous plexus beneath the mucous membrane. They open into:

1) Sphenopalatine vein and anterior facial vein, from the plexus.
2) Ophthalmic veins, from the ethmoidal veins.
3) Veins on the orbital surface of the frontal lobe of the brain, through the foramina in the cribriform plate.
4) Superior sagittal sinus, through the foramen caecum.

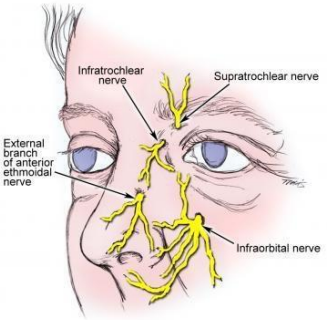


they are valveless so they can go anterograde , retrograde -> infection can spread to the brain.433team.

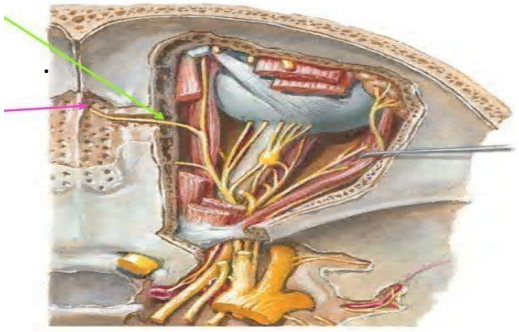
facial vein->internal jugular->angular vein->ophtalmic->cavernus sinus

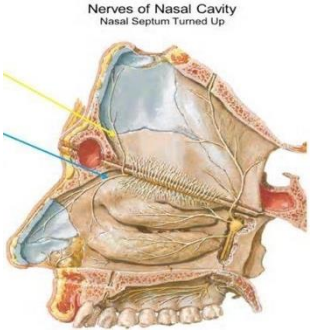
❖**Nerve supply**: contains the olfactory nerve, common sensation(trigemenal) and autonomic supply(sphenopalatine gangilion).

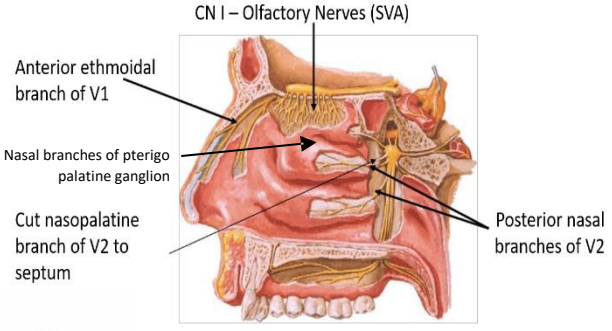
the most important thing to know is olfactory nerve, V1 & V2

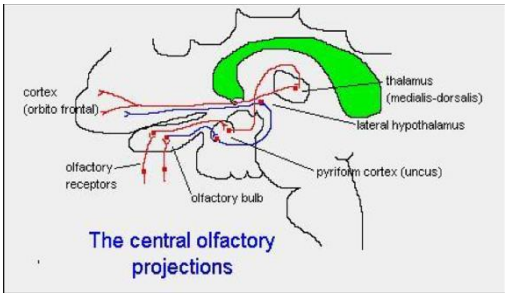


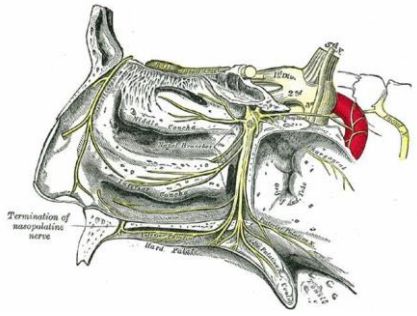
- External nose – infra orbital nerve, infra trochlear, External nasal nerve.
  - **Olfacroty:**
    - The olfactory nerves from the olfactory mucous membrane ascend through the cribriform plate of the ethmoid bone to the olfactory bulbs.
  - Cmmon sensation: Trigemenal:
    - The nerves of ordinary sensation are branches of the ophthalmic division (V1) and the maxillary division (V2) of the trigeminal nerve
      - Nerves of <u>common sensation</u> are derived from:
        - Branches of the Vth cranial nerve trigeminal nerve:
          - <u>Anterior ethmoidal nerve</u> (green arrow) (a branch of ophthalmic, 1st division). It enters the nasal cavity through the <u>anterior ethmoidal foramen</u> (pink arrow) and divides into:
            A. **Medial branch** (yellow arrow): which supplies the anterior part of the septum.
            B. **Lateral branch** (blue arrow): which supplies the anterior part of the lateral wall of the nose, and the anterior parts of the middle and inferior turbinate











➢ **Autonomic**

- nasopalatine nerve (also called the long sphenopalatine nerve) comes from the pterygopalatine (also called sphenopalatine) ganglion
https://images.app.goo.gl/A5tfAfkpqCq2Kio16 (this link is an extra pic for sphenopalatine ganglion)

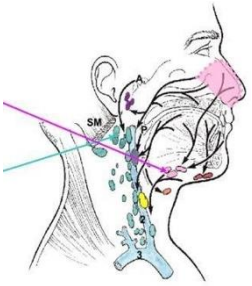
  ■ Posterior nasal branches of greater palatine nerve supply the lateral posterior walls of the nasal cavity

  - including the superior, middle, and inferior nasal concha. nasopalatine branch called the **long sphenopalatine nerve** supply posterior of the septum. (both branches of Maxillary, 2nd division). autonomic nerves supply function: control the congestion and decongestion of the nose.

❖**Lymphatic drainage**:

- The lymphatic vessels arise from a continuous network in the superficial part of the mucous membrane.

➢**Retropharyngeal**



➢ **Submandibular lymph nodes** (pink arrow)**:** collect lymph from the external nose and anterior part of the nasal cavity vestibule end.

➢ **Superior deep cervical nodes** (blue arrow)**:** drain the rest of the nasal cavity, either directly or through the retropharyngeal nodes.

Physiology:

Functions of the Nose:

1. **Respiration:**

The nose is the primary passage for the inspiratory air current in a continuous stream over the inferior and middle turbinates where it's divided by anterior ends of these turbinates into two streams above and below each turbinate to increase the contact surfaces with the mucosa for better conditioning of the inspired air to the lungs, considering that eddie's stream which may happen for a reason or another is not ideal for air passage and it may form obstruction to the subsequent current behind it. **Choanal atresia**[14]**,** we learn how to breath from our mouths it's an acquired skill it's not something you were born with. newborns are obligate nasal breathers until age of 3 months. newborns with choanal atresia keep crying because when they cry they can breathe from their mouths so they cry to breath. suspect choanal

atresia in newborns who keep crying!! it's a lifethreatening situation.

2. **Purification of inspired air:**

Large particles are detected by the vibrassies of the nasal vestibule and the smaller particles are dealt with by lysosomal enzymes, macrophages and antibodies in the mucosal blankets of the nasal fossa.

3. **Humidification and warming of inspired air:**

- A function which is carried out by the submucosal venous plexus of sinusoids and lakes of the inferior and middle turbinate by transduction of the heat to the cold inspiratory air and from the air to the sinusoids of the hot air.
- Vascular mucosa increases relative humidity to 95% before air reaches the nasopharynx. Physiologic nasal fluids and ciliary function are vital to maintain immune defense through normal mucociliary flow. Several nasal neurovascular reflexes occur as well. The naso-pulmonary reflex suggests that pressure on one nasal sidewall causes ipsilateral pulmonary congestion[15]

4. **Olfaction:**

Carried out in the superior part of the nasal fossa in the olfactory area where the odors of nearly 30 odorant types are carried by the olfactory nerve ending across the olfactory filament to the olfactory bulb where it is perceived as an odor, a sense which is intimately related to taste (agusia).

5. **To taste** indirectly

[14] **how to diagnose?** you put a suction tube size 5 into their nose if it passes through the mouth it means that the choana is normal. if not, there's a problem, **management:** intubation or oropharyngeal airway.

[15] people with prolonged nasal obstruction may have pulmonary hypertension.

6. **Increasing surface area for olfaction**
7. **Lightening the skull:** the sinuses lightens the skull

The nose and the paranasal sinuses by the virtue of their pneumotization lightens the facial bone weight over the neck

8. **Resonance** by the sinuses
9. **Absorbing shock** the sinuses absorb the shock
10. **Contribute to facial growth** the sinuses & nose are important in facial growth (have growth centers)
11. Cosmoses of the nose:

The nose occupying the middle part of the face, gives the main feature of cosmoses to the face making it one of the main part of the body where plastic surgery most frequently carried on.

12. Adding tone to the speech:

The voice is produced by voice box larynx and it's formulated into a meaningful speech by supralaryngeal vocal apparatus of pharyngeal, palatal, lingual, and lip muscles. Main tone of this spoken speech is added by the nose.

13. Nasal Cycle:

- This cycle causes turbinate hypertrophy to periodically alternate between the 2 sides of the nose, causing periodic unilateral obstruction approximately every 3 hours. During the nasal cycle, the airway that conducts most of the airflow, and with it, most of the transfer of heat and water mass, undergoes some airway surface liquid dehydration, while the other airway maintains enough hydration to allow continuous mucociliary clearance.
- The nasal cycle is the function of alternate opening and obstruction of one nasal fossa in turn with the other lasting for 3-8 hrs. (mainly 4 hrs.), this function is carried by the autonomic nervous supply to the nose where by sympathetic overactivity with parasympathetic underactivity produce venous engorgement of turbinal submucosal venous plexus of sinusides and lakes and consequently turbinal engorgement causing obstruction of the lower nasal fossa and an opposite event in the upper nasal fossa causing widening and consequently opening of that fossa.

14. Nasal Resistance:

Nasal airway resistance accounts for more than 50% of total airway resistance. The nasal cavity has been modeled as 2 resistors in parallel. The 3 components of nasal resistance are as follows: the nasal vestibule, nasal valve, and nasal cavum.

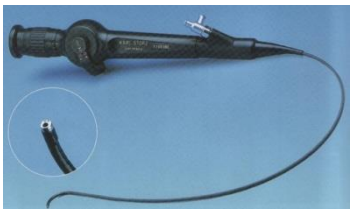
*The secretion of the nasal mucosa has three layers thin, semi-thin and thick layers. Nasal mucosa and paranasal sinuses secrete

Investigation of nasal diseases

- Endoscopy
- Rhinometry
- Measurement of olfaction
- Skin allergy test
- Mucociliary clearance tests
- Imaging

➢ **Endoscopy**

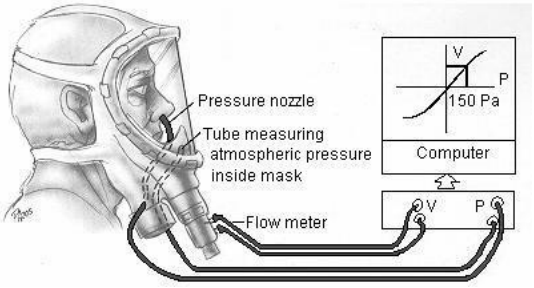
rigid

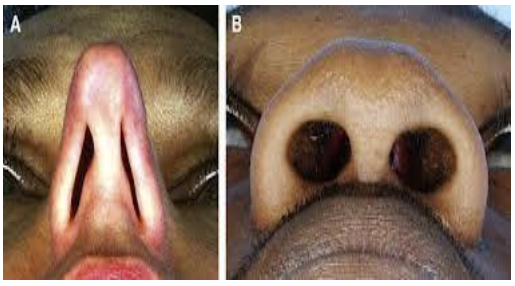


flexible

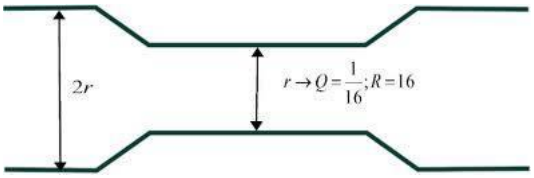
➢ **Rhinometry (more fore reasearch than clinic)**

- Objective measurement of the nasal resistance or the flow of air in the nasal cavities

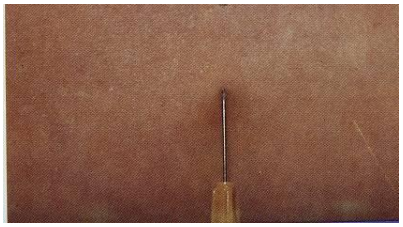




Poiseuille's Law



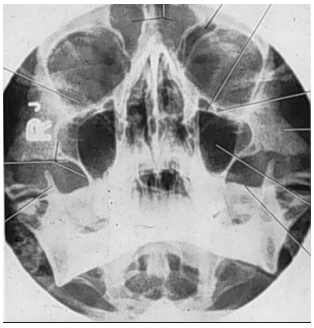
Skin allergy test

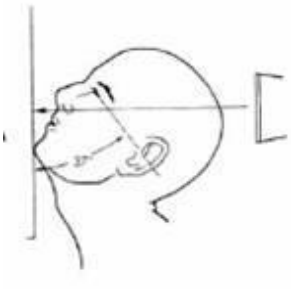


➢ **Imaging of The Paranasal Sinuses**

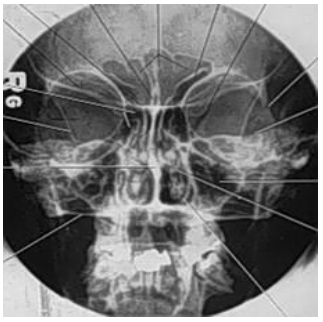
• Plain X-Rays (almost never used nowadays) • CT scan (you have to know how to identify structures on ct) • MRI (when suspecting intracranial or subtissue)

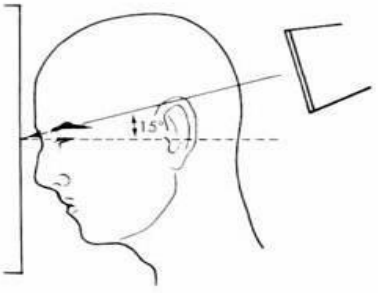
- Occipitomental View (Water's View)



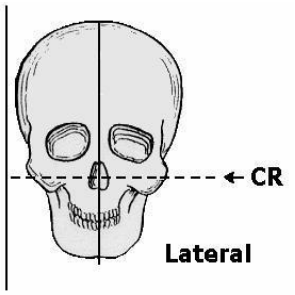


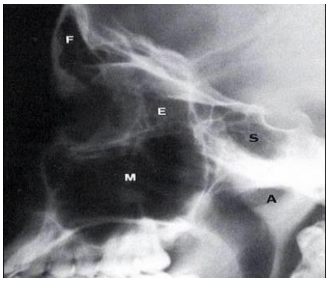
occipito-frontal View (Caldwell View)



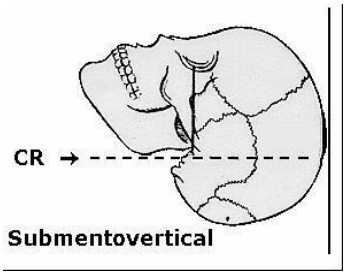


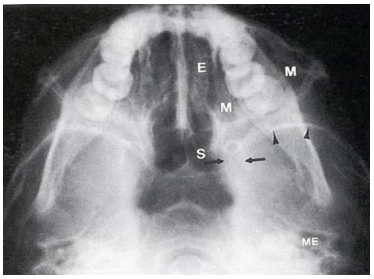
- lateral view



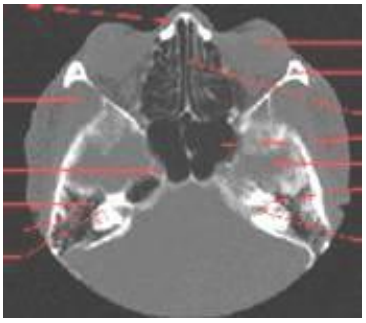


- Submento-vertical view

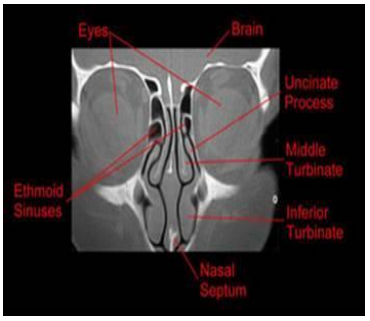


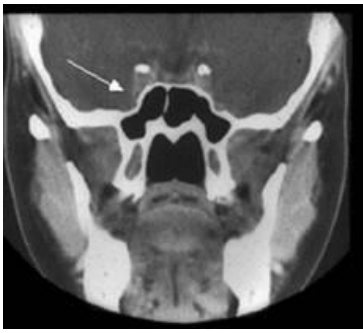


- **CT Paranasal Sinuses**
- Axial - Coronal

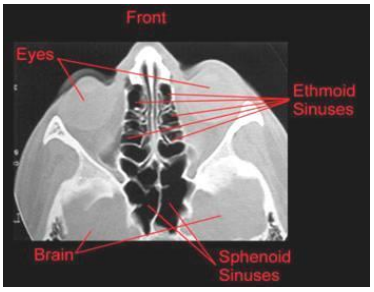


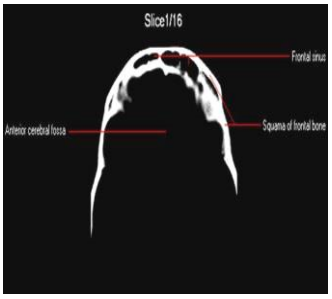
Normal coronal

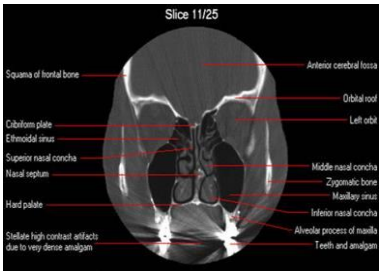


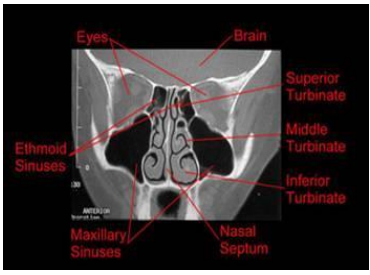


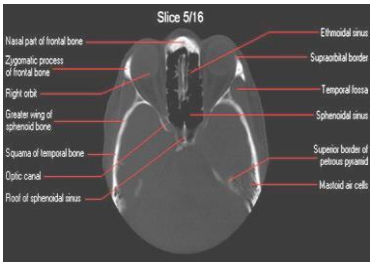
Normal axial :

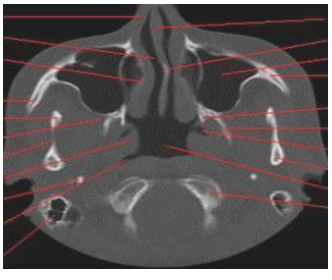




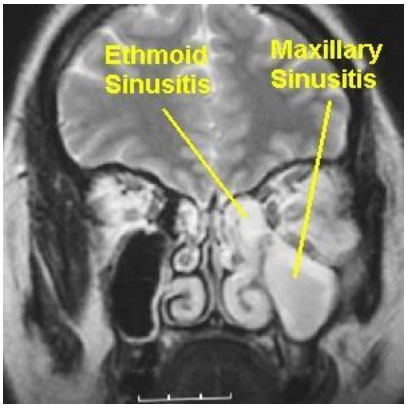




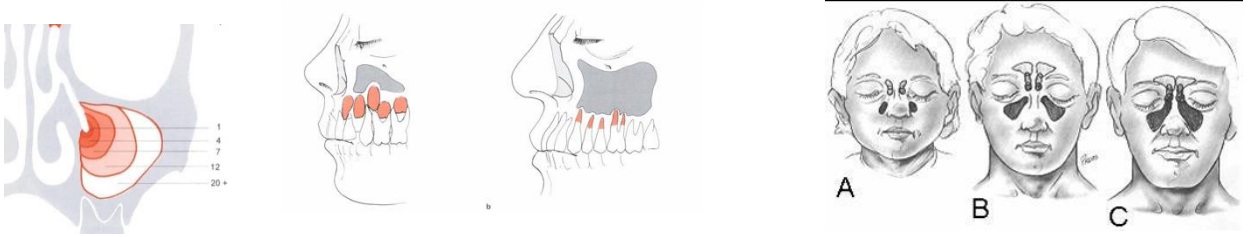




MRI



Development of the sinuses

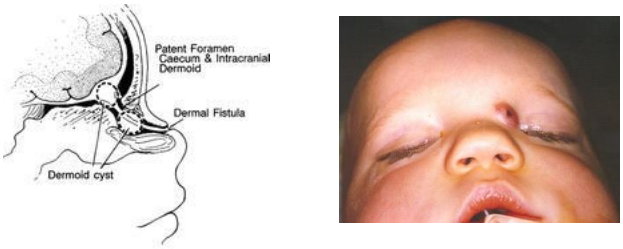


A) at birth (maxillary and ethmoid) B) at 10-years C) at 15(reach adult size)

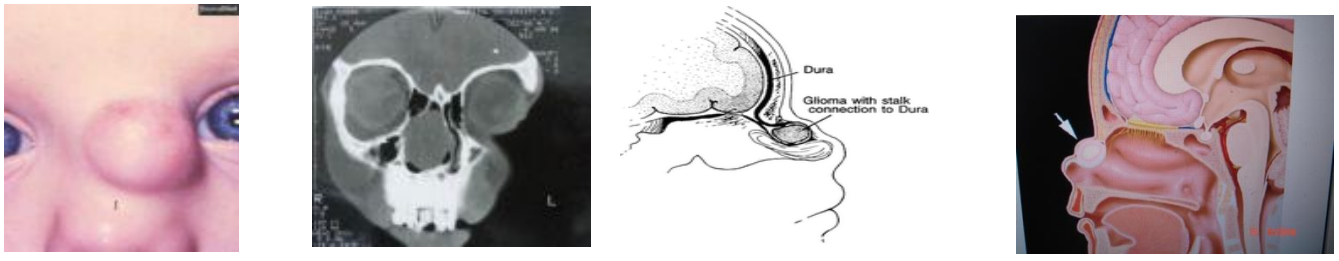
➢ CONGENITAL ANOMALIES

- Anterior Nares Deformity

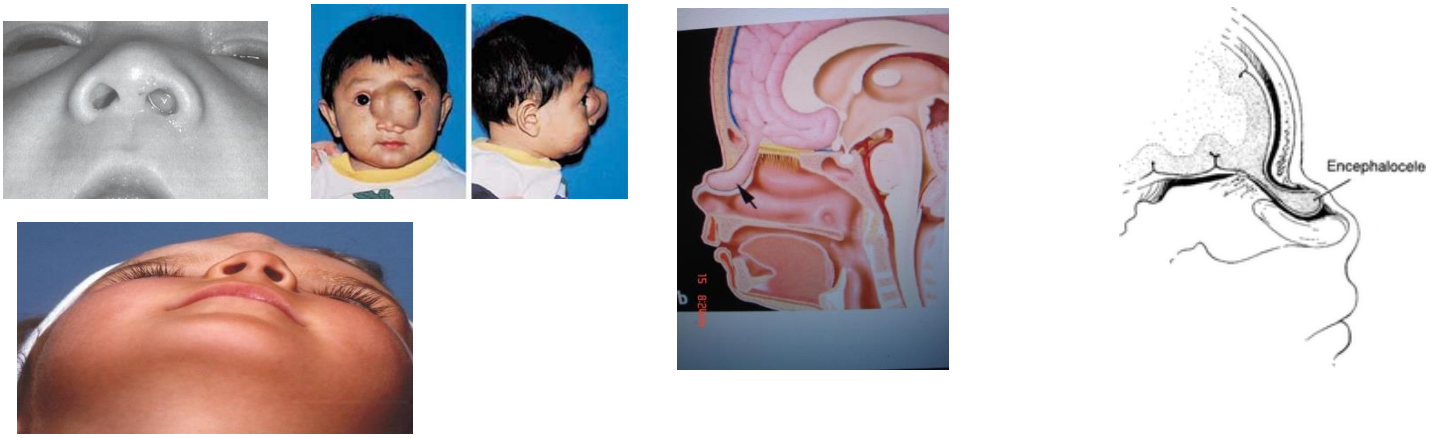
- Dermoid cysts



- Glioma



- Meningio and encephalopathies (connected brain tissue due to defect in the skull base)

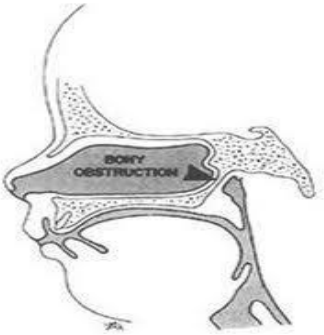


➢ Choanal Atresia

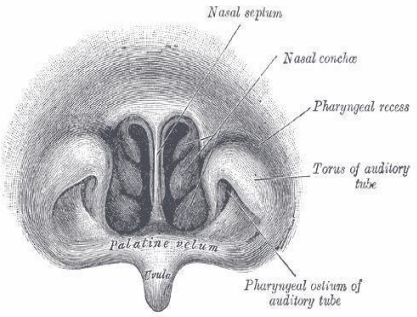
• Due to persistence of the primitive bucconasal membrane (bucconasal membrane normally disappears at 8 weeks of gestation here it doesn't)

• Unilateral or bilateral

• Bony, membranous or mixed



• could be: unilateral – bilateral – bony – membranous – mixed

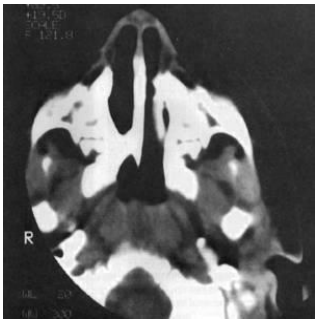


- **Unilateral choanal atresia:**

• Usually diagnosed late in life

• Presents by unilateral nasal obstruction and unilateral mucoid nasal discharge

• Treatment is by elective surgical repair



- **Bilateral Choanal Atresia**

• Isolated anomaly in 60-70%

• May be linked to CHARGE association

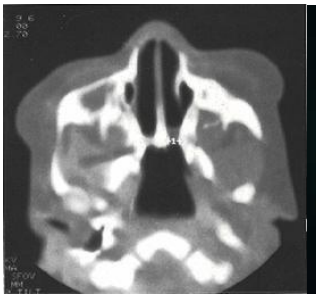
CHARGE ASSOCIATION (you have to look for it when there is bilateral choanal atresia because its not always isolated)

• Coloboma • Heart disease • Atresia • Retarded growth • Genital hypoplasia • Ear deformity

• Usually presents at birth by attacks of cyclic cyanosis and respiratory obstruction

• Nasal discharge

- **Diagnosis :**
  - Clinical examination '' mirror test''
  - Inability to pass a catheter into the nasopharynx
  - Endoscopy
  - radiograph



- **Management:**

• Emergency

– Immediate airway support with oral airway, McGovern nipple, or intubation

• Definitive surgery

The nasal vestibule:

➢ **Acute Infections :**

• Acute vestibulitis:

Inflammation of the skin of the vestibule, usually due to Staphylococcus aureus

- **Causes:**

  • Habitual rubbing of the nose • Allergy • Rhinorrhea

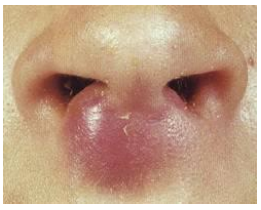
- **Clinical features:**

  • Pain • Irritation • Redness and swelling • Crusting

- **Treatment:**

  • Local antibiotics and corticosteroids (ointment)

• Furunculosis:
Acute infection of the hair follicles with Staphylococcus aureus

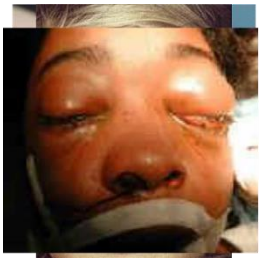


- **Comlications:**

  • Local abscess

  • Spreading cellulitis

  • Cavernous sinus thrombophlebitis (remember valveless veins ;))



- **Treatment:**
  • Avoid squeezing • Local application of heat • Antibiotics

➢ **Other Conditions of Vestibule and External Nose:**

•Erysipelas •Impetigo •Herpes simplex and zoster •Warts •Lupus vulgaris •Syphilis •Basal and squamous cell carcinoma

(431 Team)

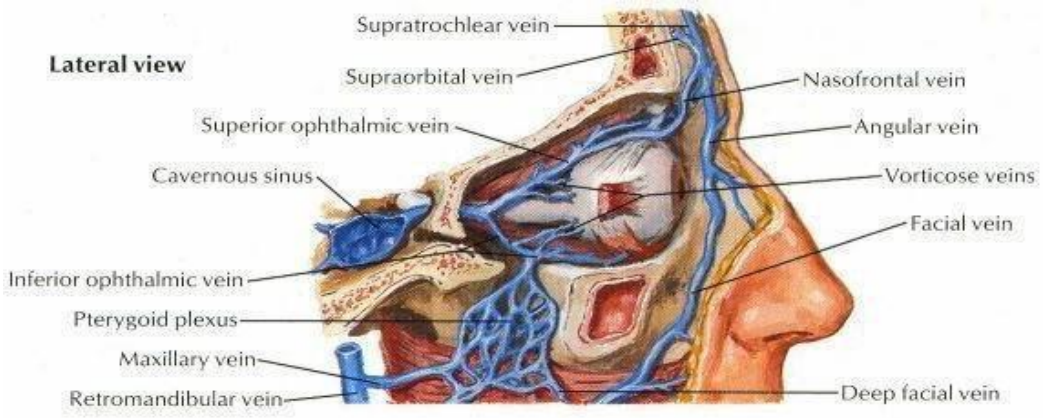
Venous Drainage of the Nose:

The veins form a cavernous plexus beneath the mucous membrane. They open into:

- **Sphenopalatine** and **greater palatine veins** > Pterygoid plexus > Maxillary vein > **External jugular vein**.
- **Anterior and posterior ethmoidal veins** > Ophthalmic vein > **Cavernous sinus**.
- **Angular**, **lateral nasal**, and **superior labial veins** > Facial vein > **Internal jugular vein**.

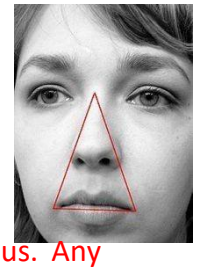
The pterygoid venous plexus and facial vein also communicate with the cavernous sinus:

Pterygoid venous plexus > Emissary vein > Cavernous sinus.



Facial vein >

1. Angular vein > Nasofrontal vein > Superior ophthalmic vein > Cavernous sinus
2. Deep facial vein > Pterygoid venous plexus > Emissary vein > Cavernous sinus



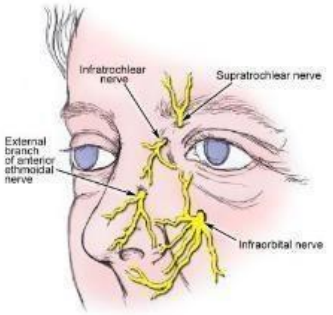
The Dangerous Area of the Face (Bermuda Triangle):

It is the area between the root of the nose and the 2 angles of the mouth. The veins that drain this region (mostly facial vein) are:

1. Connected to the cavernous sinus (so we have to be careful when dealing with anything in this area not to introduse it to the caernous sinus)
2. Valveless, which facilitates retrograde flow of blood from the face to the cavernous sinus. Any infection in this area may lead to cavernous sinus thrombosis and intracranial complications.

Nerve Supply of the Nose:

1. External Nose (Skin)



It is innervated by the ophthalmic (V1) and maxillary (V2) divisions of the trigeminal nerve (CN V).

- **Ophthalmic** (V1) > The superior aspect of the nose, including the tip >
  - Infratrochlear nerve
  - Supratrochlear nerve
  - External nasal branch of the anterior ethmoidal nerve
- **Maxillary** (V2) > Inferior and lateral aspects of the nose > o Infraorbital nerve

2. Nasal Cavity Olfactory Sensation:

Olfactory nerve > The roof and the uppermost parts of the medial and lateral walls.

General sensation:

Trigeminal nerve (CN V) > Ophthalmic and maxillary divisions (via sphenopalatine ganglion)

o Lateral wall:

1. Anterior ethmoidal nerve (V1) > Lateral internal nasal branch.
2. Sphenopalatine nerve (V2) > Lateral posterior inferior branch.
3. Sphenopalatine ganglion (V2) > Lateral posterior superior nasal branch (Short sphenopalatine nerve).

o Nasal septum:

1. Sphenopalatine ganglion (V2) >
   a. Nasopaltine nerve (Long sphenopalatine nerve)
   b. Medial posterior superior branch.
2. Anterior ethmoidal nerve (V1) > Medial internal nasal branch.

Autonomic Fibers:

Sensory branches of the sphenopalatine ganglion supplying the nasal mucosa carry postganglionic secretomotor fibers from the sphenopalatine fibers ganglions to the nasal glands.

Autonomic fibers control the vascular tone and secretion of the nasal mucous glands.

Sympathetic (GPPN)17 > vasoconstriction.

Parasympathetic deep petrosal nerve > vasodilation and increased nasal secretion.

Pathway of Autonomic Fibers:

Postganglionic sympathetic fibers pass from the superior cervical ganglion > deep petrosal nerve.

Preganglionic parasympathetic fibers pass via the sensory root of the facial nerve > greater petrosal branch.

o The deep petrosal and great petrosal nerves merge to form the **vidian nerve (important)** (Nerve of the pterygoid canal) > pterygopalatine ganglion > parasympathetic fibers synapse with the postganglionic secreto-motor fibers.

o Pterygopalatine ganglion gives terminal branches carrying the postganglionic sympathetic and parasympathetic fibers to their targets in the nasal cavity (blood vessels and nasal glands).

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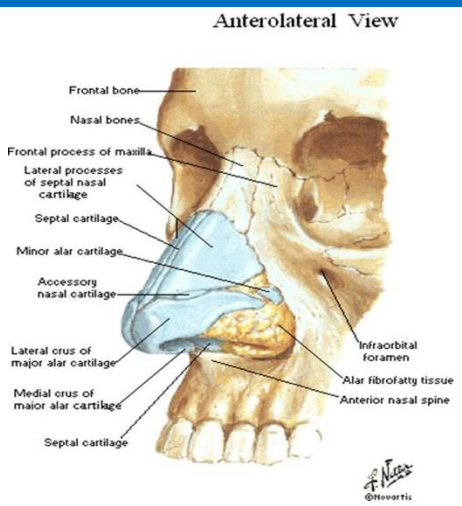
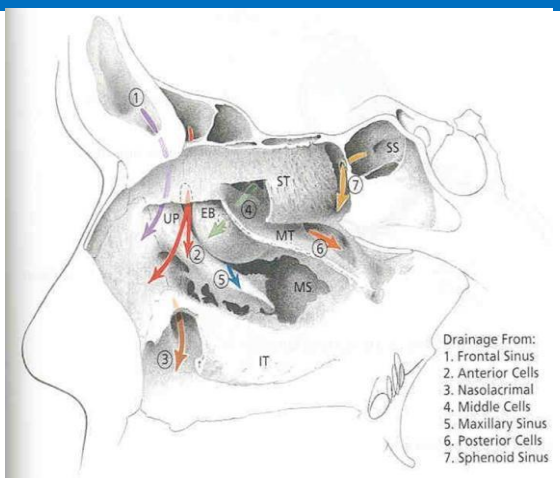
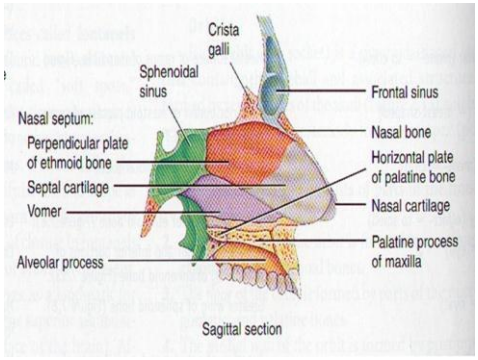
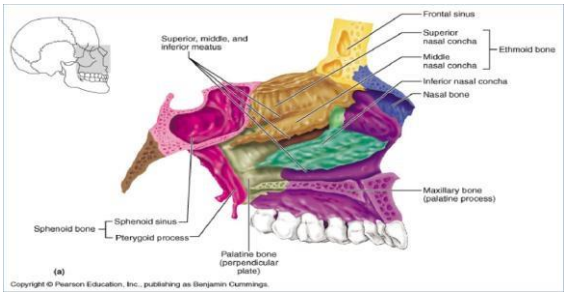
17 greater superficial petrosal nerve

Pictures





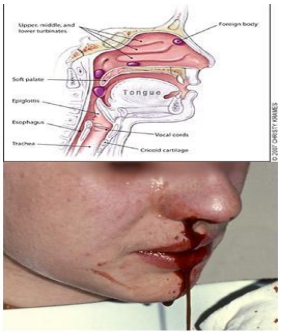




Clinical notes

Examination of nasal cavity:

- Trauma to the Nose
- Infection of the Nasal Cavity
- Foreign Bodies in the Nose
- Nose Bleeding (Epistaxis)



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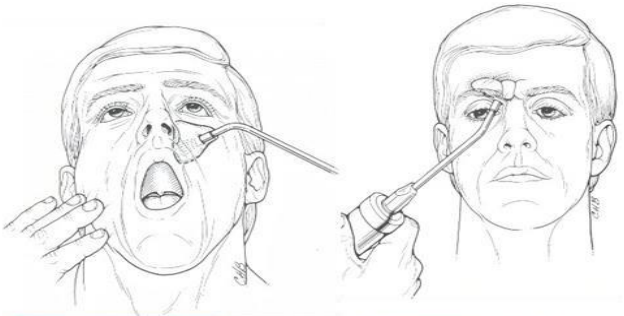
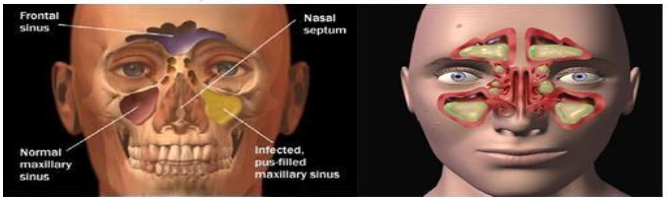
Examination of the Paranasal Sinuses>

- Sinusitis





Questions:

1- A lady had history of trauma came with anosmia no other signs what is the nerve that lead to this condition?

A. Optic. B. Vagus. C. Trigeminal. D. Olfactory.

Ans: D

2- 60-year-old patient presented to the ENT clinic. He reported having recurrent episodes of epistaxis. He is medically free and not on any medications.

What is the most common site for bleeding?

- Kiesselbach's plexus
- Hasselbach plexus
- Nasal plexus
- Ringer’s pouch

Ans: A

3- Which sinuses drain in the middle meatus?

A. posterior ethmoid, maxillary and frontal

B. anterior ethmoid, maxillary and frontal

C. maxillary, ethmoid sphenoid

D. frontal, maxillary, sphenoid

Answer: B