CASE REPORT

Ventral midbrain cavernoma, a surgical challenge: case report and review

Pedro Alberto Silva¹², António Vilarinho¹, Fernando Silveira¹³, and Rui Vaz¹²

Abstract

Background: Once considered surgically unapproachable, the brainstem remains a challenging field for neurosurgeons, despite technical advances and better anatomical understanding. Particularly in this location, vascular malformations such as cavernomas have the potential to induce severe neurological deficits and/or death.

Case Report: We report the uncommon case of a 39 year-old male who presented with diplopia, abnormal pupillary motor responses, and slight brachiofacial palsy. Imaging studies revealed a left ventral midbrain hemorrhage and subjacent cavernoma. An approach was performed to the lesion through pterional craniotomy and a pretemporal route to the interpeduncular fossa. A pial incision was directed by the presence of gliotic tissue and the cavernoma was excised, with complete reversal of symptoms.

Conclusions: We review the available literature and debate the surgical indication, the advantages, and the difficulties of this approach for cavernomas in this area. This case confirms there are relatively safe entry zones for the ventral midbrain, and that successful surgery is possible in this location with the right reference points.

Keywords: Cavernoma, Midbrain, Ventral, Microneurosurgery, Motor evoked potentials, Surgery.

¹Department of Neurosurgery, Hospital de São João, Porto, Portugal
²Faculty of Medicine, University of Porto, Portugal
³Department of Neurophysiology, Hospital de São João, Porto, Portugal

Correspondence: Pedro Alberto Silva
R. Dr. Alberto de Macedo, 196 2ª, 4100-027 Porto, Portugal
Email address: pedroalbertosilva.neurocirurgia@gmail.com

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Introduction

Cavernomas represent up to 10% of all central nervous system vascular malformations and are much more common in the supratentorial space [1]. When located in the brainstem they preferably present in the pons, and midbrain cavernous malformations (particularly the ventral aspect) are exceedingly rare [2], and offer diverse clinical manifestations [1, 3, 4].

Case report

A 39 year-old male, with no relevant previous medical history, namely cerebrovascular events in the family, presented with diplopia. Unsure of a specific time of onset due to the mildness of the symptoms and progressive improvement, he could guarantee at least one month passed after initial presentation before he developed right upper limb weakness, which motivated him seeking medical help.

Anisocoria, due to left subnormal direct and consensual pupillary response to light, and grade 4/5 right brachiofacial motor paresis, were the only clinical signs. No ophthalmoparesis could be elicited at this point. Brain CT suggested a left midbrain space-occupying lesion, and the patient was admitted for further studies. MRI reported a left midbrain hemorrhage in different stages of evolution (suggestive of a cavernous malformation with rebleeding), located ventrally and presenting itself at the medial pial surface of the left cerebral peduncle towards the interpeduncular fossa (Figure 1).

Under neurophysiological motor monitoring for left extraocular muscles and right upper/lower limbs, we per-
formed a left pterional craniotomy. After durotomy, the sylvian fissure was dissected, the temporal pole’s venous connections to the sphenoparietal sinus were sectioned, and both the mesial aspect of the temporal lobe and the oculomotor nerve were dissected from the free margin of the tentorium, opening the basal cisterns thoroughly and freeing the temporal lobe for polar retraction. After careful dissection of the internal carotid bifurcation complex, in order to create safe space, and following the oculomotor nerve posteriorly through the characteristic wedge-shaped space between the posterior cerebral and superior cerebellar arteries, a yellowish pial surface protruded anteriorly immediately above the third nerve point of exit (Figure 2).

A limited incision was performed, different densities of hematoma were drained and a small cavernous malformation was excised, sparing its drainage vein. No neurophysiological events were registered.

The patient had an uneventful post-operative clinical course and was asymptomatic from day one.

**Discussion**

Natural history for brainstem cavernomas and surgical morbidity are the defining factors in the decision to conservatively manage or to excise them [5], and seem to favor a therapeutic effort in the presence of neurological deficit, hemorrhage in the immediacy of the lesion, and short distance to a pial surface [6].

Rebleeding rates seem to differ widely from supratentorial cavernomas. Pandey et al. [7] reviewed 176 patients and found an annual rate of rebleeding of 31.5% after an initial event. Fritschi et al. [8] reported close to 30% death or disability rates with conservative management. Considering selection biases, surgery offers comparatively better neurological outcomes, with death or deficit worsening limited to 11.2% [7] to 15% [8, 9] of patients. Neurological status can be immediately improved by surgery [1] or allow for improvement after rehabilitation [7], which should be taken as encouragement if the preexisting deficits are incomplete.

Safe surgical access to the lesion is a determinant of success [10], and pathways to the midbrain are scarce [11]. Subtemporal approaches are by definition preferred to directly access the lateral and posterolateral surfaces of the midbrain, and a transtentorial step can be used to improve the width of the surgical channel into the upper pons [12]. The retrosigmoid approach can also be extended to offer good results for these locations [4]. In our case, however, the ventromedial presentation of the cavernoma suggested a longer surgical pathway and a greater risk for motor fiber injury with these.

**Figure 2.** Intraoperative caption depicting the wide surgical view the pretemporal access allows to the surgeon. *: Cavernoma Pial Surface; III: oculomotor nerve; PCA: Posterior Cerebral Artery; SCA: Superior Cerebellar Artery; BA: Basilar Artery; MCA: Middle Cerebral Artery; II: optic nerve; ACA: Anterior Cerebral Artery
Ventral approaches to the midbrain are made difficult by the particular anatomy and vital vascular and nervous structures that stand in the way. In particular, the corticofugal fibers that make the anterolateral surface of the cerebral peduncle must be spared, and the basilar apical complex, together with the oculomotor nerves, create a small window, a so-called “fairly safe entry zone” [13], that must be recognized. The pretemporal access to the skull base allows for extreme temporal lobe retraction, creating a wide surgical view for anterior midbrain exposure. Similar in concept but arguably more limited in space, a transsylvian transpeduncular approach has been reported [13, 14], and can be used if the anterior circulation presents a favorable anatomy. This approach has been described through an orbito-zygomatic craniotomy to widen the angle of vision [1, 2], something we found not necessary. Intraoperative extraocular muscle monitoring is vital to improve the safety profile if the lesion is in close proximity to oculomotor or the trochlear nerves [15], as are intermittent transcranial motor evoked potentials [16].

Conclusion

Advances in microneurosurgery and intraoperative monitoring have allowed for safe resection of lesions inside vital structures of the central nervous system. A pterional craniotomy and a pretemporal approach to the interpeduncular fossa offer a competent access for ventral midbrain cavernoma surgery, without significant morbidity.

Competing interests

The authors declare no conflict on interest.

References