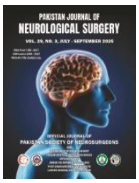

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Original Research

A Month in Cross Section: A Case Series of Eleven Sphenoid Wing Meningiomas: A Single Center Experience

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ABSTRACT

Objective: The objective of this work was to present our experience of SWM in a single-center case series of eleven patients in one month.

Materials & Methods: 11 cases of joint global sphenoid wing meningiomas were operated on in September 2022. Patient demographic, clinical, radiology, and perioperative salient features were noted. Post-operative clinical outcome included improvement in visual acuity, neural deficit, and headache. The extent of resection on radiology plus survival was noted as an outcome measure.

Results: Patients aged 28 to 65 years, with 9 females and 2 males, had giant sphenoid wing meningioma. Complete medial sphenoid wing involvement along with neurovascular structures, post operatively, they had visual deterioration; hence, the extent of resection was limited to prevent greater post-operative morbidity. 3/7 undergoing GTR had complete carotid artery encasement, in which full full-thickness MCA infarct was noted in 6 6-hour post-operative scan; they were later converted to a full 16 cm decompressive craniotomy. One survived with hemiparesis and aphasia while two died – male (49y), female (65), both had left craniectomies. STR was done in four patients, with cavernous sinus invasion and internal carotid encasement.

Conclusion: Giant sphenoid meningioma involving the medial sphenoid wing and associated neurovascular structures is surgically challenging and must be treated with STR. If GTR is to be attempted, early CT Brain postoperatively to prevent mortality.

Keywords: Sphenoid Wing Meningioma (SWM), Surgical Outcome, (GTR), (STR).

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INTRODUCTION

Sphenoid wing meningioma (SWM) is the third most prevalent type of intracranial meningioma, and it is located on the lesser wing of the sphenoid bone, encasing the anterior clinoid process.[1] It usually occurs in the fourth decade of life and is predominant in the female population. The clinical presentation can vary, and the common signs and symptoms include headache, visual disturbance, seizures, and can sometimes present as a painless unilateral mass with ptosis.[2] The management options can differ depending on the clinical and radiological findings. Starting from Observation with radiological evaluation in mild cases to surgical excision, radiostatic surgery, radiation therapy, or a combination of these can be given in cases of potential bone invasion or proximity to neurovascular structures and cavernous sinus (CS).[3] The ideal way to approach an incidental mass is to observe unless symptoms are being caused by the mass or there is a drastic increase in the size of the lesion. During the observation phase initially biannual scan for a year, followed by yearly imaging, is the ideal approach.[4]

Globoid tumors can be classified into medial, middle, and lateral types, with the medial sphenoid wing meningioma having the highest recurrence rate and lateral sphenoid wing lesions having the lowest surgical complications. The middle and the lateral lesions can be approached surgically via the pterional approach, while the medial type is difficult to deal with surgically as it extends over the dura overlying the lesser wing of the sphenoid, clinoid, and planum.[5] The medial lesions can invade the cavernous and sphenoid sinuses and the orbit, as well as invade into the sella, compressing the optic nerves. In case of bigger lesions internal carotid artery can be invaded at the supraclinoid region; however, clinoid lesions do not tend to grow in cranial directions, nor do they cross the sphenoid ridge. Patients with medial sphenoid wing meningioma can present with personality changes or cognitive disorders due to cytotoxic edema on the frontal lobe and, in other instances, cause seizures due to compression on the temporal lobe.[6] Medial SWM tend to present as a large mass usually on the dominant side, affecting speech with or without hemiparesis due to compression by a larger mass.[7]

T1WI pre- and post-contrast images on MRI brain are the diagnostic of choice for SWM. An MRI angiogram can also be of great help to determine the involvement of the supraclinoid region of the ICA. Pre-operative angiogram may also help in pre-operative embolization or coiling to decrease the blood flow to the surgical site for better surgical resection.[8]

A pre-operative checklist includes a detailed ophthalmic examination by an ophthalmologist for assessment of visual acuity and expected recovery of vision post-surgically, as well as assessment by an endocrinologist to find out the involvement of the sella and hypothalamic-pituitary axis.

Small mass with optic nerve sparing can be approached surgically via pterional incision in supine position, whereas a larger mass with ICA involvement should ideally be operated via fronto-temporo-orbito-zygomatic (FTOZ) approach via a coronal incision. In more advanced and aggressive tumor image-guided systems can be used for maximum debulking. Making planes between the base of the skull and the sphenoid wing will devascularize the mass for debulking. More importantly, shaving should be done with extreme caution around the ICA and oculomotor nerve. Absorbable collagen sponges or dural patches can be used to close the extradural openings if watertight dural closure cannot be achieved.

The objective of this work was to present our experience of SWM in a single-center case series of eleven patients in one month. This allowed us to conform to a standardization of the surgical technique while dealing with this specific pathology. Additionally, the high volume of SVMs

in a single month allowed us the opportunity to report on early surgical outcomes of these patients.

MATERIALS & METHODS

Surgical Technique

It was a prospective cross-sectional study, with non-random convenient sampling. The authors, including lead surgeons, operated on 11 cases of sphenoid wing meningiomas in September, who presented to Out Outpatient Department and were subsequently admitted.

Inclusion Criteria

All patients having a medial sphenoid wing meningioma as demonstrated by radiology and reported by a senior radiologist, as having typical features of meningioma, Hyperostosis both radiological and clinical, bright contrast enhancement, and dural tail, with minimal cortical oedema.

Exclusion Criteria

Patients aged less than 18 years and greater than 75 years, patients with more than one comorbidity Diabetes Type II, Hypertension or coronary artery disease, patients having a history of stroke or any other neurological disease, or radiological features which are atypical (atypical enhancement pattern, absence of dural tail, and absence of hyperostosis) for a classic meningioma in this region were excluded from the study sample.

Pre-operative Data

Patient demographic (Age, Sex, marital status), presenting clinical features (Headache, Decrease in Visual Acuity, Seizures, EOM Palsy, Ptosis, Anosmia) and radiological parameters (Size, shape, contest enhancement, brain invasion, brain oedema characteristic, bone hyperostosis on CT, CTA/MRA (internal Carotid delineation pre-operatively) were noted down pre-operatively.

Intra-operative Data

with intra-operative salient points of interest (bone involvement, dural invasion/adherence, engulfment of neurovascular structures in the vicinity, invasion of the cavernous sinus, extent of craniotomy and specific bony work required, consistency of the lesion, vascularity of the lesion, color characteristics, brain parenchymal invasion).

Surgical Technique

Post-operative Data: Post-operative clinical outcome criteria included improvement in visual acuity, neural deficit, and headache. Outcome criteria also included the extent of resection as noted by the principal surgeon, as well as post-operative radiology. Due to the limited number of cases and type of tumor, patient survival was the major surgical outcome criterion.

RESULTS

Demographics

All 11 cases were Giant sphenoid wing meningiomas. Among them, patient age ranged from 28 to 65, with a Female (09) to Male (02) ratio of 4.5.

Pre-operative Radiology/Clinical Presentation: Radiologically and preoperatively, invasion of the cavernous sinus was noted in 04 patients, diplopia in 09 patients, Proptosis in 05 patients, and Internal carotid artery involvement in 04 patients **(See Table 1).** The average size was 5.9cm, and all were above 5 cm. Pre-operative cognitive decline was noted in 58% of patients.

Diplopia improved in seven out of nine, and proptosis resolved completely in the five patients **(See Table 1).**

Intra-operative Summary Findings

Those patients in whom the medial sphenoid wing was completely involved with neurovascular structures, post-operatively, had visual deterioration. In so far, in these patients, the extent of resection was limited and the post-operative morbidity was less. In cases in which the surgeon opted for Gross Total Resection (GTR), three patients had complete carotid encasement. Subtotal Resection (STR) was done in four patients, all of whom had cavernous sinus invasion and internal carotid encasement.

Early post-operative Outcomes: Full full-thickness MCA infarct was noted in 6 6-hour post-operative scan of one male (49y), who had undergone left craniotomy. The patient was converted to a full 16cm decompressive craniotomy, but eventually died. Of the remaining seven patients in which GTR was attempted, diplopia improved in 7 out of 9, and proptosis resolved completely in the 05 patients **(See Figure 1).**

Table 1: *Summary of Results.*

Summary of Results	
Results	**Details**
Number of patients	11
Age	28-65
Gender	**Female (09), Male (02)**
Cavernous Sinus invasion	4
Diplopia	9
Proptosis	5
Internal Carotid Artery Involvement	4
Visual Deterioration	**Yes**
GTR Attempted	7
STR Attempted	4
Diplopia Improvement	7
Proptosis Resolved	5
Survivors	9
Deaths	2

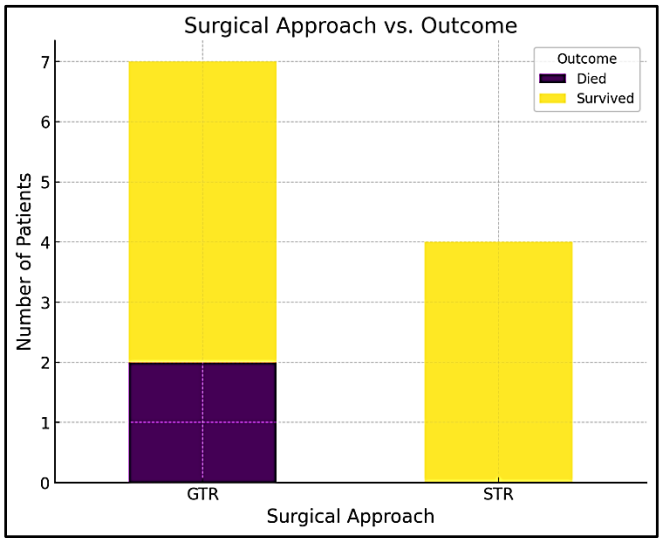

Figure 1: *Detail of Surgical Outcomes.*

Additionally, no invasion pattern was strongly predictive of the extent of resection alone, as per pre-operative radiology, it became apparent during this series that intra-operative assessment and planning and adaptation were the key for safer resections.

The mortality rate for this study for giant medial sphenoid wing meningiomas was 18.2%, and as per the Kaplan-Meir Survival Curve, the survival probability drops to 81.8% at the end of the study period.

Statistical analyses were conducted to explore relationships and differences in the patient data. Chi-square tests showed no significant associations between gender and survival ($p = 0.3455$) or between gross total resection (GTR) attempted and survival ($p = 0.4909$). However, a t-test revealed a marginally significant difference in age between patients with and without cavernous sinus invasion ($p \approx 0.048$), though caution is advised in interpretation due to the small sample size.

DISCUSSION

Sphenoid wing meningiomas represent 20% of supratentorial meningiomas. The tumor usually involves the visual pathway, the anterior vasculature, and cavernous sinus invasion. A

higher morbidity, mortality, and recurrence are documented in comparison to meningiomas of other locations. The Cushing classification is still used, but it was described before modern imaging.[9] However, modern imaging has enabled the detection of intra-tumoral brain invasion of meningiomas that was not previously possible.[10] Preoperative angiography is the most essential component in this, which enables the surgeon to identify each vessel and its probable course, and the most important vessel internal carotid. It is possible to use modern imaging to identify the extent of involvement of the CS and the internal carotid artery (ICA) as well as the degree of bone erosion of the sphenoid bone,[11-12] involvement of the CS is a real challenge intraoperatively, and as discussed in the cases operated, only a remnant of tumor was left, which was then gingerly coagulated with low power and copious irrigation.

Various adjuvant treatments have been used to treat SWM, including radiotherapy, radiosurgery, and chemotherapy.[13] Radiotherapy is a well-established treatment modality for grade I and II SWM, but its use is controversial in grade III tumors.[14] Radiosurgery has been used to treat residual or recurrent tumors, with reported rates of local control and tumor shrinkage ranging from 66% to 94%.[15] In our series, we further sent our patients for additional radiotherapy, after the first follow-up at four weeks, and patients were then sent for adjuvant radiotherapy to the resection bed.

The results of the study demonstrate that complete resection of sphenoid wing meningioma's is possible without compromising patient safety and outcome if the internal carotid artery is involved,[16,17,18] during our series, the surgeons experience was the pivotal factor at this step, surgeons who are familiar with the territory of neurovascular structures course and variation, and have vascular experience, fared better at this step, they were confident to attack the tumor judiciously and carefully, while preserving the patient safety. The results also suggest that for those cases where the medial sphenoid wing is completely involved with neurovascular structures, the extent of resection can be limited to reduce post-operative morbidity.[16-18] Therefore, it is important for surgeons to consider the possible risks of complete resection before proceeding with the surgery,[9,10,13,19,20] risks in this from our prior experience is the compromise of the vascular structures, and in our setup we have had encountered a patient with medial SWM to have an MCA infarct post operatively requiring a decompressive craniotomy to preserve life, another complication which is common to this region is ptosis, which severe at first, recovers fully, in roughly about six months. The risks of surgery and the complication profile make this a challenging surgery at each attempt; it is done.[19-20]

CONCLUSION

Our case series shows that sphenoid wing meningiomas can be managed effectively, for the most part, with surgical resection. The results demonstrate that complete resection is possible without compromising patient safety and outcome if the internal carotid artery is involved. Surgeons must assess the risks of complete resection before proceeding with the surgery, and consider alternative treatments such as subtotal resection to reduce post-operative morbidity.

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AUTHORS CONTRIBUTION

Sr.#	Author's Full Name	Intellectual Contribution to Paper in Terms of:
1.	Mushtaq	1. Study design and methodology.
2.	Sohaib Ali and Sana Umar Afridi	2. Paper writing.
3.	Muhammad Ibrahim Afridi and Sana Umar Afridi	3. Data collection and calculations.
4.	Muhammad Ibrahim Afridi and Mahrukh Afreen	4. Analysis of data and interpretation of results.
5.	Sohaib Ali, Tauseef Ullah, and Mahrukh Afreen	5. Literature review and referencing.
6.	Ehsan Sayyed	6. Editing and quality