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Original Research Article

MRI Evaluation of Intradural Extramedullary Spinal Tumors with Histopathological Correlation - A Cross Sectional Study

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Abstract: ***Introduction:*** Tumors of nerve sheath, neurofibroma and schwannoma represent 30% of intradural extramedullary tumors. Schwannomas and neurofibromas are histologically composed of Schwann cells. Schwannomas almost always arise from the dorsal sensory roots and form well- encapsulated firm masses that compress adjacent tissue, without invading the involved nerve. Neurofibromas are more complex and are composed of Schwann cells mixed with fibroblast they involve the parent nerve. Meningiomas comprise approximately 25% of primary intraspinal tumors and are second only to nerve sheath tumors in frequency. Spinal cord meningiomas are originate from meningothelial cells near the distal root ganglia. Most menongiomas are intradural extramedullary, only 5% are extradural. ***Aim of the Study:*** The aim of this study was to evaluate the role of MRI in diagnosis of intradural extramedullary 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 (54%) of our patients presented with spinal tumor were male compared to female (46%).We found schwannoma was diagnosed by (42.9%), meningioma (31.4%), neurofibroma (25.7%) respectively. Neurofibroma & schwannoma showed male predominance with 66.67% & 60% while meningioma showed female predominance with 63.6%. We found majority (55.6%, 60% & 72.7%) of neurofibroma, schwannoma & meningioma was in dorsal region respectively. ***Conclusion:*** In our study we found that MRI is a very sensitive and effective imaging procedure of suspected spinal schwannoma 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.

Key words: Spinal Tumor, Schwannoma, Neurofibroma, Meningioma, MRI.

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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

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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 these anatomic areas [8]. Intradural intramedullary lesions comprise 20 to 30% of all primary intradural tumors. The remaining 70 to 80% of primary intradural tumors are intradural extramedullary tumors [9, 10]. Primary intradural extramedullary lesions include nerve sheath tumors, meningiomas, paragangliomas, arachniod cyst, dermoid cysts and neuroenteric cysts. Tumors of nerve sheath, neurofibroma and schwannoma represent 30% of intradural extramedullary tumors [11]. Schwannomas and neurofibromas are histologically composed of Schwann cells. Schwannomas almost always arise from the dorsal sensory roots and form well- encapsulated firm masses that compress adjacent tissue, without invading the involved nerve. Neurofibromas are more complex and are composed of Schwann cells mixed with fibroblast they involve the parent nerve. They are unencapsulated, often fusiform and enlarge within the nerve itself [5]. Multiple neurofibromas are often associated with Neurofibromatosis type-1.Although many other tumors are associated with NF1, in relation to intramedullary spinal cord tumors, astrocytomas are the most likely develop [12]. Meningiomas comprise approximately 25% of primary intraspinal tumors and are second only to nerve sheath tumors in frequency. Spinal cord meningiomas are originate from meningothelial cells near the distal root ganglia. Most menongiomas are intradural extramedullary, only 5% are extradural [13]. There are various modalities 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 [14]. 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. Sometimes, it is not possible to categories the lesion to a single compartment. Some lesions of similar pathology can occur in two compartments simultaneously. For example, metasteses can be leptomeningeal as well as extradural in location [5, 15]. 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 [16].

This study was undertaken to evaluate the role of Magnetic Resonance Imaging and to reveal the validity of MRI in determining intradural extramedullary spinal tumors.

OBJECTIVE OF THE STUDY

General Objective

To evaluate the role of MRI in diagnosis of intradural extramedullary spinal tumors compared to histopathological findings.

Specific Objectives

- To record MRI findings of the intradural extramedullary spinal tumors.
- To record histopathological findings of intradural extramedullary 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 intradural extramedullary spinal tumor who attended in the Department of Radiology and 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 having clinically suspected spinal tumors & diagnosed by MRI as having intradural extramedullary spinal tumor; c)Patients diagnosed by MRI as having intradural extramedullary 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 (MagnatomAvanto, Siemens) unit with a spine surface coil. T1-weighted (repetition time msec/echotimemsec,

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 diethylenetriaminepentaacitic acid (Gd-DTPA) dimeglumine 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/ multisegmental 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 Nerve Sheath Tumor

Nerve sheath tumor includes neurofibroma and schwannoma that arise from Schwann cells of nerve sheaths. Most nerve sheath tumor arise from dorsal sensory root. Schwannoma and neurofibroma are often indistinguishable radiographically. Ingeneral, appears as rounded lesions often with associated adjacent bony remodeling, when large they may either align themselves with the long axis of the cord forming sausage shaped masses which can extend over several level or may potrude out of the neural exit foramen forming a dumbbell shaped mass. Although neurofibromas and schwannomas can look identical, schwannomas are frequently associated with hemorrhage, intrinsic vascular change (thrombosis and sinusoidal dilation), cyst formation and fatty degeneration these findings are rare in neurofibroma. Neurofibroma tends to encase the nerve root in contrast to schwannomas which commonly displace the nerve root due to their asymmetric growth. Schwannomas are usually round, whereas neurofibromas are more commonly fusiform. On MRI, nerve sheath tumors are isointense to hypointense relative to cord on T1W image and hyperintense on T2W image. After Gd-DTPA neurofibroma shows homogeneous enhancement and schwannoma shows peripheral enhancement.

MRI Findings of Meningioma

Spinal meningioma is the second most common tumor of spinal cord. Meningiomas are commonly located at thoracic region. Although most thoracic and lumbar meningiomas are based on posterior dura, craniocervical ones may be anterior or posterior in location. This tumor appears as rounded, sharply marginated masses that are isointense to spinal cord on T1WI and iso to hypointense on T2WI. Moderate relatively homogeneous enhancement is seen following contrast administration. A dural tail sign may be seen, reflecting tumor spread or reactive changes in the dura adjacent to the tumor.

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 intradural extramedullary spinal tumor was calculated.

RESULT

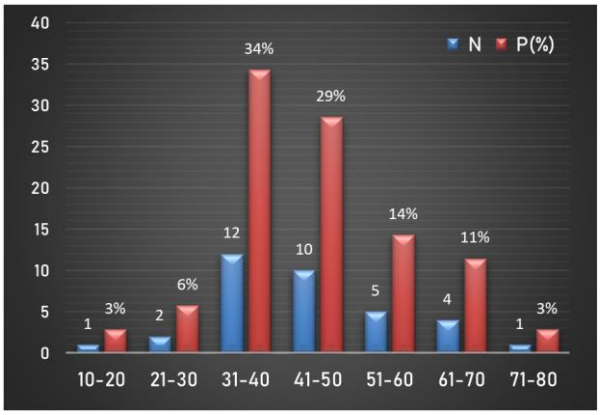


Figure 1: Age distribution among our study people

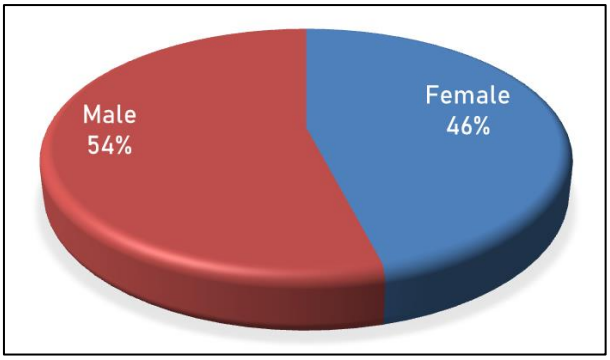


Figure 2: Gender distribution among our study participants

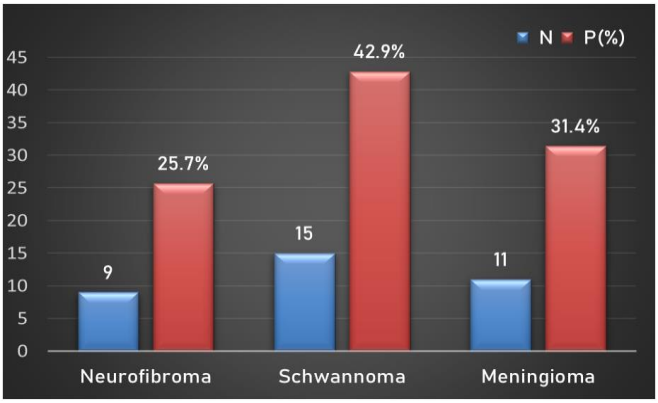


Figure 3: Distribution of intradural extramedullary spinal tumors based on MRI diagnosis

Table 1: Distribution of the intradural extramedullary spinal tumors based on demographics, clinical presentation& tumor location (n=35)

Variables	Neurofibroma		Schwannoma		Meningioma	
	N	P(%)	N	P(%)	N	%
Age group (Years)						
10-20	-	-	1	6.70%	-	-
21-30	-	-	0	-	2	18.2%
31-40	5	55.6%	7	46.60%	-	-
41-50	2	22.2%	3	20%	5	45.4%
51-60	-	-	1	6.60%	4	36.4%
61-70	2	22.2%	2	13.30%	-	-
71-80	-	-	1	6.60%	-	-
Mean ± SD	**41.71±13.9**					
Gender						
Male	6	66.67%	9	60%	4	36.4%
Female	3	33.33%	6	40%	7	63.6%
Clinical Presentation						
Back Pain	5	55.6%	6	40%	8	72.7%
Radicular Pain	3	33.3%	9	60%	5	45.5%
Motor Disturbance	2	22.2%	3	20%	4	36.4%
Sensory Disturbance	1	11.1%	1	6.60%	2	18.2%
Bowel Dysfunction	1	11.1%	3	20%	1	9.09%
Bladder Dysfunction	2	22.2%	2	13.30%	2	18.2%
Location						
Cervical	2	22.2%	1	6.60%	-	-
Cervico-dorsal	-	-	-	-	-	-
Dorsal	5	55.6%	9	60.00%	8	72.7%
Dorso-lumbar	2	22.2%	2	13.40%	3	27.3%
Lumbar	-	-	2	13.40%	-	-
Lumbo-sacral	-	-	1	6.60%	-	-

Table 2: Distribution of the intradural extramedullary spinal tumors based on MRI Characteristics (n=35)

MRI Characteristics	Neurofibroma		Schwannoma		Meningioma	
	N	P(%)	N	P(%)	N	P(%)
Shape						
Oval	6	66.7	-	-	6	54.5
Elongated	-	-	1	6.6	-	-
Lobulated	-	-	10	66.6	-	-
Round	3	33.3	1	6.6	5	45.5
Dumbbell Shaped	-	-	3	20	-	-
Margin						
Regular	7	77.8	15	100	11	100
Irregular	2	22.2	-	-	-	-
Homogeneity						
Homogeneous	7	77.8	11	73.3	11	100
Inhomogeneous	2	22.2	4	26.6	-	-
T1WI appearance						
Hypointense	4	44.4	12	50	-	-
Isointense	5	55.6	3	20	9	81.8
Iso to hypointense	-	-	-	-	2	18.2
T2WI appearance						
Hyperintense	9	100	12	80	3	27.3
Isointense	-	-	3	20	8	72.7
Iso to hyperintense	-	-	-	-	-	-
Post Gd-DTPA						
Homogeneous enhancement	5	55.6	4	26.6	9	81.8
Heterogeneous enhancement	4	44.4	11	75.3	2	18.2
Rim enhancement	-	-	-	-	-	-
Nodular enhancement	-	-	-	-	-	-
No enhancement	-	-	-	-	-	-
Components						
Solid	7	77.8	11	73.3	11	100
Cystic	-	-	4	26.6	-	-
Mixed	2	22.2	-	-	-	-
Cord compression	9	100	12	80	11	100
Cord edema	4	44.4	5	33.3	6	54.5
Associated syrinx	-	-	-	-	-	-

Table 3: Validity of MRI in diagnosis of spinal Neurofibroma (n=35)

MRI Findings	Histopathological Findings		Total	P-value
	Positive	**Negative**		
Positive	8	1	9	**0.001**
Negative	1	25	26	
	9	**26**	**35**	

Table 4: Validity of MRI in diagnosis of spinal Schwannoma (n=35)

MRI Findings	Histopathological Findings		Total	P-value
	Positive	**Negative**		
Positive	14	1	15	**0.001**
Negative	1	19	20	
	15	**20**	**35**	

Table 5: Validity of MRI in diagnosis of spinal Meningioma (n=35)

MRI Findings	Histopathological Findings		Total	P-value
	Positive	**Negative**		
Positive	10	0	10	**0.001**
Negative	1	24	25	
	11	**24**	**35**	

In figure 1 we showed the age distribution among our study people where we can see that the highest prevalence was 12(34%) aged between 31-40 years old; followed by 10(29%) & 5(14%) were 41-50& 51-60 years old respectively. The patients aged between 10-20 & 71-80 years old had the same prevalence 1% and only 4(11%) & 2(6%) patients were found aged between 61-70& 21-30 years old respectively.

Figure 2 showed the gender distribution of our study participants. Majority (54%) of our patients

presented with spinal tumor were male compared to female (46%).

In figure 3 we showed distribution of intradural extramedullary spinal tumors on the basis of MRI diagnosis. We found that among 35 cases, schwannoma was diagnosed by (42.9%), meningioma (31.4%), neurofibroma (25.7%) respectively.

In table 1 we showed the distribution of the patients with intradural extramedullary spinal tumors based on demographics, clinical presentation & tumor location. We found the Mean ± SD of age was 41.71±13.9 in years. Majority (55.6%)& (46.60%) patients of neurofibroma & schwannoma respectively belong to 31-40 years old, meningioma (45.4%) belongs to 41-50 years old. In this study neurofibroma & schwannoma showed male predominance with 66.67% &60% compared to female 33.33% &40% respectively on the other hand meningioma showed female predominance with 63.6%. It was observed that 60% patients of schwannoma had radicularpain; 55.6% & 72.7% patients of neurofibroma & meningioma had back pain respectively. It was observed that majority (55.6%, 60%& 72.7%) of neurofibroma, schwannoma & meningioma was in dorsal region respectively.

In table 2 we showed the MRI Characteristics of intradural extramedullary spinal tumors. Among of them 66.7% &54.5% neurofibroma & meningioma were oval shape; 66.6% of schwannoma were lobulated respectively. Among of 35 cases all schwannoma & meningioma had regular margin but 77.8% of neurofibroma had regular margin respectively. 77.8%, 73.3%& 100% were homogeneous among neurofibroma, schwannoma & meningioma respectively. On T1WI majority 80% of schwannoma showed hypointensity, whereas majority 55.6% & 81.8% of neurofibroma & meningioma showed isointensity respectively. On T2WI 100% of neurofibroma & 80% schwannoma were hyperintense on the other hand 72.7% meningioma were isotense. After Gd-DTPA 55.6% & 81.8% of neurofibroma & meningioma showed homogeneous while 73.3% schwannoma showed heterogeneous signal intensity. 77.8%, 73.3%& 100% of neurofibroma, schwannoma & meningioma had solid component respectively.

Table 3 showed the validity of MRI in diagnosis of spinal neurofibroma with histopathological correlation. We found them correlated with a sensitivity of (88.9%); specificity (96.15%); positive predictive value (88.9%); negative predictive value (96.15%) and accuracy (94.29%).

Table 4 showed the validity of MRI in diagnosis of spinal schwannoma with histopathological correlation. We found them correlated with a sensitivity of 93.33%; specificity (95%); positive predictive value (93.33%); negative predictive value (95%) and accuracy (94.29%).

Table 5 showed the validity of MRI in diagnosis of spinal meningioma with histopathological correlation. We found them correlated with a sensitivity of 90.9%; specificity (100%); positive predictive value (100%); negative predictive value (96%) and accuracy (94.29%).

Figure 4:

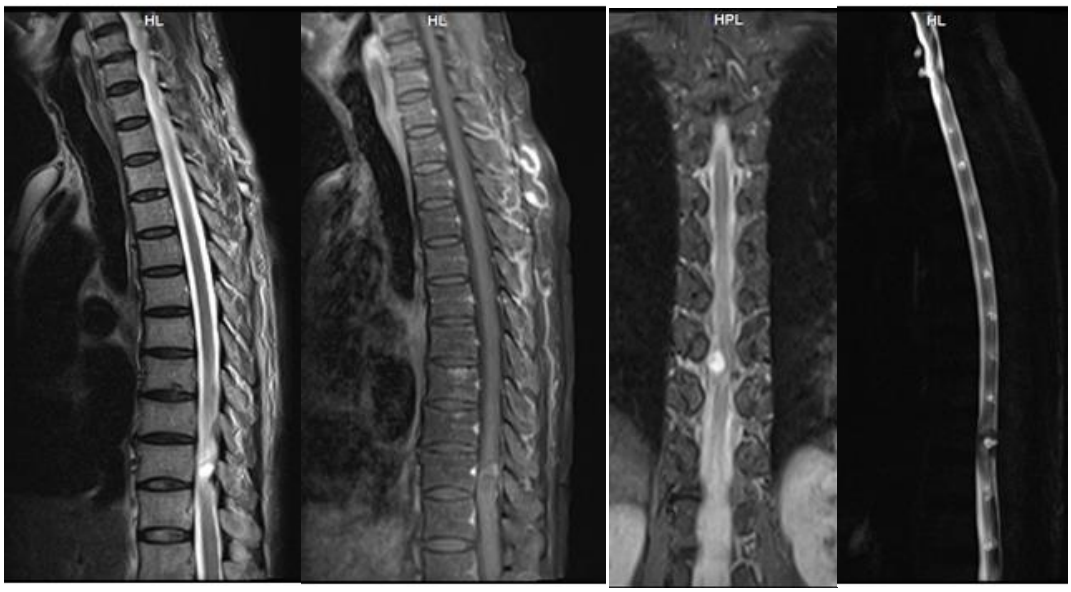
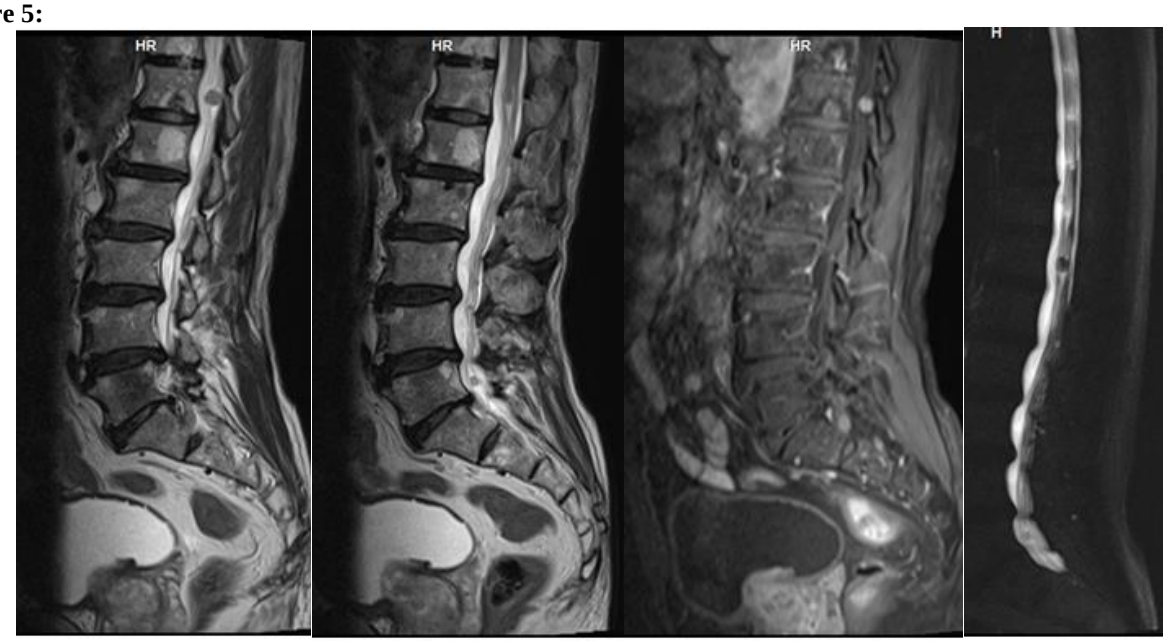


Figure 4: MRI of dorsal spine of a 62 years old male. Sagittal T2WI(A), Sagittal T1 postcontrast (B), Coronal T2WI(C), Myelogram(D) showing lobulated intradural extramedullary lesion at D10 vertebral level with right lateral paraspinal extension through neural foramen causing cord compression, the lesion is heterogeneously hyperintense on T2WI, after I/V contrast heterogeneous enhancement noted. MRI diagnosis was schwannoma. Histopathology also revealed schwannoma.

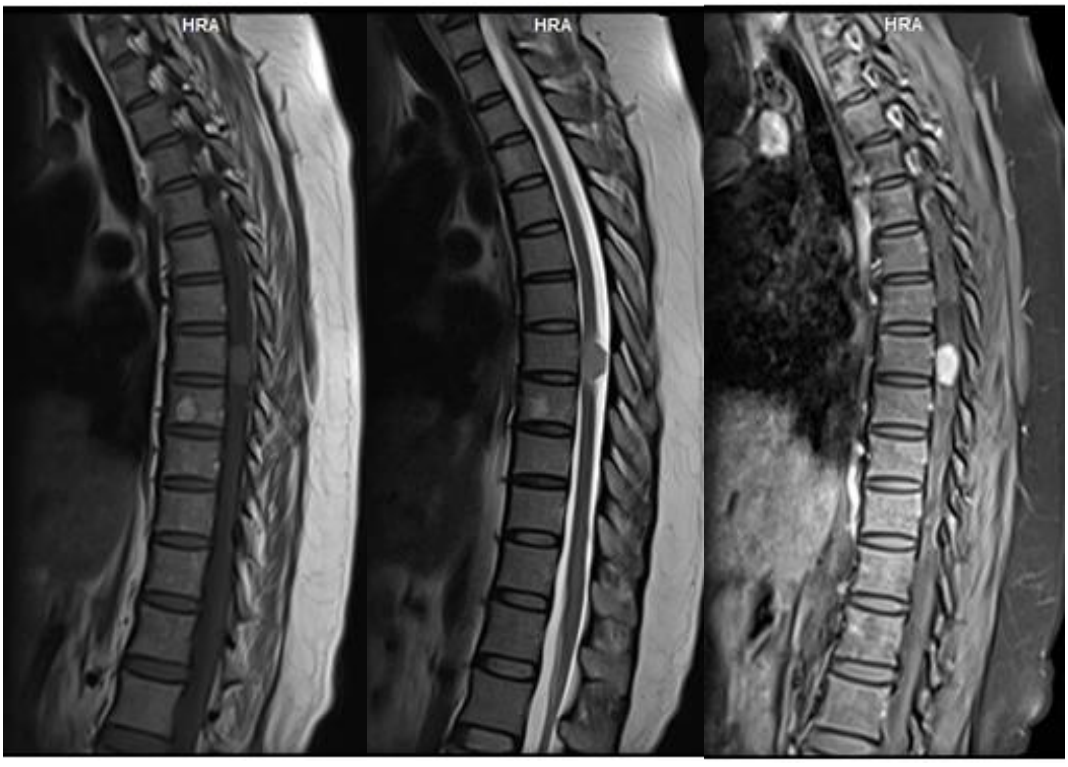
Figure 5:



A B C D

Figure 5: MRI of lumbosacral spine of 75 years old male. Sagittal T2WI(A,B),Sagittal T1 postcontras(C), Myelogram(D) showing intradural extramedullary rounded lesions at D12, L4&L5 vertebral levels, the lesions are isointense on T1WI and intermediate on T2WI. After I/V contrast lesions show enhancement. MRI diagnosis was neurofibroma. Histopathology also revealed neurofibroma.

Figure 6:



A B C

Figure 6: MRI dorsal spine of a 45 years old female. Sagittal T1WI(A), Sagittal T2WI (B), Sagittal T1 postcontrst (C) shows oval shape iso intense lesion on T1WI , which is isointense on T2WI noted at dorsal region. AfterI/v contrast lesion shows marked homogeneous enhancement. MRI diagnosis was meningioma. Histopathology also revealed meningioma.

DISCUSSION

In our study we found that the highest prevalence was 12(34%) aged between 31-40 years old; followed by 10(29%) & 5(14%) were 41-50& 51-60 years old respectively. The patients aged between 10-20 & 71-80 years old had the same prevalence 1% and only 4(11%) & 2(6%) patients were found aged between 61-70 & 21-30 years old respectively [Figure 1]. 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 by Reco*et al.,* showed that mean age was 42.0 years varied from 8-72 years of their study patient having spinal tumors. Chung *et al.*,[5, 6] studied with 39 patients who underwent MRI for evaluation of spinal tumor; the mean age of this study was 46.6 years, which correlate with present study.

In this study majority (54%) of our patients presented with spinal tumor were male compared to female (46%) [Figure 2]. 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 resemble 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 35 cases, schwannoma was diagnosed by (42.9%), meningioma (31.4%), neurofibroma (25.7%) respectively [Figure 3].

In this study we found the Mean ± SD of age was 41.71±13.9 in years. Majority (55.6%) & (46.60%) patients of neurofibroma & schwannoma respectively belong to 31-40 years old, meningioma (45.4%) belongs to 41-50 years old. In this study neurofibroma & schwannoma showed male predominance with 66.67% & 60% compared to female 33.33% & 40% respectively on the other hand meningioma showed female predominance with 63.6%.

It was observed that 60% patients of schwannoma had radicular pain; 55.6% & 72.7% patients of neurofibroma & meningioma had back pain respectively. In this series it was observed that majority (55.6%, 60% & 72.7%) of neurofibroma, schwannoma & meningioma was in dorsal region 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]. A study by Reddy *et al.,* reported 80% schwannoma were found in thoracic and lumbar region, with 20% in cervical region. 50% neurofibroma constituted at thoracic region, 80% meningioma were located at thoracic region.75% astrocytoma were found in thoracic region. Above finding regarding the location of the intradural spinal tumors are comparable with the current study [1].

In our study we found that 66.7% & 54.5% neurofibroma & meningioma were oval shape; 66.6% of schwannoma were lobulated respectively. 77.8%, 73.3% & 100% were homogeneous among neurofibroma, schwannoma & meningioma respectively. On T1WI majority 80% of schwannoma showed hypointensity, whereas majority 55.6% & 81.8% of neurofibroma & meningioma showed isointensity respectively. On T2WI 100% of neurofibroma & 80% schwannoma were hyperintense on the other hand 72.7% meningioma were isotense. After Gd-DTPA 55.6% & 81.8% of neurofibroma & meningioma showed homogeneous while 73.3% schwannoma showed heterogeneous signal intensity. 77.8%, 73.3%&100% of neurofibroma, schwannoma & meningioma had solid component respectively [Table 2]. A study done by Chowdhury *et al.,* mentioned in their report out of 52 cases, majority (24, 46.1%) of cases were schwannoma identified by MRI. Out of 24 cases 23 cases were intradural extramedullary, 1 case was extradural in location. On T1WI 58.3% were iso intense, 41.6% were hypointense to the spinal cord. On T2WI all 24 cases were hyperintense. 83.3% were heterogeneous and 16.6% were homogeneous. All of the tumor were well defined and 75% cases showed cystic areas, 4.1% can showed target sign, 75% showed heterogeneous enhancement on post contrast T1WI [19]. In the present study of MRI evaluation of neurofibroma8 cases were true positive, false positive case was 1, false negative 1 case and true negative 25 cases as diagnosed by histopathology and the validity of MRI in evaluation of intradural schwannoma was correlated by calculating sensitivity of 88.9%, specificity (96.15%), positive predictive value (88.9%), negative predictive value (96.15%) and accuracy (94.29%) [Table 3].A study done by Chowdhury *et al.,* observed that out of 52 cases MRI diagnosed 6 cases as neurofibroma. Among them 5 cases were true positive, 1 case was false positive, 1 case was false negative. They also found in their study that, the sensitivity, specificity of MRI in diagnosis neurofibroma was 80% and 95.7% [19].

In the present study of MRI evaluation of schwannoma, it was observed that 14 cases were true positive, false positive case was 1, false negative 1 case and true negative 19 cases as diagnosed by histopathology and the validity of MRI in evaluation of intradural schwannoma was correlated by calculating sensitivity 93.33%, specificity 87.5%, positive predictive value 93.33%, negative predictive value

95.00%, accuracy 94.29% [Table 4]. A study done by Chowdhury *et al.*, observed that out of 52 cases 24 cases diagnosed as schwannoma by MRI and confirmed by histopathological evaluation, which were true positive, false positive was 1 case, false negative was 1 and true negative 27 cases. The above findings are consistent with the current study. They also observed in their study that the sensitivity and specificity of MRI diagnosing schwannoma were 91.7% and 96.4% respectively; which is comparable with the present study [19]. In the present study of MRI evaluation of meningioma10 cases were true positive, false negative 1 case and true negative 24 cases as diagnosed by histopathology and the validity of MRI in evaluation of intradural schwannoma was correlated by calculating sensitivity of 90.9%, specificity (100%), positive predictive value (100%), negative predictive value (96%) and accuracy (94.29%) [Table 5].A study done by Chowdhury *et al.*, observed that MRI was able to diagnose all 5 cases of meningioma accurately in their study, these findings are compatible with the present study [19].

Limitations of the Study

Our study was a single centre study. We could only study the patients who attended at the neurology department of Sylhet M.A.G. Osmani Medical College within a short study period. We could only investigate about spinal neurofibroma, schwannoma and meningioma because of our 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 extramedullary spinal tumor 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 sizeneeds to be done to evaluate the validity of MRI in diagnosing other intraduralspinal tumors.

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