



Providing Choice & Value
Generic CT and MRI Contrast Agents



CONTACT REP

AJNR

Comment on "Aneurysms Associated with Brain Arteriovenous Malformations"

F. Clarençon, E. Shotar and N.-A. Sourour

AJNR Am J Neuroradiol 2017, 38 (1) E1-E4

doi: <https://doi.org/10.3174/ajnr.A4966>

<http://www.ajnr.org/content/38/1/E1>

This information is current as
of July 31, 2025.

Comment on “Aneurysms Associated with Brain Arteriovenous Malformations”

We read with great interest the review article entitled “Aneurysms Associated with Brain Arteriovenous Malformations” by Rammos et al.¹ This article summarizes the different subtypes of intracranial aneurysms that may be associated with brain AVMs (bAVMs). We congratulate the authors for their effort to clarify the nomenclature of such aneurysms. However, we would like to raise our disagreement with the following statement: “Given that pathologic specimens of resected AVM nidi consist of a conglomerate of venous tangles and loops, implicating that venous drainage begins at the level of the nidus, intranidal aneurysms are de facto venous.” Histopathologically, the nidus has been reported to comprise both arteries and veins with disorganized walls, as well as vessels of ambiguous nature.^{2–5} Even though we agree that some intranidal aneurysms may have a venous nature and may be responsible for some bAVM bleeding events (Fig 1), in our experience, most intranidal aneurysms in bAVMs with hemorrhagic presentation are rather false aneurysms arising from the dysplastic vessels belonging to the nidus and represent the bleeding site.⁶ Indeed, as reported by numerous series,^{7,8} in patients with intracranial bAVM-related bleeding events, intranidal aneurysms are frequently observed. A higher rebleeding rate has also been reported in patients with bAVMs harboring intranidal aneurysms.⁹ Nidal aneurysms have been defined by a joint experts group as those with any portion contained in the bAVM nidus.¹⁰ As underlined by Redekop et al,⁸ these aneurysms are often seen on early phase of the DSA, before substantial venous filling, and may present a contrast media stagnation on late phase (Figs 2 and 3). Depiction of intranidal aneurysms is both difficult and subject to a high rate of interobserver disagreement. The review of Rammos et al¹ is lacking a discussion on advanced imaging tools that may help to demonstrate these aneurysms and further our understanding of their origin. Indeed, high-rate (6 frames per second or more) DSA acquisitions, 3D rotational angiography (RA), 4D-RA technology,¹¹ and ultrasensitive angiography, or even more recent algorithms used on 3D-RA such as segmentation algorithms¹² or anamorphosis algorithm,¹³ may help to depict these aneurysms more accurately. Wall enhancement of the intranidal aneurysm

on MR imaging has also been proposed as a radiologic feature that may help to confirm the bleeding site.¹⁴

Finally, we agree with Rammos et al¹ on the fact that the depiction of these intranidal aneurysms is of tremendous importance because they may prompt the interventional neuroradiologists or neurosurgeons to perform in an emergency a target treatment or whole resection of the bAVM to prevent early rebleeding.⁹

Disclosures: Frédéric Clarençon—UNRELATED: Payment for lectures including service on speakers bureaus: Medtronic. Nader Sourour—UNRELATED: Consultancy: Medtronic, Microvention; Stock/stock options: Medina/Medtronic.

REFERENCES

1. Rammos SK, Gardenghi B, Bortolotti C, et al. **Aneurysms associated with brain arteriovenous malformations.** *AJNR Am J Neuroradiol* 2016 Jun 23. [Epub ahead of print] CrossRef Medline
2. McCormick WF. **The pathology of vascular (“arteriovenous”) malformations.** *J Neurosurg* 1966;24:807–16 CrossRef Medline
3. Mandybur TI, Nazek M. **Cerebral arteriovenous malformations. A detailed morphological and immunohistochemical study using actin.** *Arch Pathol Lab Med* 1990;114:970–73 Medline
4. Jellinger K. **Vascular malformations of the central nervous system: a morphological overview.** *Neurosurg Rev* 1986;9:177–216 Medline
5. Deshpande DH, Vidyasagar C. **Histology of the persistent embryonic veins in arteriovenous malformations of brain.** *Acta Neurochir (Wien)* 1980;53:227–36 Medline
6. Mjoli N, Le Feuvre D, Taylor A. **Bleeding source identification and treatment in brain arteriovenous malformations.** *Interv Neuroradiol* 2011;17:323–30 Medline
7. Turjman F, Massoud TF, Viñuela F, et al. **Correlation of the angio-architectural features of cerebral arteriovenous malformations with clinical presentation of hemorrhage.** *Neurosurgery* 1995;37: 856–60; discussion 860–62 Medline
8. Redekop G, TerBrugge K, Montanera W, et al. **Arterial aneurysms associated with cerebral arteriovenous malformations: classification, incidence, and risk of hemorrhage.** *J Neurosurg* 1998;89: 539–46 CrossRef Medline
9. Meisel HJ, Mansmann U, Alvarez H, et al. **Cerebral arteriovenous malformations and associated aneurysms: analysis of 305 cases from a series of 662 patients.** *Neurosurgery* 2000;46:793–800; discussion 800–02 Medline
10. Atkinson RP, Awad IA, Batjer HH, et al. **Reporting terminology for brain arteriovenous malformation clinical and radiographic features for use in clinical trials.** *Stroke* 2001;32:1430–42 Medline
11. Lescher S, Gehrisch S, Klein S, et al. **Time-resolved 3D rotational angiography: display of detailed neurovascular anatomy in patients**

with intracranial vascular malformations. *J Neurointerv Surg* 2016 Aug 4. [Epub ahead of print] CrossRef Medline

12. Clarençon F, Maizeroi-Eugène F, Bresson D, et al. **Elaboration of a semi-automated algorithm for brain arteriovenous malformation segmentation: initial results.** *Eur Radiol* 2015;25:436–43 CrossRef Medline
13. Clarençon F, Maizeroi-Eugène F, Maingreaud F, et al. **Interest of convex spherical anamorphosis in better understanding of brain AVMs' angioarchitecture.** *J Neurointerv Surg* 2016;8:959–64 CrossRef Medline
14. Omodaka S, Endo H, Fujimura M, et al. **High-grade cerebral arteriovenous malformation treated with targeted embolization of a ruptured site: wall enhancement of an intranidal aneurysm as a sign of**

ruptured site. *Neurol Med Chir (Tokyo)* 2015;55:813–17 CrossRef Medline

F. Clarençon

E. Shotar

Department of Interventional Neuroradiology

Pitié-Salpêtrière Hospital AP-HP

Paris, France

Paris VI University (Pierre et Marie Curie University)

Paris, France

N.-A. Sourour

Department of Interventional Neuroradiology

Pitié-Salpêtrière Hospital AP-HP

Paris, France

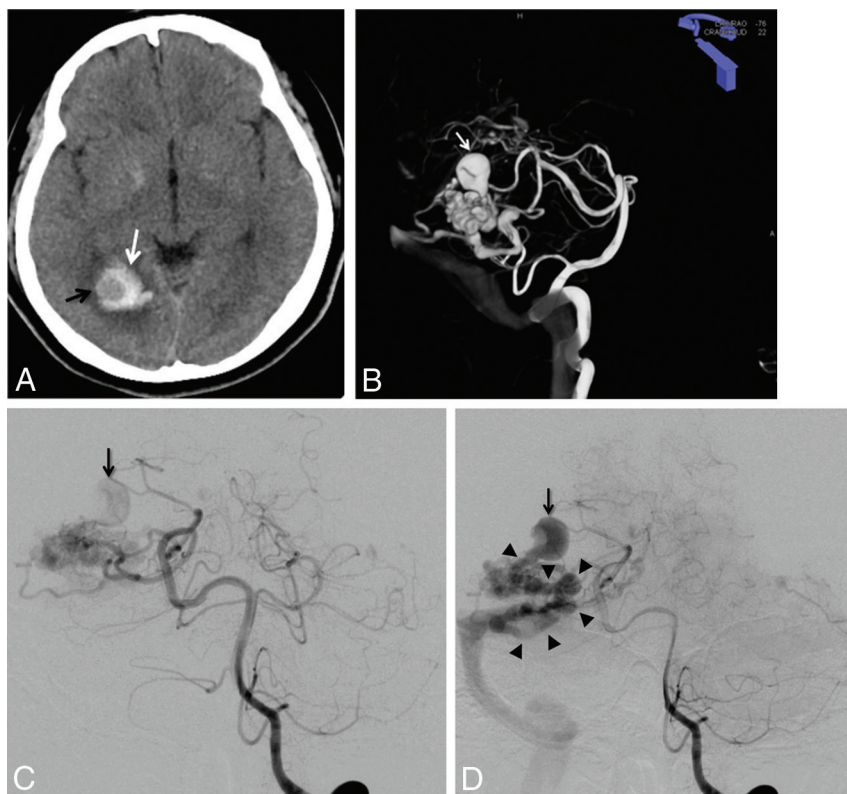


FIG 1. A, Unenhanced brain CT scan (axial section) in a 40-year-old woman with headache. Right occipital hematoma is seen (white arrow). Note a round hypoattenuated shape surrounded by the hematoma, corresponding to the intranidal aneurysm (black arrow). B, Volume rendering reconstruction from the 3D-RA acquisition through the left vertebral artery, showing a large intranidal aneurysm (white arrow). C and D, Left vertebral DSA in anteroposterior projection at early phase (C) and late phase (D). At early phase, an intranidal aneurysm is seen (C, arrow). On late phase, this nidal aneurysm appears clearly connected to the main draining vein (D, arrowheads), confirming the venous nature of this intranidal aneurysm.

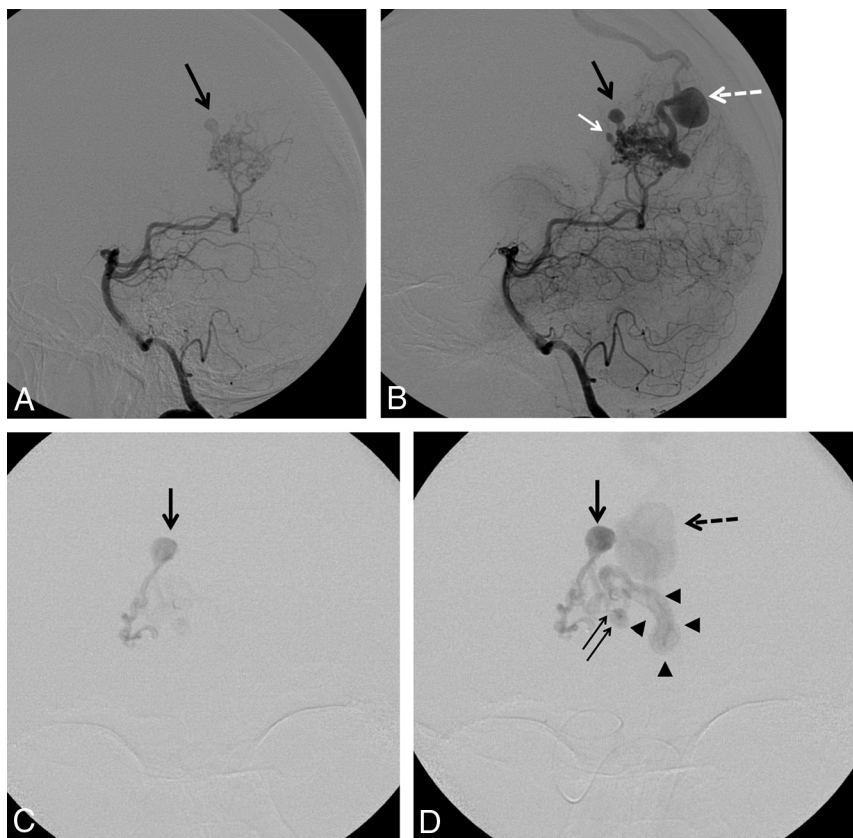


FIG 2. A and B, Left vertebral artery DSA in lateral projection in a 41-year-old woman with a ruptured right parieto-occipital bAVM. A, Early phase showing a nidus (black arrow) before filling of the draining vein. B, Intermediate phase showing a second intranidal aneurysm (white arrow) in addition to the first one (black arrow). Note a focal venous ectasia on the main draining vein (white dotted arrow). C and D, Selective DSA in anteroposterior projection from the parieto-occipital branch of the right posterior cerebral artery through a flow-dependent microcatheter. C, Early phase showing the filling of both the nidus and an intranidal aneurysm before any venous filling. D, Intermediate phase showing, in addition to the previously described intranidal aneurysm (black arrow), a second smaller nidus (double arrow) close to the origin of the main draining vein (arrowheads). Note the presence of a focal venous ectasia on the main draining vein (black dotted arrow).

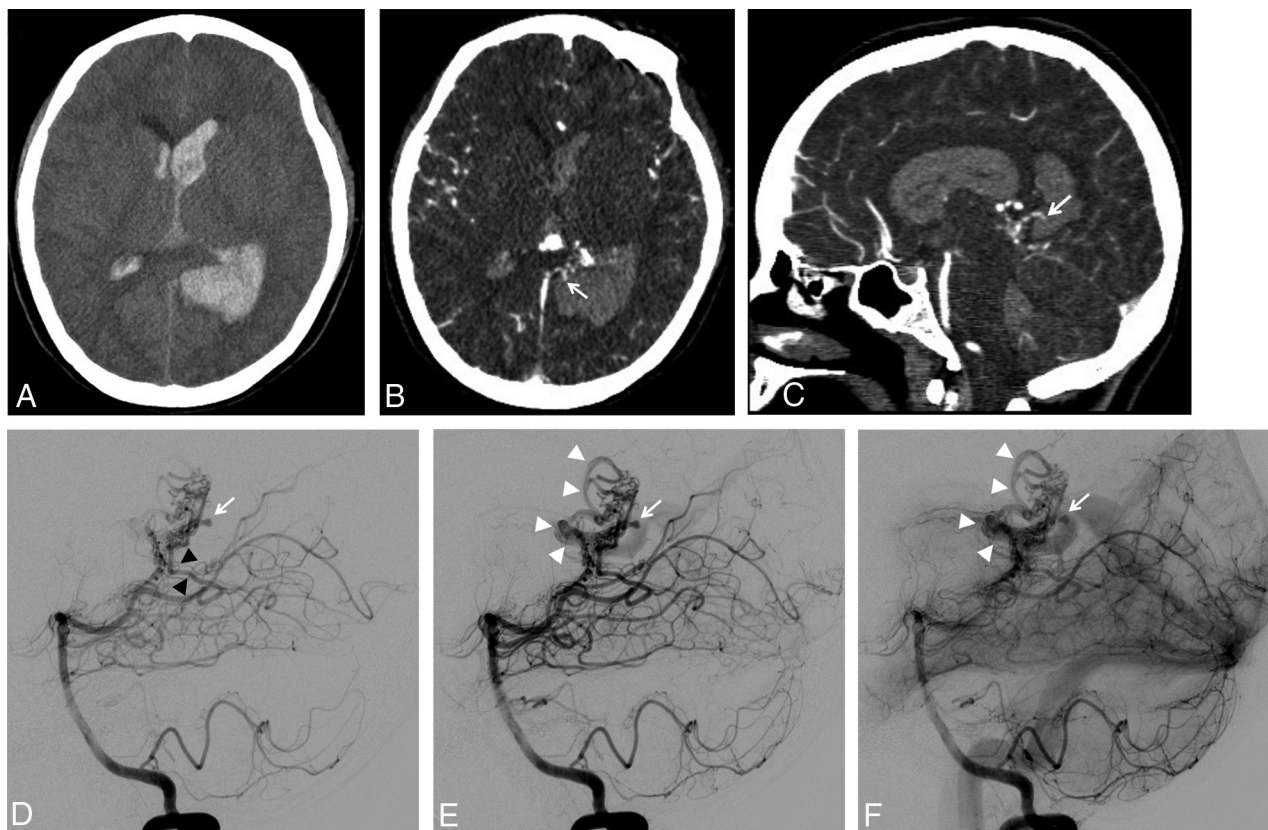


FIG 3. A, Unenhanced brain CT scan (axial section) showing a left parieto-occipital hematoma associated with intraventricular hemorrhage in a 19-year-old woman. B and C, Brain CT angiography: axial section (B) and sagittal reconstruction (C). Small false aneurysm arising from the nidus and close to the hematoma is seen on both axial and sagittal images (B and C, *white arrows*). The close relationship between the intranidal aneurysm and the hematoma suggests the aneurysm as being the cause of the bleeding. D–F, Left vertebral artery DSA in lateral projection at very early phase (D), early phase (E), and intermediate phase (F). At very early phase, opacification of the nidus is seen, supplied mainly by the left posterolateral choroidal artery (D, *black arrowheads*). Note the opacification of an intranidal aneurysm located at the posterior aspect of the nidus (D, *white arrow*) before any substantial filling of the venous drainage. At later phase, the origin of the draining vein is filling (E, *white arrowheads*) while the nidal aneurysm is still visible (E, *white arrow*). On intermediate phase, stagnation of the nidal aneurysm is seen (F, *white arrow*) while the venous drainage is more clearly seen (F, *white arrowheads*).