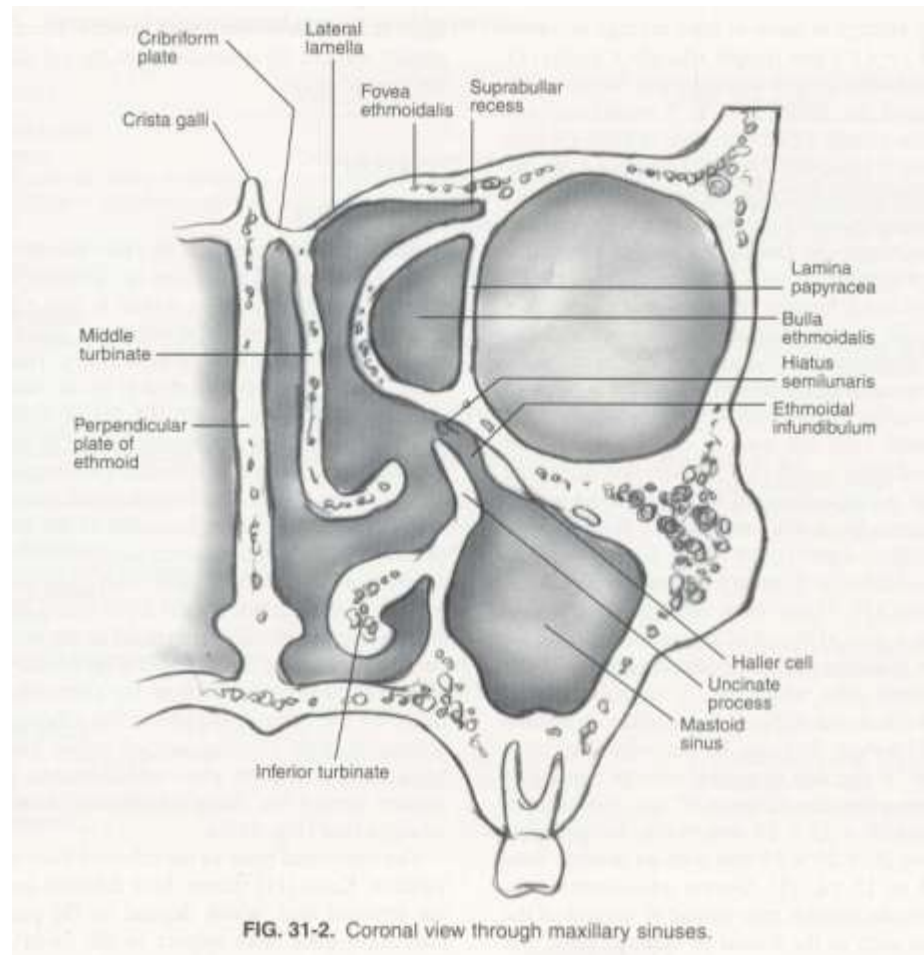


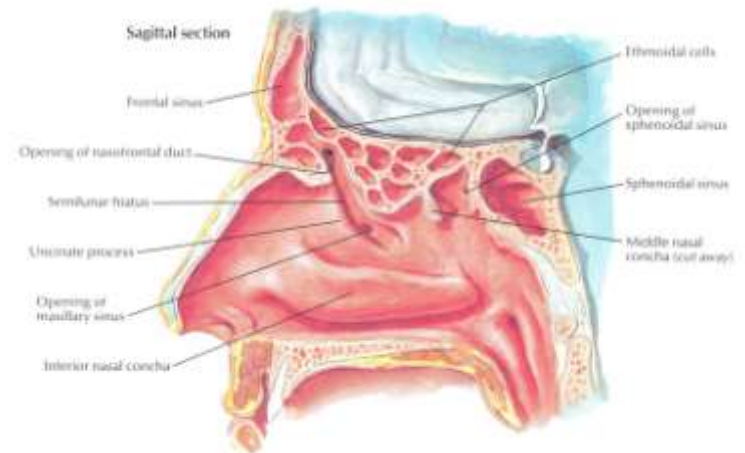
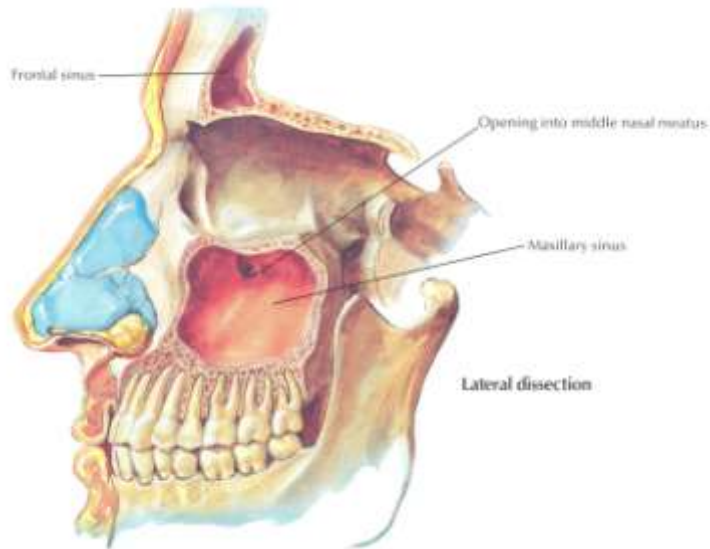
Perioperative Management of Endoscopic Sinus Surgery

Chad McCormick, MD, FAAOA

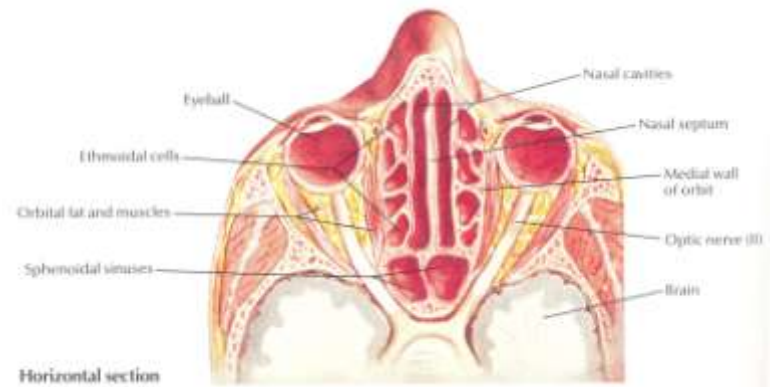
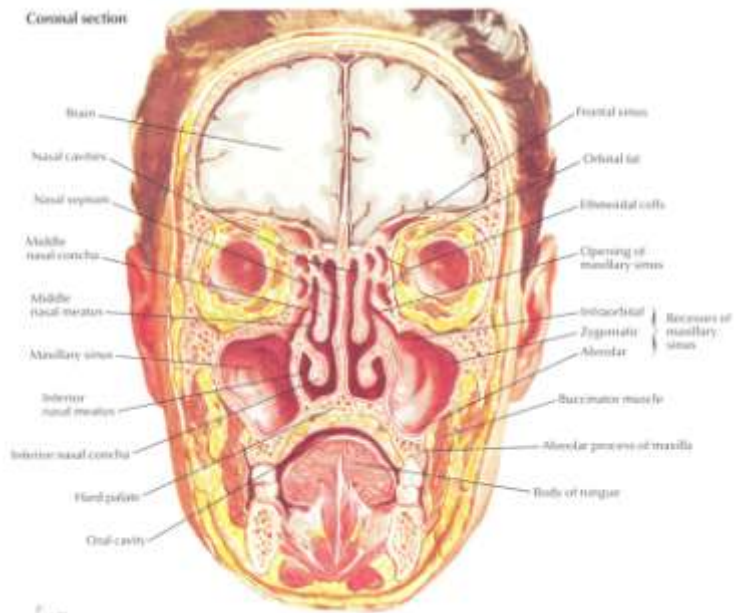
Sinus Anatomy Review



Paranasal Sinuses



Paranasal Sinuses



Sinus CT scan (coronal cut)



Sinus CT scan (axial cut)



Objectives

- Define chronic rhinosinusitis (CRS)
- Review anatomy of paranasal sinuses
- Describe medical management of CRS
- Describe surgical management of CRS
 - Preoperative, intraoperative, and postoperative care
- Discuss expected results and possible complications of sinus surgery

Definitions

- Sinusitis affects 1 in 7 adults in the United States each year
 - 31 million individuals diagnosed each year
- Direct annual healthcare cost of \$5.8 B
 - 500,000 surgical procedures performed each year
 - Executive summary (AAO/HNS). Clinical practice guideline on adult sinusitis. Rosenfeld RM. Otolaryngology-Head and Neck Surgery (2007) 137, 365-377

Definition of rhinosinusitis

- Rhinosinusitis
 - The term rhinosinusitis is preferred because sinusitis is almost always accompanied by inflammation of the contiguous nasal mucosa
 - Symptomatic inflammation of the paranasal sinuses and nasal cavity
 - Duration of symptoms
 - Acute, recurrent acute, subacute, chronic

Definition of rhinosinusitis

- Acute
 - Affected < 4 weeks
- Recurrent acute
 - 4 or more acute episodes per year without persistent symptoms between episodes
- Subacute
 - Affected 4-12 weeks
- Chronic
 - Affected > 12 weeks, with or without acute exacerbations

Chronic rhinosinusitis (CRS)

- 12 weeks or longer of **2 or more** of the following signs and symptoms:
 - Mucopurulent drainage (anterior, posterior, or both)
 - Nasal obstruction (congestion)
 - Facial pain-pressure-fullness, or
 - Decreased sense of smell
- AND inflammation is documented by **1 or more** of the following findings:
 - Purulent mucus or edema in the middle meatus or ethmoid region
 - Polyps in nasal cavity or middle meatus, and/or
 - Radiographic imaging showing inflammation of the paranasal sinuses

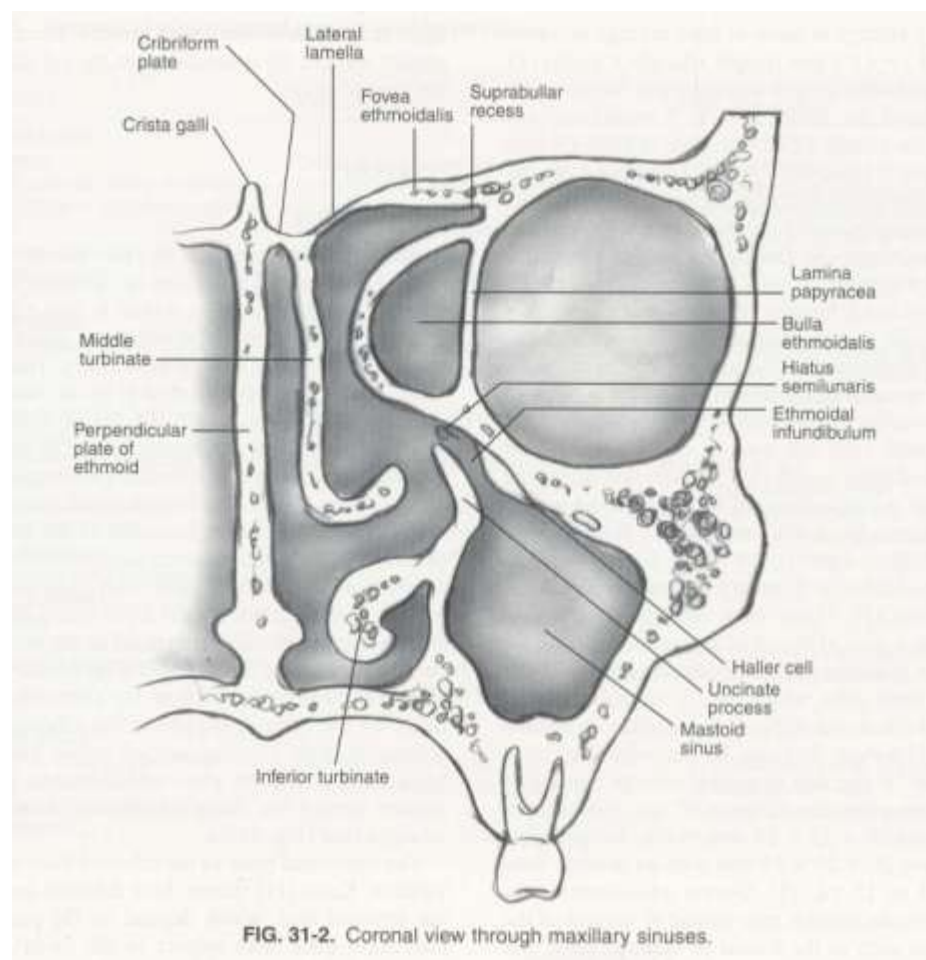
Acute Bacterial Sinusitis



Chronic rhinosinusitis



Anatomy



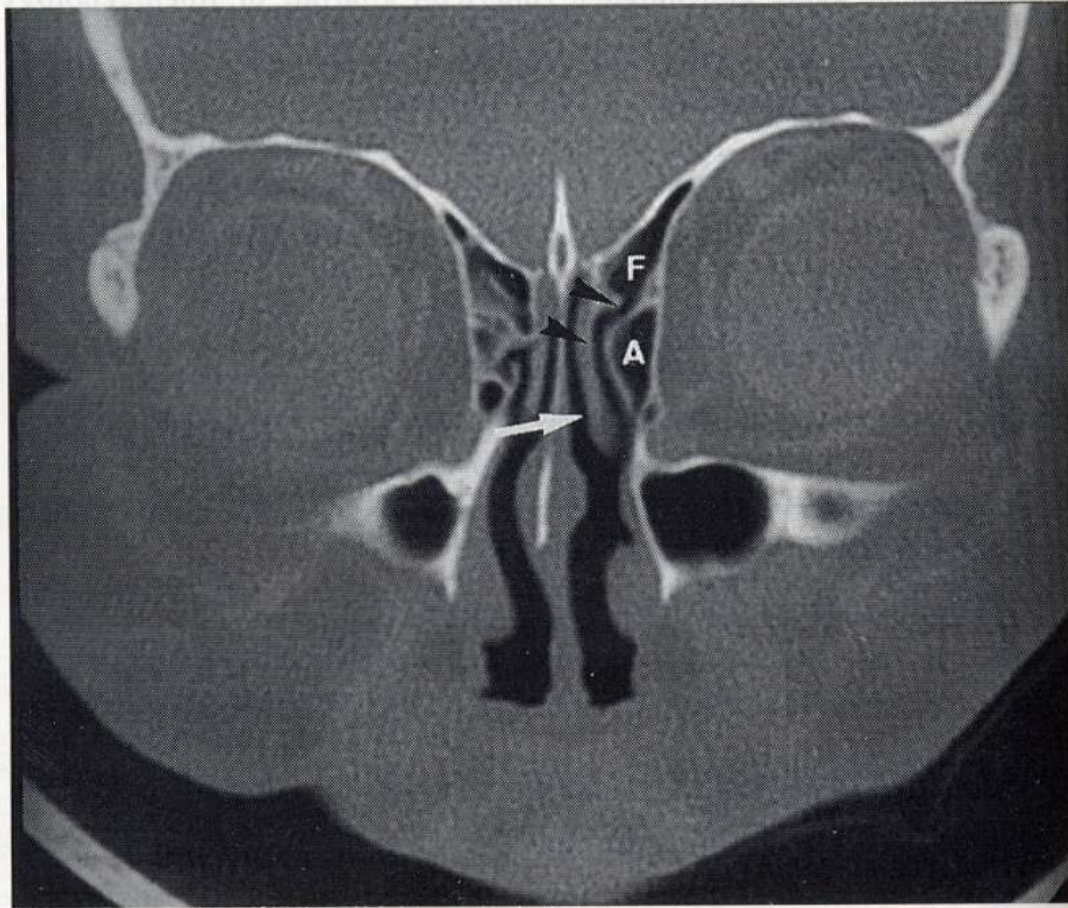


Fig. 1 – Coronal CT shows the agger nasi cell (A) inferior to the frontal recess (F). Note the frontal recess draining into the middle meatus (arrow-heads). The middle turbinate (arrow) forms the medial relationship of the frontal recess.

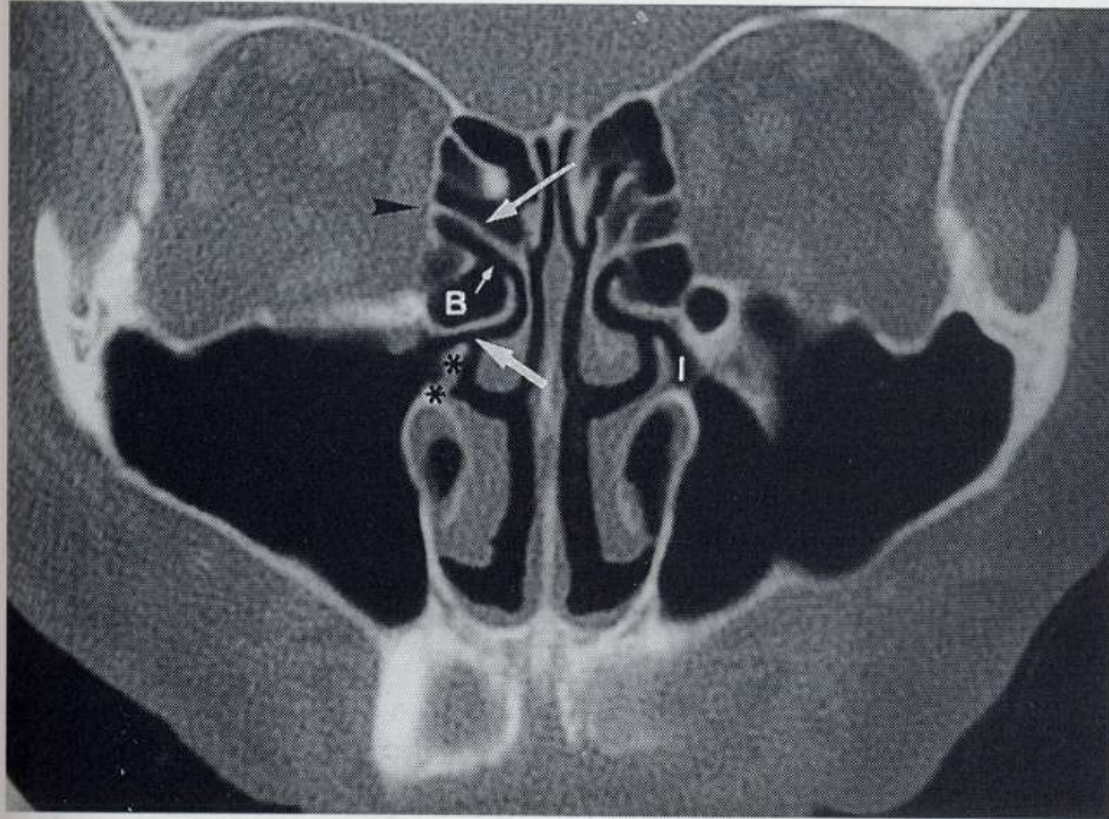


Fig. 2 – Coronal CT shows the right hiatus semilunaris (short arrow), free edge of the uncinata process (asterisks) and the bulla ethmoidalis (B) opening into the sinus lateralis (small arrow). Note the basal lamina (long arrow) attaching the middle turbinate to the lamina papyracea (arrowhead). Note also the left maxillary sinus ostium in the floor of the infundibulum (I).

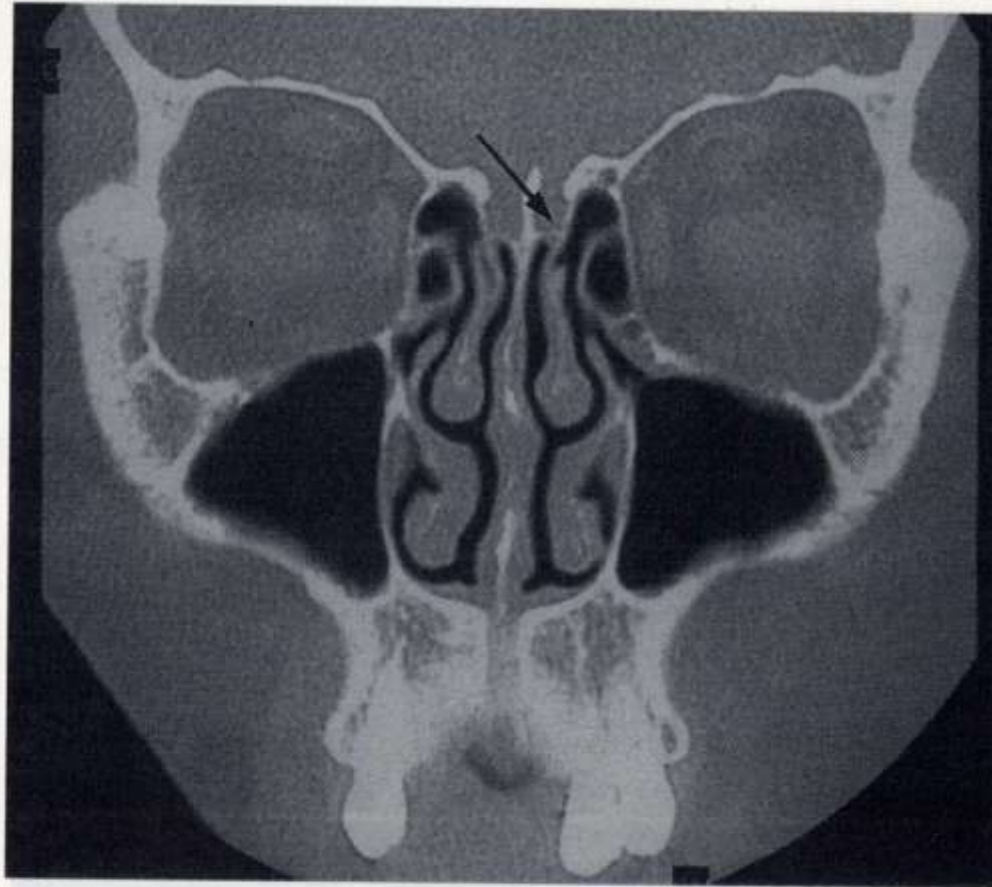
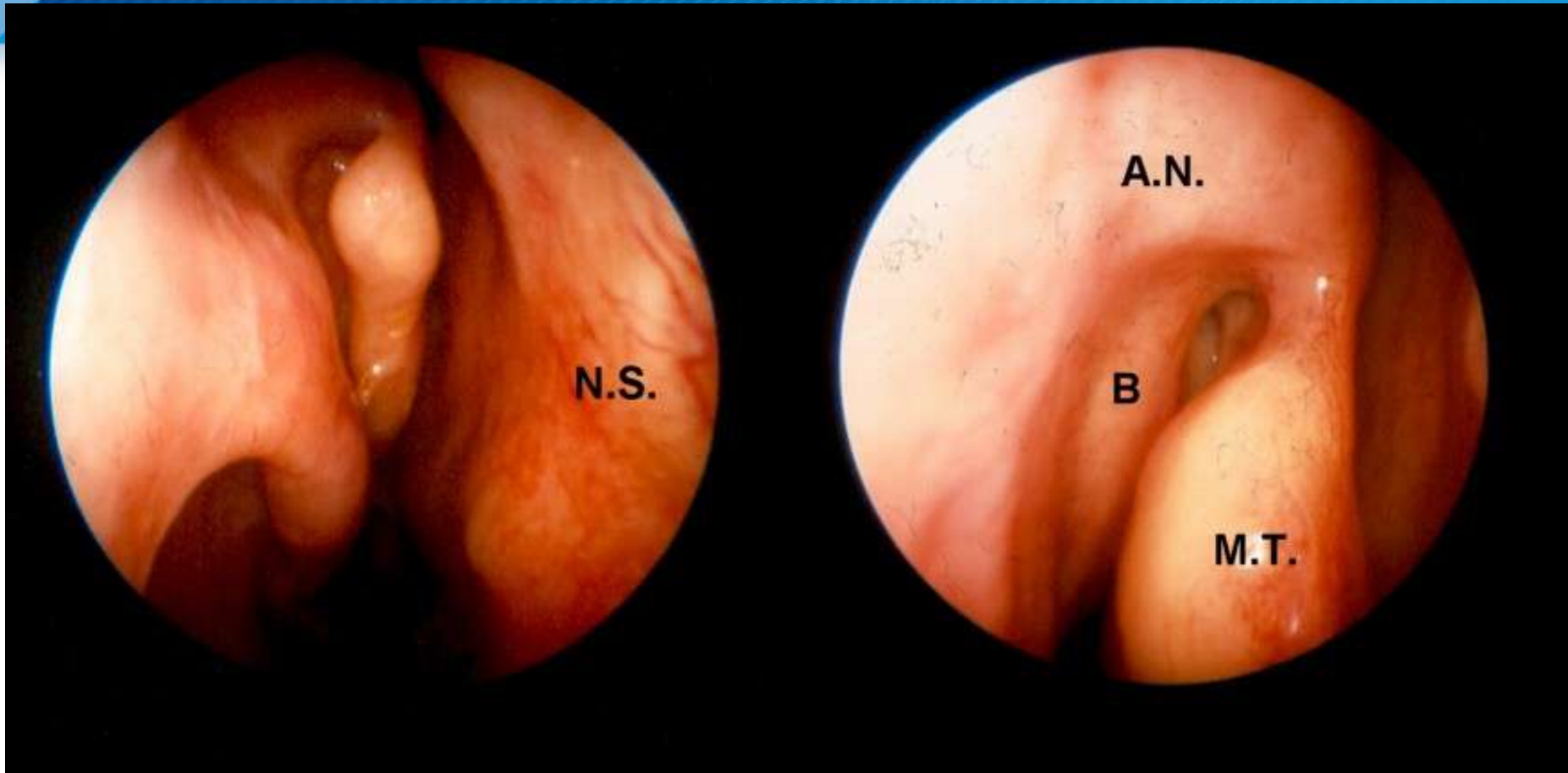
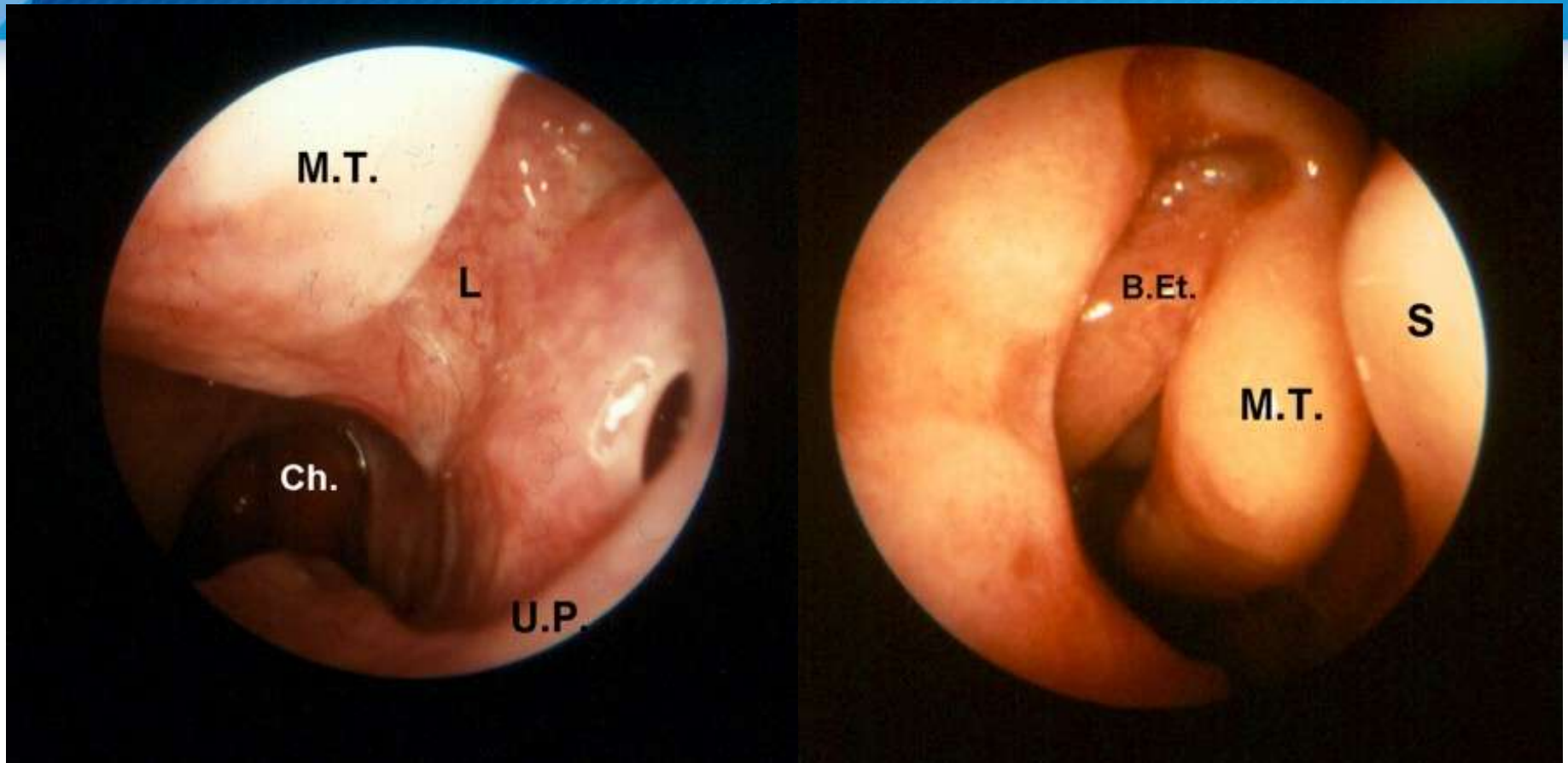
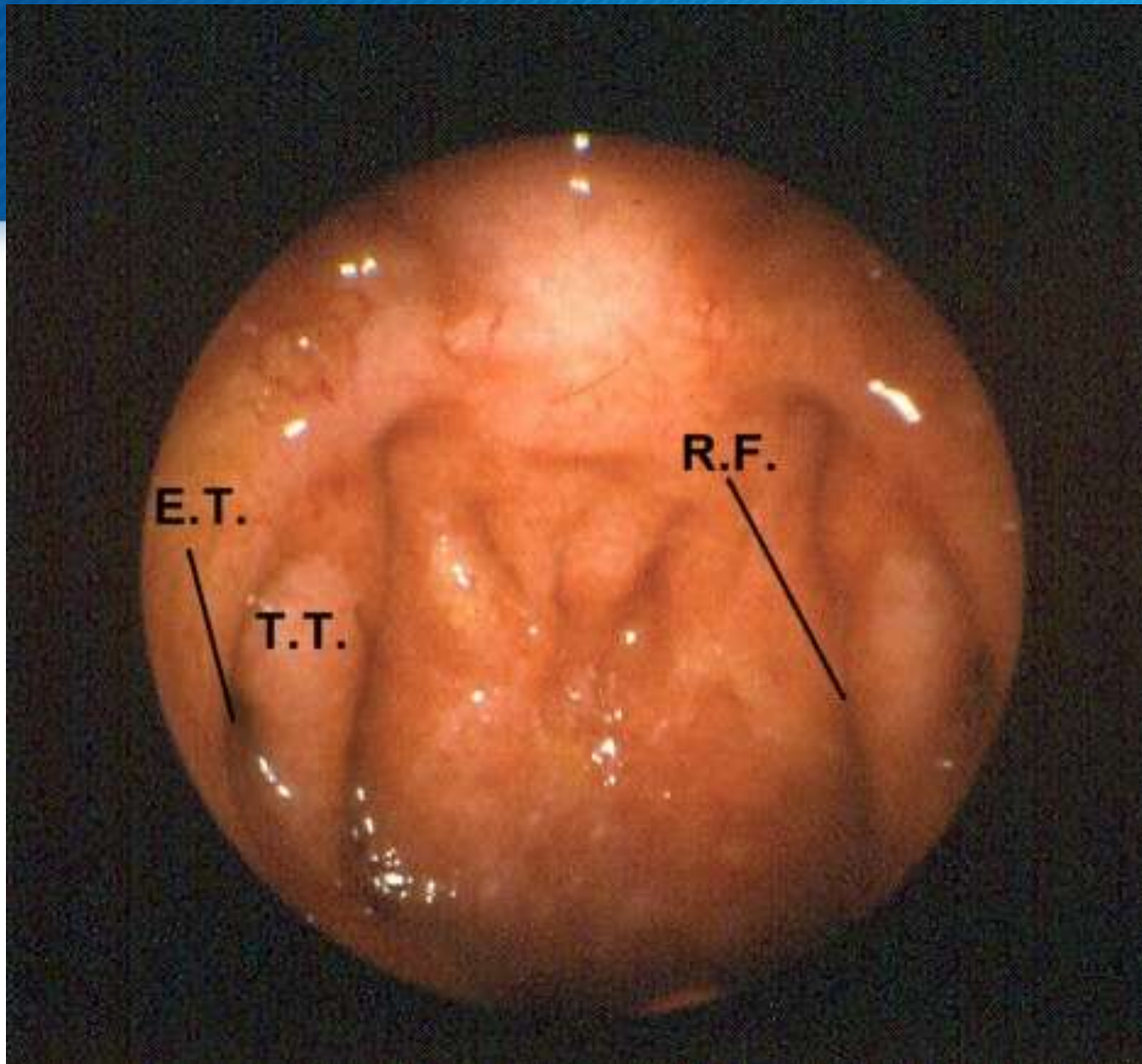
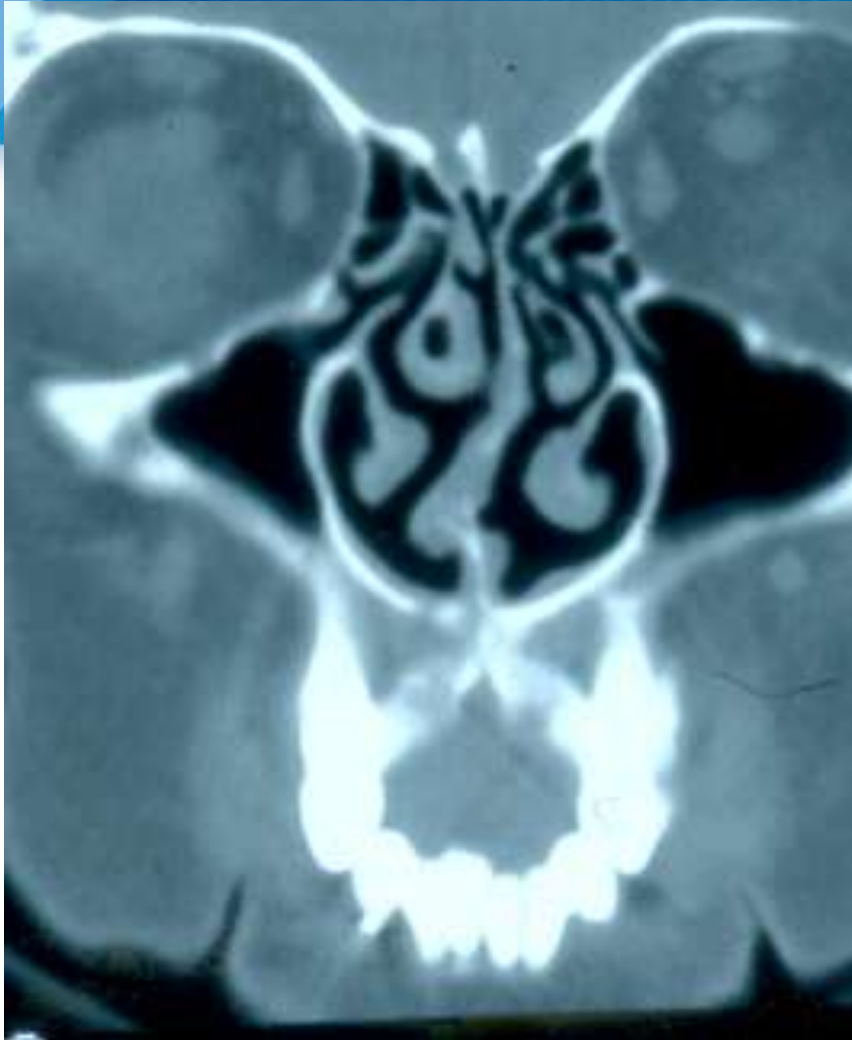


Fig. 8 – Coronal CT shows the lateral lamella of left cribriform plate to be of substantial height (arrow). Note the delicate attachment of the left middle turbinate.









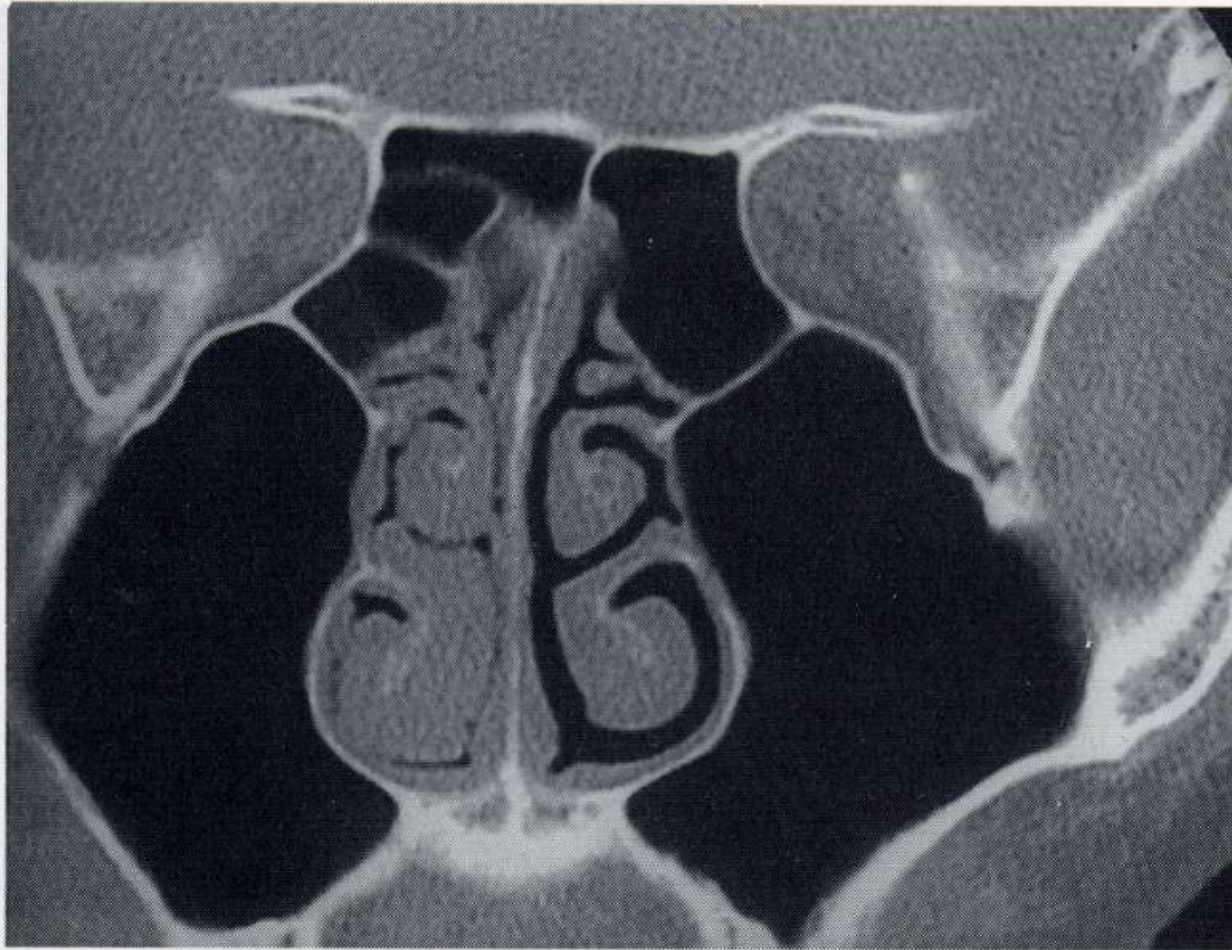
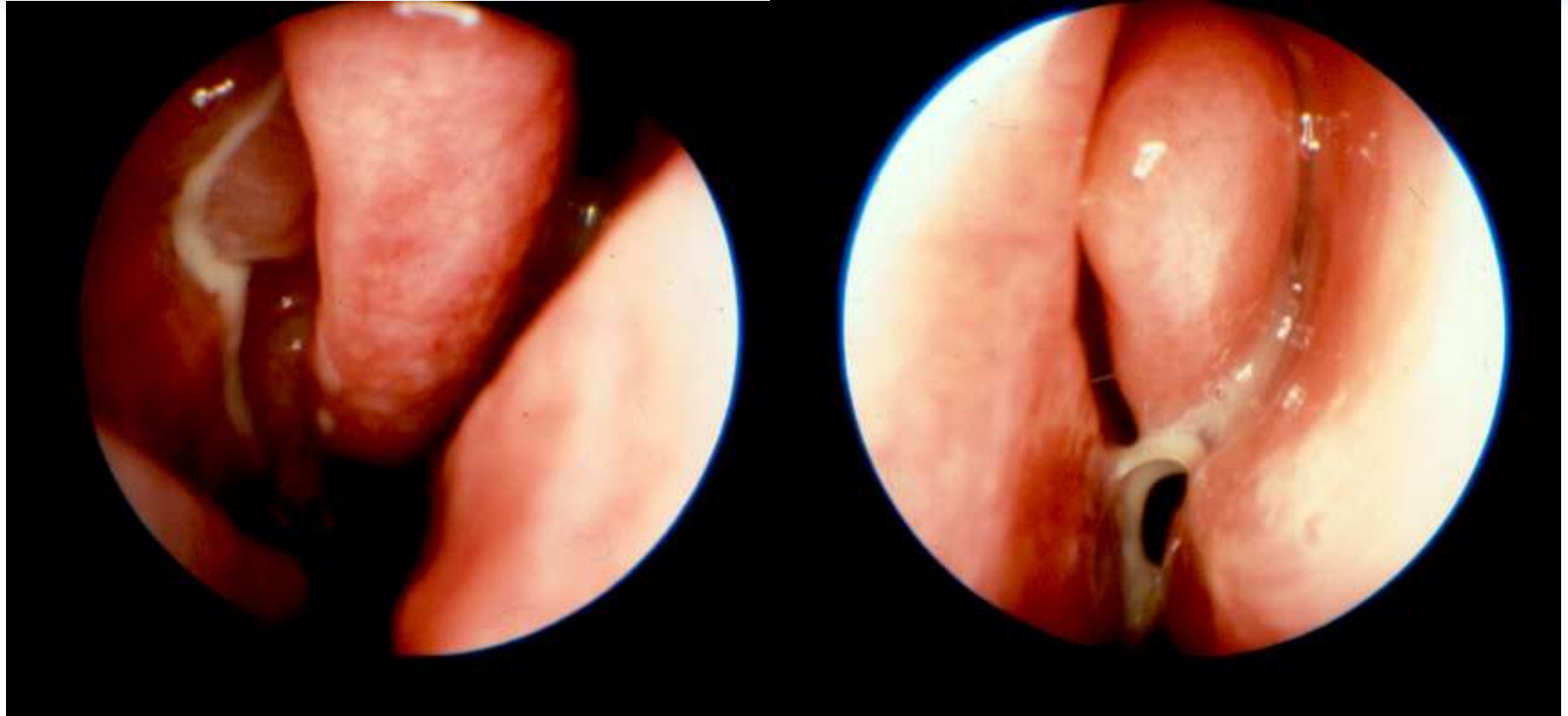
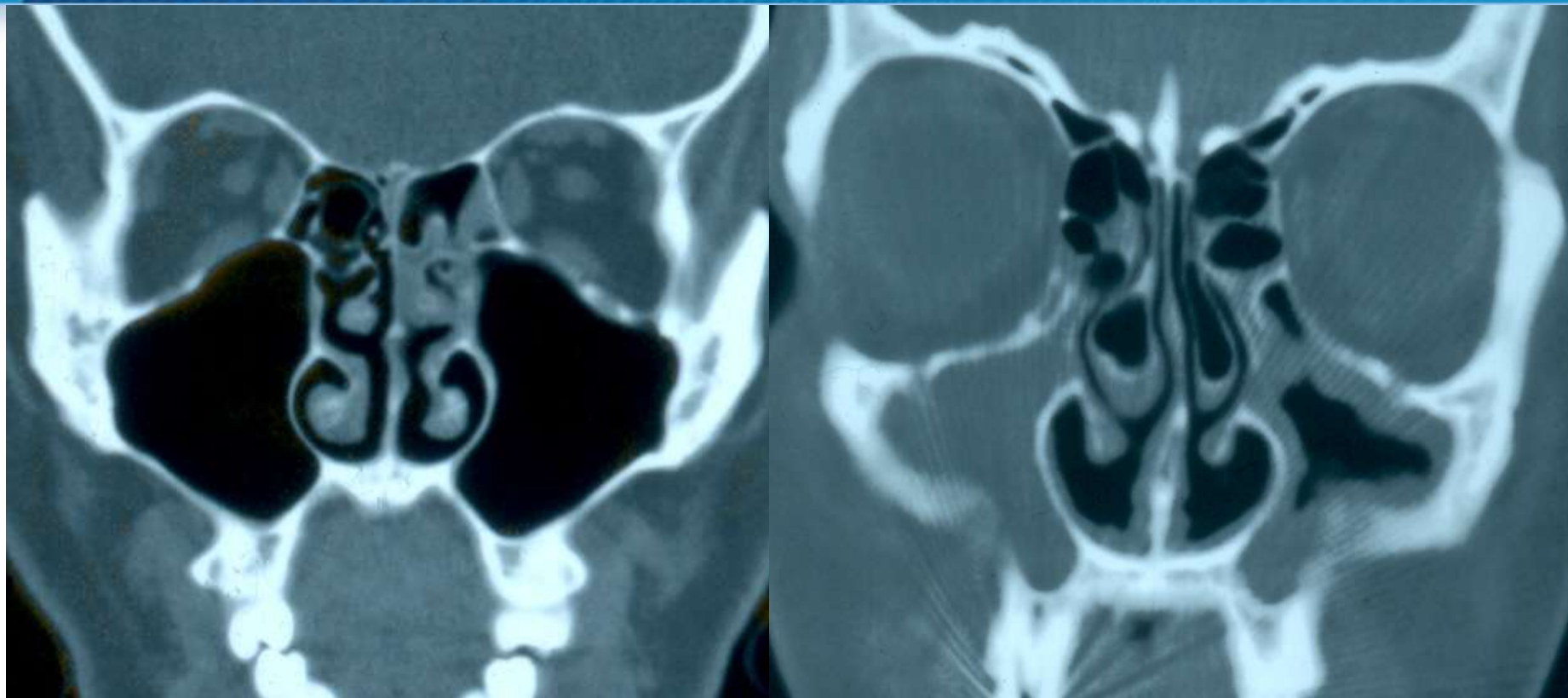


Fig. 23 – Coronal CT shows thickening of the mucosa in the right nasal cavity. This is due to a normal nasal cycle.







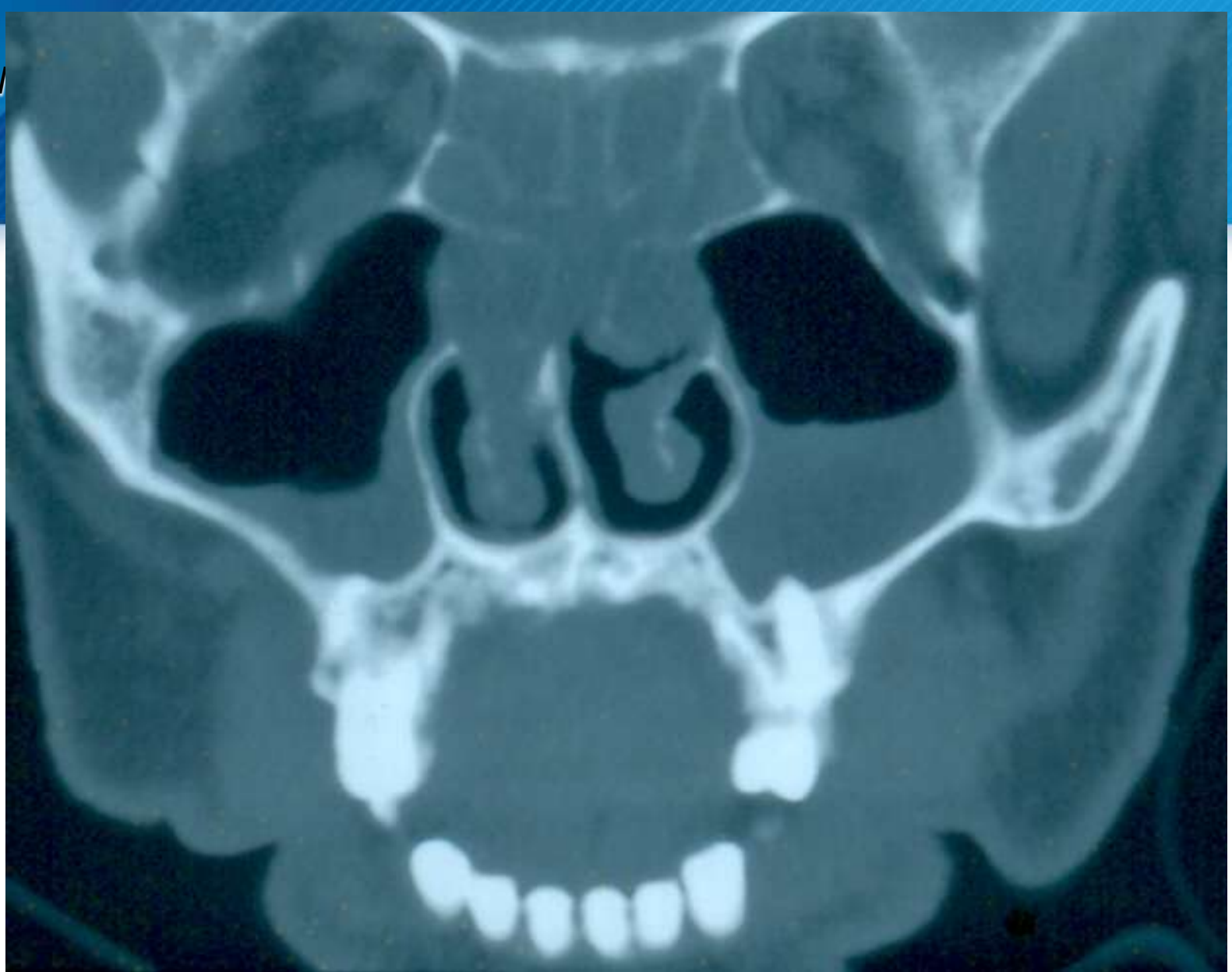
Rh



Normal







Medical management of chronic rhinosinusitis

- Oral antibiotics
- Nasal decongestants
- Nasal saline spray/irrigation
- Intranasal steroid spray
- Oral mucolytics
- Oral steroids

Medical management

- Confirmatory diagnosis
 - Nasal endoscopy
 - Culture if indicated
 - Limited sinus CT scan
 - “Gold standard”

Medical management

- Consider allergy and immune testing
 - Allergic rhinitis
 - Most patients with extensive sinus disease on CT scan have evidence of environmental allergy
 - Immunodeficiency
- Other possible contributing etiologies
 - Cystic fibrosis
 - Ciliary dyskinesia

Medical management

- Prevention
 - Practice of good hand hygiene, especially when in contact with ill individuals
 - Smoking cessation
 - Use of nasal saline spray/irrigation
 - Consider allergy shots/drops (immunotherapy) for allergic patient

Surgical management of chronic rhinosinusitis

- If medical management fails,
 - And, clear evidence of bacterial infection or anatomic obstruction,
 - And, significant symptoms and/or significant loss of times at work, school etc.,
 - Then, consider surgery
 - No official guideline for frequency of infections
 - Consider 4 or more episodes of infection during the past year

Surgical management

- Open approaches are now relatively rare
 - Trauma
 - Complications (subperiosteal abscess, etc.)
 - Complex frontal sinus disease (frontal mucocele, etc.)

Intraorbital Abscess Secondary to Acute Sinusitis



Frontal Mucocele

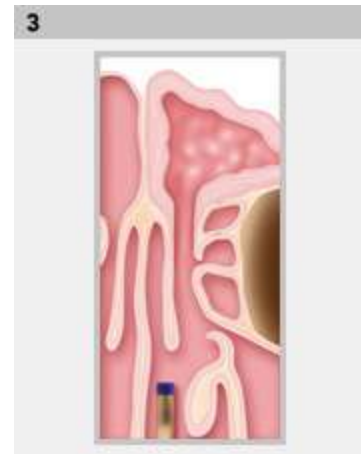


Surgical management

- Functional endoscopic sinus surgery (FESS)
 - Vast majority of sinus surgery
 - Surgical treatment is aimed primarily at re-establishment of proper drainage of the affected sinus
 - Intraoperative image guidance may be used
 - revision sinus surgery
 - diffuse nasal polyposis
 - abnormal anatomy

Surgical management

- Minimally invasive sinus surgery
 - ie, balloon sinuplasty



Surgical management - preoperative

- **Review Anatomy**
- Limit blood loss/reduce inflammation
 - Avoid aspirin, ibuprofen for 7-10 days prior to surgery
 - Preoperative oral steroids utilized by some surgeons

General preventive strategies

- Thorough preoperative evaluation of patient
 - » hx bleeding diathesis, ASA/ibuprofen usage, prolonged steroid use, poorly-controlled hypertension
- history previous sinus surgery
- detailed review of preoperative CT scan
 - » evaluate frontals, maxillary/OMC, ethmoids/cribiform plate, sphenoid
- localize key landmarks to prevent disorientation
 - » anterior ethmoid artery, anterior face sphenoid, fovea ethmoidalis, lamina papyracea, middle turbinate
 - » Skull base slopes downwardly from anterior to posterior

General preventive strategies

- excellent knowledge of anatomy and clear view of the field are mandatory
- medial skull base roof associated with anterior ethmoidal artery medially is 10X thinner than other regions
- excessive intraoperative bleeding or disorientation is indication for termination of procedure

Surgical management - intraoperative

- Intraoperative
 - Excellent knowledge of anatomy/CT scan up
 - Turn table 90 or 180 degrees
 - Endotracheal tube to left side of mouth if right handed surgeon
 - Leave eyes untaped
 - Local injection/topical decongestant use
 - Reverse Trendelenburg position/controlled hypotension

Surgical management - postoperative

- Pain control
- Antibiotics/steroids debatable
- **Nasal saline spray/irrigation**
- Oxymetazoline x 3 days
- Elevate head of bed x 2-3 days
- Plan for 4-7 days off of work
- Approximately 1 month until fully healed

Surgical management - postoperative

- Removable versus absorbable nasal dressings
 - Trend away from removable nasal dressings
 - No conclusive evidence that absorbable nasal dressings show any advantage over no dressing at all
- Postoperative debridement to prevent scarring

Possible complications of FESS

- Surgery “under the brain and between the eyes” leaves little margin for error
- “Surgery of the ethmoid has proved to be one of the easiest operations with which to kill a patient.”
 - Mosher, 1929

Complications

- Complications specific to endoscopic sinus surgery (ESS) may be categorized as:
 - intranasal
 - periorbital/orbital
 - intracranial
 - vascular
 - systemic
 - potential need for revision surgery

Major vs. minor complications

– Major

- those complications that caused permanent damage to the patient or those that might have caused permanent damage if they had not been treated
 - most commonly CSF leak

– Minor

- all other complications
 - most commonly synechiae formation, periorbital eccymosis/emphysema, hemorrhage

Possible complications of FESS - minor

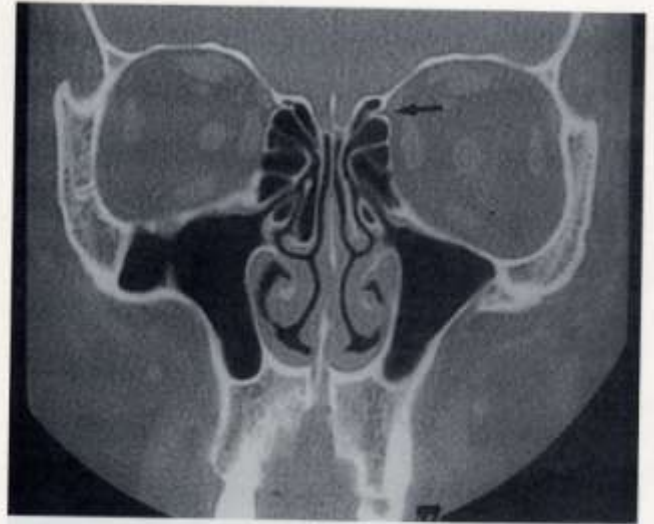
- Anesthesia risks
- Bleeding
- Synechiae (scar formation)
- Nasolacrimal duct injury
- Diminished sense of smell
- Surgical failure (failure to improve)
 - 5-15%

Complications

- **Intranasal**

- synechiae (~8%)
- stenosis or closure of surgically enlarged maxillary sinus ostium (~2%)
- nasolacrimal duct injury (variable incidence)

Ant. ethmoid artery

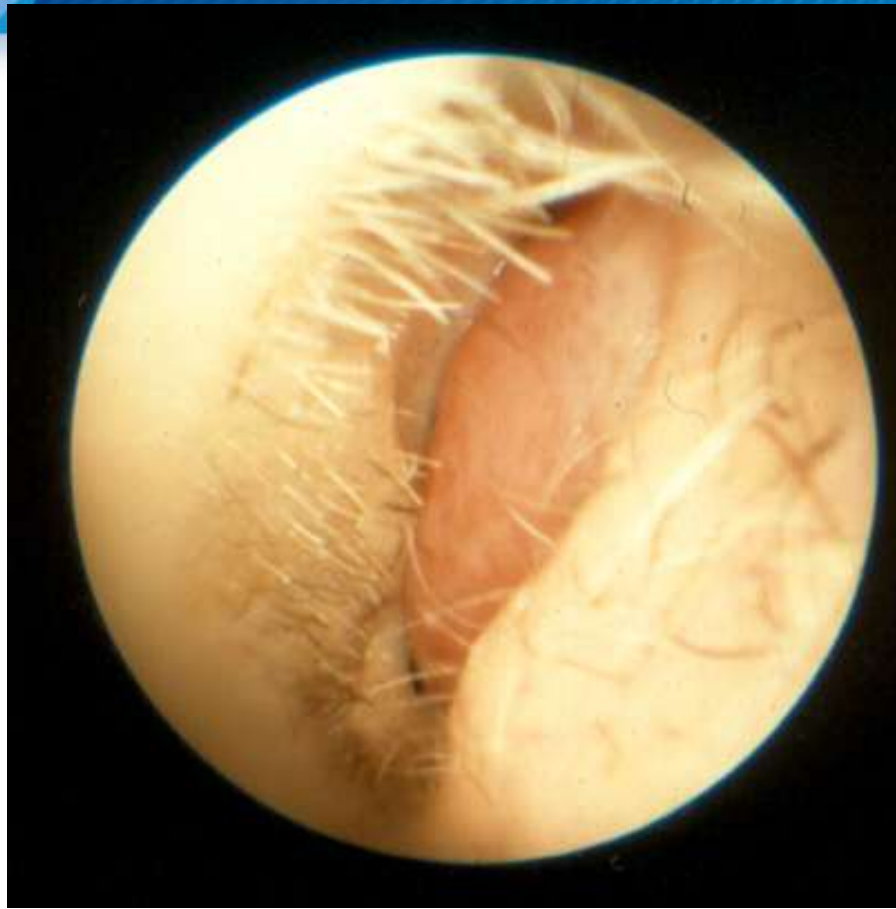


(a)



(b)

(Fig. 9 – (a) Coronal CT shows canal for the left anterior ethmoidal artery (arrow) leaving the orbit. (b) Coronal CT 3 mm anterior to (a) shows left anterior ethmoidal artery (arrowhead) entering the anterior cranial fossa.



Terris MH, et al. Review of published results for ESS. Ear Nose Throat J. 1994. (UCSD)

- Reviewed 10 large series of reports on ESS (1713 patients)
 - major complication rate - 1.56%
 - most commonly bleeding
 - minor complication rate - 2%
 - most commonly temporary epiphora, periorbital ecchymosis or emphysema
 - need for revision surgery - 12%
 - as patients are followed for longer periods, revision rate likely to increase

Terris MH, et al. Review of published results for ESS. Ear Nose Throat J. 1994. (UCSD)

- Patients subjectively rated own results
 - very good result (63%): either complete resolution of symptoms or rare episodes of sinusitis (<2/year) which respond to antibiotics
 - good result (28%): improvement but no resolution of symptoms (2-5 episodes of sinusitis per year with good response to antibiotics)
 - poor result (9%): no resolution or worsening of symptoms
- Objective results are more difficult to assess

Possible complications of FESS - major

- Intracranial injury
- Orbital injury
- Carotid artery injury

Complications

- **Intracranial injury**

- most commonly secondary to cribriform plate damage or penetration of medial ethmoid wall
 - » CSF leak (0.05-0.9%)
 - » pneumocephalus
 - » meningitis
 - » intracranial abscess
 - » intracranial hemorrhage

Complications

- **Periorbital/orbital**

- periorbital ecchymosis/edema/emphysema
 - » disruption of lamina papyracea (0.5-1.5%)
- diplopia
 - » medial rectus or superior oblique muscle/nerve injury
- optic nerve injury or blindness
 - » intraorbital or retrobulbar hemorrhage
 - » direct optic nerve injury

Complications

- **Vascular**

- anterior or posterior ethmoid artery
- sphenopalatine artery
- internal carotid artery
 - » 10-20% ICA's dehiscent in sphenoid and only mucosally protected

Maniglia AJ. Fatal and other major complications of ESS. Laryngoscope. 1991. (Case Western)

- Emphasized that informed consent is necessary
 - patients should be aware of potential devastating problems and alternative forms of medical treatment

Low cribriform plate

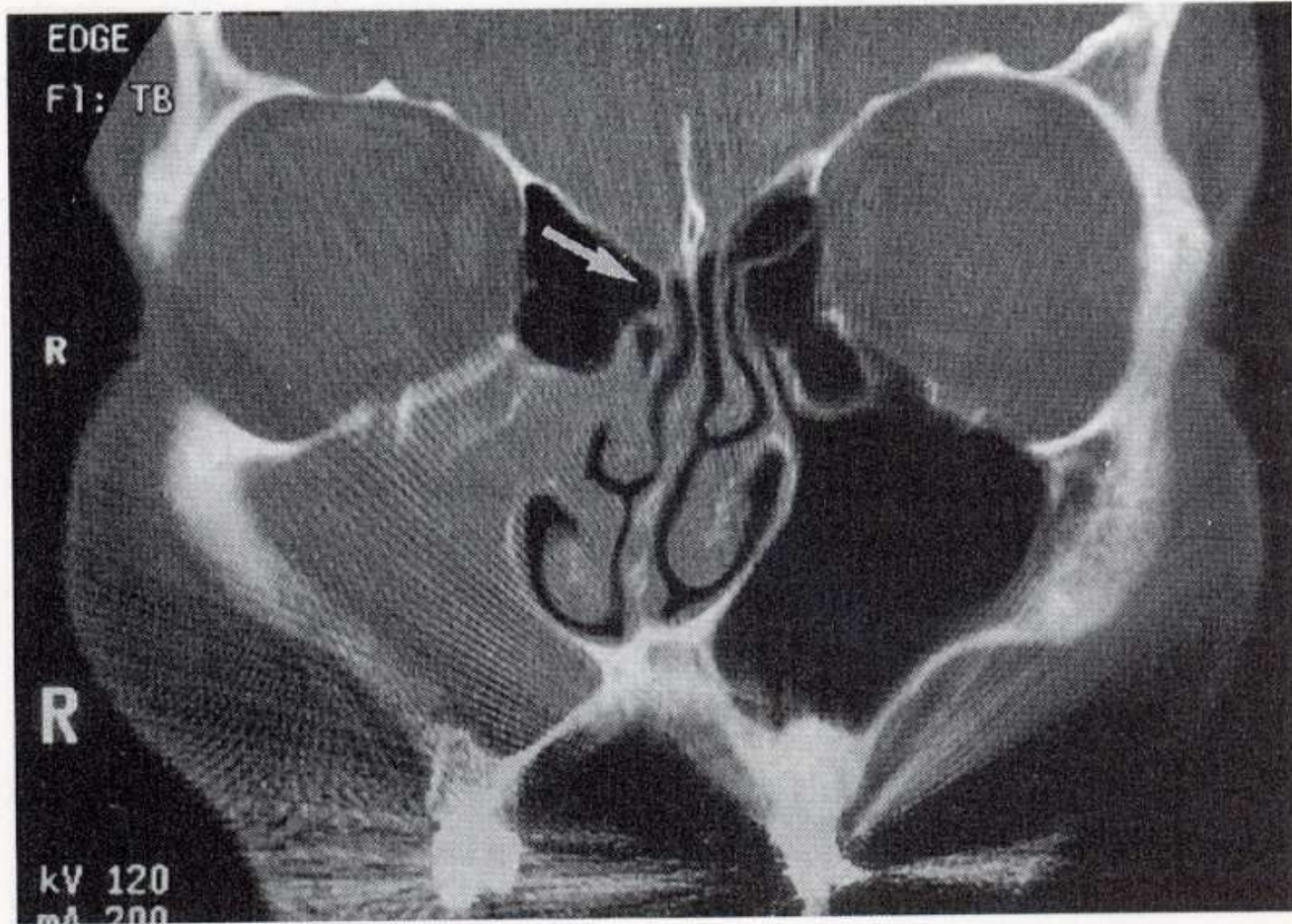


Fig. 3. Low sloping fovea. Arrow indicates a low sloping fovea extending to the midorbital plane.

Intracranial injury



Fig. 3. Patient 3. **Top.** Coronal cut of CT scan showing bony defect of cribriform plate bilaterally (arrows). **Bottom.** Axial and longitudinal MRIs of an intracerebral hematoma (right frontal lobe) (arrows).

Dehiscent lamina papyracea

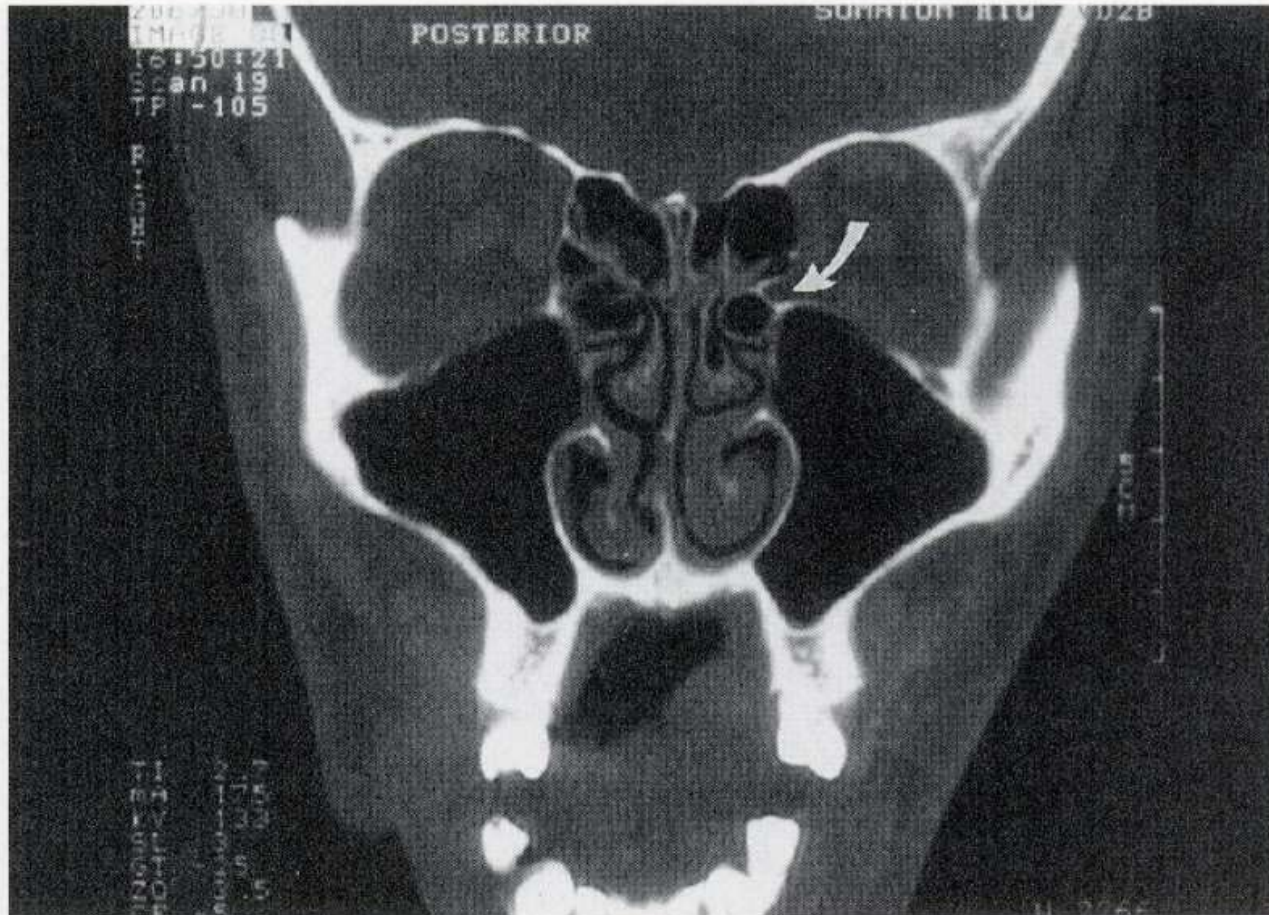


Fig. 5. Dehiscent lamina papyracea. Arrow indicates protrusion of orbital contents into anterior ethmoid sinus.

Orbital injury



Fig. 1. Patient 1. Proptosis of (R) orbit. Osseous defect in the region of the lamina papyracea bilaterally. The right medial rectus appeared to be bowed laterally by soft-tissue mass (arrow).

Optic nerve

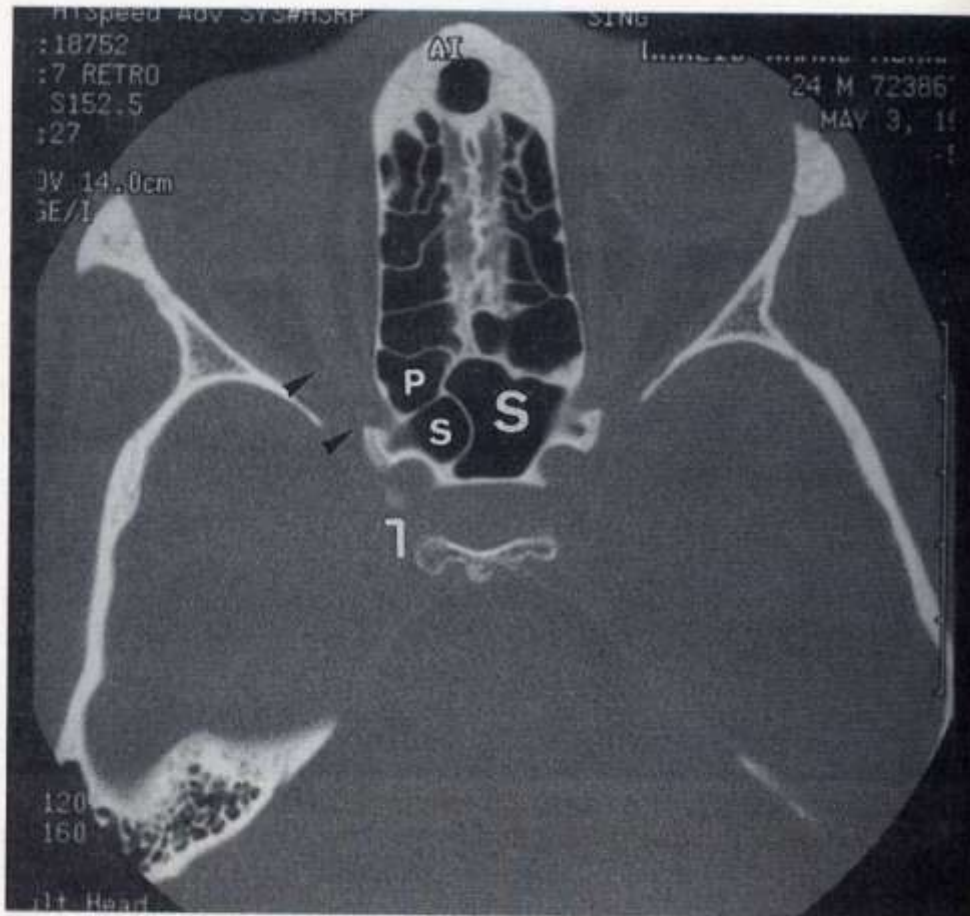


Fig. 10 – Axial CT shows the posterior relations of the right posterior ethmoid cell (P), right sphenoid sinus (s), left sphenoid sinus (S) and right optic nerve (arrowheads).

Optic nerve

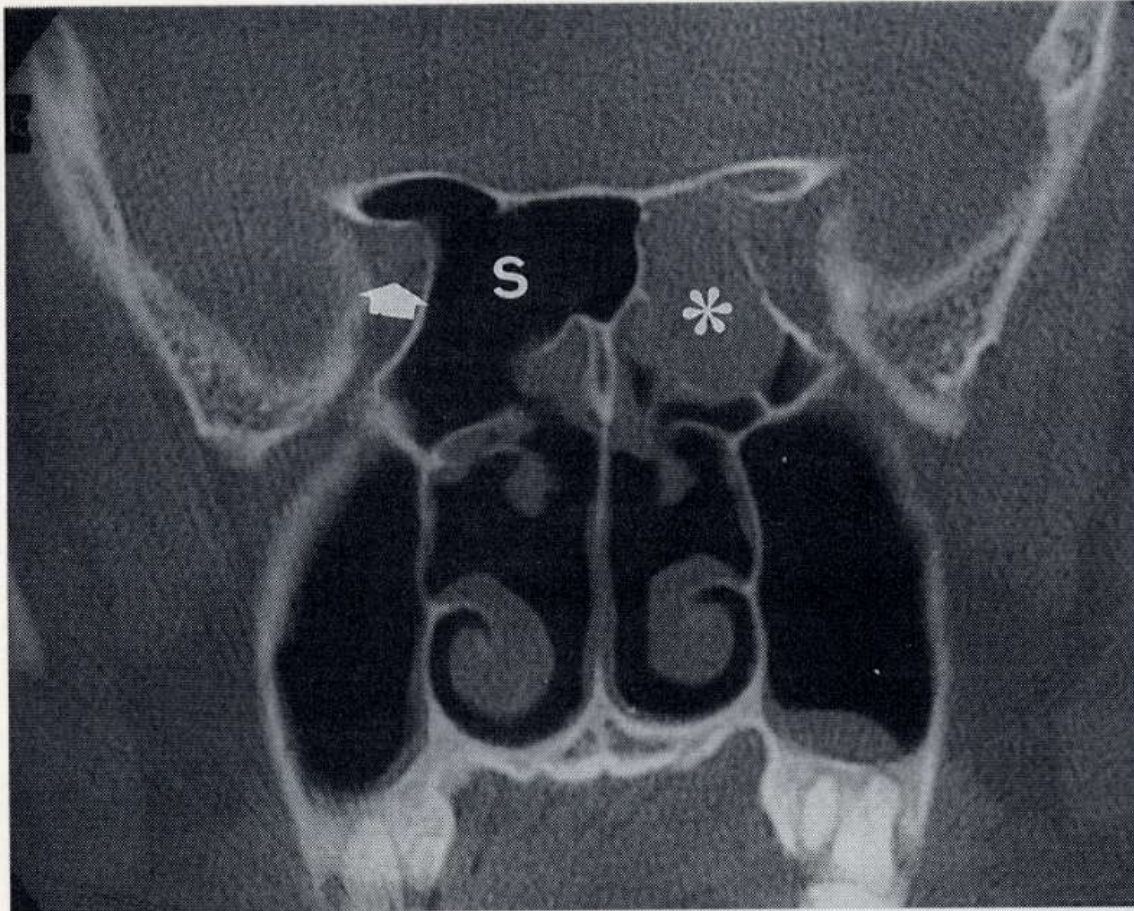


Fig. 15 – Coronal CT shows the relationship of the right optic nerve (arrow) and the sphenoid sinus (S). Note the mucosal thickening in the left sphenoid sinus (asterisk) and potential risk to the left optic nerve during surgery.

Dehiscent optic nerve

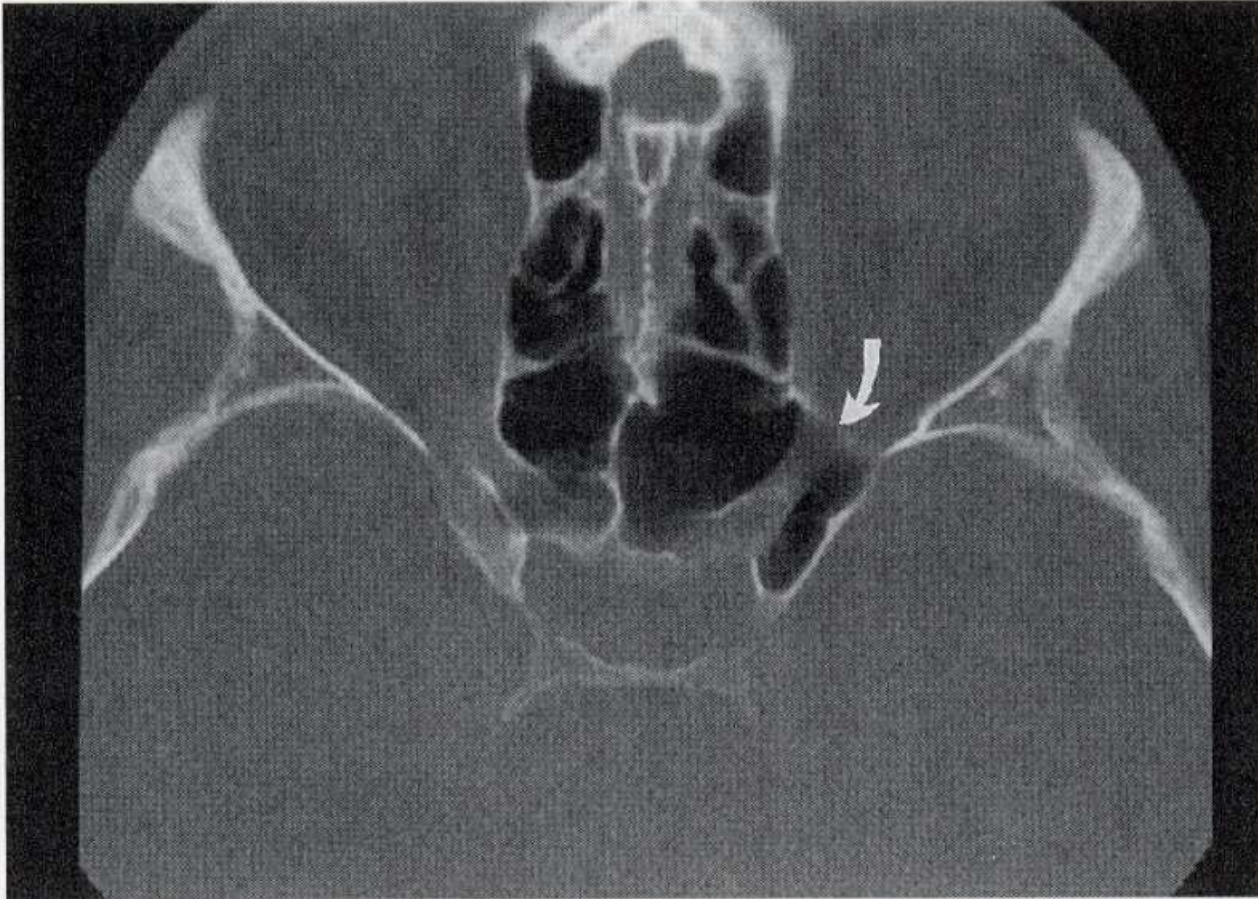


Fig. 7. Free coursing optic nerve in sphenoid (axial view). Arrow indicates optic nerve passing freely through sphenoid in continuity with aerated anterior clinoid.

Optic nerve injury

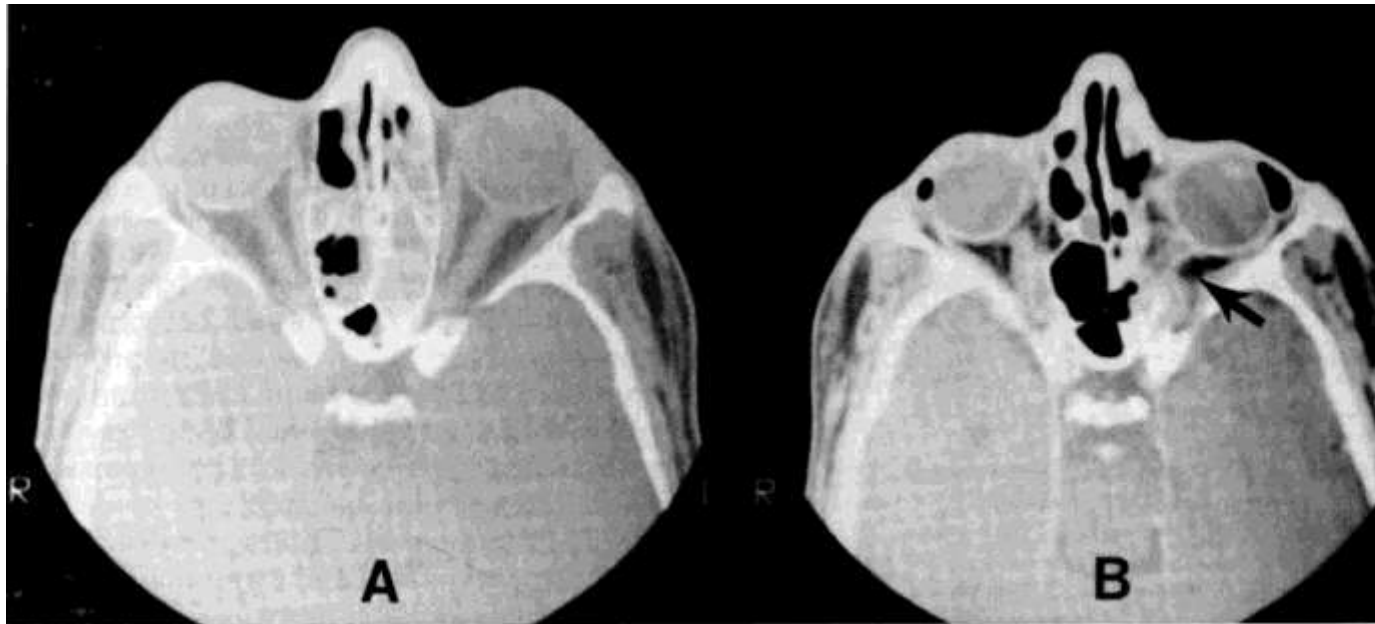


Fig. 2. Patient 2. CT scan (axial plane). **A.** Intact optic nerves, preoperatively. **B.** Both lamina papyracea are damaged. Optic nerve on the right is anatomically intact, but completely severed on the left (arrow).

Pneumatization

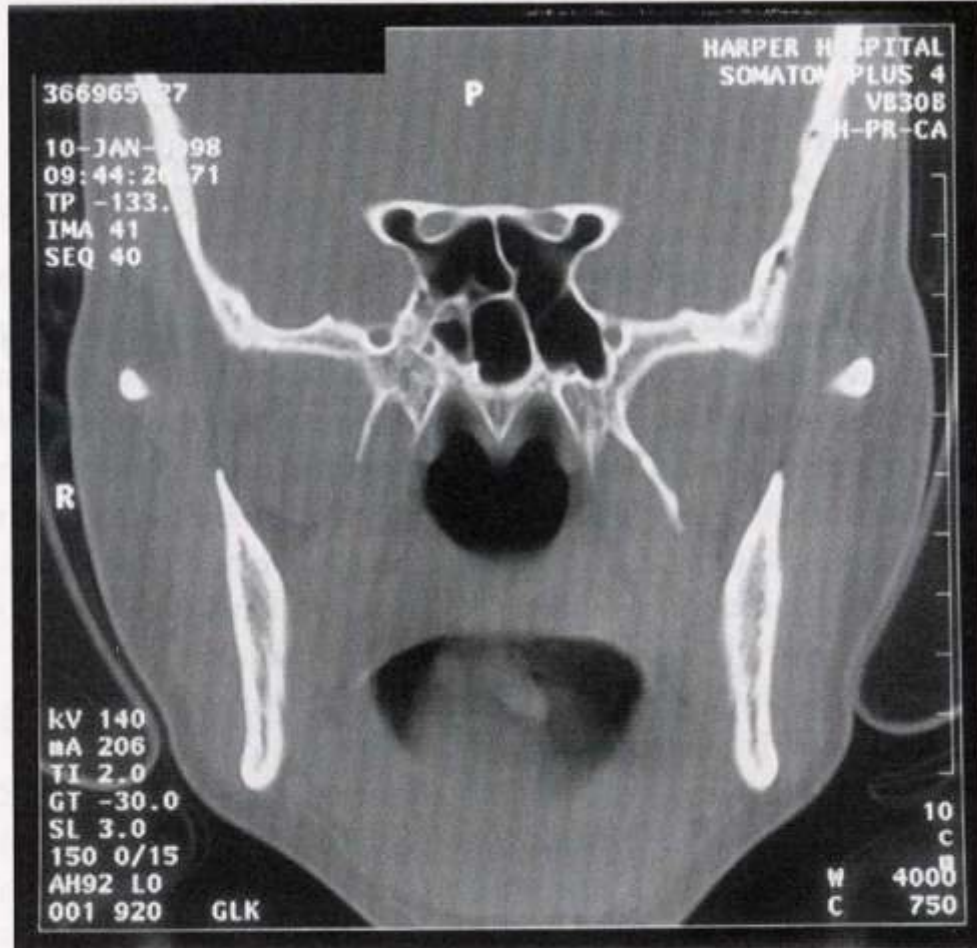
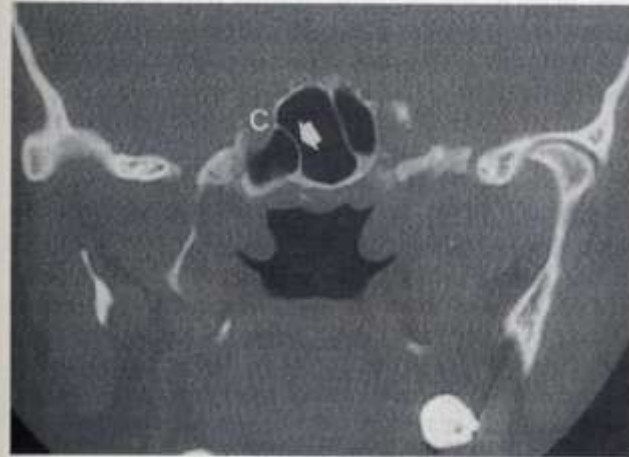
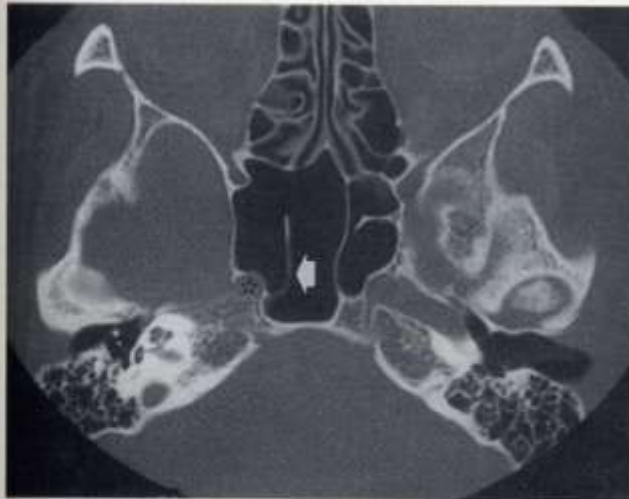


Figure 3-8. Coronal CT scan demonstrating pneumatization of the anterior clinoid process with evagination of the optic canals into the sphenoid sinuses bilaterally.

Carotid artery



(a)



(b)

Fig. 13 – (a) Coronal CT shows sphenoid septum deviated to the right (arrow) and inserted over the bone covering the right carotid artery (c). (b) Axial CT shows a sphenoid septum (arrow) attached to a partially dehiscent carotid canal (star).

Carotid artery

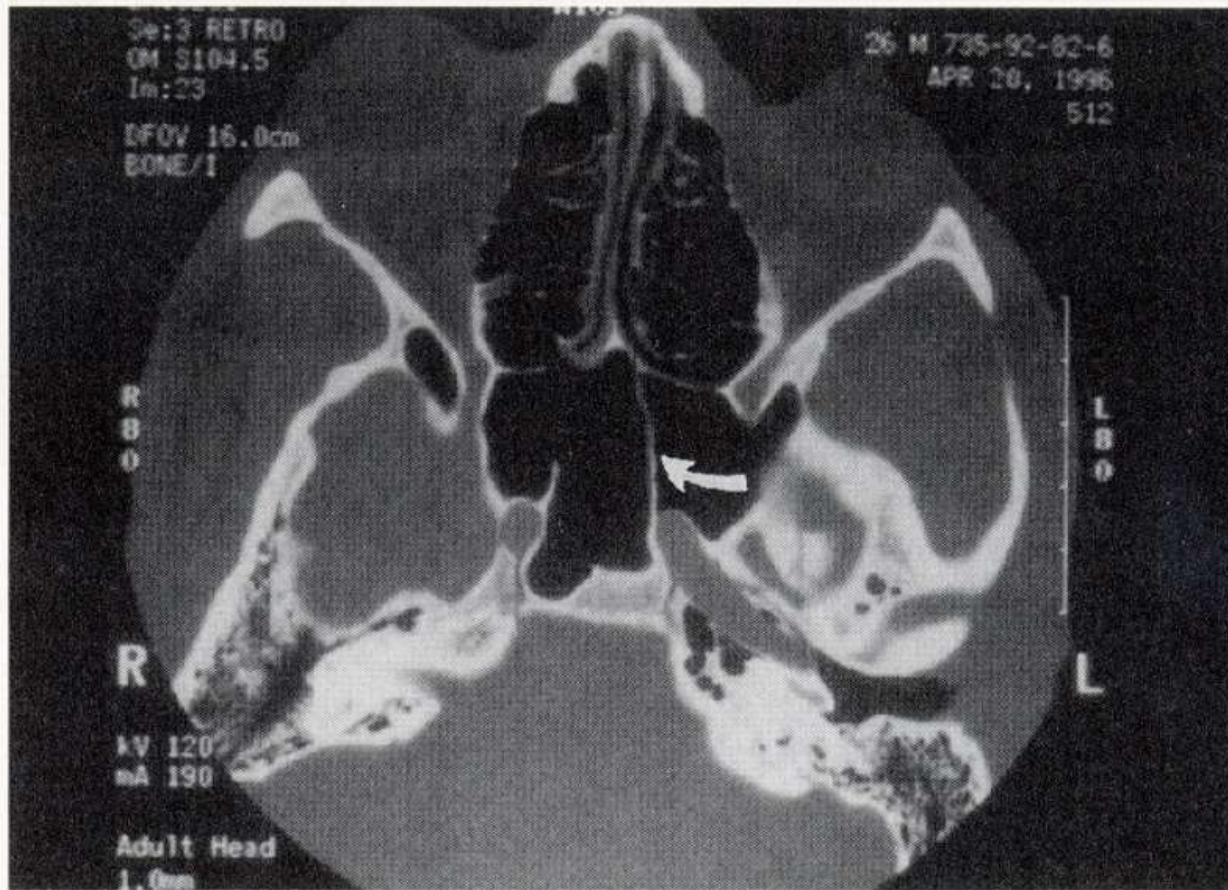
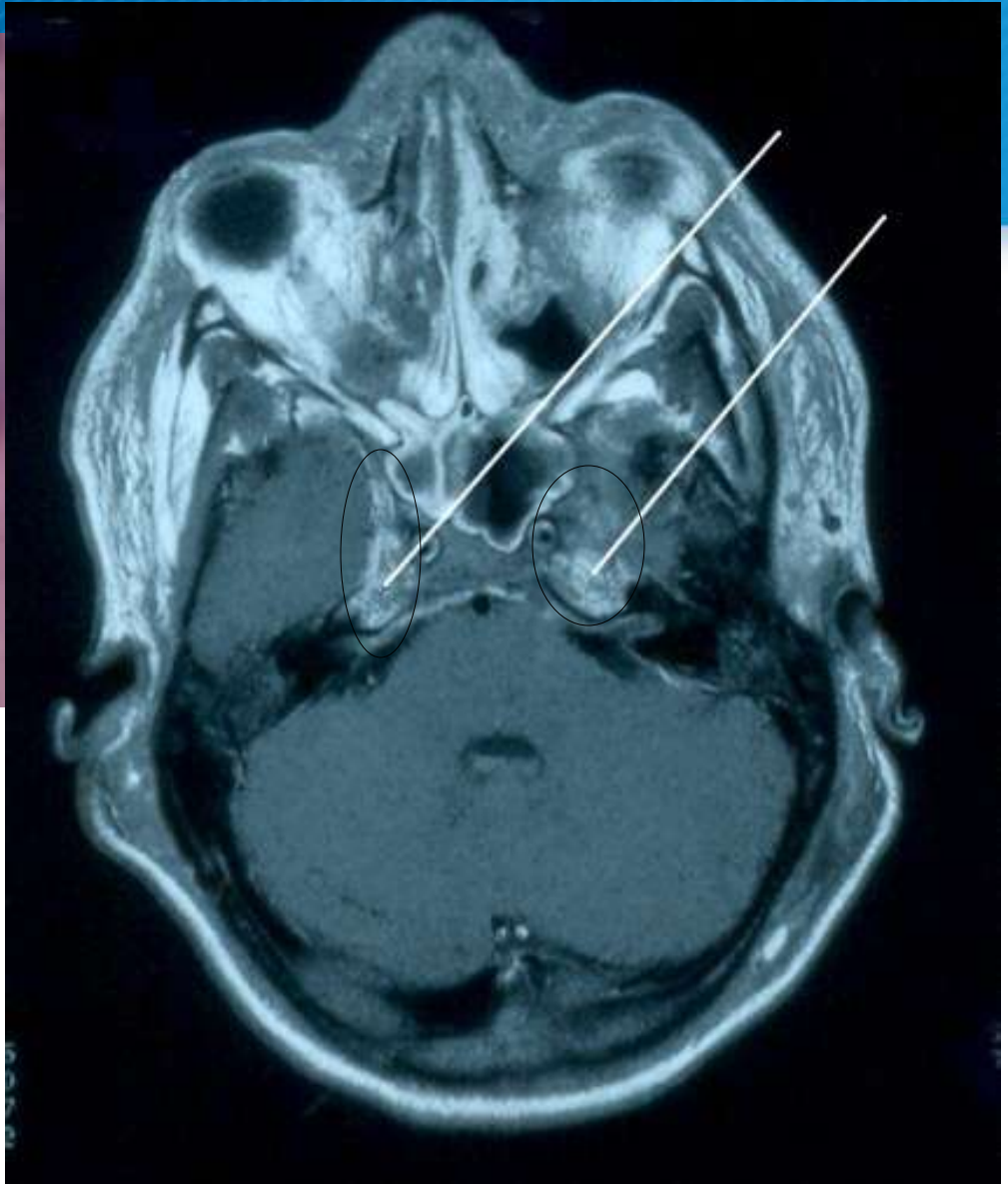
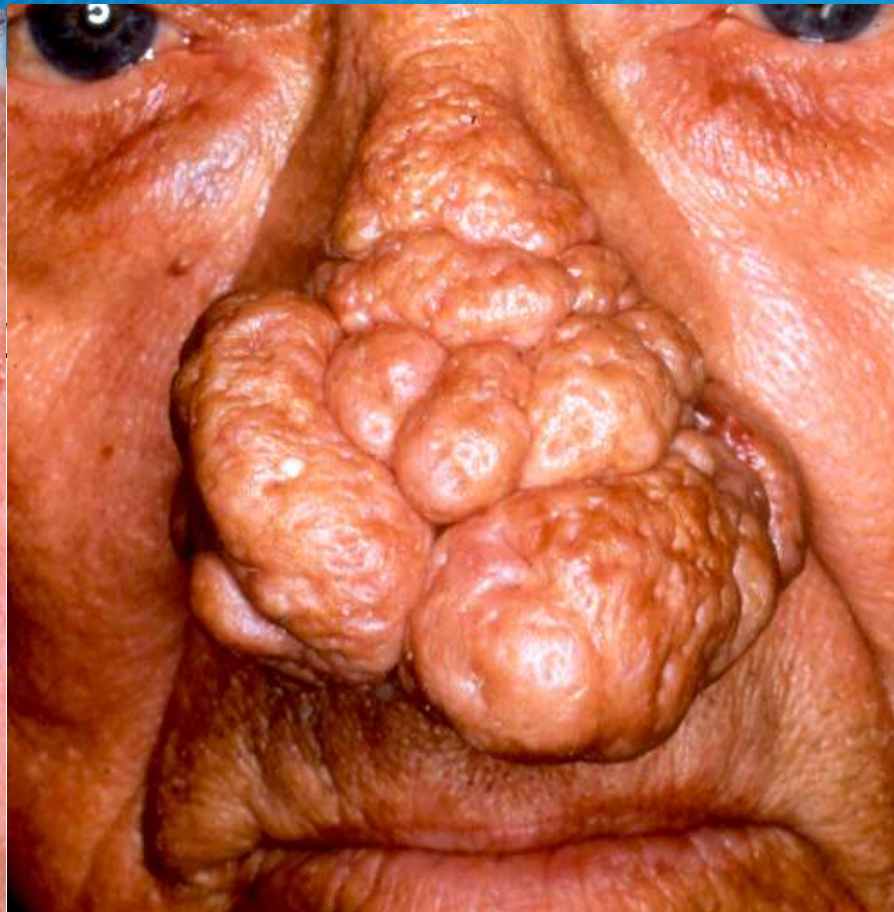
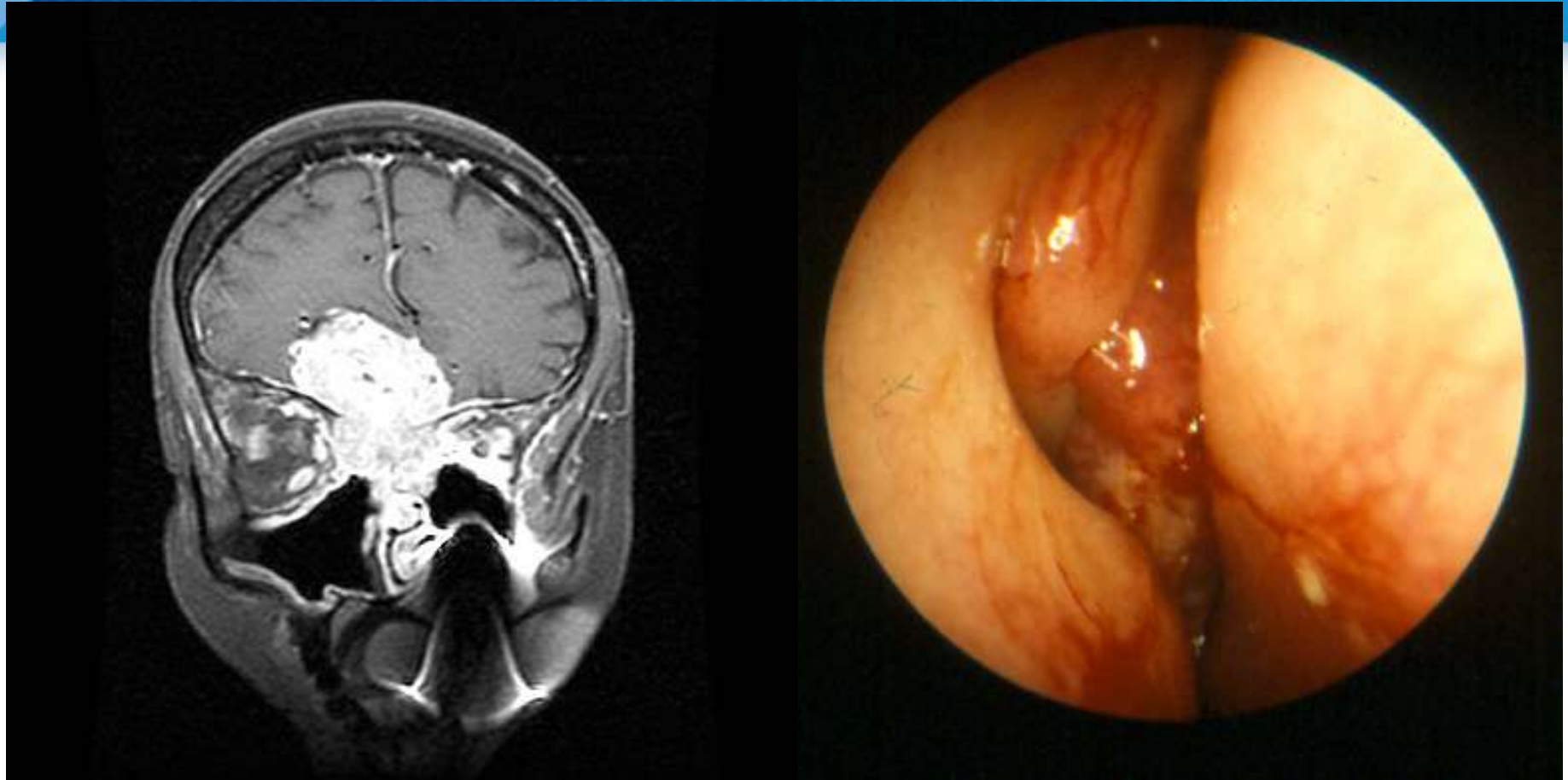


Fig. 9. Complete sphenoid septum attached to carotid. Arrow indicates sphenoid septum extending from anterior wall of sphenoid to carotid with absence of bony covering over carotid.







Review

- Define chronic rhinosinusitis (CRS)
- Review anatomy of paranasal sinuses
- Describe medical management of CRS
- Describe surgical management of CRS
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- Discuss expected results and possible complications of sinus surgery

- Questions