RADIOLOGY OF NOSE AND PARANASAL SINUSES

-DR. DHIRENDRA V. PATIL M.S. (ENT) J.N.M.C., Aligarh Muslim University

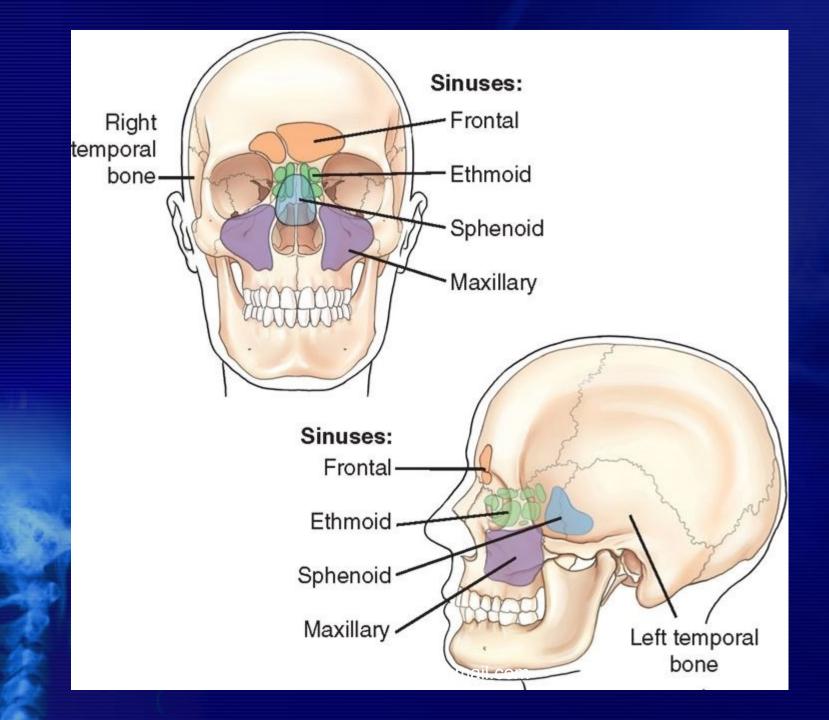
PARANASAL SINUSES

The large, air-filled cavities of the paranasal sinuses are sometimes called the accessory nasal sinuses because they are lined with mucous membrane, which is continuous with the nasal cavity. These sinuses are divided into four groups, according to the bones that contain them:

- 1.Maxillary (2) Maxillary (facial) bones
- 2. Frontal (usually 2) Frontal (cranial) bones
- 3. Ethmoid (many) Ethmoid (cranial) bones
- 4. Sphenoid (cranial) bone

Only the maxillary sinuses are part of the facial bone structure. The frontal, ethmoid, and sphenoid sinuses are contained within their respective cranial bones.

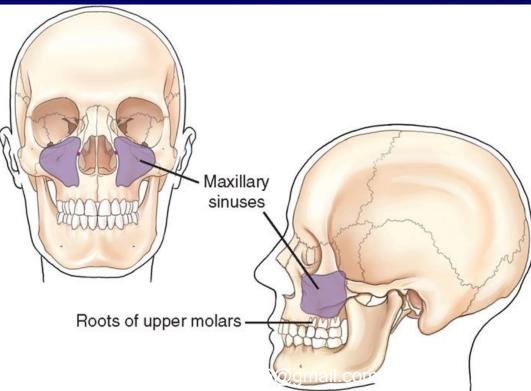
The paranasal sinuses begin to develop in the fetus, but only the maxillary sinuses exhibit a definite cavity at birth. The frontal and sphenoid sinuses begin to be visible on radiographs at age 6 or 7. The ethmoid sinuses develop last. All the paranasal sinuses generally are fully developed by the late teenage years.



Maxillary Sinuses

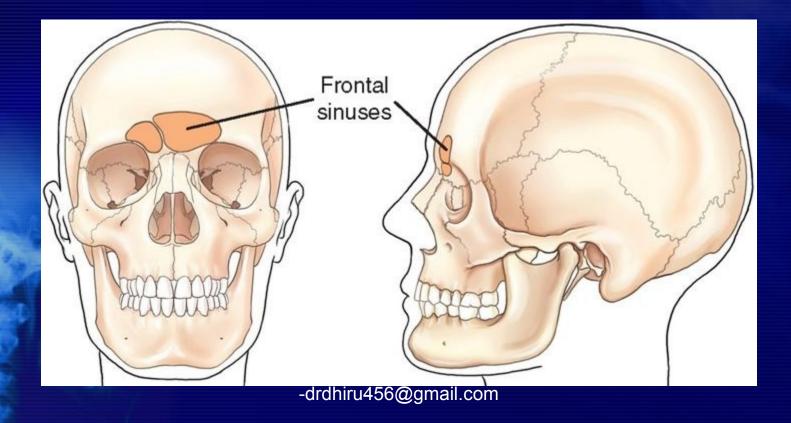
The large maxillary sinuses are paired structures, one of which is located within the body of each maxillary bone. An older term for maxillary sinus is antrum, an abbreviation for Antrum of Highmore.

Each maxillary sinus is shaped somewhat like a pyramid on a frontal view. Laterally, they appear more cubic. The average total vertical dimension is between 3 and 4 cm, and the other dimensions are between 2.5 and 3 cm.



Frontal Sinuses

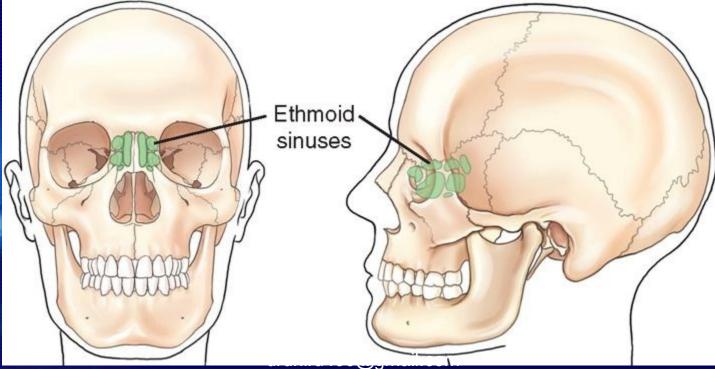
The frontal sinuses are located between the inner and outer tables of the skull, posterior to the glabella; they rarely become aerated before age 6. The maxillary sinuses are always paired and are usually fairly symmetric in size and shape; the frontal sinuses are rarely symmetric. The frontal sinuses usually are separated by a septum, which deviates from one side to the other or may be absent entirely, resulting in a single cavity.



Ethmoid Sinuses

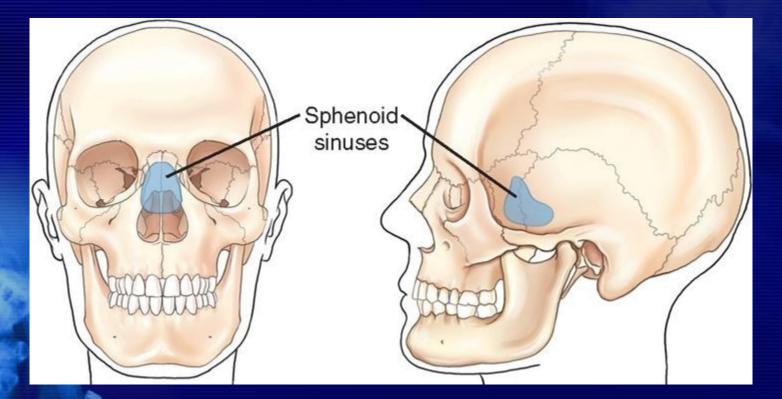
The ethmoid sinuses are contained within the lateral masses or labyrinths of the ethmoid bone. These air cells are grouped into anterior, middle, and posterior collections, but they all intercommunicate.

When viewed from the side, the anterior ethmoid sinuses appear to fill the orbits. This occurs because portions of the ethmoid sinuses are contained in the lateral masses of the ethmoid bone, which helps to form the medial wall of each orbit.



Sphenoid Sinuses

The sphenoid sinuses lie in the body of the sphenoid bone directly below the sella turcica. The body of the sphenoid that contains these sinuses is cubic and frequently is divided by a thin septum to form two cavities. This septum may be incomplete or absent entirely, however, resulting in only one cavity.



-drdhiru456@gmail.com

PARANASAL SINUSES

Technical Factors

A medium kV range of 70 to 80 is commonly used to provide sufficient contrast of the air-filled paranasal sinuses. Optimum density as controlled by the mAs is especially important for sinus radiography to visualize pathology within the sinus cavities. A small focal spot should be used for maximum detail.

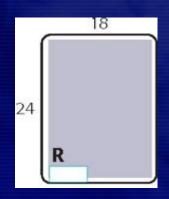
As with cranial and facial bone imaging, gonadal shielding is not useful in reducing gonadal exposure, but shields over the pelvic area may be used for patient reassurance. Close collimation and elimination of unnecessary repeats are the best measures for reducing radiation dose in sinus and temporal bone radiography

LATERAL VIEW

Lateral side of the skull lies against the film and x-ray beam is projected perpendicular from the other side. Center CR to a point midway between outer canthus and EAM.

LATERAL POSITION—RIGHT OR LEFT LATERAL: SINUSES





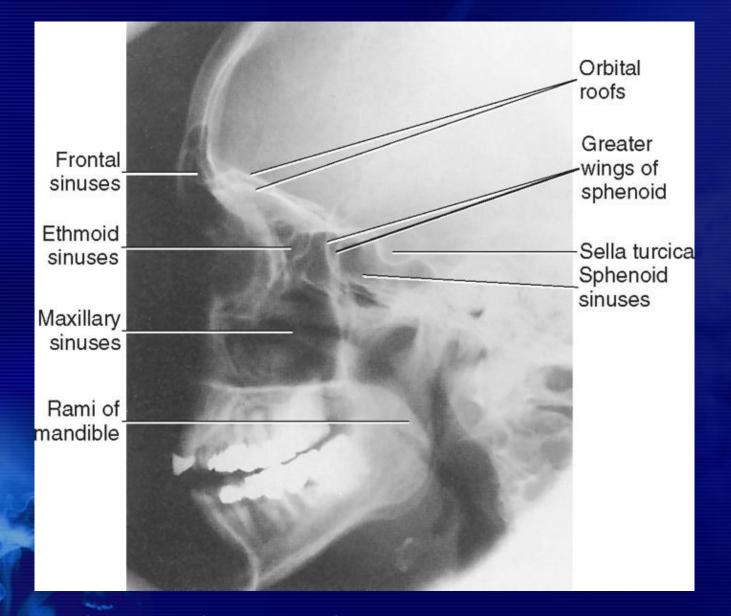
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Respiration Suspend respiration during exposure.

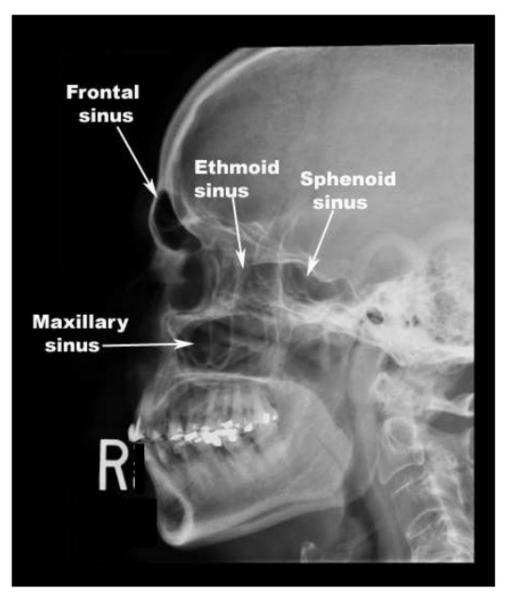
Notes: To visualize air-fluid levels, an erect position with a horizontal beam is required. Fluid within the paranasal sinus cavities is thick and gelatin-like, causing it to cling to the cavity walls. To visualize this fluid, allow a short time (at least 5 minutes) for the fluid to settle after a patient's position has been changed (i.e., from recumbent to erect).

STRUCTURES SEEN -

- ANTERIOR AND POSTERIOR EXTENT OF SPHENOID, FRONTAL AND MAXILLARY SINUSES
- SELLA TURCICA
- ETHMOID SINUSES
- CONDYLE AND NECK OF MANDIBLE



Structures Shown: • All four paranasal sinus groups are shown. -drdhiru456@gmail.com





CALDWELL VIEW

 A/K/A OCCIPITOFRONTAL VIEW OR NOSE FOREHEAD POSITION

-drdhiru456@gmail.com

Part Position

Place patient's nose and forehead against upright table with neck extended to elevate the OML 15° from horizontal. A radiolucent support between forehead and upright Bucky or table may be used to maintain this position. CR remains horizontal. (alternate method if Bucky can be tilted 15°.)

Center X-RAY to CR and to nasion, ensuring no rotation.

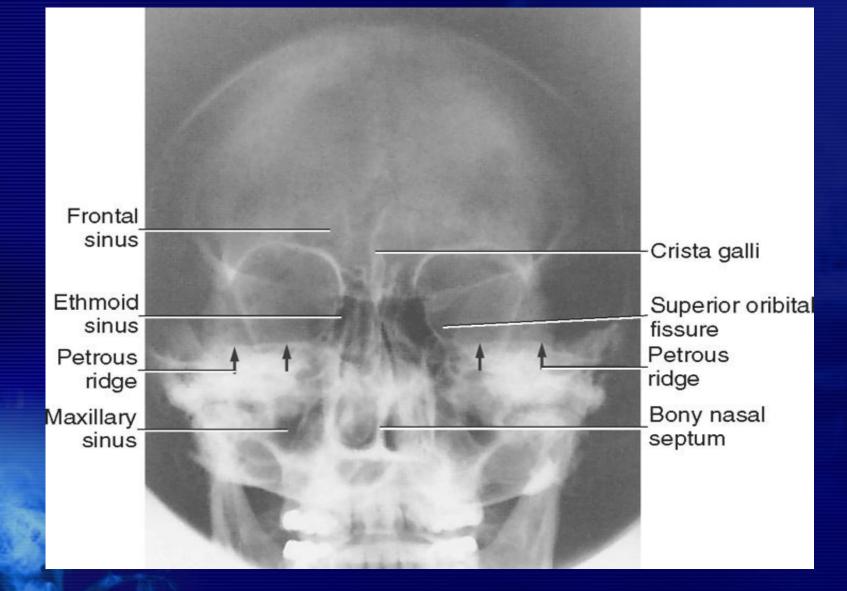
Align CR horizontal, parallel to floor.

POSITION: SINUSES Caldwell Method

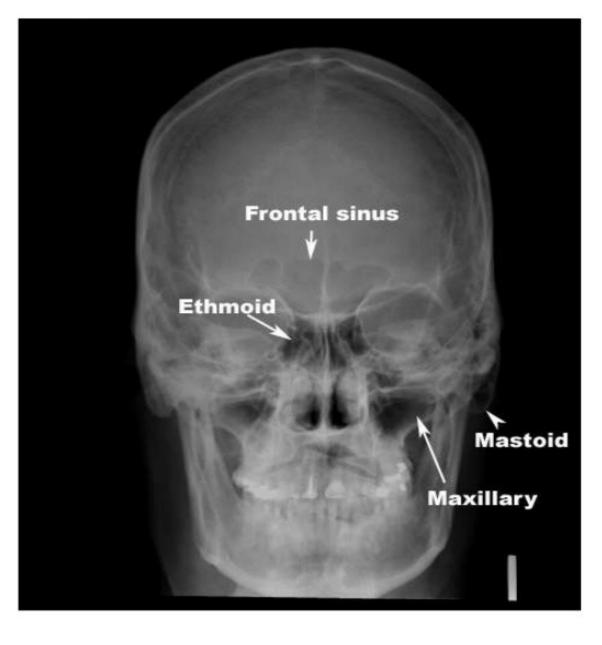


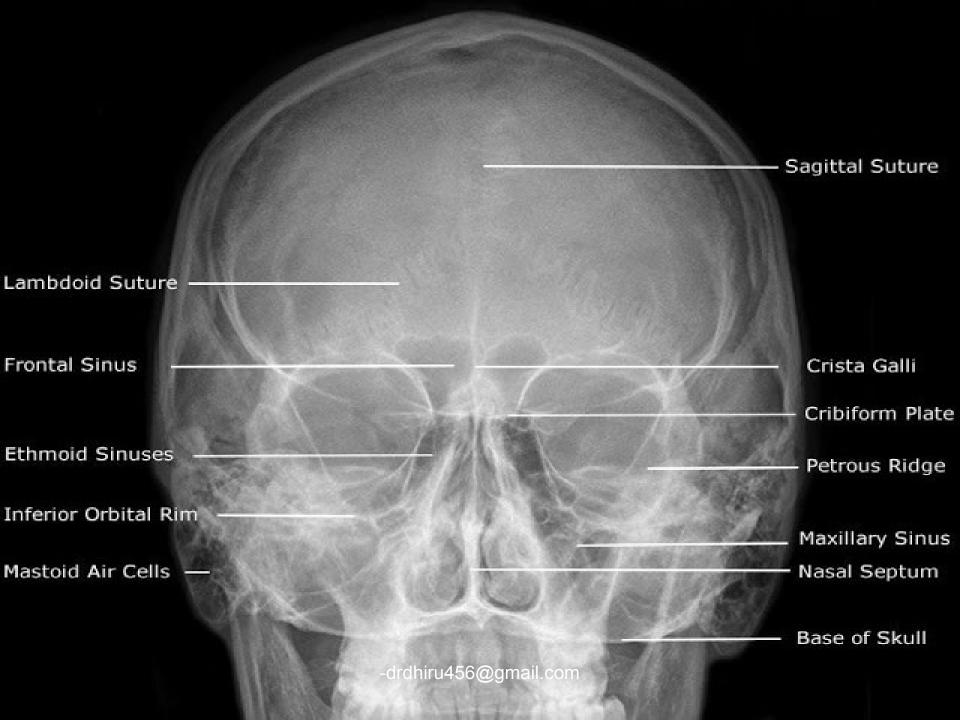
STRUCTURES SEEN

- 1. FRONTAL SINUSES (SEEN BEST)
- 2. ETHMOID SINUSES
- 3. MAXILLARY SINUSES
- 4. FRONTAL PROCESS OF ZYGOMA AND ZYGOMATIC PROCESS OF FRONTAL BONE
- 5. SUPERIOR MARGIN OF ORBIT AND LAMINA PAPYRACEA
- 6. SUPERIOR ORBITAL FISSURE



Structures Shown: • Frontal sinuses projected above the frontonasal suture. • Anterior ethmoid air cells visualized lateral to each nasal bone, directly below 4the frontal sinuses.





WATER'S VIEW

- A.K.A OCCIPITOMENTAL VIEW OR NOSE CHIN POSITION
- IT IS TAKEN IN SUCH A WAY THAT NOSE AND CHIN OF THE PATIENT TOUCH THE FILM WHILE X-RAY BEAM IS PROJECTED FROM BEHIND.

-drdhiru456@gmail.com

Part Position

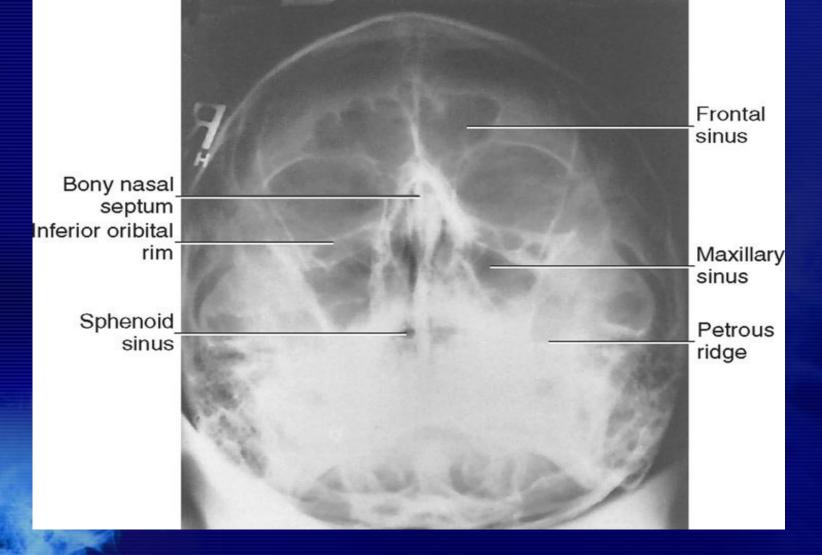
- Extend neck, placing chin and nose against table/film.
- Adjust head until MML is perpendicular to film; OML will form a 37° angle with the plane of the film.
- Ensure that no rotation or tilt exists.
- Center film to CR and to acanthion.

PARIETOACANTHIAL PROJECTION: SINUSES Waters Method



STRUCTURES SEEN

- Maxillary sinuses (seen best)
- Frontal sinuses
- Sphenoid sinuses (if the film is taken with open mouth)
- Zygoma
- Zygomatic arch
- Nasal bone
- Frontal process of maxilla



Structures Shown: • Maxillary sinuses with the inferior aspect visualized free from superimposing alveolar processes and petrous ridges, the inferior orbital rim, and an oblique view of the frontal sinuses

| | | Frontal Sinus |
|--|-----------------------|------------------------|
| Bony Nasal Septum | | |
| Anterior NasalSpine | | Inferior Orbital Rim |
| Coronoid Process ———— Maxilla ——————————————————————————————————— | AB . | Zygomatic Arch |
| Condyle | Road Martin F | Petrous Ridge Mandible |
| Mastoid ———— | | |
| Mandibular Angle | The second | Odontoid Process |
| | -drdhiru456@gmail.com | |

SUBMENTOVERTICAL (BASAL) VIEW

 THE VIEW IS TAKEN WITH VERTEX NEAR THE FILM AND X-RAY BEAM PROJECTED AT RIGHT ANGLES TO THE FILM FROM THE SUBMENTAL AREA.

Part Position

 Raise chin, hyperextend neck if possible until OML is parallel to table/film.

• Head rests on vertex of skull.

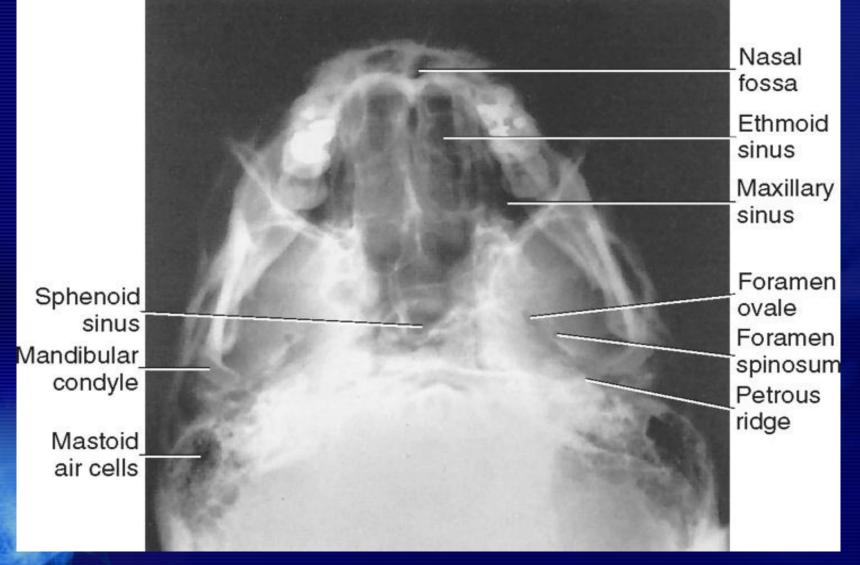
• Ensure no rotation or tilt.

SUBMENTOVERTEX (SMV) PROJECTION: SINUSES



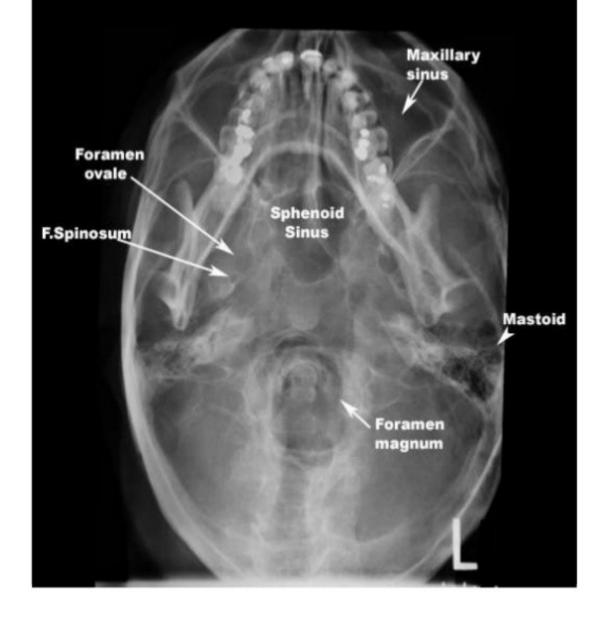
STRUCTURES SEEN

- Sphenoid, posterior Ethmoid and Maxillarry sinuses (seen best in that order)
- Mandible

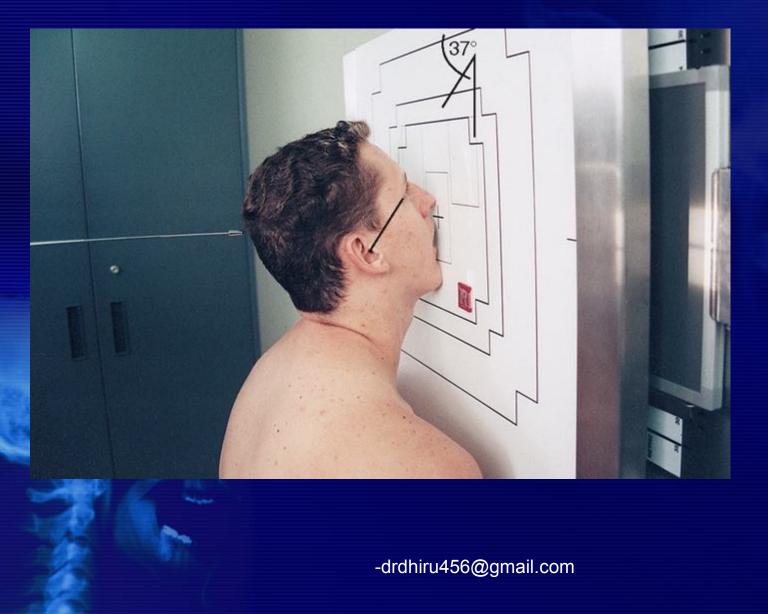


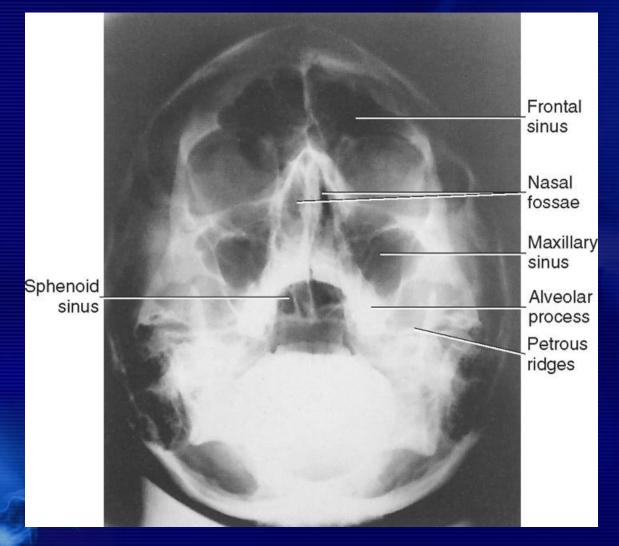
Structures Shown: • Sphenoid sinuses, ethmoid sinuses, nasal fossae, and maxillary sinuses. -drdhiru456@gmail.com

sinuses



PARIETOACANTHIAL TRANSORAL PROJECTION: SINUSES Open Mouth Waters Method





Structures Shown: • Maxillary sinuses with the inferior aspect visualized, free from superimposing alveolar processes and petrous ridges, the inferior orbital rim, an oblique view of the frontal sinuses, and the sphenoid sinuses visualized through the open mouth.

-drdhiru456@gmail.com

Advantages of x-ray imaging in rhinology include:

1. Cost effectiveness of the investigation

2. Easy availability

3. Currently available digital x-ray imaging techniques provide better soft tissue and bone resolution when compared to conventional x-rays.

Disadvantages of conventional radiographs:

1. Plain radiographs have a false positive rate of 4%.

2. Plain radiographs have false negative rate of more than 30%

CT NOSE AND PNS

BASIC CONCEPTS

- CT scans typically obtained for visualizing the paranasal sinus should include coronal and axial (3mm) cross
 - sections.
- Soft tissue and bony windows facilitate evaluation of disease processes and the bony architecture.
- The use of intravenous contrast material just prior to scanning can help define soft tissue lesions and delineate vascularized structures, such as vascular tumors.
- Contrast-enhanced CT is particularly useful in evaluating neoplastic, chronic, and inflammatory processes.

- However, for most patients with sinusitis, noncontrast CT of the paranasal sinuses generally suffices.
- The traditional x-rays of PNS are all but redundant for two reasons-
- 1. Firstly, the diagnosis of acute or chronic sinusitis is a clinical one.

2. Secondly, if surgical intervention is required in either of the cases, then the information gained from an x-ray pns is too inadequate and a CT scan becomes mandatory.

- The CT scan is the GOLD STANDARD investigation in all preoperative cases as it gives detailed bony anatomy of the area and serves as a 'road map' for the operating surgeon.
- CT scans are best done after a course of antibiotics, so that acute inflammation is not mistaken for chronic mucosal disease.

BASIC STEPS IN READING A CT SCAN-

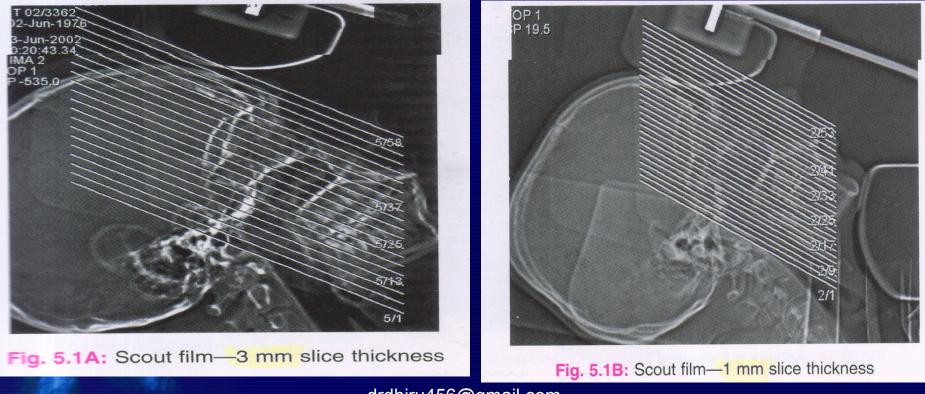
- 1) Always read a CT scan from the first cut.
- 2) Read it cut by cut, do not jump from one cut to any other random cut.
- Read the CT two times, first time for anatomical landmarks and second time for pathology and planning surgery.
- 4) See for the window setting in the CT, bone window or soft tissue window.
- 5) Never operate without a CT scan.

TYPES OF SCANS / CUTS

Coronal cuts
 Axial cuts
 Saggittal cuts

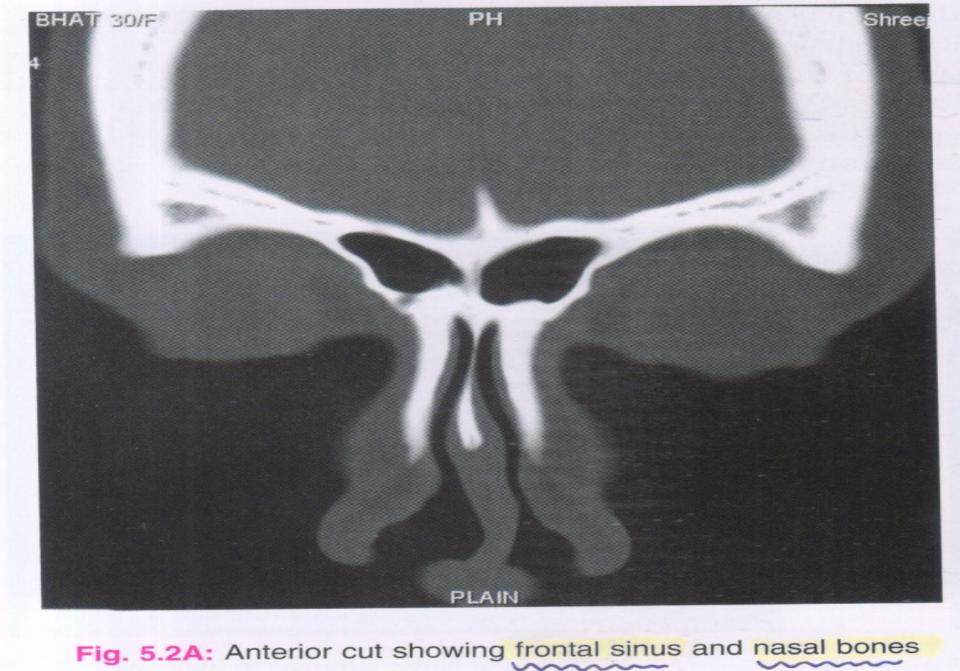
CORONAL CUTS

One should study the scout film first.



The coronal cuts should be read from anterior to posterior.

The most anterior cuts show frontal sinus and nasal bone.



The interfrontal septum is in midline inferiorly, but may deviate to either side.

The interfrontal sinus septum may at times be pneumatised.
 The multiple frontal septae show a 'classical scalloping' of the frontal sinus, which is lost in cases of mucoceles.

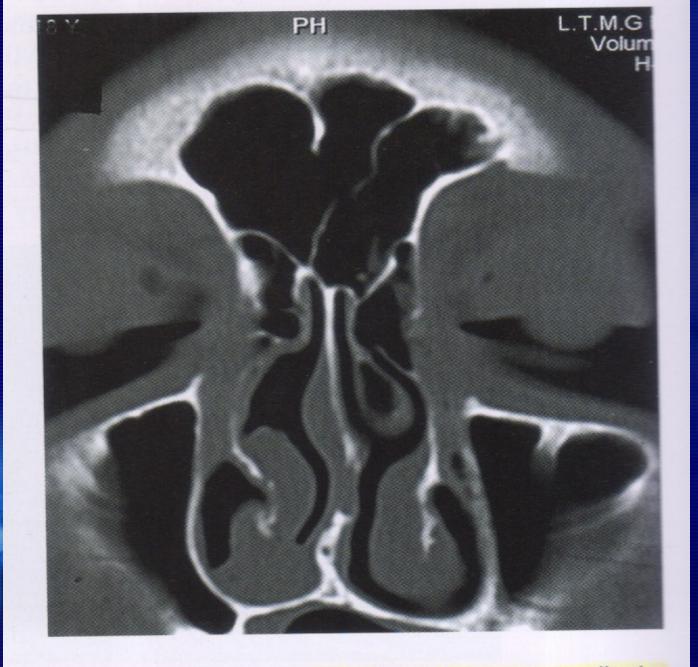


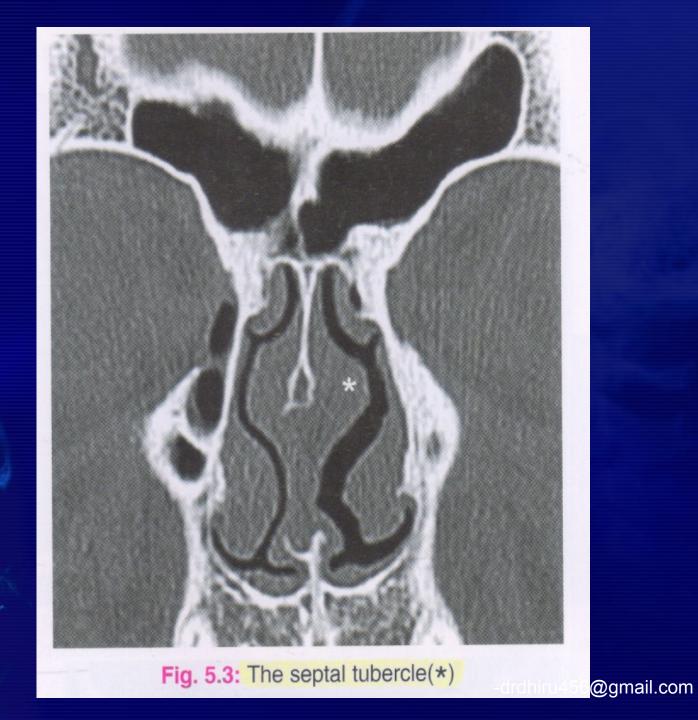
Fig. 5.2B: Cut showing interfrontal septum, scalloping of frontal sinus

u456<mark>@gmail.com</mark>

The inferior turbinate is visualised, any hypertrophy of the inferior turbinate is looked for.

A mucosal swelling is seen in the anterior part of the septum. This is the SEPTAL TUBERCLE.

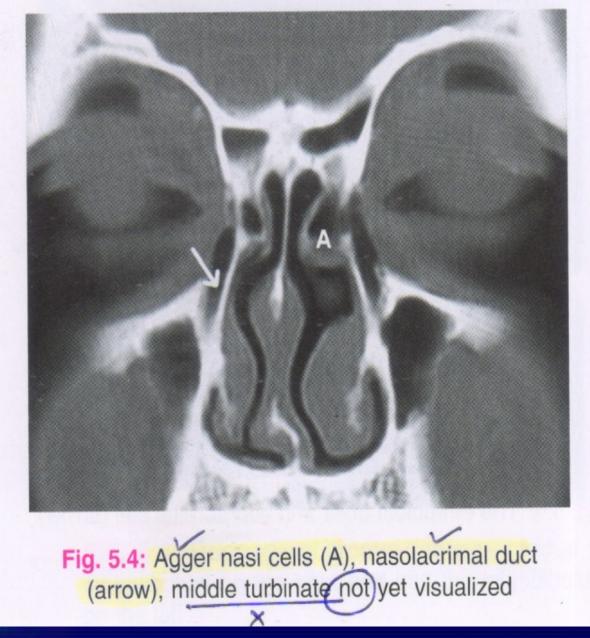
 It consists of erectile tissue and is phylogenetic remnant of vomernasal organ.
 The septum should be studied for deviations and spurs.



The air cells seen in the cuts when middle turbinate is yet to be seen, are the AGGER NASI cells.

Agger nasi's location below the frontal sinus also defines the anterior limit of the frontal recess.

Nasolacrimal duct can also be seen here.
The presence of frontal cells, type 1 to 4 should be looked for.



The middle turbinate is visualised, any anatomical variations like concha bullosa or a paradoxically curved middle turbinate should be looked for.

The attachment of MT at the junction of the medial and lateral lamellae of the cribriform plate is seen.

The level of the cribriform plate and the depth of the olfactory fossa should be assessed and classified according to KEROS classification.

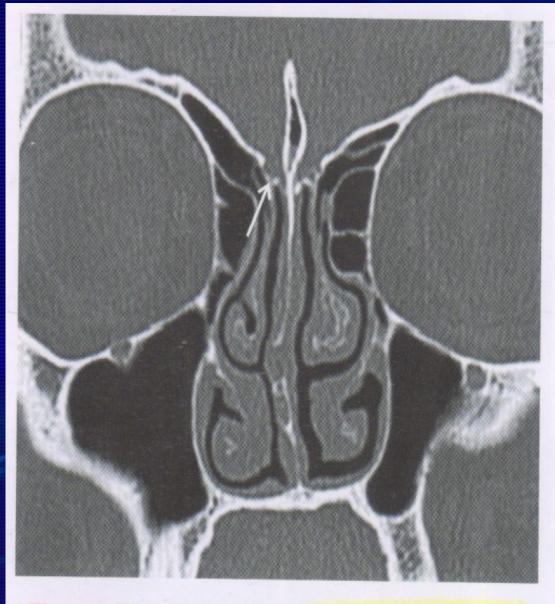


Fig. 5.5: The olfactory fossa. Anterior attachment of middle turbinate seen (arrow)

hiru456@gmail.com

 The ethmoidal bulla is seen lateral to the middle turbinate.

 A cell extending above the orbit, behind the frontal sinus is seen here. This cell is supraobital
 Centhiru456@gmail.com

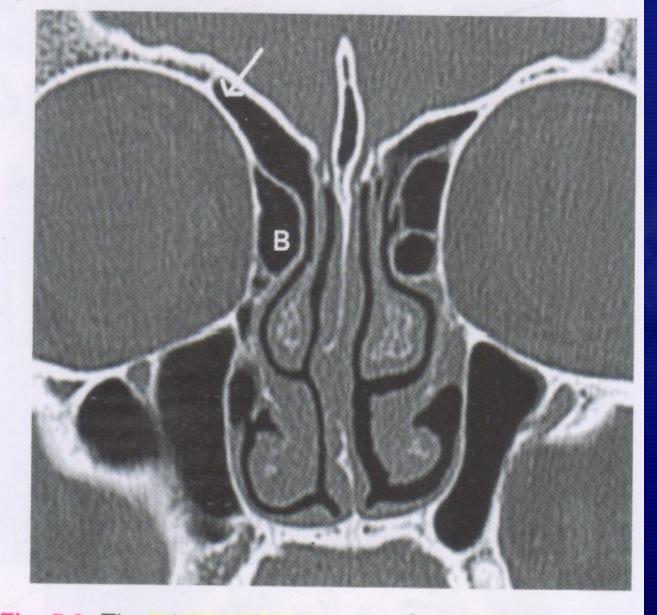


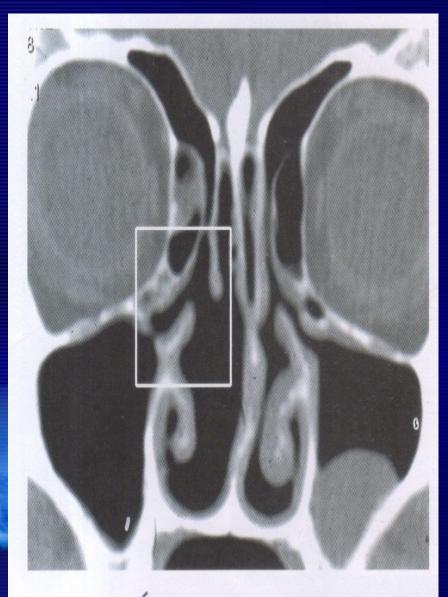
Fig. 5.6: The ethmoidal bulla and supraorbital cell (arrow)

 Uncinate process: This is a 3-dimensional sickle-shaped (also described as a hook- or Lshaped) bone of the lateral nasal wall. Anteriorly, the uncinate process attaches to the lacrimal bone; inferiorly, the uncinate process attaches to the ethmoidal process of the inferior turbinate. The posterior edge lies in the hiatus semilunaris inferioris. Superiorly, the uncinate process may attach to the middle turbinate, lamina papyracea, and/or the skull base.

The uncinate process is seen below the bulla.

The groove between the uncinate process and the bulla is HIATUS SEMILUNARIS.

Hiatus semilunaris and infundibulum are seen leading into the normal maxillary ostium.



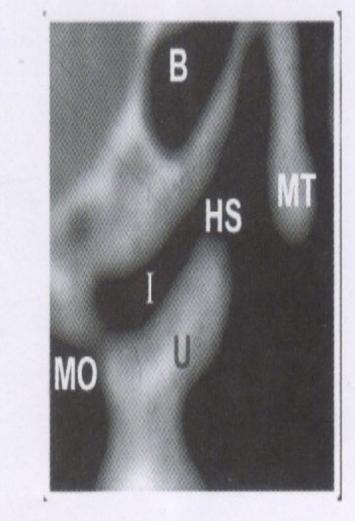
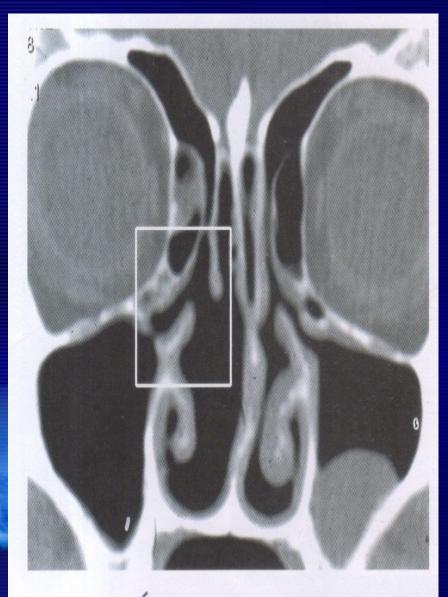


Fig. 5.7A: Osteomeatal unit

Fig. 5.7B: Osteomeatal unit (close up view)

Ostionicatal complex of unit. This term refers to a collection of middle meatal structures and is not a discrete anatomic entity. It consists of the ethmoid infundibulum, anterior ethmoid cells, and the uncinate process. It also represents the final common pathway of drainage for the frontal, maxillary, and anterior ethmoid cells. A patent ostiomeatal complex is essential for the improvement of patients with sinus disease.



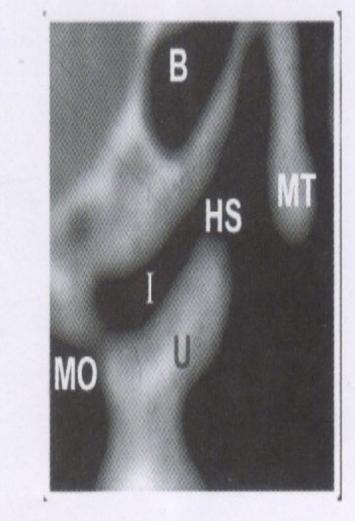


Fig. 5.7A: Osteomeatal unit

Fig. 5.7B: Osteomeatal unit (close up view)

Let the should be noted whether any of the septal spurs impinge upon, or compromise the OMC. Hypertrophy of the turbinates or a concha bullosa on the side opposite of the septal deviations should be looked for.

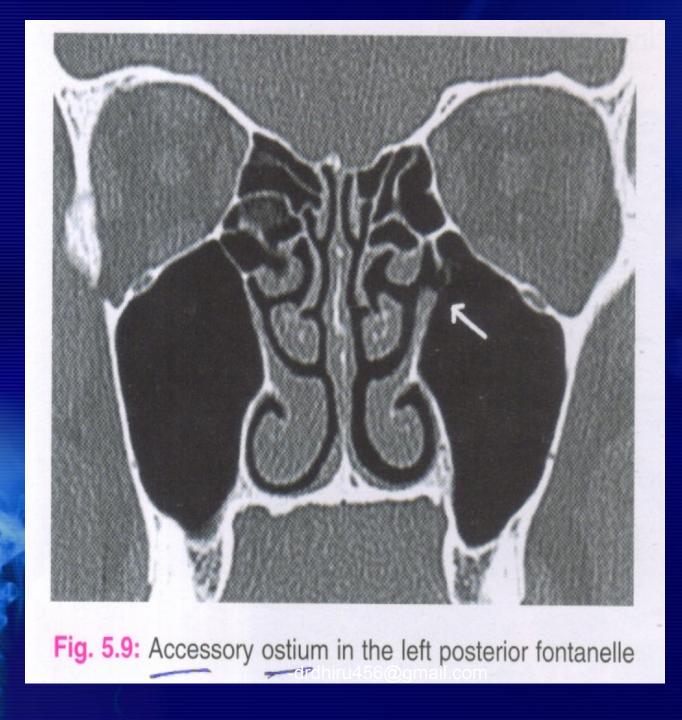
The mode of attachment of the uncinate process should be carefully studied so as to ascertain the pathway of drainage of frontal sinus.

□Variations in the anatomy of the uncinate process, and the presence of Haller cell should be forked for.



Fig. 5.8: Drainage of frontal recess—medial to infundibulum on the right and into the infundibulum on the left

Accessory ostia should be noted



Maxillary sinus is seen, it is triangular in shape in its anterior cuts.

The infraorbital nerve is seen in the roof of the maxillary sinus

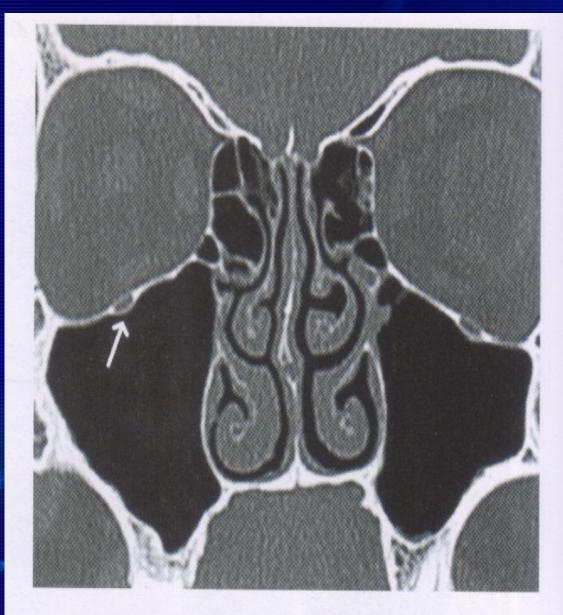


Fig. 5.10: Maxillary sinus appears triangular in anterior cuts (arrow: infraorbital nerve)

2-3 mm behind the bulla, the anterior ethmoidal artery is seen as a classical 'BEAKING' of the medial orbital wall.

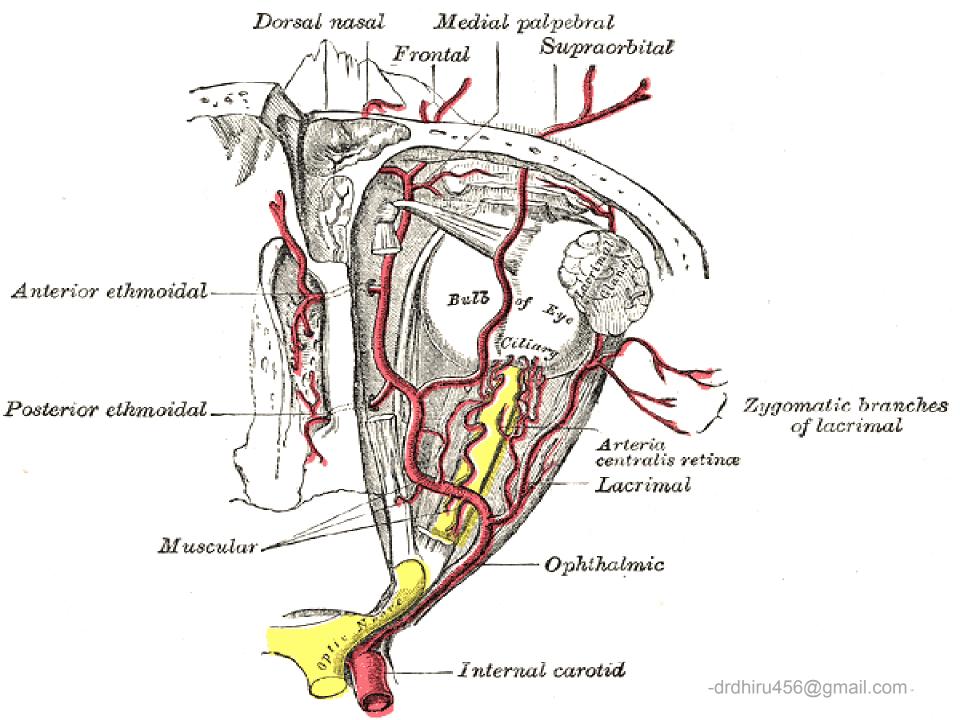
- Once branching from the ophthalmic artery, it accompanies the nasociliary nerve through the anterior ethmoidal canal to supply the anterior and middle ethmoidal cells, frontal sinus, and anterosuperior aspect of the lateral nasal wall.
- Ethmoidal artery is an important anatomical structure to be recognized during endoscopic sinus surgery.
- The anterior ethmoidal artery is the best landmark for the roof of the ethmoid sinus or the anterior base of the skull.
- The distance between AEA and ANS is approx 5.5 cm (+/_ 0.5)



Fig. 5.11: Anterior ethmoidal artery. Beaking of lamina papyracea seen on left. Orbitocranial canal seen on the right (arrow)

@gmail.com

- After reaching the medial wall of the orbit, the Ophthalmic Artery turns anteriorly. The posterior ethmoidal arteries enters the nose via the posterior ethmoidal canal and supplies the posterior ethmoidal sinuses and enters the skull to supply the meninges.
- The Ophthalmic Artery continues anteriorly, giving off the anterior ethmoidal artery which enters the nose after traversing the anterior ethmoidal canal and supplies the anterior and middle ethmoidal sinuses as well as the frontal sinus and also enters the cranium to supply the meninges



DISTANCES BETWEEN IMPORTANT ANATOMICAL LANDMARKS-

| Distances | СМ | SD |
|------------|------------------------------|-----|
| ANS - UP | 3.4 | 0.3 |
| ANS - NOMS | 3.9 | 0.5 |
| ANS - OND | 3 | 0.4 |
| ANS - SF | 5.6 | 0.2 |
| ANS - NOSS | 5.5 -drdhiru456@gmail.com | 0.4 |

| DISTANCE | СМ | SD |
|------------|-----|-----|
| ANS - AEA | 5.5 | 0.3 |
| ANS - PEA | 5.8 | 0.4 |
| ANS - POAT | 6.2 | 0.3 |
| ANS - PNS | 5.6 | 0.3 |

The middle turbinate is attached to lamina papyracea by its ground lamella. This lamella separates anterior ethmoid cells from posterior ethmoid cells.

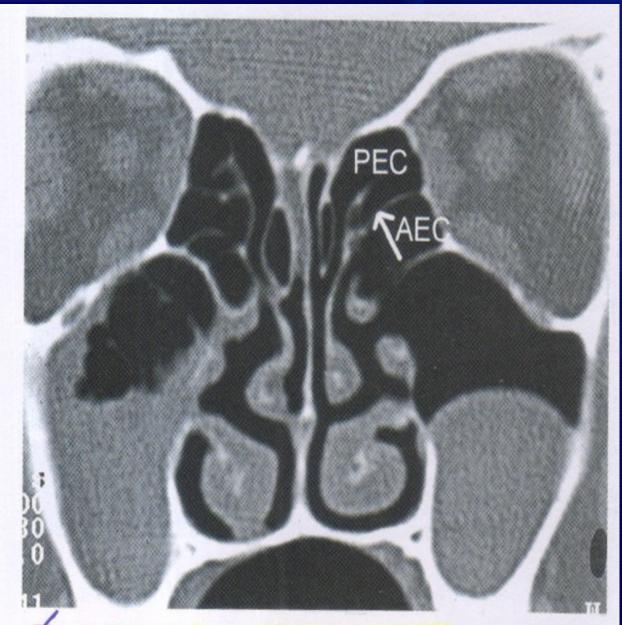


Fig. 5.12A: The ground lamella (arrow). Intermediate attachment of middle turbinate

u456@gmail.com

The posterior ethmoidal cells are larger and fewer than the anterior ethmoidal cells.

The posterior ethmoid artery may occasionally be identified in the region of the skull base.

The maxillary sinus changes shape from triangular to ovoid in its posterior cuts.

The orbit changes from a circular outline to a triangular shape.

 The posterior most attachment of middle turbinate to the palatine bone is seen.

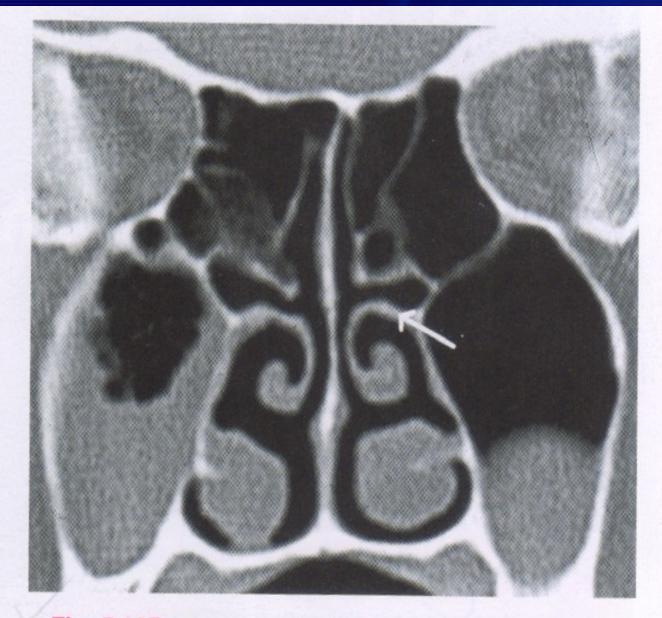
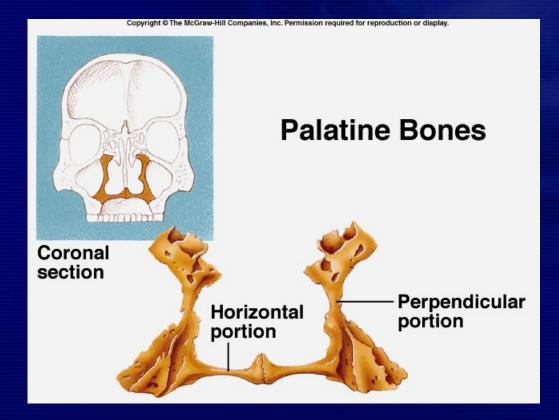


Fig. 5.12B: Posterior attachment of middle turbinate

PALATINE BONES



Posterior part of the orbit with the extraocular muscles and the optic nerve is seen.

The fissure between the orbit and the maxillary sinus i.e. the INFERIOR ORBITAL FISSURE is seen in this cut.

The INFERIOR ORBITAL FISSURE opens into the INFRATEMPORAL FOSSA.

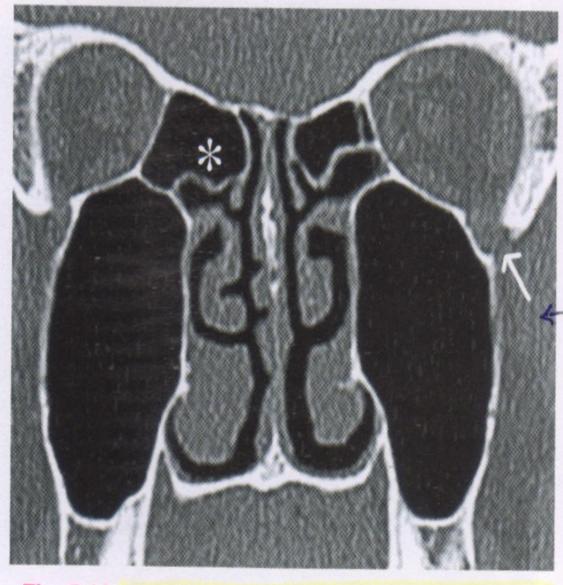


Fig. 5.13: Posterior ethmoidal cells (asterix). Inferior orbital fissure (arrow)

Medial rectus and lamina papyracea is separated by a pad of fat ANTERIORLY, but this pad of fat is absent in posterior cuts.

so, posteriorly, Medial Rectus is in direct relation with lamina papyracea and therefore more prone to injury.

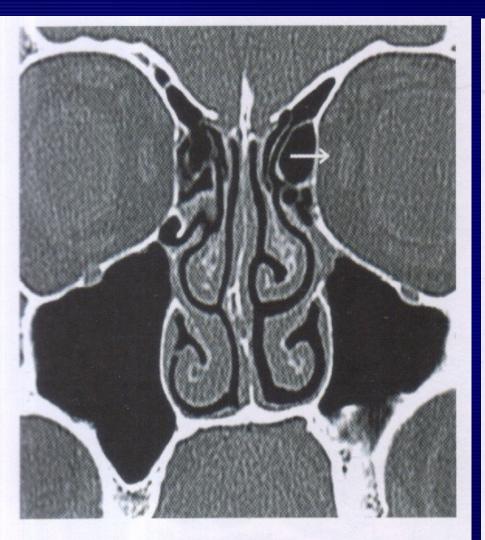


Fig. 5.14A: Fat intervening between lamina papyracea and medial rectus anteriorly

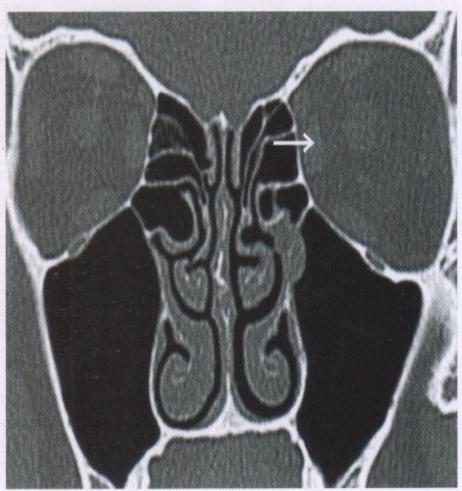


Fig. 5.14B: Medial rectus in direct contact with lamina papyracea posteriorly

Sphenoid sinus is seen.

The sphenoid dominance should be noted when the intersphenoid septum is asymmetrical.

Sphenoid sinus ostium may also be visualised, though it is better seen in saggital cuts.

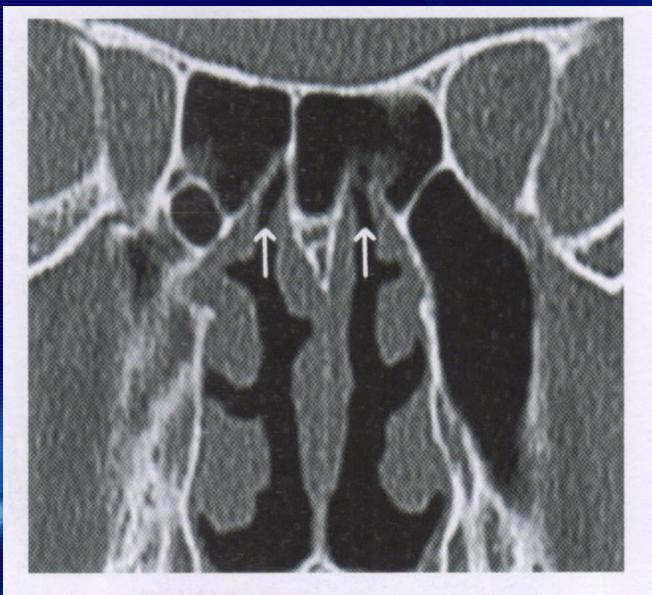
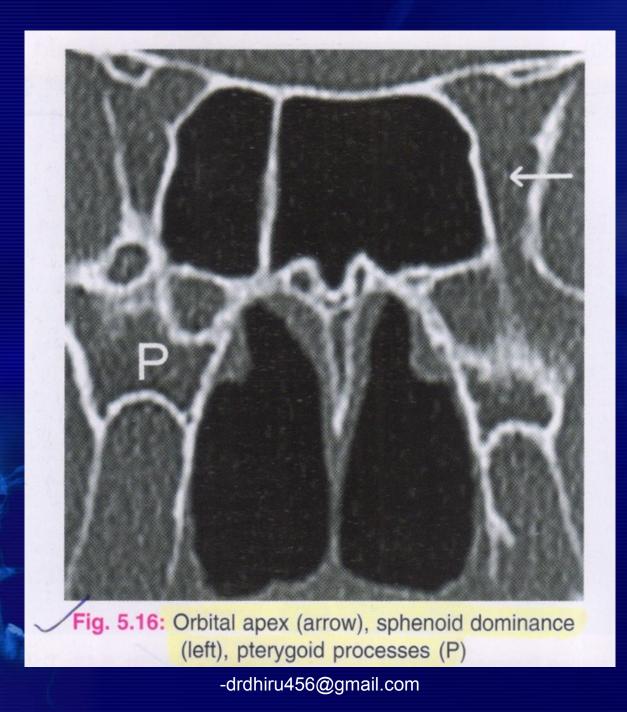


Fig. 5.15: Bilateral sphenoid ostia

The retort shaped ORBITAL APEX is seen on either side of the sphenoid sinus in the anterior cuts.



The pterygoid processes extend downwards and are perforated by two canals –

- 1. Foramen Rotundum (which is seen just below the orbital apex)
- 2.Vidian canal (inferomedial to FR)

The pterygoid processes form the posterior wall of Pterygopalatine Fossa.

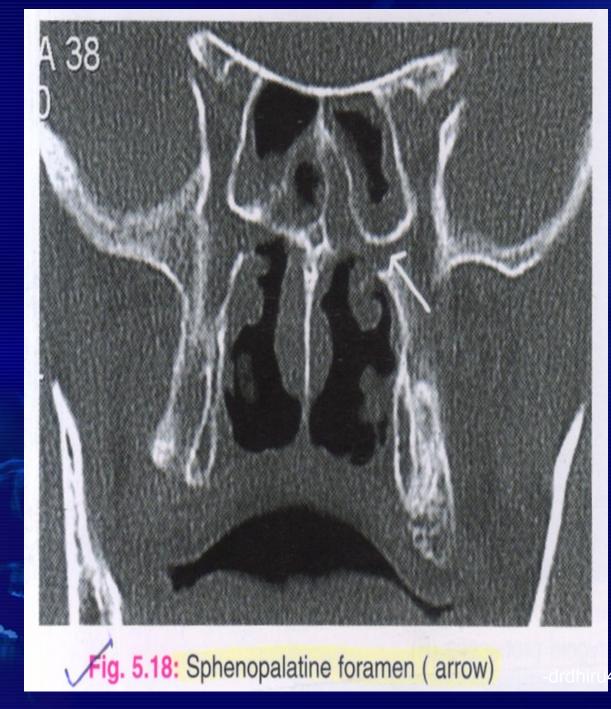


Fig. 5.17: Vidian canal (thin arrow), foramen rotundum (thick arrow), and optic nerve (curved arrow)

The maxillary nerve passes through and exits the skull via the pterygopalatine fossa and the foramen rotundum.

Vidian canal transmits the nerve of pterygoid canal (vidian nerve), artery of the pterygoid canal and vein of the pterygoid canal) A canal may be seen below the sphnoid sinus between the Pterygopalatine fossa and the posterior choana, this is SPHENOPALATINE FORAMEN.

It transmits the sphenopalatine artery and vein and the superior nasal and <u>nasopalatine nerves</u>.



456@gmail.com

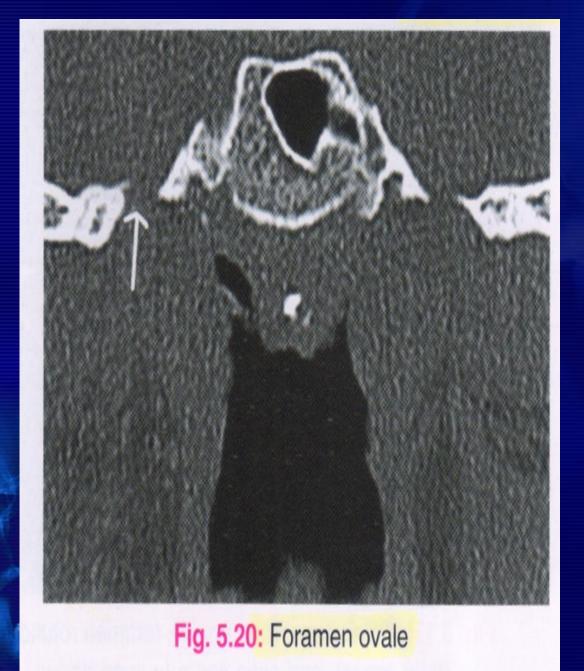
Coronal sections of the nasopharynx show theeustachian tube opening, torus tubaris. Fossa of rosenmuller and the adenoids, if present.

Asymmetry of the Fossa of rosenmuller should be looked for.



iru456@gmail.com

The foramen ovale is seen laterally in the greater wing of sphenoid.



Contents of Foramen Ovale –
1. Mandibular nerve
2. Accessory meningeal artery
3. Lesser petrosal nerve.
4.Emissary veins.

Widening of Foramen Ovale may be seen in nasopharyngeal angiofibroma.

Destruction of Foramen Ovale may be seen in carcinoma nasopharynx.

AXIAL SCANS

 Axial scans are best read from inferior to superior.
 N.L.D., anteroposterior deviations of septum and nasopharynx can be studied well in Axial cuts.

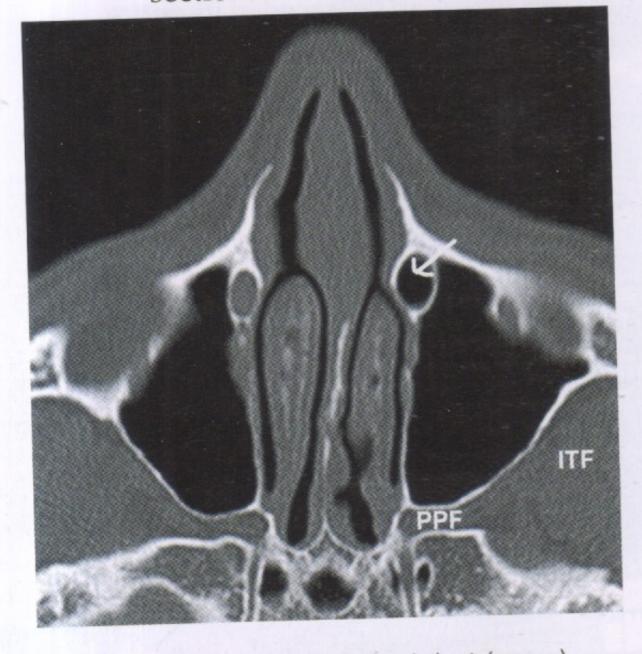


Fig. 5.21: Nasolacrimal duct (arrow)



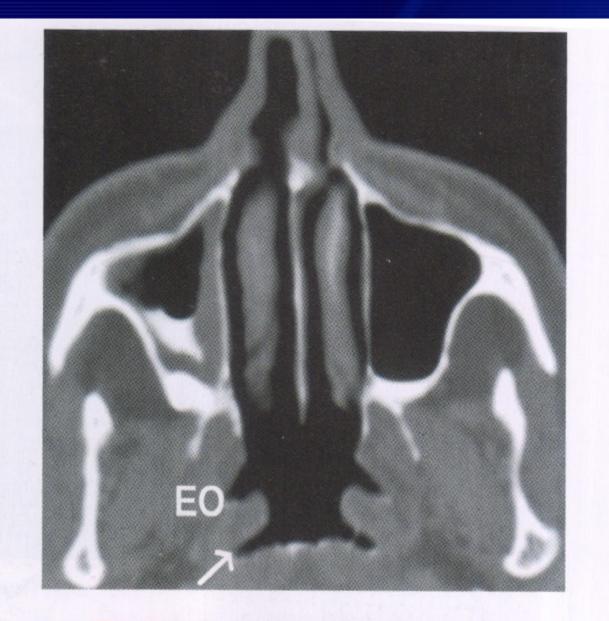


Fig. 5.22: Fossa of Rosenmueller (arrow), EO—eustachian tube opening

56@gmail.com

 The middle turbinate is attached to lamina papyracea by its ground lamella. This lamella separates anterior ethmoid cells from posterior ethmoid cells.

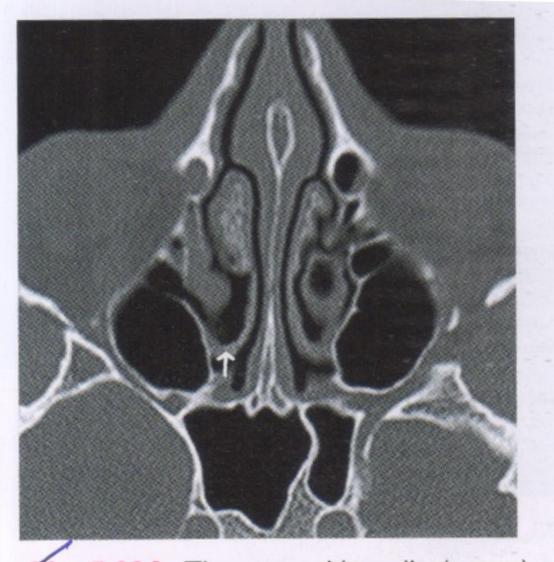


Fig. 5.23A: The ground lamella (arrow)

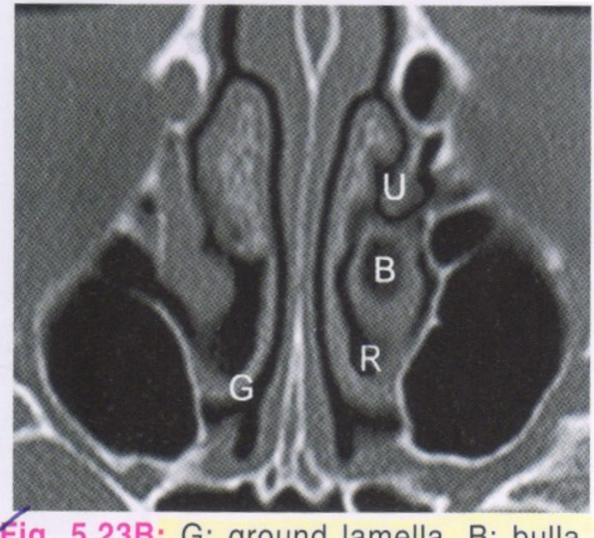
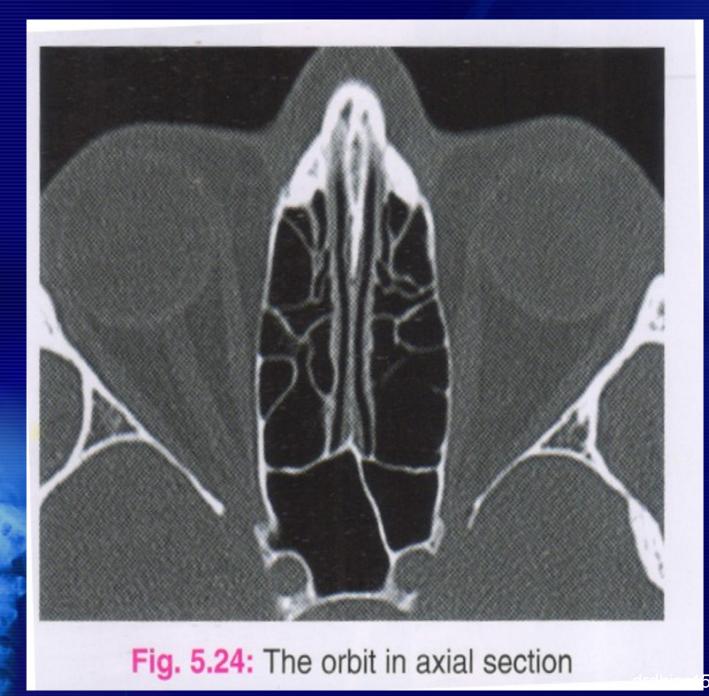


Fig. 5.23B: G: ground lamella, B: bulla, R: retrobullar recess, U: uncinate process (close up view)

-aranıru456@gmail.com



56@gmail.com

- The Lamina papyracea runs a fairly straight course in anteroposterior direction.
- However, in lower cuts of orbit, the upper part of the maxillary sinus is also seen, and hence the lamina papyracea.appears to take an abrupt turn laterally into the orbit.
- Any natural dehiscence in the lamina should be looked for

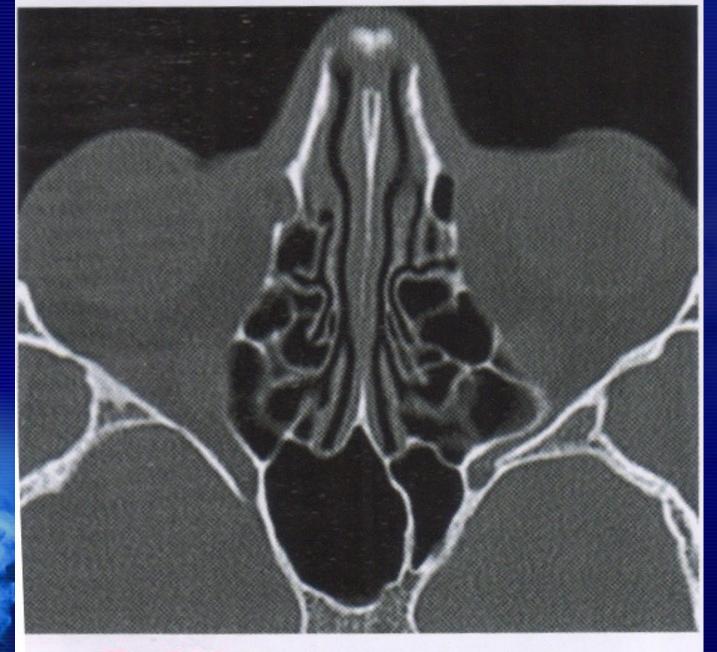


Fig. 5.25: Lamina papyracea in lower section of the orbit

6@gmail.com

- The cribriform plate, crista galli and foramen caecum can be studied in 1mm sections.
- The anterior and posterior walls of frontal sinus are better appreciated in axial than in coronal sections.

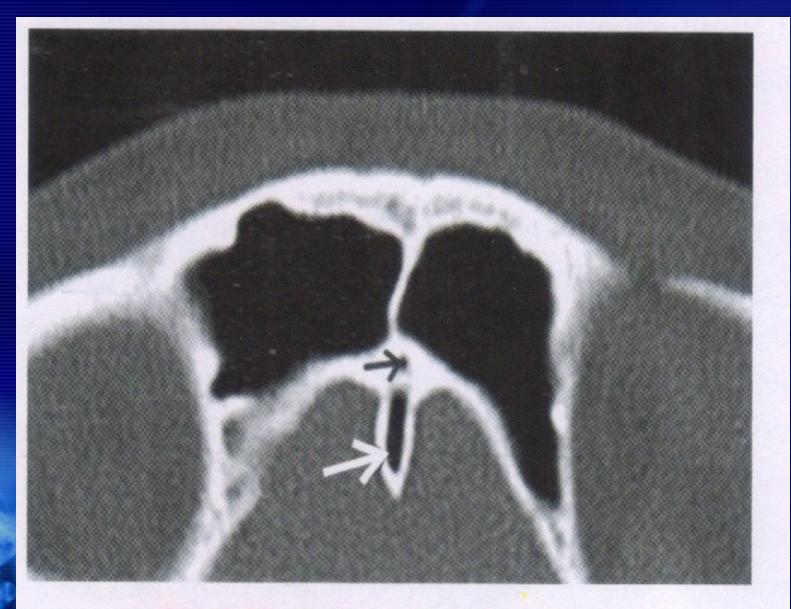


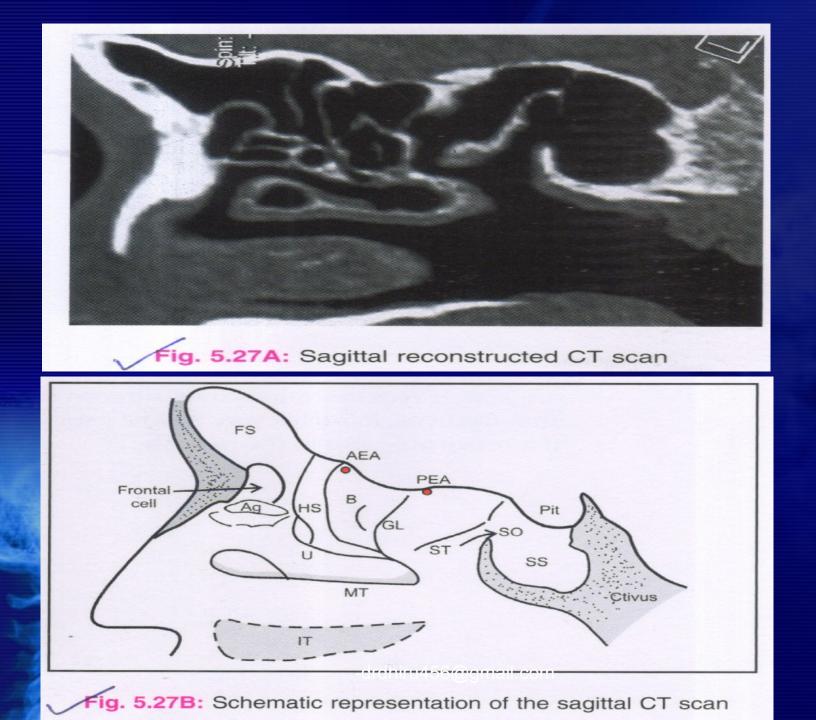
Fig. 5.26: Crista galli (thick arrow), foramen cecum (thin arrow)

 Foramen cecum transmits the emissary vein from the nose to the superior sagittal sinus. This has clinical importance in that infections of the nose and nearby areas can be transmitted to the meninges and brain from what is known as the danger triangle of the face.

SAGGITAL SECTIONS

SAGGITAL SCANS-

Best for studying details of the lateral nasal wall anatomy.



ANATOMICAL VARITATIONS

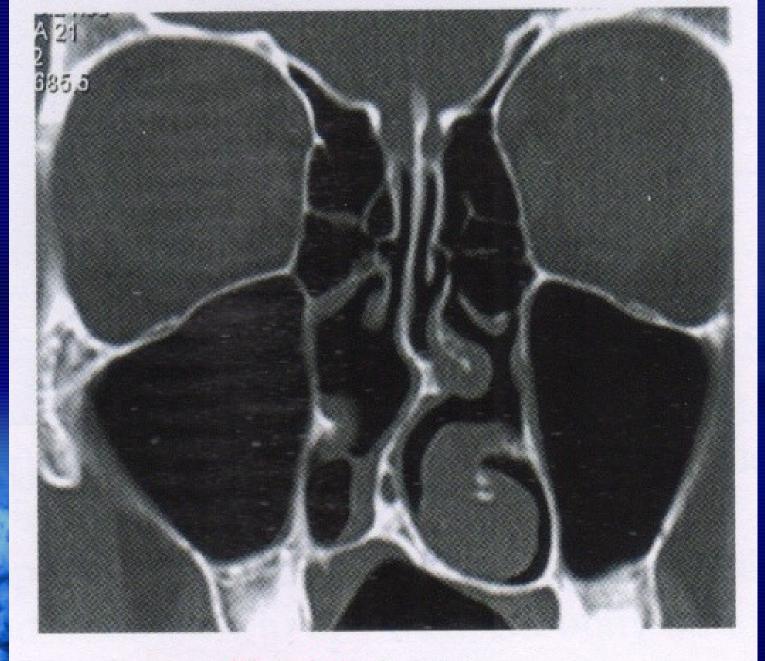


Fig. 6.1: Septal spur

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HYPERTROPHIED INFERIOR TURBINATE.

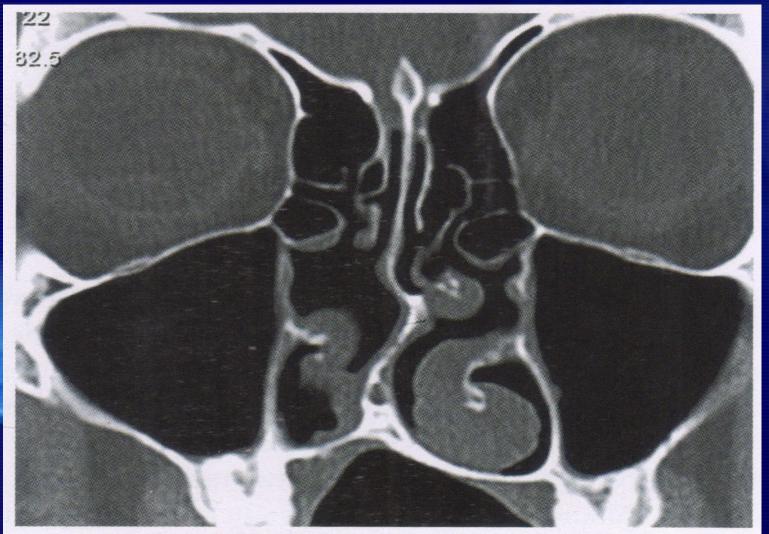


Fig. 6.2: Hypertrophied inferior turbinate

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PNEUMATISATION OF SEPTUM

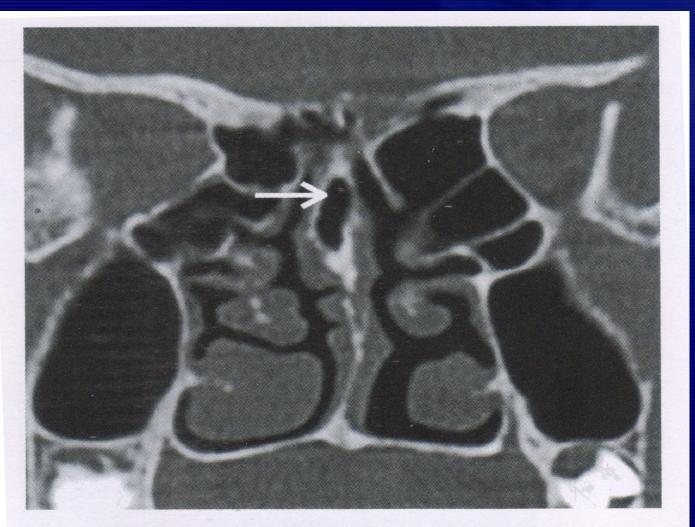


Fig. 6.3: Pneumatization of the septum

56@gmail.com

Agger nasi: This is a bony prominence that is often pneumatized in the ascending process of the maxilla. Its location below the frontal sinus also defines the anterior limit of the frontal recess

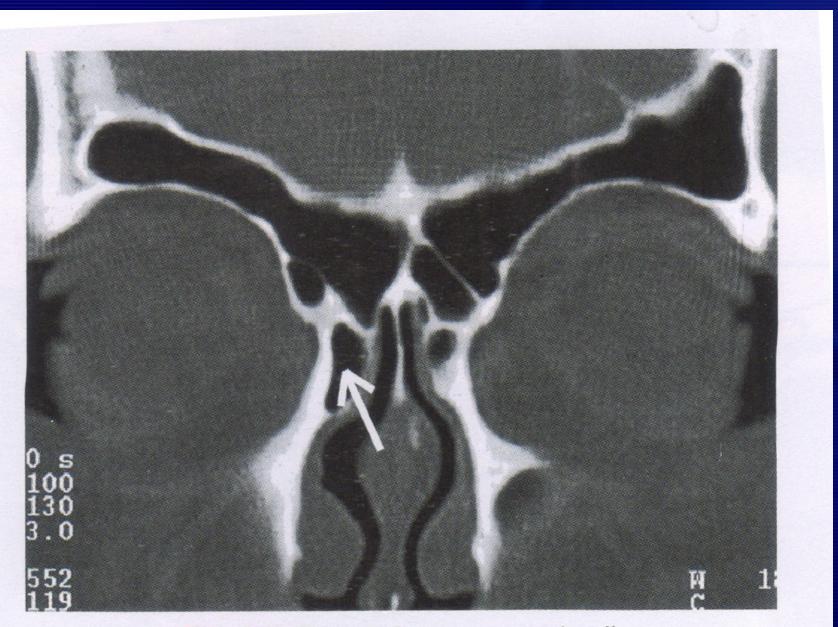
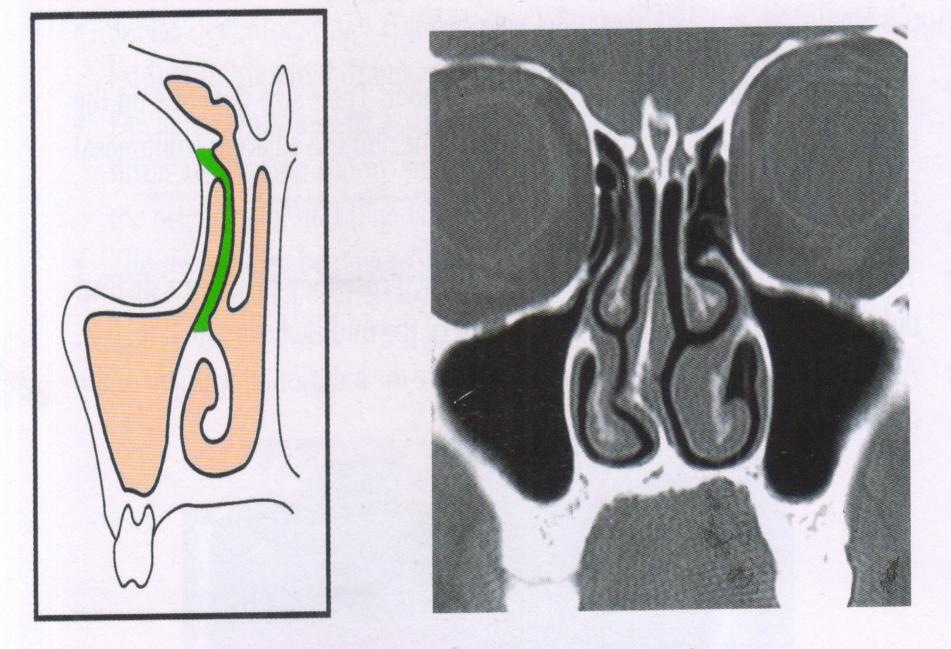


Fig. 6.4: Prominent agger nasi cell

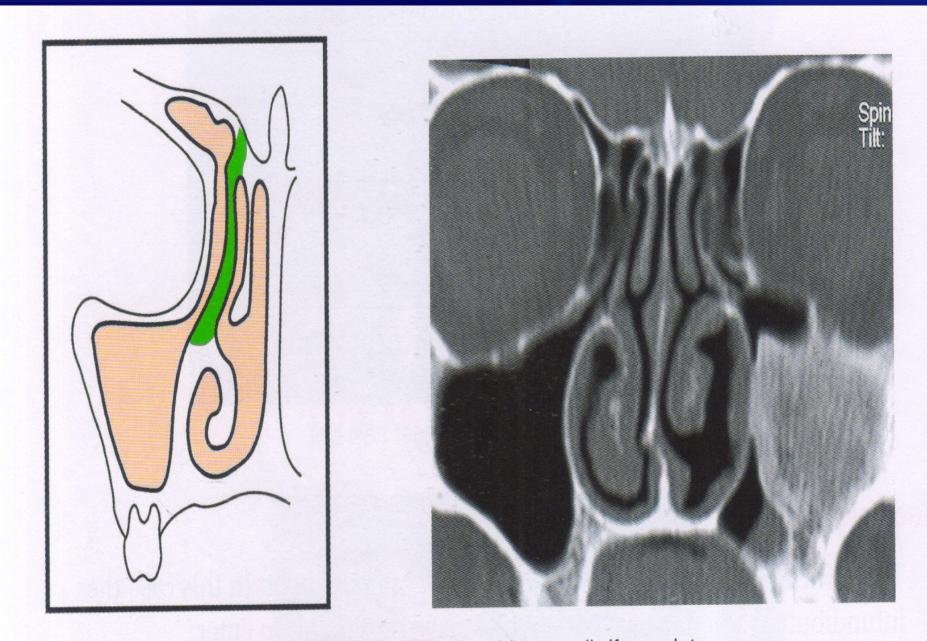
Uncinate process: This is a 3-dimensional sickleshaped (also described as a hook- or L-shaped) bone of the

- lateral nasal wall. Anteriorly, the uncinate process attaches to the lacrimal bone; inferiorly, the uncinate process
- attaches to the ethmoidal process of the inferior turbinate. The posterior edge lies in the hiatus semilunaris
- inferioris. Superiorly, the uncinate process may attach to the middle turbinate, lamina papyracea, and/or the skull

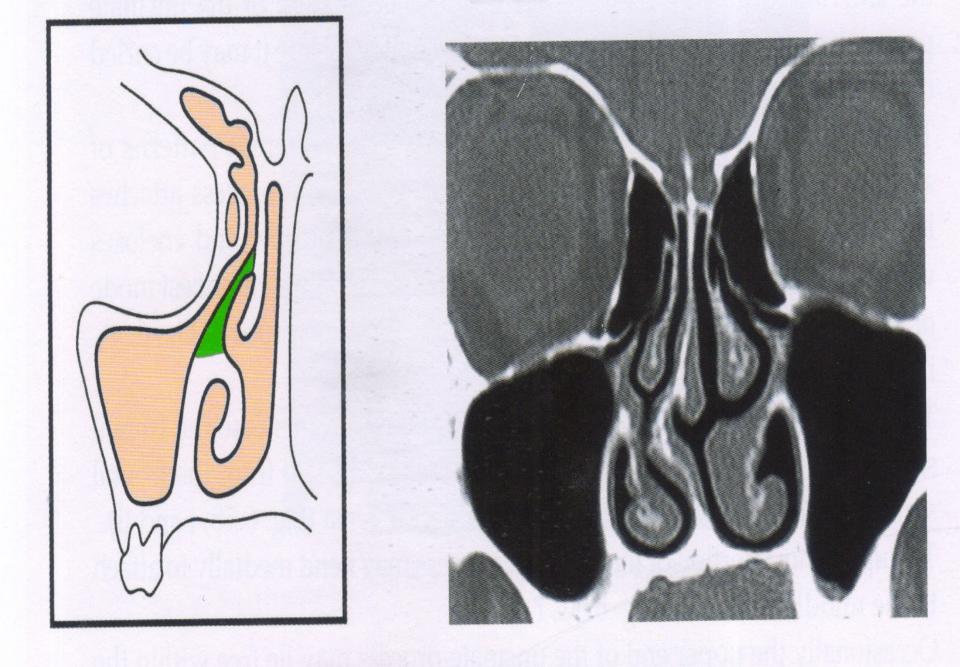
base.



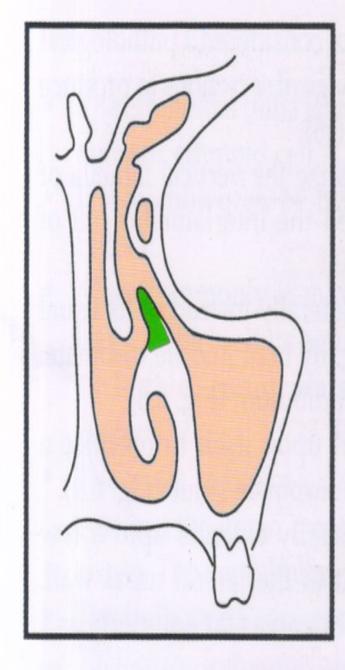
Figs. 6.5A (i) and (ii): Attaching laterally to lamina -drdhiru456@gmail.com

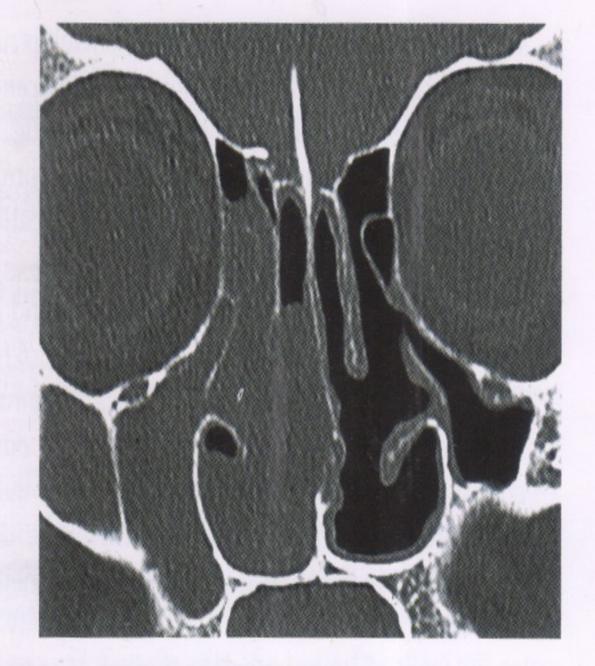


Figs. 6.5B (i) and (ii): Attaching to cribriform plate -drdhiru456@gmail.com

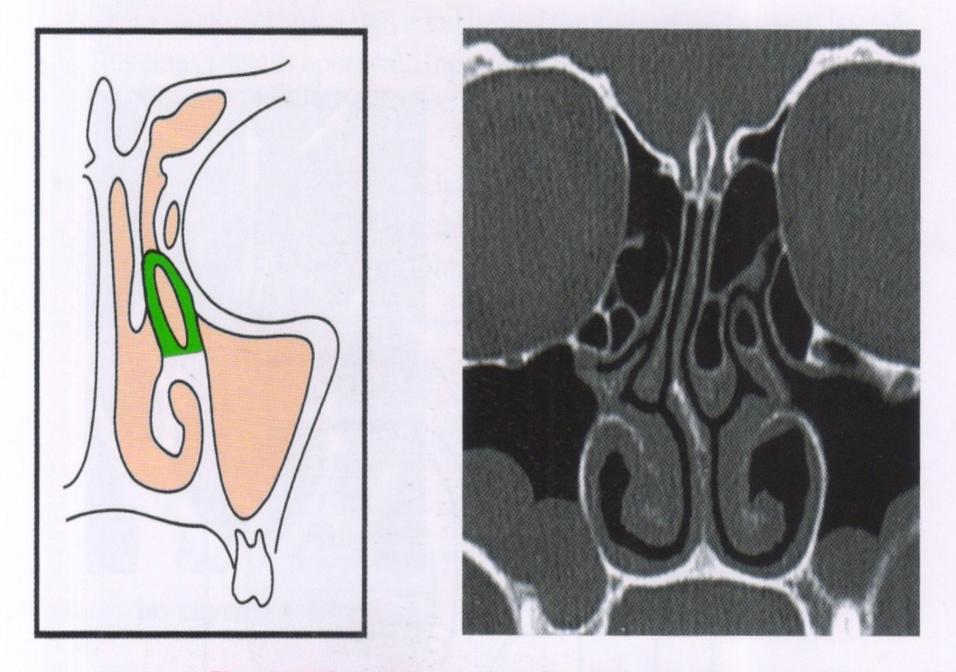


Figs. 6.5C (i) and (ii): Attaching medially to middle turbinate





Figs. 6.5D (i) and (ii): Lying free in middle meatus



Figs. 6.5E (i) and (ii): Pneumatized uncinate process

hiru456@gmail.com

Concha bullosa: The concha bullosa is a pneumatized middle turbinate. An enlarged middle turbinate may obstruct the middle meatus and the infundibulum causing recurrent disease. It may also serve as a focal area of sinus disease.

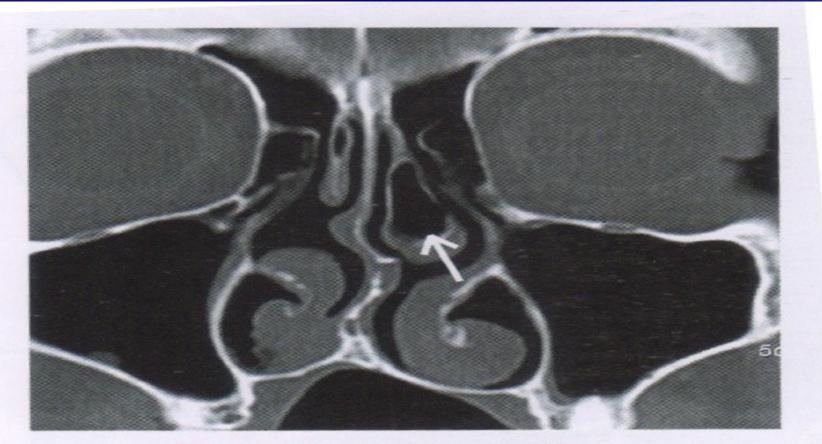


Fig. 6.6: Concha bullosa

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Paradoxical middle turbinate: The major curvature of the middle turbinate may project laterally, leading to narrowing of the middle meatus

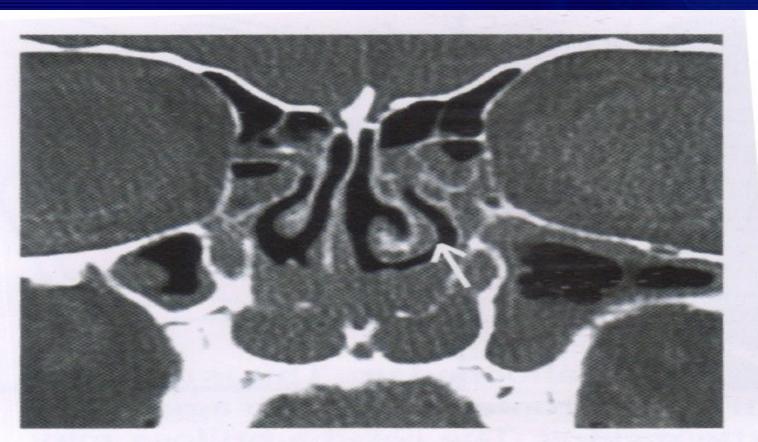


Fig. 6.8: Paradoxically curved middle turbinate

6@gmail.com



Fig. 6.9: The turbinate sinus

Haller cell (infraorbital cell): The Haller cell is usually situated below the orbit in the roof of the maxillary sinus. It is a pneumatized ethmoid cell that projects along the medial roof of the maxillary sinus. Enlarged Haller cells may contribute to narrowing of the ethmoidal infundibulum and recurrent sinus disease, despite previous (incomplete) surgery.

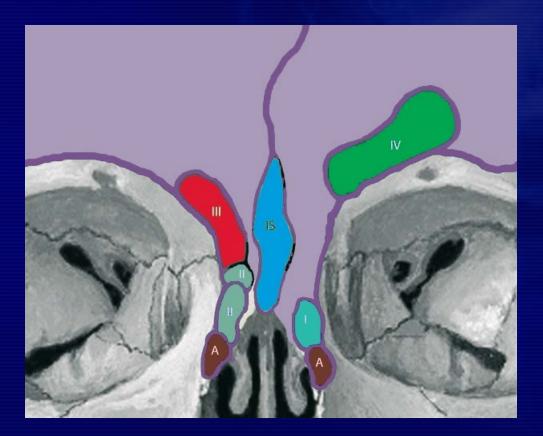


Fig. 6.12: Haller's cell

The anterior ethmoid cells may migrate into frontal recess area where they are then named Frontal cells.

- I Type I frontal cell (a single air cell above agger nasi)
- II Type II frontal cell (a series of air cells above agger nasi but below the orbital roof)
- III Type III frontal cell (this cell extends into the frontal sinus but is contiguous with agger nasi cell)al bulla (fron)
- IV Type IV frontal cell lies completely within the frontal sinus (Loner cell)

TYPES OF FRONTAL CELLS-



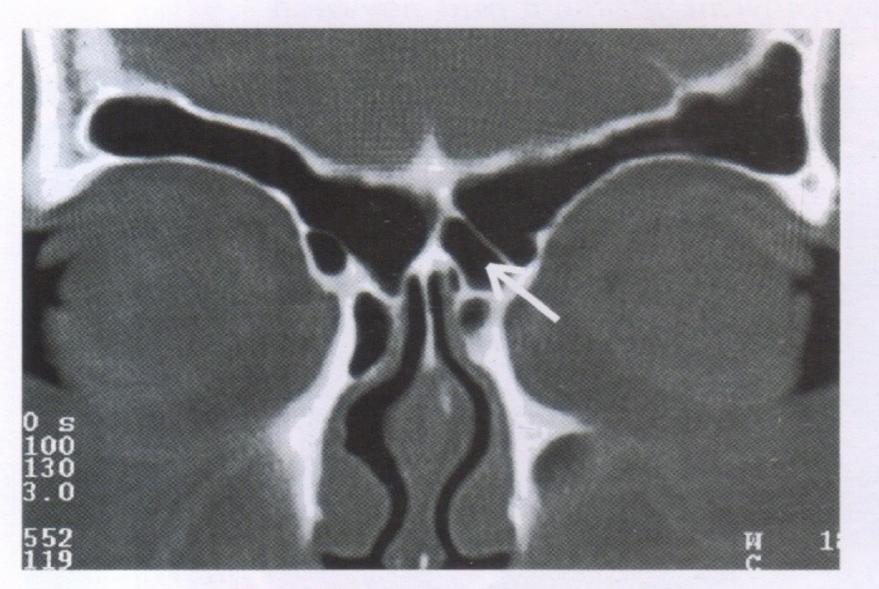


Fig. 6.13A: Frontal cell-type I

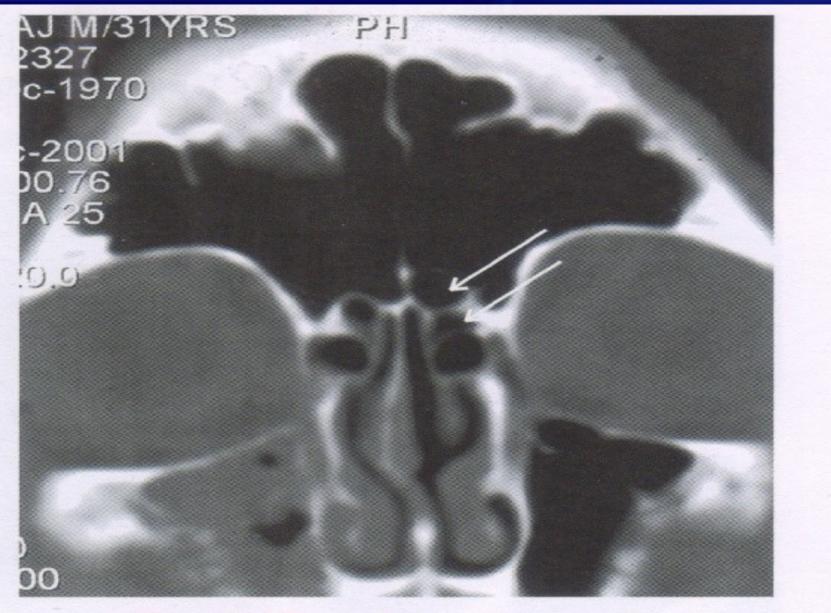


Fig. 6.13B: Frontal cell-type II

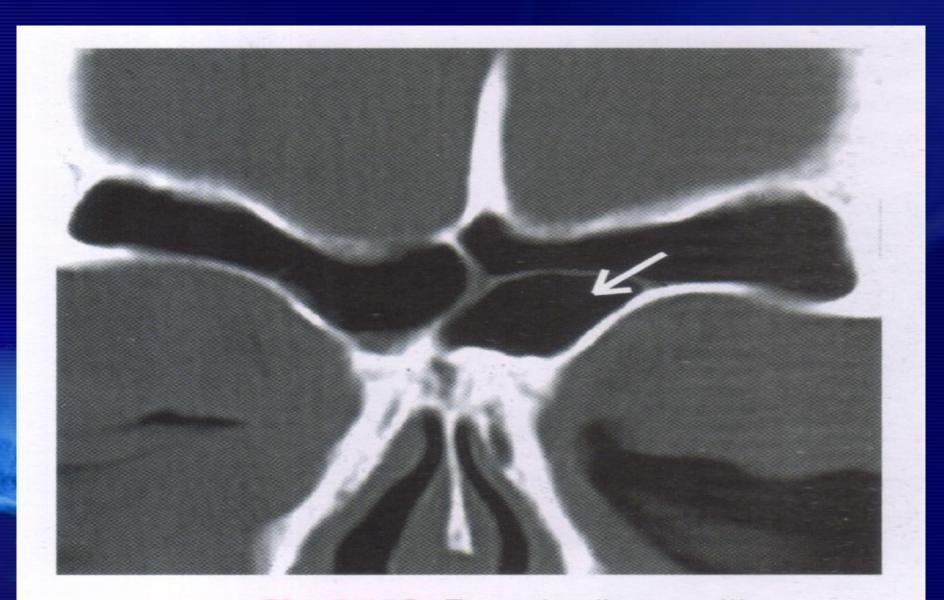


Fig. 6.13C: Frontal cell-type III

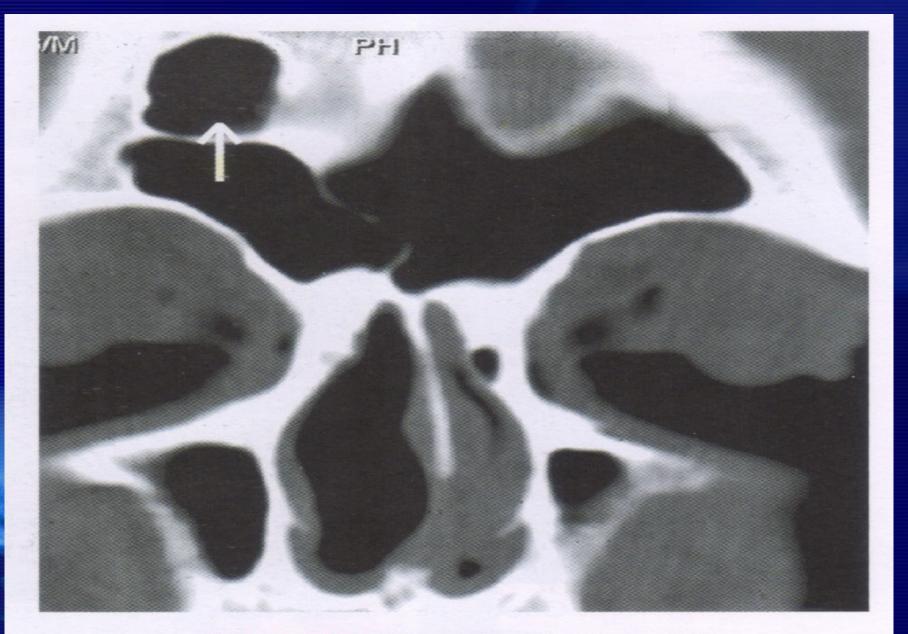


Fig. 6.13D: Frontal cell-type IV

Sphenoethmoid cell (Onodi cell): This is formed by lateral and posterior pneumatization of the most posterior ethmoid cells over the sphenoid sinus. The presence of Onodi cells increases the chance that the optic nerve and/or carotid artery would be exposed (or nearly exposed) in the pneumatized cell

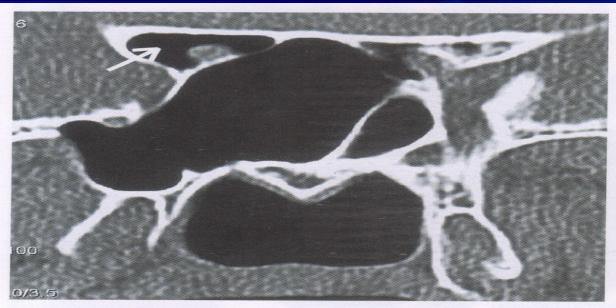


Fig. 6.16: Onodi cell with dehiscent optic nerve

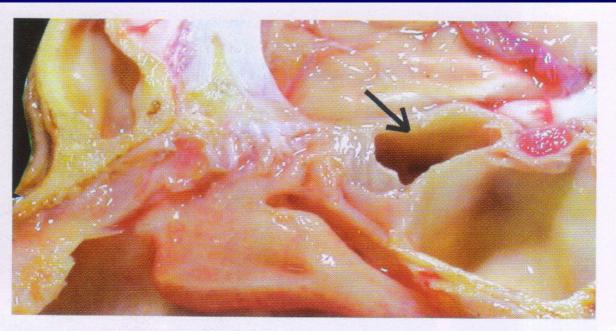


Fig. 6.17: Onodi cell seen in sagittal section

KEROS CLASSIFICATION-

The Keros classification is a method of classifying the depth of the olfactory fossa.

In adults, the olfactory recess is a variable depression in the cribriform plate that medially is bounded by the perpendicular plate and laterally by the lateral lamella. It contains olfactory nerves and a small artery

The depth of the olfactory fossa is determined by the height of the lateral lamella of the cribriform plate. Keros in 1962¹, classified the depth into three categories.

type 1 : has a depth of 1 - 3 mm (26.3% of population)

- type 2 : has a depth of 4 7mm (73.3% of population)
- type 3 : has a depth of 8 16mm (0.5% of population)

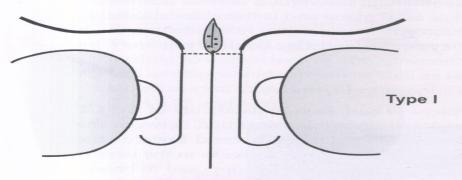


Fig. 6.23A (i)



Fig. 6.23A (ii)

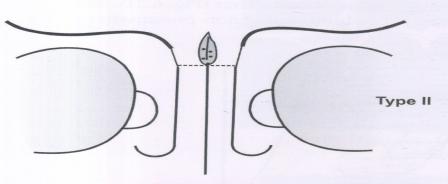


Fig. 6.23B (i)

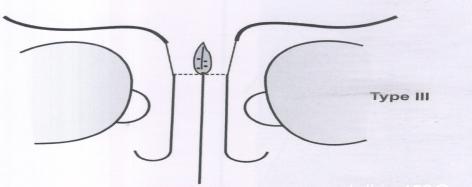


Fig. 6.23C (i)

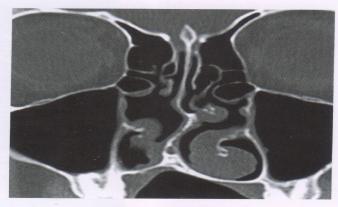
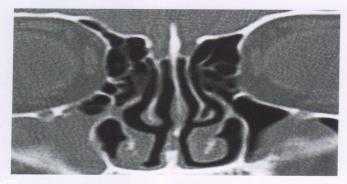


Fig. 6.23B (ii)





Figs 6.23A (i) to 6.23C (ii): Keros classification

- The type 3 essentially exposes more of the very thin cribriform plate to potential damage from trauma, tumour erosion, CSF erosion (in benign intracranial hypertension) and local nasal surgery or orbital decompression
- The deeper the olfactory fossa, the longer is the vertical lamella of the cribriform plate. This increased length of very thin bone is liable to injury.
- However, in a shallow olfactory fossa although the vertical lamella is not very long, it is placed in a more horizontal plane, and is therefore also liable to injuryby the advancing tip of the forceps.

THANK YOU

REFERENCES

- 1. ANATOMIC PRINCIPLES OF ESS BY RENUKA BRADOO
- 2. Haaga CT and MR Imaging of the Whole Body
- 3. CUMMING'S TEXTBOOK OF OORHINOLARYNGOLOGY
- 4. CT Scan of the Paranasal Sinusesmedscape.