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ORIGINAL STUDY

The incidence of cerebrospinal fluid fistula in 61 cases of olfactory groove meningiomas

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ABSTRACT

MATERIAL AND METHODS. A retrospective study on 61 consecutive patients with olfactory groove meningiomas (OGM), admitted and operated in the Clinical Hospital "Bagdasar-Arseni", between 1991 and 2009, was performed in order to assess the incidence of cerebrospinal fluid (CSF) fistula and to discuss the therapeutic options of this complication. Tumor diameter varied from 2 to 11 cm. In 39 surgical procedures (63.9%), the tumor was removed through a bilateral subfrontal approach; 13 operations (21.3%) were performed using a unilateral subfrontal approach and 9 surgical procedures (14.7%) were performed using a pterional approach. The average age at presentation was 53 (age: 20-77 years old) and the sex ratio was 1.5:1 (females/males). According to Simpson's grading system, the degree of tumor removal was: grade I in 14 cases (22.9%), grade II in 39 cases (63.9%), grade III in 5 cases (8.2%) and grade IV in 3 cases (4.9%). 58 patients had benign meningiomas (95.1%) and 3 patients had atypical meningiomas (4.9%). Two patients (3.2%) died from pulmonary embolism and bronchopneumonia.

RESULTS. There were cerebrospinal fluid leaks (CSF fistula) in 8 patients, 1 to 7 days after surgery (13.1%). In 7 cases the cerebrospinal fluid leak stopped after several days of lumbar draining. However, in one case, a surgical management has been required.

CONCLUSION. CSF fistula represents an important complication of OGM surgery, but in most cases the leaks ceased with proper conservative management.

KEYWORDS: OGM, CSF fistula, anosmia, subfrontal approach

INTRODUCTION

Olfactory groove meningiomas (OGM) arise from the midline of the anterior fossa at ethmoidal cribriform plate and comprise approximately 9-12% of all intracranial meningiomas. OGM are slow-growing tumors, often bilateral and compress the frontal lobes progressively. The most common presenting symptoms are headache, personality changes, anosmia and visual impairment, but intracranial hypertension or a seizure disorder may also be the initial symptoms. The anatomic location of olfactory groove meningiomas can cause prolonged psychiatric symptoms before the onset of neurologic deficit and OGM are among the largest tumors found intracranially[1,2,3,4].

Brain CT scan and MRI show the usual characteristics of meningiomas in the mid-subfrontal region, the extent of the tumor and the edema of the surrounding brain. The MRI also defines the relationship of the tumor to the optic nerves and anterior cerebral arteries and its extension into the ethmoidal sinus. Surgical resection is the treatment of choice for most olfactory groove meningiomas, but the size of the tumor, the encasement of important vascular and neural structures and its invasion into the paranasal sinuses rise major surgical challenges during the neurosurgical procedure.

CSF fistula represents a common complication of OGM surgery, especially when one attempts total removal of OGM, including the infiltrated underlying bone or the paranasal sinus.

We analyze the clinical and radiological data, the operative techniques and the incidence of postoperative CSF fistula in 59 patients with olfactory groove meningiomas, operated in the First Neurosurgical Department of Emergency Clinical Hospital

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„Bagdasar-Arseni" between January 1991 and December 2008.

MATERIAL AND METHODS

Between January 1991 and December 2009, a total of 656 meningiomas were operated in the First Neurosurgical Department of Emergency Clinical Hospital „Bagdasar-Arseni". Of all these cases, 61 were olfactory meningiomas (9.2%), and their data were retrospectively reviewed in this study.

The mean age of patients was 53 (range 20-77 years old). The female-to-male ratio was 1.5:1 (37/24) and the follow-up period ranged from 9 months to 146 months (mean: 86 months).

The clinical findings revealed headache as the most frequent symptom in our series, in 53 cases (86.8%), followed by anosmia in 48 cases (78,6%), personality changes in 38 cases (62.3%), visual impairment in 37 cases (60,6%), increased ICP syndrome in 31 cases (50.8%) and seizures in 22 cases (36.1%). The headache was progressive, the visual changes were very insidious and slowly progressive and the seizures were generalized. Personality changes (39 cases, 63.9%) were spontaneous loss of attention, memory impairment and temporospatial disorientation without response to medical treatment.

Diagnosis was assessed using computer tomography (CT) scans and magnetic resonance images (MRI) of the skull.

The size of these tumors was estimated by neuroimagistic evaluation. According to their size, the tumors have been classified in:

- small: 0-2 cm diameter 0 cases
- medium: 2-4 cm diameter 16 cases (26.2%)
- large: 4-6 cm diameter 33 cases (54.1%)
- giant: > 6 cm diameter 12 cases (19.6%)

The goal of the surgery was total removal of the tumors. The surgical approaches, using microsurgery, were: bilateral subfrontal - 39 cases (63.9%), unilateral subfrontal - 13 cases (21.3%) and pterional approach in 9 cases (14.7%). The extent of resection was classified according to the Simpson grading system for removal of meningiomas, 1957[5].

RESULTS

According to Simpson's grading system, the degree of tumor removal was: grade I in 14 cases (22.9%), grade II in 39 cases (63.9%), grade III in 5 cases (8.2%) and grade IV in 3 cases (4.9%).

According to the histopathological WHO classification, 58 patients had benign meningiomas (95.1%) and 3 patients had atypical meningiomas (4.9%). Postoperative complications include: seizures in 29 cases (47.5%), residual frontal lobe syndrome in 12 cases (19.6%) and transitory motor deficits in 6 cases (9.8%).

There were cerebrospinal fluid leaks (CSF fistula) in 8 patients, 1 to 7 days after surgery (13.1%). In 7 cases, the cerebrospinal fluid leak stopped after several days of lumbar draining. However, in one case, a surgical management has been required.

The clinical outcome during the follow-up period was assessed using the Glasgow Outcome Scale (GOS). GOS score at six months postoperatively was good recovery in 38 patients (62.3%), moderate disability in 19 cases (31.1%), severe disability in 2 patients (3.2%) and death in two patients (3.2%).

Recurrence of olfactory groove meningiomas occurred in 7 cases (11.4%), during a median follow-up of 86 months (range, 9-146 months).

DISCUSSION

Olfactory groove meningiomas comprise 9-10% of all intracranial meningiomas. There are several published studies which describe in detail the clinical findings, the types of neurosurgical approaches, the results and the rate of recurrences.

Our study presents 61 cases of olfactory groove meningiomas which represent 9.2% of our 656 cases of operated intracranial meningiomas. These results are similar to the literature data. Of the 61 patients, 37 (60.6%) were women and 24 (39.4%) were men; the female-to-male ratio was 1.5:1 (37/24), with a median age of 53 years (range: 20-77 years old). Sex distribution in our cases shows a slightly prevalence of females, but this is lower than in other studies with similar number of cases where the female-to-male ratio was up to 3:1. Generally, in small series (< 25 cases), there was a marked predominance of females, but as the total number of cases grew, the female/male ratio decreased to lower values[6-11].

Symptoms in patients with OGM were headaches, anosmia, visual changes and mental disorders, with a frequency of 60% in relation with increased ICP syndrome. Headache was the most frequent symptom, present in 86% of cases in our study and could be correlated with large and giant tumors (70%) or large meningeal insertion of tumors. The second symptom was anosmia, present in over 78% of patients, which could be correlated with tumor volume and bilateral involvement. Personality changes were the third most common symptom and were correlated with bilateral frontal lobe compression. Headaches, anosmia, visual disturbances and psychiatric disorders were the most common symptoms in most

studies and they have been correlated with tumor volume and local extension.

Most olfactory groove meningiomas in our series were large and giant (over 4 cm in diameter: 43 cases). This could explain the high frequency of the symptoms in our study, because, generally, the symptoms in OGM do not occur or are not recognized until the tumor reaches a large size.

The goal of surgery for OGM is total removal with minimal morbidity, restitution or preservation of frontal lobe function, preservation of olfactory function whenever possible, and avoidance of major complications. The risk of cerebrospinal fluid leakage after resection of groove meningiomas remains significant.

A number of surgical approaches were used in the past for OGM resection. The most common approaches are bifrontal approach and pterional approach.

We performed the bilateral subfrontal approach in 39 cases (63.9%). The unilateral subfrontal approach was used in 13 cases (21.3%), while the pterional approach in 9 cases (14.7%). The degree of tumor removal (according to Samson grading scale) was: grade I in 14 cases (22.9%), grade II in 39 cases (63.9%), grade III in 5 cases (8.2%) and grade IV in 3 cases (4.9%).

The postoperative complications were seizures in 29 cases (47.5%), residual frontal lobe syndrome in 12 cases (19.6%) and transitory motor deficits in 6 cases (9.8%). Cerebrospinal fluid leakage occurred in 8 cases (13.1%).

Postoperative complications were observed in up to 25% of patients with olfactory groove meningiomas in other series (infection, hematoma, epidural empyema, cerebrospinal fluid leakage and new neurological deficits)[4,6,12-17].

These complications occurred in patients with large or giant-sized tumors and these correlations have been confirmed by other studies[2,6,13,14,15,18,19].

There was no demonstrated relation between the size of the tumor and the incidence of postoperative cerebrospinal fluid leak, but the cerebrospinal fluid leak seems to be correlated with ethmoidal invasion of the tumor and the extension of dura mater resection[20,21].

The incidence of postoperative CSF leak - rhinorrhea was 13.1% in our series (8 cases). The cerebrospinal fluid leak stopped after several days of lumbar draining in seven patients. These complications occurred in patients with large or giant-sized tumors. There were cerebrospinal fluid leaks (CSF fistula) in 8 patients 1 to 7 days after surgery (13.1%). In 7 cases the cerebrospinal fluid leak stopped after several days of lumbar draining. However, in one case, a surgical management has been required. This case was a large OGM which infiltrated the ethmoid bone and a grade I Simpson resection was required. We reconstructed the anterior cranial base using autologous fat to fill the ethmoid sinus defects, and then covered with pericranial fascia and secured the entire field with fibrin glue.

Although cerebrospinal fistula has a relatively high incidence in OGM, the CSF leakage usually ceased with conservative treatment. Most frequently, the CSF fistula occurs during the first postoperative week, and these early fistulae could be usually resolved with bed rest, daily lumbar puncture and moderate fluid intake restriction. There are also some cases of late fistulae, usually after several weeks, up to several months postoperatively. These types of fistulae are usually refractory to conservative treatment and require in some cases a second surgical procedure to identify and secure the site of CSF leakage, using a combination of techniques which include autologous fat graft, pericranium and fibrin glue.

The median follow-up period was 84 months (range: 9-144 months) and the recurrence of olfactory groove meningiomas occurred in 6 cases (9.8%), 9 months to 12 years (mean: 7.2 years) after surgery. The recurrence of OGM may reflect an incomplete resection of the tumor due to the difficulty in resection correlated with tumor size (large and giant tumors) and ethmoidal bone invasion. The tumor recurrence rates depend also on the ethmoid sinus infiltration and paranasal extension of the tumor.

CONCLUSIONS

Olfactory groove meningiomas are clinically silent and benign tumors. Small olfactory meningiomas are difficult to be diagnosed because the initial symptoms are minimal or absent. Therefore, olfactory meningiomas may become very large prior to producing any signs or symptoms.

Surgical technique must be adapted to each case: the subfrontal approach is indicated in large and giant OGM, while the pterional approach in medium and large OGM. An adequate approach allows a minimal brain retraction and a good tumoral removal. The microsurgical techniques ensure a total resection, a skull base reconstruction and a low incidence of complications.

The incidence of cerebrospinal fistula could be relatively high (more then 10%), especially when the ethmoidal sinuses are invaded and when a radical resection of the tumor and infiltrated bone is performed. In most instances, the cerebrospinal fistula after OGM resection requires only a conservative treatment, and the second surgical procedure is reserved only for late CSF fistula, refractory to the initial conservative treatment.

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