Abnormal Lumbar Magnetic Resonance Imaging in Asymptomatic Individuals

Asemptomatik Bireylerde Lomber Manyetik Rezonans Görüntüleme Bulguları

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Summary

Objective: The aim of this study was to evaluate the abnormal findings on Magnetic Resonance Imaging (MRI) of lumbar spine in asymptomatic subjects.
Materials and Methods: The study included 48 asymptomatic individuals and 27 patients who had already been suffering from low back pain. All participants underwent routine blood analyses and bilateral lumbosacral roentgenograms were taken. In all participants, lumbar MRI scans were performed through L1-S1 intervertebral disc spaces.
Results: The mean age of asymptomatic individuals was 25.5±3.5 years, while of the patient group it was 26±2.9 years. In asymptomatic individuals, after lumbar MRI, disc degeneration in at least one intervertebral disc level, annular tear, endplate abnormality, disc bulging, and disc protrusion were detected in 33.3%, 16.6%, 4.16%, 6.25%, and 27% of cases, respectively. When compared with the patient group, only the difference in the disc bulging ratio (25.92%) was significantly higher ($p<0.05$).
Conclusion: MRI may reveal high rates of abnormal signs in asymptomatic individuals who do not suffer from low back pain. The present authors believe that ordering this scan on patients who suffer from low back pain but not planned to undergo surgery will unnecessarily increase health care expenses. *Turk J Phys Med Rehab 2009;55:73-7.*
Key Words: MRI, asymptomatic individuals, low back pain

Özet

Amaç: Bu çalışmanın amacı asemptomatik bireylerde lomber omurganın anormal manyetik rezonans (MR) görüntüleme bulgularını değerlendirmektir.
Gereç ve Yöntem: Çalışma 48 asemptomatik birey ve bel ağrısı yakınması olan 27 hastayı içermektedir. Bütün katılımcıların rutin kan tetkikleri yapıldı, bilateral lumbosakral grafileri çekildi ve L1-S1 disk aralıklarından lomber MR görüntüleri alındı.
Bulgular: Asemptomatik bireylerin ortalama yaşları 25,5±3,5 yıl, hasta grubunun yaş ortalaması ise 26±2,9 yıl idi. Asemptomatik bireylerde, lomber MR görüntülemede en az bir vertebra seviyesinde disk dejenerasyonu %33,3, anuler yırtık %16,6, end plate düzensizliği %4,16, disk bulging %6,25 ve disk protrüzyonu %27 oranında tespit edildi. Hasta grubu ile kıyaslandığında sadece disk bulging oranındaki (%25,92) farklılık istatistiksel olarak anlamlı yüksekti ($p<0,05$).
Sonuç: MR görüntüleme, bel ağrısı şikayeti olmayan asemptomatik bireylerde de yüksek oranda anormal bulgu verebilmektedir. Cerrahi girişim planlanmayan, fakat bel ağrısı yakınması olan her hastadan bu görüntülemenin istenmesinin gereksiz yere sağlık harcamalarını artıracağı kanaatindeyiz. *Türk Fiz Tıp Rehab Derg 2009;55:73-7.*
Anahtar Kelimeler: MRG, asemptomatik bireyler, bel ağrısı

Introduction

Low back pain is the second most frequently observed health problem following upper respiratory infections and at least 80% of the adult population suffers from low back pain at some time in their lives (1-3).

If low back pain, which may occur depending on many different etiologies, is seen together with radiculopathy, its cause is nerve root compression, but this can not be decided upon direct radiographic examinations (4).

Being one of the advanced imaging techniques, Magnetic Resonance Imaging (MRI) isincreasingly used in the examination of conditions caused by acute low back pain and sciatica (5). It is a non-invasive technique that also shows disc herniation at an early stage, with the difference from computed tomography (CT) with better soft tissue segregation (2,6).

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Although MRI is an effective modality to be preferred for diagnosing lumbar disc herniation, disc pathologies are observed on many MRI scans in asymptomatic subjects (7,8). This picture leads to questioning the specificity of MRI despite its high sensitivity (5).

The aim of this study was to evaluate the abnormal findings on MRI of lumbar spine in asymptomatic individuals.

Materials and Methods

The study consisted of 48 healthy asymptomatic individuals (38 females, 10 males), whose ages varied between 20 and 30 years and 27 patients (22 females, 5 males) of the same age group who referred to outpatient clinic for actual low back pain. Patients with low back pain for more than 3 months and patients with unilateral or bilateral sciatalgia were included in the study. Both the patient and the healthy control group were informed about the study and their written consents were taken from all the subjects. The design of the study has been approved by the local ethic committee.

Following physical examination, all participants (with and without low back pain), were tested in terms of whole blood cell count, sedimentation rate, biochemical analyses, ASO, CRP, RF, Brucella agglutination, and urinalysis. Bilateral lumbosacral roentgenograms were taken in both groups and individuals with low back pain of an inflammatory cause, those with an abnormality detected during laboratory examinations, those who had a metal implant in their bodies, and claustrophobics were excluded from the study.

Height, weight, and ages of both groups were recorded and body-mass index (BMI) was calculated. Moreover, all cases were questioned for smoking and alcohol consumption. Lumbar MRI scans of all participants were carried out using a SIGNA (General Electric) 1.5 tesla (USA) MRI device. Spin echo proton density T2- sagittal weighted images of all discs between L1 and S1 were taken in Spin echo T1 sagittal and axial plans. Five intervertebral disc spaces were examined in lumbar areas of all participants. In the group consisting of 48 healthy asymptomatic individuals, a total of 240 intervertebral disc spaces were evaluated, while in the second group including 27 patients with low back pain, 135 intervertebral disc spaces were evaluated.

MRI scans were evaluated by a radiologist blinded to the information regarding clinical and group data and results were recorded according to disc bulging, protrusion, extrusion, and sequestration levels as previously described (9,10). Accordingly, bulging was described as the circular symmetrical extension of the disc beyond endplate; protrusion as the focal or asymmetrical protrusion of the disc beyond endplate, while maintaining its connection with the main disc; extrusion as the wide extension and continuing protrusion of the disc from the edge of the vertebra toward the spinal canal, while preserving its connection with the main disc; and sequestration as a piece of disc tissue belonging to the disc material, moving separately from and having no connection with the main disc, while migrating to the spinal canal cavity. In addition, all cases were re-evaluated in terms of disc degeneration, annular tear, and endplate abnormality. Grade 1-2 disc degeneration was considered normal as previously described, while grade 3-5 was accepted as a presence of degeneration. Also, presence of High-signal-intensity zone was regarded as annular tear (11) and endplate abnormalities were evaluated in accordance with the system described by Modic et al. (12).

Statistical evaluation was performed by chi-square, student-t and Mann-Whitney U tests. $p<0.05$ was accepted as significant.

Results

Ages of 48 healthy asymptomatic individuals (38 females, 10 males) varied between 25 and 30 years (mean 25.5±3.5 years), while ages of 27 patients (22 females, 5 males) who had actual low back pain varied between 22 and 30 years (mean 26±2.9 years). When groups were compared for age, there was no significant difference ($p>0.05$).

In the asymptomatic group, BMI was 24.6±4.8 kg/m^2, while it was 25.3±5.5 kg/m^2 in the patient group, however the difference between them was not significant ($p>0.05$).

In the symptomatic patient group, 9 patients (33.3%) had only low back pain, 14 patients (51.8%) had unilateral and 4 patients (14.8%) had bilateral sciatalgia.

On lumbar MRI scans of the asymptomatic group, disc degeneration on at least one intervertebral disc level, annular tear, endplate abnormality, disc bulging, and disc protrusion were detected in 16 (33.3%), 8 (16.6%), 2 (4.16%), 3 (6.25%), and 13 (27%) cases, respectively. On the other hand, in the patient group these numbers were found as 15 (55.5%), 7 (25.9%), 1 (3.7%), 7 (25.92%), and 9 (33.3%), respectively. None of the groups revealed extrusion and sequestration in lumbar MRI scans. In statistical analyses, the disc bulging rate in the patient group was significantly high, when compared with the asymptomatic group ($p<0.05$). No significant difference was observed between these two groups in terms of other symptoms ($p>0.05$). Results are shown in Table 1.

In the asymptomatic group, a total of 240 intervertebral disc spaces were evaluated in the area between L-1 and S-1, while in the patient group this number was 135. According to them, in the asymptomatic study group, degeneration, endplate abnormality, annular tear, disc bulging, and protrusion were detected in 32 (13.3%), 3 (1.25%), 9 (3.75%), 3 (1.25%), and 19 (7.9%) disc spaces, respectively. As for symptomatic patient group, these numbers were recorded as 29 (21.55%), 1 (0.74%), 9 (6.6%), 12

Table 1. Comparison of MRI findings in asymptomatic and symptomatic patient groups.

MRI results (%)	Asymptomatic individuals (n:48)	Symptomatic patients (n:27)	p value
Disc degeneration	33.33% (16)	55.55% (15)	>0.05
Annular tear	16.66% (8)	25.92% (7)	>0.05
Endplate abnormality	4.16% (2)	3.17% (1)	>0.05
Disc bulging	6.25% (3)	25.92% (7)	<0.05
Disc protrusion	27% (13)	33.33% (9)	>0.05

(8.8%); and 15 (11.1%), respectively. Statistical comparison revealed that in patients with low back pain, only disc bulging was significantly high ($p<0.05$). Results are given in Table 2.

When MRI assessments of disc degeneration, annular tear, endplate abnormality, disc bulging, and protrusion were compared between the asymptomatic and patient groups at L1-2, L2-3, L3-4, L4-5, and L5-S1 levels, in the patient group only disc bulging at L5-S1 level carried statistical significance ($p<0.01$). Results are presented in Table 3.

Discussion

In the modern world, low back pain is a problem that affects not only individuals but also societies (13). It may occur at least once some time during the lives of 80% of the adult population (3). In many industrialized countries the prevalence of lifelong low back pain exceeds 70% (14). The higher incidence in low back pain is reported to be around 40 years of age. Prevalence is the highest in the age group of 45-54 years old (15). In the present country, no comprehensive prevalence study has been performed up to date.

Despite its weak diagnostic value, roentgenogram is the first imaging method to be employed in patients with low back pain (16). Specific diagnosis is difficult in a significant portion of patients who complained from low back pain (7). MRI provides the clinician with a detailed, non-invasive anatomical image of the lumbar spine (17). MRI is generally recommended for tumors, infections, and disc hernias in which surgery is an option. Nevertheless, MRI is frequently used to investigate other sources of pain. Serious disc or bone pathologies can easily be seen with lumbar MRI. In many studies, it has been reported that, some symptoms with suspicious clinical importance can also frequently be detected in asymptomatic individuals (7). Despite the dramatic rise in the use of MRI, the diagnostic efficiency of lumbar spine imaging lacks high quality. Studies regarding the diagnostic specificity of lumbar MRI have been insufficient (18). Specificity of MRI in diagnosing lumbar disc hernia varies between 76-96% (12). In healthy individuals who do not suffer from low back pain, abnormal MRI findings can be detected at a rate greater than or equal to 20% (19). Annular tear, stenosis, facet arthropathy, endplate alternation, and spondilolysthesis in adults may well occur without low back pain (12).

Disc degeneration has been defined in asymptomatic populations and is observed as frequent as in patients with low back pain (4). In previous studies, rates of disc degeneration varied between 72% and 89% in patients with low back pain (2,20,21). Disc degeneration was detected in 30% of asymptomatic individuals in their twenties (22). In a study by Stadnik et al. (23) the rate of disc degeneration in asymptomatic individuals younger than 30 years old was reported as 33% and no statistically significant difference was found between patients with low back pain. In the present study, the rate of disc degeneration in asymptomatic individuals between 20 and 30 years of age was 33.3%, whereas it was 55.5% in symptomatic patients. There was no statistically significant difference between groups. Disc degeneration shows an increase with age, reaching 97% by the age of 50 years (14). In the present study, although disc degeneration was more frequent in patients with low back pain, the finding carried no statistical significance when compared with healthy individuals. This makes one think that detection of disc degeneration in MRI of patients with low back pain makes no sense in terms of explaining the cause of pain (11).

There are studies reporting that annular tear (high signal intensity zone) is related with clinical symptoms and is observed most frequently between L4-5 or L5-S1 levels (10). In previous studies, rate of annular fissure in asymptomatic

Table 2. Comparison of MRI findings in asymptomatic and symptomatic patient groups in terms of disc space examination.

MRI results (%)	Disc space of asymptomatic individuals (n:240)	Disc space of symptomatic patients (n:135)	p value
Disc degeneration	13.33% (32)	21.55% (29)	>0.05
Annular tear	3.75% (9)	6.6% (9)	>0.05
Endplate abnormality	1.25% (3)	0.74% (1)	>0.05
Disc bulging	1.25% (3)	8.88% (12)	<0.05
Disc protrusion	7.91% (19)	11.11% (15)	>0.05

Table 3. Distribution of MRI findings in the asymptomatic and patient groups according to disc levels.

	L1-2		L2-3		L3-4		L4-5		L5-S1	
	Asymptomatic group n:48	Symptomatic group n:27	Asymptomatic group n:48	Symptomatic group n:27	Asymptomatic group n:48	Symptomatic group n:27	Asymptomatic group n:48	Symptomatic group n:27	Asymptomatic group n:48	Symptomatic group n:27
Disc degeneration	1	2	4	1	6	6	12	9	10	11
Annular tear	0	0	0	0	0	2	4	3	5	4
Endplate abnormality	0	1	0	0	0	0	1	0	2	0
Disc bulging	0	1	0	0	0	0	2	5	1*	6*
Disc protrusion	0	0	1	1	1	3	7	4	10	7
*p<0.01										

volunteers was reported to vary between 14% and 60% (2,10,21,23). As for the present study, rate of annular tear in the asymptomatic group and in the symptomatic patient group was recorded as 16.6% and 25.9%, respectively. Similar to the study of Stadnik et al. (23) the present study also revealed no significant difference between the asymptomatic group and the patient group. It is believed that, in the present study the rate of annular tear being lower than in other studies is caused by the fact that the present study group consists of younger cases.

It has been reported that in symptomatic patients, endplate abnormalities occur following the inflammatory changes within the disc matrix and they rarely are encountered in asymptomatic individuals between 20 and 50 years of age (11). On the other hand, in another study involving 200 cases, endplate abnormalities were observed in 18% of patients with low back pain while this rate was 25% in the asymptomatic group, however no significance was found (24). As for the present study, the rate of endplate abnormality in the asymptomatic group and the patient group was 4.16% and 3.7%, respectively. It is believed that the rate of annular tear being lower in the present study when compared with other studies is due to the present study group consisting of younger individuals. However, lack of a significant difference between asymptomatic individuals and patients with low back pain regarding frequency of endplate abnormalities makes one think that endplate abnormalities do not play an important role among causes of low back pain.

MRI studies have reported widespread bulging and protrusion in asymptomatic individuals (19). In the study of Stadnik et al. (23) in 36 asymptomatic volunteers whose ages varied between 17 and 71 years, disc bulging was detected in 81%, while in the same study group this rate was 56% in cases under 30 years of age. Similarly, Boden et al. (5) assessed MRI scans of 67 asymptomatic individuals whose ages varied between 20 and 80 years and detected disc bulging in 61.6%, whereas the rate of disc bulging was 56% in 20-39 age group. In the present study, disc bulging was detected in only 3 out of 48 asymptomatic individuals (6.25%) and in 7 of patients with low back pain (25.92%), with statistically significant difference. Disc bulging, which is defined as the bulging and convexity of disc material beyond its normal limits despite annulus fibrosus being intact, is not an anatomical and pathological entity (25) and occurs with the loosening of annular fibers following changes on the three joint complex in the vertebra (26). The lower incidence of disc bulging in this study is likely to be the result of younger study groups, when compared to researches in the literature.

Stadnik et al. (23) detected protrusion at a rate of 33% in 36 asymptomatic cases between 17 and 71 years of age, while this rate being 11% for the 17-30 year old arm of the same group. On the contrary, Jensen et al. (9) reported the rate of protrusion as 27% in asymptomatic cases, whereas Boos et al. (20) reported the rate as 63% between 20 and 50 years of age. In the present study, disc protrusion was detected in 27% of 48 asymptomatic participants while being 33.3% in patients with low back pain group, but the difference between them was not significant.

No accurate diagnosis can be made for 85% of the patients who suffer from low back pain which affects two thirds of the adult population during certain periods of their lives. Besides providing anatomically correct information regarding disc morphology and neural compression (2), abnormal MRI findings, though at varying rates, being seen in at least 20% of individuals without low back pain lead to the questioning of this method for its specificity in spite of its high sensitivity (5,19). Despite similar MRI findings, the occurrence of different symptoms was tried to be explained by various ways. Some researchers hold proinflammatory mediators such as interleukin-6 and interleukin-8 responsible from pain (10), while others show nerve root irritation which occurs with various chemical mediators including substance P (17). It has also been reported that after foramina venous obstruction, periradicular fibrosis may develop, thus leading to symptoms (27).

As a conclusion, MRI may also reveal high rates of abnormalities in asymptomatic individuals. Because of these changes which usually are not related with the pain, it is difficult to specifically diagnose an important number of patients (9,13,21). Direct roentgenograms are the first imaging technique to be preferred in patients who suffer from low back pain (4). However, in cases that show no improvement despite 6 weeks of conservative treatment, MRI, which provides a detailed, non-invasive image of the vertebra should be favored (6,17). The present authors believe that following a careful physical examination, MRI is appropriate for the patients that do not respond to conservative treatment, for the patients with disc herniation requiring urgent surgery or for the patients with a suspicion of tumors and infections.

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