Original Article

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Clinico Pathological Study of Parenchymal Lesions of Spinal Cord

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ABSTRACT

Background: Spinal parenchymal lesions are rare with a wide spectrum of clinical and histological presentation.The aims and objectives was to study the incidence and histopathological features of parenchymal lesions of spinal cord in relation to age,sex,clinical features, radiological findings and topographical distribution.

Methods: We studied spinal lesions over a period of ten years in a tertiary care hospital. Our study comprised a total number of 241 surgical resection specimens of lesion of spinal cord out of which 73 cases of spinal cord parenchymal lesions were found. Primary vertebral tumors and paraspinal soft tissue lesions were excluded. Descriptive cross-sectional study of cases including detailed clinical data of age, sex, duration of disease, type of lesion, and radiological findings of the patients was obtained. All cases were analyzed by examining Hematoxylin and Eosin stained slides with use of special stains and immunohistochemistry, as needed.

Results: Male predominance was seen in spinal cord parenchymal lesions and 3rd and 4th decade age group was most commonly affected. These lesions were more common in thoracic region followed by cervical region .Neoplastic lesion of spinal cord parenchyma are more frequently encountered than nonneoplastic lesions. Astrocytomas (24.63 %) were commonest neoplastic spinal cord lesions with preponderance of low grade astrocytoma. Ependymomas and PNET accounted for 20.53 % and 4.10 % respectively

Conclusion: The histopathological diagnosis of spinal parenchymal lesions can be extremely challenging, the difficulty exaggerated by small size of the specimen. In such situation a multidisciplinary approach including neurosurgeons, neuroradiologist and neuropathologist is highly recommended.

Keywords: *Spinal Lesions, Cord Parenchyma, Non –Neoplastic , Neoplastic.*

Introduction

Spinal cord lesions are a distinct and interesting group of lesions with a wide spectrum of clinical and histological presentation. It is an important inclusion in the differential diagnosis for any patient with radiculopathy, myelopathy, neck and back pain. Spinal lesions are rare and form a small part of the central nervous system lesions.Spinal lesions can arise from glial cells located within the parenchyma of the cord, Schwann cells of the nerve roots or meningeal cells covering the cord. These lesions can involve any spinal level but more commonly affect thoracic region. Theses tumors can arise within or outside dura, hence they are intradural or extradural in location. Intradural lesions are characterized as either intramedullary or extramedullary. Intramedullary lesions are typically derived from glial or ependymal cells that are found in interstitium of the cord. Ependymomas that originate at the conus i.e. myxopapillary ependymoma can be wholly or partially extramedullary at this site. . The aims and objectives were to study the incidence and histopathological features of parenchymal lesions of spinal cord in relation to age,sex,clinical features, radiological findings and topographical distribution.

Materials and Methods

The institutional ethical committee approval was sought. This is a retrospective and prospective study of spinal nerve root lesions which were received at our institute in neuropathology department. The study was done over a span of 10 years. A total of 241 cases of spinal lesions were received over a period of 10 years. Clinical data was collected and the lesions were analyzed according to their age, sex, duration, clinical signs and symptoms and distribution. Amongst the various investigations, the radiological findings in terms of MRI, CT and myelogram were noted. The biopsy and surgical resection specimen were received in10 % formalin. Gross examination of the specimen in relation to the size, color, consistency, cystic or hemorrhagic areas was noted. All sections of 4 µ stained with hematoxylin and eosin for light microscopy were studied. Immunohistochemical stains like vimentin, Epithelial Membrane antigen (EMA), were done whenever indicated.The IHC was performed in 5 cases posing diagnostic dilemma in the reference laboratory as per the standard protocol.

Result

Male predominance was seen in spinal cord parenchymal lesions and 3rd and 4th decade age group was most commonly affected (Table 1). These lesions are more common in thoracic region followed by cervical region (Table 2). Neoplastic lesions of spinal cord parenchyma (52 %) were more frequently encountered than non-neoplastic lesions. 38 lesions of spinal cord were neoplastic and 35 cases were non-neoplastic out of total 73 spinal cord lesions. Neoplastic lesions included 18 cases of astrocytomas (24.63 %), 15 ependymomas (20.53 %), 3 PNETs (4.10 %) (Table 3) and 1 case (1.36 %) each of paraganglioma and neuroblastoma.

Table1 : Showing Age and Sex Distribution of Lesions of Spinal Cord.

Lesions Of Spinal Cord	AGE IN YEARS								SEX		
	00-10	11-20.	21-30	31-40	41-50	51-60	61-70	71-80	MALE	FEMALE	TOTAL
Astrocytoma	0	3	7	4	4	0	0	0	13	5	18
Ependymoma	1	0	7	2	0	0	0	0	7	3	10
Myxopap Ependymoma	0	4	1	0	0		0	0	5	0	5
Pnet	0	3	0	0	0	0	0	0	2	1	3
Paraganglioma	0	0	0	0	1	0	0	0	1	0	1
Cavernous Hemangioma	0	0	0	3	1	0	0	0	3	1	4

Table 2 : Showing Level and Location of Lesions of Spinal Cord.

Lesions Of Spinal Cord	Spinal Level					Location		
	Cerv	Cerv-Thor	Thor	Thor-Lumbar	Lumbo-Sacral	Extra Dural	Extra Medullary	Intra Medullary
Astrocytoma	6	3	8	0	1	0	4	14
Ependymoma	0	3	5	0	2	0	3	7
Myxopap Ependymoma	0	0	0	2	3	0	4	1
PNET	3	0	0	0	0	0	3	0
Paraganglioma	0	0	0	0	1	0	1	0
Cavernous Hemangioma	0	0	2	1	1	0	2	2

Table 3 : Showing Lesions of The Spinal Cord Parenchyma

	NUMBER OF CASES	PERCENTAGE
A.NEOPLASTIC		
ASTROCYTOMA (18)		
.PILOCYTIC ASTROCYTOMA (GR.I)	5	6.84 %
.FIBRILLARY ASTROCYTOMA (GR.II)	8	10.95 %
.GLIOBLASTOMA MULTIFORME (GR.IV)	5	6.84 %
EPENDYMOMA (15)		
.CELLULAR (GR.II and III)	10	13.69 %
.MYXO-PAPILLARY (GR. I)	05	6.84 %
PNET (GR.IV)	03	4.10 %
PARAGANGLIOMA (GR.I)	01	1.36 %
NEUROBLASTOMA (GR.IV)	01	1.36 %
B.NON-NEOPLASTIC		
1.CONGENITAL MALFORMATIONS (20)		
-MENINGOCELE	03	4.10 %
-LIPOMENINGOCELE	09	12.32 %

	NUMBER OF CASES	PERCENTAGE
-MENINGOMYELOCELE	07	9.58 %
-SYRINGOMYELIA	01	1.36 %
2.INFLAMMATORY (06)		
-ABSCESS	03	4.10 %
-TUBERCULOMAS	02	2.73 %
-CYSTICERCOSIS	01	1.36 %
3.VASCULAR MALFORMATIONS (06)		
-CAVERNOUS HEMANGIOMA	04	5.24 %
-AV MALFORMATIONS	02	2.73 %
UNCLASSIFIED	**03**	**4.10 %**
TOTAL	**73**	**100**

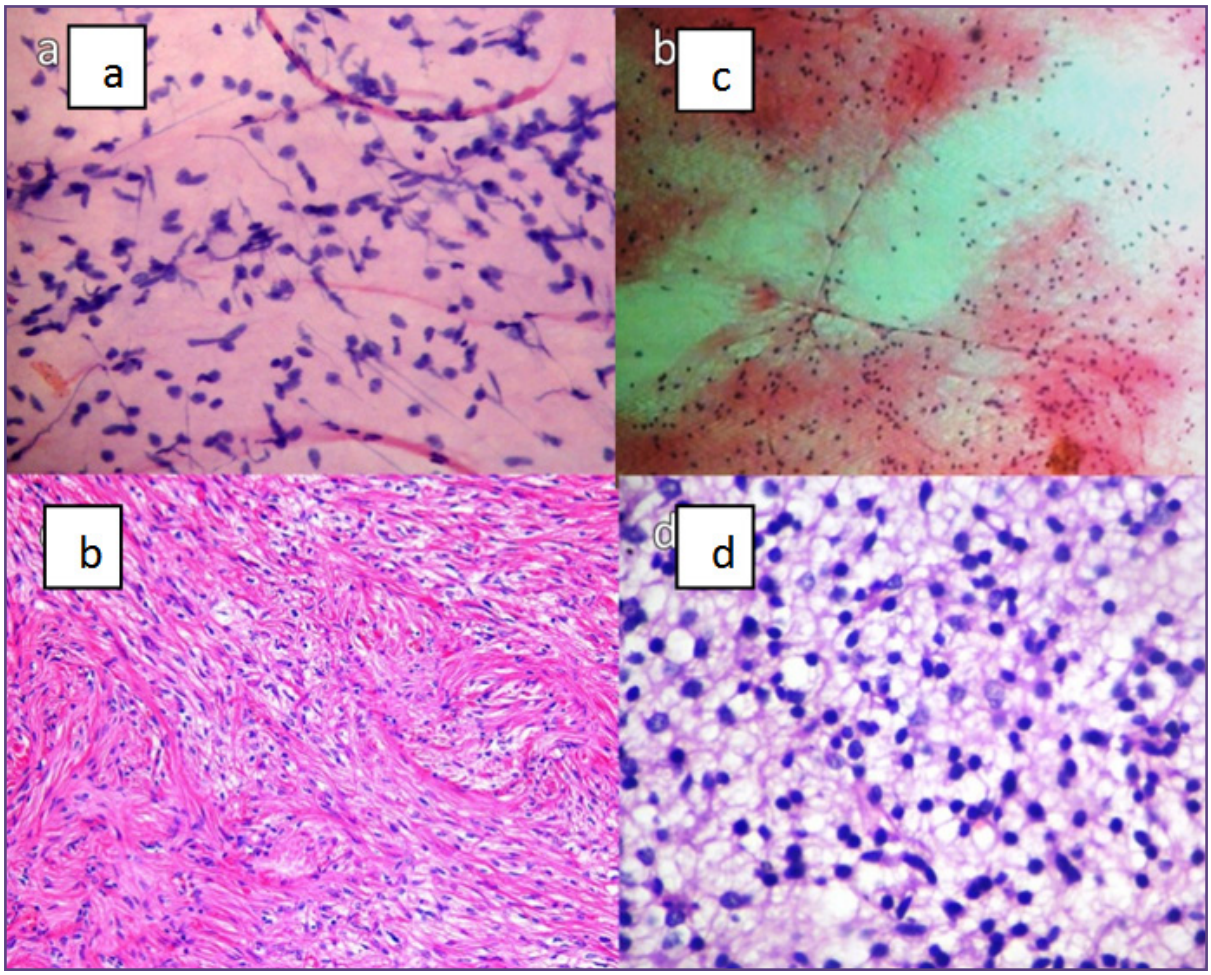

Fig. 1 a Pilocytic astrocytoma- squash smear showing piloid cells with round to oval bland nuclei. (H&E, X 400), Fig 1 b Pilocytic astrocytoma-biphasic pattern, compacted bipolar cells and loose textured cells with microcysts (H&E, X 100). Fig 1 c:- Diffuse fibrillary astrocytoma- squash smear shows low cellularity, elongated cells with interlacing fibrillary processes. (H&E, X 40). Fig 1 d:- Diffuse fibrillary astrocytoma- shows fibrillary neoplastic astrocytes against loose, microcystic stroma. (H&E, X100).

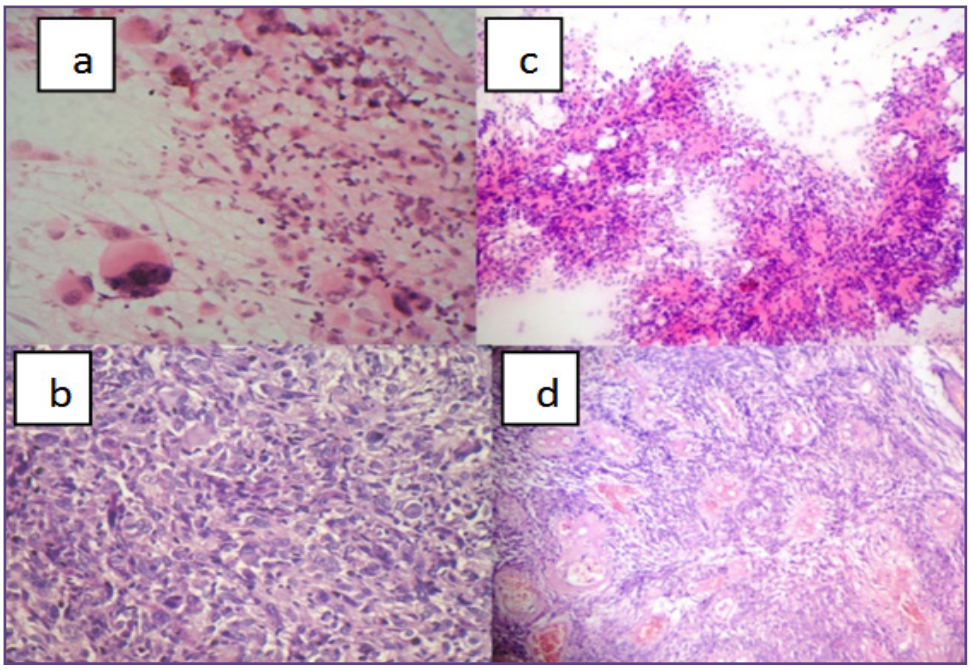

Fig. 2 a :- Glioblastoma-squash smear shows binucleate cells and multinucleate giant cells against fibrillary backgrounnd (H&E, X400), Fig 2 b :- Glioblastoma- showing hypercellularity, highlly pleomorphic astrocytes with nuclear atypil and brisk mitotic activity. (H&E, X400). Fig 2 c Ependymoma-highly cellular squash smear showing striking papillary pattern. (H&E, X 100). Fig 2 d Ependymoma- cellular tumor showing round to oval cells with perivascular pseudorosettes. (H&E, X100)

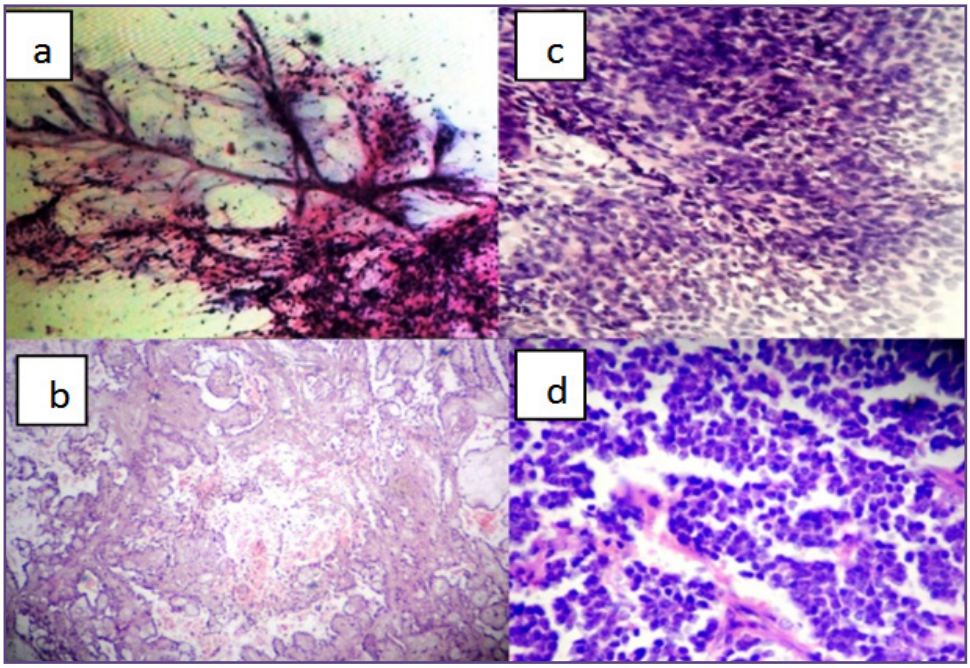

Fig. 3 a :- Myxopapillary ependymoma- squash smear showing papillary arrangement of cells against myxoid matrix. (H&E, X40), Fig 3 b :- Myxopapillary ependymoma- showing elongated tumor cells radially arranged around a myxomatous fibrovascular stroma. (H&E, X100). Fig 3 c PNET- squash smear shows sheets of closely packed round cells having hyperchromatic carrot shaped nuclei. (H&E, X400). Fig 3 d PNET- shows tumor composed of sheets of small, round cells with hyperchromatic nuclei and scant cytoplasm. (H&E, X100)

Discussion

Astrocytoma was the commonest neoplastic spinal cord lesion. In spinal tumors, 18 cases of astrocytomas accounted for (24.63%. Engelhard et al [1] observed incidence of astrocytoma as 9.5 %.

77.77 % of astrocytomas were seen in 11-40 years of age group with M: F ratio 2.6:1. The documented study of Milano et al [2] noted 45 % incidence in 11-45 years age group. 44 % of astrocytic tumors occurred in thoracic and cervical (33.33%) region. Our findings compared well with observation of Craciunas et al [3] who found 67 % cases in thoracic and 45 % in cervical region. 77 % of astrocytomas were intramedullary in location. Innocenzi et al [4] also documented predominant intramedullary location for astrocytoma in 80 % cases.

Of the 18 astrocytic tumors 72.22 % were low grade (Pilocytic and diffuse fibrillary astrocytoma) (Figs 1 a,b,c and d) and 27.78 % were high grade (glioblastoma multiforme) (Fig 2 a and b). Our findings correlated well with studies of Engelhard et al [5], Adam et al [6] and Milano et al [7] who cited astrocytomas were predominantly low grade in 50 % to 72 % of cases.

Immunohistochemical examination on a case of glioblastoma was performed. Strong positivity for glial fibrillary acidic protein (GFAP) which showed cytoplasmic staining pattern was seen. Ki-67 index was very high with nuclear staining pattern [8].

15 cases of ependymomas were seen of which 10 (13.69 %) were conventional (Grade II) while5 (6.84 %) were myxo-papillary ependymomas. Ependymomas constituted 8.57 % of spinal tumors (Fig 2 c and d). Engelhard et al [1] and Craciunas et al [3] noted their incidence ranging from 24 % to 40 %. Ependymomas were observed in 21 to 40 years of age group with male predominance with M: F ratio of 2.3:1. They were located in thoracic (50 %) region and intramedullary (70 %) compartment. Our findings compared well with studies of Adam et al [6] who observed thoracic involvement in 26.3 % cases and cervicothoracic in 50 %. Immunohistochemical examination on ependymomas showed GFAP positivity with cytoplasmic staining pattern and highlighted the presence of perivascular rosettes [9] .

Myxo-papillary ependymomas (Fig 3 a and b) were seen in younger age group and occurred only in males.. They were predominantly located in lumbosacral region and occupied the intradural extramedullary location. Similar observation was noted by Traul et al [10] and Parsa et 11.

Our study displayed astrocytomas (18) were slightly more than ependymomas (15). Various comparative studies conducted by Adam et al [6], Craciunas et al [3], Milano et al [7] and Brotchi et al [2] showed ependymomas were more common as compared to astrocytomas. Mean age for spinal cord gliomas was 28 years. We found gliomas at younger age as compared to other studies of Adam et al [6], Craciunas et al [3] and Milano et al [7] who noted mean age for gliomas in the range of 40 to 44 years.

3 cases (4.10 %) of primitive neuroectodermal tumor (PNET) (Fig 3 c and d) occurred in 11-20 years of age group with M: F ratio 2:1. They were located in cervical region and intradural extramedullary compartment. This is in accordance with the study of Sevick et al [11] who found that PNET were common in young age, located in cervical region and intradural extramedullary compartment. Immunohistochemical examination was performed on 1 case. It was positive for CD 99 and showed membrane staining pattern. [9]

An extremely rare case of paraganglioma in 50 year male in lumbar region and intradural extramedullary compartment was noted which accounted for 0.57 % of spinal tumors. Yang et al [12] reported the incidence of paragangliomas as 0.5 % with peak incidence from 5th to 7th decades and female predominance, M: F ratio was 1:3. Lumbar region and intradural extramedullary location was noted in all cases. Immunohistochemical examination was performed. Chief cells showed positivity for Neuron specific enolase (cytoplasmic staining), Chromogranin (cytoplasmic) and Synaptophysin (membrane staining pattern). [9]

A rare case of spinal neuroblastoma was noted in 30 year female. It accounted for 0.57 % of spinal tumors and located in cervical region and intramedullary compartment. Traul et al [10] observed neuroblastoma as rare intramedullary spinal cord tumor located commonly in cervical region.

Of the 35 non-neoplastic lesions, 57 % were congenital malformations and 17 % each were vascular malformations and inflammatory lesions.

80 % of congenital malformations were lipomeningocele and meningomyelocele. They were observed in newborn to 20 years with equal gender incidence. Lumbosacral region and extradural location was noted. Odebode et al [12] also reported myelomeningocele lesions in 1st decade and lumbosacral involvement in 62 % cases.

In vascular malformations 66 % cases were of cavernous hemangioma (4). They were noted in 4th and 5th decades with M: F ratio of 3:1. They were located in thoracic (50 %) and lumbar (50 %) region and equally distributed in intramedullary (50 %) and extramedullary location. These findings were comparable with study of Cantore et al [13] who observed cavernomas in 5th and 6th decades with male predominance (M: F ratio 5:1). 66 % were in thoracic region and 100 % in intramedullary location.

Spinal abscess was found in 3 cases, present in 3rd to 7th decades with M: F ratio of 2:1. Thoracic site and intradural extramedullary location was common. Nejat et al [14] reported abscess as rare and common in 1st and 3rd decades with male predominance. In 80 % cases thoracic cord was affected.

2 cases of spinal tuberculomas were found of which one was rare case of intramedullary tuberculomas. It was noted in 18 year female in thoracic region. Thacker et al [15] reported intramedullary tuberculomas as rare and found in 0.2 to 0.5 % of all CNS tuberculomas. MacDonell et al [16] also observed intramedullary tuberculomas in young females and thoracic involvement in 72 % cases.A rare case of isolated spinal cysticercosis was noted in 35 year male in thoracic region and intradural extramedullary location. It accounted for 0.41 % of spinal lesions. Ahmad et al [17] reported isolated spinal cysticercosis in intramedullary as well as extramedullary location. Kishor et al [18] observed spinal cysticerci in thoracic region in 44.5 %.

Conclusion

Astrocytic tumors (24.63 %) were commonest neoplastic spinal cord lesions with preponderance of low grade astrocytoma. Ependymomas and PNET accounted for 20.53 % and 4.10 % respectively. The histopathological diagnosis of spinal lesions can be extremely challenging, the difficulty exaggerated by small size of the specimen. In such situation a multidisplinary approach including neurosurgeons, neuroradiologist and neuropathologist is highly recommended.

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