AMSER Case of the Month

51-Year-Old Man with Right-Sided Facial Pain and Swelling

Bhavya Kanuga, MS-IV, Drexel University College of Medicine
Neiladri Khan, DO, PGY-4, Allegheny Health Network
Warren Chang, MD, Allegheny Health Network
Matthew Hartman, MD, Allegheny Health Network

DREXEL UNIVERSITY College of Medicine

Allegheny Health Network

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Patient Presentation

- History of Present Illness: 51-year-old man with recent history of dental surgery presents to the emergency department with a two-week history of progressive right-sided facial pain, swelling, dysphagia, and difficulty breathing. Evaluated by the dentist one week ago and started on broad-spectrum antibiotics with no improvement in symptoms. Denies chest pain, palpitations, sputum production.
- Past Medical History: Type II diabetes mellitus, coronary artery disease, hypertension
- Past Surgical History: Molar extraction, coronary artery bypass graft
- Medications: Augmentin, Lipitor, Metformin, Coreg
- Review of Systems: Positive for fevers, blurry vision, nausea

Pertinent Labs

Elevated white blood cell count and elevated blood sugars

Pertinent Physical Exam Findings

Significant soft tissue edema of the right face that is erythematous, indurated, and painful to touch

Bilaterally moist rhonchi with wheezing

What Imaging Should We Order?

Select the applicable ACR Appropriateness Criteria

Variant 3: **Acute rhinosinusitis. Suspected orbital or intracranial complication.**

Radiologic Procedure	Rating	Comments	RRL*
MRI maxillofacial without and with IV contrast	9	This procedure is complementary to CT paranasal sinuses without contrast.	O
MRI head without and with IV contrast	8	This procedure is complementary to MRI maxillofacial without and with contrast.	O
CT paranasal sinuses with IV contrast	8	This procedure is complementary to MRI maxillofacial without and with contrast.	☢☢
CT paranasal sinuses without IV contrast	7	This procedure is complementary to MRI maxillofacial without and with contrast.	☢☢
CT head with IV contrast	6		☢☢☢
MRI maxillofacial without IV contrast	6		O
MRI head without IV contrast	6		O
CT head without IV contrast	4		☢☢☢
CT head without and with IV contrast	4		☢☢☢
CT paranasal sinuses without and with IV contrast	2		☢☢☢
CT cone beam paranasal sinuses without contrast	1		☢☢

Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate

*Relative Radiation Level

This imaging modality was ordered by the ER physician

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CT Paranasal Sinuses with Contrast

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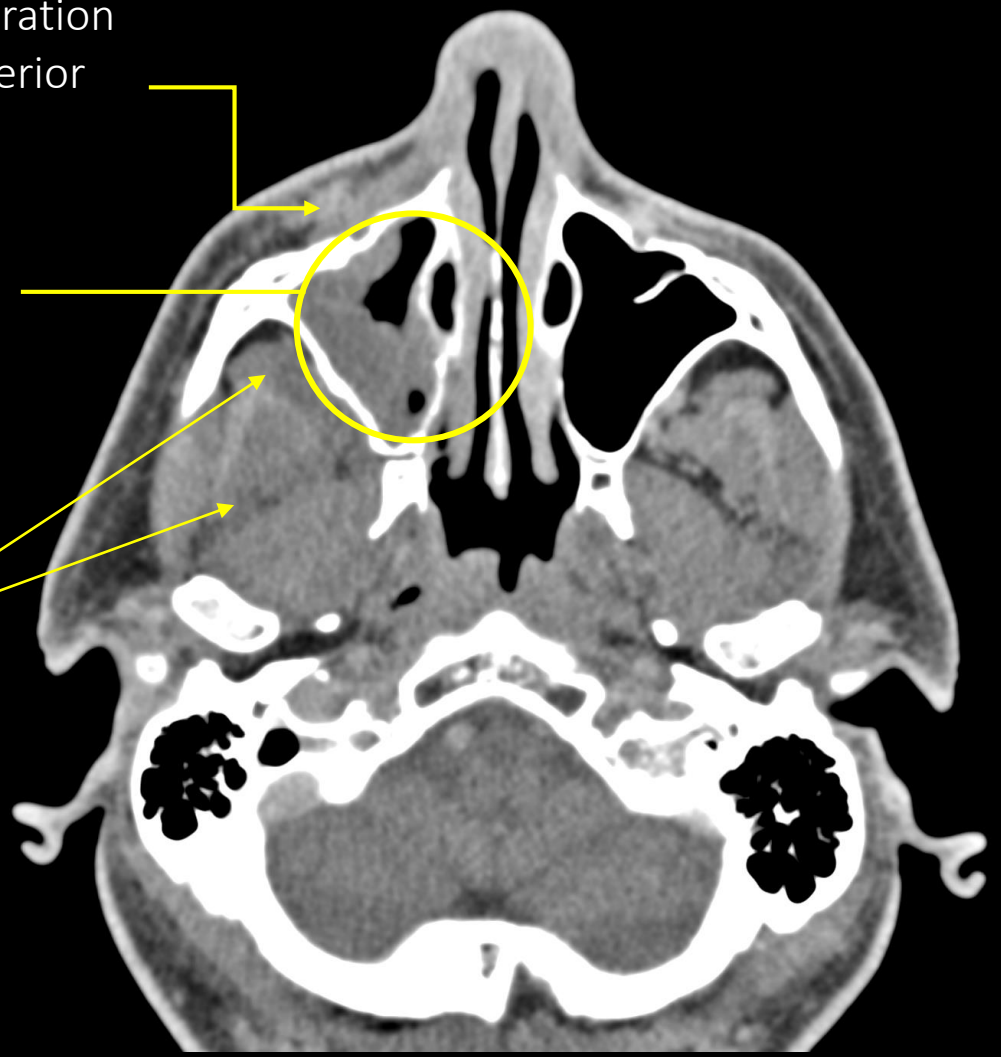
CT Paranasal Sinuses with Contrast (Labeled)

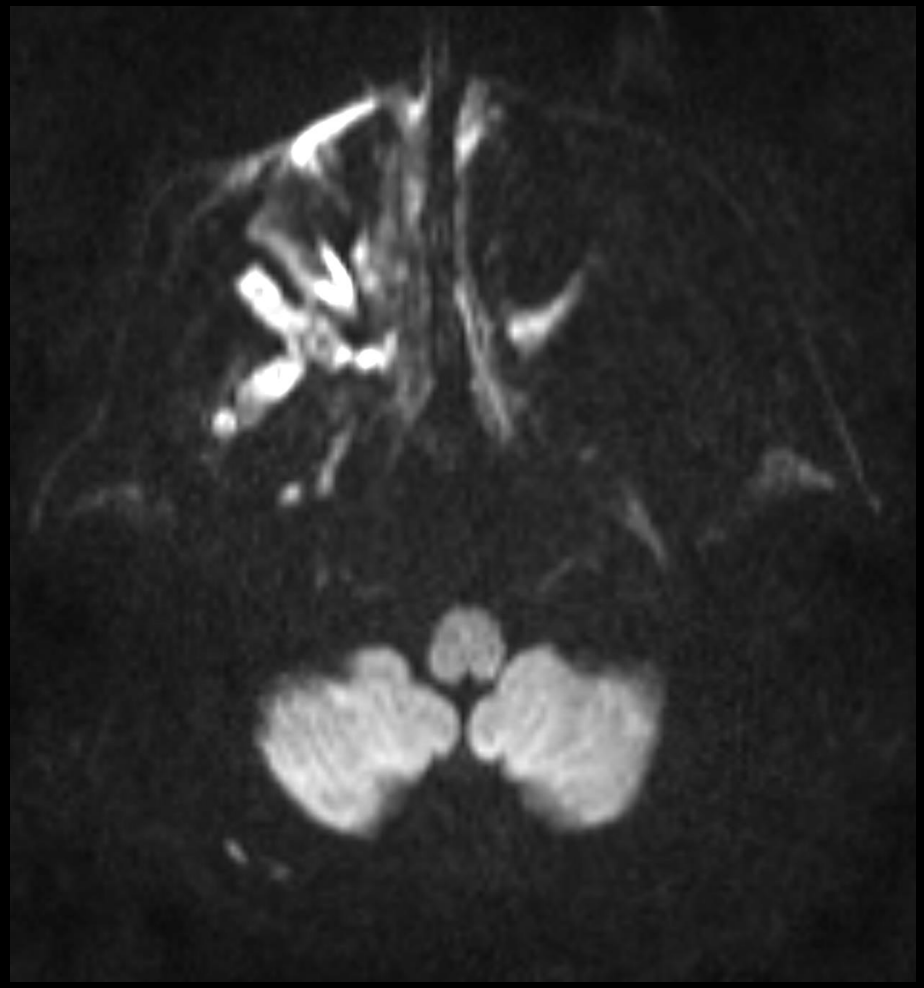
Soft tissue infiltration of the right anterior periantral fat

Maxillary sinus and nasal mucosal thickening; opacification of the right maxillary sinus with thick secretion

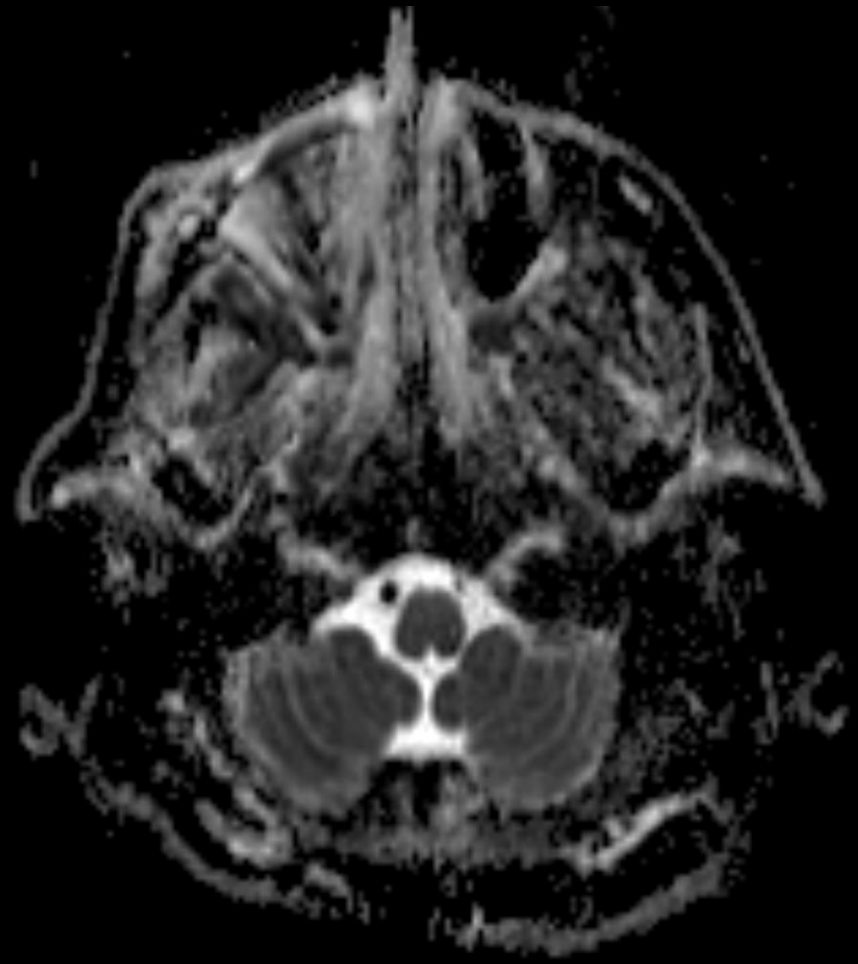
Soft tissue infiltration of the right masticator space and opacification of the retromaxillary fat pad



MRI Brain With and Without Contrast

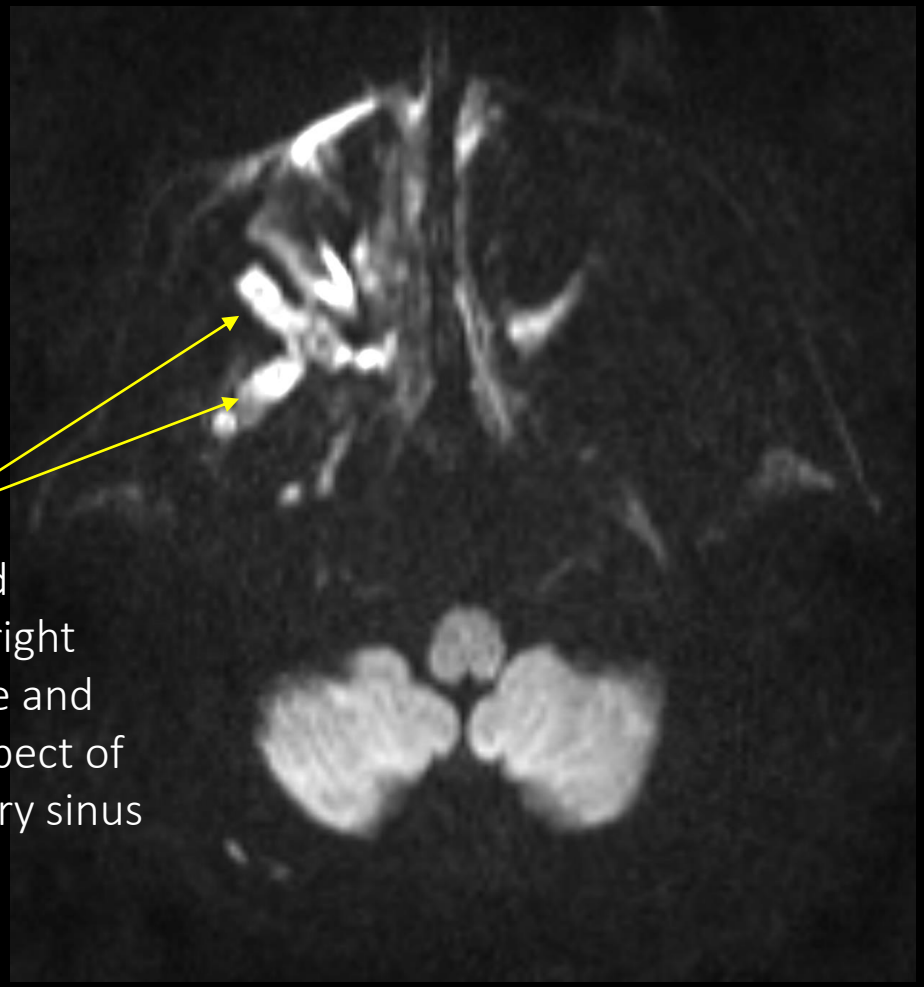


DWI



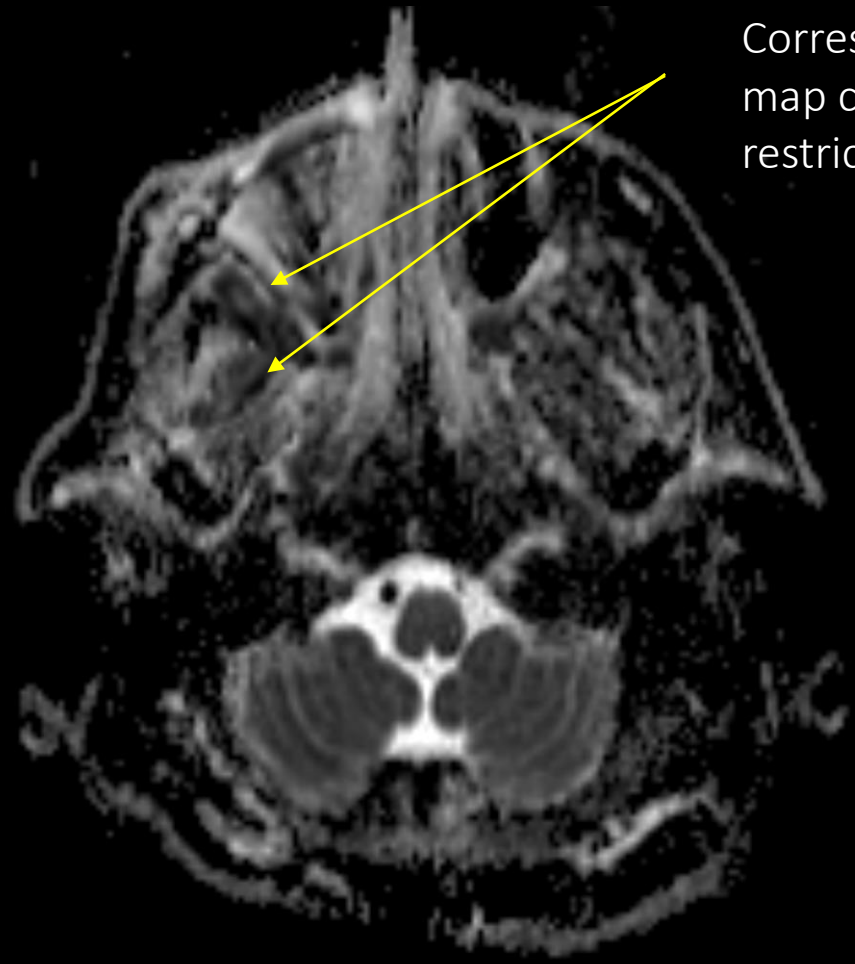
ADC

MRI Brain With and Without Contrast (Labeled)



Foci of restricted diffusion in the right masticator space and the posterior aspect of the right maxillary sinus

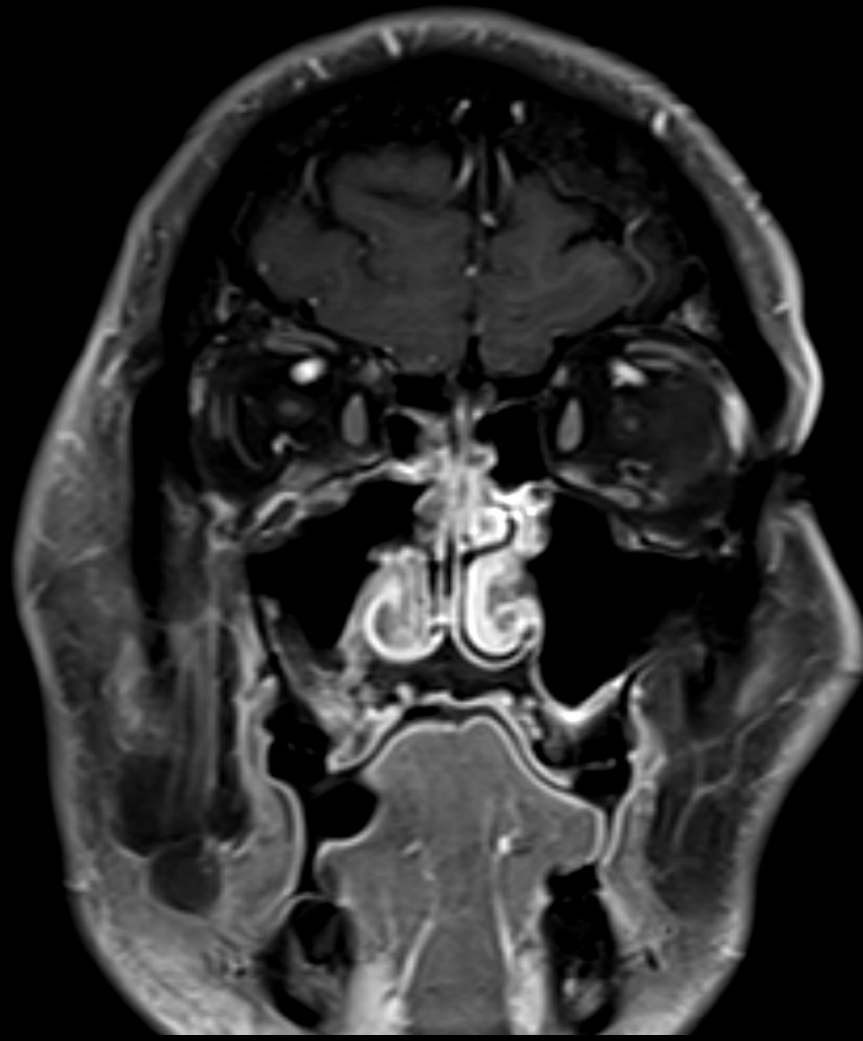
DWI



Corresponding ADC map confirms true restricted diffusion

ADC

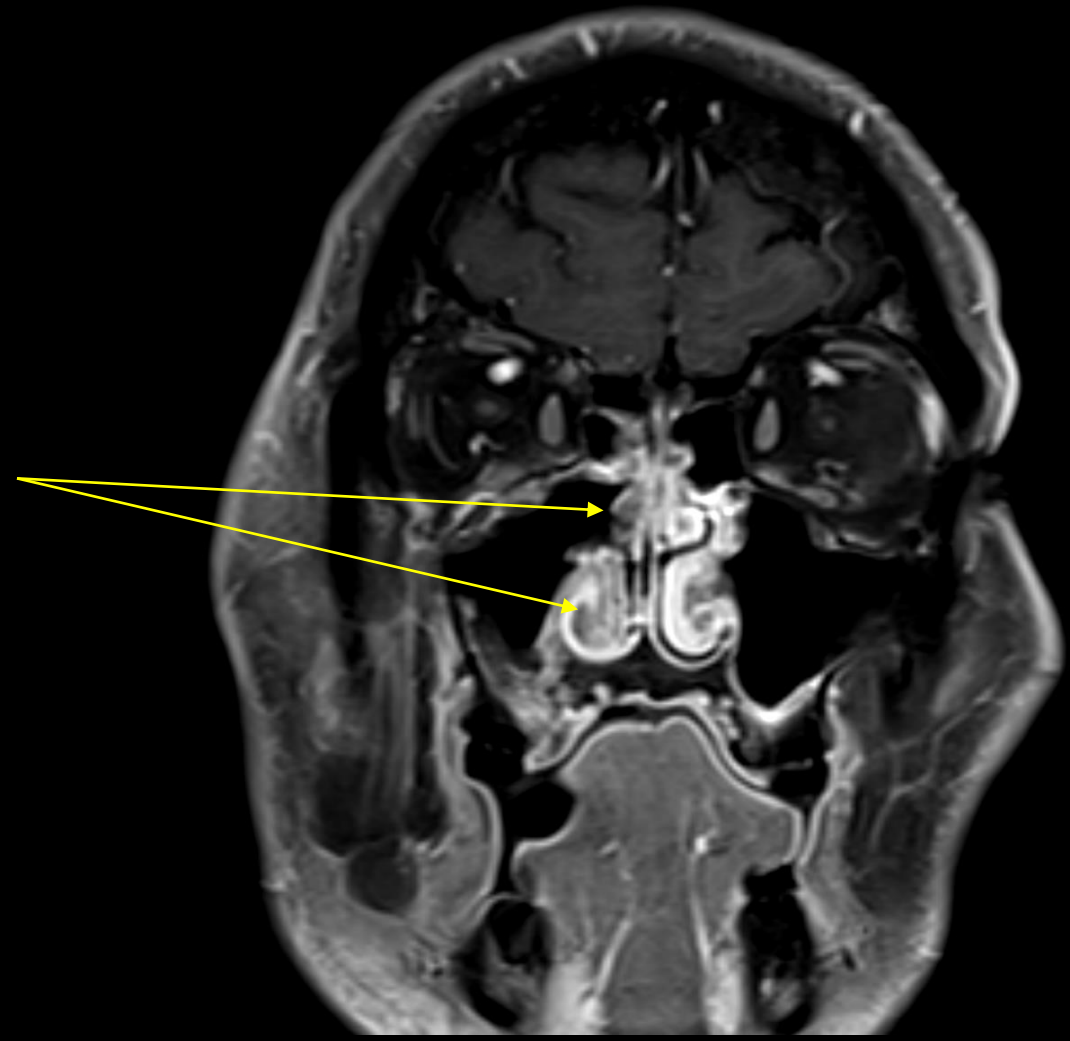
MRI Brain With Contrast



Coronal T1 Post Contrast

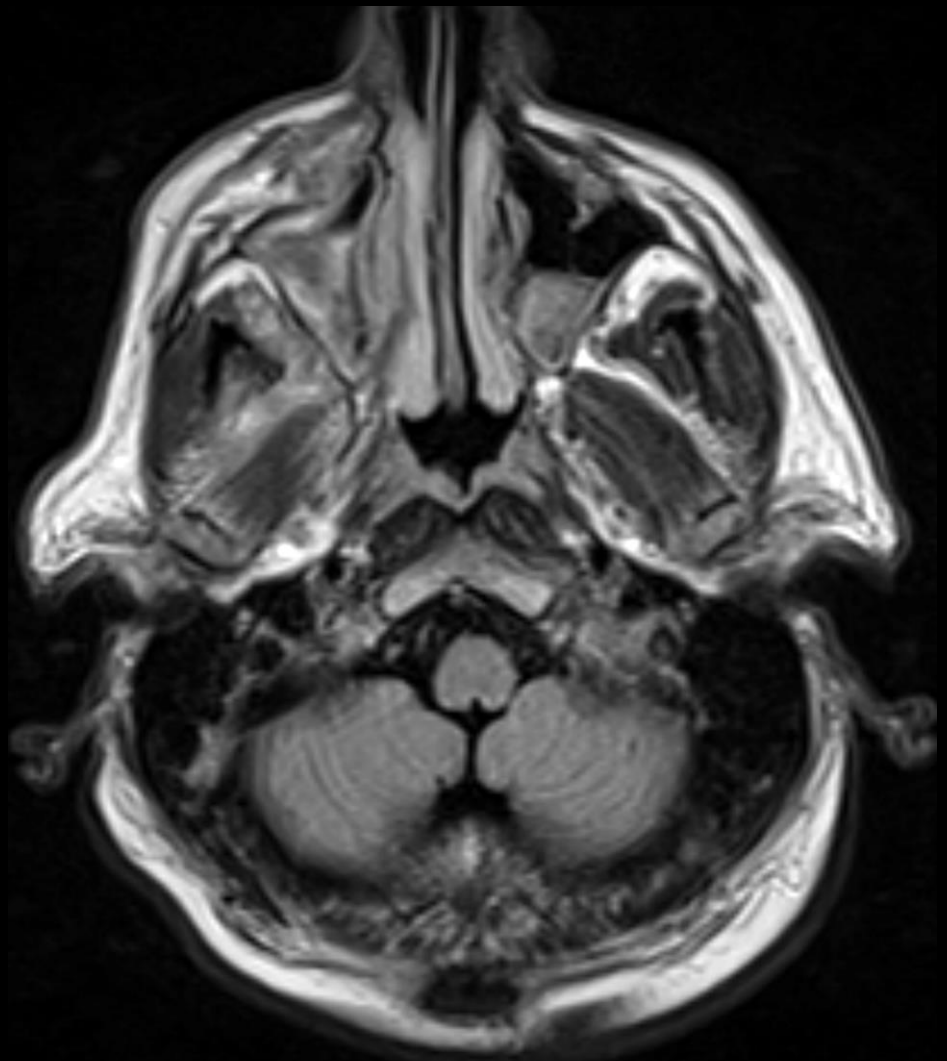
MRI Brain With Contrast (Labeled)

Decreased enhancement of right middle and inferior turbinates



Coronal T1 Post Contrast

MRI Brain With and Without Contrast

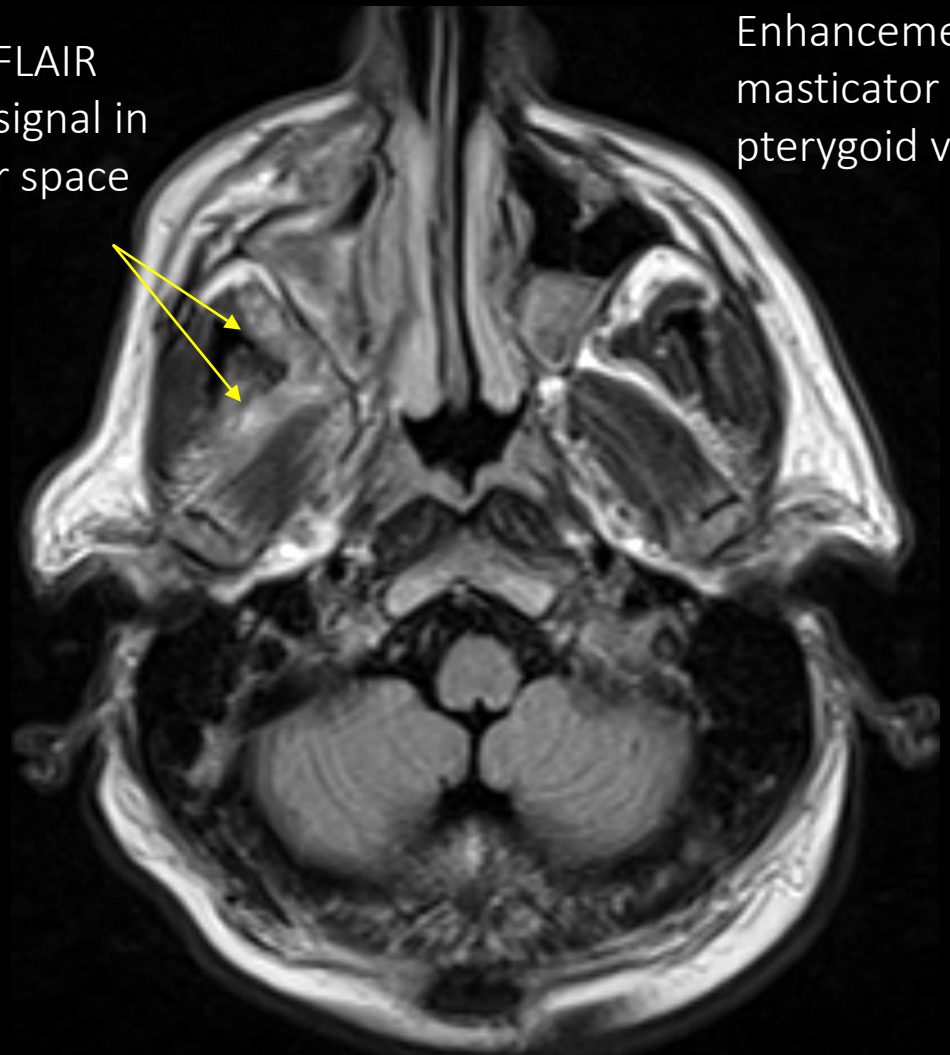


Axial FLAIR

Axial T1 Post-Contrast

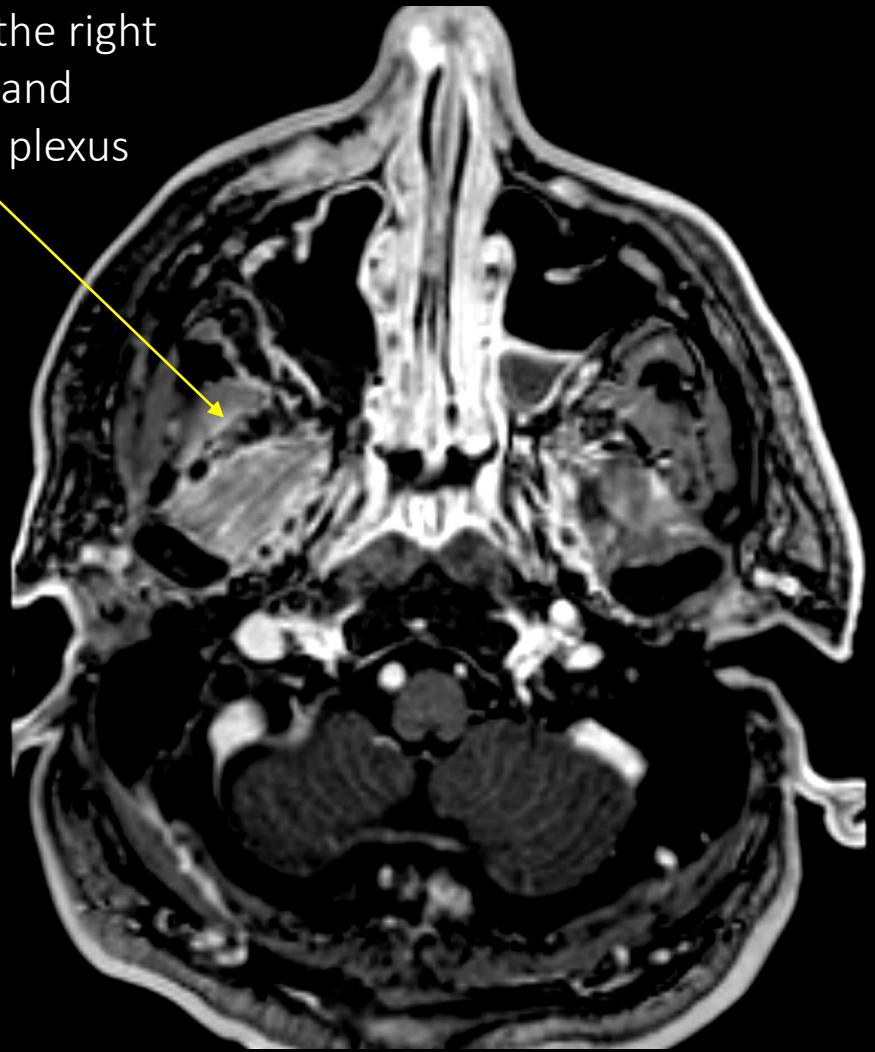
MRI Brain With and Without Contrast (Labeled)

Intermediate FLAIR hyperintense signal in the masticator space



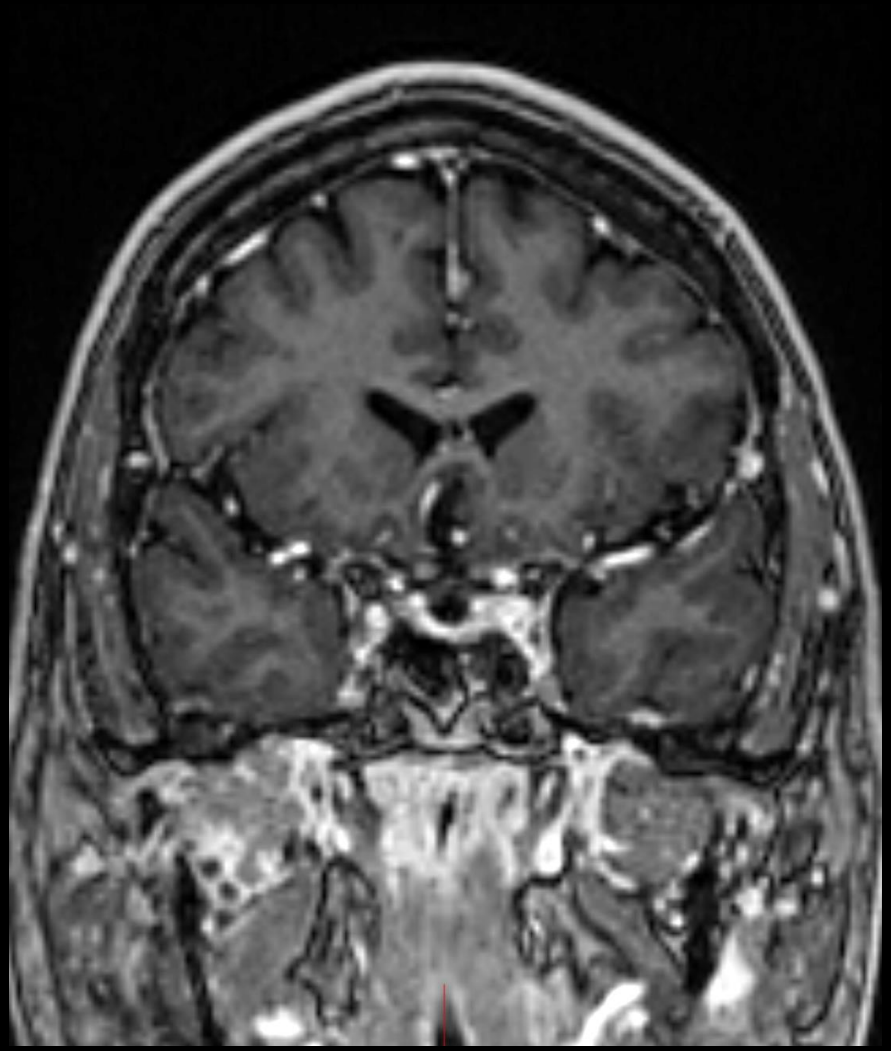
Axial FLAIR

Enhancement of the right masticator space and pterygoid venous plexus

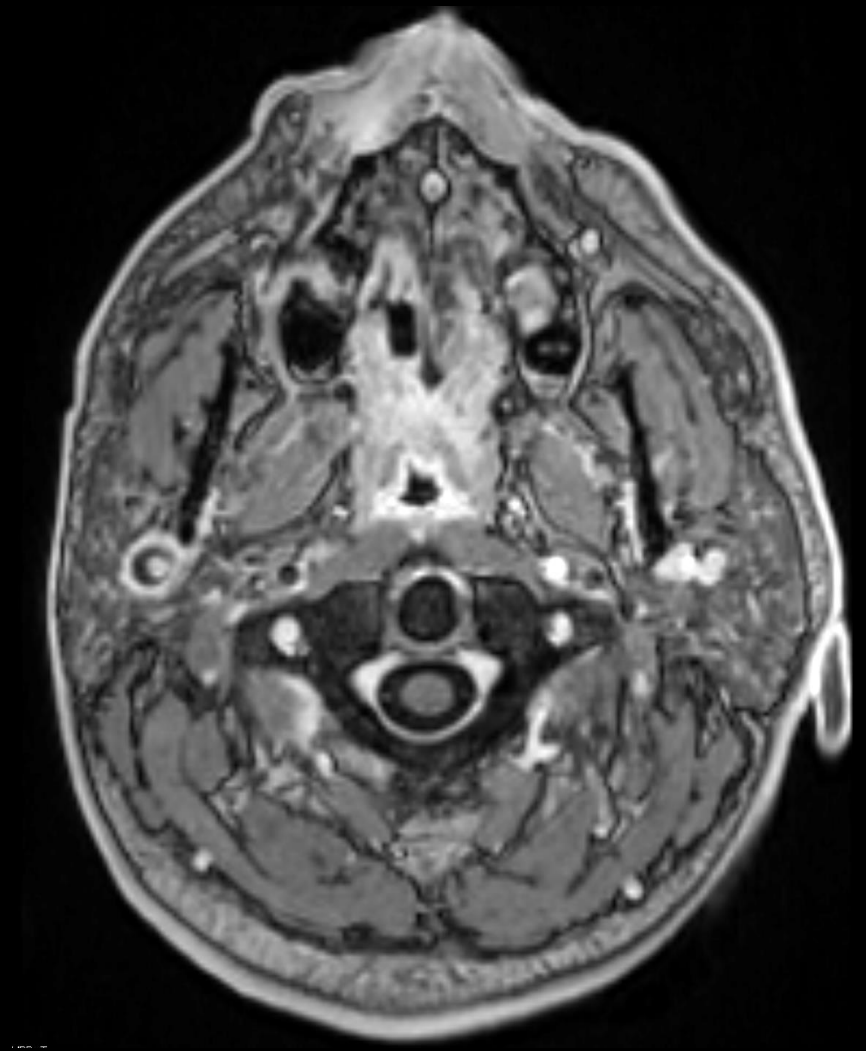


Axial T1 Post-Contrast

MRI Brain With Contrast



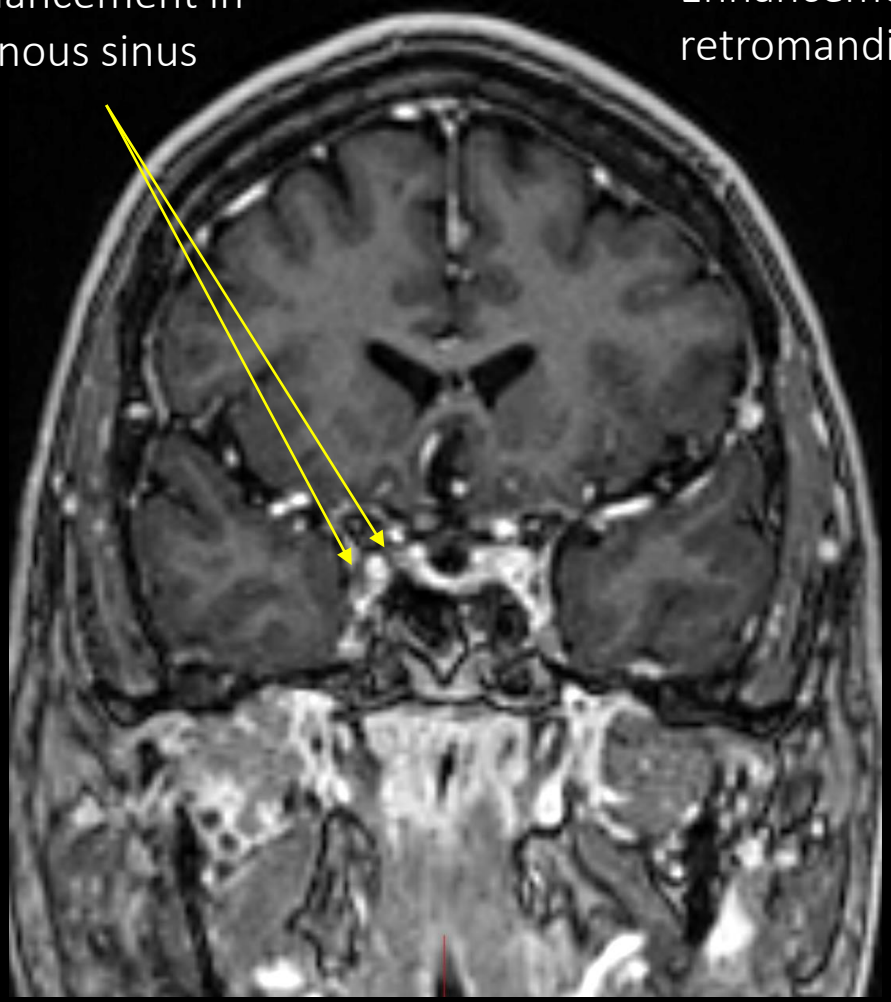
Coronal T1 Post-Contrast



Axial T1 Post-Contrast

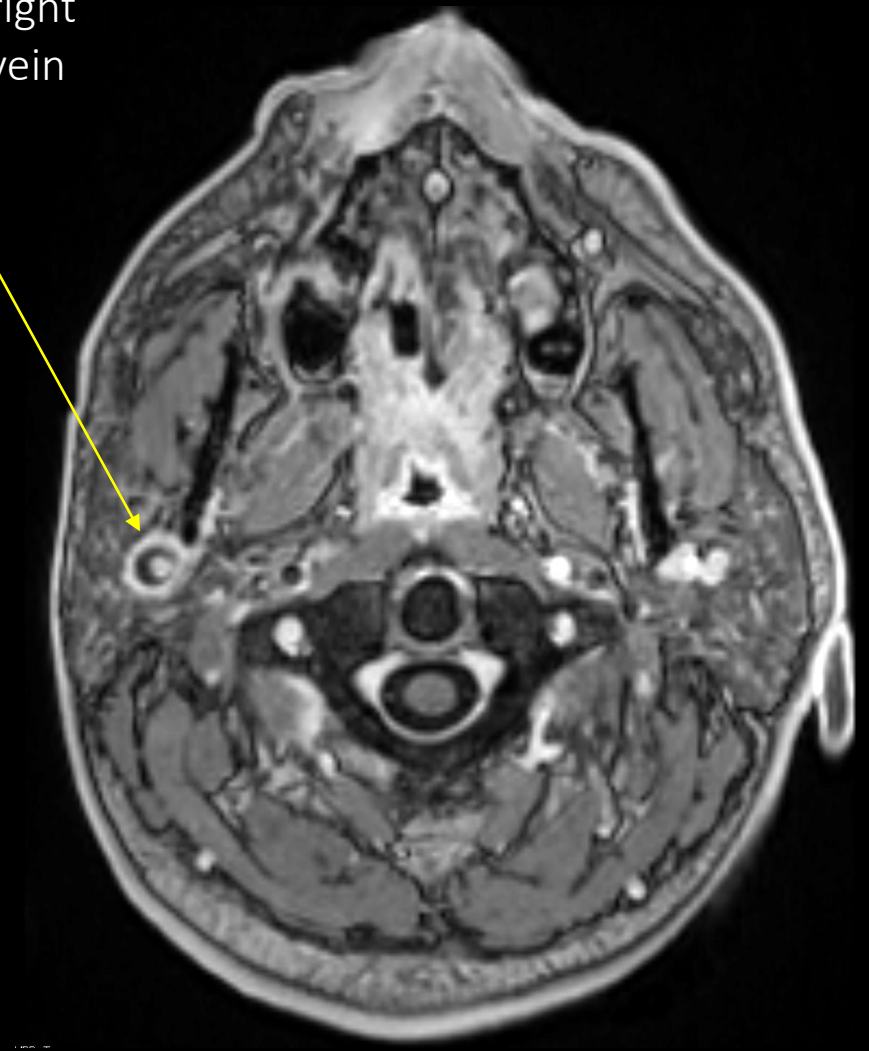
MRI Brain With Contrast (Labeled)

Decreased enhancement in the right cavernous sinus



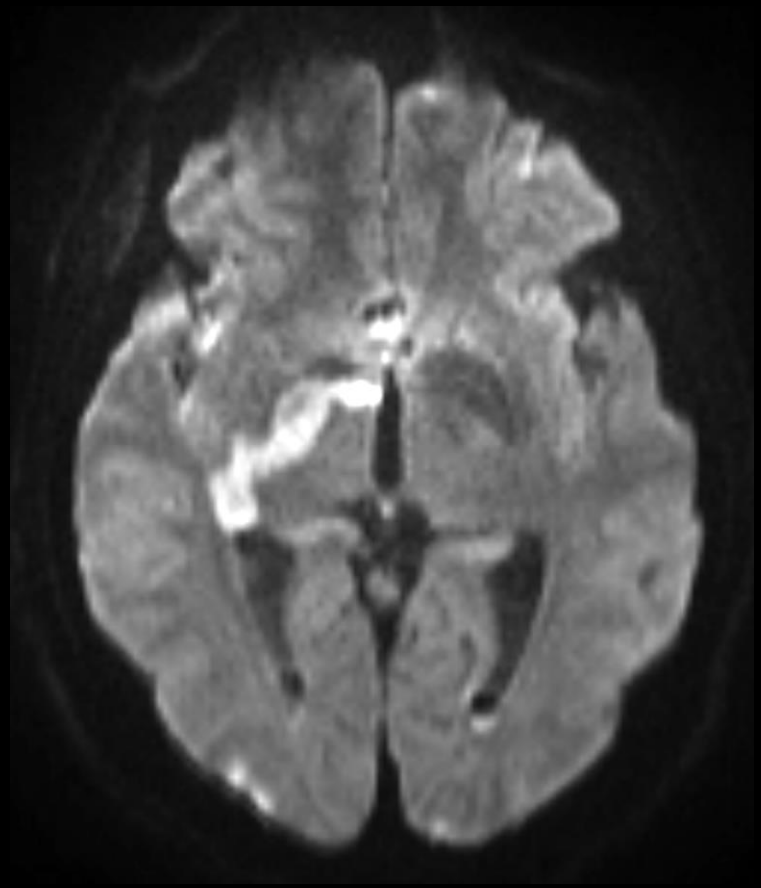
Coronal T1 Post-Contrast

Enhancement of right retromandibular vein

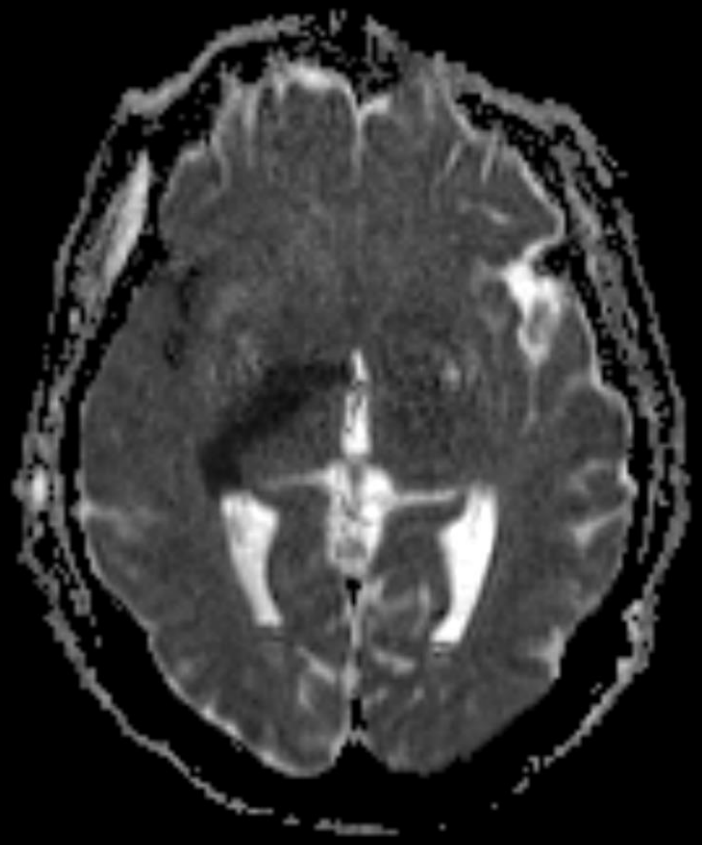


Axial T1 Post-Contrast

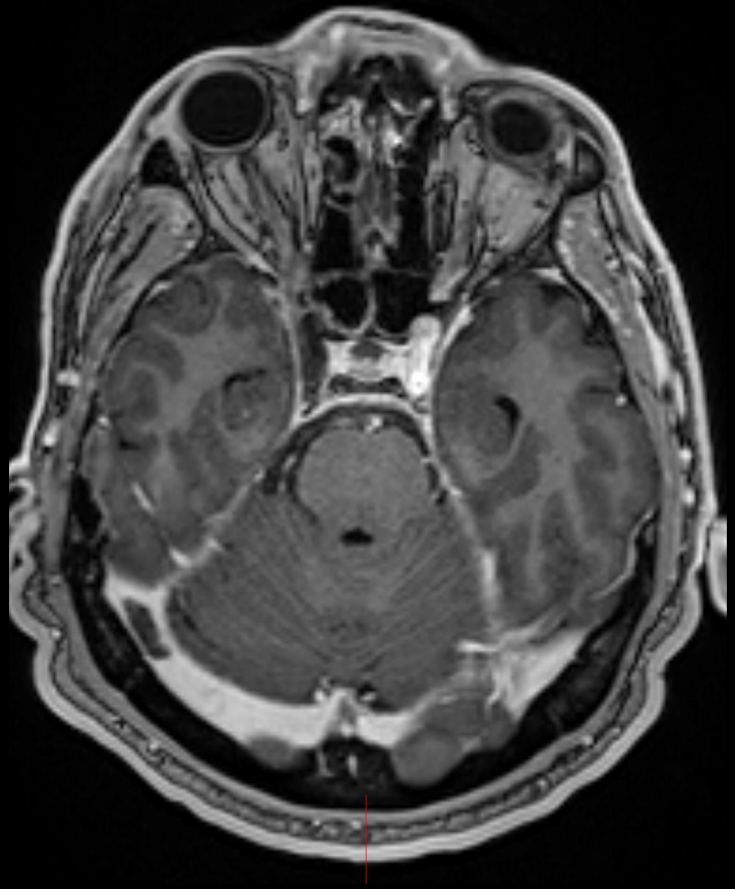
MRI Brain With Contrast



DWI

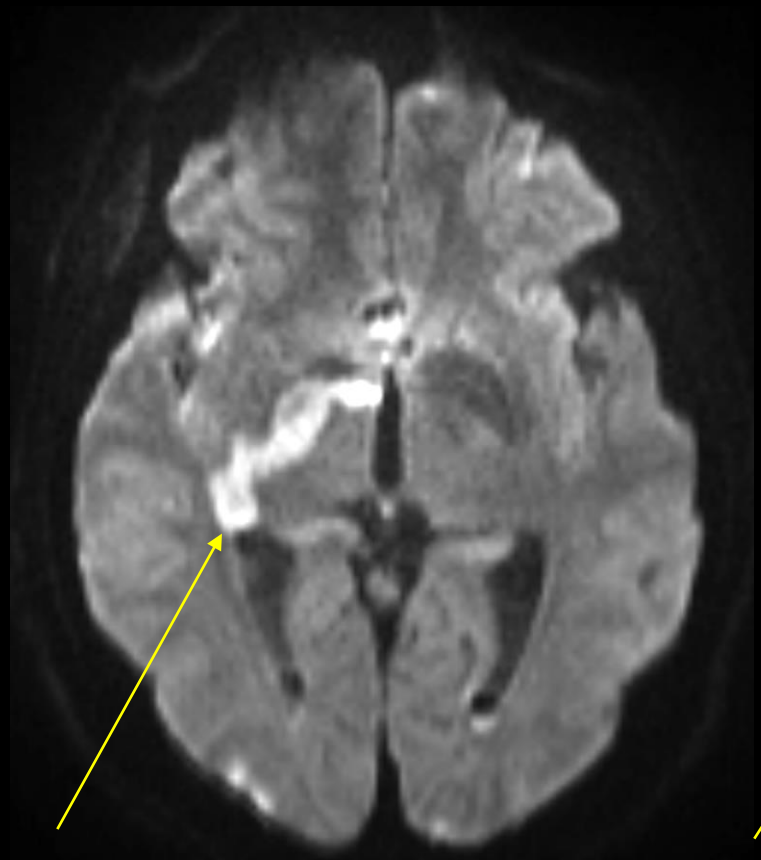


ADC



T1 Post-Contrast

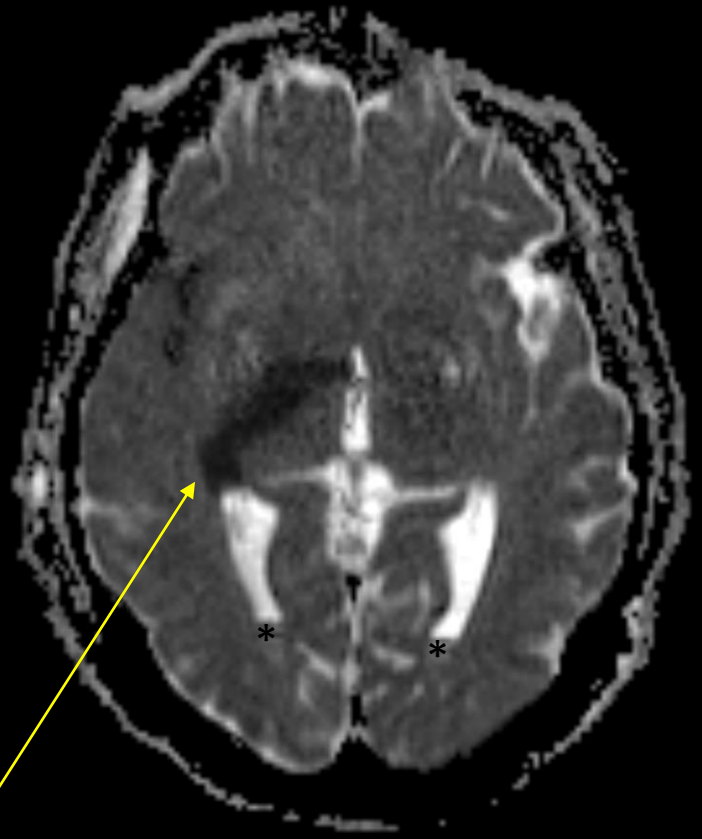
MRI Brain With Contrast (Labeled)



Restricted diffusion in the posterior limb of the internal capsule

DWI

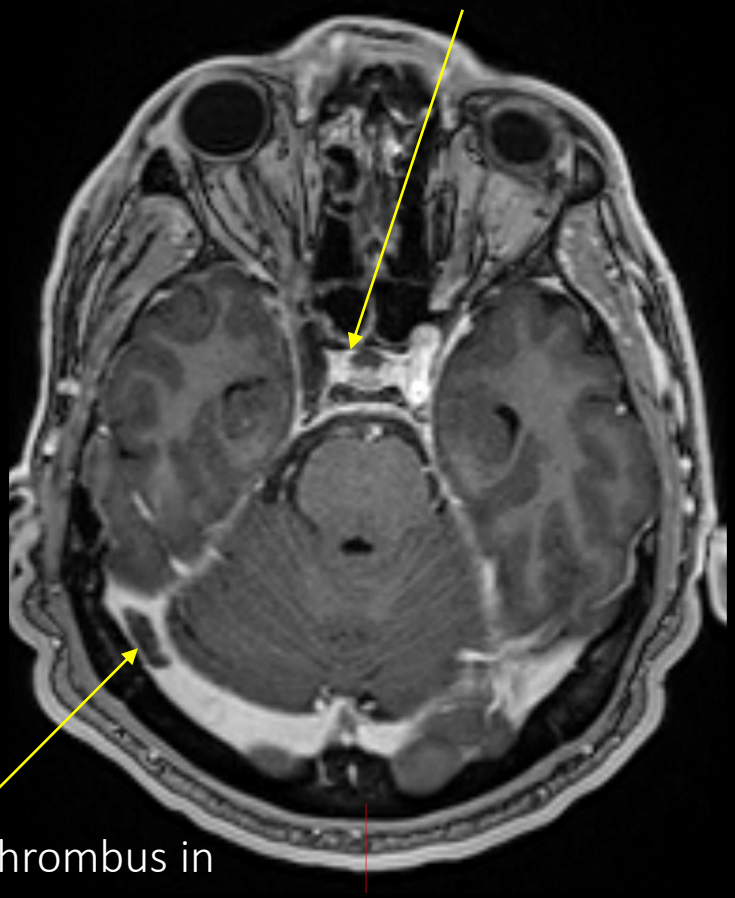
Layering blood products in the lateral ventricles (*)



Corresponding ADC confirms true restricted diffusion

ADC

Right internal carotid artery occlusion



Incidental thrombus in the right transverse sinus

T1 Post-Contrast

Final Dx:

Rhinocerebral Mucormycosis

Rhinocerebral Mucormycosis

- An acute invasive fungal rhinosinusitis that is life-threatening due to its propensity to invade adjacent structures (e.g., orbit, cavernous sinus, blood vessels, and brain parenchyma)
- Caused by saprophytic fungi in the *Mucor*, *Rhizopus*, and *Absidia* genera
- High morbidity and mortality due to rapid progression to fulminant disease, poor surveillance, and advanced presentation
- Risk Factors: immunocompromise, poorly-controlled diabetes, chronic corticosteroid use, diabetic ketoacidosis
- Clinical Presentation: fever, facial pain, headache, nasal discharge, nasal obstruction
  - Rapid progression within hours to days that leads to CNS extension
  - Proptosis, cranial nerve palsies, altered mentation, seizures, coma, death
- Disease Course: acute infection involving nasal cavity (primary site) and paranasal sinuses
  - Orbital involvement from spread through nasolacrimal duct and medial orbital wall
  - Invasion into brain parenchyma through retrograde venous flow, direct bony extension through cribriform plate or walls of nasal sinuses, hematogenous/lymphatic dissemination
  - Intracranial angioinvasion into cavernous sinus and carotids leading to thrombosis
  - Soft tissue extension into masticator space, pterygopalatine fossa, hard palate
- Treatment: surgical debridement, systemic antifungal chemotherapy

Rhinocerebral Mucormycosis Imaging Features

CT Findings

- Isodense to minimally hypodense (relative to masticator space) soft tissue infiltration with no post-contrast enhancement
- Low-density opacification of nasal sinuses with mucosal thickening and absence of air-fluid levels
- Retroantral, facial, orbital fat stranding
- Loss of normal fat planes (e.g., masticator space)
- Turbinate hypertrophy secondary to inflammation and septal involvement in some patients
- Extrasinus spread typically leaves bones intact
    - Bony involvement seen on CT through bone rarefaction, erosion, and permeative destruction
    - CT highly sensitive for bony lesions

Rhinocerebral Mucormycosis Imaging Features

MRI Findings:

- Greatest utility for vascular extension, including cavernous sinus or internal carotid artery thrombosis, and intraorbital or intracranial extension
- Sinonasal involvement: T2 signal hypointensity but varies based on presence of necrosis or paramagnetic elements
  - Heterogenous enhancement post-contrast
  - Post-contrast T1W imaging shows characteristic nonenhancement in areas that typically enhance => ”Black Turbinate” sign
- Extension beyond sinuses
  - Fat-suppressed T2 and postcontrast T1W images
  - Edema and enhancement of bony walls
  - Useful in detecting fat stranding, e.g., retromaxillary or orbital fat stranding
- Cavernous sinus and arterial extension
  - Loss of concavity and filling defect in cavernous sinus post-contrast
  - Arterial wall enhancement, narrowing of lumen
- Intracranial extension
  - Irregular areas of altered signal intensity, typically T2 hyperintense, in nonvascular distribution

References:

- Alam A, Chander BN, Sabhikhi GS, Bhatia M. Sinonasal Mucormycosis: Diagnosis Using Computed Tomography. *Med J Armed Forces India*. 2003;59(3):243-245. doi:10.1016/S0377-1237(03)80018-7

- American College of Radiology. ACR Appropriateness Criteria. Available at https://www.acr.org/Cli nical-Resources/ACR-Appropriateness-Criteria. Accessed March 19, 2021.

- Aribandi M, McCoy VA, Bazan rd. Imaging features of invasive and noninvasive fungal sinusitis: a review. *Radiographics*. 2007;27(5):1283-1296. doi:10.1148/rg.275065189

- Herrera DA, Dublin AB, Ormsby EL, Aminpour S, Howell LP. Imaging findings of rhinocerebral mucormycosis. *Skull Base*. 2009;19(2):117-125. doi:10.1055/s-0028-1096209

- Sreshta K, Dave T, Varma D, et al. Magnetic resonance imaging in rhino-orbital-cerebral mucormycosis. *Indian journal of ophthalmology*. 2021;69(7):1915-1927. doi:10.4103/ijo.IJO_1439_21

- Therakathu J, Prabhu S, Irodi A, Sudhakar SV, Yadav VK, Rupa V. Imaging features of rhinocerebral mucormycosis: A study of 43 patients. *Egyptian journal of radiology and nuclear medicine*. 2018;49(2):447-452. doi:10.1016/j.ejrnm.2018.01.001