Unruptured cerebral arteriovenous malformation rupture risk

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Although most unruptured cerebral arteriovenous malformations do not cause symptoms, they can sometimes rupture and cause serious complications, such as bleeding in the brain.

The risk of an unruptured cerebral AVM rupturing and causing bleeding varies depending on several factors, including the size, location, and morphology of the AVM, as well as the patient's age, medical history, and overall health.

Studies suggest that the risk of rupture for an unruptured cerebral AVM is approximately 2-4% per year, and the lifetime risk of rupture is estimated to be around 20-25%. However, the risk can be higher in certain cases, such as AVMs located in deep brain regions or those with an associated aneurysm.

It is important to note that not all cerebral AVMs require treatment, and the decision to treat or monitor an unruptured AVM should be based on a thorough evaluation of the risks and benefits for each individual patient. Close monitoring with imaging studies and regular follow-up with a healthcare provider is recommended for patients with unruptured cerebral AVMs.

Among 3962 patients (2311 men [58.3%]; median [IQR] age, 26.1 [14.6-35.5] years), 3585 patients (2100 men [58.6%]; median [IQR] age, 25.9 [14.6-35.0] years) were included in the derivation cohort, and 377 patients (211 men [56.0%]; median [IQR] age, 26.4 [14.5-39.2] years) were included in the multicenter external validation cohort. Thirty-six hemorrhages occurred over a median (IQR) follow-up of 4.2 (0.3-6.0) years among 1028 patients in the conservative treatment validation cohort. Four risk factors were used to develop the scoring system: ventricular system involvement, venous aneurysm, deep location, and exclusively deep drainage (VALE). The VALE scoring system performed well in all 3 cohorts, with areas under the receiver operating characteristic curve of 0.77 (95% CI, 0.75-0.78) in the derivation cohort, 0.85 (95% CI, 0.81-0.89) in the multicenter external validation cohort, and 0.73

(95% CI, 0.65-0.81) in the conservative treatment validation cohort. The 10-year hemorrhage-free rate was 95.5% (95% CI, 87.1%-100%) in the low-risk group, 92.8% (95% CI, 88.8%-97.0%) in the moderate-risk group, and 75.8% (95% CI, 65.1%-88.3%) in the high-risk group; the model discrimination was significant when comparing these rates between the high-risk group and the low- and moderate-risk groups (P < .001 for both comparisons).

Conclusions and relevance: In this prognostic study, the VALE scoring system was developed to distinguish rupture risk among patients with AVMs. The stratification of unruptured AVMs may enable patients with low risk of rupture to avoid unnecessary interventions. These findings suggest that the scoring system is a reliable and applicable tool that can be used to facilitate patient and physician decision-making and reduce unnecessary interventions or unexpected AVM ruptures [1)]

Spetzler Ponce classification Class A patients may be offered surgery if they are good surgical candidates and have a good number of high-quality years of life left. The exception is diffuse Spetzler-Martin AVM grading system grade 2 in a patient older than 40 years: radiosurgery for unruptured and embolization for ruptured. Spetzler Ponce classification Class B may be offered surgery if a compact nidus or if younger than 40 years. If diffuse or age greater than 40, radiosurgery may be preferred if the Pollock-Flickinger score is less than 2.5. For the remainder of Spetzler Ponce classification Class B, conservative management may be preferred. Spetzler Ponce classification Class C is generally not treated unless young or those patients with poorly controlled seizures affecting their quality of life are willing to risk permanent neurological deficits [2)].

A prediction model was developed in a cohort consisting of 412 patients with bAVM between January 2010 and December 2020. All cases were partitioned into training and testing sets in the ratio of 7:3. Features were extracted from the 3D model built on CT angiography. Logistic regression was used to develop the model, with features selected using L1 Regularization, presented with a nomogram, and assessed with a calibration curve, receiver operating characteristic (ROC) curve, and decision curve analysis (DCA).

Significant variations in an associated aneurysm, deep location, number of draining veins, type of venous drainage, deep drainage, drainage vein entrance diameter (Dv), type of feeding arteries, middle cerebral artery feeding, volume, Feret diameter, surface area, roundness, elongation, mean density (HU), and median density (HU) were found by univariate analysis ($p < 0.05$). The prediction model consisted of the associated aneurysm, deep location, number of draining veins, deep drainage, Dv, volume, Feret diameter, surface area, mean density, and median density. The model showed good discrimination, with a C-index of 0.873 (95% CI, 0.791-0.931) in the training set and 0.754 (95% CI, 0.710-0.795) in the testing set [3)]

Clinical results suggest that nonconservative treatment is better for pediatric patients with AVMs [4)].

1)

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2)

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3)

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4)

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