

# Cavernoma in the medulla oblongata – Case presentation and review of the literature

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## ABSTRACT

Cerebral cavernous venous malformations (also called cavernous hemangiomas or cavernomas) are the third most common cerebral vascular malformations having an incidence of 0.4-0.8% in the general population and being diagnosed more frequently incidentally during an imaging procedure. Usually solitary, but cavernomas can also be present as multiple lesions with autosomal dominant inheritance pattern.

We present a rare case and the MRI imaging of a type I Zabramski cavernoma that bled, localized in the medulla oblongata of a 41-year-old man, admitted with paresthesia of the right upper limb, very mild right hemiparesis and impaired fine motor movements of the right hand and intractable persistent hiccups.

**Keywords:** cerebral cavernous venous malformations, medulla oblongata, cavernous hemangiomas, cavernoma, Zabramski classification, persistent singultus.

## INTRODUCTION

Cerebral cavernous venous malformations (CCVM), also known as cavernous hemangiomas or cavernomas, are the third most common cerebral vascular malformation after the developmental venous anomaly and the capillary telangiectasia. They are usually solitary but multiple lesions may be familial, with an autosomal dominant inheritance pattern [1,2].

Their incidence is approximately 0.4% to 0.8% in the general population, with no gender predilection. 20-50% of cavernous malformations are found incidentally using neuro-imaging procedures. Histologically, CCVM are clusters of abnormal and hyalinized capillaries, surrounded by hemosiderin deposits and a gliotic rim, without intervening brain tissue [1,3,4].

Supratentorial location is the most common (70-80%), but they also can be found in the brainstem

(20-35%), cerebellum and spinal cord. Supratentorial CCVM clinically start most frequently with new-onset seizures and headaches, while infratentorial CCVM usually lead to progressive neurological deficits [3,4].

The hemorrhagic risk for infratentorial cavernomas is 3.8% and 0.4% for supratentorial ones. Infratentorial, deep location, size, multiplicity, presence of an associated developmental venous anomaly, young age, female gender and familial cases are associated with increased risk of rupture [2,3,4].

MRI is the gold standard tool for the diagnosis and staging. According to the Zabramski classification, CCVM can be divided into 4 types:

- Type I: hyperintensity on both T1 and T2-weighted sequences due to subacute hemorrhage and hemosiderin core;
- Type II: the classic “popcorn” lesions with mixed signal intensity on both T1 and T2-weighted sequences;

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- Type III: chronic hemorrhage within an isointense core;
- Type IV: small capillary telangiectasias [2,3]

The differential diagnosis can be done with: cerebral amyloid angiopathy, chronic hypertensive encephalopathy, diffuse axonal injury, cerebral vasculitis, radiation-induced vasculopathy, hemorrhagic cerebral metastases or other cerebral vascular malformations such as arteriovenous malformations, venous angiomas, dural arteriovenous fistulas, capillary telangiectasias, aneurysm and vein of Galen malformations [1,3].

The three main options for the management of CCVM are: conservative management, microsurgical resection and stereotactic radiosurgery. Incidental cavernomas are managed conservatively and followed yearly with cerebral MRI scans. They are treated by microsurgical resection or stereotactic radiosurgery if the cases evolve with severe symptoms, such as intractable seizures, progressive neurological deterioration, a severe hemorrhage in a non-eloquent region of the brain or at least two severe hemorrhages in eloquent brain regions. Due to the increased complication risk, the main criteria for selecting surgery in the case of brainstem cavernomas are severe clinical presentation, including hemorrhage and location within 2 mm from pial surface. Radiosurgery has 2-year latency period before optimal risk reduction of recurrent hemorrhage occurrence. Steroids should be considered one to two weeks before surgery to reduce edema and aid resection [3,4].

Concerning antithrombotic therapy, it was demonstrated that its use was associated with a lower risk of intracranial hemorrhage or focal neurological deficit during long-term follow-up [2].

The overall mortality associated with CCVM hemorrhage is low, estimated at 2.2% [5].

## CASE PRESENTATION

We present the case of a 41-year-old man, known only with asthma, treated with inhaled corticosteroid, who was admitted in our clinic for paresthesia in his right upper limb, inability to perform fine motor skills (ex. writing) that started 2 weeks before and associated 1 week later persistent hiccups.

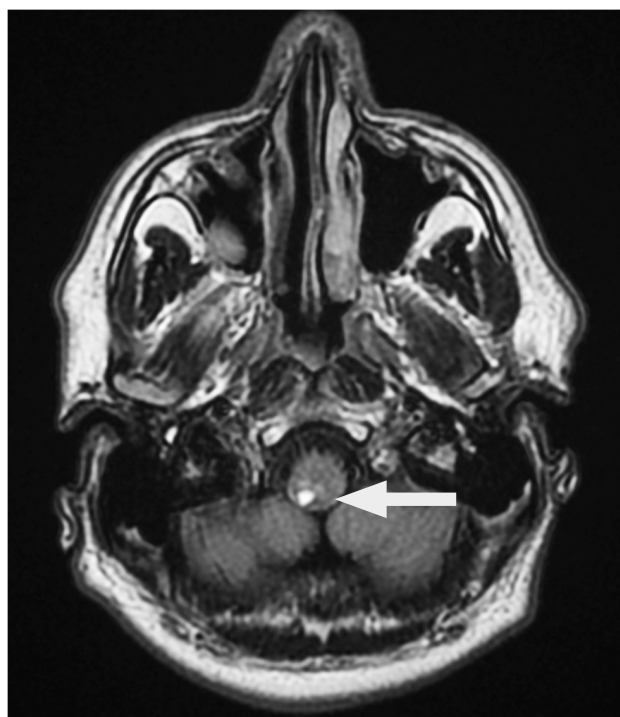
The neurological examination revealed: muscle weakness in the right upper and lower limb (4+/5 BMRC), a positive Romberg test with systematized deviation to the right side, right Babinski sign, paresthesia and hyperesthesia in the right hand and forearm with normal proprioception and vibration sensitivity, inability for fine motor skills and persistent hiccups.

Immunological tests were within normal limits, as well as all the other metabolic or toxicological ones.

The patient performed an upper endoscopy for the persistent hiccups which was normal.

We performed an MRI scan with Gadolinium of the brain which showed: a hyperintense, well-delimited lesion on both T1 and T2/FLAIR – weighted sequences (Fig. 1) and a hypointense lesion on the SWAN weighted sequences (Fig. 2) with nodular aspect, measuring 0.5/0.4/0.8 cm. No-contrast hyperintense image due to hemorrhage in the T1 weighted sequences (Fig. 3), located in the right posterior part of the medulla oblongata (aria postrema). This CCVM is surrounded by a hypointense rim of hemosiderin and oedema and is associating a small subacute hemorrhage. Another smaller lesion was incidentally found in the left hemisphere, localized medial and along with a small dilated vessel representing a venous angioma (Fig. 4, Fig. 5). It is the case of a type I cavernoma accompanied by a venous angioma.

The patient was treated with Mannitol 20% 250 ml/day and Dexamethasone 8 mg/day. No specific treatment could stop the persistent singultus. Oedema reduction conducted to the disappearance of all signs and symptoms. The patient received only conservative treatment, as he did not fulfill the criteria for surgical intervention, the risk being higher than the benefits due to the localisation in the brainstem. We couldn't explore by MRI his parents, in order to establish if there was a hereditary case.



**FIGURE 1.** FLAIR weighted MRI (magnetic resonance imaging) sequence showing hyperintense cavernoma in the right posterior part of the medulla oblongata

DISCUSSION

It is considered that 25% of people with cavernous malformations in the brain never have symptoms being diagnosed by chance, while using MRI for another disease. Symptoms appear more frequently after 30 years of age [6]. The type, severity and duration of symptoms can vary depending on the localization of the cavernoma. In our patient it was the first neurological event generated by the small hemorrhage of the brainstem cavernoma which, due to the mass effect and the surrounding edema, presented with stroke-like symptoms and progressive neurological deficits (sensitive and motor), but also with a persistent singultus, due to the

same cause, as the most frequent gastro-enterological, metabolic or toxic causes were excluded. The patient was treated conservative, but will be monitored with MRI and gadolinium (angiography and venography) every year or as soon as possible after the emergence of any new symptoms in order to reveal a new hemorrhage or the emergence of any new malformations (the risk can be of 4-25% each year), and a multidisciplinary team containing a general or cardiovascular neurologist, a neurosurgeon, a neuroradiologist, a geneticist and other spe-

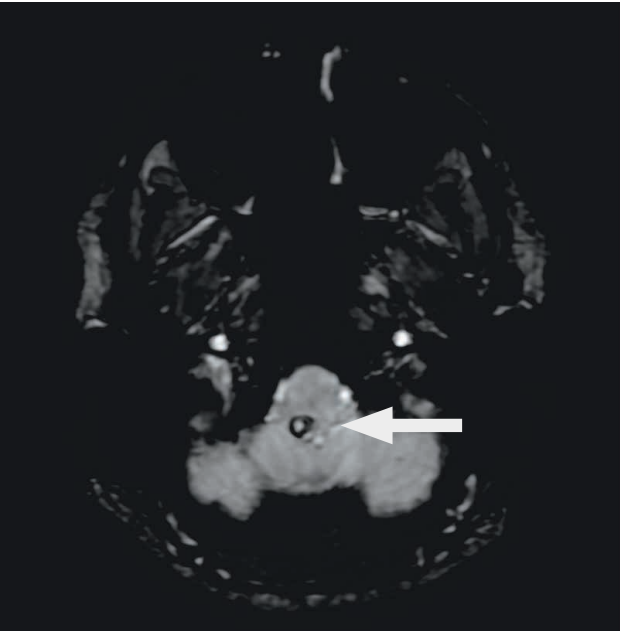


FIGURE 2. SWAN weighted sequences showing hypointense cavernoma in the right posterior part of the medulla oblongata

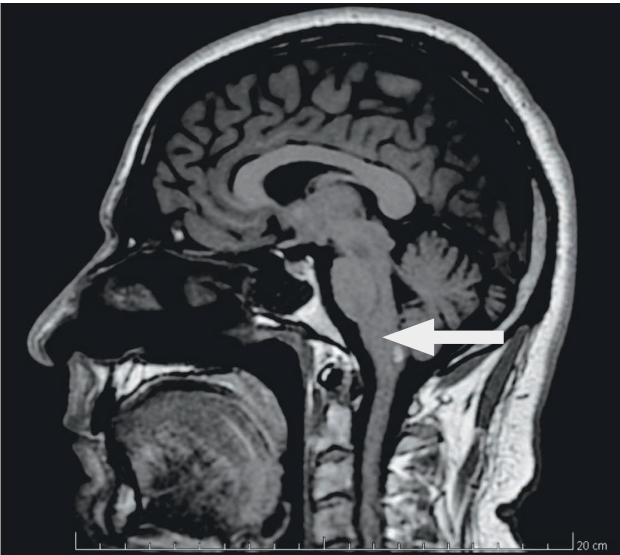


FIGURE 3. No-contrast hyperintensity due to hemorrhage from the cavernoma in the medulla oblongata in T1 weighted MRI sequences

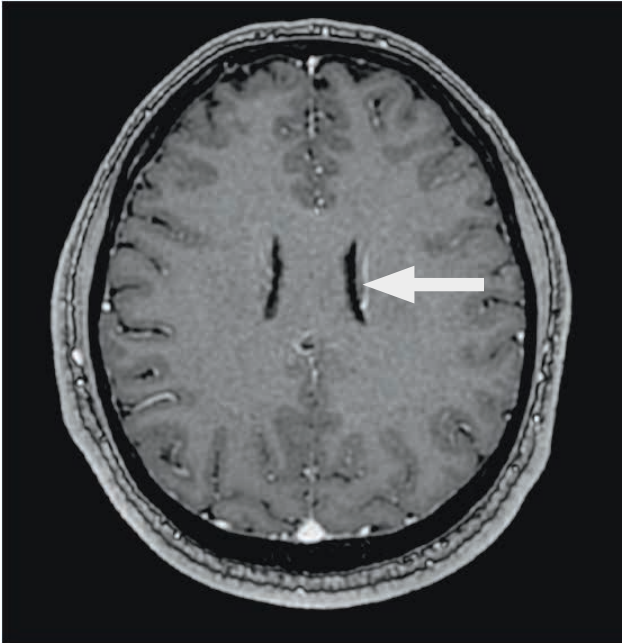


FIGURE 4. T1 weighted MRI sequences showing the contrast enhancement of a venous angioma in the left hemisphere

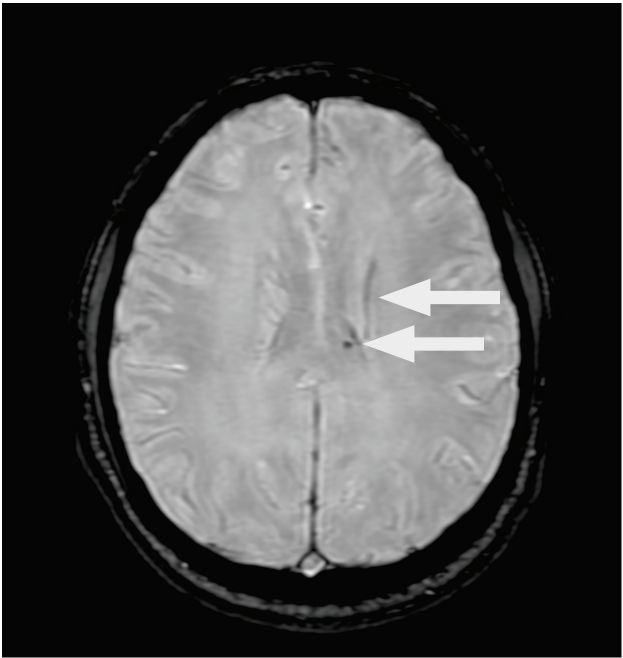


FIGURE 5. SWAN weighted MRI showing a hypointense smaller CCVM localized medial to a venous angioma



cialists will be available for diagnosis and treatment [6]. A detailed symptom calendar is very useful for monitoring, and if surgery is necessary some new imaging techniques may help (functional MRI, tractography, dynamic contrast-enhanced MRI for permeability, and quantitative susceptibility mapping). Genetic testing may also be useful, as about 50% of cases are thought to be genetic, being a 1 in 2 chance of passing this condition to the next generation.

The patient should stop driving until symptoms are controlled and avoid contact sports, high-altitude climbing and scuba diving. To avoid re-hemorrhage, in selected cases, complete resection should be the goal of surgery, due to the high cure rates and low rates of postoperative morbidity (15.8% medulla oblongata, 60% pons, 24.5% midbrain) [6]. For critical locations of the cavernoma minor changes can result in severe neurological deficits. All the neurological symptoms can disappear, as in most of the presented cases in the literature, and also in our patient, even if treated conservatively, but 60% can present subsequent hemorrhages. Surgical interventions are often delayed and are used for a second event if the criteria are fulfilled. Surgery is used for acute life-threatening neurological symptoms or if the cavernoma has an accessible location [6].

Our patient presented also a persistent singultus (hiccup) – this means it was lasting more than 48 hours, didn't respond to specific treatments (pharmacological and non-pharmacological) being very unpleasant for the patient. The persistent singultus can appear if one of the three parts of the respiratory – swallowing reflex is disturbed. The afferent pathway represented by the phrenic and vagus nerves and the thoracic sympathetic chain T6-T12, the central part – brainstem and hypothalamus and the efferent pathway using some fibers of the phrenic nerve (C3-C5), the recurrent branch of the

vagus nerve, the spinal nerves T1-T11 innervating the diaphragm, the anterior scalene muscles and the glottis [7].

Persistent singultus should be taken very seriously, as it can be the only and first sign of a cavernoma bleeding, as also described by Eisenächer et al. and the diagnosis can be established using MRI [7]. According to Guelaud et al., two thirds of the cases of persistent singultus may be due to gastrointestinal problems and need CT scans of the chest and abdominal region or more invasive techniques like gastroscopy or bronchoscopy [8]. Our patient performed a gastroscopy and it was normal. According to Askenasy et al., a lesion in the olivary area and in the posterolateral regions of the reticular formation of the medulla oblongata is the neurological cause of the persistent singultus [9]. The persistent intractable singultus as in occurred in our patient was also described by Mattana et al. and Porter et al. [10,11].

## CONCLUSIONS

We presented a rare case of a patient with medulla oblongata cavernoma, with no risk factors and no family history. Cavernoma can be diagnosed by chance, while performing an MRI for other reasons, or after a small or severe bleeding. A small bleeding, as in our case, can induce clinical signs and symptoms according to its localization, stroke-like symptoms, but also persistent singultus – very important, in the medulla oblongata cavernomas, headache or epileptic seizures in hemispheric cavernomas. The treatment can be conservative needing a strict follow-up in the following years or neurosurgical calculating the risks and benefits, with removal of the cavernoma, reducing the risk of re-bleeding.

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