A study on Magnetic Resonance Imaging Evaluation of Low back pain.

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Abstract- Low back pain (LBP) is one of the most prevalent complaints among the people worldwide. According to the medical statistics, about 80 percent of people have at least one episode of LBP during their lifetime cause them to visit a physician for treatment. LBP is the most prevalent cause of work disability and its related leaves among people under 45 years old. Numerous studies have been conducted on the connection between clinical signs, patients' complaints, the level of lumbar disc herniation, and abnormal findings of magnetic resonance imaging (MRI). A Japanese population study reported that the lifetime prevalence of LBP was >80%, as in other industrialized countries [1]. In many cases, contradictory views have been reported and even in some cases canal stenosis and herniated disc have been reported in patient without clinical sings. The aim of this study was to evaluate specific area or location of pain, cause of pain and the types of pathology e.g.-disc bulge or herniation, spinal arthritis, spondylolisthesis etc. The justification of the study was that physicians or doctors might get detail information about the cause of low back pain by MRI within a very short time. In this study, 117 cases of low back pain was analyzed. There were 60 males and 57 females having age range from 21 to 68 years. Back pain was commonly observed in the third to fifth decade. Disc bulge (35%, N=41) & disc protrusion (39%, N=46) are very common cause for low back pain. It was also observed that males are suffering more from LBP.

Index Terms: Back pain, herniated disk, lumbar magnetic resonance imaging, spondylolisthesis, vertebral collapse

Introduction

Low back pain (LBP) is a common problem involving the spine and back muscles. LBP may be classified into acute (0–6 weeks), subacute (6–12 weeks), and chronic (>12 weeks) based on the duration of disease. The lifetime prevalence of LBP has been reported to be 70–85%. [2] Acute LBP is one of the most common conditions encountered in primary care. When acute back pain is associated with neurologic symptoms, then an extensive workup is warranted to look for causes such as herniated intervertebral disk, spinal stenosis, and cauda equine syndrome, which accounts for only 5% of acute back pain cases. [3] A study revealed a higher proportion of Bangladeshi physiotherapists were suffering from LBP which was associated with lack of maintenance of correct posture, most frequent postures during practice and absence of lumber support on chair shown in table 2. [5] Physicians or doctors needs detail information about the cause of low back pain for proper treatment and most of physicians prefer to advice diagnosis with imaging modalities.

The most commonly used imaging modalities are X-ray, magnetic resonance imaging (MRI), computed tomography, and nuclear medicine bone scan. It is important to keep in mind the limitations of the diagnostic studies and to consider how the management will be influenced by the information obtained from these studies. MRI plays a vital role in back pain associated with radiculopathy or spinal stenosis and back pain associated with progressive neurologic deficits. However, because of no radiation exposure and better delineation of soft tissue surrounding the vertebrae, it has become one of the preferred imaging modality in the evaluation of back pain.

Magnetic resonance imaging (MRI) is a medical imaging technique used in radiology to form pictures of the anatomy and the physiological processes of the body in both health and disease. MRI scanners use strong magnetic fields, magnetic field gradients, and radio waves to generate images of the organs in the body. MRI does not involve X-rays or the use of ionizing radiation & any age of patient can do MRI except those patient who has any electronic devices in their body (like- pacemaker or cochlear implant) or even pregnant women also. Magnetic resonance (MR) imaging, which is able to provide a clear three-dimensional visualization of spinal structures, is regarded as the best non-invasive approach to detect lumbar pathologies. Although plain radiography remains initial imaging tool, MRI due to its inherent high quality soft tissue contrast resolution, lack of ionizing radiation and rare requirement of contrast media remains invaluable modality to evaluate back pain in patients. [8]

2. Methodology:

This is a prospective study done and it had been carried out in Apollo hospitals, Dhaka and the population was the both outdoor and indoor patients in Apollo hospitals, Dhaka, who came in the Department of Radiology and Imaging for MRI Scan for evaluation of low back pain. Sample size was determined purposively, 117 cases of evaluation of low back pain in lumber spine, which were detected by Non-contrast & contrast MRI. Those with ferromagnetic metallic implants and uncooperative cases were excluded from the study. A semi structure questionnaire was prepared according to the objectives of the study. Before data collection permission was taken from the Head of the Department of Radiology and Imaging in different Apollo hospitals, Dhaka, and verbal consent from Radiology & imaging Department In-charge in different Hospital in Dhaka city. Prior to interview the purpose of the study was clearly elaborated to the patient and guidance of the patient and their verbal consent was taken before filling the questionnaire. Data was collected by face to face interview separately.

All patients referred to the Department of Radiology for MRI lumbar spine underwent MRI examinations as per protocols. The routine protocol included was sagittal and axial T1- and T2-weighted images and short tau inversion recovery (STIR) coronal images. Special sequences such as myelogram, gadolinium-enhanced T1-weighted images were also done whenever needed. All MRI examinations were performed on a 1.5 Tesla Siemens Avanto MRI scanner. All images were reviewed at an electronic PACS workstation by radiologists, and a consensus diagnosis was given by two radiologists in controversial cases. All lumbar levels and in some cases to look for multi-vertebral involvement, whole spine screening were done. After collection, Data was checked, verified, and processed to reduce error. Then it was analyzed by computer.

3. Result and discussion

3.1 Distribution of various causes of low back pain in different age groups:

This study involved 117 cases. There were 60 males and 57 females. The age of the patient ranged from 21 to 68 years with an average of 41.3 years. In this study back pain was commonly observed in the third to fourth decade. The distribution of cause of low back pain in different age groups is tabulated in table-1.

Table 1: Distribution of cause of low back pain in different age groups

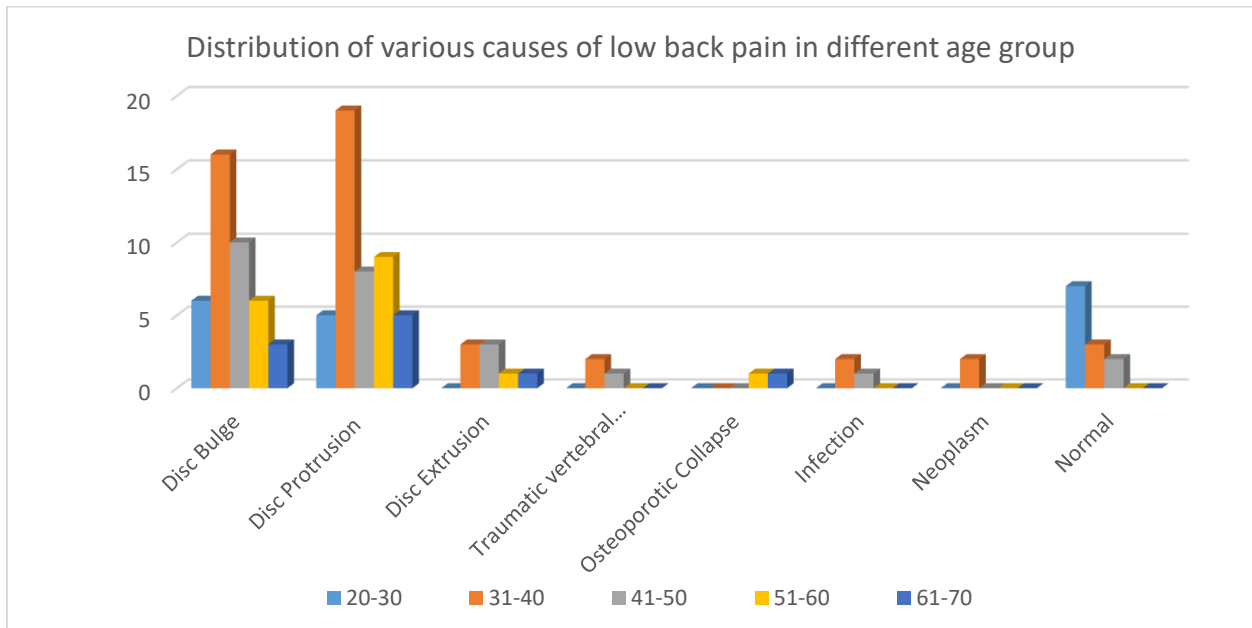| Age group	Disc Bulge	Disc Protrusion	Disc Extrusion	Traumatic vertebral collapse	Osteoporotic Collapse	Infection	Neoplasm	Normal	Total
20-30	6	5	0	0	0	0	0	7	18
31-40	16	19	3	2	0	2	2	3	47
41-50	10	8	3	1	0	1	0	2	25
51-60	6	9	1	0	1	0	0	0	17
61-70	3	5	1	0	1	0	0	0	10
Total	41	46	8	3	2	3	2	12	117

Fig. 1: Distribution of cause of low back pain in different age groups

3.2 Distribution of various causes of low back pain:

As shown in figure 2 and 3, among 117 participants, 41 patients had been suffering low back pain due to disc bulge (35%) & 46 patients due to disc protrusion (39%). These two causes are very common for low back pain. When we are young, disks have high water content and the content lessens as we age. The disks become less flexible, decrease in size and the space between the vertebrae narrows.
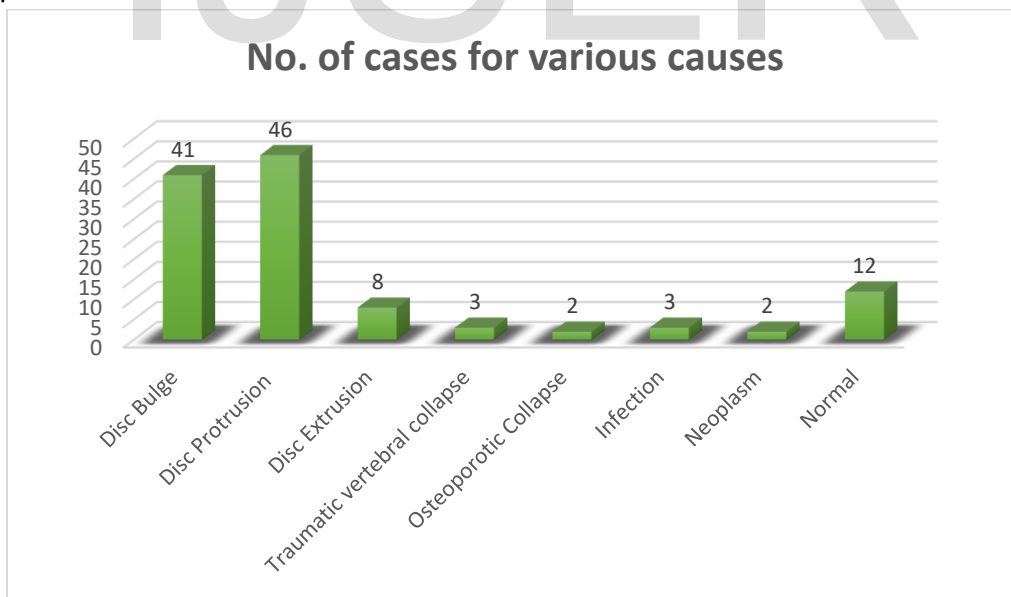

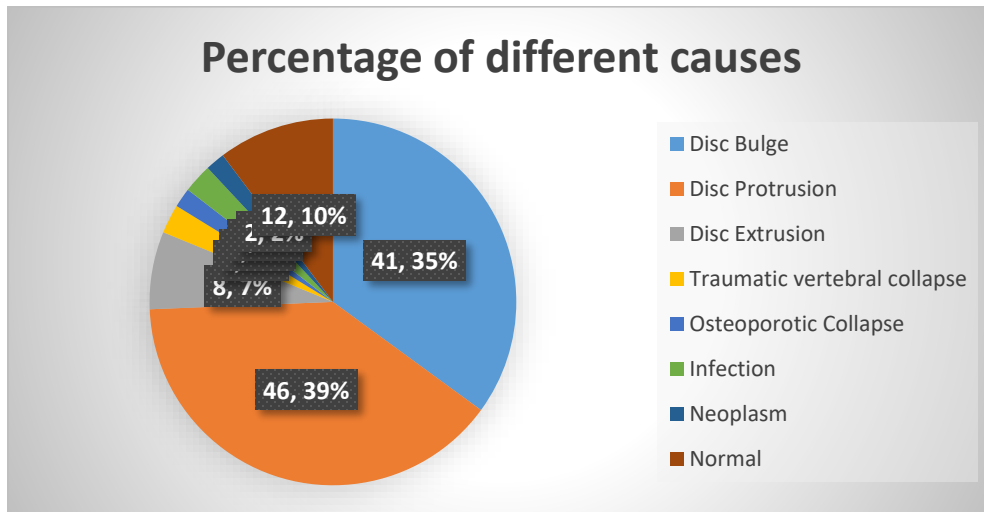**Figure 2: Number of cases for various causes of low back pain**

Figure 3: Percentage of various causes of low back pain

3.3 Sex of the participant

Among 117 participant 51% (N=60) were male and 49% (N=57) were female shown in figure 4 and 5. It was also revealed in a previous study that is shown in table 2. [5]
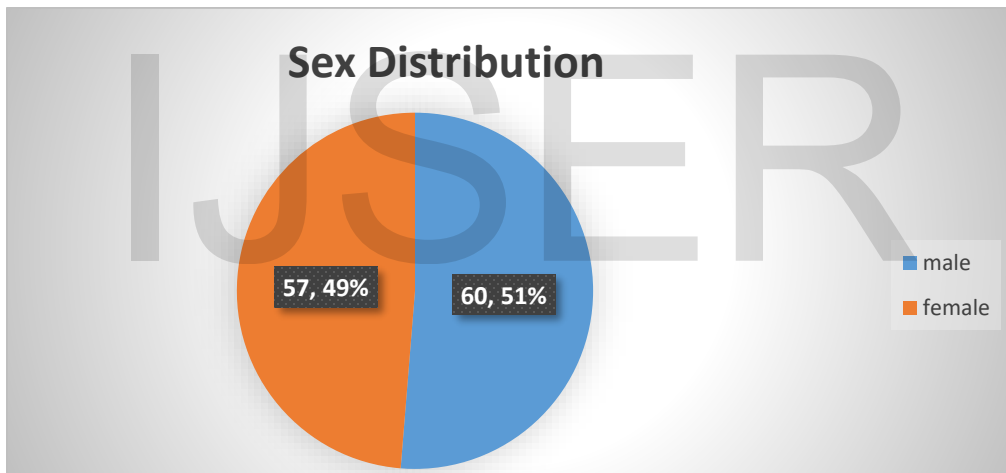

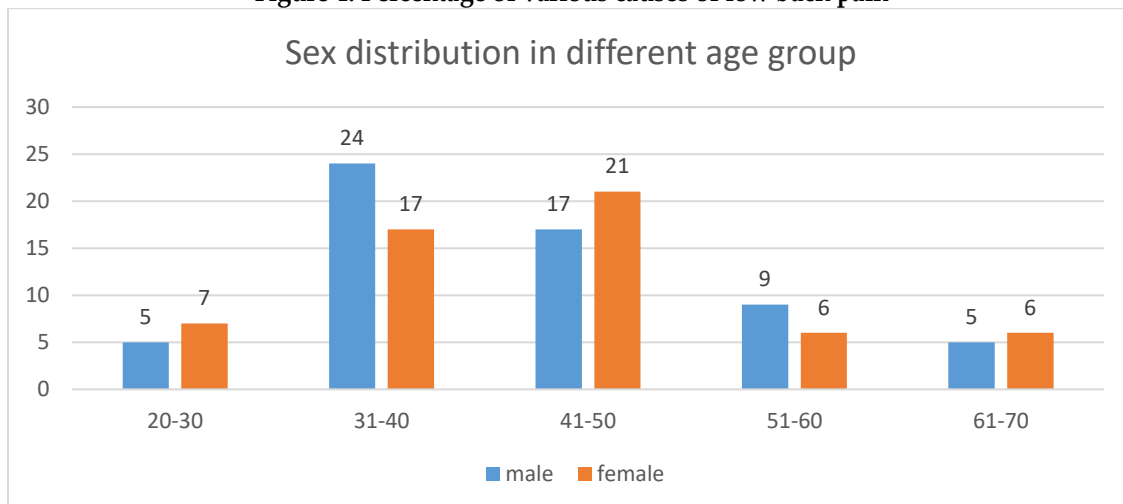**Figure 4: Percentage of various causes of low back pain**

Figure 5: Percentage of various causes of low back pain

3.4 Distribution of socio-demographic factors and their relationship with low back pain among the physiotherapists of Dhaka City, Bangladesh, in 2016 (n = 130). [5] In this study, low back pain was observed more in males, and it was commonly seen in third and fourth decades.

Table 2 : Distribution of socio-demographic factors and their relationship with low back pain among the physiotherapists of Dhaka City, Bangladesh, in 2016 (n = 130) [5]

Variables		N (%)	Low back pain (%)		Chi-square	p value
			Yes	No		
Sex	Men	85 (65.4)	58.8	41.2	0.390	0.532
	Women	45 (34.6)	64.4	35.6		
Age	Below 30 years	69 (53.1)	59.4	40.6	1.125	0.771
	30-34 years	32 (24.6)	59.4	40.6		
	35-39 years	12 (9.2)	75.0	25.0		
	40 years and above	17 (13.1)	58.8	41.2		
Educational status	Diploma in physiotherapy	8 (6.2)	50.0	50.0	1.716	0.424
	Bachelor in physiotherapy	111 (85.4)	63.1	36.9		
	Masters in physiotherapy	11 (8.5)	45.5	54.5		
Marital status	Unmarried	51 (39.2)	66.7	33.3	1.224	0.269
	Married	79 (60.8)	57.0	43.0		
Body mass index	Underweight	2 (1.5)	50.0	50.0	1.918	0.590
	Normal weight	57 (43.8)	56.1	43.9		
	Over weight	63 (48.5)	66.7	33.3		
	Obese	8 (6.2)	50.0	50.0		
Monthly income (BDT)	Up to 30000	79 (60.8)	60.8	39.2	2.158	0.340
	30001-50000	43 (33.1)	65.1	34.9		
	More than 50000	8 (6.2)	37.5	62.5		

p value obtained from Chi-square test.
LBP: low back pain; BDT: Bangladeshi Taka

The prevalence of LBP in Indian population has been found to vary between 6.2% (in general population) to 92% (in construction workers). Low socioeconomic status and poor education have been found to be associated with LBP.[5]

4. Discussion

The common causes for back pain are disc herniations (disc bulge – 35.3%, disc protrusion – 39.6%, disc extrusion – 7.2%) accounting to 82.1%, followed by normal study (10.2%), vertebral collapse (traumatic – 2.1%, osteoporotic – 1.7%), infections (2.1%), and neoplasm (1.7%) [Table 1].

The most common etiology in this study was disc disease and herniation. Disc herniations when associated with ligamentum flavum thickening and facetal joint hypertrophy results in lumbar canal stenosis. There were forty one cases of disc bulge in our study which was more common in middle- and old-age group. The second most common condition found associated with disc herniations were spondylolysis with or without listhesis. Our study showed 18 cases of spondylolysis with or without listhesis. Vertebral collapse either due to trauma or osteoporosis, and infective etiologies (pyogenic and tuberculous) were the other most common causes; whereas neoplastic conditions were rare causes of back pain in our study. MRI lumbar spine did not show any abnormality with normal study in 12 cases (10.2%) but incidentally other causes of back pain such as ruptured cyst, hemorrhagic cyst, and pelvic inflammatory diseases in females, ureteric calculus with hydroureteronephrosis in males were found.

In this study, back pain was observed more in males, and it was commonly seen in third and fourth decades. The prevalence of LBP has been found to vary between 6.2% (in general population) to 92% (in construction workers). Low socioeconomic status and poor education have been found to be associated with LBP. [5] There are multiple known risk factors such as : Heavy lifting, twisting, vibration, obesity, poor conditioning, long duration of daily work, lack of knowledge on maintaining correct posture, lack of physical activity. Prevention should be taken care about all of risk factors. MRI remains main stay of spinal imaging to evaluate various pathologies of vertebrae, bone marrow, discs, ligaments, spinal cord and sacroiliac joints.

5. Limitations of the study:

With a successive completion of this project, there are some limitations related to the study. Some of them are pointed out below –

Cardiac Pacemaker, Cochlear Implants & some orthopedics prosthesis patient can't do the MRI.

Cost effective is relatively more than X-ray or CT Scan.

The sample was taken purposively, so it may not reflect the actual situation.

MRI are not available in most of the rural area in Bangladesh.

Wheel chair or bed patient can't take directly to the MRI.

Claustrophobic & disoriented patients are very difficult to do MRI.

MRI take long time to complete the whole scan.

References

1. Fujii T, Matsudaira K. Prevalence of low back pain and factors associated with chronic disabling back pain in Japan. Eur Spine J. 2013;22: 432–438.

2. Andersson GB. Epidemiological features of chronic low-back pain. Lancet. 1999; 354:581–5.

3. Jarvik JG, Deyo RA. Diagnostic evaluation of low back pain with emphasis on imaging. Ann Intern Med. 2002;137:586–97.

4. Bindra S, Sinha AG, Benjamin AI. Epidemiology of low back pain in Indian population: A review. Int J Basic Appl Med Sci. 2015;5:166–79.

5. Rajib Mondal, Rajib Chandra Sarker , Sumi Akter , Palash Chandra Banik , Simson Kalyan Baroi; Prevalence of low back pain and its associated factors among physiotherapists in Dhaka city of Bangladesh in 2016: JOHE. 2018; 7(2):70-4

6. Jin K, Sorock GS, Courtney TK. Prevalence of low back pain in three occupational groups in Shanghai, Peoples Republic of China. J Safety Res 2004; 35(1):23-8.

7. Roudsari B, Jarvik JG. Lumbar spine MRI for low back pain: Indications and yield. Am J Roentgenol. 2010;195:550–9.

8. Hapani H, Hapani J, Anjana T, Jagruti K. Magnetic resonance imaging of back pain in young population. J Evol Med Dent Sci. 2014;3:12644–9.

9. Modic MT, Feiglin DH, Piraino DW, Boumphrey F, Weinstein MA, Duchesneau PM, et al. Vertebral osteomyelitis: Assessment using MR. Radiology. 1985;157:157–66.

10. Juichi Tonosu, Hiroyuki Oka , Akiro Higashikawa, Hiroshi Okazaki, Sakae Tanaka, Ko Matsudaira, The associations between magnetic resonance imaging findings and low back pain: A 10-year longitudinal analysis, https://doi.org/10.1371/journal.pone.0188057