FROM COMA TO RECOVERY – A RARE CASE OF RUPTURED PONTINE CAVERNOMA IN A YOUNG PATIENT

OD KOME DO OPORAVKA – REDAK SLUČAJ RUPTURE KAVERNOMA PONSA KOD MLADE PACIJENTKINJE

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Case report
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Abstract

Introduction. Cavernous hemangiomas are benign vascular malformations with an estimated prevalence of 0.4–0.8%. Pontine cavernomas account for approximately 14–30% of intracranial cavernous malformations and represent a significant therapeutic challenge due to the high density of critical neural pathways within the brainstem. Although technically demanding, surgical treatment may be lifesaving in carefully selected cases. **Case Report**. A 23-year-old woman with multiple supratentorial cavernomas was initially managed conservatively due to mild clinical symptoms. Nine months later, she was found unresponsive following sudden onset of headache and vomiting. On admission, she was in deep coma and required immediate endotracheal intubation. Computed tomography revealed a large pontine hemorrhage with obstructive hydrocephalus, and magnetic resonance imaging confirmed a markedly enlarged cavernoma with acute bleeding. Given her critical neurological condition, emergent surgery was performed to evacuate the hematoma, resect the cavernoma, and relieve brainstem compression. With intensive postoperative care and five months of structured neurorehabilitation, the patient demonstrated gradual neurological improvement, including recovery of the swallowing reflex, initiation of speech, and significant motor recovery. At one-year follow-up, she achieved full cognitive recovery, normal communication abilities, and independent ambulation with residual hemiparesis. **Conclusion.** Despite the severity of presentation, this case illustrates that timely surgical intervention combined with meticulous neurocritical care and structured rehabilitation can enable meaningful functional recovery. With appropriate patient selection and modern microsurgical techniques, even critically ill patients with pontine cavernomas may achieve favorable long-term outcomes.

Key words: Coma; Hemangioma, Cavernous; Hemorrhage; Pons; Young Adult; Diagnosis; Acute Care Surgery; Postoperative Care; Neurological Rehabilitation; Recovery of Function

Sažetak

Uvod. Kavernozni hemangiomi su benigne vaskularne malformacije sa prevalencijom procenjenom na 0,4–0,8%, dok kavernomi ponsa čine 14–30% intrakranijalnih kavernoma i predstavljaju veliki terapeutski izazov zbog bogatstva vitalnih nervnih puteva u moždanom stablu. Iako tehnički zahtevno, hirurško lečenje u pažljivo odabranim slučajevima može spasiti život pacijenta. **Prikaz slučaja.** Dvadesettrogodišnja žena sa višestrukim supratentorijalnim kavernomima inicijalno se lečila konzervativno zbog postojanja blagih simptoma. Devet meseci kasnije nađena je bez svesti nakon pojave iznenadne, jake glavobolje i povraćanja. Na prijemu je bila komatozna i zahtevala je hitnu intubaciju. Nalaz kompjuterizovane tomografije pokazao je opsežnu hemoragiju u regiji ponsa, a pregledom magnetne rezonance potvrđeno je značajno uvećanje kavernoma sa prisustvom akutnog krvarenja te kompresivnog efekta krvi. S obzirom na kritično stanje pacijentkinje načinjeno je hitno operativno lečenje u cilju evakuacije hematoma, uklanjanja kavernoma i dekompresije moždanog stabla. Zahvaljujući intenzivnoj postoperativnoj brizi i petomesečnoj neurorehabilitaciji pacijentkinja je postepeno napredovala sa povratkom refleksa gutanja, inicijacijom govora i značajnim poboljšanjem motorike. Na kontrolnom pregledu nakon godinu dana imala je potpuni ko-gnitivni oporavak i normalno je komunicirala, bila je pokretna uz rezidualnu hemiparezu. **Zaključak.** Uprkos težini kliničkog stanja ovaj slučaj pokazuje da pravovremena hirurška intervencija, pažljiva neurointenzivna nega i strukturisana rehabilitacija mogu omogućiti značajan oporavak. Uz pažljiv odabir pacijenata i upotrebu savremenih tehnika povoljan ishod se može postići čak i kod pacijenata u kritičnom stanju.

Ključne reči: koma; kavernozni hemangiom; krvarenje; pons; mlada osoba; dijagnoza; urgentna hirurgija; postoperativna nega; neurološka rehabilitacija; oporavak funkcije

Introduction

Cavernous hemangiomas (CHs), also referred to as cavernous malformations, are benign vascular lesions composed of clusters of dilated, thin-walled capillary channels surrounded by hemosiderin deposits and gliotic tissue [1,2]. They are relatively rare, with an estimated prevalence of 0.4–0.8% in the general population, approximately 20% of which are associated with hereditary forms [1,3,4,5]. Cavernomas can occur anywhere within the central nervous system and demonstrate a broad clinical spectrum, rang-

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Abbreviations

CHs	– cavernous hemangiomas
MRI	– magnetic resonance imaging
CT	– computed tomography
CTA	– computed tomographic angiography
DSA	– digital subtraction angiography
ICU	– intensive care unit
PEG	– percutaneous endoscopic gastrostomy
CN	– cranial nerve
GRE	– gradient recalled echo
SWI	– susceptibility weighted imaging
SEZ	– safe entry zone

ing from incidental asymptomatic findings to severe neurological deficits depending on lesion location and the presence of hemorrhage [1,2,6].

Because these lesions are characterized by slow blood flow and low hemodynamic pressure, the overall risk of rupture is lower compared with other vascular malformations [1,2]. However, hemorrhage within eloquent or critical regions can result in significant neurological impairment even when bleeding volume is relatively small [2,6]. Nearly half of cases (approximately 47%) are detected incidentally during magnetic resonance imaging (MRI), which remains the gold standard due to its superior soft-tissue contrast. Computed tomography (CT) is primarily used for detecting acute hemorrhage, while digital subtraction angiography (DSA) may aid in differentiating cavernomas from other vascular malformations [7,8].

Brainstem cavernomas account for approximately 14–30% of all intracranial cavernous malformations, with 62–70% located within the pons [7,9–11]. Owing to the dense concentration of critical neural pathways and nuclei within the pontine region, even minor hemorrhages can lead to severe neurological deficits [11]. Management requires careful balancing of the significant risks associated with surgical intervention against the potentially devastating consequences of recurrent or progressive hemorrhage [9,11].

Rupture of a pontine cavernoma presenting with deep coma is rare and typically associated with poor prognosis if not treated emergently [12]. Given the limited literature describing favorable outcomes in such severe presentations, individual cases provide valuable insights for guiding clinical decision-making [9,13]. Here, we report a young female patient admitted in a comatose state due to a ruptured pontine cavernoma who achieved remarkable neurological recovery following urgent surgical intervention.

Case Report

Patient Presentation: A 23-year-old woman with a history of multiple small supratentorial cavernomas and well-controlled epilepsy presented to the emergency department with bilateral hand paresthesia, diplopia, and right eye strabismus. CT/CTA revealed multiple hyperdense lesions, including a pontine lesion measuring 15 x 16 x 15 mm **(Figure 1).** MRI demonstrated the characteristic "popcorn-like" appearance with a hemosiderin rim. Digital subtraction angiography (DSA), performed to exclude associated developmental venous anomalies, was negative. Given mild neurological symptoms and the patient's otherwise good clinical condition, conservative management was initially adopted. Serial follow-up MRI studies demonstrated gradual reduction in lesion size **(Figure 2).**

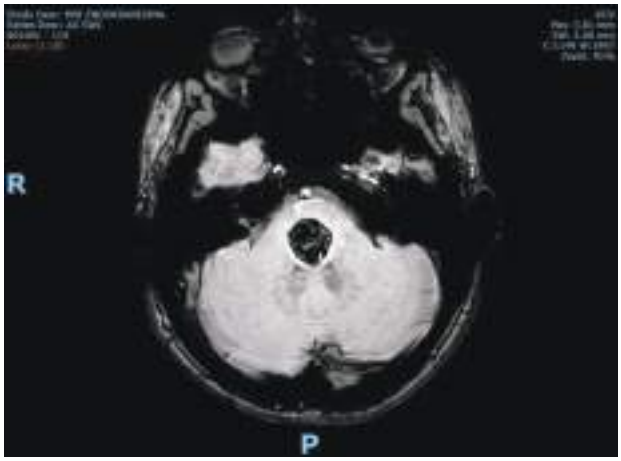

Figure 1. MRI- SWI weighted sequence – first hemorrhage

Nine months later, the patient was emergently readmitted after sudden onset of severe headache, vomiting, and loss of consciousness, without preceding trauma. On arrival, she showed no purposeful motor responses, no eye opening, and only minimal brainstem reflexes, corresponding to a Glasgow Coma Scale score of 3 (GCS3). Pupils were reactive; however, immediate endotracheal intubation was required.

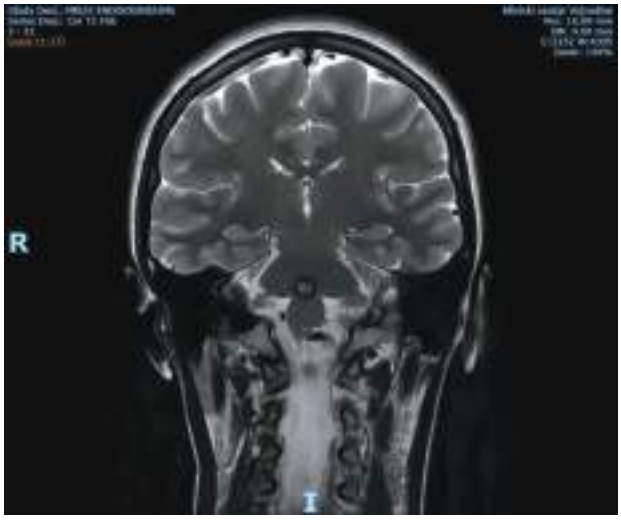

Figure 2. MRI T2 FSE – follow-up MRI between the two hemorrhagic events

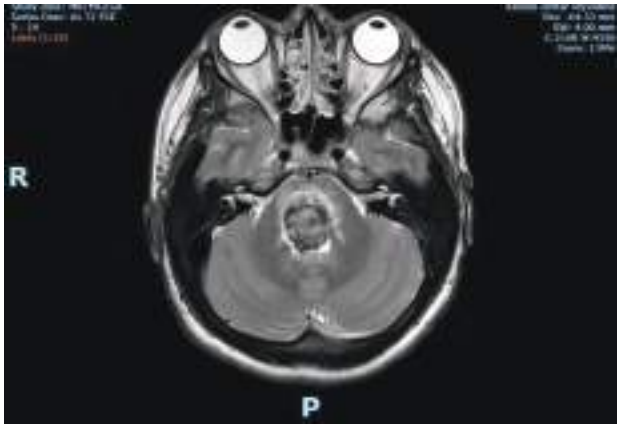

Figure 3. MRI T2-weighted sequence – rehemorrhage

Initial Investigations: Following stabilization, urgent non-contrast CT imaging revealed centrally located hyperdense pontine hemorrhage causing significant mass effect on the fourth ventricle, indicating a life-threatening condition with high risk of acute obstructive hydrocephalus. Emergency MRI confirmed enlargement of the pontine lesion to 22×27×21 mm, with radiological evidence of recent hemorrhage extending into the dorsal pons **(Figure 3).** MR angiography showed no additional vascular abnormalities.

Surgical Intervention: Given the patient's critical neurological status and imaging findings, emergency microsurgical intervention was undertaken to evacuate the hematoma, remove the cavernoma, and relieve brainstem compression.

The patient was positioned prone in a Mayfield head holder for a posterior fossa approach. A midline suboccipital craniotomy was performed to expose the cerebellar vermis and cisterna magna. After dural opening, cerebrospinal fluid was gently released from the basal cisterns to reduce cerebellar tension.

A telovelar approach was used to access the fourth ventricle. Due to cerebellar swelling, partial resection of the inferior vermis was required to achieve adequate exposure. The floor of the fourth ventricle demonstrated bluish discoloration and bulging in the region corresponding to the dorsal pontine cavernoma identified on MRI.

Using microsurgical technique, the suprafacial triangle was selected as the safe entry zone. Continuous intraoperative neurophysiological monitoring, including facial nerve and long-tract monitoring, was utilized. The cavernoma and associated hematoma were carefully evacuated while minimizing traction on surrounding pontine tissue and maintaining meticulous hemostasis **(Figure 4).** The surgical field was irrigated, fourth ventricle outlets were inspected for patency, and standard dural and bone closure was performed.

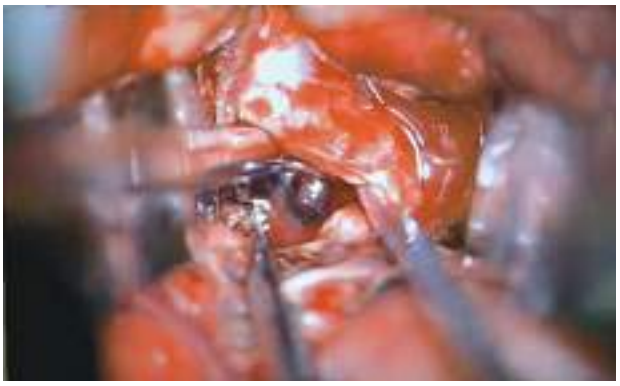

Figure 4. Intraoperative finding – SEZ approach and evacuation of hematoma

Postoperative Course in the ICU: The patient was transferred to the ICU under mechanical ventilation and sedation. Immediate postoperative CT confirmed complete lesion removal, adequate hematoma evacuation, and decompression of the brainstem without new hemorrhage **(Figure 5).** During the first 24–48 hours, comprehensive neurocritical care was provided. Although initially comatose, the patient gradually demonstrated improvement in brainstem reflexes. Due to impaired swallowing and airway protection, tracheostomy and percutaneous endoscopic gastrostomy (PEG) placement were performed for respiratory and nutritional support.

The postoperative course was complicated by episodes of dysautonomia, including tachycardia, blood pressure fluctuations, and temperature instability, likely related to central autonomic dysfunction following brainstem injury. These were managed with supportive pharmacologic therapy.

Over a two-week period, consciousness improved progressively and sedation was tapered. Respiratory function gradually recovered, allowing successful ventilator weaning after approximately six weeks.

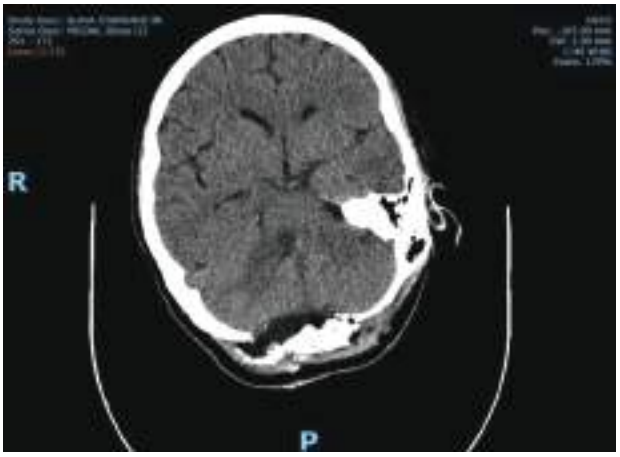

Figure 5. CT on the first postoperative day – complete evacuation of hematoma and decompression

Neurological Rehabilitation: Following medical stabilization, the patient was transferred to an in-hospital neurorehabilitation unit approximately 6–7 weeks after hemorrhage. At that time, she was awake and intermittently alert, with dysphagia and severe tetraparesis (left side more affected), consistent with corticospinal tract involvement from the pontine lesion. Cognitive function remained preserved, and communication was initially achieved through gestures.

She underwent intensive physiotherapy and speech/swallow therapy. By the fourth month, she was able to sit and stand with assistance for approximately 17 minutes and demonstrated progressive improvement in swallowing function. At discharge, she was able to initiate speech by occluding the tracheostomy and tolerated soft oral intake with supervision, while PEG feeding remained necessary for supplemental nutrition.

Follow-up and outcomes: After approximately five months of hospitalization, the patient was discharged home with structured outpatient rehabilitation. Family members received training in tracheostomy care and PEG feeding, and a multidisciplinary follow-up was arranged.

At one year follow-up, the tracheostomy tube had been successfully removed following recovery of airway reflexes and adequate respiratory function. Swallowing function improved to near-normal levels, allowing maintenance of body weight on a regular diet with minor texture modifications.

The patient was alert, cognitively intact, and able to communicate effectively with only minor speech difficulties. Residual deficits included moderate left-sided hemiparesis, facial weakness, and mild right lateral gaze palsy consistent with abducens nerve involvement. Coordination had significantly improved compared with early postoperative status.

Discussion

We conducted a focused review of the literature regarding similar clinical presentations and current management strategies for pontine cavernomas. Cavernous malformations typically present at a younger age compared with hypertensive intracerebral hemorrhages, most frequently affecting individuals between the second and fourth decades of life, with some studies suggesting a slight female predominance [6,10,14]. The annual hemorrhage risk for previously unruptured cavernomas is relatively low, estimated at approximately 2.7–5% per lesion per year; however, following an initial bleed, the risk of re-hemorrhage increases significantly, reaching 21–30% per lesion annually [9,10]. This elevated rebleeding risk, combined with cumulative neurological injury from repeated hemorrhages, represents a major argument in favor of surgical treatment of accessible brainstem cavernomas, particularly in younger patients with long life expectancy [9,15].

Unlike hypersensitive pontine hemorrhages, which are often associated with high mortality and limited surgical options, hemorrhages secondary to cavernous malformations represents a distinct entity in which the underlying bleeding source may be definitely removed through microsurgical resection [9,12].

Consequently, carefully selected cases may benefit from aggressive surgical management despite the inherent risks associated with brainstem surgery.

Diagnostic and Surgical Considerations: In the emergency setting, non-contrast CT remains essential for rapid identification of acute hemorrhage and hydrocephalus. MRI (T2, T2, GRE, and SWI sequences) provides definitive diagnosis and detailed anatomical characterization necessary for surgical planning [8,15,16].

The decision to operate on pontine cavernomas requires careful risk-benefit analysis. However, in patients presenting with severe neurological deterioration or coma, surgical intervention may represent the only realistic chance for survival or meaningful functional recovery [9,13]. Favorable surgical candidates often include lesions that reach a pial or ependymal surface [17]. Trajectory planning is critical. Although techniques such as the two-point method can assist in minimizing retraction and defining optimal surgical corridors, established brainstem safe-entry zones (SEZs) remain the preferred strategy to reduce injury to eloquent neural structures [10,18]. Within the pontine portion of the fourth ventricle, there are three principal SEZs include the suprafacial and infrafacial triangles as well as the median sulcus [20]. Nevertheless, any entry into the pons carries substantial risk of long-tract and cranial nerve injury [19,20].

Postoperative course: Paroxysmal sympathetic hyperactivity is reported in approximately 8–33% of patients with severe brain injury and is generally managed with supportive and symptomatic treatment [21,22]. Furthermore, multiple studies emphasize the importance of early, specialized, and prolonged neurorehabilitation, as patients frequently experience dysphagia, ataxia, dysarthria, paresis, and diplopia, all of which significantly impact functional independence and quality of life. Despite the complexity of recovery, a multidisciplinary approach can result in meaningful functional improvement [9–11,23,24].

Conclusion

Ruptured pontine cavernomas represent life-threatening neurosurgical emergencies that challenge both

surgical decision-making and neurocritical care management. Although emergency brainstem surgery carries substantial risks, selected cases may achieve favorable outcomes.

This case contributes to the limited body of literature demonstrating that meaningful recovery is possible even in patients presenting in deep coma following brainstem cavernoma hemorrhage. While neurological recovery is typically prolonged and gradual, significant functional gains may occur over months to years.

For clinicians, this case underscores an important message: severe initial presentation should not automatically preclude aggressive treatment in young patients with surgically accessible pontine cavernomas. When anatomical conditions permit safe access and comprehensive perioperative care is available, surgical intervention may offer the potential for substantial neurological recovery.

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