

# Paranasal Sinuses – Beyond Drips and Sniffles

Ervin Lowther, MD

# Obligatory Opening Joke



# Frosty's Not The Only One!

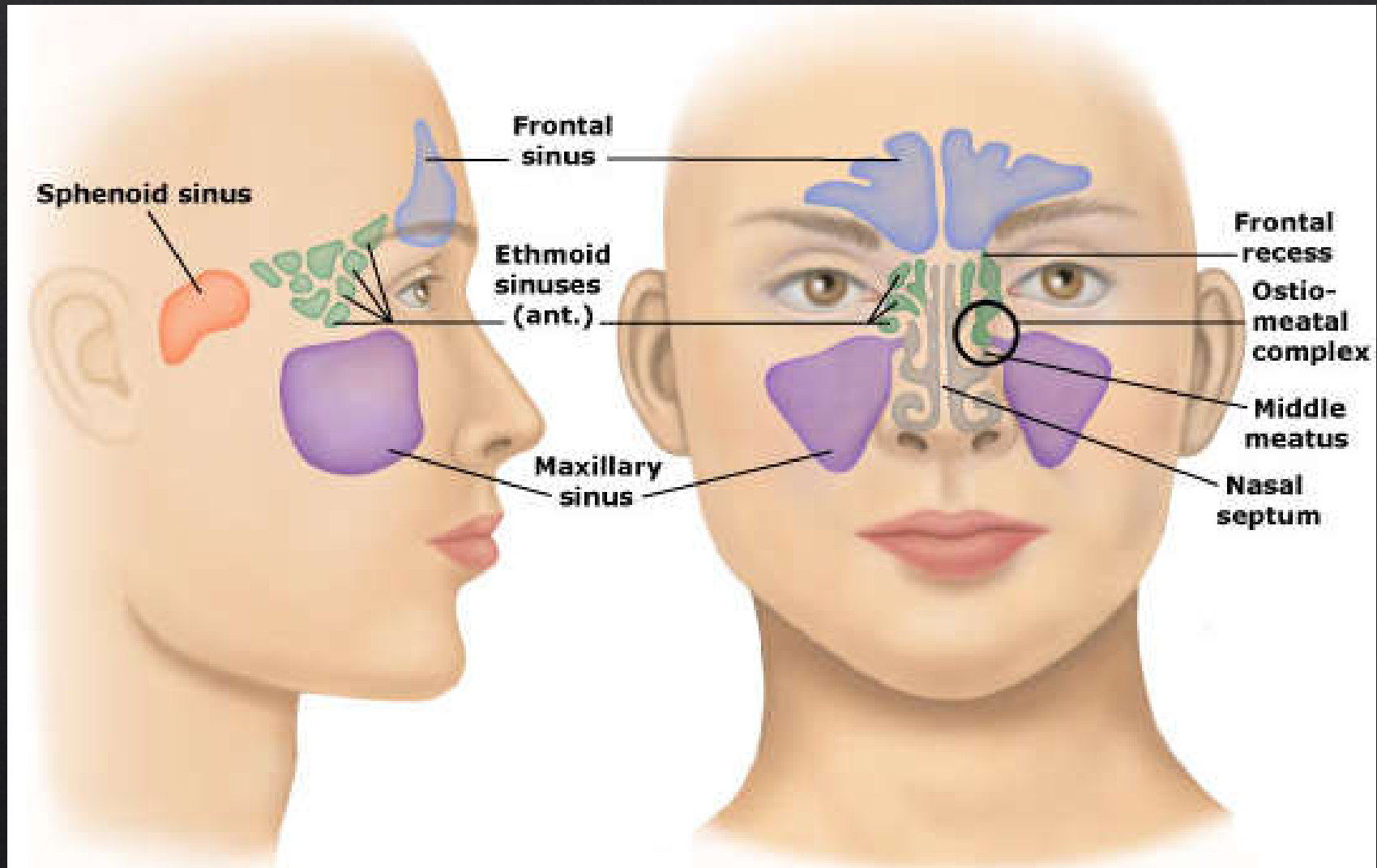


# Overview

- ◆ Roles of imaging
- ◆ Complicated Sinusitis
- ◆ Sinonasal Tumors



# Paranasal Sinuses



# Roles of Imaging

## ◇ CT

- ◇ High spatial resolution
- ◇ Delineate anatomy
- ◇ Identify anatomic variants
- ◇ Pre-FESS planning
- ◇ Characterize inflammatory disease

## ◇ MRI

- ◇ High contrast resolution
- ◇ Characterize abnormalities seen on CT
- ◇ Evaluate tumors and extent of disease

# MRI in Sinonasal Imaging

- ◇ Distinguishes tumor from obstructed secretions
- ◇ Evaluates
  - ◇ Extent of disease
  - ◇ Perineural tumor spread

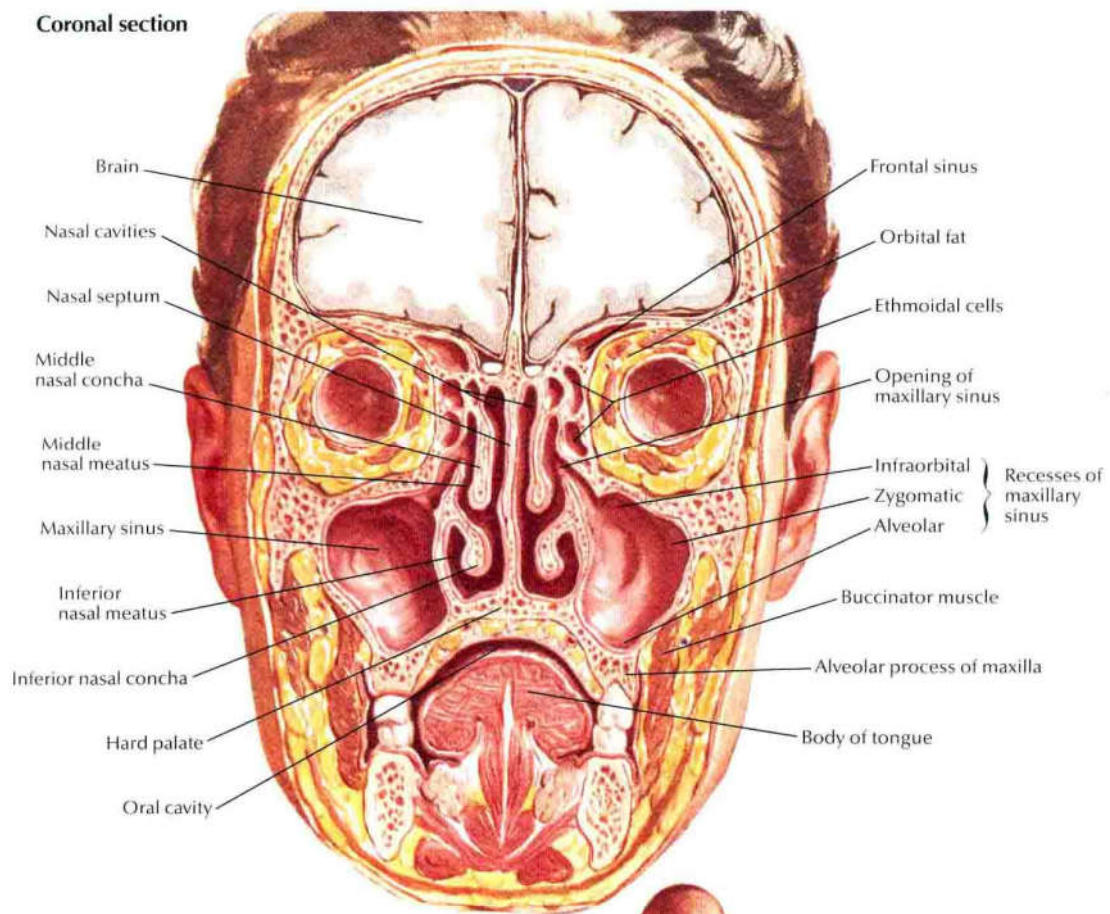


# Anatomy - Global

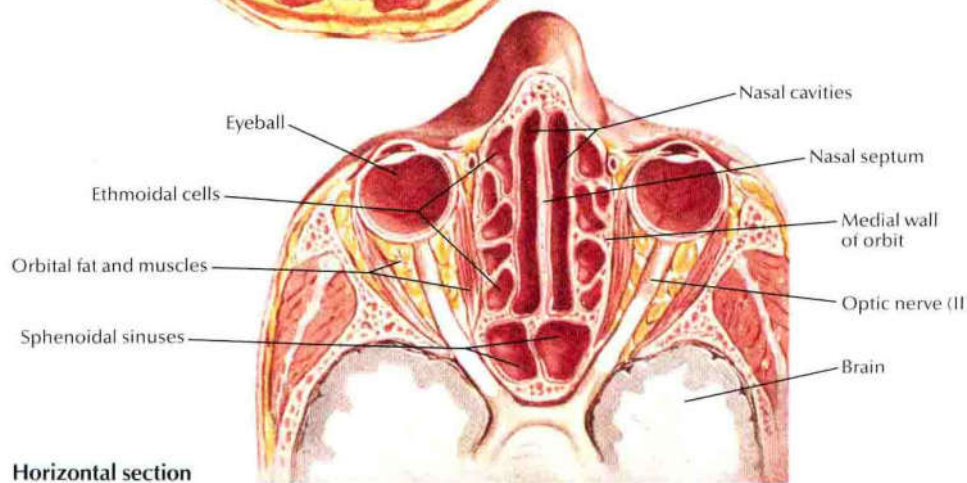
- ◇ Central – nasal cavity
- ◇ Around – paranasal sinuses
- ◇ Above – anterior cranial fossa
- ◇ Below – oral cavity
- ◇ Posterior – nasopharynx and central skull base



**Coronal section**



**Horizontal section**



# Sinonasal Infection/Inflammation

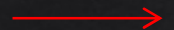
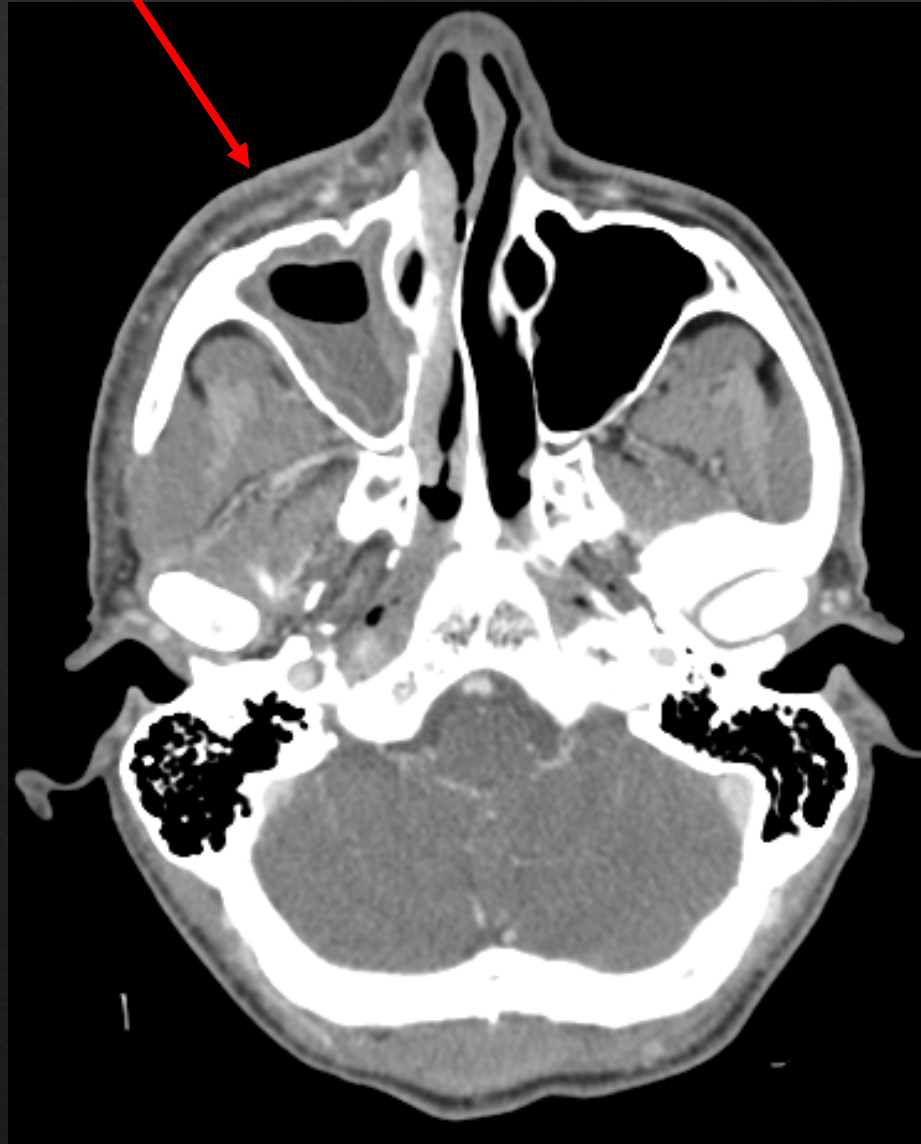
- ◇ Sinusitis complications
  - ◇ Orbital abscess
  - ◇ Venous thrombosis
  - ◇ Epidural abscess
  - ◇ Pott's puffy tumor
- ◇ Invasive fungal sinusitis
  - ◇ Many of the same complications

# Sinusitis Complications

- ◇ Contiguity of the sinuses w/ adjacent structures allows infection to spread
- ◇ Orbits
  - ◇ Orbital abscess
  - ◇ Superior ophthalmic vein thrombosis
- ◇ Anterior cranial fossa
  - ◇ Meningitis
  - ◇ Epidural abscess
  - ◇ Cerebritis/parenchymal abscess

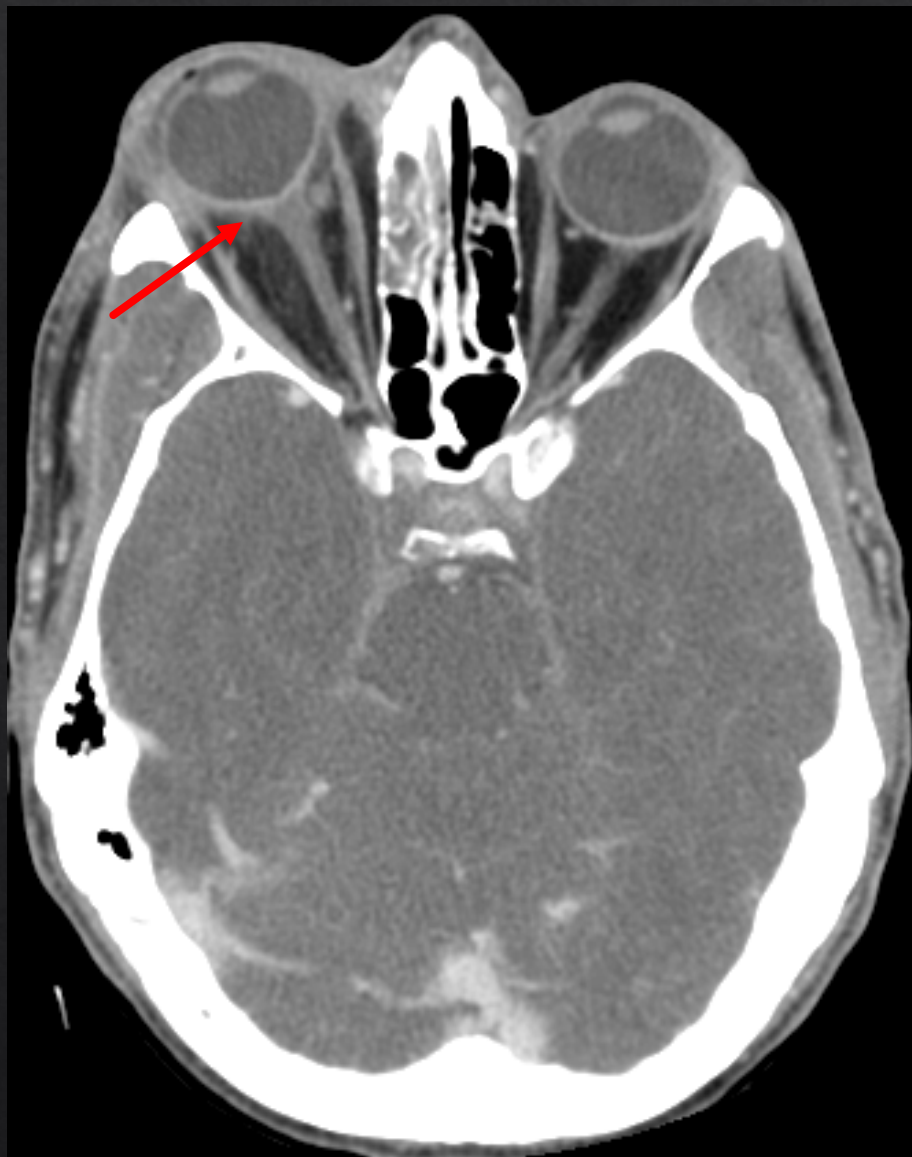


# Case 1

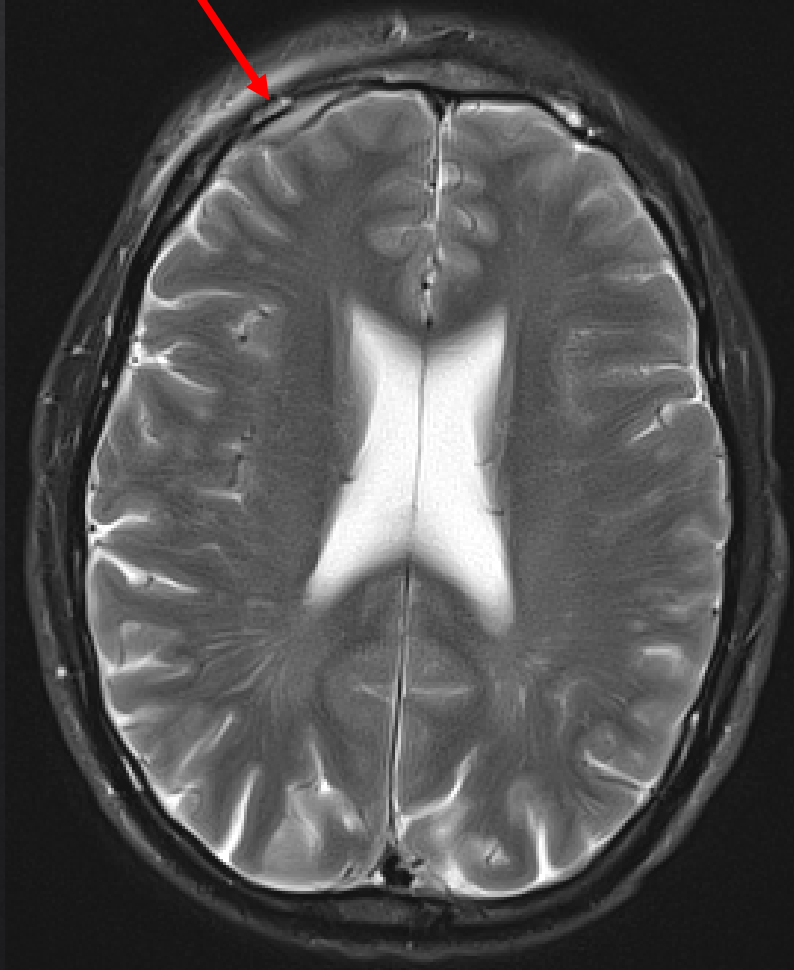




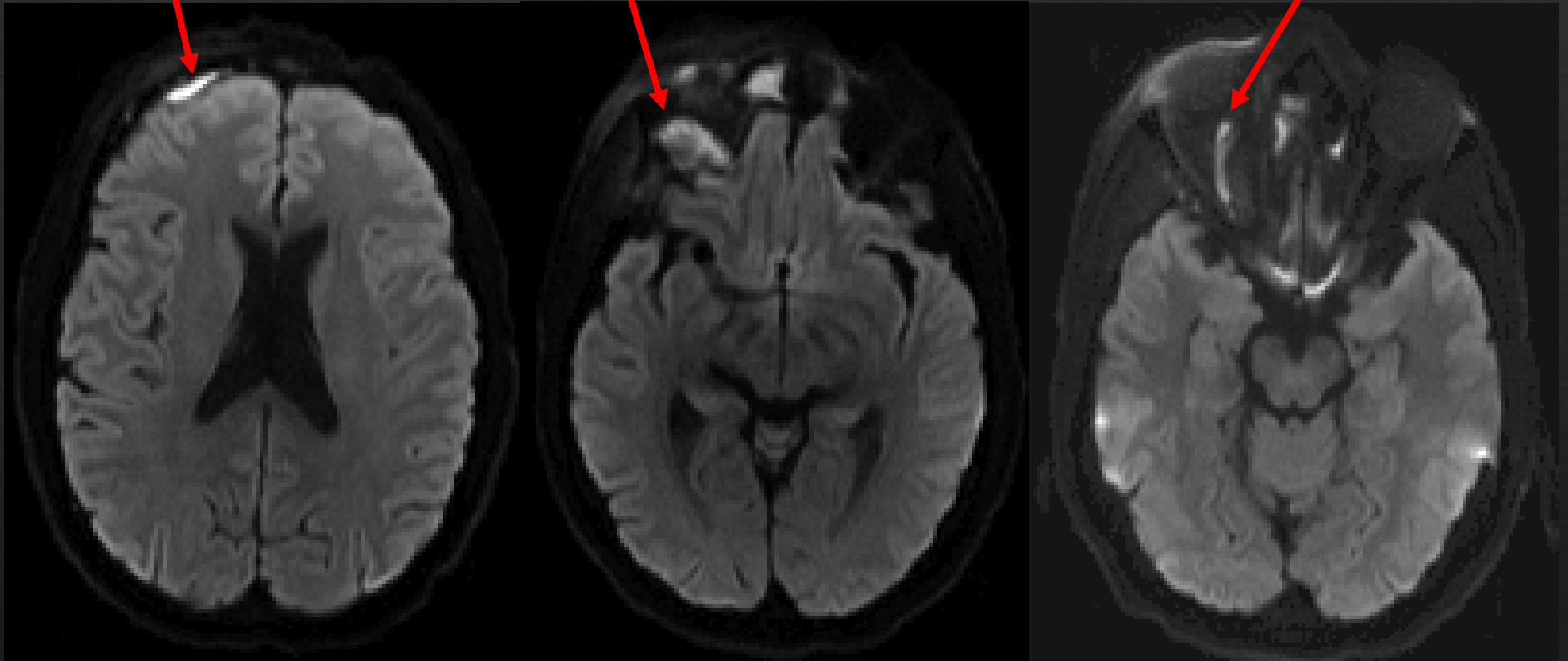
# Case 1



# Case 1



# Case 1

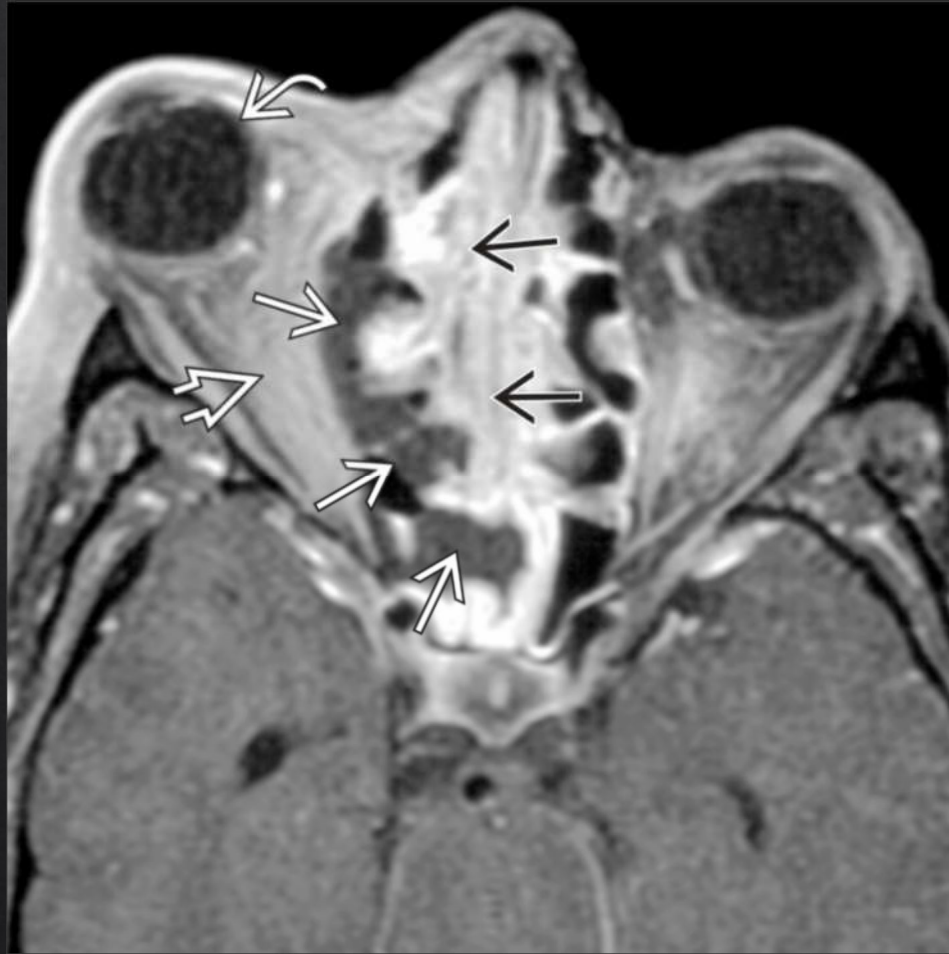


# Orbital Subperiosteal Abscess - CT





# Orbital Subperiosteal Abscess - MRI



# Another Abscess



# Case 2



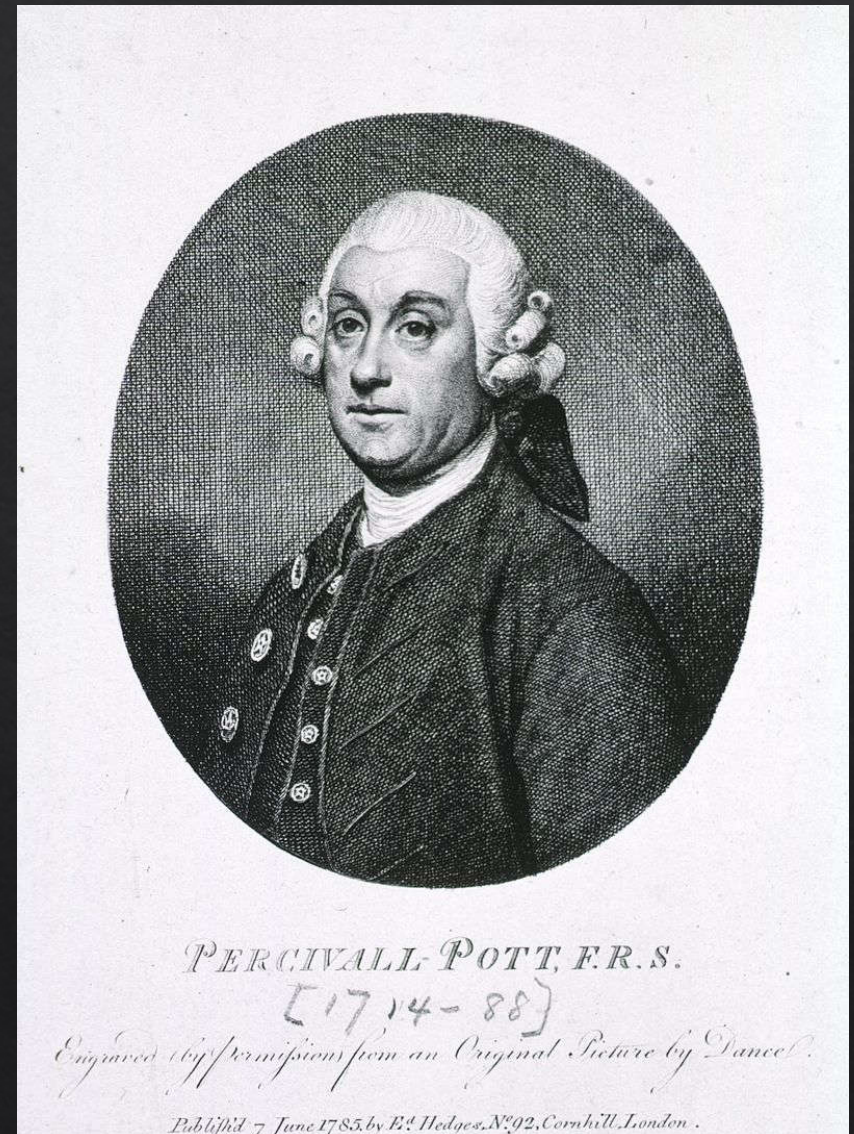
# Pott's Puffy Tumor

- ◇ Puffy “tumor” is a misnomer
- ◇ Frontal bone osteomyelitis with subperiosteal abscess
- ◇ Usually a complication of frontal sinusitis



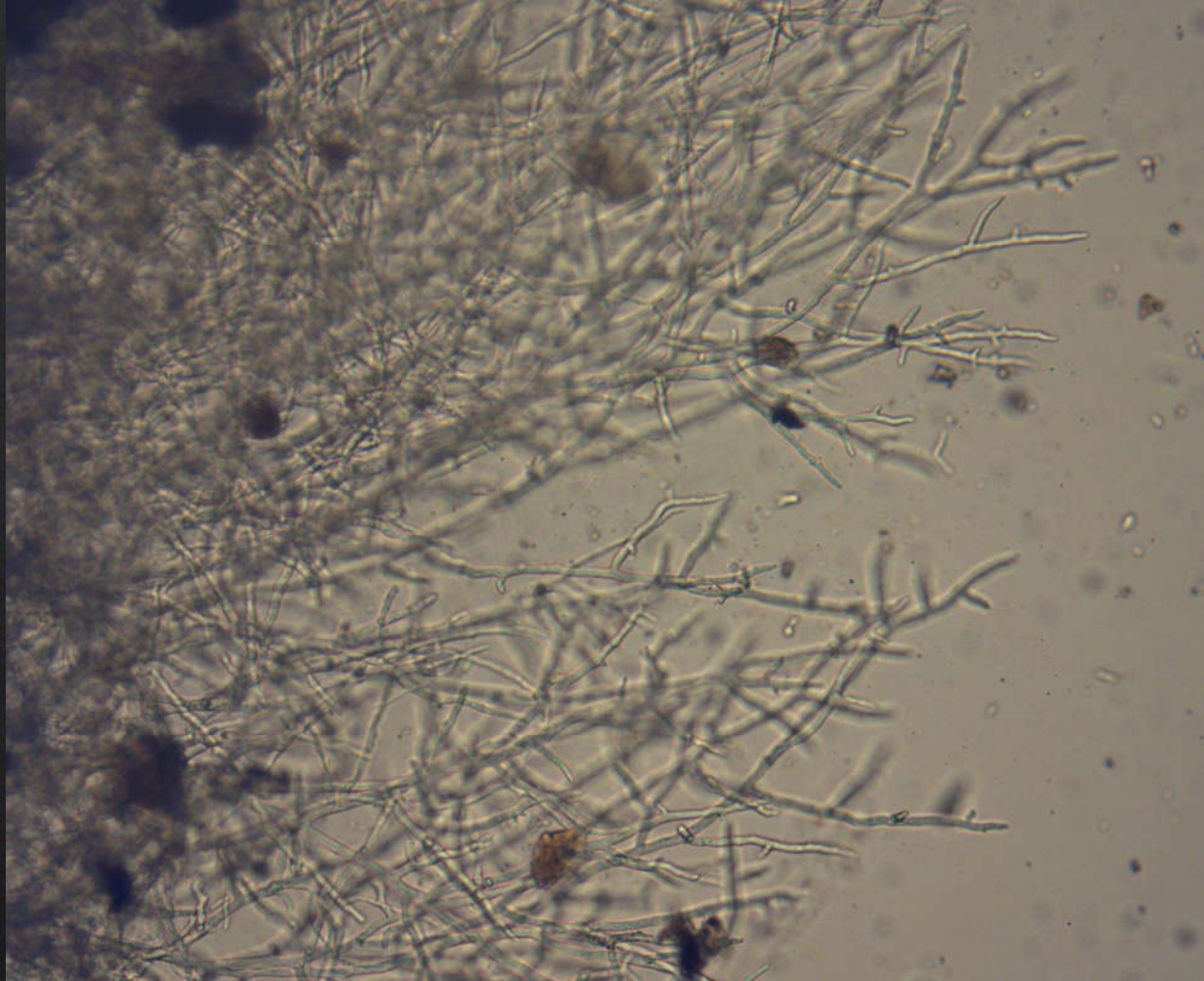
# Sir Percivall Pott

- ◆ English physician/surgeon
- ◆ Described frontal swelling with subperiosteal abscess in 1760
- ◆ 1<sup>st</sup> physician to describe tuberculous infection of the spine (Pott's disease)
- ◆ 1<sup>st</sup> physician to link environmental exposure to cancer
  - ◆ Chimney sweeps and scrotal cancer





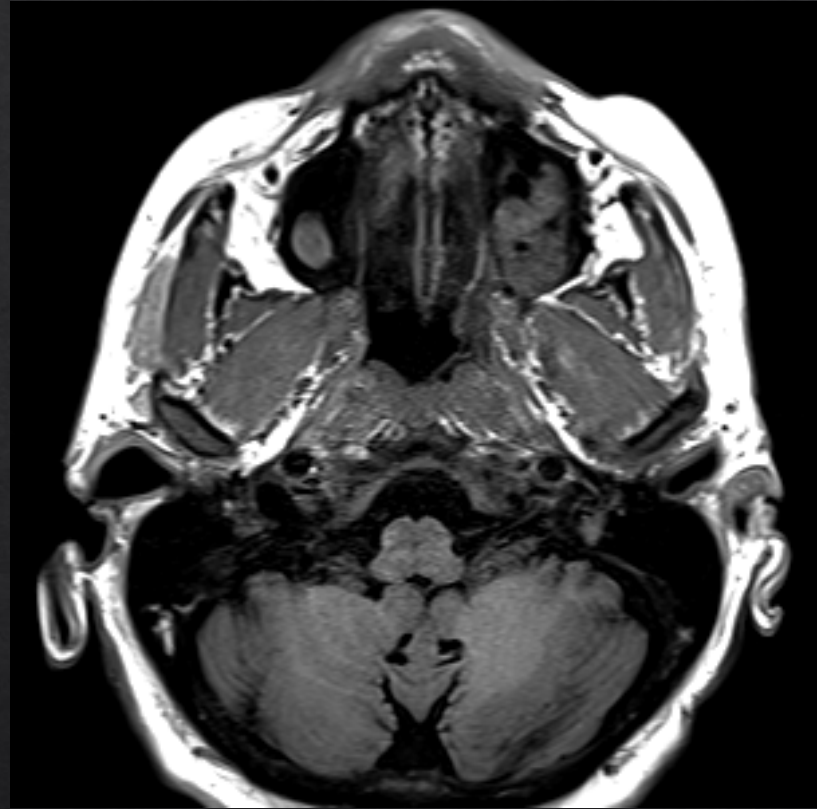
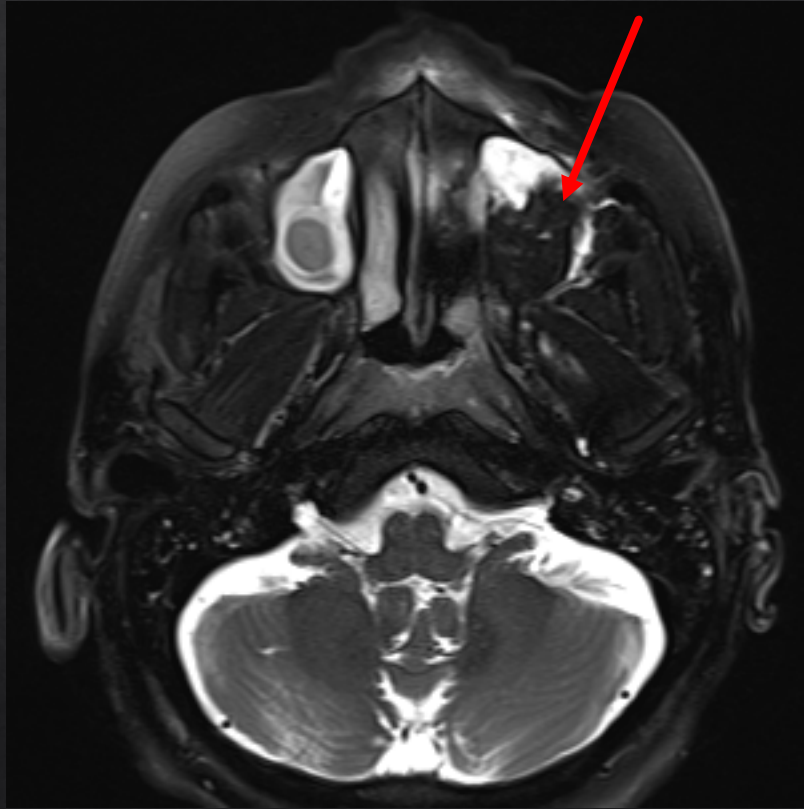
# Another Flavor of Sinusitis



# Invasive Fungal Sinusitis - IFS

- ◇ Typically occurs in immunocompromised pts
  - ◇ Not just cancer patients
    - ◇ Diabetics
- ◇ Offending agents
  - ◇ Aspergillus
  - ◇ Mucor

# Fungus Ball (Mycetoma)

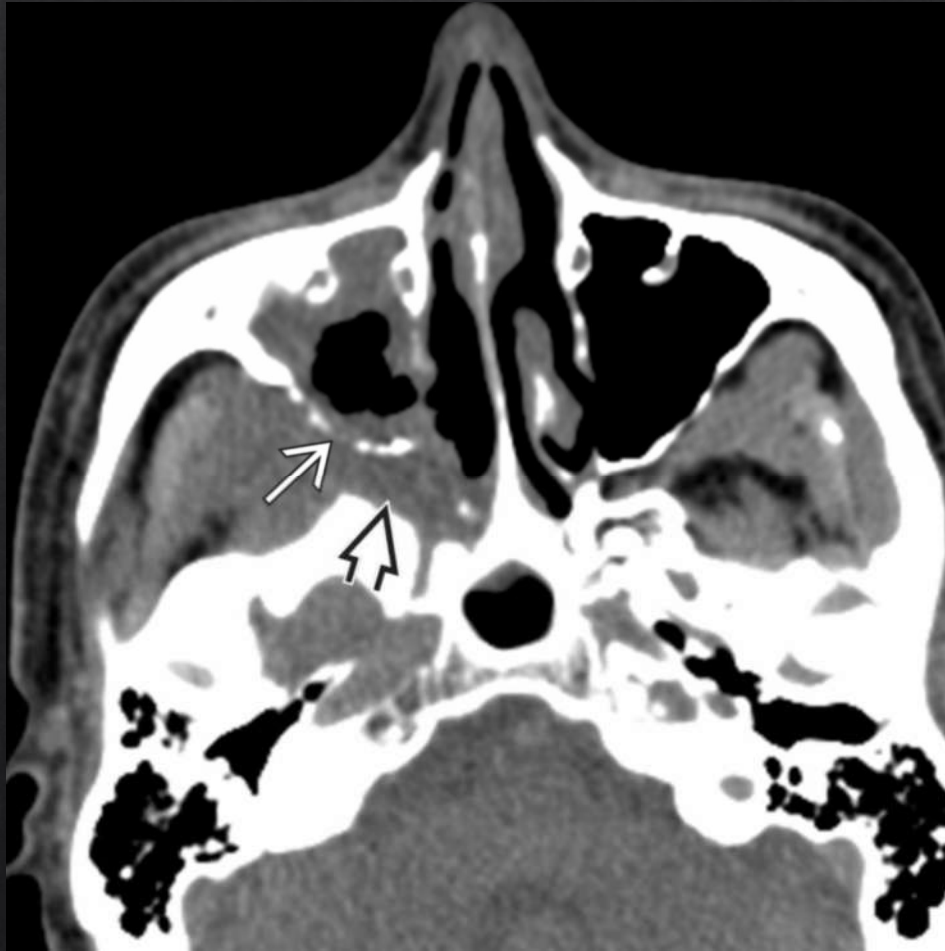




# Invasive Fungal Sinusitis



# Two Different Patients

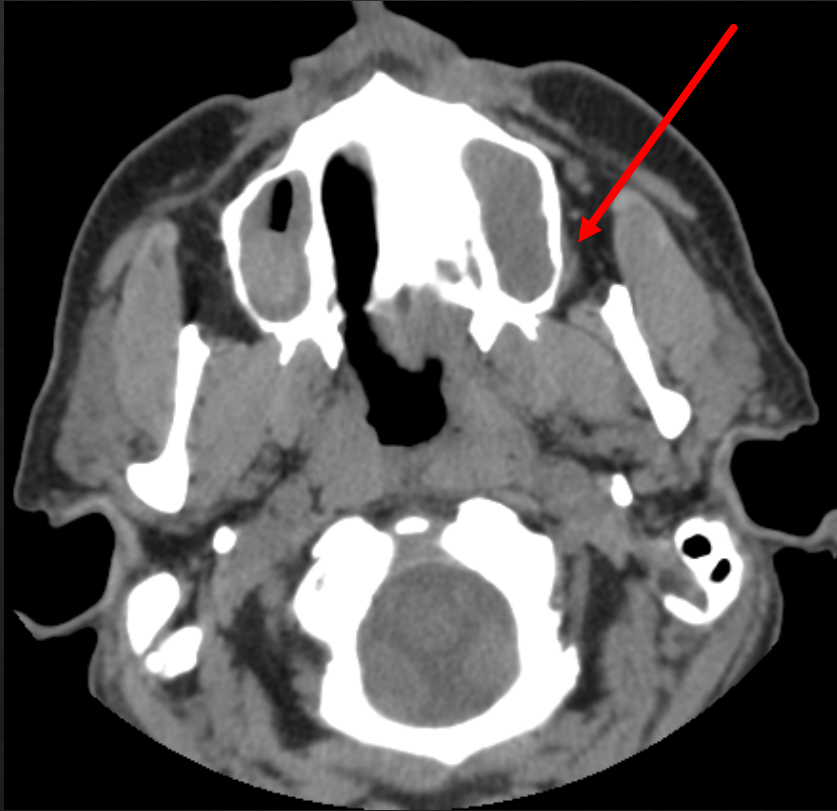


# Relatively Minor Dz In The Sinus





# Early Invasion





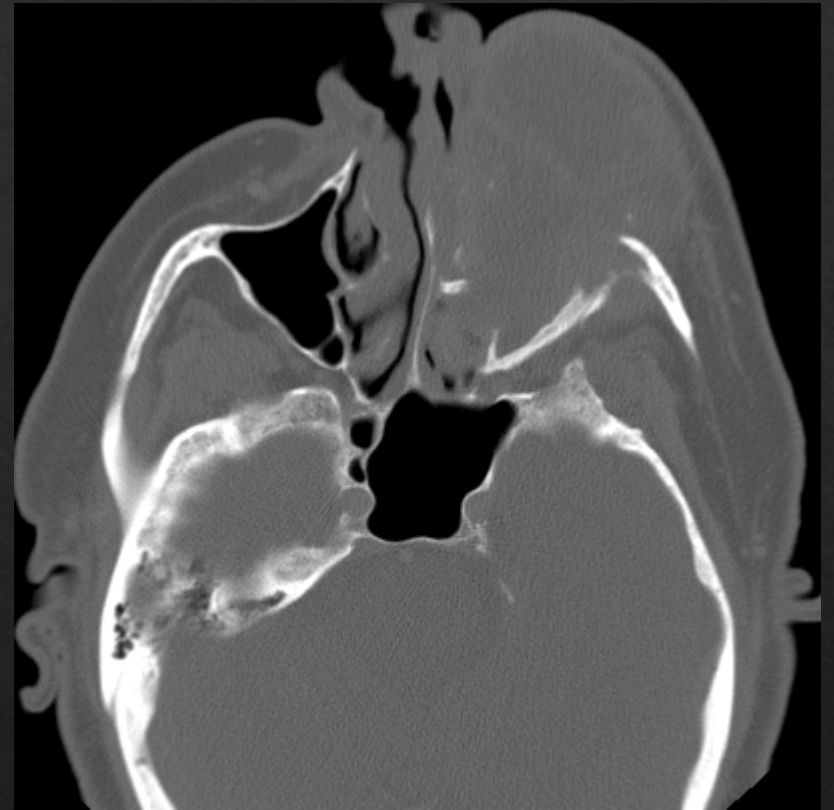
# Getting Creative!



# Selected Sinonasal Tumors

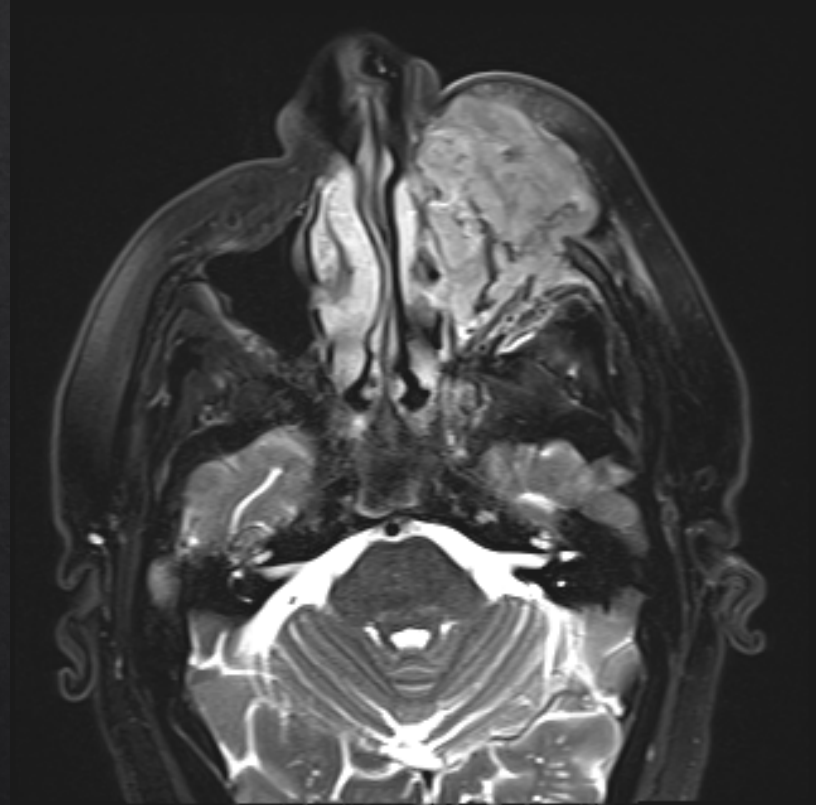
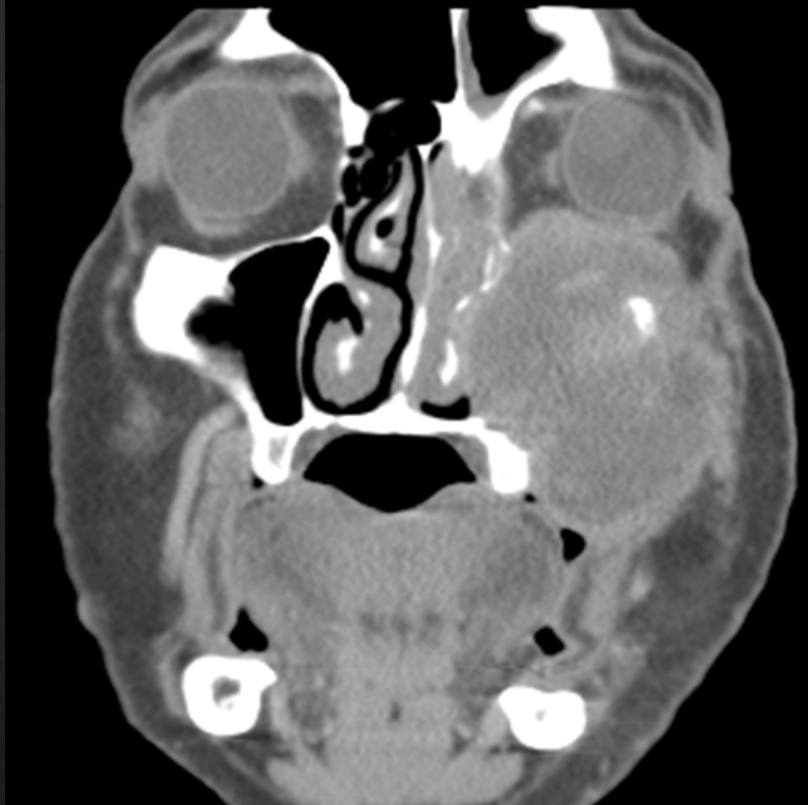
- ◇ Squamous cell carcinoma
  - ◇ Inverted papilloma
- ◇ Sinonasal Lymphoma
- ◇ Esthesioneuroblastoma
- ◇ Sinonasal undifferentiated carcinoma (SNUC)
- ◇ Juvenile angiofibroma

# Case - 72 yo M



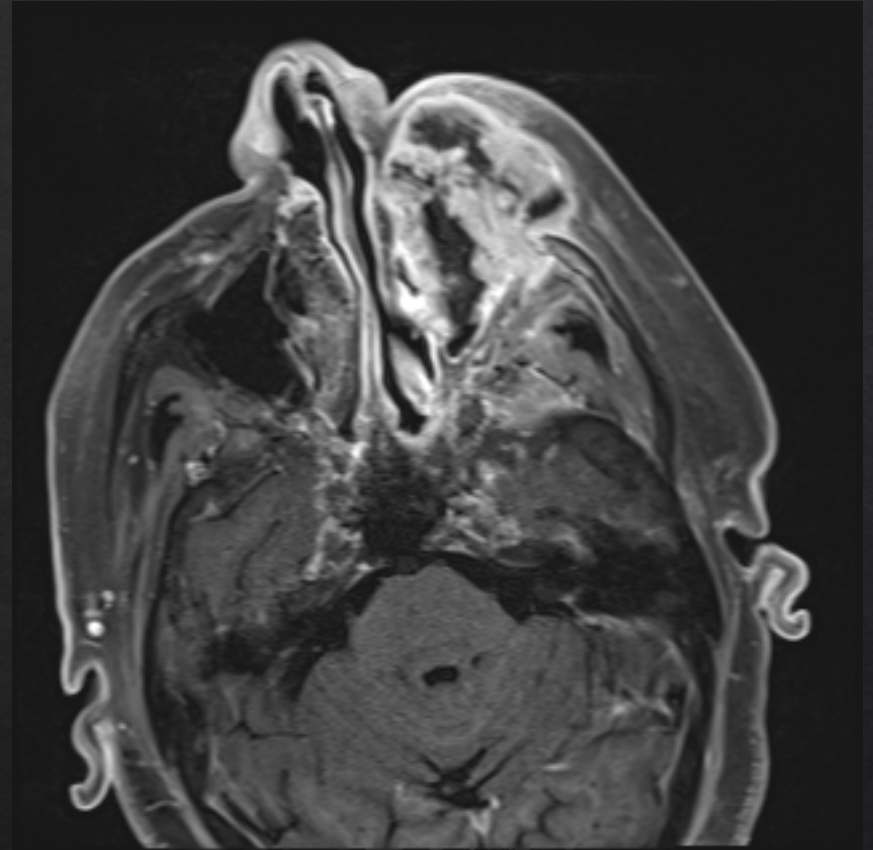
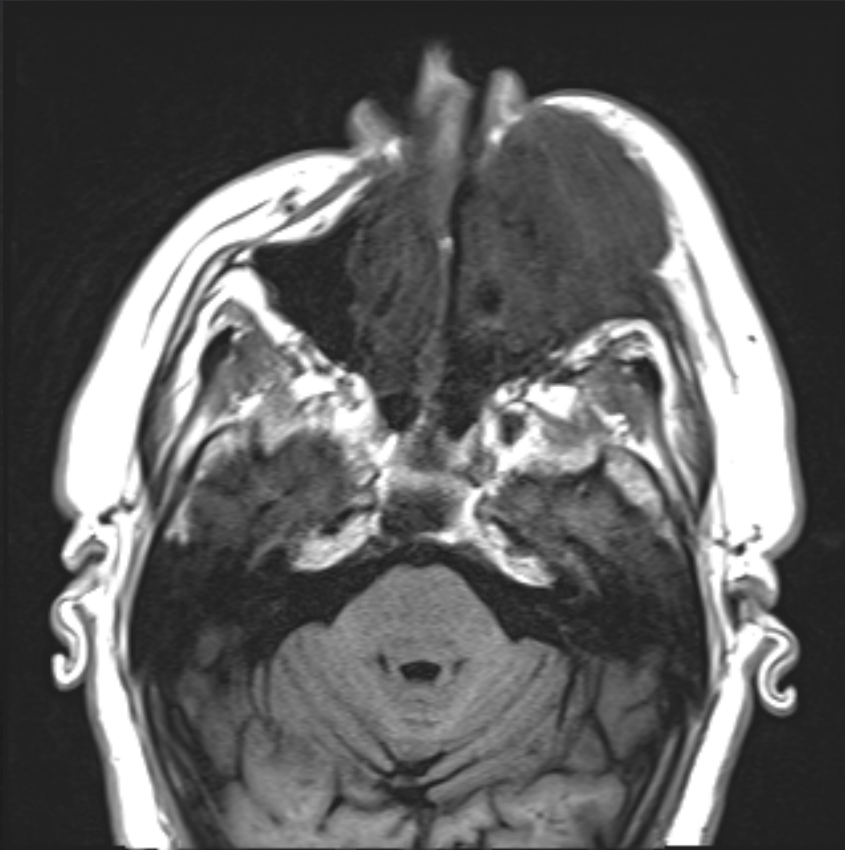


# Case





# Case



# Sinonasal Squamous Cell Carcinoma

- ◇ **Most common malignancy of sinonasal region**
  - ◇ ~ **80%** of malignant sinonasal tumors
- ◇  $\frac{3}{4}$  in paranasal sinuses and  $\frac{1}{4}$  in nasal cavity
  - ◇ Maxillary antrum (85%)
  - ◇ Ethmoid (10%)
  - ◇ Frontal/sphenoid (< 5%)
- ◇ 50-70 years old
- ◇ M > F

# Sinonasal Squamous Cell Carcinoma

- ◇ No direct link to smoking
- ◇ Risk factors
  - ◇ Inhaled wood dust and metallic particles
  - ◇ HPV
  - ◇ Inverted papilloma\*
  - ◇ Formaldehyde
  - ◇ Asbestos



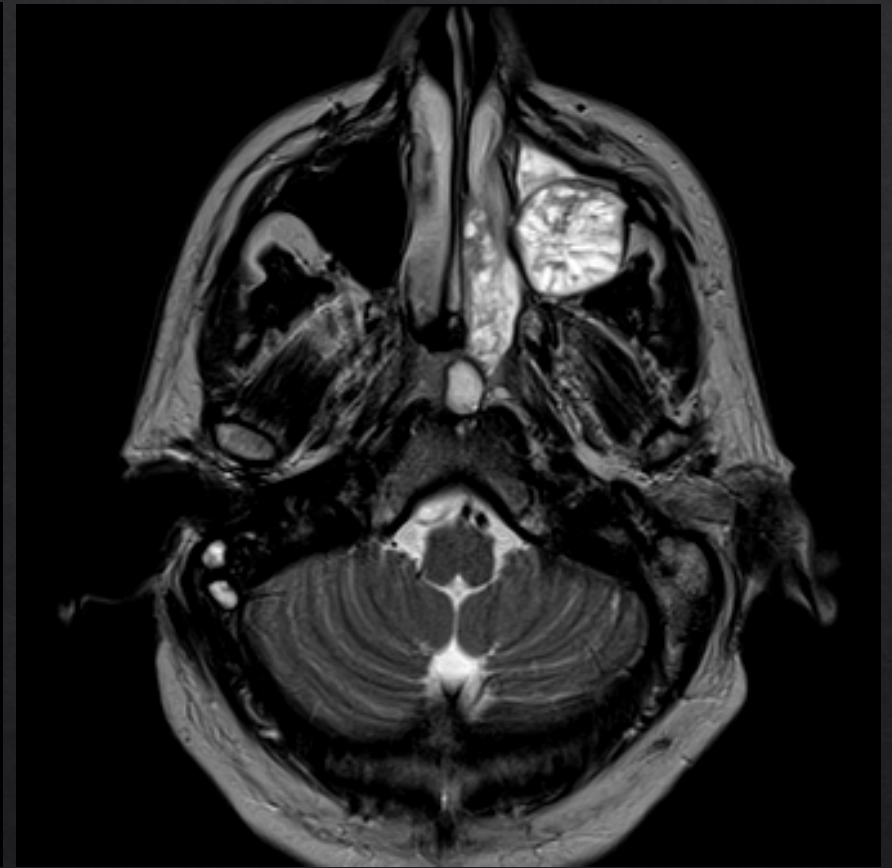
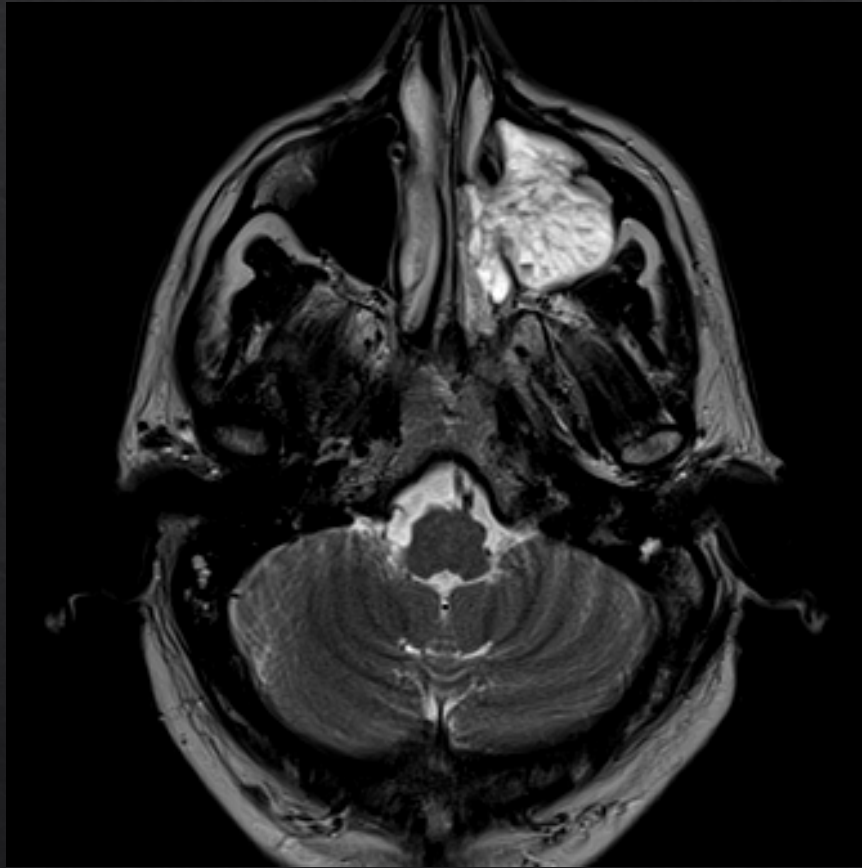
# Sinonasal Squamous Cell Carcinoma

- ◆ Soft tissue density mass
  - ◆ Irregular margins
  - ◆ Aggressive bone destruction
- ◆ Frequently contains areas of necrosis
- ◆ Enhances to a lesser degree other sinonasal malignancies

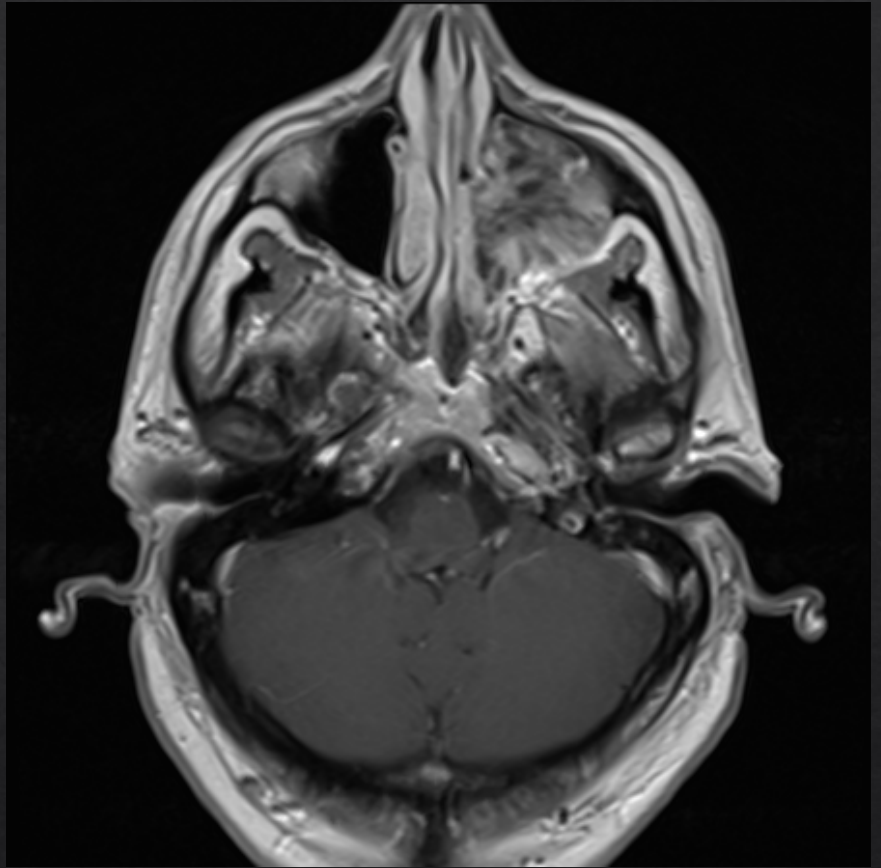
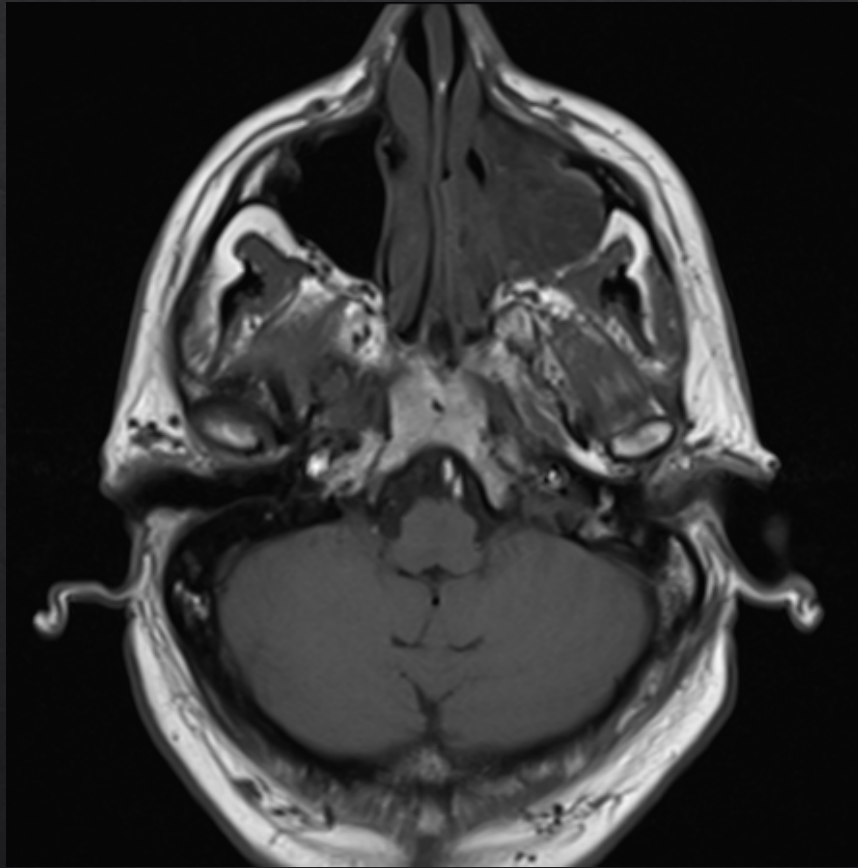
# Sinonasal Squamous Cell Carcinoma

- ◇ 15% of maxillary sinus SCCa have malignant adenopathy
  - ◇ Retropharyngeal or level II jugular chain nodes
- ◇ Overall 5-year survival ~60 %
- ◇ Combined surgery & XRT most common treatment

# Case – 34 yo M



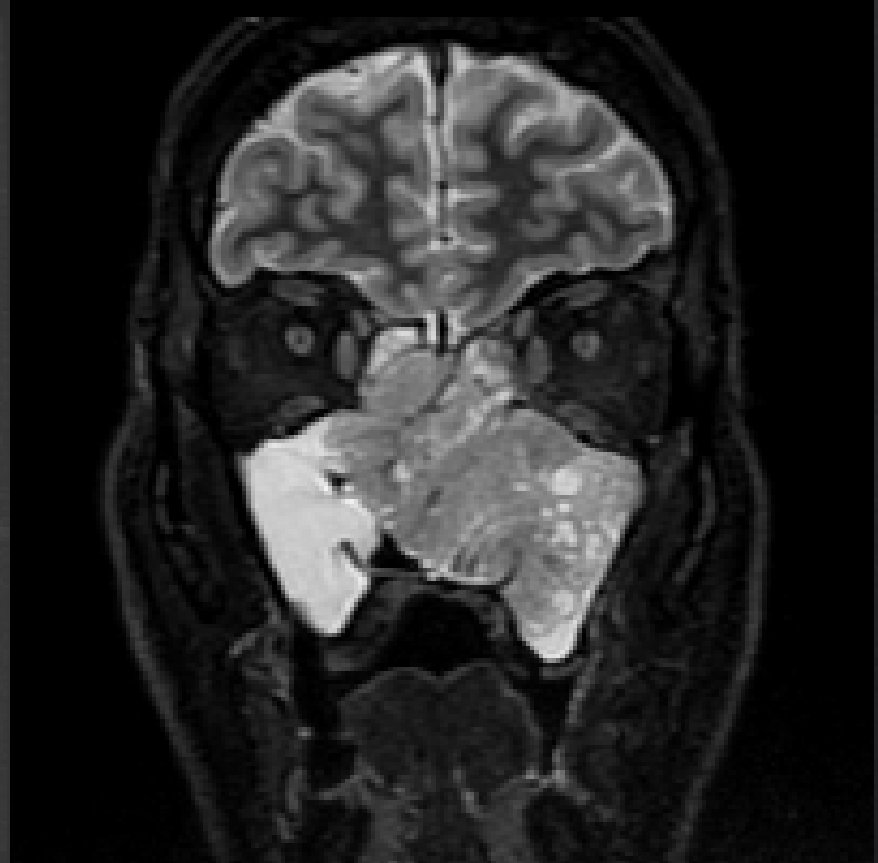
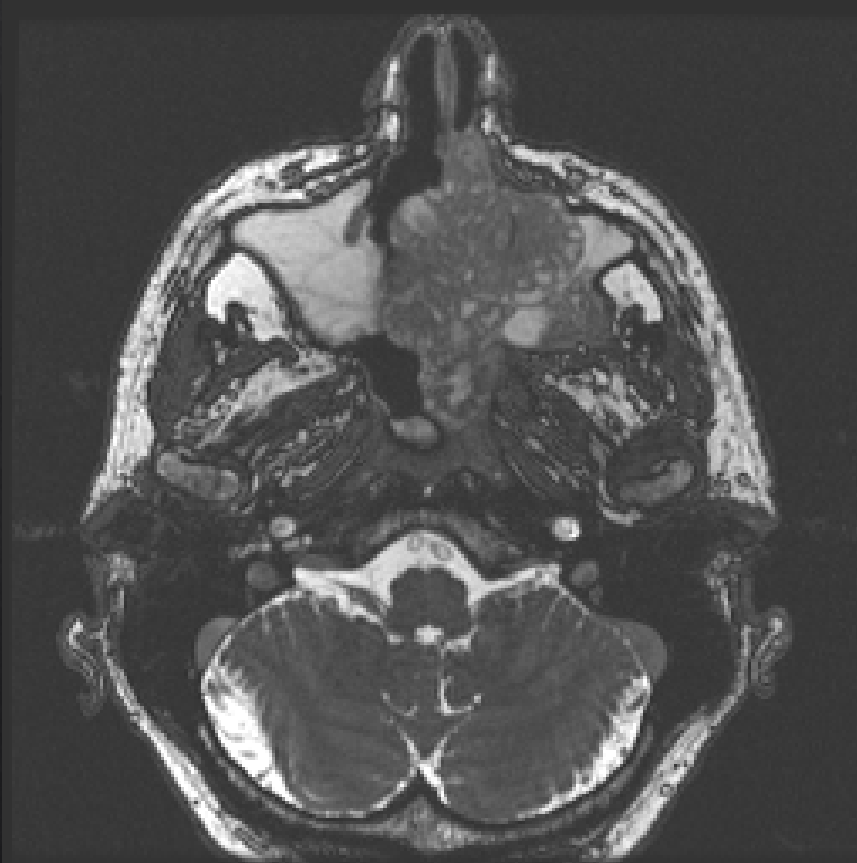




# Inverted Papilloma (IPap)

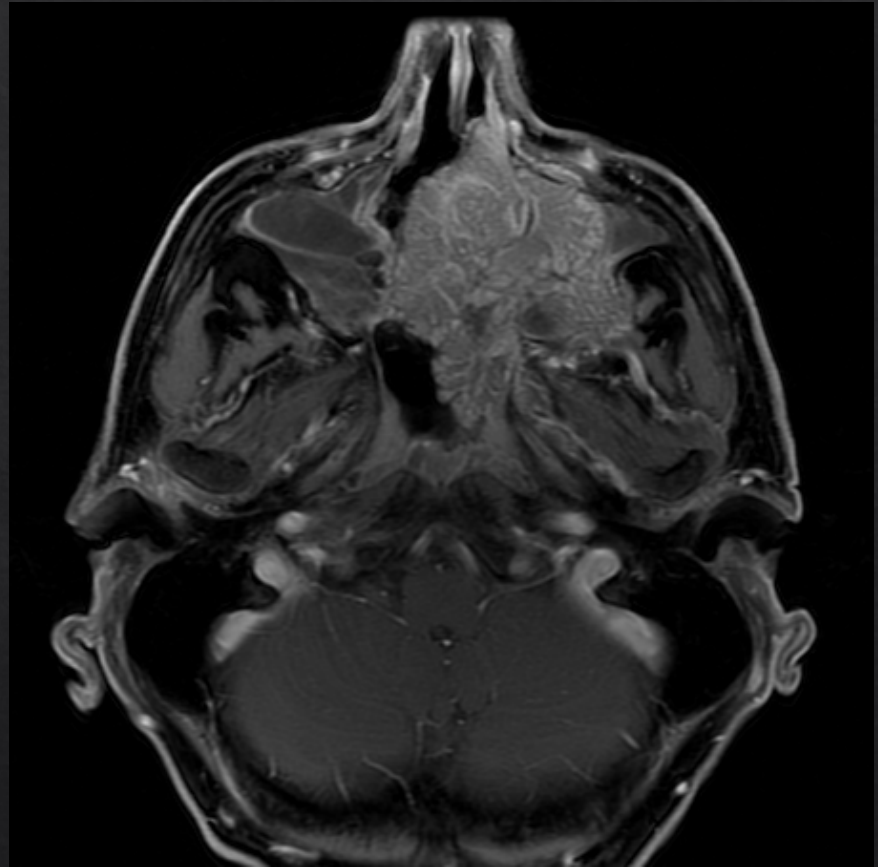
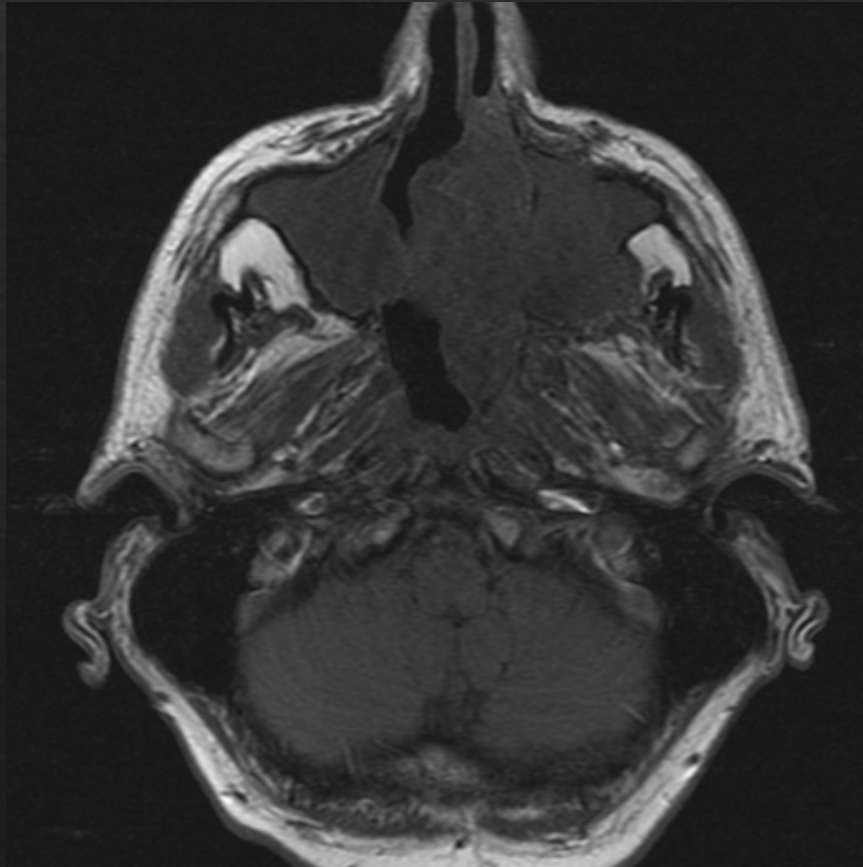
- ◇ Benign but locally aggressive tumor
- ◇ Typically 40-70 yoa
- ◇ M > F = 4-5:1
- ◇ 10% either degenerate into or coexist with SCCa

# Companion Case

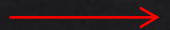


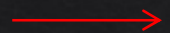
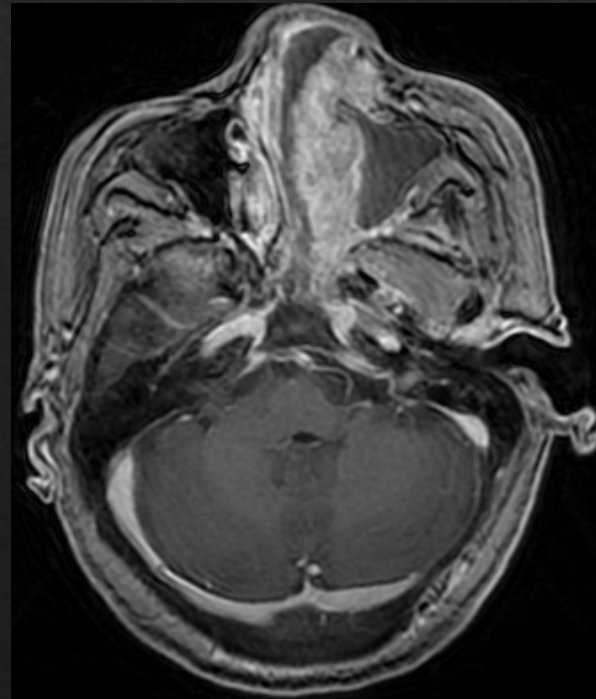
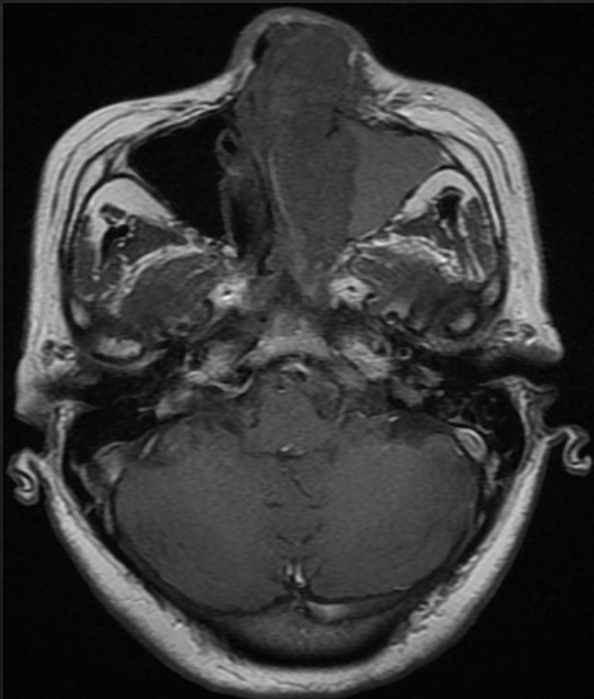
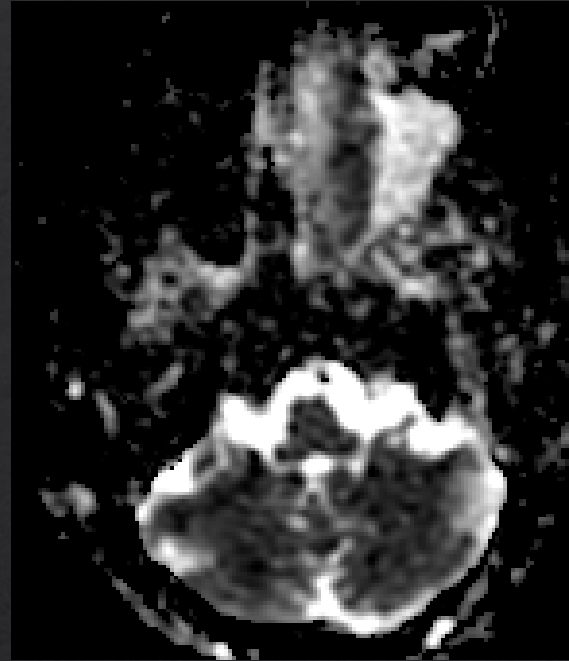
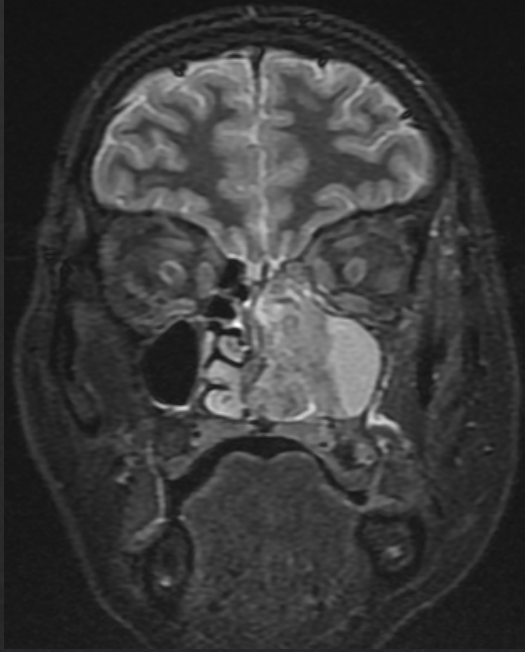


# Convoluted Cerebriform

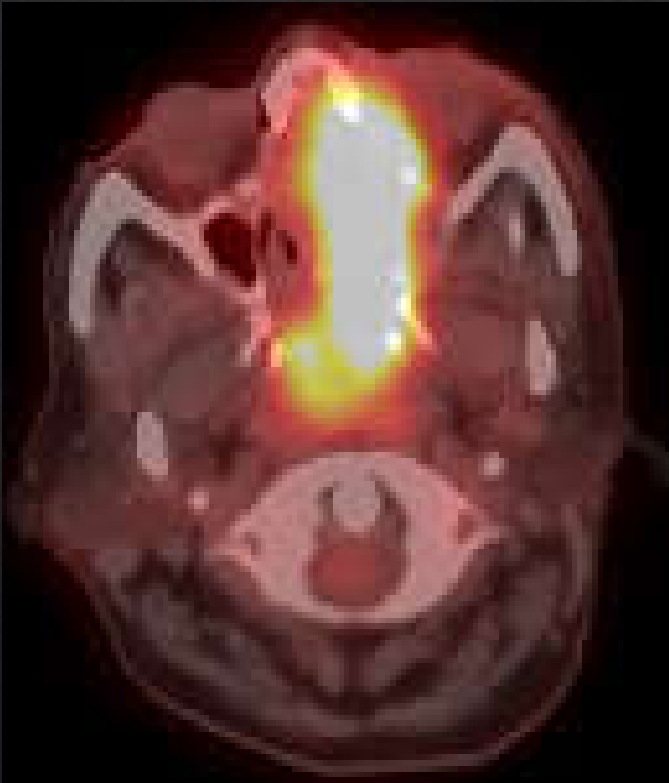


# Case – 42 yo F









# Non-Hodgkin Lymphoma - Sinonasal (NHL-SN)

- ◇ 2nd most common SN malignancy after SCCa
- ◇ Difficult to distinguish from other neoplasms
  - ◇ Could include in DDx for almost any aggressive adult nasal ST mass
- ◇ Enlarged LN and Waldeyer ring involvement clue to diagnosis

# Imaging Appearance of NHL-SN

- ◇ Bulky, lobular, soft tissue mass in nasal cavity ± sinuses
- ◇ Hyperdense on CT and restricts diffusion
- ◇ T1WI
  - ◇ intermediate, homogeneous signal similar to muscle
- ◇ T2WI
  - ◇ Low to intermediate homogeneous signal
- ◇ Variable but diffuse & homogeneous enhancement
- ◇ PET
  - ◇ may show moderate to avid uptake



# 3 subgroups of NHL-SN

## ◇ B-cell (Western)

- ◇ most frequent type in paranasal sinuses
- ◇ less aggressive
- ◇ 6th decade and M = F

## ◇ T-cell (Asian)

- ◇ more common in nasal cavity
- ◇ more aggressive
- ◇ 7th decade and M > F

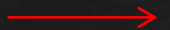
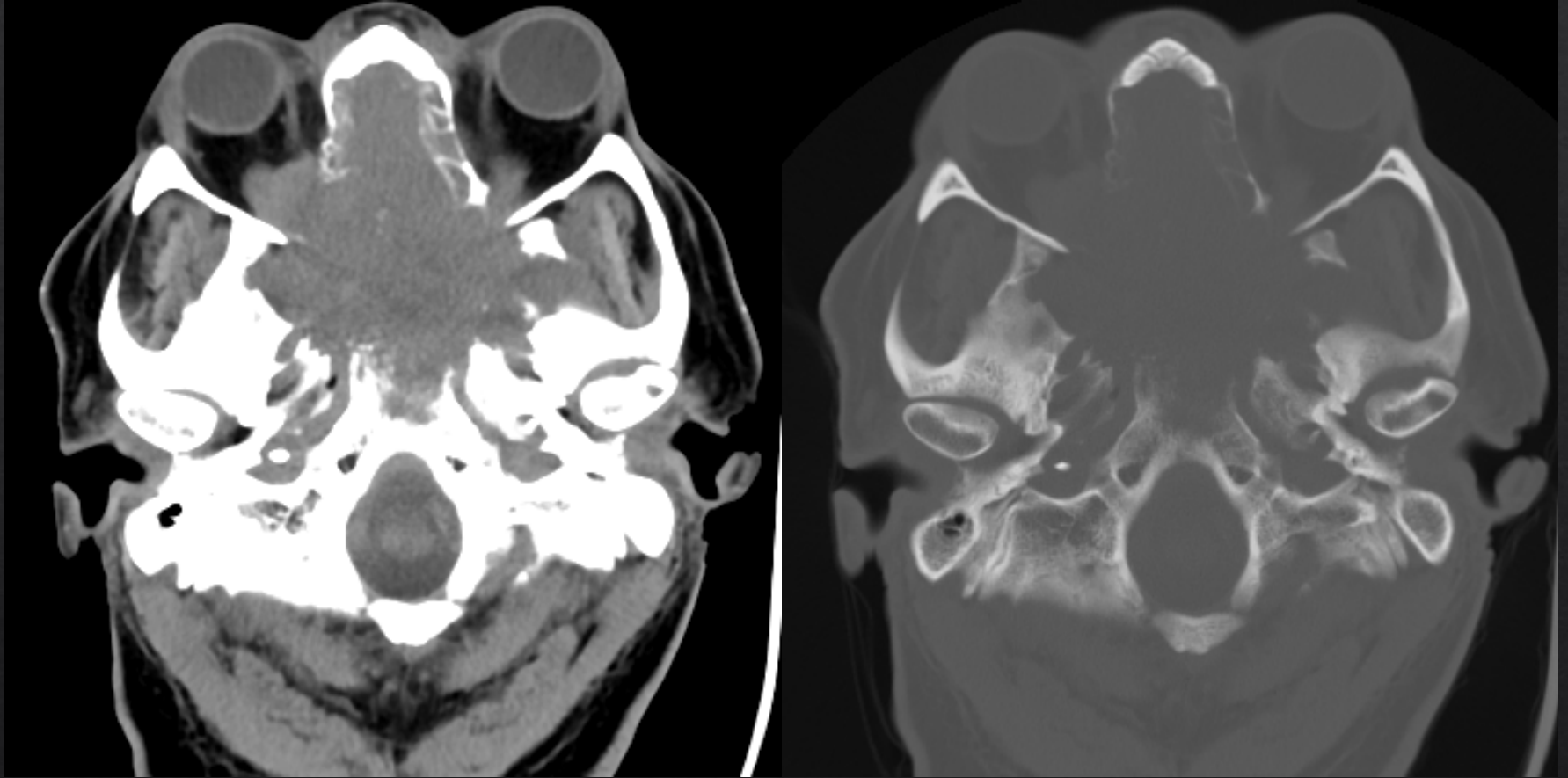
## ◇ Natural Killer (NK) T-cell

- ◇ subtype of T-cell lymphoma w/ **EBV association**
- ◇ more common in nasal cavity
- ◇ **more aggressive**
- ◇ wide age range w/ peak 6th decade and M > F

# Adenocarcinoma

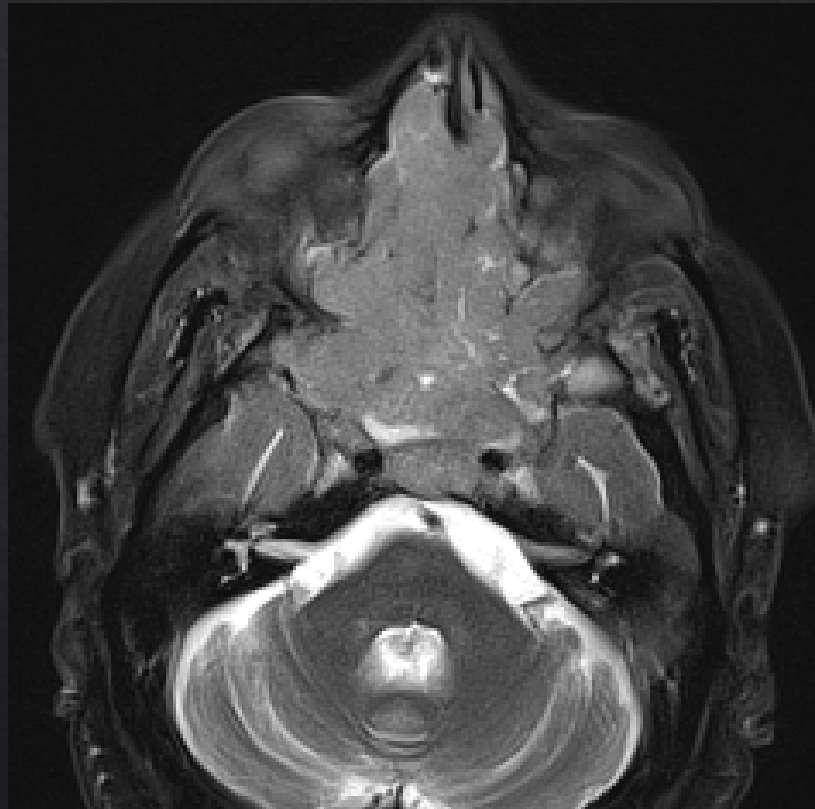
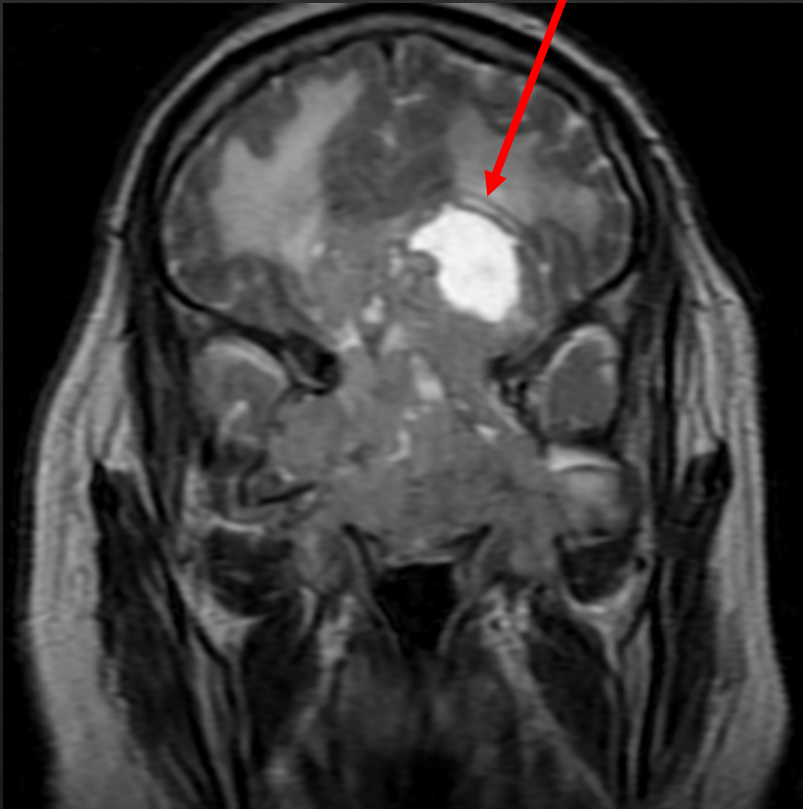
- ◇ Imaging features can be similar to SCCa
- ◇ Predilection for **ethmoid sinuses**
- ◇ Enhancement
  - ◇ More than SCCa
  - ◇ Less avidly & more heterogeneously than esthesioneuroblastoma
- ◇ Risk factors
  - ◇ **inhaled wood dust and occupational exposures**

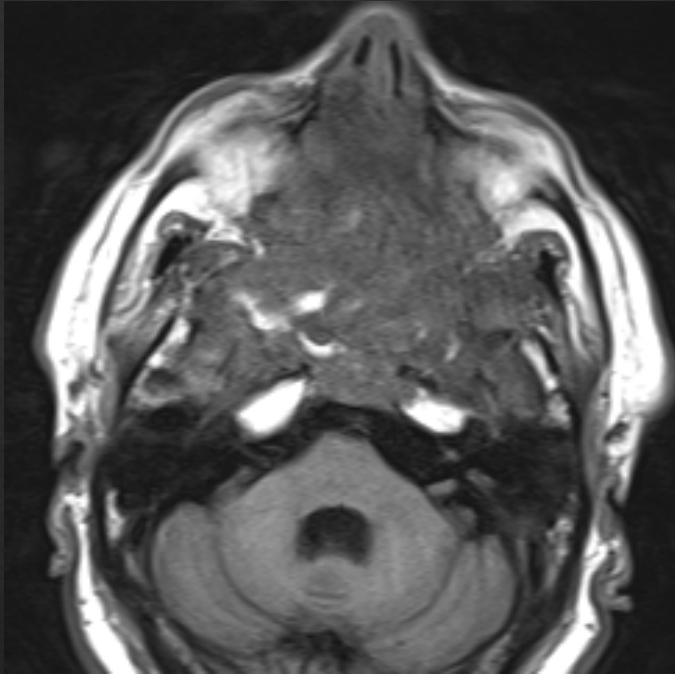
# Case



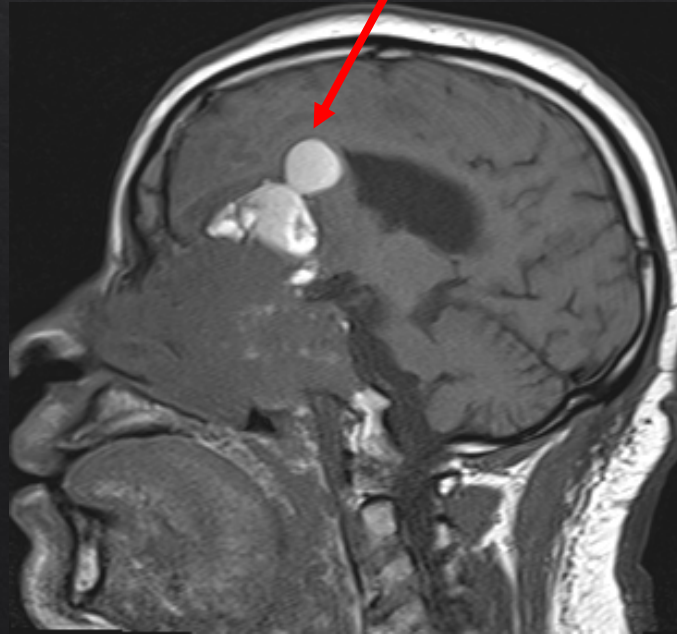
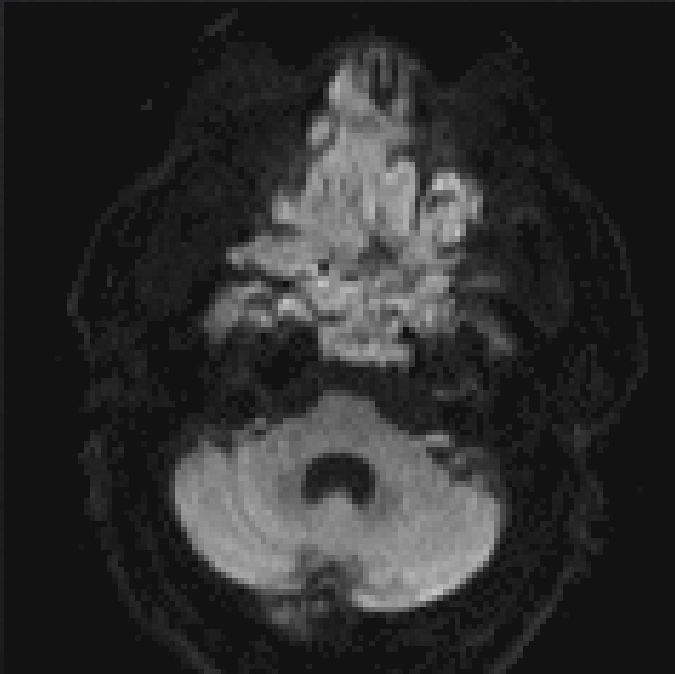
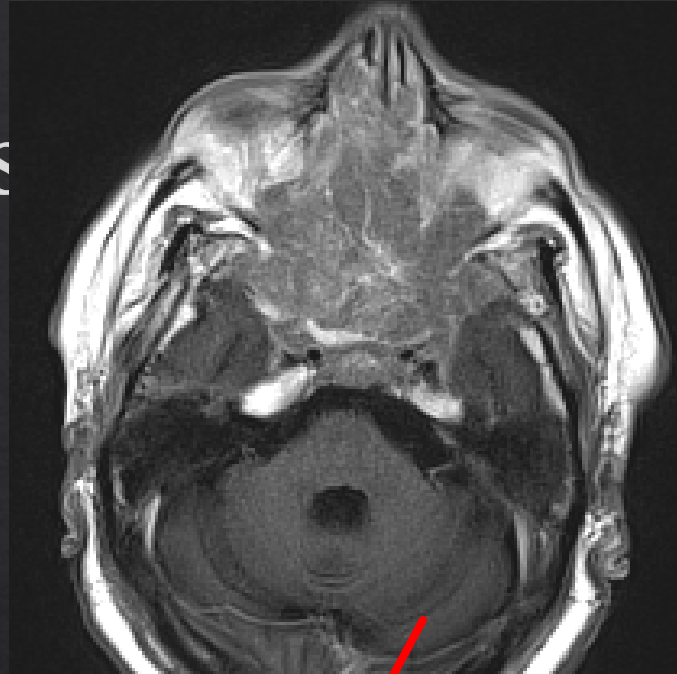


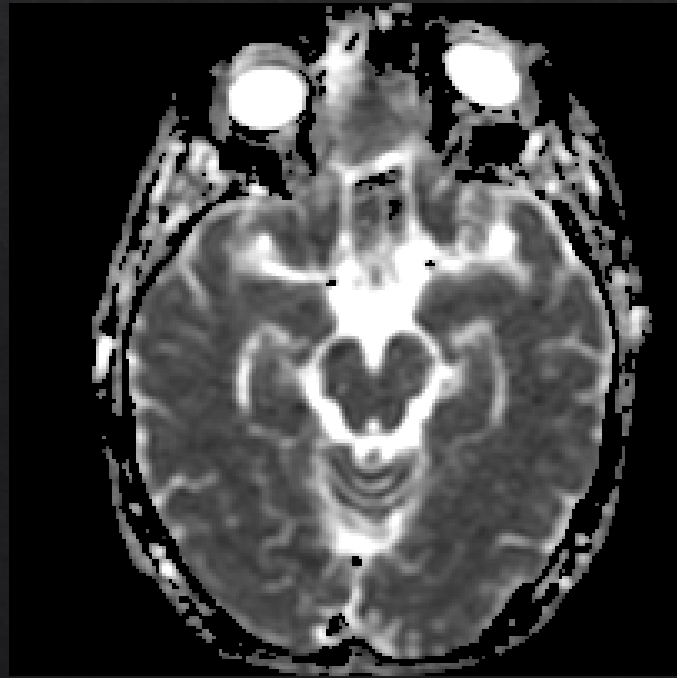
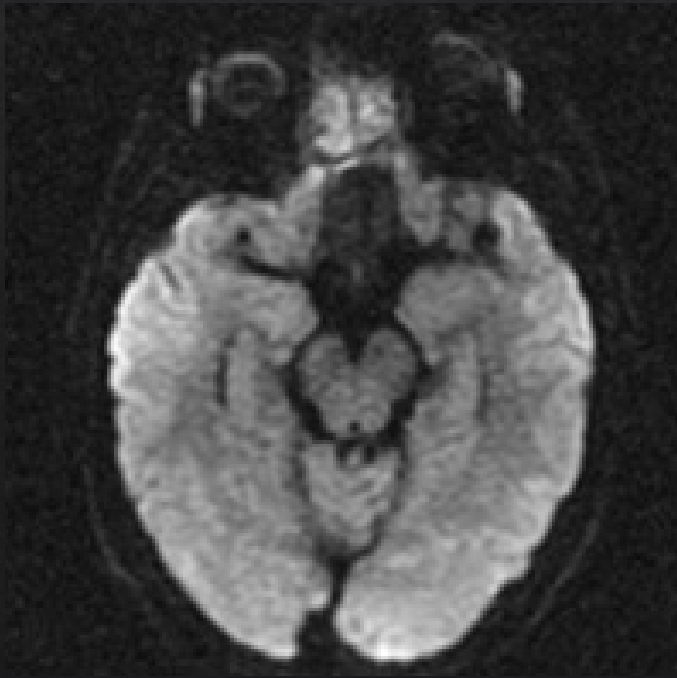
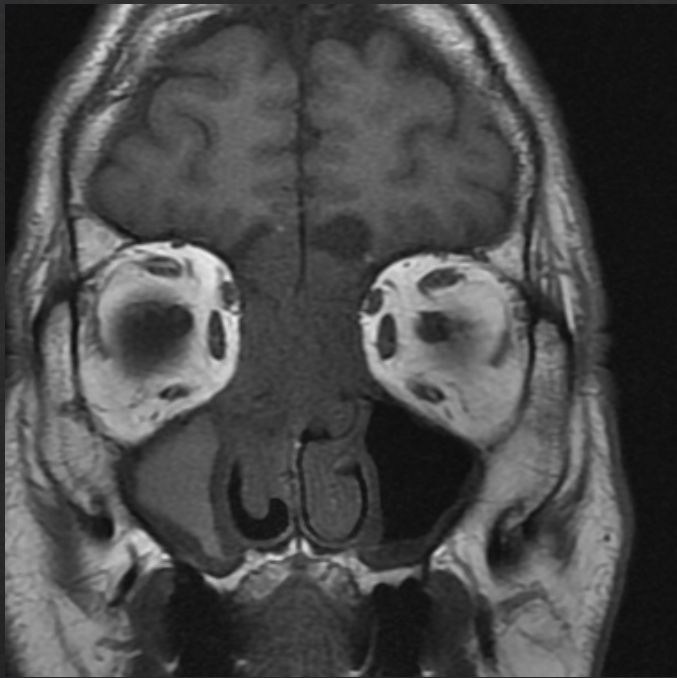
# Case – 55 yo M





Case







# Esthesioneuroblastoma (ENB)

- ◇ Malignant neuroectodermal tumor
- ◇ Arises from olfactory mucosa in superior nasal cavity
- ◇ Dumbbell-shaped mass with "waist" at cribriform plate
- ◇ Bimodal distribution in 2nd & 6th decades

# Esthesioneuroblastoma (ENB)

- ◇ No etiologic basis or risk factors elucidated
- ◇ **Peripheral cysts at interface with brain**
  - ◇ highly suggestive of ENB
- ◇ Bone remodeling mixed with bone destruction

# Esthesioneuroblastoma (ENB)

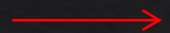
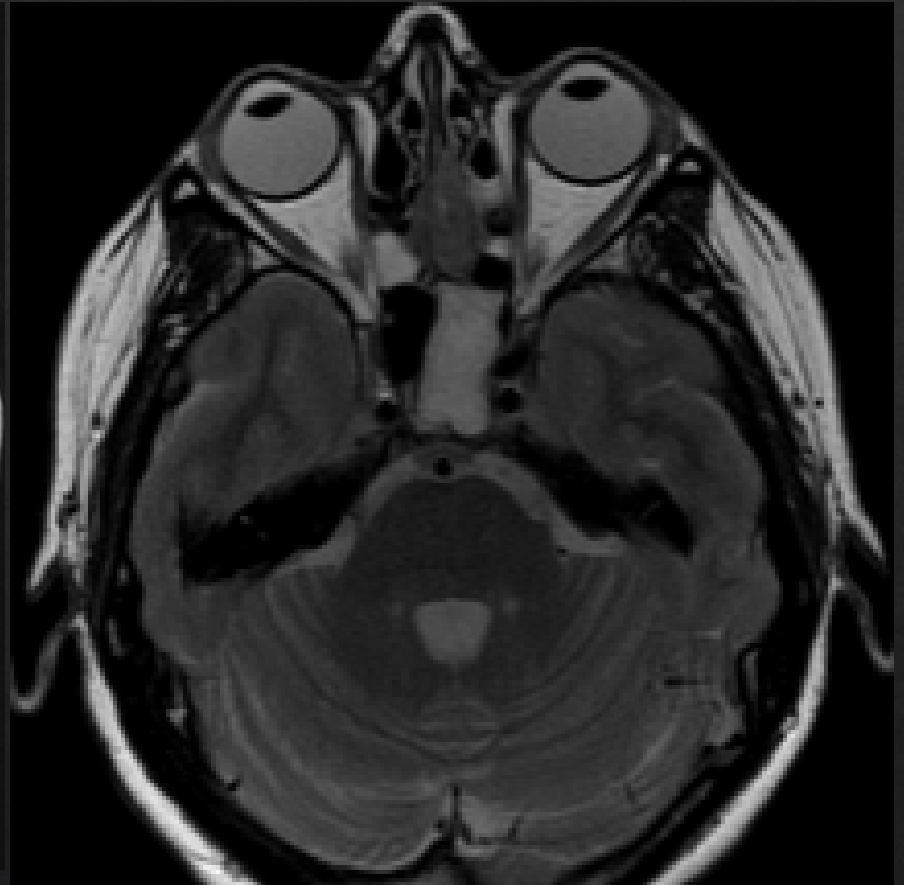
- ◇ T1
  - ◇ hypointense to intermediate signal compared to brain
- ◇ T2WI
  - ◇ Intermediate to hyperintense to brain
- ◇ Avid homogeneous tumor enhancement
  - ◇ heterogeneous enhancement in areas of necrosis

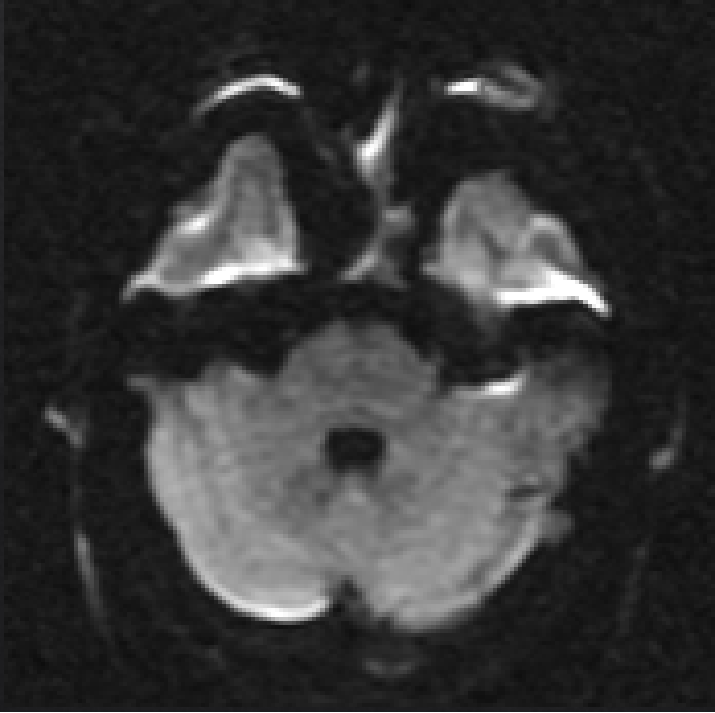
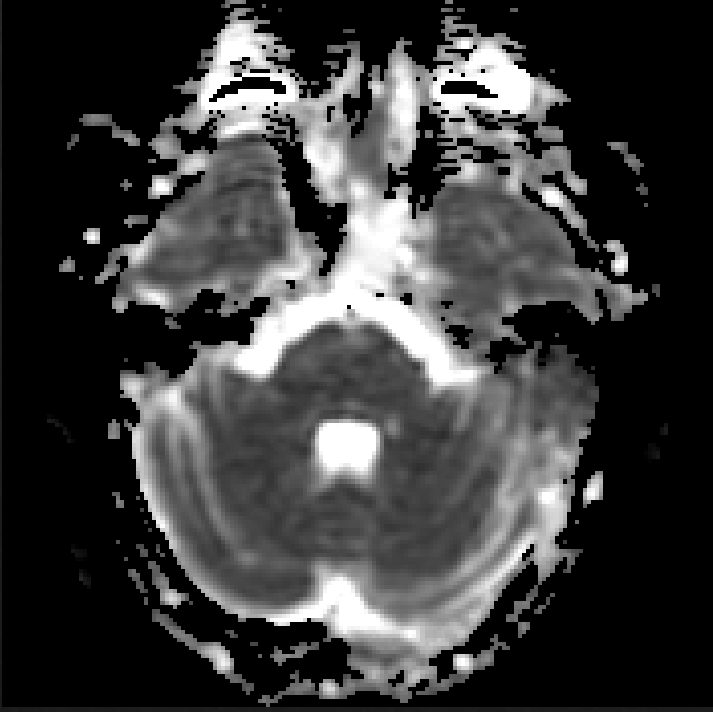
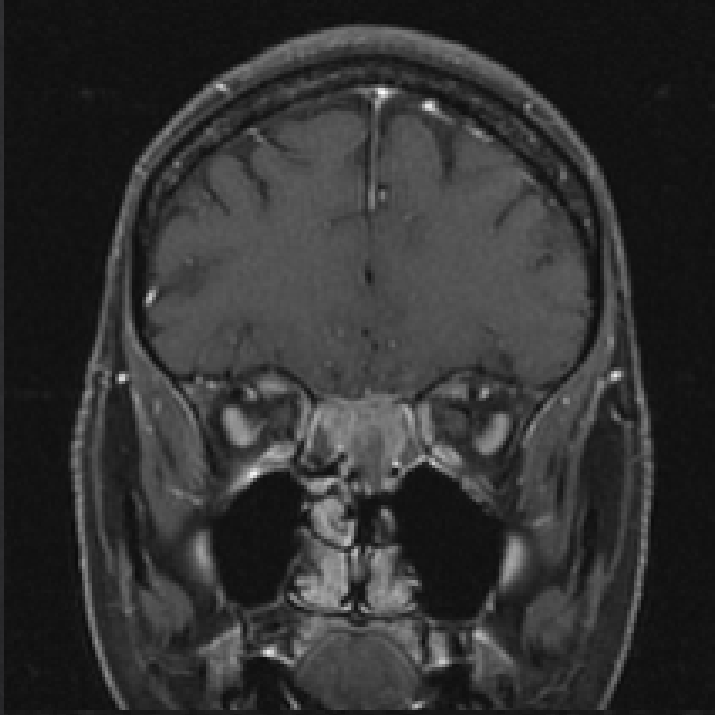
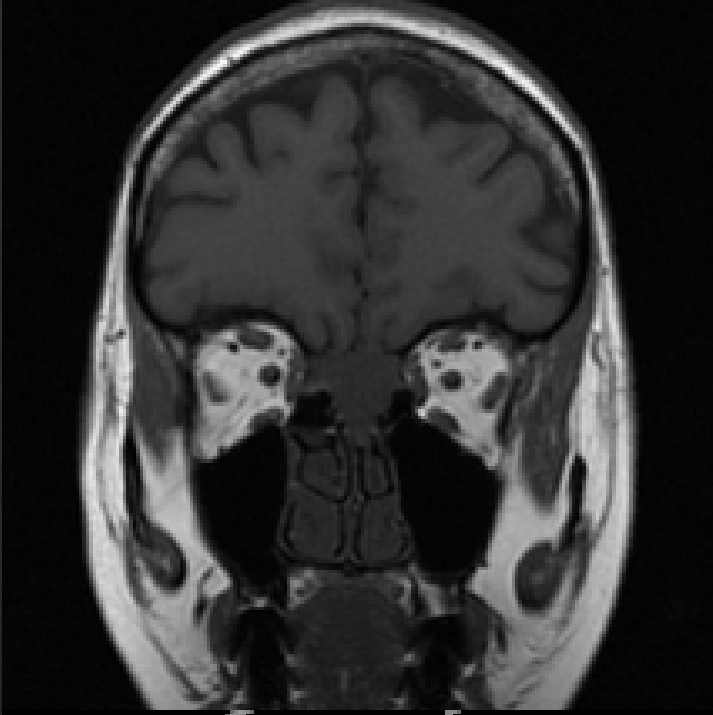


# Esthesioneuroblastoma (ENB)

- ◇ Tx = Surgery and radiotherapy
- ◇ Chemotherapy reserved for larger, high-grade ENB and metastatic disease
  - ◇ Metastases in 10-30% of patients
- ◇ **Excellent prognosis vs. other sinonasal malignancies**
  - ◇ 5-year survival rates: 75-77% overall
- ◇ Long-term follow-up (5-10 years)
  - ◇ **tendency to recur late**

# Case – 52 yo M







# Sinonasal Undifferentiated Carcinoma

- ◇ **Aggressive neoplasm** of varying histogenesis
- ◇ Most common in nasal cavity with extension into paranasal sinuses
  - ◇ Ethmoid more common than maxillary
- ◇ Broad age range (3rd-9th decades)
  - ◇ Median age = 6th decade
- ◇ M > F; 2-3:1

# Sinonasal Undifferentiated Carcinoma

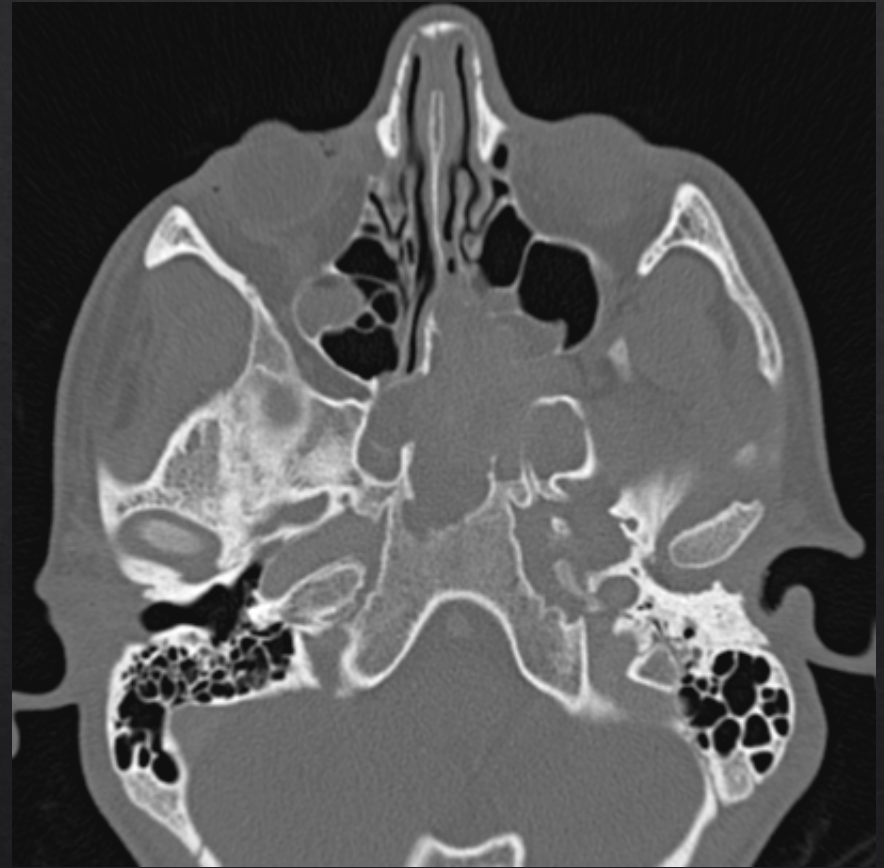
- ◇ Imaging features are **nonspecific**
  - ◇ Difficult to distinguish from SCCa
- ◇ **Aggressive sinonasal mass with bone destruction & rapid growth**
- ◇ No known etiologic agents
  - ◇ EBV negative

# Sinonasal Undifferentiated Carcinoma

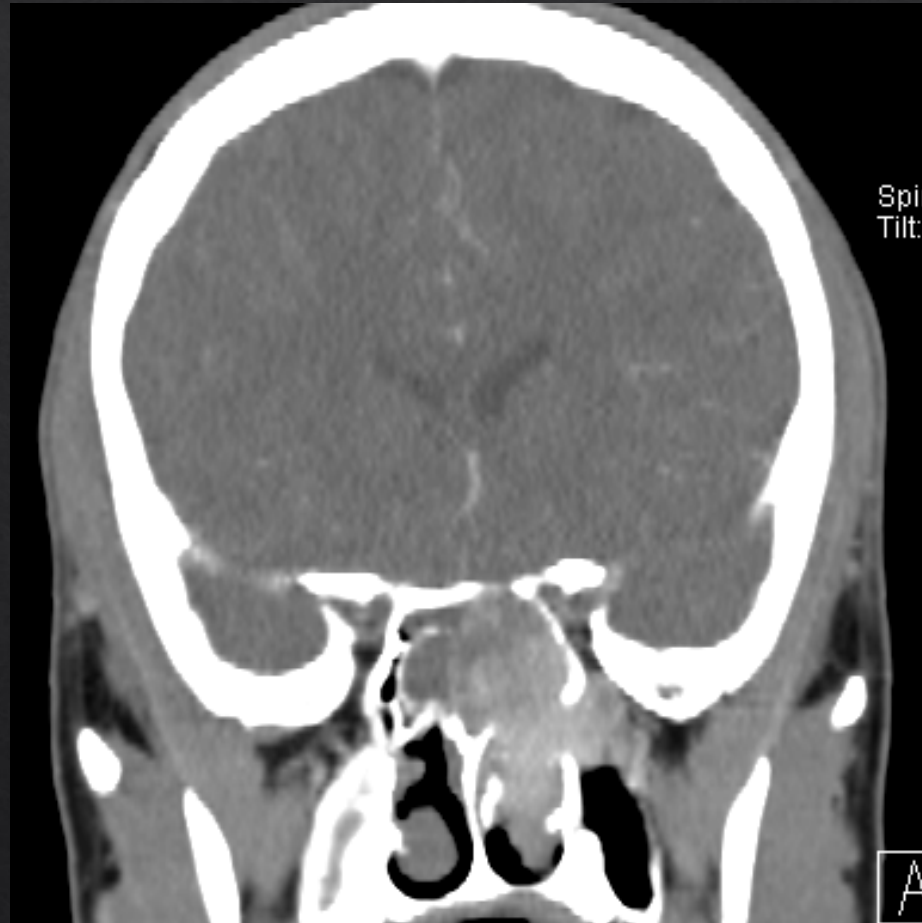
- ◇ 10-30% have positive regional nodes
- ◇  $\geq 20-30\%$  have local-regional recurrence after treatment
- ◇ 25-30% have distant dissemination of disease
- ◇ Rapidly growing and usually fatal despite all attempts at controlling disease



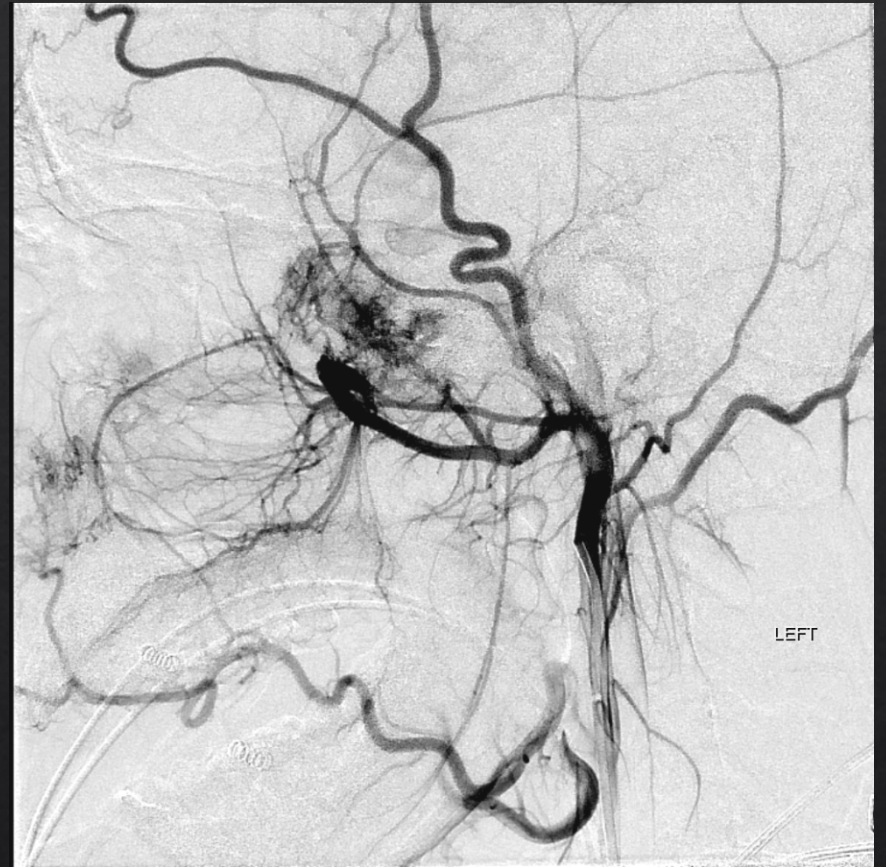
# Case – 18 yo M



# Case



# Case





# Juvenile Angiofibroma

- ◇ AKA Juvenile nasopharyngeal angiofibroma (JNA)
- ◇ Benign but locally invasive nasal cavity mass
- ◇ Centered in posterior nasal cavity near sphenopalatine foramen
- ◇ Almost exclusively occurs in adolescent males



# Juvenile Angiofibroma

- ◇ T1
  - ◇ heterogeneous, intermediate signal
- ◇ T2
  - ◇ heterogeneous, intermediate to high signal intensity  $\pm$  flow voids
- ◇ **Intense enhancement  $\pm$  flow voids**
- ◇ Internal maxillary and ascending pharyngeal arteries from ECA

# Juvenile Angiofibroma

- ◆ Most helpful things for ID are location, gender, and age
- ◆ Treated with surgical excision
  - ◆ often undergo preoperative embolization

# Review

- ◇ Location of paranasal sinuses allows intracranial and intraorbital spread of infection
- ◇ Invasive fungal sinusitis can be present with minimal sinus disease
  - ◇ High index of suspicion



# Review

- ◇ SCCa is most common malignancy in SN region
  - ◇ most common in maxillary antrum
- ◇ NHL is 2<sup>nd</sup> most common
  - ◇ B-cell in paranasal sinuses
  - ◇ T-cell in nasal cavity

# Review

## ◇ JNA

- ◇ Intensely enhancing mass originating at sphenopalatine foramen (SPF) in adolescent male

## ◇ ENB

- ◇ Avidly enhancing mass centered at the cribriform plate with cysts at tumor-brain interface

## ◇ IPap

- ◇ Mass centered at middle meatus with convoluted cerebriform appearance

# Tumors with LN

◇ SCCa

◇ NHL- SN

◇ SNUC

◇ ENB

Questions?