Microsurgery of Brainstem Cavernoma: Challenges & Outcomes

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Date of submission: 12th December 2023 Date of Acceptance: 17th January 2024 Date of publication: 15th January 2024

Abstract

Cavernous malformation of brainstem is at increased risk of hemorrhage compared to supratentorial cavernomas. Increased morbidity associated with brainstem cavernoma(BCs) is defined by the inherent eloquence of the surrounding structures. At present watchful waiting, microsurgical resection and gamma knife surgery are the treatment modalities for symptomatic brainstem cavernoma. However, in the resource limited settings microsurgical excision by selecting an appropriate corridor can help in gross total removal in the meantime improving the neurological deficit and patient satisfaction. In this case series we have reviewed cavernomas of midbrain and pons, the technical difficulty with its management and its outcomes.

Keywords: Microsurgery, Brainstem, Cavernoma, Outcomes.

Introduction

Cavernous malformations are angiographically occult, low pressure vascular malformation of central nervous system with estimated prevalence of 0.4-0.5%.[1] Brainstem cavernomas comprises for 15%-35% of overall cases. Brainstem cavernomas (BC) are at fivefold increased risk of rehemorrhage compared to the supratentorial cavernomas.[2] Increased morbidity associated with BCs is defined by the inherent eloquence of the surrounding structures. At present microsurgical and gamma knife surgery are the treatment modalities for symptomatic brainstem cavernoma.[3] Although resection of these BCs eliminates the risk of recurrent hemorrhage and associated morbidity, it still remains a surgical challenge owing to complex surgical anatomy, narrow corridor and risk of further neurological deterioration. Optimal surgical approach with axis along safe entry zone or where the lesion is subpial could reduce postoperative morbidity.[4] This case series highlights the challenges with microsurgical resection for of symptomatic brainstem cavernoma and its outcome.

Access this article online

Website: https://www.nepjol.info/index.php/NJN

DOI: https://doi.org/10.3126/njn.v20i4.60640

HOW TO CITE
Paudel K, Khadka N, Rai P, Rajbhandari B, Aryal S, Bhattarai SM, Shrestha R, Jha R. Microsurgery of Brainstem Cavernoma: Challenges and Outcomes . NJNS. 2023;20(4):69-71

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ISSN: 1813-1948 (Print), 1813-1956 (Online)

Case Series

Case 1

40-year-old female presented with headache for 6 days which was acute onset, generalized and relieved with medication. It was associated with nausea and 3 episodes of non-projectile vomiting. There is no history of loss of consciousness, abnormal body movements, and weakness of limbs. Her clinical examination revealed normal neurological findings. The Magnetic resonance Imaging (MRI) of brain revealed T1 hyper intensity in dorsal midbrain with T2 hyper intensity and no enhancement with gadolinium contrast. The lesion was consistent with midbrain cavernoma and planned for microsurgical excision as in figure 1.

She underwent right temporal craniotomy and sub temporal approach and excision of cavernoma. The sub temporal vein of Labbe and veins to sphenoparietal sinus were carefully preserve, temporal lobe retraction visualized the anterolateral aspect of midbrain with approximately 1*1cm2 reddish subpial mass crossed by fourth cranial nerve and Posterior cerebral artery on superior aspect. The Overlying arachnoid was dissected and posterior communicating artery and 4th carnial nerve was mobilized. A linear pial incision was given over the mass and internal debulking of hematoma followed by circumferential dissection and en bloc resection was carried out. Post operatively she developed weakness of right upper and lower limb which made complete recovery on 6 week follow up.

Figure 1: Preoperative MRI Brain

(a)TheT1sagittalimageshowinghyperintensesignalintensitylesionondorsalmidbrain (b) T2 Coronal and (c) T2 axial images showing mixed signal core with low signal rim - Typical Popcorn pattern of cavernoma

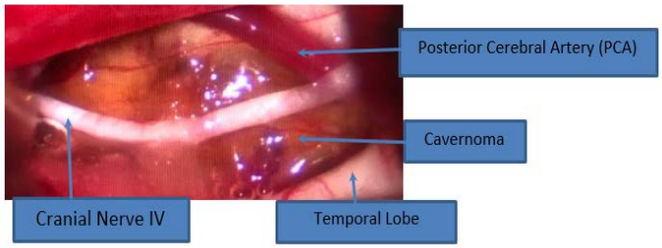

Figure 2: Intraoperative view in subtemporal approach

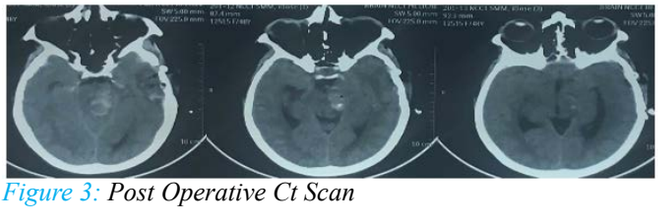

Figure 3: Post Operative Ct Scan

Noncontrast Ct scan of head showing gross total removal of Midbrain cavernoma with postoperative changes.

CASE 2

16-year-old female with sudden onset loss of consciousness for 30 mins, followed by weakness of right lower limb. On examination her motor power was 4/5 on right lower limb . Rest of the neurological examination was within normal limit. MRI of brain revealed a T1 hyperintense, T2 hyperintense lesion on dorsal aspect of pontomedullary region with no contrast enhancement.

She underwent suboccipital craniotomy and excision of brainstem cavernoma. Per - operatively there was 2*2 cm2 well encapsulated brownish mass over dorsal aspect of medulla oblongata. The lesion was incised and internally debulked of sub-acute blood clots and resected in piecemeal fashion followed by meticulous extracapsular dissection preserving the gliotic hemosiderin laden plane to prevent inadvertent neural injury. Motor power of right lower limb improved to MRC grade 5 on 6 weeks postoperatively.

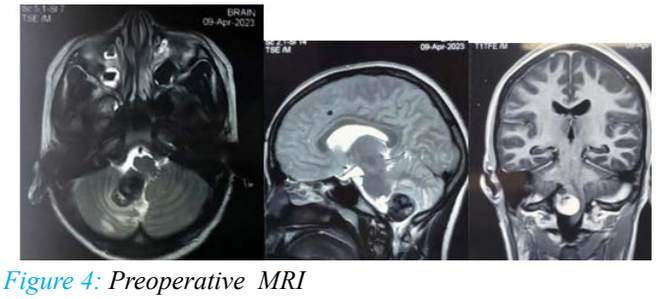

Figure 4: Preoperative MRI

(a)Axial and (b) Sagittal T2 Turbo spin echo sequence (TSE) sequence showing reticulated core of mixed signal dropout over dorsal aspect of medulla oblongata (c) Coronal T1 without contrast showing high signal intensity suggestive of subacute hemorrhage

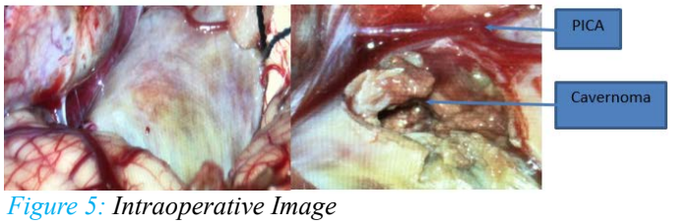

Figure 5: Intraoperative Image

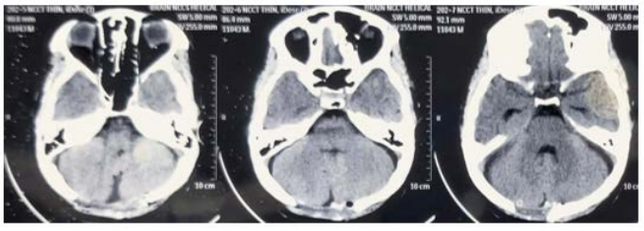

Figure 6: Post operative CT showing complete excision

Discussion

Brainstem cavernous malformations are usually asymptomatic with hemorrhage rate of 0.25-0.7% per person per year. The conservative approach with watch and see policy has been advocated for asymptomatic and familial multiple cavernomas. Re-hemorrhage risk may be increased significantly after each episode with annual hemorrhage risk as high as 32.3%.2 Currently, radiosurgery and microsurgery are the two treatment modalities available for treatment of brainstem cavernoma. Gamma knife radiosurgery with dosage less than 15 Gy has been shown to be effective to reduce the annual rehemorrhage rate from 32% to 3.6% with minimal radiation induced complications.[5]

Microsurgical resection still remains a gold standard treatment for symptomatic brainstem cavernoma those over subpial region and in safe entry zones.[6] Cavalcanti et al. described an orbitozygomatic pterional, sub temporal and supracerebellar infratentorial approaches to provide a straightforward route to ipsilateral anterior, lateral and posterior lateral surfaces of the midbrain respectively.[7] The longitudinal axis of the lesion dictates the optimal surgical corridor. While dissection a hemosiderin lined boundary guides the boundary of cavernoma and assist in gross total resection without inadvertent injury to neural structure.[8] We approached midbrain cavernoma with sub temporal approach and suboccipital craniotomy was done for medulla oblongata lesion taking into consideration the need of minimal tissue retraction ,maximizing the operative field, and identification of anatomical landmark for safely entering the cavernoma.

Zimmerman et al. suggested for surgical extirpation of brainstem cavernomas when patient is symptomatic, lesion is subpial and an operative approach can spare eloquent tissue.[9] When surgery is planned, elective surgical excision during the subacute phase following hemorrhage may be preferable as by this time distinct plane with brainstem parenchyma is developed.[10] Both of reported cases in our series were exophytic type and with optimal surgical approach gross total removal was accomplished while preserving eloquent structure.

Porter et al. reported improved outcomes in 87% of 84 patients following surgical extirpation of brainstem cavernomas, 10% worsened postoperatively and 4% died.[11] Similar, Abla et al. in their series of 300 patients reported a postoperative neurological deficit in 51% with 35% developing permanent deficit.[12] Philipp et al. highlighted-on health-related quality of life (HRQOL) after surgery of brainstem cavernoma, with substantial impairment in those with balance impairment and cranial nerve deficit.[13] So, the decision to proceed with resection

or manage them conservatively is primarily based on individual risk profile considering potential risk of hemorrhage, post operative morbidity and conservative treatment options. It is imperative to have 'shared decision making' with active patient participation which increase understanding of surgical risk and benefit, treatment satisfaction and encourage participation in postoperative physiotherapy for enhanced recovery. Both of our cases had post operative transient weakness of limbs which made complete recovery in 6 weeks follow up.

Conclusion

Brainstem cavernomas are benign lesion with risk of recurrent hemorrhage and increased morbidity. In general, asymptomatic lesion are managed conservatively while symptomatic and superficial brainstem cavernomas though challenging can be cured with optimal surgical approach and meticulous microsurgical technique.

Conflict of interest

There are no conflicts of interest.

Declaration of patient consent

The author confirms that a written consent from the patient/ patient guardian was obtained to publish the images and clinical details to be reported in the journal.

Ethical approval

The IRC granted ethical approval.

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