Short Survey

An Audit of Histopathological Cases of Spinal Cord Tumor in a Single Tertiary Care Hospital

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ABSTRACT

OBJECTIVE: To determine the frequency of different spinal cord tumor subtypes across age and gender groups.

METHODOLOGY: A retrospective study was conducted at the Pathology Department of the Basic Medical Sciences Institute, JPMC Karachi, between October 2019 and September 2022. All spinal cord tumor specimens submitted for histological assessment were included in the research. The age, gender, and histological results of the samples were considered while reviewing them in detail.

RESULTS: A total of 25 cases of spinal cord tumors were examined, according to this study. The most common histopathological spinal cord tumors are Meningioma, followed by Astrocytoma. Patients with spinal cord tumors ranged in age from 7 to 65 years old, with a mean age of 37. The findings of this study show that with a male-to-female ratio of 0.4:1, spinal cord tumors are more common in females than in males.

CONCLUSION: Meningioma 13 (7.2%) and astrocytoma 3 (1.7%) were the most common types of spinal tumors observed. Patients with spinal tumors are more likely to be in their 30s, and they also tend to be more prevalent in women.

KEYWORDS: spinal cord, tumor, Astrocytoma, Meningioma, histopathology, CNS.

INTRODUCTION

A substantial subgroup of central nervous system (CNS) cancers are spinal cord tumors, a broad category of neoplasms that develop inside or close to the spinal cord. The two main types of these malignancies are primary tumors, which originate from cellular components of the spinal cord, meninges, or vertebral structures, and secondary (metastatic) tumors, which spread from extracranial sources through hematogenous pathways such as the Batson plexus[1,2]. Astrocytomas and ependymomas are examples of primary spinal tumors, while metastatic lesions usually affect the vertebral column and have the ability to penetrate or compress the spinal cord[3].

Primary spinal cord tumors are very uncommon but clinically significant because of their potential to cause neurological damage. The frequency of spinal cord tumors varies throughout the world. Compared to adults, spinal cord tumors are more common in pediatric populations, with juvenile tumors frequently manifesting earlier and displaying unique biological features[3,4]. Their link to significant morbidity, neurological impairments, and higher healthcare utilization highlights the burden of these neoplasms and their significance for both clinical and public health.

Because spinal cord tumors can result in neurological abnormalities, diminished functional capacity, and a shorter life expectancy, controlling them presents additional clinical hurdles. The location of the tumor and the fragile surrounding brain systems frequently limit the effectiveness of treatment; therefore, careful diagnostic and therapeutic approaches are required[5]. Additionally, ionizing radiation exposure has been linked to the development of CNS cancers, highlighting the significance of careful radiological procedures and surveillance[6].

Even with continuous progress, there are still a lot of unanswered questions about the pathogenesis, epidemiology, and best practices for treating spinal cord tumors, especially in environments with limited resources. To guide clinical practice and enhance patient outcomes, more research is needed, as evidenced by the scarcity of comprehensive national and regional data. To improve understanding of spinal cord tumours' effects and inform future treatment approaches, this study aims to clarify their epidemiological profile, clinical characteristics, and management outcomes.

Purpose of the study

Study data was collected from the Pathology Department, B.M.S.I, JPMC Karachi. The study aimed to determine the frequency of different types of spinal cord tumors in a single tertiary care hospital.

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METHODOLOGY

A retrospective study was conducted at the Pathology Department, JPMC Karachi, and the Basic Medical Sciences Institute between October 2019 and September 2022. Out of the 180 CNS tumors received, 25(13.9%) spinal cord tumor specimens submitted for histological evaluation during the study period were analyzed. Before the study was conducted, the Ethics Committee approved it.

The study covered all individuals with space-occupying lesions (SOL) in the spine. Specimens were fixed in 10% formalin in compliance with recognized standards, and the biopsy sample was processed and paraffin-embedded. Histopathological sections 3–4 µm thick were obtained, and hematoxylin and eosin staining were used to visualize the cells. Specific histopathological criteria, which usually entail microscopic analysis of tissue samples to determine the tumor kind and features, were used to confirm the diagnosis. Two pathologists used a light microscope to examine the sections and diagnose the pathology. The age and gender of the patients were disclosed in the early surgical biopsy reports.

Inclusion Criteria: Histologically confirmed CNS tumor specimens that were properly formalin-fixed and paraffin-embedded.

Exclusion Criteria: Poorly fixed tissues, samples with insufficient material or degradation, and tumors other than Astrocytoma were excluded to ensure data quality and focus on the target tumor type.

Statistical Analysis

Data were analyzed using SPSS 23.0. Descriptive statistics, including means ± standard deviations for continuous variables and frequencies with percentages for categorical variables, were initially calculated to summarize the data. To examine associations between categorical variables, the Chi-Square test was employed. Differences among group means for continuous variables were assessed using One-Way ANOVA. A significance level of $p < 0.05$ was adopted for all statistical tests.

RESULTS

The study findings demonstrate a clear predominance of Meningioma within the studied population, underscoring the importance of tumor type distribution in clinical assessment and diagnosis. Although spinal tumors were more frequently observed in females, with a male-to-female ratio of approximately 0.4: 1, statistical analysis showed that gender did not significantly influence tumor type distribution ($P = 0.43$), this suggests that while tumors are more common in females overall, gender alone may not be a key determinant in the specific types of spinal tumors encountered.

Furthermore, age-related analysis revealed notable differences among tumor types. The one-way ANOVA indicated a statistically significant difference in patient age across tumor categories ($P = 0.005$). For example, Ganglioglioma was identified predominantly in young children at a mean age of 7 years, while metastatic neoplasia was more common in older adults at an average age of 62 years. These findings highlight the tendency of certain tumors to occur within specific age groups, which can aid clinicians in diagnosis and in individualize treatment strategies.

Overall, these results emphasize the importance of demographic factors, such as age and gender, in understanding spinal tumour patterns. Recognizing tumor prevalence and age distribution can improve diagnostic accuracy and facilitate tailored management, ultimately enhancing patient outcomes. Further research is warranted to investigate the underlying factors influencing these distribution patterns and their clinical implications.

Table I displays the distribution of spinal cord tumor types, with Meningioma being the most prevalent, accounting for 52% (13 cases). Astrocytoma and Ependymoma each represented 12% of the cases (3 cases). The Chi-Square test revealed a highly significant difference in the distribution of tumor types, with a P-value of less than 0.0001, indicating that the observed variation is unlikely due to chance.

Table I:

All Morphological Types of Spinal Cord Tumors

Diagnosis	Number of spinal cord tumors (%)
Meningioma	13(52)
Astrocytoma	3(12)
Ependymoma	3(12)
Schwannoma	2(8)
Chondrosarcoma	1(4)
Ganglioglioma	1(4)
Metastatic neoplasm	1(4)
Neurofibroma	1(4)
Total	25(100)

Table II displays the distribution of spinal cord tumors by gender. Meningioma, Astrocytoma, Schwannoma, Chondrosarcoma, Metaplastic neoplasm and Neurofibroma were more prevalent in females, whereas Ependymoma and Ganglioglioma were more common in males. The Chi-Square test yielded a P-value of 0.43, indicating no statistically significant difference in tumor distribution between genders. Overall, spinal tumors were more frequently observed in females, with a male-to-female ratio of approximately 0.4:1.

Table III displays the age distribution of patients with various spinal cord tumors. The mean ages for specific tumor types were as follows: Ganglioglioma at 7 years (SD=±... not specified, please add if available), Ependymoma at 18 years (SD=±6), Schwannoma at 26 years (SD=±6), Astrocytoma at 30 years (SD=±14), Meningioma at 46 years (SD=±12), Neurofibroma at 45 years, Chondrosarcoma at 30 years and Metastatic neoplasia at 62 years. The

overall age range of the 25 patients was 7–65 years, with a mean age of 37 years (SD=±16). One-way ANOVA revealed a statistically significant difference in age among the tumor types (P of 0.005).

Table II: Types of Spinal Cord Tumor by Gender

Diagnosis	Gender				M: F
	Male		Female		
	N	%	N	%	
Meningioma	3	1.7	10	5.6	1:0.2
Astrocytoma	1	0.6	2	1.1	0.5:1
Schwannoma	0	0.0	2	1.1	0:1
Chondrosarcoma	0	0.0	1	0.6	0:1
Ependymoma	2	1.1	1	0.6	1:0.5
Ganglioglioma	1	0.6	0	0	1:0
Metastatic neoplasm	0	0.0	1	0.6	0:1
Neurofibroma	0	0.0	1	0.6	0:1
Total	7	4	18	10.2	0.4:1

Table III: Types of Spinal Cord Tumors by Age

Diagnosis	N	%	Age in years			
			Mean	SD*	Min.	Max.
Meningioma	13	52	46	12	30	65
Astrocytoma	3	12	30	14	14	38
Ependymoma	3	12	18	6	11	23
Schwannoma	2	8.0	26	6	21	30
Chondrosarcoma	1	4.0	30		30	30
Ganglioglioma	1	4.0	7	--	7	7
Metastatic neoplasia	1	4.0	62	--	62	62
Neurofibroma	1	4.0	45	--	45	45
Total	**25**	**100**	**37**	**16**	**7**	**65**

**Note: SD cannot be calculated in the case of (n=1). The standard deviation is substantial because of the large range of minimum and maximum age differences.*

DISCUSSION

Of the 180 CNS malignancies in our investigation, 25 involved the spinal cord. Consistent with the present investigation, cross-sectional retrospective research conducted in Nepal over 4 years documented 138 cases, of which 25 were spinal tumors[7]. Shrestha A 2020[8] reported that within 8 years, 12% of cancers develop in the spinal cord; this figure is closer to our study.

Our research indicates that Meningioma 13(52%) was the most prevalent tumor in the spinal cord, followed by Astrocytoma 3(12%), and Ependymoma 3(12%) came next. Meningioma was the most prevalent spinal cord tumor, according to the Indian study, which is consistent with our findings[9]. Conversely, another study discovered that the most pervasive spinal tumors were Schwannomas[8].

In both studies, the percentages of tumors in the spinal cord were not stated. Additionally, a recent study shows that women who have a ratio of men to women of 0.4:1 are at a higher risk of developing spinal cord malignancies. With a ratio of men to women of 0.6:1, spinal cord tumors are more common in women, per a related previous study conducted at B.M.S.I, JPMC Karachi[10]. Contrary to our findings, the male-to-female ratio of 2.1:1 indicated that spinal cord tumors were more common in males[11].

According to present research, the average age of patients with tumors of the spinal cord is 37. The mean age of the research was not specified, but a prior study from the JPMC also shows that individuals between the ages of 31 and 40 are more likely to have spinal cord tumors[10].

In the current study, 13 (52%) Meningioma was identified in spinal cord tumors, with 3(1.7%) male and 10(5.6%) female. The age range is thirty to sixty-five years old. Similarly, an Indian study reveals that Meningioma was the most prevalent kind of spinal cord tumor[9].

In the present research, there were 3 cases of Astrocytoma (12%), including 1 male case (0.6%) and 2 female cases (1.1%), with a maximum age of 38 and a minimum of 14. According to (Grimm & Chamberlain et al., 2009), gliomas account for 80% of spinal cord tumors, with Astrocytoma making 30% to 40% of cases[12].

Three cases of Ependymoma (12%) with a minimum age of eleven and a maximum age of twenty-three were identified in our investigation; two of the cases (1.1%) were male, and one of the cases (0.6%) was female. A study found that gliomas account for 80% of spinal cord tumors, with 60–70% of these being ependymomas[12].

In our study, only two (8%) female patients were diagnosed with Schwannoma. One was thirty years old, and the other was twenty-one. According to an Indian investigation, 8 (5.2%) of the tumors that were revealed to be Schwannoma were spinal tumors, which is higher than our study[8].

In our investigation of spinal cord malignancies, 1 (4%) case of metastatic neoplasia was also discovered; the patient was a 62-year-old woman. Since all pertinent immunohistochemistry results were negative, an exact diagnosis cannot be made. A study by Shrestha A 2020[8] found that over the 8-year trial, 3.38% of patients with CNS tumors developed metastatic tumors; this number is greater than our study due to the extended study length, and the inclusion of all CNS tumors.

An uncommon and severely epileptogenic tumor, Ganglioglioma (GG) accounts for around 1.3% of primary brain tumors[13]. 1 (4%) Ganglioglioma in the spinal cord was discovered in the current investigation; the patient was a 7-year-old male. Since these tumors are rare, no studies have been found to

support the association.

According to the current investigation, one 45-year-old female patient with Neurofibroma (4%) had spinal cord involvement. The research discovered that 6 (3.9%) of the spinal tumors had a diagnosis of Neurofibroma[8]. Intracerebral mesenchymal tumors account for less than 0.16% of all intracranial cancers[14]. Orguc S 2014[15] found that 3-12% of chondrosarcomas originate in the spine. A 30-year-old female patient with a single (4%) case of Chondrosarcoma has been found among spinal cord malignancies in this study. The diagnosis is based solely on histopathology; no association was found with radiological films or clinical data.

CONCLUSION

The most frequent spinal cord tumors identified in this study are Meningioma, Astrocytoma, and Ependymoma. The results indicate that spinal tumors are more prevalent in adults and adolescents, with a higher incidence in women. These findings underscore the importance of considering age and gender in the diagnosis and management of spinal cord tumors. Given the limited existing research, there is a critical need for further studies to deepen our understanding of the epidemiology, risk factors, and optimal treatment strategies. Such research is essential for improving patient outcomes and developing more targeted and effective therapies.

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AUTHOR CONTRIBUTION

Bashir P: Devised the idea and wrote the manuscript.
Rahat N: Write up and proofread
Shahzad H: Tabulation and proofreading
Jalbani A: Editing, statistics and data collection.
Siraj F: Literature search and data collection
Amir E: Literature search and statistical analysis.

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