Brainstem cavernous malformation (BSCM)

- Brainstem cavernous malformations in pediatrics: case report and literature review
- Surgical timing and approach for brainstem cavernous malformation warranting thorough preoperative evaluation
- A multiregional multimodal machine learning model for predicting outcome of surgery for symptomatic hemorrhagic brainstem cavernous malformations
- Outcomes of brainstem cavernous malformation resection, without and with use of a flexible omnidirectional carbon dioxide laser: a single-surgeon series of 277 surgical procedures
- Persistent trigeminal artery variant functioning as a duplicate superior cerebellar artery
- QSM predicts haemorrhage risk in brainstem cavernous malformations: a multicentre prospective study
- Outcomes of surgically managed brainstem cavernous Malformations: A systematic review and Meta-Analysis
- Cavernoma of the left ventral striatum, anatomical and microsurgical implications of the ipsilateral transcallosal transrostral pathway

Symptomatic brainstem cavernous malformations carry a high risk of permanent neurological deficit related to recurrent hemorrhage, which justifies aggressive management. Detailed knowledge of the microscopic and surface anatomy is important for understanding the clinical presentation, predicting possible surgical complications, and formulating an adequate surgical plan [1)].

Natural history

The natural history of brainstem cavernous malformation is particularly complex.

Classification

Medulla Oblongata cavernous malformation…

Rather than developing a grading system for all cerebral cavernous malformations that is weak with BSCMs, Garcia et al. propose a system for the patients who need it most. The BSCM grading system differentiates patients who might expect favorable surgical outcomes and offers guidance to neurosurgeons forced to select these patients [2)].

There isn't a standardized classification system for brainstem cavernous malformations that is universally accepted, but they are often classified based on their location within the brainstem and the associated symptoms. Here's a general classification scheme:

Midbrain Cavernomas: Cavernous malformations located within the midbrain, which is the upper part of the brainstem. These can lead to various neurological symptoms depending on their specific location within the midbrain.

Pons Cavernomas: Cavernous malformations located within the pons, which is the middle part of the

brainstem. Due to the critical functions of the pons, these cavernomas can cause a wide range of neurological deficits.

Medulla Oblongata Cavernomas: Cavernous malformations located within the medulla oblongata, which is the lower part of the brainstem. These lesions can impact functions such as breathing, heart rate, and other autonomic functions.

Diffuse Brainstem Cavernous Malformations: Some cases involve multiple cavernous malformations dispersed throughout different parts of the brainstem. These can present complex challenges due to the potential for widespread neurological effects.

The classification can also take into account the size of the lesion, the presence of hemorrhage (bleeding), and associated symptoms such as cranial nerve deficits, motor weakness, sensory changes, and others.

Diagnosis

Brainstem cavernous malformation diagnosis.

Treatment

see Brainstem cavernous malformation treatment.

Complications

Brainstem cavernous malformation complications.

Retrospective multicenter cohort studies

170 patients were treated with Gamma Knife stereotactic radiosurgery at 11 radiosurgical centers. Hemorrhagic risk reduction, risk factors of post-SRS hemorrhage, and clinical outcomes were retrospectively analyzed. Most patients had single (165/170 patients) brainstem CCMs treated; the majority of CCMs (165/181) presented with bleeding. Using recurrent multivariate analysis, single-session SRS decreased the risk of repeat hemorrhage in patients with hemorrhagic brainstem CCM (HR: 0.17, $p < 0.001$). The annual hemorrhage rate decreased from 14.8 per 100 CCM-years before SRS to 2.3 after treatment. Using univariate Cox analysis, the probability of new hemorrhages after SRS was reduced for patients older than 35 years (HR = 0.21, $p = 0.002$) and increased with a margin dose > 13 Gy (HR = 2.57, $p = 0.044$). Adverse radiation effect (ARE) occurred in 9 patients (5.3%) and was symptomatic in four (2.4%). At a median follow-up of 3.4 years (Inter-quartile range: 5.4), 13 patients (8.0%) had a worsened clinical status, with the treated CCM being the cause in 5.6% (10) of the patients. Single-session SRS decreased the risk of repeat hemorrhage in patients with hemorrhagic brainstem CCM and conveyed this benefit with a low risk of adverse radiation effects

(ARE) and worsening clinical status [3].

Case series

Brainstem Cavernous Malformation Case Series.

Case reports

In a Case report + literature review Heredia-Gutiérrez et al. from the Hospital para el Niño Poblano, San Andrés Cholula; Centro Médico Nacional Manuel Ávila Camacho, Puebla; Hospital General de Zona No. 20, IMSS, Puebla — México. published in the Journal Cirugía y Cirujanos to report a 10-year-old girl with a pontobulbar cavernous malformation presenting with headache, hemiparesis, ataxia, and cranial nerve VI, VII, IX, X palsies; to describe surgical resection and outcomes; and to review existing literature on pediatric brainstem cavernomas. Complete resection led to full symptom resolution at one-year follow-up. Pediatric brainstem cavernomas, although rare, warrant surgical treatment if hemorrhagic; asymptomatic lesions may be managed conservatively under surveillance [4].

Strengths

Well-documented presentation with multi-cranial nerve involvement, supported by MRI findings.

Clear surgical course with favorable one-year neurological outcome—valuable insight for rare pediatric brainstem cavernomas.

Limitations & Concerns

Single case: inherently limited generalizability.

Literature review seems superficial—omits deeper data from larger pediatric series and meta-analyses. For example, studies like Velz et al. (2022) on 40 children or Ammar Haider et al. (systematic review/meta-analysis of 630 pediatric CCM cases) provide broader context on outcomes and surgical decision-making

Conclusions restate current consensus without advancing novel insights.

No discussion of lesion classification (Zabramski type), timing of surgery relative to hemorrhage, approach selection nuances, intraoperative monitoring use, or long-term functional follow-up beyond one year.

Brief follow-up period; no data on re-bleeding or neurodevelopmental implications over longer term.

Final Verdict

Score: 5/10

Valuable as a documented rare instance, but lacks broader impact or robust analysis.

Takeaway for Practicing Neurosurgeons

Surgical resection of symptomatic pediatric brainstem cavernomas can yield excellent outcomes when complete resection is achieved.

However, surgical decision-making should integrate data from larger series and meta-analyses—consider patient's age, hemorrhagic history, Zabramski classification, lesion size/location, and center experience.

Bottom Line

Heredia-Gutiérrez et al.'s article contributes a detailed clinical snapshot but does not significantly enhance existing evidence. Larger comparative studies and long-term data remain essential for informed neurosurgical decision-making.

A case of a 42-year-old man with a brainstem cavernous hemangioma presenting with fever of unknown origin and mild headache without meningismus. The patient underwent a midline suboccipital craniectomy and removal of a ruptured brainstem cavernous hemangioma and the surrounding thrombus. Postoperatively, the patient developed left facial nerve palsy, left abducens nerve palsy, and xerostomia. Abducens palsy and xerostomia resolved spontaneously days after the operation. At the 6-month follow-up, the patient showed stable improvement with resolution of his neurological deficits. CONCLUSIONS To our knowledge, there is no reported case of a patient with a ruptured brainstem cavernoma presenting with fever of unknown origin as the main symptom. We assume that the minimal intraventricular hemorrhage triggered the hypothalamic thermoregulating mechanism. Thus, it would be useful for physicians to raise the suspicion of a ruptured brainstem cavernous malformation with further imaging evaluation when investigating fever of unknown origin [5)].

1)
Giliberto G, Lanzino DJ, Diehn FE, Factor D, Flemming KD, Lanzino G. Brainstem cavernous malformations: anatomical, clinical, and surgical considerations. Neurosurg Focus. 2010 Sep;29(3):E9. doi: 10.3171/2010.6.FOCUS10133. Review. PubMed PMID: 20809767.
2)
Garcia RM, Ivan ME, Lawton MT. Brainstem cavernous malformations: surgical results in 104 patients and a proposed grading system to predict neurological outcomes. Neurosurgery. 2015 Mar;76(3):265-78. doi: 10.1227/NEU.0000000000000602.PubMed PMID: 25599205.
3)
Dayawansa S, Dumot C, Mantziaris G, Xu Z, Pikis S, Peker S, Samanci Y, Ardor GD, Nabeel AM, Reda WA, Tawadros SR, Abdelkarim K, El-Shehaby AMN, Eldin RME, Elazzazi AH, Moreno NM, Álvarez RM, Liscak R, May J, Mathieu D, Tourigny JN, Tripathi M, Rajput A, Kumar N, Kaur R, Picozzi P, Franzini A, Speckter H, Hernandez W, Brito A, Warnick RE, Alzate J, Kondziolka D, Bowden GN, Patel S, Sheehan JP. Stereotactic radiosurgery (SRS) for patients with brainstem cerebral cavernous malformations

(CCMs): an international, multicentric study. Sci Rep. 2024 Oct 29;14(1):25933. doi: 10.1038/s41598-024-77140-z. PMID: 39472707.

4)

Heredia-Gutiérrez A, Carbarín-Carbarín ME. Brainstem cavernous malformations in pediatrics: case report and literature review. Cir Cir. 2025;93(3):328-332. English. doi: 10.24875/CIRU.22000227. PMID: 40609104.

5)

Fermeli DD, Theofanopoulos A, Papadakos D, Boulieris S, Constantoyannis C. Hemorrhage of a Cavernous Hemangioma of the Brainstem Presenting with Fever of Unknown Origin: A Case Report. Am J Case Rep. 2021 May 25;22:e930437. doi: 10.12659/AJCR.930437. PMID: 34031354.