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Evaluation of spinal tumors and its comparison with histopathological findings

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Abstract---Objective: The objective of the study is usefulness of diagnostic MRI in evaluation of spinal tumors. Methodology: This cross-sectional study was carried out in Radiology Department, Dhiraj Hospital, SBKS medical college, Pipariya, Vadodara. The data was collected from July 2021 to March 2022 and total 60 patients were included in the study. Data was collected from MRI diagnosed spinal tumors who attended at Radiology and Imaging department from OPD and indoor patients. Sensitivity, specificity, positive predictive value, negative predictive value, and accuracy of MRI for evaluation of spinal tumors were detected. Results: Out of 60 patients 31 (51.6%) was intradural extramedullary, 15 (25.0%) was extradural and 13 (21.6%) was intramedullary. Distribution of patients according to MR

diagnosis, among the 60 patients 49 were diagnosed spinal tumor and 11 were not spinal tumor by MRI. Among the 49 spinal tumor diagnosed 13 (26.5%) were schwannoma, 02(4.0%) were neuro fibroma, 12(24.4%) were meningioma, 08(16.3%) were ependymoma, 06(12.2%) were astrocytoma, 03(6.1%) were metastasis and 2 (4.0%) was osteoblastoma. Out of all cases 49 were diagnosed as spinal tumour by MRI and among them 48 were confirmed by histopathological evaluation. They were true positive. Diagnosed one case having spinal tumour by MRI which was not confirmed by histopathological findings. That was false positive. Out of 11 cases of non tumour which were confirmed by MRI, 4 were confirmed as spinal tumour and 7 were non-tumour by histopathological findings. They were false negative and true negative respectively. Sensitivity, specificity, positive predictive value, negative predictive value and accuracy of the MRI in the diagnosis of spinal tumour were 93.76%, 85.79%, 97.95%, 63.63% and 92.50% respectively. Conclusion: The present study conducted to assess usefulness of diagnostic MRI in evaluation of spinal tumors. Study revealed high sensitivity, specificity and accuracy of the MRI in the diagnosis of spinal tumour. MRI should be the initial procedure in the evaluation of suspected tumors of the spine.

Keywords---spinal tumors, histopathological findings, MRI.

Introduction

Spinal tumors are not uncommon in our country. Spinal tumors can cause significant morbidity. Primary spinal cord tumors constitute 0.5-0.65% of all tumors. Spinal tumors can be classified as intramedullary, intradural extramedullary and extradural. MRI has a special role in the visualization of spinal tumors, easily allowing tumors classification as extradural, intradural extramedullary, or intramedullary which is very useful in tumor characterization. Intradural tumors;extramedullary in majority ,with nerve sheath tumors most commonly seen. (Struffert et al. 2004)². The role of MRI for the evaluation of the spine is expanding rapidly. In addition to being noninvasive, MRI offers high soft-tissue contrast and multiplanar imaging capability. MRI examinations of the spine usually include a T1- weighted spin-echo and a T2-weighted spin- echo and/or a gradient-echo sequence (Berns et al. 1989)³.

Several health care institutions for the management of spinal tumours have already been established in india both in private and public sectors. Though the exact statistics of incidence and prevalence of spinal tumour in our country is not available but it is the common opinion that the number of such kind of problem is increasing day by day. Appropriate diagnostic procedure should always need upgrade for better management of the spinal tumour. SBKS medical college and research institute is a tertiary level Hospital in Vadodara. Sophisticated technology and multidimensional services have been added a new dimension in this hospital for health care services.

Materials and Methods

This cross-sectional study was carried out on 68 patients from 11-70 yrs of age, referred for MRI of spine with a clinical suspicion of intraspinal tumour to radiology and imaging department of Dhiraj Hospital, S.B.K.S. Medical Institute and Research Centre, Pipariya, Vadodara. from July 2021 to March 2022 after approval of ethical committee. Three cases were excluded from the study due to unavailability of histopathological report in two patients and other one refused to do operation. Finally, 60 patients were included in the study. Patients with clinically suspected spinal tumors referred to Radiology & Imaging department of Dhiraj Hospital either by OPD or Inpatient department of Neurosurgery, Neuromedicine and orthopedics were selected as cases. Estimated 60 patients fulfil the inclusion criteria and were evaluated. Sampling technique was purposive sampling. Appropriate data was collected by using a preformed data sheet. . All other needed data was collected from history sheet and investigation papers. After tissue biopsy all histopathological reports were collected. Statistical analysis of the results was done by using computer based statistical software, SPSS (SPSS Inc, Chicago, IL, USA).

Results

Among the 60 patients 38 (63.3%) were male and 22 (36.6%) were female. Male to female ratio is 1.72:1. Among 60 patients 05(8.3%) were in the age group of 20 years, 08(13.3%) were in the age group of 21 to 30 years, 16 (26.6%) were in the age group of 31 to 40 years, 21(35.0%) were in the age group 41-50 years, 6 (10%) were in the age group of 51 to 60 years and rest 4 (6.6%) were in the age group of >60 years. The mean age \pm SD is 39.45 ± 11.50 years with a range of 13 – 65 years. Among the patients location of tumour of 31 (51.6%) was intradural extramedullary, 15(25.0%) was extradural and 13 (21.6%) was intramedullary. Among the 60 patients 49 were diagnosed spinal tumour and 11 were not spinal tumour by MRI. Among the 49 spinal tumour diagnosed 13(26.5%) were schwannoma, 02 (4.0%) were neuro fibroma, 12(24.4%) were meningioma, 08(16.3%) were ependymoma, 06(12.2%) were astrocytoma, 03(6.1%) were metastasis and 2(4.0%) was osteoblastoma.

Among the 11 patients diagnosed other than spinal tumor by MRI 3 (27.2%) were sequestered disc, 5(45.4%) were tubercular spondylitis, 2 (18.1%) were epidural abscess and rest 1 (9.0%) was subdural Haematoma. According to histopathological diagnosis among the 60 patients 52 were diagnosed spinal tumour and 8 were not spinal tumour by histopathology. Among the 52 spinal tumour diagnosed 15(28.8%) were schwannoma, 03(5.7%) were neuro fibroma, 13(25%) were meningioma, 08(15.3%) were ependymoma, 06(11.5%) were astrocytoma, 05(9.6%) were metastasis and 2 (3.8%) was osteoblastoma. Among the 8 patients diagnosed other than spinal tumor by histopathology 3 (37.5%) were sequestered disc, 4(50%) were tubercular spondylitis and rest 1(12.5%) were epidural abscess.

Out of all cases 49 were diagnosed as spinal tumour by MRI and among them 48 were confirmed by histopathological evaluation. They were true positive. Diagnosed one case having spinal tumour by MRI which was not

confirmed by histopathological findings. That was false positive. Out of 11 cases of non tumour which were confirmed by MRI, 4 were confirmed as spinal tumour and 7 were non-tumour by histopathological findings. They were false negative and true negative respectively. The validity test Sensitivity, specificity, positive predictive value, negative predictive value and accuracy of the MRI in the diagnosis of spinal tumour were 92.30%, 87.5%, 97.95%, 63.63% and 92.50% respectively.

Table I
Validity of MRI diagnosis of spinal tumors

	Positive	Negative	
Positive	48(92.3)*	01(12.5)	49(81.6)
Negative	04(7.6)	07(87.5)	11(18.3)
Total	52(100.0)	08(100.0)	60 (100.0)

intramedullary, intradural extramedullary, and extradural. Metastases, lymphoma, and multiple myeloma are the frequently observed malignant spinal tumors. A correct and complete diagnosis of neurologic symptoms is necessary to give appropriate treatment (Bilsky et al. 1999)⁴. In the present study among the 60 patients 38 (63.3%) were male and 22 (36.6%) were female. Male to female ratio is 1.72:1. Avramov et al. (2015)⁵ in a study of 122 patients with reported that 54.0% were male and 46.0% were female with male to female ratio was 1.18:1 Among 60 patients 05(8.3%) were in the age group of 20 years, 08(13.3%) were in the age group of 21 to 30 years, 16 (26.6%) were in the age group of 31 to 40 years, 21(35.0%) were in the age group 41-50 years, 6 (10%) were in the age group of 51 to 60 years and rest 4 (6.6%) were in the age group of >60 years. The mean age \pm SD is 39.45 \pm 11.50 years with a range of 13 – 65 years. The average follow-up period was 23.8 months. The mean patient age was 46.6 years.

CampelloMRI Histopathology Total

*Figure within parentheses indicates column percentage.

Table II
Validity test

Validity test	Value (%)
Sensitivity	92.3
Specificity	87.5
PPV	97.95
NPV	63.63
Accuracy	92.15

Discussion

Primary spinal cord tumors constitute 2% to 4% of all central nervous system neoplasms and are characterized based on their location as. et al. (2009)⁶ in a recent study of 70 patients with intramedullary spinal cord tumors (IMSCTs)

showed that the median age at presentation was 41 years with a range of 18 to 47 years. Primary spinal cord tumors constitute 2% to 4% of all central nervous system neoplasms and are characterized based on their location as intramedullary, intradural extramedullary, and extradural. Characteristic magnetic resonance imaging findings are helpful for localization and characterization of these lesions before treatment, as well as for follow-up after treatment (Beall et al. 2007)⁷. Among the patients location of tumour of 31 (51.6%) was intradural extramedullary, 15 (25.0%) was extradural and 13 (21.6%) was intramedullary.

Among 60 patients 20(33.3%) had enlarged CSF spaces and 40(66.6%) had not. 54(90.0%) had cord compression and 06(10.0%) had not. They reported that MR correctly assigned one of three compartments to all lesions, 13 intramedullary, 31 intradural extramedullary (13 schwannomas, 02 neurofibromas, 12 meningiomas), and 15 extradural (13 schwannomas, 12 meningiomas, 5 metastatic renal cell carcinoma). Characteristic magnetic resonance imaging findings are helpful for localization and characterization of these lesions before treatment, as well as for follow-up after treatment (Beall et al. 2007)⁷. According to contrast enhancement 4(6.6%) had non-enhancing lesion and 56(93.3%) had enhancing lesion. Enhancing lesion heterogeneous, homogeneous and ring enhancement were 18(32%), 29(51%) and 9(16%) respectively.

Diagnosis of a primary spinal cord tumor requires a high index of suspicion based upon clinical signs and symptoms as well as spine-directed MRI (Chamberlain and Tredway 2011)¹. The category of extramedullary intradural masses includes a variety of lesions from meningiomas and nerve sheath tumors (neurofibromas, schwannomas) to less common tumors (hemangiopericytoma), metastases, benign tumors (lipoma, dermoid, epidermoid), inflammatory disorders (arachnoid adhesions, sarcoidosis), vascular lesions (spinal-dural arteriovenous fistula), and cystic lesions (perineural or Tarlov cysts) (Beall et al. 2007)⁷. Among the 60 patients in the present study 49 were diagnosed spinal tumour and 11 were not spinal tumour by MRI. Among the 49 spinal tumour diagnosed 13(26.5%) were schwannoma, 02 (4.0%) were neuro fibroma, 12(24.4%) were meningioma, 08(16.3%) were ependymoma, 06(12.2%) were astrocytoma, 03(6.1%) were metastasis and 2(4.0%) was osteoblastoma. Among the 11 patients diagnosed other than spinal tumour by MRI 3(27.2%) were sequestered disc, 5(45.4%) were tubercular spondylitis, 2 (18.1%) were epidural abscess and rest 1 (9.0%) was subdural Haematoma (Table XI).

Histopathological diagnosis of 52 was spinal tumour and 8 were not spinal tumour. Among the 52 spinal tumour diagnosed 15(28.8%) were schwannoma, 03 (5.7%) were neuro fibroma, 13(25%) were meningioma, 08(15.3%) were ependymoma, 06(11.5%) were astrocytoma, 05(9.6%) were metastasis and 2(3.8%) was osteoblastoma (Table XII). Among the 8 patients diagnosed other than spinal tumour by histopathology, 3(37.5%) were sequestered disc, 4(50%) were tubercular spondylitis and rest 1(12.5%) were epidural abscess. Out of all cases 49 were diagnosed as spinal tumour by MRI and among them 48 were confirmed by histopathological evaluation. They were true positive. Diagnosed one case having spinal tumour by MRI which was not confirmed by histopathological findings. That was false positive. Out of 11 cases of non tumour which were

confirmed by MRI, 4 were confirmed as spinal tumour and 7 were non-tumour by histopathological findings. They were false negative and true negative respectively. The validity test Sensitivity, specificity, positive predictive value, negative predictive value and accuracy of the MRI in the diagnosis of spinal tumour were 92.3%, 87.5%, 97.95%, 63.63% and 92.50% respectively.

Summary

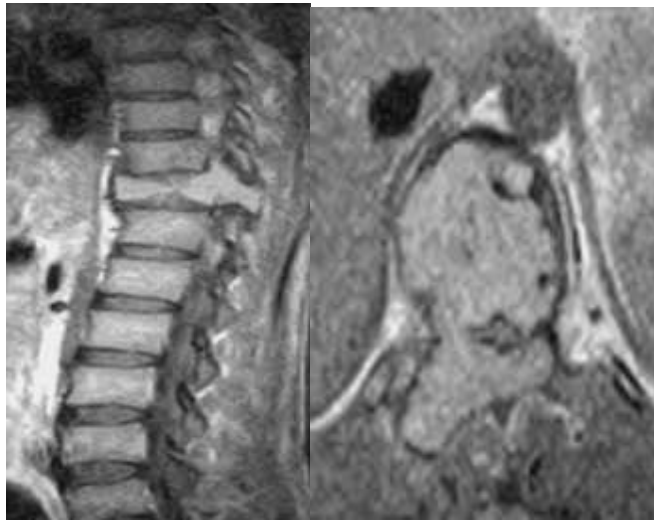
The present cross sectional study was conducted in the Department of Radiology & Imaging in collaboration with Department of Neurosurgery, Dhiraj hospital & Department of Pathology, SBKS medical college, Vadodara, Gujarat between the periods of July 2021 to March 2022 to assess the diagnostic usefulness of MRI in evaluation of spinal tumors. Total 60 patients were included in this study. The summary of the study as follows:

- In the present study among the 60 patients 38 (63.3%) were male and 22 (36.6%) were female. Male to female ratio is 1.72:1. The mean age \pm SD is 39.45 ± 11.50 years with a range of 13–65 years. 05(8.3%) were in the age group of 20 years, 08(13.3%) were in the age group of 21 to 30 years, 16 (26.6%) were in the age group of 31 to 40 years, 21(35.0%) were in the age group 41-50 years, 6 (10%) were in the age group of 51 to 60 years and rest 4 (6.6%) were in the age group of >60 years.
- Most common presenting symptoms was back pain (98.0%). Limb weakness was the presentation in 45 (88.2%)



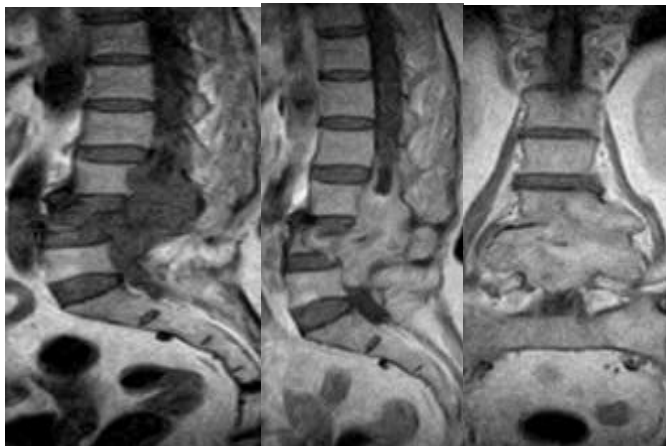
Hemangiomas

There is hyperintense round lesion at the level of L1 vertebral body on T2 weighted imaging suggestive of haemangioma of vertebral body.



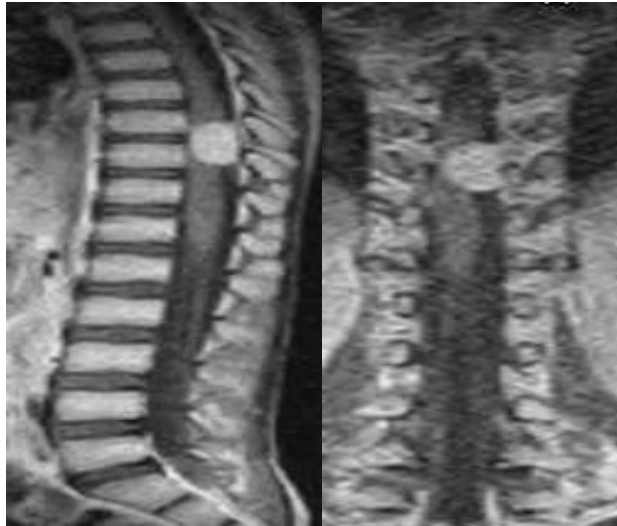
Osteoblastoma

There is compression of D11 body and expansion of posterior elements of D11 body with compression of spinal

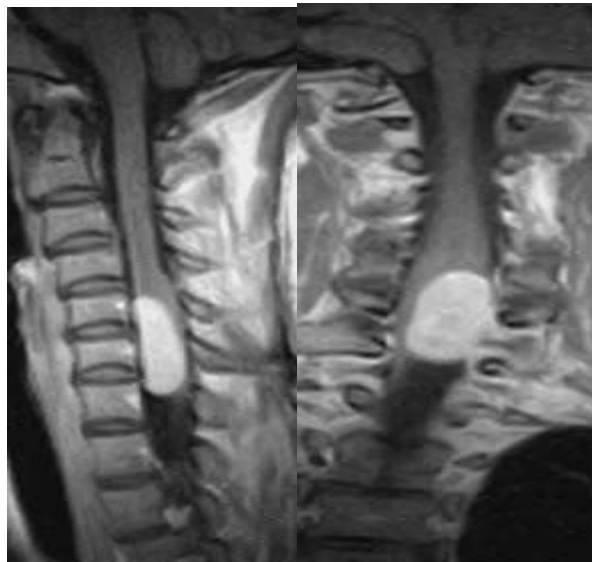


Lymphoma

MRI with contrast shows erosion of L3-L4 vertebral bodies with expansion of spinal canal and posterior scalloping of L3 vertebral body

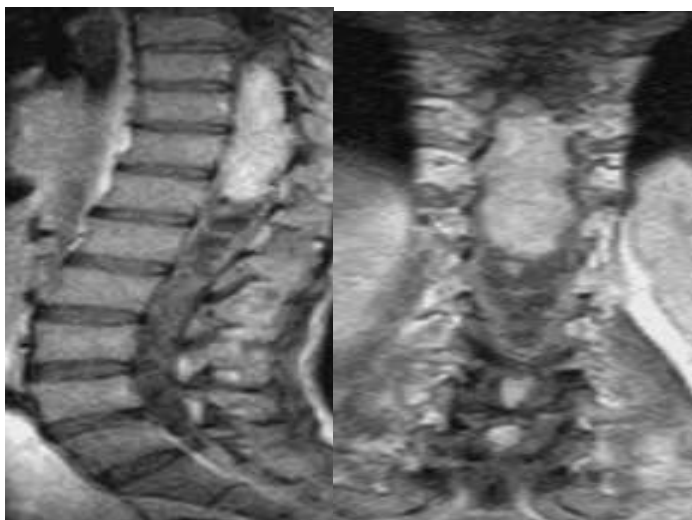


MRI with contrast shows well defined round lesion in intradural-extramedullary compartment displacing and compressing spinal cord with homogenous enhancement.



Neurofibromatosis

There is oval or long enhancing lesion at C5-C7 level with extension into extradural compartment (dumbbell shape)



Ependymoma/Astrocytoma

Expansile intradural intramedullary lesion hyper intense on T2 weighted imaging with few specks of calcifications.



Syringohydromyelia with Chiari Type-I Malformation patients. Other presenting symptoms loss of bowel and bladder control, loss of sensation and paraplegia were 17(28.3%), 20(33.3%) and 23(38.3%) respectively. Among the patients location of tumour of 31 (51.6%) was intradural extramedullary, 15 (25.0%) was extradural and 13 (21.6%) was intramedullary.

- 20(33.3%) had enlarged CSF spaces and 40 (66.6%) had not. Among 60 patients 54 (90.0%) had cord compression and 06 (10%) had not. Among 60 patients 15 (25%) had swelling of spinal cord compression and 45 (75%) had not. Among the 60 patients 4 (6.6%) had non enhancing lesion and 56

(93.3%) had enhancing lesion. Enhancing lesion heterogeneous, homogeneous and ring enhancement were 18(32%), 29(51%) and 9(16%) respectively.

- Out of 60 patients, 49 were diagnosed spinal tumour and 11 were not spinal tumour by MRI. Among the 49 spinal tumour diagnosed 13(26.5%) were schwannoma, 02 (4.0%) were neuro fibroma, 12(24.4%) were meningioma, 08(16.3%) were ependymoma, 06(12.2%) were astrocytoma, 03(6.1%) were metastasis and 2(4.0%) was osteoblastoma. Among the 11 patients diagnosed other than spinal tumour by MRI 3 (27.2%) were sequestered disc, 5(45.4%) were tubercular spondylitis, 2 (18.1%) were epidural abscess and rest 1 (9.0%) was subdural Haematoma.
- According to histopathological diagnosis among the 60 patients 52 were diagnosed spinal tumour and 8 were not spinal tumour by histopathology. Among the 52 spinal tumour diagnosed 15(28.8%) were schwannoma, 03(5.7%) were neuro fibroma, 13(25%) were meningioma, 08(15.3%) were ependymoma, 06(11.5%) were astrocytoma, 05(9.6%) were metastasis and 2 (3.8%) was osteoblastoma.

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Conclusion

The present study conducted to assess the usefulness of diagnostic MRI in evaluation of spinal tumors. Study revealed high sensitivity, specificity and accuracy of the MRI in the diagnosis of spinal tumour. MRI should be the initial procedure to evaluate the suspected tumors of the spine.

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