CASE REPORT

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Surgical management for ponto-mesencephalic cavernoma: determining the brainstem safe entry zone – a case report

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ABSTRACT

Introduction: Cavernous malformations of the brainstem are groups of dilated sinusoidal tracts. The surgical excision of cavernous abnormalities of the brainstem is high-risk and challenging. Clinical manifestations due to mass effect or hemorrhage, as well as MRI studies, have become valuable factors in determining the most appropriate procedure for brainstem cavernoma to achieve the safe entry zone of the brainstem.

Case: A case report on a brainstem cavernoma is reported here. A 10-year-old male with a pontomesencephalic cavernoma is presented. The cavernoma was surgically removed using a lateral supracerebellar infratentorial approach. The safe brainstem entry point was obtained with an intraoperative neuromonitoring (IOM) in spite of a neuronavigation devices. Post-op MRI images revealed a small residual mass. The patient had a favorable surgical outcome and was discharged on day 5.

Conclusion: Recognizing a microsurgical anatomical landmark and an intraoperative neuromonitoring instrument will be critical in preventing neurologic function injury.

Keywords: brainstem cavernoma, safe entry zone, surgery.

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INTRODUCTION

Cavernous malformations or the cavernoma of the central nervous system are estimated to account for 8-15% of all cerebrovascular lesions and have a 0.1%-4% prevalence in the general population.[1] Mainly the cavenorma found in supratentorial, around 20% are discovered in the brainstem.[2,3] The clinical appearance and location of the CM determine the risk of intracerebral hemorrhage (ICH).[4] Because of the critical functions of the brainstem, recurrent hemorrhages that lead to irreversible neurological deficits.[4] As a result, these entities should be regarded as potentially deadly conditions that necessitate additional management.

When presenting with focal neurological deficits, brainstem cavernous malformations have a 5-year estimated risk of ICH of 30.8%.[4] Brainstem cavernomas bleed and rebleed at much higher rates than other types of cavernomas.[5,6] In contrast to other cerebral cavernomas, brainstem cavernoma hemorrhages are never clinically silent. Because of the frequent hemorrhages, they produce serious neurological deficits.[6]

Many surgeons experience suggests that the veins in cavernoma drain the normal brain tissue, and the obliteration of this vein can result in venous infarctions.[7] We presented a brainstem pontomesencepalic cavernoma that was surgically removed using a lateral supra cerebellar infratentorial (L-SCIT) approach. Surgical strategies in brainstem cavernoma can result in post-operative morbidity or neurological impairments. Therefore, a good MRI assessment is required to establish a safe entry zone and reduce the risk. The lateral pontomesenchepalic zone has the thinnest cortex, and was chosen as the safe entry zone.

CASE REPORT

A 10-year-old male patient came with an abrupt loss of consciousness three weeks before the most recent admission. He experienced right-side motor impairment and palsy of the left 6th cranial nerve. He also had an unstable gait and tremor, according to clinical evaluation. A hyperdensity mass lesion on the brainstem was identified on plain head CT from a previous hospital. A magnetic resonance imaging (MRI) exam indicated a brainstem cavernoma in the mesencephalon and upper pons and evidence of recent bleeding (**Figure 1**). The lesion appears to favor the left side, which has the thinnest cortical layer with clot expansion on the left side. We determined the safe entry zone on the pontomesencephalic sulcus on the left side.

The patient was lying on a park bench position, with the head rotated 45° away from the lesion and flexed laterally downward toward the floor. The lateral supracerebellar infratentorial approach was used to expose the occipital bone (**Figure 2**). It was possible to expose both the transverse sinus and the sigmoid sinus. Dura mater opening in the T shape into the transverse sigmoid junction (**Figure 3**).

Follow the lateral surface of the brainstem, exposing the lateral pontomesencephalic sulcus. The surface of the brainstem appears yellowish (hemosiderin staining) as the safe entry zone (**Figure 3**). Neurophysiological monitoring is used to ensure there is no corticospinal tract below the surface of the safe entry zone (**Figure 4**). Superficial venous coagulation on the surface of the brainstem. The clot is removed to provide area for the cavernoma excision. Cavernoma excision from the entire capsule was accomplished with limited the use of bipolar coagulation (**Figure 5**).

The patient then treated in the intensive care unit for 24 hours, post operatively. The patient had left abducens palsy and worsened tremors in all four extremities. No dysphagia was found, the patient was able to walk with assistance, and the patient was discharged D+5 postoperatively.

DISCUSSION

Cavernomas of the brainstem have been linked to serious neurological disorders and recurrence hemorrhages. The recurrence bleeding rate rises to 45% per person annually after the initial hemorrhage.[8,9] Surgical treatment is being given to patients who have substantial neurological impairment and cavernoma along the pial or ependymal surface. Although morbidity rates are mostly related to surgical experience, nonsurgical groups had worse long-term results than surgically treated patients.[10,11]

MRI in cavernous malformation is a noninvasive differentiation method from other pathologies.[12] MRI was utilized for the initial diagnosis in the presented case. A follow-up MRI proved beneficial to the patient's long-term follow-up. For brainstem cavernoma, various procedures for surgery have been proposed. The most frequent are the orbitozygomatic approach, supra cerebellar infratentorial approach (SCIT), retrosigmoid approach, midline suboccipital craniotomy, and far lateral approach.[13]

The paramedian parts of the mesencephalon and pons are difficult to reach surgically. To access lateral and paramedian pontomesenchepalic cavernoma, a retrosigmoid exposure and a lateral pontomesenchepalic sulcus

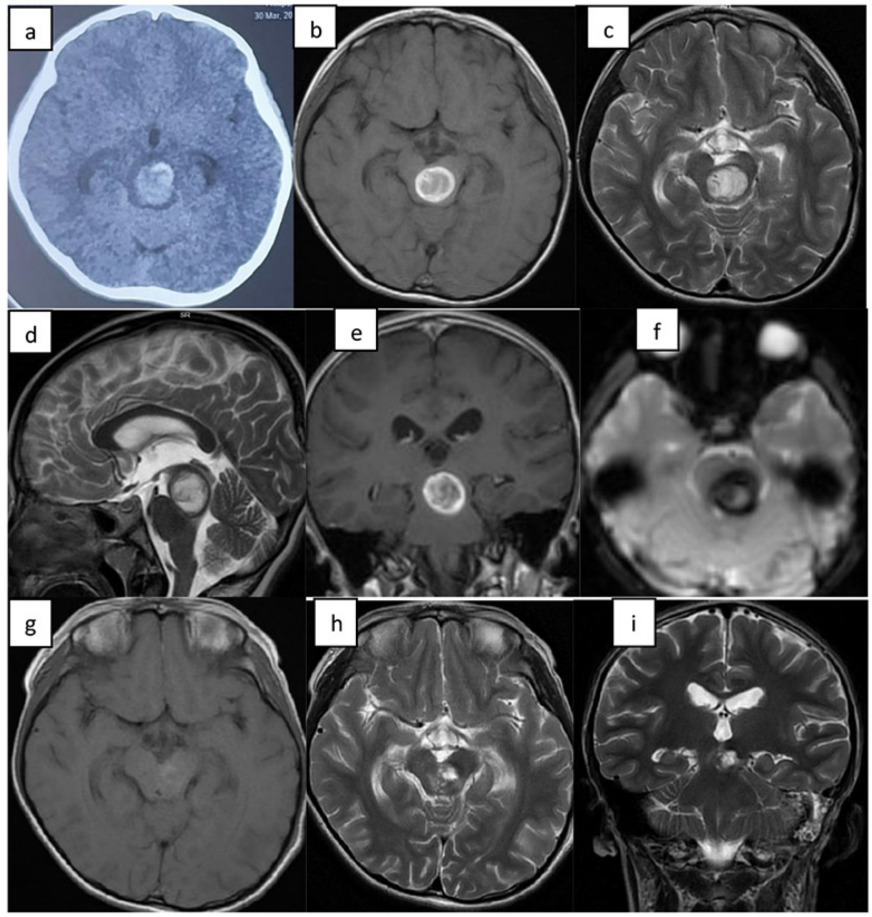

Figure 1. (a) Plain Head CT revealed hyperdensity mass on the brainstem. (b&e) Magnetic resonance imaging T1-weighted images show hyperintensity round mass on the mesencephalon and upper pons, and the clot expanded to the left cerebral peduncle. (c-d) T2-weighted image shows subacute bleeding of cavernoma on the ponto-mesencephalic zone. (f) Diffusion-weighted image (DWI) shows attenuation in the middle of the mass. (g) Post-operative T1- weighted images show small residual mass. (h&i) Post-operative T2- weighted images show hyperintensity on the mass was reduce with mix intensity in the median of pons.

Figure 2. The patient was placed in the park bench position, and a U-Shape Skin incision was planned. A lateral SCIT approach: expose the occipital bone from the left side.

route are usually used.[14,15] This type of exposure raises the chance of a venous brainstem infarction. In such cases, a recently developed method through the pontomesenscephalic sulcus with low morbidity and fatality rates could become more widely used.[16]

In this case, the safe entry zone in the brainstem was through the lateral pontomesenchepalic sulcus, providing simultaneous surgical exposure to the central and paramedian pons and the mesencephalon. There was a residual cevernoma in the presented case. Conservative observation and follow-up MRI exams were performed. We discovered that a hypothetical reoperation raises the chance of venous brainstem infarction. Because the residual lesion appeared non-aggressive on MRI, a cautious strategy was decided for this patient.

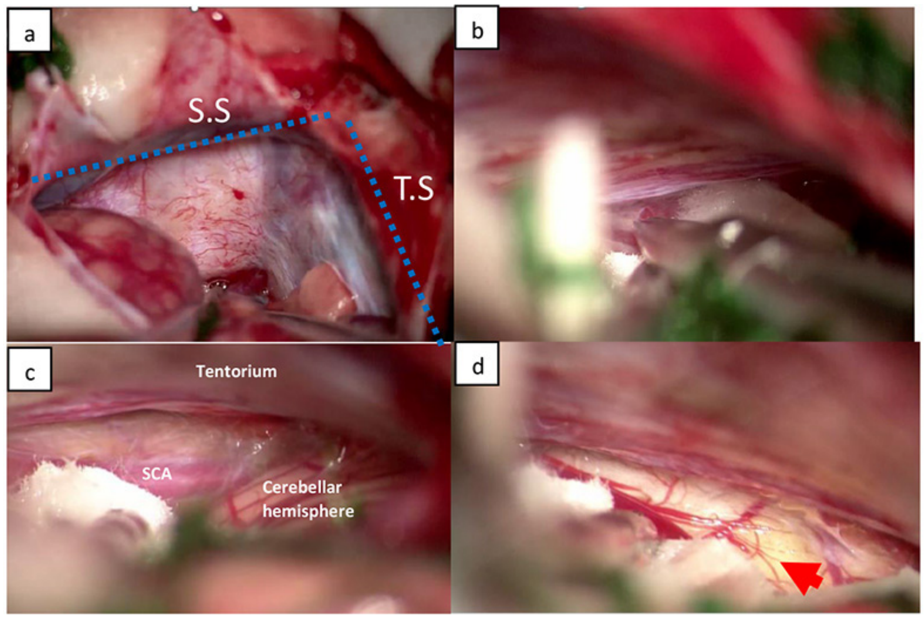

Figure 3. (a) Dura mater opening with T-shape into the transverse sigmoid junction. (b) Without brain retractors, open the arachnoid mater on cisterna magna and CPA, releasing CSF and Identification of the trochlear nerve. (c) The arachnoid layer is dissected along the SCA into the brainstem surface. The Fourth Cranial Nerve pushes down to the caudal side of the entry zone. (d) Red Arrowhead: yellowish brainstem surface (hemosiderin stain), suggested as the safe entry zone. SS: Sigmoid sinus; TS: Tranverse Sinus; SCA: Superior Cerebellar Artery

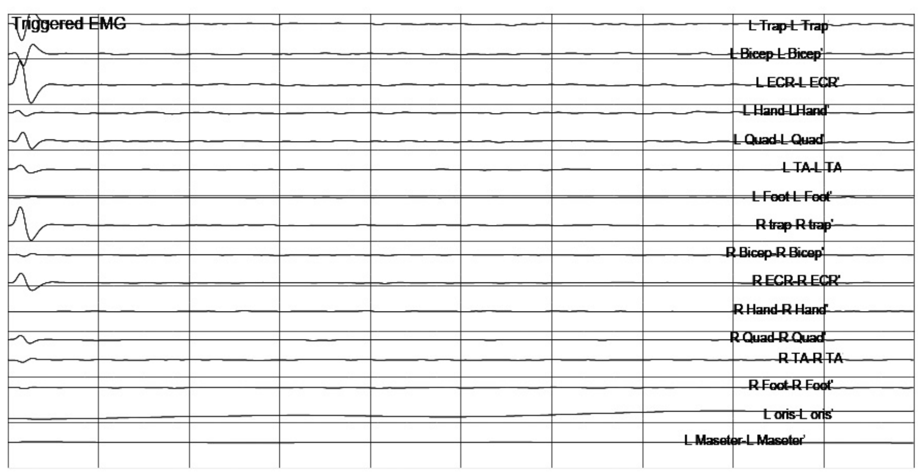

Figure 4. Intraoperative Neurophysiology monitoring confirmed the safe entry zone.

CONCLUSION

Recognizing a microsurgical anatomical landmark and an intraoperative neuromonitoring instrument will be critical in preventing neurologic function injury. To prevent future neurological deficits an appropriate surgical approach, selection, and careful handling of the surrounding structures are crucial. Clot expansion is one of the parameters to determine the surgical approach.

DECLARATION OF PATIENT CONSENT

Written informed consent was obtained from a parent. The parent has given their consent in the form for the images and other clinical information to be published in the journal. The patients understand that their names and initials will not be published, and that while every attempt will be utilized to conceal their identities, anonymity cannot be guaranteed.

CONFLICTS OF INTEREST

There are no conflicts of interest in this study.

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AUTHOR CONTRIBUTION

All authors had contributed to manuscript writing and agreed for the final version of manuscript for publication.

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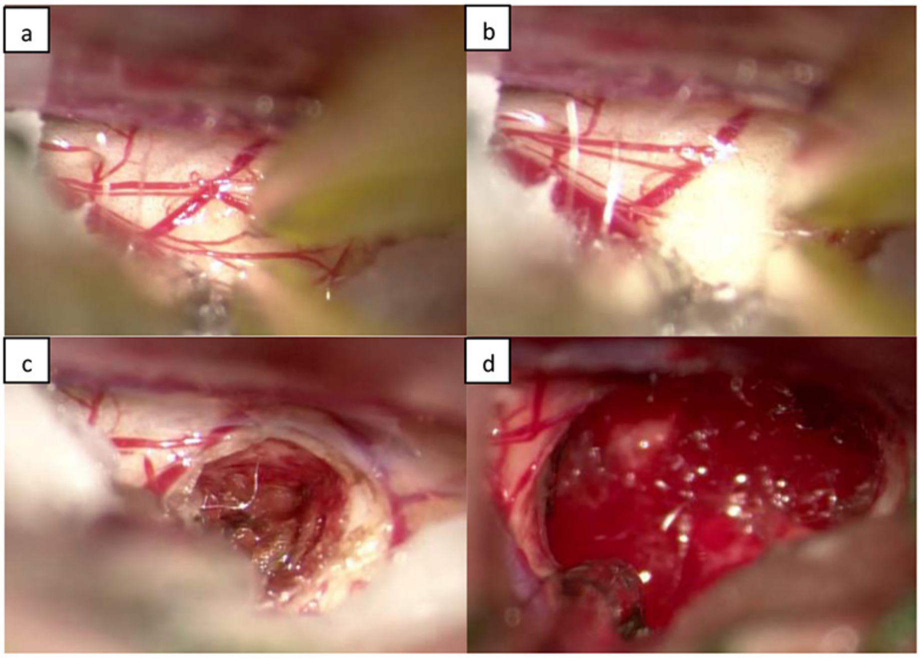

Figure 5. (a & b) Low voltage bipolar coagulation on the surface of pons. (c) Internal decompression of the hematoma. (d) After the removal of cavernoma, we placed a hemostatic agent into the cavity.

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