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Histopathological spectrum of primary spinal cord tumors: A retrospective study

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Abstract
Introduction: Primary spinal cord tumors are one of the rarest categories of tumors, representing about 4-16% of all tumors arising from the CNS. Spinal lesions relate to epidural space's spinal tissues, which involve spinal meninges, spinal nerve roots and spinal cord. It commonly affects the thoracic region. Spinal cord tumors can be classified according to their anatomical locations as Extradural and intradural. Intradural tumors can be further classified as extramedullary and intramedullary. Clinical history, radiological features and pathological examination are required to diagnose spinal tumors.
Aims & objectives: To study incidence, morphological features of various Spinal tumors at tertiary care hospital. To study age, sex and location wise distribution.
Methodology: Received resected specimens and biopsies of spinal cord tumors in histology section of our department. All the specimens were fixed in 10% buffered formalin and processed by routine paraffin method. Haematoxylin & Eosin stained sections were studied microscopically.
Results: This study was undertaken from May 2023 to May 2024 and the total cases encountered were 71 with males constituting 25(35%) and females constituting 46(65%) cases. The distribution of spinal tumors based on anatomical locations, 23(32%) intramedullary, 38(54%) intradural extramedullary, 10(14%) cases extradural. The tumors include Meningiomas 30(42%), Ependymomas 19(26%), Neurofibroma 10(14%), schwannomas 7(10%), Astrocytomas 1(2%) case and others (6%) which includes 1 Ganglioglioma, 2 Ewing's sarcomas and 1 case of hemangioblastoma.
Conclusion: The most common primary spinal tumor was meningioma followed by ependymoma, neurofibroma, schwannoma, astrocytoma and others. Most common symptom was motor weakness followed by pain, bladder dysfunction and sensory loss. All differential diagnosis of spinal tumors are kept in mind as correct diagnosis helps in the treatment and prognosis.

Keywords: Spinal cord tumors, ependymoma, meningioma, schwannoma, astrocytoma, ganglioglioma, Ewing's sarcoma, hemangioblastoma

Introduction
Primary spinal cord tumors constitute 10-15% of all primary Central Nervous System tumors. Spinal cord tumors can be classified according to their anatomical location: Intramedullary tumors arise within the spinal cord itself. Most primary intra medullary tumors are either Ependymomas or Astrocytomas. WHO grade I and II are considered as benign and grade III and IV are malignant. Ependymomas are the most common glial tumors in adults, whereas Astrocytomas are the most common intramedullary tumor in children [2, 4]. Intradural-extramedullary tumors arising within the dura but outside the actual spine.
The most common tumors in this group are meningiomas and nerve sheath tumors [3]. Of these meningiomas are most common followed by neurofibroma. Other lesions include hemangioblastoma, paraganglioma and cystic lesions. Extradural tumors account for less than 25% of primary spinal tumors and mainly include meningiomas and metastatic lesions.
Primary spinal cord tumors commonly present with following symptoms: Muscle weakness, Back or Neck pain, Bladder dysfunction, Sensory disturbance, Spinal tumors can be treated with medications, surgery, radiation or combination of treatments.

Aims and objectives
To study the incidence of primary spinal tumors at Tertiary Care Hospital.
To study the morphological features of spinal tumors.
To study the relative incidence of various spinal tumors.
To study age, sex and location wise distribution.

Materials and Methods

This retrospective study includes all the resected specimens and biopsies of spinal cord tumors received at histology section of our department from May 2023 to May 2024. Relevant clinical data and imaging details were also reviewed. Cases arising from spinal cord were included, cases secondarily extending to spinal cord from vertebrae and cases with insufficient data were excluded. All the specimens were fixed in 10% buffered formalin for 24 hours. Bony parts were decalcified in HNO_3. Thorough gross examination for its size, shape and consistency was done. Several representative areas of tissue were taken from received surgical specimens and subjected to routine paraffin embedding. Hematoxylin & Eosin staining was done in all cases and examined under microscope.

Results and Observations: In our study, total cases encountered were 71 with males constituting 25 cases (35%) and females constituting 46 cases (65%). Tumors presented in my study includes Meningiomas 30 cases (42%), Ependymoma 19 cases (26%), Neurofibromas 10 cases 14%), Schwannomas 7 cases (10%), Astrocytoma 01 cases (2%) and others (6%) which includes 1 case of Hemangioblastoma, 1 case of Ganglioglioma, 2 cases of Ewing's sarcomas**.**

Table 1: Gender wise distribution

Tumor type	Males	Females	Total cases
Meningioma	9	21	30(42%)
Ependymoma	8	11	19(26%)
Neurofibroma	4	6	10(14%)
Schwannoma	3	4	7(10%)
Astrocytoma	0	1	1(2%)
Others	1	3	4(6%)

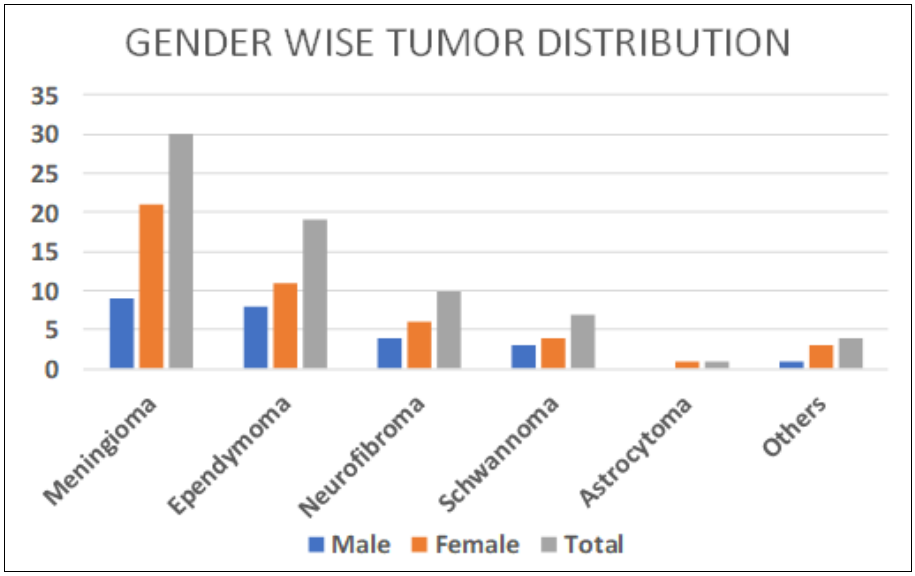

Fig 1: Gender wise distribution

Age wise distribution

Most tumors are encountered in 21-30 years of age, followed by 31-40 years and less numbers of cases are seen in 51-60 years and above 60 years.

Table 2: Age wise distribution

Age (Years)	Number of cases
0-10	6
11-20	10
21-30	25
31-40	17
41-50	9
51-60	2
>60	2

Location wise distribution

Based on location in relation to spinal cord they are divided into intramedullary tumors constitute 23 cases (32%), intradural extramedullary constitute 38 cases (54%) and extradural constitute 10 cases (14%) (Table 3).

Table 3: Location wise distribution

Location	Number of cases
Intramedullary	23(32%)
Intradural extramedullary	38(54%)
Extradural	10(14%)

Site wise distribution

In relation to site, they constitute, cervical 14 cases (20%), thoracic 40 cases (56%) and lumbo-sacral 17 cases (24%) (Table 4).

Table 4: Site wise distribution

Site	Number of cases
Cervical	14(20%)
Thoracic	40(56%)
Lumbo-sacral	17(24%)

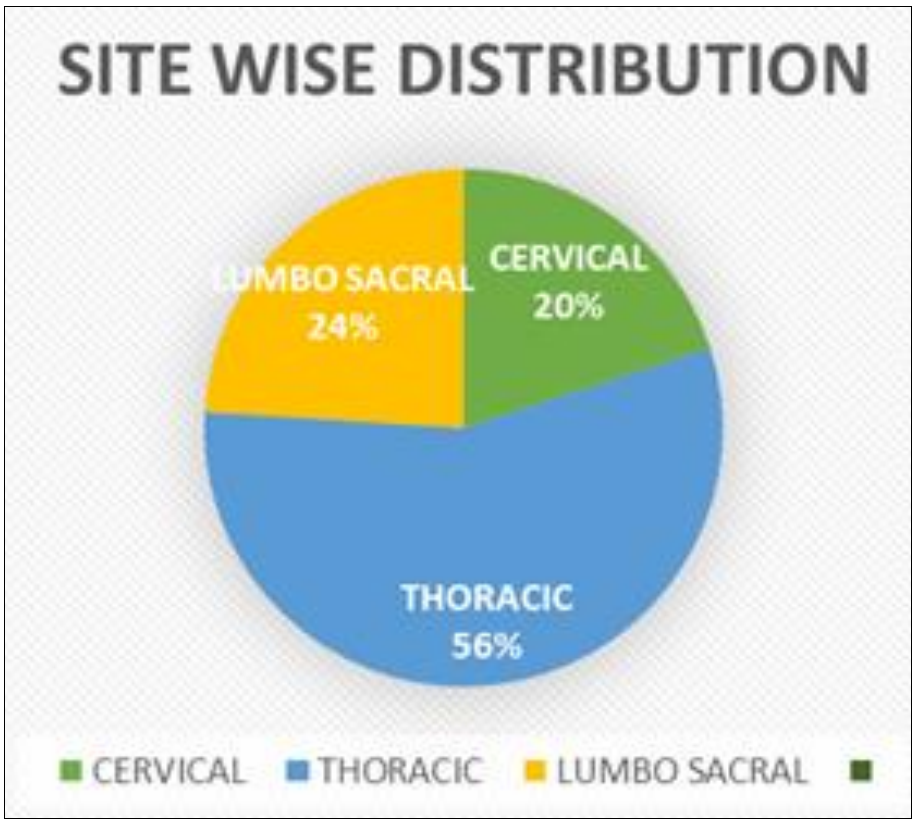

Fig 2: Site wise distribution

Symptoms wise distribution

Most common symptom was motor weakness followed by pain, bladder dysfunction and sensory disturbance.

Table 5: Symptoms wise distribution

Symptoms	Number of cases
Motor Weakness	45(63%)
Pain	21(30%)
Bladder Dysfunction	3(4%)
Sensory Disturbance	2(3%)

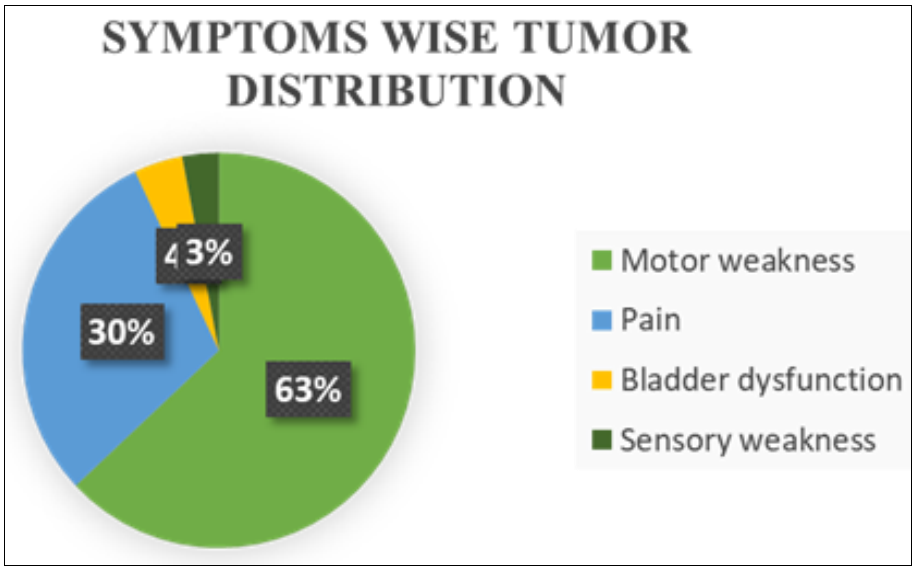

Fig 3: Symptoms wise distribution

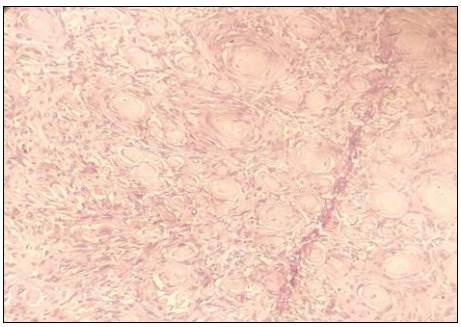

Fig 4: Meningioma (H&E)

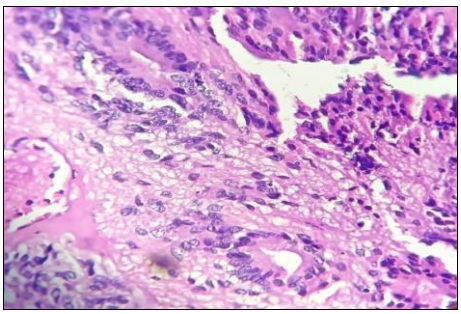

Fig 5: Ependymoma (H&E)

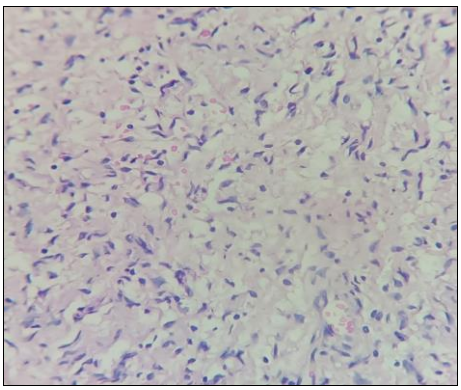

Fig 6: Neurofibroma (H&E)

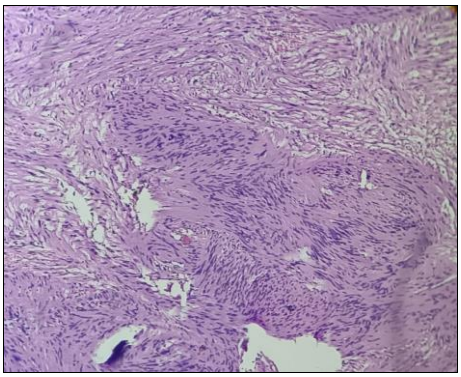

Fig 7: Schwannomas (H&E)

Distribution

Primary spinal cord tumors are one of the rarest categories of tumors, representing about 4-16% of all tumors arising from the central nervous system [1, 2]. Tumors of glial origin (e.g. astrocytoma, ependymoma) are usually intradural intramedullary in location, whereas nerve sheath tumors (e.g. neurofibroma, schwannoma) are typically intradural extramedullary lesions.

Meningiomas can be either extradural or intradural extramedullary lesions. In our study total spinal tumors were 71 cases with males constituting 25 cases and females constituting 46 cases. According to the Engelhard *et al* [4] the most common tumor types were meningiomas and ependymoma which correlated with our study.

Pain, weakness and sensory disturbance have been found to be the most frequent presenting symptoms and signs in adult and pediatric patients with intraspinal tumors [4, 5]. In our study the most common symptom was motor weakness followed by pain which correlates with Krishna Reddy CH *et al.* [1].

Intramedullary tumors mainly include ependymomas followed by astrocytomas. Astrocytomas are the most common intramedullary tumor in children. The most common site is thoracic followed by cervical cord. In our study they are second common intramedullary tumors which correlated with study done by Ferreira *et al*.

Meningiomas are benign tumors arising from arachnoid cells and mostly located in the intracranial compartment. Spinal meningiomas are rare and accounts about 1.2% of all meningiomas and 25% of all spinal cord tumors. The common site was thoracic with 75% of cases which correlated with study done by Sandalcioglu *et al*.

Ependymomas are the most common glial tumor in adults. It tends to manifest in younger ages with a median age of 34 years. In our study 19 cases were reported of ependymomas and all of them were found to be intramedullary. The two most common ependymoma subtypes are cellular and myxopapillary. Cellular ependymomas usually occur in the cervical cord, whereas myxopapillary ependymomas occur almost exclusively in the conus medullaris and filum terminale. Nerve sheath tumors constitute about 25% of tumors arising in intradural extramedullary space. Benign spinal nerve sheath tumors often occur on dorsal nerve roots sporadically or in neurofibromatosis type 1 and type 2.

In our study we reported 10 cases of neurofibroma. Mean age of presentation is 31 years. Patients with neurofibromatosis type1 may have multiple spinal cord neurofibromas that often increase in number with age.

Spinal schwannomas account for about 25% intradural tumors in adults. I reported 7 cases of schwannoma. There was 3 cases in males and 4 in females which corresponds to many studies. The mean age of presentation was 32 years. In my study all schwannomas were intradural extramedullary.

Ewing's sarcoma of spine is rare tumor. Its incidence is highest in second decade of life. Low back pain is the most common symptom followed by a palpable swelling. I reported 2 cases of Ewing's sarcoma of spine which is Extradural in location.

Hemangioblastoma can occur throughout the CNS that originate primarily in cerebellum (83-95%) and then spinal cord (3.2-13%). It commonly associated with Von hippel lindau disease. I reported 1 case which is located intramedullary and cervical cord in region.

Ganglioglioma of spine is much less common which consisting of neoplastic glial and neuronal elements. I reported 1 case which is intramedullary located and involve thoracic region.

Conclusion

A histopathological study of spinal tumors was undertaken at tertiary care hospital to know the occurrence of different types of spinal tumors. A total 71 cases were studied from May 2023 to May 2024. The findings are as follow: The most common primary spinal cord tumor was meningioma followed by ependymoma, neurofibroma, schwannoma, astrocytoma and others. Spinal tumors are more common in

females than male with a ratio of 1.73:1. Muscle weakness was the most common mode of presentation. Spinal tumors are more commonly located in intradural than in extradural location. Within spinal cord tumors are more commonly located in the thoracic region followed by the lumbo-sacral region.

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