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Original Article

Evaluation of Risk Factors Influencing Surgical Outcome in Meningiomas with CLASS Algorithm

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Abstract

Introduction: Meningiomas are one of the most common extra-axial neoplasms constituting 13-25% of all intracranial neoplasms. It is imperative that proper assessment of the risk and benefit ratio of surgery for patients with meningiomas is done.

Materials and Methods: The analysis was done on patients who were admitted during the period 2010-2013 and were diagnosed as having meningiomas on the basis of clinical and radiological features. Patients were stratified using CLASS scoring. Outcome was assessed by the Glasgow outcome scale (GOS) and the presence of complications (neurological and medical) of the surgery for the various types of meningiomas, and the observations are presented.

Results: Meningiomas are more common in the age group of 40-49 with a female preponderance. Headache was the most common symptom (86%), and convexity meningiomas were the most common accounting for about 30%. The CLASS algorithm revealed that 59% of patients in Group I, 32% in Group II, and 9% in Group III. The grade of resection with respect to the CLASS algorithm grouping was elucidated as 44% of Group I patients, 40% of Group II, and 25% of Group III undergoing Grade 1 resection. The outcome based on the "CLASS" scoring with respect to the poor outcome as measured by the GOS score of 1-3 was observed to be about 15% in Group I and 20% in Group II and about 50% in Group III.

Conclusions: "CLASS" algorithm forms a viable alternative for pre-operative standardization and stratification of meningiomas and thus helps in effective risk factor analysis and in helping to predict the risk-benefit ratio in patients with meningiomas and in eventual identification of those participants who would benefit the most in relation to the pre-operative characteristics and the patient associated morbidities.

Key words: CLASS algorithm, Glasgow outcome scale, Meningiomas, Simpson resection

INTRODUCTION

Meningiomas are one of the most common extra-axial neoplasms of intracranial nature constituting 13-25% of all intracranial neoplasms. Recent advances in neuroimaging have increased the incidence of asymptomatic meningiomas. Arising from arachnoid cap cells, meningiomas are present in varied locations and are of diverse histopathological types primarily stratified by the WHO classification into three grades with the majority being of benign grade.[1-3]

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Treatment options for meningiomas have varied historically from mere observation to surgery to radiation therapy to combined modalities of treatment. Most meningiomas being benign and slow growing proper planned treatment is possible, thus providing higher chances of complete extirpation of these tumors. The degree of complete surgical removal essentially depends on the location of the tumor and the presence of nearby vital neurovascular structures and eloquent brain matter. The success or otherwise of the surgical modality of treatment offered rests on the completeness of resection as graded by Simpson grading which primarily correlates the degree of extirpation of the meningioma and associated dura with the probability of recurrence.

The varying and heterogeneous nature of presentation of the various types of meningiomas and the commonality of occurrence has sparked efforts to primarily predict the success of surgical outcomes in meningioma surgery. It is

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imperative that proper assessment of the risk and benefit ratio of surgery for individual patients with meningiomas is done keeping with the basic tenet of benefits to far outweigh the risks involved.[3-6] With this aim in mind, various stratification systems like the "CLASS" algorithm have been developed the validity of which is assessed in this study.

Aim of the Study

Aim of the study is:

1. To analyze the various epidemiological and risk factors associated with and influencing surgical outcome in the treatment of meningiomas.
2. To assess the validity of the CLASS algorithm as applied to patients diagnosed with meningiomas and subject to surgical treatment and comparing the findings and outcome of this study with other major studies in literature utilizing CLASS algorithm for meningiomas.

With this background of information, the "CLASS" algorithm was proposed by Lee, the purpose of which was to analyze the risk-benefit ratio of the surgical alternatives provided to patients with meningiomas and the study of the impact of the various pre-operative risk factors on the degree of functional outcome after surgery (Table 1).

The stratification of patients is based on the factors.

Comorbidity

It is assessed the use of the American Society of Anesthesiologists (ASA) scale with reference to the ability or otherwise of patients to withstand surgical procedures and tolerate anesthetic medications. The scores assigned are 0 for Grade I, −1 for ASA II, and −2 for ASA III. ASA IV and ASA V are not included as they are not considered desirable candidates for surgery.

Location

Tumor location was classified as "low-risk" locations included convexity and lateral skull base (lateral and middle sphenoid wing, posterior petrous) and were given a score of 0.

Table 1: Parameters of CLASS algorithm

Factors	Score				
	−2	−1	0	1	2
Comorbidity	ASA 3	ASA 2	ASA 1		
Location	Complex	Moderate	Simple		
Age	≥71	61-70	≤60		
Size (cm)			≤2	2.1-4	>4
Signs and symptoms			Asympt.	+	++
Other		Prior RT/Sx[1]		Progress[2]	

ASA: American society of anesthesiologists, [1]Prior radiotherapy or surgery, [2]radiographic progression

Olfactory groove, planum sphenoidale, tentorial (lateral/paramedian), parasagittal, intraventricular, cerebellopontine angle, falcine, posterior/lateral foramen magnum as well as para-sigmoid and para-transverse sinus locations constituted the "moderate-risk" group and were assigned a score of −1.

The "high-risk" locations included clinoidal, cavernous sinus, tuberculum sellae, tentorial (medial/incisural), ventral petrous, petroclival, and anterior/anterolateral foramen magnum, for which a score of −2 was given.

Age

A score of 0 was assigned for patients who are 60 years of age or younger, −1 for 61-70 years, and −2 for 71 years or older.

Size

A score of 0 was given if the maximum tumor size was 2 cm or less, +1 for between 2.1 and 4 cm, and +2 for tumors larger than 4.1 cm.

Signs and Symptoms

A score of 0 was assigned for incidental tumors and +1 for mild symptoms or irreversible neurologic deficits. A score of +2 was assigned for severe symptoms or reversible neurologic deficits.

The stratification of outcome is done using the Glasgow outcome scale (GOS), and the attendant neurological, post-operative, and medical complications are factored in the compartmentalization of the patients undergoing surgical treatment of meningiomas and the risk-benefit ratio assessment thereof.

MATERIALS AND METHODS

The analysis was done after proper approval from the IRB/IEC of Government Rajaji Hospital, Madurai, on patients who were admitted in the Department of Neurosurgery, Government Rajaji Hospital, during the 3 years' period and were diagnosed as having meningiomas on the basis of clinical and radiological features.

The variables studied included the age, sex, and presenting symptoms of the patient with stratification of the patients with regard to their comorbidities and pre-existing medical and chronic disorders and the clinical profile and placed as per the ASA grading from I to IV.

The radiological picture was recorded, and the parameters studied were the cross-sectional size of the lesion in its maximum extent as reported by the radiologist using standard protocol. Other parameters studied were the

anatomical location of the lesion with respect to the normal anatomical disposition of the tumor and the degree of proximity to the vital neural, and the vascular entities present in that area and the degree of secondary effects caused by the lesion to the internal milieu of the brain and intracranial compartments.

The inclusion criteria for the patients were categorized as those who were offered the surgical alternative and were willing for surgery as well as amenable and accessible to regular follow-up.

The patients who underwent surgery were studied with regard to the degree of extirpation that was done based on the Simpson grading of meningioma resection. The post-operative course was monitored, and the patients were assessed at the end of the 1st week of convalescence and after 6 weeks following surgery based on the GOS between 1 and 5 (worst-best).

All these parameters were included in the risk stratification and with special emphasis with respect to comorbidities, location, age, size, and signs and symptoms, and these were used for calculation of the CLASS scoring and grouping of patients based on this algorithm.

Based on the outcome as assessed by the GOS and the presence of complications (neurological and medical), the outcome evaluation of surgery was done for the three groups of patients under the various CLASS groups, and the results were analyzed with regard to the success and otherwise of the surgery for the various types of meningiomas, and the observations are presented.

The information collected regarding all the selected cases were recorded in a master chart, and data analysis was done.

RESULTS

The study encompasses the analysis of the evaluation done of about forty-six patients who underwent surgery for meningiomas during the period 2013-2016.The patients were stratified on the basis of the CLASS algorithm, and the outcome parameters were analyzed.

The demographic epidemiology of the forty-six patients is as follows. The grouping of patient with respect to the age-wise breakup is age range of <29-13%, 30-39-22%, 40-49-39%, the highest, 50-59-17%, >60-9%. The sex-based incidence showed a female preponderance of about 76% in females and 24% in males.

With regard to the symptomatology of presentation, the findings were as follows:

- Headache and vomiting - 38
- Headache alone - 2
- Seizures - 9
- Hemiparesis/Deficits - 3
- Behavioral disturbances -2
- Diminution of vision - 7
- Papilledema - 3.

The location of the lesion and the radiological correlate were found to be:

- Left-sided lesions - 46%
- Right-sided lesions - 39%
- Midline structures - 15%.

The anatomical location of the meningiomas as radiologically diagnosed and the findings were shown in Table 2.

The other parameter that was diagnosed radiologically was with respect to the size of the lesion:

- Size >4 cm - 19
- Size <4 cm - 27.

The pre-operative functional status of the patient was analyzed based on the ASA scale, and the stratification was 59% of patients in ASA Stage II, 39% of patients in Stage III, and 2% of patients in Stage I. The grade of resection according to Simpson grading was also stratified and the results were shown in Table 3.

Based on the above findings with regard to the comorbidity, location, age, size, and symptoms and signs of the various kinds of meningiomas in the sample evaluated the CLASS scoring was performed and the groups were assigned and the following findings were noted with 59% in CLASS I, 32% in CLASS II, and 9% in CLASS III.

All patients were subject to surgical treatment, and the results of the surgery were measured by the parameters of the Glasgow outcome scoring at the end of the period of 6 weeks postoperatively. The overall GOS distribution was shown in Table 4.

Table 2: Classification based on site

Location of the lesion	Percentage
Convexity	30
Parasagittal	15
Tentorial	13.5
Sphenoid wing	13.5
Falcine	7
Olfactory groove/basifrontal	7
Suprasellar	4
Cerebellopontine angle	4
Petroclival	2
Clinoidal	2
Intraventricular	2

The scoring of the patients was done with GOS ≤3 taken as poor outcome and GOS more than 3 taken as representative of good outcome (Table 5).

The outcome was also assessed on the basis of the post-operative neurological and medical complications that were also analyzed (Table 6).

The grouping of the complications observed with respect to the stratification by the CLASS algorithm is observed as follows (Table 7).

The distribution of the type of complications included wound-related predominantly pseudomeningocele and neurological complications such as visual deterioration, hemiparesis, aphasia, and behavioral disturbances.

The study also included medical complications the most important of which was deep vein thrombosis leading on to pulmonary embolism, and the overall mortality was 3/46 (2 of which were due to associated medical complications).

DISCUSSION

The study encompasses the results of the analysis of 46 patients who underwent surgical treatment for meningiomas in the Department of Neurosurgery at Government Rajaji Hospital, Madurai.

The epidemiological analysis revealed that the incidence of meningiomas in terms of occurrence was more common in the age group of 40-49 with 39% of patients presenting in this age group closely followed by the age group of 30-39 with 22% with an incremental incidence with increasing age.

The overall ratio of sexual preponderance of meningiomas heavily tilts toward the female sex with three times more likely incidence and an odds ratio of 10.02 indicating ten times the odds of developing meningiomas (Table 8).

With regard to the primary symptomatology of presentation, the study indicates that the most common symptom is headache and vomiting both of which are non-specific in the sense that no localization could be attributed to the headache as was evidenced in 40 of 46 patients about 86.9% of the total sampled.

The site of lesion as exemplified in this study was found to be left sided lesions in 46% of cases, right sided in 39% and midline in 15% of cases. The location of the meningioma was of the order that convexity meningiomas were the most common accounting for about 30% of the lesions with parasagittal and falcine meningiomas making up about 22% of the lesions (Table 9).

Table 3: Stratification of CLASS with Simpson grading

	Simpson grade			
Class	Grade 1	Grade 2	Grade 3	Grade 4
Group I	12	13	2	0
Group II	6	6	2	1
Group III	1	2	1	0

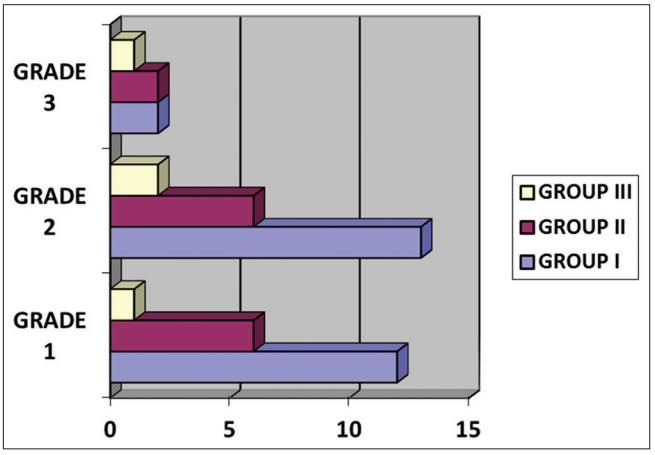

Table 4: Distribution of cases according to GOS

GOS 1	GOS 2	GOS 3	GOS 4	GOS 5
4 (9%)	3 (7%)	2 (4%)	35 (76%)	2 (4%)

GOS: Glasgow outcome scale

Table 5: CLASS outcome

Class group	Total	Poor outcome (%)
I	27	4 (15)
II	15	3 (20)
III	4	2 (50)

Table 6: Analysis of outcome

Total surgeries	Complications	No complications
46	12 (26%)	34 (74%)

Table 7: Stratification by CLASS algorithm

CLASS grouping	Complications (%)
Group I	5/27 (18)
Group II	5-15 (33)
Group III	2/4 (50)

Table 8: Sex distribution

Male:female	24:76	1:3	OR - 10.02

OR: Odds ratio

Table 9: Correlation of location in meningiomas

Location of the lesion	Observed
Convexity	30
Parasagittal/falcine	22
Tentorial	13.5
Sphenoidal	15.5
Olfactory groove/basifrontal	7
Suprasellar	4
Posterior fossa	6
Intraventricular	2

With regard to the size of the lesions, the findings of the study were of the order that 59% of lesions measuring <4 cm and 41% of lesions were >4 cm with no significant odds ratio of occurrence.

The stratification of patients according to the CLASS algorithm revealed that 59% of patients were placed in Group I, 32% of patients in Group II, and 9% of patients in Group III.

The pre-operative morbidity status of the patients analyzed in the study was of the finding of 59% of patients placed in the ASA II category and 39% of patients in the ASA III category.

The analysis of grade of resection with respect to the CLASS algorithm grouping was elucidated as 44% of Group I patients undergoing Grade 1 resection and 40% of Group II and 25% of Group III undergoing Grade 1 resection.

The outcome parameters of the surgical methodology adopted with reference to the CLASS stratification were then analyzed in reference to the Glasgow outcome scoring with 80% of GOS 4-5 and 20% of GOS 1-3.

The outcome of surgical intervention based on the "CLASS" scoring with respect to the poor outcome as measured by the GOS score of 1-3 was observed to be about 15% in Group I and 20% in Group II and about 50% in Group III. Odds ratio of having unfavorable outcome according to the CLASS score was compared, and the analysis is 5.6 in Group III versus Group I and 1.4 in Group II versus Group I. The comparisons of post-operative complications observed in the study using odds ratio with respect to the grouping according to the CLASS algorithm analysis was calculated as 4.55 when Group III and Group I was compared and 2.03 when Group II and Group I were compared indicative of a prominent and higher probability of occurrence of complications.

CONCLUSION

The overall results and conclusions from the study corroborate that the following findings were on the basis of the results of the observations on the forty-six patients in the study.

The epidemiological conclusions were that the incidence of meningiomas is highest in the fourth decade with a marked preponderance of lesions in females. The primary symptomatology is headache of a non-localizing variety accompanied by vomiting. Most of these symptoms were mild to moderate in intensity and severity.

With regard to the imaging findings, the location of the lesion was more in the convexities of the cerebral hemispheres, followed by the parasagittal/falcine varieties and tentorial and sphenoid wing varieties with no specific predilection for side- and midline-located lesions formed a third of these varieties.

"CLASS" algorithm forms a viable alternative for pre-operative standardization and stratification of meningiomas, and the validity of the algorithm is very well demonstrated by this study as is evidenced by the higher correlation of complications and poor outcome in the Group III patients.

REFERENCES

1. Central Brain Tumor Registry of the United States. 2009-2010 CBTRUS Statistical Report: Primary Brain and Central Nervous System Tumors Diagnosed in 18 States in 2002-06. Hinsdale, IL: Central Brain Tumor Registry of the United States; 2009. Available from: http://www.cbtrus.org.
2. Claus EB, Bondy ML, Schildkraut JM, Wiemels JL, Wrensch M, Black PM. Epidemiology of intracranial meningioma. Neurosurgery 2005;57:1088-95.
3. Nakamura M, Roser F, Michel J, Jacobs C, Samii M. The natural history of incidental meningiomas. Neurosurgery 2003;53:62-70.
4. Bindal R, Goodman JM, Kawasaki A, Purvin V, Kuzma B. The natural history of untreated skull base meningiomas. Surg Neurol 2003;59:87-92.
5. Jaaskelainen J, Haltia M, Laasonen E, Wahlström T, Valtonen S. The growth rate of intracranial meningiomas and its relation to histology. An analysis of 43 patients. Surg Neurol 1985;24:165-72.
6. Lee JH, editor. Meningiomas: Diagnosis, Treatment, and Outcome. London: Springer; 2008. p. 457-63.

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