# Role of magnetic resonance imaging in the evaluation of intraspinal tumor

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**Abstract**

**Background:** Magnetic resonance imaging (MRI) is a noninvasive diagnostic tool in patient with spinal tumors. MRI has made a significant impact on the differential diagnosis of intraspinal tumor. **Objective:** To evaluate the validity of MRI as a diagnostic tool in patient with spinal tumors. **Methods:** This cross sectional study was conducted in Radiology & Imaging Department (RID) of Dhaka Medical College Hospital, Dhaka. Total 50 clinically suspected patients of Intraspinal tumor referred to RID for MRI were included in this study. MRI of cervical, dorsal and lumbar spine were done according to requirement. After operation histopathology report of the mass was collected in each case. This histopathlogical report was taken as gold standard test for identifying the type of the intraspinal mass. The validity indices namely sensitivity, specificity, positive predictive value and negative predictive values of MRI report to detect the intraspinal mass were calculated. **Results:** A total of 50 patients, 30 (60.0%) were male and the rest 20(40.0%) were female with mean age of 38.89 years. Weakness of the limbs was the most common (46, 92%) symptoms of the patients. Another common symptom was back pain (45, 92%) patients. On MRI the commonest location of spinal tumors was intradural extramedullary (29, 58%). The highest number{13 cases (26%)} were identified as Schwannoma, followed by Meningioma {11 cases (22%)}, then Ependymoma {7 cases (14%)}. Most of the tumors show hypointense signal on T1WI (52%) and hyperintense signal on T2WI (62%) and post contrast heterogeneous enhancement (44%). Sensitivity and specificity of MRI to detect intraspinal tumor were 92.68% and 88.0% respectively. **Conclusion:** MRI can be accepted as the most effective imaging modality in the diagnosis of intraspinal tumor.

**Key words:** MRI, validity, intraspinal tumor

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## Introduction

Intraspinal tumor are not uncommon lesion, that may result in serious morbidity. Their clinical symptoms are often non specific and include back pain, radicular symptom and slowly progressive neurological deficits such as limb weakness, paresthesia, gait problem, impotence, bowel and bladder dysfunctions are the most common. Less common are acute headache, skeletal deformity such as kyphoscoliosis. Intraspinal tumor are classified as either extradural or intradural. Intradural tumors are further divided into intramedullary or extramedullary.[1] Spinal tumors account for approximately 5-15% of the nervous system neoplasm.[2] Intradural extramedullary spinal cord tumor constitute approximately two third (about 53-65%). Extradural tumors are about 28-30% and intramedullary tumor estimated to be 7-22%. Spinal intramedullary neoplasm account for about 4% - 10% of all central nervous system (CNS) tumors and 2% - 4% of CNS glial tumors. Although spinal cord tumors constitute only 20% of all intraspinal tumors in the adult population, they constitute 35% of such tumors in children. Most spinal cord tumors are malignant and 90% - 95% are classified as gliomas. Most of the glial tumors are either ependymomas or astrocytomas. Ependymomas are the most common glial tumors in adults, whereas astrocytomas are the most common intramedullary tumor in children.[3]

In conventional myelography, CT myelography all have radiation hazards and also need experienced technician. CT has prefixed protocol which may missed the lesion. MRI has made a significant impact on the differential diagnosis of intraspinal tumor. MRI has made multiplanner imaging,

cross sectional anatomical details, sagital, coronal, axial reformate.[4] The enhancement of intradural extramedullary lesion with gadolinium is often dramatic. Even small nodules generally enhance brightly and are easily seen.[5,6]

MRI has proven to be an excellent technique for visualizing the spinal cord and its tumor. MRI has several general well-recognized advantage over the imaging methods, including superior soft tissue discrimination ability to directly image in the sagittal and coronal planes, more specifically to imaging the spinal cord.[4]

In the detection and identification of intraspinal tumors by MRI accuracies are found 92% correlation between MRI and histopathology have been reported.[7] In multi institutional prospective study, the sensitivity of contrast MRI for detection of intraspinal tumor was 95%.[4] Gd-DTPA enhanced MR imaging improves the reliability and spinal tumor diagnosis and increases MRI sensitivity and specificity.[8,9] This study was done to identify the efficacy of MRI to detect intraspinal tumor.

## Methods

This cross sectional study was conducted in Radiology & Imaging Department (RID) of Dhaka Medical College Hospital. Dhaka. The patients clinically suspicion of Intraspinal tumor referred to RID for MRI were constituted the study population. Total 50 patients were included in this study, who were referred from July 2008 to March 2010. MRI of cervical, dorsal and lumbar spine were done according to requirement. After operation histopathology report of the mass was collected in each case. This histopathlogical report was taken as reference (gold standard ) test for identifying the type of the intraspinal mass. Data were collected in a predesigned data collection sheet from MRI and histopathogical reports. Data were compiled, analyzed and results were prepared. The validity indices namely sensitivity, specificity, positive predictive value and negative predictive values of MRI report to detect the intraspinal mass were calculated.

### Protocol of the MR scan of the spine

MRI of the spine was performed in the axial and sagital planes using a combination of pules sequences. The study was performed while patients lying supine with their median sagital plane coinciding with the midline of the scanner table. We performed all MR scan was done on 0.3-Tesla open MR machine (AIRIS-II-HITACHI) was used. Images were taken of T1WI,T2WI and T1 contrast sequences in sagital, axial and coronal plane. A circular surface (synergy body) coil was used to obtain a high signal-to-noise ratio and high spatial resolution. The sequences performed are shown in Table 1.

Paramagnetic contrast gadopentetate dimeglumine diethylenetriaminepenta-acetic acid (Gd-DTPA).

**Table 1: Shows protocol of MRI in spinal tumors imaging**

| Parameters | Sagital T1 | Sagital T2 | Axial T1 | Axial T2 |
|---|---|---|---|---|
| TR | 6000 | 3500 | 431 | 4000 |
| TE | 10 | 100 | 10 | 100 |
| FOV | 45x30 | 45x30 | 20 | 20 |
| MTX | 256x384 | 256x384 | 192x384 | 224x320 |
| FA | 90/180 | 90/180 | 90/180 | 90/180 |
| NAQ | 2 | 2 | 2 | 2 |

## Results

A total of 50 patients, 30 (60.0%) were male and the rest 20(40.0%) were female. The mean age of them was 38.89 years with the range of 11- 70 years.

Weakness of the limbs was the most common (46, 92%) symptoms of the patients. Another common symptom was back pain (45, 92%) patients. Twenty patients (40%) had loss of bowel and bladder control and 15 (30%) patients had paraplegia. Only 10 (20%) patients had loss of sensation.

**Table 2: Comparison between histopathological and MRI findings.**

| Disesae | Histopathological findings | | MRI Findings | |
|---|---|---|---|---|
| | No. of cases(N) | Percentage (%) | No. of cases | Percentage (%) |
| Schwannoma | 13 | 26.0 | 13 | 26.0 |
| Neurofibroma | 1 | 2.0 | 1 | 2.0 |
| Meningioma | 11 | 22.0 | 11 | 22.0 |
| Ependymoma | 07 | 14.0 | 07 | 14.0 |
| Astrocytoma | 05 | 10.0 | 04 | 8.0 |
| Metastasis | 02 | 4.0 | 02 | 4.0 |
| Hemangioma | 01 | 2.0 | 01 | 2.0 |
| Chordoma | 01 | 2.0 | 00 | 0.0 |
| Others/Negative for Intraspinal tumor | 09 | 18.0 | 11 | 22.0 |
| | **50** | **100** | **50** | **100** |

**Table 3: Validity of MRI evaluation to detect intraspinal tumors.**

| MRI report | Histopathology report | | Total |
|---|---|---|---|
| | Positive result | Negative result | |
| Positive result | 38 (True positive) | 1 (False Positive) | 39 |
| Negative result | 3 (False Negative) | 8 (True Negative) | 11 |
| Total | 41 | 9 | 50 |

Out of 50 cases, on MRI the commonest location of spinal tumors was intradural extramedullary (29, 58%) followed by intradural intramedullary (13, 26%) and extradural (8, 16%). The highest number 13 cases (26%) were identified as Schwannoma, followed by Meningioma 11 cases (22%)}, then Ependymoma 7 cases (14%). Among 11(22%) cases identified as other than intraspinal tumors, 5(10%) were sequestrated disk, 3 (6%) were chronic inflammatory lesion, and the rest 3 cases were identified as epidural abscess, intramedullary abscess and intramedullary hematoma respectively. The MRI findings of the tumors were more or less same as the histopathological reports (Table 2) On T1WI 22(44%) tumors were hypointese and 28(56%) tumors are isointense. On T2WI 4( 8%) tumors were hypointese, 15(30%) were isointese and 31(62%) were hyperintense. After I/V contrast 17 (34%) cases were enhanced homogeneously and 22 (44%) were enhanced heterogeneously. Ring enhancement were 8(16%) and non enhancing was 1 (2%).

Among the 50 cases MRI diagnosed 39 cases as intraspinal tumor and 11 cases as other than intraspinal tumor (5 cases as sequestrated disc, 3 cases as chronic inflammatory lesion, 1 case as intramedullary abscess, 1 case as intramedullary haematoma and 1 case as epidural abscess). Of the 39 cases of intraspinal tumors reported by MRI, 38 were corretly diagnosed as intraspinal tumors except one. A patient with intramedullary abscess was falsely diagnosed (false positive) as intramedullary astrocytoma on MRI. On the other hand MRI failed to detect three intraspinal tumors (false negative). The 3 patients, who were falsely reported negative for intraspinal tumor on MRI, two were Astrocytoma and another was Chordoma intraspinal tumour confirmed by histopathologically. In eight patients MRI correctly diagnosed the lesion to be other than intraspinal tumors (Table 3 ). The sensitivity, specificity, positive predictive value and negative predictive values of MRI report were 92.68%, 88.88%, 97.00% and 72.74% respectively.

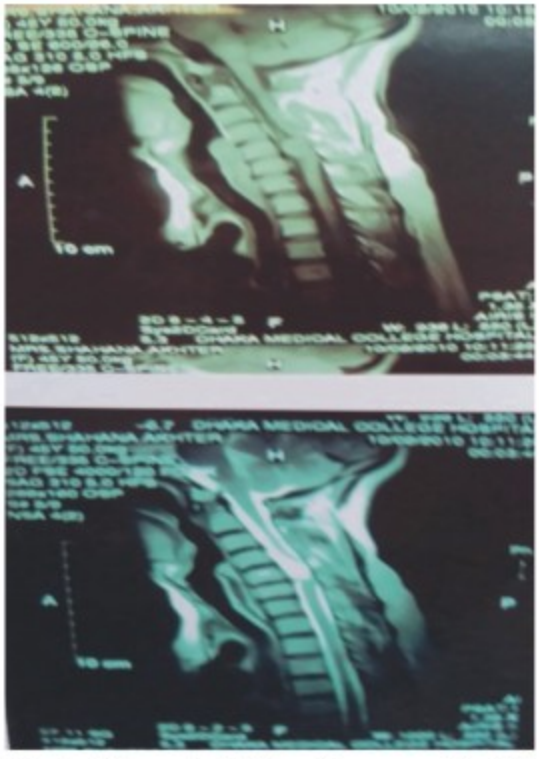

**Fig 1:** Intraspinal Neurofibroma : Sagital T1WI (A) Pre contrast shows isointense signal (B)Post contrast shows hyperintense signal.

**Fig 2:** Intraspinal schwannoma (A) Sagital Pre-contrast shows isointense signal (B) Sagital post contrast shows intense enhancement.

**Fig 3:** Intramedullary Ependymoma involving conus medullaries. (A) Sagital T1WI shows isointense signal (b) Axial T1WI after contrast shows heterogeneous enhancement.

**Discussion**

In this study with intraspinal peak incidence ranging from 41-50 years. Mean age was 38.89 years. The mean age of the patients with intraspinal tumour were ranging from 37 to 39.5 years. The age range of the present study which is almost similar to the studies.[8,10]

As regards to sex incidence of intraspinal tumors, 30(60%) were male and 20(40%) were female. Male to female ratio was 3:2 in this study. Similar result was found in the study of Holtas et al.[10] and Jinkins et al.[11] Parizel et al.[8] have mentioned intraspinal tumors are slightly more common in male which is consistent with this study. In another study, Dilon et al.[9] found that 36% were female which is almost close to the findings of present study.

Analysis of clinical features revealed that most common presenting symptom were Back pain, loss of sensation, loss of bowel and bladder control, neck pain and weakness.[1] Most of the symptoms were related to mass effect by the tumor. Maximum (30%) patients present with back pain. Xu et

al.[12] and Smoker et al.[4] observed loss of sensation, weakness and pain presented with intramedullary spinal cord tumor which is almost same in the present study.

This study suggests, the most common location of intraspinal tumor is intradural extramedullary compartment. Haaga JR et al.[13] mentioned that intradural intramedullary tumors are the most common intra spinal tumors followed by intramedullary tumor. In present study most common intradural extramedullary location(58%), intramedullary(26%) and extradural (16%) which correlate with the study.[3]

In this study majority (53%) of schwannoma tumors were iso intense and 46% were hypo intense on T1W1. On T2WI 85% schwannoma were hyper intense. Heterogeneous contrast enhancement was noted in 62% cases. This findings are almost similar to the result.[3,5,14] Eleven cases detected meningioma 81% were isointense and 19% hypointense on T1WI. On T2WI 55% were isointense and 18% were hyperintense and 27% were hypo intense. After I/V contrast immediately and homogeneous enhancement occurs in all. In this study which strongly correlate with the study.[3,8,9]

In this study more than 50% of astrocytoma was hypointense and rest are isointense on T1WI. On T2WI image 100% of astrocytoma was hyperintense. After contrast all astrocytoma tend to enhance in more patchy irregular way, consistent with a more diffusely infiltrating tumor. In case of ependymoma 100% were isointense with cord.

On T2WI 100% of ependymoma were hyperintense. After contrast 100% of ependymoma showed intense, homogenous and sharply marginated focal enhancement. These findings are almost similar to the result.[8,9,15] On T1WI and T2WI all vertebral hemangioma shows intermediate signal intensity and enhancement occurs after I/V contrast which strongly correlate with the study.[16]

From the result of the present study the overall sensitivity of MRI as a diagnostic modality is 92.68%, Specificity with 88%. Accuracy 92%. Predictive value of positive test 97% and predictive value of negative test 72.7%. as well as the findings obtained by others.[8,9,11]

It is conceivable that MR scanning is a highly accurate and sensitive modality in the evaluation of intraspinal tumors.

MRI is crucial in patients with spinal tumors for assessment of the spinal cord and osseous and soft tissue structures. This is especially important when an accurate clinical examination and history are limited because of soft tissue swelling or disturbed consciousness level. The various MR findings in spinal cord tumors are correlated well with histopathological findings. It can be concluded that MRI can be accepted as the most effective imaging modality in the diagnosis of intraspinal tumor.

**References**


1. Frank BL, Harrop JS, Hanna A, Ratliff J. Cervical extradural meningioma: Case report and literature review. JSCM 2008; 31(3): 302-5.
2. Stawicki SP, Guarnaschelli JJ. Intradural Extramedullary Spinal Cord Tumors: A Retrospective Study. Internet Journal of Neurosurgery 2007; 4(2), 1-10.
3. Takemoto K, Matsuma Y, Hashimoto H, Inone Y, Fukuda T, Shakudo M et al. MR Imaging of Intraspinal Tumors Capability in Histological Differentiation and Compartmentalization of Extramedullary Tumors. Neuroradiology 1988; 30: 303-9.
4. Smoker WRK, Godersky JC, Knutzon RK et al. The role of MR imaging in evaluating metastatic spinal disease. AJR 1987;149: 1241-8.
5. Dillon WP, Norman D, Newton TH, Bolla K, Mark A. Intradural spinal cord lesions: Gd-DTPA-enhanced MR Imaging. Radiology 1989; 170: 229-37.

6. Sze G. Magnetic Resonance imaging in the evaluaiton of spinal tumours. Cancer 1991; 67: 1229-41.
7. Verdelhan OD, Haegelen C, Carsin-Nicol B, Riffaud L, Amlashi SFA, Brassier G, Carsin M, Morandi X. MR Imaging features of spinal schwannomas and meningiomas. JNR 2005; 32(1):42-9.
8. PM, Baleriux D, Rodesh G, Segebarth C, Lalmand B, Christophe C et al. Gd-DTPA Enhanced MR Imaging of Spinal Tumors. AJR 1989; 152: 1087-96.
9. Dillon WP, Norman D, Newton TH, Bolla K, Mark A. Intradural spinal cord lesions: Gd-DTPA-enhanced MR Imaging. Radiology 1989; 170: 229-37.
10. Holtas S, Li MH & Larson, EM. MR Imaging of spinal intramedullary Tumors. Acta Radiology 1992; 33: 207-12.
11. Jinkins, J.R. Leillc, C.C. L. Xiong. MR of Neoplasm of (he spinal cord in patients with neuro fibromatosis Type-2. Asian Occasion Journal of Radiology 2000; 6: 51-68.
12. Xu QW, Wei-Min, Bao, Ren-Ling,Mao, Guo-Yuan, Yang. Magnetic Resonance Imaging and Microsurgical treatment of intramedullary Hemangioma of vspinal cord. Neurosurgery 1994; 35(1): 671-76.
13. Haaga JR, Lanzieri CF, Sartories DJ, Zerhouni EA. Computed tomography and magnetic resonance imaging of the whole body. USA: Mosby, 1994, 651-7.
14. Friedman DP, Tartaglino LM, Flanders AE. Intradural Schwannomas of the spine: MR findings with contrast Enhancement characteristics. AJR 1992; 158: 1347-50.
15. Goy AMC, Pinto RS, Raghavendra BN, Epstein FJ, Kricheff II. Inrtramedullary spinal cord tumors: MR imaging, with emphasis on associated cyst. Radiology 1986; 161: 381-6.
16. Jeffrey S. Ross, Thomas J. Masaryk. Michel T. Modie, John R. Carter, Timothy Mapstone, Fredric, H. Dengel. Vertebral Hemangioma:MR. Imaging-Radiology 1987; 165: 165-9.