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Medial sphenoid wing meningioma: cavernous sinus involvement

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Abstract:
***Background*:**. *Medial sphenoid wing meningiomasrepresents a distinct entity of meningioma;the tumours are medially located with involvement of the anterior clinoid process .Medial sphenoid wing meningiomas had an inherited surgical difficulties, morbidities & mortalities due to its intimate relations to optic nerve, cavernous sinus, cranial nerves that enter superior orbital fissure and arteries of anterior circulation.*
Materials and Methods*: This is a retrospective study conducted from January 2018 to november 2020 on 24 consecutive patient who were operated with diagnosis of sphenoid wing meningiomain our department.*
Results*: A total of 24 patients were included in this study.In majority (70.83%) of patients, headache is the most common clinical presentation.Cavernous sinus involvement(58.33%) is found to be commonly involved by the tumour in this study along with the internal carotid involvement (41.67%).Patient with Cavernous sinus involvement in this study is found to significantly influenced the resectability of the tumour and also leads to significant post operative morbidity.*
Conclusion:*Due to intimate relations to optic nerve, cavernous sinus, cranial nerves,internal carotid artery;management of medial sphenoid wing meningiomas present a challenge which is important for the treating surgeon to take note of so that migitate the devasting surgical outcome that may occur*
Key Word: *Medial sphenoid wing meningioma,cavernous sinus,outcome.*

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I. Introduction

Meningiomas account for 14−18% of all intracranial neoplasms. Meningiomas arising from the sphenoid ridge constitute approximately 14−20% of all meningiomas.[1,2]

Two main types of tumours have been described according to their presentation: globoid tumours with a nodular shape and en plaque tumour.[3]The nodular type an encapsulated tumour of variable size that displaces or encases intracranial arteries or cranial nerves (CNs). In meningioma enplaque, the tumour produces a hyperostotic reaction due to tumour cells filling the haversian canals and spreading into the adjacent bones that include the pterion, orbital wall, malar bone, zygomatic, temporal and middle cranial fossa.

Cushing and Eisenhardt3 have classified these tumours based on their site of origin along the sphenoid wing as inner third, middle third and outer third tumours. Inner third tumours have been subdivided into Spheno cavernous tumours ,arising from the external wall of the cavernous sinus (CS) and clinoidal tumours (those that from the clinoid process).

Nakamura et al.[4] have subclassified inner third tumours into Group 1 comprising tumours without CS involvement and Group 2 that includes tumours with CS involvement.

Medial sphenoid wing meningiomas had an inherited surgical difficulties, morbidities & mortalities due to its intimate relations to optic nerve, cavernous sinus, cranial nerves that enter superior orbital fissure and arteries of anterior circulation.[4] The rate of recurrence for medial sphenoid wing meningiomas is reported as one of the highest for intracranial meningiomas.[2]

II. Material And Methods

This is a retrospective study conducted from January 2018 to november 2020 on 24 consecutive patients and their data who underwent surgicalmanagement for meningiomas involving themedial sphenoid wing (the location was defined by preoperative imaging and the pathology wasconfirmed by histological assessment) .All cases that involved middle & lateral two thirds ofsphenoid wing were excluded. Also, weexcluded all meningiomas enplaque in thispaper as it is not limited to medial sphenoidwing .All patient received standard treatment as per institutional protocol for TBI. Statistical analysis was performed using SPSS version 21.

III. Result

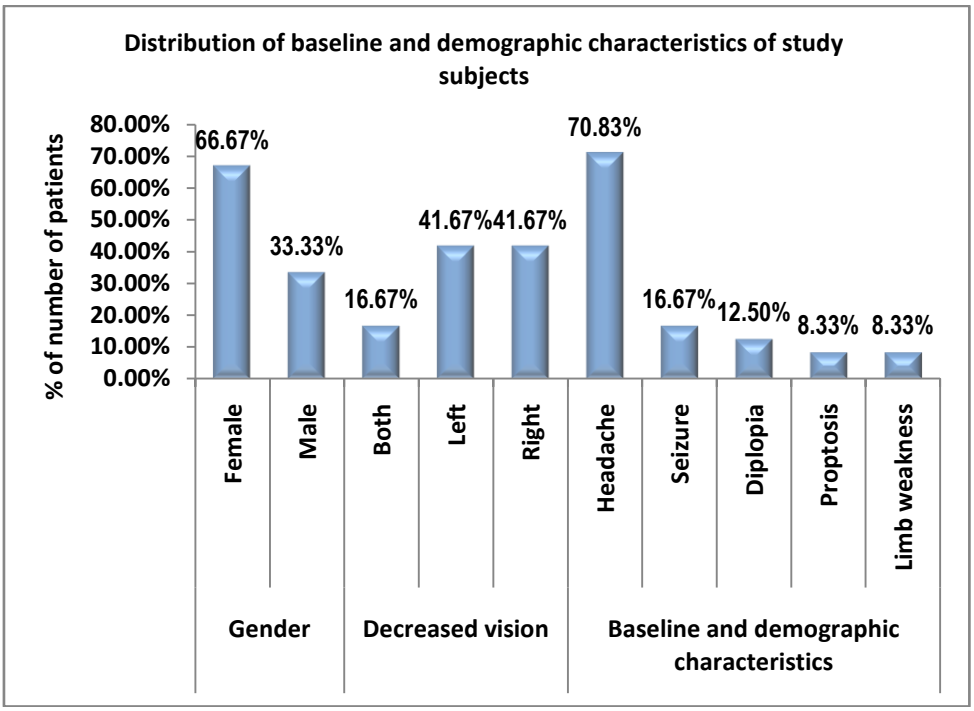

Figure 1:-Distribution of baseline and demographic characteristics of study subjects.

Mean value of age(years) of study subjects was 47.58 ± 6.2 with median(IQR) of 48(43-52).
In present study, 66.67% of patients were females and 33.33% of patients were males.
In majority (41.67%) of patients, decreased vision was on left and right each. Decreased vision was on both sides in only 4 out of 24 patients (16.67%).

In majority (70.83%) of patients, headache was seen followed by seizure (16.67%) and diplopia (12.50%). Proptosis and limb weakness was seen in only 2 out of 24 patients (8.33%) each.

Table 1:-Distribution of MRI features of study subjects.

MRI features	Frequency	Percentage
Site		
Left medial sphenoid wing	10	41.67%
Left medial sphenoid wing extending to right	2	8.33%
Right medial sphenoid wing	10	41.67%
Right medial sphenoid wing extending to left	2	8.33%
MRI features		
Peri tumoral edema	11	45.83%
Calcification	3	12.50%
Cavernous sinus involvement	14	58.33%
Internal carotid involvement	10	41.67%
Optic nerve involvement	4	16.67%

In present study, in majority (41.67%) of patients, site involved was left medial sphenoid wing, right medial sphenoid wing each. Site involved was left medial sphenoid wing extending to right and right medial sphenoid wing extending to left in only 2 out of 24 patients (8.33%) each.

In majority (58.33%) of patients, MRI features was cavernous sinus involvement followed by peri tumoral edema (45.83%), internal carotid involvement (41.67%) and optic nerve involvement (16.67%). MRI features was calcification in only 3 out of 24 patients (12.50%).

Mean value of size(cm) of study subjects was 4.11 ± 0.94 with median(IQR) of 4(3.375-4.625).

Table 2:-Distribution of surgery of study subjects.

Surgery	Frequency	Percentage
FTOZ	7	29.17%
Pterional	17	70.83%
Total	24	100.00%

In present study, in majority (70.83%) of patients, surgery performed was pterional. Surgery performed was FTOZ in only 7 out of 24 patients (29.17%).

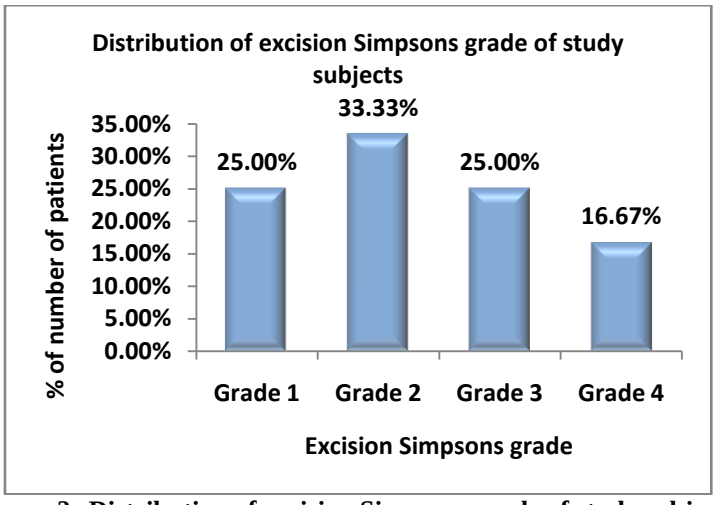

Figure 2:-Distribution of excision Simpsons grade of study subjects.

In present study, in 33.33% of patients, excision Simpsons grade was grade 2 followed by grade 1 (25.00%) and grade 3 (25.00%). Excision Simpsons grade was 4 in only 4 out of 24 patients (16.67%).

Table 3:-Distribution of histopathology of study subjects.

Histopathology	Frequency	Percentage
Anaplastic	1	4.17%
Angiomatous	2	8.33%
Atypical	1	4.17%
Fibroblastic	2	8.33%
Meningothelial	8	33.33%
Psammomatous	1	4.17%
Transitional	9	37.50%
Total	24	100.00%

In present study, in 37.50% of patients, histopathology finding was transitional followed by meningothelial (33.33%), angiomatous (8.33%) and fibroblastic (8.33%). Histopathology finding was anaplastic, atypical and psammomatous in only 1 out of 24 patients (4.17%) each.

Table 4:-Distribution of post-operative complications of study subjects.

Post-operative complications	Frequency	Percentage
CSF leakage	2	8.33%
Extradural hematoma	3	12.50%
Tumour bed bleeding	2	8.33%
Aphasia	4	16.67%
Infarct	2	8.33%
Occulomotor nerve palsy	4	16.67%
Abducens nerve palsy	1	4.17%

In present study, in 16.67% of patients, post-operative complications was aphasia, occulomotor nerve palsy each followed by extradural hematoma (12.50%), CSF leakage (8.33%), tumour bed bleeding (8.33%) and infarct (8.33%). Post-operative complication was abducens nerve palsy in only 1 out of 24 patients (4.17%).

Table 5:-Association of cavernous sinus involvement with Simpsons grade for excision of tumour .

Cavernous sinus involvement	Grade 1 (n=6)	Grade 2 (n=8)	Grade 3 (n=6)	Grade 4 (n=4)	Total	P value	Test performed
No	6 (100%)	4 (50%)	0 (0%)	0 (0%)	10 (41.67%)	0.0003	Fisher Exact test
Yes	0 (0%)	4 (50%)	6 (100%)	4 (100%)	14 (58.33%)		
Total	6 (100%)	8 (100%)	6 (100%)	4 (100%)	24 (100%)		

Proportion of patients of **Cavernous sinus involvement** was significantly higher in grade 3 and grade 4 as compared to grade 1 and grade 2. (100%,100% vs 0%, 50%) (p value = 0.0003).

Table 6 :-Association of post-operative complications with cavernous sinus involvement.

Post-operative complications	**No cavernous sinus involvement (n=10)**	**Cavernous sinus involvement (n=14)**	**Total**	**P value**	**Test performed**
No	4 (40%)	6 (42.86%)	10 (41.67%)	1	Fisher Exact test
Yes	6 (60%)	8 (57.14%)	14 (58.33%)		
Total	10 (100%)	14 (100%)	24 (100%)		

Distribution of Post-operative complications was comparable in patients without cavernous sinus involvement and with Cavernous sinus involvement (60% vs 57.14%) (p value = 1). It is shown in table 6.

IV. Discussion

Medial Sphenoid Wing meningiomas poses a surgical challenge due to critical location that bounded by optic nerve, Clinoid Process, Sphenoid wing, ICA and cranial nerves .In spite of its narrow site, it represent over than half of all meningiomas that appear in sphenoid wing.[5]

In the past decades, the total resection of those tumour was not achieved in most cases due to its association with high morbidity & mortality related to attempts of radical removal of tumour thus leading to the trends for partial removal. But advances in microscopes, micro instruments, modern neurosurgery tools and imaging studies make the goal of gross total resection possible with minimal morbidity and mortality.[6]

In present study, in 33.33% of patients, excision Simpsons grade 2 was done followed by grade 1 in 25.00% and grade 3 in 25.00% and Simpsons grade 4 excision in 16.67%. The results is comparable to what is mentioned by Brotchi and Bonnal, Nakamura et al and Sughrue.[4,7] in spite of the old series showed complete removal of the medial sphenoid wing meningioma fluctuated between23 to 50%.[8]

The main causes for incomplete excision in our research could be correlated to increased firmness of the tumours, lack of clear arachnoid plane between ICA & its branches ,adherent of the tumours on the vessels adventitia making total resection impossible without vascular injury that may be fatal beside encasement of cranial nerves & optic apparatus and inability to remove the intra-cavernous part which make complete tumor removal possess a very high morbidity.

In our study, in 16.67% of patients, post-operative complications was aphasia, occulomotor nerve palsy each followed by extradural hematoma (12.50%), CSF leakage (8.33%), tumour bed bleeding (8.33%) and infarct (8.33%). Post-operative complication was abducens nerve palsy in only 1 out of 24 patients (4.17%).

The most common complication in our cases was 3rd N. Palsy and aphasia that occur in 4 cases(16.67%).occulomotor palsy is similar to the study Zhang et al who stated post-operative 3rd Nerve Palsy in 18.9%.[9]

CSF leak recorded in 2 cases (8.33%) in our study. We treat it with lumbar drain for few days then Acetazolamide tablets dosage as per body weight under coverage of broad spectrum antibiotic. One of the two cured. Nakamura et al mentioned a case of post-operative CSF Leak who treated by endoscopic endonasal transsphenoid repair .[4]

Aphasia occurred in 4 cases (16.67%) 2 of them improved We assumed the surgical manipulation around perforator in territory of MCA (Middle Cerebral Artery) may trigger spasm in some extent, larger tumour tend to extend posteriorly and superiorly with adherence to MCA or ACA perforators or to the MCA or ACA adventitia.[10]

Thus also explain the presence of two cases of cerebral infarction which was evident clinically & radiologically.There was 3 case of acute epidural haematoma: two case treated surgically and acase managed conservatively. The bleeder was the stem of Middle meningeal in two cases due to retraction in foramen spinosum. The tumor bed hemorrhage occurred in 2 cases which were managed conservatively because of there was no midline shift or progressive increasing of the volume and resolved during the follow up period

In our study cavernous sinus involvement tends leads to poor excision of tumour volume; Proportion of patients of Cavernous sinus involvement was significantly higher in grade 3 and grade 4 as compared to grade 1 and grade 2. (100%,100% vs 0%, 50%) (p value = 0.0003).

Nakamura et al.,4 found a recurrence rate of 7.7% in clinoidal meningiomas without CS involvement in contrast to a recurrence rate of 27.5% in tumors that invaded the CS, during a mean follow-up period of 69.3 months (5.8 years). The causes for recurrence in these studies were CS infiltration and a higher histological grade of the tumor.

V. Conclusions

Medial sphenoid wing meningiomas because of the critical structures that surrounds it poses significant challenge which ultimately influenced the outcome of surgery in terms of morbidity and mortality.Cavernous sinus involvement by the tumour confers an added risk to the surgical morbidity and outcomes.However the recent advances made in the field of neurosurgery helps in migitating the morbidity and mortality post surgery to some extent.

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