

RADY 401 Case Presentation

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SCHOOL OF MEDICINE
Radiology

Focused patient history, PE and workup

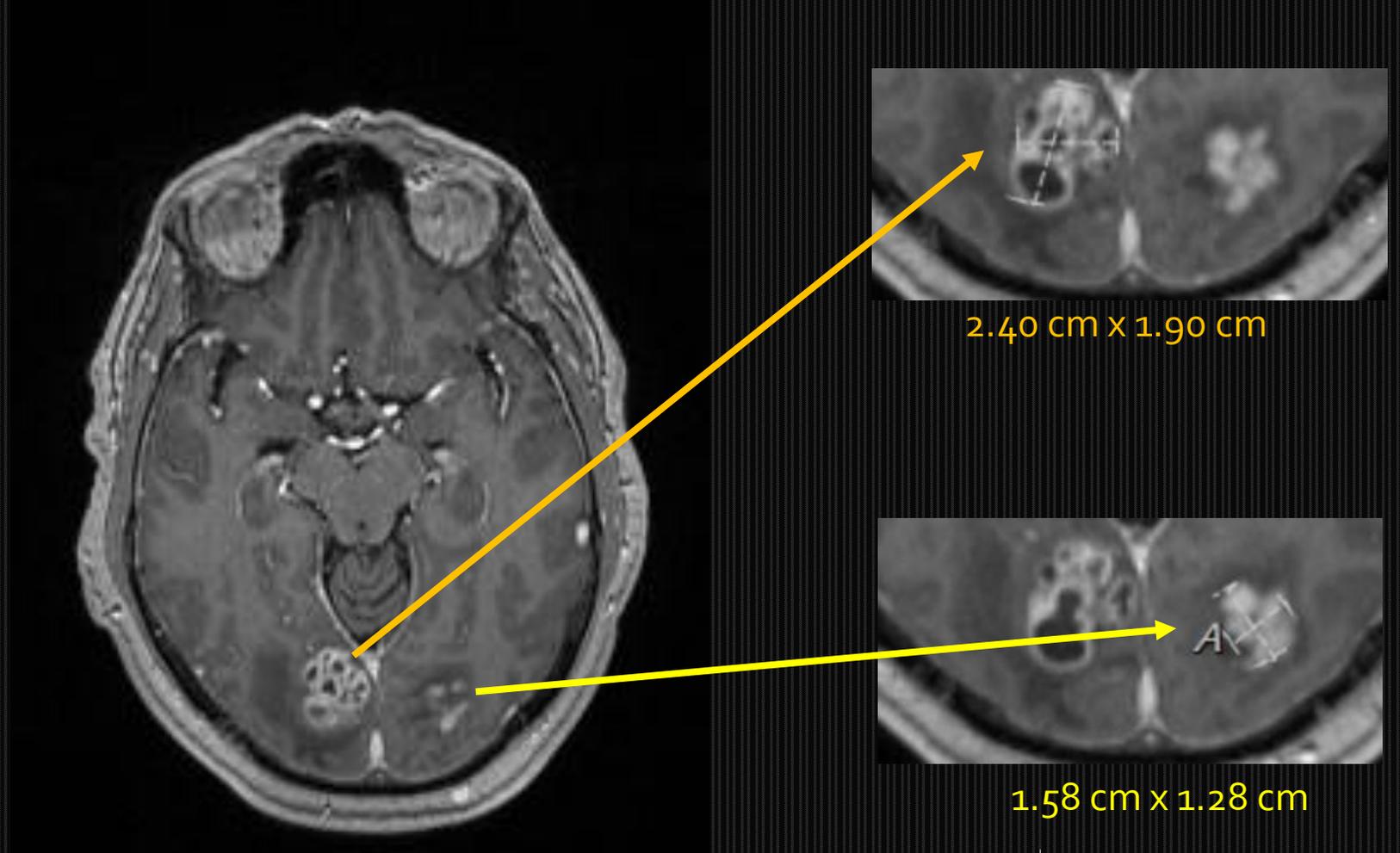
- HPI:
56-year-old male with PMHx of bilateral renal transplant (2005, 2016), renal cell carcinoma, T2DM, HTN, currently on an immunosuppressive regimen, with 1 month history of headache and vision changes. Patient had an MRI brain 2.5 weeks ago that showed "lesions". Patient now presents with 3 days of worsening, now constant HA and vision changes with blurriness with L-side > R-side and "flashes of light."
- PE:
HEENT: PERRL; **Saccadic eye movements bilaterally**. R eye VFF, **L eye visual fields cut in all quadrants**
Neuro: Normal speech and language. AO x 3. Follows commands. **Left visual field cuts, remainder of CN intact.**
Normal cerebellar function, normal gait. Normal sensation in all extremities. No pronator drift.
- Workup:
 - Labs:** CBC w/ diff, BMP, HIV, RPR, BCx, Urine histoplasma antigen, quantiferon TB gold, cryptococcal antigen
 - LP with CSF studies including:** bacterial, AFB and fungal cultures, cryptococcal antigen, VDRL, EBV, toxoplasma
 - Bronchoscopy with:** bronchial culture, respiratory viral panel, AFB culture, pneumocystis DFA, fungal culture, aspergillus galactomannan AG, CMV PCR, mycoplasma PCR, actinomyces screen, legionella culture

List of imaging studies

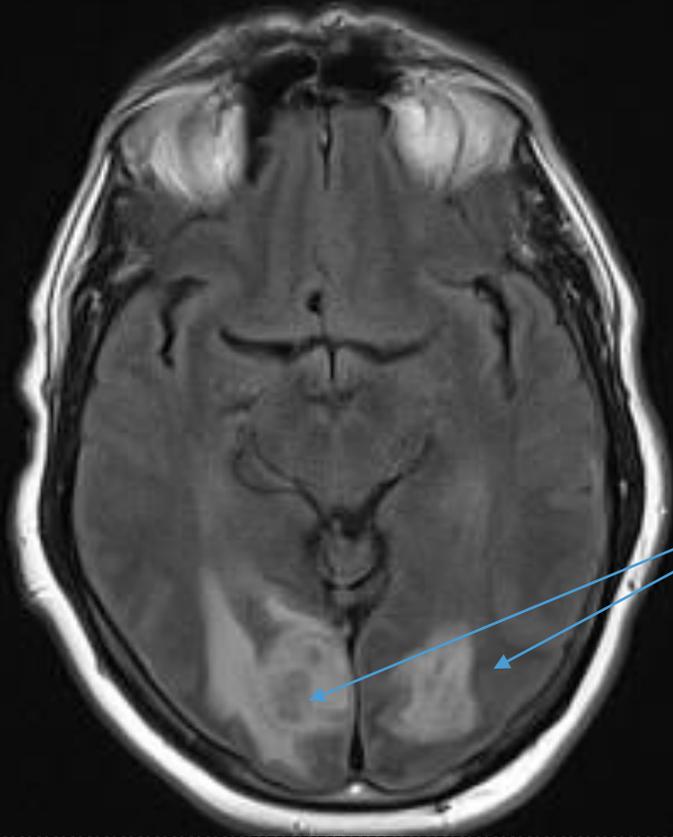
- MRI Brain WWo Contrast (x 2)
- CXR, 2 views
- CT Chest Wo Contrast
- CT Head Wo Contrast (x 2)

Imaging studies: MR Brain

T₁ post contrast axial MRI showing rim-enhancing lesions in right occipital lobe and vasogenic edema in bilateral occipital lobes with associated headache and vision changes concerning for infection vs. CNS lymphoma

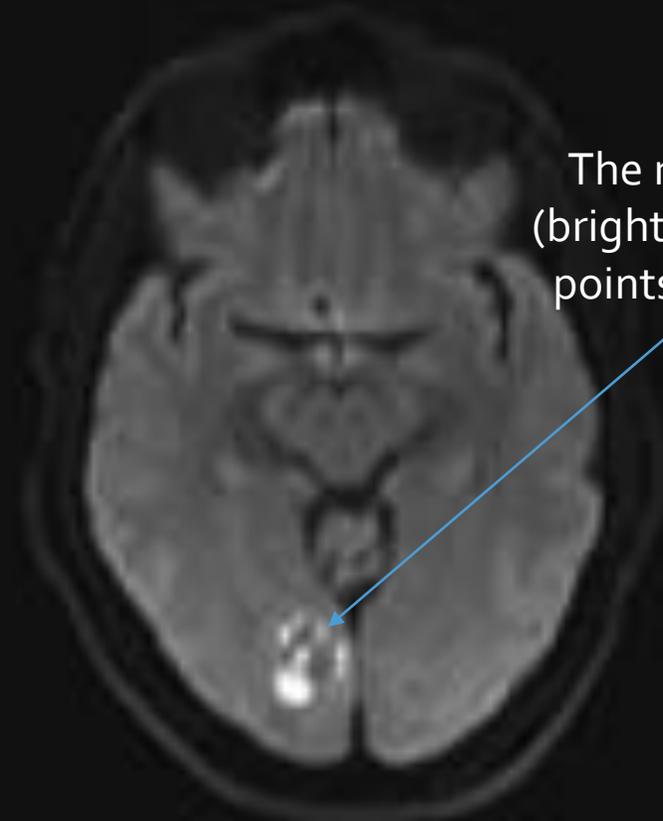


Imaging studies: MR Brain Axial



Post-contrast T2 FLAIR sequence is used with an inversion pulse that nulls the signal intensity of CSF. This increases its sensitivity to detect lesions and edema.¹

FLAIR



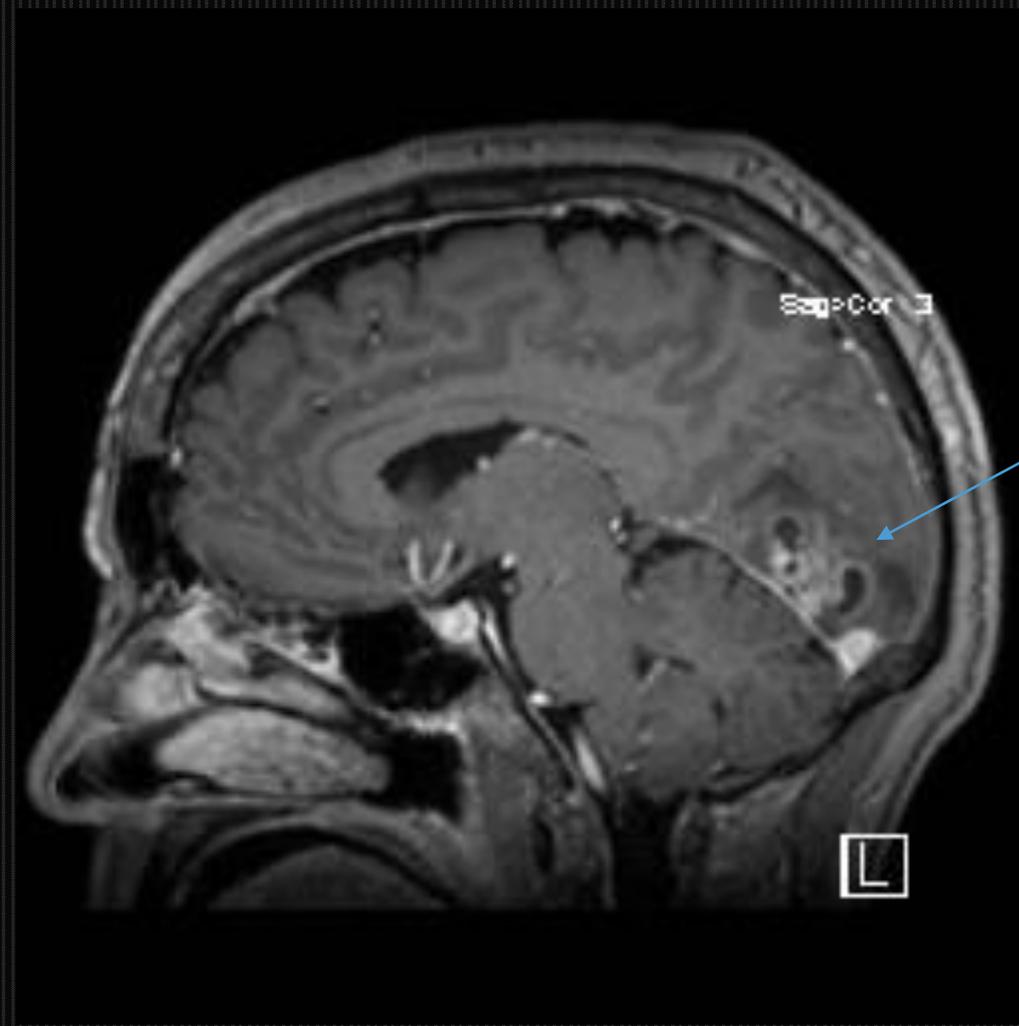
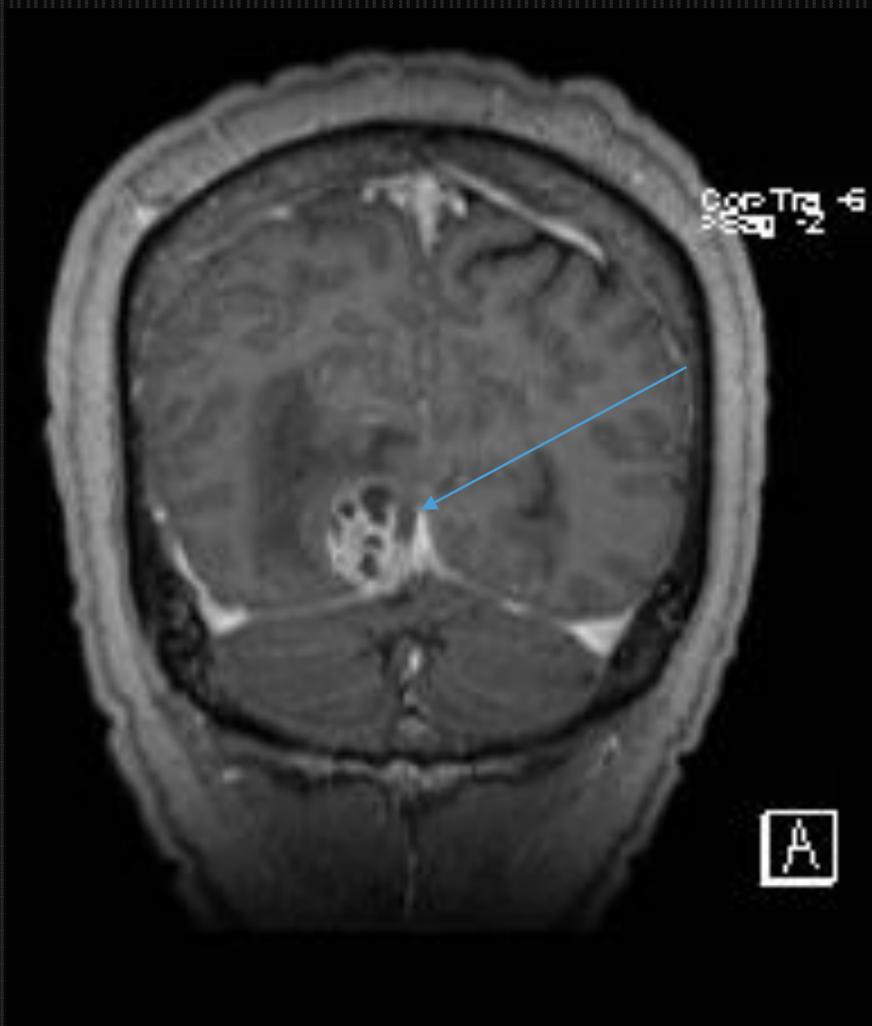
The restricted diffusion (brightness) seen with DWI points towards tumor vs. infection.¹

DWI

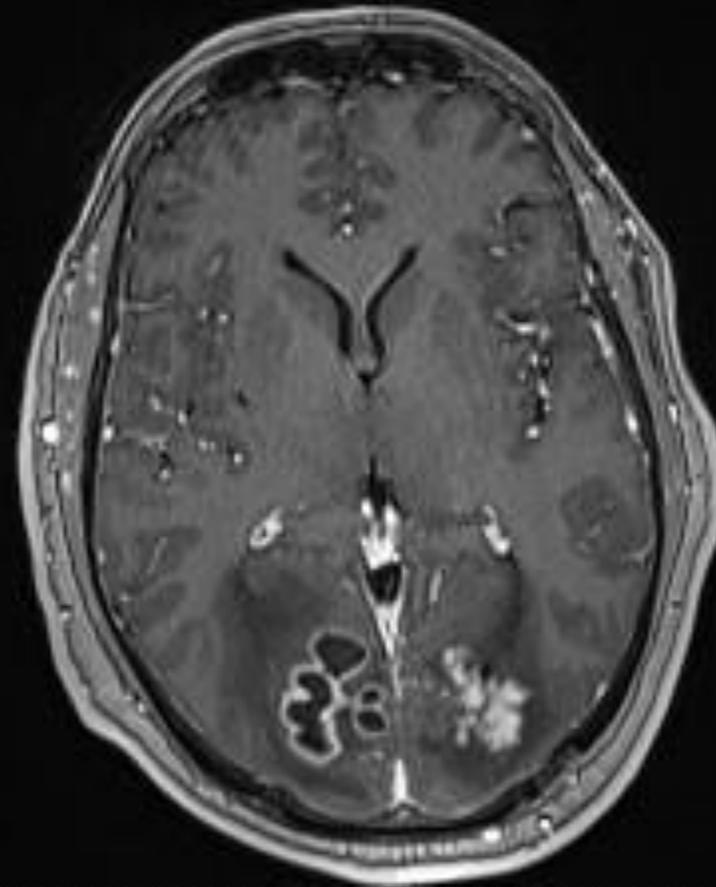
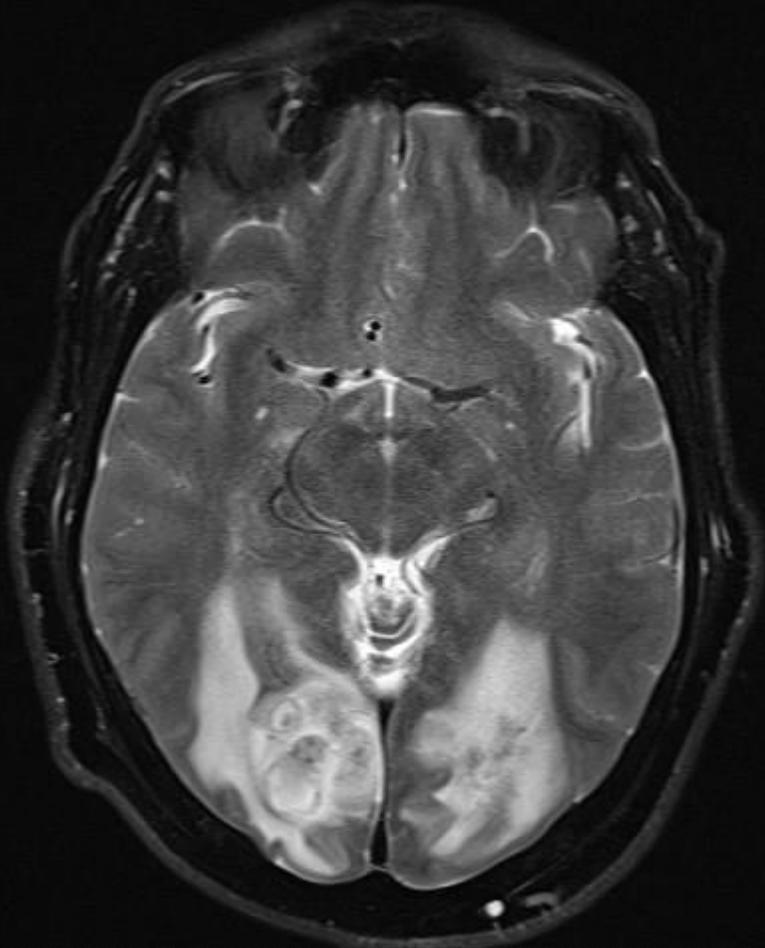
Imaging studies: MR

- **Diffusion weighted imaging (DWI)** is designed to detect the random movements of water protons. Water molecules diffuse relatively freely in the extracellular space; their movement is significantly restricted in the intracellular space.
- **Fluid Attenuated Inversion Recovery (Flair)**. The Flair sequence is similar to a T2-weighted image except that the TE and TR times are very long, producing an image in which abnormalities remain hyperintense (bright) but normal CSF fluid is attenuated and made dark. This sequence is very sensitive to pathology and makes the differentiation between CSF and an abnormality much easier.
- **Post-contrast T2 FLAIR sequence** is used with an inversion pulse that nulls the signal intensity of CSF, increasing its sensitivity to detect lesions and edema. Post-contrast FLAIR imaging constitutes an essential part of the basic study protocol for brain conditions when potential infection is being evaluated, mainly because of the ability of this sequence to recognize the edema associated with most bacterial and viral infections of the brain parenchyma.

Imaging studies: MR Brain Coronal and Sagittal

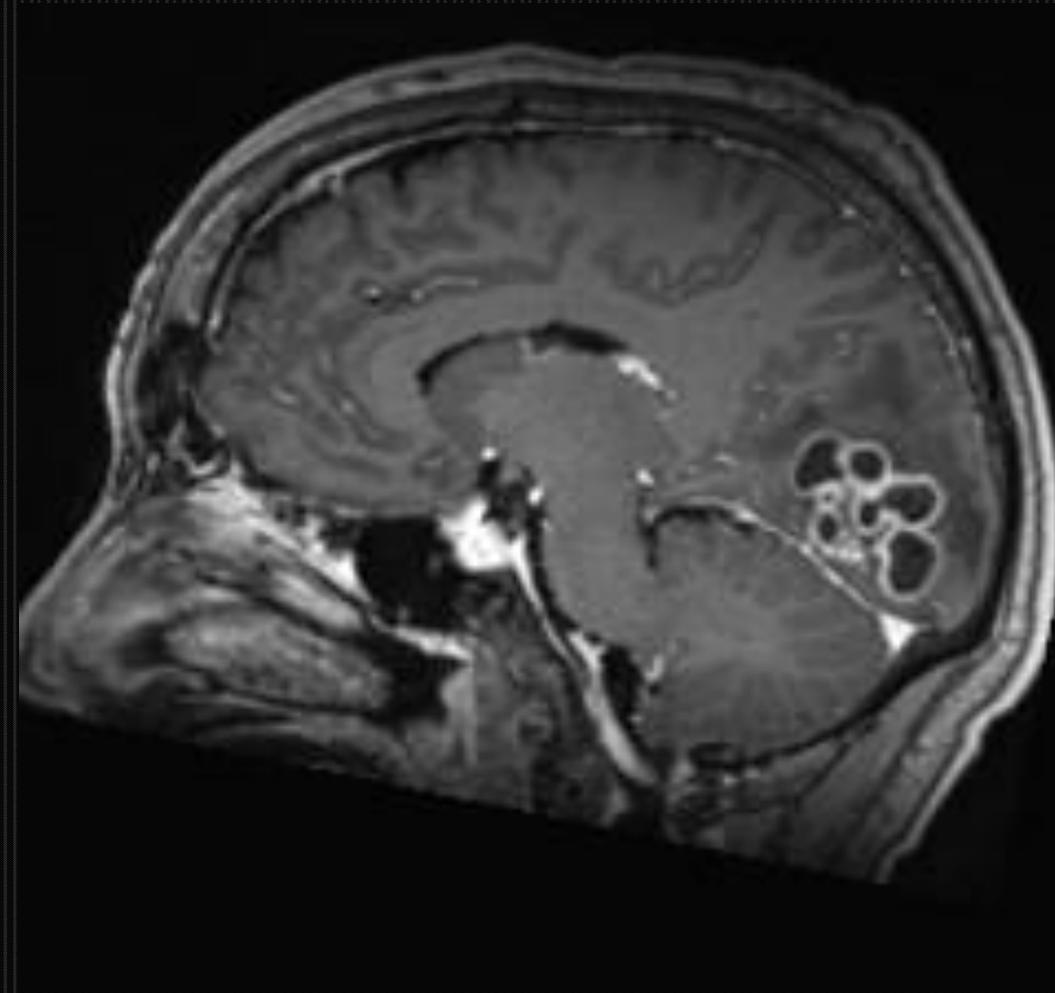
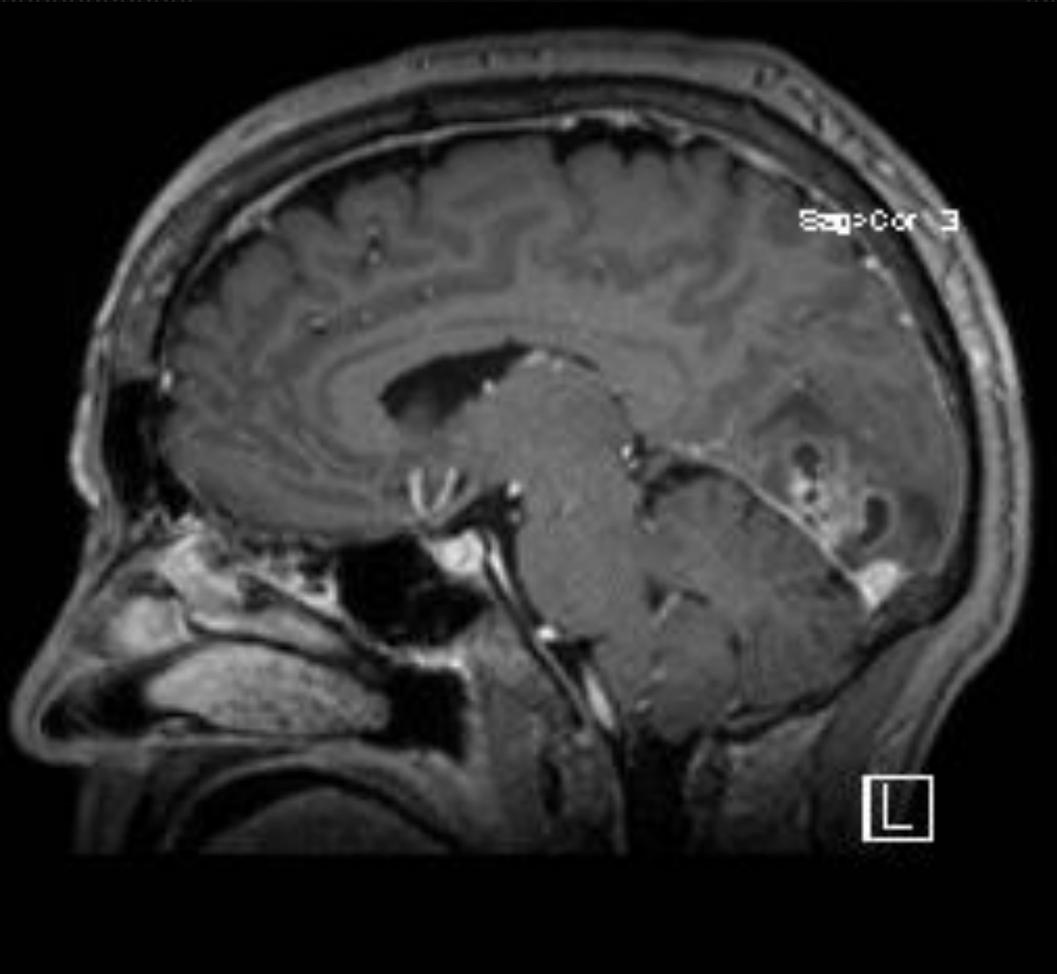


Follow-up MRI after one week of linezolid+imipenem shows interval worsening and spread of lesions and edema.



Fun Fact: White matter is dark on FLAIR vs light on T₁

Follow-up MRI after one week of linezolid+imipenem shows interval worsening and spread of lesions and edema.



Putting it Together: Outcome and Treatment

- Biopsy of right occipital lesions showed pigmented hyphae on H&E, so Amphotericin B, micafungin and voriconazole started on 11/7 to treat a cerebral fungal infection, cerebral phaeohyphomycosis
- Fungal cultures grew **Cladophialophora bantiana** (a type of dematiaceous fungi)
- Neurosurgery is not willing to resect the lesions at this point, but will reassess clinical improvement in several weeks to see if debulking is a possible option
- This infection carries a **70% mortality rate** despite advances in surgical resection capabilities and the use of both systemic and intrathecal antifungal treatments²

Was the Correct Imaging Done?³

American College of Radiology ACR Appropriateness Criteria[®]

Clinical Condition: Headache

Focal neurological defect (L visual field defect)

Patient on immunosuppressive medications and also diabetic

Variant 13: New headache. Focal neurologic deficit or papilledema.

Radiologic Procedure	Rating	RRL*
MRI head without and with IV contrast	8	O
MRI head without IV contrast	7	O
CT head without IV contrast	7	☹☹☹
MRA head without and with IV contrast	6	O
CT head without and with IV contrast	6	☹☹☹
MRA head without IV contrast	5	O
CT head with IV contrast	5	☹☹☹
CTA head with IV contrast	5	☹☹☹

Variant 10: New headache in cancer patient or immunocompromised individual.

Radiologic Procedure	Rating	Comments	RRL*
MRI head without and with IV contrast	9		O
MRI head without IV contrast	7		O
CT head without and with IV contrast	6		☹☹☹
CT head with IV contrast	6		☹☹☹
MRA head without IV contrast	5		O
MRA head without and with IV contrast	5		O
CT head without IV contrast	5	Perform this procedure if MRI is not available.	☹☹☹
CTA head with IV contrast	5		☹☹☹
FDG-PET/CT head	4	This procedure is useful if an indeterminate mass is present.	☹☹☹☹
Thallium-201 SPECT head	3		☹☹☹☹
Arteriography cervicocerebral	2	Perform this procedure if noninvasive imaging is unrewarding.	☹☹☹
Tc-99m HMPAO SPECT head	2	This procedure is useful if an indeterminate mass is present.	☹☹☹☹

Was the Correct Imaging Done?³

Concern for infectious etiologies, including Nocardia and TB

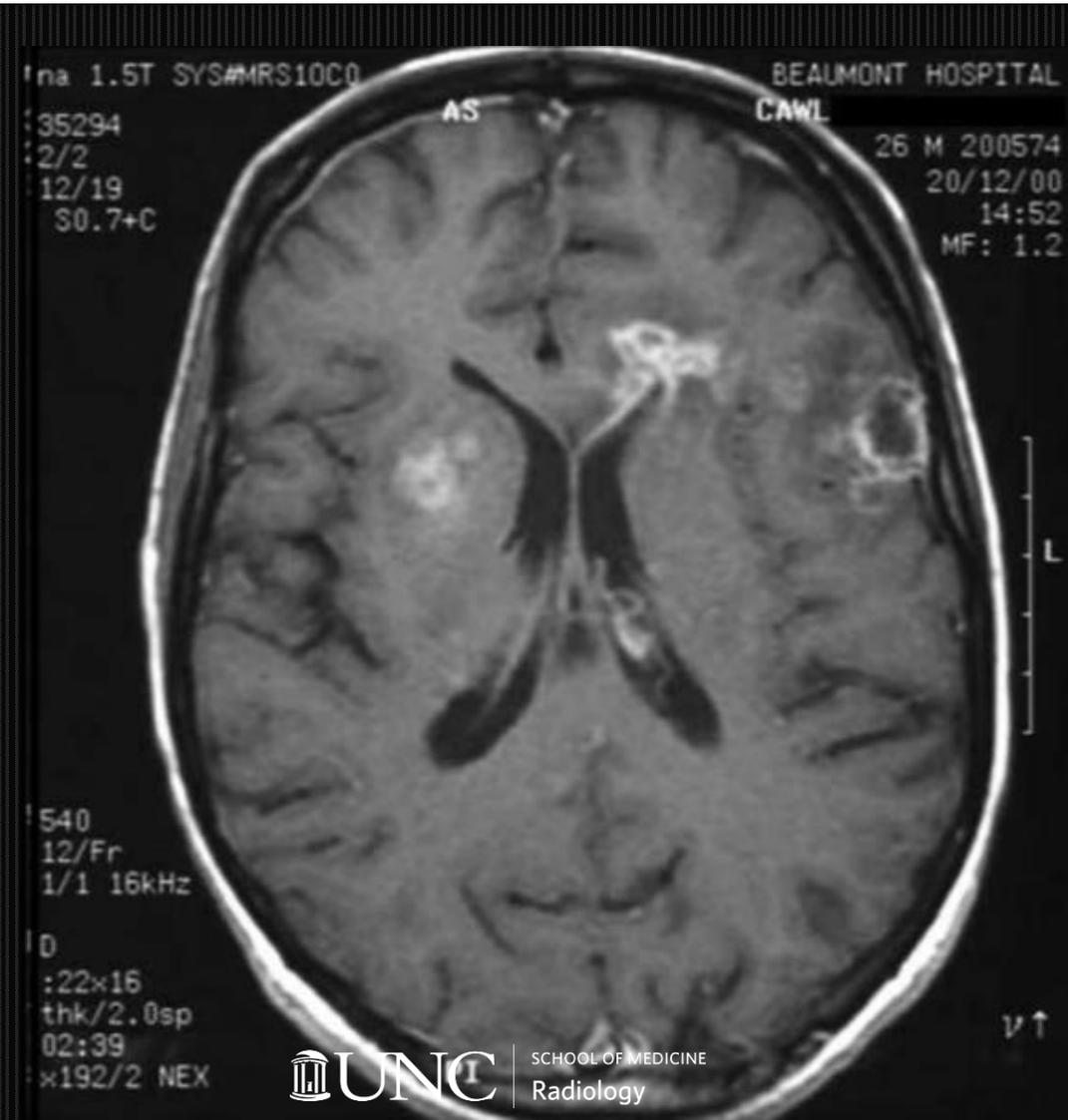
American College of Radiology ACR Appropriateness Criteria[®] Imaging of Possible Tuberculosis

Variant 1: Suspect active tuberculosis.

Radiologic Procedure	Rating	Comments	RRL*
X-ray chest	9		☼
CT chest without IV contrast	7	This procedure is recommended if x-ray is equivocal.	☼ ☼ ☼
CT chest with IV contrast	6		☼ ☼ ☼
CT chest without and with IV contrast	3		☼ ☼ ☼
MRI chest without IV contrast	3		0
MRI chest without and with IV contrast	3		0
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

Classic Imaging Findings of Cerebral Phaeohyphomycosis

- Neuroimaging typically shows a single, enhancing hypodense lesion in the frontal or parietal lobe. However, some patients, especially those who are immunocompromised, may present with multiple lesions⁴.
- This MRI⁵ is from a case report of an immunocompromised individual who presented with multiple ring-enhancing lesions in the posterior frontal region, corpus callosum and right basal ganglia.



Sensitivity and Specificity of Brain MRI for detecting CNS infection

- MRI protocol should include conventional, FLAIR, T2- and T1-weighted imaging, and contrast-enhanced images
- The use of new modalities, mainly diffusion- and perfusion-weighted imaging, is essential, and **allows for detection of CNS infection with near 100% sensitivity and specificity¹**
- We must not forget that **imaging does not=diagnosis**. It aids in:
 - establishing the presence of an infection
 - ruling out differential diagnoses
 - analyzing the mechanism of infection
 - providing guidance about the etiologic agent
 - follow-up and treatment monitoring

Cost and Radiation Doses

Imaging Exam	Cost ⁶	Radiation Dose ⁷
Brain MRI (w and wo contrast)	\$1315-\$4608+	0 mSv
CT Head (wo contrast)	\$304-\$1873+	2 mSv
CT Chest (wo contrast)	\$319-\$1964+	7 mSv
Chest X-ray	\$29-\$472+	0.1 mSv

References

- 1) Sgarbi, N. (2015). Central nervous system infections: New diagnostic tools. *Rev. Argent. Radiol.*, 79(1), 12-31. Retrieved November 11, 2018.
- 2) Ahmad, M., Jacobs, D., Wu, H., Wolk, D., Kazmi, S., Jaramillo, C., & Toms, S. (2017). Cladophialophora Bantiana: A Rare Intracerebral Fungal Abscess—Case Series and Review of Literature. *Surg J*, 03(02), 62-68. doi:10.1055/s-0037-1598248
- 3) Acsearch.acr.org. (2018). Appropriateness Criteria. [online] Available at: <https://acsearch.acr.org/list> [Accessed 9 Nov 2018].
- 4) Cox, G. M. (2018). UpToDate: Central nervous system infections due to dematiaceous fungi (cerebral phaeohyphomycosis). Retrieved November 11, 2018, from <https://www.uptodate.com/contents/central-nervous-system-infections-due-to-dematiaceous-fungi-cerebral-phaeohyphomycosis>

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- 5) Roche, M., Redmond, R. M., O'Neill, S., & Smyth, E. (2005). A case of multiple cerebral abscesses due to infection with *Cladophialophora bantiana*. *Journal of Infection*, 51(5), 285-288. doi:10.1016/j.jinf.2005.02.029
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- 7) Radiation Dose in X-Ray and CT Exams. (2018, April 20). Retrieved November 11, 2018, from <https://www.radiologyinfo.org/en/pdf/safety-xray.pdf>