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Original Article

Association of Lumbar Spine Degeneration on Magnetic Resonance Imaging (MRI) with Occupational Activity

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Abstract

Objective: The purpose of this study was to determine the association of lumbar spine degeneration on magnetic resonance imaging with occupational activity in Pakistani population.

Methods: The current cross-sectional study was conducted in Lahore General Hospital's Diagnostic Radiology department for nine months. 146 patients underwent MRI using Siemens 1.5T scanner (Siemens Healthcare GmbH, Erlangen, Germany). If found, degenerative alterations in the spine were noticed.

Results: In the high occupational activity group spine degeneration was seen in 46 (95.8%) patients whereas in low and inter spine degeneration group spine degeneration was seen in 83(84.7%) patients (p-value=0.049). In high occupational activity group straightening of spine was seen in 25(52.1%) patients and in low and inter activity group it was seen in 78(79.6%) patients (p-value=0.001). In the high occupational activity group disc bulge was noted in 32(66.7%) patients and in low and inter activity group it was found in 48(49%) patients (p-value=0.044). In high occupational activity group disc protrusion was seen in 30(62.5%) patients and in low and inter activity group it was noted in 81(82.7%) patients (p-value=0.007). In high occupational activity disc extrusion was noted in 7(14.6%) patients and in low and inter activity group it was noted in 4(4.1%) patients (p-value=0.041). In high occupational activity disc desiccation was noted in 27(56.2%) patients and in low and inter activity group it was noted in 37(37.8%) patients (p-value=0.034).

Conclusion: From the findings of this study, we may conclude that lumber spine degeneration on magnetic resonance imaging is significantly higher in high occupational activity group as compared to inter and lower activity group.

Keywords: Magnetic Resonance Imaging, Occupational Activity, Lumbar Spine Degeneration, Bacillus Calmette-Guérin (BCG), Vaccination, Children, Tuberculous meningitis

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Introduction

A typical symptom that can cause incapacity and have significant socioeconomic and professional effects is low back pain. The cause of pain is frequently unknown despite advances in imaging.[1] Degenerative spinal alterations are assumed to begin with intervertebral disc degeneration, which is often followed by the slow development of osteophytes, disc constriction, and spinal stenosis.[2] Early lumbar plate degeneration in youngsters with lower back torment demonstrates progressive degenerative changes in the comparing circles, however not agony, handicap, or clinical side effects.[3]

Both symptomatic and asymptomatic people have common imaging findings of spine degeneration.[4] Attractive Reverberation Imaging (X-ray), Processed Tomography (CT), MRI, and myelography are types of indicative imaging. The favored imaging strategy right now is MRI, which has the advantage of not using ionizing radiation and has great picturing abilities, especially for delicate tissue.[5] Due to the lack of a clearly defined etiology in the majority of patients, the traditional therapeutic methods frequently fail. The most famous methodology for assessing people with lower back torment is attractive reverberation imaging (MRI), which can assess the examples of intervertebral plate degeneration specifically. Decreased signal from the core pulposus and the internal filaments of the annulus are marks of plate degeneration.[6]

Inflammation and associated signaling pathways have

been found to play a substantial role in the initiation and progression of disc degeneration, a major cause of lower back pain, according to recent studies. Additionally, essential to the treatment of discogenic lower back pain are inflammatory mediators. Although it is a major objective of therapeutic treatment, disc research studies have not paid enough attention to the suppression of lower back pain.[7]

Back issues are regarded as occupational ailments in several nations. This injury model is based on the idea that mechanical work-related variables, either from a single occurrence or repetitive loads, destroy the spine's structural components and are the main cause of back problems. Mishap related injury, exhausting actual burdens and material dealing with including lifting, bowing, and contorting — delayed sitting, supported non-neutral work stances, and engine vehicle activity are among the word related factors remembered to hurry spinal degeneration. There is evidence that disc degeneration may be impacted by work exposures. But only a small portion of the variation in degeneration seen in the adult population can be attributed to these causes. Moreover, there are concerns in regards to areas of strength for a relationship since there is definitely not a reasonable portion reaction connection between time spent in different word related stacking conditions and degenerative discoveries.[8]

The risk of lumbar spine disc degeneration is influenced by workload. Disc degeneration is more likely to occur when driving a car and sustaining accidental back injuries. Different kinds of physical stresses appear to be associated with anterior and posterior disc bulges.[9]

The rationale of this study is to find the degenerative spine changes on MRI in patients with lower back pain in relation to their occupational activity. Literature showed that the frequency of degenerative spine changes varies in different occupations. This may be related to their daily life routine. This study can help people with different occupations to get prior awareness about degenerative spine changes in relation to their occupational activity, in order to adopt modified lifestyle. And once they have lower back pain, should come for an MRI for early diagnosis and treatment. So, I want to conduct this study to find degenerative spine changes in patients with lower back pain using MRI in local population to get local data and implement results in local setting. Purpose of this study is to determine the association of lumbar spine degeneration on magnetic resonance imaging with occupational activity in Pakistani population.

Methods

Sample Size: Sample size (n) calculated is 146 cases. Sample size was calculated using 95% confidence level, 8% margin of error and percentage of degenerative disc disease i.e., 58.6%. [10]

Sampling Technique: Non-probability consecutive sampling was used for the study.

Inclusion criteria: Patients of age between 30 and 60 years, both genders, presenting with compliant of lower back pain, having visual analogue scale for pain >3, in current occupation for more than 5 years.

Exclusion criteria: Patients with post-traumatic or post-surgical back pain, with skeletal or muscular dystrophy or congenital disease related to back, known low bone mineral density, tumor in spinal cord or metastatic disease, evidence of osteoporosis and history of interventional pain management of spine were excluded from the study.

Data Collection Procedure: Data was collected on the structured questionnaire by following the following steps. Approval was obtained from the REC, FAHS of University of Lahore. Permission was obtained from the head of Department of Radiology, Lahore General Hospital, Lahore. Written informed assent was taken from every one of the members prior to being signed up for the review and secrecy of information was completely kept up with. Demographics like name, age, gender, duration of symptoms, severity of pain, lifestyle, family status, residence, occupation, working hours, financial dependence, and socioeconomic status, were noted. Then the MRI scan was done. All scans were done by using Siemens 1.5T scanner (Siemens Healthcare GmbH, Erlangen, Germany). All MRI scans was digitized and reviewed on a designated high-resolution monitor using GE Medical Systems Centricity Enterprise Web V3.0 platform (GE Healthcare, Chalfont St Giles, UK). All images were reviewed by a radiologist and orthopedic physician. Degenerative changes in the spine were note if detected. Involvement of one or more than one vertebra was noted. Then patients were asked about the occupation, lifestyle (active or sedentary), working hours, exercise hours and occupational activity level was noted as low activity, intermediate activity, and high active occupation.

Occupational activity: It was categorized by getting information about their profession, lifestyle (active / sedentary), hours of sitting, hours of exercising, etc. Occupational activity means any physical activity carried out in the course of an economic activity, a business, or an undertaking. Occupational physical activity is classified as:[11]

- High action occupations are the ones with actual stacking and materials taking care of, including

lifting, bowing, and bending; and supported non-neutral work stances.

- Intermediate activity occupations are the ones with walking and standing.
- Low activity occupations are physically very easy, sitting office work.

A semi-structured proforma was constructed to record the findings of MRI.

Data Analysis: Statistical analysis was completed through Statistical Package for the Social Sciences version 25. Continuous data was presented as mean and standard while categorical data was presented as frequencies and percentages.

Results

About 127(86.99%) patients were male, and 19(13.01%) patients were females. Male to female ratio of the patients was 6.7:1. The study results showed that the high occupational activity was seen in 48(32.88%) patients, inter occupational activity was seen in 36(24.66%) patients and low occupational activity was seen in 62 (42.47%) patients. In this study straightening of spine was noted in 43(29.5%) patients, disc bulge was seen in 80(54.8%) patients, disc protrusion was seen in 35(24%) patients, disc extrusion was noted in 11(7.5%) patients and disc desiccation was noted in 64(43.8%) patients. According to this study disc height loss was found in 19(13%) patients, annular tears were seen in 24(16.4%) patients, Modic changes were seen in 83(56.8%) patients and osteophyte formation was found in 21(14.4%) patients. In this study L1-L2 level of disease was found in 3(2.1%) patients, L2-L3 level of disease was found in 4(2.7%) patients, L3-L4 level of disease was found in 18(12.3%) patients and L4-L5 level of disease was noted in 92(63%) patients. L5-S1 level of disease was noted in 85(58.2%) patients. Table # 1

In high occupational activity group straightening of spine was seen in 25(52.1%) patients and in low and inter activity group it was seen in 78(79.6%) patients (p-value=0.001). In high occupational activity group disc bulge was noted in 32(66.7%) patients and in low and inter activity group it was found in 48(49%) patients (p-value=0.044). In high occupational activity group disc protrusion was seen in 30(62.5%) patients and in low and inter activity group it was noted in 81(82.7%) patients (p-value=0.007). In high occupational activity disc extrusion was noted in 7(14.6%) patients and in low and inter activity group it was noted in 4(4.1%) patients (p-value=0.041). In high occupational activity disc desiccation was noted in 27(56.2%) patients and in low and inter activity group it was noted in 37(37.8%) patients (p-value=0.034). In high occupational activity disc height loss was noted in 4(8.3%) patients and in low and inter activity group it was noted in 15(15.3%) patients (p-value=0.239). In high occupational activity group annular tear was noted in 10(20.8%) patients and in low and inter activity group it was noted in 14(14.3%) patients (p-value=0.316). In high occupational activity group Modic changes were seen in 20(41.7%) patients and in low and inter activity group it was seen in 63 (64.3%) patients (p-value=0.010). In high occupational activity group osteophyte formation were seen in 9(18.8%) patients and in low and inter activity group it was seen in 12(12.2%) patients (p-value=0.293). In high occupation activity group L1-L2 level of disease was found in 0(0%) patients and in low activity group it was noted in 3(3.1%) patients (p-value=0.551). In high occupation activity group L2-L3 level of sickness was seen as in 0(0%) patients and in low action bunch it was noted in 4(4.1%) patients (p-value=0.303). In high occupation action group L3-L4 level of illness was seen as in 8(16.7%) patients and in low activity group it was noted in 10(10.2%) patients (p-value=0.265). In high occupation movement bunch L4-L5 level of sickness was viewed as in 28(58.3%) patients and in low action group it was noted in 64(65.3%) patients (p-value=0.412). In high occupation activity group L5-L5 level of sickness was viewed as in 28(58.3%) patients and in low action group it was noted in 64(65.3%) patients (p-value = 0.412). In high occupation activity group L5-S1 level of disease was found in 26(54.2%) patients and in low

Table 1: *Basic characteristic of patients at enrollment nature (a), and level of diseases (n = 146)*

Age		**44.05 ± 7.17**
Gender	Male	127(86.99%)
	Female	19 (13.01%)
Occupational activity	high occupational	48 (32.88%)
	inter occupational	36 (24.66%)
	low occupational	62 (42.7%)
Nature of disease	Straightening of spine	43 (29.5%)
	Disc Bulge	80 (54.8%)
	Disc Protrusion	35 (24.0%)
	Disc Extrusion	11 (7.5%)
	Disc Desiccation	64 (43.8%)
Nature of disease (a)	Disc Height Loss	19 (13.0%)
	Annular Tears	24 (16.4%)
	Modic Changes	83 (56.8%)
	Osteophyte formation	21 (14.4%)
Level of disease	L1-L2	3 (2.1%)
	L2-L3	4 (2.7%)
	L3-L4	18 (12.3%)
	L4-L5	92 (63.0%)
	L5-S1	85 (58.2%)

activity group it was noted in 59(60.2%) patients (p-value=0.487). In patients having age ≤45 years; In high occupational activity group spine degeneration was seen in 29(93.5%) patients whereas in low and inter spine degeneration group spine degeneration was seen in 56(90.3%) patients (p-value=0.601). In patients having age > 45 years; In high occupational activity group spine degeneration was seen in 17(100.0%) patients whereas in low and inter spine degeneration group spine degeneration was seen in 27(75%) patients (p-value=0.044). In male patients; In high occupational activity group spine degeneration was seen in 39(95.1%) patients whereas in low and inter spine degeneration group spine degeneration was seen in 71(82.6%) patients (p-value=0.052). In female patients; In high occupational activity group spine degeneration was seen in 7(100.0%) patients whereas in low and inter spine degeneration group spine degeneration was seen in 12(100.0%) patients. In high occupational activity group spine degeneration was seen in 46(95.8%) patients whereas in low and inter spine degeneration group spine degeneration was seen in 83(84.7%) patients. This distinction was measurably significant, for example p-value=0.049.Table # 2

Discussion

Back pain can range from a dull, consistent yearning to an unexpected, sharp ache. Low back torment has a high pervasiveness in industrialized nations, influencing up to 66% of grown-ups sooner or later in the course of their life. Back torment is related with high medical care costs and has significant financial results because of loss of efficiency from back torment related incapacity.[12] Low back torment is the chief reason for long haul handicap around the world.[13]

In this review, in high word related movement bunch spine degeneration was seen in 46(95.8%) patients while in low and entomb spine degeneration bunch spine degeneration was seen in 83(84.7%) patients (p-value = 0.049). In high occupation action bunch L4- L5 level of illness was seen as in 28(58.3%) patients and in low action bunch it was noted in 64(65.3%) patients (p-value =0.412). In high occupation action bunch L5-L5 level of illness was seen as in 28(58.3%) patients and in low movement bunch it was noted in 64(65.3%) patients (p-value=0.412). L5-S1 level of illness was observed in 26 (54.2% of patients) in the high occupation/movement group, and 59 (60.2% of patients) in the low action group (p-value = 0.487).

Disc degeneration is viewed as the basic step of degenerative sickness of the spine, and it is consistently trailed by intervertebral plate limiting, osteophyte strategy, and resultant spinal stenosis and might be associated with torment and other neurological eventual outcomes.[14] The Pfirrmann Classification of spinal disc degeneration is based on disc structure homogeneity, Nucleus Pulposus - Annulus Fibrosus distinction, MR signal intensity of Nucleus Pulposus, and preservation of disc height.[15,16]

Berg et al., directed a concentrate on 730 patients. They saw that 58.6% had X-ray proof of lumbar plate illness (Pfirrmann III, IV, V). Around 59.6% showed single level pathology and 41.4% staggered contribution. Given the impressively higher than expected predominance

Table 2: *Comparison of nature of disease between occupation activity groups*

		Occupational Activity		Chi-square	p-value
		High	Low and inter		
Nature of disease	Straightening of spine	23 (47.9%)	20 (20.4%)	11.73	0.001
	Disc Bulge	32 (66.7%)	48 (49.0%)	4.069	0.044
	Disc Protrusion	18 (37.5%)	17 (17.3%)	7.180	0.007
	Disc Extrusion	7 (14.6%)	4 (4.1%)	5.101	0.024
	Disc Desiccation	27 (56.2%)	37 (37.8%)	4.476	0.034
Nature of disease (a)	Disc Height Loss	4 (8.3%)	15 (15.3%)	1.384	0.239
	Annular Tears	10 (20.8%)	14 (14.3%)	1.006	0.316
	Modic Changes	20 (41.7%)	63 (64.3%)	6.720	0.010
	Osteophyte formation	9 (18.8%)	12 (12.2%)	1.107	0.293
Level of diseases	L1-L2	0 (0.0%)	3(3.1%)	0.3647	0.5459
	L2-L3	0 (0.0%)	4 (4.1%)	0.7738	0.3790
	L3-L4	8 (16.7%)	10 (10.2%)	1.245	0.265
	L4-L5	28 (58.3%)	64 (65.3%)	0.6721	0.412
	L5-S1	26 (54.2%)	59 (60.2%)	0.4828	0.487
Spine Degeneration	Yes	46 (95.8%)	83 (84.7%)	3.886	0.049
	No	2 (4.2%)	15 (15.3%)		

distinguished and the critical weight related with lower back torment, further examination ought to be supported.[10] In another review, the recurrence of degenerative plate illness was 40% more than the whole spine (28% gentle, 9% moderate and 3% extreme).[17]

Suzuki et al. surveyed cervical plate degeneration on X-ray in a colossal people of intriguing successive patients uncovering neck torture or radiculopathy paying little mind to neurologic deficiencies. The force of cervical circle degeneration at more than 1 level was 41.0% in patients in their 20s.[18]

There are irregularities in discoveries in regards to the relationship of word related stacking with spinal degeneration or underlying harm.[19] Between each vertebral body of the spine are heap of fibrocartilage-based structures that recommendation help, adaptability, and minor weight sharing known as the intervertebral plates. These are essentially made out of two layers: (1) a delicate, thick core pulposus within the circle and (2) an encompassing firm construction known as the annulus fibrosus.[20] In their lifetime, 80% of individuals will have lower back pain, making it one of the leading causes of disability globally. The intervertebral disc's deterioration has been related to persistent lower back discomfort.[21] The ageing of the patient is closely connected with disc degeneration. Interestingly, women with disc degeneration are likely to be more vulnerable to the consequences, despite the fact that males are likely to start this degeneration roughly 10 years sooner than women (e.g., malalignment, instability).[22,23]

Discogenic illnesses of the spine are now officially recognized as occupational diseases according to the second amendment to the Ordinance on Occupational Diseases (BeKV) of December 18, 1992. If spine-stressing jobs have been conducted for a long time, it may be possible to classify degenerative disorders as occupational diseases. In evaluation practice, the radiological data on the stressed-out parts of the spine are compared to those of the stress-free regions (cervical/thoracic spine).[24]

Carpenters and machine drivers both had a higher chance of developing anterior disc bulges, but occupation had no effect on signal intensity reduction. Anterior disc bulges were also linked to driving. Body height, being overweight, smoking, or how frequently you exercised had no effect on the occurrence of disc degeneration.[9]

There is no proof that working in the majority of jobs, the military, the police, the fire department, or the medical field causes more degenerative changes in the spine. This is presumably due to the fact that only a tiny amount of time is spent engaging in laborious manual labor. The majority of the typical tasks that firefighters, police officers, and members of the armed forces would perform are not linked in any convincing way to back discomfort.[25] In a study of US urban firemen, it was discovered that 80% of them had had neck, back, or shoulder discomfort, and that this was adversely connected with how often they engaged in aerobic activity.[26]

The cumulative or repetitive damage model of spine degeneration used to be the mainstream theory. As a result, it has long been believed that physically demanding jobs increase the risk of spinal degeneration. The connection between actual pressure and lumbar spine degeneration has, be that as it may, produced conflict and uncertainty because of errors across concentrate on discoveries, with some supporting this relationship and others not. Furthermore, current research indicates that the intervertebral discs and other spinal column components adapt to increased regular physical loads and could even benefit from it.[27] Understanding this association can be improved by using objective markers of spine degeneration to overview the effects of word related trouble on the spine. A reliable and objective method for evaluating the impacts of rehashed weight on the spine, which thusly might be a middle person of the improvement of back torment in this gathering, is to survey spine degeneration on imaging.[19]

Conclusion

Low back pain resulting from lumbar disc degenerative disease is one of the most common causes of disability in working age adults. On imaging, the earliest visible changes of intervertebral disc degeneration are best visualized on magnetic resonance imaging (MRI). From the findings of this study, we may conclude that lumber spine degeneration on magnetic resonance imaging (MRI) is significantly higher in high occupational activity group as compared to inter and lower activity group.

Conflict of Interest: *None*

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