

# Neuroimaging for the Speech-Language Pathologist – Part II

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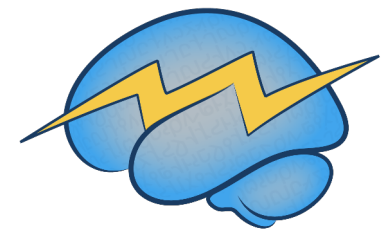
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MedStar National  
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# Disclosures

- Employed by Georgetown University
- Affiliated with MedStar National Rehabilitation Network
- Grants from NIDCD, NINDS, NCATS, Doris Duke Charitable Foundation

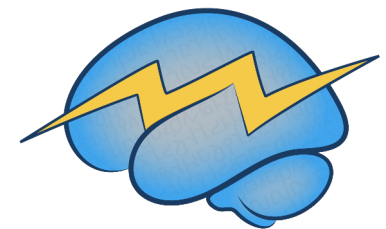


# Goals and Plan for this Talk

- Review the differences between neuroimaging modalities and the clinical indications for each type
- Learn some basics of how to look at brain images and what to look for



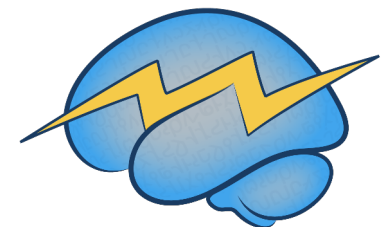
# Review of Part I





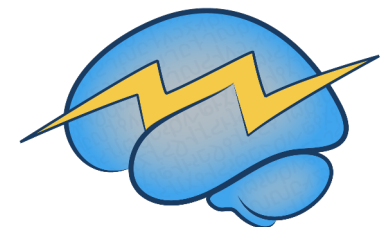
# CT vs. MRI

- CT Clinical indications: a very quick (1 minute) scan to find acute hemorrhages or major issues in the brain (e.g., hydrocephalus, herniation)
  - Not very sensitive to hyperacute ischemic strokes or any small stroke
- MRI Clinical Indications: Any time you want a detailed picture and don't need it super fast
  - Ischemic stroke
  - Brain atrophy (neurodegeneration)
  - Older damage to white matter (“chronic small vessel ischemic disease”)
  - To assess the brain stem or cerebellum (difficult to see on CT)
  - Old bleeds
  - TBI
  - MS or other inflammatory diseases
  - Infection (meningitis, encephalitis)
  - Tumors



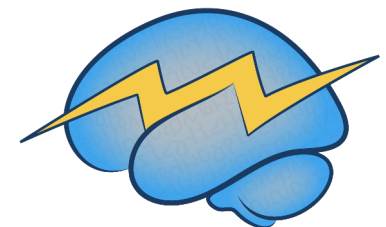
# Main Types of MRI Scans

- **T1-Weighted:** standard anatomical scan used to assess structure and atrophy
- **T2-Weighted:** good for assessing white matter damage; better for assessing the brainstem than FLAIR
- **Fluid-Attenuated Inversion Recovery (FLAIR):** also good for assessing white matter damage, particularly the areas around the ventricles
- **Diffusion-Weighted (DWI):** primarily used to detect acute ischemic stroke
- **Gradient Echo (GRE) or Susceptibility-Weighted (SWI):** used to detect bleeding that has occurred at any time in a person's life

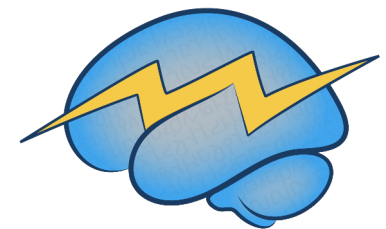


# CTA vs. MRA

- CTAs and MRAs are both used to assess blood vessels
  - Computed Tomography Angiography (CTA):
    - Requires IV contrast
    - Used during acute ischemic stroke to determine interventions such as tPA or thrombectomy
  - Magnetic Resonance Angiography (MRA):
    - Can be used without contrast
      - This is helpful if the person has a contrast allergy or renal issues
    - The picture can sometimes be less clear than a CTA if the person doesn't stay still since this scan lasts longer
    - If acute treatment planning is not necessary, an MRA might be ordered instead, especially if a structural MRI is already being ordered

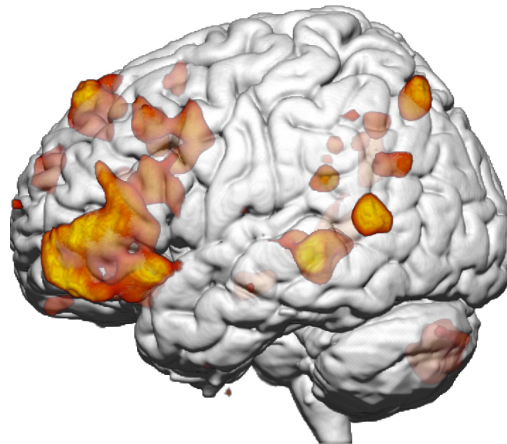
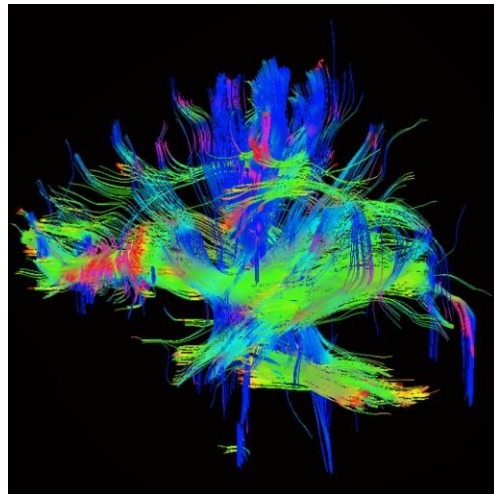


# Answering Your Questions



# Neuroplastic Changes

- Can you see neuroplastic changes/recovery in brain imaging?
  - Unfortunately, not yet on clinical scans
  - This is something we are looking at in our current study with:
    - Diffusion Tensor Imaging (DTI) scans– can trace white matter connections
    - Functional MRI– examines brain activity while doing a task and “functional connectivity”
  - Stay tuned for our upcoming lecture: Research Neuroimaging for the SLP!



# CT or MRI?

- For a patient admitted with an ischemic stroke, if they develop new symptoms why is a CT ordered over an MRI?
- A CT is ordered first to check for hemorrhagic transformation or herniation
  - Much faster to get (<30 min from time of order)
  - As good as MRI for hemorrhage or herniation



# Neuroimaging for COVID

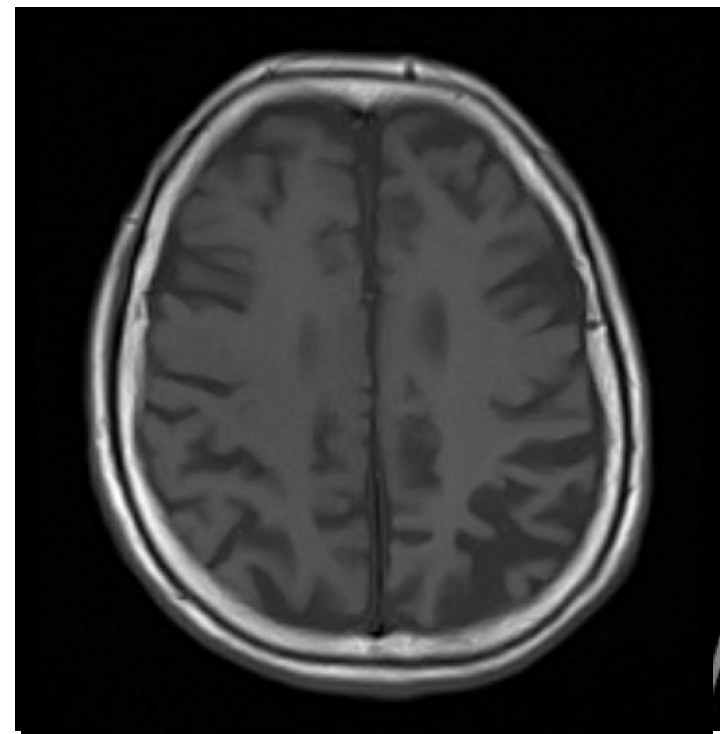
- What is relevant neuroimaging phenomena to be aware of in non-stroke populations (dementias or long COVID in particular)?
- Neuroimaging in COVID patients: more studies are still needed, but a couple of studies have found:
  - White matter abnormality
  - Acute/subacute ischemic infarction
  - Leptomeningeal enhancement
  - Encephalitis

(Kremer et al, 2020; Kim et al, 2021)



# Neuroimaging for Dementia

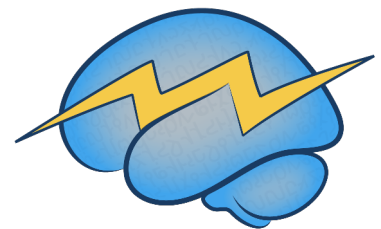
- What is relevant neuroimaging phenomena to be aware of in non-stroke populations (dementias or long COVID in particular)?
- Neurodegenerative Dementias:
  - Atrophy (look at T1 and T2 scans)
    - Big ventricles, big sulci
    - Pattern can be helpful (but isn't diagnostic)
      - PPA = L > R atrophy, sometimes more specific
      - Alzheimer = hippocampi, parietal lobes
  - Hypometabolism (on PET)
    - Ordered for Alzheimers vs. FTD





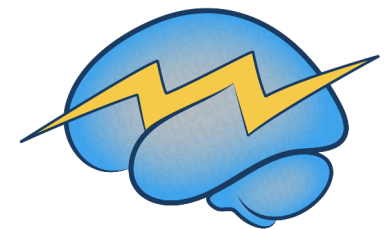
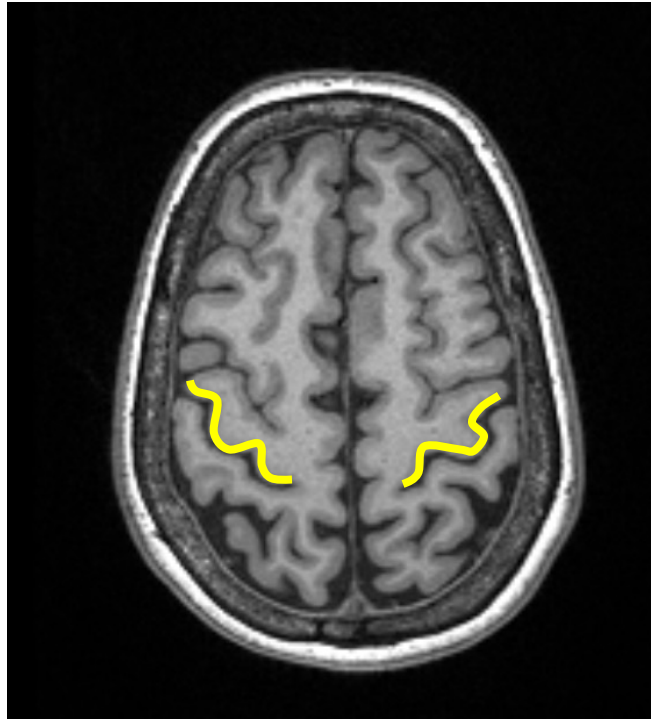
# Lesion Location and Expected Impairments

- How can we use lesion location to determine expected speech, language, and swallowing deficits?
  - Stay tuned for our next round of lectures on Brain-Behavior Relationships!



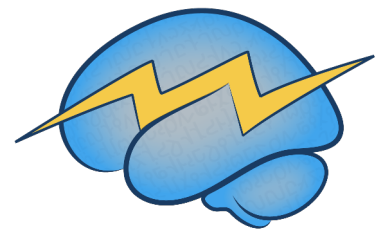
# Brain Regions

- How can SLP's recognize specific location of infarction or damaged tissue? (i.e. how to locate Broca's area, the motor cortex etc.)
  - Let's look at some scans!



## Let's look at scans!

- Locating key structures on an MRI
- Computed Tomography Angiography (CTA)
- Magnetic Resonance Angiography (MRA)



# Upcoming Lecture Topics

- Brain-Behavior Relationships
  - This will include multiple lectures covering gross anatomy, subcortical structures, the brainstem, the cerebral vascular system, and the cerebellum
  - We will focus on the functions of each region and the types of impairments you may see with damage
- Research Neuroimaging
  - Including Diffusion Tensor Imaging (DTI) and Functional MRI (fMRI)
- Neuroplasticity
  - What is it and how do you capitalize on it in therapy?
- And more...Please remember to answer our brief survey to help us plan future lectures!



# Thank You!

## Georgetown University, Cognitive Recovery Lab

### Faculty/Staff

Peter Turkeltuab, MD, PhD  
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### Drexel University Collaborators

John Medaglia, PhD  
Apoorva Kelkar



## Funding Sources

The Vernon Family Trust



NCATS  
NIDCD  
NINDS



Georgetown-Howard Universities  
Center for Clinical and Translational Science | GHUCCTS





# References

- Kim, Pyeong Hwa, Minjae Kim, Chong Hyun Suh, Sae Rom Chung, Ji Eun Park, Soo Chin Kim, Young Jun Choi, et al. “Neuroimaging Findings in Patients with COVID-19: A Systematic Review and Meta-Analysis.” *Korean Journal of Radiology* 22, no. 11 (2021): 1875. <https://doi.org/10.3348/kjr.2021.0127>.
- Kremer, Stéphane, François Lersy, Mathieu Anheim, Hamid Merdji, Maleka Schenck, Hélène Oesterlé, Federico Bolognini, et al. “Neurologic and Neuroimaging Findings in Patients with COVID-19: A Retrospective Multicenter Study.” *Neurology* 95, no. 13 (September 29, 2020): e1868–82. <https://doi.org/10.1212/WNL.0000000000010112>.

