

AMSER Case of the Month

June 2026

52-year-old female with left-sided facial droop and
dizziness

KING'S
College
LONDON

Omar Ba-Abbad MSc, MS4, King's College London

Dr. Thomas Dang DO, Cleveland Clinic

Dr. Deborah Brahee MD, Cleveland Clinic



Patient Presentation

- 52-year-old female with no significant medical history presented to the ED with acute onset left-sided facial droop and dizziness
- Physical exam revealed decorticate posturing of the left arm and diaphoresis, she was unable to follow commands
- Patient became agitated with altered mental status, preventing neurological examination and further clinical history
- Vitals
 - Pulse 43
 - BP 133/119
 - SpO2 100% on RA

Pertinent Labs

Key positives

- Na^+ 132 mmol/L
- Hb 11.1 g/dL
- Hct 34.1%
- HCO_3^- 20 mmol/L / CO_2 20 mmol/L
low bicarbonate
- pCO_2 33 mmHg

Other investigations

- EKG showed sinus bradycardia
excluding a cardiogenic cause

Key negatives

- No severe electrolyte derangement
- No metabolic abnormality
- Platelet count normal
- No coagulopathy

What Imaging Should We Order?

ACR Appropriateness Criteria

Variant: 2 Adult. Focal neurologic deficit. Clinically suspected acute ischemic stroke. Initial imaging.

Procedure	Appropriateness Category	Relative Radiation Level
MRI head without IV contrast	Usually Appropriate	○
CT head without IV contrast	Usually Appropriate	☼☼☼
CTA head with IV contrast	Usually Appropriate	☼☼☼
CTA neck with IV contrast	Usually Appropriate	☼☼☼
US duplex Doppler carotid artery	May Be Appropriate	○
MRA head without IV contrast	May Be Appropriate	○
MRA neck without and with IV contrast	May Be Appropriate	○
MRA neck without IV contrast	May Be Appropriate	○
MRI head perfusion with IV contrast	May Be Appropriate	○
CT head perfusion with IV contrast	May Be Appropriate	☼☼☼
US duplex Doppler transcranial	Usually Not Appropriate	○
Arteriography cervicocerebral	Usually Not Appropriate	☼☼☼
MRA head without and with IV contrast	Usually Not Appropriate	○
MRI head without and with IV contrast	Usually Not Appropriate	○
MRV head without and with IV contrast	Usually Not Appropriate	○
MRV head without IV contrast	Usually Not Appropriate	○
CT head with IV contrast	Usually Not Appropriate	☼☼☼
CT head without and with IV contrast	Usually Not Appropriate	☼☼☼
CTV head with IV contrast	Usually Not Appropriate	☼☼☼

These imaging modalities were ordered by the ED physician.

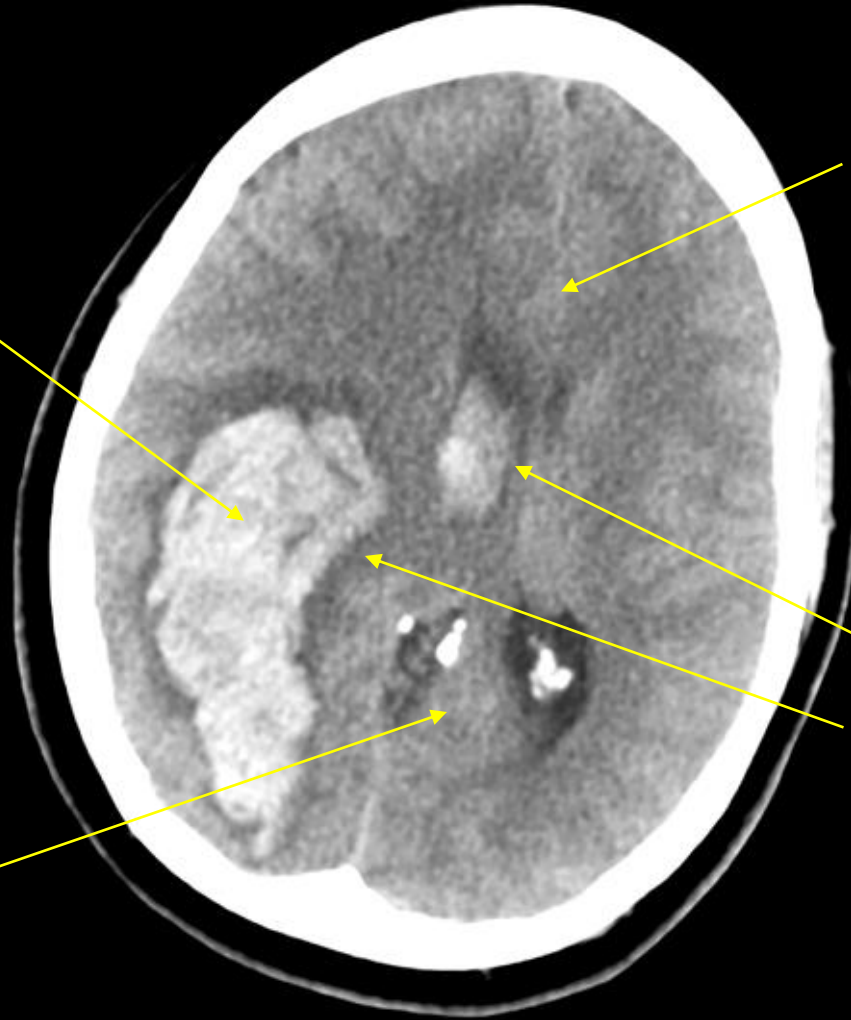
CT Head W/O IV Contrast Findings (unlabeled)



CT Head W/O IV Contrast Findings (labeled)

Right parieto-occipital **intraparenchymal hemorrhage** measuring approximately 90 x 40 x 65 mm

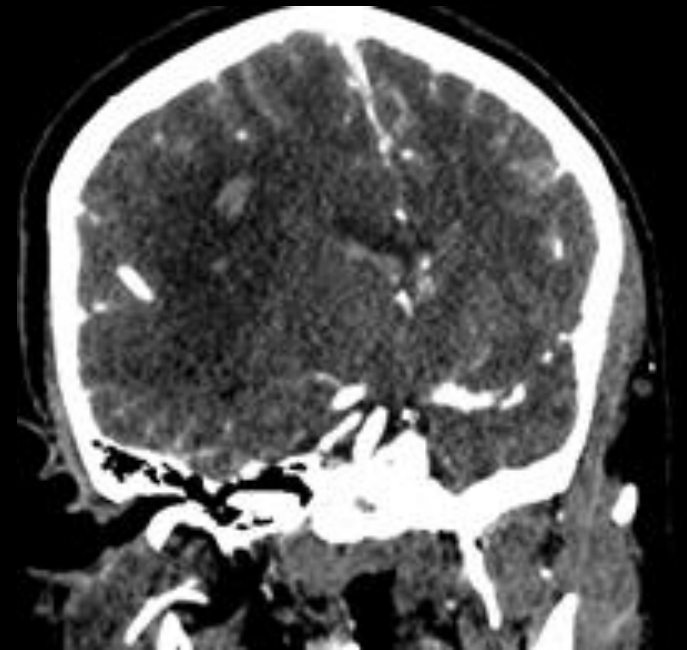
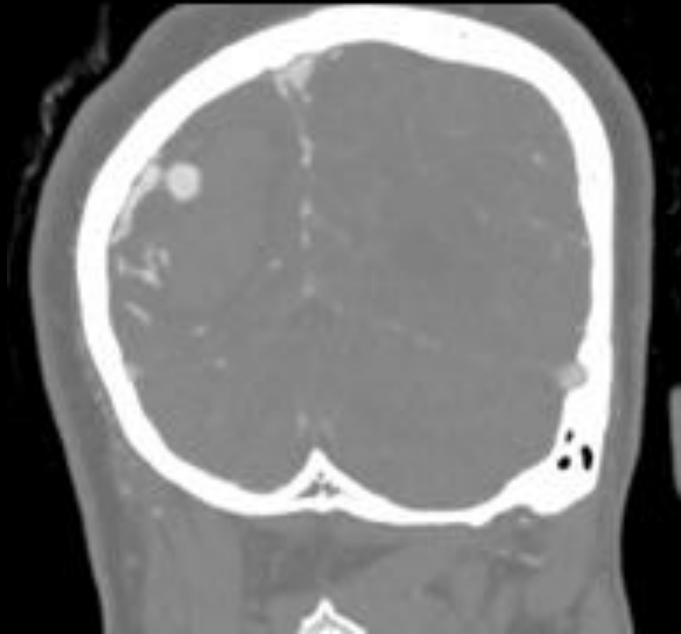
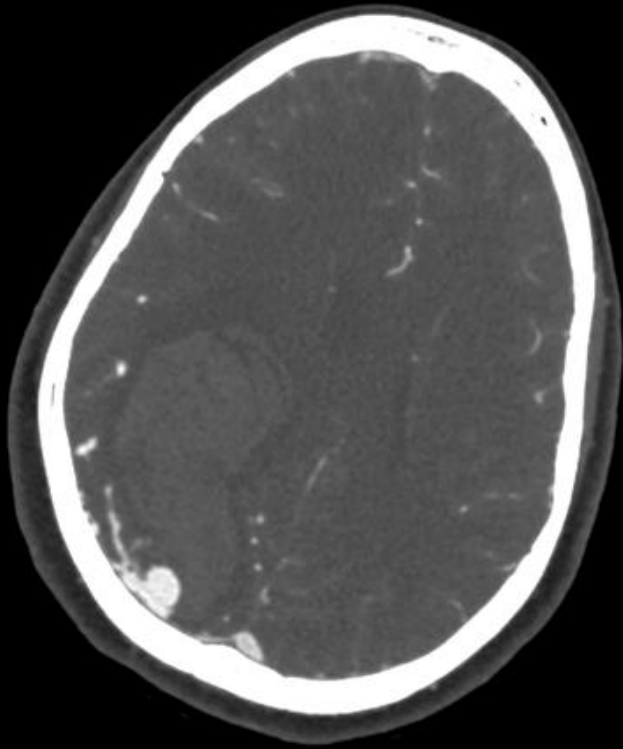
Asymmetric enlargement of **left occipital horn** may reflect **ventricular entrapment**



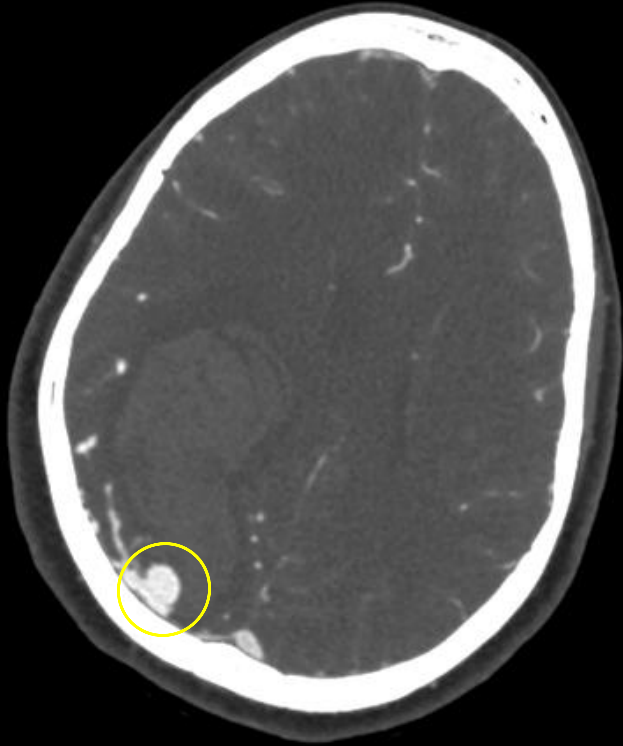
Mass effect results in **13 mm** right to left **midline shift** concerning for subfalcine herniation

Extension into right lateral ventricle with surrounding **hypodensity** consistent with **vasogenic edema**

CTA Head W/ IV Contrast Findings (unlabeled)



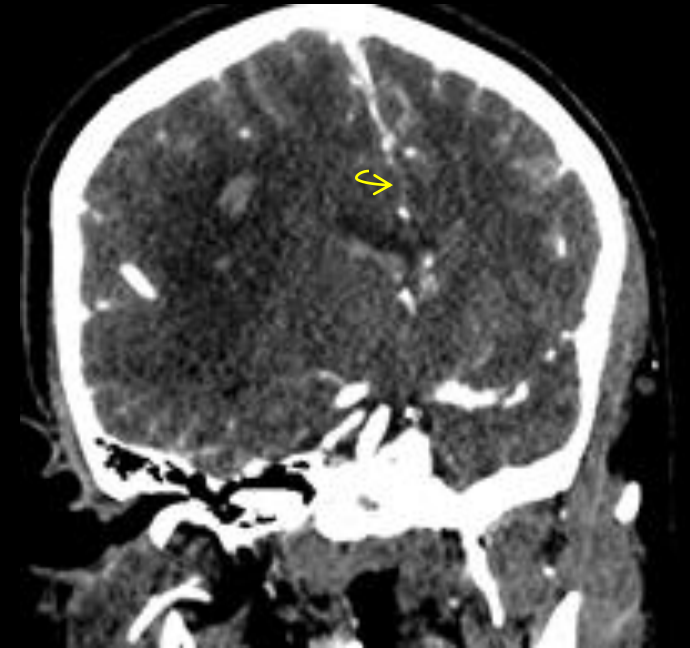
CTA Head W/ IV Contrast Findings (labeled)



Right occipital **arteriovenous malformation** (AVM) measuring **38 mm** in diameter

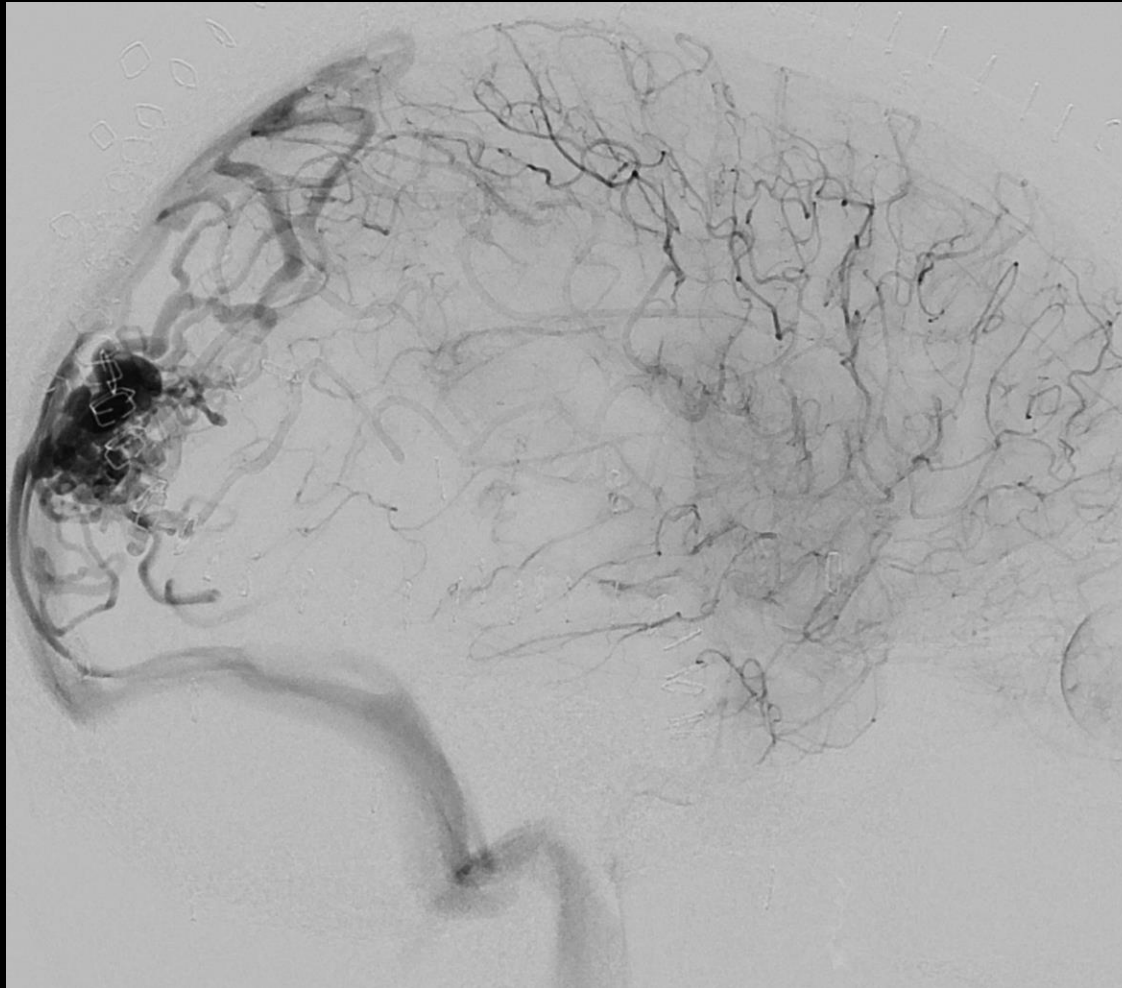


Feeding arteries from the **M3/M4** segments of **right MCA** and **P3/P4** segments of **right PCA**



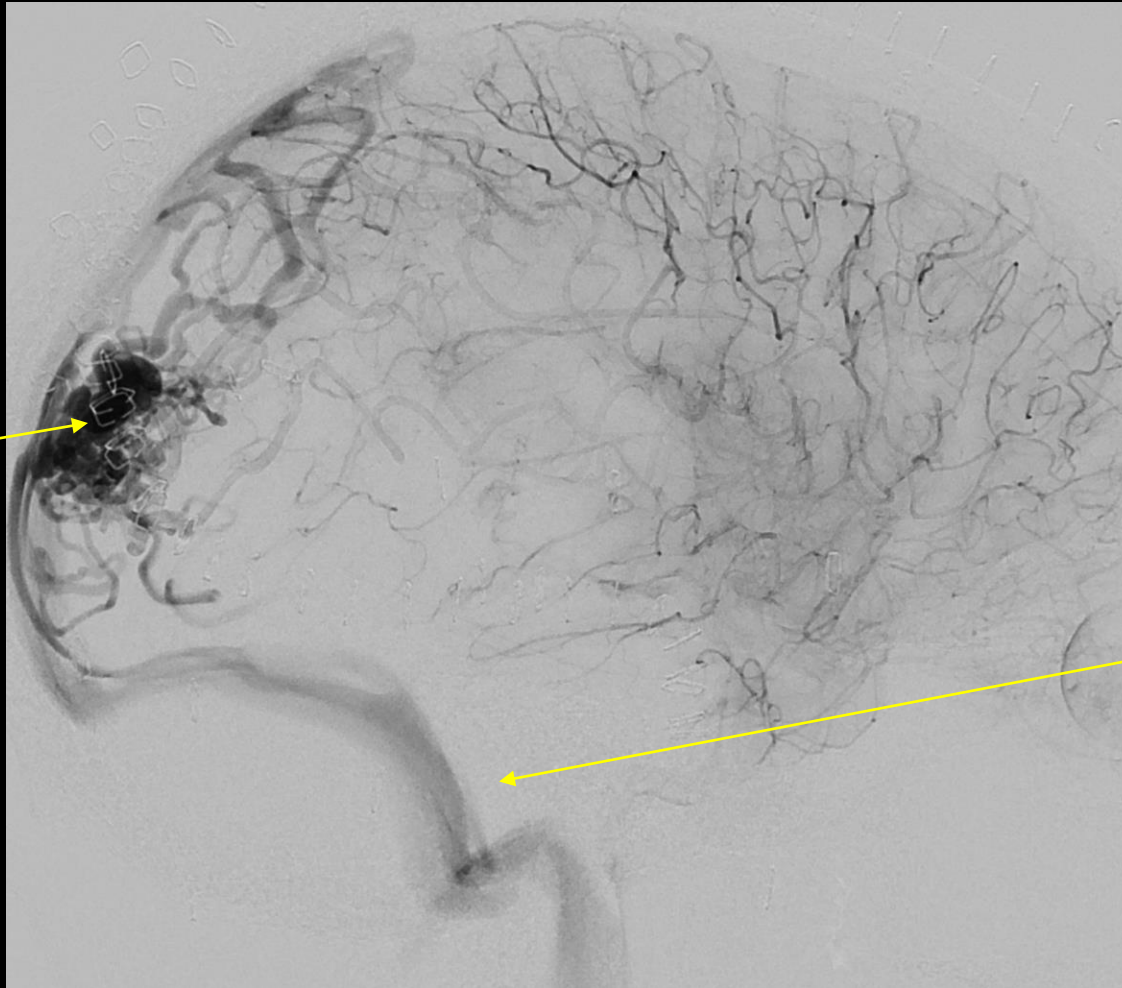
Subfalcine hernia in coronal view demonstrating **downward displacement** of **cingulate gyrus** under **falx cerebri**

Digital Subtraction Angiography (unlabeled)



Digital Subtraction Angiography (labeled)

AVM Nidus



Lateral right ICA DSA
demonstrates early cortical
venous drainage during
arterial phase

Final Dx:

Intraparenchymal hemorrhage secondary to
ruptured arteriovenous malformation

Case Discussion

- Abnormal tangles of **dysplastic blood vessels** that form direct connections between cerebral arteries and veins, with a prevalence rate of **10-18 per 100,000** adults (95% CI, 0.010–0.018) [2]
- Without an intervening capillary bed, this creates a high-flow, low-resistance **AV shunt** which is prone to rupture
- Once considered congenital, several theories have been proposed in the literature regarding their etiology including:
 - Somatic KRAS and RASA1 mutations [3]
 - Association with Hereditary Hemorrhagic Telangiectasia [2]
 - De novo formation arising from **multi-factorial processes** [4]
- **Hemorrhage** is the most common presenting symptom following rupture (~58% of symptomatic cases) with ICH being the most frequent subtype, followed by seizures (20-34%) and headaches (~15%)
- Focal neurological deficits are rarer and may be a consequence of the complications of ruptured AVMs [1,5]

Case Discussion

Figure 1: Spetzler-Martin Grading Scale for Arteriovenous Malformations of the Brain [1]

Feature	Criteria	Scoring	Our Case
Size	< 30 mm	1	2 (38 mm)
	30-60 mm	2	
	> 60 mm	3	
Eloquent Cortex	No	0	1 (Visual cortex)
	Yes	1	
Venous Drainage	Superficial	0	0 (Superficial only)
	Deep	1	
Total Score:			<u>3</u>

Spetzler Martin Grading System

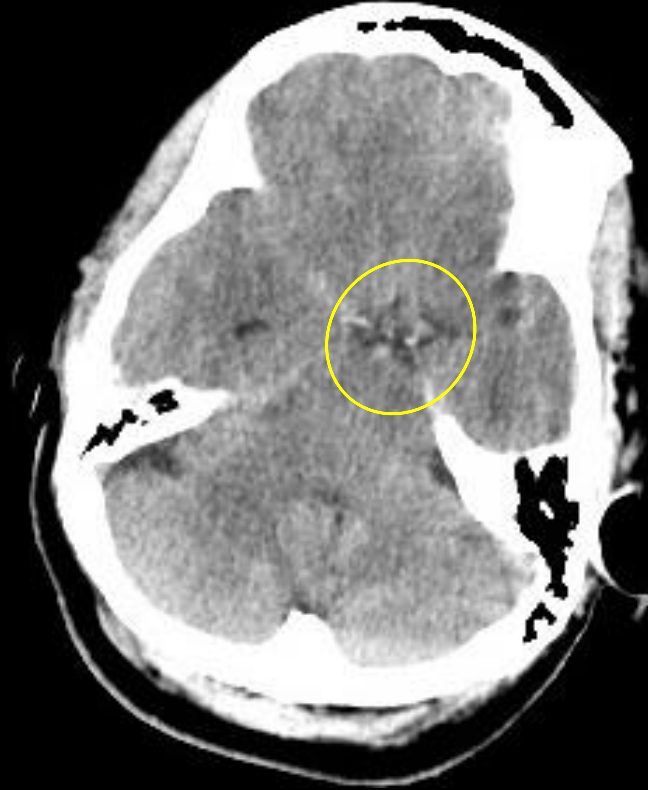
- Used to predict surgical risk and guide management strategy
- Assigns points based on 3 anatomical features:
 - Size
 - Eloquent cortex
 - Venous drainage

Our patient had a ruptured **Spetzler-Martin Grade III AVM** requiring urgent **multimodal management**

Case Discussion



Diffuse sulcal effacement and global loss of CSF spaces



Encroachment of suprasellar cistern is a sign of early descending transtentorial herniation (TTH) [6]

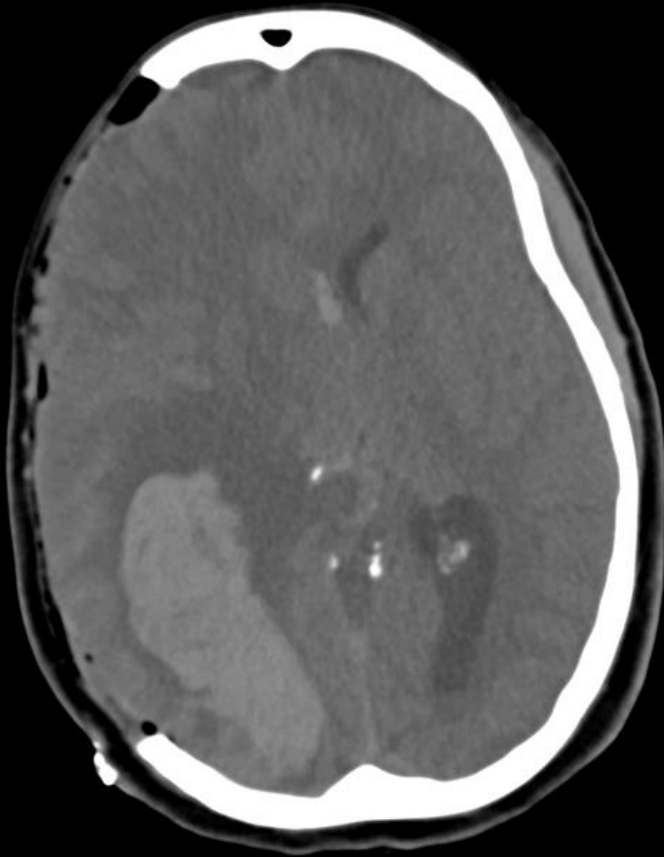
Figure 2: Non-contrast CT head at level of pons (not seen in our patient)



Flame-like hyperdensity in the anteromedial upper pons represents Duret hemorrhage, a critical complication of descending TTH [7]

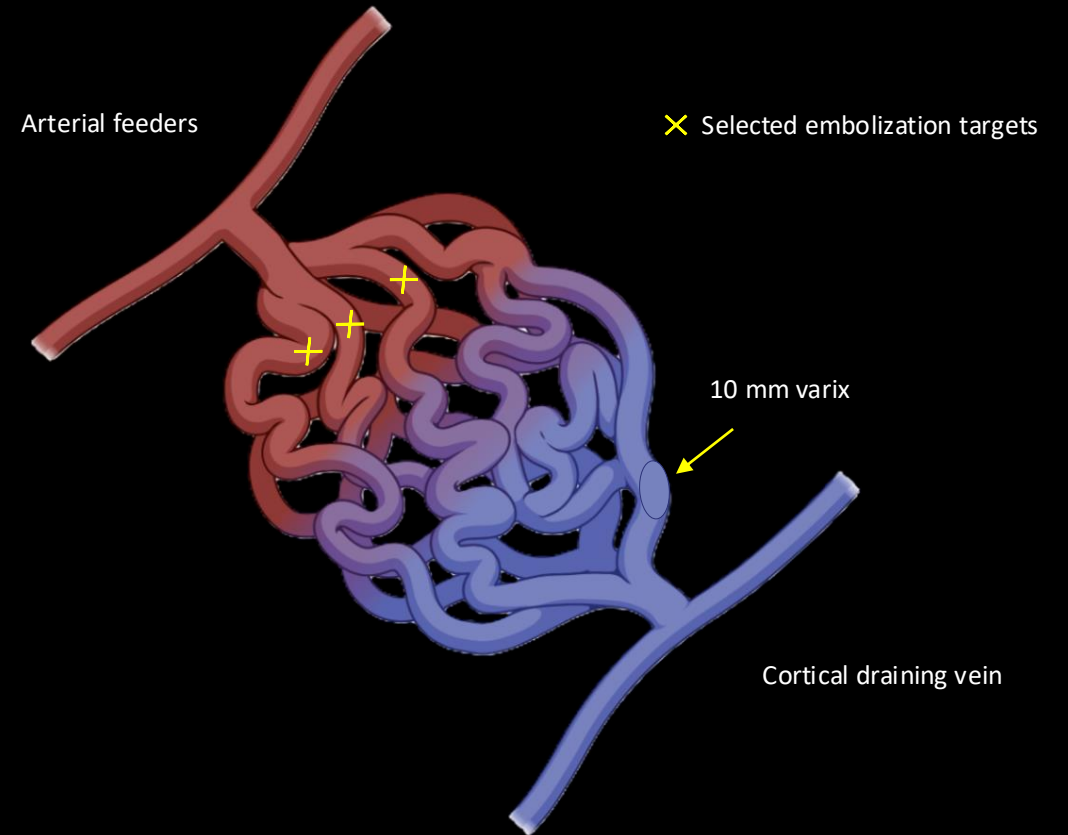
Case Discussion

Post-operative non-contrast head CT



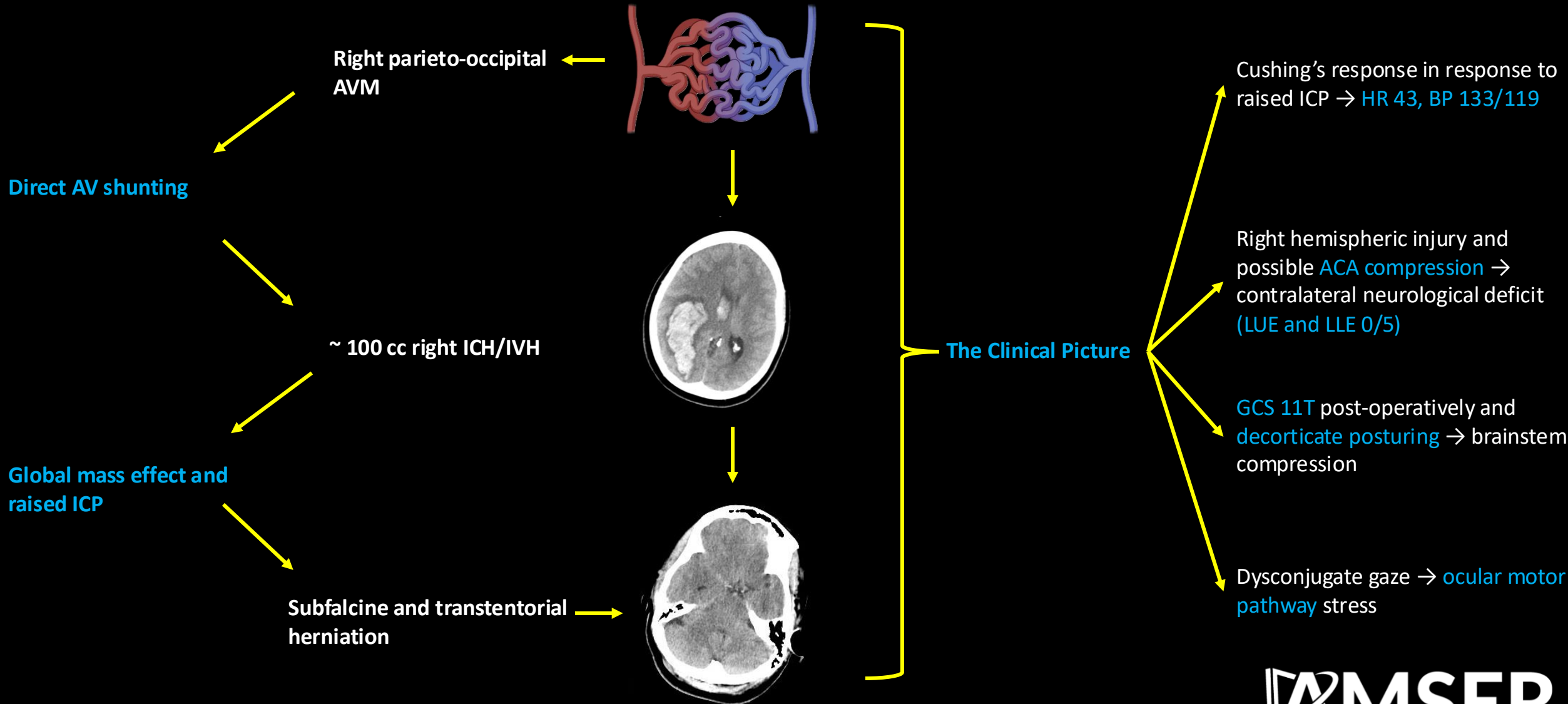
Right decompressive hemicraniectomy with durotomy to relieve raised ICP

Figure 3: Zoomed schematic of AVM nidus



Onyx 34 embolization performed of PCA pedicles with resultant reduction of AV shunting

Case Discussion



Take-Home Points for the Radiologist

- **Intracranial hemorrhage** in a younger patient should alert suspicion for a vascular etiology
- Integrate assessing for **downstream consequences** of primary pathology into **search patterns** (e.g. Duret hemorrhages once transtentorial hernia identified)
- Correlate imaging with patient presentation, recognizing that the clinical picture can show the **combined effect of multiple overlapping syndromes** in neurological injury

References

- [1] Solomon RA, Connolly ES. Arteriovenous Malformations of the Brain. Ropper AH, ed. *New England Journal of Medicine*. 2017;376(19):1859-1866. doi:<https://doi.org/10.1056/nejmra1607407>
- [2] Derdeyn CP, Zipfel GJ, Albuquerque FC, et al. Management of Brain Arteriovenous Malformations: A Scientific Statement for Healthcare Professionals From the American Heart Association/American Stroke Association. *Stroke*. 2017;48(8). doi:<https://doi.org/10.1161/str.000000000000134>
- [3] Nikolaev SI, Vetiska S, Bonilla X, et al. Somatic Activating KRAS Mutations in Arteriovenous Malformations of the Brain. *New England Journal of Medicine*. 2018;378(3):250-261. doi:<https://doi.org/10.1056/nejmoa1709449>
- [4] Nagai Y, Anan M, Fujiki M. Cerebral Arteriovenous Malformations as Acquired Lesions: Case Reports and Review of the Literature. *Journal of Stroke and Cerebrovascular Diseases*. 2020;29(10):105157. doi:<https://doi.org/10.1016/j.jstrokecerebrovasdis.2020.105157>
- [5] Ogilvy CS, Stieg PE, Awad I, et al. Recommendations for the Management of Intracranial Arteriovenous Malformations. *Circulation*. 2001;103(21):2644-2657. doi:<https://doi.org/10.1161/01.cir.103.21.2644>
- [6] Riveros Gilardi B, Muñoz López JI, Hernández Villegas AC, et al. Types of Cerebral Herniation and Their Imaging Features. *RadioGraphics*. 2019;39(6):1598-1610. doi:<https://doi.org/10.1148/rg.2019190018>
- [7] Beucler N, Pierre-Julien Cungi, Amaud Dagain. Duret Brainstem Hemorrhage After Transtentorial Descending Brain Herniation: A Systematic Review and Meta-Analysis. *World Neurosurgery*. 2023;173(173):251-262.e4. doi:<https://doi.org/10.1016/j.wneu.2023.02.110>

Figure 3 adapted from BioRender.com