ORIGINAL RESEARCH ARTICLE

Magnetic Resonance Imaging in Spinal Tumors

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A B S T R A C T

Introduction: Different tumor and tumor like conditions can affect the spinal cord and its supporting structures. They account for 15% of craniospinal tumors. They can affect both adults and children and can lead to severe neurological deficits and several morbidities if not diagnosed on time and treated accordingly. MRI is the essential procedure of choice for the workup and plays an integral role in evaluation and improving anatomic delineation and early diagnosis of spinal tumors and also plays an important role in follow up and to monitor response to treatment. Study aimed to evaluate the imaging features of spinal tumors by MRI, to classify spinal tumors according the imaging findings into extradural, intradural extra-medullary, intra-medullary Tumors and to correlate imaging findings with Histopathological findings .

Material and methods: This was a retrospective analytical study conducted in 60 patients over a period of 3 years (2016 to jan 2019) in Gandhi Hospital with 1.5 Tesla MRI machine Avanto System Siemens Limited. The MRI images were studied and following characteristics were evaluated: Location, shape, extent, component characteristics, signal intensities on different MRI sequences and enhancement patterns of the lesions, the lesions were classified into extradural, intradural extra-medullary, intra-medullary and correlated with histopathology.

Results: In my study it was found that spinal tumors are more common in men (60%) and in adults (83%) with maximum tumors occurring in the age group of 41 to 50 yrs. Out of 60 cases studied, 26(43%) were located in intradural extramedullary compartment, 22(37%) were located in intramedullary and (20%) were in extradural compartment.

Conclusion: MRI is the modality of choice for evaluation of spinal tumors. It is useful to study associated soft tissue extension, marrow infiltration, epidural, cord and nerve involvement. The different MRI findings are helpful in classifying different tumors and narrow down the diagnosis, Radiologic manifestations of these tumors need to be correlated with age, sex, location and presentation to arrive at a close differential diagnosis.

Keywords: Magnetic Resonance Imaging, Spinal Tumors, Intradural, Extramedullary, Intramedullary, Extradural, Compartmental Classification

INTRODUCTION

A spinal tumor is an abnormal mass of tissue within or surrounding the spinal cord and spinal column.[1] Intraspinal tumors may originate from the spinal cord, filum terminale, nerve roots, meninges, intraspinal vessels, sympathetic chain, or vertebrae. They can be benign or malignant, primary or secondary, and may result in serious morbidity. Intraspinal tumors are relatively uncommon lesions. However, these lesions can cause significant morbidity and can be associated with mortality as well. In establishing the differential diagnosis for a spinal lesion, location is the most important feature.[2-5]

Today, MRI is always considered the procedure of choice for the workup of all spinal tumors . It permits high-resolution imaging of not only the osseous structures but also the soft-tissue structures in multiple orthogonal planes through the use of varying pulse sequences. MR imaging plays an integral role in evaluation and improving anatomic delineation and early diagnosis of spinal tumors.[2] Radiological manifestations of these tumors need to be correlated with age, sex, location and presentation to arrive at a close clinical diagnosis.[8]

Contrast-enhanced images can be important for tumor detection, delineation, characterization, and grading. They help differentiate the tumor from the spinal cord, nerve roots, or thecal sac as well as from peri-tumoral edema or cysts. They are also crucial to ensure correct staging and treatment planning. MRI also plays an important role in follow-up and to monitor response to treatment.[7,2] Hence MRI has virtually

replaced all other modalities while evaluating spinal tumors.[2]

Compartmental Classification

Tumors in the spine can be localized into one of three compartments: extradural, intradural-extramedullary, and intramedullary. Lesions in each of these compartments have common characteristic appearances that help to identify the compartment in which the tumor is located. Once the lesion is localized, a differential diagnosis can be developed based on the tumors that commonly occur in that compartment

Extradural tumors: The tumors located external to the dural layer and cause impingement on the thecal sac. With progressive increase in size of the mass, the subarachnoid space is at the interface of the mass & the cord gets obliterated with extrinsic cord compression

Intradural extramedullary tumors: The tumors located in the subarachnoid space between the dura and spinal cord. They will be seen as intradural filling defect outlined by sharp meniscus of CSF with enlarged ipsilateral subarachnoid space up to mass and cause deviation of the spinal cord away from the mass

Intradural intramedullary tumors: The tumors located within the spinal cord and cause cord expansion – essential imaging criteria or focal or diffuse multi-segmental smoothly enlargement of the cord with gradual effacement of adjacent subarachnoid space.

Study aimed to evaluate the imaging features of spinal tumors by MRI, to classify spinal tumors according the imaging findings into extradural, intradural extra-medullary, intra-medullary Tumors and to correlate imaging findings with Histopathological findings .

MATERIAL AND METHODS

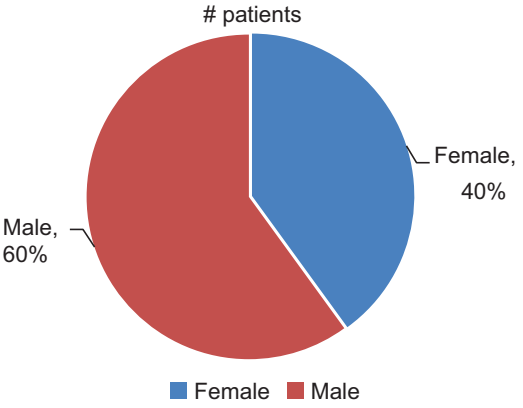
This was a retrospective analytical study conducted in Gandhi Hospital, Secunderabad, Telangana for a period of 3 years extending from 2016 to January 2019. 60 patients diagnosed with tumors of spine by MRI while being evaluated for back pain and other neurological symptoms like quadriparesis, paraperesis, bladder and bowel dysfunction, sensory deficits and underwent surgery were included in the study. Patients of both pediatric and adult age groups and of either sex were included in the study. The patients with other causes for similar symptoms due to infections, prolapsed intervertebral discs and trauma were excluded from the study.

The MRI images were studied and following characteristics were evaluated: Location, shape, extent, component characteristics, signal intensities on different MRI sequences and enhancement patterns of the lesions. The lesions were then classified into extradural, intradural extra-medullary, intra-medullary compartments . Those patients who were diagnosed as having spinal cord tumors were followed up till surgery for confirmatory histopathological / cytological diagnosis.

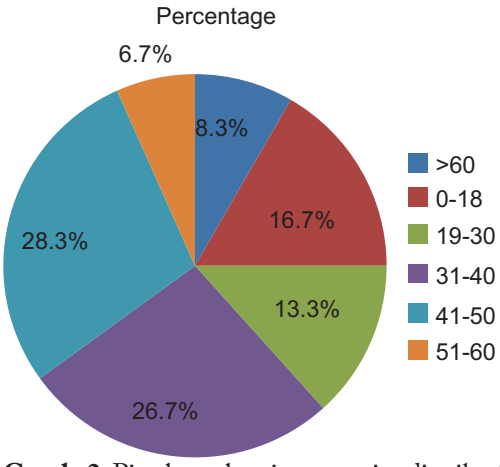
All the MRI scans in this study were performed using 1.5 Tesla MRI machine Avanto System Siemens Limited. The following MRI protocol was used. T1, T2 (sagittal and axial, coronal), DWI and ADC, STIR (Sagittal), POST CONTRAST T1(sagittal, coronal, axial) with intravenous administration of 0.1mmol/kg of body weight of gadolinium

RESULTS

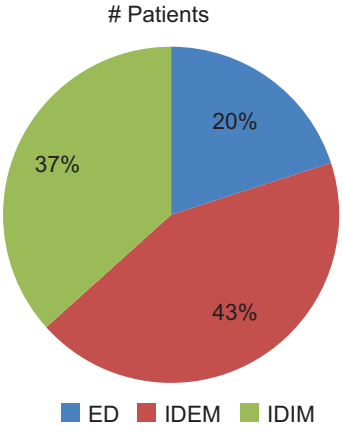
Spinal tumors are more common in men (60%) and in adults (83%) with maximum tumors occurring in the age group of 41 to 50yrs. Out of 60 cases studied, 26 (43%) are located in intradural extramedullary compartment, 22(37%) are located in intramedullary and (20%) are in extradural compartment. Individually in our study ependymoma and nerve sheath tumors were found to be the most common subtypes with 14 cases (23%) each followed by meningioma and epidural



Graph-1: Pie chart showing gender wise distribution



Graph-2: Pie chart showing age wise distribution



Graph-3: Pie chart showing compartment wise distribution of spinal tumors in our study

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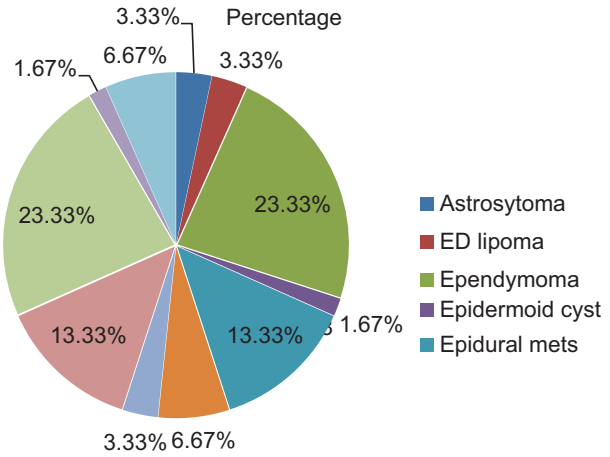
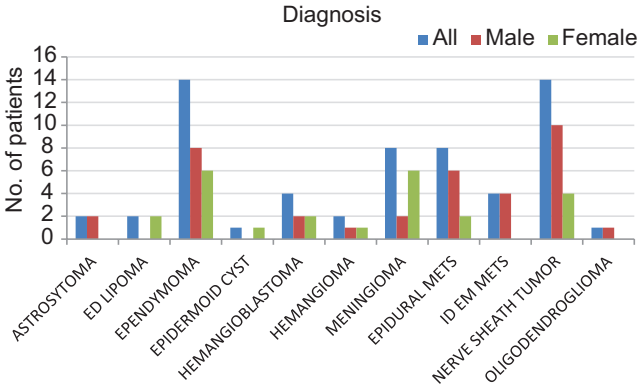


Graph-4: Pie chart showing distribution of individual spinal tumor



Graph-5: Bar chart showing gender wise distribution of individual spinal tumor

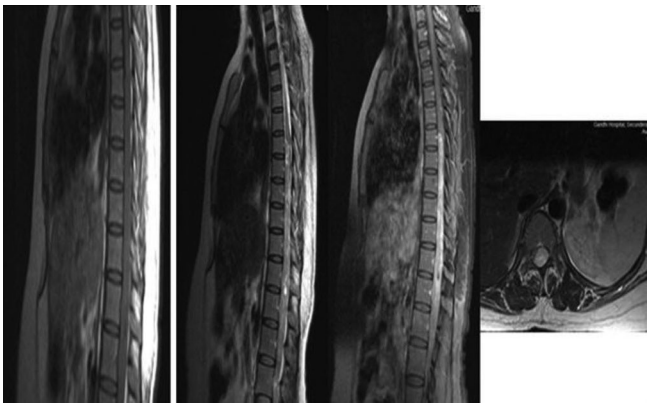


Figure-1: 32 year old with urinary incontinence.
Long segment altered signal intensity noted in intramedullary region from D6 to L2-L3 level showing T1 hypointense, T2 isointense with few areas of hyperintensity causing mild expansion of spinal canal.
Post contrast heterogenous enhancement noted with few areas of non enhancement.
Imaging diagnosis: intramedullary neoplasm-astrocytoma/ ependymoma
HPE: Ependymoma

metastases with 8 cases(13%) each.
Meningioma is predominantly seen in females while rest of the tumors were found to be much more common in men.

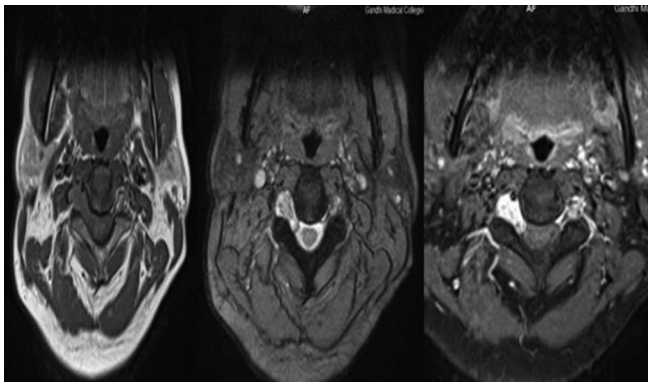


Figure-2: 49 year old patient incidental finding
Small T1 hypointense, T2 heterogenously hyperintense lesion of size 15x7mm enhancing heterogeneously noted along the right neural foramina at C2-C3 level.
Imaging diagnosis: likely nerve sheath tumor
HPE: Neurofibroma

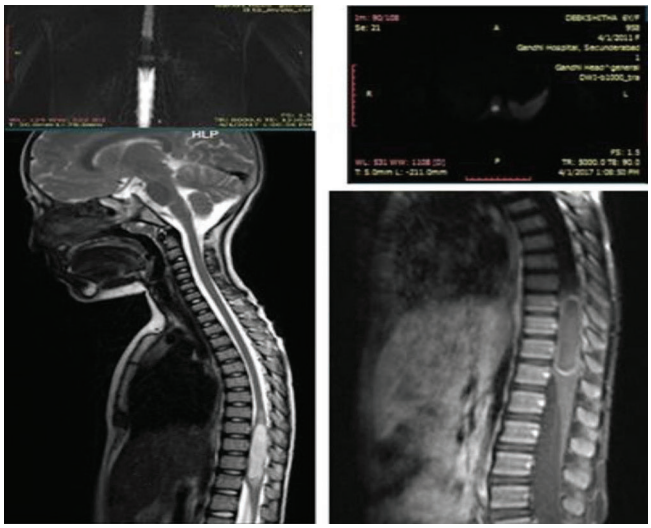


Figure-3: 6 yr old girl with back pain.
Spinal cord enlargement extending from D9 to D12 with 5x1 cm well defined intramedullary T2 hyperintense lesion showing restriction on DWI. Post contrast lesion is showing peripheral enhancement at proximal and distal aspect with central non enhancing area.
Imaging diagnosis: intramedullary neoplasm
HPE: Epidermoid cyst

Out of 60 cases, majority of the cases were seen in male population-36 cases (60%) (Graph-1). Most of the spinal tumors were seen in patients belonging to the age group of 41 to 50 years-17 cases (28.3%) (Graph-2).
It was observed in our study that maximum number of spinal tumors were located in intradural extramedullary compartment-26 cases (43%) (Graph-3).
The spinal tumors in our study were distributed among the three compartments as mentioned in the table below. It was observed that ependymoma was the most common intradural intramedullary tumor, metastases was the most common extradural spinal tumor and nerve sheath tumors were the most common intradural extramedullaary spinal tumor (table-1).
Nerve sheath tumor and ependymoma were found to be the

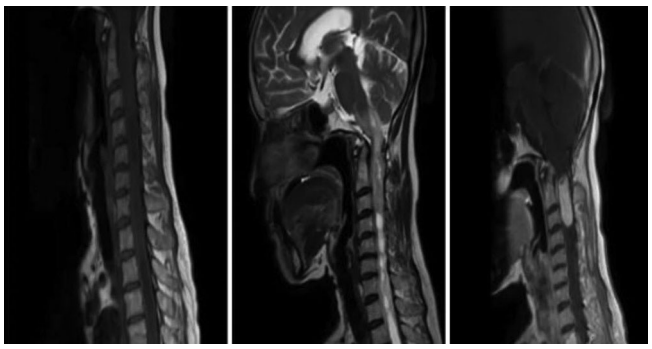


Figure-4: 64 year old female with progressive quadriparesis
A well defined T1 hypointense, T2 hypointese with few T2 hyperintensities within showing avid post contrast enhancement in the upper cervical cord at the level of C2-C3 with significant cord and lower brain stem edema and long segment syrinx.
Imaging diagnosis: Intramedullary neoplasm
HPE: Hemangioblstoma

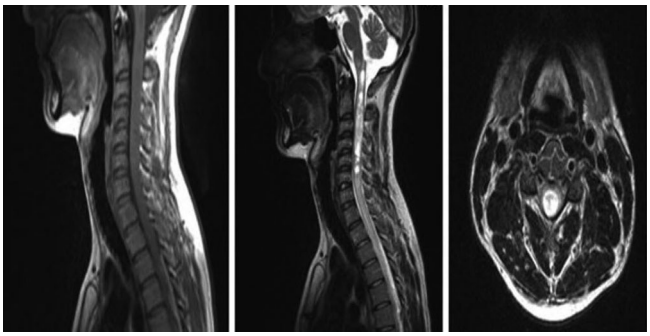


Figure-5: 27 year old male with weakness of bilateral upper and lower limbs
T1 hypointense lesion, T2 heterogenous lesion with cystic areas within located centrally within cord, causing cord expansion and extending from cervicomedullary junction to C6 vertebrae level.
Intramedullary T2W hyperintensity noted extending from lower medulla upto the lesion and from C7 upto D4 level s/o cord edema
Imaging diagnosis: ntramedullry neoplasm
HPE: Astrocytoma

most common spinal tumor accounting for 14 cases each (23.3% each) (Graph-4).
It was observed that most of the spinal tumors were seen predominantly in males except meningioma which was more common in female population (Graph-5).

DISCUSSION

A spinal tumor is an abnormal mass of tissue within or surrounding the spinal cord and spinal column. Earlier xray-myelography, postmyelography CT scan and bone scans and CSF fluid analysis were used for evaluation of possible tumors of spine and spinal cord. Nowadays, MRI is the most commonly used . Central nervous system comprises of brain and spinal cord. Spinal cord tumors account for 15% of all central nervous system neoplasms. Spinal cord tumors can be grouped according to their location into extradural, intradural extramedullary and intradural intramedullary tumors which help in diagnosis of the type of tumor. Lesions can occasionally compromise more than one compartment. Intradural compartment comprises of intradural

Figure- 6: 48 year old female with backache
Well defined oval T2 isointense lesion seen in anterior thecal space at D9 to D10 level causing dilatation of ipsilateral subarachnoid space and narrowing of contralateral subarachnoid space displacing the cord posteriorly showing homogenous post contrast enhancement
Imaging diagnosis: intradural extramedullary lesion
HPE: Meningioma

intramedullary and intradural extramedullary compartments. Intradural extramedullary tumors are seen within the Dural sheath but outside the spinal cord. Neurofibroma and meningioma are the common primary tumors in this location which are commoner than the secondary tumors or leptomeningeal tumor spreads . These lesions cause widening of the subarachnoid space . Intramedullary tumors occur within the spinal cord resulting in cord expansion and narrowing of subarachnoid space . Most of the intramedullary tumors are malignant and 90-95% are gliomas. Commonly the glial tumors are ependymoma and astrocytoma. In adults, ependymomas are the commonest glial tumors and in children astrocytomas are common . Intramedullary metastasis is extremely rare . Spinal tumors present with symptoms like back pain, progressive paraparesis, sensory loss, sphincter dysfunction.[5]

According to our study, spinal neoplasms were more common in male population and in adults. Similar to ours, in the study conducted by Santosh.K.Panda[5] et al mentioned that out of spinal tumor patients 57.3% were males and 42.7% were females. Among them 5.6% were in pediatric age group and 94.4% were adults.
Majority of spinal tumors are seen in elderly patients with most common age group being 41 to 50yrs. This observation is similar to study by Santosh et al[5] which also found the most common affected age group to be 41 to 50yrs.
Ependymomas and nerve sheath tumors were the commonest of tumors accounting for 23% of cases each followed in decreasing order of frequency by meningioma, epidural metastases, intradural extramedullary metastases, hemangioblastoma, astrocytoma, lipoma, hemangioma, oligodendroglioma and epidermoid cyst. Chung et al[4] and Santosh et al[5] reported schwannomas as the commonest tumor similar to our study followed by meningioma, ependymomas etc. Parizel et al[1] also reported ependymomas are the commonest tumor in adults. Study conducted by DR.Ravi N et al[2] found that intradural extramedullary tumors were commoner than intramedullary tumors.

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In our study meningioma showed female predominance(M:F::1:3). Similar to our study the study by Santosh et. al[5] showed the male to female ratio in meningiomas to be 1:2

Ependymomas and nerve sheath tumors were the most common spinal tumors in intramedullary and intradural extramedullary compartments respectively in our study. This is similar to the study results of Chung et al[4], Parizel et al[1] and Santosh et al.[5]

CONCLUSION

Spinal tumors accounts for approximately 15% of cranio-spinal tumours and can cause significant morbidity and can be associated with mortality as well. MRI is helpful to classify the tumours into different compartments and narrow down the differential diagnosis so MRI is the essential procedure of choice for the work up of all spinal tumors and plays an integral role in evaluation and improving anatomic delineation and early diagnosis of spinal tumors and also plays an important role in follow-up and to monitor response to treatment.

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