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Role of MRI in the Diagnosis of Intra Medullary Spinal Tumor with Histopathological Correlation

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Abstract **Original Research Article**

Introduction: Intramedullary spinal cord tumor (IMSCT) constitutes 8% to 10% of all primary spinal tumors with the majority comprised of gliomas (80% to 90%), of which 60% to 70% are ependymomas and 30% to 40% are astrocytomas. Astrocytomas are common in the thoracic region whereas ependymomas are common in cervical region. Ependymomas are the most common glial tumor in adults, whereas astrocytomas are the most common intramedullary tumor in children. Overall, 15% of all primary intramedullary spinal cord tumors are ependymal in origin and include one of three histopathologic subtypes: ependymoma, subependymoma and myxopapillary ependymoma. ***Aim of the Study:*** The aim of this study was to evaluate the role of MRI in diagnosis of intra medullary spinal tumors compared to histopathological findings. ***Methods:*** This was a cross sectional study and was conducted in the Department of Radiology and Imaging, Sylhet M.A.G. Osmani Medical College, Sylhet in collaboration with Department of Neurosurgery & Pathology of the same hospital, Sylhet, Bangladesh during the period from September, 2018 to August 2020. ***Result:*** In total 35 patients completed the study. In our study we found the Mean ± SD of age was 41.71±13.9 in years. Majority (57%) of our patients presented with intramedullary spinal cord tumor were male compared to female (43%).We found that among of our 35 patients 20 (57.14%) were ependymoma, 15 (42.86%) patients were astrocytoma diagnosed by MRI. Majority (40%) patients of ependymoma belong to 41-50 years and majority patients of astrocytoma (40%) belong to 10-20 years old. Both ependymoma and astrocytoma showed male predominance with 55% and 60% respectively. It was observed that majority (70% & 55%) patients of ependymoma had back & radicular pain respectively. Majority (80% & 60%) patients of astrocytoma had back & radicular pain respectively. Ependymoma was determined by calculating sensitivity 95.0%, specificity 100%, accuracy 97.14%, PPV 100% and NPV 93.75% respectively. Astrocytoma was determined by calculating sensitivity 100%. Specificity 95.24%, PPV, NPV, accuracy was93.33%, 100%, 97.14% respectively. ***Conclusion:*** In our study we found that MRI is a very sensitive and effective imaging procedure of suspected tumor of the spinal cord for accurate pre-operative diagnosis and correct decision making for the optimal surgical management as well as post-operative follow up of the patient.

Keywords: Spinal cord tumor, Magnetic resonance imaging, Ependymoma, Astrocytoma.

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INTRODUCTION

Spinal tumors are relatively rare tumors and can present with a wide variety of symptoms. Primary tumors of the spinal cord are 10 to 15 times less common than primary intracranial tumors and overall represent 10-15% of all primary tumors of the central nervous system [1]. Incidence of spinal tumors is 1.1 cases per 1,00,000 population [2]. There are estimated 850 to 1700 new adult cases of primary spinal tumors diagnosed each year in the United State [3]. These tumors occur predominantly in the middle decades and except for the unusually high incidence of meningiomas in females, the sex ratio is about equal [4]. Though spinal tumors are relatively rare, but if left untreated, can cause serious neurological deficits and disability. An accurate diagnosis is therefore crucial in determining prognosis and directing therapy. [5]The Clinical presentation of primary spinal cord tumors is determined by the location of the tumor. In a recent series of SCTs, pain is the most common presenting symptom (72%) and may manifest as back pain (27%), radicular pain (25%) or central pain (20%).Motor disturbance was the next most common presenting

symptom (55%) followed by sensory loss (39%), dermatomal, saddle or segmental level. Sphincter disturbance was the least common presenting symptom seen in only 15% of all patients. Diagnosis of a primary spinal cord tumor requires a high index of suspicion based upon clinical signs as well as spine-directed MRI. [6]Spinal tumors are classified based on their location into extradural, intradural extramedullary and intramedually tumors [7]. Extradural tumors and masses, which localize in the area between the bony structures and the dura. Next are intradural tumors and masses, which are subdivided into, extramedullary and intramedullary. Extramedullary refers to the area within the dura but not part of the spinal cord and intramedullary is within the spinal cord parenchyma. Different types of tumors and masses are predominantly found within this anatomic area [8]. Intradural intramedullary lesions comprise 20 to 30% of all primary intradural tumors [9]. The remaining 70 to 80% of primary intradural tumors are intradural extramedullary tumors [10-13]. Other nonglial tumours include- Spinal paragangliomas, Primary CNS lymphoma, Melanoma, Spinal primitive neuroectodermal tumours (PNETs), Epidermoid cysts, Dermoid cysts, Spinal lipomas, Intramedullary metastasis.Intramedullary metastases originating from a systemic cancer can occur throughout the length of the spinal cord. Metastasis ranges from 0.1% to 2% of all spinal cord tumors [14]. Of the intramedullary tumors with metastatic origins, 40 to 60% and 14% arise from primary neoplasms of the lung and breast, respectively. Spinal lipomas are rare congenital tumors that constitute 1%of intra spinal tumors. Commonly found in the caudaequina and conus medullaris [15]. Primary spinal cord lymphomas are extremely rare relative to intracranial primary CNS lymphoma. On contrast enhanced MR images, intramedullary spinal tumors almost always manifest as expansion of the spinal cord and show enhancement. Syringohydromyelia and cystic lesions are frequently associated with intramedullary tumors. Though various modalities are available for spinal tumors detection like myelography, either with conventional radiography or CT revealed an intramedullary mass as a complete or partial block in the flow of intrathecal contrast material. Myelography, however could rarely help define the character of the spinal cord lesion. The development of magnetic resonance (MR) imaging revolutionized the noninvasive investigation of these lesions. Identification of internal structural abnormalities of the spinal cord, such as cysts, syringohydromyelia, hemorrhage and edema became routine in the setting of an intramedullary spinal mass. Not surprisingly, MR imaging is the current imaging modality of choice in the evaluation of spinal masses [12]. MR images are often used as primary diagnostic imaging tool and are the preoperative study of choice. The need for biopsy may be obviated because of the increasingly accurate preoperative histologic diagnosis, as obtained through MR images. The goal of imaging is to be 100% sensitive and specific in identifying tumor, give precise anatomic detail, identify distant metastases and show recurrent tumor following the placement of instrumentation. No single imaging modality accomplishes all of these goals, but understanding the advantages and disadvantage of different imaging modalities will assist the clinician in patient screening and treatment planning [5, 16].

This study was undertaken to evaluate the role of Magnetic Resonance Imaging and to reveal the validity of MRI in determining intra medullary spinal tumors among Bangladeshi population.

OBJECTIVE OF THE STUDY

General Objective

To evaluate the role of MRI in diagnosis of intra medullary spinal tumors compared to histopathological findings.

Specific Objectives

- To record MRI findings of the intramedullary spinal tumors.
- To record histopathological findings of intra medullary spinal tumors.
- To correlate MRI findings with histopathological findings.

METHODOLOGY & MATERIALS

This was a cross sectional study and was conducted in the Department of Radiology and Imaging, Sylhet M.A.G. Osmani Medical College, Sylhet in collaboration with Department of Neurosurgery & Pathology of the same hospital, Sylhet, Bangladesh during the period from September, 2018 to August 2020. There were total 35 patients in our study. In this study we studied on patients with intramedullary spinal tumors, who attended in the Department of Radiology & Imaging and Department of Neurosurgery, Sylhet M.A.G. Osmani Medical College, Sylhet during the study period. These are the following criteria to be eligible for the enrollment as our study participants: (a) Patients who were aged between 10 to 80 aged years old; (b) Patients clinically suspected & diagnosed by MRI as having intramedullary spinal tumor; (c) Patients diagnosed by MRI as having intramedullary spinal tumor incidentally; (d) Patients who subsequently underwent surgery and histopathological examination. And (a) Patients not willing to do surgery; (b) Patients with previous spinal surgery; (c) Patients having absolute contraindication for MRI (eg. Cardiac pacemaker, claustrophobia); (d) Patients with any history of acute illness (e.g., renal or pancreatic diseases, ischemic heart disease etc.) were excluded from our study.

MR images were obtained on a 1.5 Tesla (Magnatom Avanto, Siemens) unit with a spine surface coil. T1- weighted (repetition time msec/echotime

msec, 400-600/8-22) and T2-weighted (2,000-3,500/20-104) spin echo images was obtained in the sagittal plane, with 5 mm section thickness. Axial images were obtained in any area of the spine where sagittal images demonstrated abnormal findings. Contrast-enhanced images were obtained in all patients after injection of 0.1 mmol/kg of gadolinium-diethylenetriamine pentaacetic acid (Gd-DTPA) solution. Contrast-enhanced images were obtained using the same T1-weighted pulse sequences as in the non-enhanced studies. During the MRI examination there was no occurrence of adverse drug reaction due to contrast agent. Spinal angiography was not done for any patient.

Image Analysis

Firstly, it was assessed that focal/ multi segmental enlargement and any compression of the spinal cord present or not. Location of the lesion intra-medullary or extramedullary was identified. Lesion signal intensity was compared to adjacent normal tissue. The level of involvement of the cord, shape of the lesion, margin (regular/ irregular) was recorded. Homogenicity and heterogenicity in T1W, T2W and Gd-DTPA enhanced images were evaluated. Presence or absence of nodular and rim/peripheral enhancement was also assesed. Component of the lesion eg. solid, cystic or mixed was judged. All lesions were grossly evaluated for presence or absence of focal hemorrhage, necrosis, calcification and fat. Presence or absence of syrinx, cord edema also recorded.

MRI Findings of Ependymoma

Cellular ependymomas occurs at anywhere but mostly at cervical cord and myxopapillary ependymoma exclusively found at conus medullaries and cauda equine, but these are considered as extramedullary. Ependymomas are well demarcated or diffusely infiltrating lesion commonly associated with cyst. The lesion causes symmetric cord expansion. Appears as isointense to hypointense mass relative to spinal cord on T1WI and hyperintense on T2WI.One third of cases have an extremely hypointense rim at tumor poles on T2WI due to hemorrhage called “cap sign”. Mostly intense homogeneous enhancement after Gd-DTPA.

MRI Findings of Astrocytomas

Astrocytomas most often are located in the thoracic and cervical cord. They are typically eccentrically located within the posterior spinal cord and causes fusiform expansion of cord, are diffusely infiltrative and several spine segments are involved. Cystic components are present in 30%, on T1WI this lesion s appears of low signal intensity on T2WI, these lesions and the associated edema appears of high signal intensity. After Gd- DTPA the lesions almost always enhance. Enhancement can be focal, nodular, patchy, inhomogeneous, diffuse enhancement and does not define the tumor margin. Sometimes no enhancement is seen. Like ependymomas they do not tends to hemorrhage and therefore do not usually display the cap sign.

Surgical Intervention

Then patient who went for surgery and immediately after tumor operation specimen were taken in jar containing 10% formalin and send to the department of pathology for histopathology. The reports were collected and MRI findings were evaluated taking into account the histopathology as gold standard method.

Statistical Analysis

Data were processed and analyzed with the help of SPSS (Statistical package for social sciences) software version 22.0 for windows 10.Continuous variables were expressed as mean, standard deviation and categorical variables as frequencies and percentage. For the validity of study outcome, sensitivity, specificity, positive predictive value and negative predictive value of the MRI evaluation of intramedullary spinal tumor was calculated.

RESULT

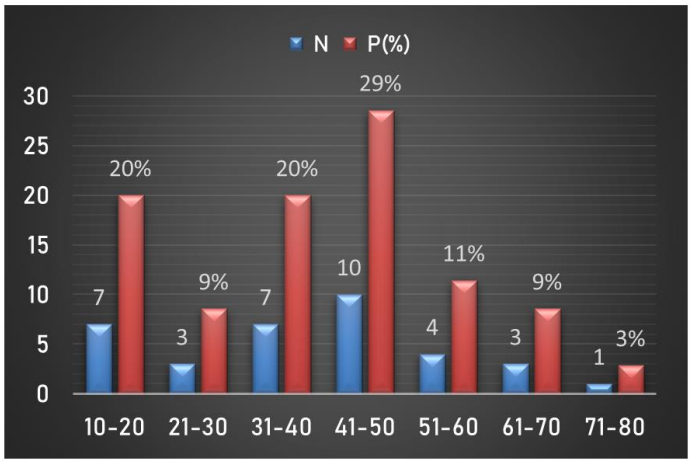


Figure 1: Age distribution among our study people

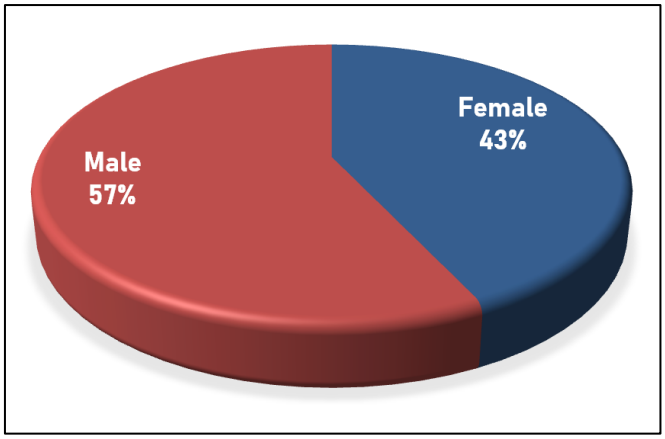


Figure 2: Gender distribution among our study participants

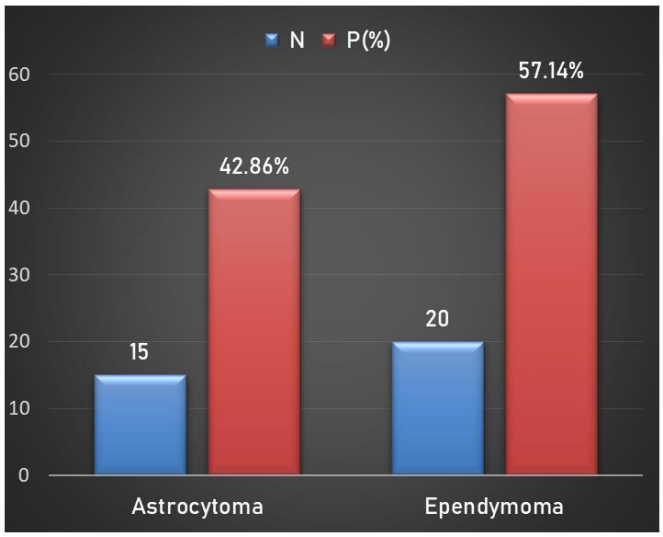


Figure 3: Distribution of intramedullary tumors on the basis of MRI findings

Table 1: Distribution of the intramedullary tumors based on demographics and clinical presentation

Variables	Ependymoma		Astrocytoma	
	No.	%	No.	%
Age group (Years)				
10-20	1	5	6	40
21-30	2	10	1	7
31-40	4	20	3	20
41-50	8	40	2	13
51-60	2	10	2	13
61-70	2	10	1	7
71-80	1	5	-	-
Mean ± SD	**41.71±13.9**			
Gender				
Male	11	55	9	60
Female	9	45	6	40
Clinical Presentation				
Back Pain	12	70	12	80
Radicular Pain	11	55	9	60
Motor Disturbance	7	35	4	27
Sensory Disturbance	5	25	3	20
Bowel Dysfunction	-	0	6	40
Bladder Dysfunction	4	20	-	0

Table 2: Distribution of spinal Ependymoma based on MRI Characteristics & Location (n=20)

	Feature	Number	%
Shape	Oval	-	-
	Elongated	12	60
	Lobulated	8	40
	Round	-	-
	Dumbbell Shaped	-	-
Margin	Regular	14	70
	Irregular	6	30
Homogeneity	Homogeneous	9	45
	Inhomogeneous	11	55
T1WI appearance	Hypointense	13	65
	Isointense	3	15
	Iso to hypointese	4	20
T2WI appearance	Hyperintense	20	100
	Isointense	-	-
	Iso to hyperintese	-	-
Post Gd-DTPA	Homogeneous enhancement	6	30
	Heterogeneous enhancement	14	70
	Rim enhancement	-	-
	Nodular enhancement	-	-
	No enhancement	-	-
Components	Solid	4	20
	Cystic	8	40
	Mixed	8	40
Cord compression		-	-
Cord expansion		20	100
Associated hemorrhage		14	70
Associated syrinx		15	75
Location	Cervical	5	25
	Cervico-dorsal	3	15
	Dorsal	3	15
	Dorso-lumbar	-	-
	Lumbar	9	45
	Lumbo-sacral	-	-

Table 3: Validity of MRI in diagnosis of spinal Ependymoma

MRI Findings	Histopathological Findings		Total	P-value
	Positive	Negative		
Positive	19	0	19	**0.001**
Negative	1	15	16	
	20	15	35	

Table 4: Distribution of spinal Astrocytoma based on MRI Characteristics & Location (n=15)

	Feature	Number	%
Shape	Oval	-	-
	Elongated	4	27
	Lobulated	11	73
	Round	-	-
	Dumbbell Shaped	-	-
Margin	Regular	-	-
	Irregular	15	100
Homogeneity	Homogeneous	4	27
	Inhomogeneous	11	73
T1WI appearance	Hypointense	10	67
	Isointense	3	20
	Iso to hypointese	2	13

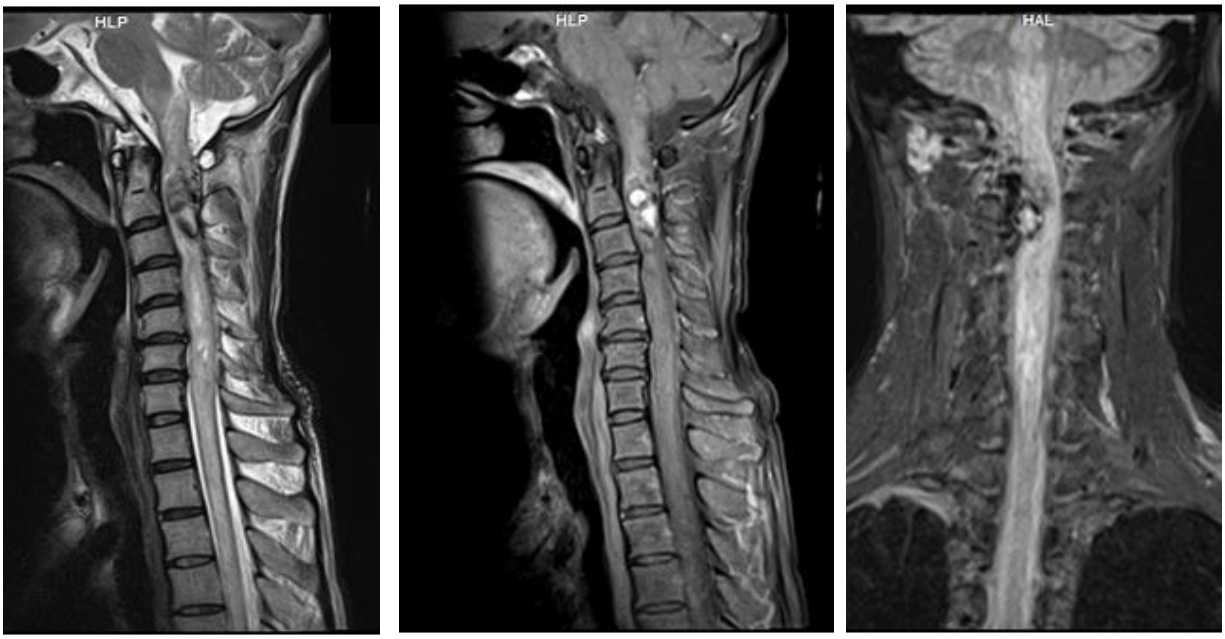
	Feature	Number	%
T2WI appearance	Hyperintense	12	80
	Isointense	2	13
	Iso to hyperintese	1	7
Post Gd-DTPA	Homogeneous enhancement	-	-
	Heterogeneous enhancement	12	80
	Rim enhancement	3	20
	Nodular enhancement	-	-
	No enhancement	-	-
Components	Solid	-	-
	Cystic	-	-
	Mixed	15	100
Cord compression		-	-
Cord expansion		15	100
Associated hemorrhage		-	-
Associated syrinx		13	87
Location	Cervical	8	53
	Cervico-dorsal	4	27
	Dorsal	3	20
	Dorso-lumbar	-	-
	Lumbar	-	-
	Lumbo-sacral	-	-

Table 5: Validity of MRI in diagnosis of spinal Astrocytoma

MRI Findings	Histopathological Findings		Total	P-value
	Positive	Negative		
Positive	14	1	15	**0.001**
Negative	0	20	20	
	14	21	35	

In figure 1 we showed the age distribution among our study people where we can see that the highest prevalence was 10(29%) aged between 41-50 years old; followed by 7(20%) & 4(11%) were 10-20, 31-40& 51-60 years old respectively. The patients aged between 21-30 & 61-70 years old had the same prevalence 9% and only 1(3%) patient was found aged between 71-80 years old. Figure 2 showed the gender distribution of our study participants. Majority (57%) of our patients presented with spinal tumor were male compared to female (43%). In figure 3 we showed the distribution of intramedullary tumors on the basis of MRI findings. We found that among of our 35 patients 20 (57.14%) were ependymoma, 15 (42.86%) patients were astrocytoma diagnosed by MRI. In table 1 we showed the distribution of the intramedullary tumors based on demographics and clinical presentation. We found the Mean ± SD of age was 41.71±13.9 in years. Majority (40%) patients of ependymoma belong to 41-50 years and majority patients of astrocytoma (40%) belong to 10-20 years old. Both ependymoma and astrocytoma showed male predominance with 55% and 60% respectively. It was observed that majority (70% &55%) patients of ependymoma had back & radicular pain respectively. Majority (80% &60%) patients of astrocytoma had back & radicular painrespectively. In table 2 we showed the MRI Characteristics of spinal Ependymoma. We found that 20 cases were identified as ependymoma by MRI. Among them 60% had elongated shape and rest of the 40% were lobulated. 70% tumor showed regular margin, 30% had irregular margin, 55% had heterogeneous and 45% had homogeneous appearance. On T1WI 65% showed hypointense signal, 20% showed iso to hypointense signal and rest of the 15% showed iso intense signal relative to cord. All of them showed hyperintense signal on T2WI. After Gd-DTPA 70% showed heterogeneous enhancement and 30% showed homogenous enhancement. 40% were mixed, 40% had cystic competent and rest of 20% were solid and 70% showed evidence of hemorrhage. All of them causes cord expansion and 75% showed associated syrinx. Table 3 showed the validity of MRI in diagnosis of spinal Ependymoma with histopathological correlation. We found them correlated with a sensitivity of 95.0%, specificity 100%, accuracy 97.14%, PPV 100% and NPV 93.75% respectively. In table 4 we showed the MRI Characteristics of spinal astrocytoma. We found that 15 cases were identified as astrocytoma by MRI. Most cases (73%) were lobulated in shape, 27% were elongated. All of the cases showed irregular margin. 73% were heterogeneous and 27% were homogeneous in appearance. On T1WI 67% were hypointense, 13% iso to hypointense, rest of the 20% were iso intense. On T1W2 80% were hyperintense, 7% iso to hyperintense, rest of the 13% were iso intense. After Gd-DTPA 80%

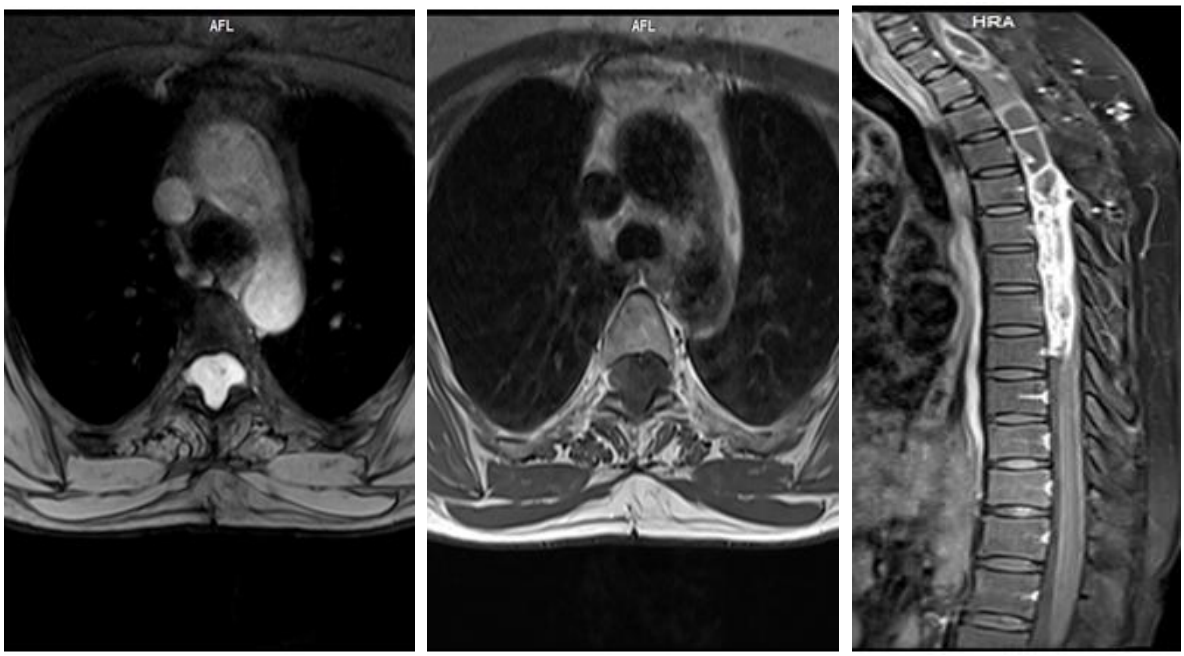
showed heterogeneous enhancement & 20% showed rim enhancement. All of them showed mixed components & cord expansion. No evidence of hemorrhage was noted but 87% showed associated syrinx. Table 5 showed the validity of MRI in diagnosis of spinal astrocytoma with histopathological correlation. We found them correlated with a sensitivity of 100%, specificity 95.24%, PPV, NPV; accuracy was 93.33%, 100%, 97.14% respectively.



A B C

Figure 4: MRI of cervical spine of a 42 years old male

MRI of cervical spine of a 42 years old male, Sagittal T2WI(A),T1C+(B), FLAIR(C), showing intramedullary long segment altered signal intensity lesion causing cord expansion at lower medulla to D2 vertebral level which is hyperintense with signal void area on T2WI and FLAIR representing hemorrhage and shows heterogeneous enhancement of I/V contrast. MRI diagnosis was ependymoma and Histopathology also revealed ependymoma.



A B C

Figure 5: MRI of cervical spine of a 42 years old female

Figure 5: MRI of cervical spine of a 42 years old female showing long segment expansile mixed signal intensity lesion at cervicodorsal cord which is intermediate to hyperintense on T2WI (A), iso to hypointense on T1WI (B), After I/V contrast (C) lesion shows heterogeneous enhancement. MRI diagnosis was astrocytoma. Histopathology revealed astrocytoma.

DISCUSSION

In our study we found that the highest prevalence was 10(29%) aged between 41-50 years old; followed by 7(20%) & 4(11%) were 10-20, 31-40& 51-60 years old respectively. The patients aged between 21-30 & 61-70 years old had the same prevalence 9% and only 1(3%) patient was found aged between 71-80 years old [Figure 1]. In other study (Campello *et al.*,) did study of 70 patients with spinal tumors, the median age at presentation was 41 years with a range of 18 to 47 years [3]. Another study (Reco *et al.*,) showed that mean age was 42.0 years varied from 8-72 years of their study patient having spinal tumors and (Chung *et al.*,) studied with 39 patient who underwent MRI for evaluation of spinal tumor, The mean age of this study was 46.6 years, which correlate with present study [5, 6]. In this study majority (57%) of our patients presented with spinal tumor were male compared to female (43%) [Figure 2]. Another studies (Raco *et al.*, & Ferrante *et al.*,) showed 59.0% and 58.0% patient were male respectively. (Rahman S.) Observed 36 patients with spinal cord tumor with majority (58.3%) of male patient and 41.7% were female patient which is closely resembled with the present study [6, 17, 18]. On the other hand (Chung *et al.*,) observed 39 patients and found 46.2% and 53.8% were male and female respectively, which differ with the current study [5]. In this study we found that among of our 35 patients 20 (57.14%) were ependymoma, 15 (42.86%) patients were astrocytoma diagnosed by MRI [Figure 3]. In our study we found the Mean ± SD of age was 41.71±13.9 in years. Majority (40%) patients of ependymoma belong to 41-50 years and majority patients of astrocytoma (40%) belong to 10-20 years old. Both ependymoma and astrocytoma showed male predominance with 55% and 60% respectively. It was observed that majority (70% & 55%) patients of ependymoma had back & radicular pain respectively. Majority (80% & 60%) patients of astrocytoma had back & radicular pain respectively [Table 1]. (Raco *et al.*,) Observed the presenting symptoms and signs were hyparesthesia, or parasthesia or both complaints in 70.0%, motor disorders in 20.0% and sphincter dysfunction in 10.0% [6]. In another study done by Rahman S (2014) mentioned that most common presenting symptom was back pain (63.9%) followed by 47.2% redicular pain, 44.4% motor disturbance, 27.8% sensory disturbance 11.1% bowel dysfunction and bladder dysfunction respectively. which are consistent with the current study [18]. In our study we found that 20 cases were identified as ependymoma by MRI. Among them 60% had elongated shape and rest of the 40% were lobulated. 70% tumor showed regular margin, 30% had irregular margin, 55% had heterogeneous and 45% had homogeneous appearance. On T1WI 65% showed hypointense signal, 20% showed iso to hypointense signal and rest of the 15% showed iso intense signal relative to cord. All of them showed hyperintense signal on T2WI. After Gd-DTPA 70% showed heterogeneous enhancement and 30% showed homogenous enhancement. 40% were mixed, 40% had cystic competent and rest of 20% were solid and 70% showed evidence of hemorrhage. All of them causes cord expansion and 75% showed associated syrinx [Table 2]. A studydone by (Rahman S.) it was observed that out of 36 cases, 21 cases were identified as ependymoma by MRI. Among them more than half (52.5%) had elongated shape, margin found regular in majority (71.4%) case. Appearance were homogeneous is 57.1% case and heterogeneous 42.9% cases. On T1WI 38.1% were iso to hypointense, 28.6% hypointense, iso intense lesion were 19% and rest of 14.3% case were iso to hyperintense. On T2WI 66.7% lesion were hyperintense, 33.3% were iso to hyperintense. 61.9% were solid, 28.6% were mixed and 9.5% were cystic in nature. 38.1% showed associated hemorrhage and syrinx. These above-mentioned findings are nearly similar with the present study [18]. Another study (Chowdhury *et al.*,) mentioned in their report that ependymoma were the commonest intramedullary tumors. Out of 10 cases of intramedullary tumor half of the (50%) cases were ependymoma diagnosed by MRI. All of their 5 lesions were located in the conus medullaris. On T1WI 60% cases were hypointense 2 cases were iso intense to spinal cord. All of them were hyperintense on T2WI. All of the 5 cases were well defined but appeared heterogeneous. 80% cases showed cystic areas and hemorrhagic foci were noted in 60% cases. Cord edema was present in 60% cases. All of the cases showed spinal cord enlargement with compression of cauda equina nerve roots. 20% cases were associated with syringohydromyelia. On post contrast T1WI; 80% cases showed heterogeneous enhancement and 20% showed homogeneous enhancement. All of the above mentioned findings are comparable with the present study [19]. In the present study of MRI evaluation of intramedullary ependymoma it was observed that, true positive 19 cases, 1 false negative and 15 true negative cases as diagnosed by histopathology and the validity of MRI evaluation of intramedullary ependymoma was correlated by calculating a sensitivity of 95.0%, specificity 100%, accuracy 97.14%, PPV 100% and NPV 93.75% respectively [Table 3]. A study (Rahman S.) observed out of 36 cases 19 cases were ependymoma diagnosed by MRI and confirmed by histopathological evaluation, which were true positive, false positive 2 cases, false negative 1 case and true negative 14 cases as diagnosed by histopathology calculating sensitivity 95.0%, specificity 87.5%,

accuracy 91.7%, PPV 90.5% and NPV 93.3% in diagnosing ependymoma. All the above findings are consistent with the present study [18]. Another study (Chowdhury *et al.*,) found sensitivity 80% and specificity 100% in their study in diagnosing ependymoma. Ferrante *et al.*, (1992) showed in diagnosing ependymoma sensitivity 95.35%, specificity 90.6%, accuracy 92%, PPV 89.3% and NPV 90.12% [19]. In our study we found that 15 cases were identified as astrocytoma by MRI. Most cases (73%) were lobulated in shape, 27% were elongated. All of the cases showed irregular margin. 73% were heterogeneous and 27% were homogeneous in appearance. On T1WI 67% were hypointense, 13% iso to hypointense, rest of the 20% were iso intense. On T1W2 80% were hyperintense, 7% iso to hyperintense, rest of the 13% were iso intense. After Gd-DTPA 80% showed heterogeneous enhancement & 20% showed rim enhancement. All of them showed mixed components & cord expansion. No evidence of hemorrhage was noted but 87% showed associated syrinx [Table 4]. A studydone by (Rahman S.) observed out of 36 cases, 13 cases were identified as astrocytoma by MRI. Among them sixty percent (61.5%) had lobulated shape. 23.1% elongated and rest of the 15.4% oval shape. Irregular and regular margin were 61.5% and 38.5% respectively. Appearance heterogeneous 53.8% and homogenous 46.2%. On T1WI 53.8% iso to hypo and 46.2% hypo intense. On T2WI 69.2% hyperintense and 30.8% iso to hyperintense. After Gd-DTPA 53.8% showed heterogeneous enhancement and 46.2% showed rim enhancement. Mixed lesion found in 53.8%, cystic 30.8% and solid 15.4%. Hemorrhage not found, associated syrinx 46.2% cases were identified. All of above-mentioned findings are almost similar with the current study.[18]Another study (Chowdhury *et al.*,) mentioned in their study that astrocytoma was the 2nd most common intramedullary tumor. Among 10 cases of intramedullary tumor 2 (20%) cases were astrocytoma diagnosed by MRI. On T1WI one was hypointense another one was iso intense to the cord. On T2WI both were hyperintense. Both the lesion was ill defined and heterogeneous in appearance. Hemorrhagic foci and cystic areas were noted in both lesions. Both lesions were associated with cord edema and cord enlargement. On post contrast T1WI both lesions demonstrate heterogeneous enhancement [19]. In the present study of MRI evaluation of intramedullary astrocytoma it was observed that 14 true positive case, 1 false positive and 20 true negative case as diagnosed by histopathology and the validity of MRI evaluation of intramedullary astrocytoma was correlated by calculating sensitivity 100%. Specificity 95.24%, PPV, NPV, accuracy was 93.33%, 100%, 97.14% respectively [Table 5]. A study done by (Rahman S.) showed out of 36 case, 12 cases were astrocytoma which confirmed by histopathology and represents true positive, false positive 1 case, false negative 1 case and true negative 22 case as diagnosed by histopathology calculating sensitivity 95.0%, specificity 87.5%, accuracy 91.7%, PPV 90.5%, NPV 93.3% respectively [18]. Another study done by (Constantini *et al.*,) found sensitivity 95.2%, specificity 89.1%, accuracy 88.9%, PPV 91.4%, and NPV 94.6% respectively in diagnosing astrocytoma. All the above findings are comparable with the present study [8].

Limitations of the Study

Our study was a single centre study. We could only study the patients who attended at the Radiology & Imaging and Neurosurgery department of Sylhet M.A.G. Osmani Medical College within a short study period. In our study small sample size was also a limitation. After evaluating once those patients we did not follow-up their treatment and have not known other possible interference that may happen in the long term with these patients.

Conclusion and Recommendations

This study was under taken to evaluate diagnostic usefulness of MRI in evaluation of intradural spinal tumors confirmed by histopathology. By virtue of non-invasiveness, lack of radiation hazard and by ability to demonstrate structural changes, MRI is a very sensitive and effective imaging procedure of suspected tumor of the spinal cord for accurate pre-operative diagnosis and correct decision making for the optimal surgical management as well as post- operative follow up of the patient. So further study with a longitudinal study design including a large number of sample size needs to be done to evaluate the validity of MRI in diagnosing intramedullary spinal tumors.

References

1. Reddy, K. C. H., Bheemavathi, A., & Durga, K. (2017). Tumours of Spinal Cord: Histopathological and Radiological Correlation with Review of Literature. *Scholars Academic Journal of Biosciences*, 5(9), 674-681.
2. Constantini, S., Houten, J., Miller, D.C., Freed, D., Ozek, M. M., Rorke, L. B., Allen, J. C., & Epstein, F. J. (1996). Intramedullary spinal cord tumors in children under the age of 3 years. *Journal of neurosurgery*, *85*(6), 1036-1043.
3. Campello, C., Le Floch, A., Parker, F., Bauchet, L., Dufau, H., Dufour, H., Barrie, M., Chinot, O., Lonjon, M., Lejeune, J. P., & Loiseau, H. (2009). Neuroepithelial intra medullary spinal cord tumors in adults: study of 70 cases, in American Academy of Neurology Annual Meeting 2009, *Neurology*, 72(11), A33-A33.
4. Dhanapandian, J., & Merla, J. J. (2016). A Study of Clinical, Radiological and Pathological Correlation of Intraspinal Compressive Lesions. *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)*, 15(5), 23-31.
5. Chung, J. Y., Lee, J. J., Kim, H. J., & Seo, H. Y. (2008). Characterization of magnetic resonance

images for spinal cord tumors. *Asian spine journal*, *2*(1), 15-21.
6. Raco, A., Esposito, V., Lenzi, J., Piccirilli, M., Delfini, R., & Cantore, G. (2005). Long-term follow-up of intramedullary spinal cord tumors: a series of 202 cases. *Neurosurgery*, *56*(5), 972-981.
7. Elsberg, C. A. (1925). Some aspects of the diagnosis and surgical treatment of tumors of the spinal cord with a study of the end results in a series of 119 operations. *Annals of Surgery*, *81*(6), 1057-1073.
8. Constantini, S., & Epstein, F. (1999). *'Pediatric intraspinal tumors',* In: Choux, M., Di Rocco, E., Hockley, A. and Walker, M., eds.,*Pediatric Neurosurgery*. London, UK: Churchill Livingstone; pp. 601-602.
9. Duong, L. M., McCarthy, B. J., McLendon, R. E., Dolecek, T. A., Kruchko, C., Douglas, L. L., & Ajani, U. A. (2012). Descriptive epidemiology of malignant and nonmalignant primary spinal cord, spinal meninges, and cauda equina tumors, United States, 2004-2007. *Cancer*, *118*(17), 4220-4227.
10. Grimm, S., & Chamberlain, M. C. (2009). Adult primary spinal cord tumors. *Expert review of neurotherapeutics*, *9*(10), 1487-1495.
11. Parsa, A. T., Chi, J. H., Acosta, F. L., Ames, C. P., & McCormick, P. C. (2005). Intramedullary spinal cord tumors: molecular insights and surgical innovation. *Clinical neurosurgery*, *52*, 76.
12. Koeller, K. K., Rosenblum, R. S., & Morrison, A. L. (2000). Neoplasms of the spinal cord and filum terminale: radiologic-pathologic correlation. *Radiographics*, *20*(6), 1721-1749.
13. Lonser, R. R., Weil, R. J., Wanebo, J. E., Devroom, H. L., & Oldfield, E. H. (2003). Surgical management of spinal cord hemangioblastomas in patients with von Hippel—Lindau disease. *Journal of neurosurgery*, *98*(1), 106-116.
14. Kalaycı, M., Cağavi, F., Gül, S., Yenidünya, S., & Açıkgöz, B. (2004). Intramedullary spinal cord metastases: diagnosis and treatment–an illustrated review. *Acta neurochirurgica*, *146*(12), 1347-1354.
15. Samartzis, D., Gillis, C. C., Shih, P., O'Toole, J. E., & Fessler, R. G. (2015). Intramedullary spinal cord tumors: part I—epidemiology, pathophysiology, and diagnosis. *Global spine journal*, *5*(5), 425-435.
16. Brotchi, J., Dewitte, O., Balériaux, D., Vandesteene, A., Raftopoulos, C., Flament-Durand, J., & Noterman, J. (1991). A survey of 65 tumors within the spinal cord: surgical results and the importance of preoperative magnetic resonance imaging. *Neurosurgery*, *29*(5), 651-657.
17. Ferrante, L., Mastronardi, L., Celli, P., Lunardi, P., Acqui, M., & Fortuna, A. (1992). Intramedullary spinal cord ependymomas—a study of 45 cases with long-term follow-up. *Acta neurochirurgica*, 119(1-4), 74-79.
18. Rahman, S. (2014). 'Magnetic resonance imaging evaluation of spinal cord tumors compared with histopathological findings', Department of Radiology & Imaging, Bangabandhu Sheikh Mujib Medical University, Dhaka,(Thesis), pp.51-60.
19. Chowdhary, A. S., Durai, B., & Mohanty, J. (2017). MRI Evaluation of Spinal Cord Tumours with Histopathological Correlation. *Journal of Evidence Based Medicine and Healthcare*, 4(95), 5978–5986.