NEUROIMAGING CASES Q&A

Joshua P. Klein, MD, PhD

A series of diagnostically challenging neuroimaging cases will be presented. The clinical history and demographic of each patient will be emphasized as essential data in framing a radiographic differential diagnosis.

With respect to clinical history, the pace of onset of neurologic symptoms and the course of disease (i.e., transient, resolving, worsening, fluctuating, episodic) can assist in predicting the most likely category of disease (i.e., vascular, inflammatory, neoplastic, degenerative) as well as the most likely anatomic localization (i.e., central versus peripheral nervous system, single lesion versus multiple lesions versus diffuse spread).

For lesions producing neurological deficits, identification of the space of origin of the lesion (i.e, epidural, subdural, subarachnoid, intraparenchymal, intraventricular) is critical, as these different compartments harbor different lesion-types. For intraparenchymal lesions, determine whether the lesion involves the gray matter (cortical and deep), white matter (juxtacortical, periventricular), or both, and whether the lesion is restricted to an arterial territory.

For a given lesion, associated volume-gain (i.e., edema, inflammation) versus volume loss (i.e., sclerosis, gliosis, atrophy) can help refine a differential.

Different substances have different imaging characteristics:

On CT, from lower to higher Hounsfield unit measurements: air (< -1000), fat (-30 to -70), water (0), CSF (15), muscle (20 to 40), white matter (20 to 30), gray matter (35 to 45), acute hemorrhage or thrombus (60 to 100), iodinated contrast (100 to 600), bone (>1000).

On T1 weighted sequences:
- Hyperintense (T1-shortening): lipid, cholesterol, dense protein, hypercellularity, methemoglobin, slowly flowing blood, manganese, melanin
- Hypointense (T1-prolongation): water, CSF, bone, calcification, hemosiderin, gliosis, air

On T2 weighted sequences:
- Hyperintense (T2-shortening): water, CSF, gliosis, edema, demyelination, slowly flowing blood, intracellular oxyhemoglobin, extracellular methemoglobin
- Hypointense (T2-prolongation): dense protein, hypercellularity, intracellular deoxyhemoglobin, intracellular methemoglobin, hemosiderin, air

On T2-FLAIR MRI (T2 with fluid suppression, used mostly in brain imaging): free water darkens, vasogenic and interstitial water remains hyperintense.

On DWI, ADC hypointensity (reduced diffusivity / increased anisotropy) is seen with cytotoxic edema as in acute ischemia, as well as in highly cellular lesions such as lymphoma and abscess.

On DWI, ADC hyperintensity (elevated diffusivity / decreased anisotropy) is the so-called “T2-shine- through” effect, and is seen in vasogenic edema and in chronic sclerosis and gliosis.

On STIR (T2 with fat suppression, used mostly in spine imaging), fat becomes dark and edema and acute/subacute blood remain bright.

Patterns of contrast enhancement
a. Rim enhancement: abscess (regular rim), glioma (irregular rim), demyelination (open rim), metastasis, contusion, radiation necrosis, infarction.
b. Solid/nodular enhancement: lymphoma, metastasis, demyelination (small lesions), radiation necrosis (small lesions),

c. Pachymeningeal: low intracranial pressure, syphilis, tuberculosis, sarcoid, granulomatous diseases, lymphoma, leukemia, metastasis.
d. Leptomeningeal: inflammation, meningitis, infarction, metastasis.
e. Nerve root: Guillain-Barre syndrome, Elsberg syndrome, granulomatous disease, external compression, metastasis, neurofibroma, schwannoma, Lyme disease, cytomegalovirus, schistosomiasis, metastasis.

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