

AMSER Case of the Month

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60 y/o man with recent onset of left-sided numbness and tingling

Jeremy Bancroft Brown, MD/PhD Student¹

Matthew Barkovich, MD, Neuroradiology¹

Anthony Mefford, MD, Neurology²

Leo Sugrue, MD, PhD, Neuroradiology Clerkship Director¹

Emily Webb, MD, Abdominal Imaging, Co-Director of Goldberg Center for Advanced Imaging Education¹



University of California
San Francisco

¹Department of Radiology and Biomedical Imaging, University of California, San Francisco

²Department of Neurology, University of California, San Francisco



Patient Presentation

- HPI: 60 y/o man with HIV and HLD who awoke from sleep 2 weeks before presentation with numbness and tingling in L torso, which then progressed within 1 week to include his chest, abdomen, back, left arm, and left leg. He did not have any right-sided symptoms.
- ROS: No pain, burning, weakness, diplopia, dizziness, speech difficulty, incoordination, or headache. No fevers, chills, chest pain, SOB, nausea/vomiting, abdominal pain, bowel or bladder issues.
- PMH: HIV (well-controlled), HLD (poorly controlled), OSA.
- PSH: none.
- SH/HRB: no tobacco, occasional EtOH, no drugs.

Objective Data

- Vitals: non-contributory.
- Neuro exam: notable for diminished L hemibody sensation to light touch and vibration, with intact temperature sensation. The precise distribution of the deficit includes the L arm and L leg but spares the neck and head above the collar line. No R-sided sensory deficits. Otherwise AOx3, CN II-XII intact, motor strength globally 5/5, finger to nose intact, normal gait, normal reflexes.
- Labs: cholesterol 268, triglycerides 435, LDL incalculable.

What Imaging Should We Order?

Select the applicable ACR Appropriateness Criteria

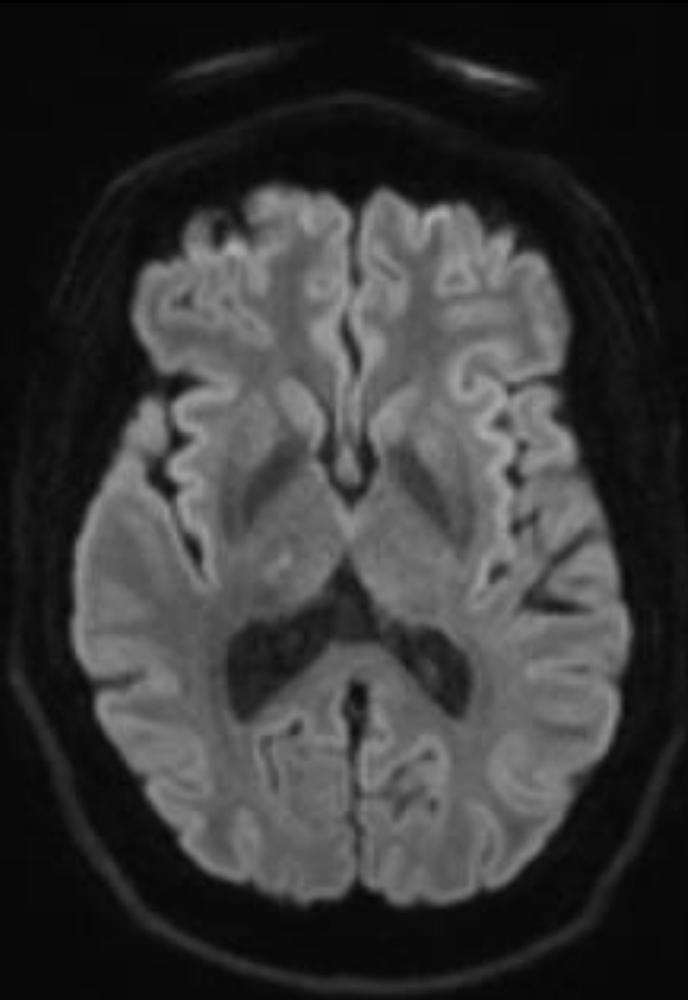
Variant 4: New focal neurologic defect, fixed or worsening. Longer than 6 hours. Suspected stroke.

Radiologic Procedure	Rating	Comments	RRL*
MRI head without IV contrast	8	Parenchymal brain imaging and CT or MR vascular imaging of the head and neck should be considered. Noncontrast head CT is often obtained first to assess for hemorrhage or large infarct. Can be useful if there is a contraindication to contrast. MRI is more sensitive than CT for acute infarct.	○
MRI head without and with IV contrast	8	Parenchymal brain imaging and CT or MR vascular imaging of the head and neck should be considered. Noncontrast head CT is often obtained first to assess for hemorrhage or large infarct. MRI is more sensitive than CT for acute infarct.	○
MRA head and neck without IV contrast	8	Can be obtained in conjunction with MRI head. Preferred MR vascular imaging of the head and neck includes noncontrast head MRA and contrast-enhanced neck MRA. May be useful in patients with renal failure or contrast allergies.	○
MRA head and neck without and with IV contrast	8	Can be obtained in conjunction with MRI head. Preferred MR vascular imaging of the head and neck includes noncontrast head MRA and contrast-enhanced neck MRA.	○
CT head without IV contrast	8	Noncontrast head CT is often obtained first to assess for hemorrhage or large infarct. MRI is more sensitive than CT for acute infarct.	⊗⊗⊗
CTA head and neck with IV contrast	8	CTA can be obtained after NCCT.	⊗⊗⊗

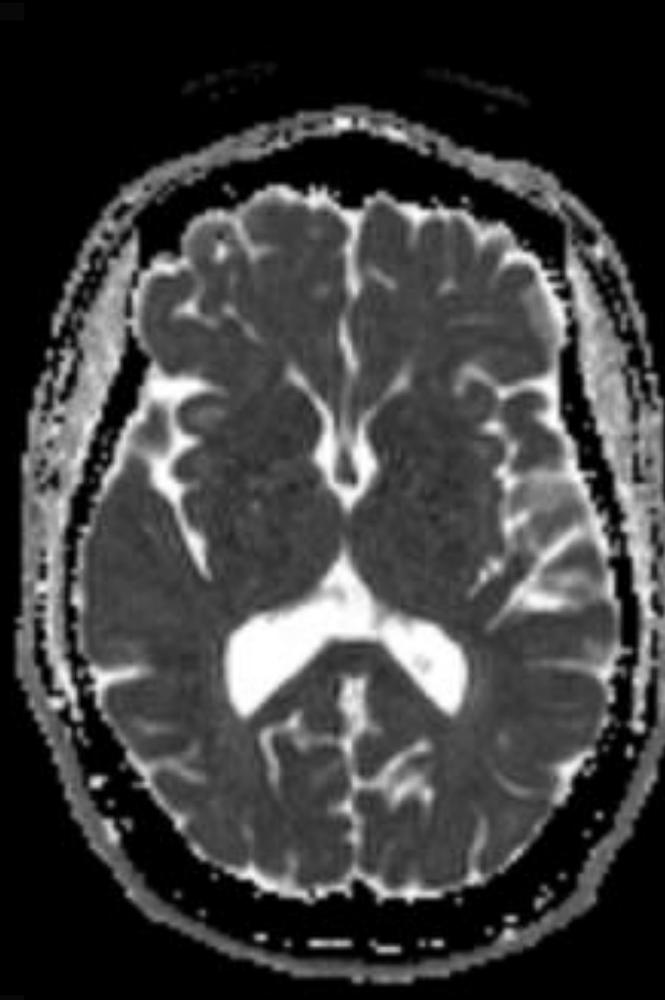


This imaging modality was ordered by the Neurologist

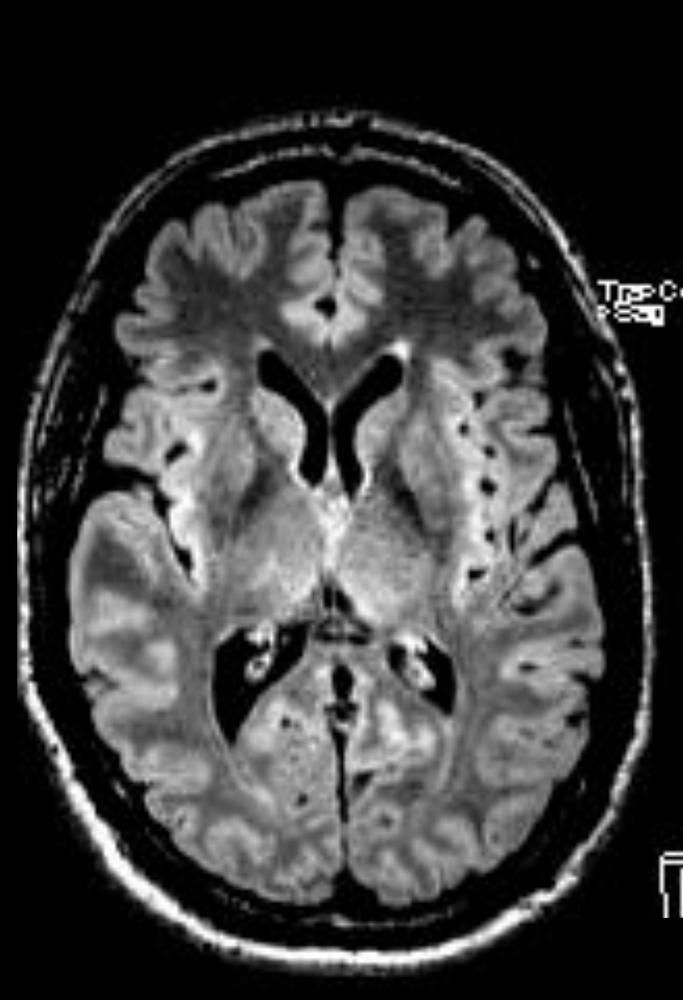
MRI Head (unlabeled)



DWI (diffusion-weighted imaging)



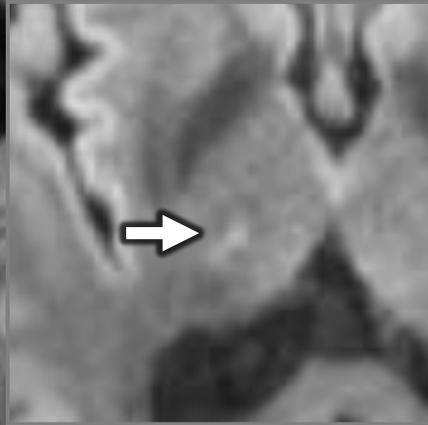
ADC (apparent diffusion coefficient)



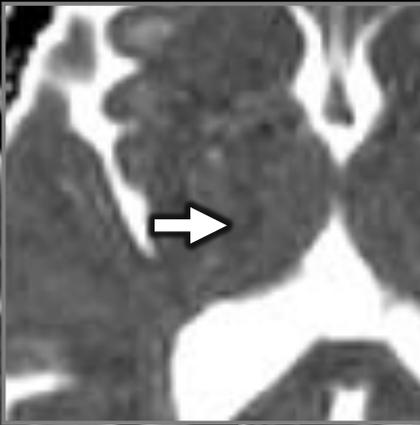
FLAIR (fluid-attenuated inversion recovery)

MRI Head (labeled)

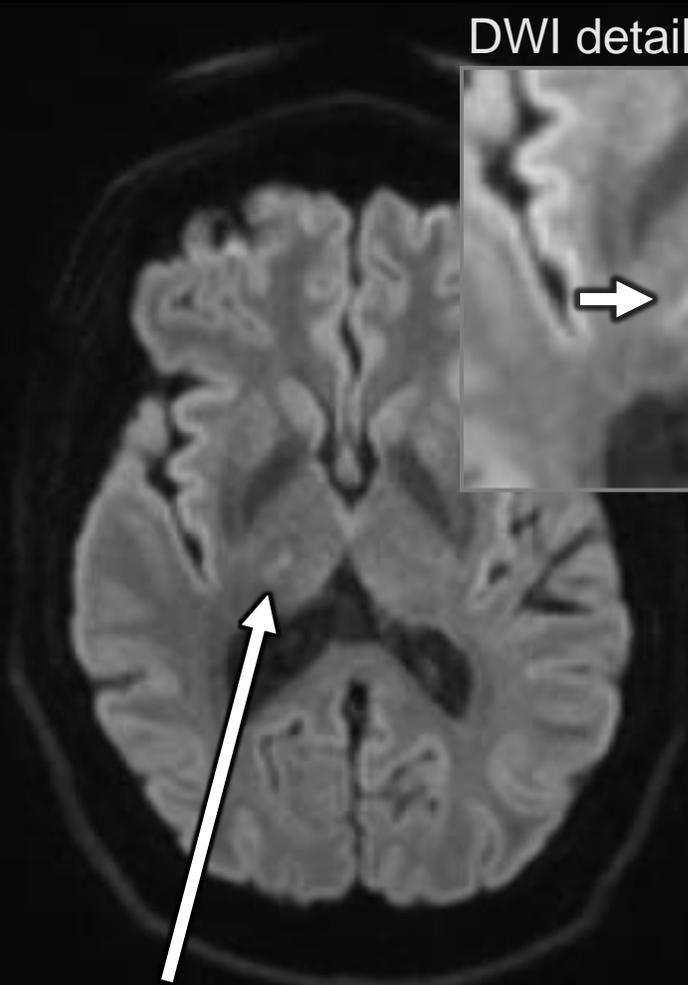
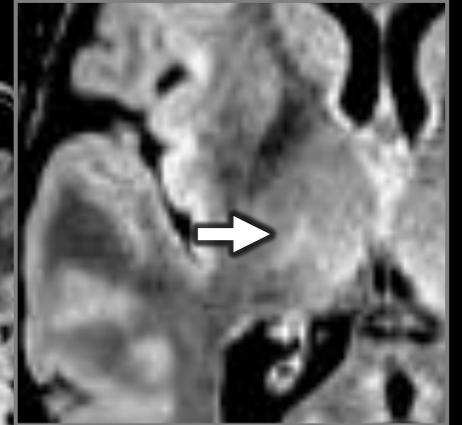
DWI detail



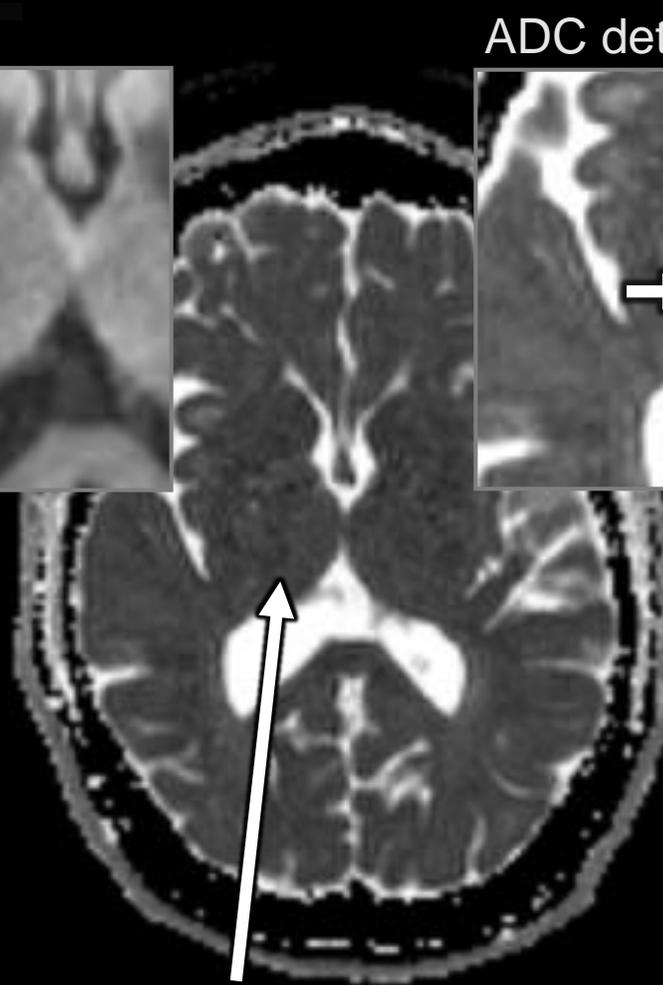
ADC detail



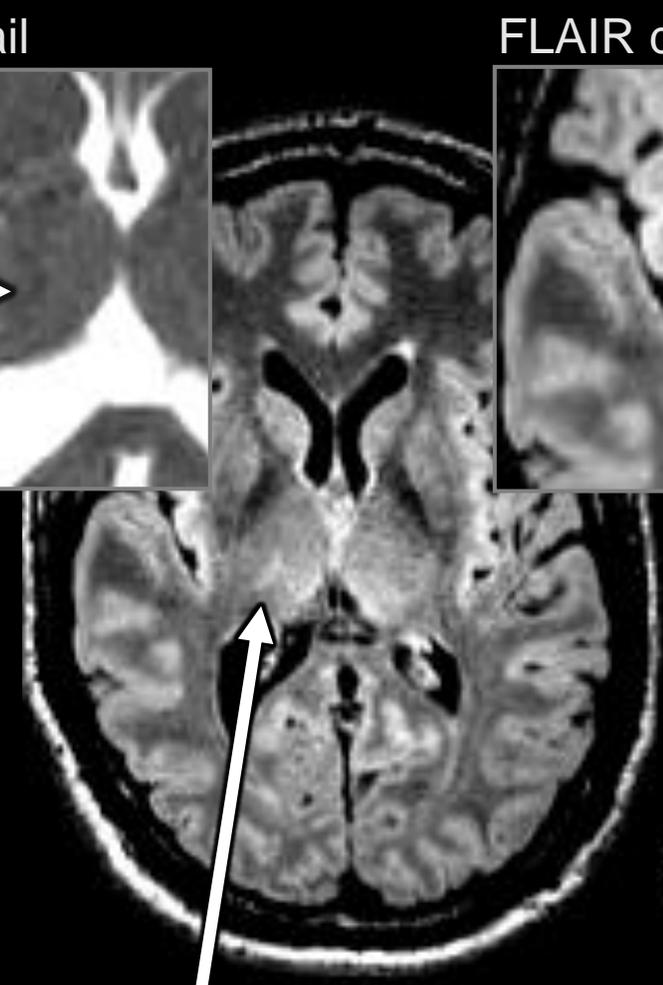
FLAIR detail



DWI: mildly reduced diffusion in R thalamus



ADC: mildly reduced diffusion in R thalamus



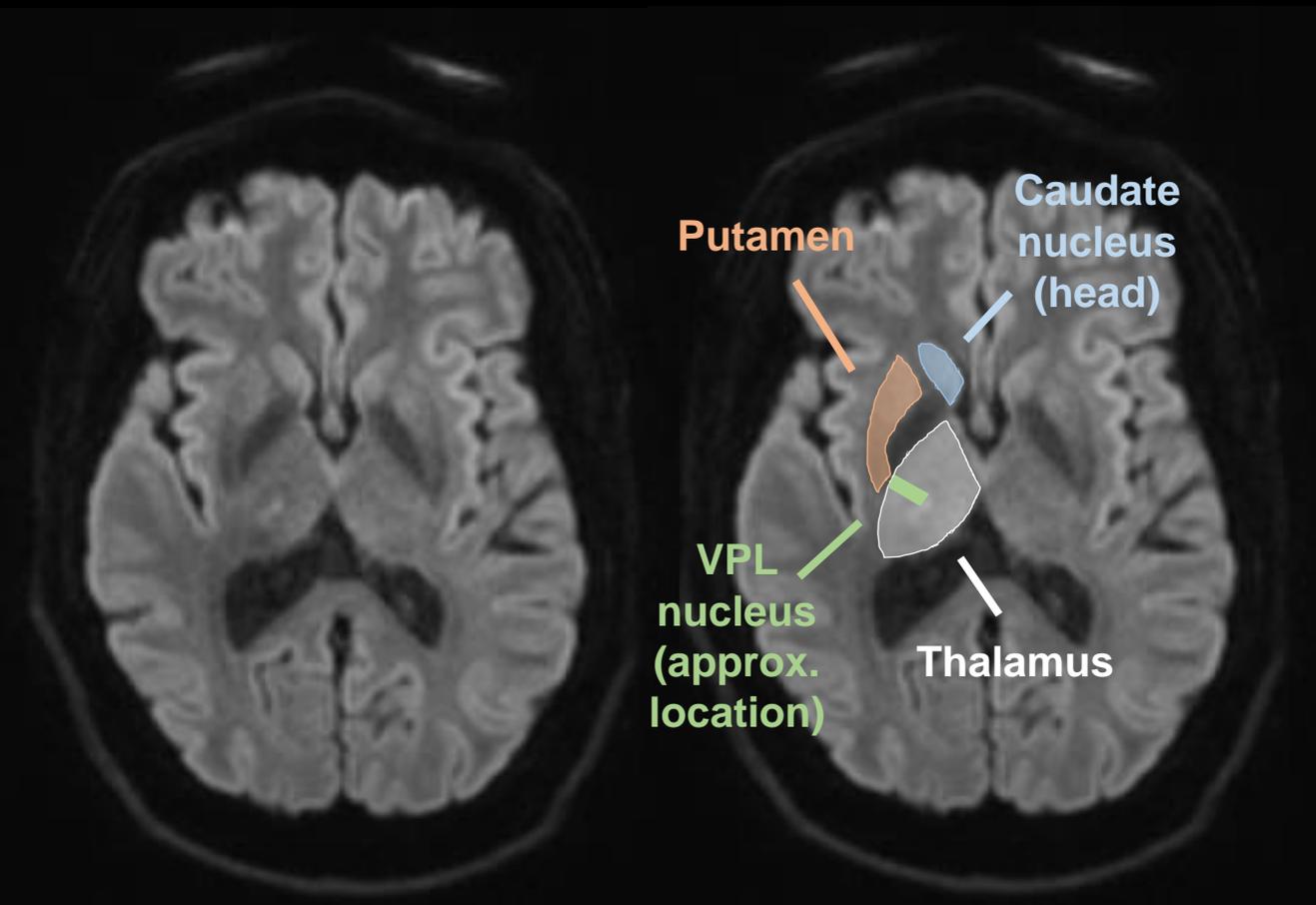
FLAIR: hyperintensity in R thalamus



Final Dx:

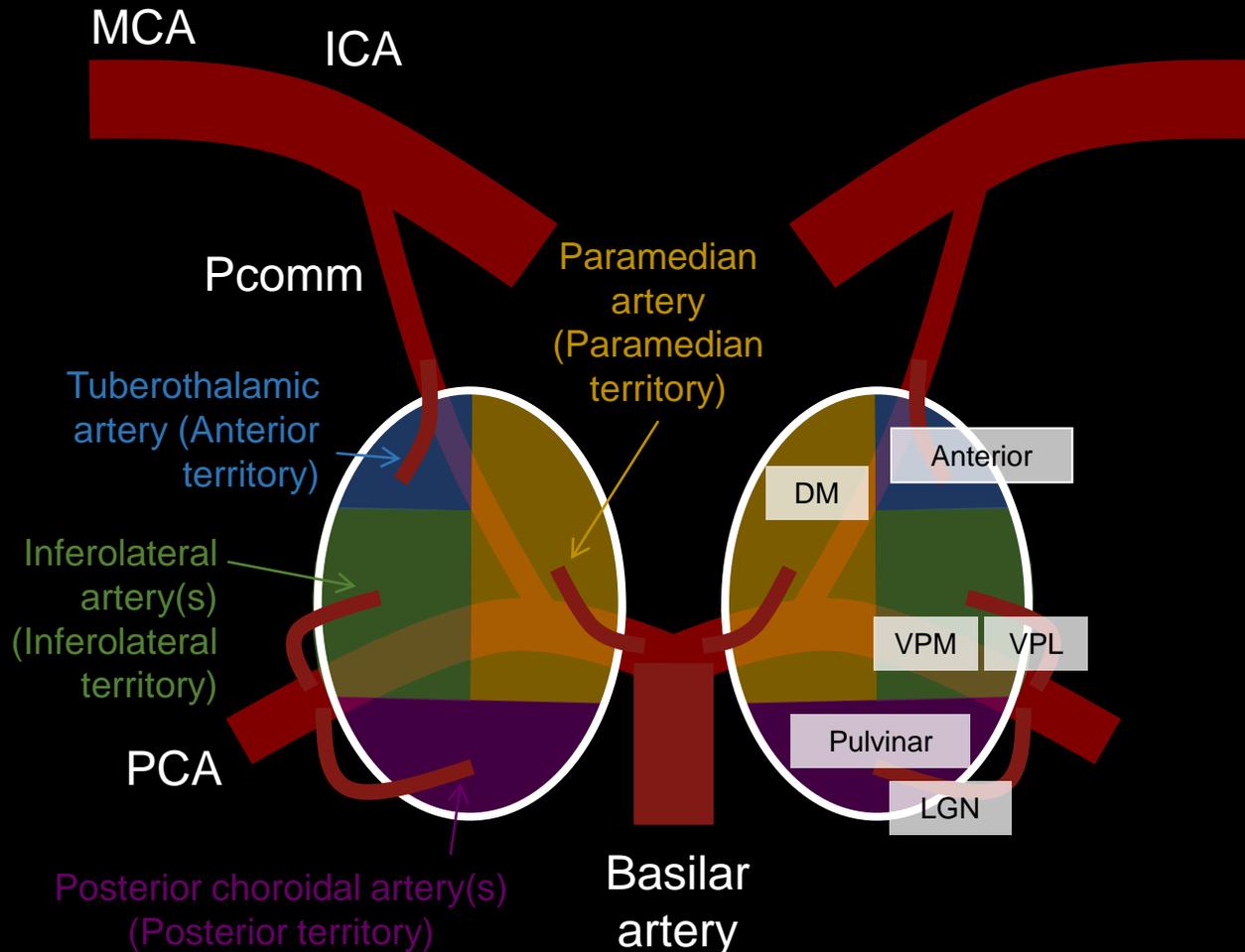
Subacute Pure Sensory Stroke of Right Lateral Thalamus

Recognizing Basal Ganglia Structures and Thalamic Sensory Nuclei on MRI



- The ventroposterolateral (VPL) nucleus of the thalamus contains the third order neuron cell bodies that relay somatosensory information from the spinothalamic and medial lemniscus pathways to the primary sensory cortex
- On axial images near the level of the anterior and posterior commissures, the VPL nucleus starts laterally in the posterior thalamus near the internal capsule and runs medially in the direction of the posterior commissure (Yamada et al., *AJNR* 2010)
- The ventroposteromedial (VPM) nucleus (not pictured) performs the same function in facial sensation (receiving input from the trigeminal nerve)

Vascular Territories and Selected Nuclei of the Thalamus



- Different vascular territories in the thalamus are associated with different nuclei, leading to extremely varied presentations of thalamic stroke
- The arterial supply of the thalamus arises from the Pcomm and the P1 and P2 segments of the PCA, and is divided into four major territories (Schmahmann, *Stroke* 2003):

Anterior and **paramedian** territories: important for arousal, personality, memory, language* (DM and Anterior nuclei)

Inferolateral territory: important for sensation (body- VPL nucleus, face- VPM nucleus)

Posterior territory: important for vision (LGN/Pulvinar)

*Language functions reside in the thalamus ipsilateral to the dominant hemisphere

Artery abbreviations

MCA – Middle cerebral artery
 ICA – Internal carotid artery
 Pcomm – Posterior communicating artery
 PCA – Posterior cerebral artery

Thalamic nuclei abbreviations

DM – Dorsomedial nucleus
 VPM – Ventroposteromedial nucleus
 VPL – Ventroposterolateral nucleus
 LGN – Lateral geniculate nucleus

Thalamic vascular territories

Yellow – Paramedian territory
 Blue – Anterior territory
 Green – Inferolateral territory
 Purple – Posterior territory

Dating Infarcts Using MRI

- In an **acute** infarct, low ATP → impaired Na⁺/K⁺ ATPase → cellular swelling → **reduced diffusion** (hyperintense DWI, low ADC)
- These signal changes may persist for 1-3 weeks during the **subacute** phase of the infarct
- In the **chronic** phase, DWI signal is variable (e.g. low in cystic encephalomalacia, but can also be high from T2 shine-through)

Signal According to Infarct Age

	Hyperacute (<6h)	Acute (<1w)	Subacute (1-3w)	Chronic (>3w)
DWI	White	White	Dark Gray	(Variable)
ADC	Dark Gray	Dark Gray	Light Gray	White
FLAIR	Dark Gray	White	Dark Gray	Dark Gray

Allen et al. (*RadioGraphics*, 2012)

References:

- Yamada, K., Akazawa, K., Yuen, S., Goto, M., Matsushima, S., Takahata, A., Nakagawa, M., Mineura, K. and Nishimura, T., 2010. MR imaging of ventral thalamic nuclei. *American journal of neuroradiology*, 31(4), pp.732-735.
- Schmahmann, J.D., 2003. Vascular syndromes of the thalamus. *Stroke*, 34(9), pp.2264-2278.
- Allen, L.M., Hasso, A.N., Handwerker, J. and Farid, H., 2012. Sequence-specific MR imaging findings that are useful in dating ischemic stroke. *Radiographics*, 32(5), pp.1285-1297.