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Giant Olfactory Groove Meningiomas: A Case Series Demonstrating the Surgical Management and Functional Outcomes

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Abstract

Objective Giant olfactory groove meningiomas (OGMs) present technical challenges in their management, especially when their size and location complicate the evaluation and planning process, making complete removal difficult. This study provides a comprehensive analysis of the surgical approaches and outcomes encountered in the management of giant OGMs at a single institution.

Materials and Methods This retrospective study evaluated surgical and functional outcomes in 71 patients diagnosed with giant OGMs larger than 6 cm. Tumors were excised using microsurgical resection via the bifrontal, pterional, or combined pterional and unifrontal approaches.

Results The study comprised 48 females (67.6%) and 23 males (32.4%), with a mean age of 54.1 years. The most common pathological type was meningothelial meningioma (45%). The bifrontal approach was the most frequently used ($n = 47$, 66.2%) and resulted in Simpson grade I or II resection in 41 patients (87.2%). The combined pterional and unifrontal approaches were used in 16 patients (22.5%), achieving Simpson grade I or II resection in 12 (75%). The pterional approach was the least commonly used ($n = 8$), with Simpson grade I or II resection achieved in 50% of these patients. Postoperatively, visual acuity and cognitive function improved during follow-up. Postoperative complications were frequently observed after the bifrontal approach. Three patients (4.2%) died.

Conclusion The bifrontal approach resulted in better resection of giant OGMs than other approaches but was associated with more complications. The combined pterional and unifrontal approach was superior to the pterional approach in terms of OGM resection, with no differences in complication rates. Significant postoperative improvements in functional outcomes, including visual acuity and cognitive function, were observed.

Keywords
- giant
- olfactory groove
- meningioma
- skull base
- bifrontal approach

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Introduction

Meningiomas represent the most prevalent benign intracranial neoplasms, constituting approximately 20% of all primary brain tumors. Olfactory groove meningiomas (OGMs) comprise approximately 10% of all meningiomas and are characterized by their slow, asymmetrical growth pattern and bilateral occurrence.[1]

These neoplasms originate from arachnoid cap cells located in the midline ventral skull base dura surrounding the cribriform plate and planum sphenoidale. The anterior and posterior ethmoidal arteries serve as their primary vascular supply. As OGMs expand, they may involve the olfactory nerve, compress the optic nerves, or encapsulate the anterior cerebral circulation.[2]

Common clinical manifestations include anosmia, visual disturbances, headache, and alterations in mental status. Erosion of the ethmoidal sinus by these tumors often necessitates complex resection and skull base reconstruction procedures.[3]

Due to their origin in an area of maximal brain compliance, OGMs can attain considerable size before patients become symptomatic.[4] Traditional treatment modalities include unilateral or bilateral subfrontal approach resection, although less invasive techniques have been developed in recent years.[2]

Surgical management of these neoplasms is a crucial component of neurosurgical training. While each surgical approach presents distinct advantages and disadvantages, no single method can be universally applied as the ideal surgical approach for giant OGMs. This is due to specific considerations related to their substantial size, proximity to neurovascular structures at the posterior border, frontal lobe manipulation, and postoperative edema. Despite their imposing presence, surgical resection of OGMs is generally considered a relatively safe procedure. Various studies have suggested that increased neurosurgical experience correlates with improved surgical outcomes.[3]

The present study aims to evaluate surgical treatment strategies and functional outcomes following the resection of giant OGMs.

Materials and Methods

The authors conducted a retrospective study at Mansoura University Hospitals, including 71 patients diagnosed with giant OGMs exceeding 6 cm in size between 2009 and 2021. A tumor was classified as giant if its equivalent diameter, calculated using the formula ABC/2 (where A, B, and C represent the maximum diameters in each plane), exceeded 6 cm.[4,5]

The study population was identified through clinical records, radiological studies, operative notes, follow-up visits, and histopathological reports. Inclusion criteria encompassed cases with anterior cranial fossa meningiomas originating from the dura at the cribriform plate, while planum sphenoidale, tuberculum sellae, and anterior clinoid meningiomas were excluded.

Radiological evaluation included magnetic resonance imaging (MRI) to assess tumor extension and its relationship to the optic chiasm and anterior cerebral arteries (ACAs). A neuroradiologist evaluated peritumoral edema using T2-weighted and proton-weighted MRI sequences. Cerebral angiography revealed tumor vascularity, with ACA encasement observed in 13 cases. The primary blood supply was predominantly from the anterior or posterior ethmoidal arteries. Preoperative computed tomography (CT) with bone window settings demonstrated hyperostosis in 49 cases, while invasion of ethmoidal air cells was detected by MRI and CT, particularly in sagittal and coronal views. Routine brain CT scans were performed 24 hours postsurgery.

Cognitive function was assessed using the Mini-Mental State Examination (MMSE) preoperatively, at 1 and 12 months' follow-up by a neuropsychiatrist. Ophthalmological function was evaluated at the ophthalmology center, including visual acuity assessment using the Snellen chart at 6 m, fundoscopy, and Goldmann perimetry for visual fields.

Tumor resection was performed under general anesthesia using microsurgical techniques via bifrontal,[6] pterional,[7] or combined pterional and unifrontal approaches. The combined pterional and unifrontal approach involved a frontobasal extended pterional craniotomy with extensive sphenoid wing drilling and frontal craniotomy extension toward the midline and superior orbital rim. Craniotomy differences are illustrated in ►**Fig. 1**.

Surgical approach selection was based on tumor characteristics observed radiologically, tumor size (all exceeding 6 cm), and surgeon experience. The bifrontal approach was employed for large, bilaterally presenting tumors invading the frontal and ethmoid air sinuses, necessitating skull base reconstruction. The pterional and combined pterional-unifrontal approaches were utilized for relatively smaller tumors invading the optic canals. The pterional approach was selected when a definitive plane of cleavage existed between the tumor and posterior neurovascular structures. The combined approach was employed for cases with optic structures, ACA, and/or internal carotid artery encasement, and unilateral or possibly bilateral tumor presentation.

Extent of tumor resection was evaluated using the Simpson grading system. Histopathological findings were analyzed according to the World Health Organization (WHO) classification.[8] Intraoperative blood loss and complications were documented.

The primary outcomes of the study were the degree of tumor resection and improvements in visual symptoms and cognitive function. Secondary outcomes included postoperative complications. Mortality was defined as death occurring within 1 month of surgery.

Follow-up evaluations were conducted at 1 month and 1 year postoperatively, comprising clinical examinations, cognitive assessments, visual acuity and field testing, and postcontrast brain MRI.

Statistical analysis was performed using SPSS version 22 for Windows (SPSS Inc., Chicago, Illinois, United States). Qualitative data were presented as frequencies and

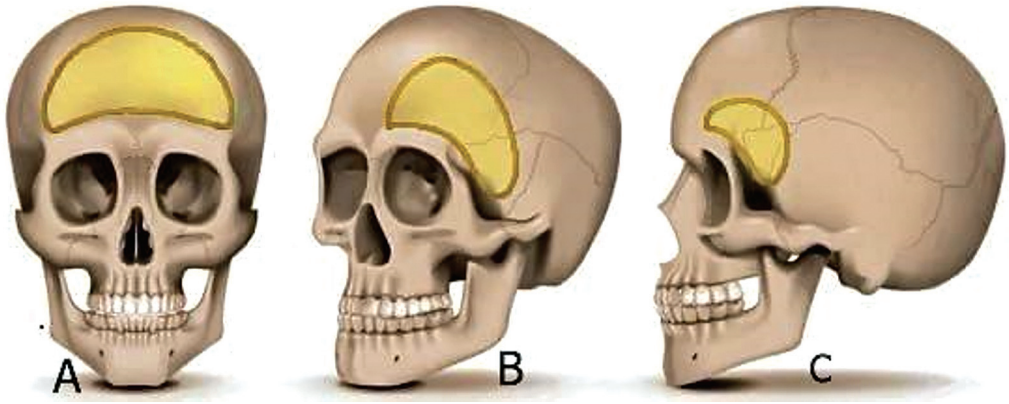

Fig. 1 An illustration of different craniotomy flaps used for resection of giant olfactory groove meningioma (OGM): (**A**) bifrontal craniotomy, (**B**) combined pterional and unifrontal craniotomy, and (**C**) pterional craniotomy. (The figure used and edited with permission from: Shutterstock—Realistic human skull, front and side view).

proportions, while quantitative data were tested for normality using the Kolmogorov–Smirnov test and expressed as median and range. The Mann–Whitney *U* test was used to compare continuous variables and ordinal variables between groups. The chi-square test was used to compare categorical data between groups and *p*-values lower than 0.05 were considered statistically significant.

Results

The study population comprised 48 females (67.6%) and 23 males (32.4%), with a mean age of 54.1 years (range: 32–69). The mean duration of symptom observation prior to diagnosis was 23.7 months.

Regarding medical history, 27 patients (38.03%) presented with hypertension, 11 (15.49%) with diabetes mellitus, and 5 (7.04%) with ischemic heart disease. A history of smoking was reported in 28 patients (39.44%).

As demonstrated in ►**Table 1**, the most prevalent pathological types were meningothelial meningioma ($n = 32$, 45%) and transitional type ($n = 24$, 33.8%). The syncytial type was observed in 10 patients (14%), while psammomatous and angioblastic types were present in 3 and 2 patients, respectively.

Presenting symptoms included anosmia ($n = 56$, 78.9%) and cognitive functional impairment ($n = 51$, 71.8%). Visual deterioration and headaches were observed in 39 and 37 patients, respectively. Additional symptoms included seizures, incontinence, motor weakness, and dysphasia (►**Table 2**).

Preoperative mental state assessment revealed confusion in 30 patients (42.2%), depression in 20 (28.1%), amnesia in 18, and apathy in 17 patients (►**Table 3**).

Table 1 Distribution by pathological type

Pathological type	*N* (%)
Meningothelial	32 (45)
Transitional	24 (33.8)
Syncytial	10 (14)
Psammomatous	3 (4.2)
Angioblastic	2 (2.8)

Table 2 Distribution by clinical manifestations

Signs and symptoms	*N* (%)
Anosmia	56 (78.9)
Cognitive functional impairment	51(71.8)
Visual deterioration	39 (54.9)
Headache	37 (52.1)
Seizures	17 (23.9)
Urinary bladder incontinence	16 (22.5)
Motor weakness	7 (9.8)
Dysphasia	8 (11.8)

Table 3 Distribution by preoperative mental and psychological state

Preoperative mental and psychological state	*N* (%)
Confusion	30 (42.2)
Depression	20 (28.1)
Apathy	17 (23.9)
Amnesia	18 (25.3)
Dementia	9 (12.7)
Aggressiveness	8 (6.4)
Psychic anxiety	5 (7)

MMSE scores demonstrated significant improvement postsurgically, with mean values increasing from 15.3 preoperatively to 23.1 and 25.1 at 1-month and 1-year follow-up, respectively (►**Table 4**).

Preoperative visual acuity was normal in 7 patients (9.8%), fair in 33 (46.5%), and inadequate in 12 (16.9%). Fundus examination revealed optic disc atrophy in 16 patients (22.5%) and optic disc swelling in 7 (9.8%). Foster–Kennedy syndrome was noted in 5 patients (7%). Visual field defects were observed in 26 patients (36.6%) (►**Table 5**).

Postoperative visual outcomes showed improved visual acuity in 17 patients (23.9%), worsened in 3 (4.2%), and

Table 4 MMSE changes after surgery

MMSE	Preoperative	1 month after surgery	1 year after surgery
Normal (24–30)	17	37	38
Mild (20–23)	19	22	24
Moderate (10–19)	23	13	9
Severe (1–9)	12	0	0
Mean	15.3	23.1	25.1

Abbreviation: MMSE, Mini-Mental State Examination.

Table 5 Distribution by preoperative ophthalmological assessment

Visual acuity	*N* (%)
Normal	7 (9.8)
Good ($\geq$ 0.5)	19 (26.8)
Fair ($<$ 0.5 to $>$ 0.1)	33 (46.5)
Not useful ($\leq$ 0.1 to 0)	12 (16.9)
Fundus examination	*N* (%)
Disc swelling	7 (9.8)
Optic disc pallor (atrophy)	
Right eye	10 (27.7)
Left eye	4 (11.1)
Bilateral	2 (5.5)
Forster–Kennedy	5 (7)
Visual field defects	*N* (%)
Right eye	4 (5.6)
Left eye	9 (12.7)
Bilateral	13 (18.3)

Table 6 Distribution by postoperative visual improvement

Postoperative visual results	*N* (%)
Visual acuity	
Improved	17 (23.9)
Unchanged	51 (71.8)
Worsened	3 (4.2)
Visual field defects	
Improved	18 (25.3)
Unchanged	5 (7)
Worsened	3 (4.2)

remained unchanged in 51. Visual field defects improved in 18 patients (25.3%), worsened in 3 (4.2%), and remained unchanged in 5 (►**Table 6**).

Radiological findings included meningioma-induced hyperostosis in 49 patients (69%), ethmoidal invasion in 21 (39.6%), optical canal involvement in 16 (22.5%), vascular encasement in 13 (18.3%), and middle cranial fossa extension in 11 (15.5%) (►**Fig. 2**).

Three surgical approaches were employed: bifrontal ($n = 47$, 66.2%), combined pterional and unifrontal ($n = 16$, 22.5%), and pterional ($n = 8$, 11.3%). The bifrontal approach achieved Simpson grade I or II resection in 41 patients (87.2%), while Simpson grade III or IV resection occurred in the remaining 6 cases (12.8%). ►**Fig. 3** demonstrates a case of giant OGM resected as Simpson grade I to II via the bifrontal approach. The combined pterional and unifrontal approach achieved Simpson grade I or II resection in 12 patients (75%), while the pterional approach achieved this in 50% of cases. The bifrontal approach was most frequently utilized and allowed for a higher rate of Simpson grade I or II resection compared with other approaches (►**Table 7**, ►**Fig. 4**).

Regarding the correlation between surgical approach selection and patient-specific factors, no significant association was observed between presenting symptoms and the chosen surgical approach. All tumors exceeded 6 cm in size, and no correlation was found between tumor size and surgical approach selection ($p = 0.19$). The bifrontal approach was predominantly utilized in cases associated with hyperostosis and skull base invasion ($p = 0.021$), while the pterional approach was more commonly employed for cases presenting with optic nerve compression ($p = 0.033$).

Postoperative complications included cerebrospinal fluid (CSF) rhinorrhea in five patients (7%), with three cases occurring after the bifrontal approach. Management strategies included spinal lumbar drainage ($n = 3$) maintained for an average of 5 days, or skull base reconstruction ($n = 2$) using a galea-periosteal flap reinforced with sutures and sealed with fibrin glue. Pneumocephalus was diagnosed in eight patients (11.3%), with six cases managed surgically via frontal sinus packing using abdominal fat or temporal muscle covered with fascia lata. Two cases responded to conservative treatment. Four patients (5.6%) developed epilepsy, which was controlled with antiepileptic drugs (phenytoin).

Postoperative edema was observed in 12 patients (16.9%): 7 following the bifrontal approach, 1 after the pterional approach, and 4 after the combined pterional and unifrontal approach. All cases were medically managed with mannitol, furosemide, and dexamethasone (16 mg/day for 1 week, followed by gradual tapering over the subsequent week).

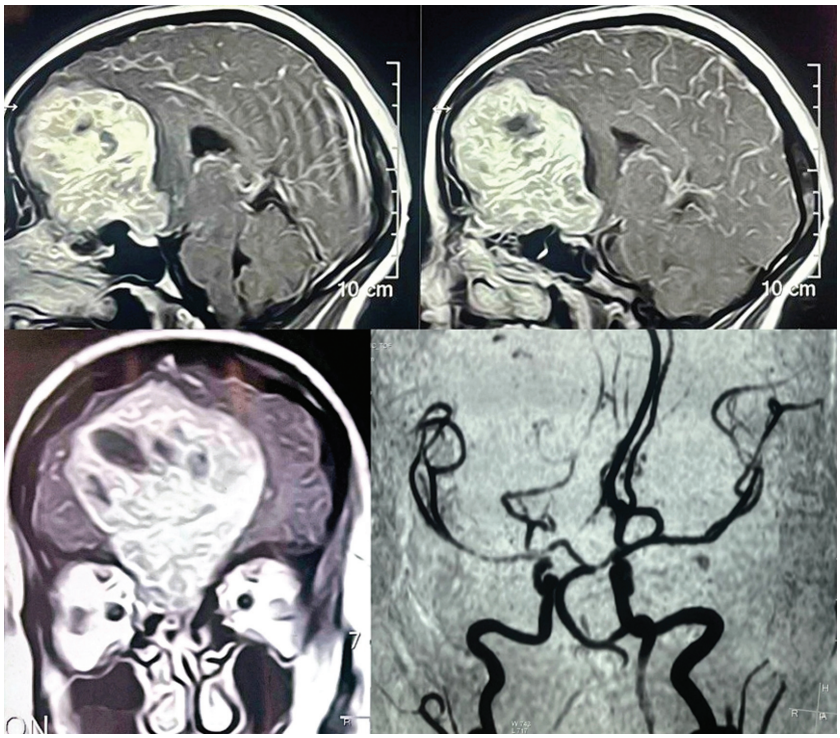

Fig. 2 A postcontrast T1-weighted magnetic resonance imaging (MRI) brain, displaying olfactory groove meningioma (OGM) extending through the ethmoidal plate into ethmoidal air cells. Posteriorly and superiorly: it is seen displacing related frontal lobes, genu of corpus callosum posteriorly, and both anterior cerebral arteries (ACAs) to the left side of the lesion.

Contusion occurred in 11 patients (15.5%): 7 after the bifrontal approach, 2 after the pterional approach, and 3 after the combined approach. All cases were medically managed.

Hematoma was observed in seven patients (9.8%), managed either conservatively ($n = 4$) or surgically ($n = 3$) with craniotomy and evacuation. Local wound infection occurred in nine patients (12.7%), with two requiring surgical debridement. Diabetes insipidus developed in two patients following the pterional approach and was managed with desmopressin supplementation, with gradual normalization of urination and electrolyte balance.

Three patients (4.2%) died in this study: two due to hypothalamic infarction following the pterional approach, confirmed by laboratory investigations indicating panhypopituitarism. Despite intensive care management, replacement therapy, and resuscitative measures, both patients succumbed after 2 and 3 weeks, respectively. The third mortality was attributed to pulmonary embolism. These data are presented in ►**Table 8**.

Recurrence was observed in six cases (8.45%) after a minimum 6-month follow-up. Three cases managed with a subfrontal approach required subtotal resection due to proximity to the anterior cerebral arteries and optic apparatus. Two cases underwent extended surgical resection, with pathology confirming WHO grade 1 meningioma. One case was effectively treated with radiotherapy. The remaining three cases, involving preoperative paranasal sinus invasion, were surgically excised (Simpson grade I or II) via pterional or combined pterional and unifrontal approaches. All recurrent cases responded to radiotherapy. There was a lack of data regarding recurrence rate during follow-up.

Discussion

The surgical management principles for OGMs were initially delineated by Cushing and Eisenhardt in 1938, emphasizing the necessity of tumor decompression preceding capsule dissection to preserve adherent ACAs.[9] These neoplasms typically exhibit progressive growth to substantial dimensions, displacing adjacent cerebral tissue, yet often manifesting with subtle symptomatology. Tumor size significantly influences resection complexity, surgical approach selection, and both immediate postoperative and long-term outcomes.[10]

This study evaluated the surgical and functional outcomes of giant OGM resection in 71 patients. Consistent with a previous investigation of 129 patients (mean age 46 years, range: 18–75 years), OGMs demonstrated a female predilection.[3] In the current cohort, 67.6% of patients were female, aligning with prior findings.[3]

Clinical presentation improvement was common but variable, contingent upon multiple factors, which were compared with previous studies as elaborated subsequently.

In this series, anosmia was the predominant manifestation, followed by cognitive functional impairment and visual deficits. Mental and psychological alterations were frequently observed, with confusion and depression being most prevalent. OGMs typically originate unilaterally to the midline, with early symptomatology potentially including compromised

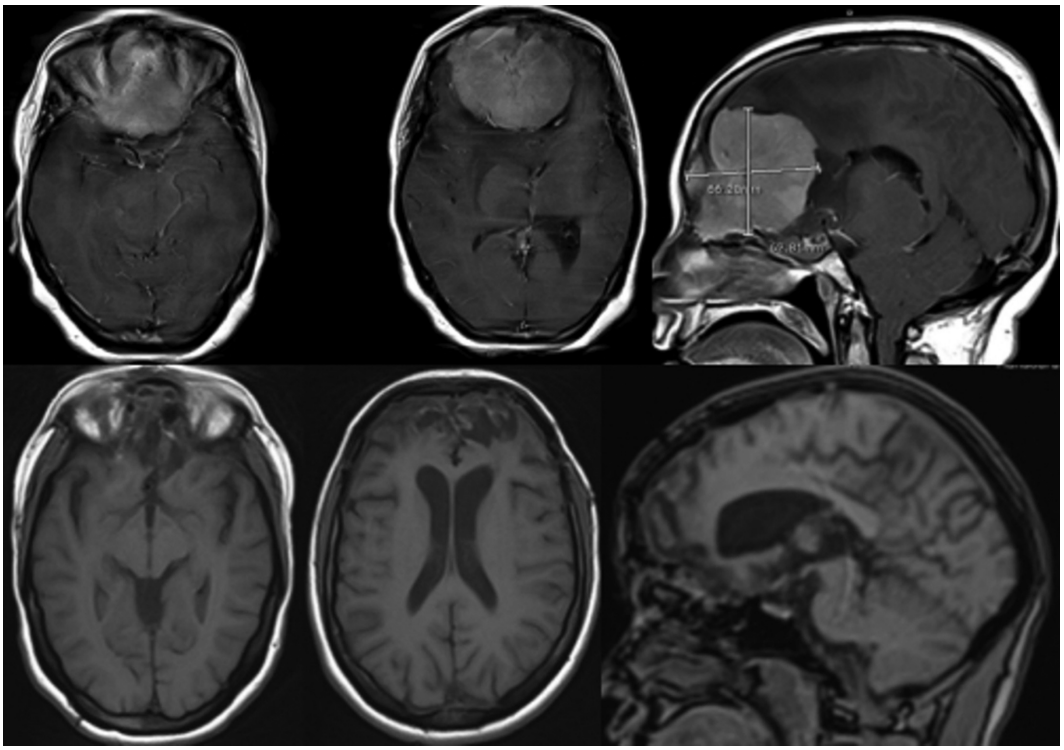

Fig. 3 Upper row: a preoperative giant olfactory groove meningioma (OGM) that has been resected as shown in the *lower row*: a postoperative follow-up brain magnetic resonance imaging (MRI). A totally resected olfactory groove meningioma with an area of cerebrospinal fluid (CSF) and (encephalomalacia) was seen at the site of the operative bed with surrounding mild perifocal edema.

olfactory function. Anosmia may result from ischemic deprivation of olfactory nerve blood supply, infiltration or compression by a slow-growing neoplasm, or transection of fila olfactoria during surgical intervention. However, this is rarely the primary presenting symptom. Extensive tumor dimensions and cerebral displacement generally exert a more substantial impact on cognitive function.[3]

Several large retrospective reviews of OGM patients have reported headache as the most common presenting symptom, typically associated with giant tumors. Anosmia and mental changes were consistently reported as the second and third most frequent symptoms, respectively.[7]

The degree of visual deficit significantly influenced the surgical procedure's course and outcome, with larger deficits indicating a closer relationship between the tumor and the optic nerve. Consequently, the pterional approach was frequently employed. Optic nerve compression and increased intracranial pressure can precipitate visual deficits, necessitating more extensive and challenging dissections to achieve optimal decompression and early identification and protection of optic nerves.

In this study, visual acuity improved in 23.9% of patients, and visual field defects improved in 25.3%. These results were congruent with a previous study by Gazzeri et al, where visual function improved in 22.8% of patients and remained unchanged in 74.2%. No deterioration of visual acuity was observed following bifrontal excision, although one patient presented with worsened visual field defect.[11] However, Nakamura et al reported inferior postsurgical visual outcomes associated with the treatment of tuberculum sellae meningiomas using a bifrontal approach compared with a frontolateral approach.[12]

Cognitive Function

Analysis of presentation and outcomes revealed an association between giant OGMs and cognitive disturbances, which

Table 7 Distribution by surgical approach and extent of surgical removal

Surgical approach	*N* (%)	Simpson grade I–II	Simpson grade III–IV
Pterional	8 (11.26)	4 of 8 (50%)	**4 of 8 (50%)**
Bifrontal	47 (66.2)	41 of 47 (87.2%)	**6 of 47 (12.8%)**
Combined pterional and unifrontal	16 (22.5)	12 of 16 (75%)	**4 of 16 (25%)**
Total	**71 (100)**	**57 (80.3%)**	**14 (19.7%)**

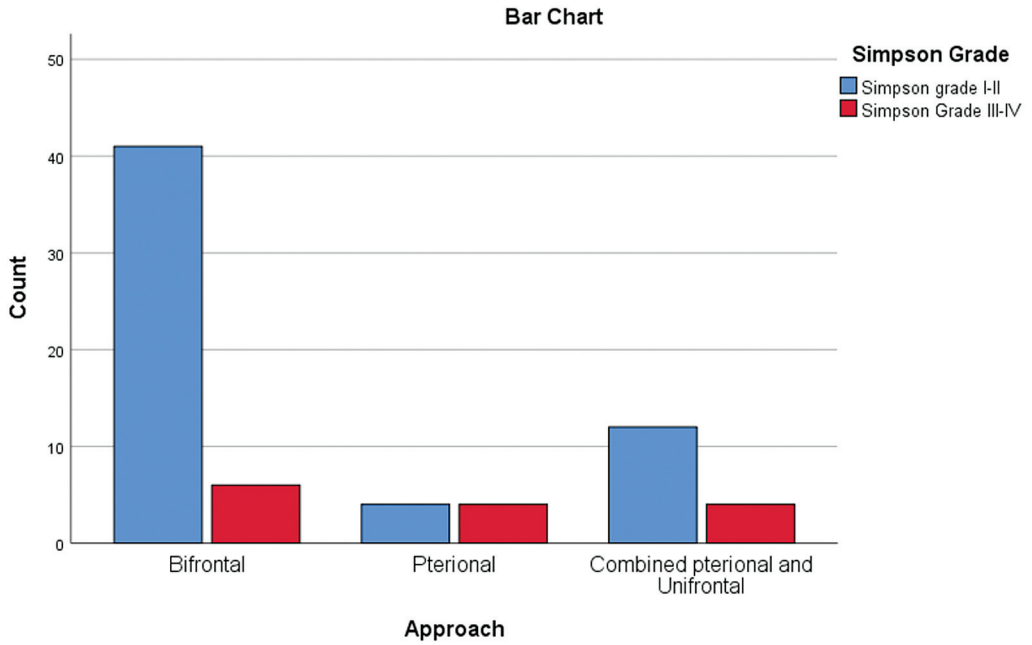

Fig. 4 A chart illustrates the relationship between surgical approaches and the extent of surgical resection as per the Simpson grade. The bifrontal approach was the most effective regarding tumor resection.

improved posttumor resection. No specific surgical approach demonstrated superiority regarding neurocognitive outcomes.

This study observed favorable neuropsychiatric outcomes, with MMSE scores showing significant improvement from a mean preoperative value of 15.3 to 23.1 and 25.1 at 1 month and 1 year postsurgery, respectively. These findings align with previously reported cognitive outcomes. Bakay and Cares reported definite improvement in preoperative mental status in 47% of their study cohort,[13] while Solero et al observed a decrease in the proportion of patients with mental disturbances from 7 to 4% posttumor resection.[14] Ojeman's 1996 patient series demonstrated complete resolution of personality changes in the postoperative period for 19 OGM patients.[15]

Surgical Approach

The selection of surgical approach is primarily influenced by the surgeon's personal experience and familiarity with both the technical aspects of the approach and the anatomy of the lesion and involved areas from the chosen perspective.

In this study, three surgical approaches were employed. The bifrontal approach was most frequently utilized, resulting in improved Simpson grade resection of giant OGMs.

Our study associated hyperostosis and skull base invasion with the bifrontal approach. This approach provides a wide

Table 8 Distribution by postoperative complications

Complication	*N* (%)	Bifrontal 28 (39.4%)	Pterional 14 (19.7%)	Combined pterional and unifrontal 20 (28.1%)	Management
Rhinorrhea	5 (7)	3	1	1	-3 patients, spinal lumbar drainage -2 patients, skull base reconstruction
Edema	12 (16.9)	7	1	4	Medical treatment
Pneumocephalus	8 (11.3)	4	1	3	-6 patients, surgery -2 patients, conservative
Epilepsy	4 (5.6)	1	1	2	Medical treatment
Contusion	11 (15.5)	7	2	3	Medical treatment
Hematoma	7 (9.8)	2	2	3	-4 patients, conservative -3 patients, surgery
Local wound infection	9 (12.7)	3	2	4	-7 patients, conservative -2 patients, surgery
Diabetes insipidus	2 (2.8)	0	2	0	Medical treatment
Mortality	3 (4.2)	1	2	0	-2 patients, hypothalamic infarction -1 patient, pulmonary embolism

surgical corridor suitable for manipulation of giant OGMs and resection of hyperostotic cribriform plates with subsequent skull base repair. It also facilitates extension to resect tumors invading ethmoid air cells. Multiple previous studies have demonstrated the efficacy of the bifrontal approach in achieving maximal OGM resection and anterior cranial fossa postoperative skull base repair, as well as its potential for extending to resect tumors invading ethmoid air cells.[3,6,10,16]

However, pterional and combined pterional-unifrontal approaches offer superior early recognition and dissection of optic structures and anterior cerebral arteries at the posterior meningioma border. The pterional approach was commonly employed in cases with optic nerve compression. No correlation was observed between presenting symptoms and surgical approaches utilized. All tumors exceeded 6 cm in size. No association was found between tumor size and choice of surgical approach.

Pathology

In the current study, meningothelial and transitional meningiomas were the most frequently encountered pathological types, while psammomatous and angioblastic variants were less common. A previous patient series reported fibrous meningiomas as the predominant type, followed by syncytial variants. Clear cell, psammomatous, and angiomatous meningiomas were also observed, albeit in smaller numbers.[1]

Complications

The most prevalent postoperative complication was cerebral edema, followed by cerebral contusions and wound infections. The bifrontal approach was significantly associated with a higher rate of complications, particularly anosmia. This approach for resecting giant OGMs can lead to various complications due to its invasive nature. Extensive brain retraction may result in cerebral edema, frontal lobe damage, and postoperative cognitive deficits. Interruption of venous drainage, especially through ligation of the anterior superior sagittal sinus, can precipitate venous infarction, increased intracranial pressure, and cerebral edema. The risk of CSF leaks and subsequent infections is elevated due to frontal sinus opening and skull base drilling during the procedure. Furthermore, this approach typically sacrifices any remaining olfactory function, leading to higher rates of permanent anosmia compared with alternative surgical methods. These factors collectively contribute to the increased complication rate associated with the bifrontal approach for giant OGM resection. However, no significant difference in complications was observed between pterional and combined pterional-unifrontal approaches.

In a previous patient series, OGM resection was associated with anosmia, CSF leakage, seizures, and additional medical complications.[13,17,18] Another study reported retraction-related brain swelling as the most common complication (14.2%), followed by deep vein thrombosis/pulmonary embolism (8.0%), pneumonia (7.1%), and hydrocephalus (5.3%).[17] Aguiar et al reported CSF leakage as the most frequent complication among 21 OGM patients. Additionally, hydrocephalus occurred in 9.5% of patients who required ventriculoperitoneal shunt placement, while ventriculitis and postoperative hematoma each occurred in 4.8% of patients.[19] Each surgical approach has its associated complications, with bilateral subfrontal approaches involving bilateral orbital osteotomies being associated with a higher incidence of CSF leakage and a lower risk of brain swelling.[17]

Regarding mortality, three patients (4.2%) in the current study succumbed, with two deaths attributed to hypothalamic infarction and one to pulmonary embolism. Due to advances in neurosurgery and improved postoperative care, mortality rates have significantly declined to 0 to 4.9%. Nakamura et al reported a mortality rate of 4.9%, with the cause being postoperative cerebral edema after employing the bifrontal approach.[20] In the presence of large tumors, intraoperative retraction can exacerbate cerebral edema, resulting in severe and potentially fatal complications. Aguiar et al reported a perioperative mortality rate of 4.8%, attributed to cerebral edema worsened by hyponatremia.[19] Nanda et al observed no deaths in their study after using frontal or anterolateral approaches in 57 patients.[21] Mortality rates may also differ between approaches, with Nakamura et al reporting no mortality after using the frontal lateral approach and 8.7% mortality with the bifrontal approach.[20] Similarly, Pallini et al observed a higher mortality rate (5.7%) with the bifrontal approach compared with the lateral (0%) and fronto-orbito-basal (0%) approaches.[17] Over the past few decades, mortality rates associated with open approaches have markedly improved.[2] However, older studies suggest higher mortality rates, with one reporting a mortality rate of 12% after using bilateral or unilateral frontal approaches between 1950 and 1970,[13] and another suggesting a mortality rate of 17.3% after frontal craniotomy, with cerebral edema, major artery clipping, and hematoma as the common causes of postoperative mortality.[14]

Limitations

This study has several limitations, primarily due to its retrospective design, which introduces potential biases and weaknesses. Cognitive function assessment was limited to the MMSE, omitting other neuropsychological tests that could have provided a more comprehensive evaluation of cognition and brain reserve capacity. The study was further constrained by significant patient attrition during follow-up and a relatively short follow-up period, which limited the ability to assess long-term recurrence rates of resected OGMs. Additionally, the postoperative evaluation of olfactory function was inadequate. Further research is warranted to elucidate the impact of various surgical procedures on olfaction.

Conclusion

This study aimed to evaluate the efficacy and safety of different surgical approaches for the management of giant OGMs. The results demonstrated that the bifrontal approach was the most frequently employed method and yielded the highest rate of tumor resection. However, this approach was also associated with a higher incidence of

complications. In contrast, the combined pterional and unifrontal approach demonstrated superior OGM resection rates compared with the pterional approach alone, with both approaches exhibiting lower complication rates than the bifrontal approach. Furthermore, the study revealed that surgical intervention for giant OGMs resulted in significant improvements in functional outcomes, particularly in visual acuity and cognitive function. These findings suggest that surgical management of giant OGMs is a viable therapeutic option, and the selection of surgical approach should be tailored to individual patient factors and surgeon expertise. In conclusion, this study provides valuable insights into the surgical management of giant OGMs and underscores the importance of carefully weighing the risks and benefits of each surgical approach to optimize patient outcomes.

Ethical Approval

This study was reviewed and approved by the Institutional Review Board (IRB) of Mansoura University Faculty of Medicine (approval number: RP.24.08.993). The IRB is responsible for ensuring that research conducted at the institution adheres to ethical standards and protects the rights and welfare of potential research subjects. It is important to note that this article does not contain any studies involving human participants that were performed by any of the authors.

Authors' Contributions

All authors contributed to the conception and design of the study and reviewed and approved the final manuscript for submission and publication. M.B., A.E., and A.A. were responsible for conceptualization. Methodology was led by M.B., while formal analysis and investigation were carried out by A.E., M.B., and A.A. The original draft was prepared by M.B., with both A.E. and M.B. involved in reviewing and editing. Resources were provided by A.E., M.B., and A.A., and supervision was managed by A.E. and M.B.

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Conflict of Interest

None declared.

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