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Sphenoid Wing Meningiomas: Experience from a Tertiary Care Hospital in Western India

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Abstract

Background: Meningiomas account for approximately 15 percent of primary cranial tumor and the most common tumors of the sphenoid wing region in the anterior cranial fossa base [1]. A thorough knowledge of the anatomy of the region and adherence to basic microneurosurgical principles can help achieve outstanding surgical results. We present our experience in surgical management of these cases for a total of 23 cases and a mean follow up of 18 months at a single centre. *Methods:* This prospective observational study was conducted from August 2013 to December 2016 in the department of Neurosurgery in our centre which is a tertiary care hospital in western India. All patients were operated using standard microneurosurgical techniques. *Results:* The average age of the patients was 43.13±11 years. Middle-lateral location was the most common presentation (43.47%) followed by lateral location (30.43%). Optic canal invasion, cavernous sinus involvement was more in medial tumours as compared to lateral tumours. Gross total resection of the tumour was achieved in 19 of 23 (82.60%) cases. Orbitozygomatic craniotomy was done in 8 (34.78%) cases. Majority (69.56%) of the tumours were found to be grade-II on HPE. No new neurodeficit developed in most cases. Persistent neuro-deficits were observed in 5 patients (Diplopia-3, seizures-1, headaches-1). *Conclusion:* Our results are consistent with the current acceptable standards in treatment lateral sphenoid wing meningioms. However, there is scope for much improvement in dealing with medial sphenoid meningiomas, treatment of which should be planned on case to case basis.

Keywords: Sphenoid Wing Meningioma; Microneuro Surgery.

Introduction

Meningiomas account for approximately 15 percent of primary cranial tumor and the most common tumors of the sphenoid wing region in the anterior cranial fossa base [1]. They are benign tumors arising from arachnoid cap cells. Different classification systems have been proposed for Sphenoid wing meningiomas (SWM). However, all the systems aim to separate lateral origin tumours from medial origin tumours which involve the parasellar areas and critical neurovascular structures like the cavernous sinus [2,3,4]. The commonest classification used is Cushing and Eisenhardt which classifies them according to lesser sphenoid wing involvement [5].

According to this classification scheme the lesser sphenoid wing is divided into thirds—a medial third, which represents the medial posterior-to-anterior projecting segment most adjacent to the anterior clinoid process; a middle third, which runs medial to lateral; and a lateral third, which runs anterior to posterior, eventually joining with the temporal squamosa [5].

Understandably, meningiomas which are close to the medial part of the lesser wing, are intricately related to critical neurovascular structures like the optic canal and the cavernous sinus and those that involve the lateral part push these structures medially and are away from them [6,7].

Every neurosurgeon should expect to be confronted with these cases in his or her surgical practice on a regular basis and a thorough knowledge of the anatomy of the region and adherence to basic microneurosurgical principles can help achieve

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outstanding surgical results .We present our experience in surgical management of these cases for a total of 23 cases and a mean follow up of 18 months at a single centre.

Material and Methods

Subjects: This prospective observational study was conducted from August 2013 to December 2016 in the department of Neurosurgery in our centre which is a tertiary care hospital. Twenty three patients belonging to all age groups and both sexes who underwent surgery for Sphenoid wing meningiomas at our centre were included in the study. Patients with en-plaque meningiomas, patients operated for recurrent lesions and patients unwilling to give consent were excluded from the study.

Surgical Management

Preoperatively the patient data like age, sex, presenting symptoms, neurological deficits, intracranial location of the tumour, radiological appearance, histopathological findings were meticulously recorded. All patients underwent T1 and T2 weighted MRI studies with contrast.

All cases underwent surgery under general anaesthesia with endotracheal intubation. We prefer to use horseshoe headrest as compared to rigid head clamps as it allows for minor adjustment in head position intra-operatively. All patients were operated using standard microneurosurgical techniques. In our centre, we do not have neuronavigation and ultrasonic aspirator facilities, hence these were not used. Pre-operative embolisation was not done in any case. Reconstruction was done using bone in all but three cases in which bone was diffusely involved and could not be used. Titanium mesh was used in these three cases.

Intraoperatively, all patients received Inj. Ceftriaxone 2 gm at the time of induction and Inj. Mannitol (1gm/kg) before craniotomy. Dexamethasone was not used in intraoperative period.

Postoperative Management

Postoperatively, patients were cared for in the neurosurgical ICU for a period of three days before being shifted to ward. CECT was done 36-48 hrs after surgery and images were compared. Post-operative neurological status was assessed in each patient and compared with preoperative status. Follow up MRI was repeated after 6 months in all cases.

Follow up: All the patients enrolled in the study are under an ongoing follow up. All 23 patients have completed at least 12 months of follow up postoperatively and no recurrence has been reported as yet.

Ethical considerations: A written, informed consent was obtained from the patients/guardians.

Results

A total of 23 patients diagnosed with sphenoid wing meningiomas were included in the study consisting of 10 males and 13 females. The average age of the patients was 43.13±11 years. Headache (91.30%), nausea (21.73%) and vomiting (21.73%) were the most common complaints followed by diplopia, vertigo, behavioural changes amongst others [Table 1].

Table 1: Demographic data of the patients operated for Sphenoid wing meningiomas (n=23)

S. No.		Number (N=23)	Percentage
1.	Males	10	44%
2.	Females	13	56%
3.	Total Number	23	-
4.	Average Age (years)	43.13	-
		Presenting symptoms	
1	Haedache	21	91.30%
2	Nausea	5	21.73%
3	Vomitting	5	21.73%
4	Diplopia	4	17.39%
5	Seizures	3	13.04%
6	Proptosis	2	8.69%
7	Ptosis	1	4.34%
8	Vertigo	4	17.39%
9	Behavioural Changes	3	13.04%
10	Facial Numbness	2	8.69%

Fifteen patients had a right sided and eight patients had a left sided sphenoid wing meningioma. According to the cushings classification, tumours were classified into medial, middle and lateral and middle-lateral location was the most common presentation (43.47%) followed by lateral location (30.43%)[Table 2].

Preoperative CT/MRI revealed that optic canal invasion, cavernous sinus involvement was more in medial tumours as compared to lateral tumours. Preoperative GCS was E4V5M6 in most patients (19/23) and found to be lower in 3 cases with medial tumours and one case with lateral tumour [Table 2].

Intraoperative and Postoperative Characteristics

Preoperative embolization was not done in any patient. Gross total resection of the tumour was achieved in 19 of 23 (82.60%) cases [Image 1]. Orbitozygomatic craniotomy was done in 8 (34.78%) cases. Majority (69.56%) of the tumours were found to be grade-II on HPE [Table 3].

Table 2: Preoperative characteristics of the cases

S. No.		Number (N=23)	Percentage
	Ct/MRI characteristics		
1	Optic Canal Invasion	7	30.43%
2	Orbital Roof Involvement	7	30.43%
3	Cavernous Sinus Involvement	4	17.39%
4	ICA Involvement	3	13.04%
5	MCA Involvement	6	26.08%
	Preoperative GCS		
1	E4V5M6	19	82.60%
2	E4V5M5	1	4.34%
3	E4V4M5	3	13.04%
	Location of the tumor		
1	RIGHT	15	65.21%
2	LEFT	8	34.78%
	*Classification of tumours		
	Medial/middle/lateral sphenoid		
1	+/+/-	4	17.39%
2	+/-/-	2	8.69%
4	-/+/+	10	43.47%
5	-/-/+	7	30.43%

*Cushing and Eisenherd Classifiction System
ICA– Internal Carotid Artery, MCA– Middle Cerebral Artery

Table 3: Operative and postoperative characteristics of the cases

S. No		Number (N=23)	Percentage
	Histopathological Grade		
1	GRADE I	5	21.73%
2	GRADE II	16	69.56%
3	GRADE III	2	8.69%
	Gross total resection		
1	YES	19	82.60%
2	NO	4	17.39%
	Orbitozygomatic Craniotomy		
1	DONE	8	34.78%
2	NOT DONE (PTERIONAL)	15	65.21%
	Postoperative complications/new neurodeficits		
1	TRANSIENT	4	17.39%
2	PERSISTENT	5	21.73%
	Follow up CT/MRI		
1	RESIDUAL LESION	4	17.39%
2	NO LESION	19	82.60%

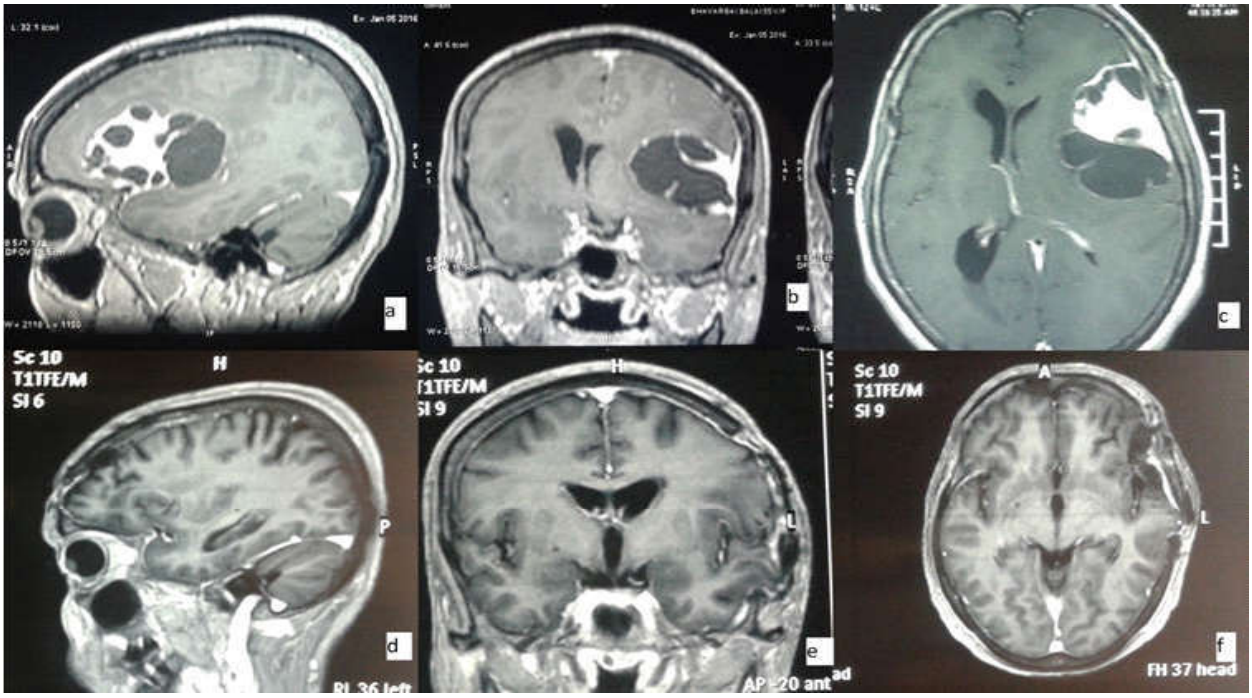

Image 1: Pre and Post Operative MRI images in a case of Lateral Sphenoid wing Meningioma in a 55 year old male showing complete resection (a-c: Pre-operative, d-f:post-operative images)

Postoperatively, the GCS value of E4V5M6 was maintained in the 19 cases. One case with preoperative GCS of E4V5M5 improved to E4V5M6. Amongst the other three with GCS E4V4M5, two improved to E4V5M6 and one to E4V5M5. There was no new neurodeficit/postoperative complication in 13 patients. Transient aphasia/diplopia was observed in 4 patients in the immediate postoperative period which recovered in the following 10 days. Persistent neuro-deficits were observed in 5 patients (Diplopia-3, seizures-1, headaches-1).

One patient developed postoperative wound site infection which was managed by antibiotics. All patients have achieved minimum one year of follow up. Investigations revealed residual lesions in 4 cases in which gross total resection was not achieved. No recurrence of lesion was seen in rest of the patients.

Discussion

Sphenoid wing meningiomas are commonly encountered tumours in neurosurgical practice and therefore it is very important to understand the concept behind excision surgery for these tumours.

The location of the meningiomas is varied, so is the surgical technique .It can vary from a routine pterional craniotomy for lateral sphenoid wing meningiomas to a very complicated and tedious procedure for removal of medial sphenoid wing meningiomas. However, we have found that generally these tumors attain fairly large size before presentation, especially in a country like India where timely referral is much delayed, and tend to involve two of the three compartments of the sphenoid bone. Rarely do we encounter purely lateral or purely medial tumors. We are yet to see a case of purely middle sphenoid wing tumor at our centre, although a few have been reported.

In this study, we have tried to present our experience in dealing with these tumors. Ours is a fairly basic neurosurgical set up with no neuronavigation or preoperative embolization facilities. We think that with the help of careful presurgical planning and use of contemporary microneurosurgical techniques, one can deliver results that are acceptable in modern age.

Medial sphenoid wing meningiomas, by virtue of their location are very close to sensitive neurovascular structures like the optic nerve and optic apparatus. Cavernous sinus involvement is also commonly seen in these cases. Since these are deep seated lesions, it is very important that the surgeon spends enough time at the craniotomy stage to gain proper exposure. We routinely do orbitozygomatic (OZ) craniotomy for such cases as it is mandatory to achieve the required trajectory and proper visualization. The exact pattern of involvement of the medial structures may vary from

case to case with cavernous sinus just occluded and not infilterated in some cases. It does not matter if it is a single piece orbitozygomatic craniomtomy or two piece, depends upon the surgeon [8]. We generally prefer two-piece orbitozygomatic craniotomy for these lesions.

In lateral sphenoid wing tumors, OZ craniotomy is not required in most cases. These tumors though away from the medial structures, should not be treated with any less respect, especially on the dominant side. The fact that these are extra-axial lesions should never be forgotten during surgery. These tumors can be very well devascularized by generous cauterization of the basal and temporal dura. Intradurally, the arachnoid plane around the tumour should always be preserved. Too much use of the bipolar can make the plane impossible to maintain. If too much bleeding and vessels are encountered, surgeon must stop and reassess his plane of separation of tumor. Missing the right plane and arachnoid can result in dangerous post operative oedema and neuro-deficits like aphasia. Reconstruction in these cases is done by a generous periosteal flap .Bone reconstruction can be problematic due to hyperosotosis of lateral orbital wall greater sphenoid wing. Some authors have used the orbitozygomatic craniotomy in these cases also to better facilitate the removal of hyperostotic bone around the superior orbital fissure area but we do not usually use it [9].

Medial tumors demand immense patience and understanding on the part of the surgeon. The relationship of the tumour with cranial nerves like third, fourth and fifth has to be studied and rate of postoperative palsies is significantly higher [10]. We were unable to achieve gross total resection in 4 of the 6 medial sphenoid tumours that we operated .Even after having a conservative attitude towards resection in these cases, the rate of post operative complication was much higher in this subset of patients.

Invasion of cavernous sinus and optic canal are strong predictors of safety of a subtotal resection than a total resection. Behari *et al* tried to predict the degree of resection possible preoperatively [11]. The exact implication of these has yet to be standardized in our view as a lot depends on the experience of the surgeon in these cases.

Sphenoid wing meningiomas are cranial base lesions and have better outcomes in higher volume centres. Surgeons must understand very good radio surgery options are available today which can deal with the residual lesions very effectively and not be too aggressive in their approach to medial lesions especially those involving the cavernous sinus. Lateral tumors can be excised completely with minimal post operative complications, even in cases with MCA involvement as generally the arachnoid plane permits separation of the vessel. Further studies are required to demonstrate the ideal approach to these lesions for young neurosurgeons but majority cases can be dealt by following the contempory microneurosurgical principles of using minimal brain retraction, judicious use of bipolar cautery and respecting the archnoid planes. The rate of cranial nerve palsies even when CS is not entered varies from 12-20%. This should come down in future as more experience is gained in treating these lesions.

Conclusion

We present our institutional experience with surgical treatment of sphenoid wing meningiomas. Our results are consistent with the current acceptable standards in treatment lateral sphenoid wing meningioms. However, there is scope for much improvement in dealing with medial sphenoid meningiomas, treatment of which should be planned on case to case basis and the principle of "DO NO HARM'' should always be kept in mind.

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