IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 22, Issue 10 Ser.3 (October. 2023), PP 06-15
www.iosrjournals.org

Evaluation Of Risk Factors Influencing Surgical Outcome In Parasagittal Meningiomas

Country: INDIA
Authors: Dr. Thalluri Prashanth, Dr. B. Hayagriva Rao, Dr. G. Mithun, Dr. D. Ravi.

Date of Submission: 01-10-2023 Date of Acceptance: 10-10-2023

I. INTRODUCTION

Meningiomas, aremost common extra-axial intracranial tumours, mesodermal or meningeal origin, and the most common benign tumour that rarely invades substance of the brain, thus presenting the potential for cure after surgery. The prevalence varies from 2.3/1 lakh people during their life span to 5.5/1 lakh population if autopsy data were included.[1]

Cushing and Eisenhardt defined the parasagittal meningioma as one that fills the parasagittal angle, with no brain tissue between the tumour and the superior sagittal sinus (SSS).[2] Cushing (1922),in his series of 751 intracranial tumours, reported parasagittal meningioma accounting for 32% of total.[3]Subsequent large series have shown that parasagittal meningioma accounts for 17% to 32% of all meningiomas.[3]

The term parasagittal meningioma applies to those tumours involving the superior sagittal sinus and the adjacent convexity dura.The involvement of the overlying bone may occur with or without hyperostosis.

While considering the symptoms and the surgical aspects of parasagittal meningiomas, thosetumours arising from the middle third segment are most common. They present with motor and sensory seizures and gradual progressive neurological deficits, initially starting in the lower extremities.The meningiomas from the anterior third segment tend to be more insidious in onset and often become large before a diagnosis is made. Headache is the commonest symptom. The personality change may be there, up to the level of dementia, and seizure is infrequent.

The meningiomas arising from posterior third segment often present with headache, increased intracranial pressure and visual symptoms in the form of field defect.

Progress in meningioma treatment relates to advances in neurosurgery, and they are put to maximal use in improving the treatment of meningiomas. Complete surgical resection is the only definitive cure for meningiomas, the same for parasagittal meningiomas. The more complete the resection, the less is the chance of recurrence.

However, decisions regarding the sinus should be individualized for each case according to several factors: the patient's age and symptoms, patency of the sinus, location of the tumour, and cortical venous collateral system. The importance of preserving collateral venous channels, a vital part of the operation, cannot be overemphasized.

Parasagittal meningiomas have higher rate of recurrence (8% to 24%). High levels of VEGF expression constituted the most useful predictor of recurrence, followed by a high MIB-1 labelling index. Only the tumour's shape was significant; "mushrooming" and lobulated meningiomas were more likely to recur than round ones (Nakasu and coworkers).[4]

Nonsurgical therapies are used for incompletely resected or recurrent meningiomas. Standard or stereotactic irradiation can be used. Both conformal fractionated radiotherapy and radiosurgery can be used as initial therapy and as adjuvants to surgical resection. Recently, the role of hormonal agents like receptor antagonists have been studied and established with satisfactory results as a treatment modality. Other antineoplastic drugs (hydroxyurea, interferon alpha- 2B) have also been used.[4]

Recent advances in imaging techniques, immunohistochemistry, and the role of receptor antagonists have revolutionized the diagnosis at an earlier stage and better treatment options with the best possible functional outcome even in surgical failure cases of meningioma.

The present study is aimed to enlighten a complete picture of parasagittal at our institution, biological behaviour, clinical picture, diagnosis, management techniques, various complications, and functional outcome at subsequent follow-ups on a regular monthly basis for up to 6 months within the period of the present study.

II. AIMS & OBJECTIVES

The study aims to analyze the various risk factors associated with and influencing surgical outcomes in the treatment of parasagittal meningiomas in our institution.

III. MATERIALS & METHODS

This study consists of 17 patients with parasagittal who were admitted and treated in the department of neurosurgery, Andhra medical college, Vishakhapatnam. All these patients were admitted and treated in the department of neurosurgery, Andhra medical college, Vishakhapatnam, over a period of one year.

IV. PATIENT SELECTION:

All patients with clinical and radiological evidence of parasagittal meningiomas were admitted to the hospital for treatment. A specific data form was filled out for all patients, stressing many variables, including patient age, gender, symptoms, and signs. Meningiomas other than parasagittal location, with comorbidities (ASA IV and ASA V), were excluded from this study.

All patients upon admission were subjected to detailed clinical and neurological examination and investigated for clinically suspected intracranial space-occupying lesions.

All patients had the usual routine investigations to assess their systemic functions followed by imaging whichincludedCT scan images and MRI for all cases

CT Angiogram was performed for select cases to look for vascularity.The surgical management included total removal of the tumour, including the involved dura and bone, if possible. Simpson's five-grade classification still holds good. The surgical management of parasagittal meningioma is based on certain principles, e.g. (1) Incision as per location, (2) Pericranial flap reflected separately, (3) Multiple burr holes in close approximation to one another at the periphery of the tumour, (4) Burr holes straddling the superior sagittal sinus (SSS), and (5) Microsurgical separation of the tumour capsule from surrounding cortex preserving the vessels overlying the normal cortex.[7]

The resected tumour tissue was subjected for histopathological examination and diagnosis was confirmed.

Postoperatively, all patients were subjected to CT of the brain within 72 hours.

Neurological assessment was done at the immediate postoperative period, at the time of discharge, and subsequent follow-ups.

All patients were regularly followed up for 6 months.They were assessed for their postoperative status, especially worsening of the pre-existing neurological condition, development of new neurological deficit, overall improvement in the patient's condition and were looked for recurrence.

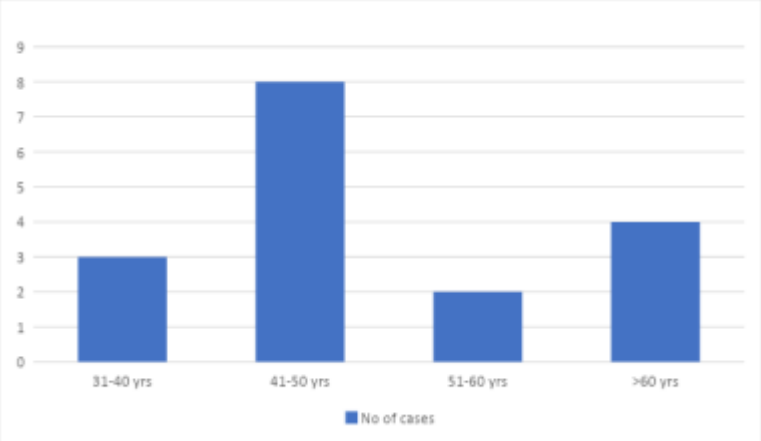
V. RESULTS

AGE WISE INCIDENCE OF PATIENTS

In this prospective study of 17 patients with parasagittal meningioma, youngest patient was 31 years and oldest 72 years. The age incidence revealed the maximum incidence of 47.05% in the age group of 41-50 years followed by 23.52% in the age group >60 years. We could not find any patient in the first two decades of life.

Age in years	No of cases	Percentage
<20 yrs	0	0%
21-30 yrs	0	0%
31-40 yrs	3	17.64%
41-50 yrs	8	47.05%
51-60 yrs	2	11.76%
>60 yrs	4	23.52%
Total	17	100

Table 1: Age wise distribution of parasagittal meningioma

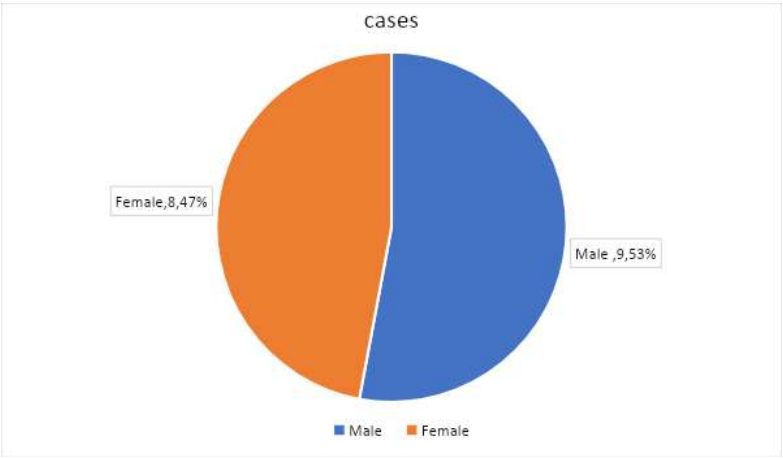


SEX INCIDENCE OF PARASAGITTAL MENINGIOMA

There were 9 males and 8 females, a ratio of approximately 1.125:1.

Sl No.	Sex	No. of cases
1	Male	9
2	Female	8
	M: F	1.125:1

Table 2 : Incidence among male and female

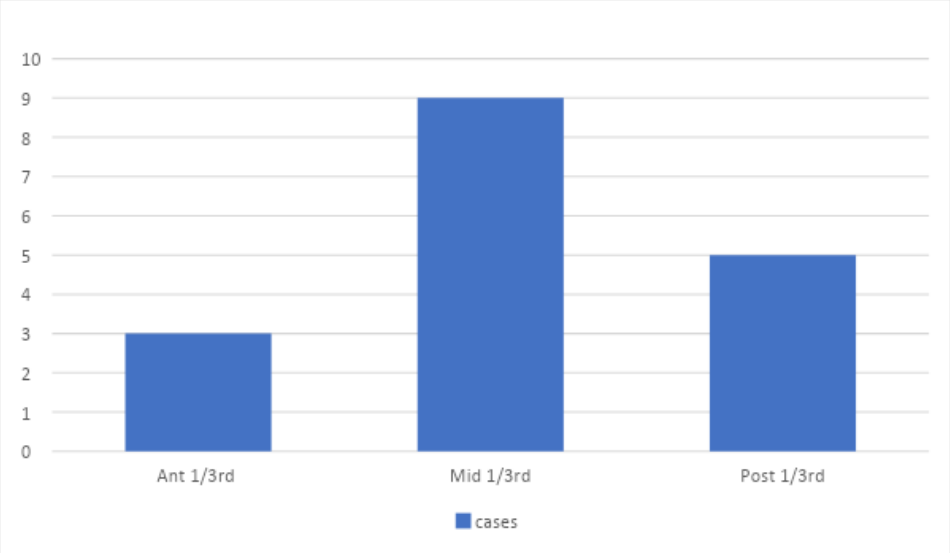


SITUATION OF PARASAGITTAL MENINGIOMA

Parasagittal meningiomas in relation to superior sagittal sinus, 3 were in anterior group, 9 were in central or middle group and 5 were in posterior group. The middle third was the most common and anterior third was the least common in this study.

ANT 1/3RD	MID 1/3RD	POST 1/3RD	TOTAL
3	9	5	17

Table 3: Incidence of Parasagittal meningioma as per location

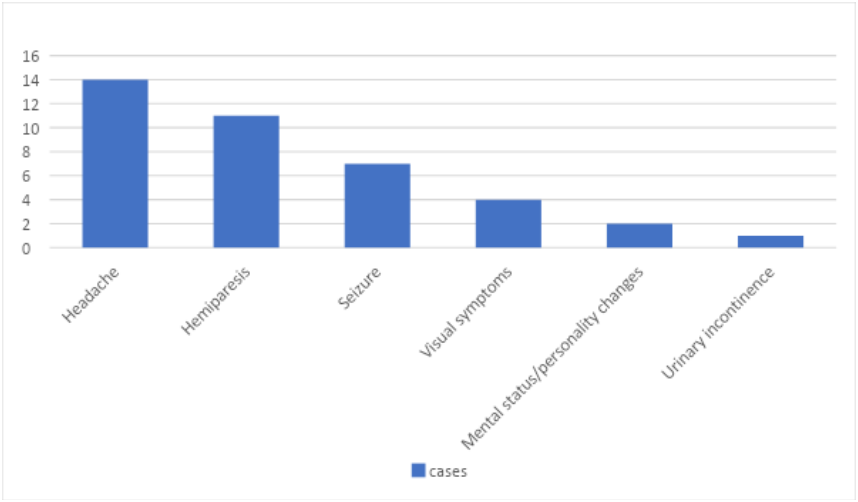


CLINICAL PRESENTATION OF PARASAGITTAL MENINGIOMA

In 17 of parasagittal meningiomas, 14 (82.35%) patients presented with headache (making it the commonest presenting symptom followed by hemiparesis in 11 (64.70%), seizure 7 cases (41.17%), visual disturbance in 4 cases (23.52%), mental status or behavioural changes in 2 cases (11.76%), and 1 patient had urinary disturbances

SYMPTOMS	NUMBER	PERCENTAGE
Headache	14	82.35%
Hemiparesis	11	64.70%
Seizure	7	41.17%
Visual symptoms	4	23.52%
Mental status/personality changes	2	11.76%
Urinary incontinence	1	5.88%

Table 4: Clinical presenting symptoms of Parasagittal meningioma



PRESENTING CLINICAL SIGNS OF PARASAGITTAL MENINGIOMA

In 17 cases of parasagittal meningioma on clinical examination in 11 cases (64.70%) we found pyramidal signs, in 8 cases (47.05%) papilledema was found and lobar signs were seen in 2 cases (11.76%).

SIGNS	NUMBER	PERCENTAGE
Pyramidal signs	11	64.70%
Papilledema	8	47.05%
Lobar signs	2	11.76%

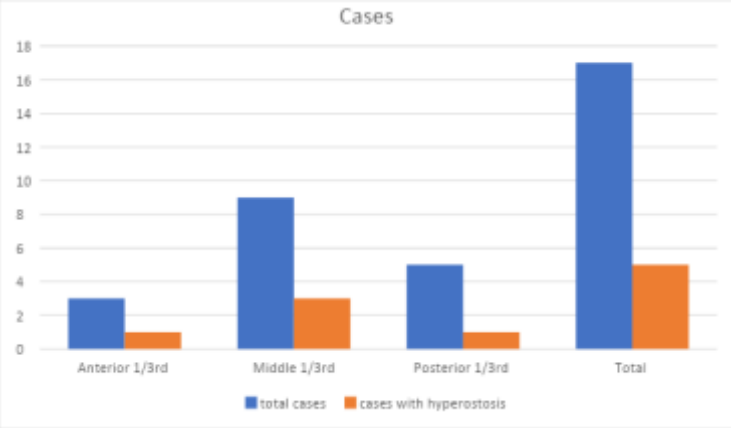
Table 5: Clinical signs of Parasagittal meningioma

HYPEROSTOSIS

Despite much controversy, the current concept of hyperostosis is that it is not necessarily due to tumor infiltration. We found the overall incidence of hyperostosis in 29.41% cases, more common in middle third group

SITE	TOTAL NO OF CASES	NO OF CASES WITH HYPEROSTOSIS	PERCENTAGE
Anterior 1/3rd	3	1	33.33%
Middle 1/3rd	9	3	33.33%
Posterior 1/3rd	5	1	20%
Total	17	5	29.41%

Table 6: No of cases of parasagittal meningioma with hyperostosis

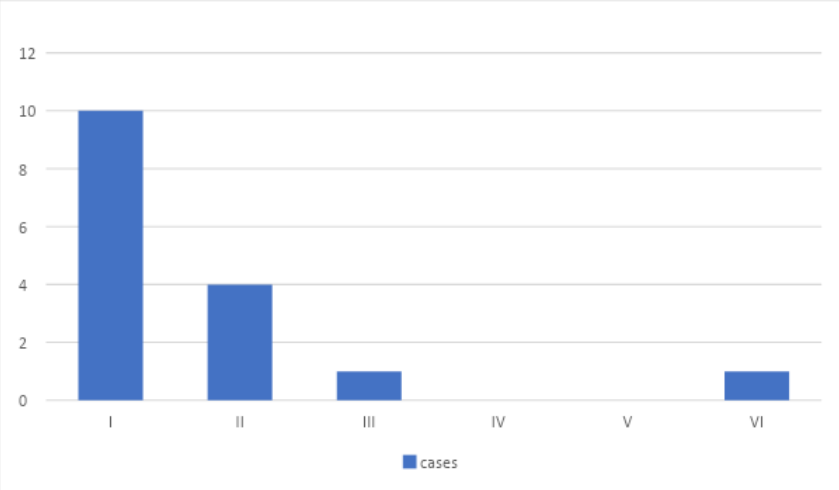


TYPE OF SSS INVOLVEMENT BY PARASAGITTAL MENINGIOMA

Of the 17 cases of parasagittal meningioma, 10 (58.33%) were of Sindou type I i.e., touching the lateral wall of superior sagittal sinus, 4 (23.52%) were of Sindou type II i.e., involving lateral wall and lateral recess,1 (5.88%) was of Sindou type III i.e. invading the lateral wall, 1 (5.88%) was of Sindou type VI i.e. whole sinus including opposite wall involvement. No cases we found of Sindou type IV and V probably due to small sample size.

SINDOU TYPE	NUMBER	PERCENTAGE
I	10	58.82%
II	4	23.52%
III	1	5.88%
IV	0	0%
V	0	0%
VI	1	5.88%
TOTAL	17	100%

Table 7: Sindou Types of Parasagittal meningioma



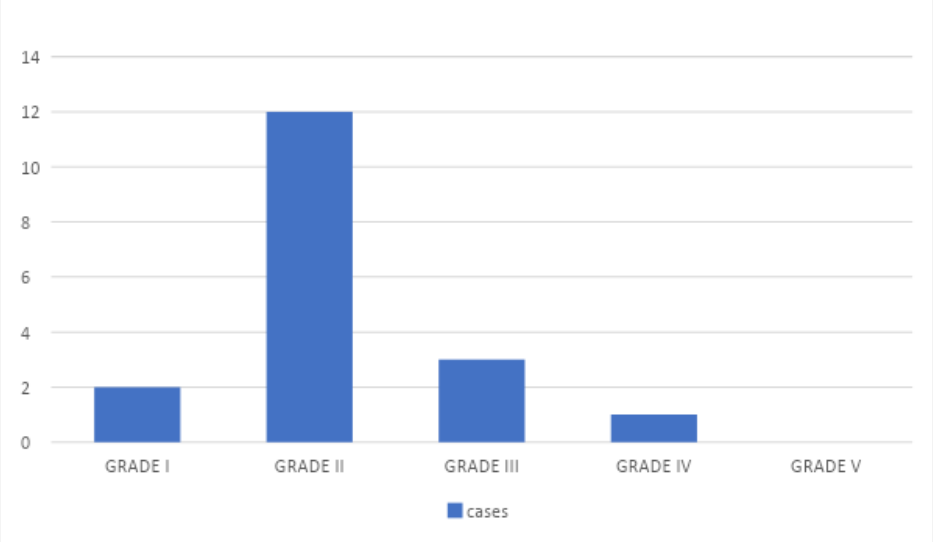
SIMPSON'S GRADE OF RESECTION OF PARASAGITTAL MENINGIOMA

In the present study of 17 cases of parasagittal meningiomas definite procedure was carried out in all patients. Surgery was planned after careful evaluation of clinical history and findings, observation of radiological and imaging study and after a detail discussion with the patients and their relatives about the benefit and risk of the procedure.

12 cases (70.58%) out of the 17 cases of parasagittal meningioma underwent grade II resection, 3 cases (17.64%) underwent grade III resection, 2 case(11.76%) underwent grade I resection and 1 case (5.88%) underwent grade 1 resection. No cases of parasagittal meningioma underwent grade V resection

GRADE OF RESECTION	NO OF CASES	PERCENTAGE
GRADE I	2	11.76%
GRADE II	12	70.58%
GRADE III	3	17.64%
GRADE IV	1	5.88%
GRADE V	0	0%
TOTAL	17	

Table 8: Simpson's Grading of Parasagittal meningioma resection

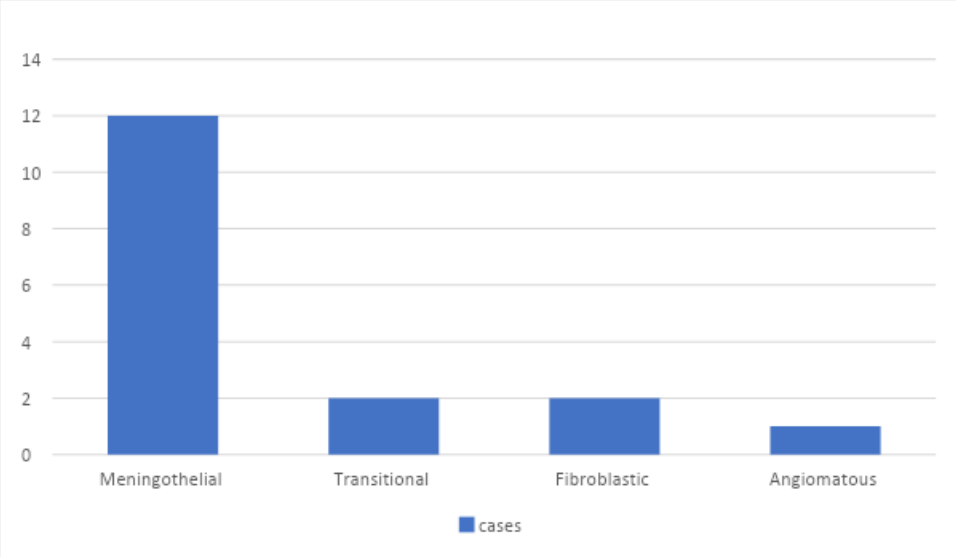


HISTOPATHOLOGICAL STUDY OF PARASAGITTAL MENINGIOMA

On histopathological analysis of the different samples after excision of the tumor meningothelial meningioma found in 12 cases (70.58%), transitional and fibroblastic variety in 2 cases (11.76%) in each type and angiomatous variety in 1 (5.88%) case. No grade II or III were seen.

WHO GRADE	TYPE	NO OF CASES	PERCENTAGE
I	Meningothelial	12	70.58%
I	Transitional	2	11.76%
I	Fibroblastic	2	11.76%
I	Angiomatous	1	5.88%
		17	100%

Table 9: Histopathological subtypes of resected specimen of Parasagittal meningioma



POSTOPERATIVE COMPLICATIONS OF PARASAGITTAL MENINGIOMA

Seizures were encountered in 2 patients out of 17 (11.76%), increased hemiparesis in 3 patient (17.64%) and hematoma collection was seen in 2 patients (11.76%). New onset focal neurological deficit was seen postoperatively in 1 case (5.88%). No case of visual deterioration was seen in our series. No case of mortality was seen both during the discharge and after one month of discharge.

COMPLICATIONS	NO OF PATIENT	PERCENTAGE
Seizure	2	11.76%
Increase hemiparesis	3	17.64%
New onset neurological deficit	1	5.88%
Hematoma collection	2	11.76%
Deterioration of vision	0	0%
TOTAL	8	47.05%

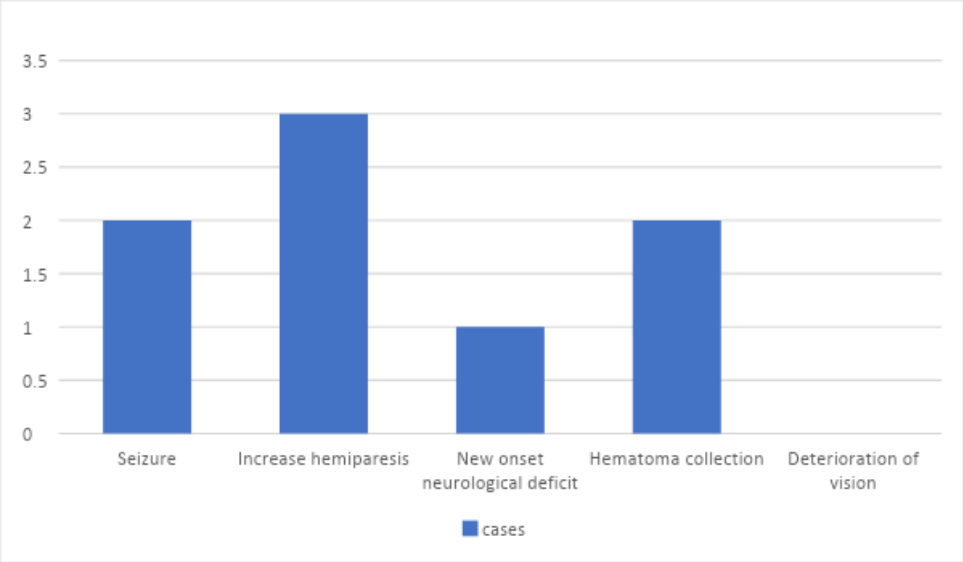


Table 10: Postoperative complications of parasagittal Meningioma

DEATH

During hospital stay	2	11.76%

FOLLOW UP AND RECURRENCE

Out of 17 cases, 13 cases (76.47%) came for follow-up protocol, 2 were lost to follow-up. Post-operative FND resolved in 3 cases and one patient had a permanent deficit. There were no cases of recurrence during 6 months of follow up

	NO OF CASES	PERCENTAGE
Follow up for 6 months		
Completed	13	76.47%
Lost to follow up	2	11.76%
Focal neurological deficit		
Resolution	3	17.56%
Permanent	1	5.88%
Recurrences		
Within 3 months	0	0%
Within 6 months	0	0%

Table 11: Follow up and recurrence of parasagittal meningioma

VI. DISCUSSION

This is a prospective study of parasagittal meningiomas for a period of one year at our institution. This study comprises 17 cases of parasagittal meningiomas and was carried out at the department of neurosurgery, Andhra medical college, Vishakhapatnam. We have studied the history, clinical findings, investigations, surgical procedure, outcome, and follow-up of the patients and compared our results with published national and international studies.

Some clinical features were unique for this study with statistical significance, while other was comparable to other studies.

AGE INCIDENCE:Meningiomas in children are often malignantand of hemangiopericytic and papillary type, having an overall incidence of 0.4-4.6%

of all intracranial neoplasms (Guthrie B.L. et al., 1990) [5]Germano IM et al. (1995), found maximum incidence in 40-60 years.[6] Deshpande et al. (1981), found the prevalence in 30-50 years of age group. Nowak A. et al. (2014), in 37 cases with parasagittal meningioma, reported the occurrence in < 40 years (22%), 40-65 years (70%), > 65 years (80%)[7]. We also found the age incidence maximum in 51-60 years of age group (41.17%) followed by 23.52% in 41-50 years. Combining both the data, our incidence (64.70%) is comparable to the finding by Germano IM et al [6].

SEX INCIDENCE : Most of the national and international studies showed a female preponderance over males. Deshpande et al. (1981), in a series of 473 patients, reported the M: F ratio as 2: 3[8] .Germano IM et al. (1995) reported the absence of female dominance[6] . Colli BO et al. (2006), in a series of 53 patients with parasagittal meningioma, found 34 (64.2%) were female and 19 (35.8%) were male[9] . German C Castillo (2007) reported the female predominance with M: F ratio of 1:2 and a reverse M: F ratio of 3:1 in malignant form.[10] Di Meco F et al. (2008), in a series of 108 cases of parasagittal meningioma, found the female predominance (73 women, 35 men) with F: M ratio as 2.09:1.[11]Nowak et al. (2014), in series of 37 cases with parasagittal meningioma, reported (27 women; 10 men) the F: M ratio 2.7:1.[7] In our series, there were 9 males and 8 females with M: F ratio as 1.125:1 with almost equal distribution as to what was found in the literature, i.e. female preponderance, in comparison to other studies owing to less number of cases (n = 17).

SITE OF ORIGIN:Raza SM et al (2010), in series of 110 cases of parasagittal meningioma, found 21% as anterior, 62% middle, and 17% as posterior third parasagittal meningioma. [12] Nowak A. et al. (2014), in 37 cases with parasagittal meningioma, reported anterior third in 11 (30%) patients, middle third in 21 (57%), and posterior third in 5 (13%) patients. [7]

Most international studies report the commonest type of parasagittal and falx meningiomas in the middle third. We also found middle third as the commonest location making 52.9% of total parasagittal meningioma cases, similar to literature.

CLINICAL PRESENTATIONS:Gauthier-Smith (1970) found anterior tumours with headache (36%), mental status changes (36%), whereas posterior third present with headache (36%), visual symptoms (21%), focal seizures (21%), or mental status abnormalities (21 %). Biroli et al. (2012) found visual disturbances followed by headache as the commonest presenting symptom of posterior third parasagittal meningioma. [13] Nowak A et al. (2014) found seizure (38%), limb weakness (30%), visual disturbances (16%), and headache (8%) in his series of 37 patients with parasagittal meningioma.[7]Elbrorady M. A. et al. (2014), in a retrospective analysis of 20 cases of middle and posterior third parasagittal meningioma, found headache as the most common presenting system (85%). Headache was associated with either weakness or seizures in 60%, with only headache as the presenting symptom in 25% of cases.[14]

We found headache as the commonest presenting symptom in 82.35% of cases, hemiparesis in 64.70%, seizures in 41.17%, mental status/ behavioral changes in 11.76%, and visual disturbances in 23.52% cases

owing to the predominance toward middle third parasagittal region in our series. Thus, the symptoms were comparable to other studies.

HYPEROSTOSIS :The current concept of hyperostosis is not necessarily due to tumour infiltration.[4,15]Cushing and Eisenhardt (1938) found 25% cases of hyperostosis in their series.[2] Goyal N. et al. (2012), in his series of 40 cases of meningiomas, found hyperostosis in 75% of cases (maximum in convexity and sphenoid wing meningiomas) and concluded that tumor invasion of the bone did not show any significant correlation with WHO grade and MIB- 1 labeling index in their study.[15]

Literature reports hyperostosis ranging from 25% to 49% of meningiomas [24]. We found hyperostosis in 29.41% of cases.

SIMPSON'S GRADE OF RESECTION:In the present study of 17 patients, a definite surgical procedure was carried out in all patients.

Di Meco et al. (2004), in 108 patients of parasagittal meningioma with SSS involvement, achieved Simpson Grade I/II removal in 100 patients with preservation of cortical veins without need to reconstruct the sinus and achieving good results.[16]Sindou and Alvernia (2006), in 100 patients with parasagittal meningioma invading SSS, reported excellent results with a grossly complete removal (Simpson Grade I/II) in 93% of the patients and Simpson Grade III removal in other 7%.[17] Raza SM et al. (2010), with 110 cases of parasagittal meningioma, achieved Simpson grade I/II resection in 81% cases without excessive manipulation of vascular structures.[12]

We achieved Simpson's resection grade -II in 70.58 % and grade III in 17.64% in parasagittal meningiomas comparable to other studies.

HISTOPATHOLOGICAL SUBTYPES:Review of world literature suggests meningothelial as the commonest type.[4] Banerji AK et al. (AIIMS) ,Yao YT et al. (1994), Asseffa G et al. (2006) showed similar results to our study.Raza SM et al. (2010), 110 cases of parasagittal meningioma, found 80% grade I meningiomas, 13% grade II meningiomas, and 7% grade III meningiomas on histopathology.[12] Nowak A. et al. (2014), series of 37 cases with parasagittal meningioma on histopathology, observed 89% (WHO Grade I), 8% (WHO Grade II), and 3% (WHO Grade III).[7]

Our histological subtypes of 17 cases revealed meningothelial variety (70.58%) being the commonest followed by transitional and fibroblastic (11.76%) and angiomatous type (5.88%), the data comparable to other studies.

MORBIDITY AND MORTALITY : Banerji et al. (1974), reported an operative mortality rate of 15.1% in 93 operated cases.[19]

Di Meco et al. (2004), in 108 patients of parasagittal meningioma with SSS involvement, found morbidity rate of 11.1% and mortality rate of 1.85 %.[11]Sindou and Alvernia (2006), in 100 patients with parasagittal meningioma invading SSS, reported permanent neurological morbidity rate as 8% and the mortality rate 3%.[18]Raza SM et al. (2010), in 110 cases of parasagittal meningioma, found incidence of postoperative venous sinus thrombosis as 7%.[12]Elborady M.A. et al. (2014), in a retrospective analysis of consecutive 20 cases between January 2009 and December 2012, found postoperative morbidity in 4 cases (20%) without mortality. [14]

In our series of 17 patients, morbidity rate was 47.05% (worsening of pre-existing FND in 3 cases, 1 case of new-onset FND and 2 cases of subgaleal collection. The worsening of pre-existing hemiparesis or new-onset hemiparesis may be due to tumor location near the motor cortex. Our study's mortality rate was 11.6%, which is similar to what is reported in literature.

FOLLOW UP AND RECURRENCE:Recurrence rate, greatly influenced by Simpson's grade of resection, histopathological subtype, length of follow up, ranging from 4% to 29% in several works of literature.Di Meco et al. (2004), in 108 patients of parasagittal meningioma with SSS involvement, with a mean follow-up period of 79.5 months, found the recurrence in 15 patients (13.9%).[11]Sindou and Alvernia (2006), in 100 patients with parasagittal meningioma invading SSS, reported a recurrence rate of 4% over a mean 8-year follow-up period. [18]Raza SM et al. (2010), in 110 cases of parasagittal meningioma invading SSS, found recurrence rate 11% with a mean follow-up of 41 months.[12]Elborady M. A. et al. (2014), found no recurrence with follow up period ranging from 12 to 48 months with a mean of 30 months.[14]

In the present study, of 17 cases, 15 cases were discharged to home with advice for regular monthly check-ups. All cases of subtotal resection were referred for a full course of postoperative radiotherapy. 13 cases (76.47%) came for regular monthly follow-up, with 2 cases lost to follow-up (11.76%). Postoperative focal neurological deficit resolved in 3 of 4 cases with permanent deficit of the patient with new onset FND.

The present study conducted for last 2 years, showed no recurrence. The lower recurrence rate in our study might be due to a shorter period of observation, where more cases of recurrence may be seen in the long term.

VII. SUMMARY & CONCLUSION

- In our series, there was an almost equal distribution of sex ratio as to what was found in the literature, i.e., female preponderance.
- The commonest location is middle third parasagittal group.
- The middle third parasagittal meningioma group of patients are more symptomatic than anterior or posterior group before diagnosis.
- The commonest age group for parasagittal meningiomas is 4th-5th decade of life.
- Before diagnosis, the average duration of symptoms is longer in parasagittal meningioma, attributed to their large size at the time of diagnosis.
- The most common histological type is meningothelial meningioma.
- Careful history taking and proper physical examination proper MRI studies will help in early detection of the tumour with consequent early surgical intervention and good surgical outcome.
- Proper surgical planning and the introduction of proper anaesthetic monitoring and use of recent surgical techniques and good pre and postoperative medical care will result in good surgical outcomes and decrease postoperative complications.
- The recurrence rate is not very high might be due to a shorter follow up period.

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