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Research Article

Investigating a Possible Link between MRI Findings and Clinical Complaints in the Patients with Chronic Low Back Pain

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Abstract

Background: Low Back Pain (LBP) is one of the most common causes of daily limitation and functional disability. Objective: The purpose of this study is to investigate the relationship between the severity of clinical and para-clinical (magnetic resonance imaging; MRI) findings in the patients with chronic low back pain.

Methods: This cross-sectional study was performed on 65 patients with chronic low back pain. Clinical findings were based on Oswestry Disability Index (ODI) and Visual Analogue Scale (VAS) questionnaires, while para-clinical data were gathered with MRI scanning. Finally, the collected data were analyzed using SPSS version 20 software.

Results: The results of this study indicated a higher prevalence of chronic LBP in female patients. MRI's results were also abnormal in all cases. The main pathology seen on MRI was discopathy (26.2%), spinal stenosis (26.2%), and spondylolisthesis (20.0%), respectively. There was no significant relationship between the ODI and MRI findings. The majority of the patients with moderate and severe pain had no vertebral slippage. The highest pain intensity was observed in the patients with grade II of disc degeneration (P = 0.005).

Conclusion: In the patients with chronic LBP, the greatest severity of pain was observed in those cases with grade II of L4-L5 disc degeneration and no sign of spondylolisthesis. It seems that the old axiom denoting the presence of no link between MRI findings and clinical complaints is beginning to be questioned.

Keywords: Low back pain; Chronic; Magnetic Resonance imaging; Relationship

Introduction

Low Back Pain (LBP) is one of the most common musculoskeletal disorders that most of the people experience it at least once throughout their life [1,2]. LBP has many causes, and this makes it difficult to find effective ways to cope with it. Magnetic Resonance Imaging (MRI) scanning is widely used to assess LBP especially in its chronic conditions. Abnormal findings in lumbosacral MRI are very common and many of them may not be directly related to the clinical status of the individual [3,4]. For example, Modic changes may be seen in many people with and without back pain and may not be directly related to LBP's prevalence and severity [5]. Other imaging findings that may have little relation to clinical manifestations include vertebral slippage, degenerated intervertebral disc, Schmorl nodules, vertebral hemangiomas, and others [3,6-8].

The aim of this study is to investigate a possible relationship between these MRI findings and clinical manifestations in the patients with chronic LBP. In this way, we hope to be able to differentiate innocent imaging findings from prognostic ones and find a possible link between MRI findings and clinical complaints in the patients with chronic LBP.

Methods

We gained regional ethics committee and local institutional review board approval at 05.10.2016, with registration number of 941531 at Mashhad University of Medical Sciences. This cross sectional study was carried out from November 2016 to December 2017 in our spinal clinic of orthopedic department on 65 patients with chronic LBP. We included those cases with longer than three months of LBP who had a recent MRI scanning in recent two months. Our exclusion criteria were significant underlying disease (tumor, trauma, autoimmune disease, and etcetera), infection, drug abuser, immune-suppression, age below 18 years and over 65 years old, a history of previous surgery, and significant underlying psychosomatic disorders.

Clinical investigation was carried out by physical examination, Visual Analogue Scale (VAS), and Oswestry Disability Index (ODI) questionnaires (version 2.1) [9-11]. The severity of pain was measured on a numerical vertical scaling line ranged from zero (no pain at the bottom) to 10 (maximal imaginable pain at the top). Based on the study of Boonstra, et al. VAS scores ≤3.4 were graded as mild, 3.5-7.4 as moderate, and ≥7.5 as severe [12]. According to ODI questionnaire, functional disability was graded as minimal (0-20%), moderate (21-

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Table 1: Etiology of LBP in our study.

Etiology of LBP	Prevalence	Percentage
Degenerative Disc Disease	38.5	25
Spinal Stenosis	26.2	17
Spondylolisthesis	20	13
CNSLBP*	12.3	8
Degenerative Scoliosis	1.5	1
Osteoid Osteoma	1.5	1
Total	100	65

Table 2: The relationship between ODI and vertebral slippage seen in MRI.

Vertebral Slippage	No slip	Grade I	Grade II	P-value
ODI*:				
- Mild	15	2	1	
- Moderate	22	4	0	0.2
- Severe	14	5	0	
- Crippled	1	1	0	
VAS×:				
- No pain	0	0	0	
- Mild	7	3	1	0.01
- Moderate	37	3	0	
- Severe	8	6	0	

40%), severe (41-60%), and crippled (>61%). Those patients with scores more than 80% are usually interpreted as bed-ridden or malingered. MRI findings were classified based on intervertebral disc degeneration (Pfirmann classification), Modic changes, vertebral slippage, and other incidental findings like vertebral hemangioma, Schmorl nodule, synovial cyst of the facet joints, and so on.

According to Pfirrmann, et al. disc degeneration can be graded reliably based on routine T2 weighted MRI scanning into five categories [13]. Vertebral endplate signal changes were also investigated by Modic criteria [14]. Although assessing the vertebral slippage is better to be determined with standing lumbosacral radiographies, in this study we used routine MRI for detecting any associated spondylolysis or spondylolisthesis and classified them according to Meyerding [15].

Statistical analysis

Descriptive statistics were characterized by abundance, mean and standard deviation using descriptive statistics and in the form of appropriate tables and charts. Chi-square test was used to examine the relationship between quantitative and qualitative variables. Kolmogorov-Smirnov test was used to determine the normal distribution of data. The results showed that the distribution of data related to the variables was abnormal. Statistical analysis was performed using SPSS version 20 software. The significance level was considered statistically as 5%.

Results

We studied 65 patients (29 male; 44.6% and 36 female; 55.4%) with mean age of 49.5 ± 15.2 years old (ranged; 20 to 64), weight of 76.1 ± 13.3 kilogram, and height of 164 ± 20.1 centimeter, respectively.

Table 3: The Relationship between functional disability and MRI findings.

MRI findings \ ODI*	Mild	Moderate	Severe	P value
L4-L5 level				
1-Spondylolisthesis:	6	35	12	
-No Slip				
-Grade I	3	4	1	0.239
-Grade II	0	0	0	
2-Disc Degeneration:				
-Grade I	1	7	0	
-Grade II	3	13	6	
-Grade III	1	15	1	0.005×
-Grade IV	1	2	2	
-Grade V	3	2	4	
3-Modic Change:				
-No Change	7	37	10	
-Type I	1	0	0	
-Type II	1	2	3	0.257
-Type III	0	0	0	
L5-S1 level				
1-Spondylolisthesis:				
-No Slip	7	37	12	
-Grade I	1	2	1	0.536
-Grade II	1	0	0	
2-Disc Degeneration:				
-Grade I	2	5	2	
-Grade II	4	11	3	
-Grade III	0	18	5	0.415
-Grade IV	1	2	2	
-Grade V	2	3	1	
3-Modic Change:	9	36	12	
-No Change				
-Type I	0	2	0	
-Type II	0	0	1	0.368
-Type III	0	1	0	
Schmorl Node:				
-Yes	4	13	2	
-No	5	26	11	0.313
Hemangioma:				
-Yes	3	2	1	
-No	6	37	12	0.238
Degenerative Scoliosis:				
-Yes	0	1	0	
-No	9	38	13	0.763

*ODI: Oswestry Disability Index

Etiology of LBP in our patients was shown in (Table 1).

There was no significant relationship between functional disability

Table 4: The Relationship between VAS and MRI findings.

MRI findings \ VAS*	Mild	Moderate	Severe	P value
L4-L5 level				
1-Spondylolisthesis:				
-No Slip	6	35	12	
-Grade I	3	4	1	0.239
-Grade II	0	0	0	
2-Disc Degeneration:				
-Grade I	1	7	0	
-Grade II	3	13	6	
-Grade III	1	15	1	0.005×
-Grade IV	1	2	2	
-Grade V	3	2	4	
3-Modic Change:				
-No Change	7	37	10	
-Type I	1	0	0	
-Type II	1	2	3	0.257
-Type III	0	0	0	
L5-S1 level				
1-Spondylolisthesis:				
-No Slip	7	37	12	
-Grade I	1	2	1	0.536
-Grade II	1	0	0	
2-Disc Degeneration:				
-Grade I	2	5	2	
-Grade II	4	11	3	
-Grade III	0	18	5	0.415
-Grade IV	1	2	2	
-Grade V	2	3	1	
3-Modic Change:				
-No Change	9	36	12	
-Type I	0	2	0	
-Type II	0	0	1	0.368
-Type III	0	1	0	
Schmorl Node:				
-Yes	4	13	2	
-No	5	26	11	0.313
Hemangioma:				
-Yes	3	2	1	
-No	6	37	12	0.238
Degenerative Scoliosis:				
-Yes	0	1	0	
-No	9	38	13	0.763

(ODI) and vertebral slippage (chi-square test, P= 0.2), but there was a meaningful reverse relationship between VAS and vertebral slippage (p=0.01, (Table2)). In other words, most patients with moderate or severe pain are in the non-slippery group.

The relationship between functional disabilities associated with other MRI findings were also investigated and depicted in (Table 3). As shown, we could not find a significant relationship between existence of Schmorl nodules, vertebral hemangioma, and degenerative scoliosis with functional disability of the relevant patients. Similarly, we could not find a significant relationship between the severity of pan and MRI findings except L4-L5 disc degeneration; there was a significant pain in the patients with L4-L5 disc degeneration grade II (P = 0.005, (Table 4)).

Discussion

LBP is the world's second most prevalence cause of work leave only after upper respiratory infection [16]. An overview of the old scientific studies suggested that there is definitely no correlation between imaging and clinical findings in the patients with LBP, but recent studies have found some links between these two entities, however, these relationships are still not fully proven [17,18].

Modic, et al. in 1988 introduced three types of vertebral end plate signal changes in lumbar spine that proposed to be related with degenerative disc disease [14]. These Modic changes are not necessary permanent and not always getting worse, as in some cases, they may be getting better over time and therefore, should not be applied as a surgical criteria or clinical outcome tool [19]. Martínez-Quiñones and colleagues in 2017 conducted a retrospective study on the clinical impact of Modic changes in young workers below 40 years old suffering from LBP [20]. They found a prevalence of 13.05% that was always associated with degenerative disc disease. They concluded that this prevalence increases with age and denoted an underlying degenerative disease but emphasized surgical decision should not be merely based on these changes. In contrast to these studies, a recent great cross-sectional study on 2,449 Southern Chinese volunteers showed a positive correlation between Modic change and LBP [21]. This study appears to be the largest study on lumbosacral MRI about this subject denoted that Modic changes are more prevalent in lower two lumbar levels and in these area, these changes are associated with age, weight, Schmorl nodes, disc degeneration, smoking, a history of lumbar trauma and LBP (both severity and duration of symptoms). In the study we conducted, we could not find such an association between these Modic change and clinical complaints.

A review in literature shows that most of the authors believe that there are not a strong relationship between vertebral slippage and clinical complaints [3,7,22]. We also failed to find a strong association between the two in our study. In 80% of our patients with LBP, there was not any evidence of vertebral slippage. Similar to our results, Kalichman et al. in 2009 investigated 188 patients aged 40-80 years old with a history of LBP in recent year [7]. They evaluated the cases with Computer Tomography (CT) imaging to find out radiographic features potentially associated with LBP. Twenty-one cases showed spondylolysis and thirty-eight reported significant LBP, but no significant association was found between spondylolysis or –listhesis (degenerative or isthmic) with clinical complaint of LBP. A systematic review and meta-analysis was also conducted on 2015 about the prevalence of degenerative features in lumbosacral MRI in adult cases under 50 years old with or without LBP [3]. According to this study,

Modic change, central canal stenosis, and spondylolisthesis were not associated with LBP. In contrast to these studies, there are some studies reporting some relationships between vertebral slippage and LBP. Igbinedion and Akhigbe in 2011 reported their results about correlations of radiographic findings in 337 patients with LBP and according to them;lumbar spondylolisthesis especially degenerative types are more likely to be associated with LBP [23]. Prevalence of spondylolisthesis in their study was 13.4% (versus 20% in our study).

As the intervertebral disc is the biggest avascular tissue throughout the human body, it usually degenerate so early in the life and the prevalence of disc degeneration is so high that most authors believe that disc degeneration is a normal finding in adult population. In support of this, we mention the research done by Corniola et al. that prospectively studied 284 patients with degenerative disc disease scheduled for lumbar spine surgery. They investigated their cases with numerous clinical questionnaires (including ODI and VAS) and imaging scans [24]. At last, they failed to find an association between questionnaires' scores and imaging features. In contrast, recently, Middendorp et al. investigated the possible correlation between ODI and disc degeneration at L4-5 and L5-S1 levels [25]. Similar to our study, they also used Pfirrmann classification for grading of degenerative discs. In their study most of the patients had moderate functional disability (ODI: 21-40%) and Pfirrmann grade II-IV changes. They could find a weak but statistically meaningful relationship between these two items for both levels. They finally concluded that with increased disc degeneration, the amount of ODI also increases. In our study, we could find only a strong relationship between L4-5 disc degeneration and pain (not ODI) in the patients with chronic LBP.

Strengths and Limitations of the Study

Our study had some important flaws. First, in comparison with other similar studies, number of the cases was not significant and this problem could reduce the power of the conclusion. Second, although a spine surgeon with 11 years' experience on academic spine surgeries (FOK) reviewed all the cases and their imaging scans, presence of a skilled radiologist in this study could have raised the value of this study.

Conclusion

In conclusion, it seems that the old axiom denoting the presence of no link between MRI findings and clinical complaints is beginning to be questioned. In the patients we studied, the greatest severity of pain was observed in those cases with grade II of L4-L5 disc degeneration and no sign of spondylolisthesis.

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