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10 cases of meningioma in skull base clinical report treated by microsurgery

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[**Abstract**] Objective To summary the experience of microsurgery of meningioma in skull base treatment. Methods To study the clinical data of 10 cases patients of meningioma in skull base who were subjected to microsurgery by using retrospective analysis. Among the 10 patients, there were 3 cases of meningioma of the olfactory groove. There were 2 cases of sphenoid ridge meningioma, meningioma in the middle cranial fossa, meningioma in the cerebellopontine angle respectively. There was 1 case of meningioma of velarium in temporal lobe. Results In 7 cases, the meningioma was completely removed. And in another 3 cases, the meningioma got subtotal resection. During and after the operation, there were no severe complications observed or death occurrence in all the 10 cases of meningioma patients. Two months post of operation, all patients got a significant amelioration in their symptoms. A total of 9 cases were followed up. There was 1 case of IIa type meningioma recurred. Conclusion: To elevate the whole shearing rate of meningioma in skull base and reduce the mortality of it, it is most important for appropriate operative route selection and well mircosugical technique application.

[**Key words**] Meningiomas; Skull base; Microsurgery

颅底脑膜瘤的显微手术治疗

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[**摘要**] **目的** 总结颅底脑膜瘤的显微手术治疗经验. **方法** 回顾分析显微镜直视下手术切除 10 例颅底脑膜瘤的临床资料, 其中嗅沟脑膜瘤 3 例, 蝶骨嵴脑膜瘤、中颅窝底脑膜瘤、桥小脑角脑膜瘤各 2 例, 颞叶天幕脑膜瘤 1 例. **结果** 肿瘤全切除 7 例, 次全切除 3 例. 无严重并发症或死亡病例. 术后 2 个月全部病人症状改善. 9 例获随访、2a 脑膜瘤复发 1 例. **结论** 选择好手术入路和运用好显微外科技术可以提高颅底脑膜瘤的全切率, 降低死亡率.

[**关键词**] 脑膜瘤; 颅底; 显微外科手术
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A total of 10 cases of patients who were subjected to the meningioma in skull base were recruited in the Microinvasive Neurosurgery Department of the 1st Affiliated Hospital of Kunming Medical University. They all underwent microsurgical treatment and had a satisfactory therapeutic effect without severe

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complications observed or death occurrence. To summary the experience of microsurgery of meningioma in skull base treatment, we used retrospective analysis to investigate the therapeutic effects in these patients with aim to elevate the whole shearing rate of meningioma in skull base and reduce the mortality of it.

1 Clinical data and methods

1.1 General data

Among 10 cases of meningioma patients, 4 cases were male, 6 cases were female. The average age was 50.2 year-old. The longest medical history was two years, while the shortest was five months. Among these 10 cases, there were 3 cases of meningioma of the olfactory groove. There were 2 cases of sphenoid ridge meningioma, meningioma in the middle cranial fossa, meningioma in the cerebellopontine angle respectively. There was 1 case of meningioma of velarium in temporal lobe.

1.2 Clinical manifestation and signs

Different manifestation occurred in different patients. A total of 8 cases complained headache. Dizziness emerged in 5 cases. In 3 cases of patients, epilepsy emerged. Papilledema was observed in 5 cases. Hemiparesis was found in 3 cases of meningioma patients. Olfaction disorders were found in 2 cases. In another 4 case of patients, slight aphasia, positive mono-pathological sign, attenuation of ability of memory and tinnitus was observed respectively.

1.3 Test of iconography

All 10 cases of patients in this study underwent CT and MRI examination. Among them, 6 cases of patients were subjected to computed tomographic arteriography (CTA) examination apart from CT. The images of CTA/CT and MRI mainly displayed as extra-brain space-occupying focus with clear-cut boundary, accordant with optical density and affluent blood supply. The morphology of meningioma was diversity, mainly oval in shape. In 1 case of meningioma in cerebellopontine angle, the cerebellopontine angle exhibited thin and flat. According to the measurement during the operation and from CT and MRI, the biggest diameter of the meningioma was 7.0 cm, and the smallest was 4.5 cm, the mean diameter of the meningioma was 5.35 cm.

1.4 Operative methods

All 10 patients recruited in this study were subjected to microsurgery to remove the meningioma under the operating microscope (10-15 folds in amplification) following General Anesthesia. The operative route was selected according to the localization by using CT, MRI and CTA. Most importantly, low order incision was adopted. The excision standard of the meningioma was ascertained by the observation by the operator and the recheck outcome revealed by CT or MRI. Grade of Simpson Ⅰ or Ⅱ was considered as whole excision. Grand of Simpson Ⅲ was considered as subtotal resection.

2 Results

The meningioma was wholly removed, concomitantly removed its basilar part dura mater and skull, or only the dura mater it attached and skull, which was considered as whole removal. Among the 10 patient group studied, the meningioma was completely removed in 7 cases, the excision rate was 70% .In another 3 cases, the meningioma was subtotal resected. The pathological examination (classification was not perfomed) revealed that there were 5 cases exhibiting fibrous type, 2 cases exhibiting menigeal endothelial cellular type, 1 case showing untypical meningioma, 1 case showing transitional form, another one showing grit type. All the 10 patients got symptom improving, among which headache and izziness transference cure occurred in 5 cases, occupied 62.5 and 100% respectively. In another 5 cases, papilledema attenuated or partial relieved. In a part of patients, the newly occurred facial nerve impair symptom ameliorated post of operation. Within half a year post of operation, the preoperative symptom of nearly all patients further ameliorated or even disappeared. Following the operation, 9 cases were followed up, another a case exhibited recurred with Meningioma type 2a.

3 Discussion

The anatomic structure of skull base is very complex. The meningioma of skull base commonly encapsulated important nerves and blood vessels, such

as basilar artery, carotid arteries, even invade the brain stem. Up to now, the therapy of meningioma of skull base mainly depends on microsurgery treatment. However, it is a challenge to wholly remove the meningioma, with concomitant high mutilation and mortality. Pichierri et al [1] advocated that the therapeutic purpose of meningioma is to control the progress of the disease and ameliorate the symptoms, rather than whole resection of the tumors, which based on accumulating clinical practice and experience in recent 20 years.

As for preoperative examination, MRI is the most necessary one which not only can ascertain the diagnosis, judge the texture of the tumors and the prognosis, but also ascertain the blood supply of the tumors, especially evaluation from using MRI reinforced image. To further understand the blood supply and relationship among large arteries and their branches intra- and extra-calvarium, CTA and DSA examination can be employed. In this study, a total of 6 cases underwent CTA examination which showed that in 1 case among these, large sphenoid ridge meningioma partially encapsulated ipsilateral internal carotid artery and its branches. For the meningioma with affluent blood supply, ultraselectively embolism of the artery of the meningioma during DSA examination can significantly reduce the transoperative bleeding and decrased gross tumor volume [2]. Furthermore, Lichtenbaum et al [3] found that direct injection of hydrogen peroxide can also reduce the transoperative bleeding and shorten the operating time, avoiding the preoperative tumor- embolism.

Notably, during the microsurgery, the firstly important is the operative routine selection, which warrants the smooth of the operative procession. According to CT, MRI and cerebral angiography (CAG), personalized design for the operative routine and ascertain the position of the skull window characterized by "exposure of the tumors" is the emphasis prior to the operation. In the microsurgical procedure of all the patients in this study, low-set incision was adopted. Yasargil et al[5] advocated enlarged skull base operative routine. Because of this, the bony valve is big enough to facilitate to operative procedure, which not only can completely expose the basilar part of the tumors, feeding artery and draining vein, but also avoid cutting redundant surface brain tissues beneath the meningioma, damaging blood vessels and other important structures. The concept of microinvasive surgery is not relied on the small skull window, as small skull window or small incision is hard to prevent the difficulties involving the whole removal of the meningioma in the skull base, operative exudation, erosion of the dura mater and the removal of the skull [6]. Therefore, small skull window or small incision is not the exclusive judge standard of microinvasive operation. As for the technique for meningioma removal, it is important for operators have intimate knowledge of microanatomy and microsurgical technique. During the microsurgical procedure, the meningioma would be removed by utilizing the arachnoid interface. It is postulated that the arachnoid interface between the tumors and nerves may be the main cause that permanent nerve injury did not occur when removal of the tumors[1]. In our study, there were 4 cases in which the biggest diameter exceeded 6.0 cm. As to whole removal of these giant meningioma, we must abide three main principles: firstly, manipulate the operative bleeding and remove the meningioma by fractionation. Most importantly, protect the brain function in that intratumorally should be conducted firstly in order to shorten the tumor body, and then isolate the peri-tumor carefully, remove the tumor wall by fractionation, ultimately wholly remove the tumor gradually. As for meningioma with affluent blood supply, it is must be removed as soon as possible, concomitantly prevent the important blood vessels and brain tissues from injury. Given the patients were under secure condition and the rate of neural functional impairment was not increased, the tumors should be extensively removed. If the whole removal of the tumors would aggravate the nerve functional impairment, a few important structure, such as internal carotid artery and cavernous sinus adhered to tumor tissues should preferably reserved so as to elevate the life quality of patients after the operation. During our microsurgical procedure, there was no obvious arachnoid space observed between the meningioma and ipsilateral internal carotid artery in 1 case of sphenoid ridge meningioma patient. However, under this condition, the meningioma did not closely adhere with partial artery branches encapsulated, and the substance of the

meningioma was soft. So under the temporal blockage of ipsilateral internal carotid artery for less than 12 min, the meningiom tissues were isolated securely from the wall of the supplying blood vessels.

In our patient group, there were three cases of meningioma of the olfactory groove were divided into 3 types according to Romani principle–large, moderate and small type respectively, with 1 case in each type. The meiningioma in these 3 patients all located at middle line without lateral growth. These 3 patients were all subjected to bi–forehead craniotomy through anterior longitudinal crack operative routine. For this operative routine, although the anterior of superior longitudinal sinus was cut off, the anterior cerebral artery would be at the early stage of the operative procedure, ultimately facilitate to the well protection of the arteries and their branches.

During the handling the skull and dura mater, in principle, the invasive skull and dura mater by the meningioma should be removed. The dura mater adhered with the olfactory groove and cavernous sinus would be cauterized by using bipolar coagulation forceps. Dura mater defect located at functional area should be patched up and sutured or repaired with artificial materials so as to prevent pallium adhesion and reduce the incidence rate of epilepsy post of the operation. If the brain pressure of the brain was not high, the skull could be reset. Even though the skull had been extensively invaded, it can be reset following fulguration.

As for patients whose facial nerve breakage occurred, end–to–end anastomosis of injured facial nerve is an ideal retrieving method. If the end–to–end anastomosis of the facial nerve could not be performed, facial–hypoglossal nerve or accessory nerve anastomosis should be adopted at the early stage to ameliorate the symptom of facial paralysis. The overall clinical effect of the former is better than that of the latter. So, it is considered as the preferred method under the condition that the facial nerve breakage[7]. In the present study, during the removal of 1 case meningioma in cerebellopontine angle, facial and detachment of nerve were gradually isolated during the dissection of the tumors, with integrated facial nerve. However, even under this situation, patient showed facial nerve dysfunction to some extent. The possible cause may be involved in the ischemic lesion of facial nerve resulted from the injury and embolism of blood vessels supplying the facial nerve during the microsurgical procedure. Another reason that resulted in facial nerve dysfunction may involved in the functional impairment produced by oncothlipsis on facial nerve and aggravated due to the inappropriate drag [4].

As for the recurrence of the meningioma, there are five important factors closely associated with this problem, including meningioma position, the extent of edema of peri–tumor, extent of brain atrophy, the circumstance of encasulation of nerves and blood vessels and the controlling skill of perfusion quantity of cerebral blood vessels [8]. Although surgery of skull base has been achieved great development, radiation therapy still has critical effects. It has been demonstrated that radiation therapy (FSRT and Radiosurgical therapy) is an exclusively widely accepted effective adjunctive treatment mode that can be applied for the therapy of residuary tumors post of operation, high grade (II and III grade) meningioma and recurrence mengingioma [1, 9]. Radiation therapy can alter the nature history of these tumors [10]. The recurrence rate of tumors is tightly related to the type of the tumors and depends on whether or not can they be wholly removed. Regular CT or MRI examination has important value for identification of the recurrence of the meningioma. Most of the benign meningioma has a distinct feature of maintaining stable no matter how they were under nature condition or accept assistant radiotherapy [11]. It is useful for patients with benign meningioma to calculate the risk of recurrence by using BIB–1 label index [11]. When patients suffered from recurrence meningiom subject to operation again, it is more difficult for the isolation and dissection of the nerves and blood vessels. Therefore, it is better to actively remove the meingioma as complete as possible so as to relieve the pathogenetic condition and prolong the life of patients.

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