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Clinical characteristics and prognosis factors analysis for post-operative ptosis of sphenocavernous meningiomas: A single institution study

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ABSTRACT

Objective: Complete and safe resection of sphenocavernous (SC) meningiomas is difficult and also a great challenge for neurosurgeons. The goal of our study was to report the surgical results and complications for these patients treated at our institution as well as trying to find the factors resulted in ptosis after the operation.

Materials and methods: Forty-nine consecutive SC meningiomas cases that underwent surgery between April 1997 and December 2012 were reviewed. The clinical courses of all patients were recorded. Prognosis factors of post-operative ptosis were evaluated.

Results: There were 38 female and 11 male patients. Mean duration of symptoms was 20.9 months. Visual deficit (34.7%) and headache (22.4%) were the most common presenting symptoms. Mean maximum diameter of the tumors on MRI was 5.1 cm. Subtotal resection was achieved in 51.0% of patients. Follow-up data were available for 39 patients, with a mean follow-up of 73.7 months, and four patients died during follow-up period. Of the 35 living patients, 22 (62.9%) lived a normal life. Univariate analyses showed that factors associated with post-operative ptosis included female patient, with primary operation and the cavernous extension in Category 3 of Hirsch' grading, while multivariate regression analyses showed that only the cavernous extension in Category 3 of Hirsch' grading was independently associated with post-operative ptosis.

Conclusions: Our experience suggests that the most common complication after the SC meningioma surgery is ocular cranial nerve dysfunction, and the only significance factor relative to post-operative ptosis is the level of extension to the cavernous.

1. Introduction

Sphenocavernous (SC) meningioma is a kind of media sphenoid ridge meningioma occupying the region of the anterior clinoid and adjacent medial sphenoid wing, which involve the pericavernous or cavernous sinus structures [1–3]. The involvement of the cavernous sinus makes the complete and safe resection of SC meningioma extremely difficult for even most experienced neurosurgeons. Although there has been great development of the anatomical understanding and operative techniques for skull base tumors, higher morbidity of cranial nerves dysfunction have been observed in these tumors compared with meningiomas in other locations [2–10]. Ocular nerve palsy is one of the most frequent complications for SC meningiomas surgery [1,11–14]. The prime symptoms of it include binocular diplopia, pupil enlargement and lack of light reaction, and ptosis. Dropping of eyelid has seriously affected cosmetic and communication of the patients. The neurosurgeons have to face the troublesome question whether ptosis will happen or not after operation, and if it occurs, whether it recover or not, and how long. However, only few reports with small patient cohort have paid special attention to ptosis. Therefore, the aim of our retrospective study was to analyze the clinical characteristics, surgical outcomes and complications of SC meningiomas, with

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special concerning of ptosis, in the Department of Neurosurgery Center of Beijing Tian Tan Hospital to get a better understanding of the results and complications of sphenocavernous meningiomas.

2. Patients and methods

2.1. Patient population

From April 1997 to December 2012, a total of 49 consecutive adult SC meningioma patients underwent operation by the senior author (JT Zhang) in the Department of Skull Base and Brain Stem, Neurosurgery Center of Beijing Tian Tan Hospital, Capital Medical University, China. This study was approved by the Research Ethics Committee of Beijing Tian Tan Hospital.

2.2. Neuroimaging studies and ocular examination

All patients were evaluated preoperatively with computerized tomography (CT) and/or a contrast enhanced magnetic resonance imaging (MRI) scan. In some patients with large tumors or with extensive involvement of the branches of internal carotid artery (ICA), cerebral angiography was performed to evaluate the blood supply to the tumor. Encasement and narrowing of blood vessels was assessed using both MRI scans and cerebral angiography. The presence of a long T2 signal in the adjacent brain parenchyma indicated disruption of the blood–brain barrier and invasion or adherence of the tumor. The extent of tumor removal was judged objectively according to the postoperative MRI within 1 week. All patients in our cohort had received routine examinations by ophthalmologists pre- and postoperatively, including vision, eye movement, ptosis, and so on, to evaluate the effect of surgery.

2.3. Surgical procedure

The patient was placed supine with shoulder ipsilateral to the approach slightly elevated and the head fixed in the Mayfield 3-pin head-rest and turned 30° to the opposite side. Electrophysiological monitoring of the ocular nerves was used in the operations since 2000. Three approaches were used for the resection of SC meningiomas. For most of the patients (30 cases), a standard frontotemporal craniotomy as described by many reporters is performed [15,16], including extensive drilling off the sphenoid wing and the remove of posterolateral orbital wall to completely decompress the superior orbital fissure. Great care was taken for drilling off the roof of the optic canal in order to prevent heat damage of optic nerve from drilling. After opening the dura the sylvian fissure was dissected. The tumor was devascularized and then carefully removed in a piecemeal fashion. Special care was taken for identification and controlling of the middle cerebral artery (MCA) and its branches to avoid post-operative cerebral infarction. For the tumor in the cavernous sinus, the lateral wall of the cavernous sinus was dissected and tumor was removed with cautious bipolar coagulation. Aggressive removal of the tumor in the cavernous sinus was not attempted for the preservation of neurologic function. For some patients (14 cases) with tumor extension to subtemporal region, a frontotemporal zygomatic craniotomy was performed to reduce the dragging of brain tissues. For the patients (5 cases) with extensive tumor growth to suprasellar, prepontine or superior orbital fissure, frontotemporal approach associated with orbitozygomatic osteotomy was adopted to facilitate the removal of roof and lateral wall of the orbit.

2.4. Patient follow-up

Follow-up data were available for the patients with clinical examination and MRI scans at 6 months and 1 year after surgery. Long-term follow-up in this study was based on our outpatient files and, for a few patients, by home visiting. Thereafter, patients were followed every 1 or 2 years.

Table 1
Clinical presentation of 49 patients with sphenocavernous meningiomas.[a]

Symptom and sign	No. of patients
Visual deficit (blindness)	16 (1)
Headache	11
Facial numbness	7
Seizures	7
Double vision	6
Ptosis	5
Exophthalmos	5
Dizziness	4
Mental disturbance	2
Asymptomatic	2
Limber tremor	1
Weeping	1

[a] Some patients had more than one symptom.

Table 2
Hirsch' grading in 49 patients of sphenocavernous meningiomas.

Grade	Definition	No. of patients (%)
Category 1	Touching and partially encasing the cavernous carotid artery	25 (51.0%)
Category 2	Completely encircle the artery but do not narrow its lumen	20 (40.8%)
Category 3	Completely encircle and narrow the cavernous carotid artery	4 (8.2%)

2.5. Statistical analysis

The univariate analysis of the predictors of the ptosis after operation was performed using the log-rank univariate method. Significance was determined using the log-rank test, with the p-value considered significant at the 5% ($p < 0.05$) level. A multivariate Cox regression analysis was then performed to determine the independent impact of factors found to be significant or trending toward significance in the univariate analysis. All descriptive and statistical analyses were performed using predictive analysis software statistics version 17.0 (SPSS, Chicago, IL, USA).

3. Results

3.1. Clinical data

Eleven patients were males, and 38 were females (ratio = 1:3.5). The ages ranged from 31 to 74 years (52.4 ± 8.8 years). The mean duration of symptoms was 20.9 months (ranging from 1 week to 108 months). Presenting symptoms and signs were summarized in Tables 1 and 2. The most frequent presenting symptoms were visual deficit (17/49, 34.7%) and headache (11/49, 22.4%). Cranial nerve deficits were seen most commonly (28/49, 57.1%) with dysfunction of the 3rd and 5th cranial nerves in 9 cases (18.4%) and 6 cases (12.2%), respectively. Ptosis was found in six cases with various degrees (4 cases with complete) (Table 1). Thirteen patients (26.5%) in this series had undergone previous surgeries for media sphenoid ridge meningioma (12 patients in other hospital, 1 in our hospital), and 2 (4.1%) had received radiosurgery. The preoperative Karnofsky performance scale (KPS) was 78.2 ± 6.3.

3.2. Tumor characteristics and surgical aspects

The mean maximum diameter of the tumors on MRI was 5.1 cm (range, 2.5–9.0 cm). According to Hirsch' grading [17], the tumor touches and partially encases the cavernous carotid artery were