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Surgical management of tentorial meningiomas: case series



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Abstract

Background: There are several surgical strategies involved in the treatment of patients with tentorial meningioma, and choosing the most appropriate one is not straight forward. Our study aims to illustrate our experience in the management of tentorial meningiomata at our center.

Results: This study included 32 patients with tentorial meningiomas, operated upon, with assessment of the extent of resection and the Glasgow outcome score (GOS). The mean age at the time of surgery for the studied group was 48.4 years ranging from 20 to 70 years. Total removal was considered as Simpson grade I or II and was achieved in 26 cases (81.25%). Subtotal removal was considered as Simpson grade III or IV and was achieved in 6 cases (18.75%). The final Glasgow outcome score (GOS) for all cases was GOS 1 in 4 cases (12.5%), GOS 4 in 9 cases (28.2%), and GOS 5 in 19 cases (59.3%).

Conclusion: Tentorial meningiomas can be very challenging during surgery due to their proximity to vital structures. Subtotal resection should be considered when total removal can be hazardous to the patient or result in severe morbidity.

Keywords: Tentorial incisura, Meningioma, Surgical management, Outcome

Background

Meningiomas are the most frequently reported intracranial tumors, accounting for approximately one-fourth of all reported brain neoplasms as stated by the literature. However, the incidence of meningiomas is considerably underestimated as lots of them passed asymptomatic [1]. Tentorial meningiomas are rather uncommon and represent about 5% of intracranial meningiomas [2].

The tentorium seems to have a simple structural design; however, its edges are close to the brain stem [3]. Moreover, its role in venous drainage of the brain and cerebellum makes the surgical approach a challenge, even for experienced neurosurgical teams [4].

There are several surgical strategies involved in the treatment of patients with tentorial meningioma, and choosing the most appropriate one is not straight

forward [5]. In addition to the anatomical data of the individual patient obtained through imaging exams, other factors also play an important role in the strategy, such as the clinical condition of the patient and personal experience of the neurosurgeon [6].

Our study aims to illustrate our experience in the management of tentorial meningiomata at our center.

Methods

This study included 32 patients with tentorial meningiomas, operated upon in the period from October 2017 to January 2020. Patients' data were collected retrospectively for this study. Ethical approval was obtained before data collection started.

Data collection

All patients were evaluated preoperatively by neurological, ophthalmological, and radiological assessment. Non-surgical management and previously operated cases were regarded as exclusion criteria. Data including

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Table 1 Simpson grading system for removal of meningioma

Grade	Degree of removal
I	Macroscopically complete removal with excision of the dural attachment and abnormal bone.
II	Macroscopically complete removal with endothermic coagulation of dural attachment.
III	Macroscopically complete removal without coagulation of dural attachment or its extradural extensions (for example, hyperostotic bone).
IV	Partial removal leaving small part of the tumor in situ.
V	Biopsy.

demography, past and presenting history, clinical presentation, and lab results were recorded. All patients underwent preoperative evaluation by brain CT as well as brain MRI before and after administration of intravenous contrast agent. Brain MRV was done in some cases when needed. CT scan was done 24 h after surgery, as the routine post-operative follow-up investigation for all patients. Extra scans were done for any deteriorating patient.

CT scans were performed using the following machines: General Electric® Brightspeed (USA) and Siemens® Somatom Emotion (Germany). MRI was performed using 1.5 T Siemens Magnetom Symphony Maestro Class, Syngo MR 2002B (Siemens Medical System Inc., Erlangen, Germany).

Cases were divided into 5 subgroups derived from the Yasargil's classification of tentorial meningiomas according to their relationship to the free tentorial edge as well as the peripheral edge [7]:

- Group I: medial (incisural) tentorial meningiomas
- Group II: falcotentorial meningiomas
- Group III: paramedian (intermediate) meningiomas
- Group IV: peritorcular (torcular) meningiomas
- Group V: lateral tentorial meningiomas

Assessment of resectability

The extent of resection was assessed macroscopically during surgery and postoperatively using CT scans. The extent of resection was classified according to Simpson grade of meningioma resection (Table 1). The early postoperative data were evaluated in all patients and then patients were followed on an outpatient basis. The Glasgow outcome score (GOS) (Table 2) was used for objective assessment of the degree of recovery of the patients.

Table 2 The Glasgow outcome score

1	Death	Severe injury or death without recovery of consciousness.
2	Persistent vegetative state	Severe damage with prolonged state of unresponsiveness and a lack of higher mental functions.
3	Severe disability	Severe injury with permanent need for help with daily living.
4	Moderate disability	No need for assistance in everyday life, employment is possible but may require special equipment.
5	Low disability	Light damage with minor neurological and psychological deficits.

Data was analyzed using IBM the Statistical Package of Social Science (SPSS) advanced statistics version 25 (SPSS Inc., Chicago, IL, USA).

Results

This study included 32 patients with tentorial meningiomas. The mean age at the time of surgery for the studied group was 48.4 years ranging from 20 to 70 years. There was a great female predominance. There were 25 females (78.12%) and 7 males (21.87%) which provide a female/male ratio of (3.57/1) (Table 3). The duration of the presenting symptoms ranged from 1 week to 3 years with a mean of 8 months. Headache was the most common feature occurring in 78.12% (Fig. 1). The headache was typical of increased intracranial pressure (mild throbbing, early morning headache, sometimes associated with vomiting and blurring of vision). Seizures were the main complaint in 21.87% of cases, occurring in the form of generalized tonic-clonic fits in patients with supratentorial lesions. Gait ataxia occurred in 15.6% of cases and memory disturbance in another 15.6%. One patient presented with an altered level of consciousness (3.12%) and two patients presented with an occipital head swelling overlying hyperostotic bone (6.25%).

Preoperative hydrocephalic changes were found in only one case (3.12%) and a ventriculoperitoneal shunt was inserted 1 week before tumor excision. Two cases developed hydrocephalus postoperatively and was also managed by the insertion of a ventriculoperitoneal shunt.

Cases were divided into 5 subgroups (Fig. 2) derived from the Yasargil's classification of tentorial meningiomas according to their relationship to the free tentorial edge as well as the peripheral edge (see Table 2). Group I: medial (incisural) tentorial meningiomas (11 cases), group II: falcotentorial meningiomas (2 cases), group III: paramedian (intermediate) meningiomas (2 cases), group

Table 3 Age and sex distribution among the studied group

Age	Male	Female	Total	Percentage
20–29	0	2	2	6.2%
30–39	1	5	6	18.75%
40–49	4	5	9	28.12%
50–59	2	7	9	28.12%
60 and older	0	6	6	18.75%

IV: peritorcular (torcular) meningiomas (zero cases), and group V: lateral tentorial meningiomas (17 cases).

In 20 cases (62.5%), the tumors were projecting infratentorial, 7 cases (21.87%) projected supratentorial, while the remaining 5 cases projected both supra and infratentorial (Table 4). Different surgical approaches were used in this study according to the site of the lesion. The retrosigmoid approach was the most used in 10 cases (31.25%), followed by the occipital approach in 7 cases (21.87%) and the subtemporal approach in 6 cases (18.75%). A combined occipital and retrosigmoid approach was used in 5 cases (15.6%) and a combined subtemporal and presigmoid approach was used in two cases (7.2%). The infratentorial supracerebellar approach was also used in two cases (7.2%).

Histopathological examination of the excised meningiomas is illustrated in Fig. 3.

Total removal was considered as Simpson grade I or II and was achieved in 26 cases (81.25%). Subtotal removal was considered as Simpson grade III or IV and was achieved in 6 cases (18.75%).

There were no intraoperative mortalities. All cases were initially monitored in the intensive care unit (ICU) and discharged to the ward typically on the day after surgery except in cases that required further monitoring.

Eleven of our cases (34.3%) experienced 7 postoperative complications including four new neurological deficits (which improved in 1 case), 2 cases with postsurgical ventricular dilatation that required a ventriculoperitoneal shunt, two patients developed tension pneumocephalus and was conservatively managed, two patients developed a tumor bed hematoma that was conservatively managed, one patient had a septic complication (superficial wound infection), and one developed deep venous thrombosis (DVT).

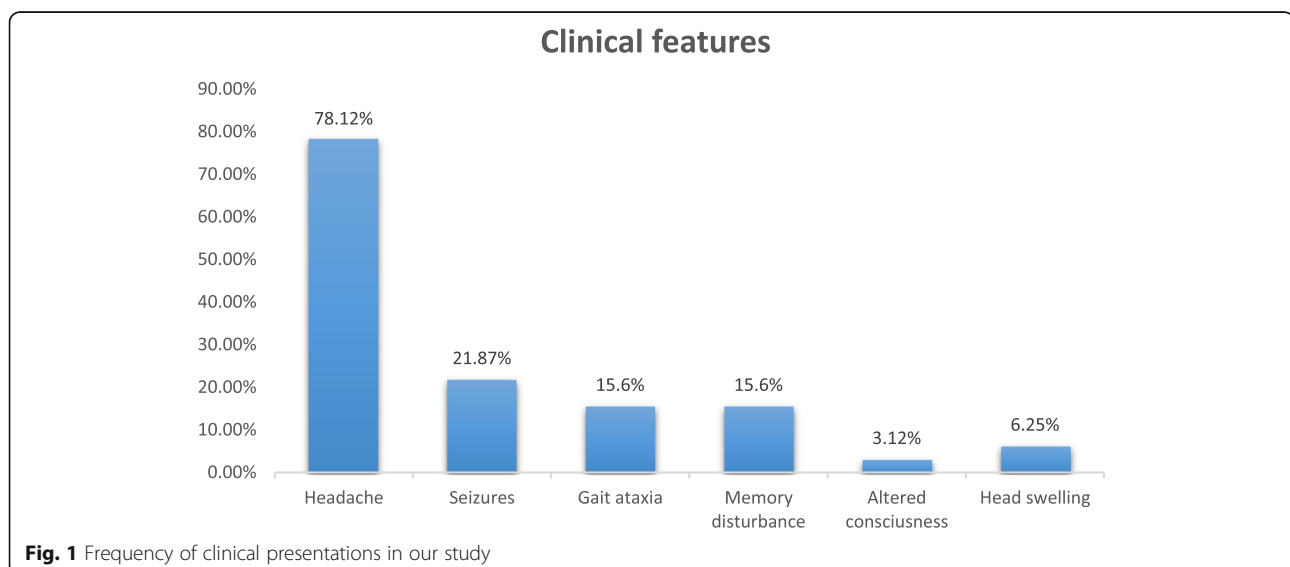
We had four mortality cases in our study (12.5%), one case developed postoperative tension pneumocephalus, followed by ventricular dilatation that required insertion of a ventriculoperitoneal shunt with no improvement and the patient died few days postoperatively. Two cases developed post-operative pulmonary complications that necessitated mechanical ventilation, and the patients died a few days postoperatively probably due to pulmonary embolism as they had elevated D-dimer levels. One case died because of severe brain edema.

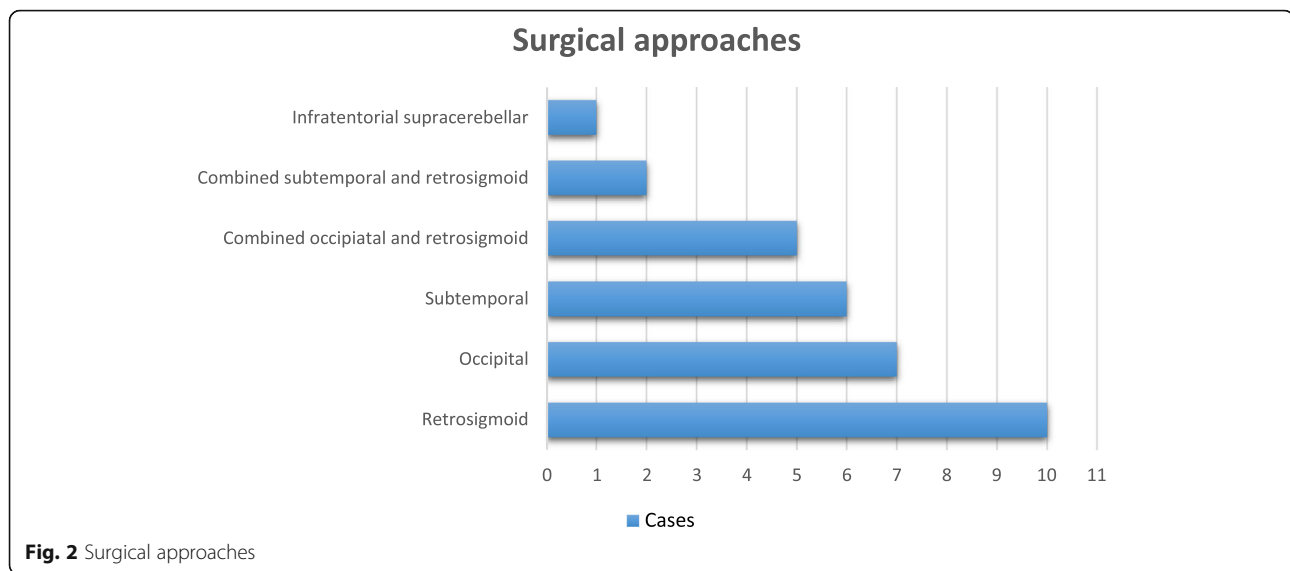
The remaining 28 patients were monitored during the follow-up period with clinical and imaging evaluation.

The final Glasgow outcome score (GOS) for all cases was GOS 1 in 4 cases (12.5%), GOS 4 in 9 cases (28.1%), and GOS 5 in 19 cases (59.3%).

Discussion

In this article, we retrospectively analyzed a series of 32 patients with tentorial meningioma at our center. We described our experience in managing tentorial meningioma through different approaches. Various publications discussed such pathology as a part of posterior fossa pathologies [1, 8, 9]. However, tentorial meningioma is a





difficult category of posterior fossa meningiomata due to interdigitating with cranial nerves, arterial tree, and venous drainage [1, 10]. Complications rate is up to 35% in early series records [11–14]. Complications rate is highly dependent on tumor location [15, 16]. Hydrocephalus and CSF fistula are the main drawbacks in the natural history of a surgically removed tumor [1, 8, 17]. Even in meticulous procedures that aimed to preserve neurological function, complications rate ranged between 24 and 33% in these reports.

Mortality is different among authors and through the past 30 years. Mortality rate decreased from 9.8% in 1988 to 2.7% in 1995 [15]. Recent series were devoid of dead cases [14, 16, 18]. Wagner and coworkers reported a 1.8% mortality [15]. Two of our cases died of pulmonary complications during the post-operative ICU stay, which if excluded, we would get a lower (6.25%) mortality rate that would be directly attributed to surgical complications. This would be a more acceptable mortality rate compared to other case series. However, this points out the importance of post-operative care, especially ICU care, which has a great impact on the overall outcome of cases.

Complete resection of tentorial meningioma (Simpson grades I and II) was achieved in our study (81.25%).

Medially located tumors seem resistant for complete resection as well as those with venous sinuses invasion [15, 19, 20].

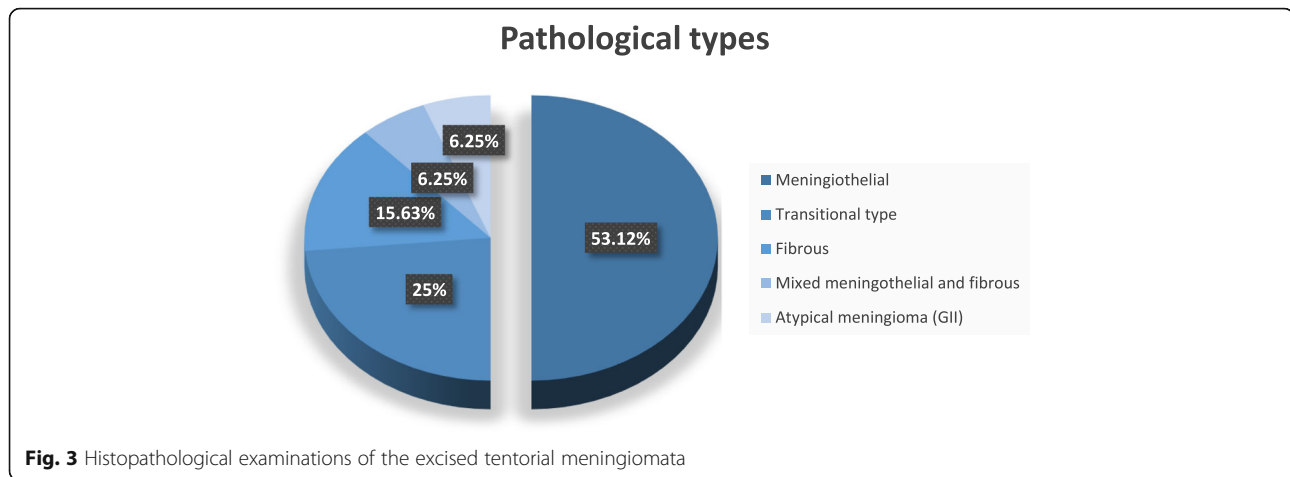
Postsurgical neurological deficit is a common phenomenon for both medially and laterally located tumors; indeed, they are temporary in most of the literatures by 12 months follow-up [14, 16, 18]. Gait ataxia and vestibulocochlear nerve affection might be seen perioperatively. They are the most common deficits in literature followed by diplopia. They are transient damages and gaining functional recovery in most literatures happened by the end of follow-up [15, 16].

In our study, we used an objective crude tool for judgment of patient recovery (GOS) instead of retrieving patients' satisfaction as in the study of Wagner and colleagues. The presence of a 'temporary' deficit reflected negatively on patient satisfaction even after the complete emphasis of complications [15].

Choosing a surgical approach for an individual case was highly dependent on the best strategy to attack the tumor and to avoid endangering a neighbor's structure [21]. However, our small series did not permit us to split comparable cases into two arms or options to measure resectability in the statistical method.

Table 4 Anatomical location of 32 tentorial meningiomas (according to Yasargil's classification and the direction of tumor projection)

Direction of projection	Anatomical location				
	Group I	Group II	Group III	Group IV	Group V
Infratentorial	7	2	–	–	5
Supratentorial	2	–	2	–	5
Supra- and infratentorial	2	–	–	–	7
Total	11 (34.3%)	2 (6.25%)	2 (6.25%)	–	17 (53.1%)



Our series pointed out the importance of paying special attention to the surgical treatment of such tumors by expert skull-base surgeons. It demands meticulous knowledge of the neurovascular structure and great care during dissection [13, 22]. If this paradigm was followed, the complications rate will be at its minimum for such lesions and resectability will be much more achieved.

Our study limitations are small sample size in comparison to recent onset articles. Absence of long-term follow-up is also reported as a limitation to this study, in the future, we might conduct a retrospective analysis for tentorial meningioma with long-term follow-up.

Conclusion

Tentorial meningiomas can be very challenging during surgery due to their proximity to vital structures. Subtotal when total removal can be hazardous to the patient or result in severe morbidity.

Abbreviations

GOS: Glasgow outcome score; CT: Computed tomography; MRI: Magnetic resonance imaging; MRV: Magnetic resonance venography; SPSS: Statistical Package of Social Science; ICU: Intensive care unit; DVT: Deep venous thrombosis

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Authors' contributions

HS contributed in design, revision of intellectual content, and follow-up. AS: contributed in data collection and drafting of the manuscript. MME contributed in data collection and data analysis. HAS contributed in writing the draft. All authors have read and approved the manuscript.

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Availability of data and materials

The dataset used and/or analyzed during the study are available from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate

The study was approved by the ethics committee of the Department of Neurosurgery, Kasr Aliny Faculty of Medicine, Cairo University, on the 8th of January 2020. Reference number is not applicable. All participants provided informed written consent to participate in this study.

Consent for publication

Not applicable

Competing interests

The authors declare that they have no competing interests.

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