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Research Article

DOES THE LOCATION OF MENINGIOMA HAVE ANY IMPACT ON POSTOPERATIVE OUTCOMES? – A PROSPECTIVE COHORT STUDY

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Abstract

Meningioma is a CNS tumour with a moderate growth rate that arises from the meninges. (1) Meningiomas are produced by arachnoid cells that are situated on the inner surface of the dura. Meningiomas are the most common primary CNS tumour, accounting for about 36% of cases and 53% of nonmalignant CNS tumours, with an incidence of 7.86 cases per 100,000 people each year (2, 3). In addition to symptoms from the mass effect of the central nervous system, such as headache, patients with meningiomas also experience a variety of neurologic symptoms brought on by the compression of surrounding central nervous system components. As a result, the type of symptoms is directly influenced by the tumour's location. Meningiomas can develop in places where there are arachnoid cells, and their locations range from the para-sagittal region to the spine. (4, 5). The management decisions depend on the particular characteristics of each area(6). For instance, patients with convexity meningiomas are more likely to present with seizures as a baseline symptom compared to skull base meningiomas which result in a higher frequency of headaches, anosmia, ocular deficits, and auditory deficits(7). The surgical care of these tumours has changed to demonstrate better results and decrease mortality and surgical morbidity, but it is still linked to significant morbidity and problems. Microsurgical methods and surgical approaches to these tumours have also improved. (8) The purpose of this prospective study is to investigate how the anatomical location of meningioma affects the postoperative outcomes after its excision. Intriguing, in our opinion, is the analysis of the clinical outcomes of meningioma patients in a setting of developing countries.

Keywords: Meningioma, Outcome , Location of meningioma, KPS.

INTRODUCTION

A meningioma is a CNS tumor with a moderate growth rate that arises from the meninges. (1) Meningiomas are produced by arachnoid cells situated on the dura's inner surface. Meningiomas are the most common primary CNS tumor, accounting for about 36% of cases and 53% of nonmalignant CNS tumors, with an incidence of 7.86 cases per 100,000 people each year(2,3). In addition to symptoms from the mass effect of the central nervous system, such as headache, patients with meningiomas also experience a variety of neurologic symptoms brought on by the compression of surrounding central nervous system components. As a result, the type of symptoms is directly influenced by the tumor's location. Meningiomas can develop anywhere where there are arachnoid cells, and their locations range from the para-sagittal region to the spine. (8)(4) The management decisions depend on the particular characteristics of each area. (5) For instance, patients with convexity meningiomas are more likely to present with seizures as a baseline symptom compared to skull base meningiomas which result in a higher frequency of headaches, anosmia, ocular deficits, and auditory deficits (6). The surgical care of these tumors has changed to demonstrate better results and decrease mortality and surgical morbidity, but it is still linked to significant morbidity and problems. Microsurgical methods and surgical approaches to these tumors have also improved. (7) This retrospective study aims to investigate how the anatomical location of meningioma affects the postoperative outcomes after its excision. Intriguing, in our opinion, is the analysis of the clinical outcomes of meningioma patients in a setting of developing countries.

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MATERIALS AND METHODS

Pre-operative data from 182 patients were obtained from the patient records at Liaquat national hospital. Every patient who underwent meningioma resection at Liaquat national hospital a minimum of 6 months before the commencement of the study was included. This was done to allow sufficient time for any postoperative outcomes to be clinically apparent. All patients who fit the inclusion criteria were followed up via phone call to assess any improvement or worsening in their functional capabilities after the surgery. If the patient could not be contacted, their postoperative data were obtained from the follow-up clinic files. Every patient whose postoperative data could not be obtained or whose pre-operative data was incomplete was excluded from the study, leaving us with a final pool of 105 patients. 10 patients with spinal meningioma were further excluded during the final analysis: making the final study group of 95 patients. The Karnofsky Performance Scale (KPS) in Figure 1 was used to evaluate a patient's functional capabilities. Apart from biodata, the pre-operative data provided us with the presenting symptoms to calculate the presenting KPS and the anatomical location of the tumor, which was assessed using MRI. An arbitrary classification for the various anatomical locations on the brain was created according to each part's relation to the cranial vault. Spinal meningiomas were excluded from the study. The anatomical classification of meningiomas used in this study and the frequency of each type of meningioma is provided in Figure 2. The symptoms obtained through the follow-up calls were used to assess the postoperative KPS, and the main outcome was evaluated as the change in KPS before and after the surgery. A positive change represents an improvement, while a negative change represents worsening functional capabilities. Further outcomes investigated independent of the KPS were the resolution of the patient's presenting complaints, recurrence of the meningioma, or death. The data was analyzed using the IBM SPSS software for a confidence interval of 95%. Therefore, a P-value of less than 0.05 was considered to be significant. Paired samples t-test was used to compare any significant differences between the mean presenting KPS and the mean postoperative KPS. ANOVA was used to compare any significant difference between the various anatomical categories relative to the change in KPS and the presenting KPS. Fisher's exact test was used for non-numeric outcomes, including recurrence, resolution of presenting complaints, and death.

Characteristics	Score
Normal no complaints; no evidence of disease	100
Able to carry on regular activity; minor signs or symptoms of the disease	90
Normal activity with effort; some signs or symptoms of the disease	80
Cares for self; unable to carry on a regular activity or to do active work	70
Requires occasional assistance, but can care for most of his personal needs	60
Requires considerable assistance and frequent medical care	50
Disabled; requires special care and assistance	40
Severely disabled; hospital admission is indicated, although death is not imminent	30
Very sick; hospital admission necessary; active, supportive treatment necessary	20
Moribund; fatal processes progressing rapidly	10
Dead	0

Fig 1. KPS scale

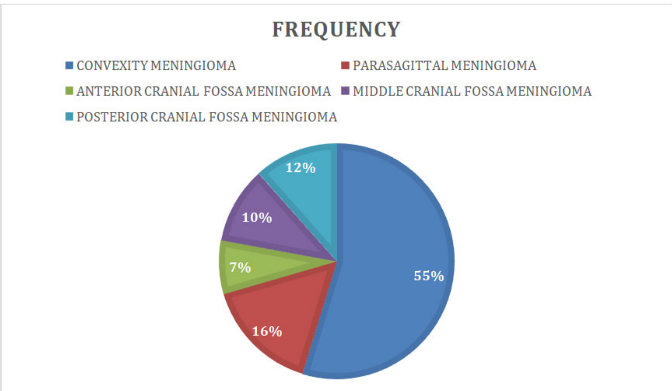

Fig 2. Frequency of meningioma by location

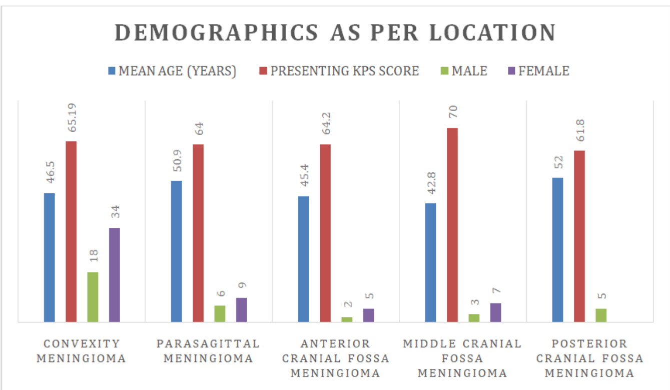

Figure 3. Demographics as per location

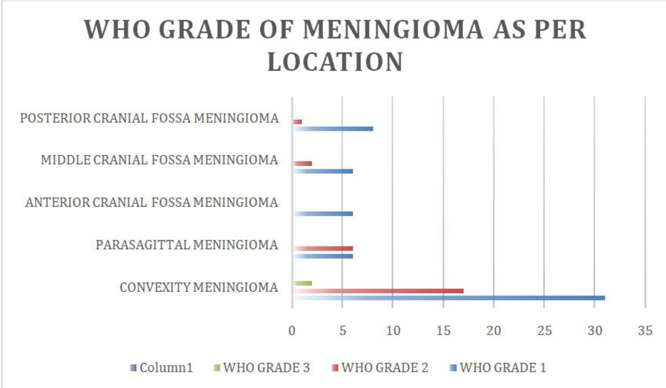

Figure 4. Who grade as per meningioma location

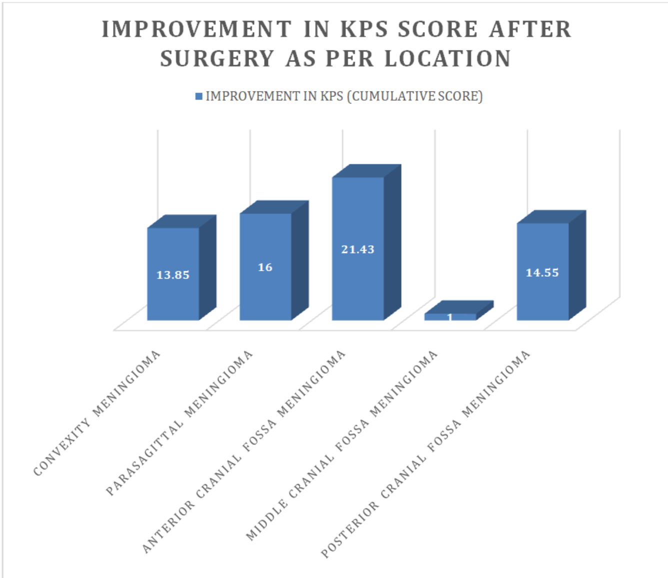

Figure 5. Improvement in kps

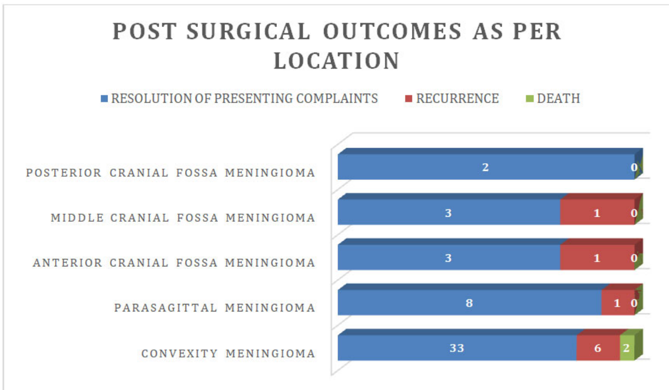

Figure 6. Post-surgical outcomes as per location

RESULTS

Figures 3, 4,5, and 6 are representative of the prevalence of non-numeric outcomes in our study population. Results of the Fisher's exact test (Table 1) show that there is no significant relationship anatomical location of the meningioma does not have a significant relationship to recurrence (P=0.808), resolution of presenting complaints (P=0.104), and death (P=1.000). Although the results of the paired samples t-test (Table 2) reveal an overall statistically significant difference between the mean values of the presenting KPS against the postoperative KPS (P=0.000), the ANOVA results (Table 3) show that there is no significant difference in the change in KPS between the different anatomical classes of the tumor (P=0.126). Although this is not an outcome, our results show a significant difference between the presenting KPS of the various anatomical classes of meningiomas (Table 3) (P=0.001). A posthoc analysis of the presenting KPS ANOVA results (Table 4) displays that in our sample population, the mean presenting KPS of spinal meningiomas (45.00) is significantly worse compared to the means of all the other classifications (P<0.05) barring posterior cranial fossa meningioma (P=0.053).

Table 1. Fischer's test:

	P-value
Recurrence	0.808
Resolution of presenting complaints	0.104
Death	1.000

Table 2. Paired T-test:

	Mean	Standard deviation	P-value
Presenting KPS-Post operative KPS	- 15. 14	23.94	0.000

Table 3. ANOVA

	Mean	Standard deviation	Degrees of freedom	F-value	P-value
Presenting KPS	63.14	14.432	5	4.511	0.001
Change in KPS	15.14	23.944	5	1.770	0.126

DISCUSSION

Meningiomas are the most common brain tumors. They are classified based on histology into 15 different types (9) as well as via grades from 1 to grade 4(10) and location (11). it is generally thought that tumors inaccessible locations have a better prognosis than those at the base of the skull (12). Similarly, meningiomas in eloquent areas are more likely to be symptomatic than non-eloquent meningiomas (13). Clinical presentation of meningioma differs by location (14). Symptoms that are commonly seen are as follows: headache (33.3–36.7%), focal cranial nerve deficit (28.8–31.3%), seizure (16.9–24.6%), cognitive change (14.4%), weakness (11.1%), vertigo/dizziness (9.8%), ataxia/gait change (6.3%), pain/sensory change (5.6%), proptosis (2.1%), syncope (1.0%), and asymptomatic (9.4%)(15-17). usually, skull base meningiomas are more eliptogenic than non-skull base meningiomas (18). Anterior cranial fossa meningiomas (anterior falcine, olfactory groove, or orbitofrontal) are often quite large at presentation and present with impaired vision (54%), headache (48%), anosmia (40%), seizure (20%), psychomotor symptoms, and behavioral disturbance with personality disintegration (19-20). Parasagittal meningiomas can grow considerably before being clinically evident and mostly present with Jacksonian seizures of the lower limbs or headaches. Anterior parasagittal meningiomas are characteristically present with papilledema and homonymous hemianopia. Tuberculum sellae meningiomas usually present with insidious unilateral visual loss, followed by scotomatous defects in the other eye. (21) Lateral sphenoid wing meningiomas often present with painless unilateral exophthalmos, followed by unilateral vision loss. Temporal lobe meningiomas frequently presented with seizures. Petroclival meningiomas can present with ataxia and cranial nerve neuropathies such as trigeminal nerve impairment. Clinoidal meningiomas are often present with a wide variety of visual impairments, cranial nerve palsies, and exophthalmos. Posterior cranial fossa meningiomas can develop obstructive hydrocephalus and present with papilledema and early-morning headache. Peritorcular meningiomas symptoms are commonly caused by compression of the occipital lobe or the cerebellum and present with a headache with occipital localized pain, papilledema, and homonymous field deficits, as well as ataxia, dysmetria, hypotonia, and nystagmus. Spinal meningiomas, most common in the thoracic spine, present with slowly progressive spastic paresis with or without radicular or nocturnal pain. (19-20) Treatment of meningioma is mostly surgical. The goal for surgery is GTR (Simpson I, GTR); however, the ability to achieve this may be limited by various factors, including tumor location, involvement of venous sinuses and neurovascular tissue, and other patient factors affecting the safety of surgery in general(21). These factors influence the decision to pursue surgery, the surgical approach, and the extent of resection (22). The extent of resection, defined by the Simpson grade, heavily impacts the recurrence rates for surgically treated meningioma of all WHO grades, and so does the location (23). FIGURE 4 shows a case of surgical management of meningioma.. currently, no chemotherapeutic agent is approved for use in meningioma(24), and radiotherapy is an adjunct to surgery (25).

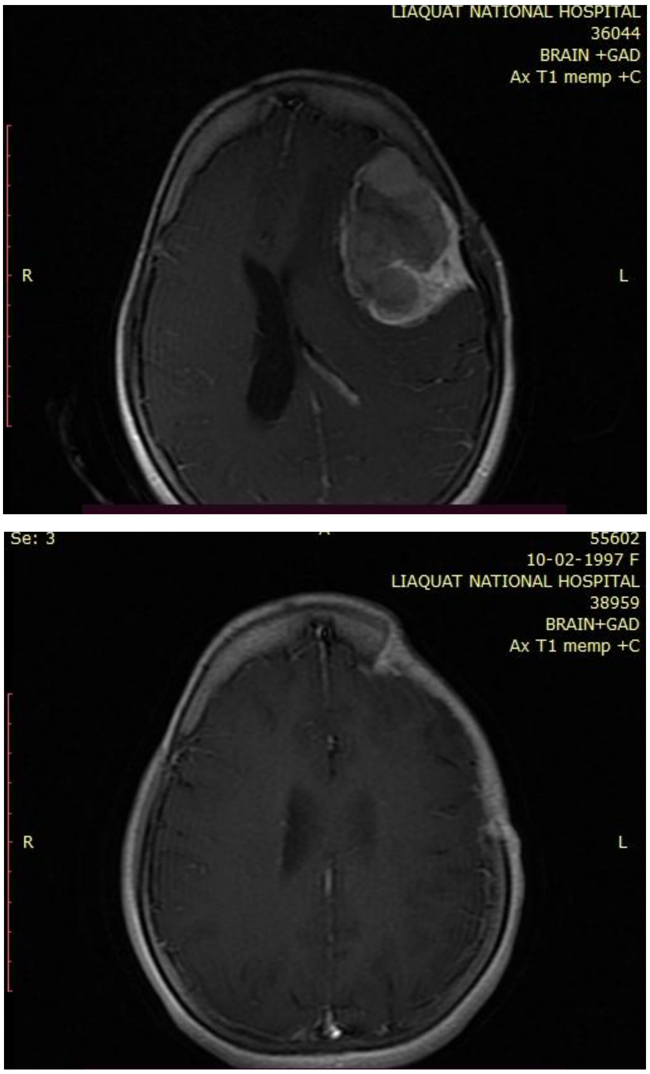

Figure 4. showing pre and post-operative images of convexity meningioma

There is a lack of information on the long-term functional outcomes of meningioma patients, which is especially concerning given the high incidence of meningiomas in routine neurosurgical practice. This is in stark contrast to outcome parameters such as the extent of resection (EOR), complications, predictors of overall survival (OS), progression-free survival (PFS), and EOR. Impaired health-related quality of life (HrQoL) and functional disability (FD) in meningioma patients are topics of considerable attention. According to the World Health Organisation, the standard indicators of quality of life (QoL) relate to the environment, education, leisure time, and physical and mental health. Quality of life (QoL) is multifactorial, taking into account the culture and value systems in which patients live concerning their goals. Our study aimed to find a relationship between the location of the tumor and its impact on outcomes (using the KPS score), if present. It was seen that larger size correlated with increased edema and mass effect (26)(27). a study done by Daniel showed a correlation between the histology of the 15 histopathological varieties of meningiomas and the predilection site of appearance as well as certain demographic aspects, such as sex (28).

Meningiomas are more common in convexity and parasagittal regions, where their growth patterns may be impacted by the fact that there is only one plane of bone structures, although they are not a limiting factor for growth or expansion. Additionally, cortical gyri, sulcus, parenchyma, and vascular structures are much more malleable to compression. This may help explain why this tumor location is diagnosed later than the skull base and/or spinal cord. The symptoms in these two locations typically manifest earlier because bone structures surround multiple anatomical planes, and structural compression and parenchymal or nerve compromise occur earlier. (29) Surprisingly, shorter space and bone structures act as growth inhibitors for meningiomas of the skull base and spinal cord. They might have a lower risk of non-benign meningiomas because their oxygen supply may not be compromised for a long enough period to allow for hypoxia adaptation. According to a study by Hashimoto et al., meningioma tumors at the base of the skull grow more slowly than those at other intracranial sites. (30) However, in our study, tumor location didn't correlate with the recurrence rate, outcome, mortality, or resolution of symptoms.

Conclusion

Even though meningioma resection seems to improve patients' functional capabilities overall, the tumor's location does not seem to play a significant role in this. Recurrence, resolution of presenting complaints, and death after meningioma resection do not seem to be impacted by the location of the tumor either.

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