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TRAUMA & EMERGENCY RADIOLOGY

Neuroradiological Emergencies: The Immunocompromised Patient

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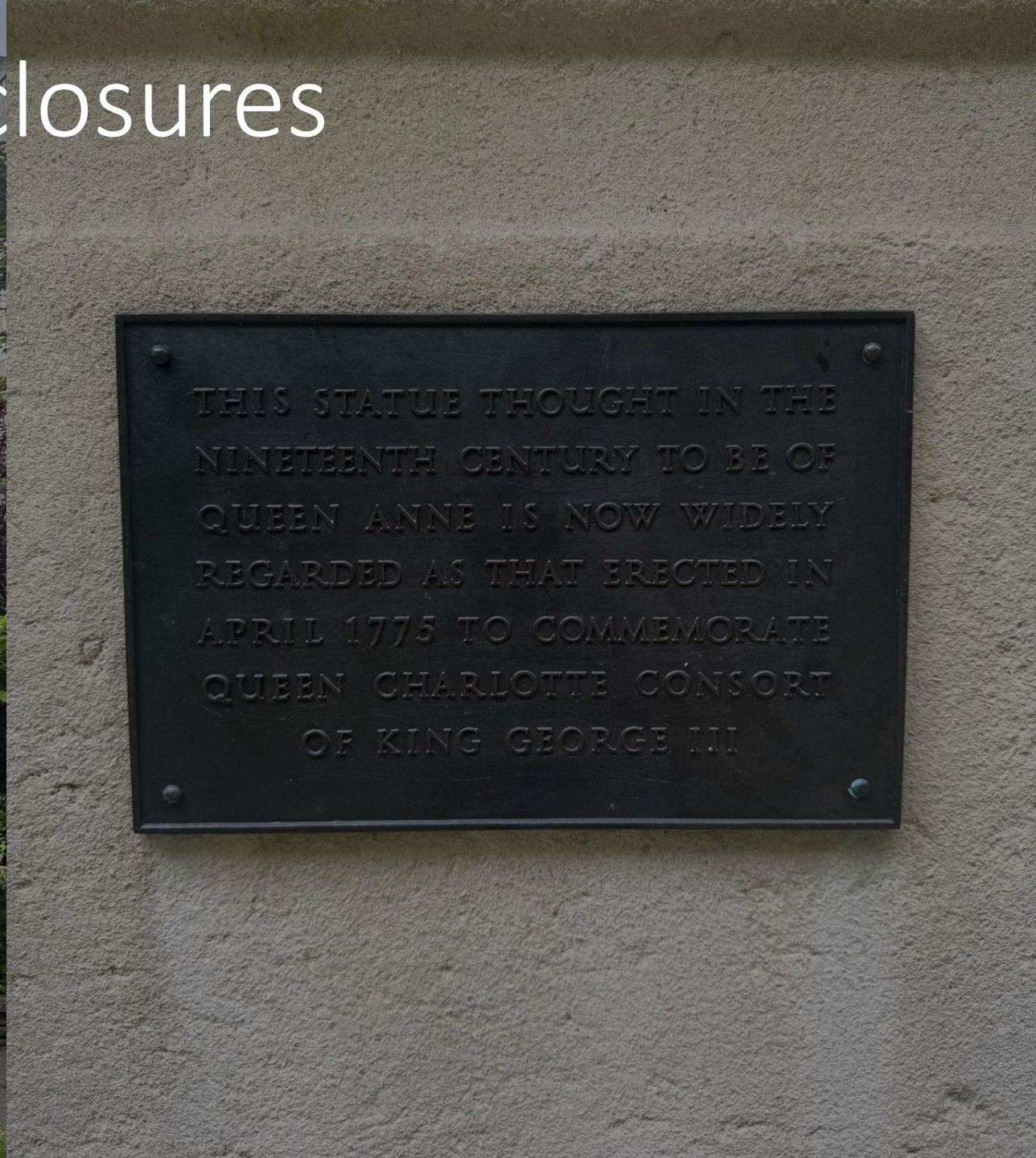
No disclosures



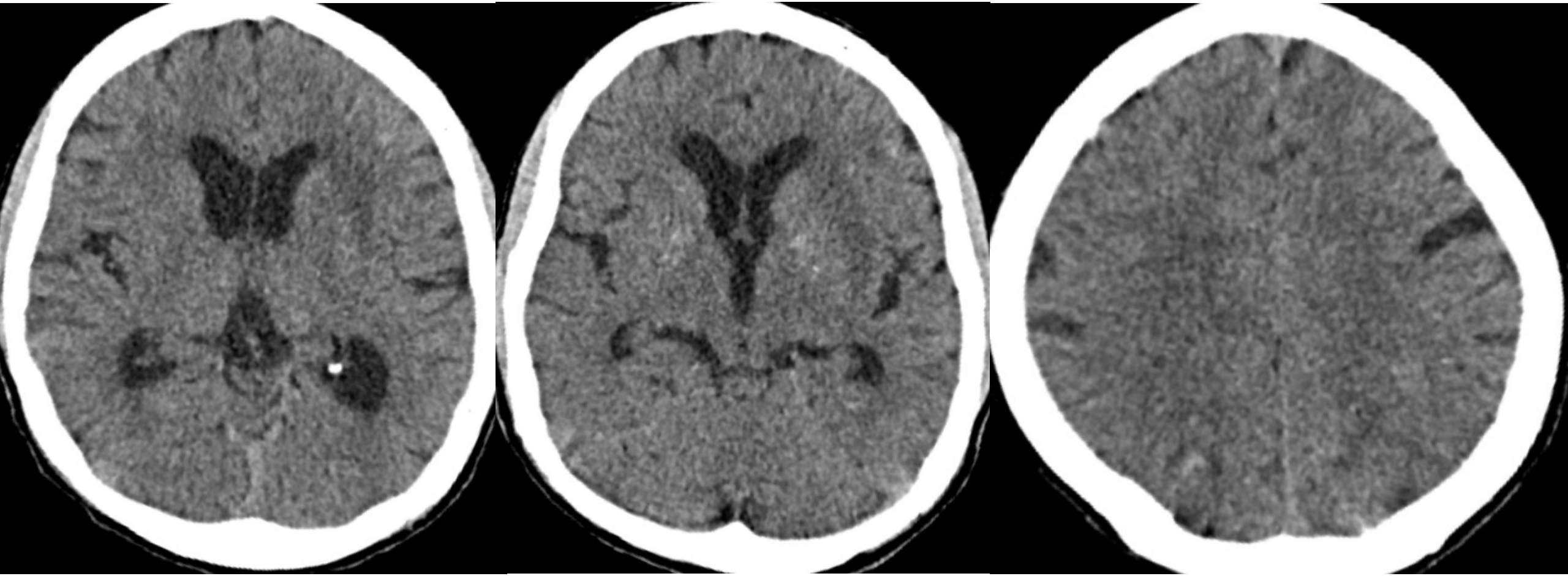
Overview

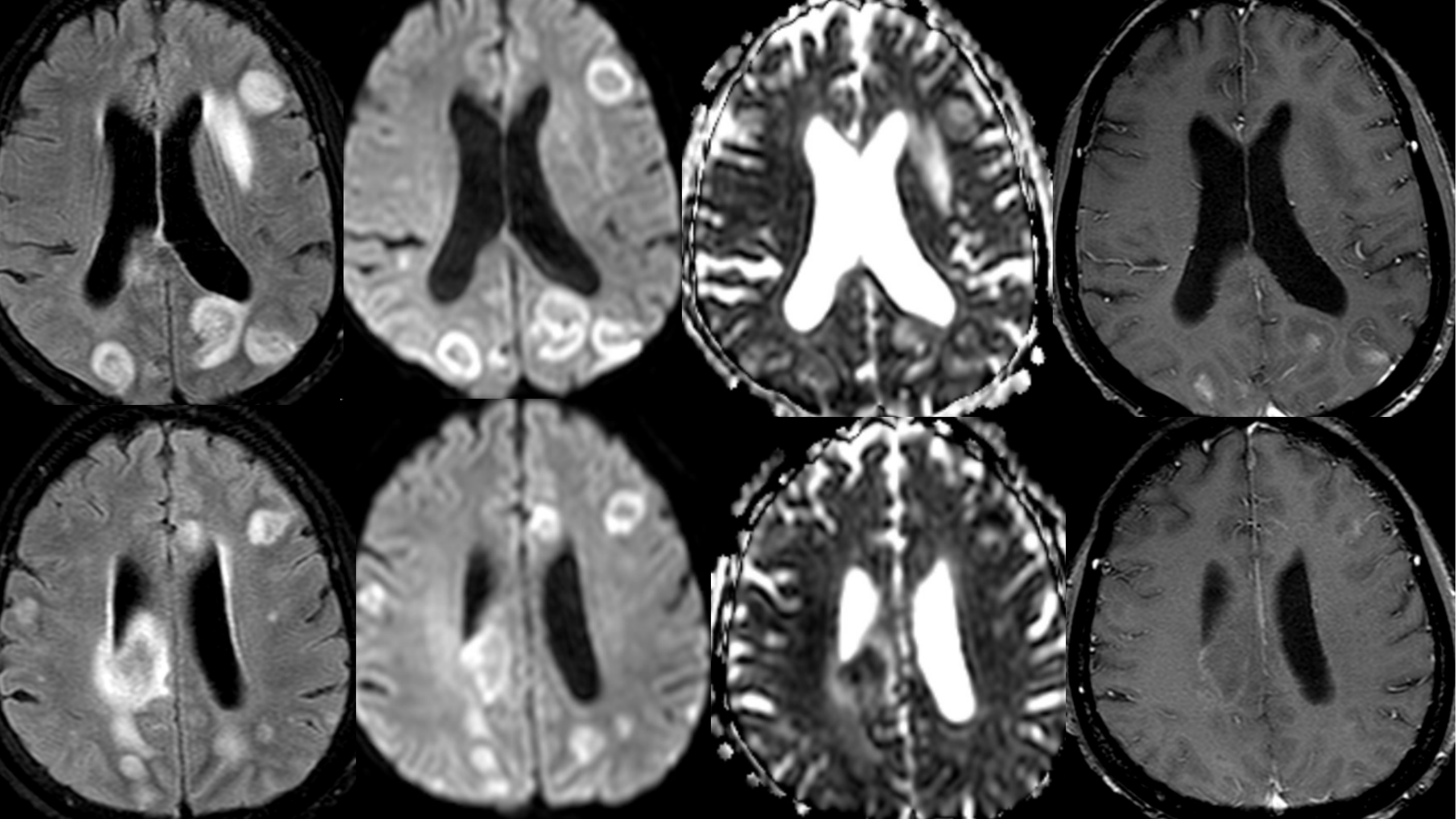
- Distinguish the imaging features of common CNS emergencies in the immunocompromised patient using a case-based approach.
- Consider imaging features of treatment-related complications.

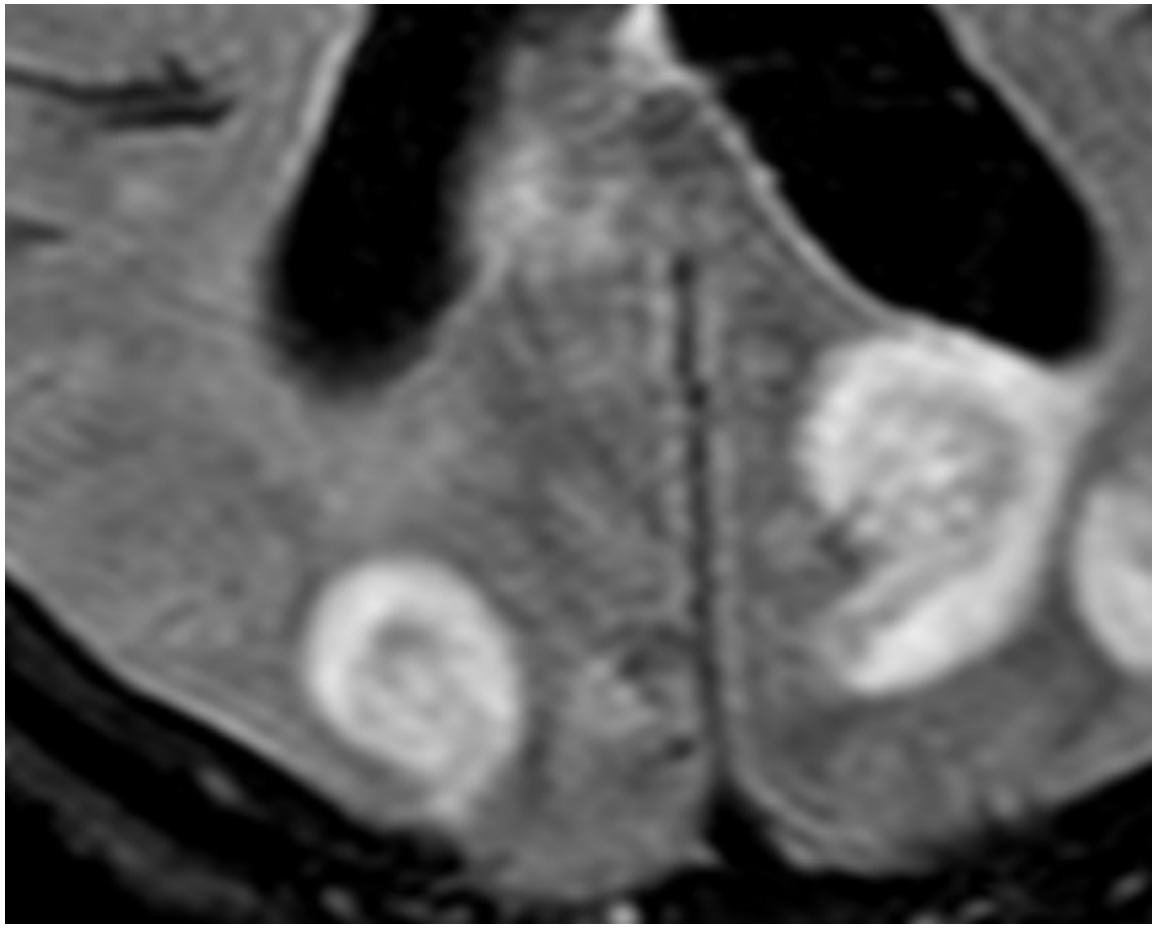
Immunocompromised

- Viral compromise - HIV
- Malnutrition
  - Alcohol excess / substance abuse
  - Surgery (e.g. bariatric)
  - GI disorders
- Immunomodulating medications
  - E.g. inflammatory disorders like RA, MS
- Malignancy
  - Treatments
  - Disease process
- Common pathologies can have atypical appearances

Case 1: new onset confusion then collapse. Fit and well previously.







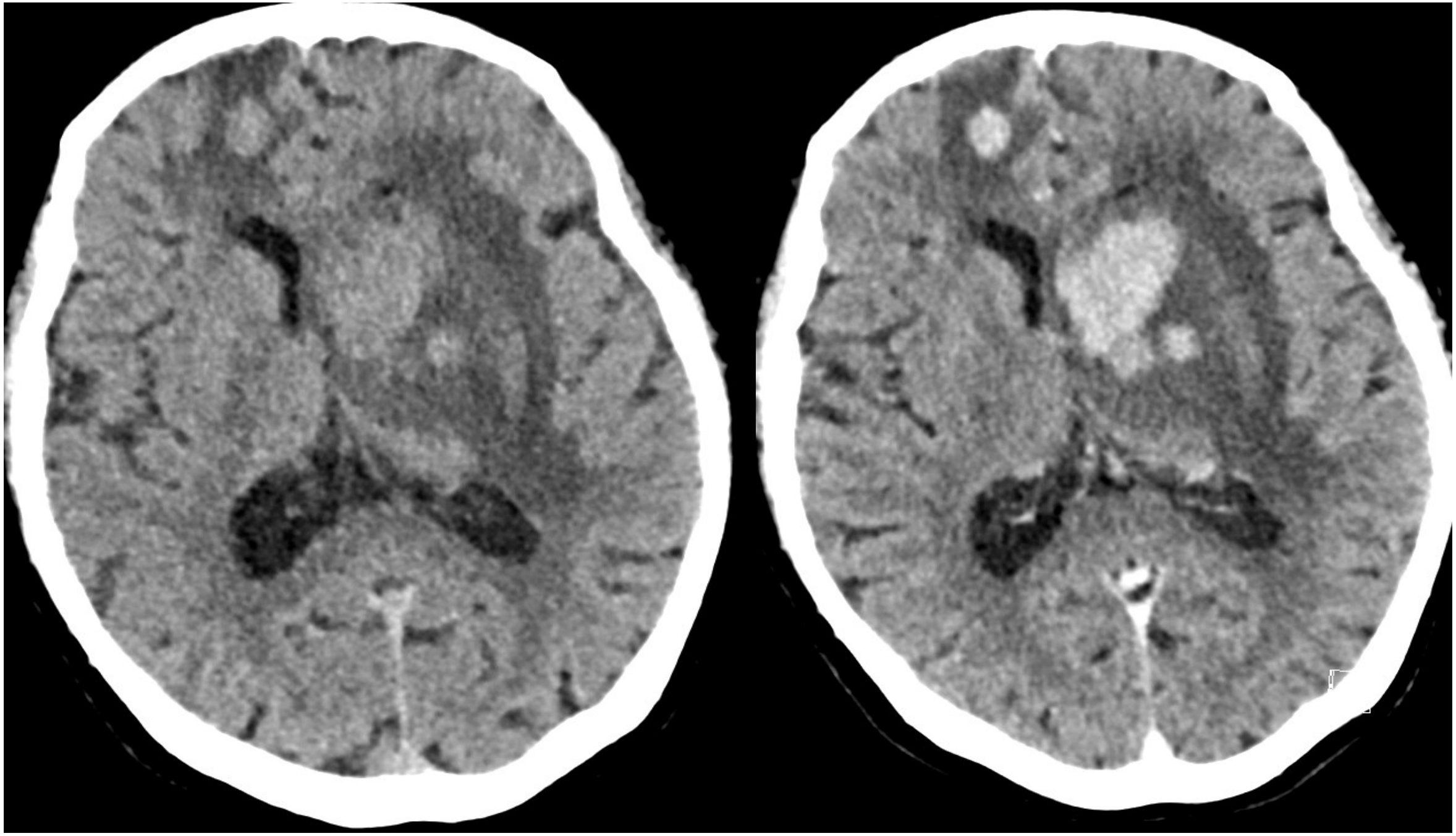
Neurotoxoplasmosis

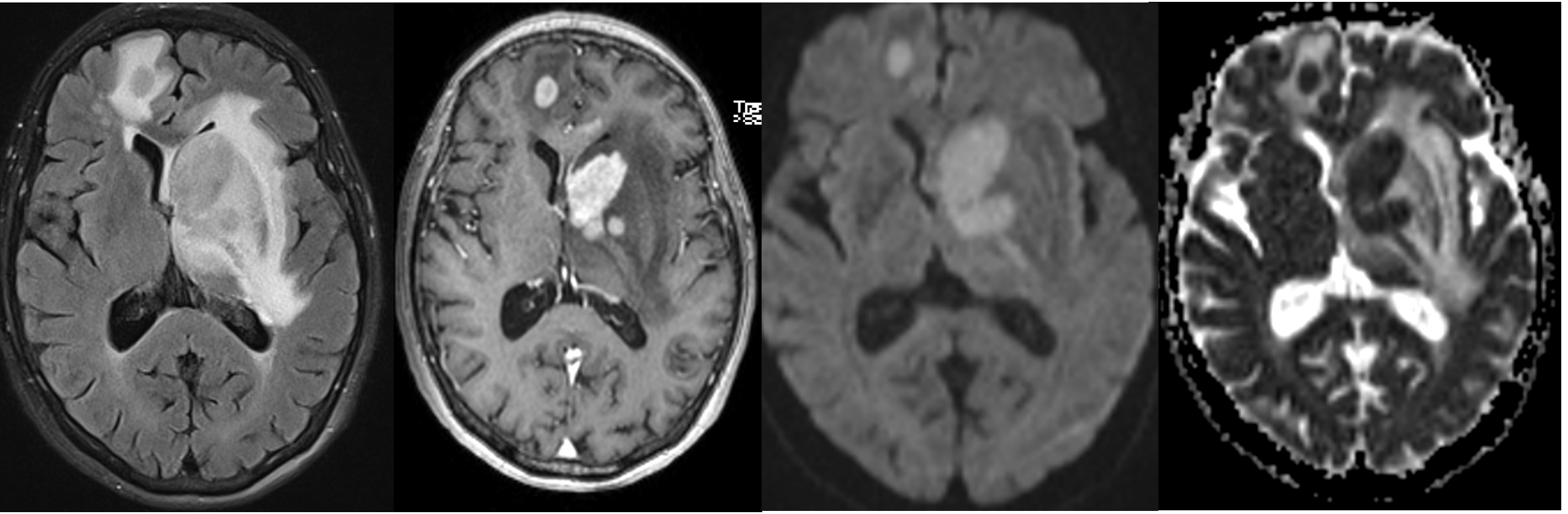
- Opportunistic infection by parasite *Toxoplasma gondii*
- Immunocompromised: CD4+ <200
- Headache, fevers, confusion
- Imaging: basal ganglia, thalami, corticomedullary junction and cerebellum lesions: concentric **target** appearances (oedema alternating with haemorrhage/ necrosis)
- Typically multifocal

Case 2: new onset confusion then collapse. Fit and well previously… (sound familiar…?)

Unenhanced CT head

Enhanced CT head





LYMPHOMA
(immunocompetent)

Primary CNS Lymphoma

Diffuse large B-cell lymphoma most common type

Can arise anywhere in the neuro axis:

Often contact CSF surface (ependymal/pial)

85% are in the cerebral white matter

MRI: diffusely infiltrating, homogenously enhancing, ADC values lower than for glioblastoma/mets

Differential: glioblastoma – enhancement is less homogenous, variable restriction

Toxoplasmosis – ring-enhancing, higher ADC values, location, multiplicity

LYMPHOMA versus TOXOPLASMOSIS

LYMPHOMA

- Solitary > multifocal
- Ependymal/subependymal contact
- Homogenous enhancement
- Low ADC (restricted diffusion)
- Haemorrhage uncommon

TOXOPLASMOSIS

- Multifocal > solitary
- Deep structures, CM junction
- Ring/nodular enhancement
- Higher ADC (facilitated diffusion)
- Can have haemorrhage

Lymphoma in immunocompromised

- Can have *peripheral enhancement* (not homogenous) with necrotic centres
- Can have *microhaemorrhages*
- Can be *multifocal*
- Can be *lobar* or *deep*

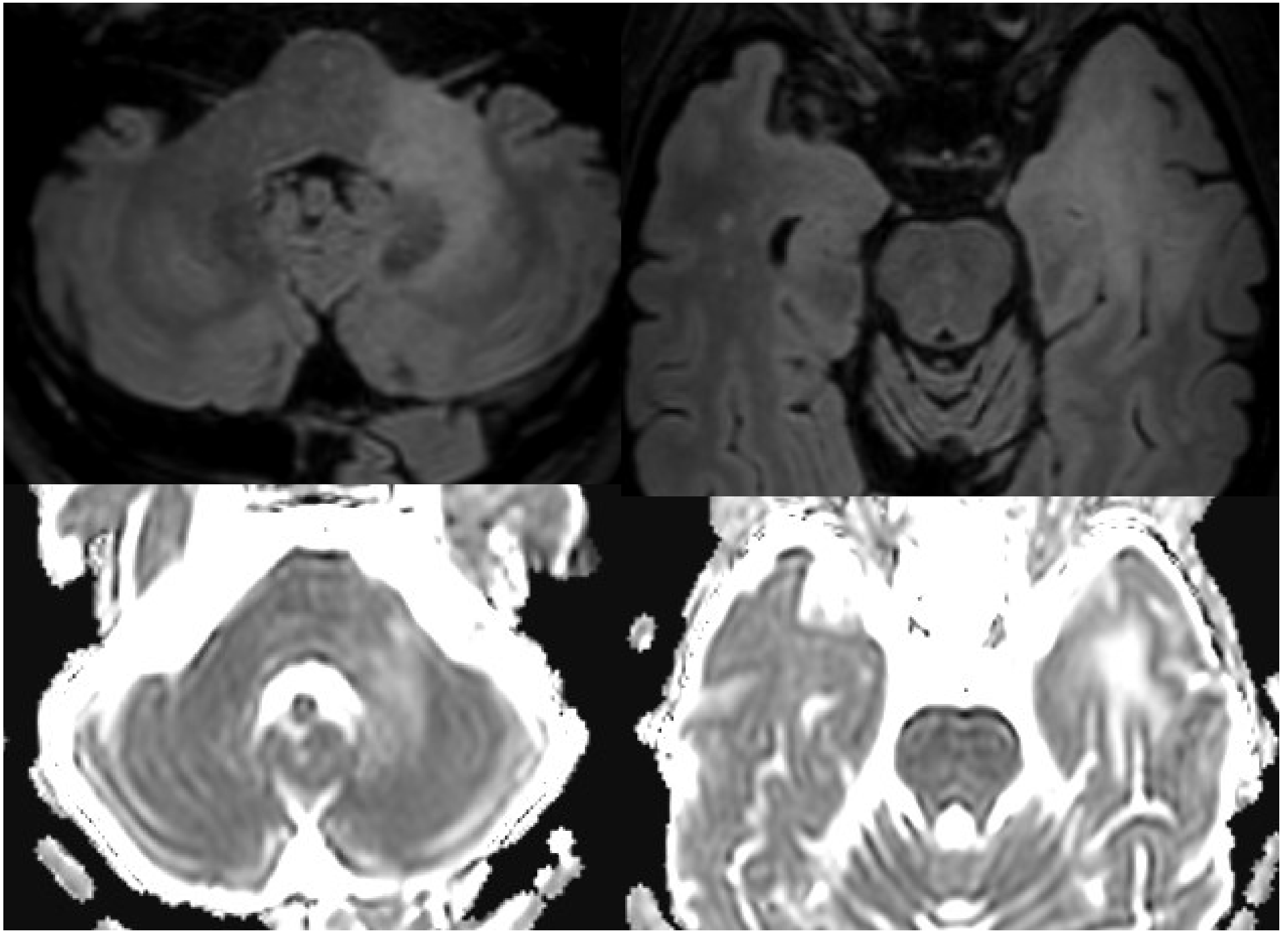
- Similar to toxo!!
  - Check for both
  - Toxo treatment – start to see imaging improvement within 2-3 weeks

Case 3: dizziness, headaches, ataxia.

FLAIR hyperintense lesions with no mass effect, involves subcortical U-fibers, do not restrict. Posterior fossa lesion spares dentate nucleus.

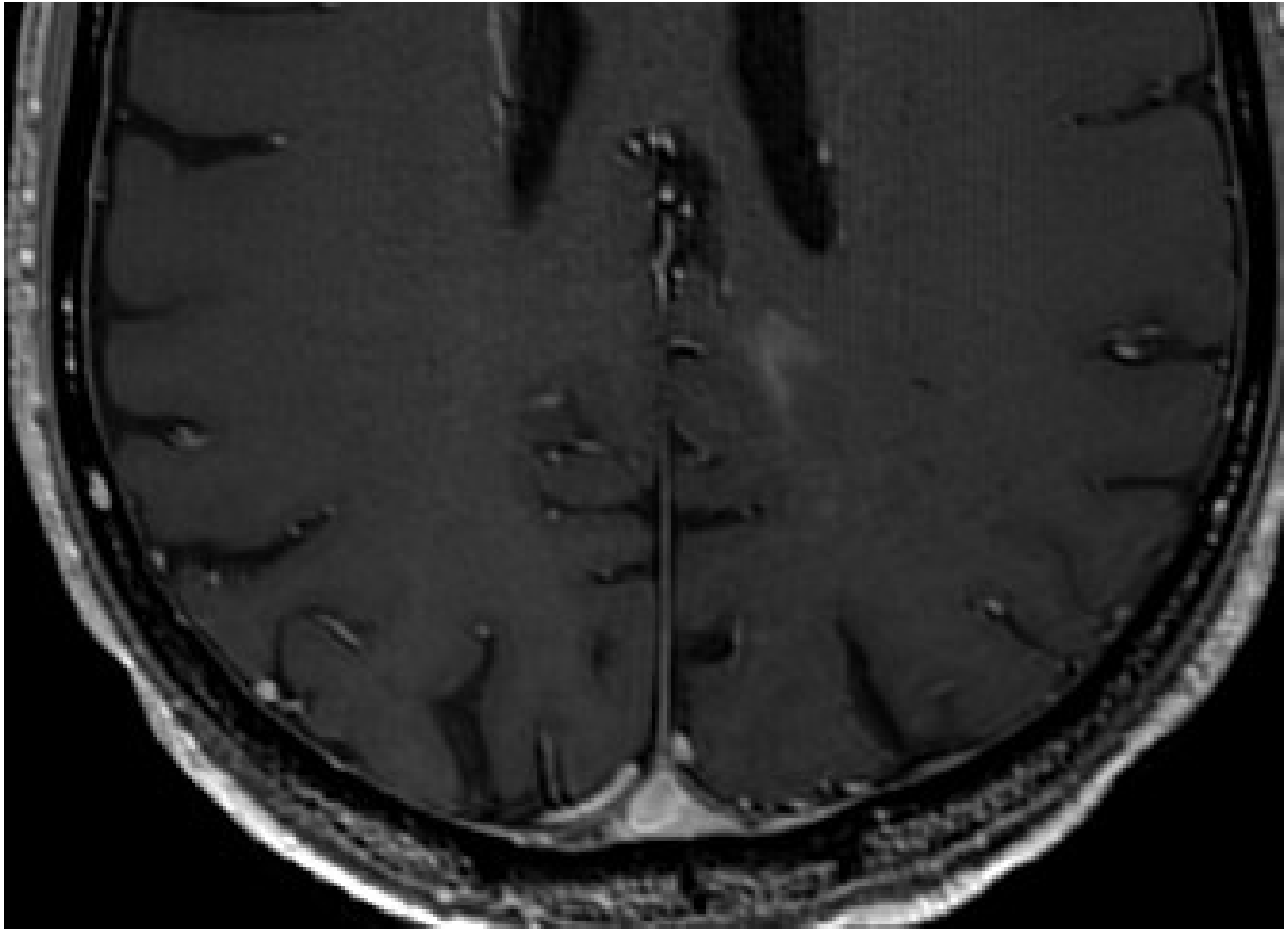
Diagnosis: PML

- JC virus positive
- Untreated, poorly controlled HIV



1 month later…punctate enhancement…

PML IRIS



PML / PML-IRIS

Progressive multifocal leukoencephalopathy / immune reconstitution inflammatory syndrome

Demyelination due to reactivation of John Cunningham virus

- s-IRIS: simultaneous development of IRIS and PML

- d-IRIS: worsening pre-existing PML

MRI: multifocal white matter lesions (U-fibers involved)

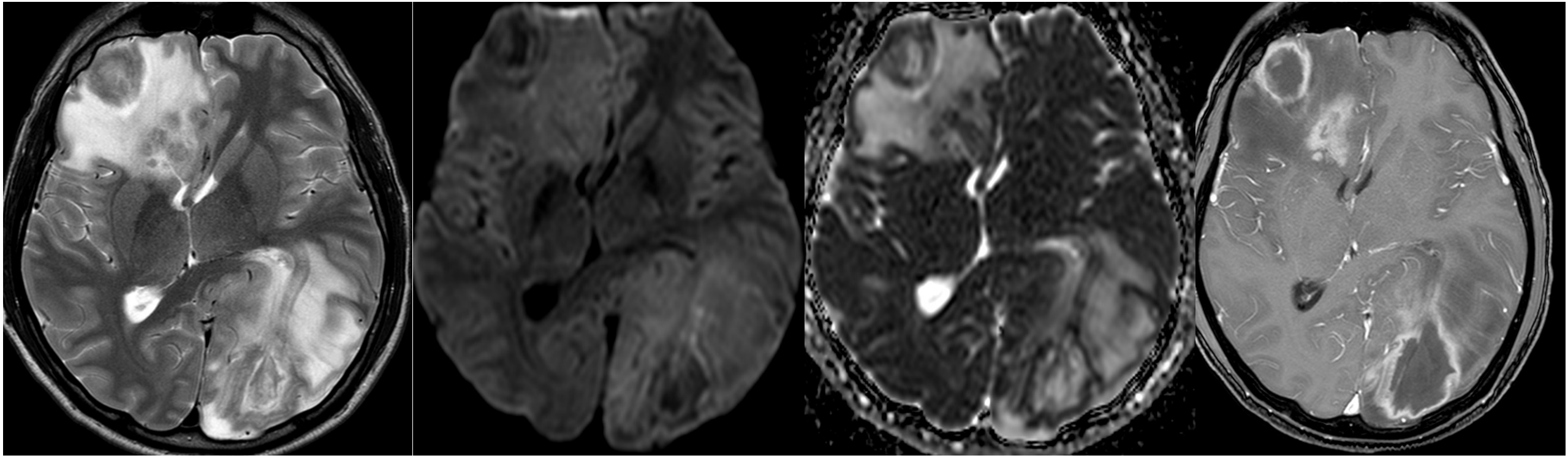
- No mass effect or enhancement
- Leading edge of demyelination
- Posterior fossa lesions spare dentate nuclei (shrimp sign) - classic
- IRIS: speckled enhancement

Differentials:

MS – periventricular lesions

HIV encephalopathy – spares U-fibers

Companion case: retroviral positive, febrile, malaise, reduced GCS.



Toxo negative

T.Cruzi and PCR positive disease - Chagas disease

Chagas disease

Parasitic infection - T.cruzi

Immunocompromised – severe disease

Reactivation of chronic disease

MRI: chagoma

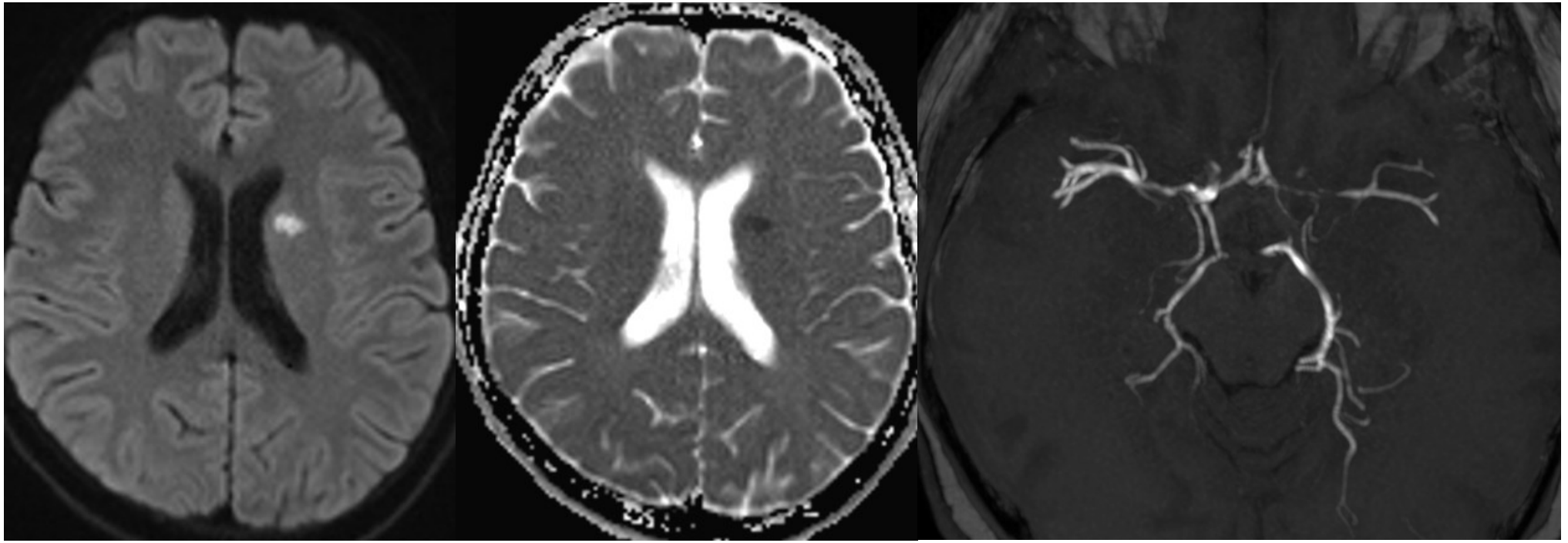
- WM lesions with mass effect:
  - Can enhance and have variable diffusion restriction
- Meningoencephalitis

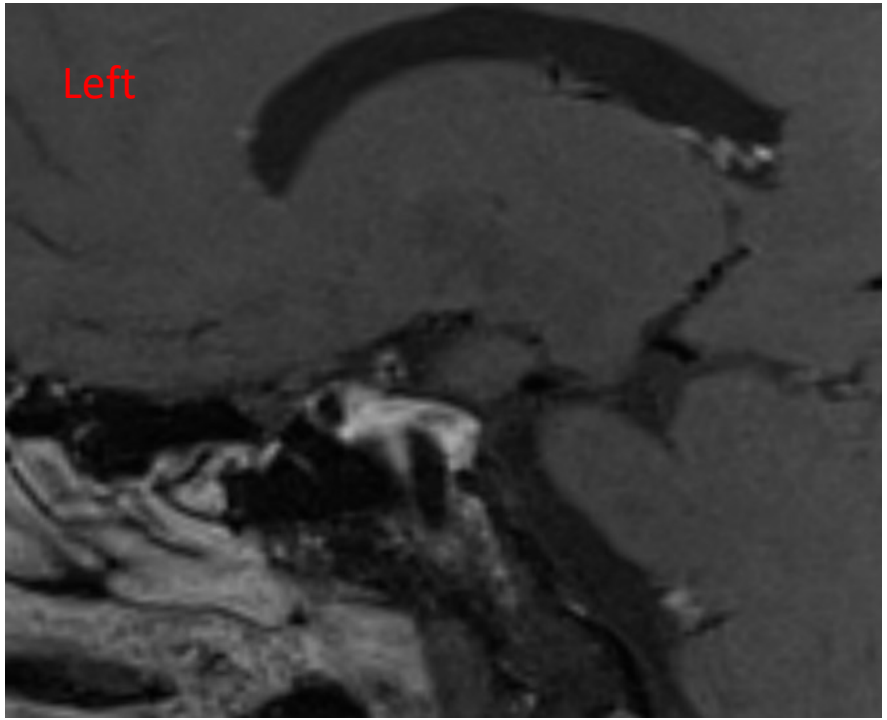
Differentials:

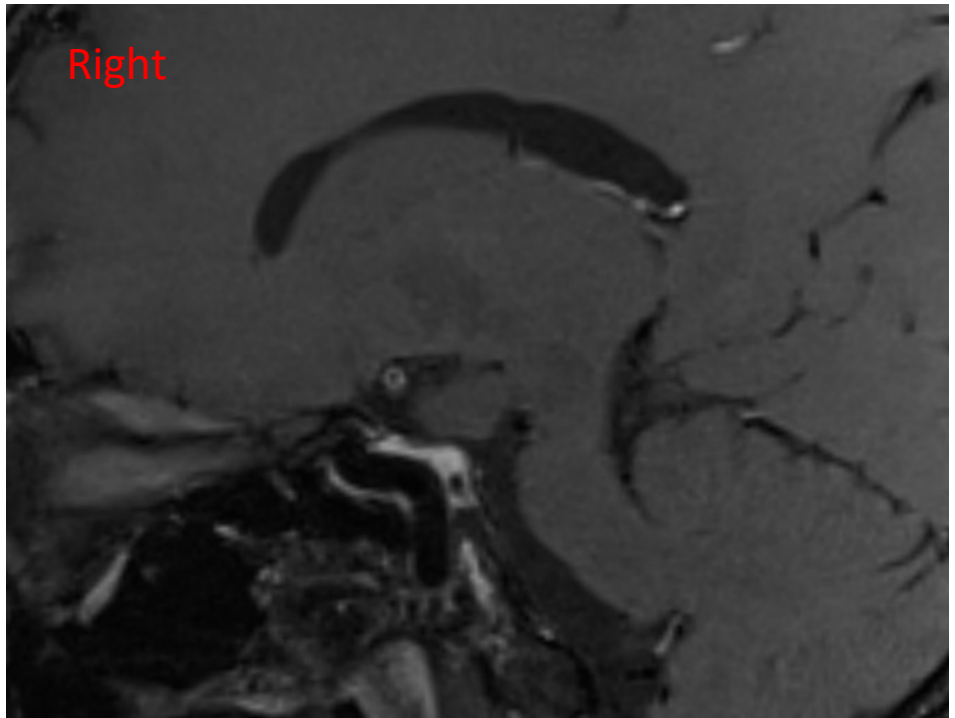
Toxoplasmosis

Multifocal lymphoma or glioblastoma

Case 4: headache, right sided weakness.







CNS VZV with a progressive, obliterative vasculopathy.

Infective vasculopathy

Inflammatory process affecting arteries – steno-occlusive disease

VZV Latent in dorsal root ganglia following initial infection

Viral reactivation due to immunocompromise – transaxonal spread to adventitia

Agents: VZV, syphilis, TB, aspergillosis

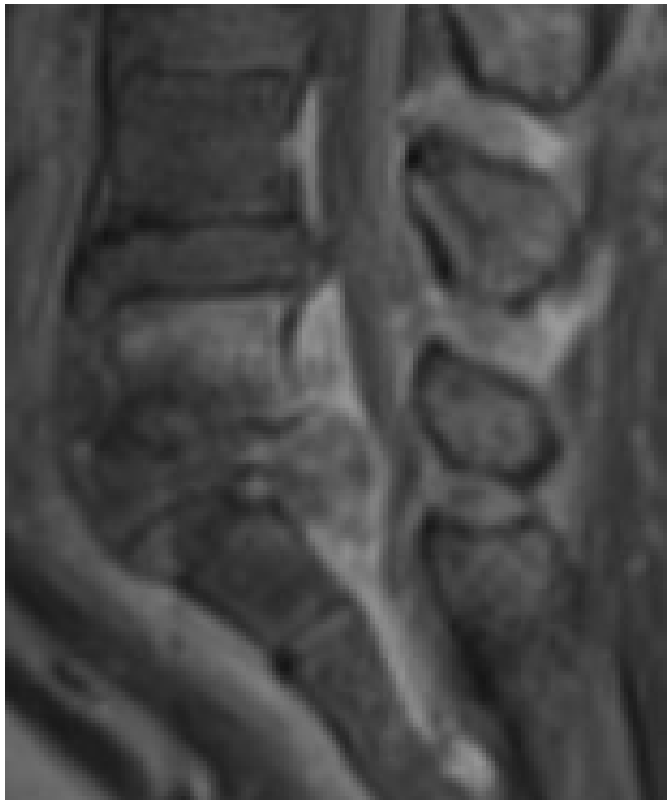
Imaging: ischaemic infarcts – grey and white matter, SAH. Can get pachymeningeal / leptomeningeal enhancement

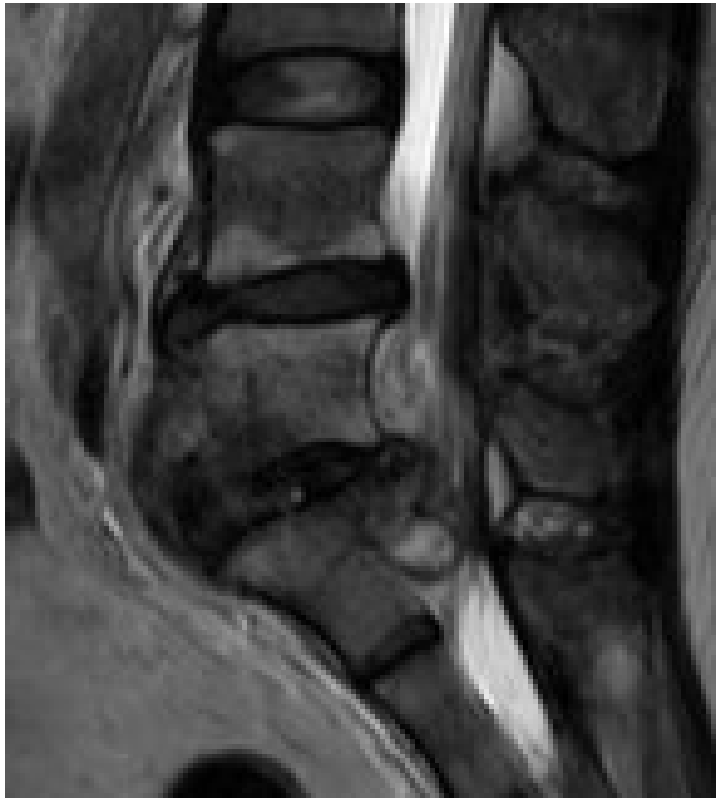
Angiography – segmental stenoses

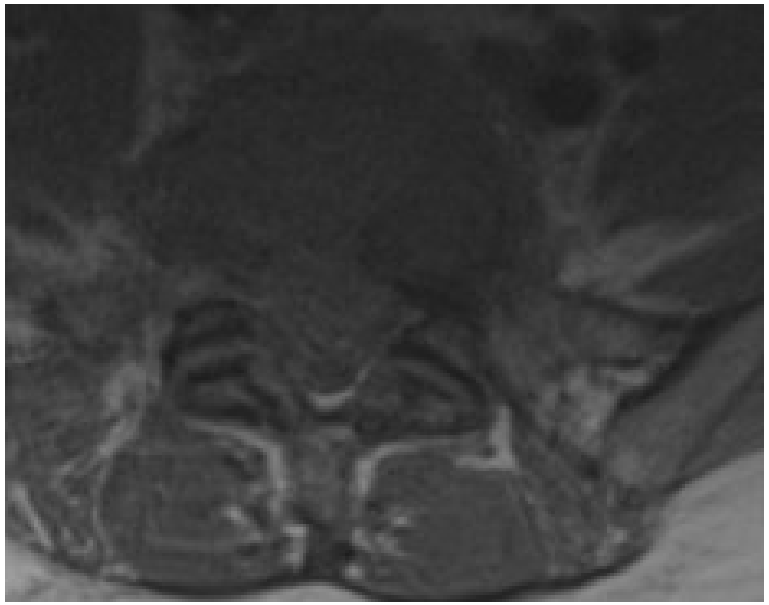
VWI: smooth, concentric enhancement c.f. atherosclerotic (irregular, eccentric), RCVS (non-enhancing).

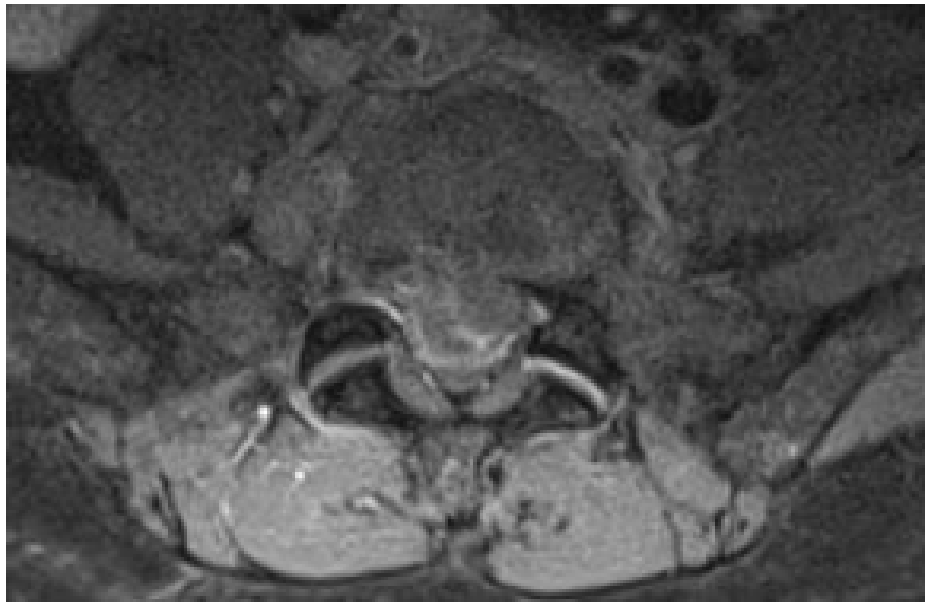
Case 5: chronic low back pain with acute bilateral sciatica, anal numbness. No fever. Known HIV.

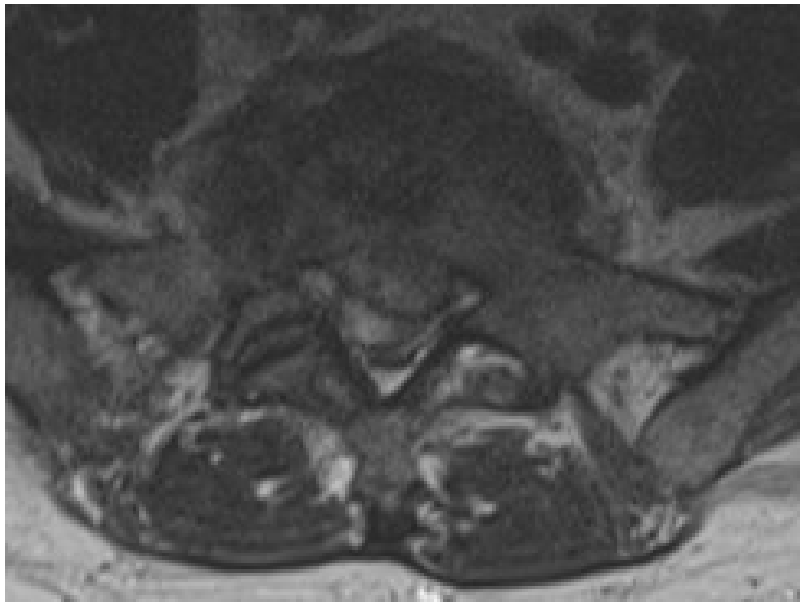
Spondylodiscitis secondary to TB.











TB

Infection from TB

- Can be more indolent than pyogenic
- Haematogenous spread
- Gradual collapse of vertebrae

Look for early bony changes on plain films / CT

MRI: subligamentous spread of disease

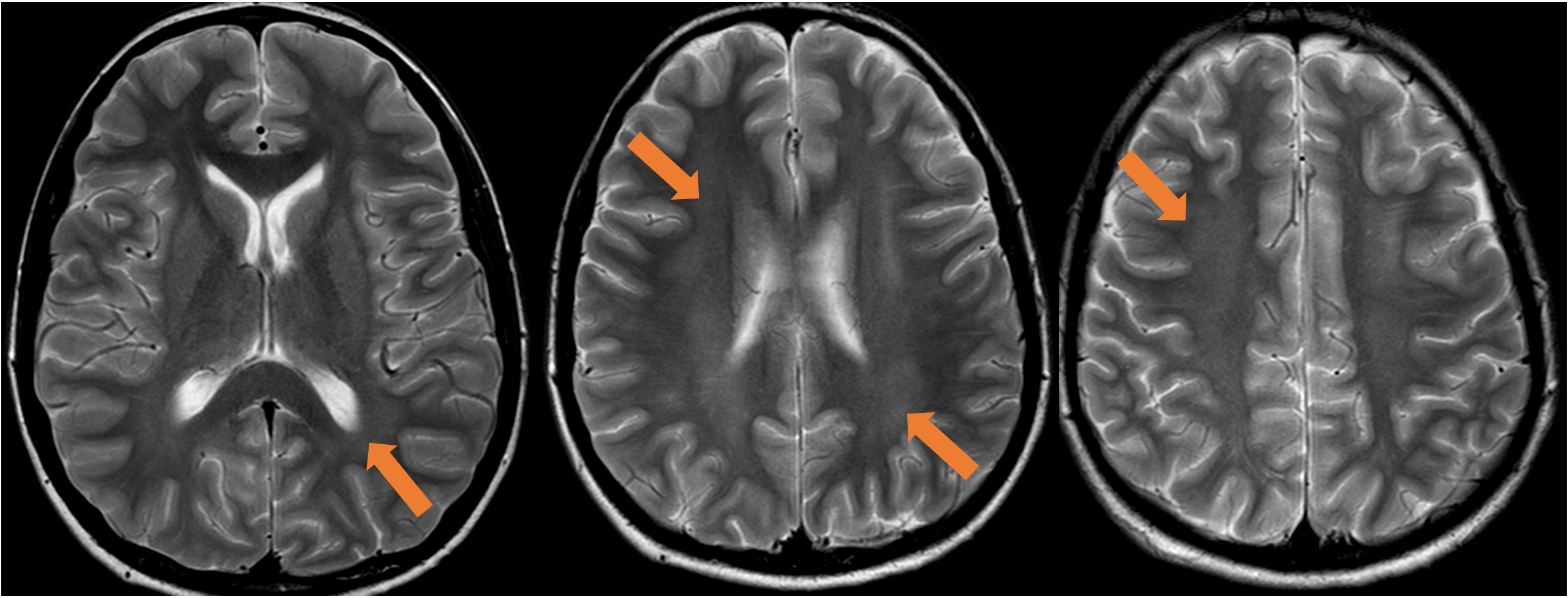
- Multilevel
- Slow development and can get very large
- Paraspinal/retroperitoneal spread

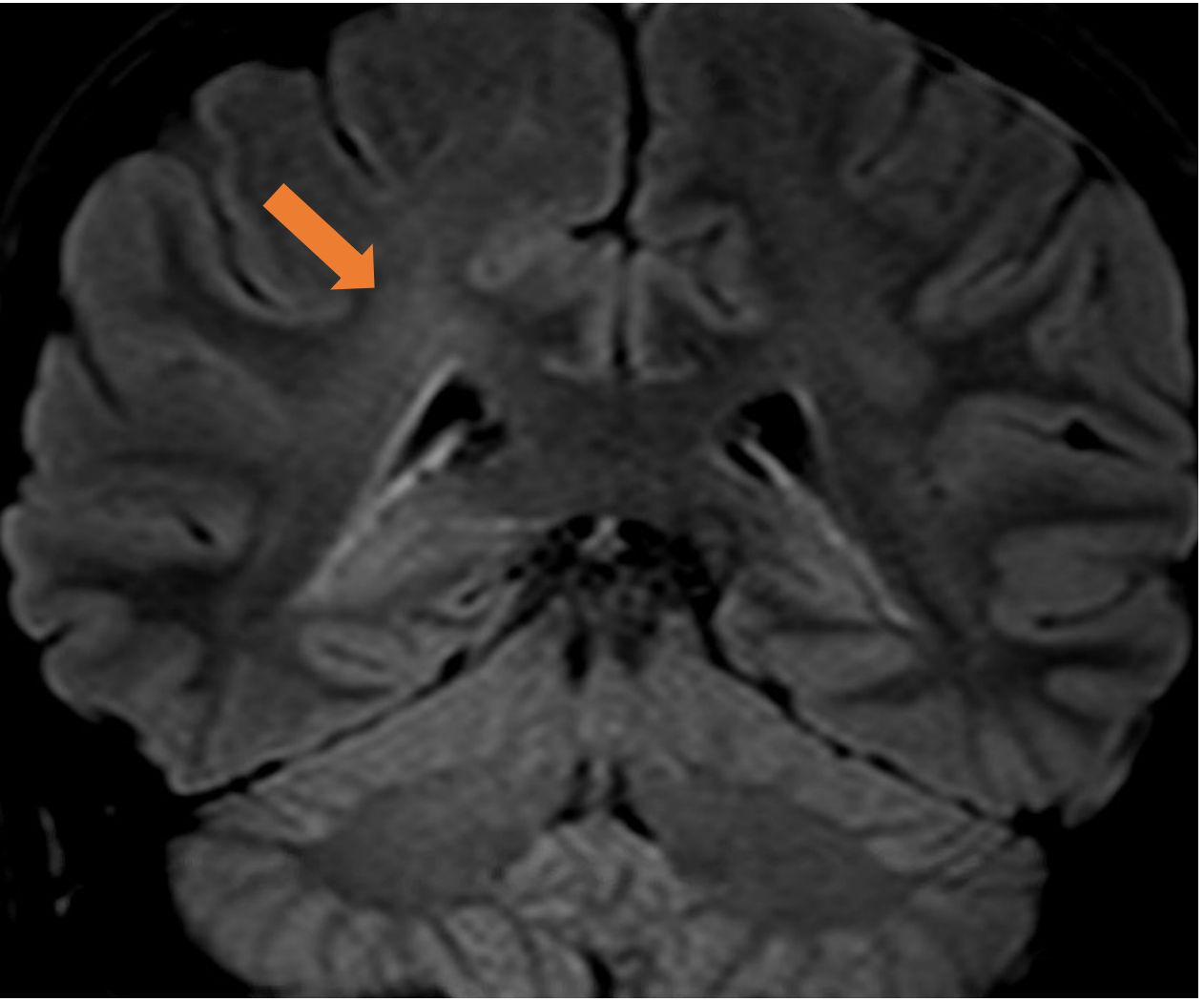
Differentials:

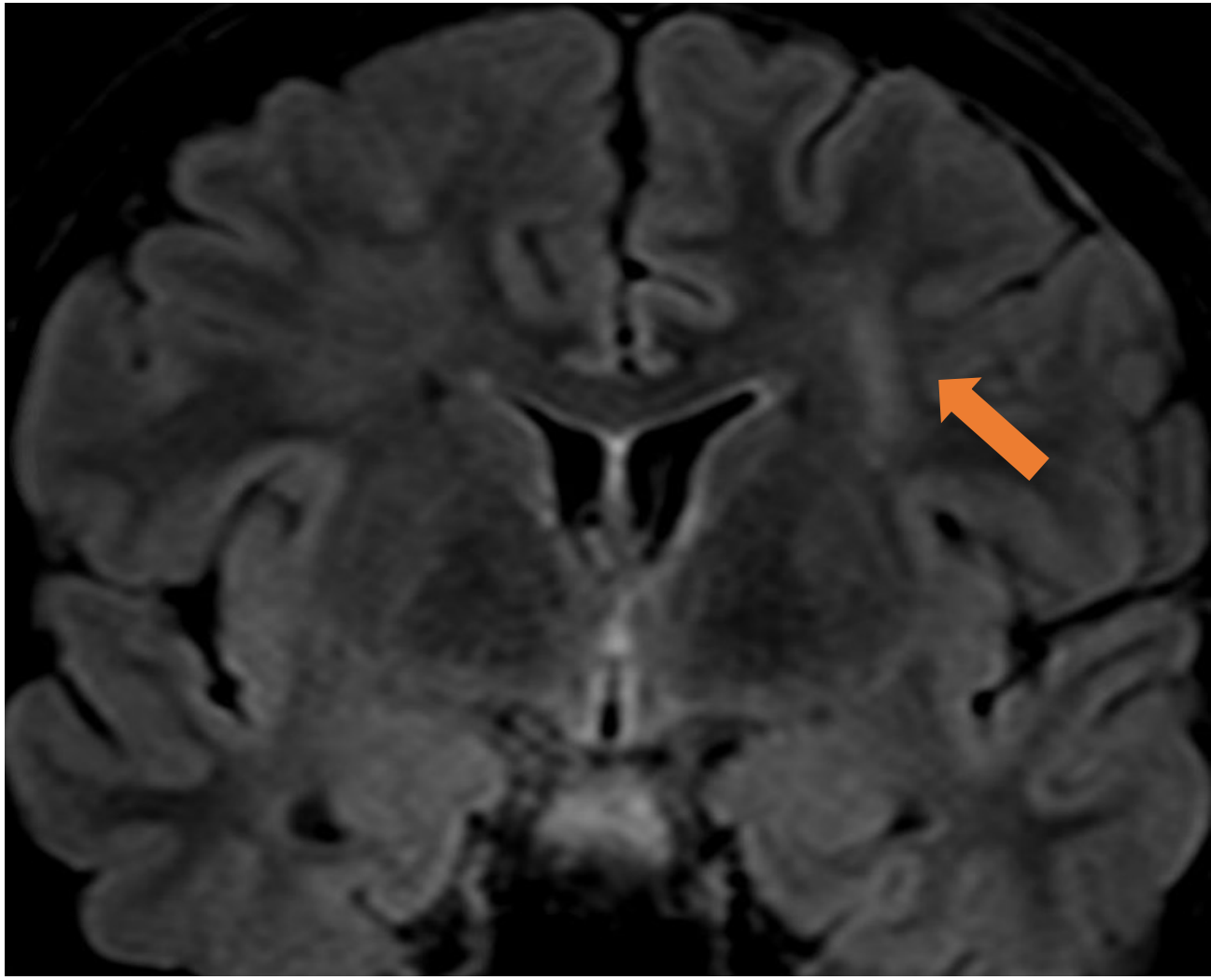
Pyogenic infection

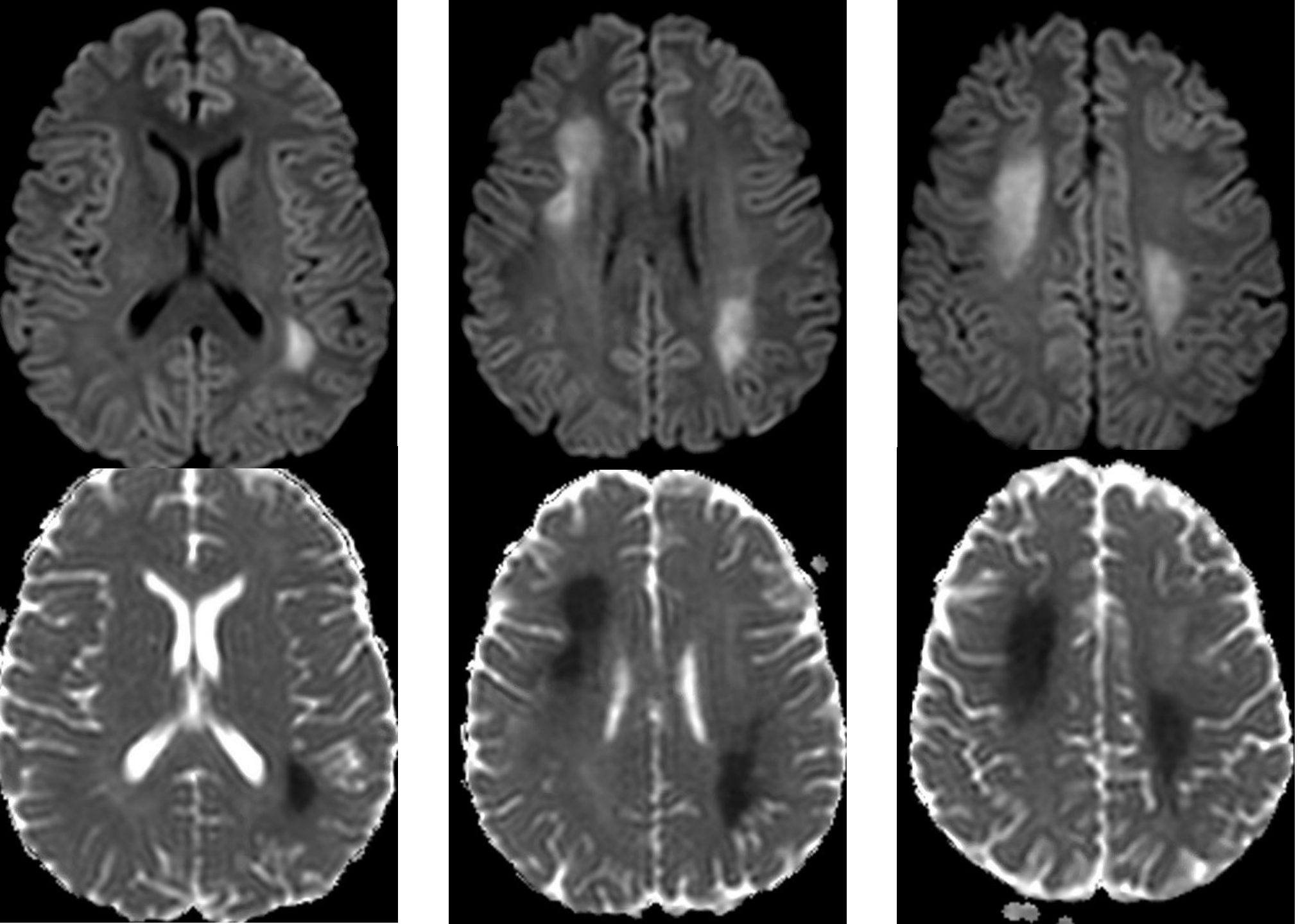
Acute degenerative disc disease

Case 6: new headaches on a background of long-term sickness (on treatment).





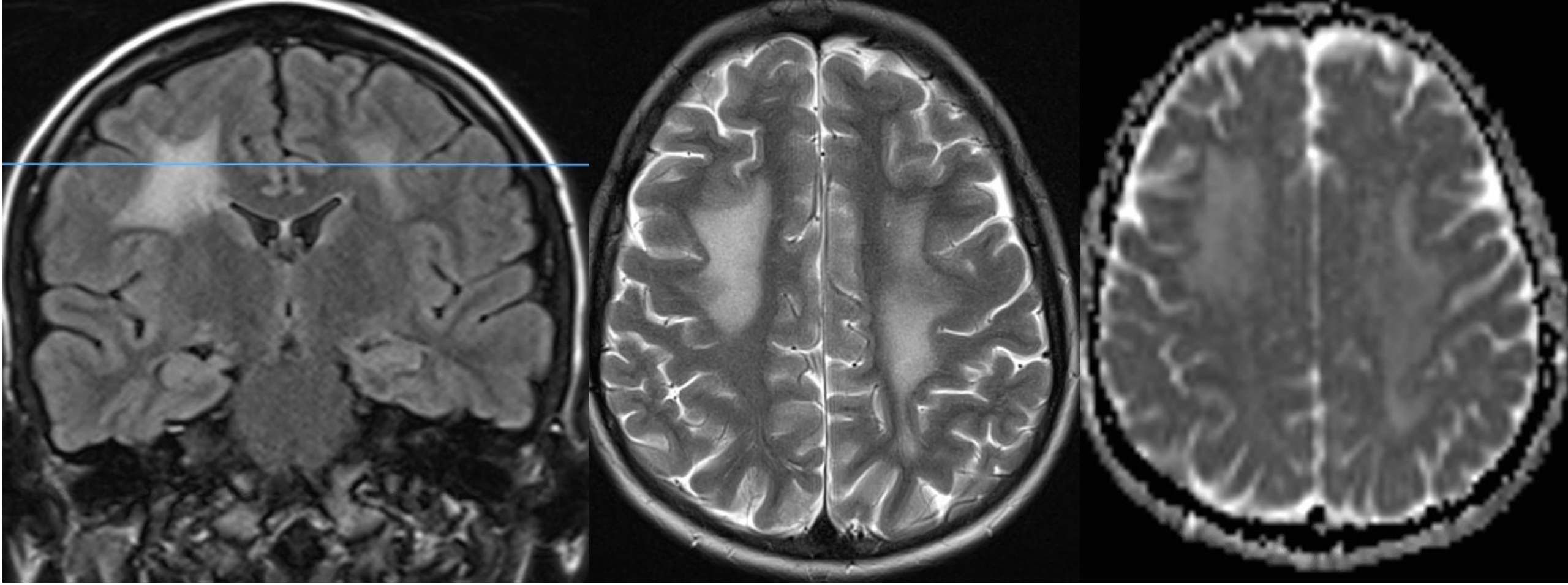




B1000

ADC

Diffusion sequences (B1000 and ADC together) are superior for demonstrating the regions of restricted diffusion.



Lesions gradually became more apparent and confluent, then following cessation of treatment stabilised and restriction settled.

METHOTREXATE LEUKOENCEPHALOPATHY

Spectrum of toxic leukoencephalopathies – folate antagonist

- Acute 2-14 days post treatment

- Headache, seizures, confusion, focal neurology

- Can mimic stroke symptoms

CT extremely subtle, if any abnormality appreciable -> MRI

T2/FLAIR signal abnormality in centrum semiovale – restriction, unilateral or bilateral

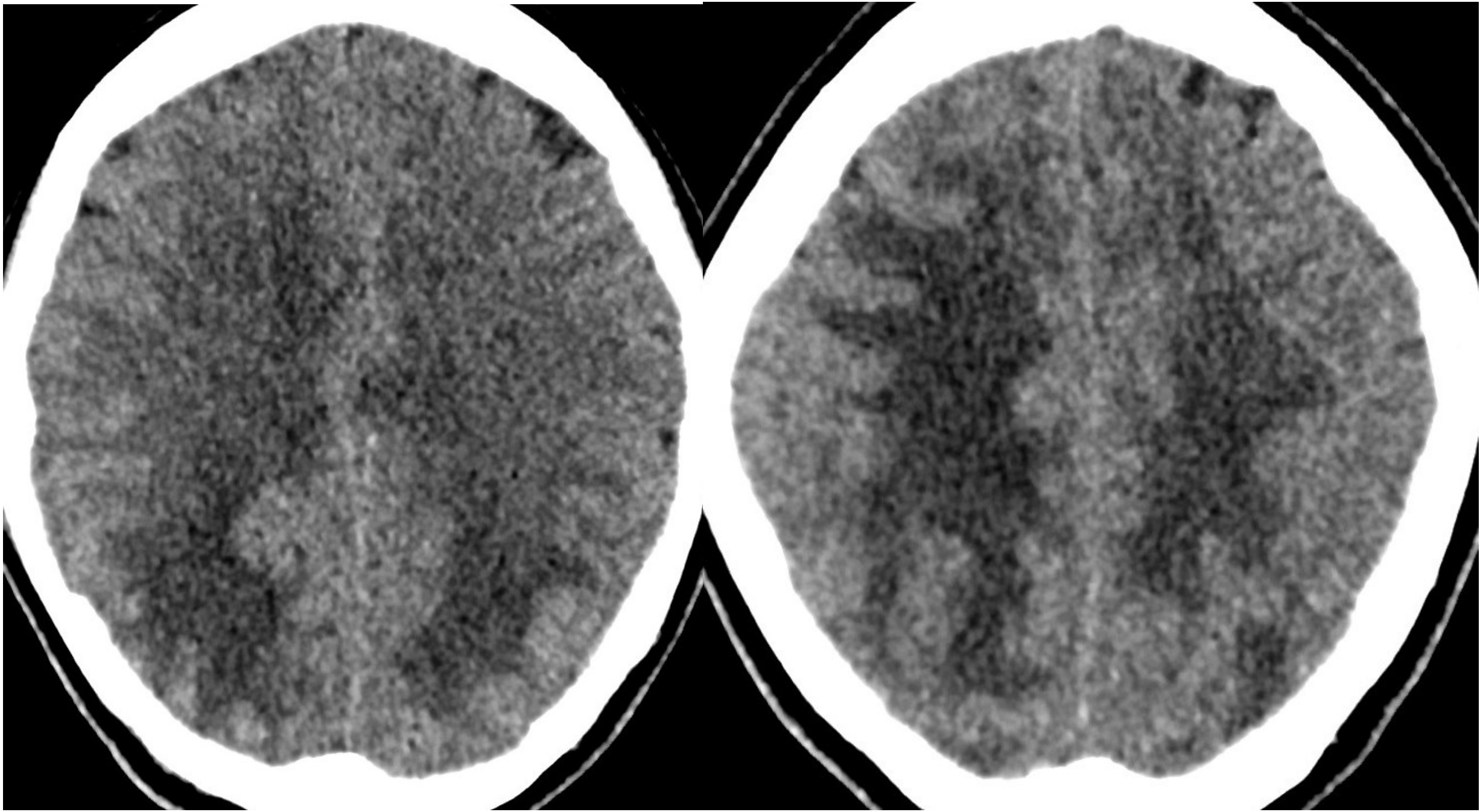
Need an MRI head quickly if high index of suspicion!

Offending agent needs to be stopped to reverse damage

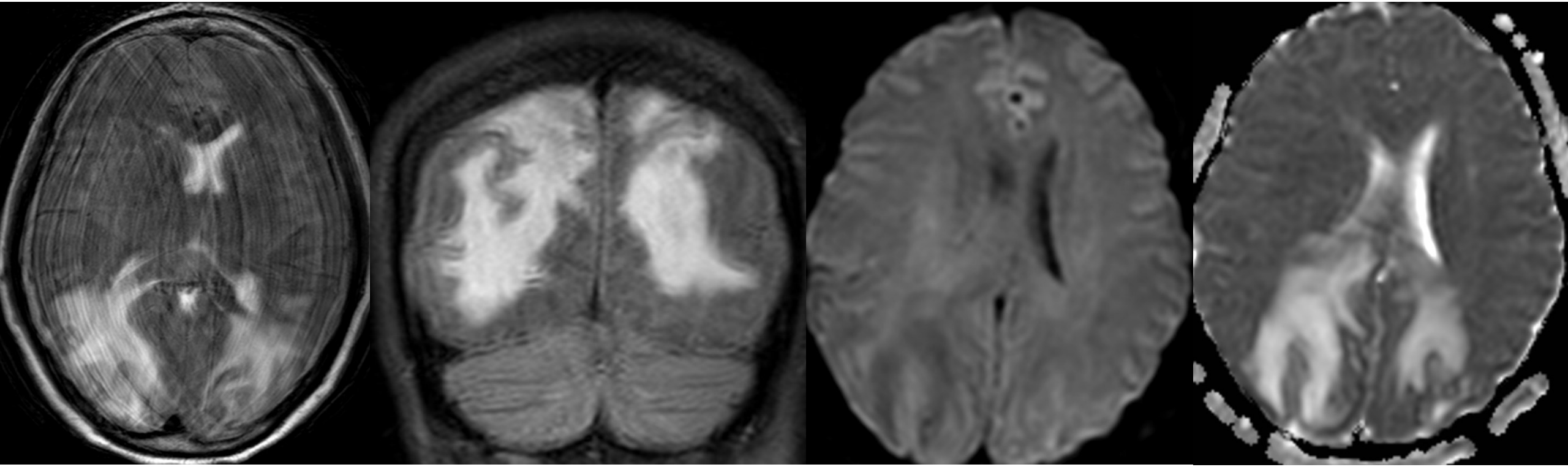
Differentials: infarct, vasculitis, inflammatory/demyelinating, adult-onset leukodystrophies

Medical history key!

Case 7: headache, confusion and seizure. PMHx: chronic illness DHx: cyclosporin.



Posterior Reversible Encephalopathy Syndrome



PRES

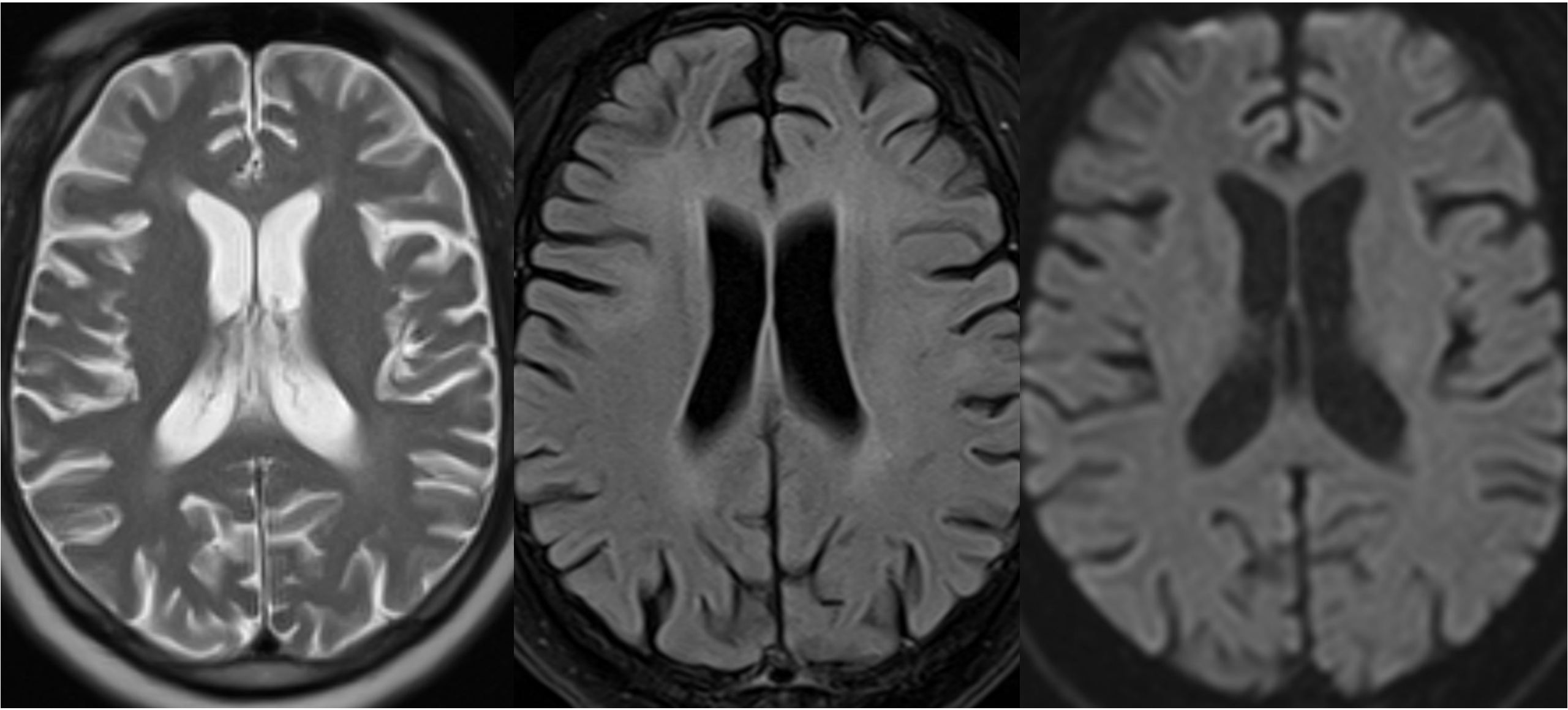
Dysregulation of cerebrovascular circulation -> vasogenic oedema

- Bilateral, cortical/subcortical
- Posterior, but CAN be frontal, watershed
- Rare: brainstem, basal ganglia, spinal cord

Number of aetiologies: marked hypertension, drugs, haemolytic uraemic syndrome, thrombocytopenic thrombotic purpura…

Imaging: T2/FLAIR hyperintense, facilitated diffusion (restriction, microbleeds and enhancement rare – consider different diagnosis)

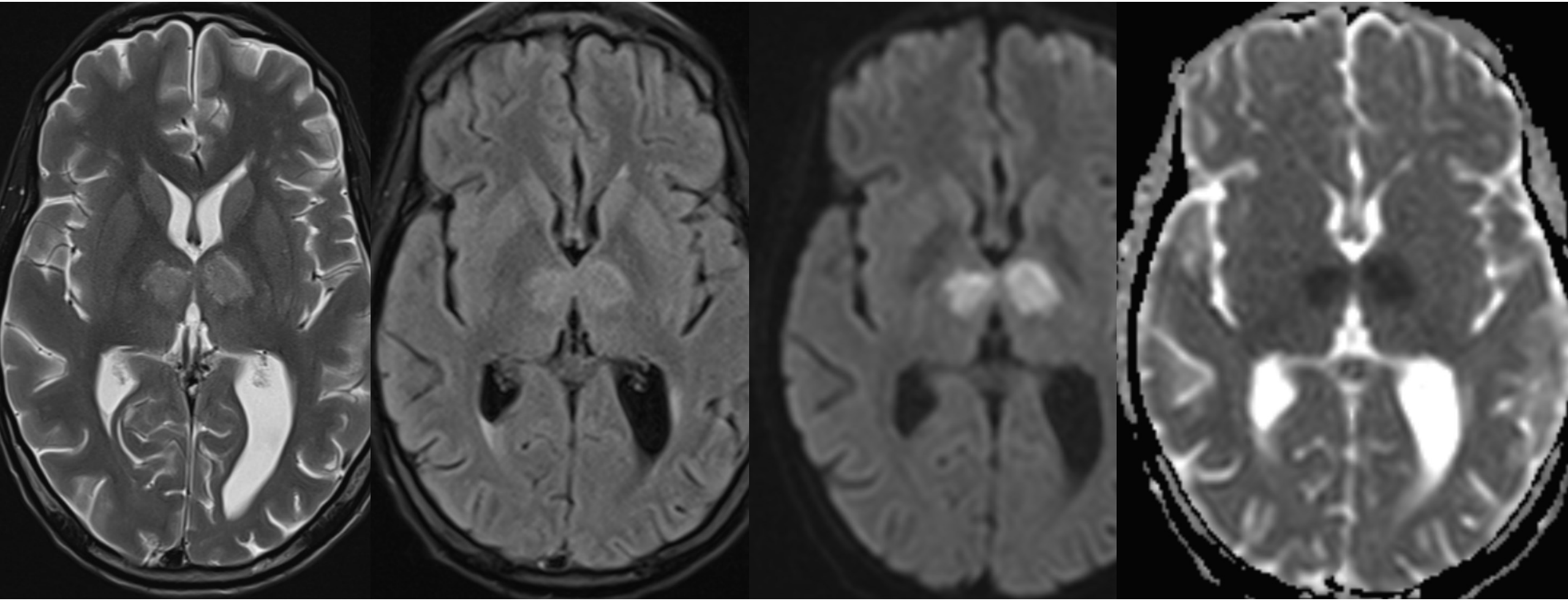
Case 8: young adult increasingly confused with ataxia.
PMHx: HIV, poorly controlled diabetes.



HIV encephalopathy

- HIV-associated neurocognitive disorders (HANDs)
  - spectrum -late stage disease (HIV-associated dementia)
- Imaging: diffuse, bilateral and symmetrical T2/FLAIR hyperintense signal change in deep white matter
  - Spares U-fibres
  - No mass effect, diffusion restriction, enhancement
- Differentials
  - HIV associated CD8+ encephalitis - enhancement, restriction
  - Arteriosclerotic small vessel disease (Binswanger) - lacunes
  - CADASIL – less symmetrical, anterior temporal and external capsule involvement
  - Leukodystrophies – restriction when acute, PMHx

Case 9: acute confusion. PMHx: RA (on methotrexate), alcohol XS, drug use, cachectic.



Wernicke’s Encephalopathy

Wernicke’s Encephalopathy

Thiamine (B1) deficiency

CT extremely subtle, if any abnormality appreciable -> MRI

T2/FLAIR signal abnormality in centrum semiovale – restriction, unilateral or bilateral

Imaging:

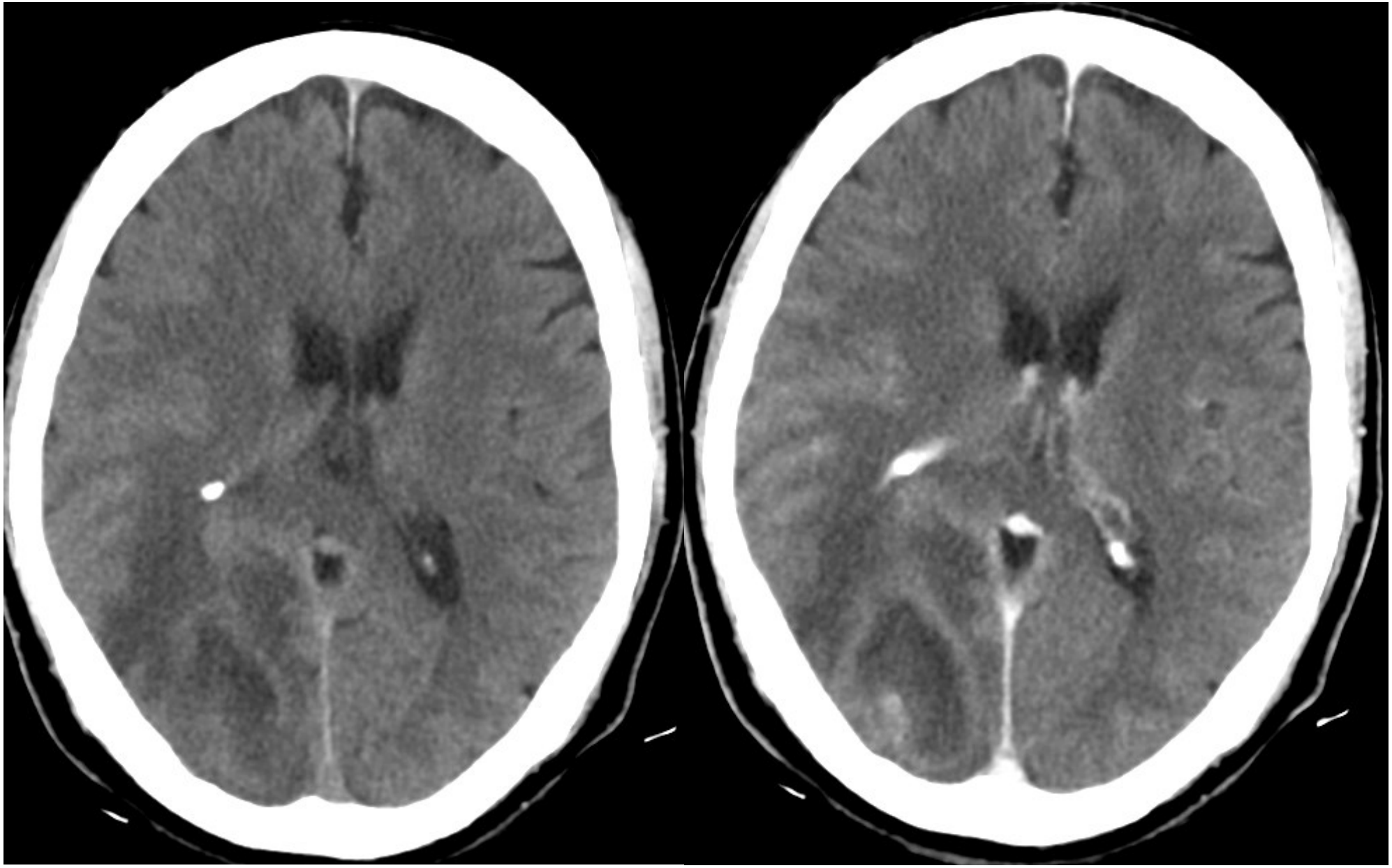
- T2/FLAIR hyperintensity in mammillary bodies, bilateral medial thalami, periaqueductal grey

- Can enhance

- Restricted diffusion

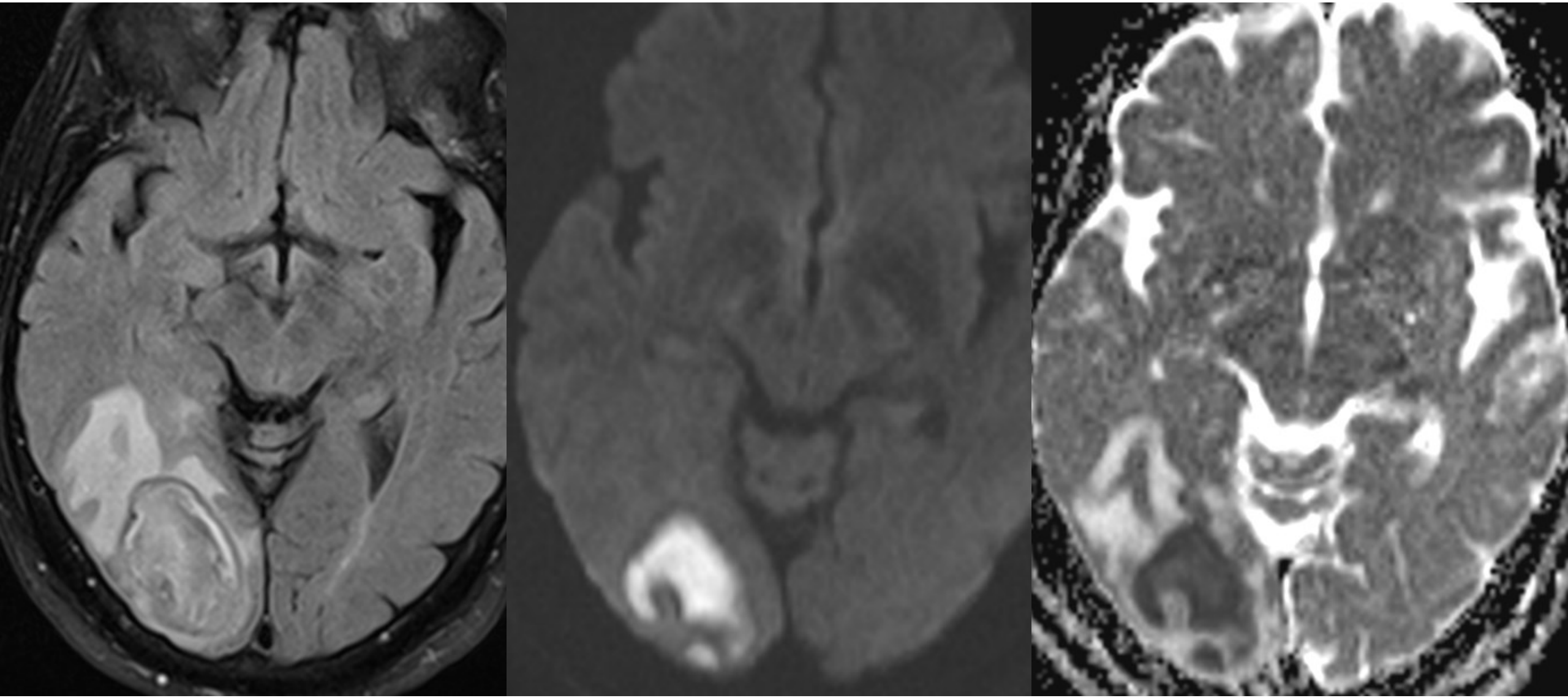
Differentials: artery of Percheron infarct, CJD

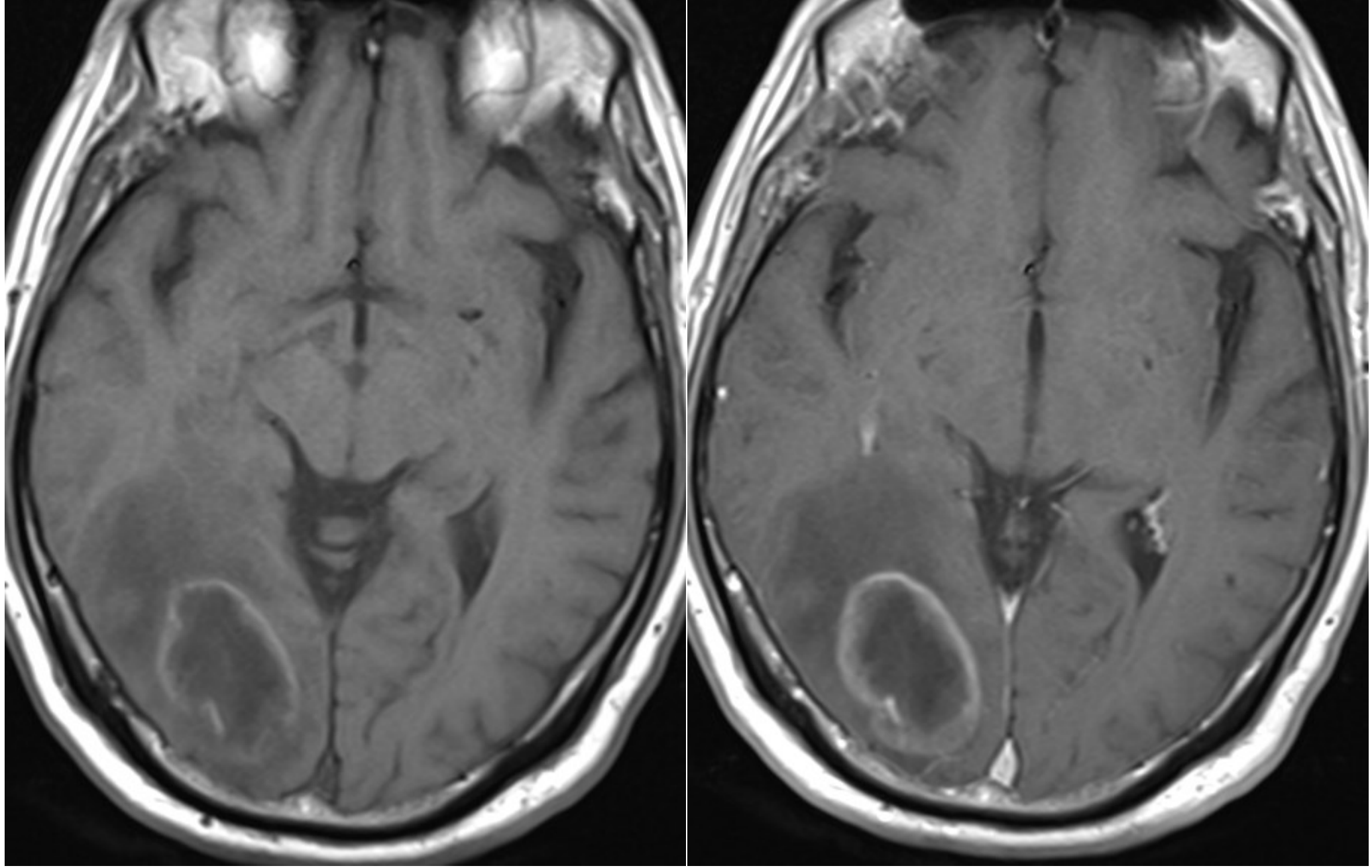
Case 10: Alcohol XS with worsening headaches and visual field defect. Recent dental work.



Unenhanced CT head

Enhanced CT head





T1W pre-contrast

T1W post-contrast

Pyogenic abscess

Cerebritis (early / late)

Abscess (early / late)

- Early cerebritis can resolve
- Late cerebritis – less well defined than abscess

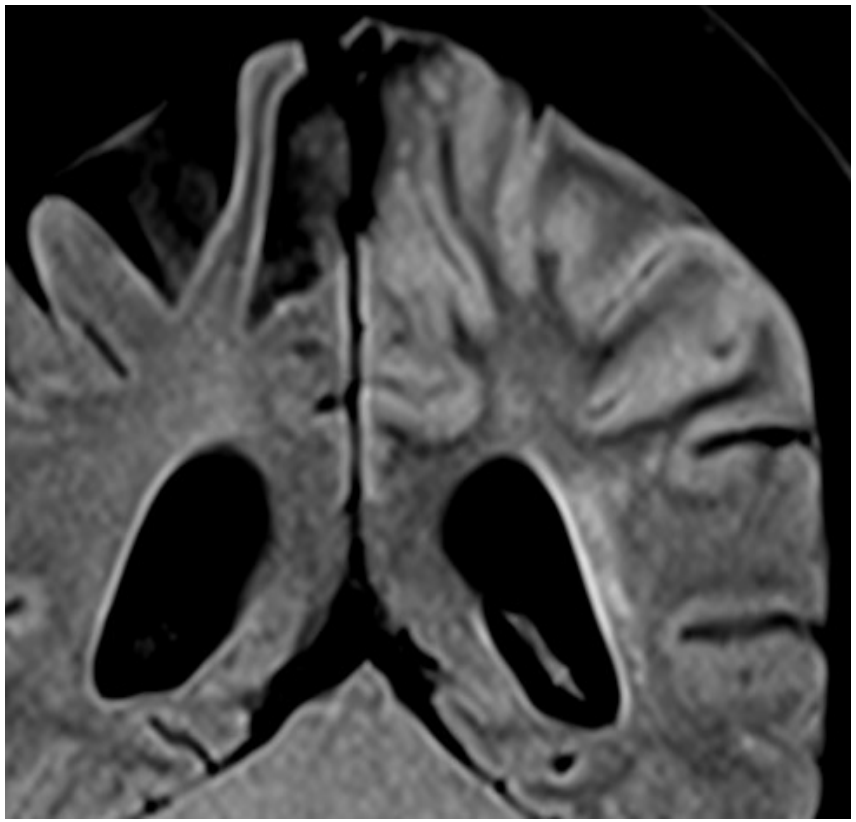
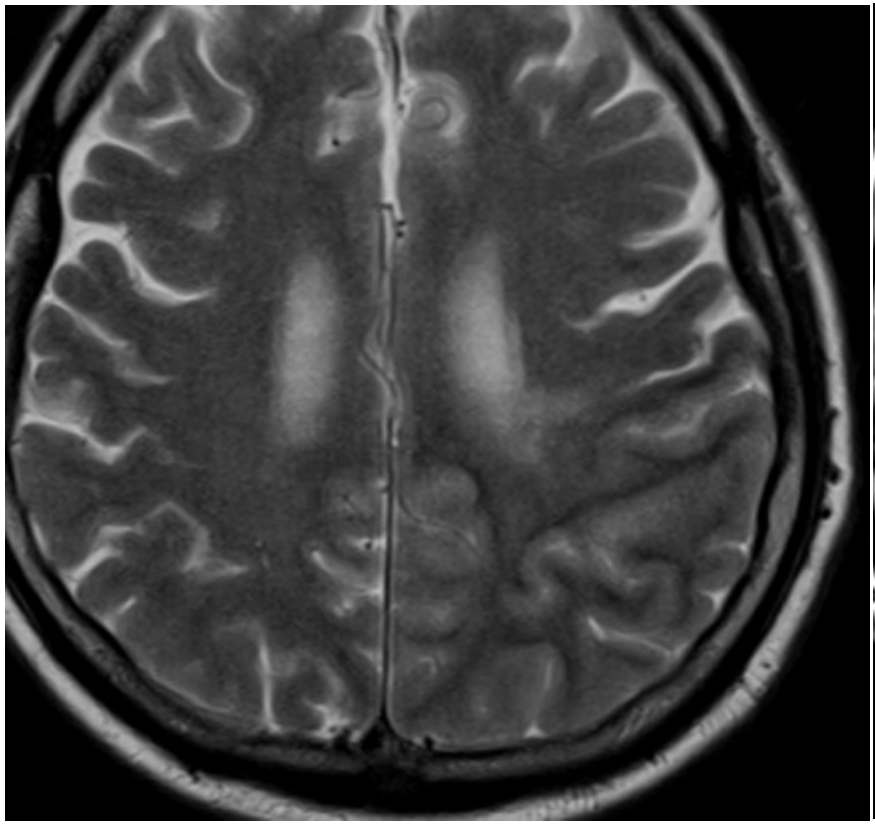
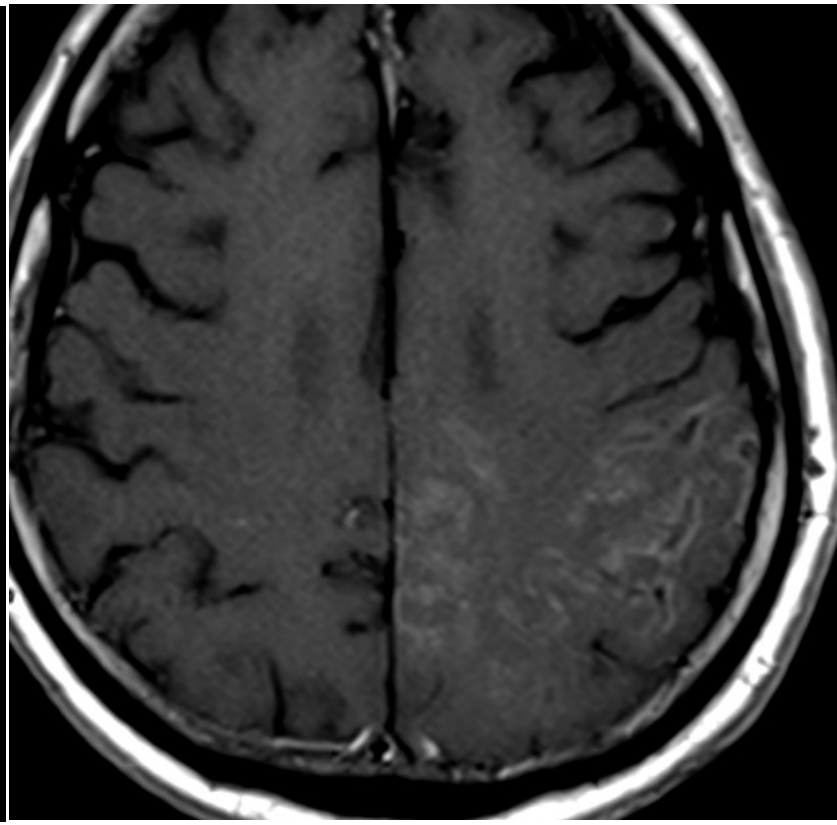
Strep infections common (group B in neonates), gram – ve in infants, listeria (pregnancy, older patients)

Imaging: T2/FLAIR hyperintense lesion/s, poorly defined with cerebritis. Well defined, peripherally enhancing mass lesion with restricted diffusion centrally once abscess.

And finally…

Glioblastoma 10 years earlier – surgery and radiotherapy. Headaches and right sided weakness.

SMART syndrome

SMART Syndrome

- **S**troke-like **M**igraine **A**ttacks following **R**adio**T**herapy
- Delayed complication: years – decades
- Presentation
  - Seizures
  - Headaches
  - Focal neurology -“stroke-like”
- Imaging appearances can lag behind clinical syndrome
  - Prominent gyral enhancement in area irradiated
- Typically resolves

Summary

- Distinguish the imaging features of common CNS emergencies in the immunocompromised patient using a case-based approach.
- Consider imaging features of treatment-related complications.

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Thank You!

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