

# High-grade arteriovenous malformation treatment

High-grade arteriovenous malformations (AVMs), such as [Spetzler-Martin AVM grading system](#) 4 and 5, <sup>1)</sup> are generally considered difficult to cure using any modalities such as surgery, [embolization](#), and/or [radiosurgery](#) <sup>2)</sup>.

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Prospectively enrolled patients with high-grade BAVMs (S-M grade  $\geq 3$ ) aged 18-65 years who underwent one-stop hybrid BAVM treatment between October 2016 and March 2021. High-grade BAVM patients who underwent surgery from 2010 to 2016 served as historical controls.

Results: Forty-one high-grade BAVM patients underwent one-stop hybrid treatment in an hOR. Sixty-one propensity score-matched patients comprised the historical control group. The groups did not significantly differ in patient and BAVM characteristics. Intraoperative angiography in four patients of the hOR group demonstrated residual nidus that required further immediate resection. Main procedural complications included hemorrhage, neurologic deficit, and seizure. In the historical control group, diffuse angioarchitecture and arteriovenous fistula were independent risk factors for incomplete resection.

One-stop hybrid BAVM treatment is safe and effective for the removal of high-grade BAVMs, especially those with diffuse or complex angioarchitecture. Preoperative embolization can effectively reduce blood flow while preserving motor and language function. The combined application of functional magnetic resonance imaging, electrophysiological monitoring, and awake craniotomy can successfully avoid causing neurological injury <sup>3)</sup>.

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The endovascular treatment potentially offers an advantage over the other two methods because of the ability to immediately target certain areas of an AVM. Partially targeted embolization could be effective in controlling the bleeding point when treating high-grade AVMs; however, it is not curative <sup>4)</sup> <sup>5)</sup>.

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Grade 4 and 5 AVMs with supply from lenticulostriate, choroidal, thalamic deep perforating arteries or deep meningeal recruitment may be best treated conservatively or possibly by multimodality treatment utilising radiotherapy and embolisation combined with surgery <sup>6)</sup>.

<sup>1)</sup>

Spetzler RF, Martin NA.: A proposed grading system for arteriovenous malformations. J Neurosurg 65: 476- 483, 1986.

<sup>2)</sup>

Ogilvy CS, Stieg PE, Awad I, Brown RD, Jr, Kondziolka D, Rosenwasser R, Young WL, Hademenos G, Special Writing Group of the Stroke Council American Stroke Association: AHA Scientific Statement: Recommendations for the management of intracranial arteriovenous malformations: a statement for healthcare professionals from a special writing group of the Stroke Council, American Stroke Association. Stroke 32: 1458- 1471, 2001.

3)

Quan K, Liu Y, Wang Y, Tian Y, Xu B, Li P, Liu P, Shi Y, Hu L, Xu G, Luo J, Song J, Zhu W. Treatment of high-grade brain arteriovenous malformations using a hybrid operating room: A prospective single-arm study. Clin Neurol Neurosurg. 2022 Nov 12;224:107517. doi: 10.1016/j.clineuro.2022.107517. Epub ahead of print. PMID: 36436434.

4)

Krings T, Hans FJ, Geibprasert S, Terbrugge K.: Partial “targeted” embolization of brain arteriovenous malformations. Eur Radiol 20: 2723– 2731, 2010.

5)

Le Feuvre D, Taylor A.: Target embolization of AVMs: identification of sites and results of treatment. Interv Neuroradiol 13: 389– 394, 2007.

6)

Ferch RD, Morgan MK. High-grade arteriovenous malformations and their management. J Clin Neurosci. 2002 Jan;9(1):37-40. doi: 10.1054/jocn.2000.0927. PMID: 11749015.

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Last update: **2024/06/07 02:54**

