

Original Research Article

Study of Clinico-pathological Spectrum of Lesions of Spinal Cord and its Coverings: at Tertiary Care Centre

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Abstract

Introduction: *The diversity of anatomic structures in the spinal region challenges both the clinician and a pathologist with distinct and interesting group of spinal lesions having wide spectrum of clinical and histological presentations. The first step of the diagnostic algorithm includes the analysis of clinical and radiological features because it narrows down the differential diagnosis to a significant extent. The next step includes the histopathology.*

Aim: *To analyse the histopathological morphology of spinal cord lesions with clinical and radiological features.*

Materials and Methods: *The study was carried out in Department of Pathology, S.M.S. Medical College, Jaipur (Rajasthan) from June 2018 to November 2019. Our study comprised of a total 85 surgical resection specimens of lesions of spinal cord and its coverings. All cases were analyzed by examining hematoxylin and eosin stained slides with use of special stains and immunohistochemistry, as needed.*

Results: *Most of the cases were in the age group 31 – 40 years. The female to male ratio 1.12:1. Backache was the most frequent symptom followed by weakness of lower limbs. Thoracic segment was most commonly involved, followed by lumbar and cervical. Most common site was intradural extramedullary followed by extradural and intradural intramedullary. 60% neoplastic, 21.18% inflammatory and 18.83% non-neoplastic lesions. Commonest was Nerve sheath tumours (24.70%) followed by meningioma (12.94%), ependymoma (9.41%), astrocytoma (5.88%), 16.47% of tuberculosis. 2 cases each of hemangioblastoma, lymphoma, and metastatic carcinoma respectively.*

Conclusion: *The combination of clinical, radiological and histopathological features forms the basis of the multi-disciplinary diagnostic approach towards the spinal cord and its covering lesions.*

Keywords: *Spinal cord lesions, Extradural, Intradural, Intramedullary, Histopathology.*

Introduction

The tumours of spinal cord are much less frequent than intracranial one. Spinal tumours are most

common spinal space occupying lesions. They constitute 15- 20 % of CNS tumours.^[1] Spinal cord tumours occur predominantly in 21- 40 years

age group and are less common in childhood and old age.

Spinal lesions can arise from glial cells located within the parenchyma of the cord, schwann cells of the nerve roots or meningotheial cells covering the cord.

These lesions can involve any spinal level but more commonly affect thoracic region. According to location spinal tumours are conveniently classified as extradural and intradural. Extradural lesions constitute the lesions of the osseous spine, epidural space and paraspinal soft tissue. Intradural tumours can be intramedullary (intramedullary spinal cord tumour IMSCT) or extramedullary (intradural extramedullary IDEM). Most of the intramedullary tumour are malignant and belong to the glioma group.^[2] In the glioma group ependyoma is the most frequent among adults constituting 60% of intramedullary tumour while astrocytoma is common in children.

Among the extramedullary tumours schwannoma and meningioma are frequently encountered. Now glial neoplasms like hemangioblastomas, metastasis, lymphoma, paraganglioma and primitive neuroectodermal tumours are much less common.

Intramedullary tuberculomas are rare and constitute 0.2% – 0.5% of all CNS tuberculomas. Among patient with spinal tuberculosis 55% present with vertebral body involvement, 30% with intraspinal granulomatous lesions without bone involvement, and only 7% with intramedullary lesions.^[3]

The objective of this study was to study the histological spectrum of these lesions, to observe the relative frequency of different lesions along with their clinical profile with respect to age, sex and topographic distribution.

Materials and Methods

This is hospital based prospective type of observational study conducted at tertiary care centre, S.M.S. Medical College, Jaipur (Rajasthan). Study was begin in June 2018 and conducted till November 2019. 85 surgically

resected specimen of spinal cord and its coverings were included. Complete clinical detail including data of age, sex, duration of symptoms, type of lesion, clinical and radiological findings of the patients was obtained. The tissue is fixed in 10% formalin. Then paraffin embedded blocks are made in the usual manner and thin sections of 5 microns are cut by using a microtome. Sections are stained by haematoxylin and eosin. All cases were analyzed by examining hematoxylin and eosin stained slides with use of special stains and immunohistochemistry as required.

Results

Total 85 cases were analysed. Most of the cases (21.17%) were in age group 31 – 40 years of age, followed by age group 11 – 20 years of age (16.48%) and the least affected age group (9.41%) was 21 – 30 years of age. Figure -1 depict incidence of lesions in various age group.

In the present study out of 85 patients 52.94% were female and 47.06% were male. The female to male ratio was 1.12: 1 with slight female preponderance as shown in Figure – 2.

We observed that backache was the most common presentation (43.5%) followed by weakness of lower limbs (31.7%), the third group is formed by paraplegia (18.8%) followed by pain in limbs (11.7%) and paresthesia (11.7%). The other symptoms included radiating pain, painful neck rotation, incontinence of urine, swelling of back, headache and vomiting [Table – 1].

In the present study we observed that neoplastic lesions (60%) were frequently encountered than non-neoplastic lesions (18.82%), and inflammatory lesions (21.18%). The frequency of various neoplastic and non neoplastic spinal lesions is enumerated in the table - 2.

In the present study thoracic region was the most frequently (38.83%) involved spinal level followed by lumbar (23.53%) and cervical (14.11%) region. Compartmental distribution of various spinal SOLs is given in table - 3.

The most common histological diagnosis was benign nerve sheath tumor (24.7%), out of these

20% were schwannoma [Figure – 3] and 4.70% were neurofibroma. We observed that benign nerve root lesions were more common in thoracic region (8/21cases)(38.09%) followed by cervical region(6/21cases)(28.57%), thoracolumbar region (6/21 cases)(28.57%) and lumbo-sacral region (1/21cases)(4.76%).Most commonly involved intradural extramedullary compartment (16/21cases) (76.19%) followed by intradural intramedullary (3/21cases) (14.29%) and extradural compartment (2/21 cases)(9.52%).

Schwannoma (17/85 cases) was common among spinal nerve root lesions with most common age group was 31-40 years and female preponderance with M:F ratio 1:1.83, Schwannoma are the most common intradural tumour accounting for 25% of all intradural tumours in adults .Pain was the most common symptom with average duration of symptoms is 11.03 month. They are WHO grade I tumors .

4 cases of Neurofibroma with most of cases also in 31-40 years and equal M:F distribution.

Meningioma [Figure – 4] was the second most common tumor with 12.94% cases, majority of cases (27.27%) were in 31-40 years age group and 51-60 years age group with M : F ratio 1:1.7.Pain and weakness of limbs being the most common complaints with average duration of symptoms is 3.95 month .The most common site was thoracic region (90.90%) with all the lesions located IDEM. On MRI most of the cases had circumscribed mass primarily hypo to isointense on T1 and hyperintense on T2 with uniform contrast enhancement. Among the histological variants of meningioma, meningothelial meningioma (54.54%) was the most common followed by psammomatous meningioma (36.36%) and 1 case of transitional meningioma.

Next in frequency is ependymoma (9.41%), equally affecting male (4/85 cases) and female (4/85cases) in middle age group, equally present in cervical and thoracic level and all are present in IDEM location. Most of the cases present with decrease sensation of limbs with average duration of symptoms is 9.31 month. Out of 8 cases, 6 were

WHO grade II ependymoma [Figure – 5], 1 was subependymoma (grade I) and 1 was myxopapillary ependymoma (grade I). [Figure – 6]

Astrocytoma (5.89%), affecting 3 male and 2 female in 11- 20 years age group. Most of the cases present in thoracic region and intradural compartment. All 5 cases were included in WHO grade I pilocytic astrocytoma.[Figure – 7]

Next in frequency is hemangioblastoma (2.35%) [Figure – 8], lymphoma (2.35%) and metastatic carcinoma (2.35%).

Among the non-neoplastic lesions most common were tuberculosis (16.48%) cases, second was the congenital malformations (5.89%) followed by non-specific inflammation(4.70%), lipoma (4.70%), epidermal cyst (3.52%), dermoid cyst (1.18%), endodermal cyst(1.18%), arachnoid cyst (1.18%), and AV malformation(1.18%).

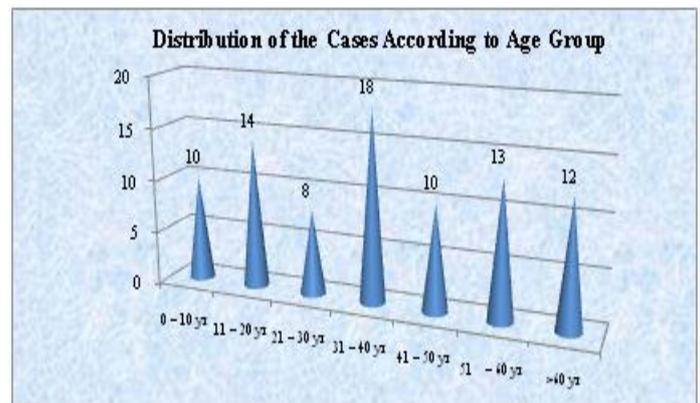


Figure- 1: Distribution of the Cases According to Age Group

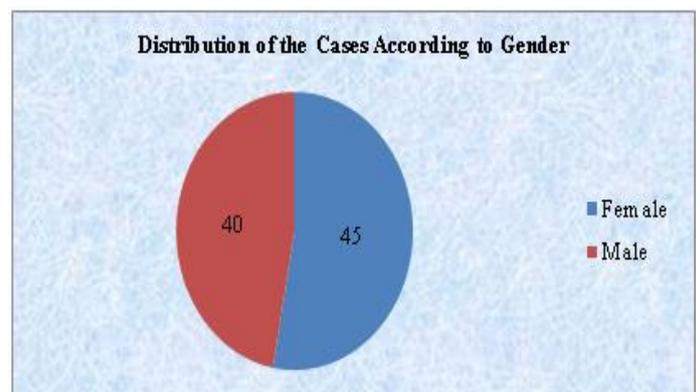


Figure - 2: Distribution of the Cases According to Gender.

Table - 1: Clinical manifestations in lesions of spinal cord and its coverings.

Clinical Features	Number of Cases	Percentage (n=85)
Swelling of back	4	4.70%
Backache	37	43.5%
Weakness of lower limbs	27	31.7%
Paraplegia	16	18.8%
Pain in limbs	10	11.7%
Parasthesia	10	11.7%
Radiating pain	6	7.05%
Incontinence of urine	5	5.88%
Headache	1	1.17%
Painful neck rotation	6	7.05%
Vomiting	1	1.17%
Sinus discharge	2	2.35%
Previous surgery	1	1.17%

Table - 2 : Incidence of inflammatory, non-neoplastic and neoplastic lesions

Type of lesions	Incidence	Percentage	Male	Female
Inflammatory	18	21.18%	09	09
Non neoplastic	16	18.82 %	09	07
Neoplastic	51	60%	22	29
Total	85		40	45

Table - 3: Site wise distribution of lesions of spinal cord and its covering.

Lesions	Extra dural	Intradural extra medullary	Intradural intra medullary	Cervical	Thoracic	Lumbar	Sacral	Total
Congenital malformations	5	-	-	-	-	2	3	5
Non specific inflammation	3	-	1	-	1	2	1	4
Tuberculosis	14	-	-	2	6	5	1	14
Epidermoid cyst	-	2	1	-	1	2	-	3
Dermoid cyst	-	-	1	-	-	1	-	1
Arachnoid cyst	-	1	-	-	1	-	-	1
Endodermal cyst	-	1	-	-	-	1	-	1
Lipoma	1	3	-	-	-	3	1	4
AV malformations	-	-	1	-	1	-	-	1
Schwannoma	1	13	3	5	9	3	-	17
Neurofibroma	1	3	-	1	1	2	-	4
Meningioma	-	11	-	-	10	1	-	11
Astrocytoma	-	-	5	2	3	-	-	5
Ependymoma	-	-	8	2	2	4	-	8
Hemangioblastoma	-	2	-	-	1	1	-	2
Lymphoma	1	1	-	1	1	-	-	2
Metastatic carcinoma	2	-	-	1	1	-	-	2
Total	28	37	20	14	38	27	6	85

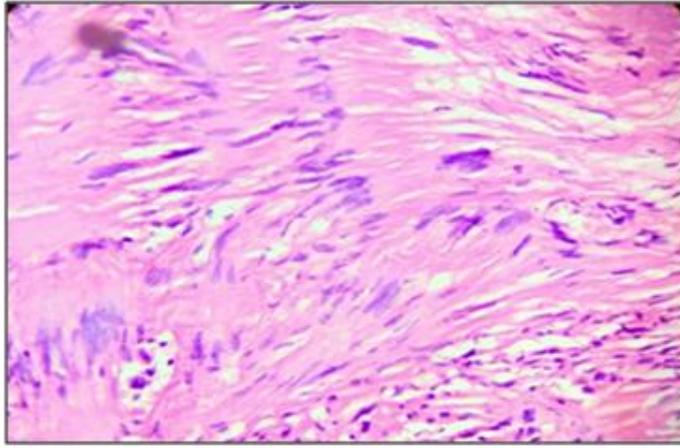


Figure-3 H&E stained slide (400X): Schwannoma, showing Verocay bodies (spindle shaped Schwann cells which show nuclear palisading)

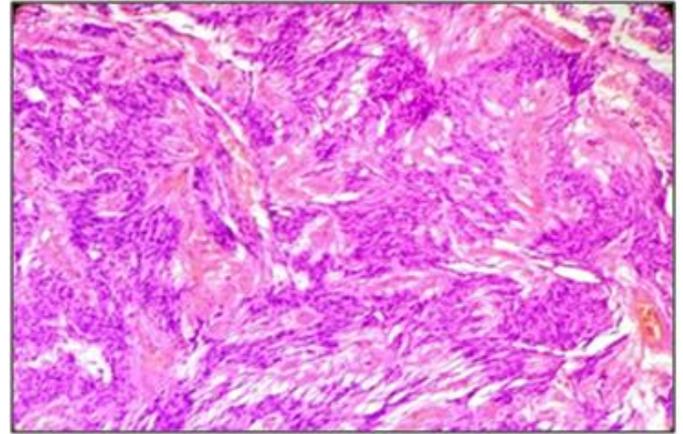


Figure - 6 H&E stained slide (400X): Myxopapillary ependymoma showing cuboidal to elongated tumor cells in a myxoid background.

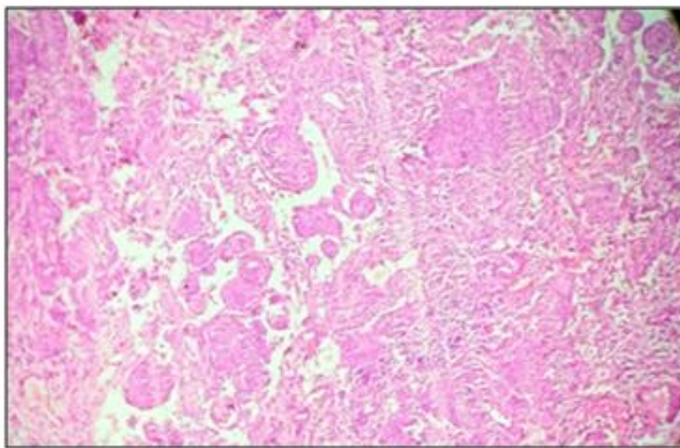


Figure-4 H&E stained slide (100X): Meningothelial meningioma show whorls and fascicles of meningeothelial cells.

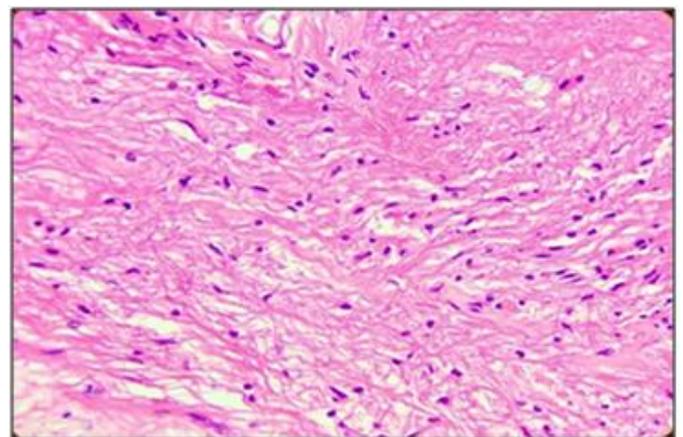


Figure - 7 H&E stained slide (400X): Pilocytic astrocytoma showing bipolar piloid cells, Rosenthal fibers and eosinophilic granular body.

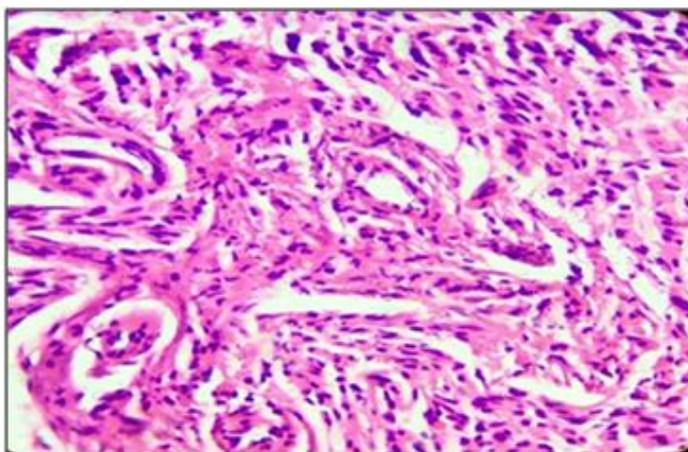


Figure -5 H&E stained slide (400X): Ependymoma showing round to oval cells with perivascular pseudorosettes against a fibrillary background.

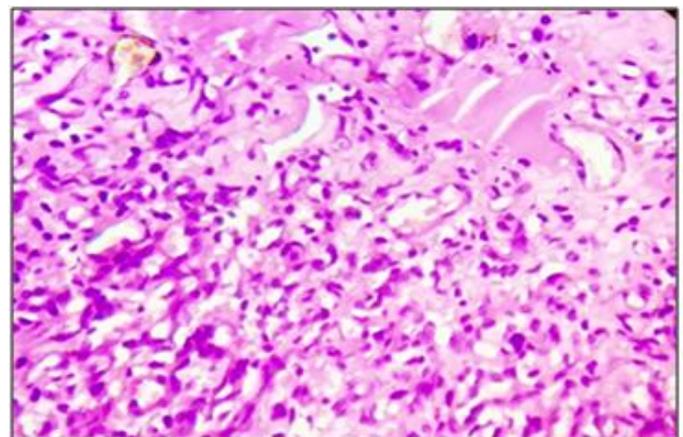


Figure- 8 H&E stained slide (400X): Hemangioblastoma showing variable size thin walled vessels with neoplastic stromal cells.

Discussion

Various spinal cord and its covering lesions were evaluate for age, sex, incidence, frequency of various lesions (inflammatory/non neoplastic/neoplastic), duration of symptoms, radiological finding and compartmental distribution.

We found that out of 85 patients 47.06% were male and 52.94% were female .The female to male ratio was 1.12:1.

Our finding are in accordance with Engelhard et al^[4] and Patil et al^[9], who also observed female predominance in their study. However Gadgil et al^[7] and Tathe et al^[10] showed male predominance in their study.

In the present study we found that most of the cases (21.17%) were in the age range 31 to 40 years and the least (9.41%) was 21-30 year of age. Our results are consistent with the study conducted by Moein et al^[5], Dikondwar et al^[6] and Gadgil et al^[7] who also encountered maximum number of patients in this age group.

Neoplastic lesion were more common (60%) than non –neoplastic lesions (18.82%). Our results are similar to studies conducted by Gadgil et al,^[7] Binayke et al,^[8] and Tathe et al^[10] who also observed that neoplastic lesions were more common than non –neoplastic lesions.

In the present study thoracic spine 33 cases (38.82%) was the most common location for spinal cord lesions which are comparable to the study of Engelhard et al^[4], Moein et al,^[5] Dikondwar et al,^[6] Gadgil et al,^[7] Tathe et al,^[10] Schelliner et al,^[11] and Kaye et al,^[12] followed in frequency lumbar region 20 cases (23.52%) and cervical 12 cases (14.11%) which is correlate well with study conducted by Dikondwar et al.^[6] Their was almost an equal distribution of cases in cervical and lumbar spine in studies conducted by Moein et al^[5] and Gadgil et al.^[7]

Backache (43.5%) and weakness of lower limbs (31.7%) was found to be most frequent presenting symptoms. Our results are similar to other studies conducted by Dikondwar et al^[6] and Tathe et al.^[10]

Most of the lesions were intradural extramedullary (IDEM) 37 cases (43.52%) followed by extradural 28 cases (32.94%) and intra medullary lesions were 20 cases (23.52%), this is closely comparable to study conducted by Tathe et al.^[10]

Intradural extramedullary (IDEM) location was also common in study conducted by Moein et al.^[5]

Amongst the tumours the commnest tumour was the nerve sheath tumour comprising 24.70% of the total cases .Out of which 20 % were schwannoma and 4.70% were neurofibroma , as similarly observed by Moein et al^[5] and Gadgil et al,^[7] followed by meningioma (12.94%).[Table – 4]

17 cases (20%) were diagnosed as schwannoma affecting 6 males and 11 females. The results in our study are concordant with Engelhard et al[4] . Most common age group affected was 31- 40 years. And were more common in thoracic region (41.17%) and IDEM compartment (76.47%) , our findings are correlate well with the study of Tathe et al,^[10] and Abbasi et al^[13]. Out of total 21 cases of benign nerve sheath tumour, 4 cases were neurofibroma mostly in31- 40 years age group with equal distribution between male and female. One case was associated with neurofibromatosis.

Meningioma was the second most common tumour with 11 cases (12.94%) out of 85 cases, similar to the result of Tathe et al.^[10] Most of the cases were included in 21-50 years age group with female predominance , similar to study carried out by Gadgil et al,^[7] Tathe et al^[10] and Hirano et al.^[18]

8 cases (9.41%) were diagnosed as ependymoma equally affecting male (4/85 cases) and female (4/85cases) in middle age group. Binayke et al^[8] noted M: F ratio of 2.3:1. Our cases are equally present in cervical and thoracic level and all are present in IDEM location, comparable to the study of Adam et al^[14] who observed thoracic involvement in a 26.3% cases and cervicothoracic in 50 % . In our study 1 case was diagnosed as myxopapillary ependymomma in a 20 year female.

5 cases were diagnosed as astrocytoma affecting 3 male and 2 female in 11- 20 years age group. In

our study 60 % cases occurred in thoracic region and 40 % in cervical region. Our findings compared well with observation of Carciunas et al^[19] who found 67% cases in thoracic and 45% cases in cervical region. In our study 100% cases located in intradural compartment, our results are similar to study of Moein et al.^[5]

2 cases were diagnosed as hemangioblastoma equally affecting male and female and present in 41-60 years age group. They are present in thoraco-lumbar region and IDEM location. 2 cases were diagnosed as lymphoma affecting elderly female patient and present in cervicothoracic region and extradural location. In our study 2 cases were diagnosed as metastatic carcinoma with unknown primary, affecting male patient with mean age is 47 years and are present in cervicothoracic region and extradural location, correlate well with study conducted by Tathe et al.^[10]

Non glial neoplasms including hemangioblastoma, PNET and lymphoma are much less common.^[15,16]

Amongst the non-neoplastic lesions we had 14 cases(16.47%) of tuberculosis of spinal cord, 7 were male and 7 were female, with 50% cases occurring in >51 years of age and M : F ratio is 1:1. Most common location was in the thoracic spine (42.85%) followed by lumbar spine

(35.71%). Our results are matched with Gadgil et al^[7] and Jain et al.^[17] All the cases were present in extradural location. Most of cases presented with weakness of limbs and backache with average duration of symptoms is 6.13 month. In our study tuberculosis presented as most common extradural space occupying lesion similar to the study of Tathe et al.^[10]

In the present study we had 5 cases of congenital malformations affecting 2 male and 3 female, present between newborn to 20 years age group. Lumbosacral region and extradural location was noted. Our results are in accordance with study of Odebode et al.^[20]

In the present study 4 cases were diagnosed as lipoma affecting 3 female and 1 male in <20 years age group. Most of were present in lumbar region and IDEM location.

Other non – neoplastic lesions diagnosed were cystic lesions (7.05%) including 3 cases of epidermoid cyst, 1 case each of dermoid cyst, endodermal cyst and arachnoid cyst. Mostly affecting male patient in young age group. Most of cases present in lumbar region and IDEM location.

In the present study 1 case was diagnosed as AV malformations and 4 cases were included in non-specific inflammatory pathology.

Table - 4: Comparison of common entities of spinal cord tumors with various studies.

References	NSCTs* (%)	Meningioma (%)	Neuroepithelial Tumors (%)	Vascular Tumors (%)	Metastasis (%)
Engelhard et al ⁴	21.2	24.4	23.7	-	-
Moein et al ⁵	33.0	15.0	38.0	-	-
Gadgil et al ⁷	42.3	25.4	23.5	-	-
Tathe et al ¹⁰	35.8	14.1	13.1	1.88	3.7
Schellinger et al ¹¹	24.4	28.9	29.2	-	-
Kaye et al ¹²	32.3	29.7	24.4	-	-
Present study	24.7	12.9	15.3	-	2.3

(* Nerve Sheath Cell Tumor)

Conclusion

The present study highlights the histological diversity in spinal space occupying lesions. Schwannoma was the commonest lesion comparable with literature experience. Next frequent diagnosis was tuberculosis that is the

most common extradural spinal space occupying lesion. The combination of clinical, radiological and histopathological features forms the basis of the multi-disciplinary diagnostic approach towards the spinal cord and its covering lesions.

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