IMAGING AND PATHOLOGY OF SINUS DISEASE

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12/19/2016

Agenda

- Function and anatomy of sinuses
- Cases
- Differential diagnosis for the cases

Sinus function

- Warm and humidify air
- Air filtration
- Smell and taste
- Voice resonance

Help to think?

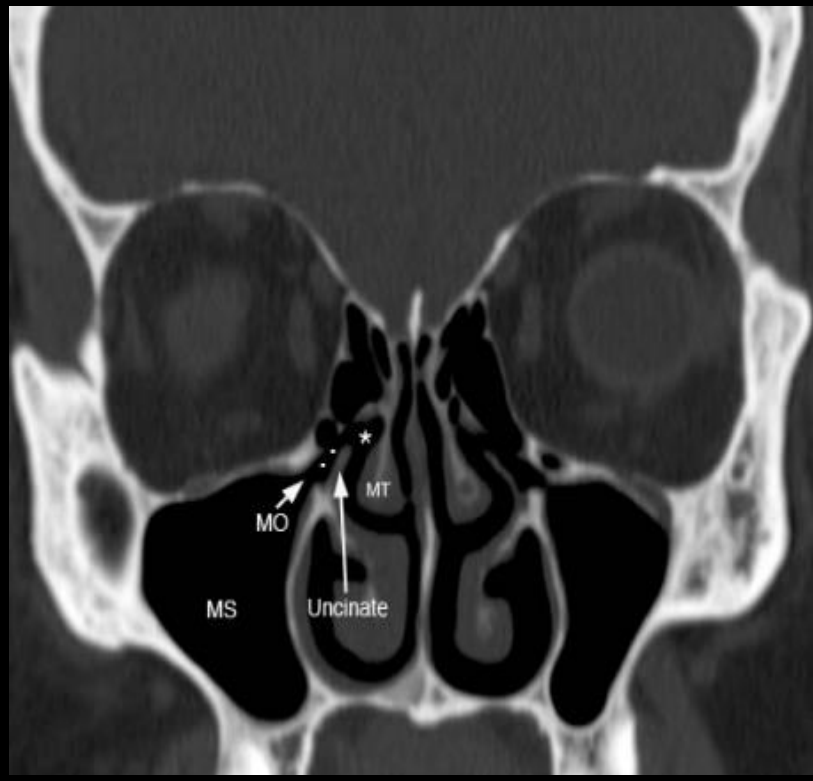
Nasal Respiration Entrains Human Limbic Oscillations and Modulates Cognitive Function

Christina Zelano, Heidi Jiang, Guangyu Zhou, Nikita Arora, Stephan Schuele, Joshua Rosenow, and Jay A. Gottfried

Journal of Neuroscience 7 December 2016, 36 (49) 12448-12467; DOI: https://doi.org/10.1523/JNEUROSCI.2586-16.2016

Sinus anatomy

- Sinuses are like fingerprints
- OMU complex
  - drainage pathway of the maxillary, frontal and anterior ethmoidal sinuses
  - Maxillary antrum -> maxillary ostium → infundibulum →uncinate process→ hiatus semilunaris → middle meatus
  - Some include frontal recess as part of OMU

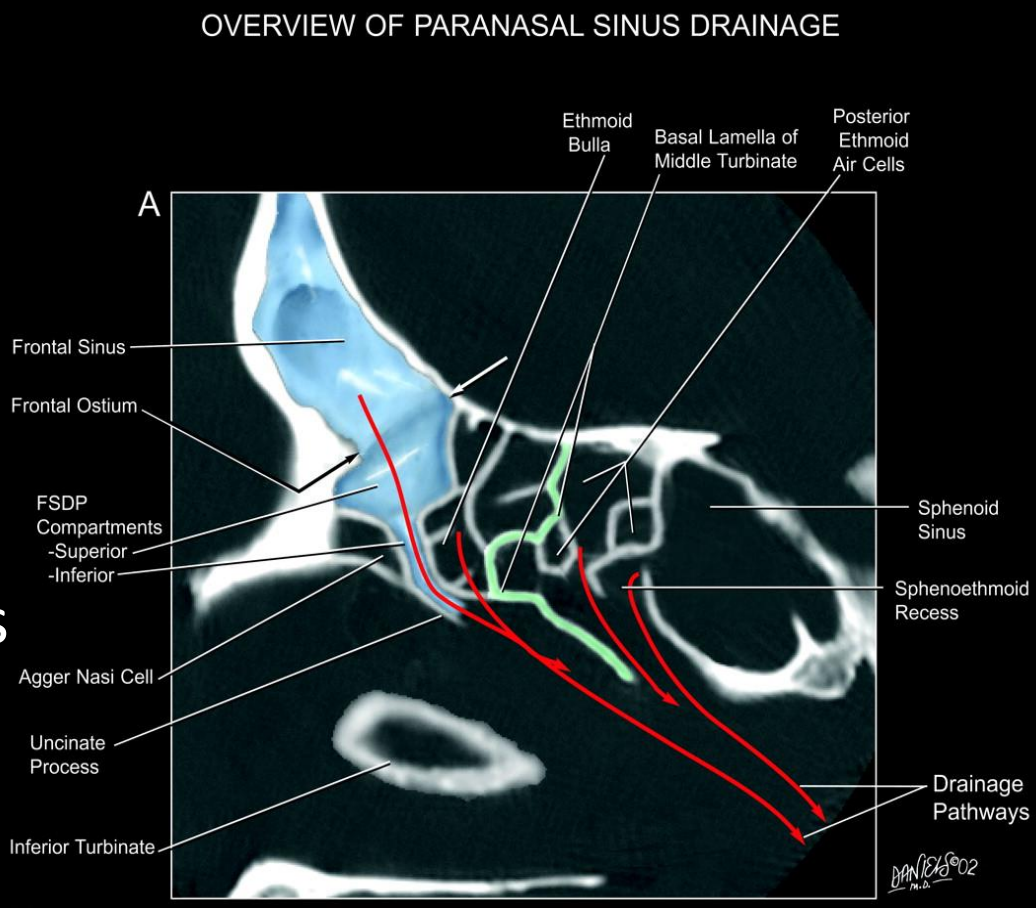


Sinus anatomy

- Frontal sinus → Frontal sinus Drainage Pathway → middle meatus or ethmoid infundibulum to middle meatus

- Sphenoid sinus and posterior ethmoid cells → sphenoethmoid recess → superior meatus

- Anterior ethmoid cells→ middle meatus



David L. Daniels et al. AJNR Am J Neuroradiol 2003;24:1618-1627

CT and sinuses

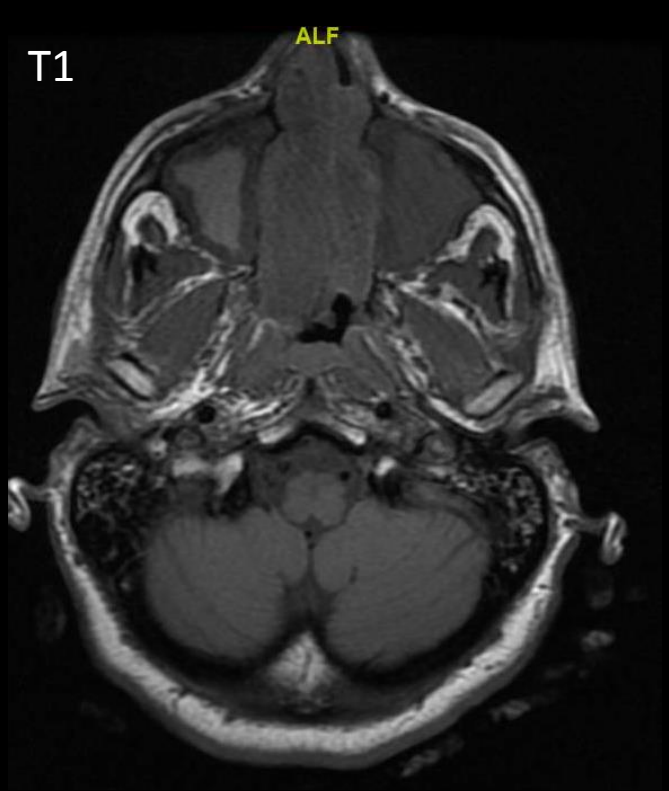
- CT – good for determining anatomic landmarks and variants
  - Septal deviation, concha bullosa etc. that can narrow OMU and lead to OMU pattern of sinonasal disease
  - Bone destructions and intraorbital, intracranial extension

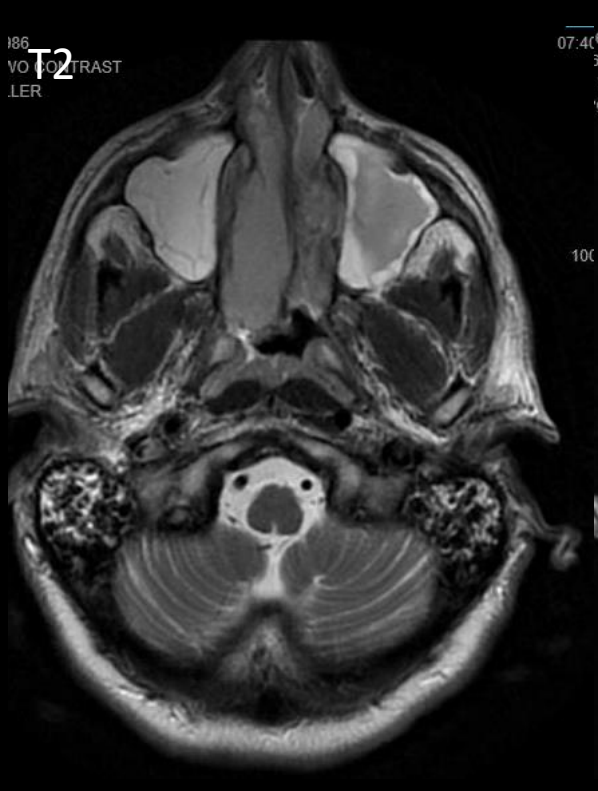
MRI and sinus disease

- Need to look at 3 sequences:
  - T1
    - Extension of the tumor beyond the sinus
      - Skin, parasinus fat planes, etc.
  - T2
    - Tumor vs. sinus secretions/polyp
  - T1 post contrast
    - tumor should enhance while mucosal secretions should not

	TUMOR	SINUS SECRETIONS	SINUS MUCOSA
T1	Dark	Dark	Dark
T2	Grey	Bright	Grey/Bright
T1 C+	Enhance	NOT enhance	Enhance

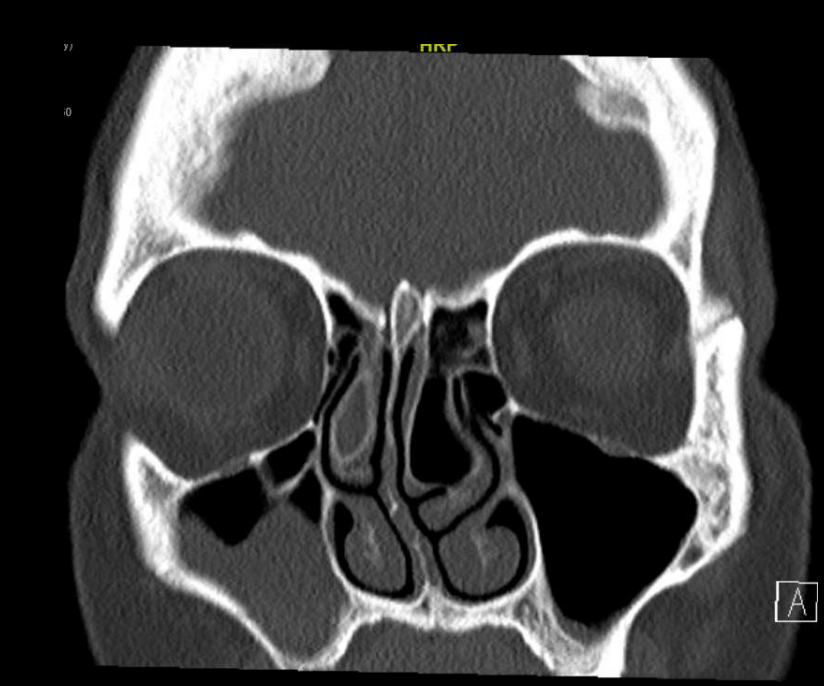
IF [protein in secretions] > 30 %, both T1 and T2 will be dark

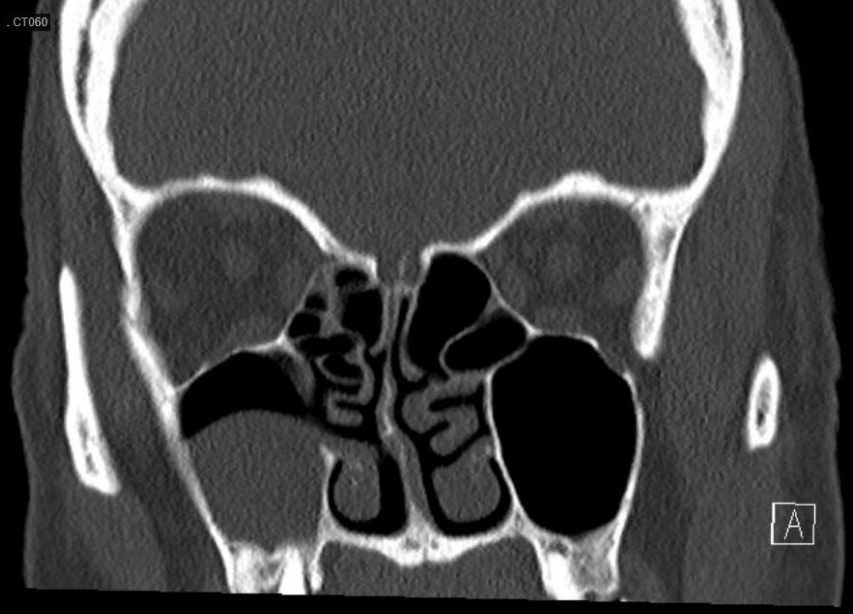


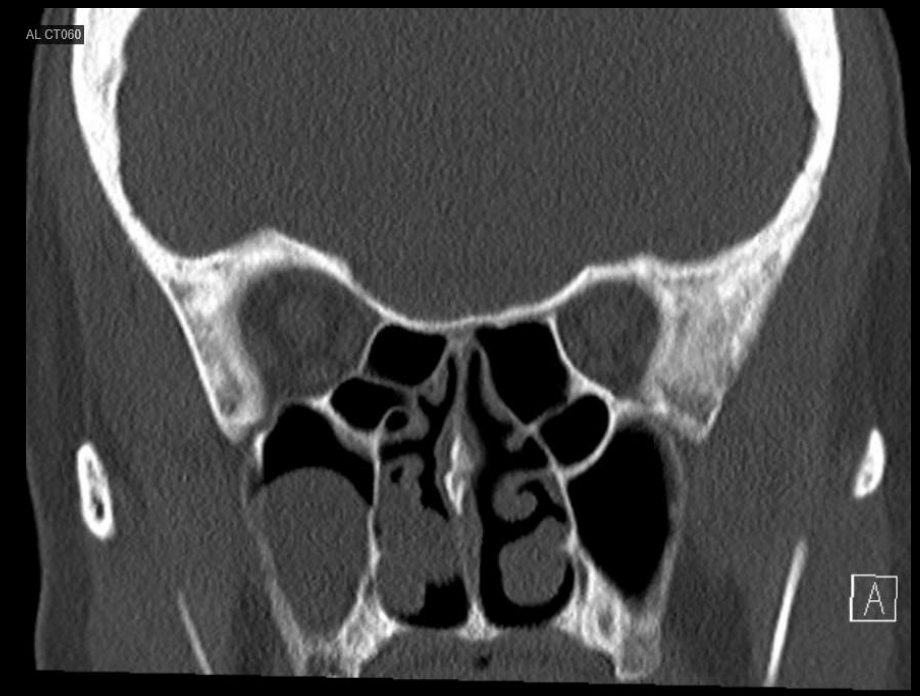


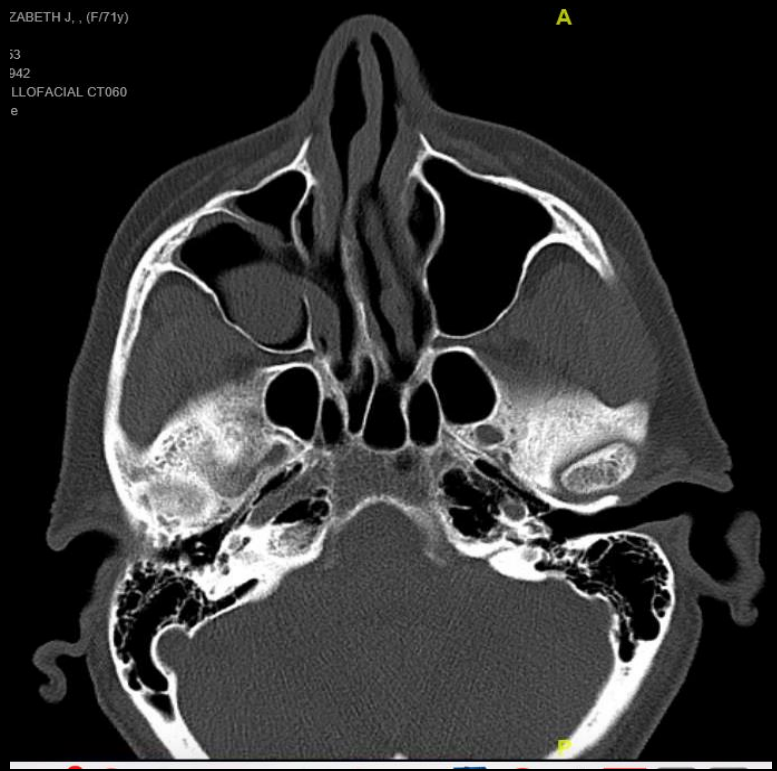
Case 1

73 year old woman with unilateral nasal congestion




. CT060


AL CT060


ZABETH J, , (F/71y)
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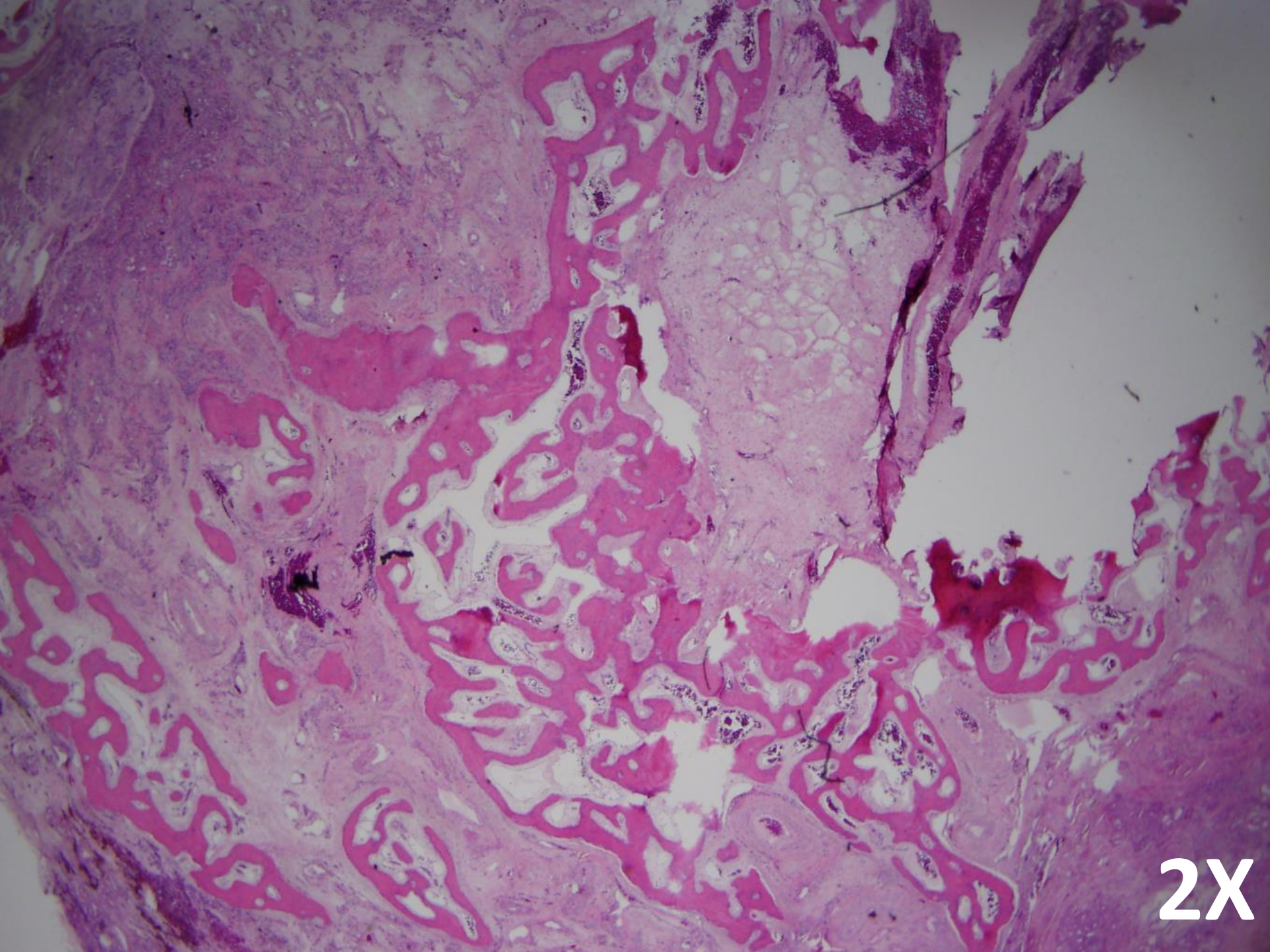
LLOFACIAL CT060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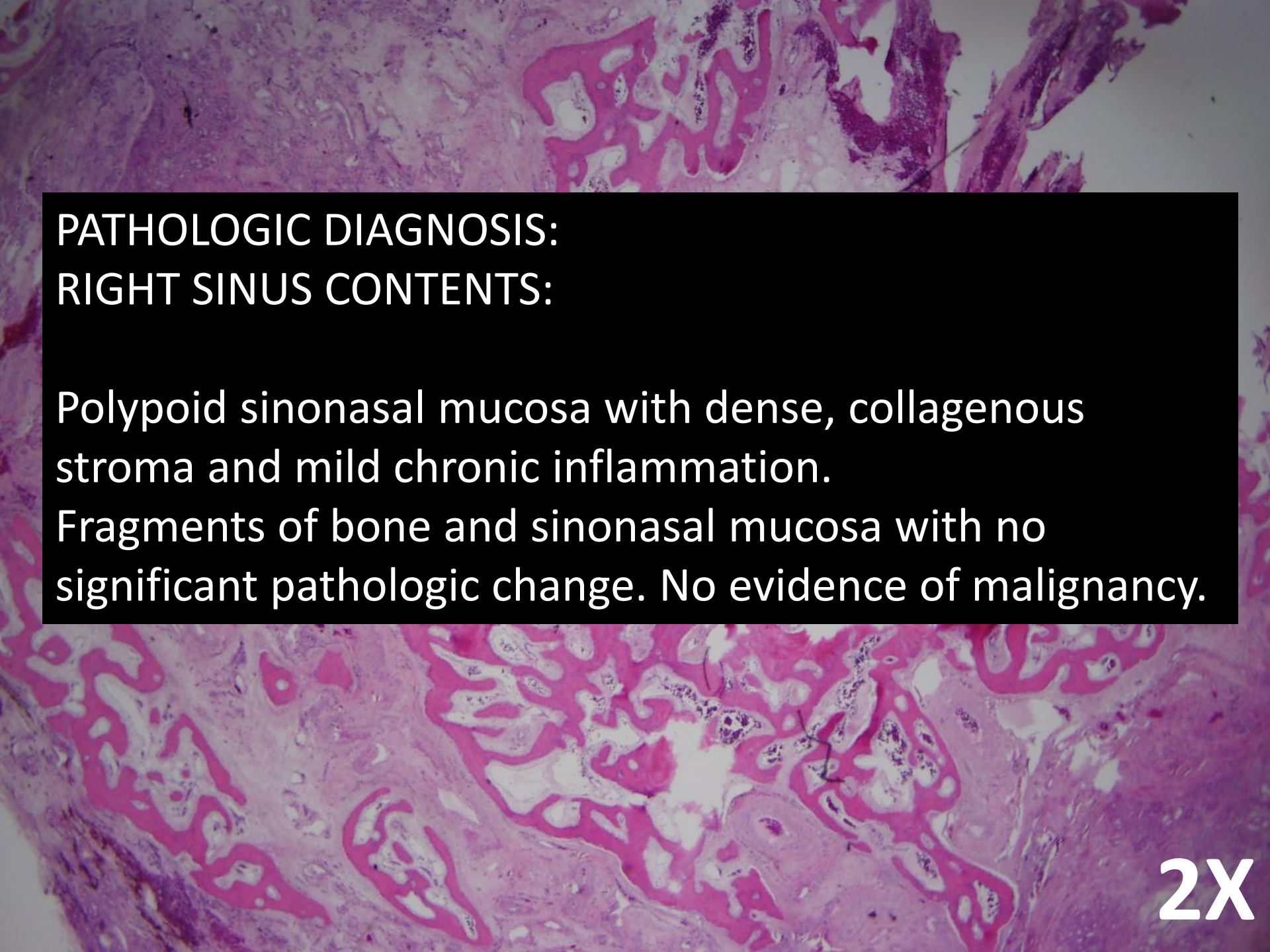

PATHOLOGIC DIAGNOSIS:
RIGHT SINUS CONTENTS:
Polypoid sinonasal mucosa with dense, collagenous stroma and mild chronic inflammation.
Fragments of bone and sinonasal mucosa with no significant pathologic change. No evidence of malignancy.
2X

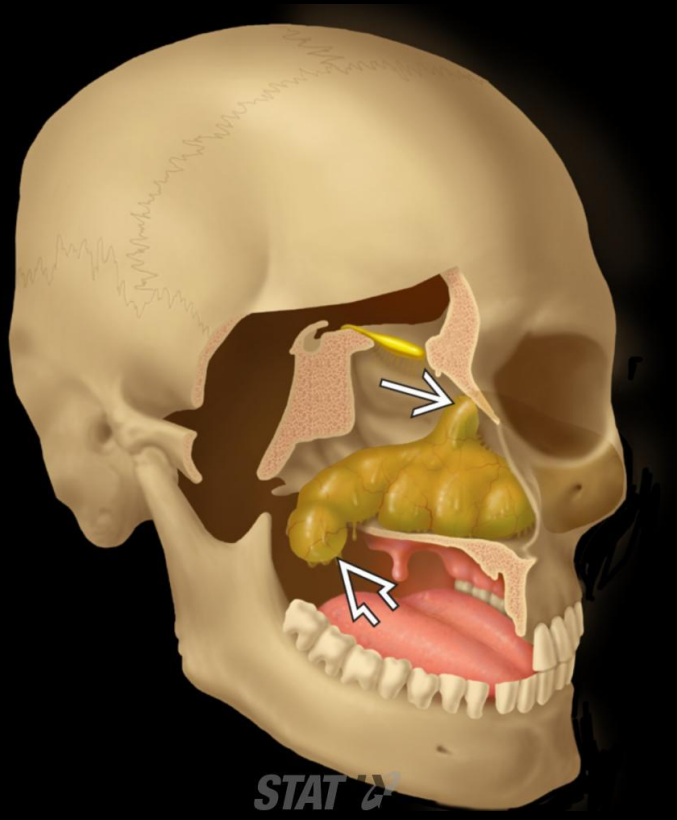
Antrochoanal polyp

- Benign inflammatory polyp – edematous hypertrophy of the respiratory epithelium
  - Most commonly originates from the mucosa of maxillary antrum
    - antrochoanal>>sphenochoanal>ethmochoanal
- Symptoms:

  Unilateral nasal obstruction, sore throat, headache, nasal breathing
- Bimodal age distribution:
  - Teenagers and young adults (mean age ~ 10 years)
  - Smaller group in 3rd-5th decade

Antrochoanal polyp

- Dumbbell shaped polypoid low density mass
- maxillary antral origin → widened maxillary ostium or accessory ostium → nasal cavity
- Bone surrounding the infundibulum remodeled but not destroyed
- Peripheral enhancement with no central enhancement



To treat antrochoanal polyp you would recommend:

1) Antibiotics
2) Steroids
3) Neti Pot daily with saline
4) Surgical resection
5) Alternative medicine

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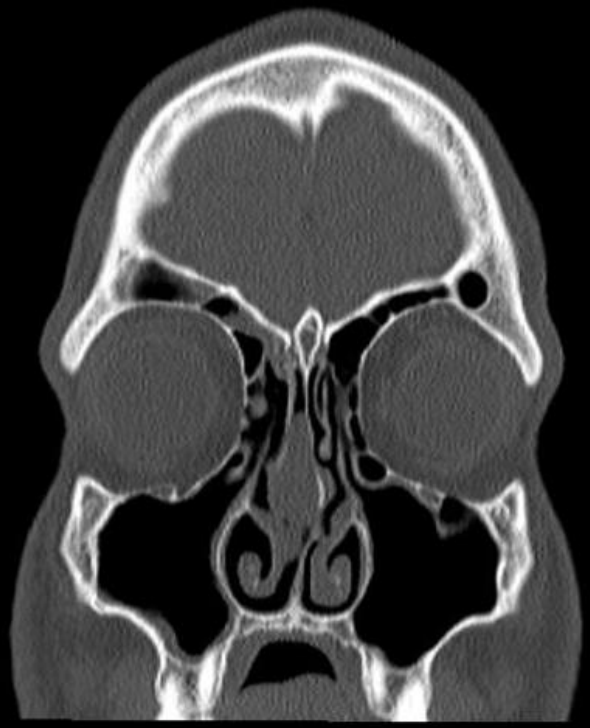
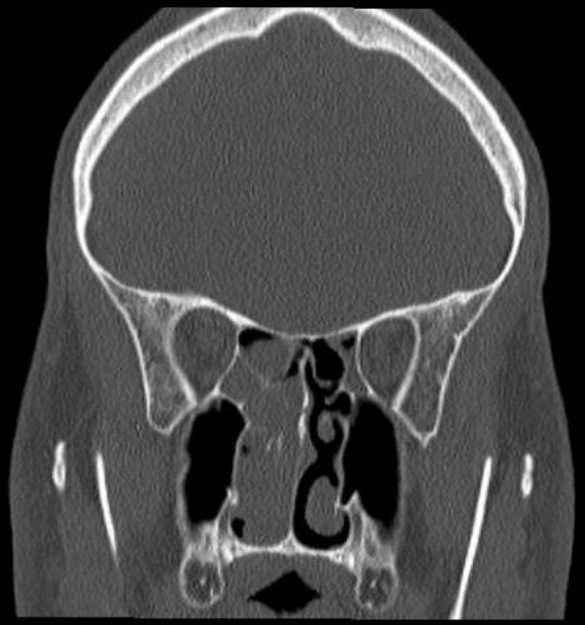
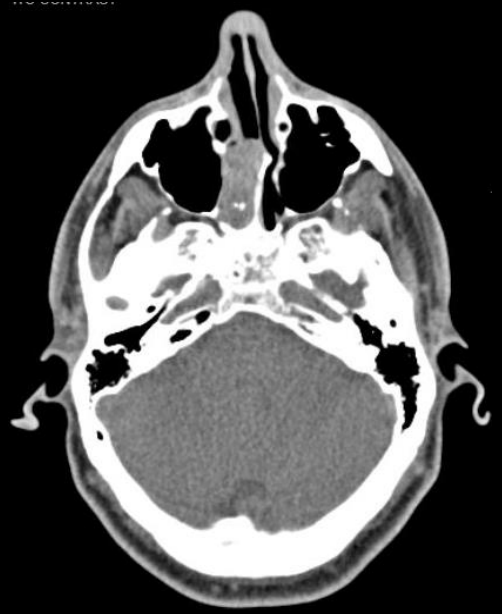
Tends to regrow if the polyp is not resected in its entirety

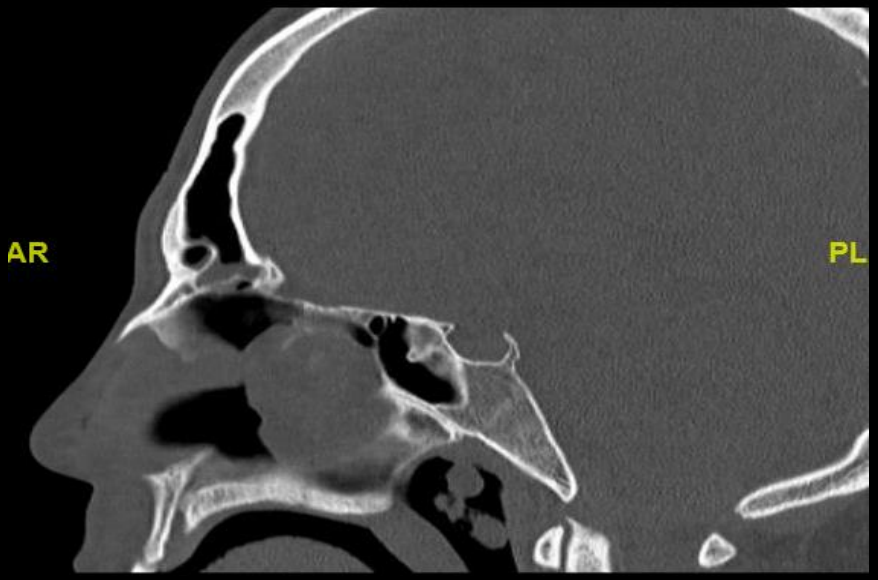
Case 2

33 year old man with history of right nasal obstruction for a month





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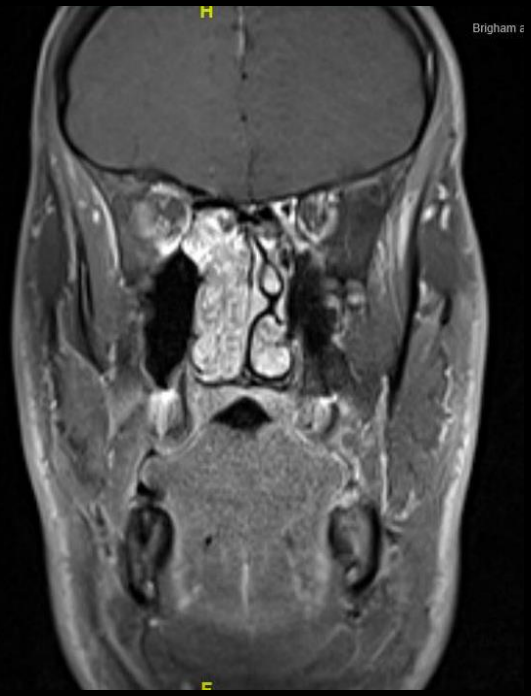
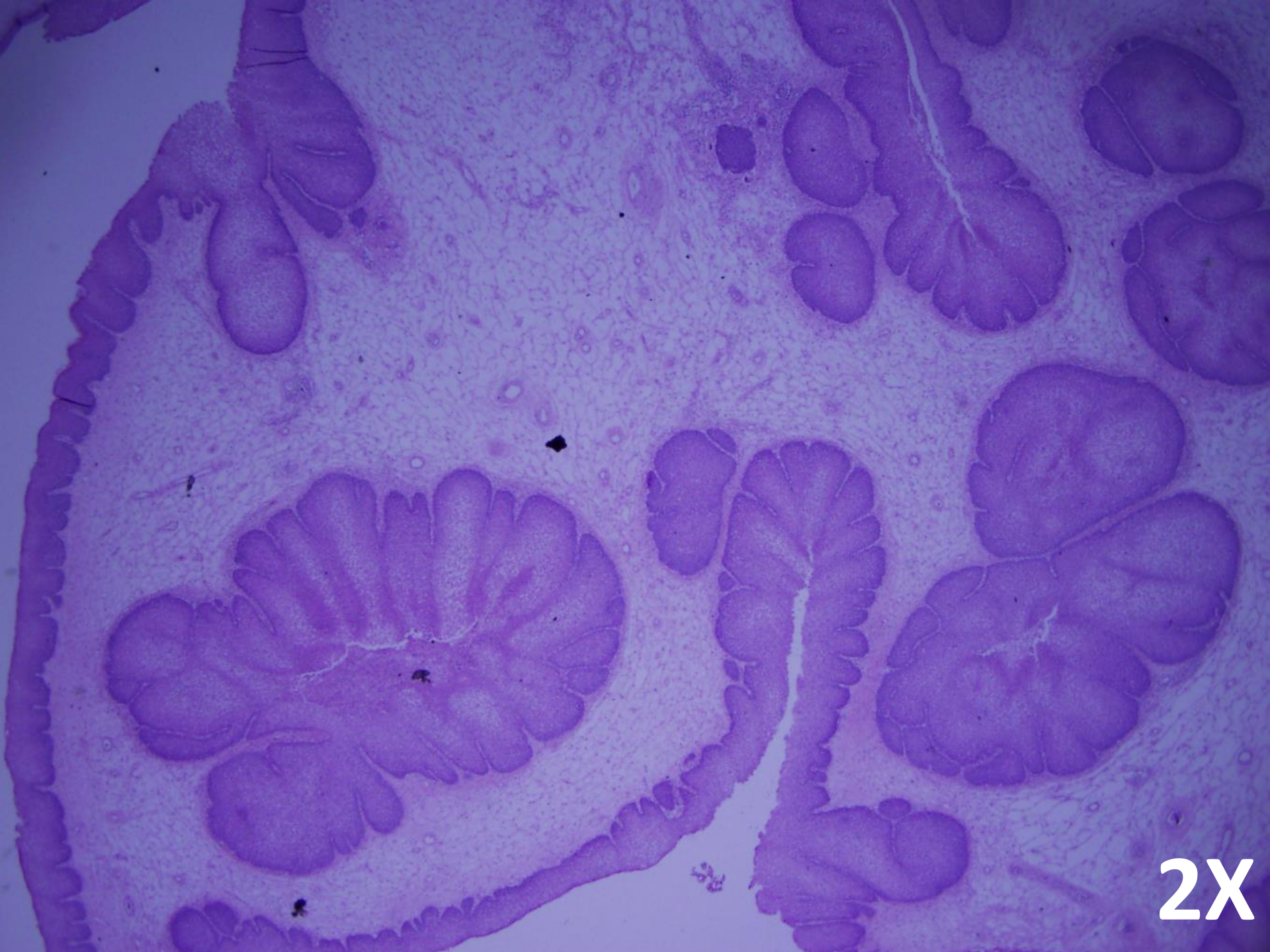
PL

T1

T2

T1FS C+

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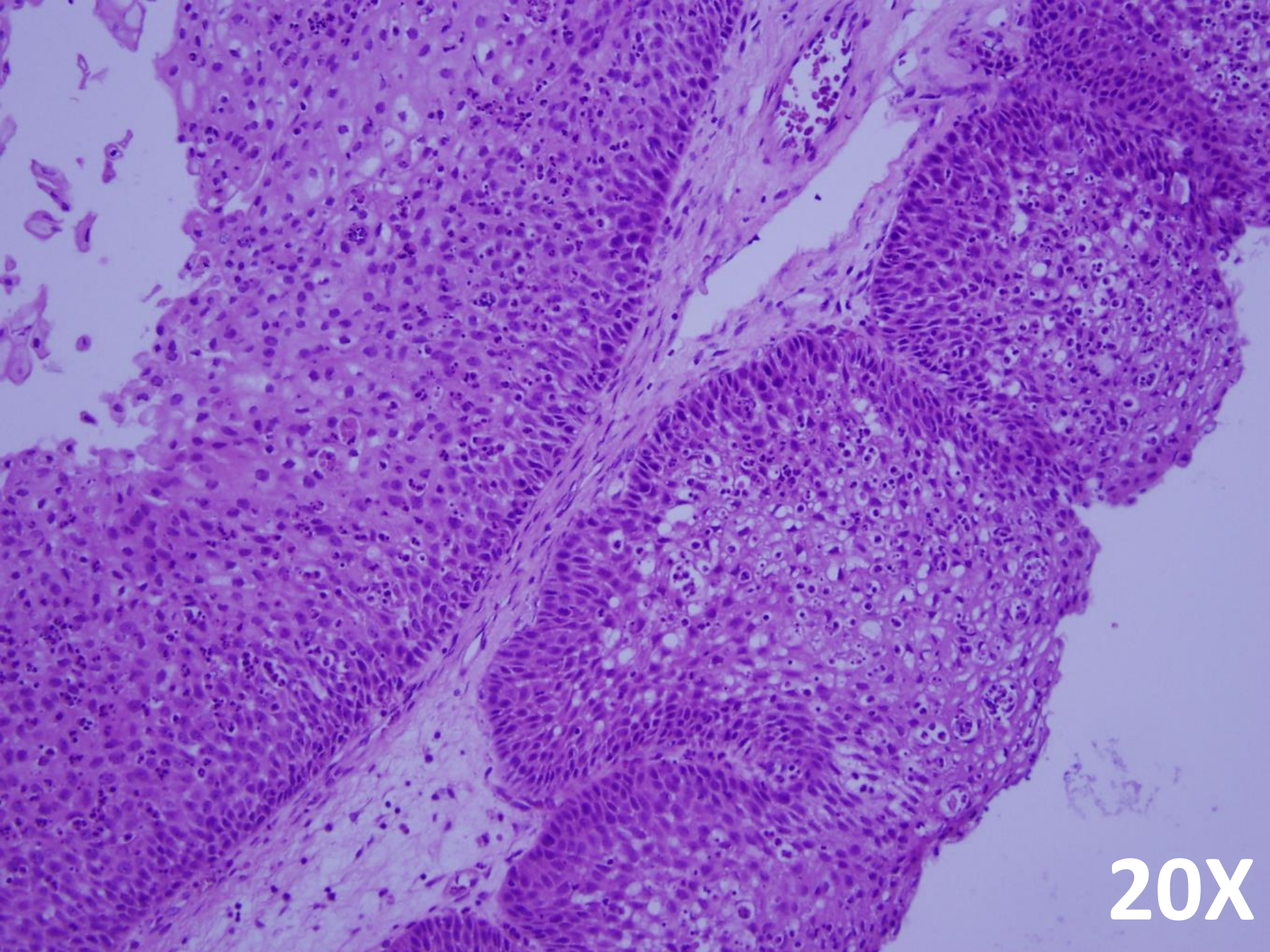

20X

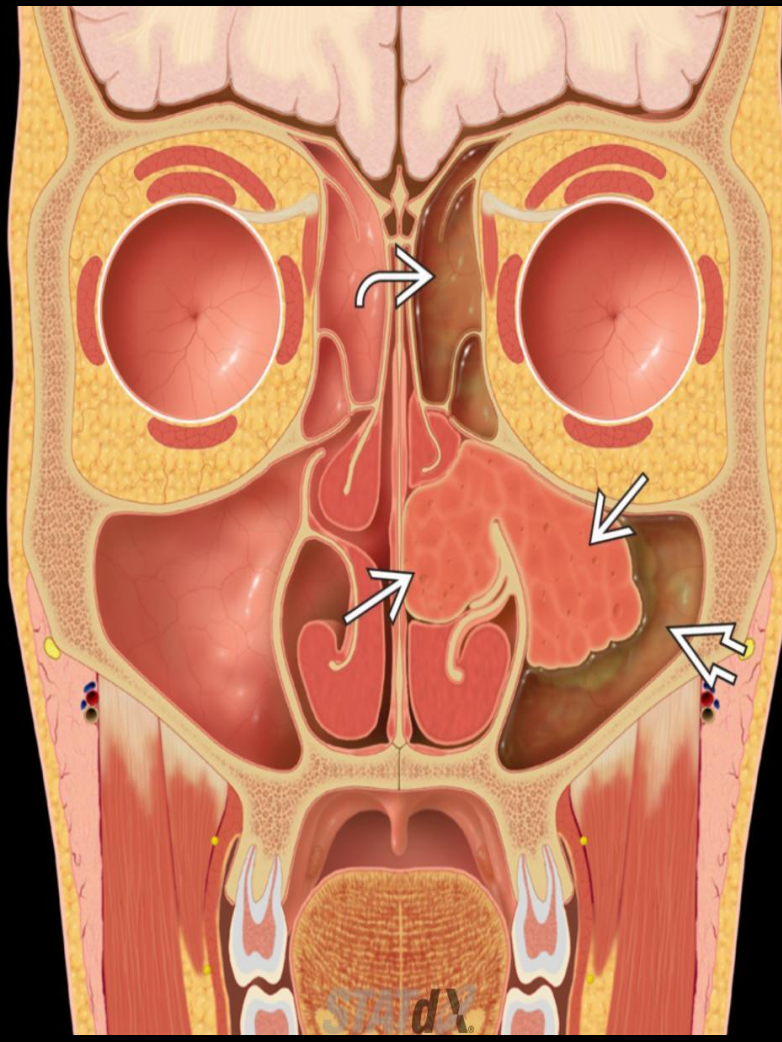

PATHOLOGIC DIAGNOSIS:
RIGHT NASAL MASS:
Fragments of **inverted papilloma**.
There is no evidence of malignancy.
20X

Inverted papilloma

- Benign lobulated tumor of sinus mucosa
- Symptoms of nasal obstruction and discharge
  - Epistaxis, anosmia, headache, pain
- Age and gender distribution
  - 40-70 years
  - M:F 4-5:1
- Treatment: Resection
  - Strong potential for local recurrence if incompletely resected

Inverted papilloma

- Located along the lateral nasal wall centered at middle meatus +/- extension into the antrum
  - 40% show entrapped bone
  - 10% show tumorous calcification
  - Focal hyperostosis of the adjacent bone may indicate point of tumor attachment
  - Cerebriform pattern of enhancement on MRI



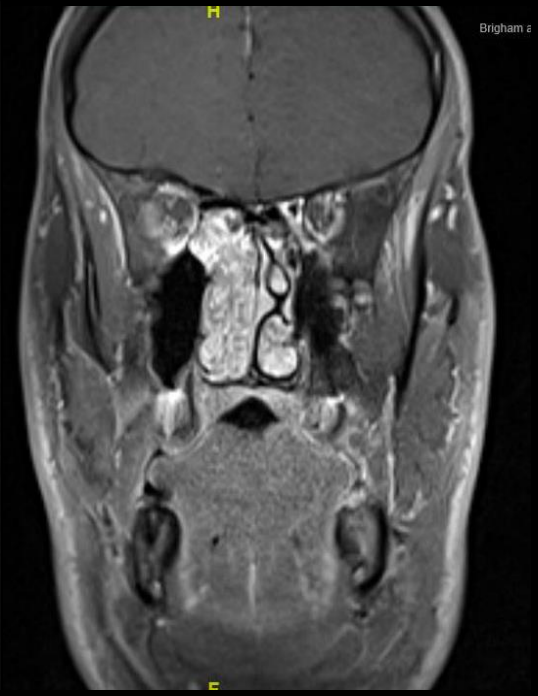
T1

Isointense to muscle

T2

Cerebriform pattern

T1FS C+



Cerebriform pattern

Inverted papilloma is associated with squamous cell cancer

1. No association
2. <10% of the time
3. 10-20% of the time
4. 70-80% of the time
5. 100% of the time

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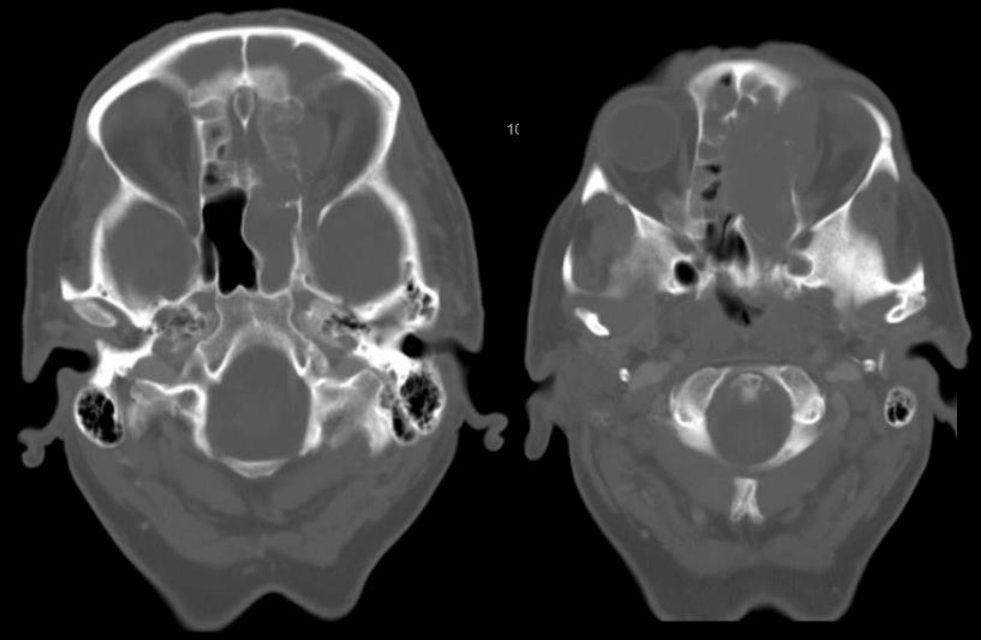
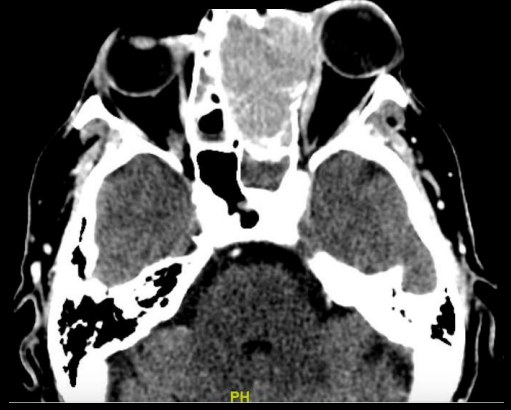
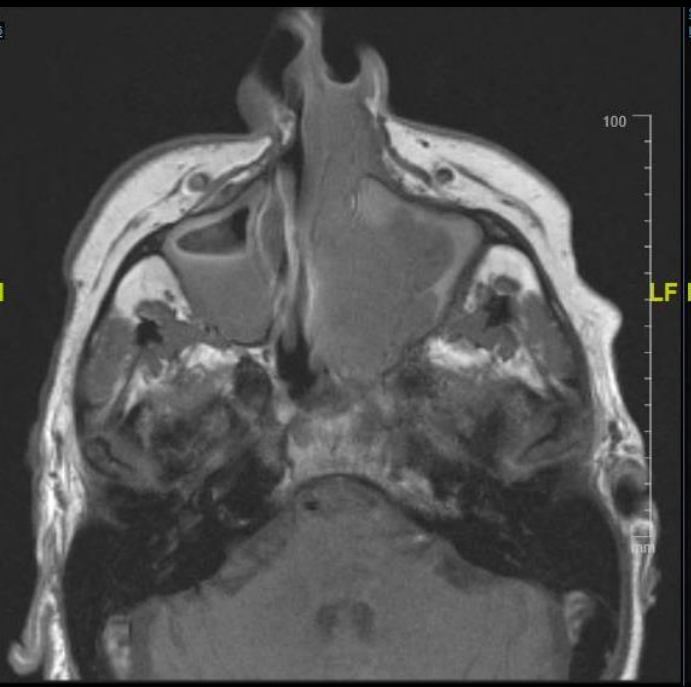
Due to high rate of recurrence and possibility of transforming into SCC follow up is necessary

Case 3

- 70 year old female with history of 7 months of left sided rhinorrhea, anosmia on the left, obstruction and facial swelling

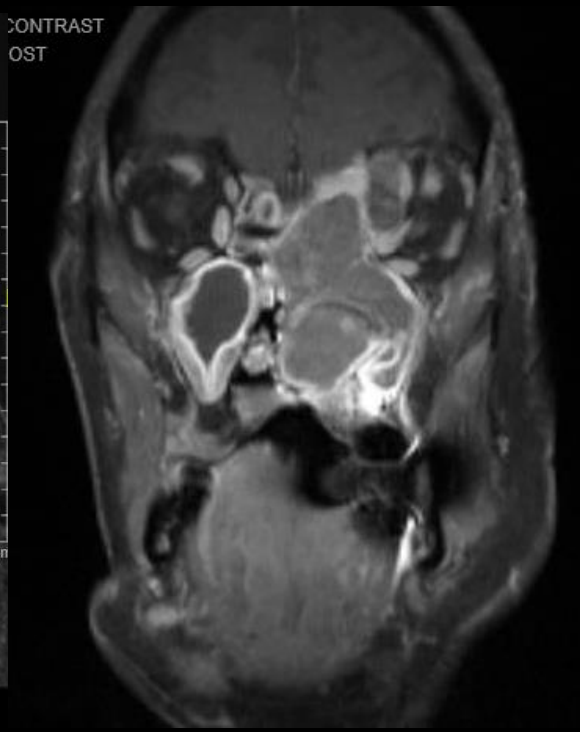



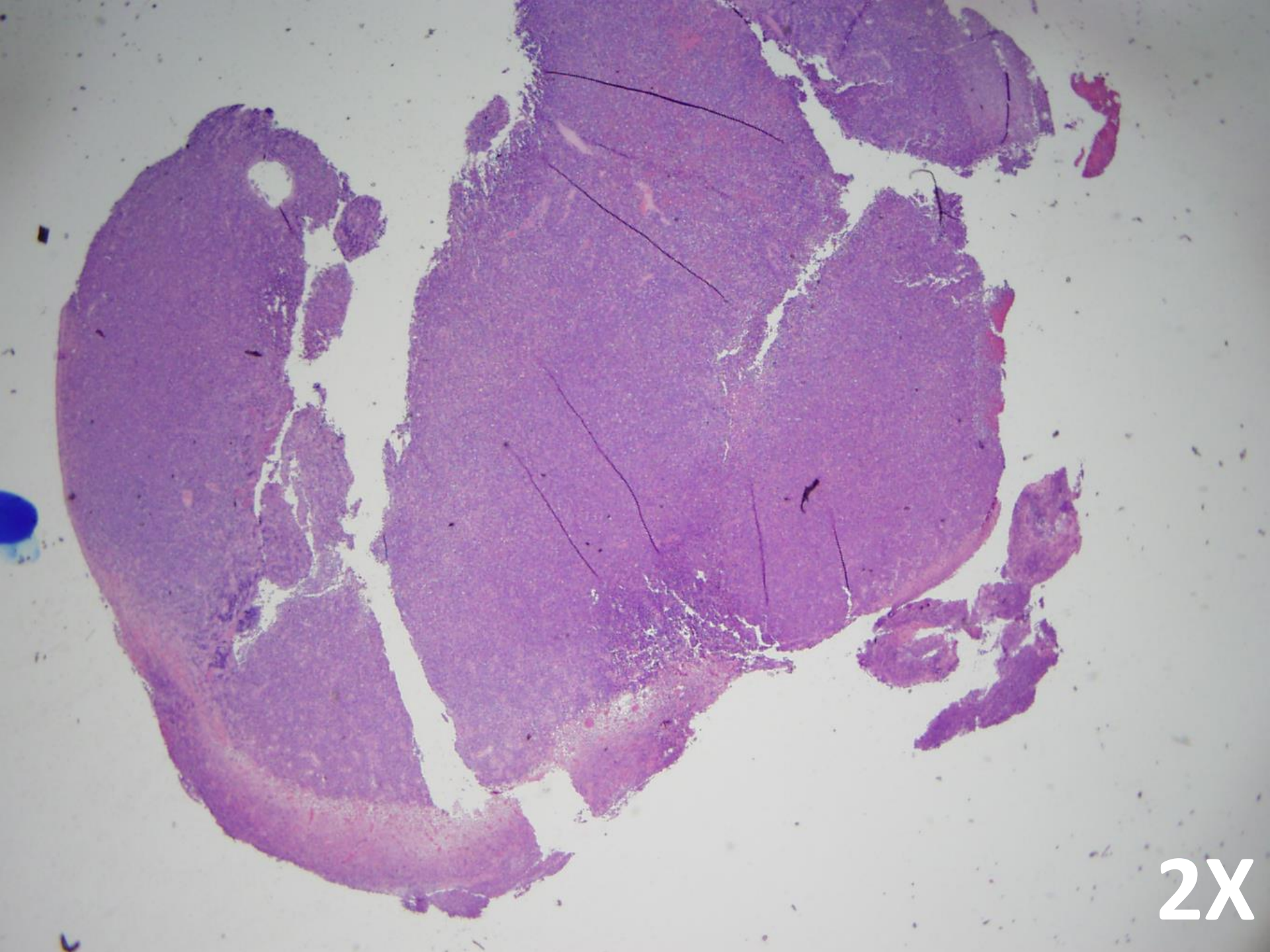
T1



T2

T1 FS+ C+

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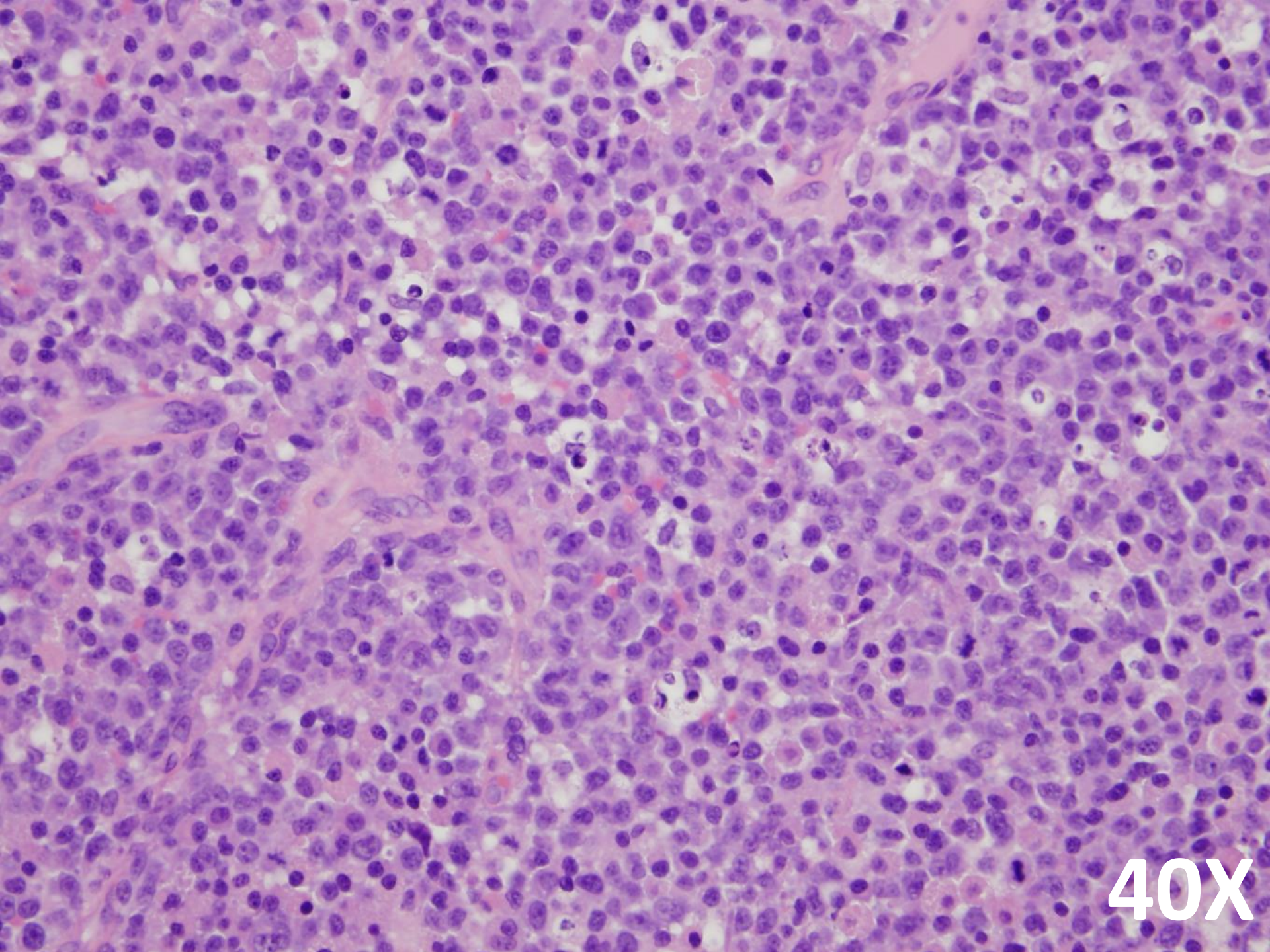
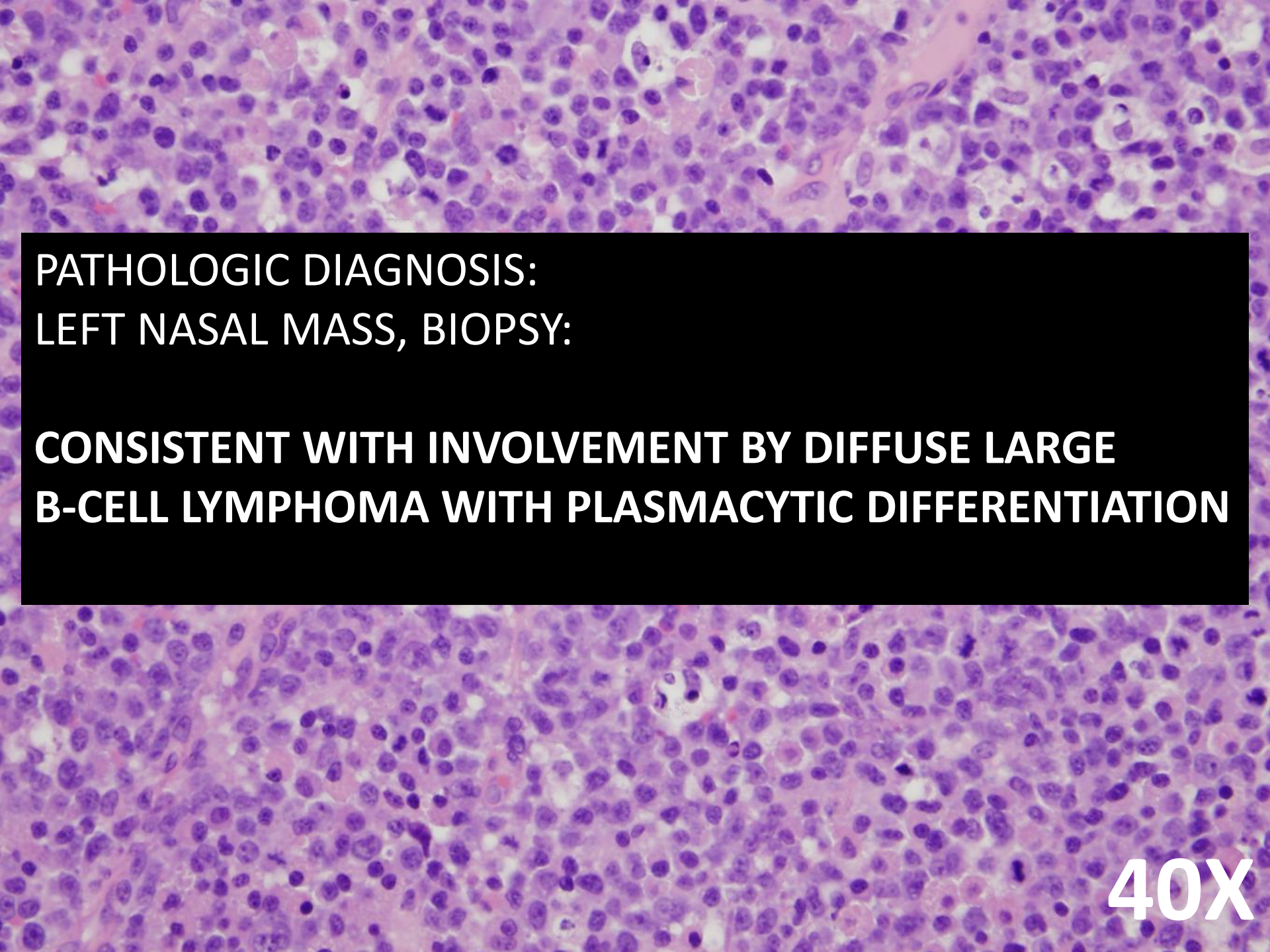

40X


PATHOLOGIC DIAGNOSIS:
LEFT NASAL MASS, BIOPSY:
CONSISTENT WITH INVOLVEMENT BY DIFFUSE LARGE B-CELL LYMPHOMA WITH PLASMACYTIC DIFFERENTIATION
40X

Sinonasal lymphoma

- Extranodal lymphoproliferative malignancy
- Homogeneous ill defined soft tissue mass with bone destruction
- Age distribution: 6th decade
- Symptoms: nasal obstruction and discharge
- Treatment – radiation +/- chemotherapy

Lymphoma types

- 3 types
  - B cell (Western type): soft tissue and osseous destruction which is more likely to invade the orbit
  - T cell (Asian type): nasal septum perforation and destruction more common
  - NKTL (Asian type): often ulceration and necrosis with symptoms of bleeding

Since sinonasal lymphoma has high N:C ratio it will generally appear:

1. Hyperdense on NECT, hyperintense on T2
2. Hyperdense on NECT, hypo to isointense on T2
3. Hypodense on NECT, hyperintense on T2
4. Hypodense on NECT, hypo to isointense on T2

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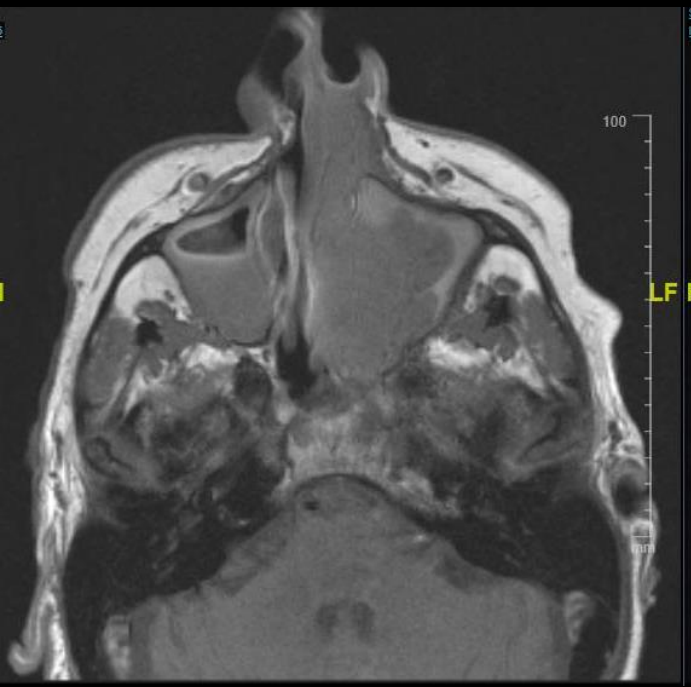
2. Hyperdense on NECT, hypo to isointense on T2
3. Hypodense on NECT, hyperintense on T2
4. Hypodense on NECT, hypo to isointense on T2

T1WI

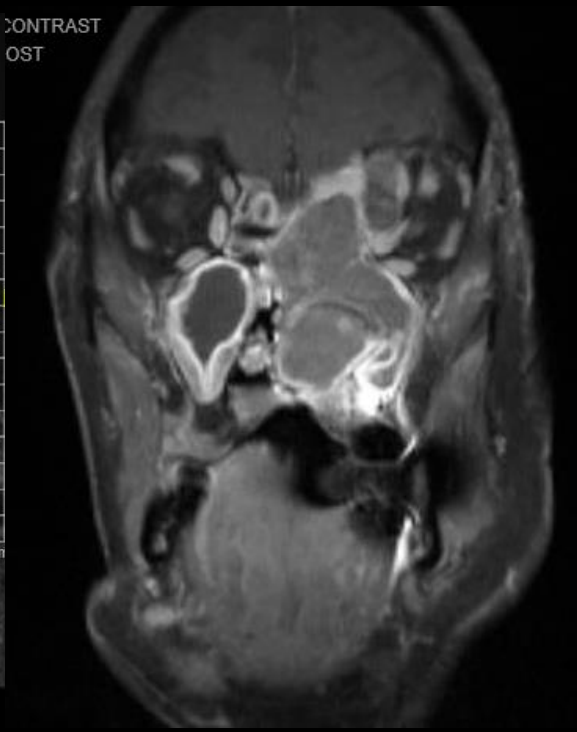


Hypo to Isointense

T1FSC+

Hypo to Isointense

T1 FS C+



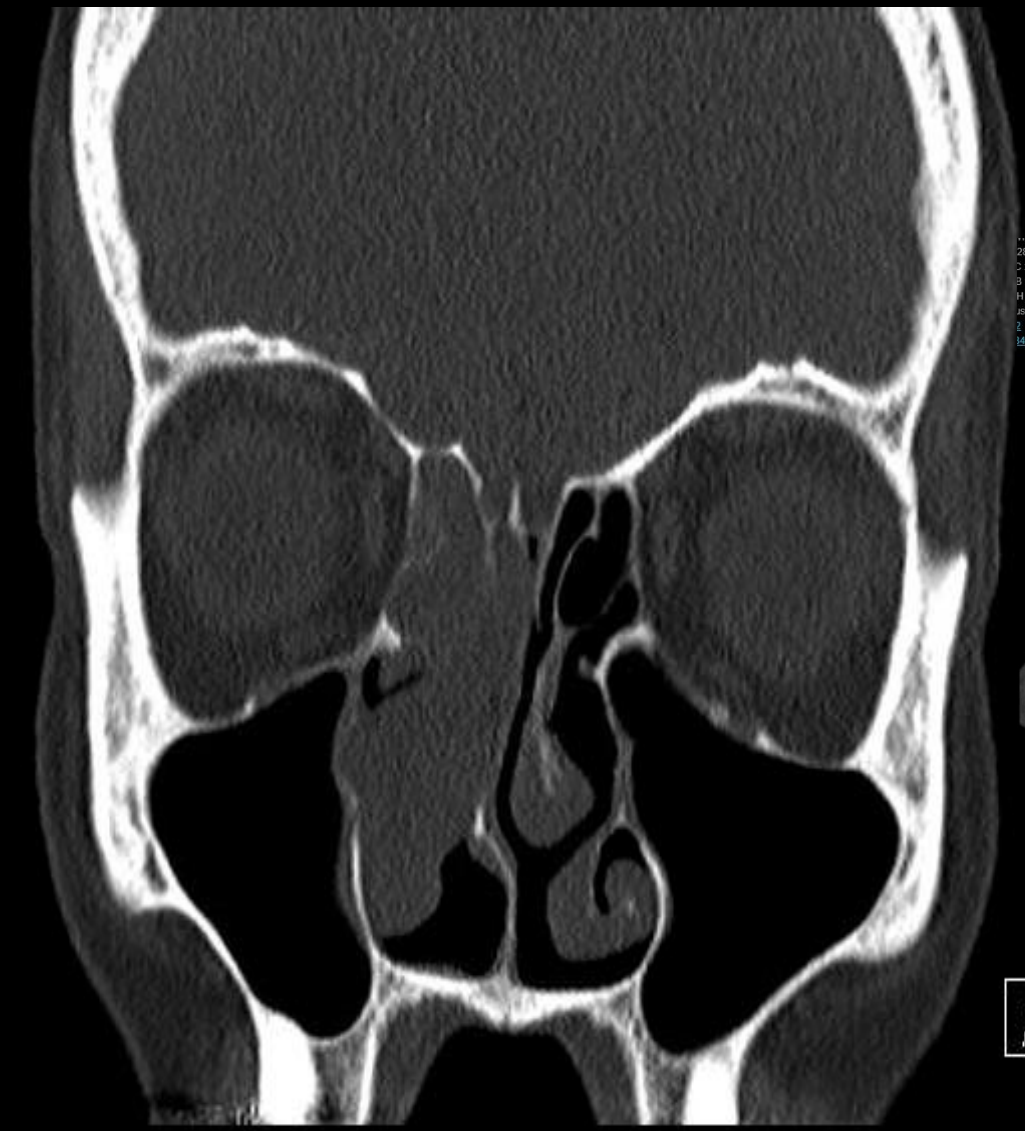
Diffuse homogeneous enhancement (degree variable)

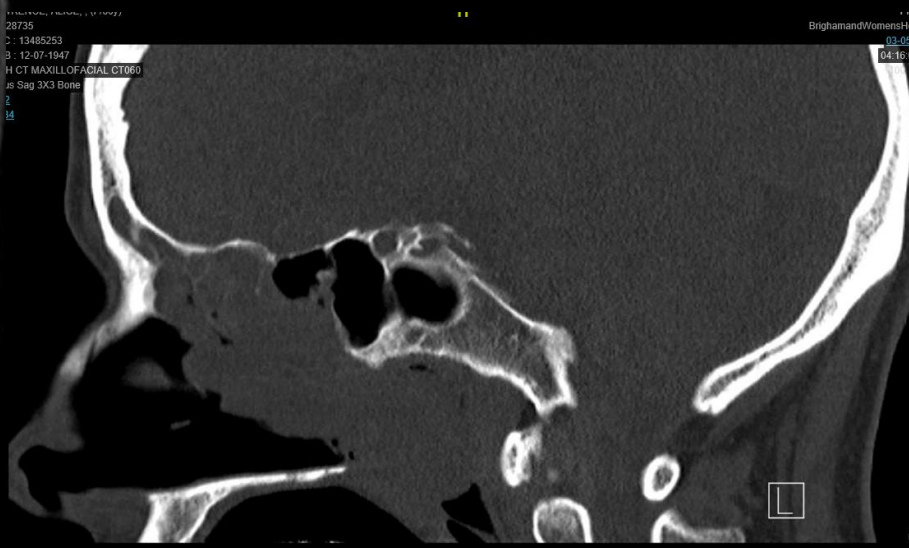
If you see an aggressive sinonasal soft tissue mass

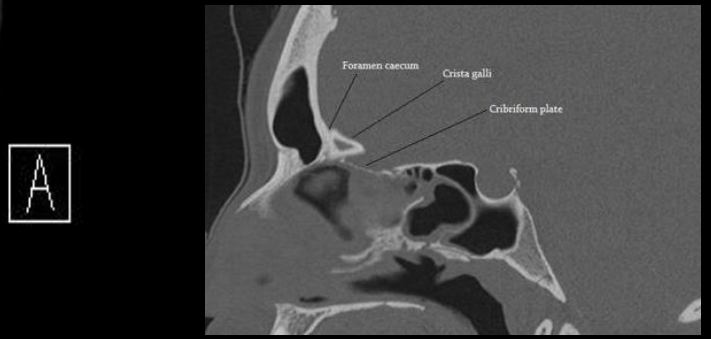
- Always add sinonasal lymphoma to the differential diagnosis as its appearance is non specific
  - Can mimic variety of neoplasms and aggressive inflammatory disorders

Case 4

- 66 year old woman with epistaxis and nasal obstruction x 6 months

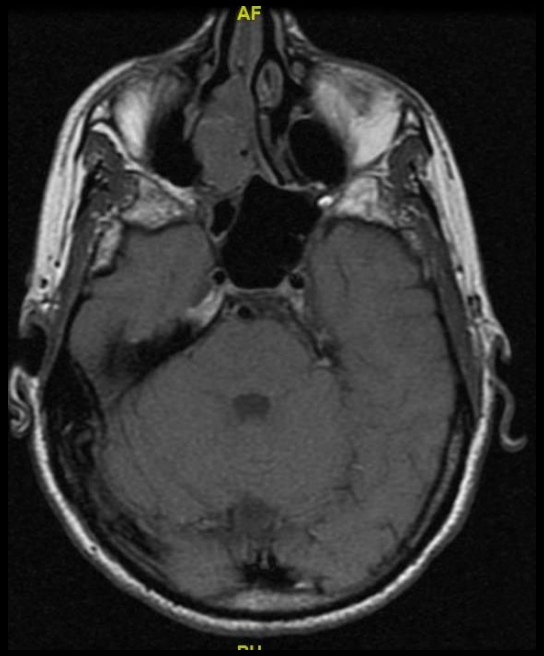






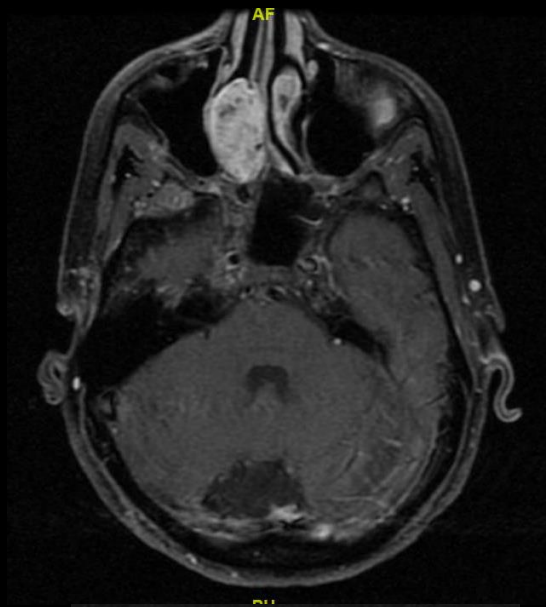
Radiopaedia.org

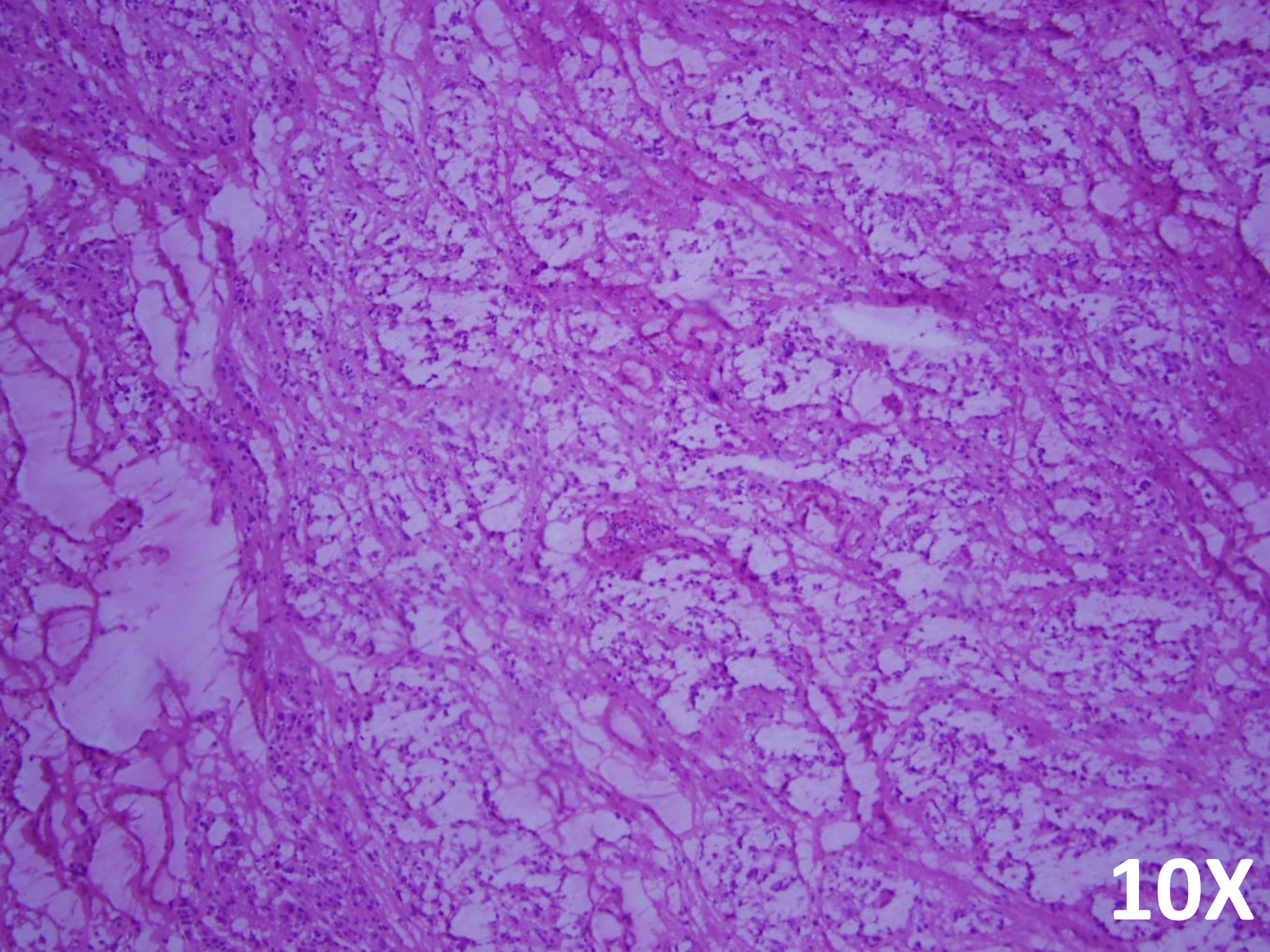
T1

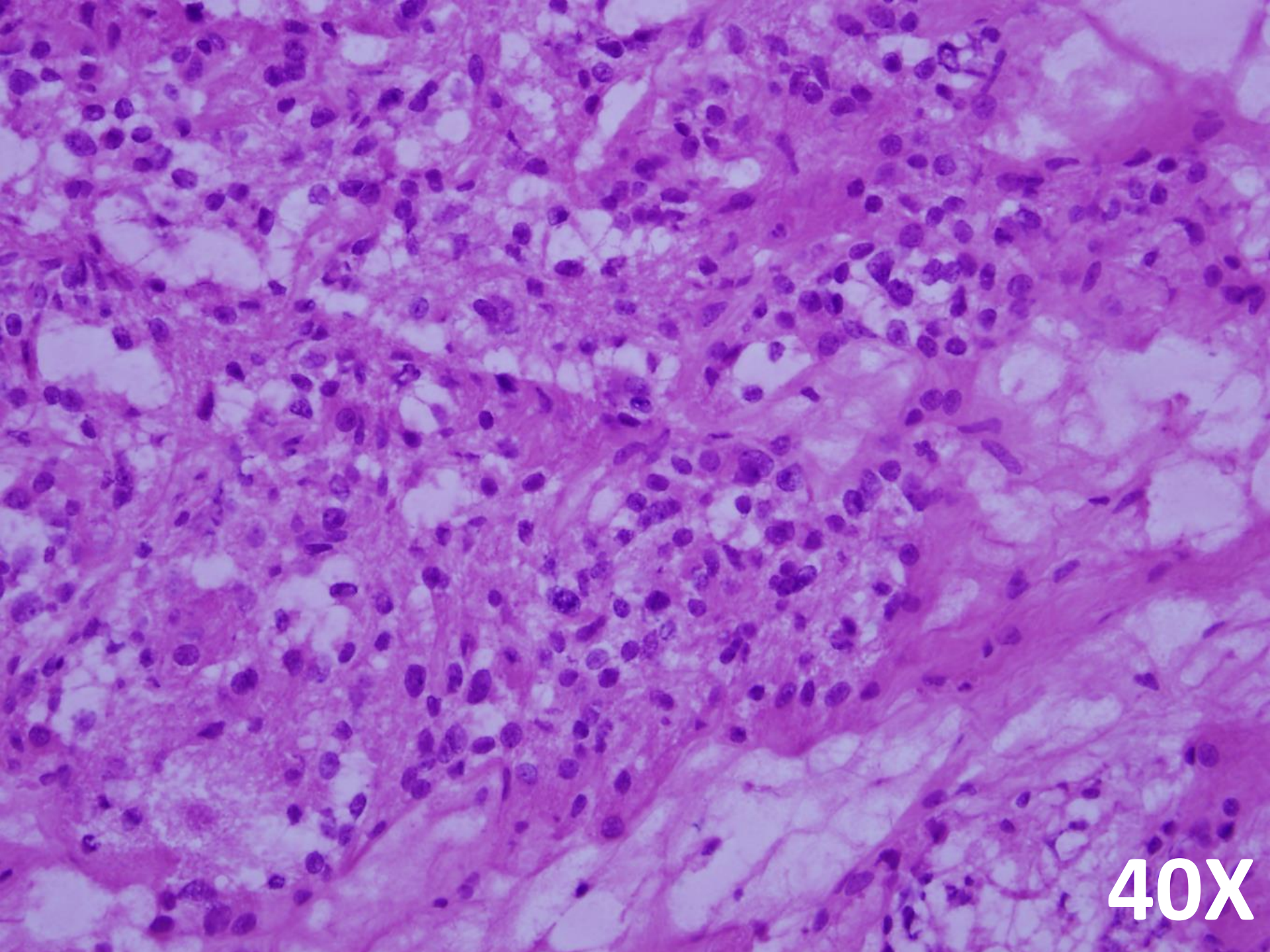


T2

T1 FS C+




10X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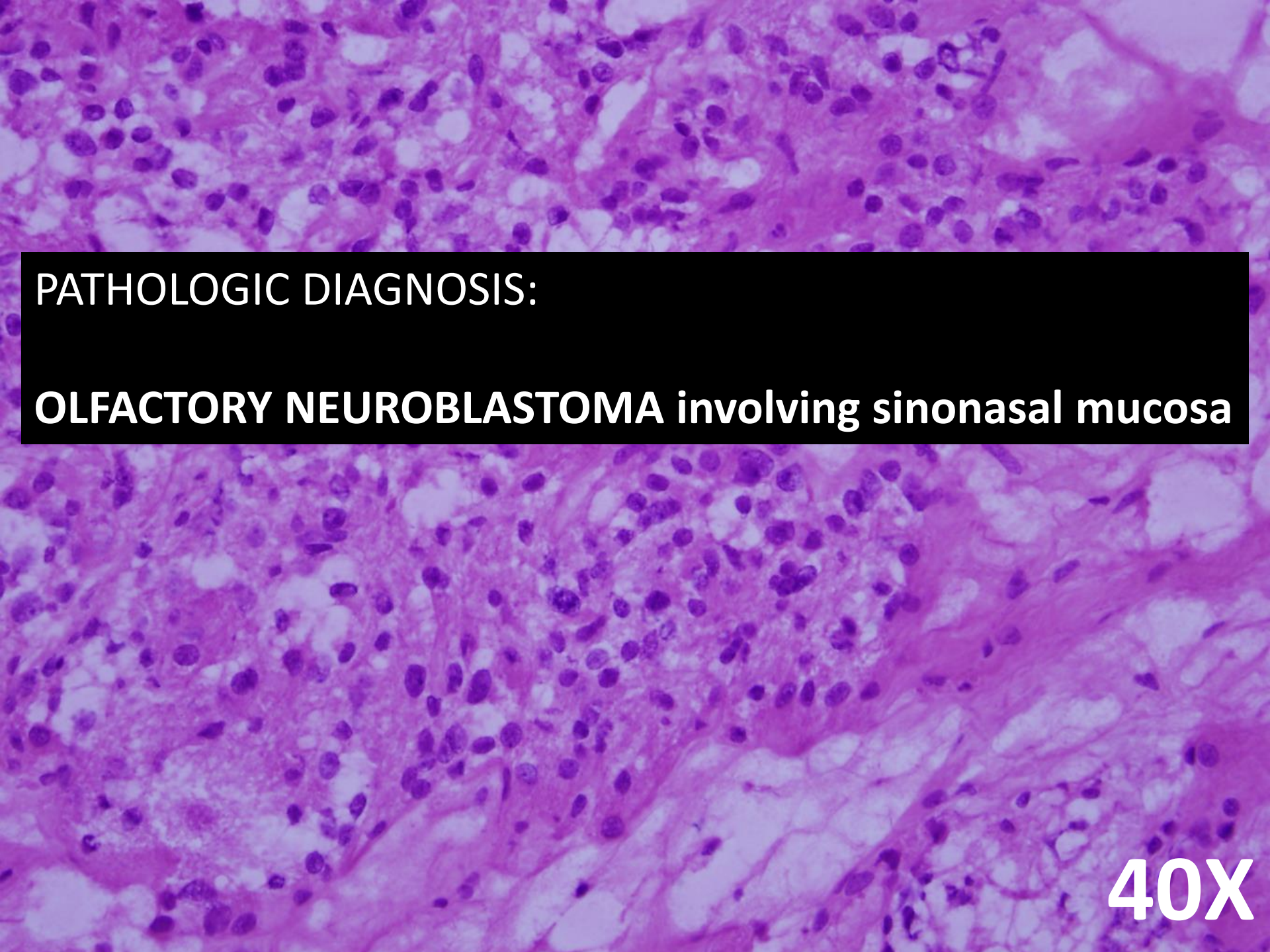
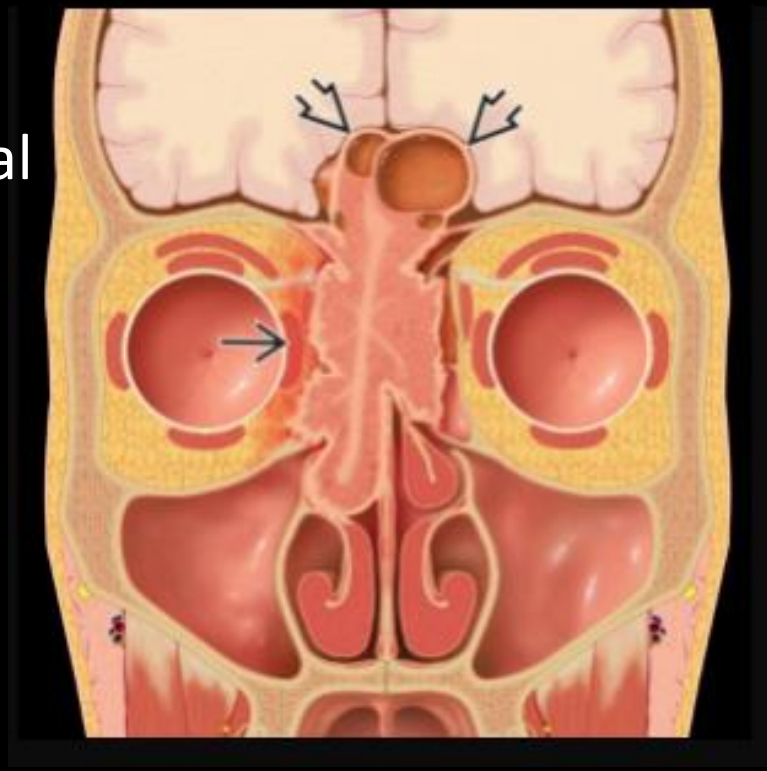

PATHOLOGIC DIAGNOSIS:
OLFACTORY NEUROBLASTOMA involving sinonasal mucosa
40X

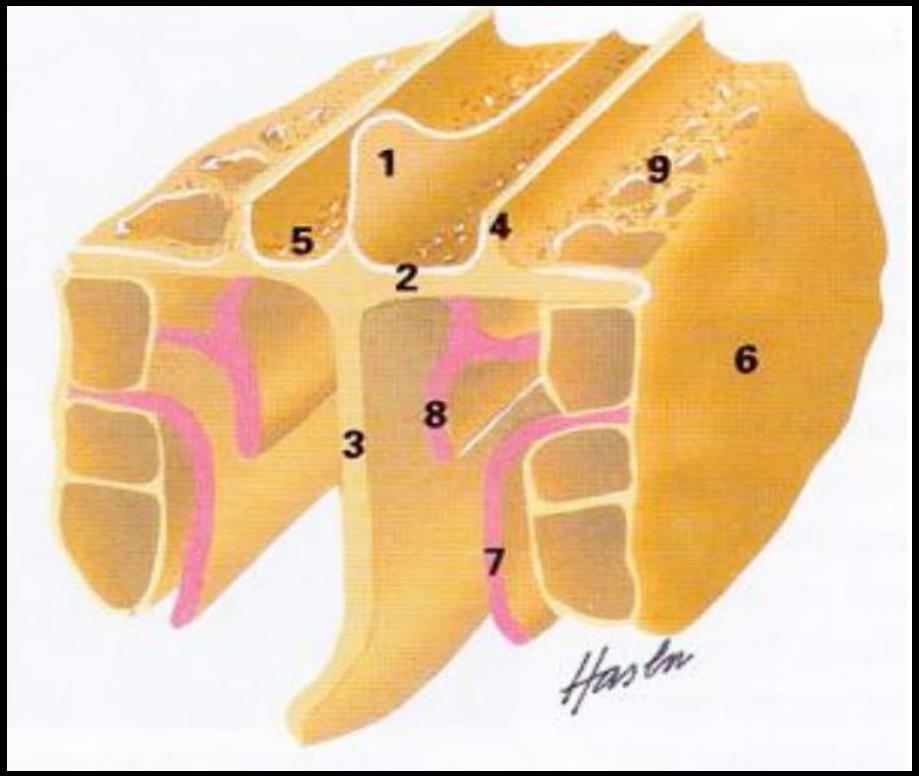
Esthesioneuroblastoma

- Malignant neuroectodermal tumor arising from olfactory mucosa in superior nasal cavity
- Symptoms: Nasal obstruction and epistaxis, usually pre dating diagnosis 6-12 months
- Bimodal distribution in 2^{nd} and 6^{th} decade
- Slight male predominance
- Can lead to distant recurrence
- Treatment – craniofacial resection and radiotherapy

Esthesioneuroblastoma

- Dumbbell/polypod shaped mass
  - upper portion in anterior cranial fossa
  - lower portion in upper nasal cavity
- Peripheral tumor cysts at intracranial tumor brain margin
- Local spread in nose and sinuses
- Bone remodeling +/- bone destruction
- Avidly enhances on post contrast MRI

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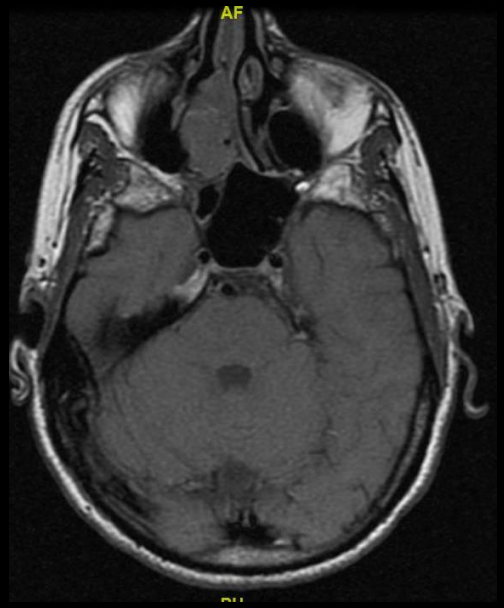
T1

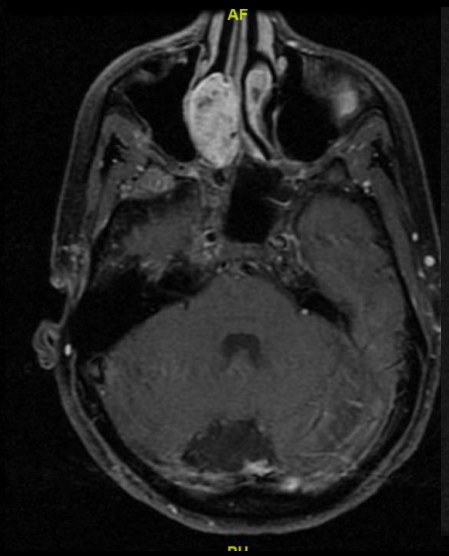


hypointense to intermediate

T2

Intermediate to hyperintense

T1 FS POST



Avid homogenous enhancement

Esthesioneuroblastoma

- Kadish classification:

  Stage A: Localized to nasal cavity

  Stage B: Localized to nasal cavity and sinuses

  Stage C: Extends beyond sinonasal cavities

Good predictor of outcome

Patients with esthesioneuroblastoma can present with the following paraneoplastic symptom:

- 1) Cushing syndrome
- 2) Lambert Eaton syndrome
- 3) Trousseau sign
- 4) Dermatomyositis

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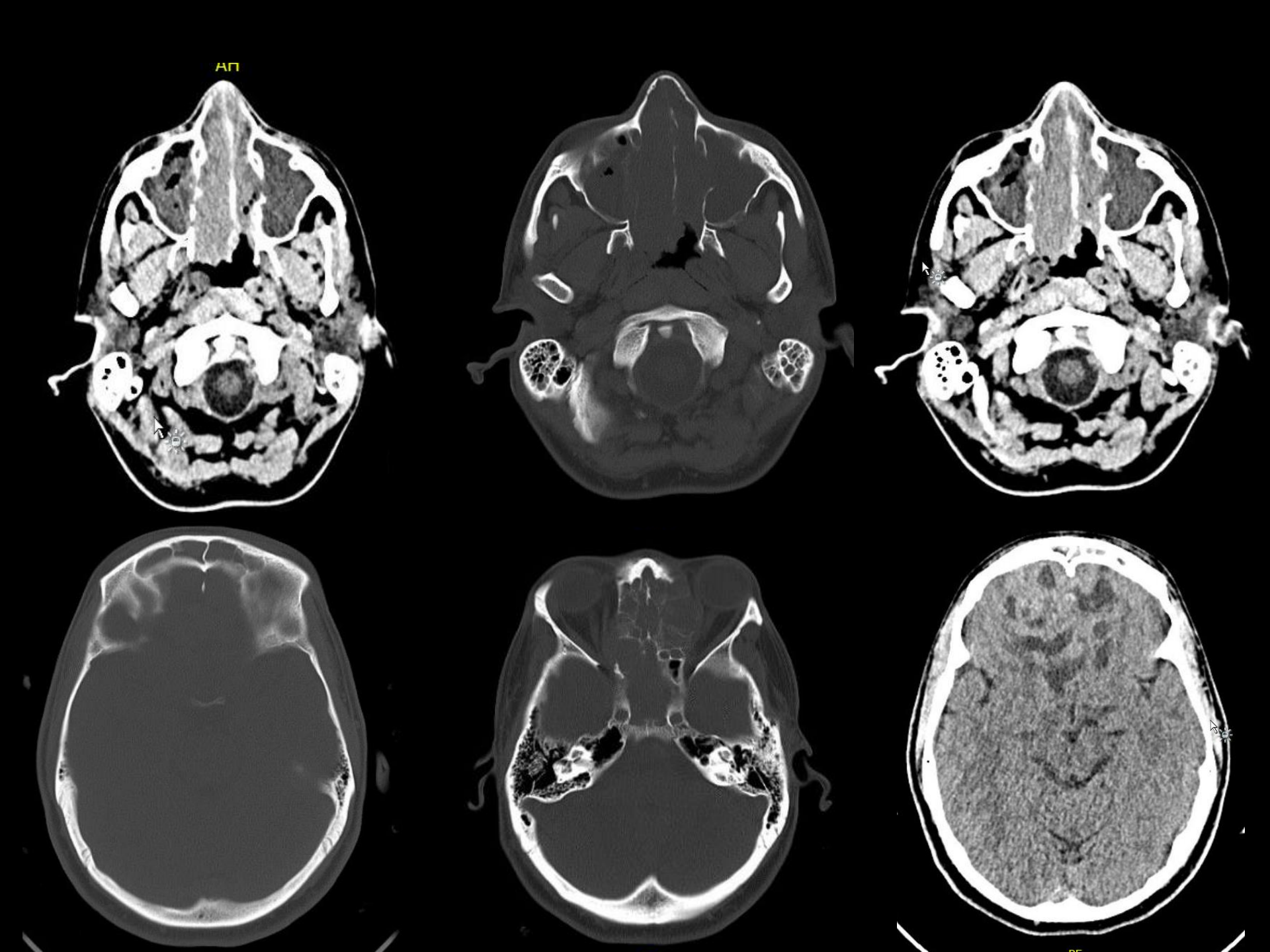
- 4) Dermatomyositis

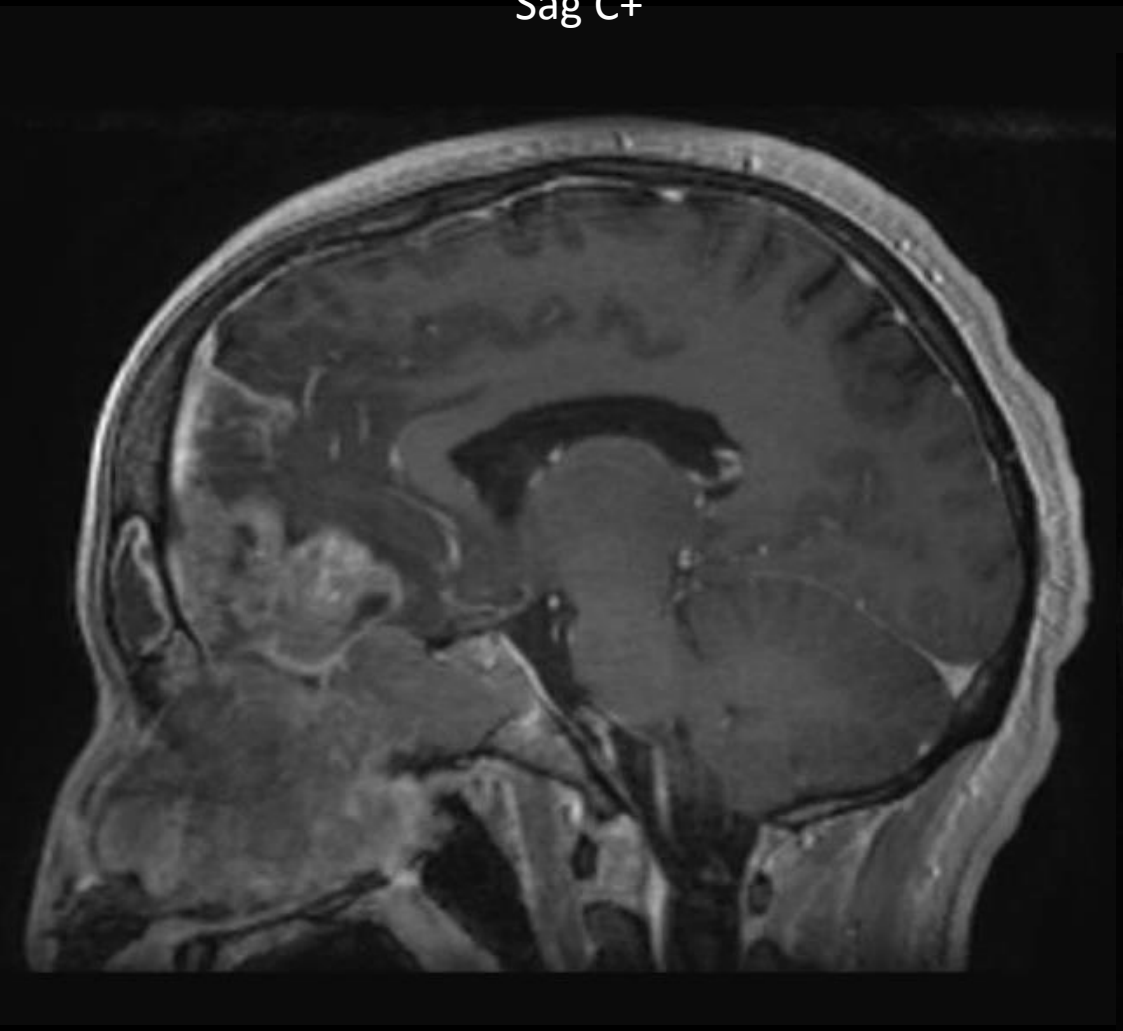
Case 5

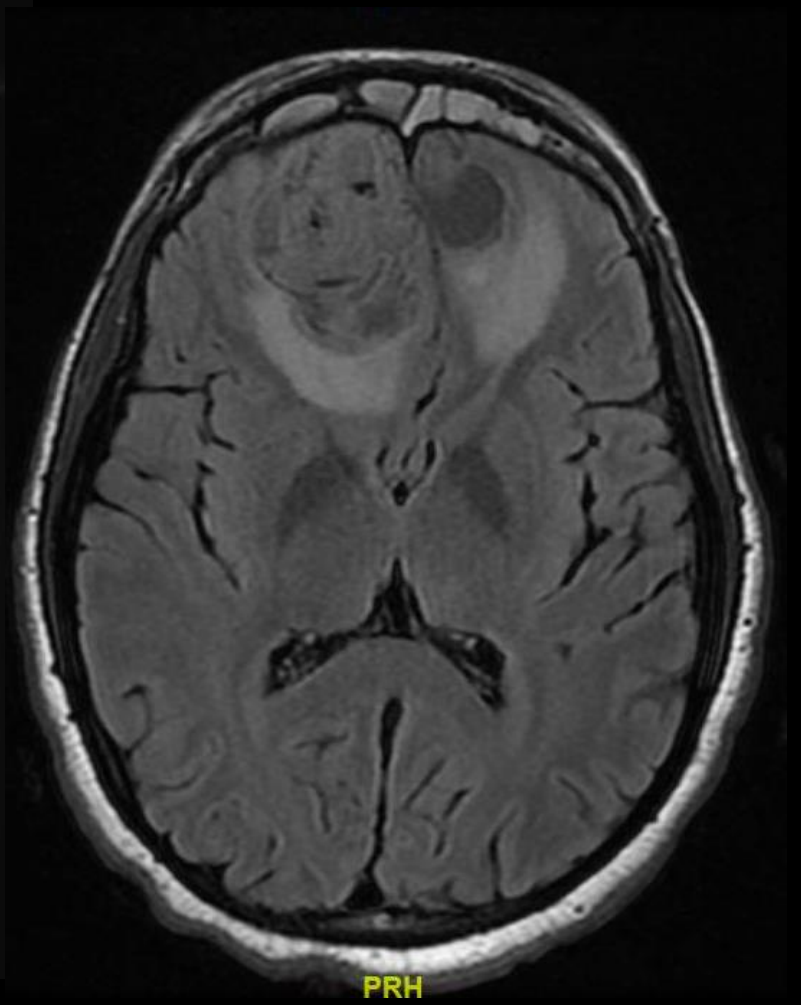
30 year old man with worsening symptoms of sinus congestion, worsening epistaxis and headaches for several week, presenting to a hospital s/p seizure episode



Sag C+

Flair

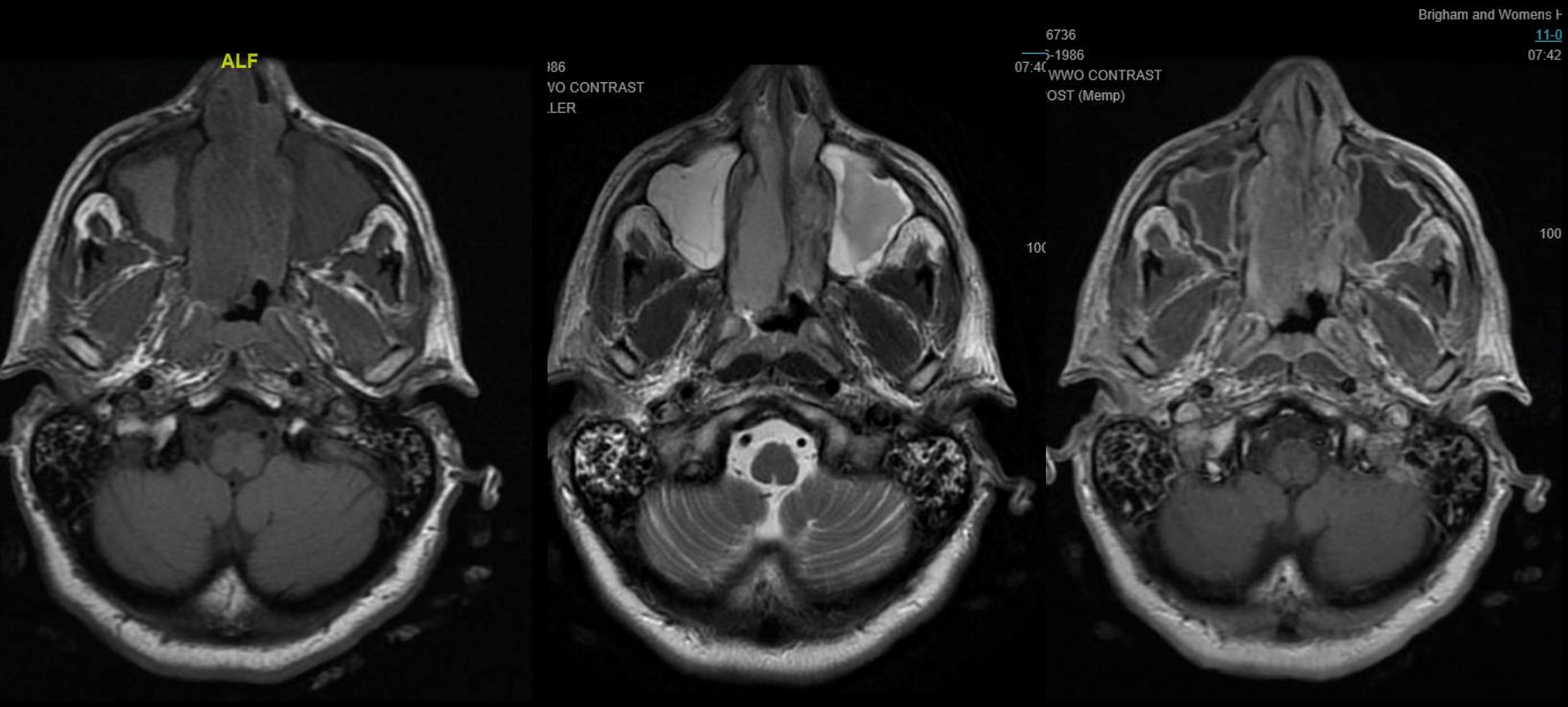




T1

T2

T1 C+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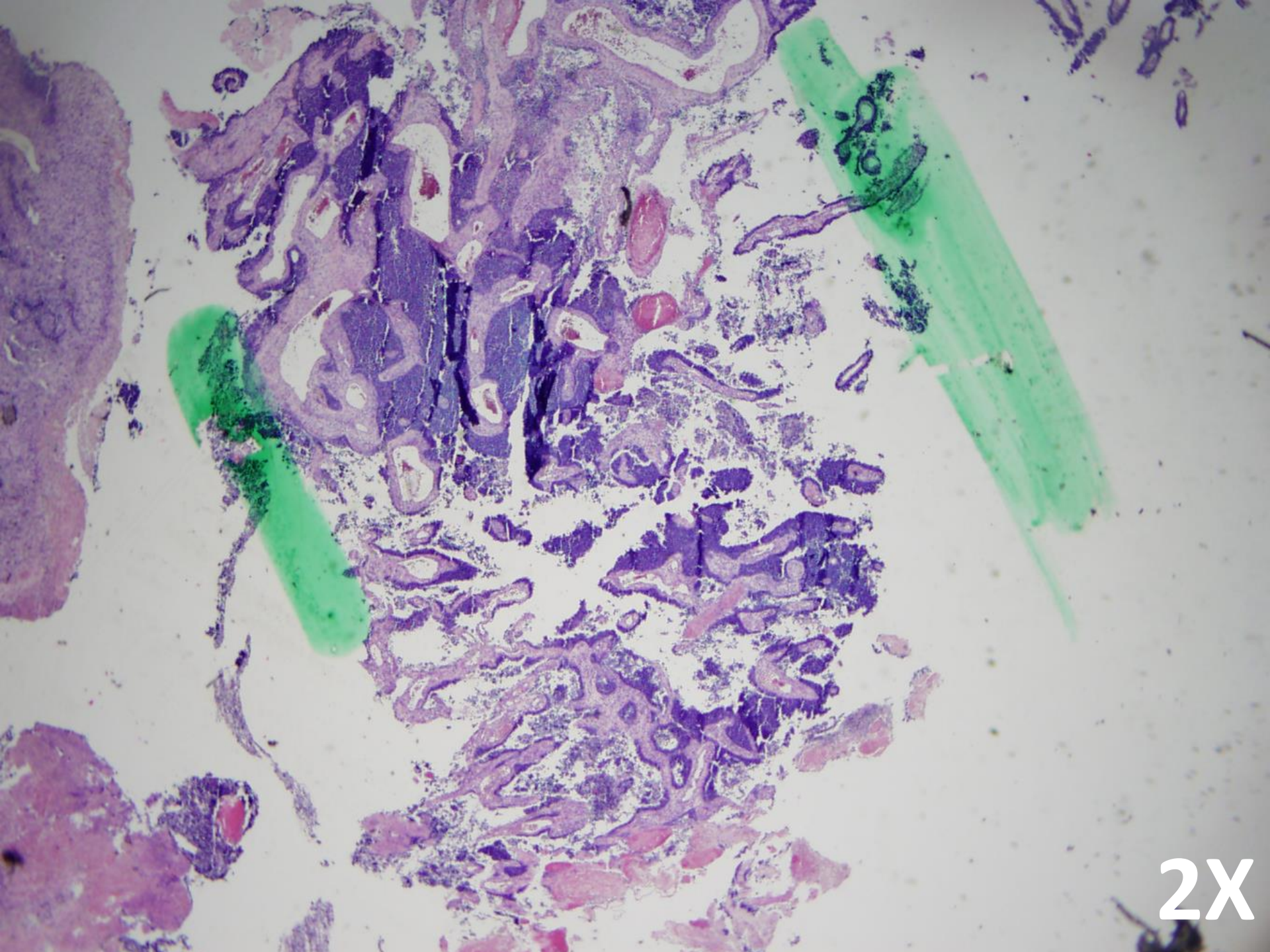
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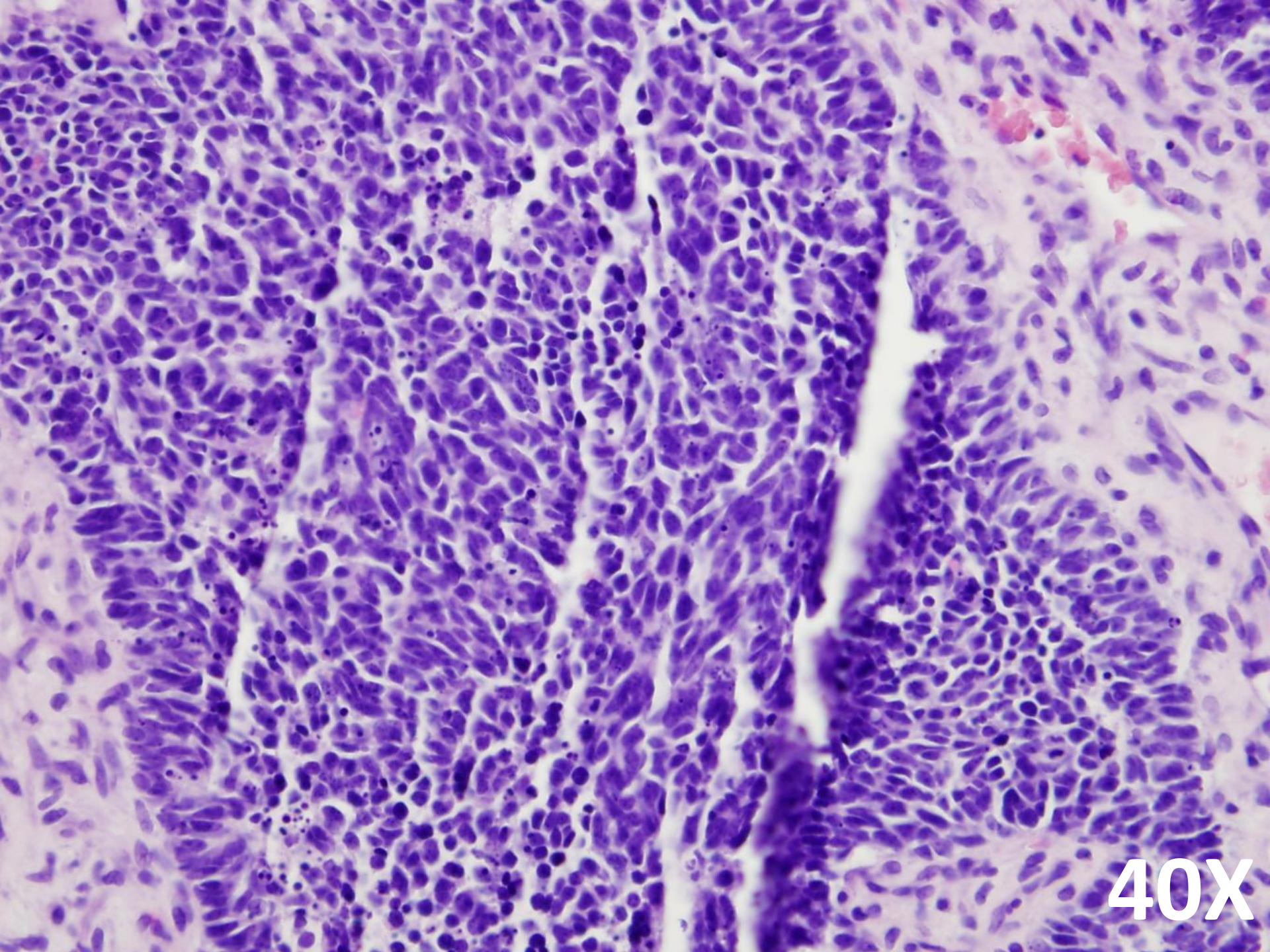
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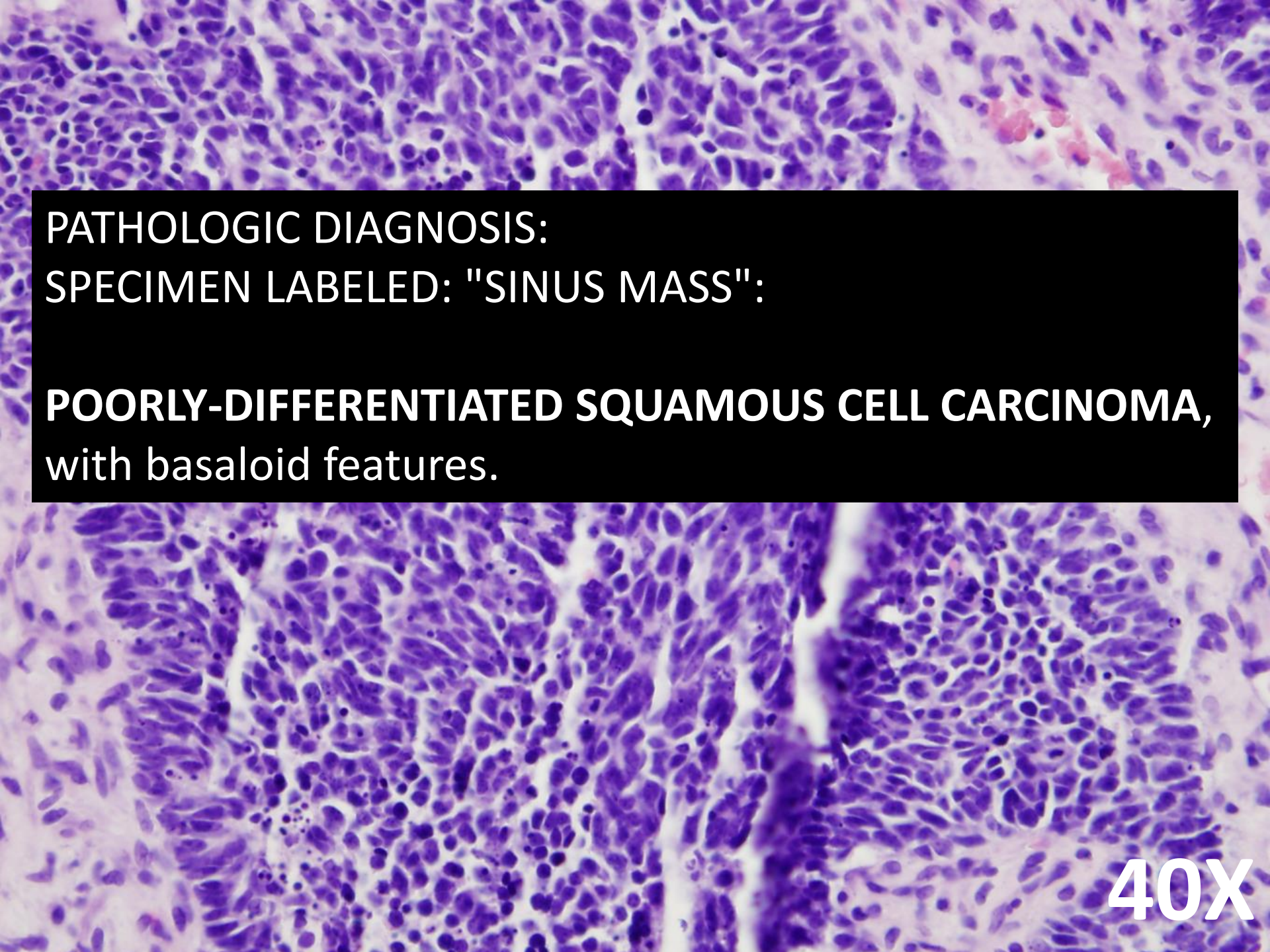
PATHOLOGIC DIAGNOSIS:
SPECIMEN LABELED: "SINUS MASS":
POORLY-DIFFERENTIATED SQUAMOUS CELL CARCINOMA, with basaloid features.
40X

Sinonasal squamous cell carcinoma

- Malignant epithelial tumor with squamous cell differentiation
- Risk factors: inhaled wood dust, metallic particles, chemicals, HPV, inverted papilloa
- Symptoms of chronic sinusitis, diagnosis often delayed
- Age: 50-70

Sinonasal carcinoma

- Most common malignancy of sinonasal area
- Maxillary Antrum origin is common
- 75% arise in sinuses, 30% arise in the nose
- Solid, moderately enhancing mass with irregular margins
- Aggressive bone destruction
- Perineural tumor spread
- Cervical malignant lymphadenopathy (15%)

Sinonasal undifferentiated squamous cell carcinoma

- Tends to be centered in nasal cavity rather then maxillary sinus
- Is extremely aggressive with bone destruction and extension into intracranial fossa
- Can occur in 3rd-9th decade of life
- Is staged with Kadish system
- M:F 2-3:1

Sinonasal tumor with aggressive features DDX:

1. Sinonasal squamous cell carcinoma
2. Sinonasal undifferentiated carcinoma – rapidly growing, tends to be in nasal cavity,otherwise indistinguishable
3. Sinonasal adenocarcinoma - similar imaging features, tends to enhance more
4. Invasive fungal sinusitis - in immunocompromised patients
5. Sinonasal Non Hodgkin lymphoma
6. Sinonasal melanoma
7. Esthesioneuroblastoma
8. Adenoid cystic carcinoma
9. Wegener granulomatosis - sinonasal disease associated with trachenobronchial and renal disease

Sinonasal tumor DDX continued

- Antrochoanal polyp
- Inverted papilloma
- Fronthoethmoid cephalocele
- Juvenile Angiofibroma
- Sinonasal polyposis
- Mucocele