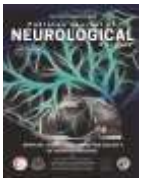

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Original Article

Importance of Simpson/Shinshu Grading in Meningioma's Excision, Outcome and Recurrence

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ABSTRACT

Objective: The study was aimed to determine the recurrence rate and recurrence-free survival of meningioma surgery with reference to Simpson grading of excision.

Material and Methods: The study was conducted in the Department of Neurosurgery, Punjab Institute of Neurosciences (PINS), Lahore. Total 325 patients both male and female of age (13 – 70 years) with supratentorial grade I meningioma operated. The craniotomy with maximum safe excision of the meningioma was done in all patients under general anesthesia. All patients followed-up to one year clinically and radiologically. MRI brain plain and IV contrast were done at 6 months and then annually. The extent of resection was determined with the help of operative notes and post-op MRI and recurrences were studied with help of follow-up MRI.

Results: There were 227 female and 98 male patients in ages 13 – 70 years. The mean age of patients was 53.5 years. 227 (70%) skull base meningioma, 71 (22.0%) convexity meningioma, and 26 (8%) falx or tentorium meningioma were operated. We achieved Simpson grade I excision in 55 (17.45%), grade II in 208 (64%), grade III in 23 (7%), and grade IV in 36 (11%) cases. The median recurrence free survival (RFS) with reference to Simpson grading of excision was 250, 120, 98, 80 months for grades I, II, III, and IV excision; it was statistically significant according to the grading of excision. The combined median survival of grades I and II, when compared with grades III and IV; this was also statistically significant at 130 and 86 months.

Conclusion: Excision of meningioma up to grades I and II had an excellent outcome with minimum chances of complications.

Keywords: Supratentorial Meningioma, Extent of Excision, Recurrence Free Survival (RFS), Simpson Grading.

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INTRODUCTION

Many types of tumors can originate intracranially and they can originate either from meninges, cranial nerves glial cells. Both benign and malignant tumors can occur intracranially. The meningiomas are the most common benign intracranial tumors representing 13%–26%.[1] WHO

classified meningiomas into 3 groups: Grade I (benign tumor), Grade II (atypical meningiomas), and Grade III (anaplastic or malignant meningiomas).[1] Most neurosurgeons prefer to remove meningioma completely without causing any harm to the patients. The meningiomas are benign lesions with extra-axial location, the complete and proper microsurgical excision gives a good prognosis. Many neurosurgeons think that the patients are cured forever if the tumor is excised completely. But recurrence can be there even after complete resection.[3] There is no specific time period in which if there is no recurrence on the MRI brain we can label the patient as cured. The Simpson claimed that recurrence can be as late up to 13.5 years of meningioma excision and can also prove in this study that recurrence will be low if there is more aggressive excision of the meningiomas.[2] The meningiomas are benign tumors and originate from arachnoid villi and have recurrence risk after excision of tumors.[3] In 1957 Simpson was the man who describes the relationship between excision and recurrence.[4] With the advancements in preoperative radiology and microsurgical techniques and a better understanding of microsurgical anatomy and complications of aggressive excision the Simpson classification of excision of meningioma was questioned by many neurosurgeons. Many variables can lead to recurrence; age, sex, tumor size, and its location with vital neurovascular structure, the extent of excision of the tumor, and post-op histopathology.[5] Some neurosurgeons believe that improvements in microscopes, micro-instruments and microsurgical techniques the more aggressive resection of meningioma is possible with fewer complications.[6] The Simpson described the grading of meningioma excision in 1957 when CT and MRI and micro-instruments and microsurgical techniques were not fully developed and WHO classification yet to be described. Keeping in mind the evolution of modern neurosurgical practice, we addressed the importance of Simpson grading in predicting recurrence rates of WHO Grade I meningiomas excision by reviewing our patients who underwent resection and were followed-up at our institution (Punjab Institute of Neurosciences – PINS).

MATERIAL AND METHODS

Study Design & Setting

The study was carried out at the Department of Neurosurgery, Punjab Institute of Neurosciences (PINS), Lahore. All 325 consecutive supratentorial (Grade I) meningioma patients were included who were operated during 2010 – 2018. The informed consent was taken from all patients included in the study. The approval was taken from the ethical committee of the hospital.

Inclusion Criteria

Patients with supratentorial (Grade I) meningioma patients of ages between 13 – 75 years and included.

Exclusion Criteria

The patients more than 75 years of age, medically unfit, infra-tentorial located meningioma, associated any other intracranial tumors and patient with neurofibromatosis II, spinal and recurrent meningioma was excluded from the study.

Surgical Technique

The location of the meningioma was classified and noted with help of MRI brain plane and contrast. In all patients, the craniotomy with maximum safe resection of the tumor was done. After surgery, all patients were shifted to neuro ICU for 24 hours and then shifted to neuro ward for proper post-operative care. After 24 hours, the CT scan brain plane was obtained in all patients.

An additional post-op CT scan was also evaluated for early post-op complications like hematoma or infarcts etc.

Clinical Management

Simpson grading of excision was determined by operation notes and post-op MRI Brain. All patients were discharged on 6th post-operative day after stitch removal. All patients were followed clinically and radiologically from their medical records. For the radiological record, we performed MRI at six months and then after one year.

Data Analysis

All the descriptive and quantitative data was entered and analyzed by the SPSS version 22.0. Recurrence free-survival (RFS) was measured from the date of surgery to the date of documented contrast-enhancing the tumor on follow-up MRI.

RESULTS

Patients' Information

There were 227 female and 98 male patients in age between 13 – 75 yrs. All patients were with supratentorial and WHO grade I meningioma. The mean age of patients was 53.5 years.

Surgical Resections

227 (70%) skull base meningioma, 71 (22.0%) convexity meningioma, and 26 (8%) falx or tentorium meningioma were operated. We achieved Simpson grade I excision in 55 (17.45%) cases, grade II in 208 (64%) cases, grade III in 23 (7%) cases, and grade IV in 36 (11%) cases. The gross total resection of meningioma was associated with a good functional outcome.

Comparison in Simpson's Grades

The outcome was compared in Simpson grades I and II with Simpson grades III and IV. We performed MRI brain with IV contrast at 6th month and at one year.

Data Analysis

The data was collected and analyzed by SPSS version 22.0. The recurrence-free survival was analyzed by Kaplan-Meier and recurrence by log-rank (Mantel-Cox) test. A p-value < 0.05 was taken as significant. The median recurrence-free survival with reference to Simpson grading of excision was 250, 120, 98, 80 months for grades' I, II, III, and IV excisions; it was statistically significant (p = 0.047) according to the grading of excision. The combined median survival of grades I and II when compared with grades III and IV was also statistically significant (p = 0.045) at 130 and 86 months. The recurrence-free survival in female at 139 months was better than male at 81 months (p = 0.015).

DISCUSSION

The majority of meningiomas of different locations are benign in nature and complete excision of the tumor is attempted to minimize the risk of recurrence. Meningiomas are non-malignant tumors that grow slowly and originate from meningothelial cells of the arachnoid.[7] Meningiomas are 20 – 30% of all primary brain tumors and are benign in nature with a good prognosis if resected completely.[8] Many surgeons studied the recurrence of meningioma and the recurrence rate varied from 15 – 25% in different studies. As meningioma are benign in nature, so high recurrence is not acceptable to many neurosurgeons. Many neurosurgeons believe that with the advancements in the microscope and microsurgical instruments and techniques, recurrence should be too low. Our recurrence was 3 percent that may be because of that we used microscope and micro-instruments for tumor excision and Simpson grading is very old and no

microsurgical techniques and gadgets were available at that time. If after excision there is a large residual volume of the tumor, then there are more chances of recurrence. Simpson gives the five grades of resection and their relationship with recurrence.[2] There is too much criticism over Simpson grading of meningioma surgery and recurrence. Many neurosurgeons do not agree with it completely. WHO classification proves that the prognosis of meningioma depends upon histological grading, mitotic activity, and other molecular markers. Ros-Sanjuan et al, also proved that necrosis inside the tumor and high Ki67 index are commonly associated with recurrence.[9]Sumkovski et al. also supported that mitotic count is the major predictor of recurrence.[10] Many molecular markers of meningiomas are being studied nowadays like monosomy of chromosome 22, deletion of Chromosome 1p, losses of chromosomes 6q, 9p, 10, 14q, and 18q in the higher-grade tumor, and mutations in the NF2 gene.[11]

Even with the advancements in molecular markers the extent of resection for neurosurgeons is a good predictor of recurrence in WHO grade I meningiomas.[12] We did grade I excision in all our convexity meningioma patients and grades II or III excision in parasagittal and anterior and middle cranial fossa skull base lesion where complete excision carries a high morbidity rate with a significant risk of mortality. Most of the neurosurgeons in the world are also in favor of maximum safe resection and leaving a small part of the tumor to minimize the risks and following that residual part by MRI or radiosurgery if required.

We studied 325 patients of WHO grade I meningiomas excised surgically in our unit. The 10 years recurrence in Simpson's work was 9%, 16%, 29% and 39% for grade I, II, III, IV, and 100% for grade V resection. In my study recurrence after meningioma excision was 3%. The recurrence rates were 3%, 13%, 27%, and 31% for grades' I, II, III, IV excision of meningiomas, respectively. Another study also proved the same recurrence rate,[13] but Sughrue et al, only support Simpson grading in convexity meningioma and did not agree with Simpson for skull base meningiomas.[14] Recent studies conducted by Hasseleid et al,[15] and van Alkemade et al.[16] proved that extent of excision is associated with recurrence of meningioma even for skull base tumors. Our study results also favored the Simpson grading of resection. In current study, the recurrence rate after complete excision of WHO grade 1 meningioma is 3%. In modified Shinshu grading the recurrence rates of WHO grade I (0.6%), thus proving the strong correlation between the extent of resection and recurrence-free survival.

Hasseleid et al,[15] reported that Sughrue included only convexity meningioma and his sample size were small. My study results correlate with the results of Hasseleid et al. Our study included 102 convexity meningioma and 318 skull base meningiomas and the recurrence rate and recurrence-free survival has a strong correlation with Simpson's grade of excision. We also included 32 meningiomas of Falx and tentorial area and the recurrence rate of these meningiomas did not correlate with Simpson grade of excision. The Sughrue's performed 30% grade IV excision and we did in 11% of our patients. vanAlkemade et al,[16] also did not agree with Sughrue et al, because of confounding factors of old age and patient selection. Sughrue et al,[34] also did pre-op embolization in 71.3% of their patients and we did not go for preoperative embolization in our patients. Preoperative embolization whether it is effective or not in meningioma is still controversial.[28,32] Sughrue et al,[14] also claimed that their results are better because of improvements in radiological imaging, better knowledge of microsurgical anatomy, betterments in microsurgical techniques, and histological grading of meningiomas. As skull base meningioma involves the nerves and vessels, their complete excision carries high mortality and

morbidity, and their recurrence directly related to extent of excision.[17,18] Our study results also prove that recurrence is also related to the extent of excision. In sphenopetroclival or cavernous meningiomas,[19,20] complete tumors excision had high morbidity and mortality. Simpson also proves that dural tail and residual tumor cells can cause recurrence.[21,22]

Limitations

Supratentorial location and surgery were performed by multiple surgeons with short follow-up. A longer follow-up is required to reach a proper conclusion because it's a benign disease.

CONCLUSION

The Simpson grading of resection has a major impact on resection-free survival of the patient and recurrence of the tumors even in skull base meningiomas. The complete resection should be the goal of meningioma surgery and resection can be tailored according to expected morbidity of patients and tumor mortality.

REFERENCES

1. Modha A and Gutin PH. Diagnosis and treatment of atypical and anaplastic meningiomas: a review. Neurosurgery, 2005; 57: 538–550.
2. Simpson D. The recurrence of intracranial meningiomas after surgical treatment. J Neurol Neurosurg Psychiatry, 1957; 20: 22–39.
3. Roser F, Samii M, Ostertag H, Bellinzona M. The Ki-67 proliferation antigen in meningiomas. Experience in 600 cases. Acta Neurochir. 2004; 146: 37-44.
4. Simpson D. The recurrence of intracranial meningiomas after surgical treatment. J Neurol Neurosurg Psychiatry, 1957; 20: 22-39.
5. Yamasaki F, Yoshioka H, Hama S, Sugiyama K, Arita K, Kurisu K. Recurrence of meningiomas. Cancer, 2000; 89: 1102–1110.
6. Sanai N, Sughrue ME, Shangari G, Chung K, Berger MS and McDermott MW. Risk profile associated with convexity meningioma resection in the modern neurosurgical era. J Neurosurg. 2010; 112: 913–919.
7. Suppiah S, Nassiri F, Bi WL, et al. Molecular and translational advances in meningiomas. Neuro-oncol. 2019; 21: i4–i17.
8. Quddusi A, Shamim MS. Simpson grading as predictor of meningioma recurrence. J Pak Med Assoc. 2018; 68: 819-821.
9. Ros-Sanjuan A, Iglesias-Morono S, Carrasco-Brenes A, Bautista-Ojeda D, Arraez-Sanchez MA. Atypical Meningiomas: Histologic and Clinical Factors Associated With Recurrence. World Neurosurg. 2019; 1: 56.
10. Sumkovski R, Micunovic M, Kocevski I, Ilievski B, Petrov I. Surgical treatment of meningiomas – outcome associated with type of resection, recurrence, Karnofsky performance score, mitotic count. Maced J Med Sci. 2019; 7: 56-64.
11. Benson VS, Pirie K, Green J, et al. Lifestyle factors and primary glioma and meningioma tumours in the Million Women Study cohort. Br J Cancer, 2008; 99: 185–90.
12. Beks JW, de Windt HL: The recurrence of supratentorial meningiomas after surgery. Acta Neurochir (Wien), 1988; 95: 3–5.
13. Jääskeläinen J, Haltia M, Servo A: Atypical and anaplastic meningiomas: radiology, surgery, radiotherapy, and outcome. Surg Neurol. 1986; 25: 233–242.
14. Sughrue ME, Kane AJ, Shangari G, Rutkowski MJ, McDermott MW, Berger MS, et al: The relevance of Simpsoaqn Grade I and II resection in modern neurosurgical treatment of World Health Organization Grade I meningiomas. J Neurosurg. 2010; 113: 1029–1035.
15. Hasseleid BF, Meling TR, Rønning P, Scheie D, Helseth E: Surgery for convexity meningioma: Simpson Grade I resection as the goal: clinical article. J Neurosurg. 2012; 117: 999–1006.
16. van Alkemade H, de Leau M, Dieleman EM, Kardaun JW, van Os R, Vandertop WP, et al. Impaired survival and long- term neurological problems in benign meningioma. Neuro Oncol. 2012; 14: 658–666.
17. Ichinose T, Goto T, Ishibashi K, Takami T, Ohata K.

The role of radical microsurgical resection in multimodal treatment for skull base meningioma. J Neurosurg. 2010; 113: 1072–1078.
18. Scheitzach J, Schebesch KM, Brawanski A, Proescholdt MA. Skull base meningiomas: neurological outcome after micro- surgical resection. J Neurooncol. 2014; 116: 381–386.
19. Couldwell WT, Fukushima T, Giannotta SL, Weiss MH. Petroclival meningiomas: surgical experience in 109 cases. J Neurosurg. 1996; 84: 20–28.
20. Talacchi A, Biroli A, Soda C, Masotto B, Bricolo A. Surgical management of ventral and ventrolateral foramen magnum meningiomas: report on a 64-case series and review of the literature. Neurosurg Rev. 2012; 35: 359–368.
21. Ayerbe J, Lobato RD, de la Cruz J, Alday R, Rivas JJ, Gómez PA, et al. Risk factors predicting recurrence in patients operated on for intracranial meningioma. A multivariate analysis. Acta Neurochir (Wien), 1999; 141: 921–932.
22. Mantle RE, Lach B, Delgado MR, Baeesa S, Bélanger G: Predicting the probability of meningioma recurrence based on the quantity of peritumoral brain edema on computerized tomography scanning. J Neurosurg. 1999; 91: 375–383.

Additional Information

Disclosures: Authors report no conflict of interest.
Ethical Review Board Approval: The study was conformed to the ethical review board requirements.
Human Subjects: Consent was obtained by all patients/participants in this study.
Conflicts of Interest:
In compliance with the ICMJE uniform disclosure form, all authors declare the following:
Financial Relationships: All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work.
Other Relationships: All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

AUTHORS CONTRIBUTIONS

Sr.#	Author's Full Name	Intellectual Contribution to Paper in Terms of:
1.	Ijaz Hussain Wadd	Analysis of data, study design and methodology.
2.	Sidra Ijaz	Literature review, statistical analysis and editing.
3.	Naem-ul-Hasan	Data Collection.