# Orbital Reconstruction after Spheno-Orbital Meningiomas Excision with Fascia Lata and Fat Graft

**Original Article**

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## ABSTRACT

**Background:** Spheno-orbital meningioma (SOM) is a very rare subtype of meningioma which arises from the sphenoid ridge with an orbital extension which results in painless proptosis and slowly progressing visual impairment.

**Methods:** Observational retrospective study evaluates the efficacy and safety of orbital reconstruction using fascia lata , fat graft, and titanium mesh following SOM excision between January 2019 and January 2022. Postoperative follow-up, conducted over one year, monitored proptosis improvement, enophthalmos, and complications.

**Results:** 14 patients with SOMs met the inclusion criteria, consisting of 9 females and 5 males with a mean age of 48.29±5.86 years. All patients presented with proptosis, and preoperative EI averaged 1.27±0.08. Postoperatively, proptosis improved in all patients, with 50% achieving complete resolution. The mean postoperative EI significantly decreased to 1.051±0.06 ($p<0.001$). Visual acuity improved in 50% of patients, with temporary deterioration observed in 1 patient (7.1%) ($p<0.001$). Ocular motility improved in 35.7% of patients ($p=0.001$). Gross total resection was achieved in 7 patients (50%), while the remaining 7 underwent subtotal resection. No CSF leakage occurred, although two patients (14.3%) experienced CSF collection, which resolved conservatively. Over one year of follow-up, no enophthalmos developed, and 85.7% of patients were satisfied with cosmetic outcomes.

**Conclusions:** Surgical resection of SOM is effective in stopping the evolution of the visual deficit and improving proptosis. Orbital reconstruction with fascia lata and fat graft along with titanium mesh gives the best results regarding the prevention of CSF leakage or collection with long-term prevention of enophthalmos with better cosmetic results.

**Key Words:** Exophthalmos index, orbital reconstruction, spheno-orbital meningioma.

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## INTRODUCTION

Spheno-orbital meningiomas (SOM) represent about 9% of all meningiomas[1] SOMs are unique among sphenoid wing meningiomas due to their two-component structure: one being spherical en masse tumors with lobulated, sometimes irregular growth, and the other being en plaque tumors that are slightly elevated and extend along the inner dural layer[2].

Due to their atypical radiological features, SOMs are difficult to diagnose. They extend along the greater wing of the sphenoid bone into the temporal bone, temporal muscle, orbital apex, and cavernous sinus, compressing cranial nerves II, III, IV, V, and VI.[3–5] Hence, patients commonly report impaired visual acuity, trigeminal neuralgia, diplopia, ptosis, and proptosis.[6,7]

While resection of spheno-orbital meningioma is considered a safe and effective therapeutic option, leading to significant improvement in visual and neurological symptoms with low complication rates, there is debate in the literature about the necessity and optimal approach of reconstructive surgery following resection. Some argue it is essential to prevent cosmetic deformity, pulsatile enophthalmos or exophthalmos, and postoperative CSF leakage, while others question its necessity.[8,9]

This observational retrospective study assesses and evaluates the efficacy and safety of orbital reconstruction after SOM excision with fascia lata and fat graft and the augmentation of the dural repair with the fat graft adherent and non-adherent to the graft for orbital reconstruction below the titanium mesh, regarding the cosmetic appearance, prevention of enophthalmos, and the development of postoperative CSF leak or collection.

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## METHODS

### Study Design

This case series reviews fourteen patients with SOMs who had excision of the tumor and orbital reconstruction with fascia lata and fat graft along with titanium mesh. All operations were done in the Neurosurgery Department, Ain Shams University, and October 6 University Hospitals from January 2019 to January 2022.

## ETHICAL CONSIDERATIONS

This study was approved by the Clinical Research Ethical Committee of October 6 University Hospitals under approval number O6U-ERC-0032. All patients signed written informed consent forms for the surgery and the possible use in future research. They were all informed about the procedure for withdrawal from research. The study was conducted according to the guidelines of the Declaration of Helsinki.

### Study Procedures

All surgeries were done by the same neurosurgical team. Hospital medical records and image databases were analyzed. All patients underwent a brain MRI with contrast to assess the soft tissue extension and thin cuts CT scan of the skull base and orbit for evaluation of the degree of hyperostosis, optic canal, and sphenoorbital fissure (SOF) involvement (Figure 1).

We selected axial images in the orbital plane of the CT scan and MRI on the optic nerve level bilaterally. A single examiner analyzed all CTs/MRIs, placing a transverse tangent on the anterior lateral orbital rim of both sides and calculating the distance from the corneal center to the tangent line at a 90° angle (Figure 2). Then, we compared the difference in length (mm) between the pre-and postoperative scans to evaluate the exophthalmos improvement.

Each patient's extent of resection was assessed according to the Simpson Grading System for removal of meningiomas[10] and was recorded; postoperative clinical assessment and CT scans were done for all cases.

### Study Participants

All SOM patients were included regardless of their age, sex, religion, and any other social or demographic factors. Patients were excluded in case of absence of proptosis, non-hyperostotic sphenoid wing, associated cavernous sinus meningiomas, optic sheath meningiomas, and clinoidal meningiomas.

### Variables

All preoperative and postoperative data of the patients were documented. It included patient demographics (e.g., age, sex), clinical presentation (complaint, symptoms, signs of medical examination, … etc.), proptosis (unilateral, non-pulsating, and not reducible), exophthalmos index (EI)[11], visual acuity, and ocular motility affection. Postoperatively, proptosis improvement and the development of new enophthalmos in follow-up visits were recorded.

Assessment was done pre- and postoperatively in each visit by the neurosurgeons and ophthalmologists using a Hertel exophtalmometer, in addition to the radiological evaluation using an axial head CT with a thin slice.

(A)

(B)

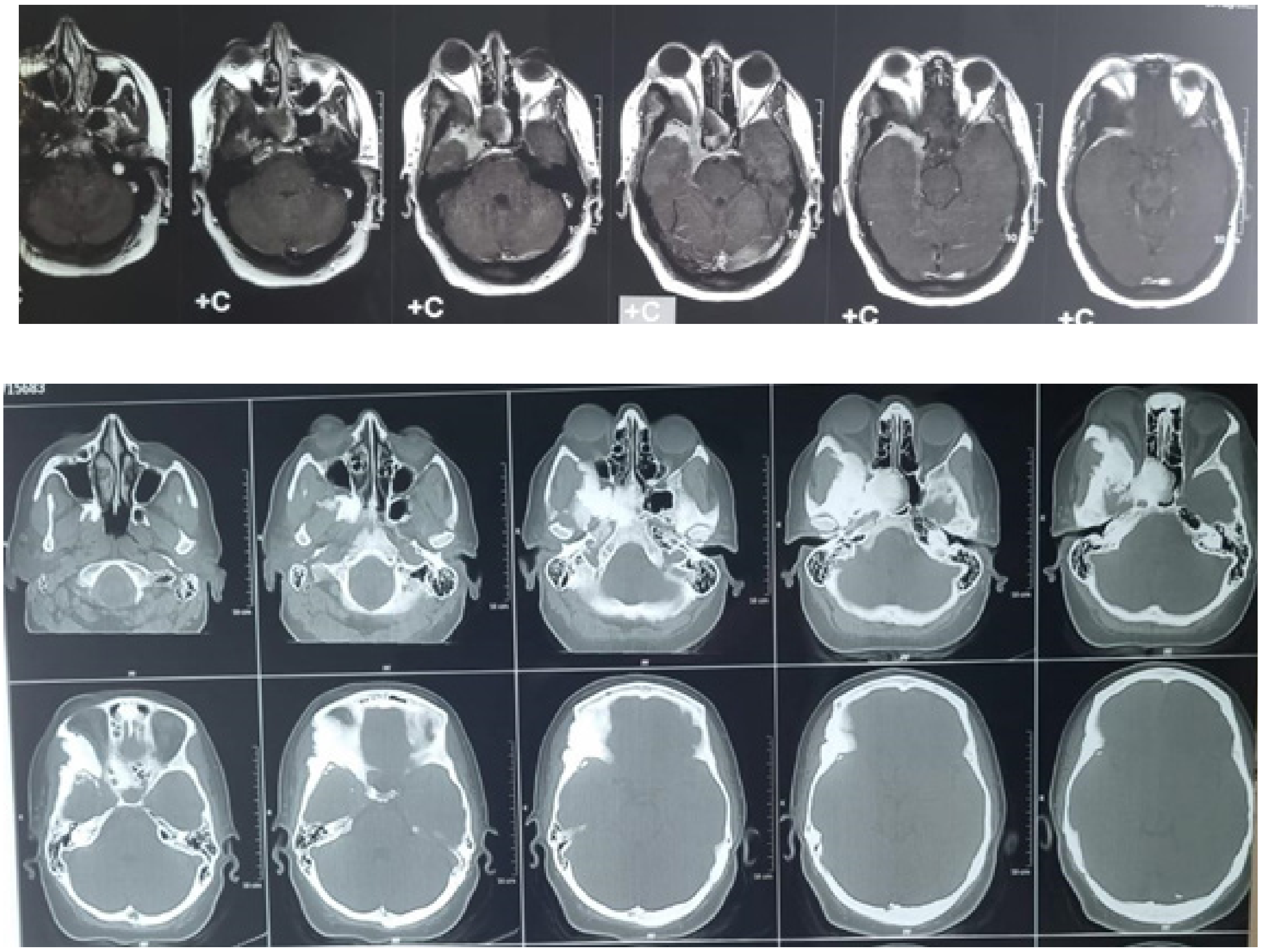

**Fig. 1:** A: Pre-operative Contrasted MRI axial T1 showing right sphenoorbital meningioma enplaque with hyperostosis of the lateral orbital wall causing right orbital proptosis. B: CT scan of bone window axial cuts showing right temporal hyperostosis including sphenoid ridge and right orbital proptosis.

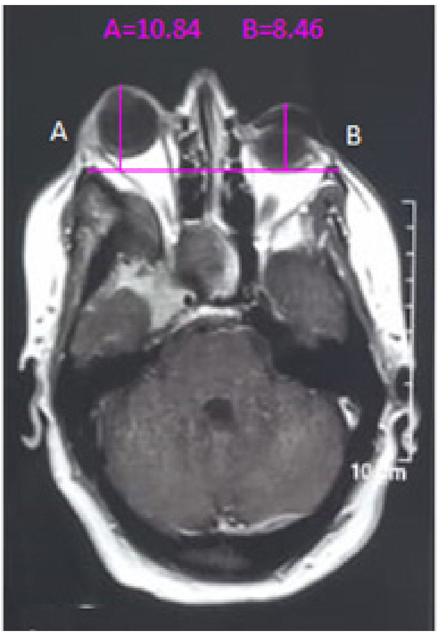


**Fig. 2:** Patient with right SOM and Radiological measurement of exophthalmos index (EI) on preoperative T1-weighted axial MR image with contrast. A slice passing through the lens on both sides was chosen. The distance in millimeters was calculated from the most anterior aspect of each globe on a section (including the lens) to a line between the anterior tips of the frontal processes of the zygomas. The EI was measured as the ratio of the distance on the pathological eye (the ipsilateral side of the tumor) to the same distance on the normal eye (the contralateral side of the tumor) (EI=A/B = 10.84/8.46 = 1.28 in this case).

**Surgical Technique**

One gm of 3rd generation cephalosporin (Ceftriaxone) was given IV to all patients one hour before induction of anesthesia after performance of antibiotic sensitivity skin test. Ondansetron 8 mg IV as antiemetic and 3mg of midazolam IV for sedation were given in the induction room. On arrival to the operating room, patients were fully monitored (5 leads ECG, noninvasive blood pressure, and pulse oximetry). Basal readings of vital data were recorded.

Induction of anesthesia after good preoxygenation was performed with IV propofol (2-2.5mg/kg), fentanyl (1.5– 2.5µg/kg), and rocuronium bromide (0.6-1.2 mg/kg). Intubation was done smoothly with the appropriate-sized armored tube. Maintenance of anesthesia was done by the inhalational anesthetic isoflurane and rocuronium bromide (0.1 mg/kg) for muscle relaxation. Immediately, a central venous line (in the subclavian vein) for intraoperative fluid management and an arterial cannula for continuous invasive blood pressure monitoring were established. A urinary catheter was inserted under complete aseptic conditions for monitoring urine output and fluid management. Intraoperatively, the data of peripheral oxygen saturation, heart rate, invasive arterial blood pressure, and end-tidal carbon dioxide level were recorded.

Scalp Block (regional anesthetic technique) was performed before the insertion of “Mayfield pins” to maintain the appropriate hemodynamic parameters, decrease inflammatory response to surgery, and cover the intra and postoperative pain. With the start of the skin incision, 1gm /kg of mannitol 20% was given intravenously over 30 minutes. The intraoperative goals were to maintain appropriate hemodynamic parameters – especially during orbital manipulation due to oculocardiac reflex–, intraoperative fluid management, and control of pCO2 (between 30-35 mmHg) and intracranial pressure.

The authors operated using the classical frontotemporal craniotomy (Pterional approach) in all cases with the drilling of the hyperostotic bone of the sphenoid ridge. Enlarging the keyhole till reaching the lateral orbital wall and good decompression from anterior to posterior reaching the orbital apex, removing all hyperostotic bone. A single-piece orbito-zygomatic craniotomy was done when needed. Drilling of the anterior part of the orbital roof preserving superior and lateral orbital rim. Microscopic extradural drilling for decompression of the optic canal “deroofing” and SOF was done with a high-speed drill matchstick diamond burr when needed to avoid possible morbidities of mechanical and thermal injury. In the case of infratemporal region extension of hyperostosis, drilling was done while ensuring an intact maxillary sinus.

The dura was then incised, and the optic nerve and carotid artery were identified first when the medial limits of the lesion were reached. Meticulous tumor excision was done, which was usually already devascularized because of the bony work, and the invaded dura was removed with caution not to incise the cavernous sinus dura. If there was a tumor inside the cavernous sinus, it was left and not excised.

The reconstruction of the resected dura was done by fascia lata, letting the fatty face outside, fixing the edges to the normal dura with simple interrupted stitches to achieve tight dural closure, thus ensuring the elimination of dead space together with adequate sealing of the skull base defect to avoid CSF collection and leakage.

Reconstruction of the drilled bony cavity was done using a fat graft from the thigh to fill the cavity and the fat graft volume was adjusted based on the orbital defect size in every patient (taken from the same incision with facia lata). This fat layer is used to ensure dural repair reinforcement and periorbita seal in case of injury during bony maneuvers. After the fat graft, a titanium mesh was used to reconstruct the lateral orbital wall posterior to the preserved lateral orbital rim as well as the temporal fossa when the lateral aspect of the sphenoid ridge was hyperostotic and drilled. The surgical technique is illustrated in (Figure 3).

At the end of the operation and removal of Mayfield pins, smooth extubation with maintenance of the hemodynamic parameters and securing of intravascular lines was done. The patients were discharged to the post-anesthesia care unit (PACU). When the patients’ Modified Alderte Score was 9 to 10, the patients were discharged from PACU to the ICU for postoperative pain and fluid management as well as hemodynamic monitoring.

**Postoperative follow-up assessment**

The postoperative clinical data were collected immediately after surgery and on the first postoperative day. A detailed neurological examination was recorded and documented including postoperative visual acuity improvement or deterioration and ocular motility improvement or affection with the occurrence of enophthalmos, CSF collection or leakage, other cranial nerve palsy, and surgical site infection.

As all patients were discharged on the third postoperative day, the follow-up of patients was done for a scheduled one year (first week, first month, and then 3, 6, and 12 months in the outpatient clinic).

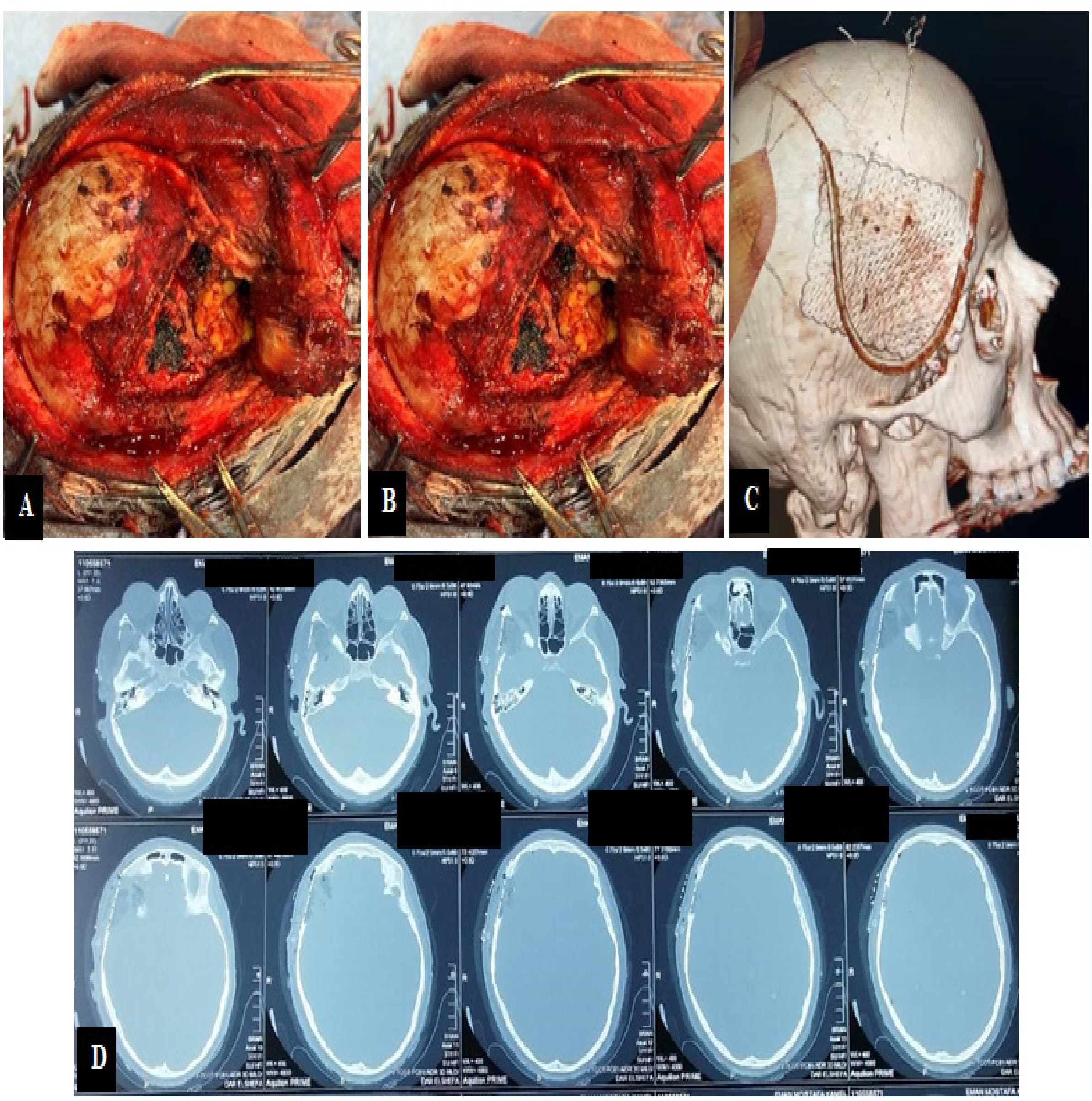


**Fig. 3:** A: Intraoperative image for fascia lata placement showing the fat outside sealing the dura and augmenting the orbit. B: The titanium mesh was placed over the fascia lata and fat graft. C: Post-operative CT scan skull 3D reconstruction showing preservation of orbital walls and mesh used for lateral wall reconstruction below the temporalis muscle. D: Postoperative CT scan of bone window axial cuts showing complete excision of right SOM with orbital reconstruction and evident improvement of right orbital proptosis.

### Statistical Analysis

Data was entered and statistically analyzed on the Statistical Package of Social Science Software program, version 25 (IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp.). Data was presented using mean and standard deviation for quantitative variables and frequency and percentage for qualitative ones. Comparison between groups for qualitative variables was performed using Chi-squared or Fisher's exact tests. For quantitative normally distributed variables, a comparison between two groups was conducted using a paired t-test. *P-values* less than or equal to 0.05 were considered statistically significant.

## RESULTS

### Clinical data

Only 14 patients with SOM met the inclusion criteria and were enrolled in our study. They were 9 females (64.3%) and 5 males (35.7%) with ages ranging from 38-60 years with a mean of 48.29±5.86 years. All patients had proptosis at presentation (100%). The side of the SOM was on the right side in 8 patients (57.1%) and on the left side in 6 patients (42.9%). Preoperatively, the proptosis and EI ranged from 1.15-1.39 mm with a mean EI of 1.27±0.08. Visual acuity was affected in 9 patients (64.3%), ocular motility in 6 patients (42.9%), and radiologically periorbita invasion in 6 patients (42.9%) (Table 1).

**Table 1:** Basic demographic data of the patients.

| | Frequency (*N*=14) | Percentage |
|---|---|---|
| Sex | | |
| Male | 5 | 35.7 |
| Female | 9 | 64.3 |
| Side of the Lesion | | |
| Right | 8 | 57.1 |
| Left | 6 | 42.9 |
| Periorbital Invasion | | |
| No | 8 | 57.1 |
| Yes | 6 | 42.9 |

**Surgical results**

Postoperatively, proptosis was improved in all patients, with 7 patients (50%) achieving complete resolution of proptosis. The postoperative EI ranged from 1.051±0.06, with a *p-value* of improvement <0.001 showing a highly statistically significant difference. Visual acuity improved in 7 patients (50%) but did not improve in 2 patients (14.3%) while temporary visual deterioration was observed in 1 patient (7.1%) whose vision was not affected preoperatively (*P-value* <0.001) and these improvements were clinically significant based on the ophthalmological assessment as compared to the preoperative visual assessment. Ocular motility improved in 5 patients (35.7%) but did not improve in 1 patient (7.1%) (*P-value* = 0.001) (Table 2).

We achieved gross total resection (Simpson grade I) in 7 patients (50%), and subtotal resection (STR) (Simpson grade II) was done in 7 patients (50%) Table 7. No CSF leakage was detected in any patient; however, two patients (14.3%) developed CSF collection, which was managed conservatively and resolved spontaneously in a couple of days (Table 3).

During the regular follow-up visits for one year postoperatively, enophthalmos was not developed in any of the patients, and 12 patients (85.7%) showed great satisfaction with the cosmetic results.

**Table 2:** Proptosis grade (EI), visual acuity, and ocular motility pre-and postoperatively.

| | Preoperative | Postoperative | Test | *P-value* |
|---|---|---|---|---|
| Proptosis grade (EI) | 1.27±0.08 | 1.051±0.06 | Paired t-test | <0.001 |
| Visual acuity | | | | |
| Not Affected | 5 (35.7%) | 4 (28.6%) | Chi-squared test | <0.001 |
| Not Improved | 0 (0%) | 2 (14.3%) | | |
| Improved | 0 (0%) | 7 (50%) | | |
| Impaired | 9 (64.3%) | 1 (7.1%) | | |
| Ocular motility | | | | |
| Not Affected | 8 (57.1%) | 8 (57.1%) | Chi-squared test | 0.001 |
| Not Improved | 0 (0%) | 1 (7.1%) | | |
| Improved | 0 (0%) | 5 (35.7%) | | |
| Impaired | 6 (42.9%) | 0 (0%) | | |

**Table 3:** Simpson Grading System for removal of meningiomas[10].

| Simpson Grading | Frequency | Percent |
|---|---|---|
| I: Macroscopically complete removal with excision of dural attachment and abnormal bone. | 7 | 50.0 |
| II: Macroscopically complete removal with endothermy coagulation (electrocautery) of dural attachment | 7 | 50.0 |

## DISCUSSION

Spheno-orbital meningiomas (SOMs) are predominantly benign tumors, constituting 9-18% of all meningiomas[12-15]. They are characterized by significant hyperostosis of the sphenoid wing and a carpet-like soft tissue component[5]. Due to their complex anatomical location at the anterior skull base and tendency to invade the periorbita, SOMs often involve intra-orbital growth and extensive hyperostosis, affecting the optic canal, superior orbital fissure, and other cranial nerve foramina. This complicates surgical resection, increasing the risk of neurological and visual deficits[16]. Complete resection is often challenging due to the tumor's proximity to delicate structures, which also contributes to a higher risk of recurrence or regrowth[17,18].

Heterogeneous outcomes are reported in the literature regarding surgical techniques of SOMs due to the myriads of surgical approaches. This has led to ongoing debate about the effectiveness and safety of SOM surgery, particularly concerning the improvement or prevention of visual, neurological, and cosmetic symptoms[8].

Proptosis is a common symptom in SOM patients, often causing both cosmetic and functional impairments. The main goals of SOM surgery are to restore functionality, improve quality of life, and allow patients to resume normal activities[19,20]. Maximum safe decompression and resection of hyperostotic bone are essential to address visual deficits or prevent further deterioration, although this approach may leave behind residual pathological cells that could contribute to recurrence, as shown in PET-CT studies [14,21,22]. The pterional approach is favored as it provides access to the middle and anterior cranial fossae, as well as the orbit[8,19].

In this study, we operated on 14 patients with SOM using the classical pterional approach. The cohort consisted of 9 females (64.3%) and 5 males (35.7%), with a mean age of 48.29±5.86 years. Preoperatively, all patients had proptosis, with a mean Exophthalmos Index (EI) of 1.27±0.08. Postoperatively, proptosis improved in all patients, with 50% achieving complete resolution. Visual acuity improved in 50% of patients, and ocular motility improved in 35.7%. Gross total resection (Simpson grade I) was achieved in 50% of patients, with the remaining undergoing subtotal resection (Simpson grade II). Importantly, no patient developed enophthalmos during the one-year follow-up, and 85.7% of patients expressed satisfaction with the cosmetic outcomes.

Orbital reconstruction using fascia lata, fat grafts, and titanium mesh was employed to prevent complications such as CSF leakage and enophthalmos. This approach proved effective, with all patients achieving satisfactory cosmetic results. Moreover, orbital repair prevents enophthalmos and gives good and satisfactory cosmetic results in all our patients indicating that surgical resection and reconstruction were very effective.

A systematic review and meta-analysis support the benefits of SOM surgery, noting improvements in proptosis and cranial nerve deficits in most patients, where ophthalmoplegia, visual acuity, and visual field deficits improved in 96%, 91%, and 87% of patients, respectively[8]. Still, several predictors of visual outcomes must be considered. Invasion of the optic canal, extension into the periorbita, and the presence of an intracranial soft-tissue component are negative predictors for postoperative visual acuity and visual field deficits. Conversely, excision of the periorbita positively impacts the reduction of proptosis, while radiological involvement of the optic canal predicts residual postoperative proptosis.[6,23,24], Other considerations include proper reconstruction of the orbital walls to prevent enophthalmos [6, 14, 16, 25-29]; reconstruction of dural defects to prevent CSF leaks, wound infection, and meningitis[30, 31]; and excising intra-orbital tumor extension without complicating it with ophthalmoplegia.[13] Hence, the periorbit is preferred to only be resected/opened when invaded[6].

The literature shows conflicting views on the need for reconstructive surgery after resection to prevent cosmetic deformities, pulsatile enophthalmos, exophthalmos, or postoperative CSF leakage. Effective repair of skull base defects with tight duroplasty is crucial to prevent serious complications such as cosmetic issues or life-threatening CSF leakage[8].

Some authors endorse reconstruction of the orbital walls and the lesser or greater sphenoid wings, particularly using autologous bone grafts, for aesthetic improvement and prevention of complications[32,39]. However, other studies have found no significant complications or aesthetic issues without orbital repair, with rare cases of enophthalmos[10,16,29,40]. Nevertheless, we assert that reconstructing the orbital wall after SOM surgery is essential for restoring normal orbital volume, thereby improving visual outcomes and preventing ocular complications[8,30,41,42].

### Study limitations

This study has several limitations that should be acknowledged. First, the retrospective design inherently limits the ability to establish causality and may introduce selection bias. Second, the small sample size of 14 patients reduces the statistical power and may limit the generalizability of the findings. Third, the follow-up period of one year, although sufficient to assess early postoperative outcomes, may not capture long-term complications, recurrence rates, or the durability of the surgical results. Additionally, the lack of a control group prevents comparisons with alternative treatments or surgical techniques, making it difficult to attribute observed outcomes solely to the surgical intervention used. Lastly, the study did not include advanced imaging techniques like PET-CT for more precise identification of residual tumor cells, which might have provided deeper insights into the recurrence risk.

Despite these limitations, the study has notable strengths. The use of a consistent surgical approach by the same neurosurgical team ensures standardization of the procedure, which contributes to the reliability of the results. The detailed documentation of both clinical and radiological outcomes provides a comprehensive assessment of the surgical efficacy. Moreover, the study contributes valuable data on the effectiveness of orbital reconstruction using fascia lata, fat grafts, and titanium mesh, offering a potential framework for improving surgical techniques in SOM management. The high patient satisfaction rate with cosmetic outcomes further underscores the clinical relevance of the approach. Finally, this study adds to the limited body of literature on SOMs, helping to address the ongoing debate about the best surgical strategies for these complex tumors.

## CONCLUSION

This study highlights the complexities of managing SOM due to their challenging anatomical location and potential for visual and neurological complications. Our findings demonstrate that the classical pterional approach, combined with orbital reconstruction using fascia lata, fat grafts, and titanium mesh, is effective in achieving significant improvements in proptosis, visual acuity, and ocular motility. The technique also yields high patient satisfaction with cosmetic outcomes, without significant postoperative complications. The results of this study underscore the importance of comprehensive surgical planning and precise reconstruction to optimize both functional and aesthetic outcomes. Further research, including larger and prospective studies, is needed to validate these findings and refine surgical strategies for SOM management.

## ABBREVIATIONS

| | |
|---|---|
| CSF | Cerebrospinal fluid |
| ECG | Electrocardiogram |
| EI | Exophthalmos index |
| ICU | Intensive care unit |
| IV | Intravenous |
| MRI | Magnetic resonance imaging |
| PACU | Post-anesthesia care unit |
| PRC | Patient Review Committee |
| SOF | Spheno-orbital fissure |
| SOM | Spheno-orbital meningioma |

## DECLARATIONS

## CONFLICT OF INTEREST

All authors certify that they have no affiliations with or involvement in any organization or entity with any financial interest (such as honoraria; educational grants; participation in speakers' bureaus; membership, employment, consultancies, stock ownership, or other equity interest; and expert testimony or patent-licensing arrangements), or non-financial interest (such as personal or professional relationships, affiliations, knowledge, or beliefs) in the subject matter or materials discussed in this manuscript.

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The authors declare they have not received funding for the conduct of this research project.

## CONSENT TO PARTICIPATE

We have obtained written consent to participate from all patients. No identifiable information was disclosed in any form.

## CONSENT TO PUBLISH

We have obtained written consent to publish from all patients. No identifiable information was disclosed in any form.

## AUTHORS' CONTRIBUTION

GHK: Conceptualization, research idea, data analysis strategy, and manuscript writing. MMR: Methodology and manuscript writing. MTA: Methodology and manuscript writing. BHE: Methodology and manuscript writing. AMM: Methodology and manuscript writing.

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# إعادة بناء الحجاج بعد استئصال الأورام السحائية الوتدية الحجاجية باستخدام اللفافة الكبرى و الدهون

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**الخلفية:** الورم السحائي الوتدي الحجاجي هو نوع نادر جداً من الأورام السحائية التي تنشأ من الحافة الوتدية ويمتد بالحجاج يؤدي إلى جحوظ العين غير المؤلم وتدهور تدريجي في الرؤية.
**الطرق:** دراسة استعادية ملاحظة تقيّم فعالية وسلامة إعادة بناء الحجاج باستخدام اللفافة الكبرى، وزرع الدهون، وشبكة التيتانيوم بعد استئصال الورم بين يناير ٢٠١٩ ويناير ٢٠٢٢. تم متابعة المرضى على مدار عام لمراقبة تحسن جحوظ العين، والانخفاض في العين، والمضاعفات.
**النتائج:** ١٤ مريضاً مكونين من ٩ إناث و ٥ ذكور بمتوسط عمر قدره ٤٨٫٢٩±٥٫٨٦ سنة. جميع المرضى يعانون من جحوظ العين، وكان متوسط قيمة مؤشر العين قبل العملية ١٫٢٧±٠٫٠٨. بعد العملية، تحسن بروز العين في جميع المرضى، حيث حقق ٥٠٪ منهم تحسناً كاملاً. كما انخفض المتوسط بعد العملية لمؤشر العين بشكل كبير إلى ١٫٠٥١±٠٫٠٦. تحسنت حدة البصر في ٥٠٪ من المرضى، مع ملاحظة تدهور مؤقت في مريض واحد. تحسنت حركة العين في ٣٥٫٧٪ من المرضى. تم تحقيق الاستئصال الكامل في ٧ مرضى، بينما خضع ٧ آخرون لاستئصال جزئي. لم تحدث أي تسرب للسائل الشوكي، رغم أن اثنين من المرضى عانوا من تجمع للسائل الشوكي، الذي تم معالجته بشكل تحفظي. على مدار عام من المتابعة، لم يتطور انخفاض في العين، وكان ٨٥٫٧٪ من المرضى راضين عن النتائج الجمالية.
**الاستنتاجات:** يعتبر الاستئصال الجراحي فعالاً في إيقاف تطور العجز البصري وتحسين جحوظ العين. تقدم إعادة بناء الحجاج أفضل النتائج فيما يتعلق بمنع تسرب أو تجمع السائل الشوكي ومنع سقوط العين داخل الحجاج على المدى الطويل مع نتائج جمالية أفضل.