



433 Teams
ENT

8

Nasal Anatomy and Physiology

Color index:

432 Team – **Important** – 433 Notes – Not important

ent433team@gmail.com



جامعة
الملك سعود
King Saud University



Objectives:

- Anatomy of the external nose, nose, nasal cavity and paranasal sinuses.
- Physiology of the nose and paranasal sinuses.
- Blood and nerve supply of the external nose, nose, nasal cavity and paranasal sinuses.
- Functions of the nose and paranasal sinuses.
- Congenital anomalies.
- Choanal atresia.

ANATOMY OF THE NOSE:

- The nose consists of the external nose and the nasal cavity,
- Both are divided by a septum into right and left halves.

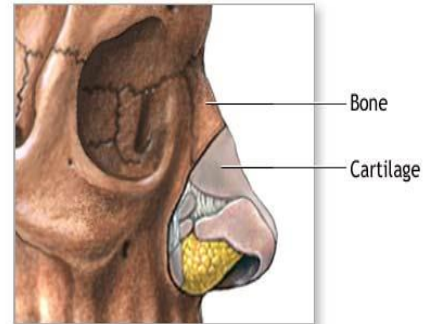
1- EXTERNAL NOSE:

A- STRUCTURE:

The framework of the external nose is made up above by (BONY PART):

- Nasal bones
- The frontal processes of the maxillae
- The nasal part of the frontal bone

Below, the framework is formed of plates of hyaline cartilage



B- MUSCLES:

- Procerus elevate the skin of dorsum
- Nasalis compressor of naris
- Dilators naris
- Depressor septi

C- BLOOD SUPPLY:

- The skin of the external nose is supplied by branches of the ophthalmic and the maxillary arteries.
- The skin of the ala and the lower part of the septum are supplied by branches from the facial artery.

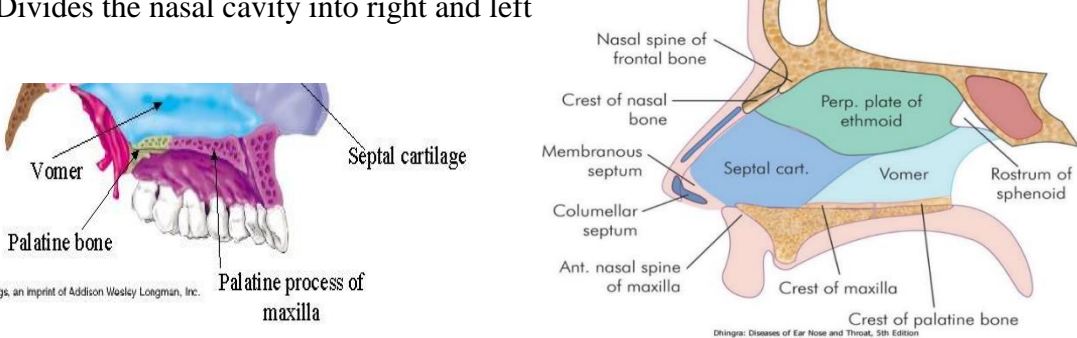
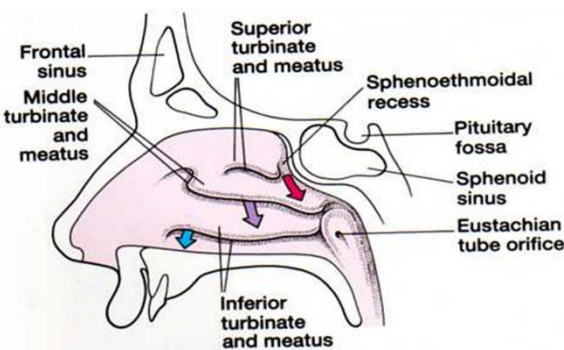
D- NERVE SUPPLY:

- The infratrochlear and external nasal branches of the ophthalmic nerve (CN V)
- The infraorbital branch of the maxillary nerve (CN V).

2- NASAL CAVITY: -

- **The nasal cavity has**
 - **Floor**
 - **Roof**
 - **Lateral wall**
 - **Medial wall or septum**

Boundaries of nasal cavity:

Floor	<ul style="list-style-type: none"> • Palatine process of maxilla • Horizontal plate palatine bone
Roof “Narrow”	<ul style="list-style-type: none"> - Formed Anteriorly beneath the bridge of the nose by the nasal and frontal bones. - In the middle by the cribriform plate of the ethmoid, located beneath the anterior cranial fossa, - Formed posteriorly by the downward sloping body of the sphenoid
Medial wall “The nasal septum”	<p>Divides the nasal cavity into right and left</p> 
Lateral wall	<ul style="list-style-type: none"> • In neonate <ul style="list-style-type: none"> - The nasal & orbital floors are located at the same level - <u>Lateral nasal wall serves as the medial orbital wall</u> - Maxilla, contributes minimally in fetus & neonate • In adult <ul style="list-style-type: none"> - <u>Only the upper half of the lateral nasal wall forms the medial orbital wall</u> - <u>The nasal floor is at lower level than orbital floor</u> • The medial surface of the maxilla is incomplete (maxillary hiatus) => the aperture of the hiatus is reduced by presence of palatine and lacrimal bones and the inferior concha <p>The lateral wall is marked by 3 projections:</p> <ul style="list-style-type: none"> - Superior concha - Middle concha - Inferior concha <ul style="list-style-type: none"> • The space below each concha is called a meatus and each meatus receive the opening of a paranasal sinus as follows: • Inferior meatus: nasolacrimal duct • Middle meatus: Maxillary sinus + Frontal sinus +Anterior ethmoid sinuses • Superior meatus: posterior ethmoid sinuses • Sphenoethmoidal recess: sphenoid sinus 

➤ Blood supply of the nasal cavity:

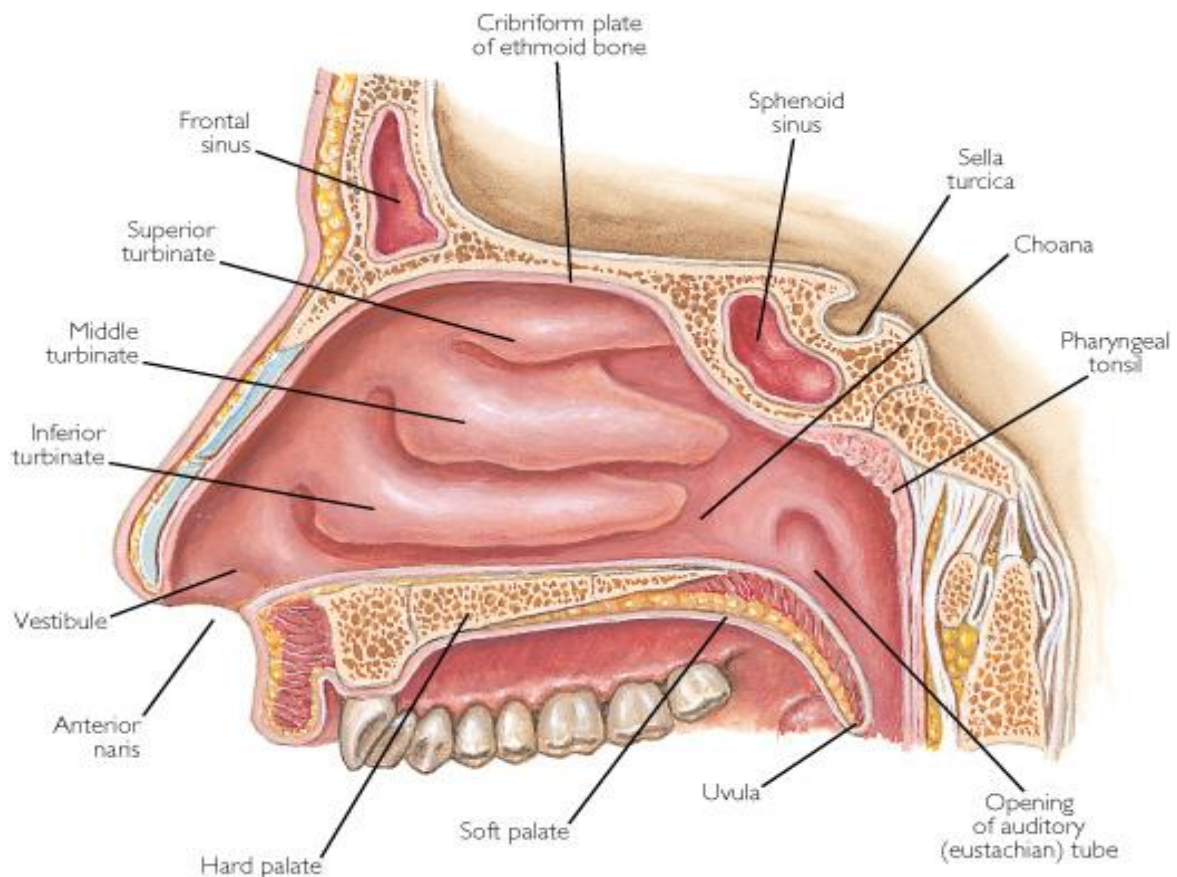
- From branches of the maxillary artery, one of the terminal branches of the external carotid artery.
- The sphenopalatine artery anastomoses with the septal branch of the superior labial branch of the facial artery in the region of the vestibule.
- The submucous venous plexus is drained by veins that accompany the arteries.

➤ Nerve Supply of the Nasal Cavity

- Olfactory nerve (CN I)
- Posterior nasal branches of maxillary nerve (V₂)
- Cut nasopalatine branch of V₂ to septum
- Anterior ethmoidal branch of ophthalmic (V₁)

➤ Lymph Drainage of the Nasal Cavity

- The lymph vessels draining the vestibule end in the submandibular nodes.
- The remainder of the nasal cavity is drained by vessels that pass to the upper deep cervical nodes.

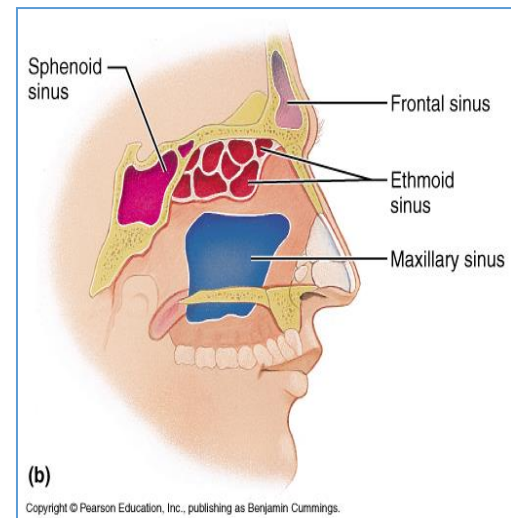


Paranasal sinuses (PNS)

- The paranasal sinuses are cavities found in the interior of the maxilla, frontal, sphenoid, and ethmoid bones.
- They are **lined with mucoperiosteum and filled with air**.
- They communicate with the nasal cavity through relatively small apertures.

➤ 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.

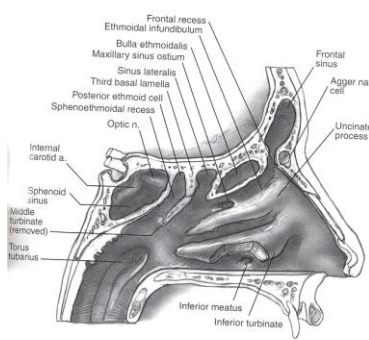
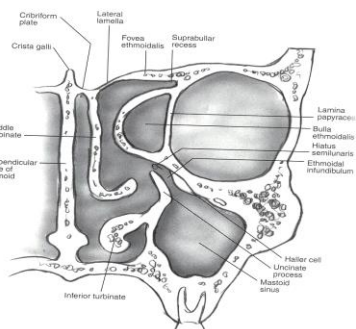


➤ Functions of the PNS:

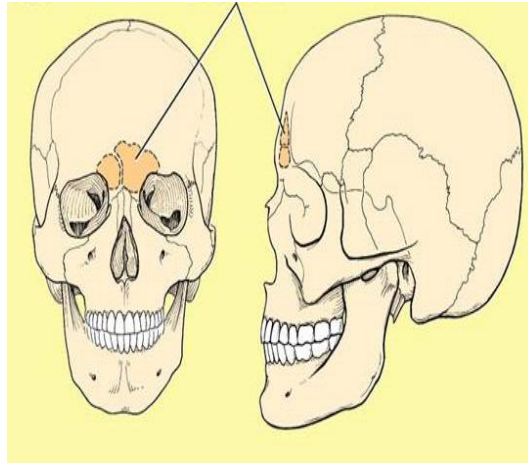
1. Resonators of the voice
2. They also reduce the skulls weight
3. Help warm and moisten inhaled air
4. Act as shock absorbers in trauma

In general, their functions are to ensure: Patent ostia + Normal Ciliary Function + Normal Quality of Mucous.

**** Disturbance of these Function will lead to sinusitis**

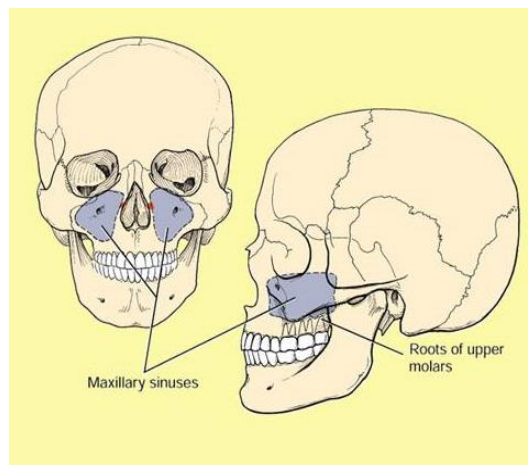


Frontal sinus



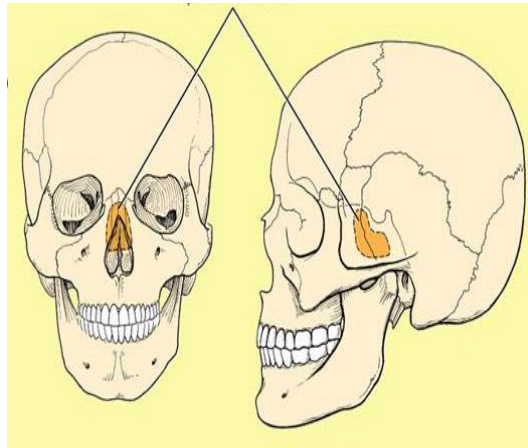
- Rarely symmetrical
- Contained within the frontal bone.
- **Separated from each other by a bony septum.**
- Each sinus is roughly triangular
- Extending upward above the medial end of the eyebrow and backward into the medial part of the roof of the orbit.
- **Opens into the middle meatus**

Maxillary sinus



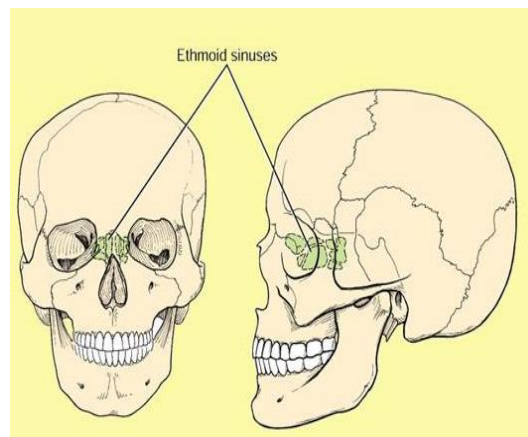
- Pyramidal in shape
- **Paired & symmetric**
- Located within the body of the maxilla behind the skin of the cheek.
- **The roof is formed by the floor of the orbit, and the floor is related to the roots of the 2nd premolars and 1st molar teeth.**
- **The maxillary sinus opens into the middle meatus of the nose**

SPHENOIDAL SINUS



- Lie within the body of the sphenoid bone
- Below sella turcica
- Extends between dorsum sellae and post clinoid processes
- Opens into the sphenothmoidal recess above the superior concha

ETHMOIDAL SINUS



- 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**
- Separated from the orbit by a thin plate of bone so that infection can readily spread from the sinuses into the orbit

PHYSIOLOGY OF THE NOSE

- 3 major functions of the nose:
 - Olfaction
 - Respiration (the most important)
 - Defense
 - Additional minor functions
 - Aiding and modifying voice production
 - Providing vocal resonance
 - Serving as a secondary sex organ
- **Modification of inspired air**
- **Humidification**
- Nose adjust precisely the inspired air to have a humidity of 85 %
 - ⇒ This enhances the gas exchange
 - Large portion returned to the nasal mucosa during exhalation.
 - ⇒ This prevents overdrying of the nasal mucosa and thickening of the nasal secretions.

- **Warms the inspired air**

The rich capillary beds that make up the side wall of the nose, along with their accompanying venous sinusoids

➤ **NASAL VALVE**

- The smallest cross-sectional diameter and **greatest resistance of the airway**
- The muscle activity prevents alar collapse during inspiration.
- Resistance in this segment is **created by the turbinate size, which is altered by the vascular tone and blood volume of the nasal sinusoids.**
- Induced by exercise, posture changes, and hyperventilation.
- Chemical irritants, medications, pain, and emotion

➤ **NASAL CYCLE**

- Alternating changes in patency of the right & the left nasal cavities
- Occur in rhythmic sequence in about 80 % of normal individuals
- **The total resistance to the nasal airflow remains constant**
- **Controlled through the**
 - **Autonomic adrenergic centers**
 - **Hypothalamic control center**
- If the cervical ganglion is sectioned, there is abolition (termination) of the nasal cycle on the same side

➤ OLFACTION

- Important in food choices and in social interaction
- Warning sign for toxic gases and spoiled foods.
- To smell a substance, it must somehow reach the olfactory mucosa located in the roof of the nose
- The odor-producing substance **must have a vapor pressure and must be relatively water- and lipid-soluble in order to be sensed.**

➤ ANOSMIA “inability to smell”

- Nasal obstruction and nasal infection.
- **The receptor molecule cannot reach the olfactory mucosa to stimulate a response.**
- Nasal polyposis and nasal deformities are reversible conditions in adults.
- Infections and allergies cause temporary interruption of smell, and olfactory capability returns when the conditions resolve.
- Smell can trigger an asthmatic attack and can worsen emphysema. (possible theory for this: Trigeminal reflex, which is induced by a chemical irritant stimulating the nasal mucosa and leads to reflex bronchial constriction)

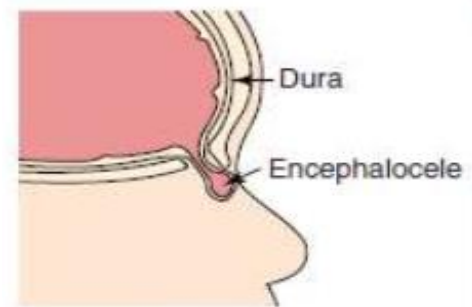
➤ IMMUNOLOGY

- **Secretory immunoglobulin A (IgA) is the major immunoglobulin found in nasal secretions**
- The concentration of IgG (3 percent) and IgM (1 percent) increases during actual infections (this might be due to transudation of plasma resulting from mucosal injury).

Developmental errors of the anterior neuropore

- Encephalocele
- Nasal glioma
- Nasal dermoid

1) NASAL ENCEPHALOCELE:



- **Definition: Extracranial Herniation of meninges and/or brain tissue through defects in the skull.**
(Meningocele: Present similarly but without herniation of brain tissue).
- Described by location of dehiscence in the skull base:
 - ✓ Occipital (75%)
 - ✓ Sincipital (25%)
 - ✓ Basal (1%)

Encephalocele is an extracranial herniation of cranial contents through a defect in the skull. When an encephalocele includes meninges only it is termed meningocele. Encephaloceles are divided into occipital, sincipital and basal types.

- Clinical Features:

- Symptoms: Bluish mass over the glabella or inside the nose that is **compressible, pulsatile** and **transilluminates with light**.
- **Positive Frustenberg test:**
Expansion with compression of bilateral jugular veins.
Expansion may also be triggered by crying or straining (Valsalva).

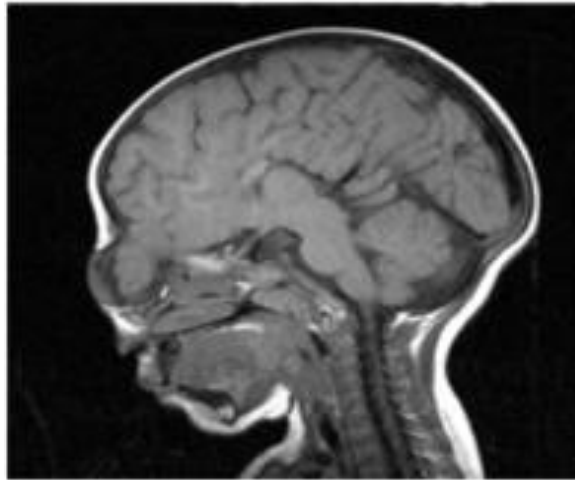
- **INVESTIGATIONS:**

▪ **MRI:**

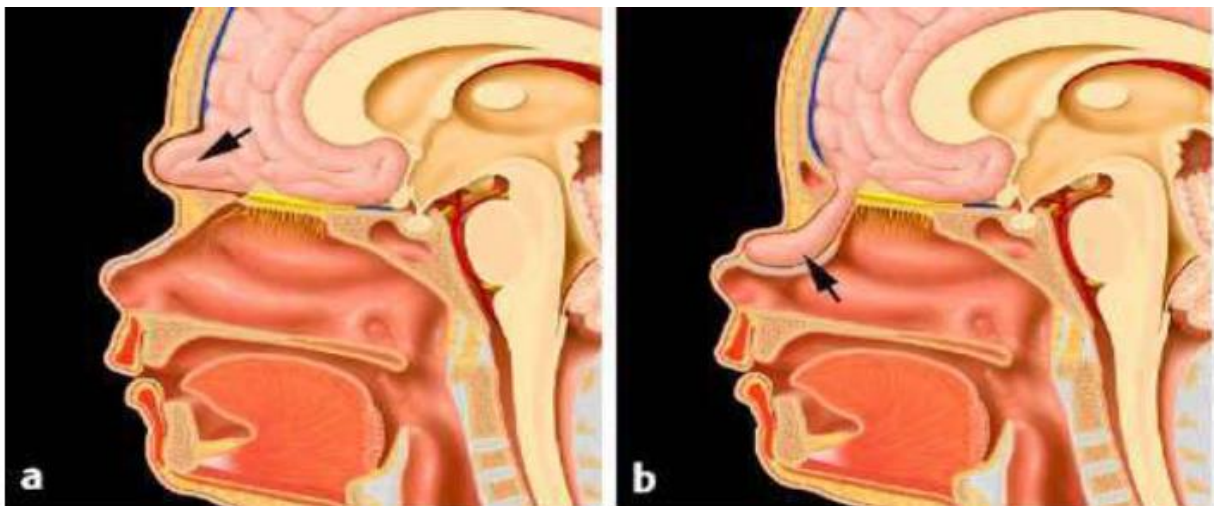
- To identify intracranial extension (masses with subarachnoid extension)
- **To differentiate between meningocele and encephalocele.**

▪ **CT scan:**

- To detect skull base defect.



Mass containing brain tissue in continuity with the frontal lobe, this is a nasoethmoidal encephalocele

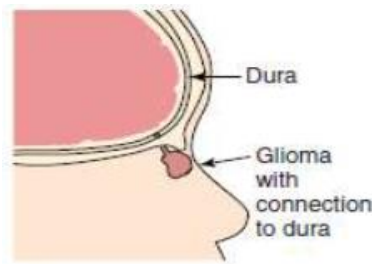


(A) Sincipital Encephalocele (B) Basal Encephalocele

A) Sincipital encephaloceles are also known as Frontoethmoidal encephaloceles. They occur between the frontal and ethmoid bones at the foramen cecum immediately anterior to the cribriform plate. They may be further subdivided as nasofrontal, nasoethmoidal and naso-orbital and manifest as **external nasal masses**

B) Generally Basal Encephaloceles arise through the cribriform plate or through the superior orbital fissure and manifest as an **intranasal mass**

2) NASAL GLIOMA:



- **Presentation (based on location):** may be present at birth “grow in proportion with the child age”
 - Extra-nasal: (60%)
 - Smooth, firm and **non-compressible** masses, skin telangiectasia
 - Glabella type “most common”, nasomaxillary suture line type.
 - Intra-nasal: (30%)
 - Arise in lateral nasal wall near the middle turbinate.
 - Polypoid type “pale masses”
 - Nasal septum type “rare”



- Combined: (10%)

- **Nasal gliomas DO NOT trans-illuminate or enlarge with with crying or straining.**

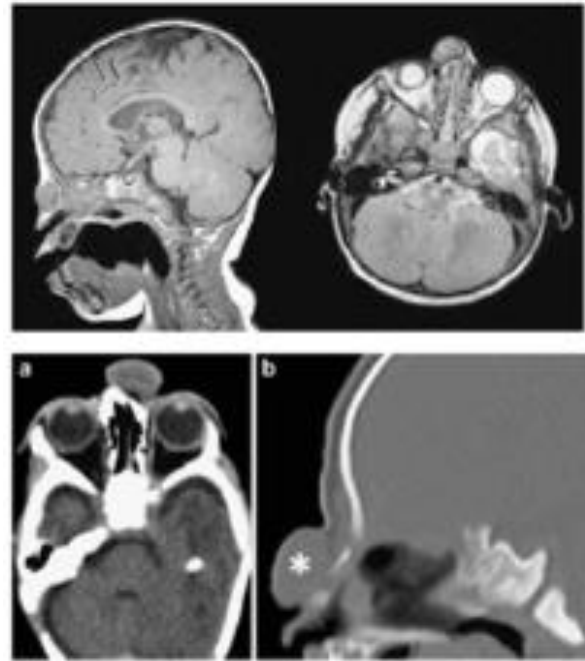
- INVESTIGATIONS:

▪ **MRI:**

- Hypotense on T1 , \pm hyperintense on T2
- Presence of fibrous stalk “in 15%”
- Rare enhancement.

▪ **CT scan:**

- To assess the bony anatomy of the skull base.



Intranasal glioma showing a fibrous stalk and are more commonly seen in those that are intranasal (35%)

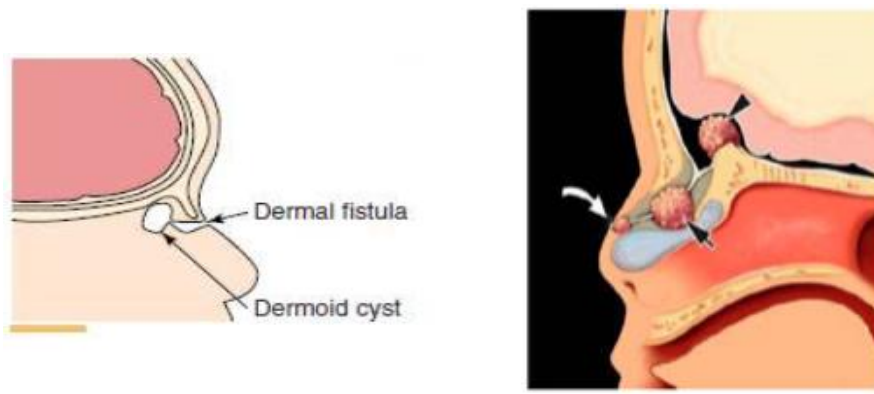
Surgical Treatment

- ▶ For Meningiomas, Gliomas limited to nasal cavity
 - ▶ Endoscopic repair with clipping the stalk
 - ▶ Defect is repaired with free mucosal grafts or mucoperichondrial flap

- ▶ For Encephaloceles, Gliomas and Dermoids with intracranial extension
 - ▶ Multidisciplinary approach
 - ▶ Translabellar Subcranial Approach
 - ▶ Frontal craniotomy in combination with external Rhinoplasty and lateral rhinotomy approach



3) NASAL Dermoids: **the commonest congenital nasal anomaly.**



- Definition: Epithelial-lined cavities (cysts) or sinus tracts consisting of both ectodermal and mesodermal elements, including hair follicles, sebaceous glands, and sweat glands.
- **Presentation:**
 - Midline mass or cyst with sinus opening:
 - Firm lobulated non-compressible mass.
 - Sinus opening -> Purulent or sebaceous material.
 - Widened nasal bridge
 - Protruding hair “Pathognomonic”: in minority of cases.
 - Intracranial extension in 2-45% “attach to dura, falx cerebri ..etc”
 - Up to 50% have fistula or sinus tract.

Dermoid sinus cysts of the nose present as a midline nasal pit, fistula or infected mass located anywhere from the glabella to the nasal columella. They may secrete sebaceous material or pus and may become intermittently infected causing abscess formation, meningitis even cerebral abscess for those with intracranial extension.

- **Treatment:**
 - Direct external excision.
 - Medial canthal approach “Lynch”, external rhinoplasty, endoscopic resection.

Done By:

Mohammed Alnafisah

Mojahed Otayf

