



Intracranial Vertebral Artery Dissections: Diffusing the Bomb

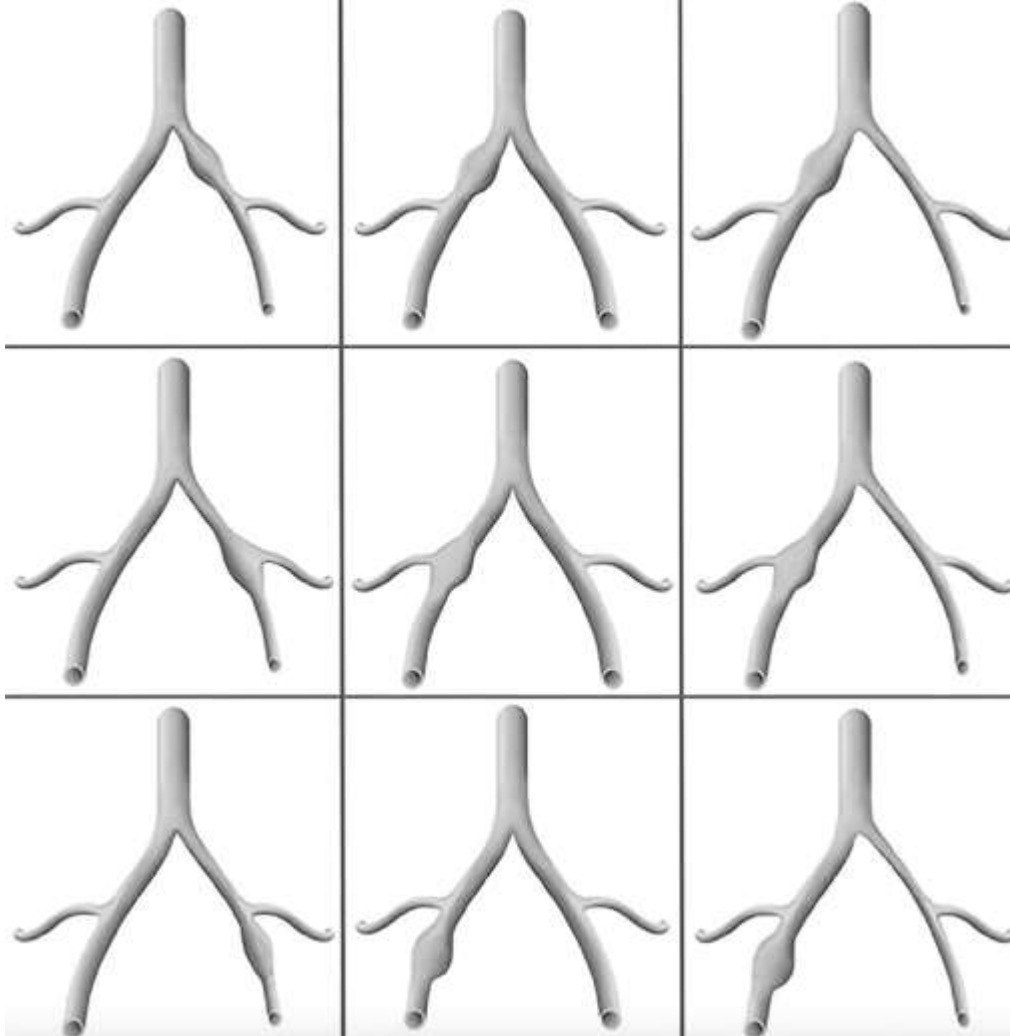
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*To all doctors,
never give up 😂😂😂*

- The overall incidence is approximately 1-5 per 100,000
- Spontaneous dissections of the carotid and vertebral artery account for only about 2% of all ischemic strokes
- Important cause of ischemic stroke in young and middle-aged patients (10-25% of such cases)
- The mortality rates from acute vertebral artery dissection vary between 70% and 95%

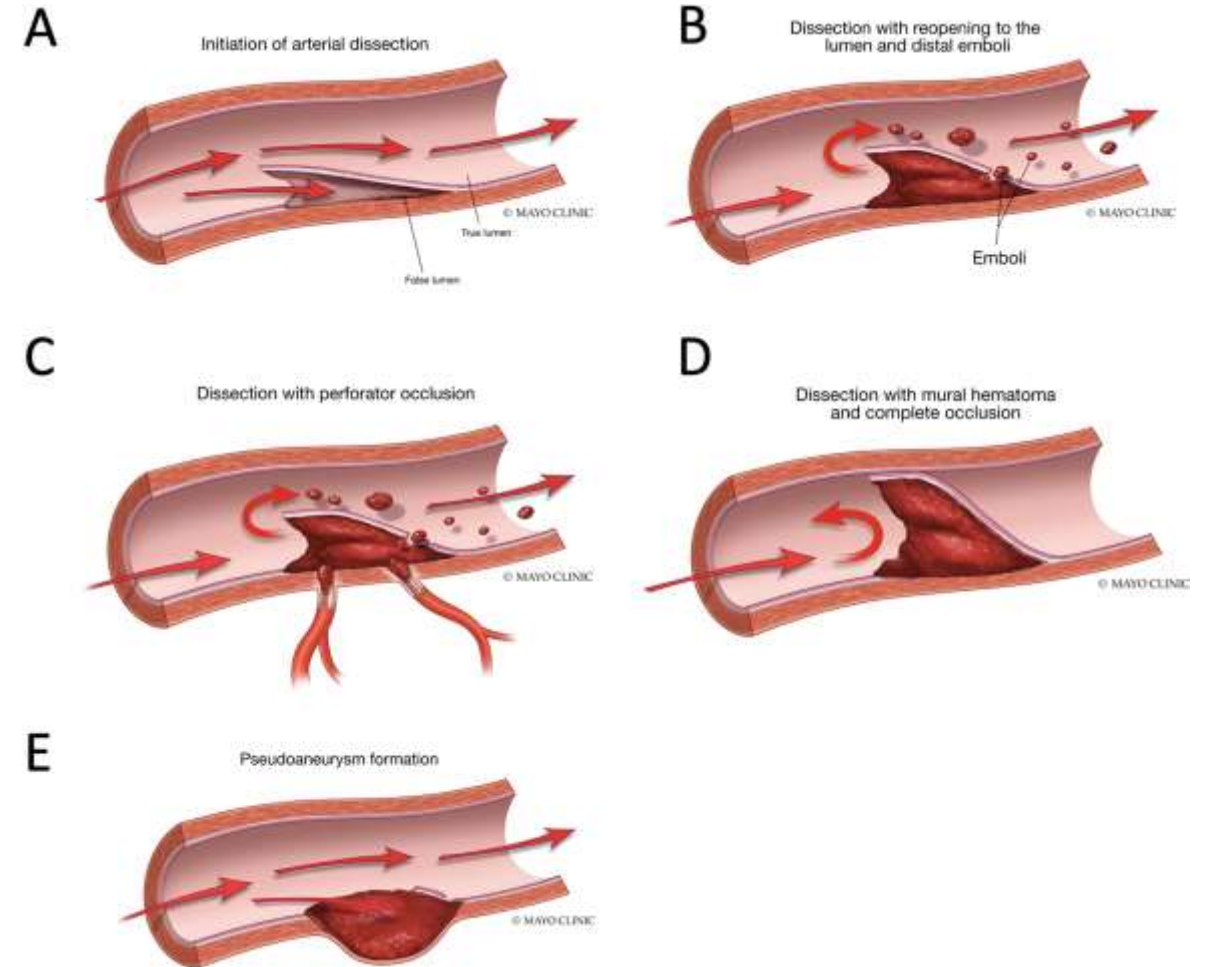
Etiology

- blunt trauma (most common)
- antecedent neck manipulation or other sudden movements
- spontaneous
- fibromuscular dysplasia (FMD)
 - connective tissue diseases
 - Ehlers-Danlos disease
 - Marfan's disease
 - pseudoxanthoma elasticum

1. Soper J, Parker G, Hallinan J. Vertebral Artery Dissection Diagnosed with CT. AJNR Am J Neuroradiol. 1995;16(4 Suppl):952-4. PMC8332251
2. Park K, Park J, Hwang S, Im S, Shin W, Kim B. Vertebral Artery Dissection: Natural History, Clinical Features and Therapeutic Considerations. J Korean Neurosurg Soc. 2008;44(3):109-15. doi:10.3340/jkns.2008.44.3.109
3. <https://radiopaedia.org/articles/vertebral-artery-dissection?lang=us>

Pathogenesis

1. Presence of thin media and adventitia with a few elastic fibers in the intradural segment of the vessel
2. Acute widespread disruption of the internal elastic lamina

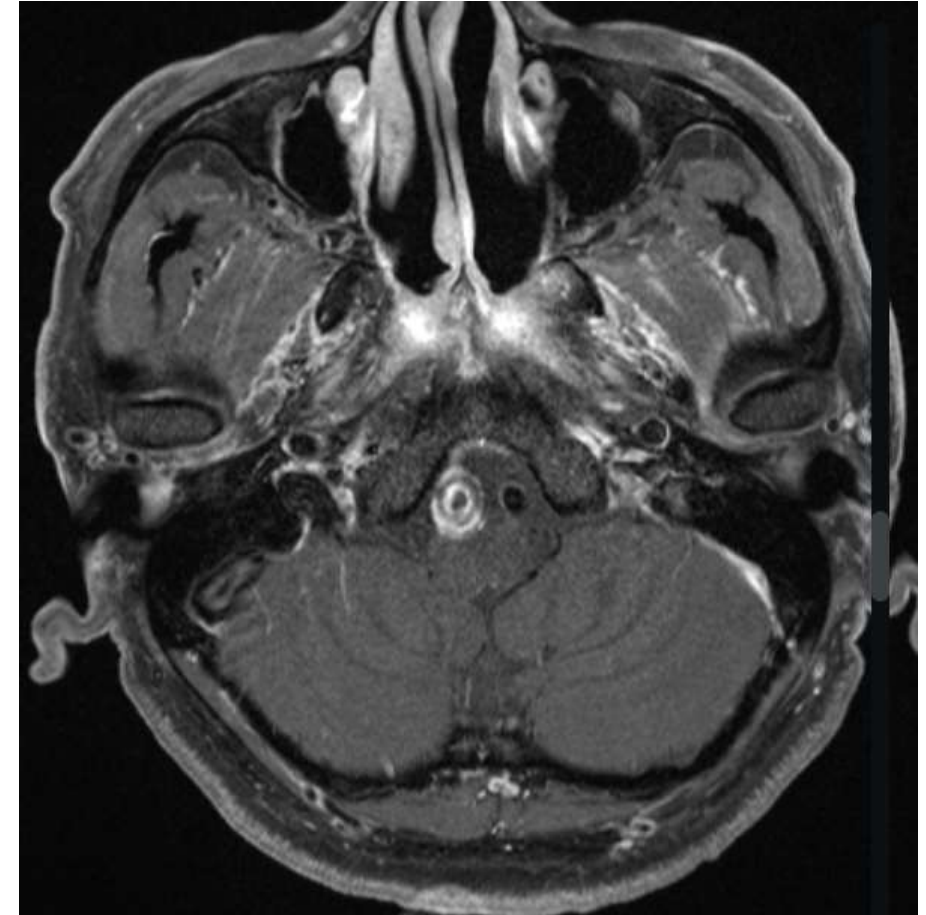


Bond KM, Krings T, Lanzino G, Brinjikji W. Intracranial dissections: A pictorial review of pathophysiology, imaging features, and natural history. *J Neuroradiol.* 2021;48(3):176-188.
doi:10.1016/j.neurad.2020.03.007

Radiological Features

1. Mural hematoma
2. Intimal flap
3. Double lumen

The use of high-resolution 3 Tesla MRI and 3-D acquisition of fat suppressed sequences with black-blood effect increase the sensitivity and specificity of the images



<https://radiopaedia.org/articles/vertebral-artery-dissection?lang=us>

1. Gupta G, Eckstein DA, Narayan V, et al. Endovascular Management of Intracranial Vertebral Artery Dissection: Technical Nuances for the Preservation of Posterior Inferior Cerebellar Artery and Basilar Artery. Oper Neurosurg (Hagerstown). 2020;19(3):241-248. doi:10.1093/ons/opaa174
2. <https://radiopaedia.org/articles/vertebral-artery-dissection?lang=us>

Treatment Goals

1. Prevent re-bleeding (in ruptured cases)
2. Prevent ischemia and infarction
3. Preserve vertebrobasilar circulation

Treatment Options

- Endovascular deconstruction of the dissected artery with coils
- Endovascular reconstruction of the dissected artery with stenting
- Endovascular stent-assisted coiling
- Surgical treatment
- Conservative methods

Selection of the ideal treatment remains controversial

Important Steps

1. Identification of the dissections (mostly located in the pars transversaria segment (V2) ~35% or in the atlas loop segment (V3) ~34%)
2. Assess whether or not the dissection involves the intradural portion of the vertebral artery (V4), and thus the origin of the PICA, as sacrificing the PICA can lead to brainstem and cerebellum ischemia.

The PICA is involved in 14.6% of intracranial VA dissecting aneurysms. PICA involvement was found to be an independent risk factor for intracranial VA aneurysm recurrence and incomplete occlusion.

1. Gupta G, Eckstein DA, Narayan V, et al. Endovascular Management of Intracranial Vertebral Artery Dissection: Technical Nuances for the Preservation of Posterior Inferior Cerebellar Artery and Basilar Artery. Oper Neurosurg (Hagerstown). 2020;19(3):241-248. doi:10.1093/ons/opaa174
2. Mohr JP, Grotta JC. Stroke, pathophysiology, diagnosis, and management. Elsevier Health Sciences. (2004) ISBN:0443066000
3. Hernández-Durán, S., Ogilvy, C.S. Clinical outcomes of patients with vertebral artery dissection treated endovascularly: a meta-analysis. Neurosurg Rev 37, 569–577 (2014). <https://doi.org/10.1007/s10143-014-0541-y>

Deconstructive Techniques

- Parent artery occlusion or trapping
- Historically favored
- Currently reserved for:
 - Hypoplastic VAs
 - Non-dominant side
 - Failed reconstruction

Endovascular deconstruction of the dissected artery with coils **is not always possible**, such as in the cases of dominant VAD with poor collateral flow or bilateral VADs

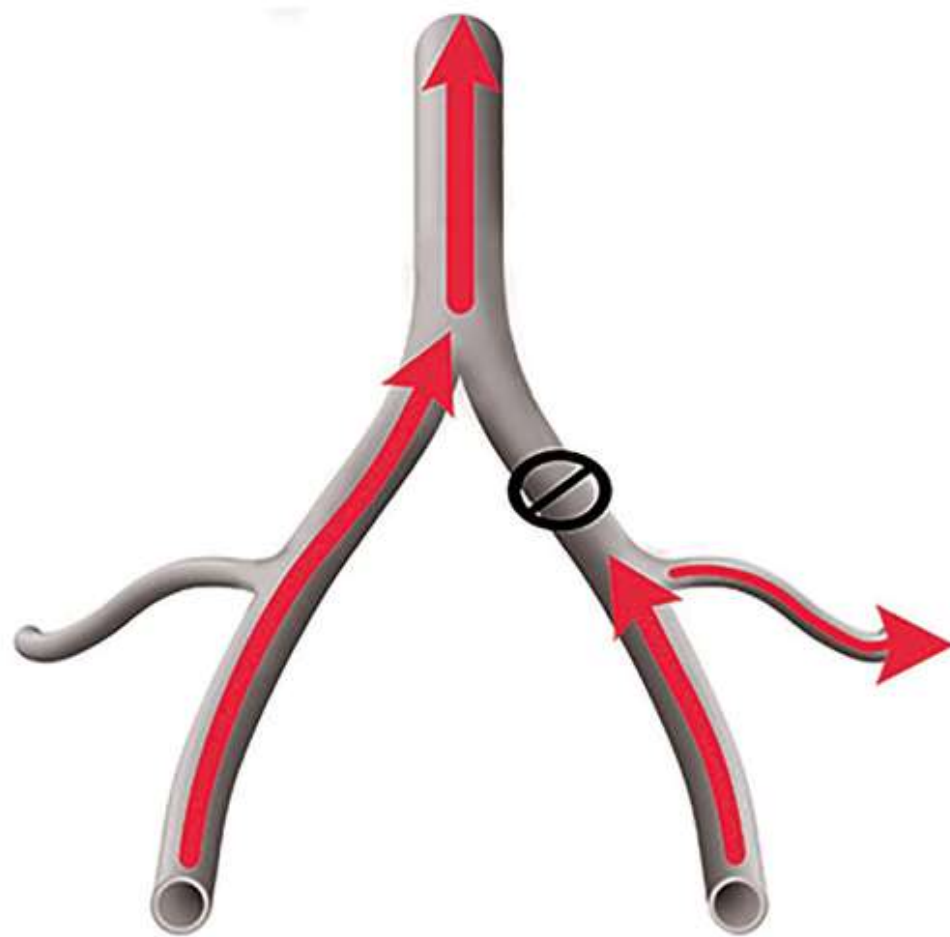
Classification of vertebral artery based on dominance

	Hypoplastic	Codominant	Dominant
Post-PICA			
Involves PICA			
Pre-PICA			

Dissection Proximal to PICA

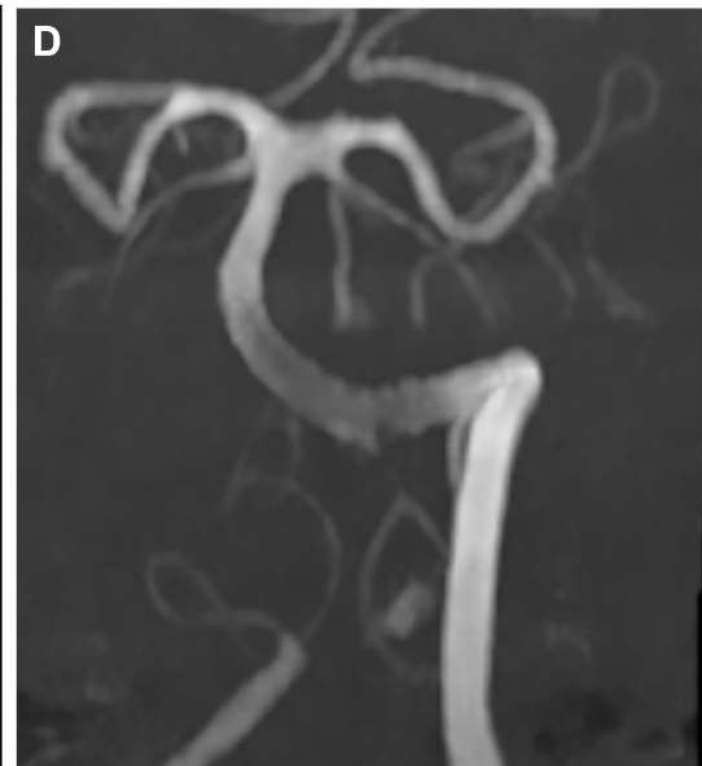
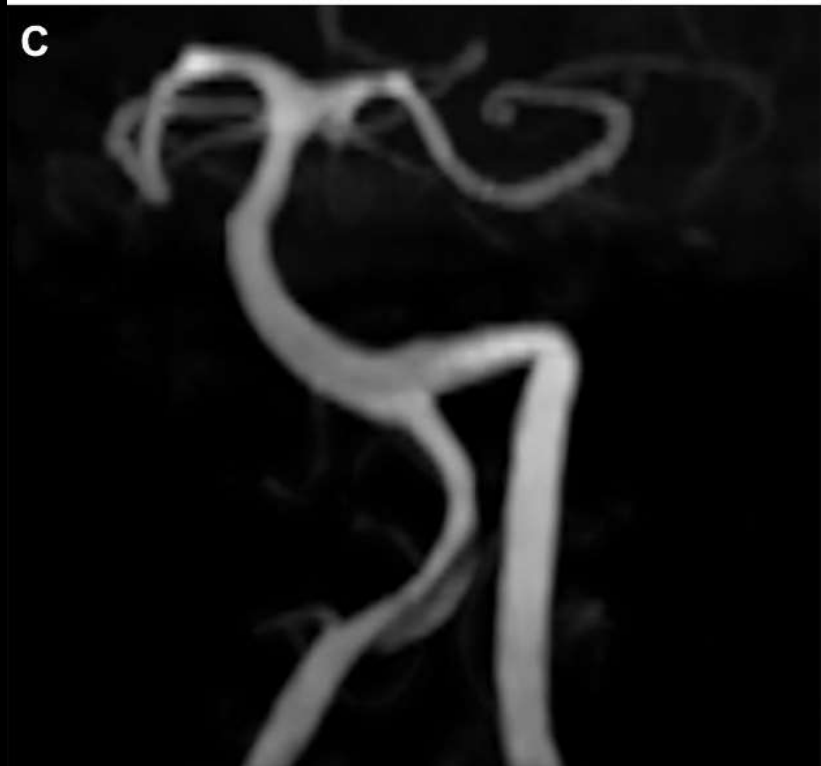
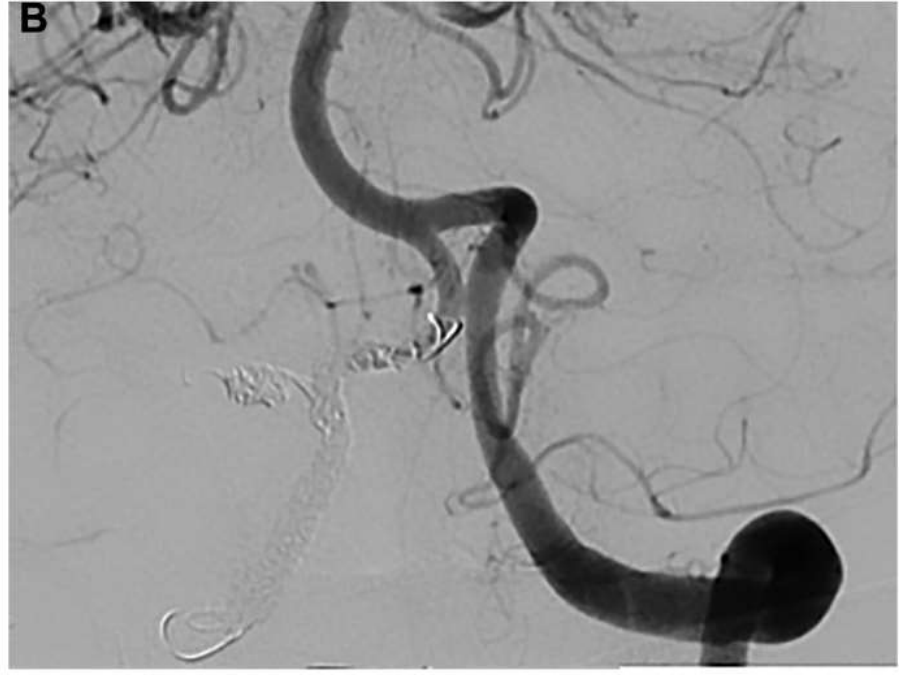


Dissection Distal to PICA



Coiling Alone

- Direct occlusion of the dissected segment
- May be insufficient if:
 - Branch vessels originate near dissection
 - Vessel is dominant or critical for perfusion



Stent-Assisted Coiling

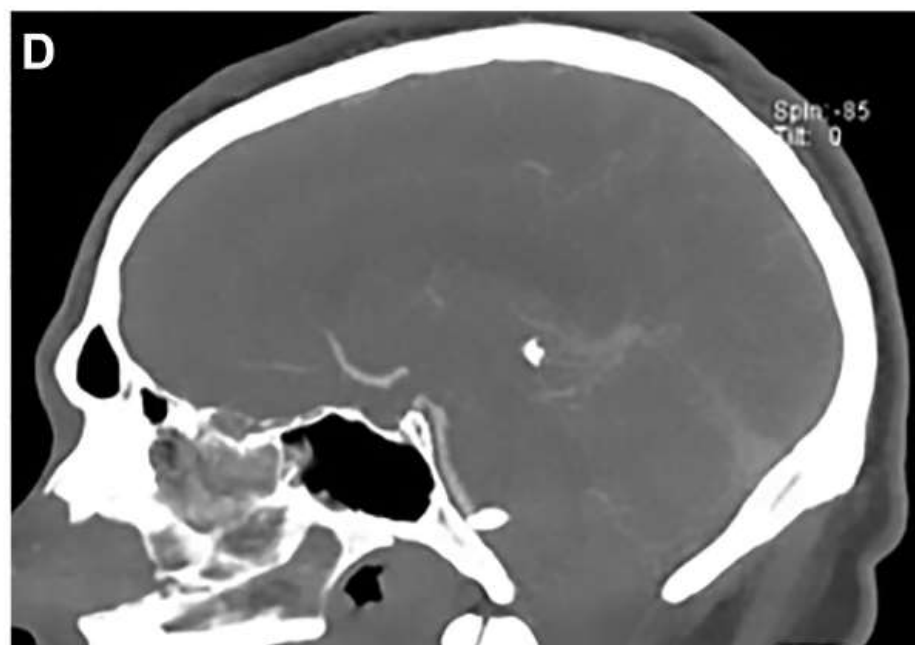
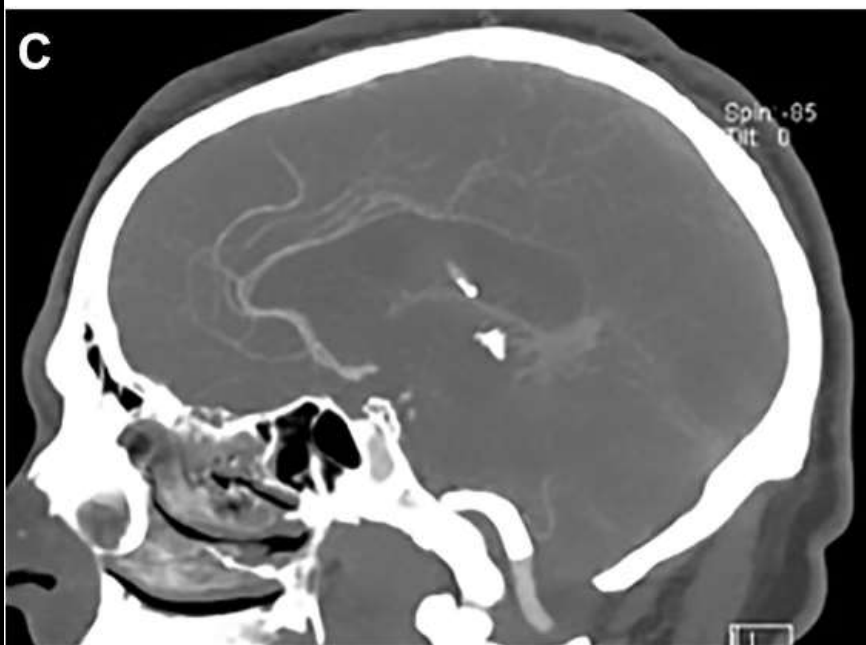
- Used when preserving parent vessel flow is critical
- Modified semi-jailing and internal trapping techniques

Flow Diversion

- Treats fusiform/pseudoaneurysmal morphology
- Remodeled diseased segment + preserved branch flow
- Alters flow to promote thrombosis of false lumen

But:

- Requires dual antiplatelet therapy
- Risk of hemorrhagic or thromboembolic complications
- Controversial in acutely ruptured cases



Microsurgical Options

- Rarely used but valuable in select cases
- PICA–PICA bypass
- Wrapping
- Indicated when:
 - Dominant PICA involved
 - Endovascular options are limited

- Favor reconstruction when:
 - Affected VA is dominant
 - PICA or eloquent branches originate near lesion
- Favor deconstruction when:
 - VA is hypoplastic
 - Revascularization not feasible
- Always evaluate collateral flow and branch involvement

