ARTERIOVENOUS MALFORMATION OR DURAL ARTERIOVENOUS FISTULA?

An incidental posterior fossa vascular malformation

Emily Ploom, MD, Banner University Medical Center-Tucson

Cameron Henry, MD, Vanderbilt University Medical Center

THE SOUTHEASTERN NEURORADIOLOGICAL SOCIETY 50th ANNUAL MEETING

AN UNEXPECTED POSTERIOR FOSSA FINDING

40-year-old woman

Unwitnessed fall followed by a first ever generalized tonic-clonic seizure

History of alcohol use disorder and cirrhosis

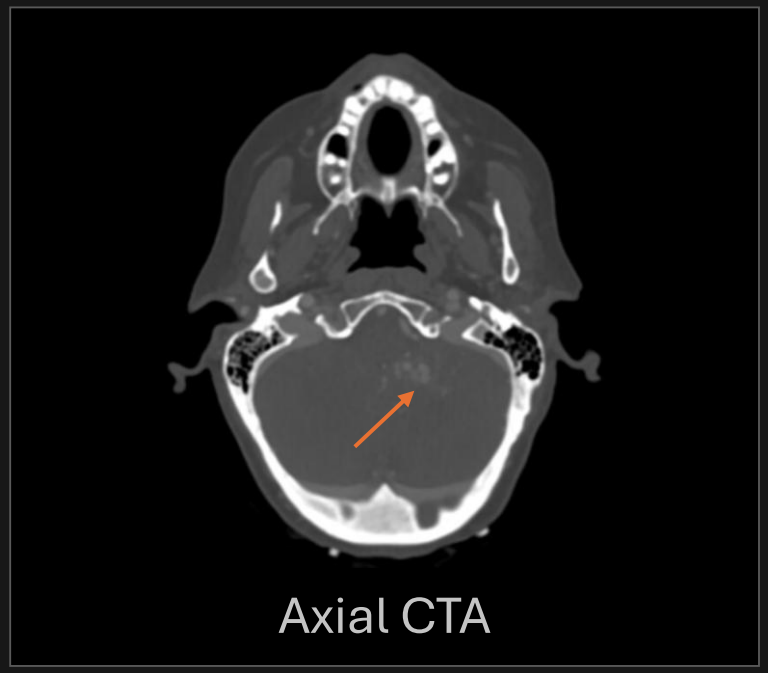
Non-contrast CT revealed prominent posterior fossa vessels



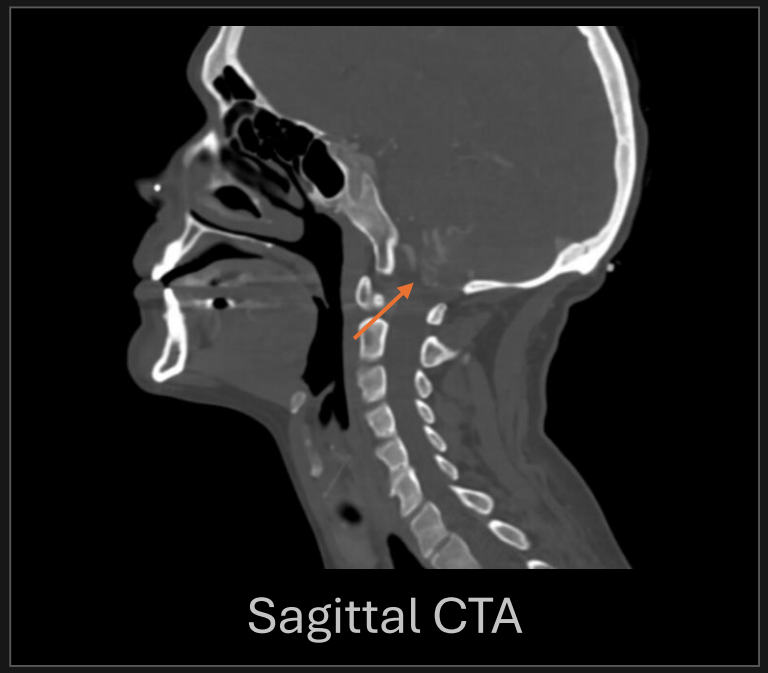
Axial Non-Contrast CT

CTA SUGGESTS ARTERIOVENOUS SHUNTING

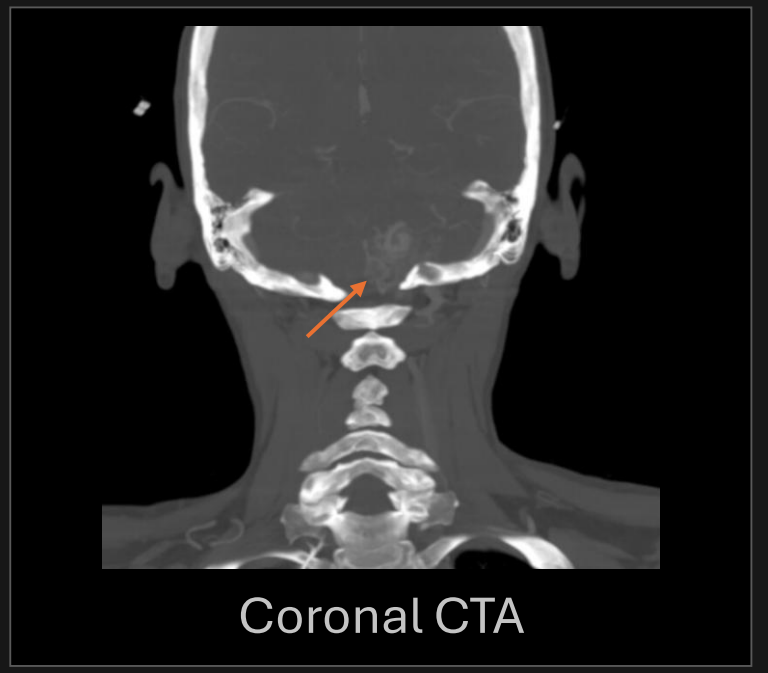
Enlarged serpiginous vessels center on the left cerebellar hemisphere.



Axial CTA



Sagittal CTA



Coronal CTA

Apparent early and asymmetric venous opacification raises suspicion.

DSA DEFINES THE SHUNT AND ITS DRAINAGE

Dynamic vascular anatomy

Selective injections identify arterial feeders and the shunt site.

Arterial-to-venous sequences resolve drainage direction.

Angiography assesses aneurysms, venous narrowing and ectasia.

ARTERIOVENOUS MALFORMATION (AVM) VERSUS DURAL ARTERIOVENOUS FISTULA (dAVF)

Shunt location and nidus distinguish the leading diagnoses.

Feature	Brain AVM	dAVF
Shunt	Parenchymal nidus	Dural fistulous connection
Arterial supply	Usually pial arteries	Usually meningeal arteries
Venous filling	Early draining veins	Early sinus or cortical vein filling
Key distinction	Nidus within brain parenchyma	No parenchymal nidus
Best injection to interrogate	Internal carotid / vertebral artery runs	Selective ECA injection (middle meningeal, occipital, ascending pharyngeal)

THE DECISIVE ANGIOGRAPHIC QUESTIONS

Reference Brain AVM

Nidus

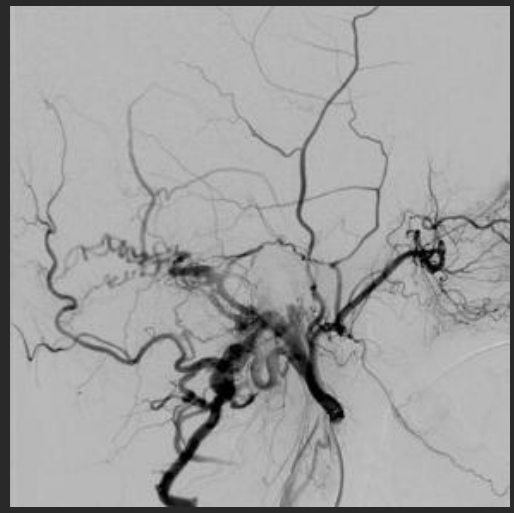
Venous drainage

Arterial Feeders



1. **Arterial supply:** Pial feeder with a distal flow-related aneurysm.
2. **Shunt site:** Cerebellar nidus, vermian subtype.
3. **Venous drainage:** Early draining vein.

Reference dAVF



1. **Arterial supply:** External carotid injection opacifies the dural shunt.
2. **Shunt site:** Sinus-based shunt at the distal sigmoid sinus.
3. **Venous drainage:** Ipsilateral jugular bulb and posterior condylar vein. Retrograde flow into proximal sigmoid and distal transverse sinuses, and cortical drainage via a temporal bridging vein.

ANGIOGRAPHIC GRADING

AVM: surgical risk. dAVF: venous drainage risk.

Spetzler-Martin

BRAIN AVM

Size: <3 / 3-6 / >6 cm = 1 / 2 / 3

Eloquent location: +1

Deep venous drainage: +1

Total: grade I-V

Why it matters

Higher grade = higher surgical risk.

Borden

dAVF: DRAINAGE PATTERN

I: sinus drainage, no cortical reflux

II: sinus drainage + cortical reflux

III: direct cortical drainage

Why it matters

II-III: higher hemorrhage risk, favoring treatment.

Cognard

dAVF: FLOW + VENOUS ECTASIA

I / IIa: no cortical reflux

IIb / IIa+b: cortical reflux

III / IV: direct cortical drainage, without / with venous ectasia

V: spinal venous drainage

Why it matters

Refines venous risk and treatment urgency.

AVM AND dAVF MANAGEMENT

Multidisciplinary review weighs natural history against treatment risk.

Brain AVM

Goal: complete nidus/shunt obliteration.

Selection: individualize unruptured AVMs. Often treat ruptured lesions. Usually observe grades IV-V.

Microsurgery: favored for I-II. Immediate obliteration.

SRS: small (≤3 cm), deep/eloquent lesions. Hemorrhage risk persists during delayed obliteration.

Embolization: mainly adjunctive or for high-risk aneurysms. Rarely curative alone.

dAVF

Goal: close the shunt, preserve normal venous outflow.

Selection: observe Borden I if symptoms are tolerable. Cortical venous reflux, hemorrhage or neurologic deficit favors treatment.

Embolization: first-line for most, with access guided by anatomy.

Surgery: anterior cranial fossa lesions or failed endovascular access.

SRS: salvage when other options are unsuitable. Too delayed for urgent treatment.

CURRENT STATUS

Planned evaluation

DSA with neurosurgery remains pending.

Interval admission

The patient required inpatient psychiatric admission for management of depression, delaying definitive angiographic evaluation.

Workup pending

Definitive diagnosis, angiographic classification and treatment planning remain pending.

TAKE-HOME POINTS

01 Prominent serpiginous posterior fossa vessels suggest AV shunting, even when incidental.

02 A compact parenchymal nidus favors AVM. A dural shunt without a nidus favors dAVF.

03 DSA is the reference standard for shunt anatomy, venous drainage, hemorrhagic-risk features and treatment planning.

04 AVM and dAVF require distinct approaches to risk stratification and treatment.

REFERENCES

01 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):e200-e224. doi:10.1161/STR.0000000000000134

02 Gandhi D, Chen J, Pearl M, Huang J, Gemmete JJ, Kathuria S.
Intracranial Dural Arteriovenous Fistulas: Classification, Imaging Findings, and Treatment.
AJNR Am J Neuroradiol. 2012;33(6):1007-1013. doi:10.3174/ajnr.A2798

03 Serulle Y, Miller TR, Gandhi D.
Dural Arteriovenous Fistulae: Imaging and Management.
Neuroimaging Clin N Am. 2016;26(2):247-258. doi:10.1016/j.nic.2015.12.003

04 Basilio-Flores JE, Aguilar-Melgar JA, Pacheco-Fernandez Baca H.
Location-based clinical and angiographic profile of brain arteriovenous malformations – a single-center observational study.
Acta Neurochirurgica. 2024. doi:10.1007/s00701-024-06105-y

05 Baltsavias G, Kumar R, Avinash KM, Valavanis A.
Cranial dural arteriovenous shunts. Part 2. The shunts of the bridging veins and leptomeningeal venous drainage.
Neurosurgical Review. 2015.