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Original Article

Pathology Section

Histopathological Spectrum of Spinal Tumours at a Tertiary Care Hospital, Gujarat, India: A Retrospective Study

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ABSTRACT

Introduction: The anatomic structures in the spinal area are diverse and unpredictable, often representing an excellent test for both the neuroclinicians and neuropathologists, thereby showing a broad heterogeneous spectrum of pathological lesions. Clinical history, radiological features, and pathological examination are required to diagnose spinal tumours.

Aim: To study the histopathological spectrum of spinal tumours in a tertiary care teaching hospital in Gujarat, India.

Materials and Methods: In this retrospective study, data was collected from the records of 100 patients who had spinal tumours and who attended the Department of Pathology. Histopathological diagnosis of the spinal biopsy specimen was the primary outcome variable. Age, gender, location of the tumour, and clinical features were other study relevant variables. The status of the spinal tumour (benign/malignant) was considered an explanatory variable. Descriptive analysis was carried out by mean and standard deviation for quantitative variables, frequency, and proportion for categorical variables. Categorical outcomes were compared using the Chi-square test.

Results: A total of 100 subjects were included, among which 42 participants were males, and 58 were females with the mean age 34.62±17.64 years. The maximum number of spinal tumours were noted in (21-30 year) 3rd decade (29%) of life. Benign spinal tumours (73%) were more common than malignant spinal tumours (27%). Schwannoma was the most common (37%) spinal tumour, followed by meningioma (20%), and ependymoma (14%). The distribution of spinal tumours based on anatomical location, 31% intradural intramedullary, 49% intradural extramedullary, and 20% extradural tumours. There was a significant difference between nerve sheath tumours and meningioma with gender (p-value <0.001).

Conclusion: The study identified schwannoma and meningiomas as the most common tumours. The thoracic region was the most frequently involved spinal level, followed by the cervical, and the most affected location was the intradural extramedullary.

Keywords: Meningioma, Schwannoma, Spinal cord neoplasms

INTRODUCTION

The anatomic structures in the spinal area are diverse and unpredictable, often representing an excellent test for both the neuroclinicians and neuropathologists, thereby showing a broad heterogeneous spectrum of pathological lesions. Spinal lesions are rare and usually relate to epidural space's spinal tissues, which involve the spinal meninges, spinal nerve roots, and spinal cord. It commonly affects the thoracic region, although it can involve any spinal level [1,2]. Spinal cord tumours comprise 4-16% of all the Central Nervous System (CNS) tumours [2]. Spinal lesions can be grouped into congenital malformations, degenerative diseases, inflammatory disorders, cystic lesions, vascular malformations, and neoplasms [1]. Spinal tumour can be divided into two major groups: the first one is primary tumours which originate from the spinal cord, meningeal, or bone cells. The second group is metastatic lesions that invade the spinal cord and surrounding tissues and originate from other cells [3,4]. Based on anatomical location, the spinal Space Occupying Lesions (SOLs) are extradural and intradural lesions. Extradural lesions occur outside the spinal dura and emerge from the bony spine, intervertebral discs, and adjacent soft tissues. Intradural lesions arise within the dura. Intradural spinal tumours are further classified as extramedullary and intramedullary [5,6].

Intradural extramedullary spinal cord tumours account for about 60% of the intraspinal tumours and include schwannomas (30%; incidence rate, 0.3-0.4 cases annually per 100,000 people), meningiomas (25%; incidence rate, 0.32 cases annually per 100,000 people), neurofibromas, teratomas, lipomas, and metastatic tumours [7-10]. Intramedullary lesions are situated in the substance of the spinal cord. Spinal cord gliomas represent roughly 80% of intradural intramedullary tumours, with astrocytic or ependymal tumours contributing the central part and the rest including hemangioblastoma (3-8%), ganglioglioma, lymphoma, and melanoma (rare) [11,12].

Tumours of the spinal cord are more common in the pediatric population than in adults [13]. The symptoms usually seen in patients with primary spinal tumours are pain along the spinal axis, neck or back pain, radiating pain, sensory disturbance, gait disturbance, sexual dysfunction, paraesthesia, and paraplegia [14]. Albeit their rarity, spinal tumours are a significant reason for morbidity and mortality [15]. Clinical history, radiological features, and pathological examination are required to diagnose spinal tumours [3]. Medications, surgery, radiation, or a combination of these treatments are employed to manage these tumours [16]. The study aimed to evaluate the spectrum of spinal tumours that presented to tertiary care teaching hospital in Gujarat, India.

MATERIALS AND METHODS

In this retrospective study, data was collected from the record available in the Department of Pathology at a tertiary care teaching hospital, Gujarat, India. The study specimen of spinal tumours were collected from the patients who attended the Pathology Department from June 2016 to September 2018 and the analysis of the collected data was carried out in October 2018. The study was approved by the Institutional Review Board and the Ethics Committee of B. J. Medical College and Civil Hospital with reference number 439/2016. Data confidentiality was maintained, and informed consent was taken from the patient while collecting the sample that the specimens might be used for study purposes in the future.

Sample size calculation: The sample size calculated assuming the proportion of any CNS tumours was 6.49% [17]. The other parameters considered for sample size calculation were 5% absolute precision and 95% confidence level. Based on the previous hospital records, the approximate number of cases attending the study setting during the one year was 100,000. Hence a finite population correction was applied for 100,000. As per the formula for sample size calculation [18], the required number of subjects was 94. To account for a non participation rate of about 6% (6 subjects), it was decided to sample about 100 subjects in the study. All the eligible specimens of the patients were included by convenient sampling till the sample size was obtained.

Inclusion criteria: All the study specimen, belonging to patients of any age and both gender, diagnosed with spinal tumours at the Department of Pathology, during study period were included in the study.

Exclusion criteria: Primary vertebral tumours and paraspinal soft tissue lesions were excluded. Non neoplastic conditions of the CNS were excluded.

Procedure

Relevant clinical data, including age, gender, and clinical symptoms, were noted. The protocol followed for a histopathological examination in our Department of Pathology for specimens was as follows- After receiving, all surgically resected specimens were fixed in the 10% neutral buffered formalin for 24 hrs. Bony parts were decalcified in Nitric acid (HNO_3). After detailed gross examination, various tissue representative areas were taken from the received surgical specimen and submitted to routine tissue processing and paraffin embedding. Sections of 5 µ thickness were cut, and stained with Haemotoxylin and Eosin (H&E), slides were examined under a light microscope, and the diagnosis was made. Recent World Health Organisation (WHO) classification of central nervous system tumours was used for the variety and grading of the tumours [19].

STATISTICAL ANALYSIS

Descriptive analysis was carried out by mean and standard deviation for quantitative variables, frequency, and proportion for categorical variables. A p-value <0.05 was considered statistically significant. R studio and coGuide version V.1.0.3 was used for statistical analysis [20].

RESULTS

A total of 100 subjects were included in the final analysis. The mean age was 34.62±17.64 years, 42 participants were male, and the remaining 58 were female. The maximum number of spinal tumours were noted in the 3rd decade (21-30 year, 29%) of life [Table/Fig-1]. Benign spinal tumours (73%) were more common than malignant spinal tumours (27%). Muscle weakness (39%) was the most common clinical feature, followed by pain (18%), and swelling (13%). Spinal tumour was more common in the thoracic region (49%), followed by cervical region (23%) [Table/Fig-2].

Age group (in years)	No. of cases		Total
	Male	Female	
0-10	3	6	9
11-20	8	2	10
21-30	9	20	29
31-40	8	5	13
41-50	7	11	18
51-60	4	11	14
61-70	3	3	6
71-80	0	1	1
Total	42	58	100
Mean	32.8	36.5	p-value-0.18

[Table/Fig-1]: Comparison of spinal tumour between gender across different age group (N=100).

Primary clinical feature	No. of cases
Swelling	13
Pain	18
Muscle weakness	39
Muscle weakness+pain	10
Muscle weakness+Sensory dysfunction	4
Muscle weakness+Bladder dysfunction	8
Bowel/bladder incontinence	1
Muscle weakness+Sensory dysfunction+bowel/Bladder dysfunction	2
Paraplegia	4
Convulsion	1

[Table/Fig-2]: Distribution of primary clinical features of patients with spinal tumours (N=100).

Schwannoma was the most common (37%) spinal tumour, followed by meningioma (20%). Out of 10 people with glioma, all of them had a malignant tumour. Out of 20 people with meningioma, all of them had a benign tumour. Out of 14 people with ependymoma, 2 (20%) had a benign tumour, and 12 (80%) had malignant tumour [Table/Fig-3].

Name of spinal tumour		Status of spinal tumour	
		Benign tumour n=73	Malignant tumour n=27
Schwannoma (n=37)		37 (50.7%)	0
Neurofibroma (n=4)		4 (5.5%)	0
Glioma (n=10)	Astrocytoma (WHO grade II)	0	7 (25.9%)
	Astrocytoma (WHO grade III)	0	1 (3.7%)
	Glioblastoma (WHO grade IV)	0	1 (3.7%)
	Oligodendroglioma (WHO grade II)	0	1 (3.7%)
Meningioma (WHO grade I) (n=20)		20 (27.4%)	0
Ependymoma (n=14)	Ependymoma (WHO grade I)	2 (2.7%)	0
	Ependymoma (WHO grade II)	0	12 (44.4%)
Lipoma (n=9)		9 (12.3%)	0
Hemangioma (n=1)		1 (1.4%)	0
Teratoma (n=1)		0	1 (3.7%)
PNET (n=2)		0	2 (7.4%)
Rhabdosarcoma (n=1)		0	1 (3.7%)
Poorly differentiated malignant tumour (n=1)		0	1 (3.7%)
Total (N=100)		73 (73%)	27 (27%)

[Table/Fig-3]: Histopathological spectrum of various spinal tumour (N=100).
WHO: World health organisation

Among the people with a benign tumour, most participants (64.38%) had intradural extramedullary location affected. In people with a malignant tumour, the majority (66.67%) of participants had intradural intramedullary tumour [Table/Fig-4].

Location of tumour	Benign tumour (n=73)	Malignant tumour (n=27)	Total
Intradural intramedullary	13 (17.81%)	18 (66.67%)	31
Intradural extramedullary	47 (64.38%)	2 (7.41%)	49
Extradural	13 (17.81%)	7 (25.93%)	20
Total	73 (100%)	27 (100%)	100

[Table/Fig-4]: Distribution of (Benign and Malignant) spinal tumours according to tumour location.

Among the male participants, 25 (60.98%) participants had nerve sheath tumours, 2 (10%) participants had meningioma, 8 (57.14%)

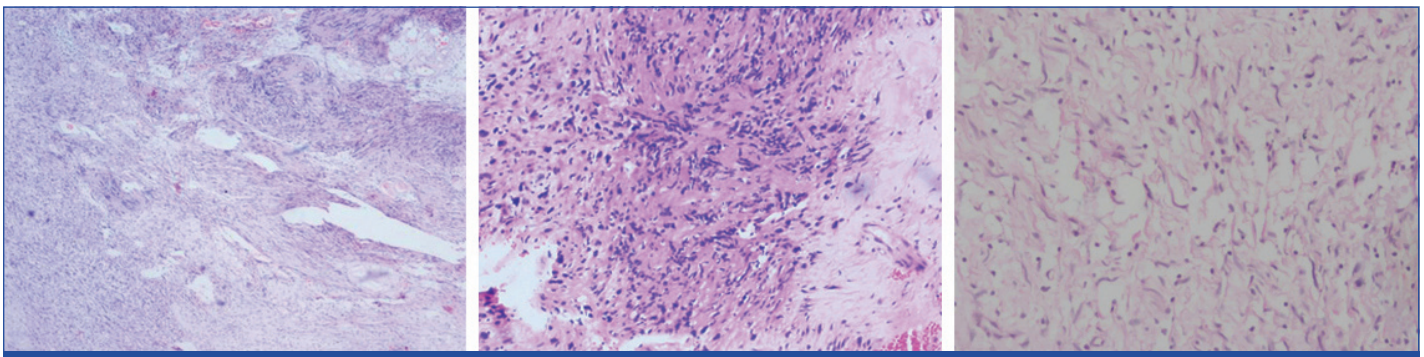
participants had ependymoma, and 5 (62.5%) participants had astrocytoma. The difference in the proportion of gender between the nerve sheath tumours was statistically significant (p-value=0.001). The difference in gender between the meningioma is found to be significant with a p-value of 0.001, with the majority of 18 (90%) female participants [Table/Fig-5].

Incidence	Nerve sheath tumours (n=41)	Meningioma (n=20)	Ependymoma (n=14)	Astrocytoma (n=8)
Gender				
Male	25 (60.98%)	2 (10%)	8 (57.14%)	5 (62.5%)
Female	16 (39.02%)	18 (90%)	6 (42.86%)	3 (37.5%)
p-value	**0.001**	**0.001**	0.216	0.275
Location of the tumour				
Intradural intramedullary	8 (19.51%)	0	12 (85.71)	7 (87.5%)
Intradural extramedullary	27 (65.85%)	19 (95%)	2 (14.29%)	0
Extradural	6 (14.63%)	1 (5%)	0	1 (12.5%)
p-value	**0.027**	*	*	*

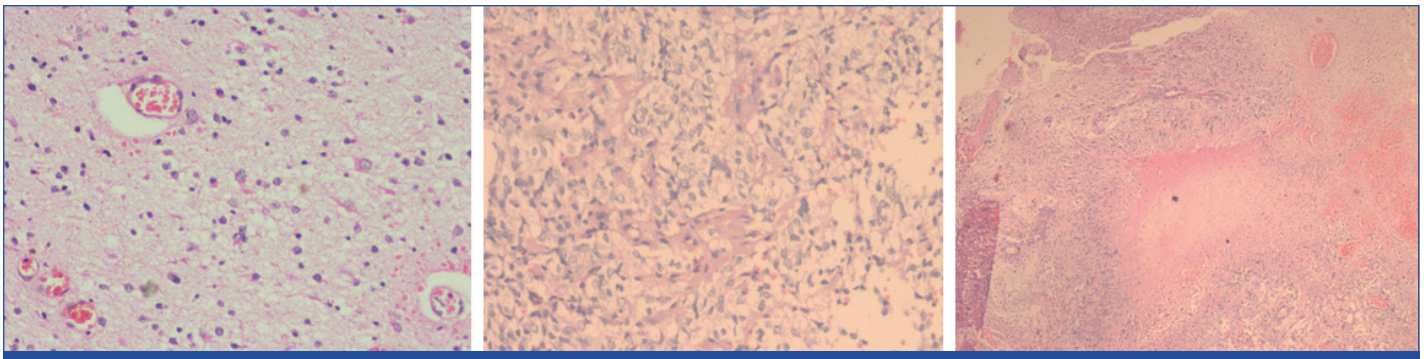
[Table/Fig-5]: Location and gender wise distribution of histological subtypes of spinal tumours in this study (N=100).
*No statistical test was applied-due to 0 subjects in the cell

Histopathological findings: When Haematoxylin and Eosin (H&E) slides of the patients were observed in case of schwanomma, it was found highly cellular, spindle cell arrange in palisading manner and tumors cells separated by abundant edematous fluid. [Table/Fig-6]. In case of ancient schwannoma, scattered atypical to bizzare appearing nuclei was observed [Table/Fig-7]. In cases of neurofibroma, characterstically markedly elongated nuclei with wavy, serpentine confuration and pointed end [Table/Fig-8]. Astrocytoma cases depict mild nuclear atypia of tumor cells and dense fibrillary background [Table/Fig-9]. Oligodendroglioma cases showed "egg fried appearance" [Table/Fig-10]. The glioblastoma cases under microscope depicted dense cellularity, marked pleomorphism and tumor cells palisading around necrosis [Table/Fig-11].

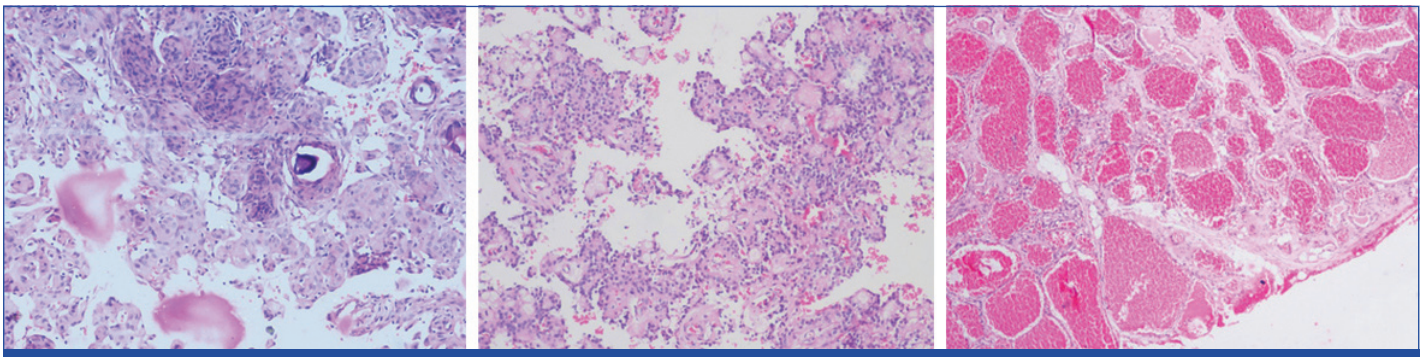
The cases of meningioma showed whorls pattern and psammoma body [Table/Fig-12]. Myxopapillary ependymoma cases showed epithelial tumor cells arranged around fibrovascular cores [Table/Fig-13]. In case of cavernous angioma, large vessels with cystically dilated lumina and thin walls were observed [Table/Fig-14]. For the diagnosis of lipoma cases, the H&E slides gave the appearance of mature adipose tissue as in [Table/Fig-15].



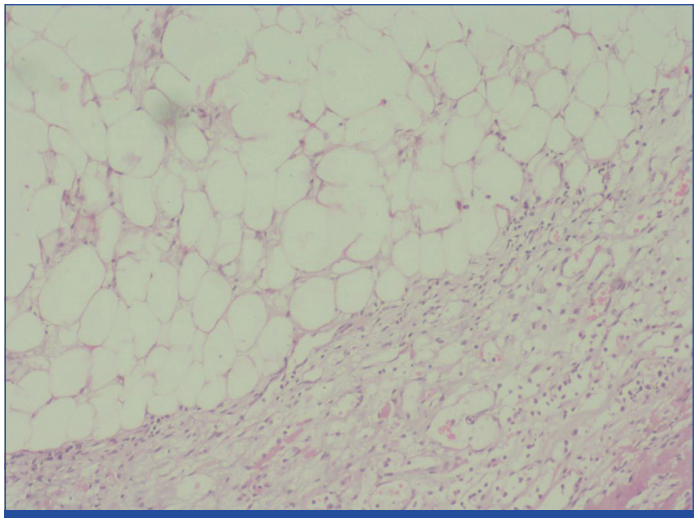
[Table/Fig-6]: Schwanomma- highly cellular, spindle cell arrange in palisading manner (Antoni A) and tumours cells seprated by abundant edematous fluid (Antoni B) (10 X, H&E stain). **[Table/Fig-7]:** Ancient schwannoma- scattered atypical to bizzare appearing nuclei (20 X, H&E stain). **[Table/Fig-8]:** Neurofibroma- markedly elongated nuclei, wavy, serpentine confuration and pointed ends (40 X, H&E stain). (Images from left to right)



[Table/Fig-9]: Astrocytoma (WHO grade II)- mild nuclear atypia of tumour cells and dense fibrillary background (40 X, H&E stain). **[Table/Fig-10]:** Oligodendroglioma (WHO grade II)- "egg fried appreance" of tumour cells (40 X, H&E stain). **[Table/Fig-11]:** Glioblastoma- Dense cellularity, marked pleomorphism and tumour cells show palisading around necrosis (10 X, H&E stain). (Images from left to right)



[Table/Fig-12]: Meningioma- Whorls pattern and Psammoma body (20 X, H&E stain). **[Table/Fig-13]:** Myxopapillary Ependymoma-epithelial tumour cells are arranged around fibrovascular cores (20 X, H&E stain). **[Table/Fig-14]:** Cavernous angioma-large vessels with cystically dilated lumina and thin walls (10 X, H&E stain). (Images from left to right)



[Table/Fig-15]: Lipoma- mature adipose tissue observed (10X, H&E stain).

which was comparable with Drashti P et al. and Santos Júnior EC et el., [27,28].

The most common presenting symptom was muscle weakness in the present study which was comparable with Drashti P et al., [27,28] and Murad et al., [29] while in some studies, the pain was the most frequent symptom [16,22,25,28]. At vertebral level, the thoracic region was the most frequently involved followed by cervical and lumbar in this study which was comparable with other studies [16,22,27,28]. Intradural extramedullary location (49%) was affected more and a similar pattern is seen in other studies [3,16,22,27,29] while in Santos J. et al., [28] intradural intramedullary location was most common site. Benign tumours (73%) were more common than malignant (27%) tumours which was comparable with other studies [Table/Fig-16] [3,16,22,27-29].

Schwannoma was the most common (37%) spinal tumour in the present study which was comparable with other studies [3,16,22,28] where [27,29] meningioma was more common.

Features	Moein P et al., [22]	Hirano K et al., [3]	Jobunputra GP et al., [16]	Drashti P et al., [27]	Santos Junior EC et al., [28]	Murad A et al., [29]	Present study
Total cases	102	678	100	91	148	96	100
Mean age (years)	40.2	52.4	45	48	49	49.3	34.62
Male:Female (M/F)	1.37 (59/43)	1.25 (377/301)	1.08 (52/48)	0.78 (40/51)	0.96 (51/53)	1.08 (50/46)	0.72 (42/58)
Vertebral level							
Cervical	31 (24%)	-	31 (31%)	20 (22%)	23 (22.1%)	-	23 (23%)
Thoracic	52 (40%)	-	55 (55%)	44 (48%)	38 (36.5%)	-	49 (49%)
Lumbar	30 (24%)	-	14 (14%)	27 (30%)	25 (24%)	-	17 (17%)
Sacral	9 (6%)	-	-		-	-	2 (2%)
Mixed	8 (6%)	-	-	-	18 (17.4%)	-	9 (9%)
Anatomical location							
Intradural intramedullary	36 (35%)	124 (18.3%)	23 (23%)	28 (31%)	55 (52.9%)	15(15.6%)	31 (31%)
Intradural extramedullary	46 (45%)	371 (54.7%)	63 (63%)	44 (48%)	24 (23.1%)	38 (40%)	49 (49%)
Extradural	18 (18%)	27 (4%)	14 (14%)	19 (21%)	18 (17.3%)	43 (44.4%)	20 (20%)
Mixed	2 (2%)	156 (23%)	-	-	7 (6.7%)	-	-
Clinical features							
Pain	53 (52%)	-	42 (42%)	28 (31%)	55 (55%)	-	18 (18%)
Muscle weakness	37 (36%)	-	24 (24%)	54 (59%)	-	84 (87.5%)	39 (39%)
Swelling	-	-	-	-	-	-	13 (13%)
Pathological profile							
Benign	82 (80.4%)	583 (86%)	89 (89%)	70 (77%)	87 (83.7%)	67 (69.8%)	73 (73%)
Malignant	20 (19.6%)	95 (14%)	11 (11%)	21 (23%)	17 (16.3%)	29 (30.2%)	27 (27%)
Morphological type							
Schwannoma	34 (33.3%)	388 (57.2%)	31 (34.8%)	9 (10%)	28 (26.9%)	15 (15.7%)	37 (37%)
Meningioma	15 (14.7%)	79 (11.7%)	24 (27%)	29 (32%)	19 (18.3%)	16 (16.7%)	20 (20%)
Ependymoma	23 (22.5%)	54 (8%)	8 (9%)	24 (26%)	14 (13.5%)	9 (9.4%)	14 (14%)
Astrocytoma	16 (15.6%)	9 (1.3%)	9 (10.1%)	6 (6.5%)	6 (5.8%)	6 (6.3%)	9 (9%)

[Table/Fig-16]: Comparison of the morphologic types of spinal tumours with other studies.

DISCUSSION

Diversity of anatomic structures in the spinal region make the histopathology report more clinically valuable [21]. In this study, various spinal tumours were evaluated for age, gender, incidence, anatomical location, clinical feature and its pathological profile.

The maximum number of spinal tumours (both benign and malignant) were noted in 3rd decade (29%) of life in this study while according to Hirako K et al., benign spinal tumour more common in 50-59 years and malignant spinal tumour more common in 40-49 years [3].

Most of previous studies showed male predominance [3,16,22-26] while the present study showed female predominance (58%)

Limitation(s)

Small sample size was the limitation of the study which hampers the generalisability of the results.

CONCLUSION(S)

Tissue diagnosis is imperative due to the broad spectrum of pathological lesions in this area with differing prognosis and therapeutic protocols. The tumour's location was essential to understanding the nature and course of the disease in these tumours. Schwannoma and meningiomas were the most common tumours identified in the present study. The thoracic region was the most frequently involved at spinal level, followed by the cervical, and the most affected location was the intradural extramedullary.

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