Original Research Article

DOI: https://dx.doi.org/10.18203/2349-2902.isj20210466

Clinical profile of meningioma: an experience from South India

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Received: 12 January 2021 Revised: 22 January 2021 Accepted: 30 January 2021

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ABSTRACT

Background: Meningiomas are one of the most common primary intracranial tumours. The incidence, varieties of tumour, site, imaging findings, resectability, outcome and prognosis vary from tumour to tumour. The understanding of these characteristics is essential in the management of meningiomas.

Methods: An observational study was carried out among 50 patients with imaging proven meningioma and involved recording of age, gender, clinical history, physical examination, imaging findings, intraoperative characteristics, anatomical and pathological diagnosis. The parameters evaluated in the study were gender distribution, age distribution, presenting symptoms, neurological deficits, mri findings, volume of tumour, intraoperative findings, grade of excision, anatomical, pathological diagnosis and recurrence rates.

Results: The male to female ratio was 1:2.57, with 50-70 years being the most affected population. The common symptomatology was that of features of raised ICP with motor deficit as the common neurological abnormality. Simpson grade 2 was the common clearance obtained. 3 common sites were parasagittal, sphenoid wing and convexity. Commonest histological type was transitional. Recurrence rate was 6%. This study also pointed out general imaging and intraoperative characteristics of Grade 3 tumours as T2 hyperintensity, heterogeneous, with significant perilesional oedema and intensely contrast enhancing, high vascularity, friable, suckable and ill-defined margins.

Conclusions: The study enables us to understand the general trend of presentation, imaging and surgical properties of Meningiomas and to compare with international standards. It also helps us to finger out the possible high-grade lesions even before the pathological diagnosis is obtained.

Keywords: Meningioma, Vascularity, Consistency, Suckability, Simpson

INTRODUCTION

Meningioma is considered the soul of neurosurgery, the progress in meningioma treatment is a direct reflection of advances in neurosurgery. ^{1,3} It is a slow growing, extraaxial tumor, usually benign, arising from arachnoid. ^{2,11} Meningiomas constitute second most common primary intracranial tumour, behind glioma. The female-male ratio is about 2:1. ^{1,5} Symptoms depend on the location of the tumor. World Health Organization (WHO) recognises three grades based on histological characteristics. ^{1,6} The

only definitive cure for meningioma is complete surgical resection.¹ Simpson grading system is used to assess the extent of tumour excision.^{1,8} The extent of surgical tumor removal is the most important factor in the prevention of recurrence.²

The aim was to study the incidence of meningiomas with respect to different types and sites; differentiate types of meningiomas based on imaging details; study various intraoperative presentations, postoperative complications, recurrence rates and mortality.

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METHODS

An observational study was carried out among 50 patients with imaging proven meningioma, in the Department of Neurosurgery, Government Medical College, Kottayam during a study period of 1 year. Study involved noting the age, gender, address and socioeconomic background, clinical history, physical examination and imaging findings of meningioma cases admitted during the study period. Following excision of the tumour, the specimen was sent for histopathological diagnosis. Patients were followed up for the next 6 months to assess the recurrence.

Study duration

The duration of the study was 12 months - July 2018 to June 2019.

Sample size

Sample size was 50. Sample size was calculated by the formula

$$N = Z \propto^2 PQ \div d^2$$

N - Sample size

$$Z\alpha = 1.96$$

P - Prevalence of various types of Meningioma = 15% (By comparing various literature)

$$Q = (1-P) = 85\%$$

d - absolute precision = 10%

 $N = 1.96 \times 1.96 \times 15 \times 85/10 \times 10$

N = 48.98

Inclusion criteria of the study was, diagnosed cases of Meningiomas based on imaging, undergoing craniotomy and excision. Patients lost to follow up were excluded from the study. A proforma was filled up for individual patients which included the following details: - age, gender, clinical presentation, comorbidities, clinical examination, CT and MRI characteristics, Intraoperative characteristics, postoperative events and follow up events. The data collected in the proforma was used to prepare a master chart. The data was analysed using charts, diagrams and they were compared with international standards and previous studies.

RESULTS

Meningioma occurs more commonly in females with a male to female ratio of 1:2.57 (Figure 1). Meningioma predominantly affected the age group of 51 to 70 years

and it constituted 58% of the entire group. There was a gradual decrease in incidence below 50 years and above 70 years. There were no patients below 29 years and above 76 years (Figure 2).

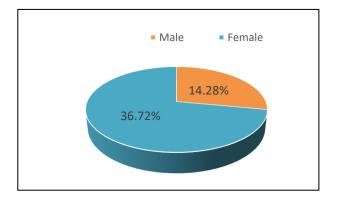


Figure 1: Pie chart for gender distribution.

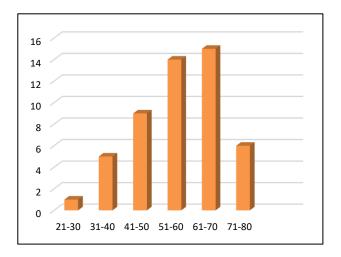


Figure 2: Age distribution.

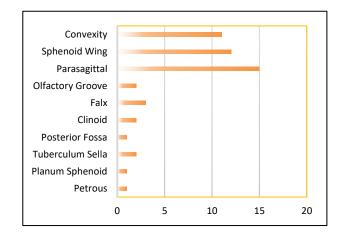


Figure 3: Anatomical locations.

Headache was the most common symptom, seen in 64%, followed by seizure in 28%, motor deficit -12%, gait abnormality - 20%, vision loss - 18%, nausea or vomiting - 16%, giddiness - 12%, memory loss - 16%, incidental finding in 4%. Other symptoms included slurred speech,

decreased sleep, hearing loss, proptosis - in sphenoid wing meningiomas, altered sensorium, anosmia and facial numbness.

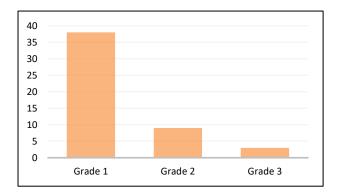


Figure 4: Grade of meningiomas.

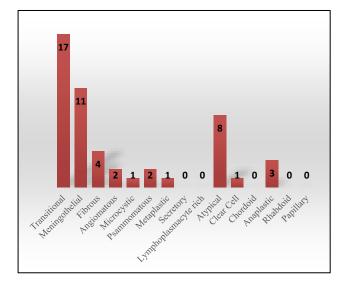


Figure 5: Distribution in different types of meningioma.

Motor deficits were seen in 16%, cognitive impairment in 14%, vision abnormality- either decreased acuity, or field defects in 24% of patients. Other deficits observed were, restricted extraocular movements, cerebellar ataxia, and papilledema.

On contrast enhanced MRI, most of the meningiomas - 50% - showed intense contrast enhancement, 34%-moderate and 16% low enhancement. 44% of the tumour showed homogeneous contrast enhancement and 56% heterogeneous enhancement. Most of them were small, 56% were less than 60 cu.cm. 3 of them, 6% were very large, >200 cu.cm.

Intraoperatively, 80% had well defined margins and 20% had ill-defined margins. 32% were highly vascular, 56% moderately vascular and only 12% showed low Vascularity. Consistency was divided into 3 types. Firm and fibrous variety was the most common- 56%; Soft,

less vascular and less suckable - 8%; Friable, vascular and suckable lesions included 36% of tumours.

Extend of tumor excision was classified using Simpson grading. Complete excision of the lesion and involved dura could be achieved in 26% of cases (Grade 1). Majority of the tumours were excised completely with coagulation of dura - grade 2 - 54%. Tumour alone removed in 10 % cases (Grade3). Subtotal excision done in 10% cases (Grade4). Grade 5 excision (decompression alone) was not reported in our study.

Based on the anatomical location, most common subtype was Parasagittal – 30%, followed by sphenoid wing – 24% and convexity 22%. Other subtypes including olfactory groove, falx, clinoidal, posterior fossa, tuberculum sella, planum sphenoid and petrous, together accounted for 24% (Figure 3).

WHO Grading system was used for pathological classification. Grade 1 meningioma, which is the benign variety constituted 76% of tumours. Within the grade1, 44.7% was transitional type, 28.9% was Meningothelial type, and 10.5% was fibrous type, rest 15.9% was constituted by other variants. When the entire meningioma group was considered, 34% was Transitional, 22% was Meningothelial, 8% was fibrous and 12% by other grade 1 variant (Figure 4,5).

Grade 2 is the intermediate group, constituted 18%. Of these 88.8% was atypical type. Atypical type included 16% of all meningiomas (Figure 4).

Grade 3, the aggressive variant constituted 6% of the tumours. All of grade 3 tumours in our study were anaplastic type (Figure 4).²⁰

Postoperatively, the most common complication associated with meningioma surgery in our study was motor deficit, mainly due to postoperative oedema, which improved gradually. New onset seizure, respiratory and urinary tract infections were also seen in postoperative period. Decreased vision occurred as a complication in the postoperative group of sphenoid wing meningioma and CSF leak followed tuberculum sella meningioma surgery.

In long term follow up, 3 patients developed recurrence. 2 cases were transitional type and 1 meningothelial type. 1 case underwent Simpson's grade 4 excision, one Grade 3 excision and last grade 0 excision.

Regarding mortality, 7 patients died in the study, 3 during the postoperative period itself and 4 late after discharge.

Another important observation made in the study was that, anaplastic meningiomas were T2 hyperintense, heterogeneous, with significant perilesional oedema and intensely contrast enhancing, on MRI. Intraoperatively,

they were highly vascular, friable, suckable and had illdefined margins.

Tumours which were T2 Iso – hypointense, homogeneous, without oedema, low – moderate vascularity, firm, nonsuckable, with well-defined margins tend to be benign – Grade 1.

DISCUSSION

This is an observational study of 50 patients who were treated and underwent surgery for Meningioma in the Department of Neurosurgery, Government Medical College, Kottayam, from 1st July 2018 to 30th June 2019.

Table 1: Comparison of gender distribution.

Study	Present study	Youmans ¹	Han et al ⁸	Rene et al ¹¹
Male: female	1:2.57	1:2	1:2.1	1:2.9

It was carried out among patients with imaging proven meningioma and involved recording of age, gender, clinical history, physical examination and imaging findings of cases admitted during the study period. Intraoperative characteristics, anatomical and pathological diagnosis were also noted. Patients were followed up for the next 6 months to assess the recurrence, morbidity and mortality.

The parameters evaluated in the study were gender distribution, age distribution, presenting symptoms, neurological deficits, MRI findings, volume of tumour, intraoperative findings, grade of excision, anatomical and pathological diagnosis, complications, recurrence, and mortality. Awareness of these parameters in our setup is essential for the early diagnosis and optimal management of meningiomas.

In the present study the male: female ratio of incidence was 1:2.57. The comparison with other literature is given in the table (Table 1).

All the studies are of the agreement that there is female predominance in meningioma.

58% of the tumours were seen in the age group of 50 - 70 years in the present study. There was a gradual decrease in incidence below 50 years and above 70 years. Han et al quoted maximum incidence in the fifth decade. Youmans et al neurological surgery reports a gradual increase in incidence with age. 1

The most common presentation was that of raised ICP features – headache in 64%, seizure in 28% and vomiting in 16%. Other notable presentations were motor deficit - 12%, gait abnormality - 20%, vision loss - 18%, giddiness - 12%, memory loss - 16%. Only 2 cases (4%) belonged to the incidentally detected group. These results were in accordance with other studies by Han et al, Joel et al, where also, the predominant symptomatology was that of raised ICP.^{8,9}

The most common neurological deficit encountered was motor deficit, mainly due to the pressure effect of the tumour on brain parenchyma. Other deficits were related to the anatomical site of the lesion like vision problems in parasellar and sphenoid wing meningiomas and cerebellar signs in posterior fossa meningioma.

MRI findings were variable in accordance with previous studies like that of Huang et al. 11 The features observed in the present study were oedema associated with meningioma seen in 72% of cases, which caused significant mass effect on brain parenchyma; necrotic foci in 12% of cases. Most of the meningiomas - 50% - showed intense contrast enhancement, 34% - moderate and 16% low enhancement. Meningiomas being a vascular tumor, the results were expected. 44% of the tumour showed homogeneous contrast enhancement and 56% heterogeneous enhancement.

Volume of the lesions was measured in cubic centimetre. Most of the meningiomas were small, 56% were less than 60 cu.cm. 3 of them, 6% were very large, >200 cu.cm. As meningiomas are slow growing tumours, small size signifies early detection, which in turn contributes to safe resection and favourable outcome.

The intraoperative characteristics noted were margins, vascularity, suckability and consistency. Most of the meningiomas had well defined margins (80%) that made the dissection and excision of the tumour easy. But 20% had ill-defined margins with brain invasion.

Table 2: Comparison of anatomical location.

	Study	Present study	Youmans	Han et al ⁸	Joel et al ⁹	Rene et al ¹¹	Jan et al ¹²
Location	Convexity	22%	35%	29.5% Most common	68.75% Most common	21%	27.9%
	Parasagittal	30%	20%			17%	
	Sphenoid ridge	24%	20%			16%	24.7%

Meningiomas are vascular tumours. In the present study, 32% were highly vascular, 56% moderately vascular and only 12% showed low vascularity. Suckability decided the ease of internal decompression. 22% of the tumours were easily suckable and 20% partly. Majority - 52%, were not suckable. Consistency was divided into 3 types. Firm and fibrous variety was the most common- 56%; soft, less vascular and less suckable - 8%; friable, vascular and suckable lesions included 36% of tumours.

Completeness of excision is an important factor determining the recurrence and need for adjuvant therapy. In present study, Simpson grading was used to evaluate the completeness of tumour excision.⁶ Grade 1 excision could be done in 26% cases. Grade 2 was the extent of excision achieved in majority of cases – 54%; Grade 3 in 10%; Grade 4 in 10%. Decompression alone – Grade 5, was not done for any of the cases.

The distribution of meningioma in various anatomical location is a commonly studied area, various literature giving Convexity as the most common site, but almost all of them describes convexity, parasagittal and sphenoid wing as the 3 most common locations. In the present study, most common anatomical subtype was Parasagittal - 30%, followed by sphenoid wing - 24%, convexity 22%. Other subtypes including olfactory groove, falx, clinoidal, posterior fossa, tuberculum sella, planum sphenoid and petrous, together accounted for 24% (Table 2).

In the convexity group, 36.3% was frontal, 36.3% was parietal and 27.3% was temporal. In the parasagittal group 60% were confined to anterior 1/3rd, 27% in the middle 1/3rd and 13% in the posterior 1/3rd region. In the Sphenoid wing group, 98% were in the lateral aspect and only 8% in the medial aspect.

WHO classification was used for grading meningiomas. Grade 1 meningioma, which is the benign variety constituted 76% of tumours. Grade 2 the intermediate group, constituted 18% and Grade 3, the aggressive variant constituted 6%. When sub classified, 34% were transitional, 22%-meningothelial, 8%-fibrous and 12%-other grade 1 variants. Atypical type included 16% and anaplastic 6%.

Within the grade1, 44.7% was transitional type, 28.9% was meningothelial type, and 10.5% was fibrous type, rest 15.9% was constituted by other variants. In the atypical group, there were 8 atypical (88.8%) and 1 clear cell type (11.1%).

In the study by Han et al, 77% of the cases were meningothelial, followed by transitional, fibroblastic and angiomatous.⁸

Joel et al reported meningothelial as the commonest type (38.89%). Huang et al reported Fibroblastic as the most common variety (27.7%); meningothelial -25.3%,

psammomatous -19%, transitional -14.3%, angiomatous -7.1%, papillary -2.3%, and grade 3-4%.

The complications evaluated in the study were those developed following surgery. The most common in our study was motor deficit, mainly due to postoperative oedema, which improved gradually. New onset seizure, respiratory and urinary tract infections were also seen in postoperative period. Decreased vision was confined to the postoperative group of sphenoid wing meningioma. CSF leak followed tuberculum sella meningioma surgery. Other complications encountered were, altered sensorium, electrolyte imbalance, pulmonary embolism, phenytoin allergy and surgical site infection.

In the present study, 3 patients developed recurrence (6%). Of these 2 cases were transitional type and 1 meningothelial type. 1 case underwent Simpson's grade 4 excision, one Grade 3 excision. But in one case, where Grade 0 excision could be achieved in the first surgery, also recurred and it was transitional type.

7 patients died during follow up. 3 deaths were during the postoperative hospital stay and 4 cases died later after discharge, due to other comorbidities and complications.

When comparing all the parameters evaluated in the study, a general presentation was seen for Grade 3 – anaplastic type of meningiomas. In MRI, these lesions were T2 hyperintense, heterogeneous, with significant perilesional oedema and intensely contrast enhancing. During surgery these tumors were highly vascular, friable, suckable and had ill-defined margins.

Though a general pattern could not made out to differentiate between Grade 2 and 1 tumors, those having the following description tend to be benign — Grade1: - T2 Iso — hypointense, homogeneous, without oedema, low — moderate vascularity, firm, nonsuckable, and well-defined margins.

The limitation of the study was that it included patients who were operated in our institution. As many cases of meningioma are asymptomatic and do not receive medical attention, the results of this study cannot be generalised for the entire population.

CONCLUSION

Meningioma is one of the most common primary brain tumours encountered in surgical practice. This study explored the presentation patterns and characteristics of meningioma in our institution. The male to female ratio was 1:2.57, with 50-70 years being the most affected population. The common symptomatology was that of features of raised ICP with motor deficit as the common neurological abnormality. These tumours were usually small with well-defined margins and high vascularity. Complete excision of the tumour with coagulation of dura (Simpson's grade2) was the common clearance obtained.

3 common sites were parasagittal, sphenoid wing and convexity in decreasing order of frequency. Commonest histological type was Transitional followed by Meningothelial. Recurrence rate was 6%. The general features of high-grade lesions were T2 Hyperintensity, Heterogeneous, with significant perilesional oedema and intensely contrast enhancing, high vascularity, friable, suckable and ill-defined margins.

The presentations, distribution, location and types of meningioma varies from population to population and literature to literature. Hence for meningioma, a common tumor being encountered in neurosurgical practice, the parameters described in western literature is not accurate in Asian population. Thus, this study helps us to understand the characteristics of the disease from a South-Indian perspective. It helps in early diagnosis, accurate treatment decisions and better outcome.

ACKNOWLEDGEMENTS

Authors would like to thank Dr. Tinu Ravi Abraham, Dr. Shaju Mathew, Dr. Vinu Gopal, all are Associate Professors in the Department of Neurosurgery and Dr. Philip Issac, Assistant Professor in the same department.

Funding: No funding sources Conflict of interest: None declared

Ethical approval: The study was approved by the

Institutional Ethics Committee

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Cite this article as: Girish KM, Irphan MPS, Balakrishnan PK, Nimiya SM. Clinical profile of meningioma: an experience from South India. Int Surg J 2021;8:816-21.