

NEURORADIOLOGY ESSENTIALS - CT

Clerkship Success Series of the Neurology Exam Prep Podcast

CT HEAD

- (+) quick, sensitive for blood and bone fractures
- (-) Poor soft tissue res, ionizing radiation

How to read: Dense = bright (hyperdense); Less dense = dark (hypodense)

Look through 4 windows:

- 1) Brain/soft tissue: look for 3 Hs (below) + ischemia
- 2) Bone: mets, fractures
- 3) Subdural: tiny subdurals
- 4) Stroke/narrow: evidence of infarct

What to look for:

- 1) **Hemorrhage:** hyperdense
 - Location:
 - o Epidural hematoma = lens-shaped, respects suture lines
 - o Subdural hematoma = crescent-shaped, crosses suture lines
 - o Subarachnoid hemorrhage = blood in ventricles + cisterns ("spider")^a
 - o Intraparenchymal hemorrhage = blood in brain tissue
 - o Intraventricular = blood in ventricles esp. occipital horns of lateral ventricles^b
 - Timing: Acute = hyperdense → Subacute (1wk-1mo) = heterogenous → Chronic (>1mo) = hypodense
- 2) **Hydrocephalus:** enlargement of ventricles
 - Obstructive = some ventricles dilate
 - 3rd and 4th ventricles dilate → posterior fossa mass → emergency!
 - Non-obstructive = all ventricles dilate
- 3) **Herniation:** effacement of cisterns & foramina
 - Tonsillar: effacement of foramen magnum
 - Subfalcine: midline shift
 - Uncal: effacement of suprasellar cistern ("pentagon")^c
 - Upward: effacement of quadrigeminal cistern ("smiley face")^d
- 4) **Large infarcts:** hypodensity and loss of gray-white differentiation
 - MCA stroke: dense artery sign^e, loss of insular ribbon sign^f, disappearing basal ganglia sign^g
 - Basilar artery thrombosis: hyperdense basilar artery sign^h, may not have other findings!

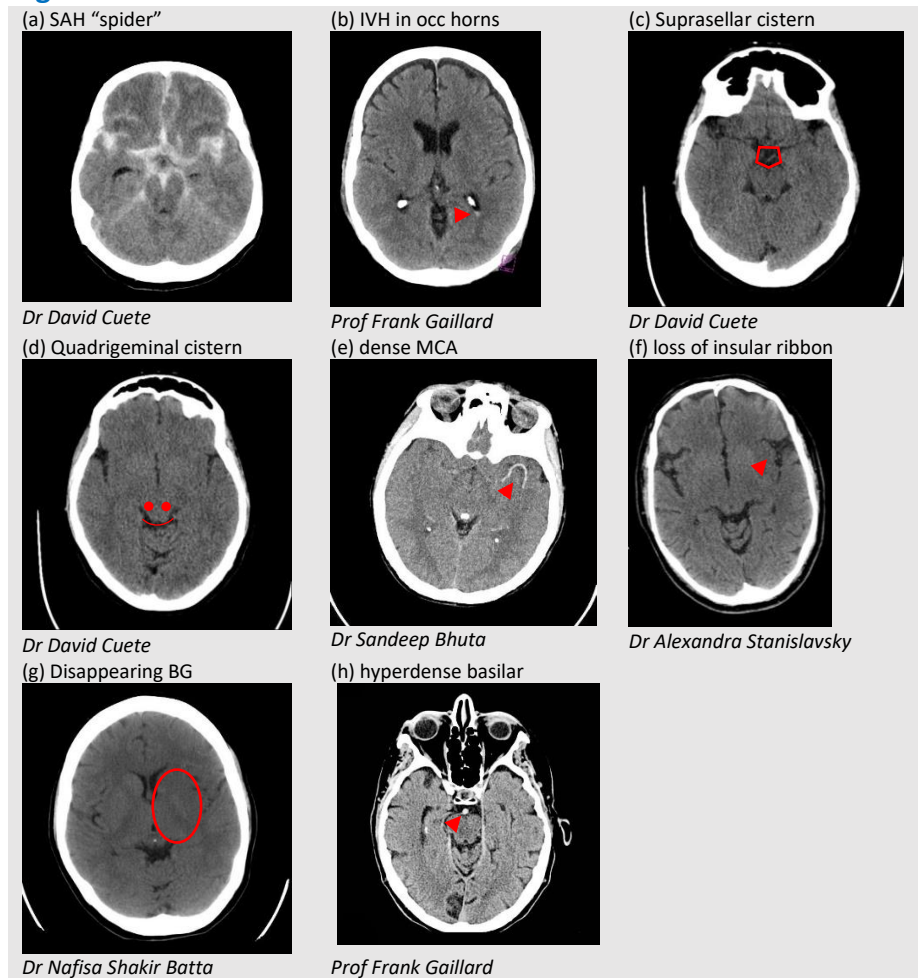
CTA

How to read: Same as CT but arteries are enhanced (bright)

What to look for:

- 1) **Ischemic stroke: Large vessel occlusions (LVOs) and some small vessel occlusions**
LVOs = MCA, ICA > Proximal ACA, PCA, vertebrals, basilar
- 2) **Carotid/vertebral artery dissection**
Classic appearance: eccentric lumen and crescent mural thrombus
- 3) **Stenosis for TIA evaluation**
- 4) **Aneurysm detection**

CT Images*:



*Images from Radiopaedia; case courtesy of contributing radiologist below image

NEURORADIOLOGY ESSENTIALS - MRI

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MRI BRAIN

(+) Great soft tissue res, no ionizing radiation (-) Cost/availability, takes longer

How to read T1 vs T2 vs FLAIR:

T1: Grey matter = dark (hypointense), White matter = bright (hyperintense), CSF = dark^a

T2: Grey matter = bright, White matter = dark, CSF = bright^b

FLAIR: Grey matter = bright, White matter = dark, CSF = dark^c

T1 pre- and post-contrast

What to look for: gross anatomical changes (pre), enhancement (post)

Contrast enhancement = breakdown of BBB

Top 3 causes of contrast enhancement: **1) inflammation, 2) infection, 3) malignancy**

T2 and FLAIR

What to look for: **1) active lesions, 2) scars from old lesions, 3) edema, 4) cysts**

Edema: Cytotoxic = cell death, disrupts grey-white junction; Vasogenic = extrudation of intracellular fluid, spares grey-white junction (“finger-like”)

DWI/ADC

Principle: DWI measures “degree of freedom” of water molecules, which depends on 1) viscosity and 2) spatial constraint; ADC is calculated from DWI

How to read:

Bright on DWI + Dark on ADC = fluid restriction (less degrees of freedom)^d

Bright on DWI + Bright on ADC = T2 shine through (artifact)^e

What to look for: **1) Acute infarct, 2) Abscess, 3) Hypercellular tumors, 4)**

Demyelination

Infarct appearance simplified:

	DWI	ADC	FLAIR	Contrast-enhancement
Hyperacute (<3h)	Bright	Dark	Normal	No
Acute (0-10d)	Bright	Dark	Bright	No
Subacute (10-20d)	Bright	Normal	Bright	Yes
Chronic (>20d)	Normal	Normal	Bright	No

SWI

How to read: Hemosiderin and calcium appear dark (more advanced sequences can distinguish between these two)

MRA/MRV

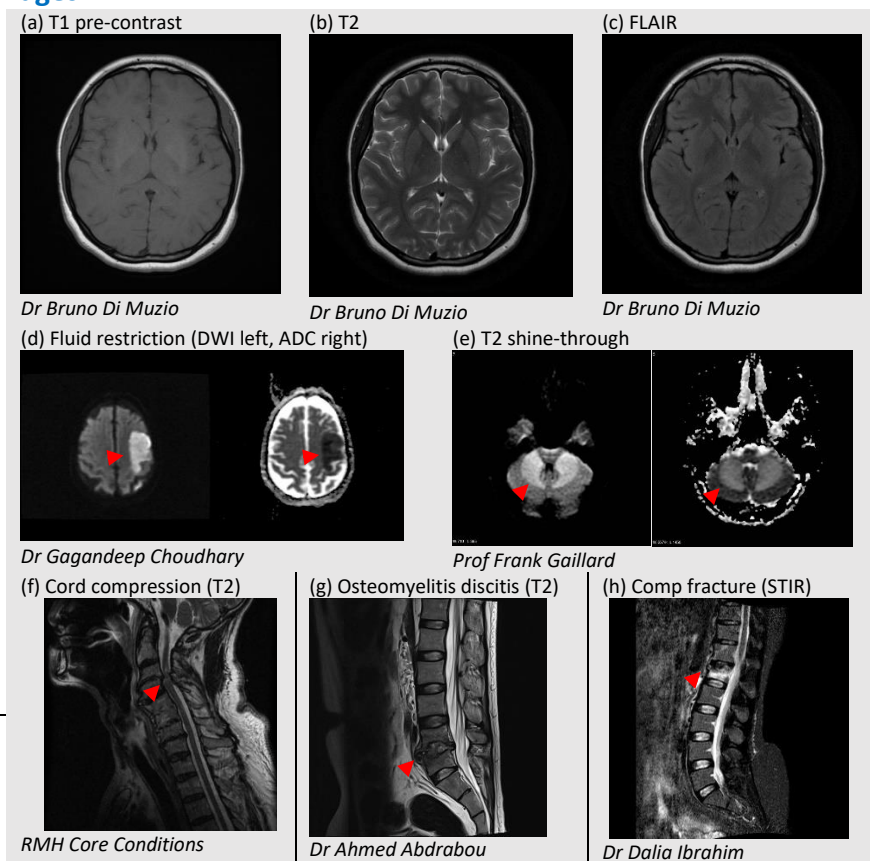
Indications: MRA = follow-up/screening of aneurysms, vascular malformations, non-acute angiographic needs; MRV = venous sinus thrombosis

MRI SPINE

Ordering tips: Cord compression = order limited sagittal T2/STIR (fat-suppressed T1); Cord pathologies = Order region-specific scan (do not order total spine → motion-degradation)

What to look for and how: 1) Cord compression: look at CSF on T2^f, also look for abnormal T2 in cord; 2) Osteomyelitis discitis: edema and enhancement in vertebral bodies^g; 3) Compression fractures: look for bony edema on STIR^h

MRI Images*:



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RMH Core Conditions

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*Images from Radiopaedia; case courtesy of contributing radiologist below image