Pre-operative CT sinus assessment - applied anatomy and basic principles

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MORTON & PARTNERS
RADIOLOGISTS

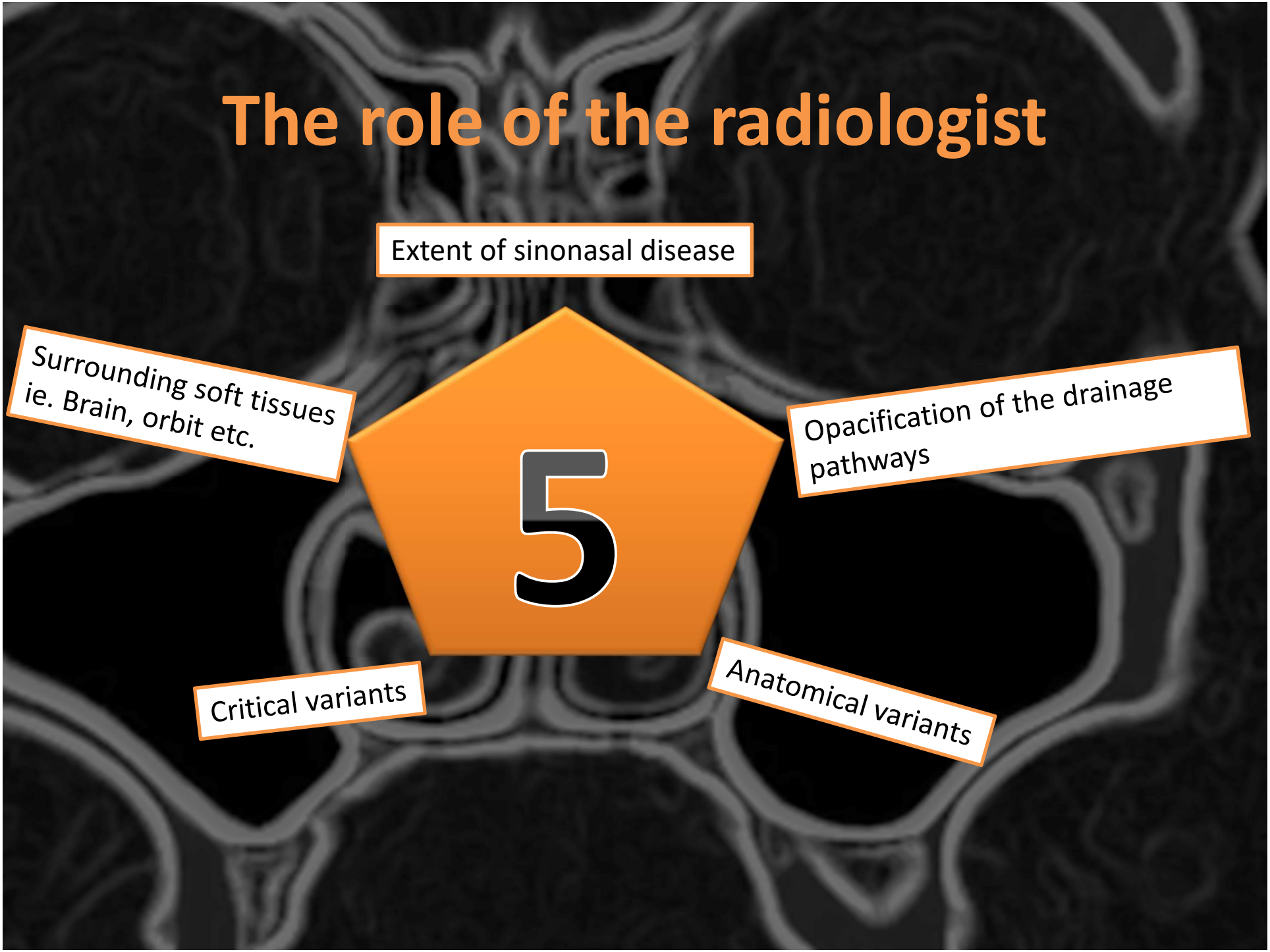
Overview

- Introduction
- Checklist
- Acquisition technique
- Bony margins
- Anatomy
- Case examples

Introduction

- Functional endoscopic sinus surgery
  - Preserve mucosa
  - Re-establish patency, mucociliary clearance and ventilation
  - Preoperative tomography (HRCT) – critical surgically relevant information to the surgeon

The role of the radiologist



Checklist

- Septum
- Middle turbinate
- Uncinate process
- OMC and maxillary sinus
- Frontal sinus drainage pathway
- Anterior skull base
- Cribiform plate
- Lamina papyracea
- Anterior ethmoid aircells
- Basal lamella
- Posterior sinus group
  - Onodi cells
  - Sphenoid sinus pneumatisation
- (Anterior) ethmoidal artery
- Bony margins of the sinuses
- Brain orbit and nasopharynx

CLOSE*

**The preoperative Sinus CT: Avoiding a "CLOSE" call with surgical complications; O' Brien et al; Radiology; Volume 281: Number 1 – October 2016*

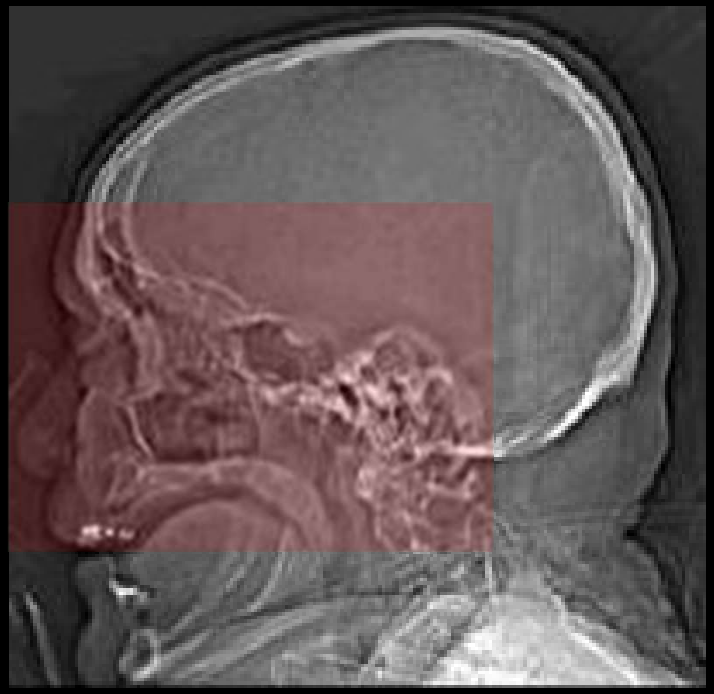
Acquisition technique

- Following episodes of acute sinusitis treatment
- Decongestant, intranasal drops
- Clearance of sinuses prior to imaging

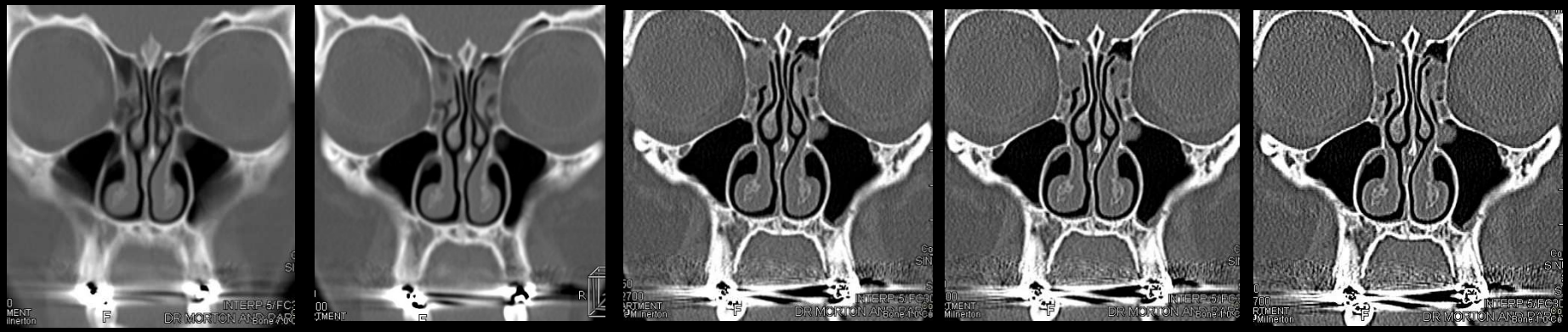
Acquisition technique

- Noncontrasted high resolution, multidetector computed tomography (HR MDCT)
  - kVp 120 – 140
  - mAs 200
  - FOV 180mm
  - Slice thickness of 0.9mm
  - Collimation 40 x 0.625
  - Multiplanar reformat imaging

Acquisition technique



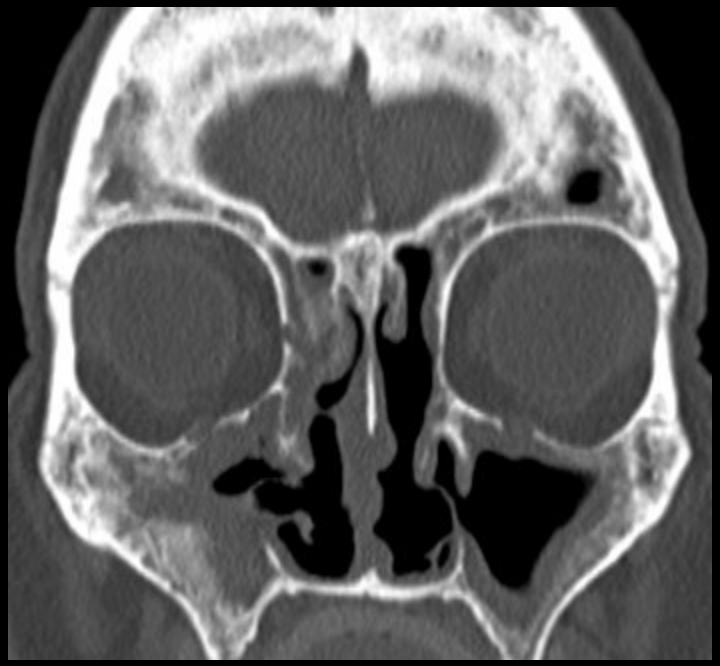
Acquisition technique



Smooth — Sharp

Post processing of the raw data

Bony margins of the sinuses



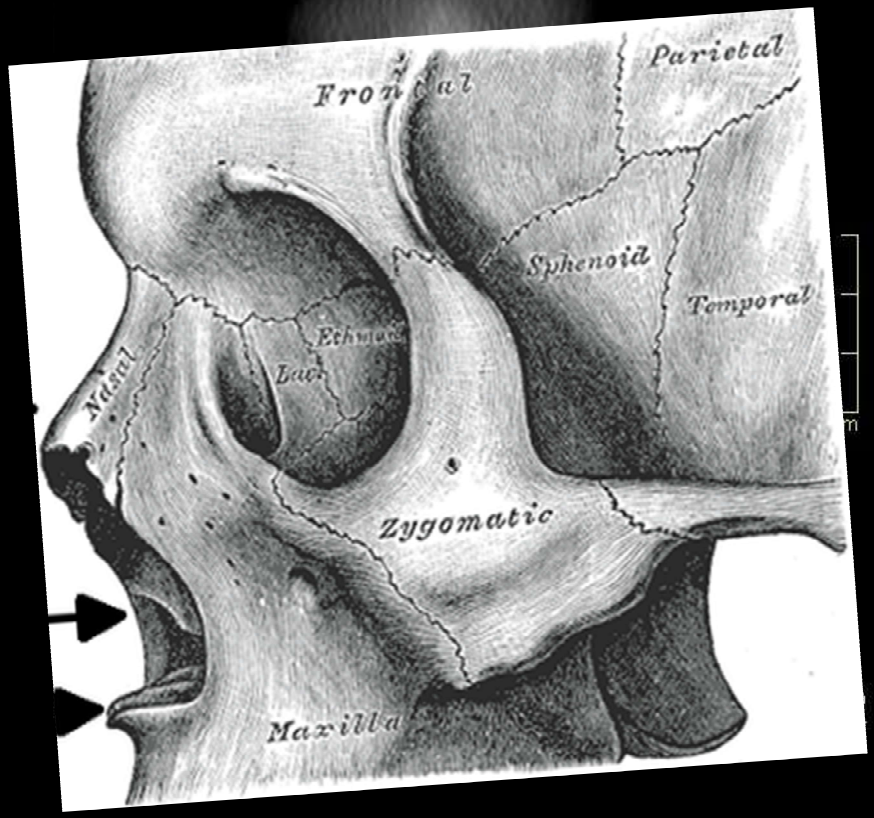
Neo-osteogenesis

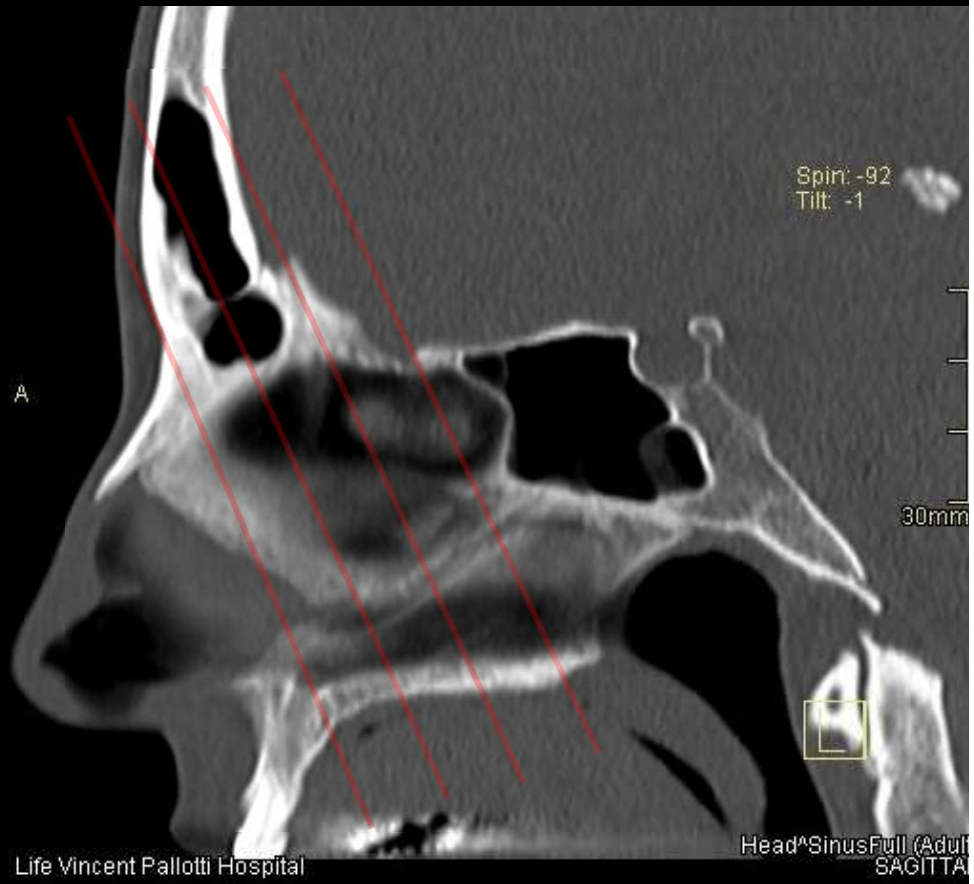
Hyperostosis and mucosal calcification

Bony margins of the sinuses

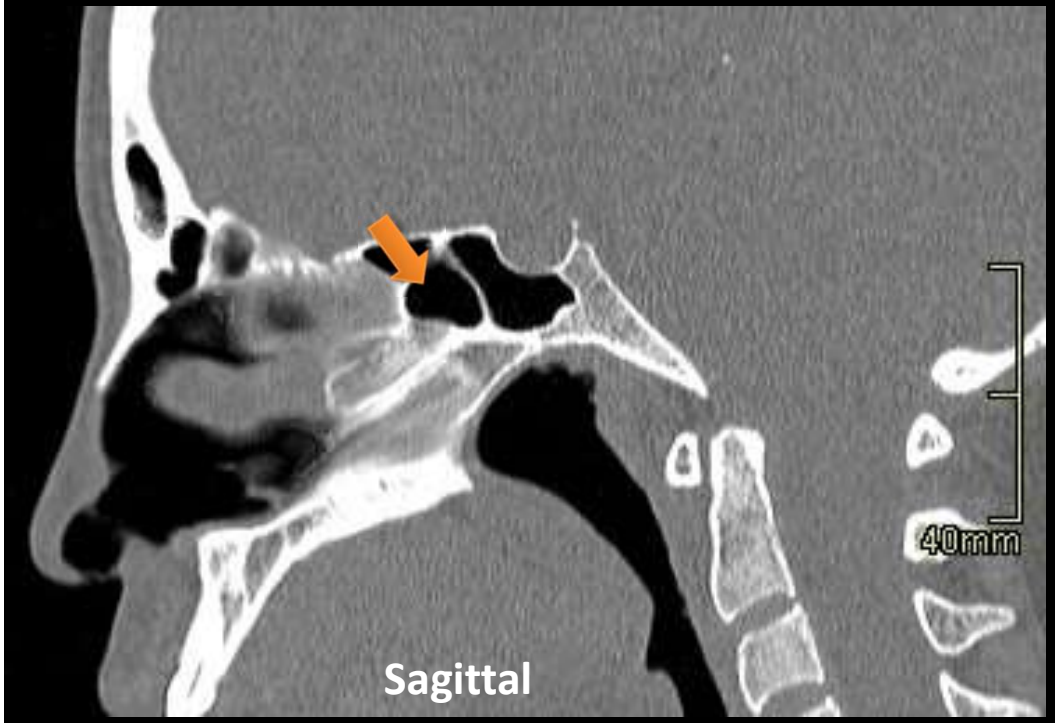
Hyperostosis and resorption of the ethmoid lamella

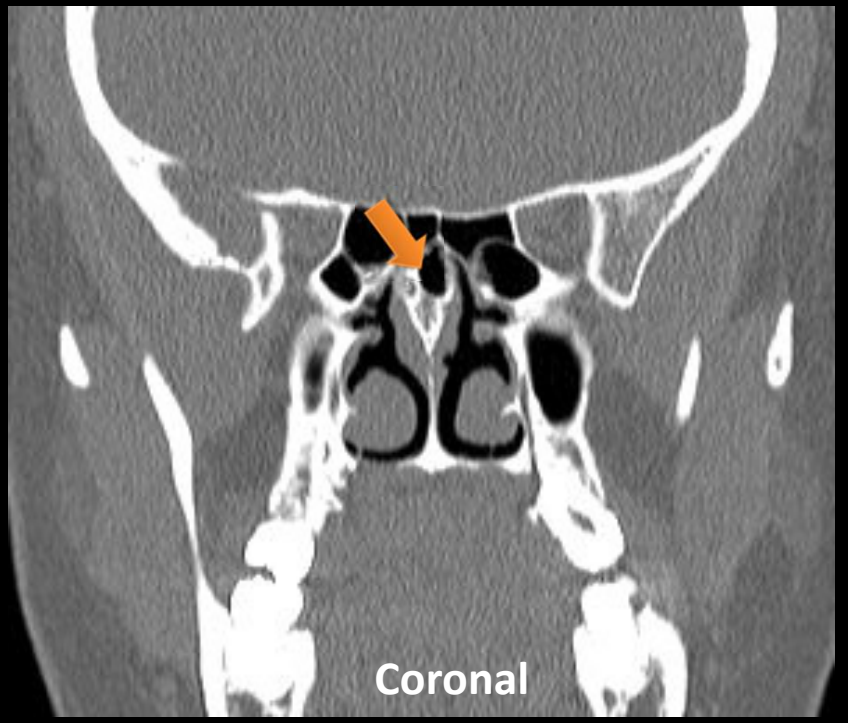
Nasal septum





Nasal septum variation





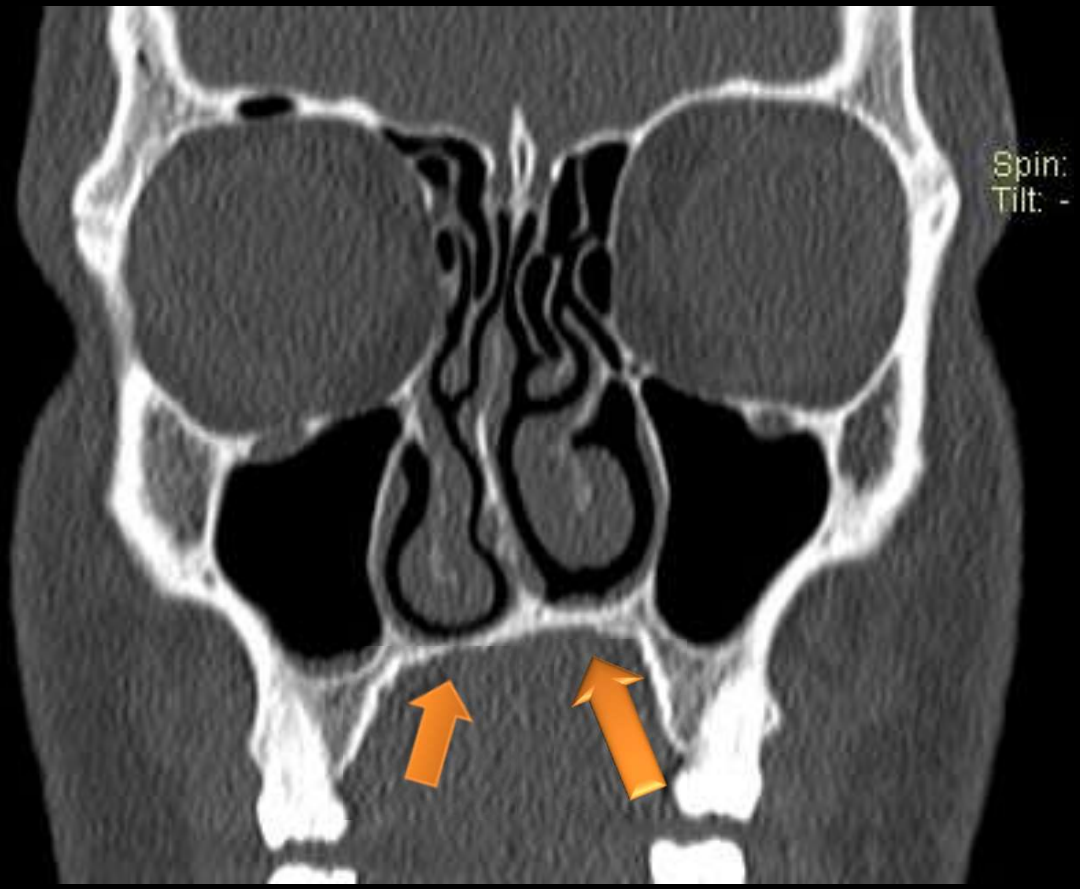
Posterior nasal septal air cell

PITFALL – may resemble cephalocoele

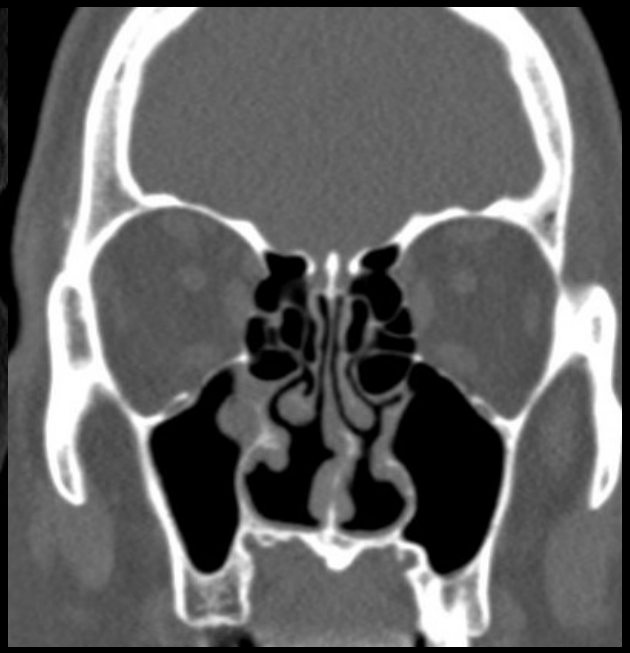
Nasal septum deformities

- Spurs or ridges
- Deviations
- Dislocation, deformity of the condrovomeral junction

Deviation



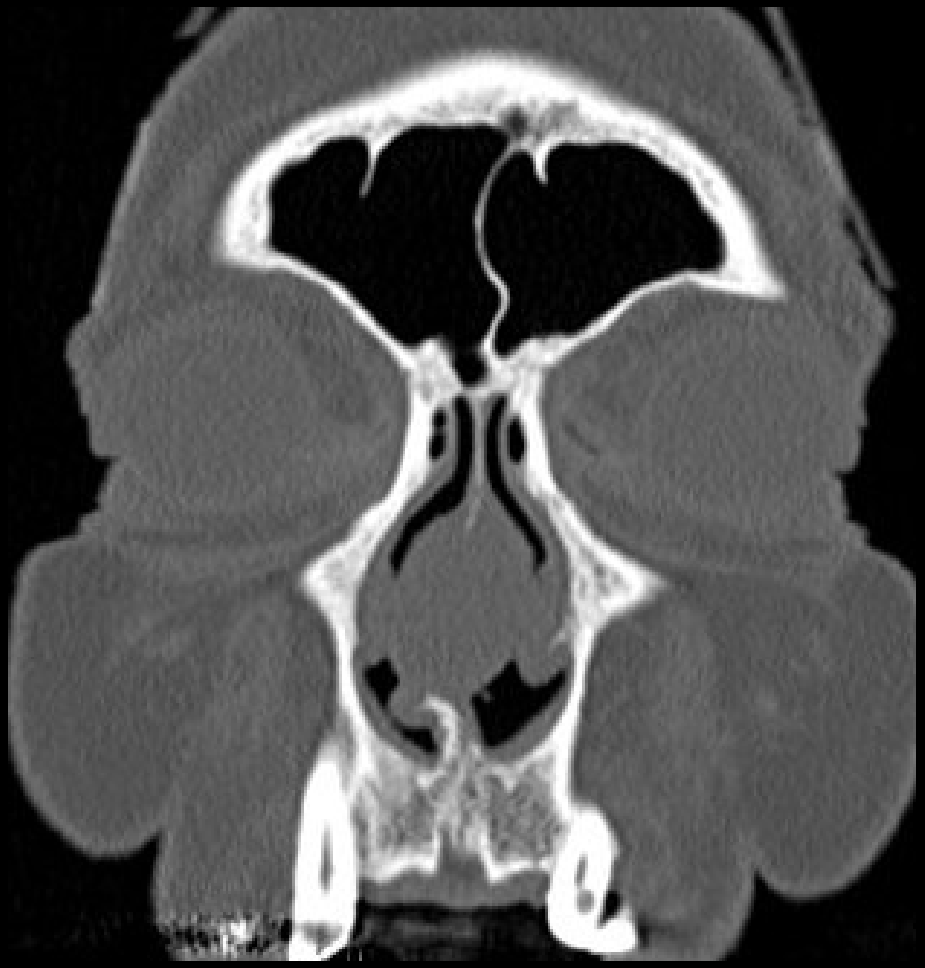
Spur, Ridge, Dislocation

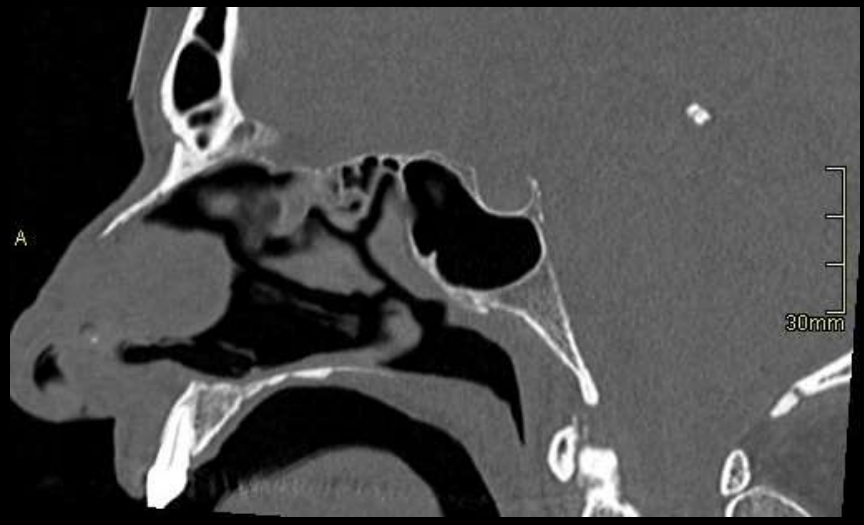


Dislocations

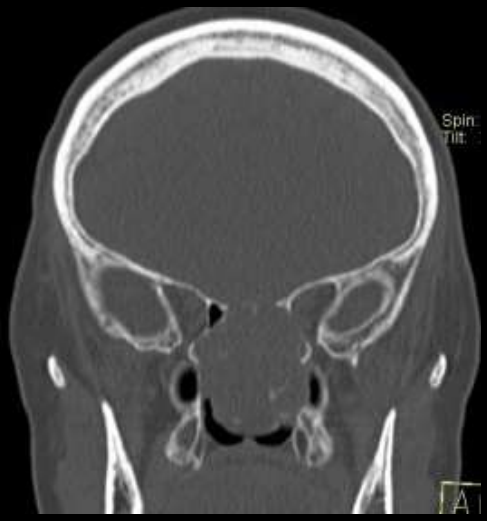
Case

Nasal septum hematoma



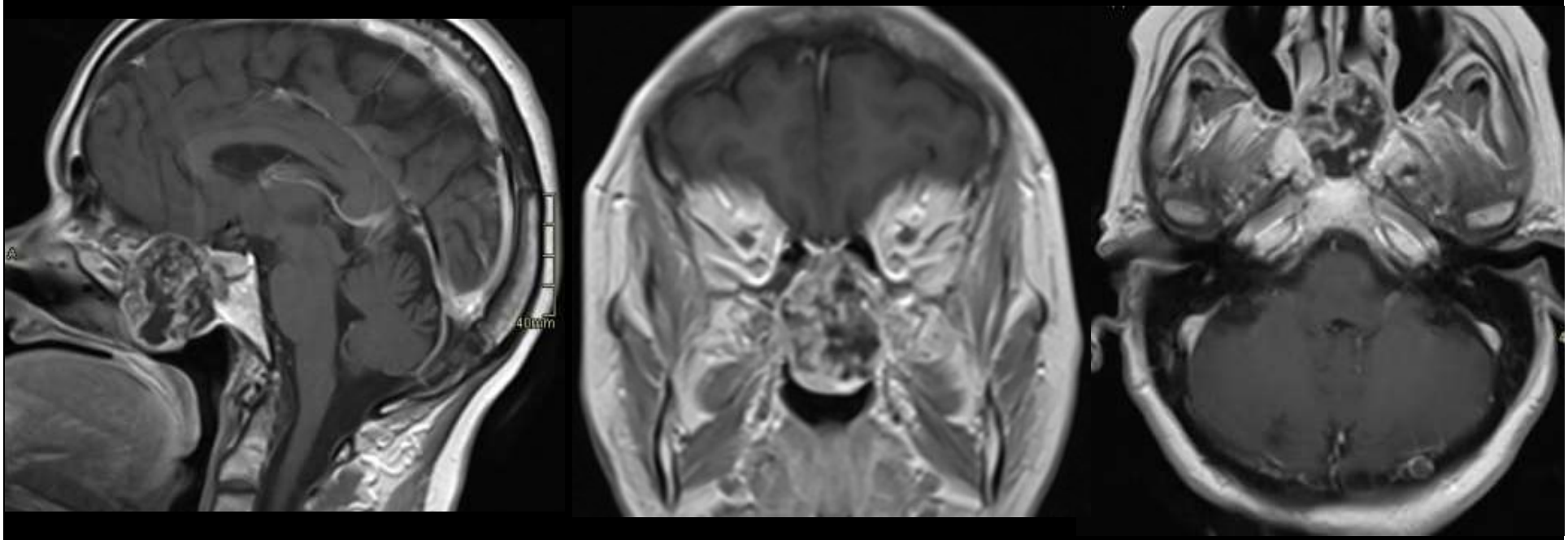


Case

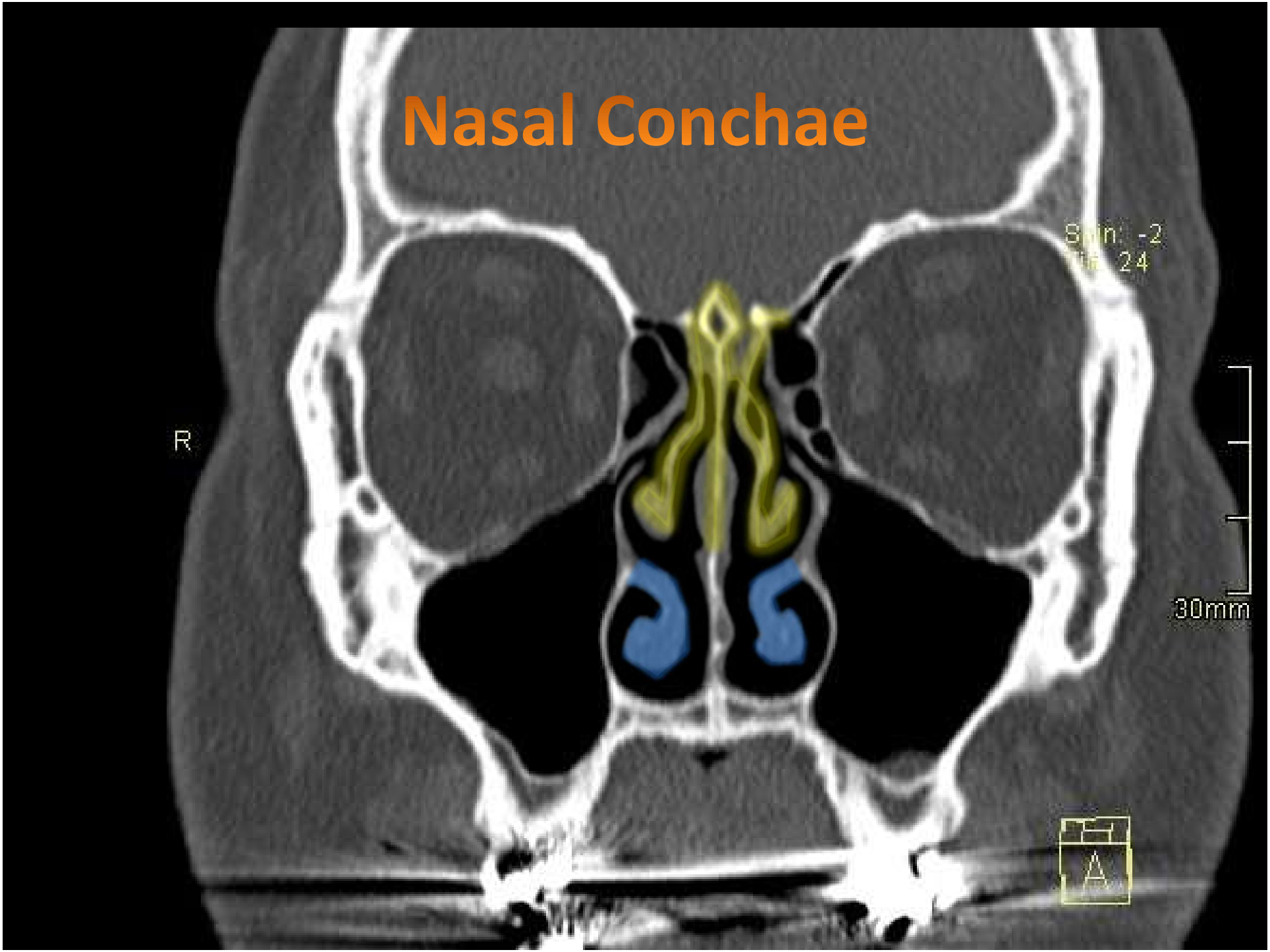


Case

Chondrosarcoma of the nasal septum



T1 Post gadolinium Sagittal, Coronal and Axial

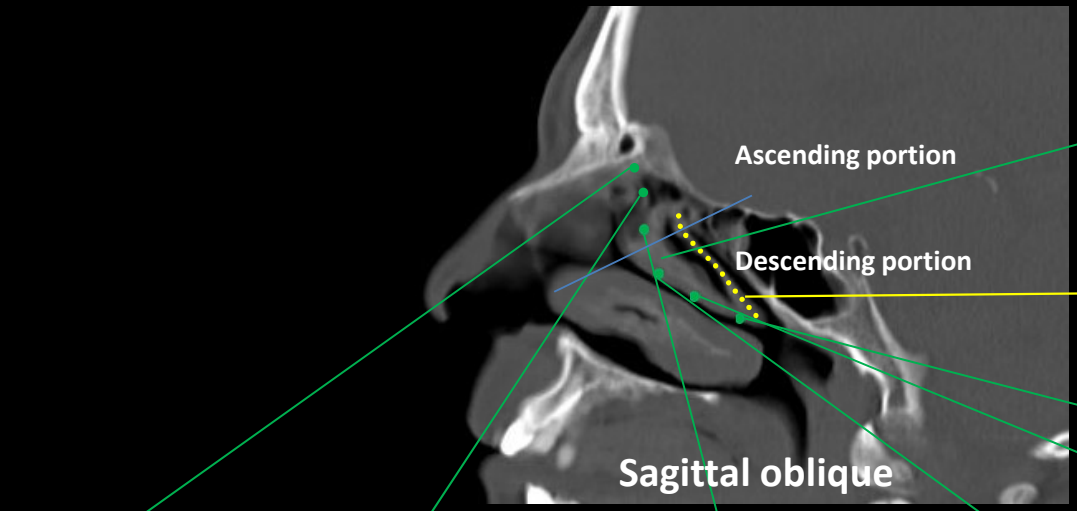

Nasal Conchae
R
30mm
A

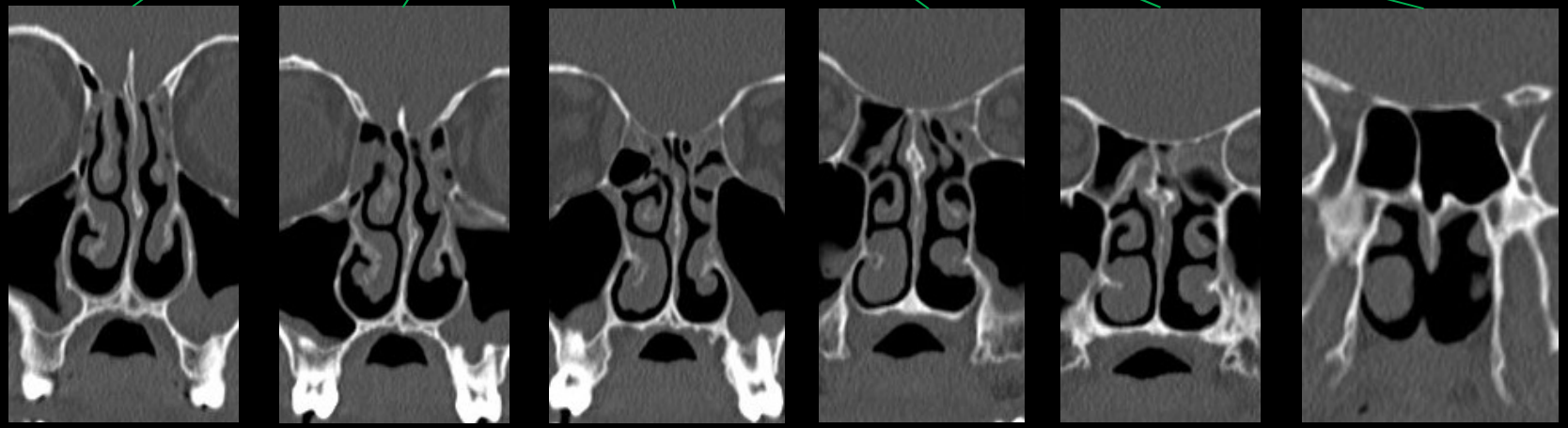
Lacrimal duct

Middle turbinate

- Length of the 5th finger
- Over the opening of the maxillary and ethmoid sinus – buffer for pressurised nasal airflow

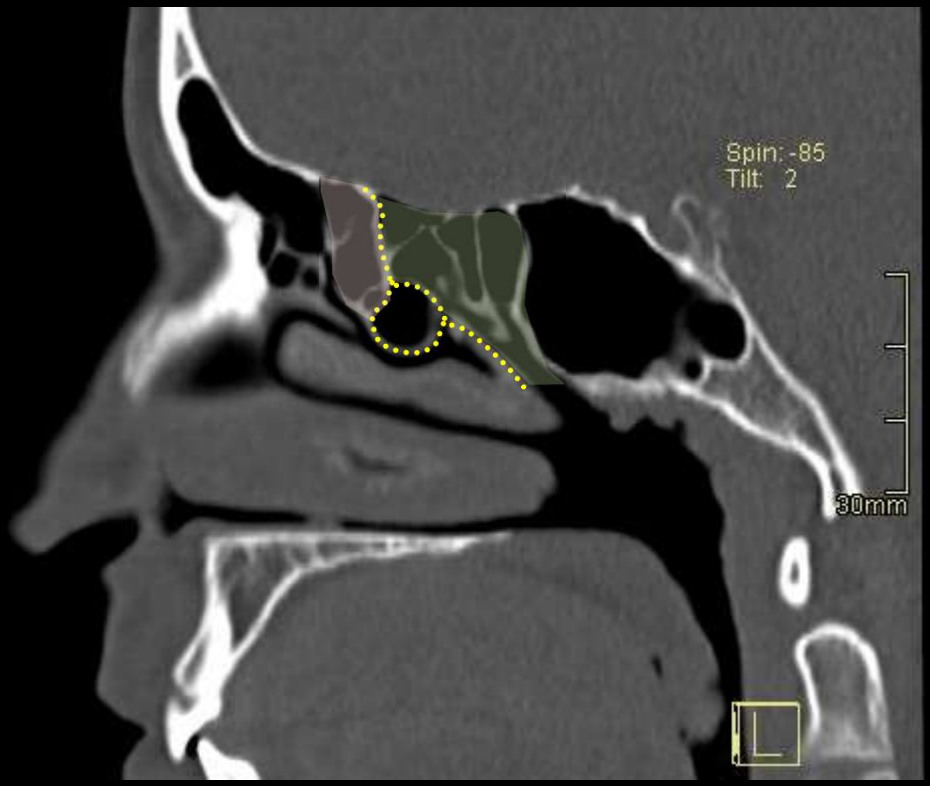
Attachment of the middle turbinate

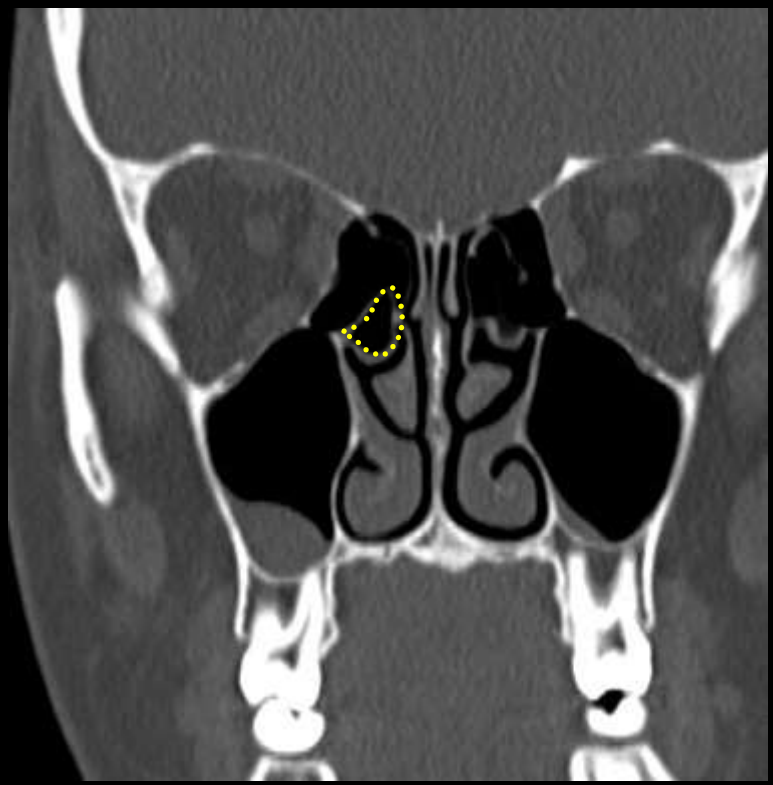




Sequential coronal imaging

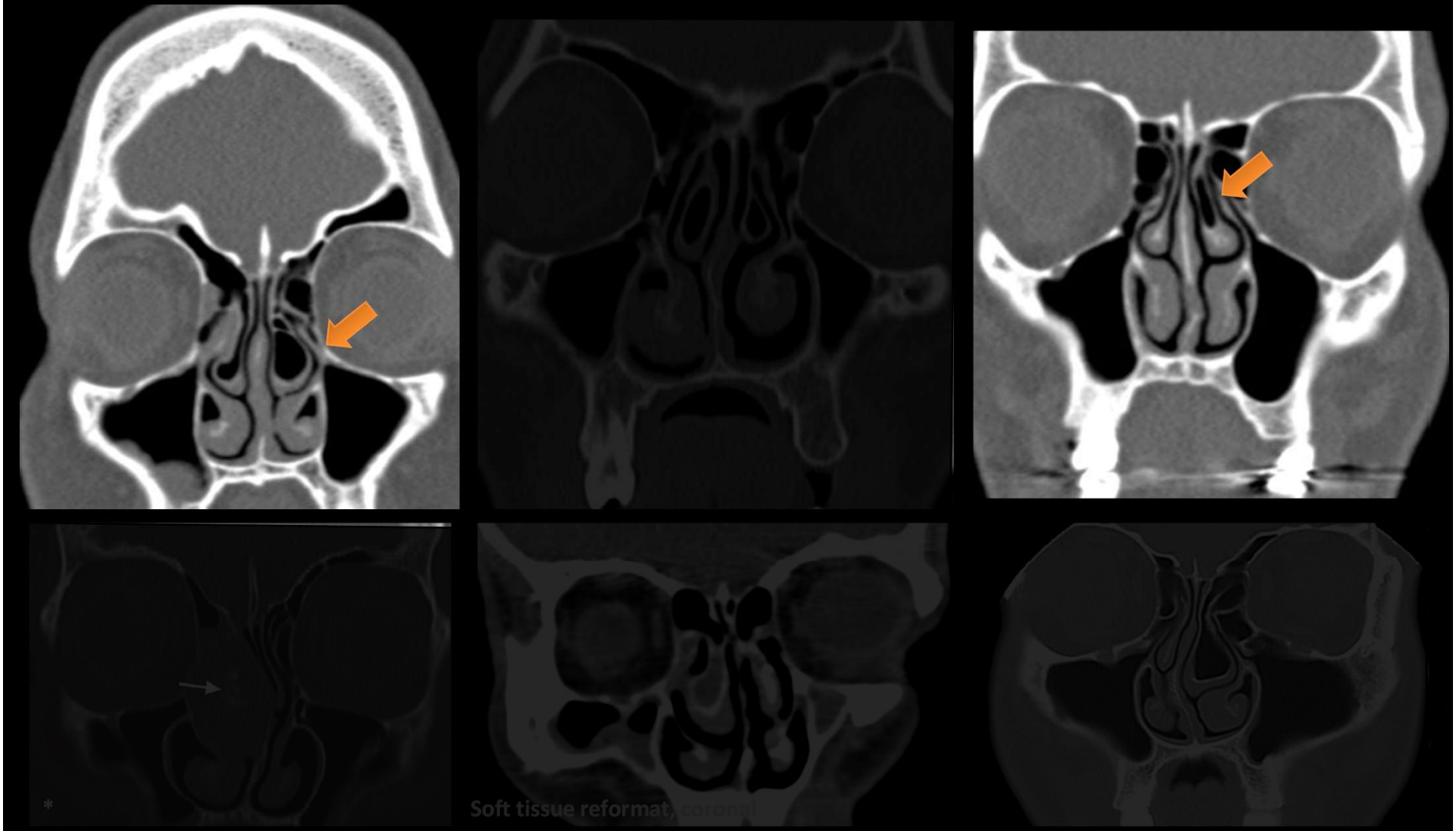
Basal Lamella





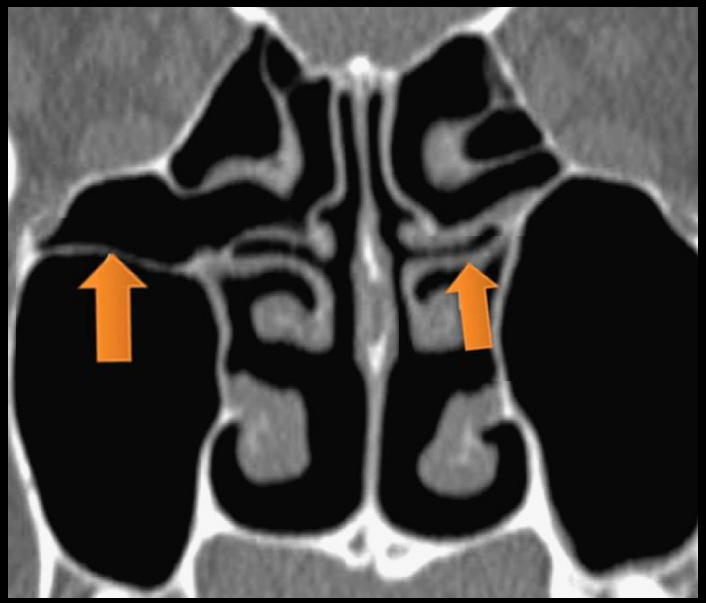
Middle turbinate - variation

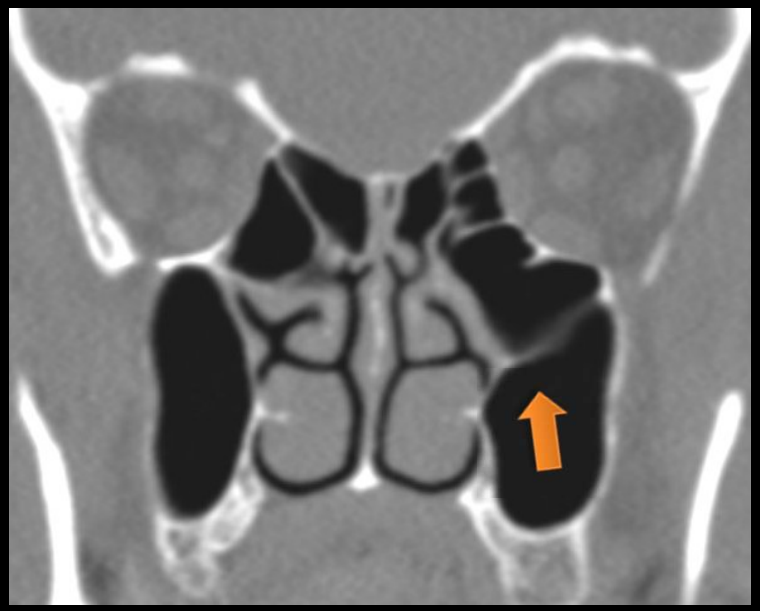
Middle turbinate - variation



*Hussain, S & Woo, Eric & Connor, SEJ. (2013). HEAD AND NECK IMAGING Sinonasal imaging. Imaging. 22. 20110001. 10.1259/imaging.

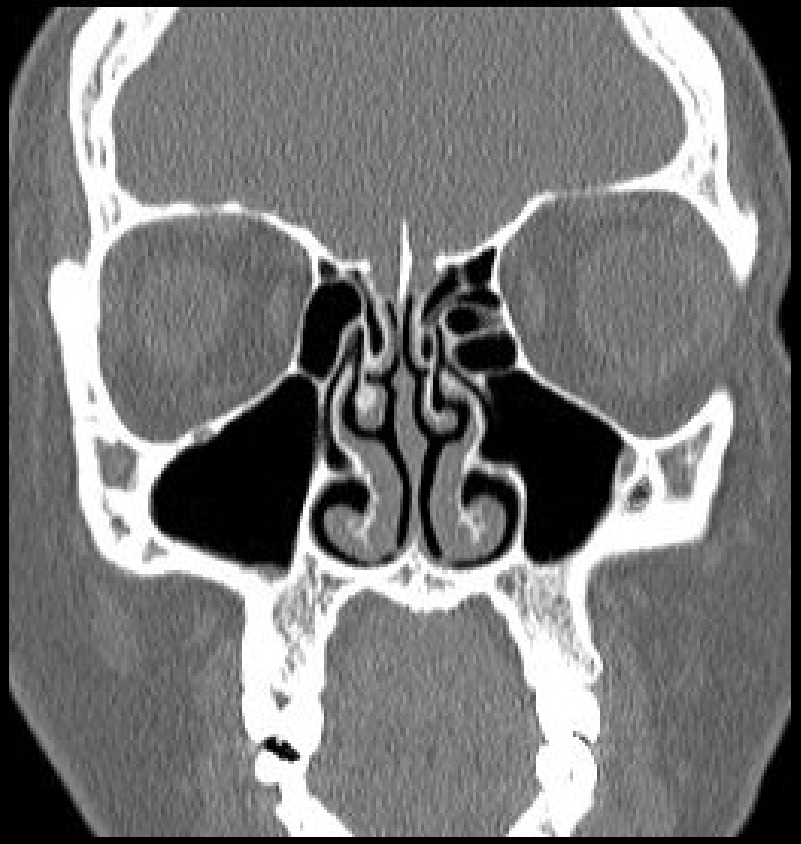
Missed Lamella

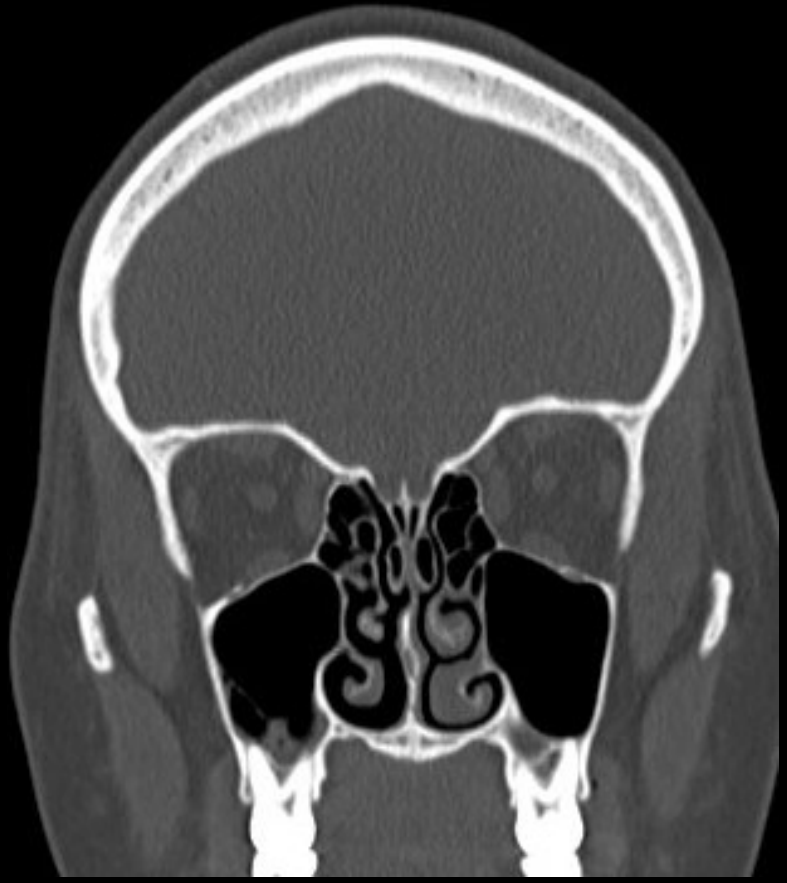




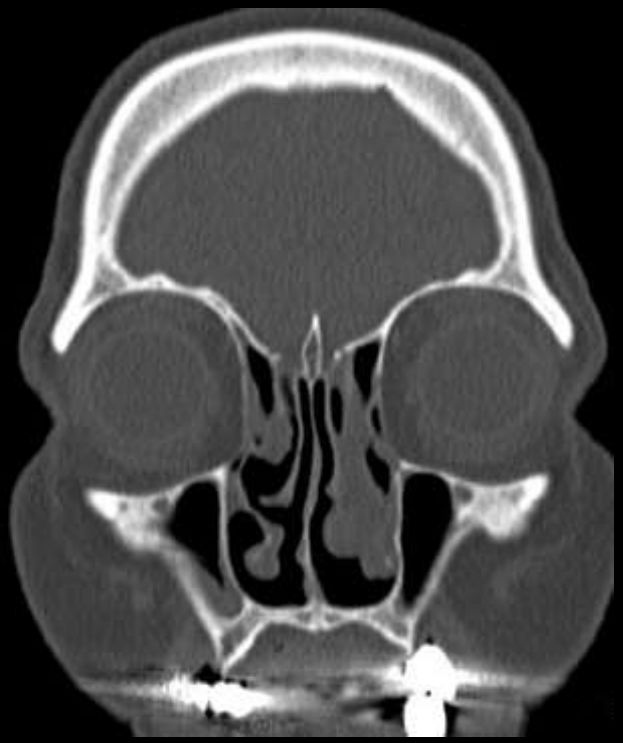
Coronal

Superior concha bullosa

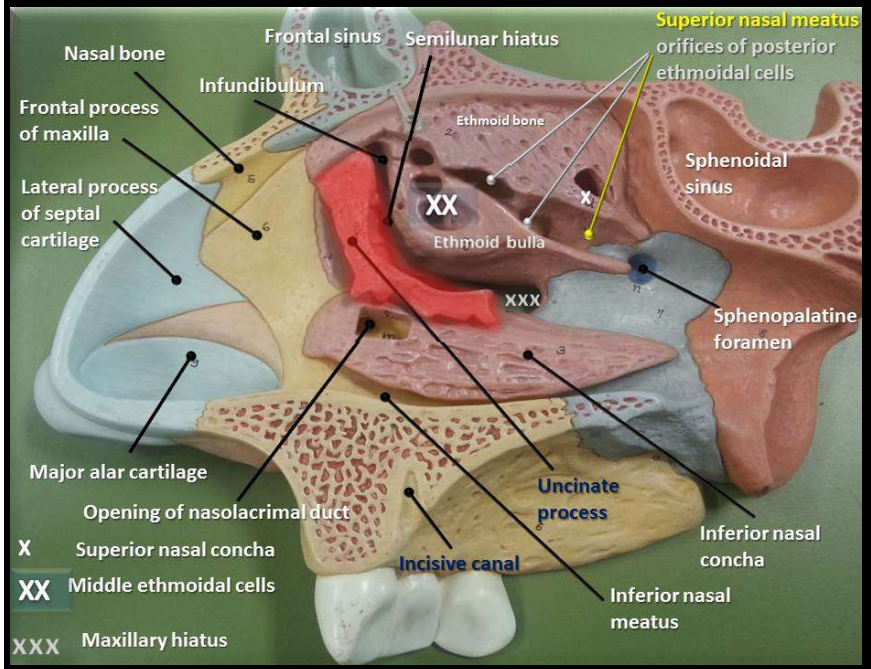




case



Uncinate process



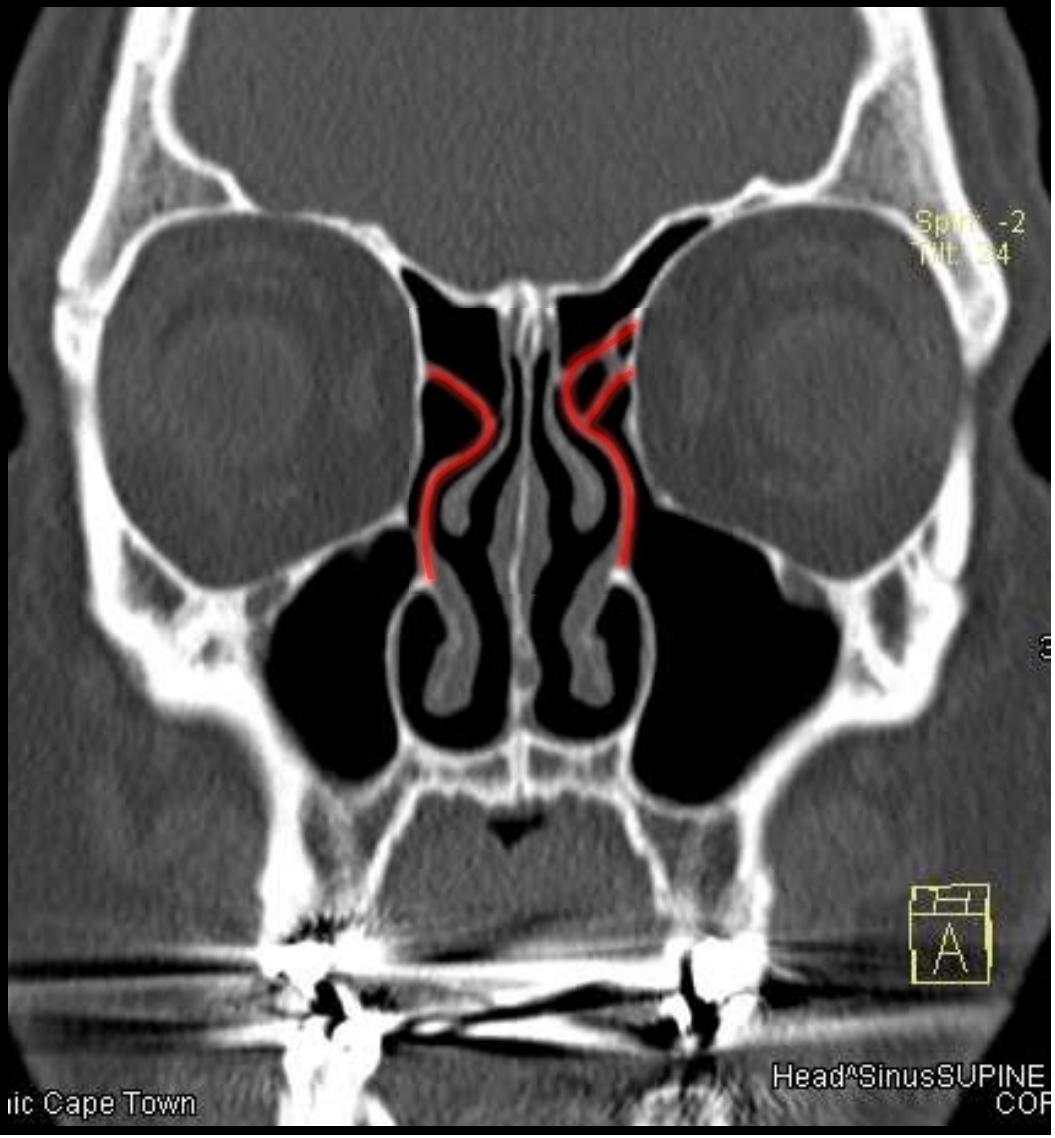
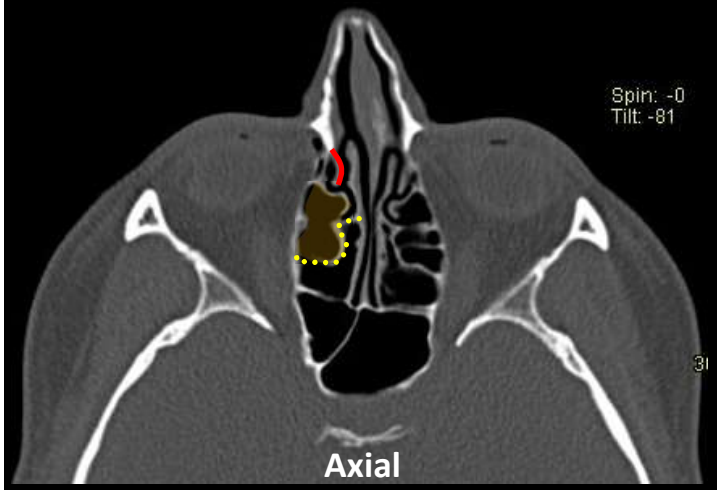


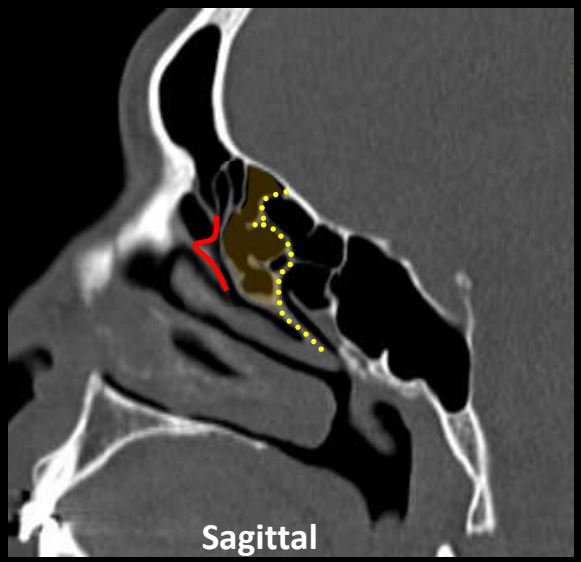
Image - Anatomy Human And Animals Education - heritance.me
Anatomy Of Uncinate Process Nose And Paranasal Sinuses E La

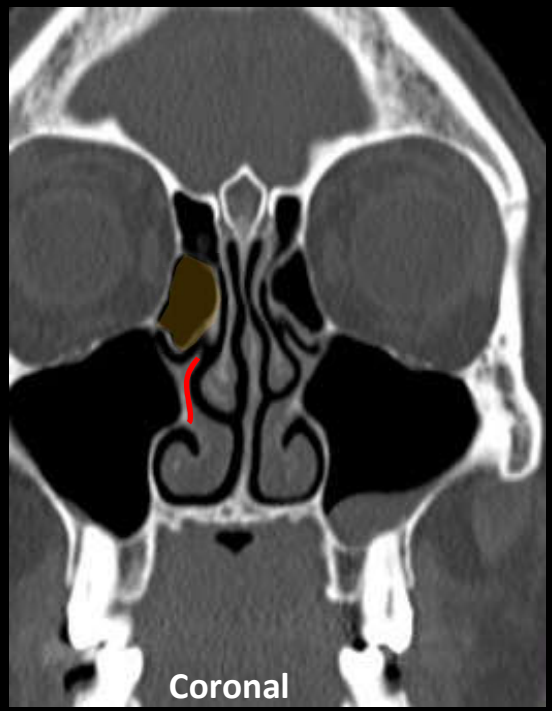
Uncinate process variation

Ethmoid bulla

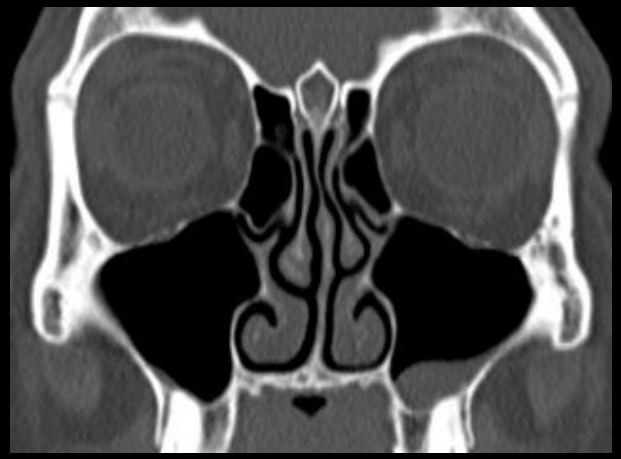
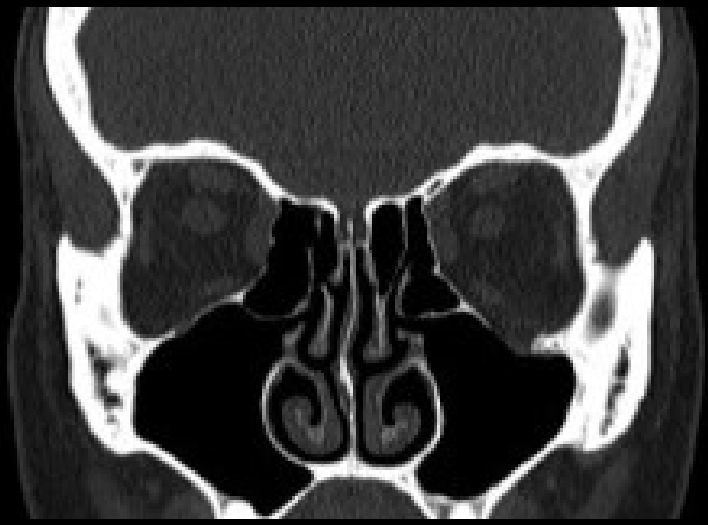
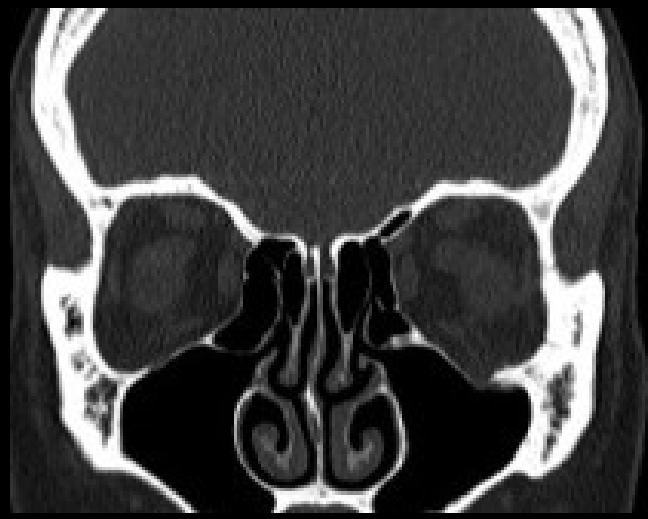
- The most posterior of all the anterior ethmoid air cells, roof of the hiatus semilunaris and posterior ethmoid infundibulum
- Derived pneumatisation of the 2nd basal lamella



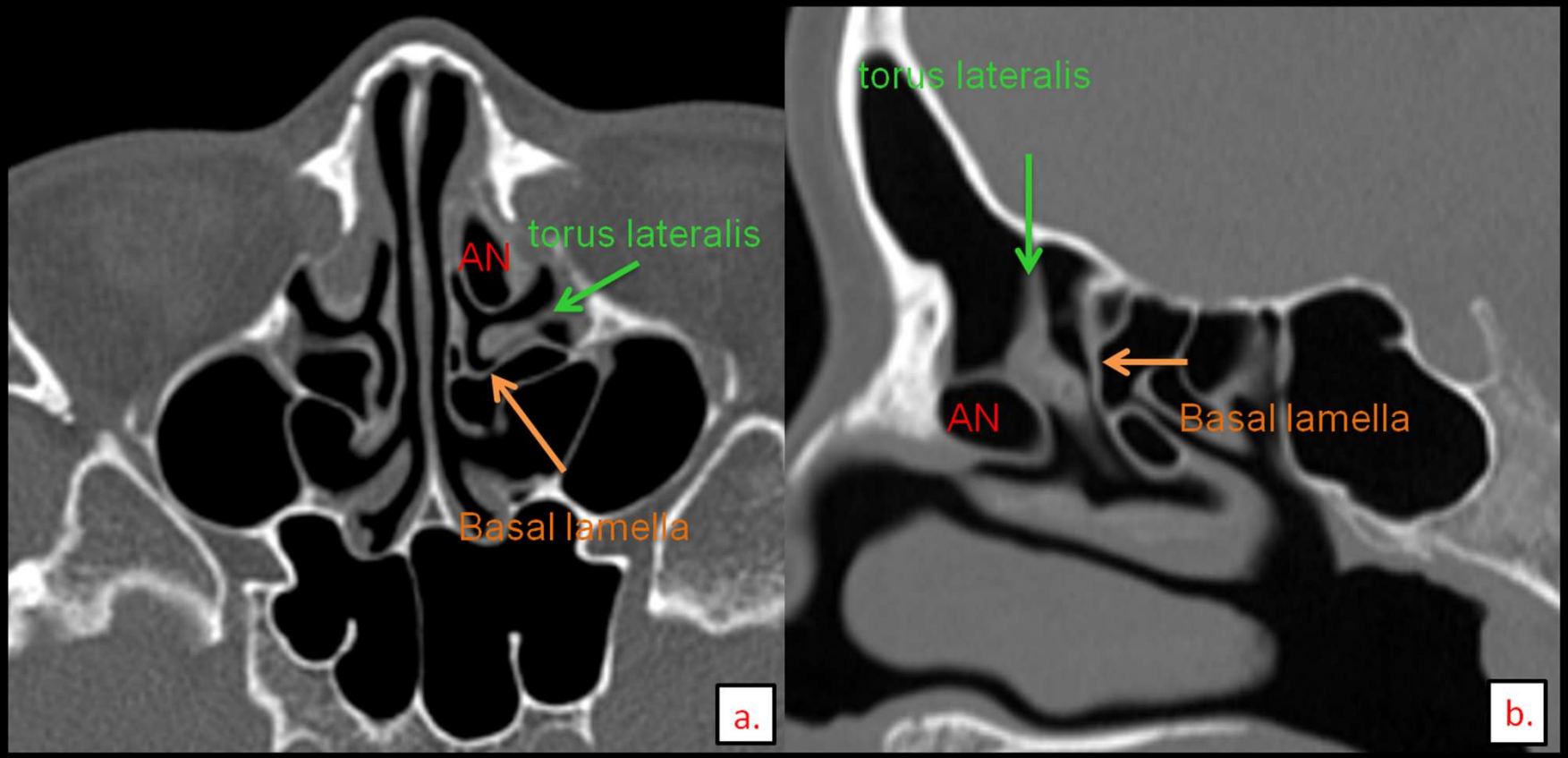




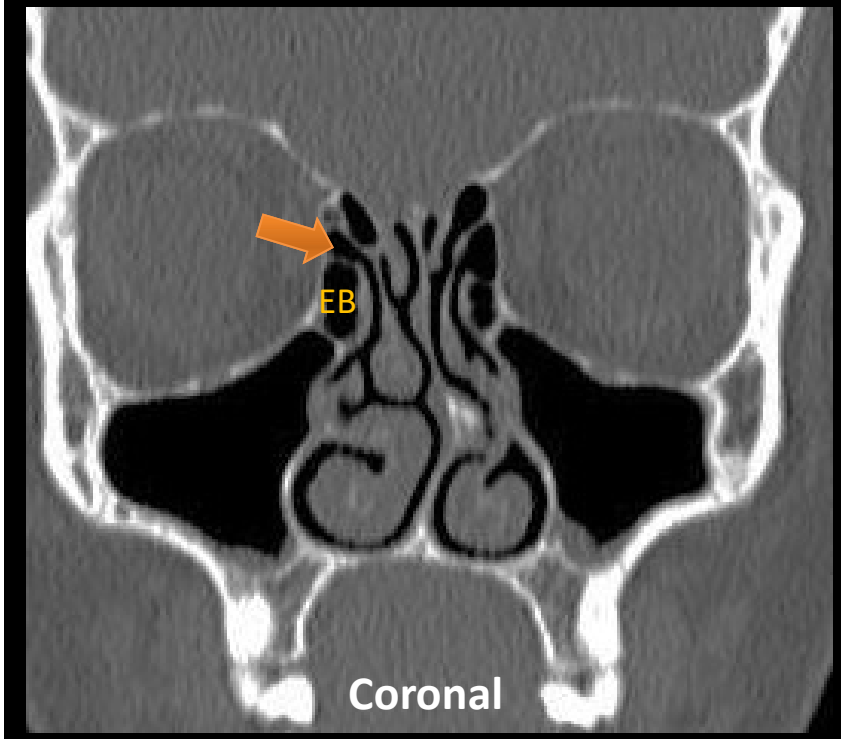
Uncinate process
Ethmoid bulla
Basal lamella middle turbinate

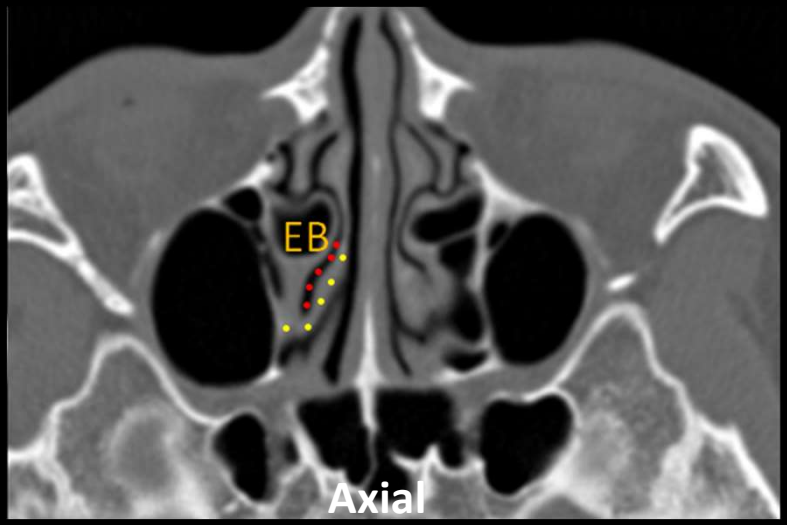





Ethmoid bulla

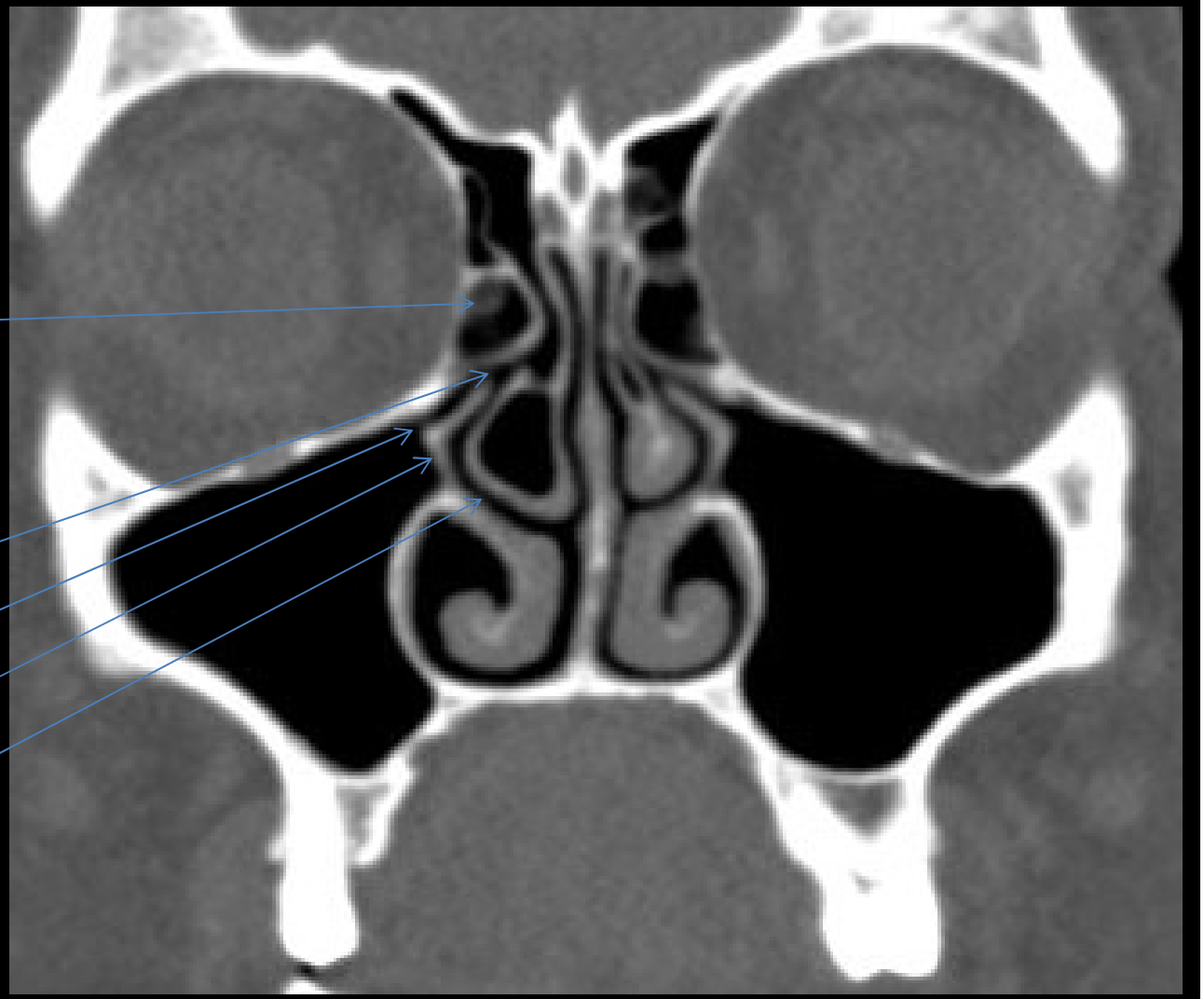


Suprabullar recess / sinus Lateralis



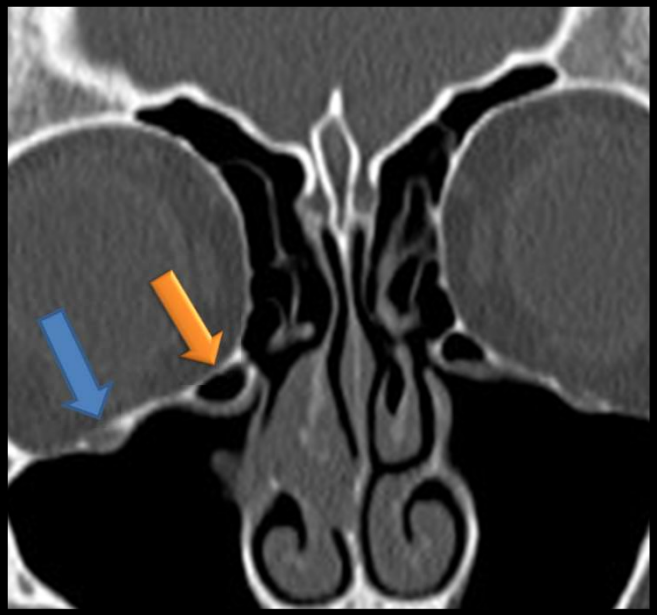


Osteomeatal complex

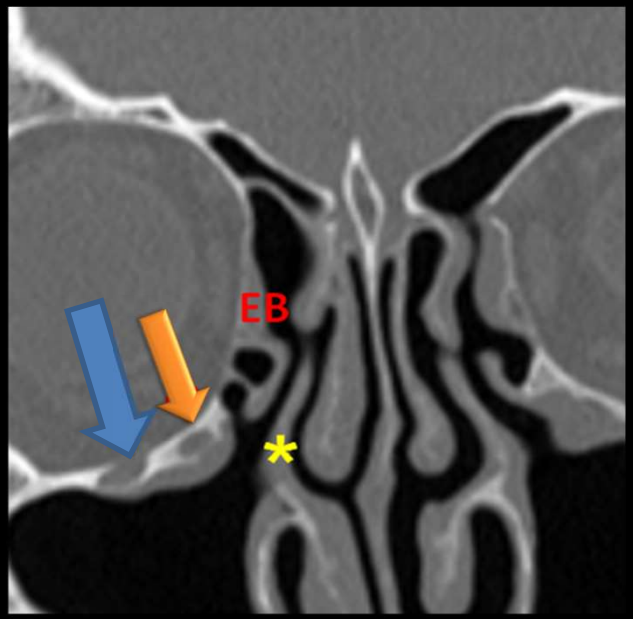


Haller cell

‘Invasive pneumatisation of the floor of orbit’



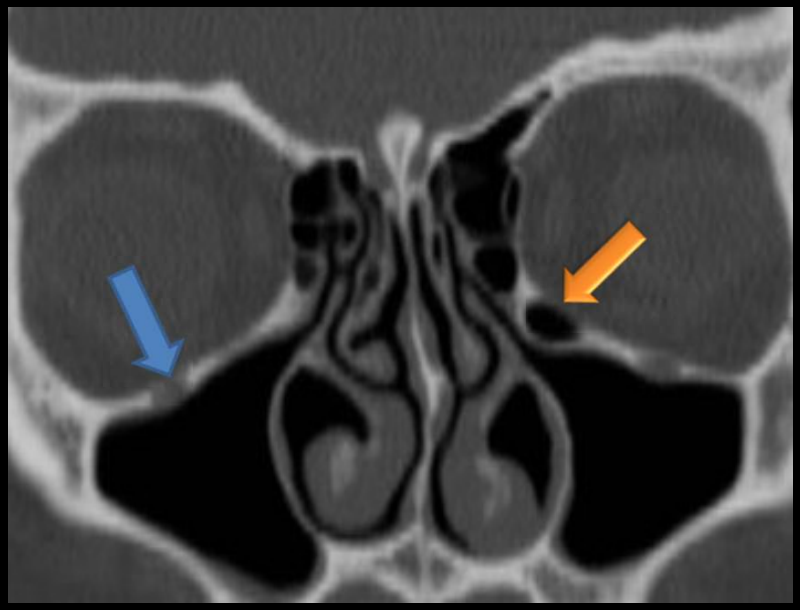
Coronal



Coronal

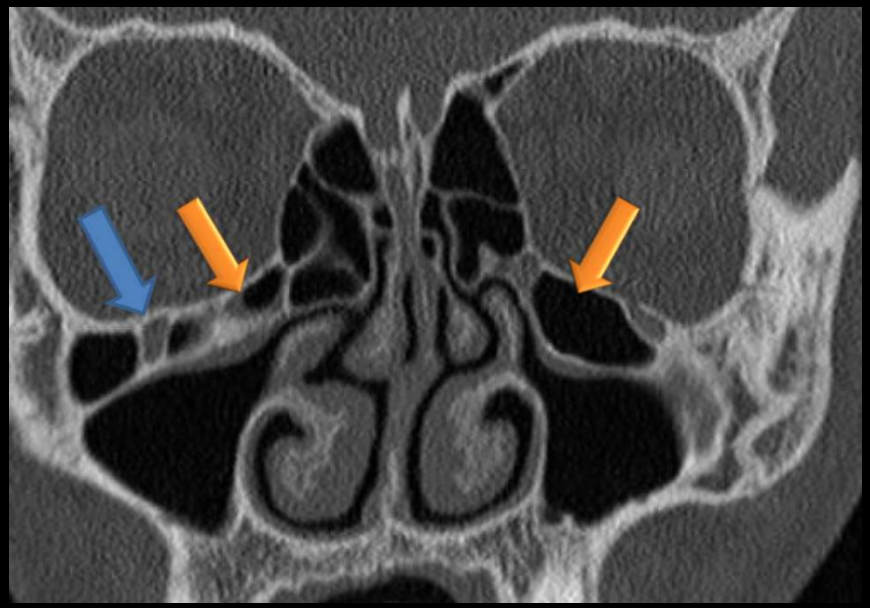
Haller cells

Case 1



Coronal

Case 2



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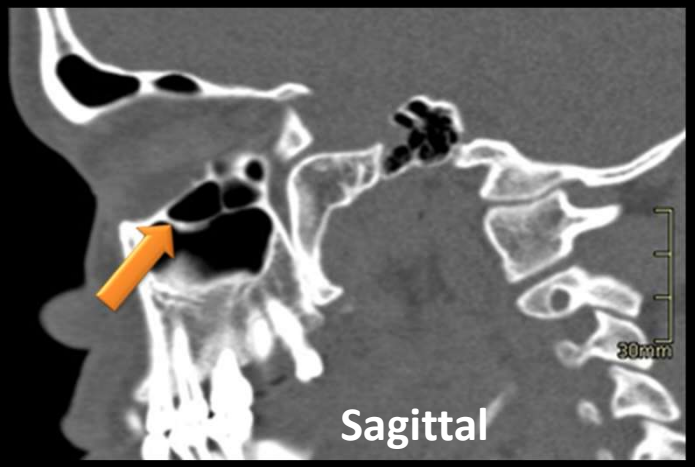
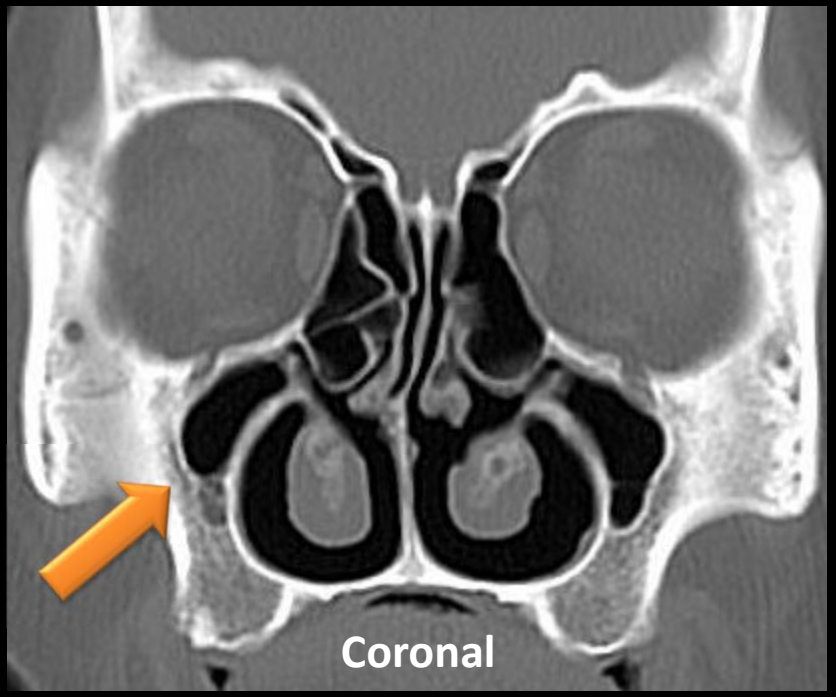


Sagittal

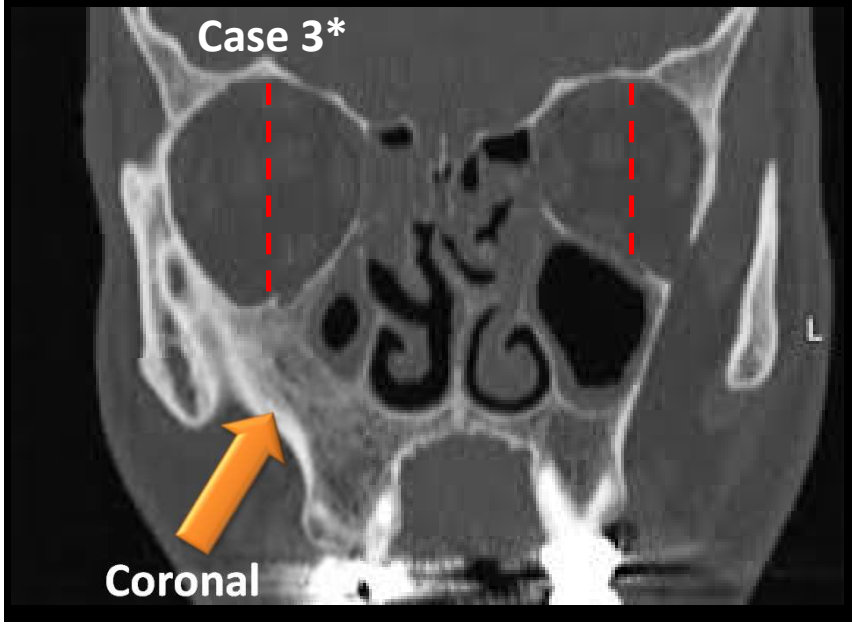
Maxilla

Case 1

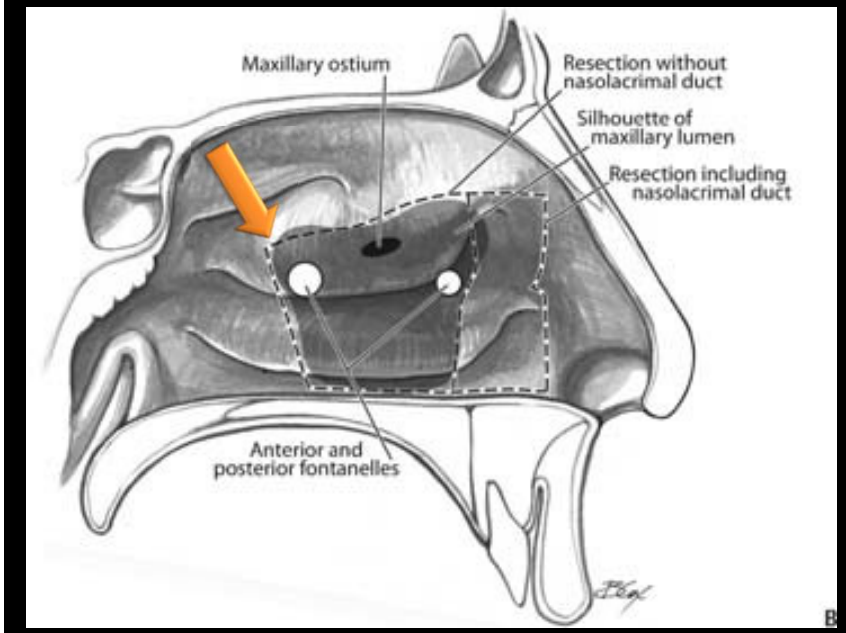
Case 2

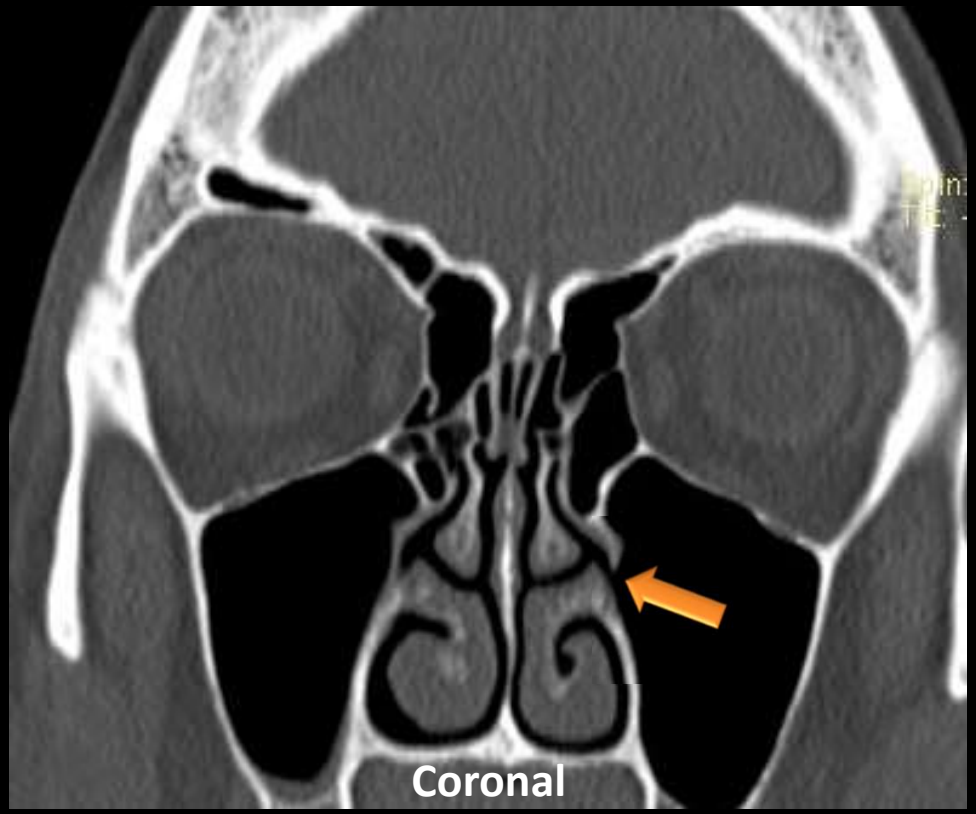


Case 3*

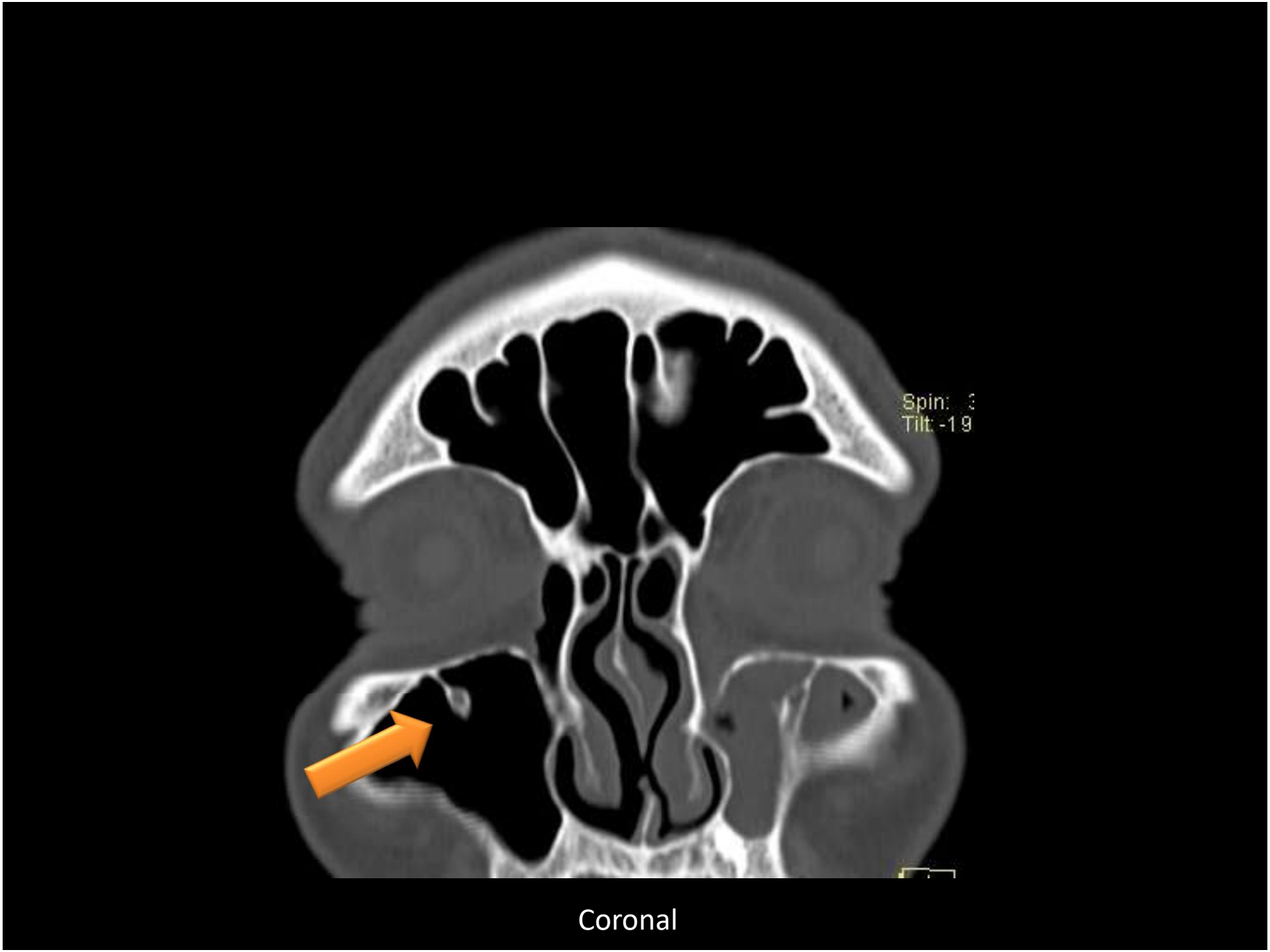


*Anatomy and Related Pitfalls in Sinus Floor Elevation; pocket densitry.com



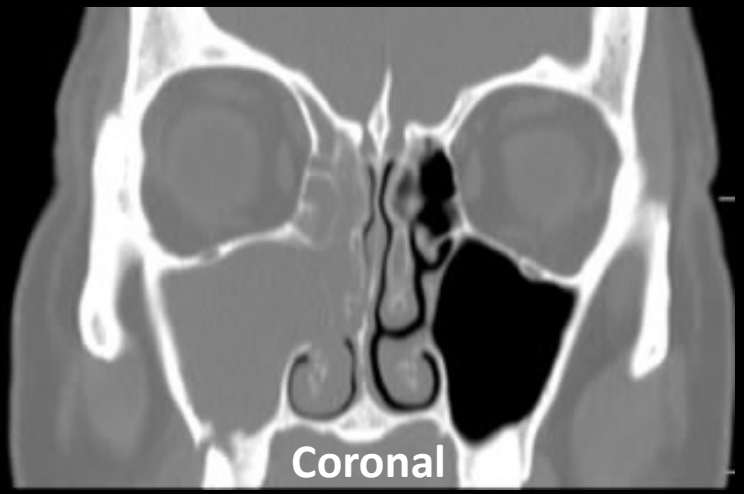


*Amir Minovi and Wolfgang Draf; Primary Endoscopic Surgery of the Maxillary Sinus

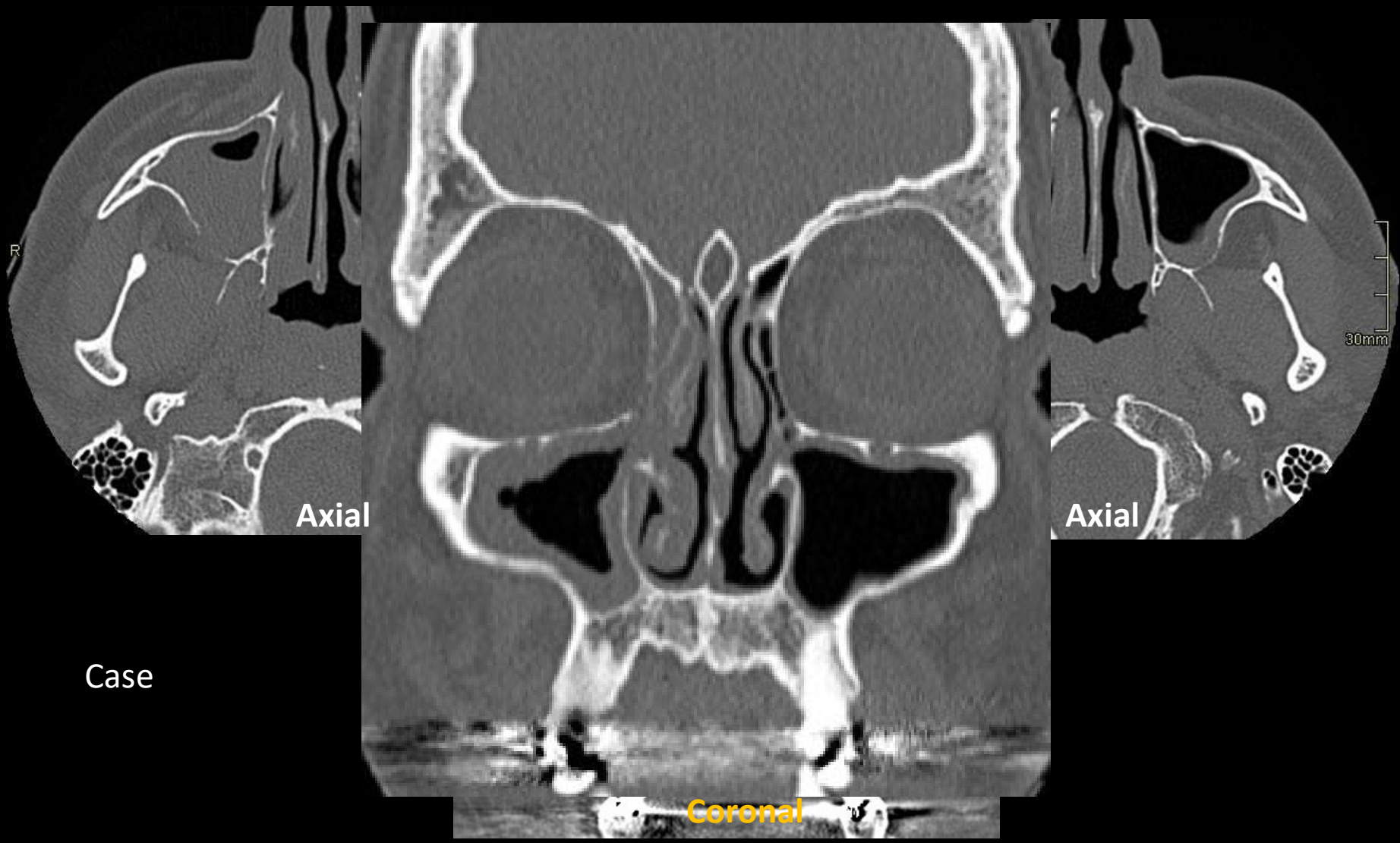


Coronal

Teeth and the maxillary antrum

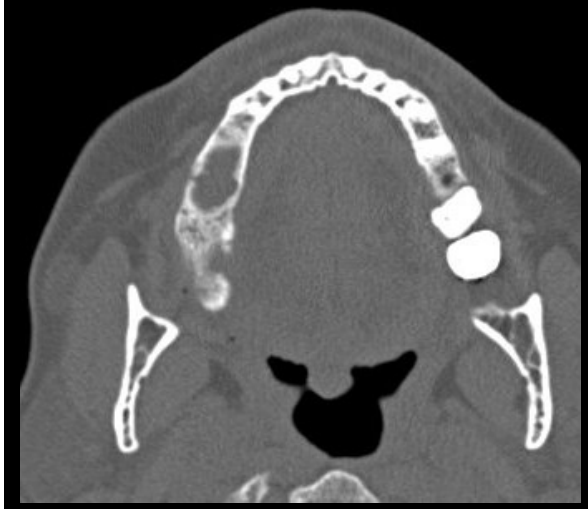


Oro-antral fistula following tooth extraction

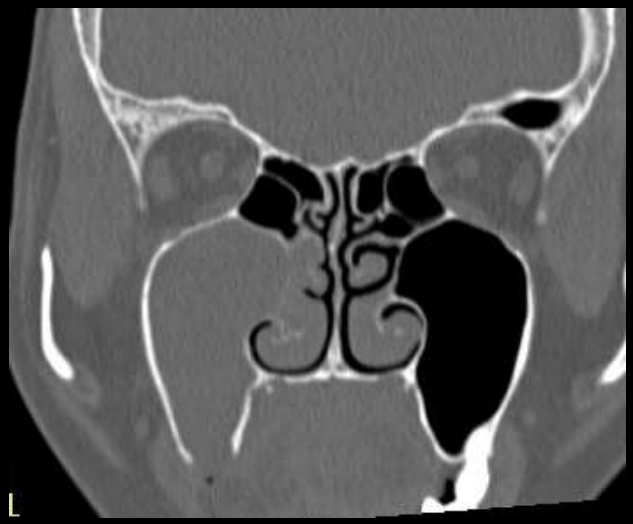


Case

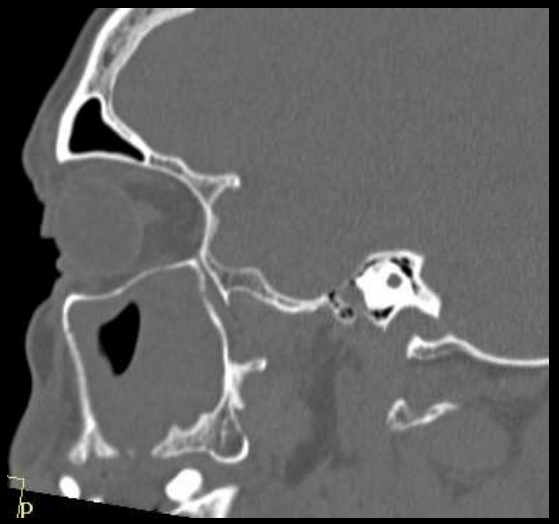
Osteitis post complicated dental extraction



Axial



Coronal

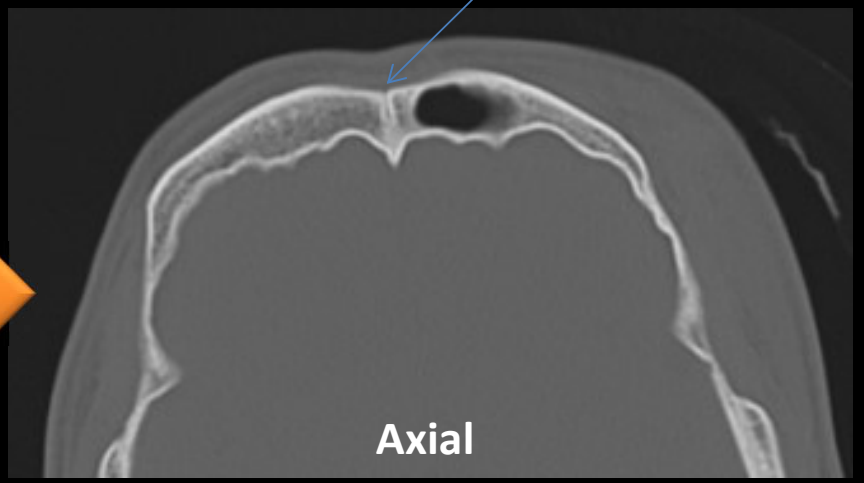


Sagittal

Frontal sinus

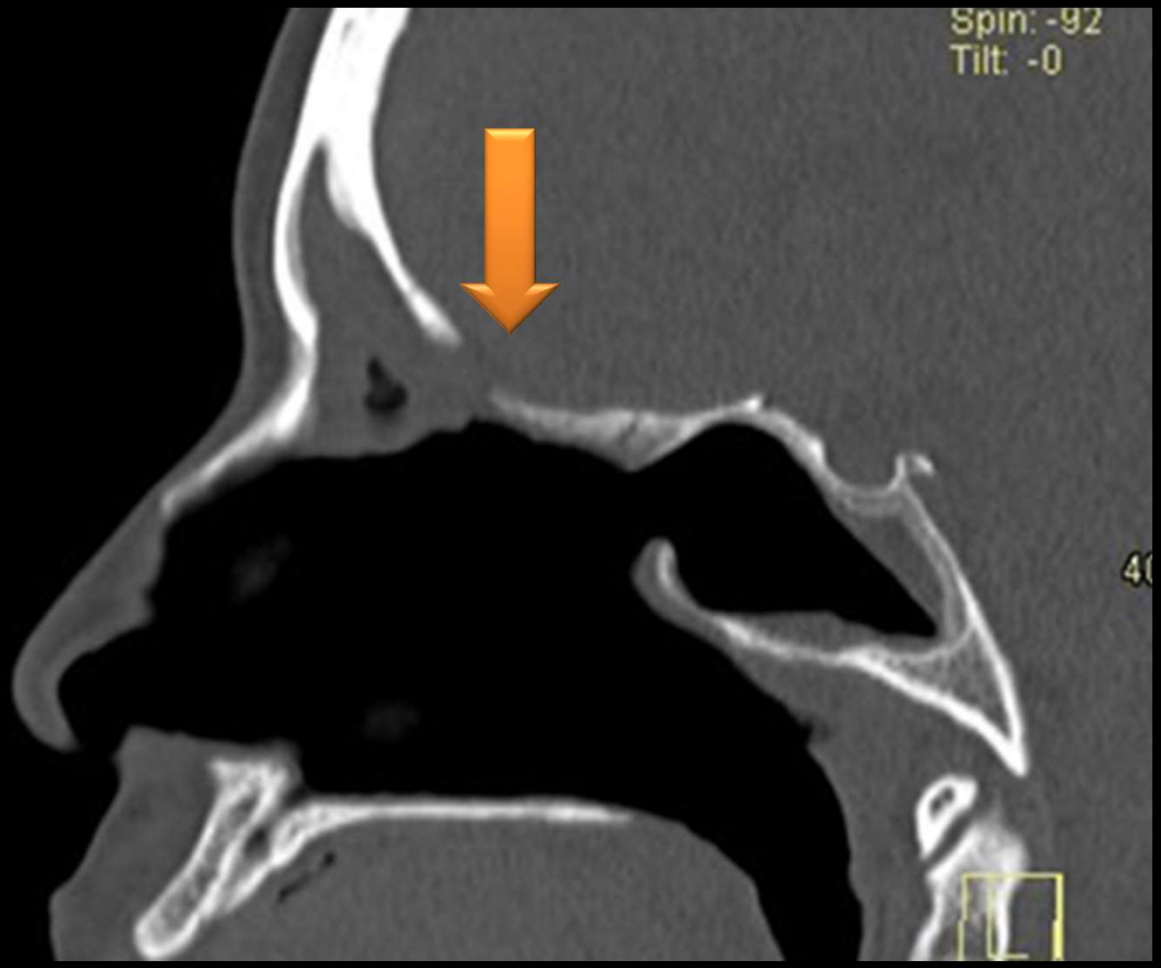
Coronal

Metopic suture



Axial

Frontal sinus

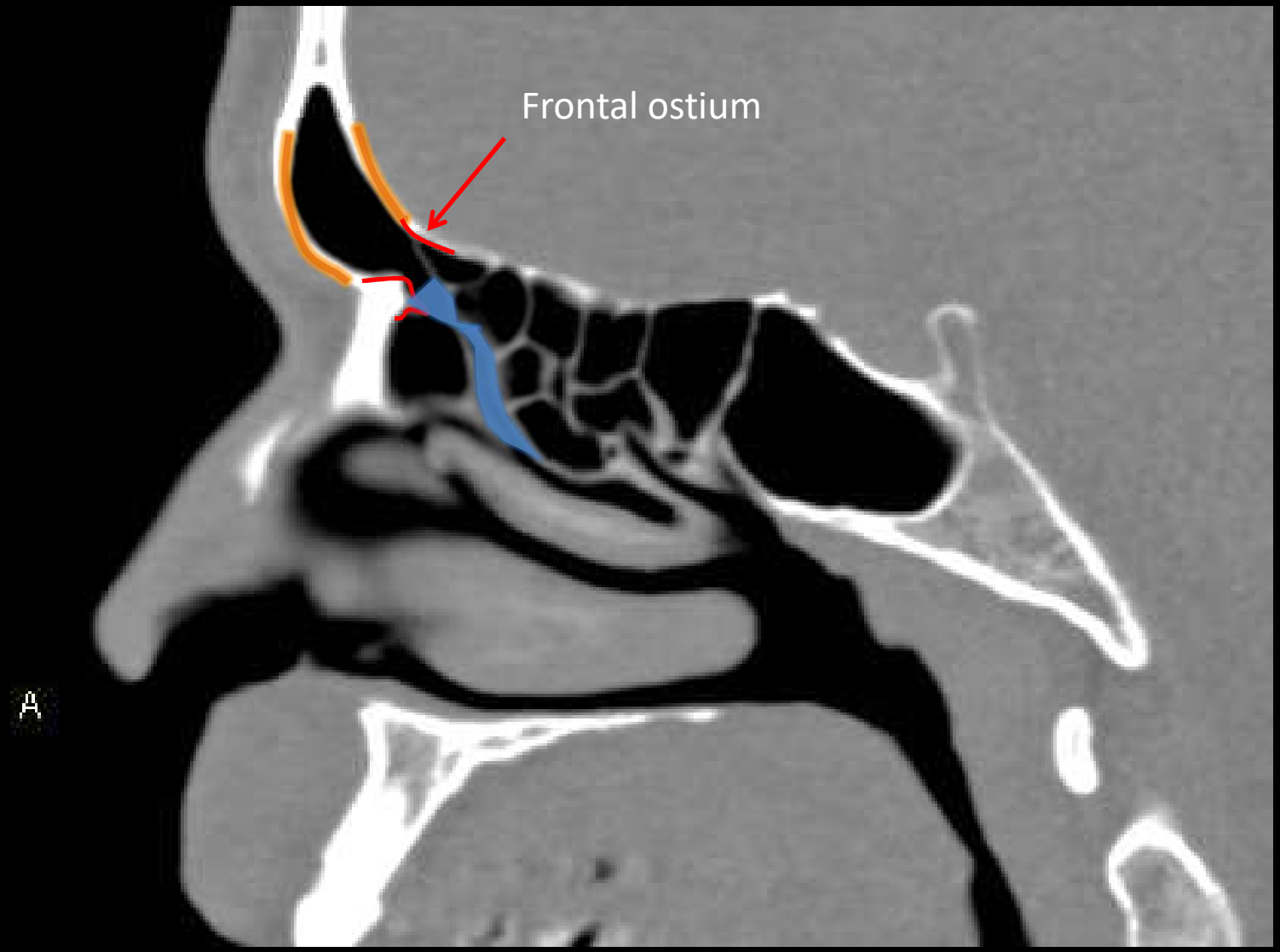


- Anterior ethmoid aircells may invade the interfrontal sinus septae, crista galli

Frontal drainage pathway

- Frontal process of the maxilla extends superiorly and forms the frontal nasal process / frontal beak
- Size of beak determine the ostium size

Frontal sinus drainage pathway

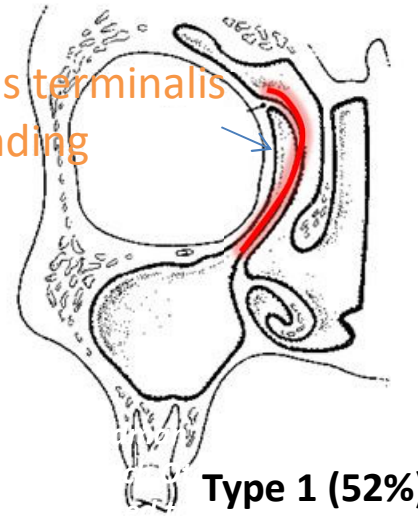


Superior attachment Uncinate Process

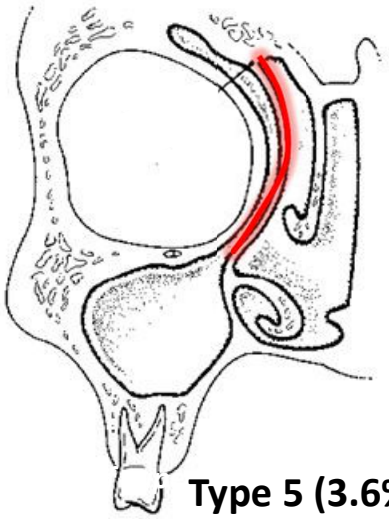
Type 2*

Type 5 *

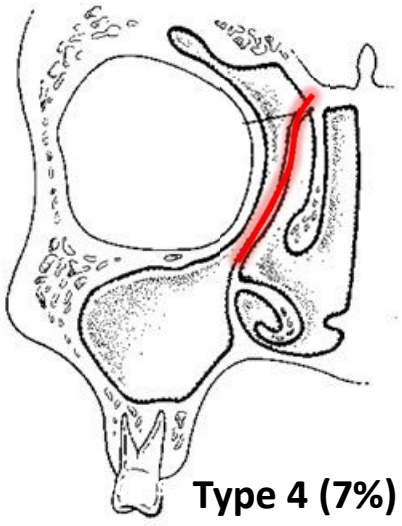
Recessus terminalis
Blind ending



Type 1 (52%)



Type 5 (3.6%)

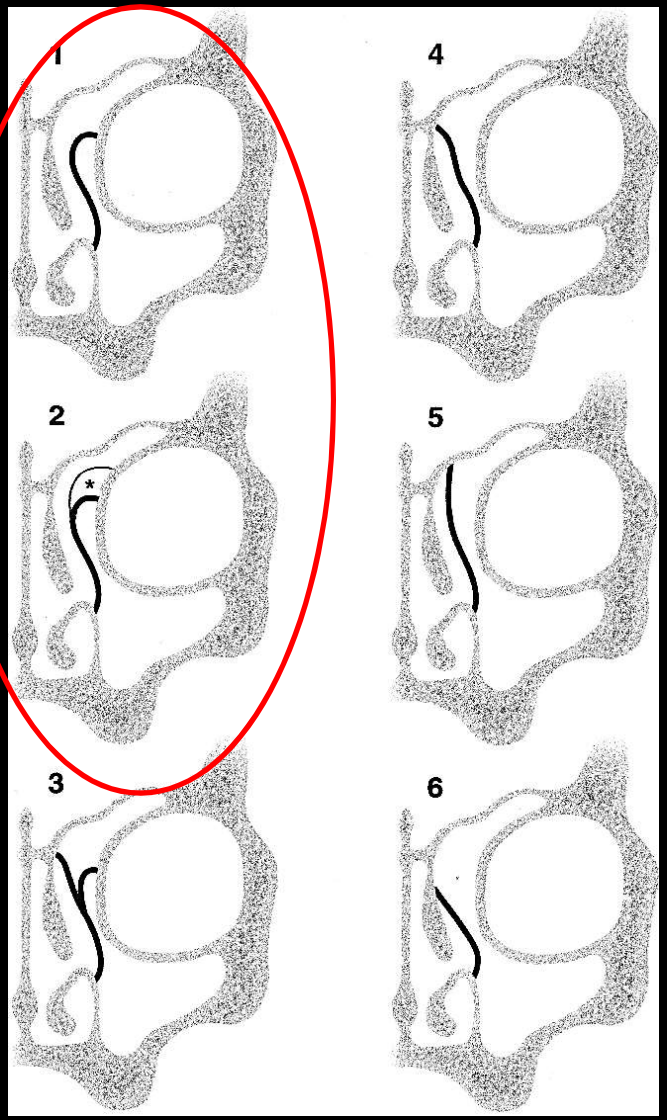


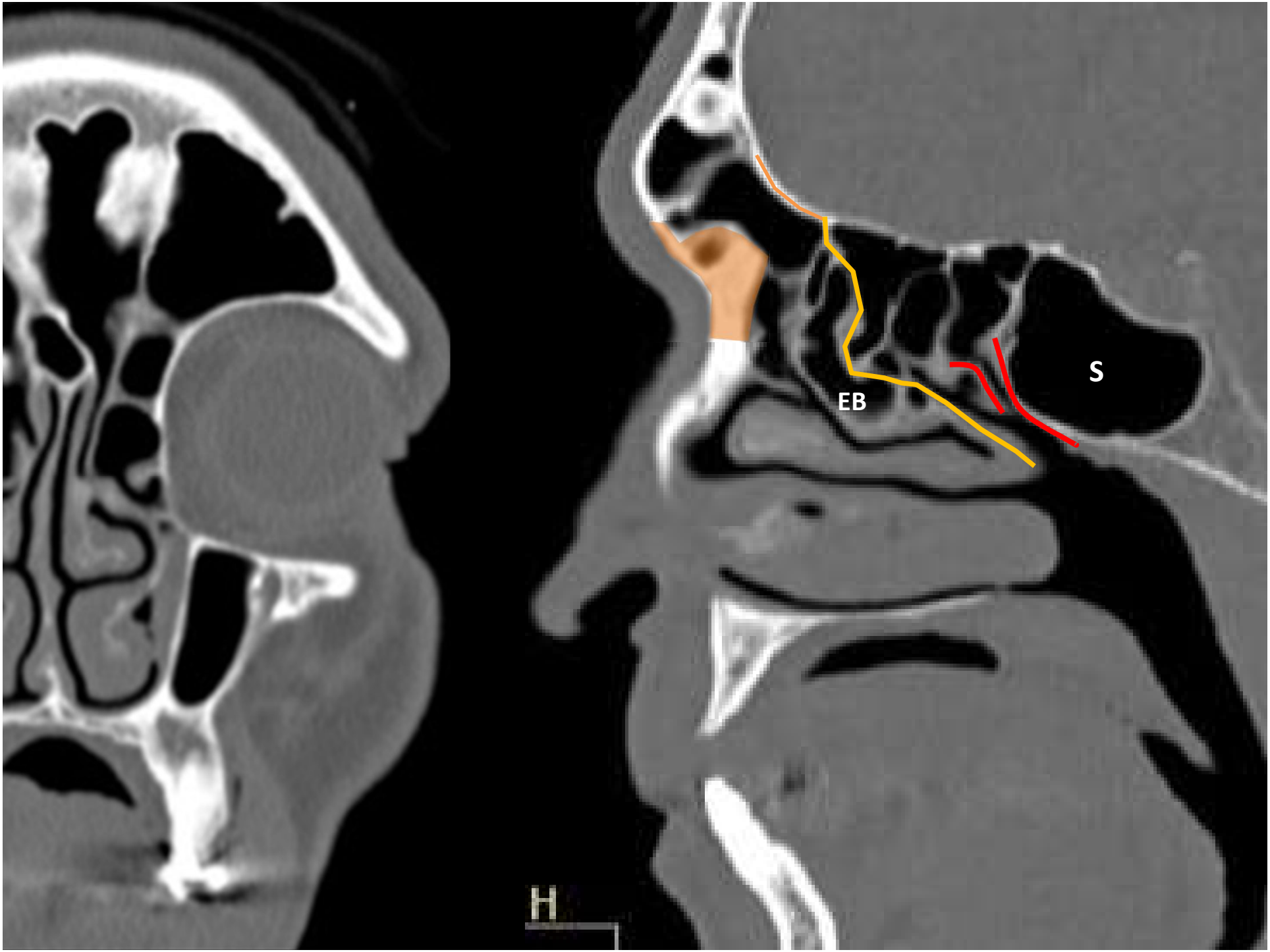
Type 4 (7%)

*Lansberg
*Cheng et
turbinate:
middle

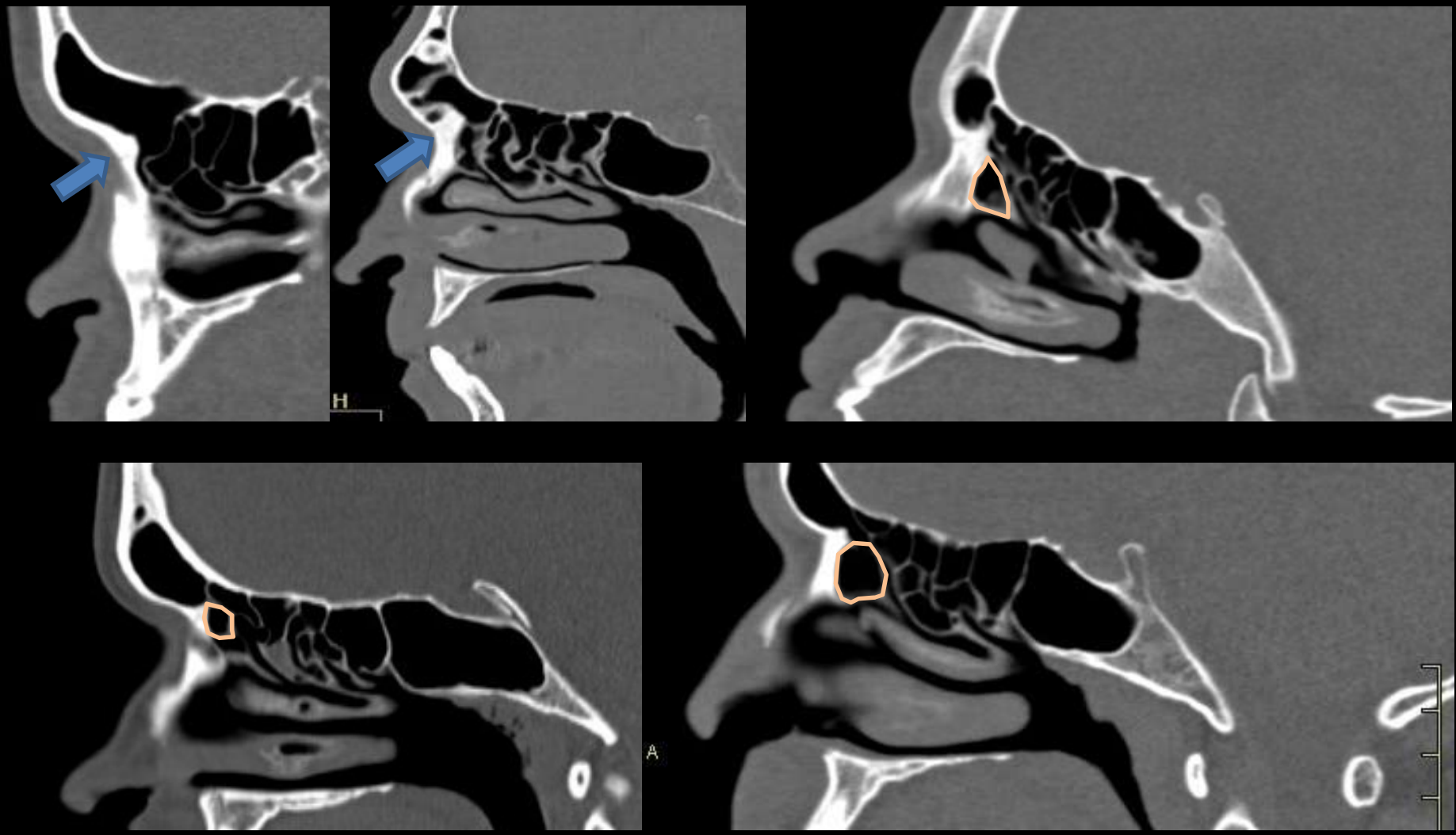
Superior attachment
Uncinate process

- Lansberg and Friedman classification




S
EB
H

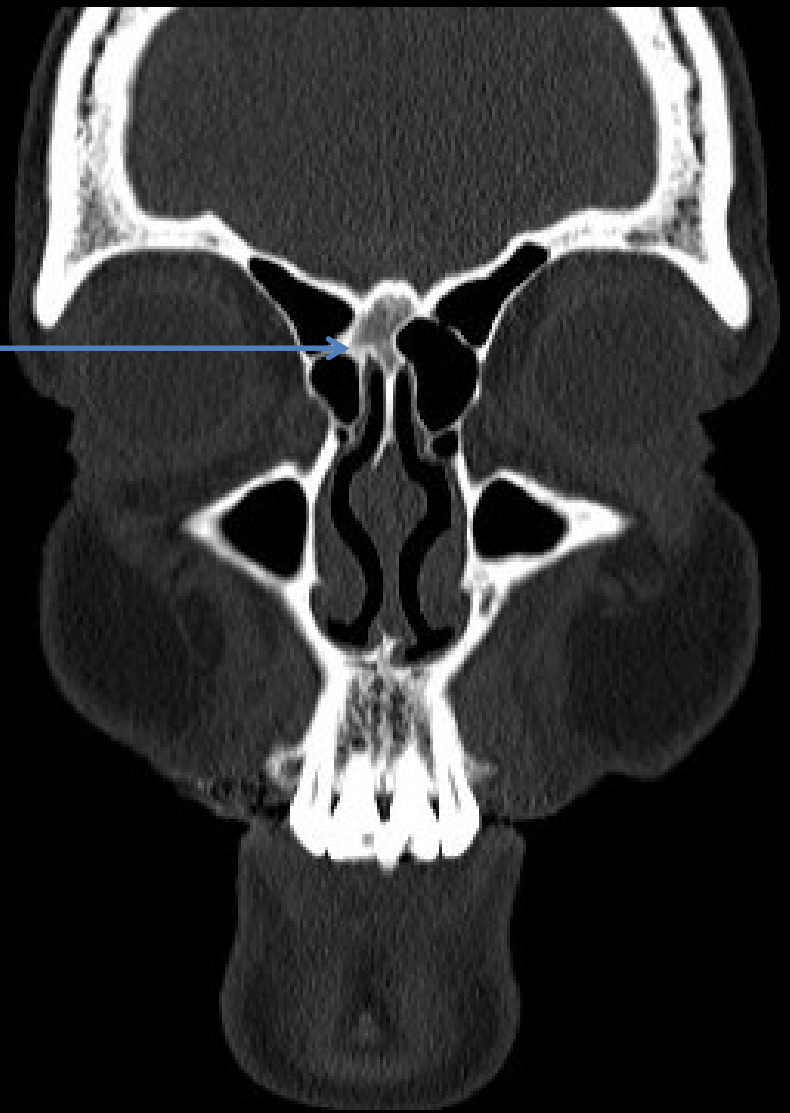
Frontal sinus drainage pathway



Agger nasi cell

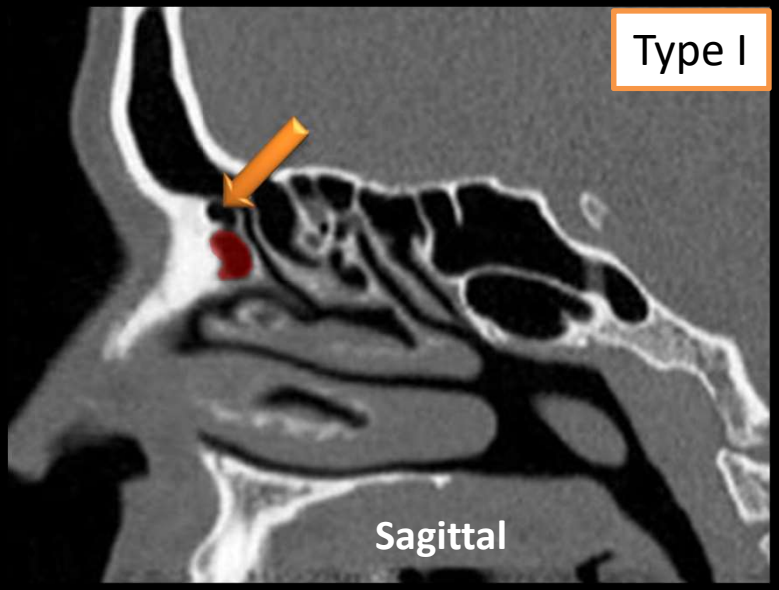
Coronal –

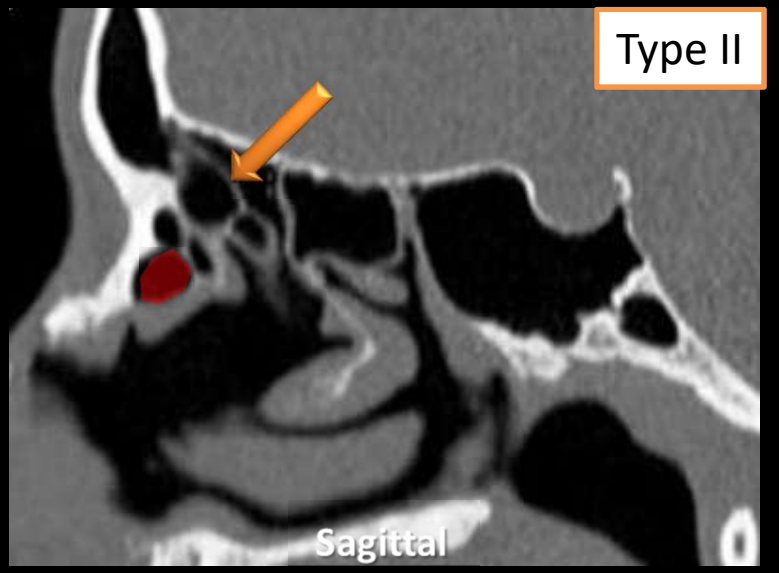
- Air cell *BELOW* the frontal beak
- Before the anterior superior attachment of the middle turbinate

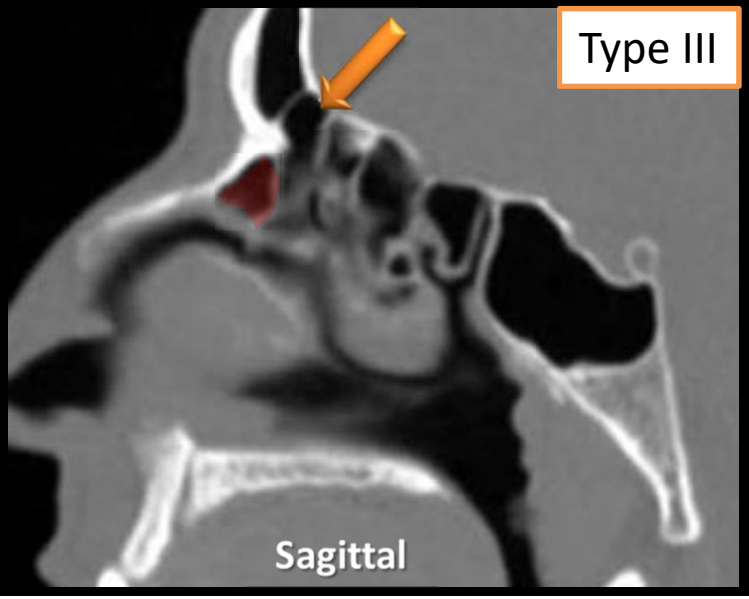


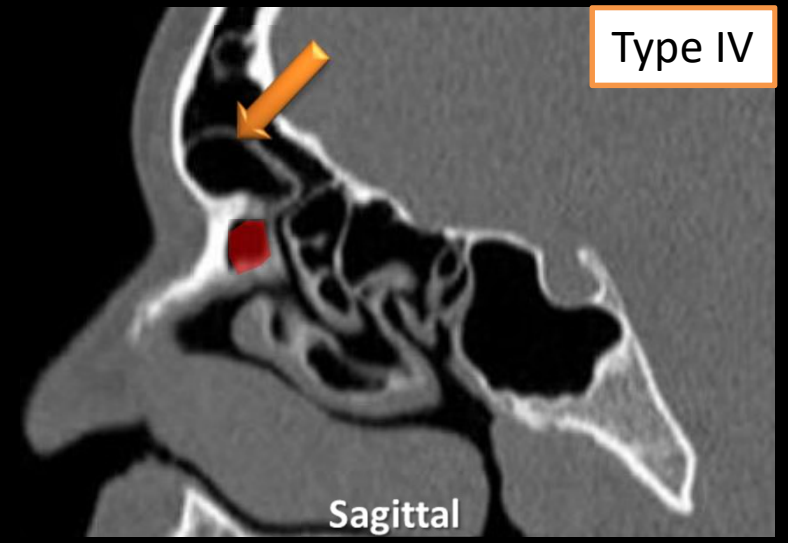
Coronal

Fronto-ethmoidal air cells

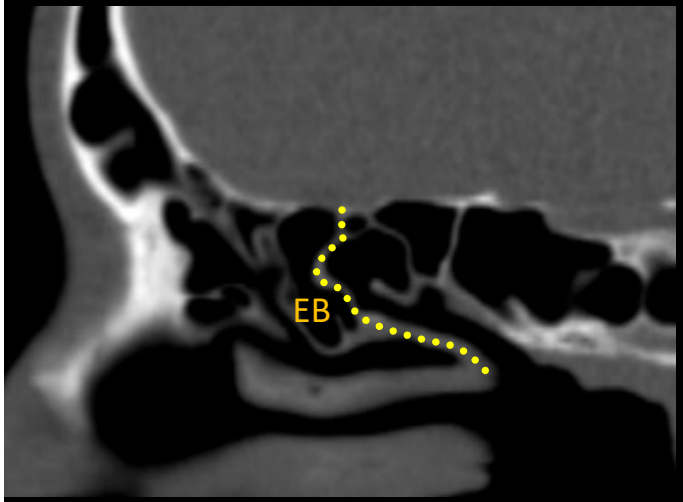




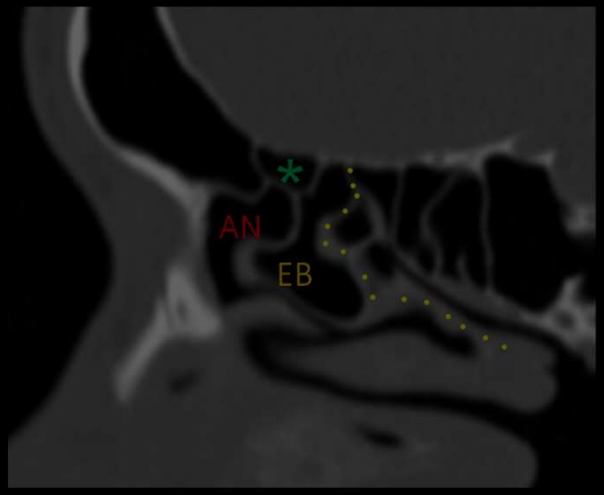




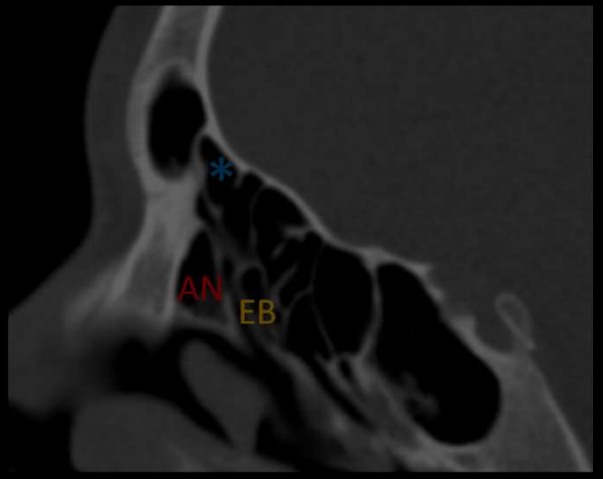
Anterior ethmoid cells

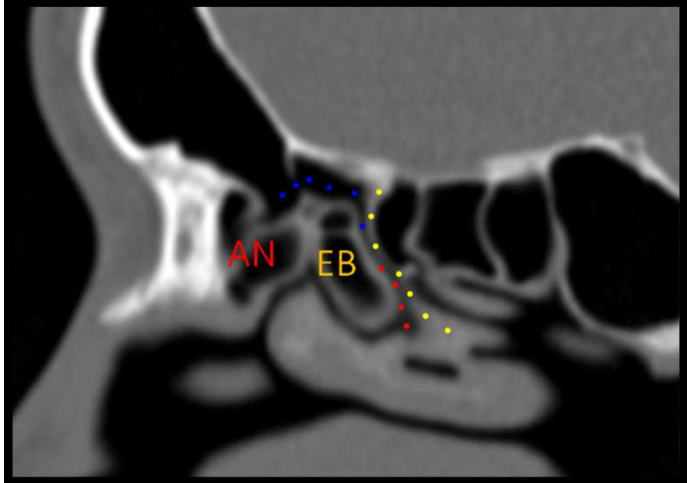


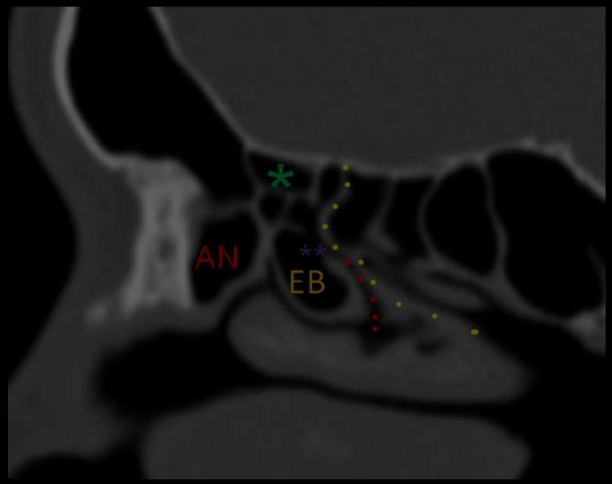
Suprabullar cell



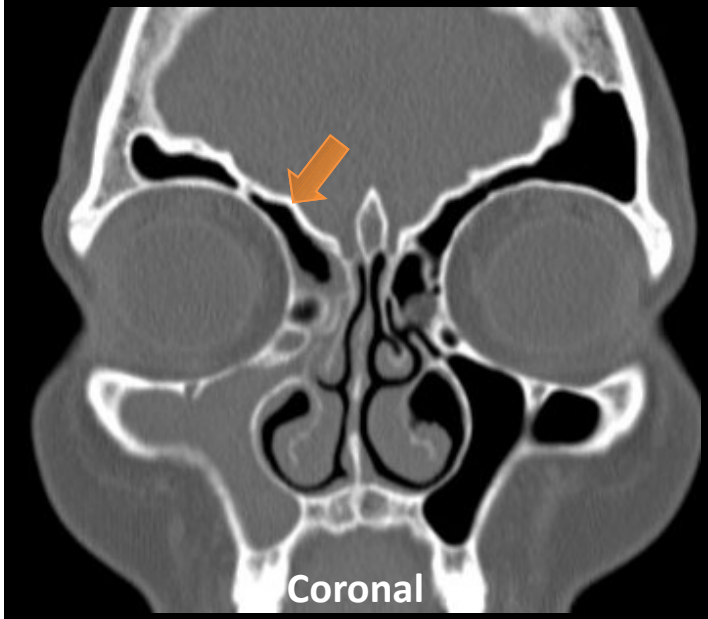
Frontal bullar cell

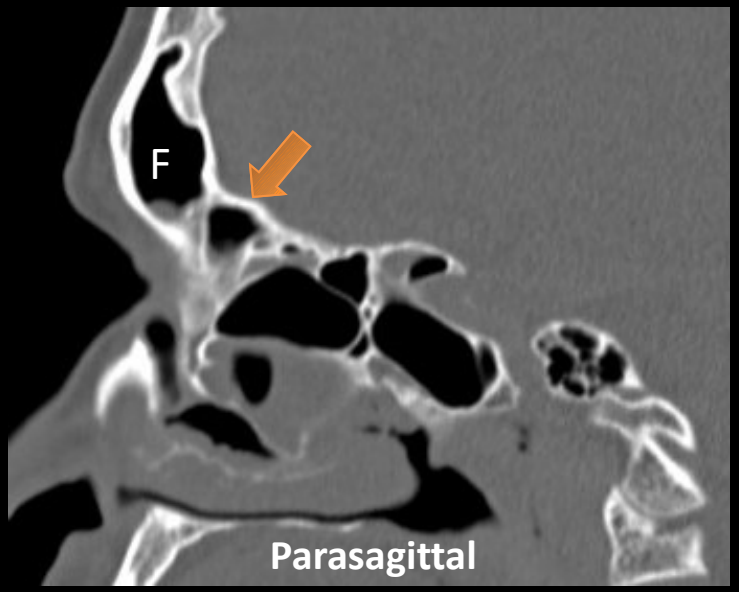


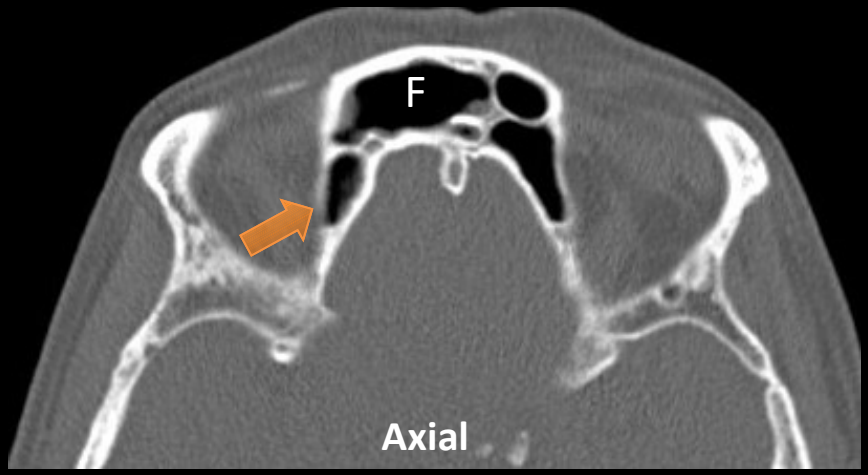




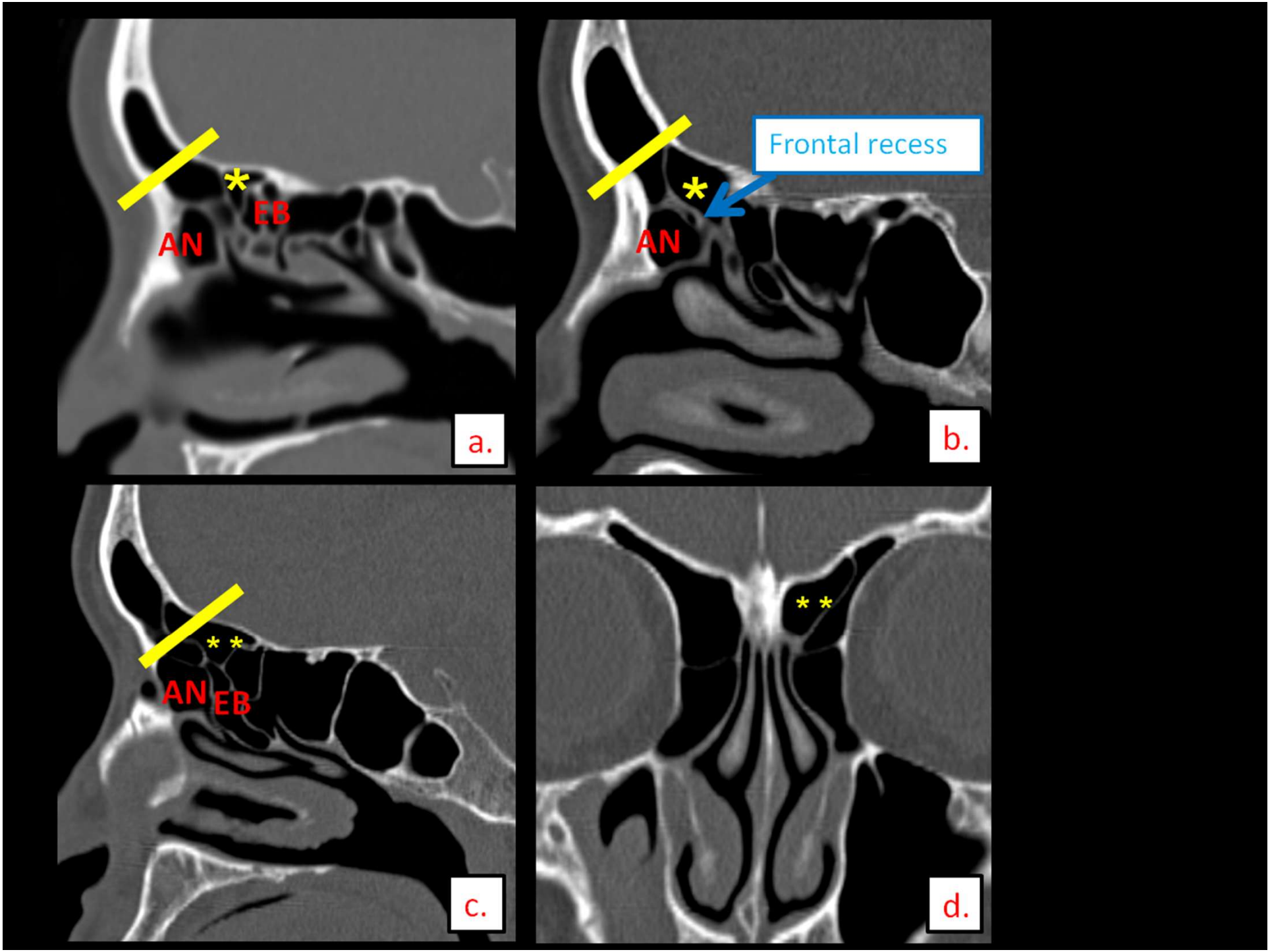
Supraorbital cells








DoB: 26-Nov-1968
A
PHILLIPA NELL BURNS (049Y)(F)
ACC# KRK2739065
DoB: 26-Nov-1968
H
SE:80277
19-Feb-2018 14:35
R
40mm
40mm
KRK
Life Kingsbury Hospital
2MM CORONAL SINUS
CT Sinuses any plane complete
2MM CORONAL SINUS

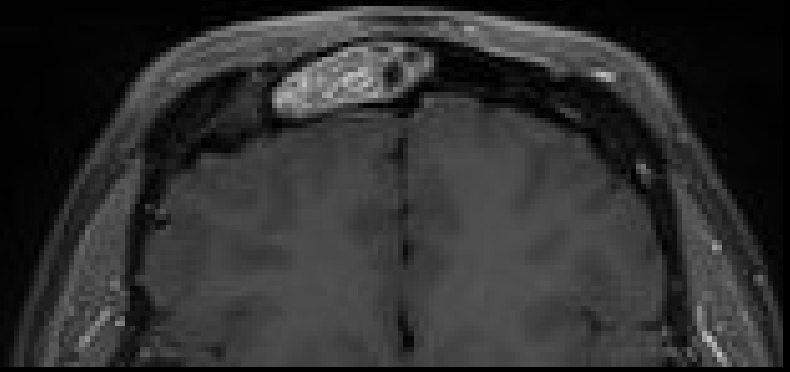

*
EB
AN
a.
Frontal recess
*
AN
b.
* *
AN
EB
c.
* *
d.

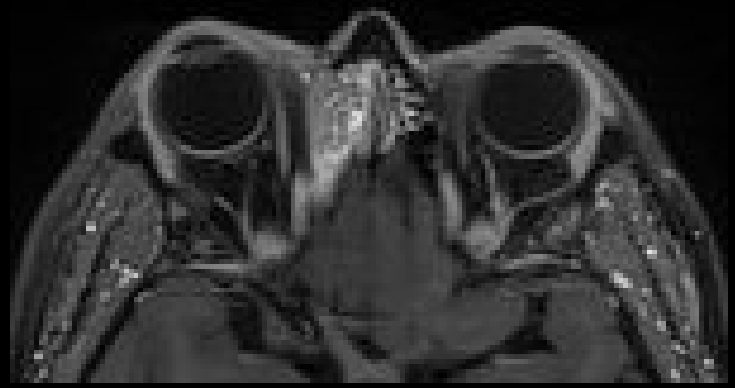
Headaches and facial pain

Coronal images

Sagittal

Inverted papilloma recurrence





T1 post gadolinium sequences

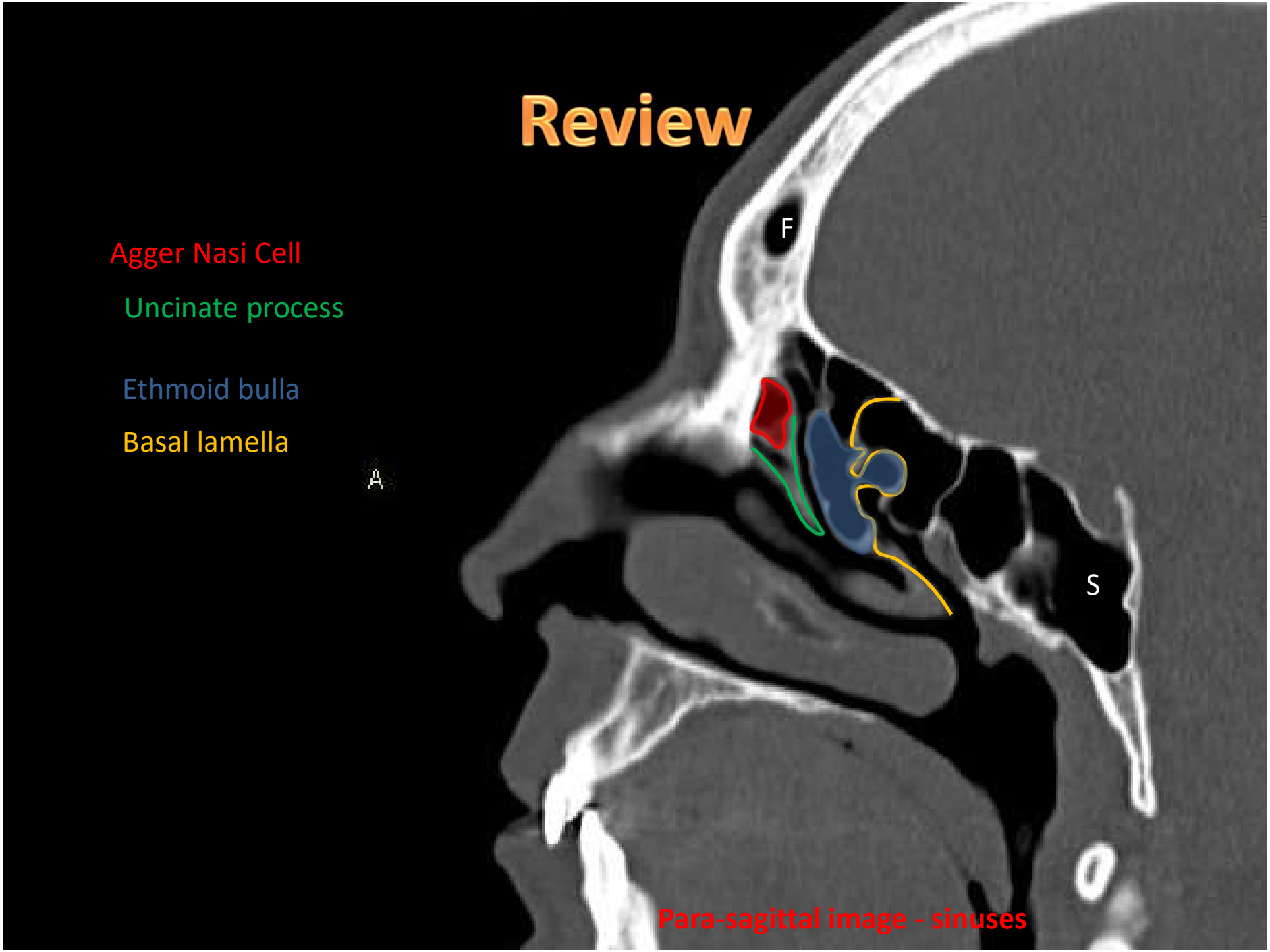
Review

Agger Nasi Cell

Uncinate process

Ethmoid bulla

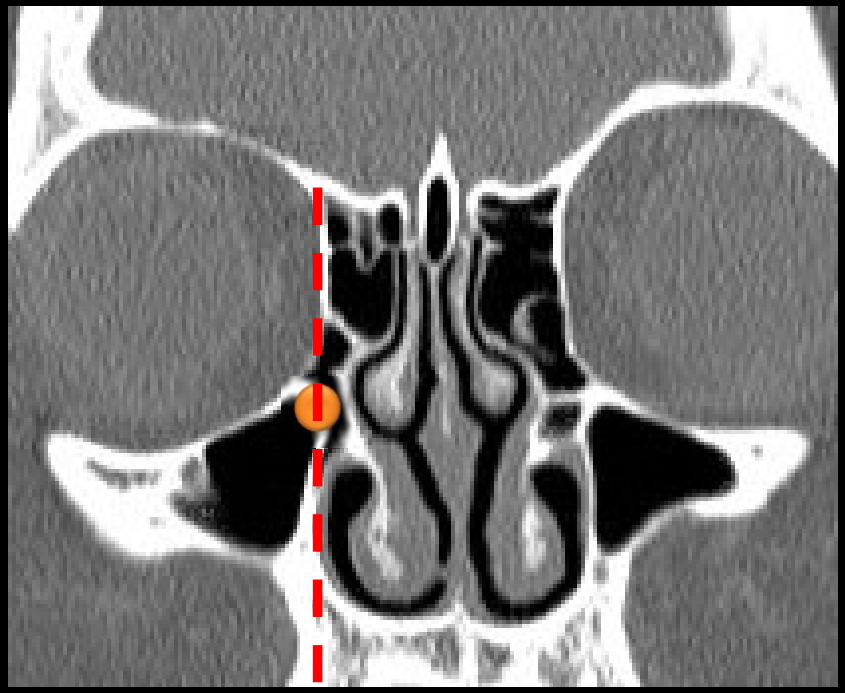
Basal lamella



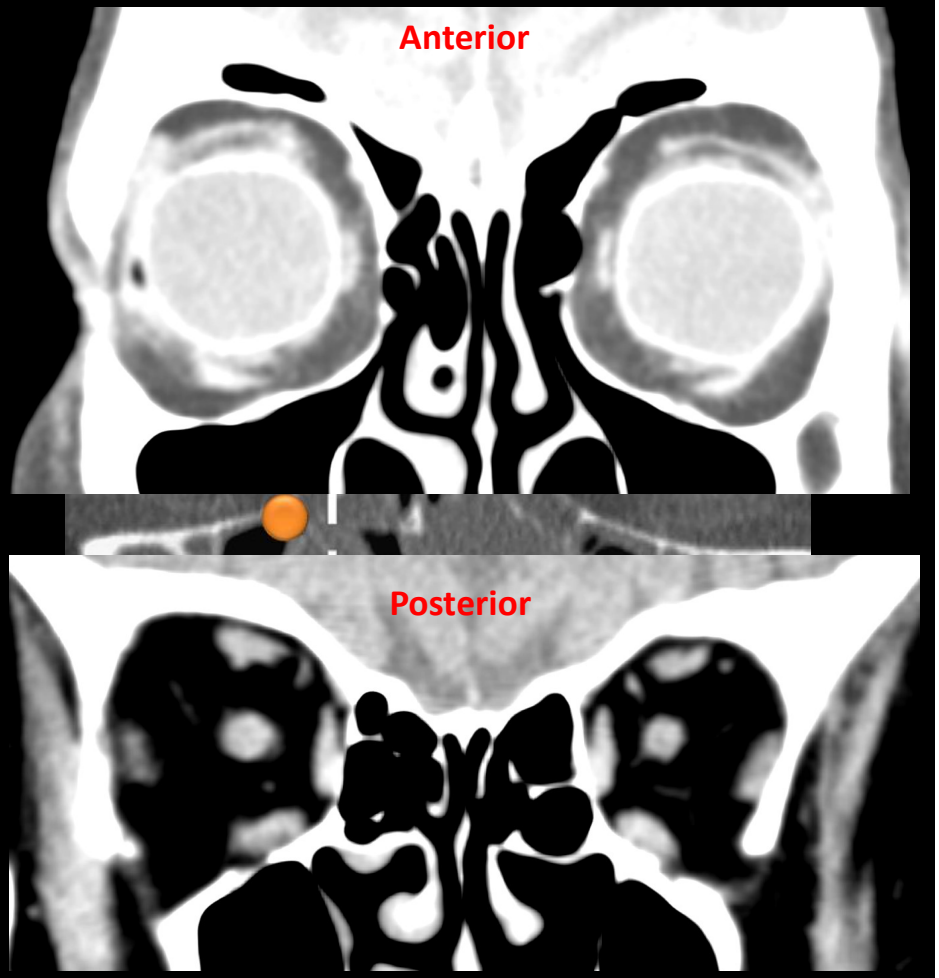
Para-sagittal image - sinuses

Lamina papyracea

Soft tissue window reformat
Coronal

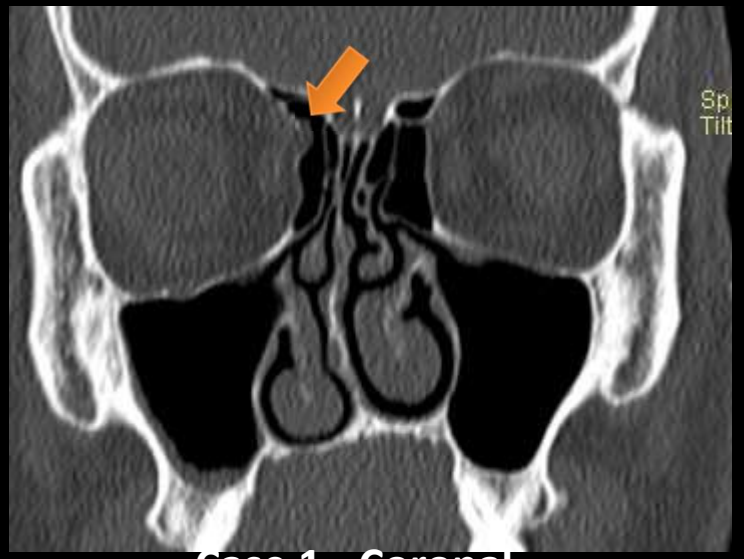


Coronal

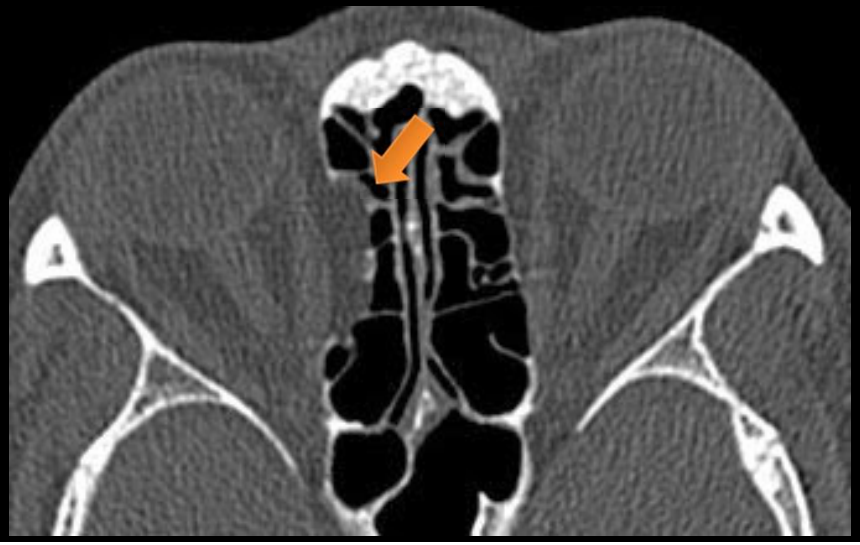


Lamina papyracea dehiscence

Case 1 - Axial

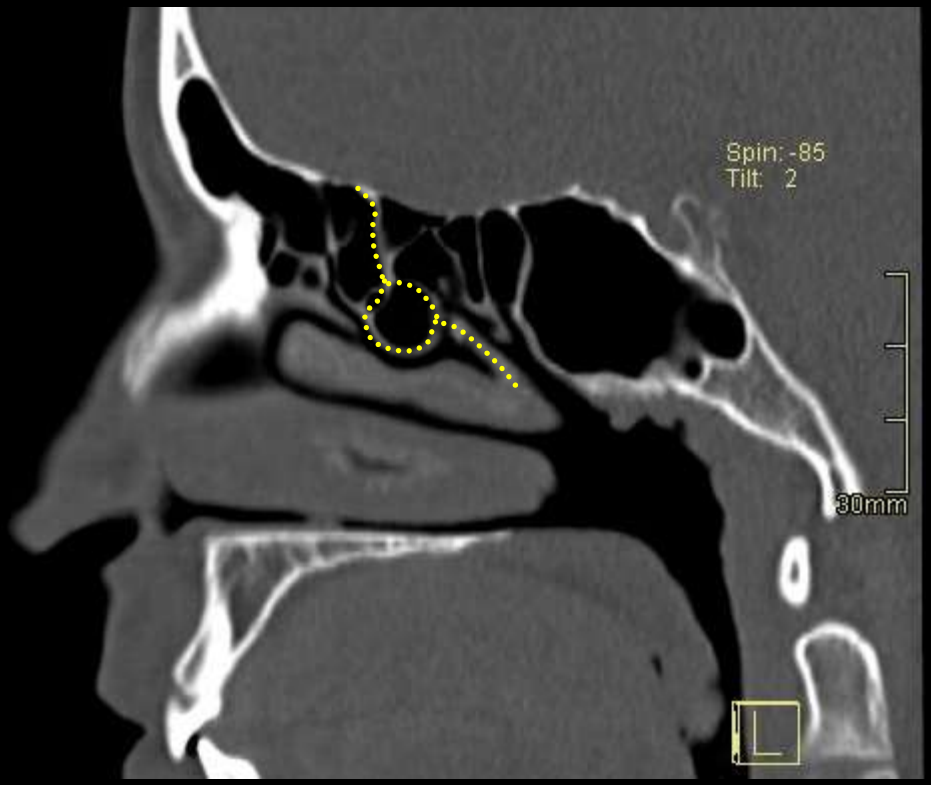


Case 1 - Coronal

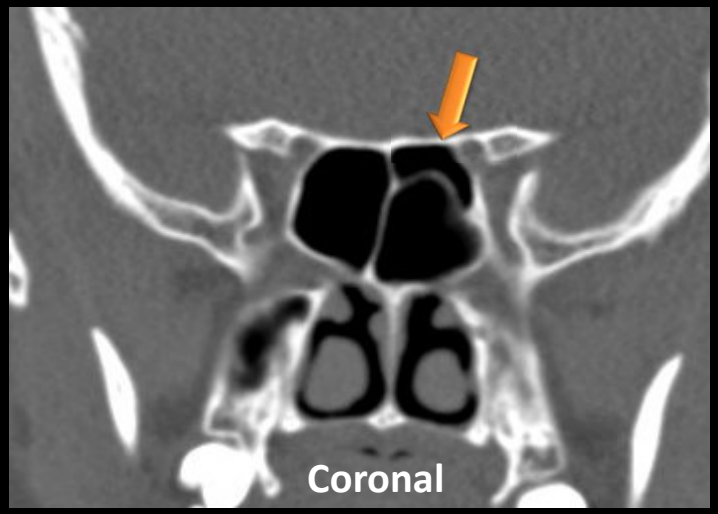


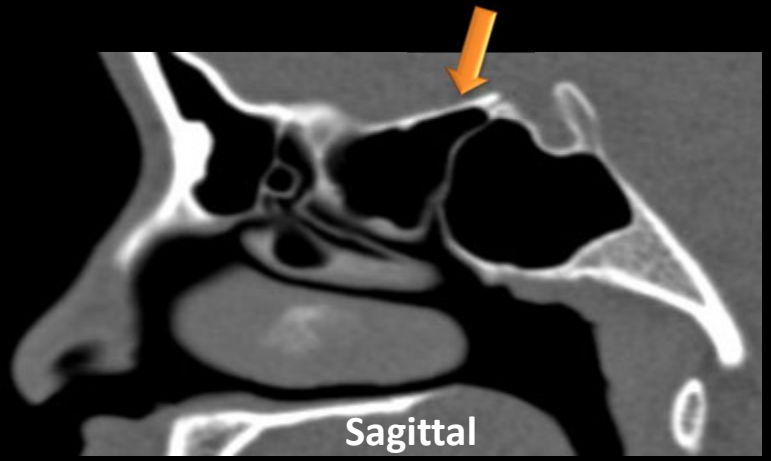
Case 2 - Axial

Posterior sinus group

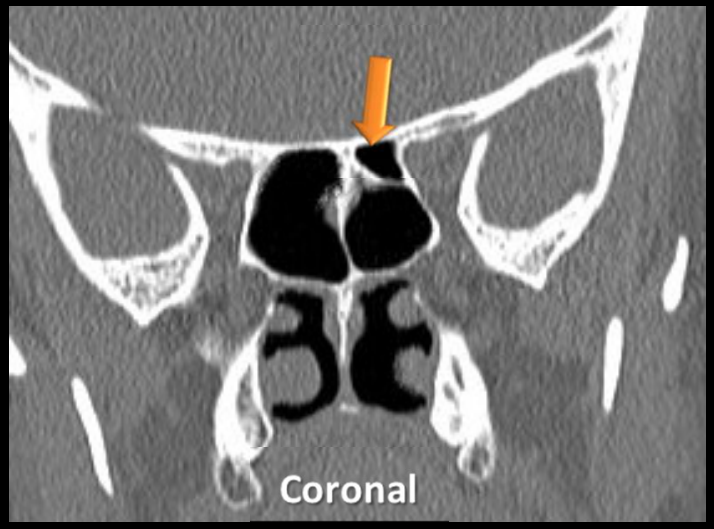


Onodi cells

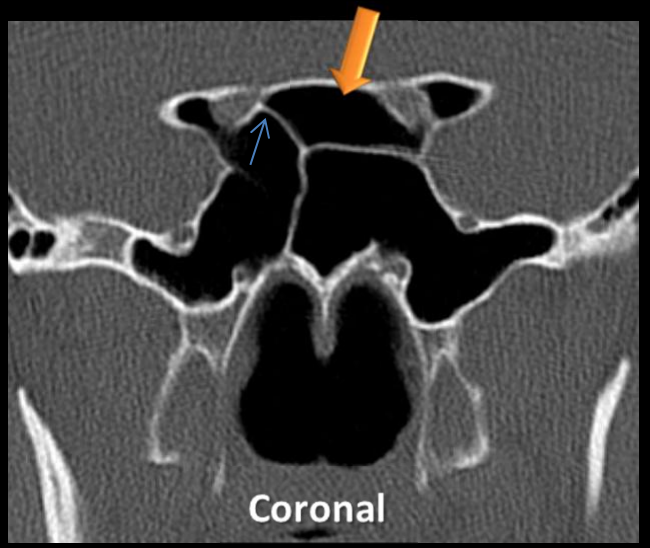




Case 1

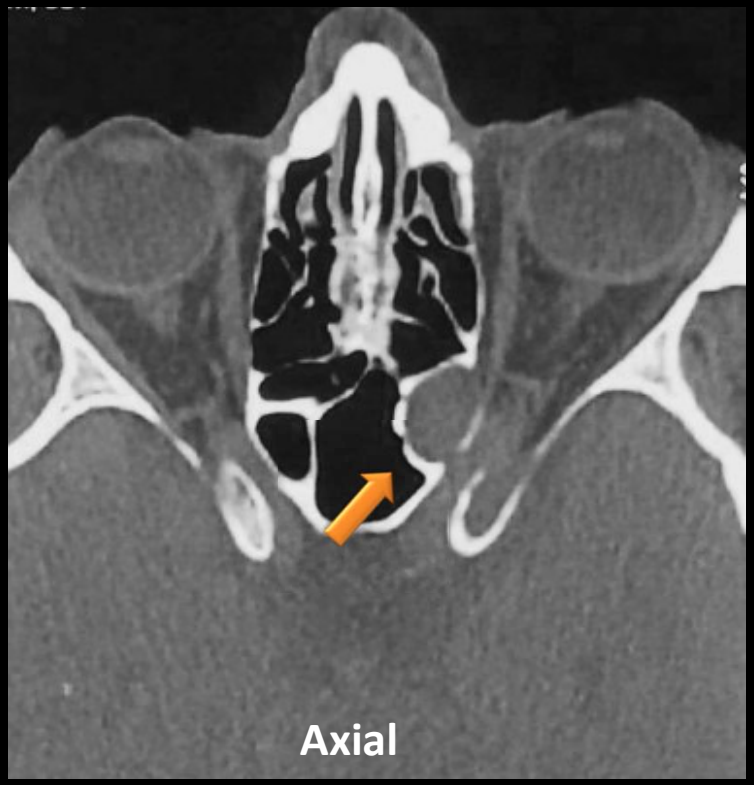


Case 2

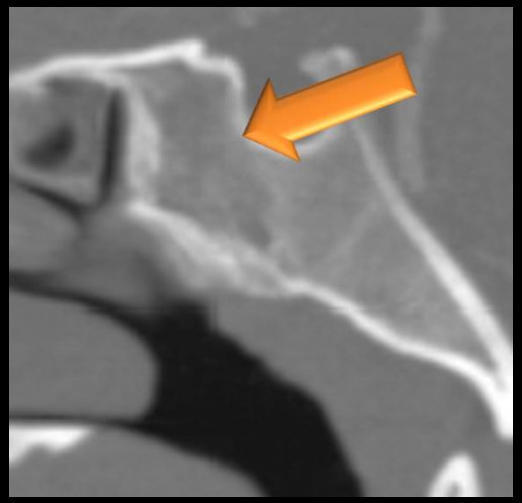


Case 3

Onodi cells

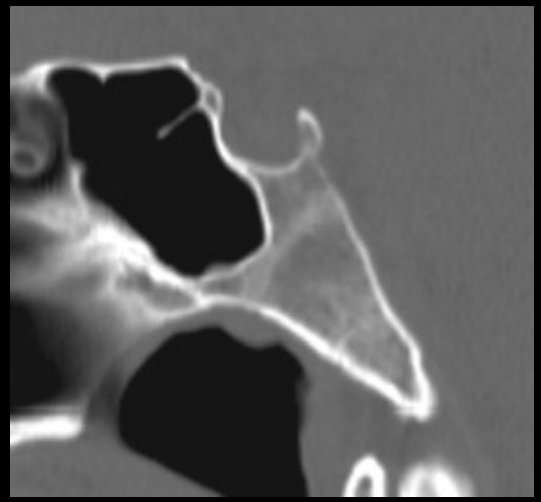


Sphenoid sinus

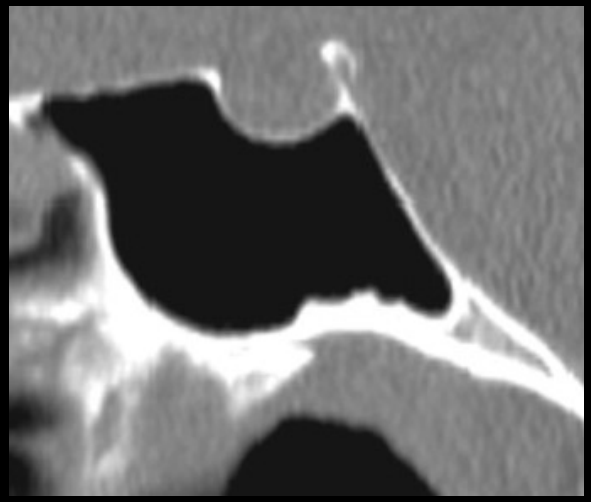


Arrested pneumatisation

Conchal



Presellar

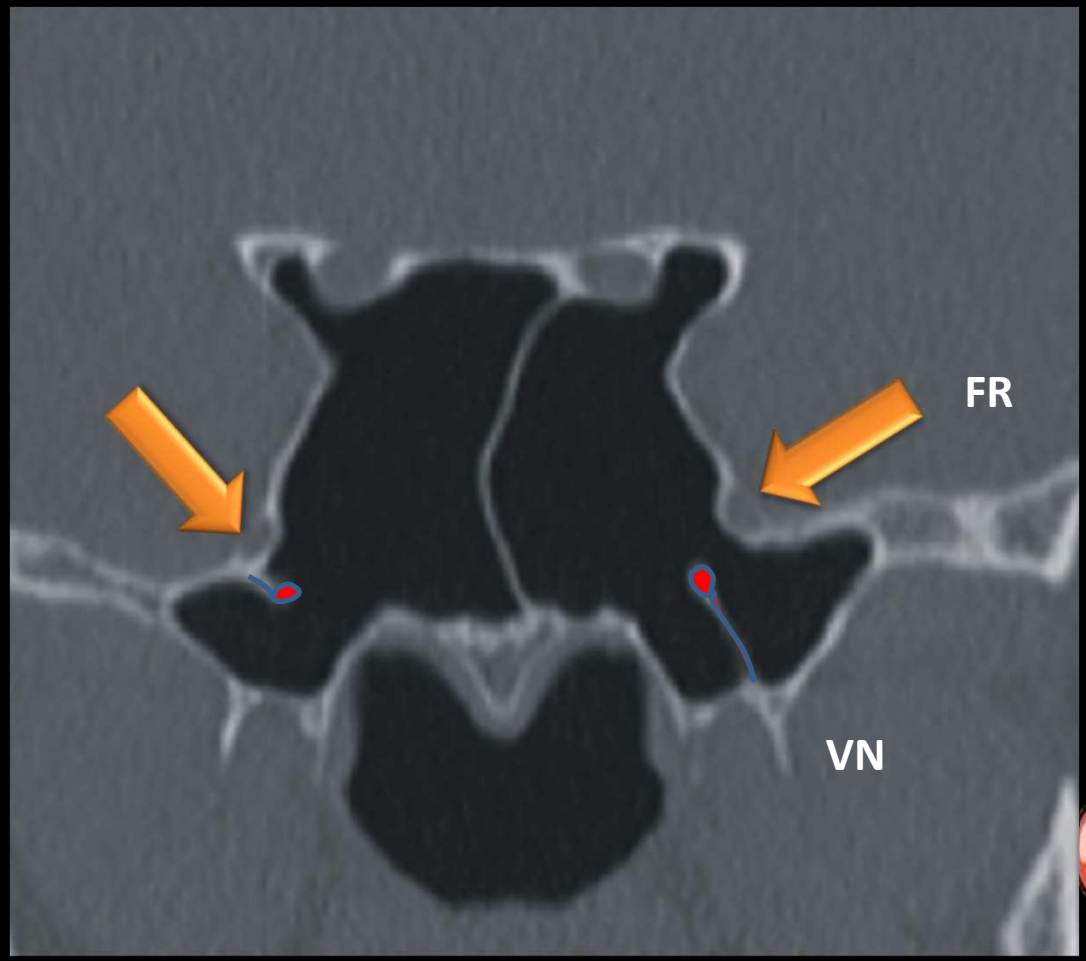


Sellar

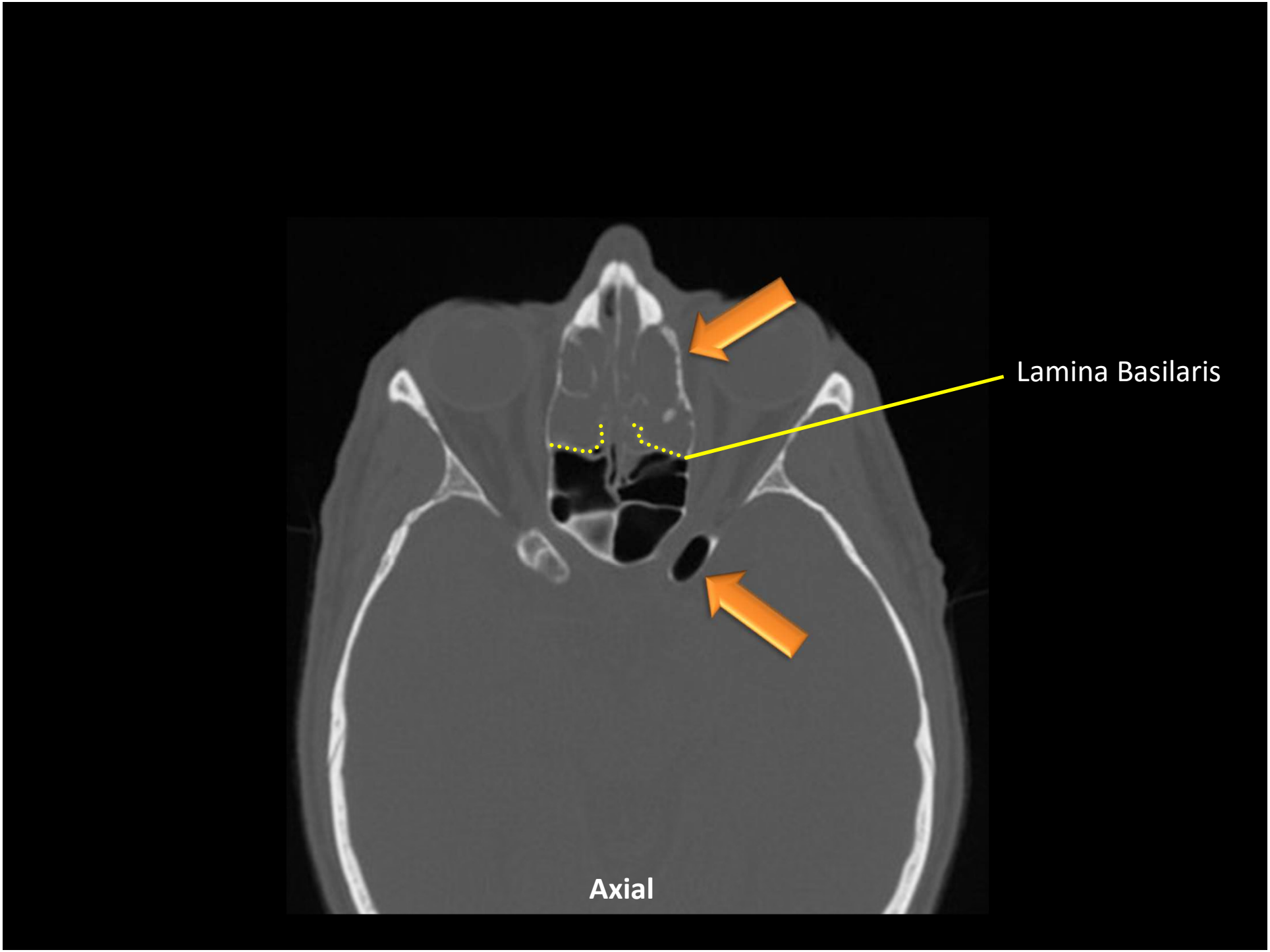
Sphenoid sinus

- Sphenoid ostia axial and sag

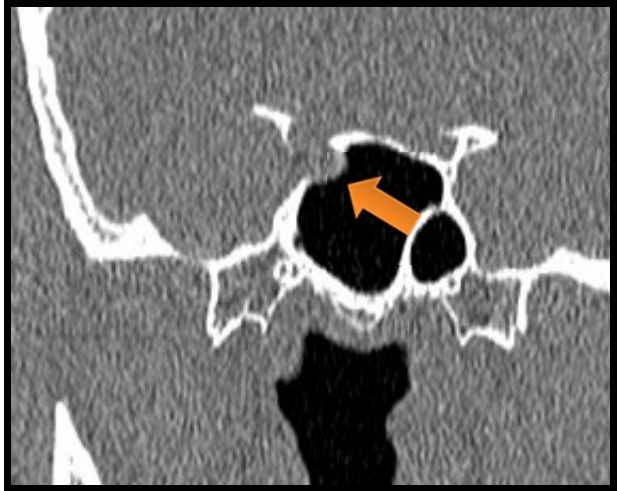
Sphenoid sinus



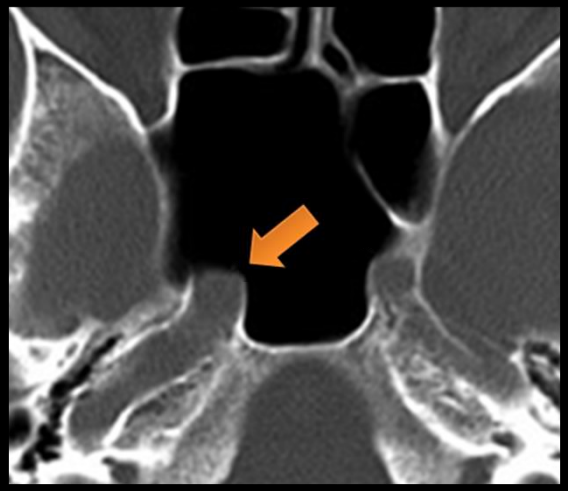
Coronal Sphenoid sinus


Lamina Basilaris
Axial

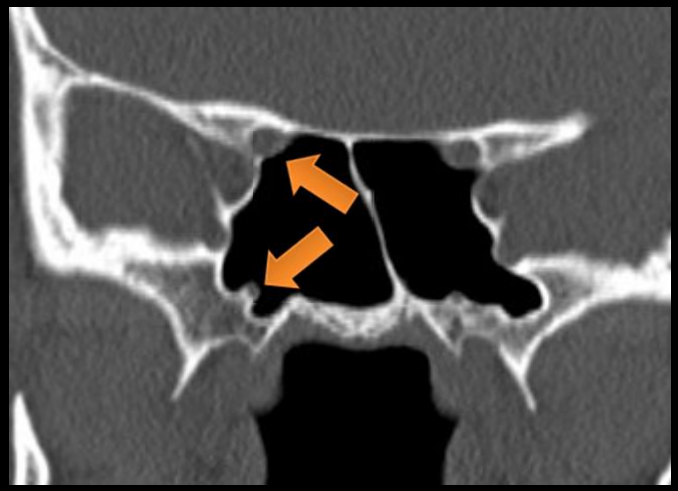
Sphenoid cell dehiscence



Coronal

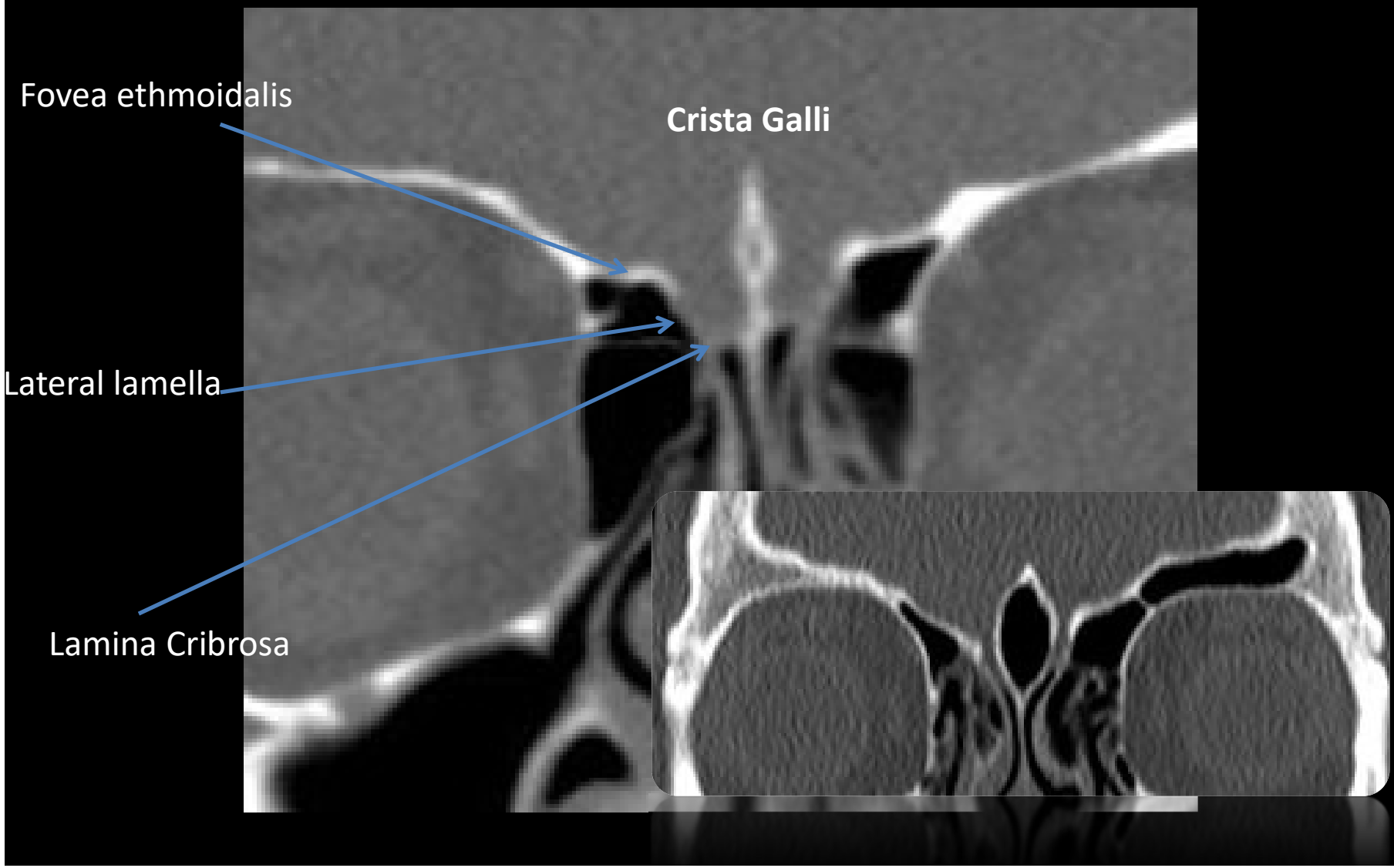


Axial

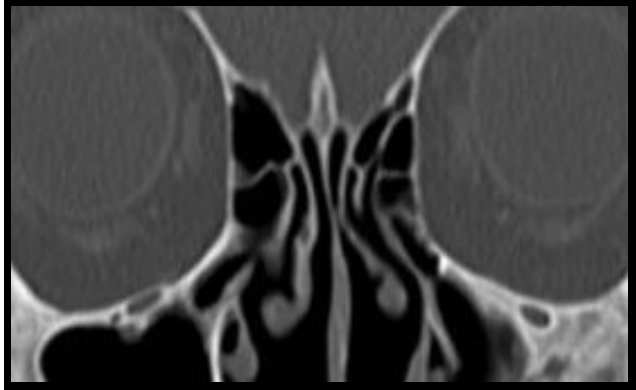


Coronal

Anterior skull base anatomy

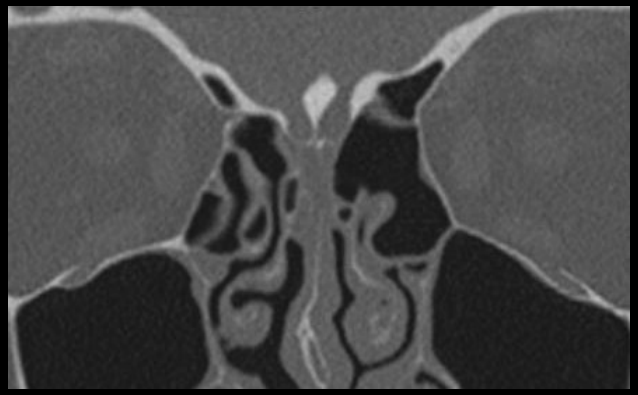


Keros classification



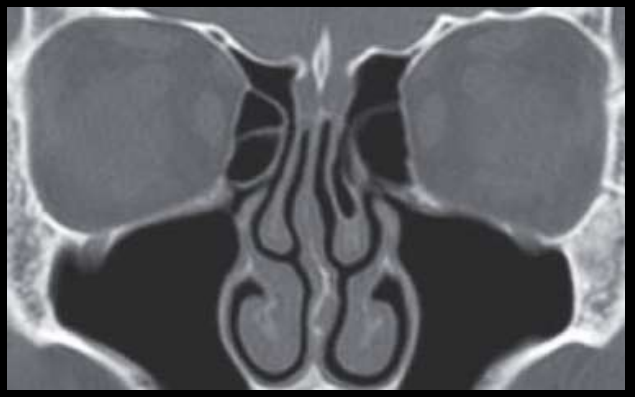
Type I
0-3mm

26.3%*



Type II
4-7mm

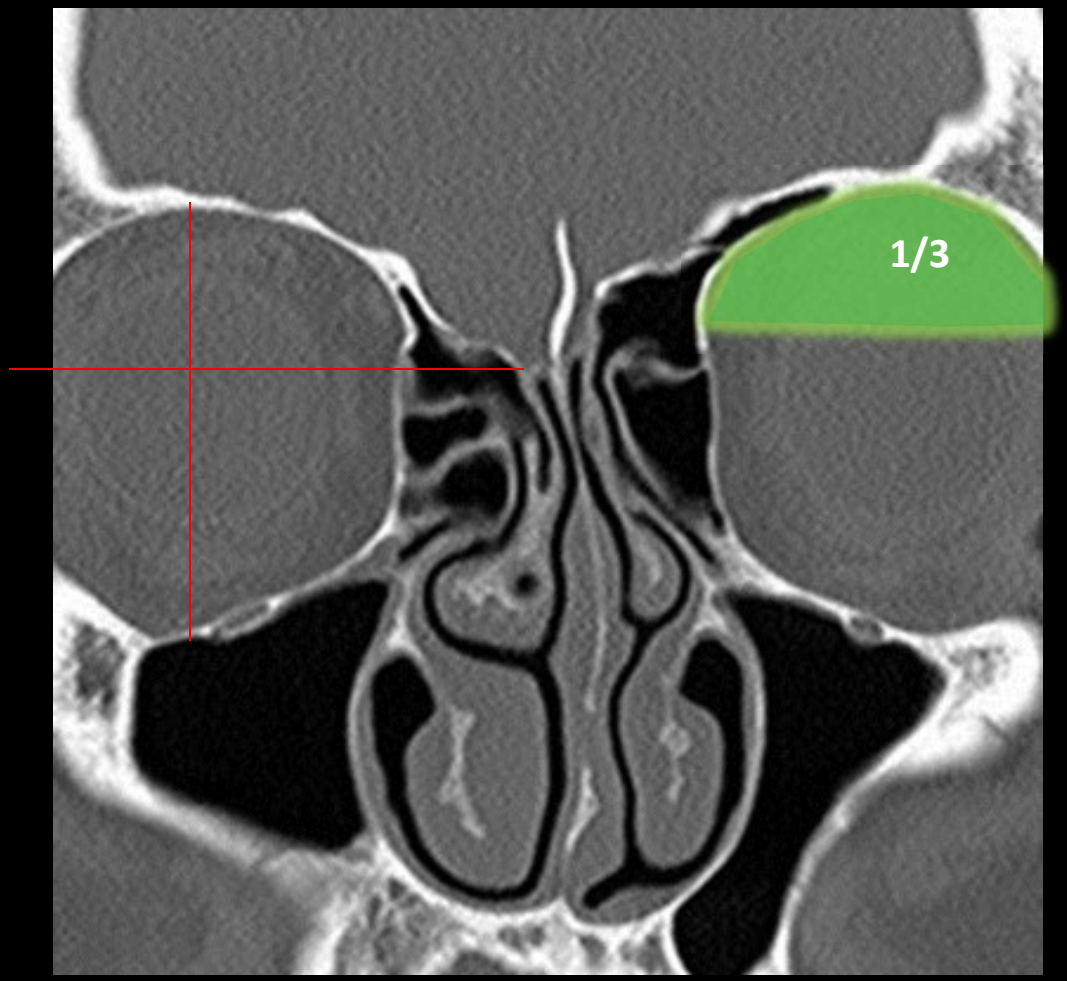
73.3%*



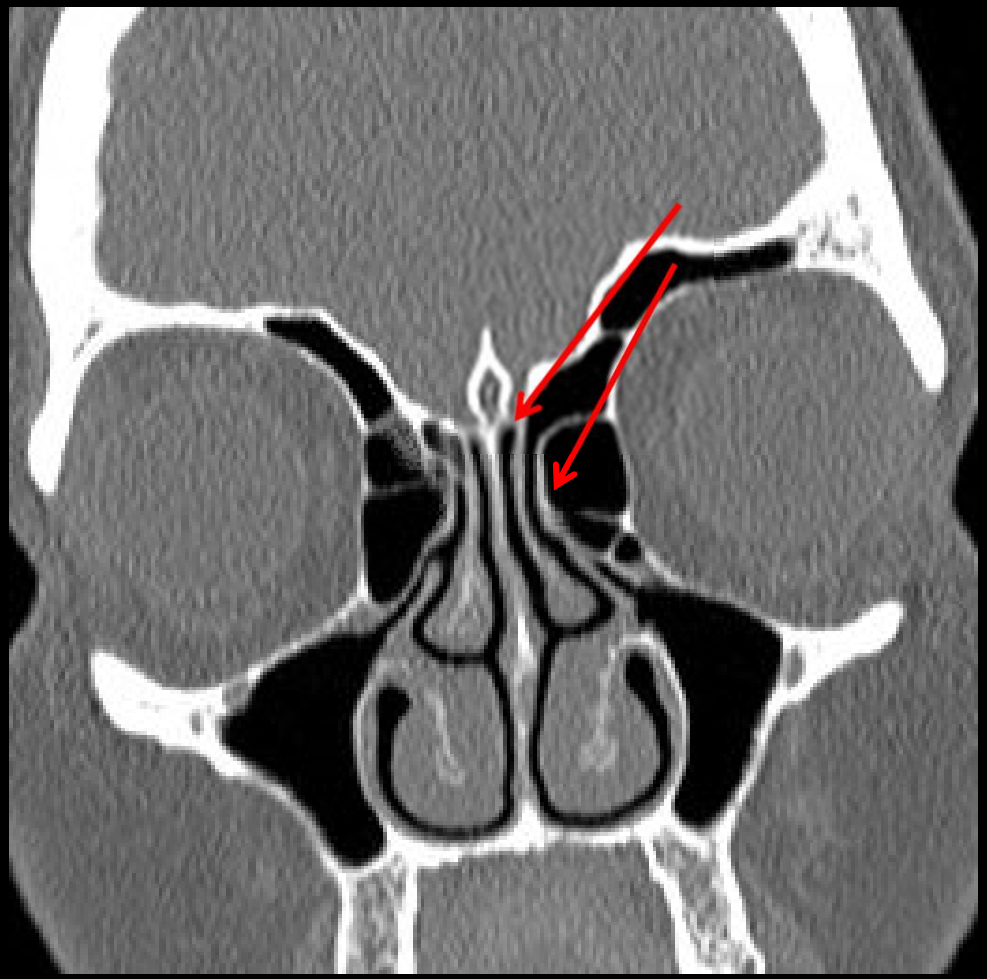
Type III
8-16mm

0.5%*

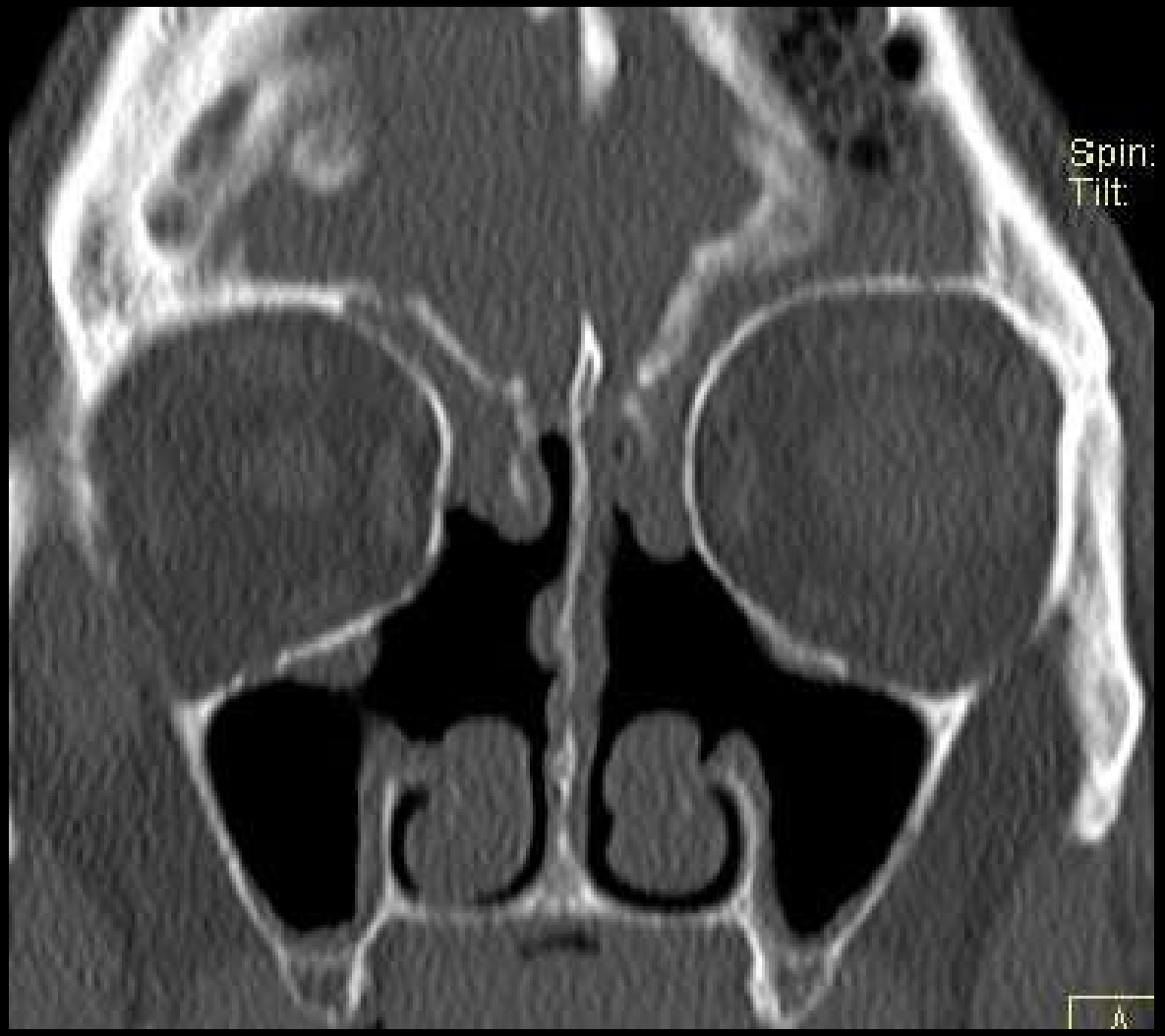
** Koshy et al; 2017; Imaging of paranasal sinuses*


1/3

Ethmoid roof



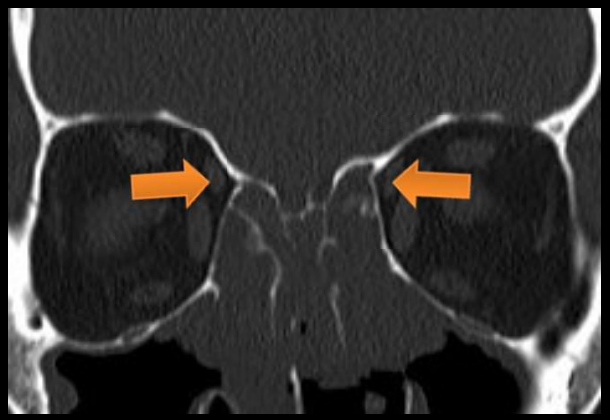
Cribriform plate integrity?

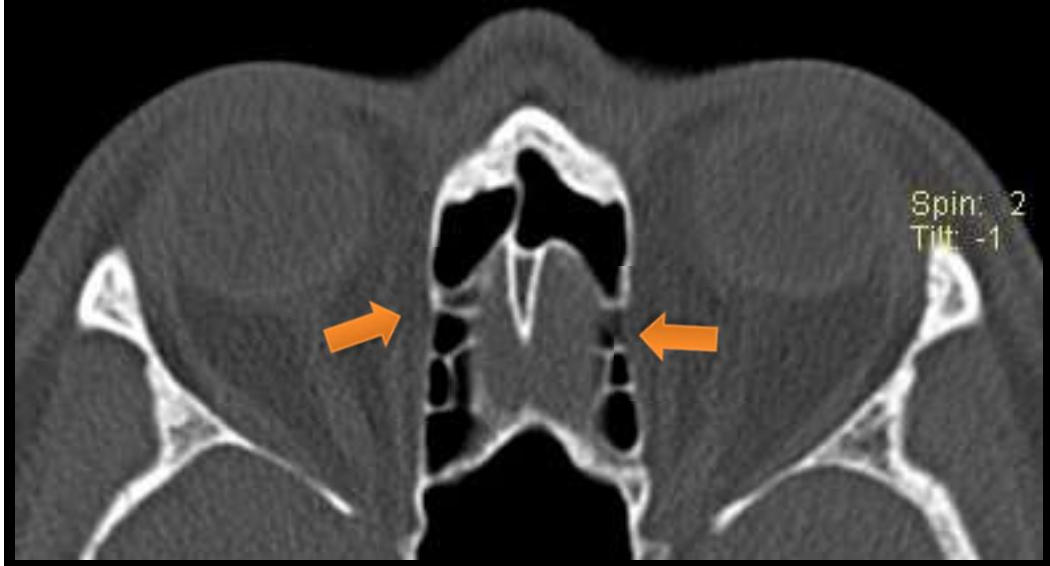


Meningoencephalocele of the anterior skull base

*Image from ENT & audiology news volume 25 issue 5 november/december 2016; Barnes et al.

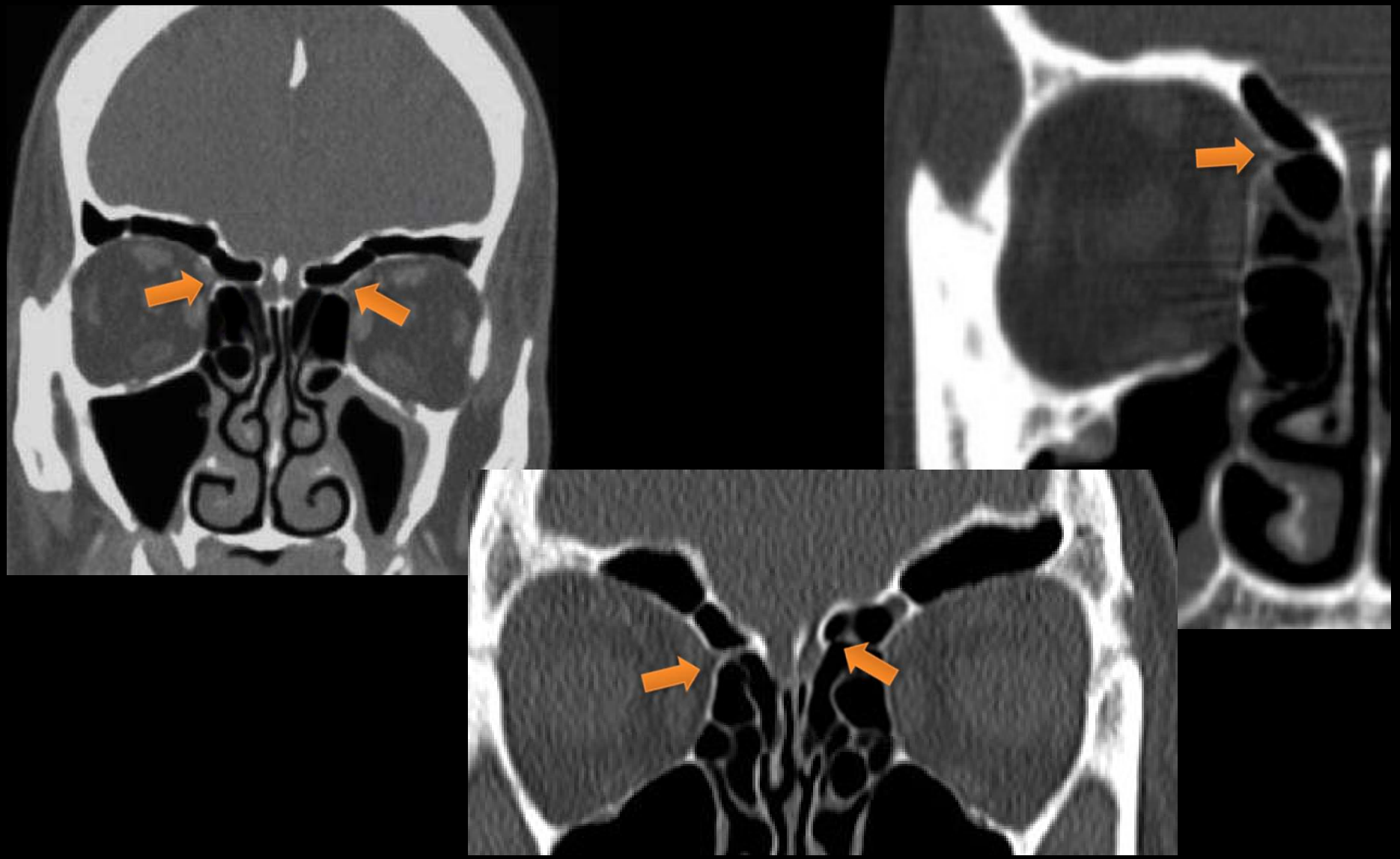
Anterior ethmoidal artery





**Netter's anatomy atlas*

Anterior ethmoidal artery



Thank you

References

- Otolaryngology – head and Neck surgery (2006) Relationship between the superior attachment type of uncinate process and presence of agger nasi cell: A computer-assisted anatomic study I ˙brahim Ercan et al.
- Eur Arch Otorhinolaryngol ; The association of superior attachment of uncinate process with pneumatization of middle turbinate: a computed tomographic analysis Sheng-Yao Cheng et al.