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Evaluation of MRI (Magnetic Resonance Imaging) For Intraspinal Tumor Detection and its Comparison with Histopathological Findings

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Abstract **Original Research Article**

Intraspinal tumors are not uncommon lesion that may result in serious morbidity. We conducted a cross sectional study in the department of Radiology & Imaging, Dhaka Medical College Hospital. Dhaka Bangladesh during from July 2008 to March 2010. Fifty (50) patients of intraspinal tumor were including in this study. The patient was of both sex and male female ratio about 3:2.Age group 11-70 years and mean age 38.89 years. This study was done with a view to evaluate the diagnostic usefulness of MRI in detection of intraspinal tumor and comparison with histopathological findings the range of the patient was 11-70.The maximum numbers of the patients were between 41-50 years. Mean age was 38.89 years. Male to Female ratio was 3:2. This observed in 46 (92%) patients. Another common symptom was back pain, which was observed in 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. Out of 50 lesions, 13 were intramedullary (26%), 29 were intradural extramedullary (58%), 8 were extradural (16%) location. After I/V contrast 17 (34%) cases were enhanced homogeneously, 22 (44%) were enhanced heterogeneously, ring enhancement 3 (6%) and none enhancing were 8 (16%). Among 50 patient 13 cases (26%) was found to be Schwannoma, 1case (2%) was neurofibroma, 11 cases (22%) were found to be Meningioma, Ependymoma 7 cases (14%) Astrocytoma. 4 cases (8%) Metastasis were 2 cases (4%) Hemangioma 1 (2%), and others than Intraspinal tumor were 11 (22%).{sequestrated disc-5, chronic inflammatory lesion-3, intramedullary abscess-1, intramedullary haematoma-1 and epidural abscess-1}. MRI diagnoses 39 (78%) cases as Intraspinal Tumor and 11 (22%) cases were diagnosed as other than intraspinal tumor. Among 11(22%) cases as others tumor 5(10%) cases were sequestrated disc, 3(6%) cases were chronic inflammatory lesion, 1(2%) case epidural haematoma,1(2%) case intramedullary abscess 1(2%) case was intramedullary hematoma Histopathological classification was done on 50 patients. Histologically 13 cases (26%) were diagnosed as Schwannoma 1 case (2%) was neurofibroma, 11 cases (22%) were diagnosed as Meningioma 07 cases (14%) as Ependymoma. Astrocytoma 5 cases (10%) Metastasis 2 cases (4%) Hemangioma were 01 (2%) Chordoma 01 (2%) cases and others/Negative for Intraspinal tumor were 9 (18%). Histopathology diagnosed 41 (82%) was Intraspinal tumor. And 9 (18%) were other than Intraspinal tumor. Among 11(22%) cases as others tumor 5(10%) cases were sequestrated disc, 3(6%) cases were chronic inflammatory lesion, 1(2%) case epidural haematoma, 1(2%) case Astrocytoma 1(2%) case was Chordoma. MR evaluation of intraspinal tumors had overall sensitivity 92.68%, specificity 88%, accuracy 92%, positive predictive value 97% and negative predictive value 72.7%. MRI (Magnetic Resonance Imaging) can be an effective diagnosis for Intraspinal Tumor.

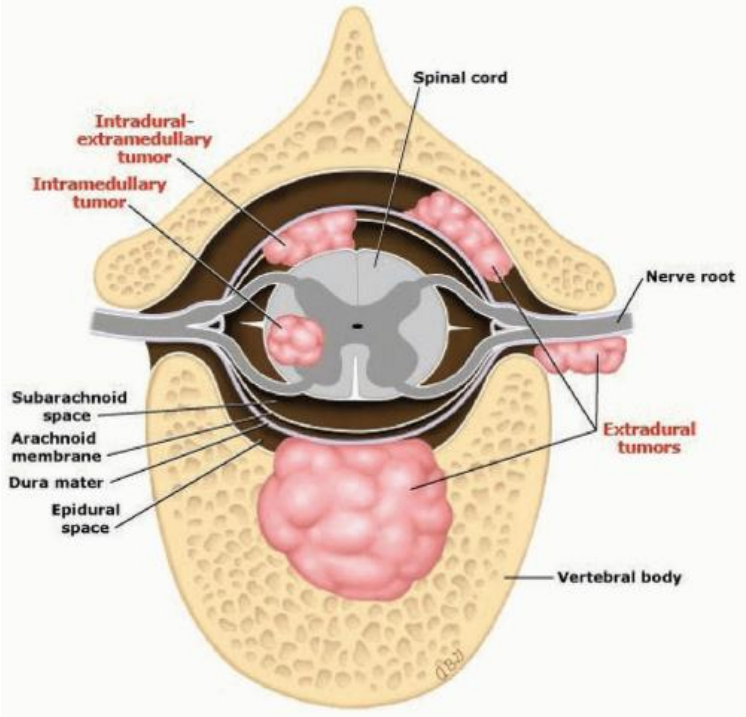
Keywords: MRI (Magnetic Resonance Imaging), Intraspinal Tumor, Histopathological Findings.

INTRODUCTION

Intraspinal tumors 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 is 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 % [3]. 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 ependymoma or astrocytomas. Ependymomas are the most common glial tumors in adults, whereas astrocytomas are the most common intramedullary tumor in children. Nonglial neoplasm including Haemangioblastomas, paragangliomas, metastases, lymphoma, and primitive neuroectodermal tumors (PNETs), are less common [4]. Intradural extramedullary neoplasm account 53% to 65% of spinal tumor in adult and 25% in children [5]. Most common are schwannoma (30%), second most common is [1]. In extradural meningioma (25%) followed by neurofibroma. Less common tumors are paraganglioma [4].



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In extradural common tumors are metastases. Neoplastic lesions that encroach epidural space include- Osteoblastoma, Chordoma, angiolipoma, Giant cell tumor [3]. In conventional myelography, CT myelography all have radiation hazards and also need experienced technician. CT has prefixed protocol which may miss the lesion. MRI has made a significant impact on the deferential diagnosis of intraspinal tumor. MRI has made multiplanner imaging, cross sectional anatomical details, sagittal, coronal, and axial reformate. The enhancement of intradural extramedullary lesion with gadolinium is often dramatic. Even small nodules generally enhance brightly and are easily seen.MRI has proven to be an excellent technique for visualizing the spinal cord and its tumor. MRI has several general well-recognized advantages 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 [5]. In the detection and identification of intraspinal tumors by MRI accuracies are found 92% correlation between MRI and histopathology has been reported [7]. In multi institutional prospective study, the sensitivity of contrast MRI for detection of intraspinal tumor was 95% [6]. Gd-DTPA enhanced MR imaging improves the reliability and spinal tumor diagnosis and increases MRI sensitivity and specificity [8].

Objectives

General Objective

- To evaluate MRI in detection of intraspinal tumors in Adults in Bangladesh

Specific Objectives

- To compare MRI findings with the histopathological diagnosis
- To find out the accuracy, sensitivity, specificity of MRI in detection of intraspinal tumor.

MATERIALS AND METHODS

This cross sectional study was carried out on 50 patients from 11-70 years of age, referred for MRI of spine with a clinical suspicion of Intraspinal tumor to Radiology & Imaging Department of Dhaka Medical College Hospital. Dhaka from July 2008 to March

2010. All these Patients were evaluated by detailed history and clinical Examination with special emphasis on nervous system who subsequently underwent for MR Scan of spine. Those patients who were operated were continuously followed up after surgery up to histological diagnosis. MR findings were compared with histopathological report. Spinal tumors account from approximately 5-15% of the nervous system [2].

Inclusion criteria

Clinically suspected cases of spinal tumor who were referred to Radiology and Imaging department of DMCH from OPD and indoor for MRI of spine?

Exclusion criteria

Patient unfit or unwilling to undergo surgery, non availability of histopathological report

RESULTS AND OBSERVATIONS

The main objective of the study was to establish the diagnostic usefulness of MRI in detection of intraspinal tumor. This cross sectional study was done on 50 purposively selected patients whose age ranged from 11 to 70 years. All the patients who were referred from OPD and indoor in the Department of Radiology and Imaging, Dhaka Medical College Hospital, Dhaka with clinical suspicion of intraspinal tumor during the period from July 2008 to June 2010 were enrolled; MRI of Spine was done and compared with that of histopathological findings. Data regarding the clinical, MRI and histopathological findings presented in tables and figures. The range of the patient was 11-70.The maximum numbers of the patients were between 41-50 years. Mean age was 38.89 years. Male to Female ratio was 3:2. This observed in 46 (92%) patients. Another common symptom was back pain, which was observed in 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. Out of 50 lesions, 13 were intramedullary (26%), 29 were intradural extramedullary (58%), 8 were extradural (16%) location. After I/V contrast 17 (34%) cases were enhanced homogeneously, 22 (44%) were enhanced heterogeneously, ring enhancement 3 (6%) and none enhancing were 8 (16%). Among 50 patient 13 cases (26%) was found to be Schwannoma, 1case (2%) was neurofibroma, 11 cases (22%) were found to be Meningioma, Ependymoma 7 cases (14%) Astrocytoma. 4 cases (8%) Metastasis were 2 cases (4%) Hemangioma 1 (2%), and others than Intraspinal tumor were 11 (22%). {Sequestrated disc-5, chronic inflammatory lesion-3, intramedullary abscess-1, intramedullary haematoma-1 and epidural abscess-1}. MRI diagnoses 39 (78%) cases as Intraspinal Tumor and 11 (22%) cases were diagnosed as other than intraspinal tumor. Among 11(22%) cases as others tumor 5(10%) cases were sequestrated disc, 3(6%) cases were chronic inflammatory lesion, 1(2%) case epidural haematoma,1(2%) case intramedullary abscess 1(2%) case was intramedullary hematoma Histopathological classification was done on 50 patients. Histologically 13 cases (26%) were diagnosed as Schwannoma 1 case (2%) was neurofibroma, 11 cases (22%) were diagnosed as Meningioma 07 cases (14%) as Ependymoma. Astrocytoma 5 cases (10%) Metastasis 2 cases (4%) Hemangioma were 01 (2%) Chordoma 01 (2%) cases and others/Negative for Intraspinal tumor were 9 (18%). Histopathology diagnosed 41 (82%) was Intraspinal tumor. And 9 (18%) were other than Intraspinal tumor. Among 11(22%) cases as others tumor 5(10%) cases were sequestrated disc, 3(6%) cases were chronic inflammatory lesion, 1(2%) case epidural haematoma, 1(2%) case Astrocytoma 1(2%) case was Chordoma. MR evaluation of intraspinal tumors had overall sensitivity 92.68%, specificity 88%, accuracy 92%, positive predictive value 97% and negative predictive value 72.7%.

Table-1: Age and Sex distribution of the study participants (n=50)

Characteristics	n	%	Mean age(In yrs)
Sex			
Male	30	60	
Female	20	40	
Age in years			
11-20	5	10	38.89
21-30	9	18	
31-40	10	20	
41-50	17	34	
51-60	6	12	
61-70	3	6	
Total	50	100	

Table-II: Distribution of clinical features of the study participants (n=50)

Clinical features	n	%
Weakness of limbs	46	92
Back pain	45	90
Loss of bowel & bladder control	20	40
Paraplegia	15	30
Loss of sensation	10	20

Table-III: Location of the lesions of the study participants (N=50)

Location of the tumor	n	%
Intramedullary	13	26
Intradural extramedullary	29	58
Extramedullary	8	16
Total	50	100

Table-IV: Signal intensity of MR diagnosed intra spinal tumors

Type of tumor	Imaging sequence	Hypo intense	Hyper intense	Iso intense	Total
Schwannoma	T1W1	6	0	7	13
	T2W2	0	11	2	13
Neurofibroma	T1WI	1	0	0	1
	T2WI	0	1	0	1
Meningioma	T1W1	2	0	9	11
	T2W2	3	2	6	11
Ependymoma	T1W1	0	0	7	7
	T2W2	0	7	0	7
Astrocytoma	T1W1	2	0	2	4
	T2W2	0	4	0	4
Metastasis	T1W1	2	0	0	2
	T2W2	0	0	2	2
Hemangioma	T1W1	1	0	0	1
	T2W2	1	0	0	1
Others	T1W1	8	0	3	11
	T2WI	0	11	0	11

Table-V: Contrast enhancement of lesions of the study participants (n=50)

Enhancement	n	%
A) Enhancing lesions		
Homogeneous	17	34
Heterogeneous	22	44
Ring enhancement	3	6
B)Non enhancing lesion	8	16
Total	50	100

Table-VI: MR classification of Lesion of the study participants (n=50)

MR diagnosis	n	%
Schwannoma	13	26
Neurofibroma	1	2
Meningioma	11	22
Ependymoma	07	14
Astrocytoma	04	8
Metastasis	02	4
Hemangioma	01	2
Others/Negative for Intraspinal tumor	11	22
Total	50	100

Table-VII: MRI diagnosis of the study participants (n=50)

MRI Diagnosis	n	%
Intraspinal Tumor	39	78
Others/ Lesion negative for Intraspinal Tumor	11	22
Total	50	100

Table-VIII: MRI diagnosis of others tumors of the study participants (n=50)

MRI Diagnosis	n	%
Sequestrated disc	5	10
Chronic Inflammatory lesion	3	6
Epidural abscess	1	2
Intramedullary abscess	1	2
Intramedullary Haematoma	1	2
Total	11	22

Table-IX: Histopathological classification of the lesions of the study participants (n=50)

Hitopathological diagnosis	n	%
Schwannoma	13	26
Neurofibroma	1	2
Meningioma	11	22
Ependymoma	07	14
Astrocytoma	05	10
Metastasis	02	4
Hemangioma	01	2
Chordoma	01	2
Others/Negative for Intraspinal tumor.	09	18
Total	50	100

Table-X: Histopathological diagnosis of lesion of the study participants (n=50)

Histopathological diagnosis	n	%
Intraspinal Tumor	41	82
Others/Lesion negative for Intraspinal Tumor	09	18
Total	50	100

Table-XI: MRI diagnosis of others tumors of the study participants (n=50)

MRI Diagnosis	n	%
Sequestrated disc	5	10
Chronic Inflammatory lesion	3	6
Epidural abscess	1	2
Astrocytoma	1	2
Chordoma	1	2
Total	11	22

Table-XII: Validity of MR evaluation of intraspinal tumors of the study participants (n=50)

MRI	Histopathology		Total
	Positive	Negative	
Positive	38 (TP)	1 (FP)	39
Negative	3 (FN)	8 (TN)	11
Total	41	9	50

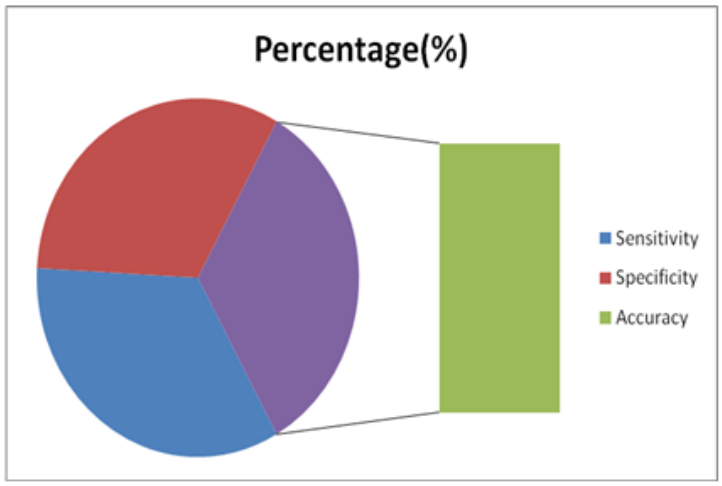

Fig-XIII: Sensitivity, specificity and accuracy of MRI in comparison with histopathology of intraspinal tumors

DISCUSSION

This cross-sectional study was carried in Department of Radiology and Imaging, Dhaka Medical College, Dhaka from July 2008 to march 2010 Finally 50 patients were included in the study. MRI of cervical, dorsal and lumbar spine was done according to requirement. Patients were operated, histopathology reports were collected in each cases. Data were collected in a predesigned data collection sheet. This cross sectional study was carried out by 0.3T MRI with 3-5 mm slice thickness. MRI of spine was performed in all cases. Among the 50 cases MRI diagnosed 39 cases as intraspinal tumor and 11 cases as other than intraspinal tumor (sequestrated disc-5, chronic inflammatory lesion-3, intramedullary abscess-1, intramedullary haemoatoma-1 and epidural abscess-1). Thirty eight cases were truly diagnosed as intraspinal tumor by this imaging modality. MRI failed to detect three intraspinal tumors. One histologically proved intramedullary abscess was falsely diagnosed as intramedullary astrocytoma. In eight patients MRI correctly diagnosed the lesion to be other than intra spinal tumors.In this study with peak incidence in occurring in decades ranging from 41-50 years. Age range was 11-70 years. Mean age was 38.89 years. Regarding intraspinal tumor Parizel *et al*. [9] and Holtas *et al*. [5] have shown in their series, the peak age incidence patients with intraspinal tumor ranged from 14-72 years (mean 39.5) and 11-78 years (mean 37) respectively. The age range of the present study is almost similar to the study of Parizel *et al*. [9] and Holtas *et al*. [5]. As regards sex incidences of intraspinal tumors 30 (60%) were male and 20(40%) were female with male to female ratio of 3:2 in this study. Similar result was found in the study of Holtas *et al*. [5] and Jinkins *et al*. [10] also found incidence of intraspinal tumor higher in male and male female ratio approximately 5.7 : 4.3. Parizel *et al*. [9] have mentioned intraspinal tumors are slightly more common in male which is consistent with this study. Another study of Dillon *et al*. [8] found in their study that 64% were male and 36% were female which is almost close to the findings of present study. The difference of sex incidence between male and female was not found statistically significant. Analysis of clinical features revealed that most common presenting symptom were limbs weakness, back pain, loss of bowel and bladder control, paraplegia and loss of sensation. Most of the symptoms were related to mass effect by the tumor. Maximum patients present with limbs weakness and back pain. Xu *et al*. [11] and smoker *et al*. [6] observed weakness and pain presented with intraspinal tumor which is almost same in the present study. Regarding location of intraspinal tumor, this study shows the most common location is intradural extramedullary compartment cervical spinal cord. Haage JR *et al*. [12] and Osborn [13] mentioned that intradural extramedullary tumors are the most common intraspinal tumor followed by intramedullary tumor. In present study most common intradural extramedullary of intramedullary location (58%), intramedullary (26%) and extradural (16%) which correlate with the study of Takemoto *et al*. [3].In this study majority of schwannoma 54% intense and 46% were hypointense on T1W1. On T2 W1 85% schwannoma were hyperintense. Heterogeneous contrast enhancement was noted in 62% cases. This finding is almost similar to the result of Verdelhan *et al*. [7]. Friedman *et al*. [14]; Dillon *et al*. [8] and takemoto *et al*. [3]. Eleven cases detected meningioma 81% were hyperintense and 27% were hypointense on T1WI. After I/V contrast immediate and homogeneous enhancement occurs in all. In this study which strongly correlate with the study of Dillon *et al*. [8], takemoto *et al*.[3] and Parizel *et al*. [9]. In this study more than 50% of astrocytoma was hypointense and rest are iso intense on T1WI. On T2WI 100% astrocytoma were hyper intense. After contrast all astrocytoma tend to enhance patchier irregular, 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 enhancement. Homogeneous and sharply marginated focal enhancement. These findings are almost similar to

the result of the Parizel *et al.* [9]. Goy *et al*. [15] and Bushberg *et al*.[16] On T1WI and T2WI all vertebral haemangioma shows intermediate signal intensity and enhancement occurs after I/V contrast which strongly correlate with the study of Jeffery *et al*. [17]. In the present study the overall accuracy of MRI as a diagnostic modality is 92.68% with sensitivity, 88%. Specificity, 92%. accuracy, predictive value of positive test 97% and predictive value of negative test 72.7%.Takemoto K *et al*. [3]. Have mentioned the accuracy in detection and identification of intraspinal tumors about 96%. All these results strongly support the present study. With regards to specificity Verdelhan OD *et al*. [3] in their study found specificity of 83.3% which is almost similar to present study. In present study specific diagnostic rate is 88%. Parizel *et al*. [9] found in their study 90% sensitivity of MRI in detection of intramedullary spinal cord tumors which is very close to the result of the present study. They concluded that Gd-DTPA increases both the MR sensitivity in defining and localizing spinal tumor and the MR specificity in the diagnosis of spinal lesion. Xu *et al*. [11] observed in their study that correlation of the preoperative neuroradiologic MR scanning evaluation with histologic diagnosis of intraspinal tumors. The sensitivity was calculated 84%. Dillon WP *et al*. [8] found in their study that MRI detection of intramedullary spinal cord neoplasm was 100% sensitive. Jinkins *et al*. [10] found 100% sensitivity of MRI in detecting seven cases of intramedullary spinal cord tumor in patient with neurofibromatosis type-2.From the result of the present study as well as the findings obtained by others [18, 9]. It is conceivable that MR scanning is a highly accurate and sensitive modality in the evaluation lf intraspinal tumor.

Limitations of the study

The study was conducted in a tertiary hospital which does not represent the whole country.

CONCLUSION AND RECOMMENDATION

It can be concluded that MRI can be accepted as the most effective imaging modality in the diagnosis of intraspinal tumor. For the evaluation of intraspinal tumor high resolution high magnetic field (1.5T) MRI would be more informative with better result. Further study with large study population may give precise result.

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