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Pathology

Detection of Lumbosacral Radiculopathy in Patients with Low Back Pain: A comparison between clinical and Magnetic Resonance Imaging

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Abstract **Original Research Article**

Magnetic resonance imaging (MRI) is the preferred investigation for most spinal diseases. However, determining the cause of radicular pain extending into the lower limb is complicated as it is often multifactorial and anatomical abnormalities detected by MRI are common in the spine and may not necessarily translate into clinical symptoms. So in the evaluation of a patient of lumbosacral radicular pain in the lower limbs, it is essential to correlate the clinical symptoms and signs with the findings detected in the MRI to arrive at a correct diagnosis and arrange an appropriate management. So this study was done to see the correlation between clinically and Magnetic Resonance Imaging detected lumbosacral radiculopathy in patients with low back pain. It was a cross sectional descriptive study in which 30 male and 10 female patients suffering from low back pain with radiation to the lower limbs were purposively selected. 67.5% of patients were between 20 to 50 years and 60% were performing heavy work. As expected, 52.18% had L5 and 32.61% patients had S1 radiculopathy. At all the root levels from L3 to S1 MRI showed radiculopathy in more patients than radiculopathy as detected clinically. Clinically radiculopathy was detected in 55 (73.33%) patients while MRI detected radiculopathy in 75 patients (there were total 40 patients but radiculopathy both clinically and by MRI was detected in more patients as some patients had involvement in more than one root). The difference in clinical and MRI detection of root involvement was statistically significant. MRI is a very sensitive test for identifying disc lesions but it is not very specific. Findings of this study are similar to what has been reported in the literature. Correlation between Clinical and Magnetic Resonance Imaging detected Lumbosacral Radiculopathy in Patients with Low Back Pain.

Key word: Magnetic Resonance Imaging (MRI), Magnetic, Radiculopathy, Lumbosacral.

INRTODUCTION

Low back pain accounts for a large amount of loss of productivity in the workforce. When the low back pain extends into the lower limb along the distribution of a dermatome then radiculopathy is said to be present. Although most people experience back pain during their lifetime, only a fraction experience lumbosacral radiculopathy as a consequence of nerve root compression or irritation [1]. Almost 5% males and 2.5% females experience lumbosacral radiculopathy at some time in their lifetime. The most frequent cause of lumbosacral radiculopathy is nerve root compression by a herniated disc. Root compression can also be caused by surrounding structures e.g. degenerative stenosis of root canal or spinal canal, spondylolisthesis or other less frequent pathological conditions like malignancies, infections or chemical irritation [2]. Most lumbar disc herniations are preceded by bouts of varying degrees and duration of back pain. In many cases, an inciting event cannot be identified. Pain eventually may radiate into the leg. Pain may be characterized as a shooting or stabbing pain. The distribution of the leg pain is somewhat dependent on the level of nerve root irritation. Higher herniation's (third or fourth lumber levels) can radiate into the groin or anterior thigh. First sacral radiculopathy causes pain in the calf and bottom of the foot [1]. Fifth lumbar radiculopathy, which occurs most commonly, causes lateral and anterior thigh and leg pain. Often accompanying numbness or tingling occurs with a distribution similar to the pain. On examination, patients may be neurologically normal or show features of radiculopathy. A positive straight leg raising sign indicates that prolapsed lumbar disc is present. However, a crossed straight leg raising sign may be even more predictive of a lumbar disc disease. The back may appear scoliotic. Gait is often abnormal.

Muscles weakness may be revealed particularly when testing is done by walking on heels and toes [3]. The back pain however is notorious for a high prevalence of asymptomatic abnormalities. Asymptomatic herniated discs are a common finding in the normal population (25%) and therefore it is assumed that within symptomatic patients a substantial number of herniated discs are asymptomatic too. Besides herniated discs, other abnormalities in the back detected by MRI may also be asymptomatic [3]. To facilitate the distinction between symptomatic and asymptomatic lesions, the ability of current MRI to visualize the nerve root is considered helpful. However, MRI alone is not enough to retrieve the cause of lumbosacral radiculopathy. Comparing clinical symptoms and signs with MRI finding remains essential to determine which of the MRI detected abnormalities are symptomatic and thus to determine whether patients are eligible for surgical intervention [4]. To evaluate the lumbar region, MRI is the investigation of choice.

OBJECTIVES

General objective

- To assess the association between clinical and MRI detected radiculopathy at different nerve root level in patients with low back pain.

Specific Objectives

- To detect frequency of MRI finding in nerve root involvement.
- To detect frequency of sensory disturbance in different nerve root level.
- To detect reflex changes in relation to nerve root level.

MRTHODOLOGY AND MATERIALS

It was a cross sectional type of descriptive study. The present study had been carried out among the patients reporting to out patient's department and patients admitted into Neuromedicine, Neurosurgery and Medicine Units of Rajshahi Medical College Hospital. Over a period of one year (form November 2011 to October 2011). The prevalence of low back pain with radiculopathy in case of male 5% and in case of female 2.5% (The prevalence of low back pain with radiculopathy patients has been determined by the consultation with the specialists working in the department of Medicine and Neuromedicine Unit at RMCH). As the information about the total number of low back pain with radiculopathy patients attending RMCH for a period of one year on an average 52. Considering 20% dropout or unwillingness to participate or any other unexpected loss during data collection. So, the sample size needed to be increased by adding 20% more ultimately it enrolled 30+6=36. I enrolled 40 patients for proposed study. The researcher regularly searched the patients in the Neuromedicine, Medicine and Neurosurgery Unit of RMCH from the register book maintained in the ward. Identification of the participant can be done by asking duty doctor or nurse in the ward. After identification of the study subject, the researcher explained the aims and objectives of the study to the prospective study subject in detail. If the respondent agreed to participate then informed written consent were obtained and thereby included in the study. So the selection of the participants indicates that a non-random sampling technique applied in this regard. But the researcher selected each study participant on the basis of predetermined inclusion and exclusion criteria.

RESULTS

This was a descriptive cross sectional study under taken in the department of Neuromedicine, Rajshahi Medical College Hospital, during the period from November 2011 to October 2012. A total number of 40 patients clinically diagnosed as lumbosacral radiculopathy were purposively selected for the study. Figure shows that clinical examination of the patients indicated that 29 (72.5%) had muscle weakness and 11 (27.5%) had no muscle weakness. Table shows the age and sex distribution of the patients. 67.5% (27) of the patients were between 20 and 50 years of age and 27.5% (11) were above 60 years of age. Out of the 10 females 4 (40%) were between 21 and 30 years of age. Male to female ratio of patients were 3:1. Frequency distribution of patients by occupation: Job type, the study showed that 17 (42.5%) patients were engaged in physically demanding occupation. It also revealed that 8 (20%) patients were sedentary worker and equal percentage (20%) of patients were housewife. 7 (17.5%) patients were working in lifting weights. So overall 60% of the patients were engaged in heavy work. Majority of patients 26 (65%) in poor socio-economic group (monthly income less than 5,000 Tk). It was also revealed that 13 (32.5%) patients were middle socioeconomic group (monthly income 5,000–10,000 Tk.) and 1 (2.5%) patients were higher socio-economic group (monthly income more than 15,000 Tk.). Distribution of pain location by side, it was revealed that 16 (40.0%) was on left side, 11 (27.5%) on right side and 13 (32.5%) on both side. Clinical examination revealed that L5 was the commonest root involved. Root involvement was diagnosed by the criteria set up for detection of each individual nerve root. Clinical examination of the patients indicated that sensory function disturbance at the nerve root level were present in 31 (67.39%) and nerve sensory function at the root level was intact in 15 (32.61%). Among them, in L3 nerve root level, sensory function disturbance was present in 2 (66.66%) and sensory function was intact in 1 (33.34%); a the L4 nerve root level, sensory function disturbance was present in 2 (50%) and sensory function was intact in 2 (50.0%), at the L5 nerve root level, sensory function disturbance was present in 17 (70.83%) and sensory function was intact in 7 (29.17%) and at the S1 nerve root level, sensory function disturbance was present in 10

(66.66%) and sensory function was intact in 5 (33.34%). L3, L4 nerve root reflect knee jerk and S1 nerve root reflects ankle jerk but L5 nerve root does not reflect any jerk. Clinical examination of the patient revealed that knee jerk diminished or absent in 3 (60.0%) and normal in 2 (40.0%); ankle jerk diminished or absent in 10 (66.66%) and normal in 5 (33.33%). Distribution of frequency and percentage of patients clinically and MRI detected lumbosacral radiculopathy revealed that right L3 nerve root level clinically lumbosacral radiculopathy was 1 (2.80%) and MRI detected lumbosacral radiculopathy was 2 (5.60%); left L3 nerve root level also equal percentage that was clinically lumbosacral radiculopathy 1 (2.80%) and MRI detected lumbosacral radiculopathy 2(5.60%). Right L4 nerve root level clinically lumbosacral radiculopathy 4 (11.10%) and MRI detected lumbosacral radiculopathy 6 (16.70%); Left L4 nerve root level clinically lumbosacral radiculopathy 2 (5.60%) and MRI detected lumbosacral radiculopathy 7 (19.40%). Right L5 nerve root level clinically lumbosacral radiculopathy 13 (36.10%) and MRI detected lumbosacral radiculopathy 19 (52.80%); Left L5 nerve root level clinically lumbosacral radiculopathy 19 (52.80%) and MRI detected lumbosacral radiculopathy 22 (61.40%). It also revealed that right S1 nerve root level clinically lumbosacral radiculopathy was 8 (22.20%) and MRI detected lumbosacral radiculopathy was 9 (25.0%); Left S1 nerve root level clinically 7 (19.40%) and MRI 8 (22.20%). P-value was statistically significant at the level of 0.05. Table showing correlation between clinically and MRI detected lumbosacral radiculopathy at different nerve root levels. Statistically significant difference was detected in L4, L5, and S1 nerve roots on both sides, but L3 root involvement was not statistically significant on both sides.

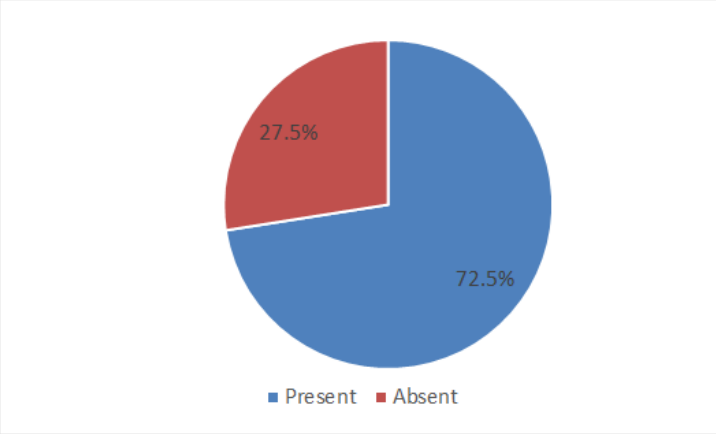

Fig-I: Pie diagram showing the frequency and percent distribution of patients by muscle weakness.(n=40)

Table-I: Frequency distribution of patient by age and sex. (n=40)

Age groups (Yrs.)	Sex				Total	
	Male		Female			
	N	%	N	%	N	%
<20	1	50.0	1	50.0	2	5.0
21-30	5	55.6	4	44.4	9	22.5
31-40	6	75.0	2	25.0	8	20.0
41-50	8	80.0	2	20.0	10	25.0
51-60	6	85.7	1	14.3	7	17.5
>60	4	13.3	0	00	4	10.0
Total	30	75.0	10	25.0	40	100.0

Table-II: Distribution of patients by occupation: Job type (n=40)

Occupation	Number	Percentage
Housewife	8	20.0
Sedentary	8	20.0
Weight lifting	7	17.5
Physically demanding	17	42.5
Standing & walking	00	00.00
Total	40	100.0

Table-III: Socio-economic condition of the patients (n=40)

Socio-economic condition	Number	Percentage
Poor (<5000 Tk./month)	26	65.0
Middle (5000-15000 Tk./month)	13	32.5
Higher (>15000 Tk./month)	1	2.5
Total	40	100.0

Table-IV: Distribution of pain location by side of the patients (n=40)

Pain location by side	Number	Percentage
Left	16	40.0
Right	11	27.5
Both	13	32.5
Total	40	100.0

Table-V: Clinical Involvement of the nerve roots (40 patients).

Nerve root involved	No of Patients	%
L3	3	6.52
L4	4	8.69
L5	24	52.18
S1	15	32.61

Table-VI: Distribution of sensory disturbance by level of nerve root involvement of patients (n=40)

Nerve root by level	Sensory disturbance		Sensory function intact	
	N	%	N	%
L3	2	66.66	1	33.34
L4	2	50.00	2	50.00
L5	17	70.83	7	29.17
S1	10	66.66	5	33.34
Total	31	67.39	15	32.61

Table-VII: Frequency distribution of reflex changes of the patients (n=40)

Reflex	Diminished/Absent		Normal	
	N	%	N	%
Knee jerk	3	60.00	2	40.00
Ankle jerk	10	66.66	5	33.33

Table-VIII: Frequency and percentage of patients clinically and MRI detected lumbosacral radioculopathy (n=40)

Nerve root involvement	Clinically lumbosacral radiculopathy		MRI detected lumbosacral radiculopathy	
	N	%	N	%
Rt.L3	01	02.80	02	05.60
Lt.L3	01	02.80	02	05.60
Rt.L4	04	11.10	06	16.70
Lt.L4	02	05.60	07	19.40
Rt.L5	13	36.10	19	52.80
Lt.L5	19	52.80	22	61.10
Rt.S1	08	22.20	09	25.00
Lt.S1	07	19.40	08	22.20

Table-IX: Correlation between clinically and MRI detected lumbosacral radioculopathy at different nerve root level. (n=40)

Nerve root involvement	Clinically lumbosacral radiculopathy		MRI detected lumbosacral radiculopathy		Pearson $\chi 2$ value	df	P-value 2-sided	Interference
	N	%	N	%				
Rt.L_3	1	2.80	2	5.60	0.061	1	1.00	Statistically not significant
Lt.L_3	1	2.80	2	5.60	0.061	1	1.00	Statistically not significant

Rt.L_4	4	11.10	6	16.70	11.025	1	0.01	Statistically highly significant
Lt.L_4	2	5.60	7	19.10	8.773	1	0.033	Statistically significant
Rt.L_5	13	36.10	19	52.80	8.276	1	0.006	Statistically highly significant
Lt.L_5	19	52.80	22	61.10	9.034	1	0.005	Statistically highly significant
Rt.S_1	8	22.20	9	25.00	21.429	1	0.000	Statistically highly significant
Lt.S_1	7	19.40	8	22.20	6.13	1	0.030	Statistically significant

DISCUSSION

Magnetic resonance imaging (MRI) is the preferred investigation for most spinal diseases and is increasingly requested for people with low back pain (LBP) as subjects have a high confidence in the reliability of an MRI examination [5]. However, determining the cause of back pain is complicated as it is often multifactorial and anatomical abnormalities are common in the spine and may not necessarily translate into clinical symptoms. Thus, national guidelines discourage the use of MRI in non-specific LBP and recommend reserving it for the investigation of severe or progressive neurological deficits or for those cases in which serious underlying pathology is suspected. It also has an acknowledged role in planning surgical management in cases of radiculopathy and spinal stenosis. The accuracy of MRI for predicting the presence of disk herniation's at surgery is relatively high (varying from 76% to 96%) [6], and thus it has become the investigation of choice for patients suspected of lumbar disk herniations[7-10]. The Royal College of Radiologists (RCR) acknowledge that MRI ''is the preferred investigation for the diagnosis of most spinal diseases'', but it can be difficult to determine whether abnormalities seen on a MRI scan are truly the cause of LBP since morphological changes are common in asymptomatic subjects. There is very poor correlation between imaging findings of disc herniation and the clinical presentation or course [11]. In a study of 33 people presumed to have been free of back pain, postmortem examination of the entire spine showed a 39% prevalence of posterior disk protrusions [12]. In another study, 24% of 300 myelograms in people without symptoms showed abnormalities of the lumbar disk [13, 14] performed MRI examinations on 98 asymptomatic people and found that only 36% of them had some abnormality detected in their disks. 38% had an abnormality of more than one intervertebral disk, and abnormalities were more common with increasing age, but the findings were similar in men and women [15] performed magnetic resonance imaging on 67 individuals who had never had low-back pain, sciatica, or neurogenic claudication. The scans were interpreted independently by three neuro-radiologists who had no knowledge about the presence or absence of clinical symptoms in the subjects. About one-third of the subjects were found to have a substantial abnormality. Of those who were less than sixty years old, 20 per cent had a herniated nucleus pulposus and one had spinal stenosis. In the group that was sixty years old or older, the findings were abnormal on about 57% of the scans: 36% of the subjects had a herniated nucleus pulposus and 21% had spinal stenosis. There was degeneration or bulging of a disc at least at one lumbar level in 35% of the subjects between twenty and thirty-nine years old and in all but one of the sixty to eighty-year-old subjects. In view of these findings in asymptomatic subjects, it was concluded that abnormalities on magnetic resonance images must be strictly correlated with age and any clinical signs and symptoms before operative treatment is contemplated [16] followed up the 67 patients of Boden's study after seven years. A questionnaire concerning the development and duration of low-back pain over a seven-year period was sent to the sixty-seven asymptomatic individuals from the 1989 study. A total of fifty subjects completed and returned the questionnaire. A repeat magnetic resonance scan was made for thirty-one of these subjects. Of the fifty subjects who returned the questionnaire, twenty-nine (58%) had no back pain. Low-back pain developed in twenty-one subjects during the seven-year study period. In general, repeat magnetic resonance imaging scans revealed a greater frequency of disc herniation, bulging, degeneration, and spinal stenosis than did the original scans. But the findings on magnetic resonance scans were not predictive of the development or duration of low-back pain. Individuals with the longest duration of low-back pain did not have the greatest degree of anatomical abnormality on the original 1989 scans. Thus follow-up studies of asymptomatic subjects have shown no [16] or only weak [17] correlations between either baseline structural abnormalities or progressive lumbar disc degeneration visualized on MRI and the development of LBP. Similarly, in subjects with mild, persistent LBP, structural changes on MRI are only weakly associated with future back pain episodes and not associated with disability or future medical care [18]. Thus it is generally concluded that clinical correlation is essential to determine the importance of abnormalities on magnetic resonance images. It was thought that clinical information would be helpful in influencing the assessment of root compression. But [19] studied 59 patients having low back pain with

radicular radiation and did MRI in all the patients. They found that detection of herniated disks did not differ between MRI evaluations performed with and without clinical information. Similar findings have been reported in some earlier studies also [20, 21]. MRI studies have revealed lumbar disc abnormalities in up to three-quarters of asymptomatic subjects, including those with no previous history of LBP, sciatica or neurogenic claudication [22-25]. So this study was done to find out the correlation between lumbosacral radiculopathy patients presenting with low back pain radiating to the lower limbs below the knee and the findings of the MRI scan of the lumbosacral region. Table 1, 2 and 3 shows the demographic characteristics of the patients of this study. 75% of the patients were male, 67% of the patients were between the ages of 20 to 50 years, and 26% were above 50 years of age. In a similar study of 119 patients of prolapsed disc with sciatica syndrome conducted in India [1], there were 57 males and 62 females, 67% (81/119) patients were between 20 to 50 years and 31% (36/119) patients were above 50 years. In subjects with and without LBP and regardless of the presence or absence of sciatica, the extent and severity of degenerative change in the lumbar spine, disc bulges, vertebral end-plate changes, canal stenosis and mild spondylolisthesis as demonstrated by MRI are directly related to increasing age [25,18,26]. Disc degeneration or bulging of at least one lumbar level is almost universal in asymptomatic subjects over 60 years old [16], which consequently limit their diagnostic value as a finding on MRI. Table II shows that 60% of the patients were engaged in heavy physical activity and 65% of the patients were from lower socio-economic group (average monthly income < Tk. 5,000/= monthly). MRI has been tested as a screening tool to assess the risk of people in different occupations developing low back pain (LBP)[26] studied the relationship between alterations of the lumbar spine, visualized with magnetic resonance imaging, and occupational variables and reported that lumbar disc degeneration increases with physical occupational exposure and that spondylolisthesis and stenosis are positively related to heavy workload and manual handling of materials, respectively, but other studies have shown that environmental factors such as physical loading seem to be less important than genetic factors in determining disc degeneration[27]. Table IV shows that 67.5% of the patients had unilateral pain while the 32.5% of the patients had bilateral pain. This is due to the fact that unilateral involvement is more common than bilateral involvement. Table V shows that clinical evaluation of our patients revealed that L5 involvement was commonest (52.18%) and S1 was next common (32.61%). In the study by [1] also, L5 involvement was found to be commonest (80/119) and S1 involvement was next common (46/119). Table 6 shows that L4, L5, and S1 sensory root involvement were present in 2, 17 and 10 patients respectively. In the study by[1] L4, L5 and S1 sensory involvement were also present in 2, 16, and 6 patients respectively. Table VII shows that L3, L4 nerve root reflect knee jerk and S1 nerve root reflects ankle jerk but L5 nerve root does not reflect any jerk. Clinical examination of the patient revealed that knee jerk diminished or absent in 3 (60.0%) and normal in 2 (40.0%); ankle jerk diminished or absent in 10. [1]in their study also found that out of 169 levels of disc lesions in the MRI only 89 (52.66%) were clinically symptomatic. MRI is a very sensitive test for identifying disc lesions but it is not very specific. Root compression without clinical substrate as a coincidental finding on MRI of the cervical spine is well known [14, 19, 28, 15]. Table IX shows the statistical significance of the above mentioned differences. At a P value of 0.05, the difference between clinical evaluation and MRI findings were statistically significant in the L4, L5, and S1 root levels but not significant at the L3 root level [30]. Studied 160 patients with unilateral sciatic pain. Clinical examination and magnetic resonance imaging (1.5 T) was performed on every patient. The degree of disc displacement, neural enhancement, and nerve root compression was evaluated from magnetic resonance scans. The correlations of symptoms and signs with magnetic resonance imaging findings were calculated. They also found that the degree of disc displacement in magnetic resonance imaging did not correlate with any subjective symptoms, nor did nerve root enhancement or nerve compression. The findings of this study thus indicate that magnetic resonance imaging is unable to distinguish sciatic patients in terms of the severity of their symptoms. Very few studies have correlated clinical findings with MRI findings in patients with low back pain radiating to the lower limb [31, 32, 16, 1]. The findings of this study correlate well to what has been reported in the literature.

LIMITATIONS OF THE STUDY

This is a hospital based study on a small sample of patients. MRI is an expensive investigation so a control group of patients could not be included to make comparison. Number of patients were too less to make a detailed comparison between different ages, sexes, occupations, and groups of patients. Which does not represent the whole country.

CONCLUSION AND RECOMMENDATIONS

Lumbosacral radiculopathy accounts for a large amount of lost productivity in the working population. Accurate diagnosis can be difficult and often requires intensive interpretation. Treatment is controversial. Surgical treatment can be technically simple and professionally gratifying for the surgeon. Treatment failures are not uncommon. As a consequence, this disease can generate distrust of physicians on the part of patients and vice versa. This study can be important for formulating guidelines for the diagnosis and treatment of low back pain with

radiculopathy. We evaluate the reliability of clinical localization by comparing it with MRI findings. MRI scan of the lumbosacral spine is the preferred investigation for most spinal diseases, but there is statistically significant difference between the findings as detected by clinical examination and as found in the MRI examination. So in patients of low back pain with lumbosacral radiculopathy, management should not be based exclusively on findings as detected by MRI scan, rather clinical findings should also be given due importance.

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