Surgical Management of Nonvascular Lesions Around the Oculomotor Nerve

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Key words
- Arachnoid cyst
- Endodermal cyst
- Nerve reconstruction
- Neuroma
- Oculomotor nerve
- Schwannoma

Abbreviations and Acronyms
CI: Cisternal segment
CI-CS: Cisternocavernous segment
CN: Cranial nerve
CS: Intracavernous segment
Gd-DTPA: Gadolinium—diethylenetriaminepentaacetate
GTR: Gross total resection
MRI: Magnetic resonance imaging
NTR: Near-total resection
PR: Partial resection
STR: Subtotal resection


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Citation: World Neurosurg. (2014) 81, 5/6:798-809. http://dx.doi.org/10.1016/j.wneu.2012.11.067

Journal homepage: www.WORLDNEUROSURGERY.org

Available online: www.sciencedirect.com

OBJECTIVE: **Schwannomas originating from the oculomotor nerve are extremely rare. We report our experience in the management of oculomotor schwannomas and other lesions mimicking them, and discuss operative strategy for these rare tumors emphasizing oculomotor nerve preservation.**

METHODS: **The clinical records of our patients and all those reported in the literature focusing on oculomotor schwannomas were reviewed and analyzed. The clinical presentations, operative approaches, complications, and results were studied.**

RESULTS: **Between 1983 and 2010, six patients with primary oculomotor nerve lesions were treated. Three of them had schwannomas. Two others had pathologies that mimicked an oculomotor schwannoma and one was suspected as schwannoma. In the literature there were 55 previous cases of oculomotor schwannomas reported (surgical treated, 41 cases; observed, 9; gamma knife surgery treated, 2; autopsy, 3). Patients presented most commonly with diplopia, followed by headache and ptosis as initial symptoms. Out of 55 patients including the present 3 cases (3 autopsy cases were excluded), 30 patients (54.5%) finally developed oculomotor nerve palsy. Fifteen of 44 patients (34.1%) who underwent surgery developed persistent postoperative oculomotor palsy. Among them, 6 patients developed total palsy after surgery. Five of 12 patients (41.7%) who did not undergo surgery also developed oculomotor palsy. Oculomotor schwannomas most often grow its cisternal segment (48.3%) followed by intracavernous (39.6%) and cisternocavernous segments (12.1%).**

CONCLUSION: **The microsurgical resection of oculomotor schwannomas carries a risk of worsening preoperative oculomotor nerve function; however, this is often transient. Considerable technical training and microanatomical knowledge of the region is required to optimize outcome.**

INTRODUCTION

Schwannomas (neurinomas, neuromas) account for about 8% of all intracranial neoplasms and most commonly arise from the vestibular nerves, the trigeminal nerve, and lower cranial nerves (CNs) in decreasing order. These lesions usually occur from sensory nerves except in patients with Recklinghausen disease (neurofibromatosis type 2) which involves motor nerves as well. Schwannomas arising from Schwann cells of the third CN are extremely rare cranial base neoplasms. In the past, surgical gross total resection (GTR) was often performed with a significant rate of complete oculomotor nerve palsy. These lesions are benign, slowly growing tumors; thus, complete resection affords the patient a chance for a cure. However, surgical treatment of these tumors requires precise microsurgical technique. It is of utmost importance to preserve the oculomotor nerve during surgery.

We report our experience with intracranial oculomotor schwannomas and other tumors mimicking oculomotor schwannoma (endodermal cyst [previously reported], hemorrhagic arachnoid cyst) and discuss our operative strategy with a review of the current literature (45).

METHODS

We retrospectively reviewed our 3 cases of oculomotor schwannomas, 48 reports (55 cases) of intracranial oculomotor schwannomas in the literature, and other pathologies arising from or around the oculomotor nerve that caused oculomotor nerve palsy. All schwannomas originated from the intracranial portion of the oculomotor nerve. Articles were identified via PubMed search using the key words "oculomotor nerve tumor," "schwannoma," "neuroma," "neurinoma," "neurilemmoma," "cavernous sinus tumor," "third cranial nerve," "oculomotor nerve palsy," and "oculomotor nerve reconstruction" alone and in combination. Tumors localized in the intraorbital space (orbital tumors) were not included. The average patient age at presentation, initial symptoms, clinical presentations, tumor

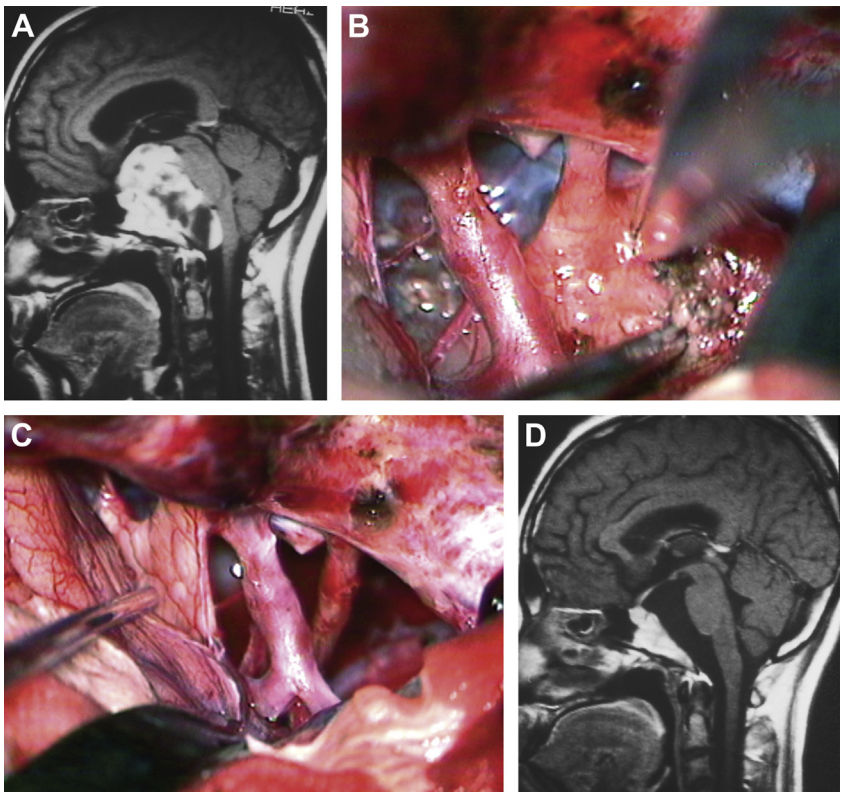

Figure 1. (**A**) Preoperative sagittal postcontrast T1-weighted magnetic resonance imaging (MRI) demonstrates an irregular lesion with heterogenous enhancement occupying the interpeduncular and the premedullary cisterns compressing the brainstem posteriorly. (**B**) A solid portion of the tumor that was located lateral to the right oculomotor nerve was exposed. The oculomotor nerve fused into the tumor at its cisternal segment. (**C**) Final view of the gross-total resection of the tumor. The oculomotor nerve was nicely preserved. (**D**) Postoperative sagittal postcontrast T1-weighted MR image demonstrates no residual tumor.

locations, surgical approaches, extent of tumor resection, postoperative oculomotor nerve status, complications, and results were reviewed and analyzed.

RESULTS

In the present series, the mean patient age of oculomotor schwannomas at presentation was 37 years (range 20–58 years). One patient was male and two patients were female. Patients presented with symptoms of headache, vomit, ptosis, diplopia, and visual disturbances. The tumors were located in the interpeduncular-prepontine cisterns, interpeduncular cistern, and interpeduncular cistern-cavernous sinus, respectively. GTR of the tumor was achieved in 2 cases, whereas subtotal resection (STR) was achieved in 1 case through transzygomatic frontotemporal, transzygomatic subtemporal, and standard frontotemporal transsylvian approaches. In two of the cases, the third nerve was able to be separated from the tumor and functionally preserved. Postoperative oculomotor nerve status temporarily worsened in 1 patient, but recovered fully by 12 months. One patient presented with preexisting ipsilateral blindness and total oculomotor palsy from previous surgery. Another patient had a 5-mm-size mass that was suspected as oculomotor schwannoma. He presented with intermittent ptosis and has been followed conservatively over the last 2 years.

We also had two other pathologies that mimicked an oculomotor schwannoma (endodermal cyst = 1; arachnoid cyst = 1) presenting with oculomotor nerve palsies. Both lesions were resected with improvement in their presenting oculomotor nerve symptoms at follow-up.

CASE PRESENTATIONS

Case 1 (Schwannoma)

History. A 20-year-old woman who presented with a several-month history of persistent headache and dizziness, and new-onset vomiting.

Examination. Clinical examination demonstrated bilateral papillary edema. No neurologic deficits were present at admission. A coronal magnetic resonance imaging (MRI) with gadolinium–diethylenetriaminepentaacetate (Gd-DTPA) using T1 revealed a 65 × 42 × 35-mm irregular mass lesion with heterogeneous enhancement occupying the interpeduncular cistern extending to the anterior edge of the foramen magnum along the clivus compressing the brainstem posteriorly (Figure 1A).

Operation and Pathologic Findings. A right orbitozygomatic frontotemporal pterional approach was used. After frontotemporal craniotomy, the orbital rim and zygomatic arch were removed to obtain a flat view of the optic chiasm and surrounding structures. The sylvian fissure was opened and the temporal lobe was retracted, revealing a mass expanding laterally and compressing the carotid artery medially. The multilobulated lesion was emptied of its cystic content and carefully separated from the internal carotid artery, posterior communicating artery, its perforators, pituitary stalk, optic chiasm, and fourth, fifth, and sixth CNs. The third CN was fused to the tumor at its cisternal segment (Figure 1B), and it was obvious that the tumor arose from the third CN. No cavernous sinus invasion or extension of the tumor was seen. The tumor origin attached to the third nerve was carefully incised, and then the rest of the tumor was separated form the brainstem and basilar artery as en bloc. The third nerve was nicely preserved (Figure 1C). The histopathologic diagnosis of the lesion was schwannoma.

Postoperative Course. Postoperative MRI demonstrated no residual tumor (Figure 1D). The patient initially developed a complete oculomotor palsy postoperatively; however, the symptoms