

Radiological Diagnosis of Cerebral Air Embolism: A Rare but Critical Entity

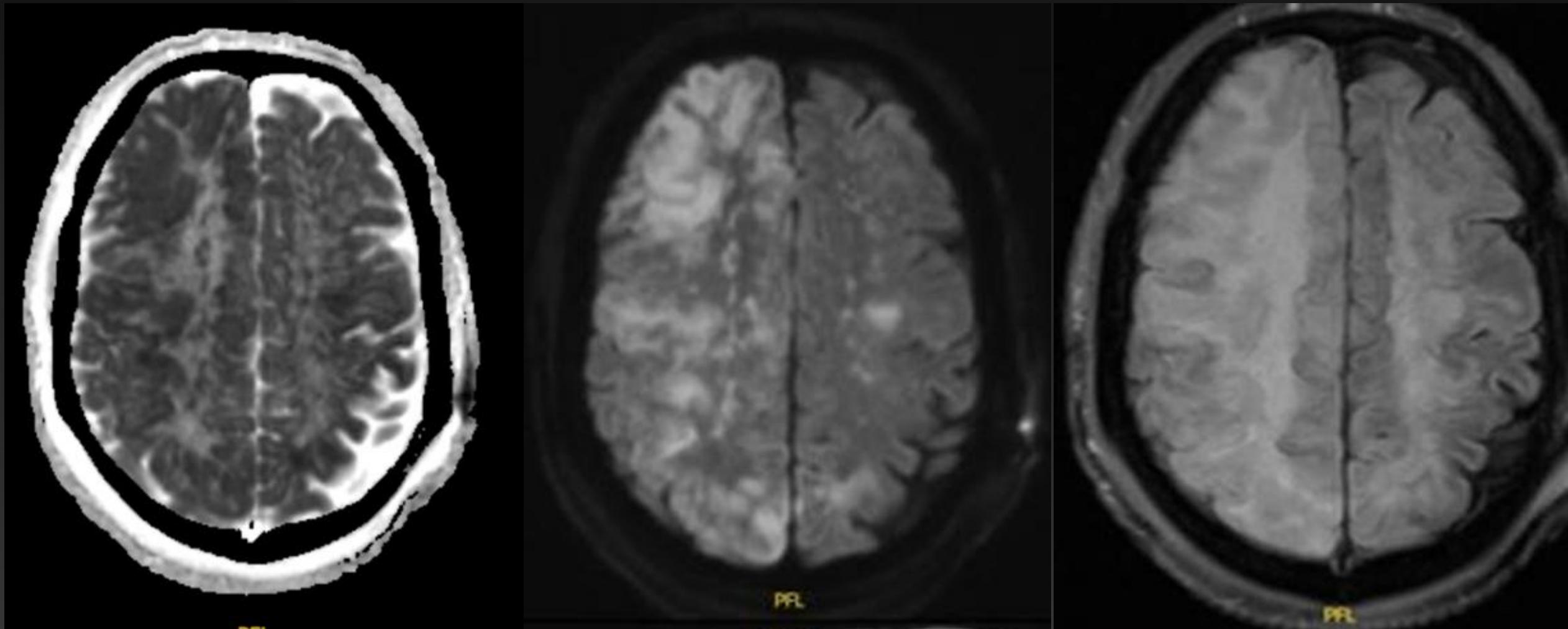


Adam Stroh, DO

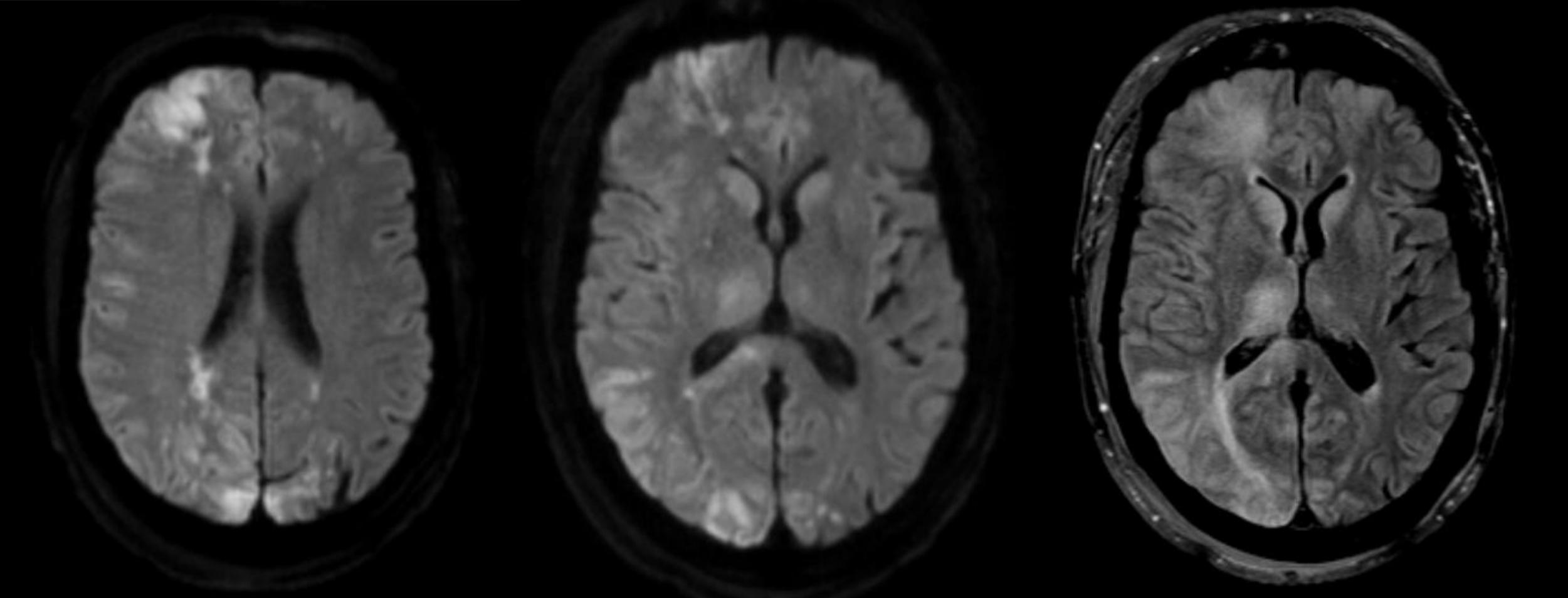
Neuroradiology Fellow, PGY6

University of Texas at Houston
Texas Medical Center

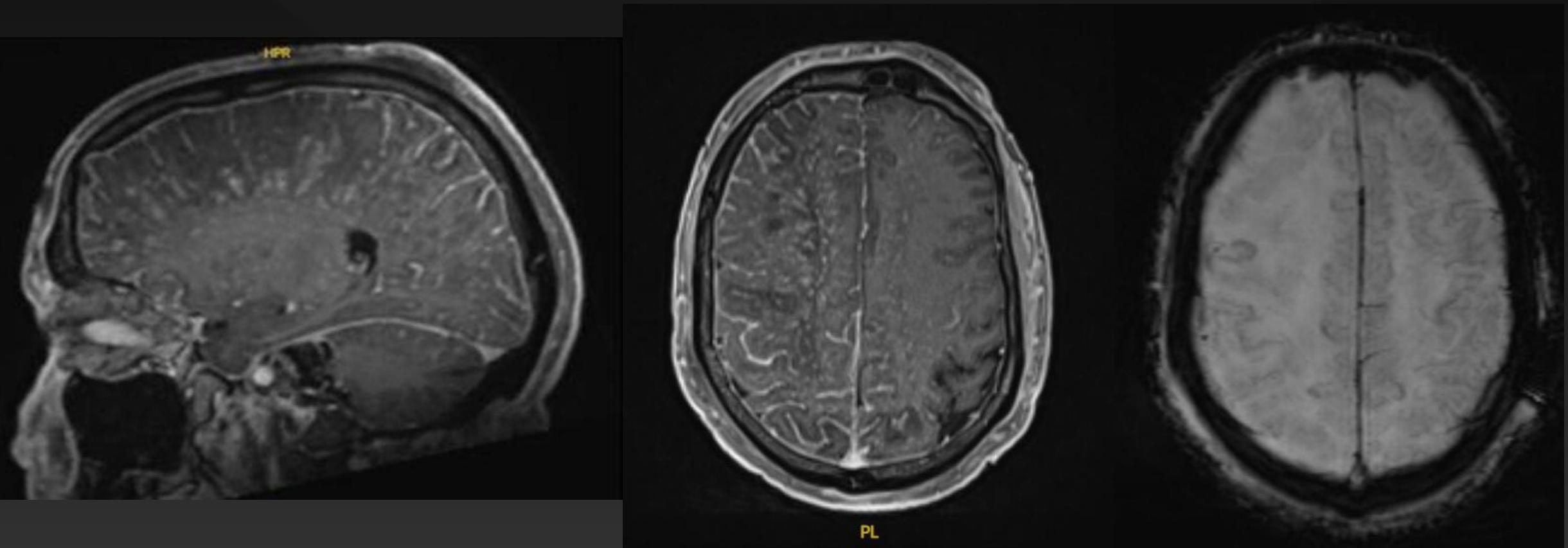
Case 1: 70 year-old male with history of AML. S/p ground-level fall and found to have pneumomediastinum. The following morning had abrupt onset encephalopathy, respiratory distress, hypoxia and fever.



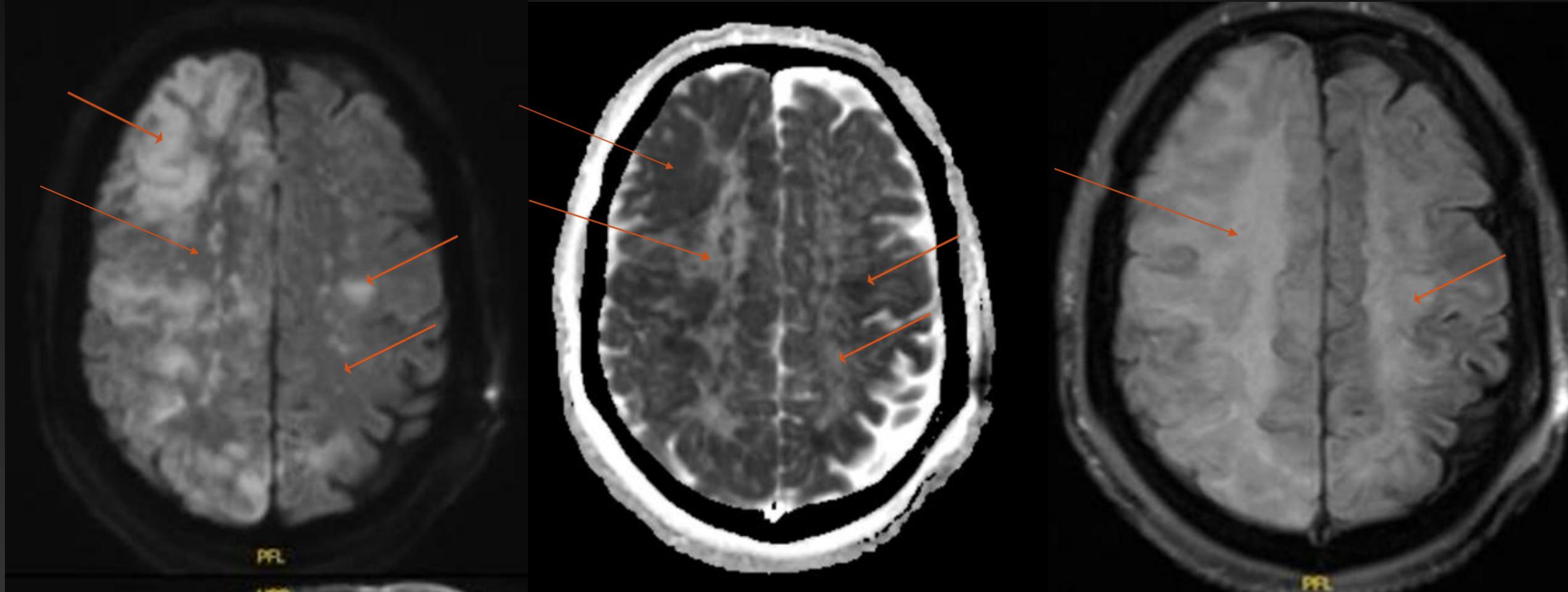
Case 1: 70 year-old male with history of AML. S/p ground-level fall and found to have pneumomediastinum. The following morning had abrupt onset encephalopathy, respiratory distress, hypoxia and fever.



Case 1: 70 year-old male with history of AML. S/p ground-level fall and found to have pneumomediastinum. The following morning had abrupt onset encephalopathy, respiratory distress, hypoxia and fever.

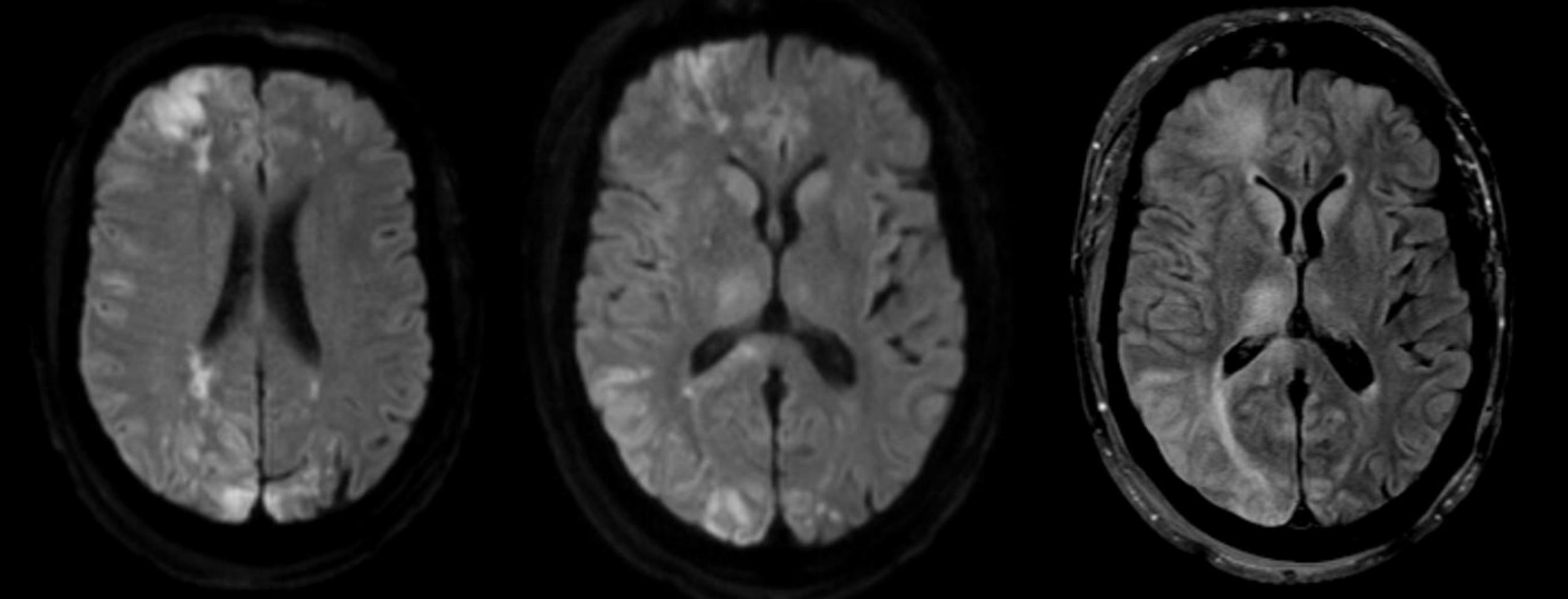


Imaging Findings



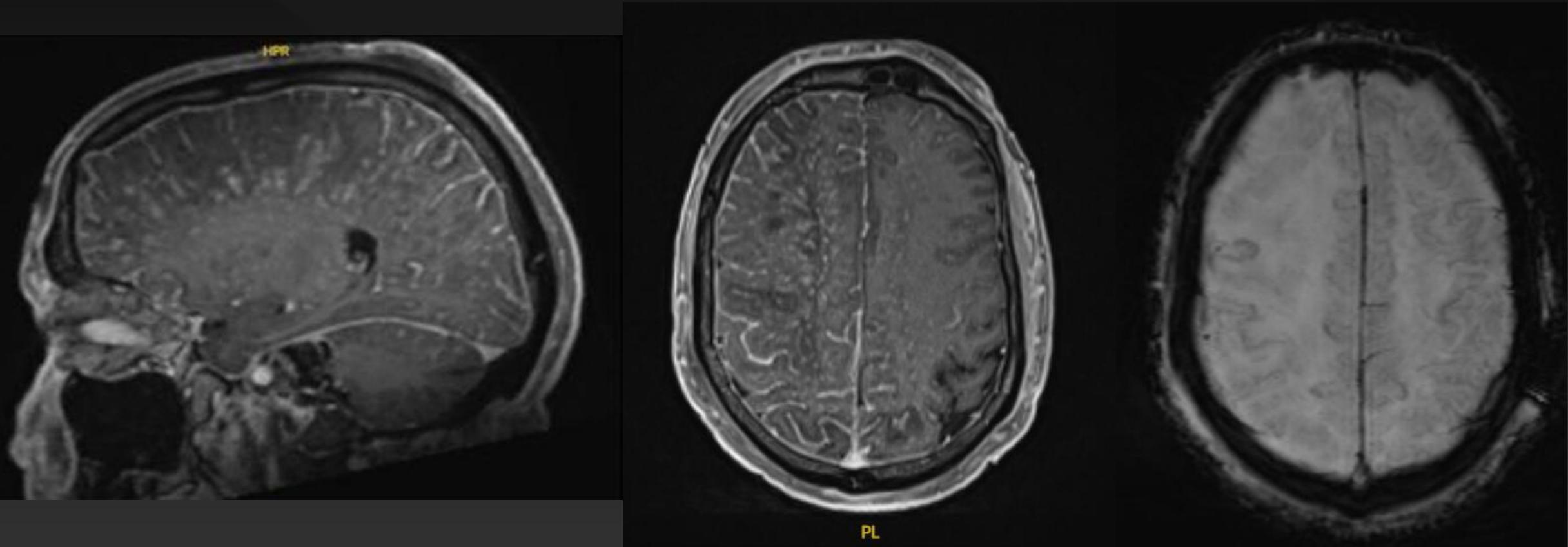
Multifocal mixed cytotoxic and vasogenic edema, predominant distal vascular bed/watershed distribution

Imaging Findings



Additional images showing the extent of involvement; R>L anterior and posterior circulation involvement with watershed predominance.

Imaging Findings



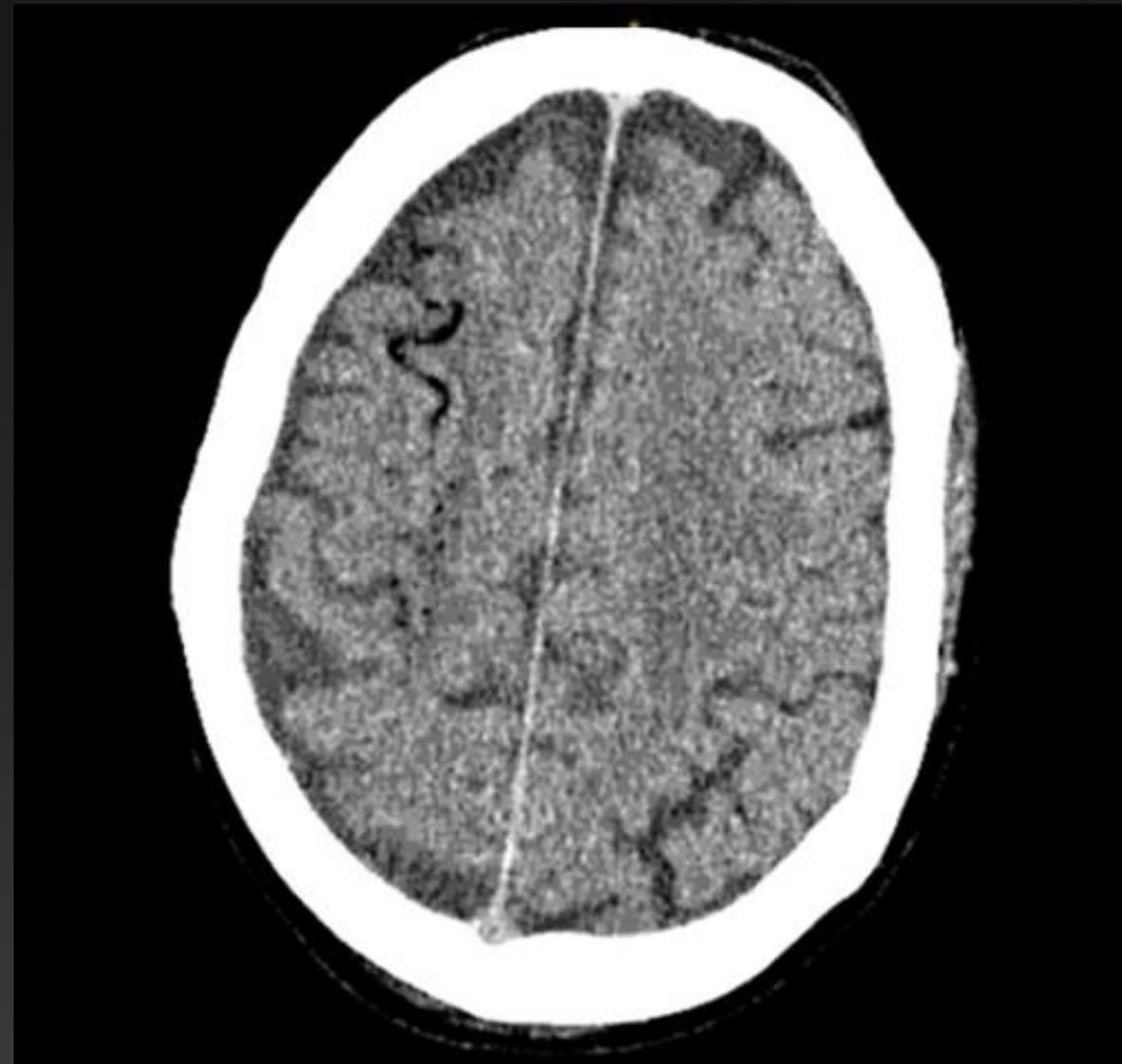
Extensive perivascular and leptomeningeal enhancement. No hemorrhage on SWI.

Differential Diagnosis

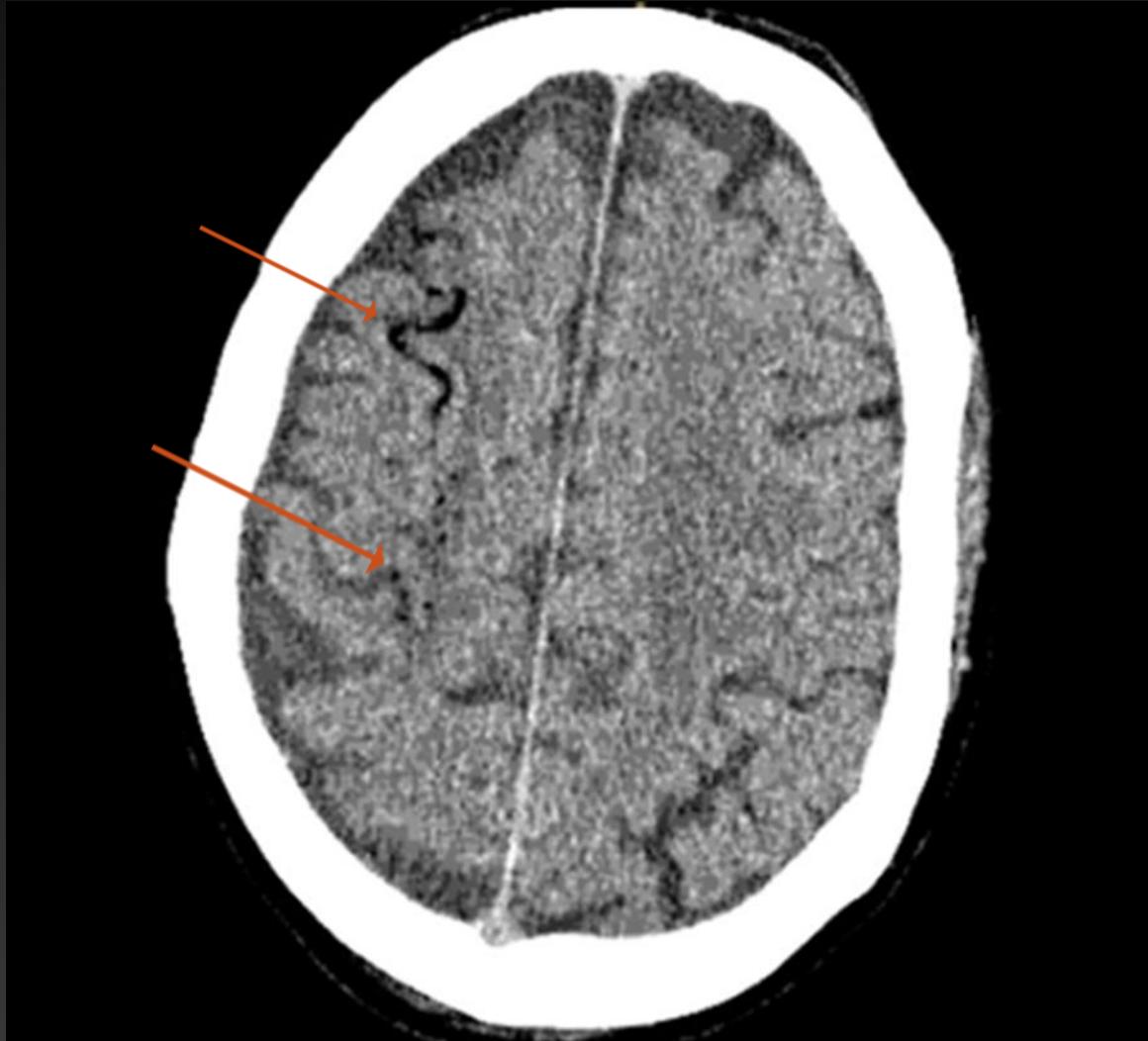


- Cerebral air emboli
- Cerebral fat emboli
- Vasculitis
- Bland thromboembolic infarcts
- Infectious meningoencephalitis

CT head the prior day



Diagnosis: Cerebral Air Embolism



CT shows extra-axial intravascular air along sulci in the superior right frontal lobe extending to the paracentral lobule.

Cerebral Air Embolism



- Cerebral air embolic ischemic infarcts are rare, yet potentially catastrophic events. The air may enter via the arterial or venous route.
- Etiologies:
 - Iatrogenic (most often): invasive procedures (i.e. central venous catheter manipulation, intravascular injection, endovascular procedures, surgeries)
 - Non-iatrogenic: trauma or decompression sickness.
- Imaging: Distal border-zone predominant pattern of mixed cytotoxic and vasogenic edema along with leptomeningeal and perivascular enhancement.
 - Of note, the finding of enhancement in the acute phase is a relatively underrecognized/underreported feature, only recently brought to attention in a case series published in AJNR in August 2024.
 - Leptomeningeal enhancement is not an expected imaging feature in acute infarcts, suggesting that leptomeningeal enhancement on MR imaging in the acute phase may be a characteristic imaging feature of air embolism.
 - While CT may directly show the extra axial air, it is not a reliable/sensitive finding given the rapidity at which it may be resorbed (in this case, there was resolution of air on CT the following day).

Cerebral Air Embolism



- Pathophysiology: Three main mechanisms account for the MR imaging manifestations.
 - 1.) Direct ischemia from end artery occlusion by the gas emboli=cytotoxic edema.
 - 2.) Inflammation and blood-brain-barrier breakdown resulting from a gas-bubble related foreign body reaction= enhancement
 - 3.) Elevated venous pressure promoting vasogenic edema and potentially venous infarctions.
- Clinical:
 - Patients often present with nonspecific encephalopathic symptoms with a temporal relation to a recent air embolic–inducing event .
 - Treatment includes hyperbaric oxygen therapy (if appropriate) and 100% FiO₂.

Re: Differential Diagnosis



- Cerebral air emboli-In this particular case was pathognomonic given the air on CT
- Cerebral fat emboli
- Vasculitis
- Bland thromboembolic infarcts
- Infectious meningoencephalitis

Reference



- [Characteristic MR Imaging Findings of Cerebral Air Embolism Infarcts: A Case Series | American Journal of Neuroradiology](#)

