RESEARCH ARTICLE

Meningioma — defining characteristics of the affected Pakistani population

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Abstract

Objective: To ascertain the age and gender differences, treatment, and management of meningiomas across Pakistan.

Methods: Data were collected as part of the PBTES, and patients with a histopathological diagnosis of an intracranial meningioma in 2019 that presented at these centres were included in this cohort study sub-analysis. Thirty-two centres participated in the study. Medical students, residents, and faculty collated data from medical records.

Results: Our data indicate that meningiomas constitute 15.6% of all intracranial tumours in Pakistan and occur more often in females (236, 55%) than in males. The mean age at diagnosis was 43.7 ± 19.9 years. Meningiomas had a slightly higher preponderance in the right hemisphere of the brain at 203 (47.32%) tumours and 267 (62.2%) of the tumours in the frontal and parietal lobes. We found that 174 (61.3%) of all meningiomas diagnosed in Pakistan in 2019 were grade I tumours, which was also the most commonly occurring tumour grade. Adjuvant chemoradiotherapy for meningiomas was rarely observed in Pakistan.

Conclusion: The PBTES reveals a low hospital-based incidence of meningiomas in 2019 when compared to the incidence in high-income countries but found evidence similar to those of other LMICs. Tumour characteristics, such as location, grading and surgical procedures, were similar to global literature.

Keywords: Meningioma, Chemoradiotherapy, Brain Neoplasms, Epidemiology, Gender traits.

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Introduction

Globally, meningiomas are the most common type of primary brain tumour and, although benign, if left untreated, can grow, and affect various brain regions and cause debilitating disease.[1] According to the Central Brain Tumour Registry of the United States (CBTRUS), between 2014 and 2018, meningiomas accounted for 39% of all brain tumours and 54.5% of non-malignant brain tumours and occurred more frequently in females than in males.[2] The conventional first-line treatment for meningiomas is surgical resection of the tumour. However, under certain circumstances, a watchful waiting approach can also be employed.[3] Where watchful waiting is appropriate, regular clinical and MRI follow-ups are required to monitor tumour progression.

In Pakistan, Ahsan et al. carried out a single-centre study investigating patients with primary brain tumours over a 5-year period and found that meningiomas were most common in the frontal and parietal lobes, were overwhelmingly grade I tumours, affected females more than males.[4] A tertiary hospital in Peshawar carried out a study of CNS tumours presenting within a six-year period between 2008 and 2012. They found that meningiomas were the second most common tumour being diagnosed between the ages of 22 and 65 and were largely grade I tumours. However, these studies only reviewed cases from individual hospitals and do not provide generalizable findings.

To address the evidence and knowledge gap in brain tumour epidemiology, The Pakistan Association of Neuro-oncology (PASNO) conducted a retrospective, cross-sectional study known as the Pakistan Brain Tumour Epidemiology Study (PBTES). Data of patients admitted at participating major medical facilities in Pakistan in 2019 were collected. From this study, we found that meningiomas were the second most common type of brain tumour being surgically treated in Pakistan and therefore warranted a separate analysis of patient characteristics and treatment strategies. In this paper, we aim to understand the sociodemographic characteristics, treatment and management of meningiomas in Pakistan. This will subsequently help to inform policy and recommend treatment strategies for intracranial

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meningiomas.

Methods

Data were collected as part of the PBTES, and patients with a histopathological diagnosis of an intracranial meningioma in 2019 that presented at these centres were included in this cohort study sub-analysis. The thirty-two centres included were the highest volume centres in the country and had dedicated neurosurgical facilities. Data on patient demographics and medical and social history, surgical resection, and adjuvant treatment were recorded.

Table-1: Fossae Categories.

Anterior Cranial Fossa	Anterior Skull Base
	Olfactory Groove
	Sellar
	Suprasellar
	Parafalcine
	Parasaggital
Middle Cranial Fossa	Sphenoid Wing
	Falcotentorial
	Tentorial
	Petrous
Posterior Cranial Fossa	Cerebellar
	Foramen Magnum
	Cerebellopontine Angle
	Clival

Students, residents, and faculty from each participating centre collated data from medical charts and electronic health records.

SPSS Version 25.0 and STATA Version 16.0 were used to analyse descriptive epidemiological data and determine age and gender distribution, extent of surgical resection, and the frequencies of tumour grade and location. Meningiomas were grouped by location as frontal, temporal, occipital, parietal, anterior cranial fossa, middle cranial fossa, posterior cranial fossa, midline, sellar, orbital and intraventricular. The fossae were categorized in Table-1.

Results

In Pakistan, the PBTES found that meningiomas are the second most common type of brain tumour, with 429 (15.6%) cases being reported in 2019. The mean age at diagnosis was 43.7 ± 19.9 years, and 236 (55%) females and 193 (45%) males were diagnosed. This accounted for 20.7% of all females diagnosed with a brain tumour and 12% of all males diagnosed with a brain tumour. Both males and females predominantly presented between 36 and 44 years of age. Most cases were diagnosed between the ages of 20 and 54, with a marked peak in the 35-to-44 age range. Figure-1 depicts the differences in gender and age at diagnosis in more detail.

Table-2: Meningioma Location Distribution.

Location	Frequency	%
Frontal	139	32.40
Temporal	29	6.76
Parietal	128	29.84
Occipital	30	6.99
Anterior Cranial Fossa	25	5.83
Middle Cranial Fossa	45	10.49
Posterior Cranial Fossa	62	14.45
Midline	23	5.36
Sellar	19	4.43
Orbital	5	1.17
Intraventricular	1	0.002

Table-3: Meningioma Grade and Laterality.

		n	%
Tumour Grade	Grade I	174	61.3
	Grade II	99	34.9
	Grade III	11	3.9
Tumour Laterality	Right	203	47.32
	Left	155	36.13
	Midline	51	11.89

The surgical procedures for 405 (94.4%) meningioma patients were recorded, and gross total resection was achieved for 312 (72.2%). Other procedures included biopsies, subtotal resections, cerebrospinal fluid diversions and craniotomies (not otherwise specified). Figure-2 elaborates on the surgical procedures carried out

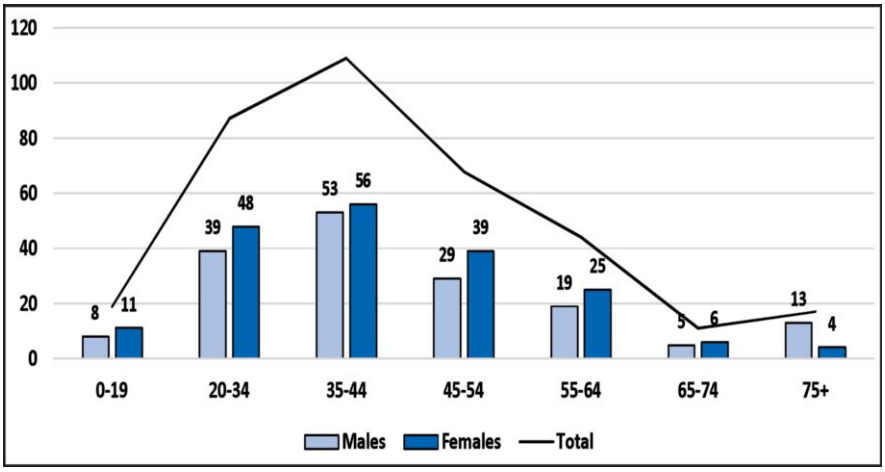

Figure-1: Meningioma Age Distribution by Gender.

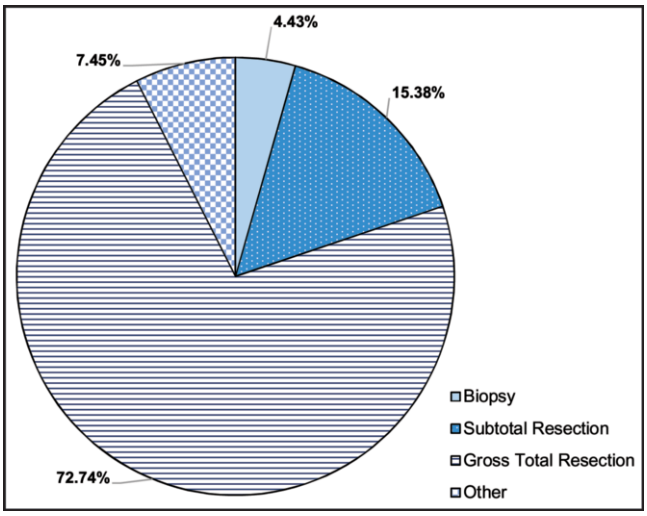

Figure-2: Extent of Resection.

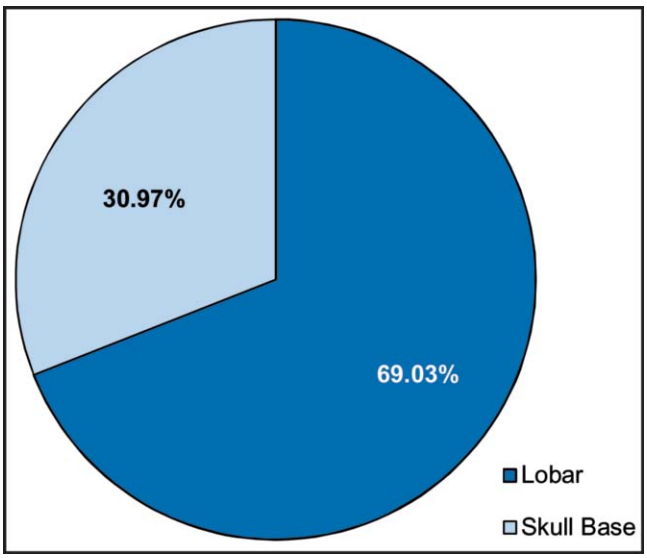

Figure-3: Meningioma Location.

in Pakistan for meningiomas.

Of the 429 intracranial meningiomas reported, only 284 (66.2%) of them were further classified by grade. Meningiomas operated on in Pakistan are largely benign grade I (n = 174, 61.3%), followed by grade II (n = 99, 34.6%) and grade III (n = 11, 3.9%) tumours. It is important to note that the grades for 145 out of 429 (33.8%) meningiomas were not reported.

Tables-2 and 3 show that the tumours had a slightly higher preponderance in the right hemisphere of the brain 203 (47.32%) and 267 (62.2%) tumours were in either the frontal or parietal lobe.

Only one(0.002%) patient was known to have received chemotherapy, and 27(6.29%) patients received radiation

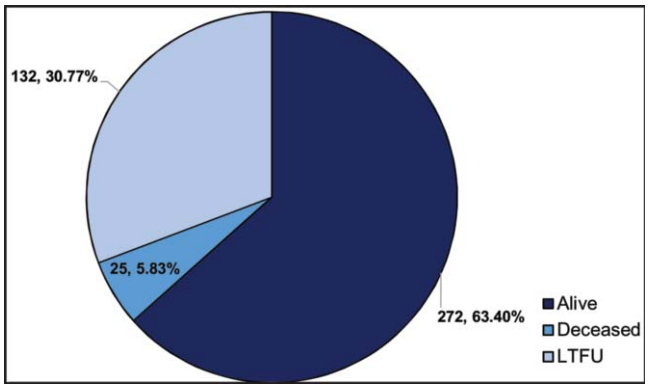

Figure-4: Current Status.

therapy. Of these, 8(29.63%) had grade I meningiomas, and 11(40.74%) had grade II meningiomas. Radiation therapy was not reported for any patients with known grade III meningiomas. The grades of 8(29.63%) meningiomas that received radiation therapy were not specified. The remaining 401 (93.47%) patients did not have adjuvant treatment data recorded, so their post-surgical care and management were unknown.

Medical records show that 272 (63.40%) of the meningioma patients that presented in 2019 were alive at the time of data collection (Figure-5). However, 132 (30.77%) of these meningioma cases were lost to follow-up, and their survival outcomes have not been documented. The date of death for deceased patients was only reported for two patients.

Discussion

Our data indicate that meningiomas constitute 15.6% of all intracranial tumours in Pakistan and occur more often in females (55%) than in males. The mean age at diagnosis was 43.7 ± 19.9 years. Most tumours were located in the right hemisphere and occur predominantly in the frontal and parietal lobes. We found that 61.3% of all meningiomas diagnosed in Pakistan in 2019 were grade I tumours, which was also the most commonly occurring tumour grade.

CBTRUS reports that meningiomas constitute 39% of all tumours diagnosed between 2014 and 2018.[2] In Georgia, a population-based study found that 45.2% of all brain tumours were diagnosed as meningiomas.[5] Between 1994 and 2013, the Girona Cancer Registry in Spain found that 28.1% of all tumours were meningiomas.[6] In France, tumours of the meninges accounted for 32.5% of all diagnosed intracranial tumours between 2006 and 2011.[7] These are all findings from UMICs and HICs, which have developed health systems.

The Iran National Cancer Registry, on the other hand,

reported that between 2010 and 2014, a mere 2.17% of all brain and CNS tumours were tumours of the meninges.[8] They also found that women were more likely to develop meningiomas compared to men. Our findings are in line with this, as PBTES data shows that women are also more likely to be diagnosed with meningiomas in Pakistan. A review of CNS tumours in Africa, which predominantly consists of LICs and LMICs, also shows a relatively low distribution of meningiomas, at 22.2%.[9] The review cited underdeveloped health infrastructure that is characteristic of low-income countries for the comparatively low brain tumour rate. This inference provides strength to our argument that Pakistan, as an LMIC, may not actually have low rates of meningioma, but in fact, meningiomas may be going undetected in the country. Despite the low hospital-based incidence that PBTES found, it is necessary to strengthen health systems and spread awareness of meningioma symptoms, diagnosis and treatment among the population.

Meningioma Diagnosis and Hormonal Changes: Previous studies conducted on risk factors for meningioma have shown a positive association between menopause and the risk of meningioma.[10] A study conducted in 2020 in Pakistan suggests that the range for which women hit menopause is between 43.81 And 52.11 years (mean = 47.96 years).[11] Our findings indicate that the mean age at diagnosis is 43.7 ± 19.9 years, indicating a clear overlap between the mean age at diagnosis and the range between when women go through menopause. Through PBTES, our findings show that the male-to-female ratio for meningiomas is 0.89. According to CBTRUS, the United States has a male-to-female ratio for meningiomas of 0.6, indicating similar results between our findings and large, established databases.[2]

Meningioma Location, Grade and Laterality: A study conducted on meningioma location in the United States showed findings similar to those in PBTES 2019. Convexity meningiomas in the right hemisphere were reported in 20.8% of all patients — this was the most common tumour location.[12] In Pakistan, our findings also suggest that the lobes were the most common tumour loci. This study also found that the most common grade was a grade 1 meningioma, which is similar to our findings. This indicates that the tumours that we have been able to detect and treat were largely benign. Liouta et al. found that patients with left hemisphere lesions performed worse on neurological exams and showed greater verbal deficits than those with right hemisphere lesions post-surgical resection.[13] This indicates that right-sided lesions may be more commonly operated on due to the decreased risk of affecting executive functions such as speech and motor skills.

Conclusion

The PBTES reveals a low hospital-based prevalence of meningiomas in 2019 when compared to the prevalence in high-income countries but found evidence similar to those of other LMICs. Tumour characteristics, such as location, grading and surgical procedures echoed those of findings from the high-income countries, while risk factors due to sex and hormonal changes were also in-line with the global literature. Frequent and thorough reporting and regular screenings will ensure early diagnosis and timely treatment for meningiomas in Pakistan.

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Conflict of Interest: None to declare.

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