



# Prevalence of Lumbar Disk Herniation in Adult Patients with Low Back Pain Based in Magnetic Resonance Imaging Diagnosis

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## Abstract

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**BACKGROUND:** Lumbar disk degenerative disease has now been proven as the most common cause of low back pain (LBP) throughout the world. Approximately 5–15% of patients with LBP suffer from lumbar disk herniation (LDH). Presenting symptoms of lumbar disk degeneration are lower back pain and sciatica which may be aggravated by walking, sitting, standing, bending, lifting, etc.

**AIM:** The aim of this study was to evaluate based on magnetic resonance imaging (MRI) images the prevalence of LDH in patients with LBP and its correlation between various demographic data.

**METHODS:** This cross-sectional and observational study was conducted from January 2016 to December 2017 at the Department of Imagery in the University Hospital Center 'Mother Theresa'. During the 2 years' period of this study, 342 patients of LBP were presented to department of imagery suspected for LDH. Diagnostic criteria were based on abnormal findings in MRI. All MRI scans were obtained with 1.5 tesla MRI machine. Data analysis was carried out with SPSS software for Windows version 20.0.

**RESULTS:** Overall 342 patients with LBP came into imagery department, the prevalence of LDH resulted 31.9% (109/342). Most of patients (60.5%) were presented with continuous LBP with a predominance of deterioration of pain by the walking activity 65.2%. The average age of patients with LDH was 51.12 years old with minimum 32 years and maximum 74 years old. The ratio male: female of LDH patients was 1.4, with predominance of males 59.6%. The active age of 40–49 years old (28.9%) and 50–59 years old (36.9%) was the most affected by LDH compared to other age groups. Based on MRI images, disk herniation was most commonly present at the level of L3/L4 and L4/L5. The most common types of disk herniation were protrusion 63.3% (69/109) followed by extrusion 21.1% (23/109). In the overall multivariate regression analysis, a significant relation between lumbar disk herniation and some of occupation was found ( $p < 0.05$ ).

**CONCLUSIONS:** Biologically, the lumbar herniation disk is a potential contributor to LBP. The prevalence of LDH among patients with LBP was 31.9%, and men were more prone to suffered from disk herniation than women, due to increased mechanical stress and injury. Results reported the frequent occurrence of lumbar disk degenerative disease in active age, especially in L3–L4, and L4–L5 level. Research efforts should endeavor to reduce risk factors and improve the quality of life.

## Introduction

Disk herniation is an abnormal protrusion of a spinal disk between vertebrae, most often in the lumbar region of the spine, causing pain due to pressure on spinal nerves. This can compress the nerves or spinal cord causing pain and spinal cord dysfunction [1]. The incidence of a herniated disk is about 5–20 cases/1000 adults annually and is most common in people in their third to the fifth decade of life, with a male-to-female ratio of 2:1 [2], and approximately 5–15% of patients with low back pain (LBP) suffer from lumbar disk herniation (LDH) [3], [4].

The patients who experience a herniated disk often remember that as a very painful. Unlike mechanical back pain, herniated disk pain is often burning or stinging and may radiate into the lower extremity [1], [5]. In some cases, the herniation of the

disk does not cause that patient any pain. Herniated disks are often seen on magnetic resonance imaging (MRI) of asymptomatic patients. Imaging is not indicated in a patient with signs and symptoms of a stable herniated disk until 6 weeks of persistent symptoms [1]. Over 85% of patients with symptoms associated with an acute herniated disk will resolve within 8–12 weeks without any specific treatments. However, patients who have an abnormal neurological examination or refractory to conservative treatments will need further evaluation and treatments [6], [7], [8]. Nowadays, there are some effective diagnostic imaging for patients with LDH. The most often used diagnostic methods are MRI and computed tomography (CT) that have a significant effectiveness for LDH. Diagnostic imaging in patients with back pain and/or leg pain is often used to assess nerve root compression due to disk herniation or spinal stenosis [9], [10]. Furthermore, diagnostic imaging can also be used to identify the affected disk

level before surgery [11]. MRI like CT scanning can be used to evaluate the spinal canal and space available for neural structures, it has additional benefit of allowing the direct assessment of neural structures as well as the disk structure, this direct evaluation not possible by CT scan, loss of water content, proteoglycans, and collagens [12], [13]. The CT scan is often used for detection of morphological degenerative disk changes [14], while MRI has a diagnostic accuracy, produce high-quality images without using ionizing radiation, and has good visualizing capacities especially of soft tissue [5]. The aim of this study was to evaluate based on MRI images the prevalence of LDH in patients with LBP and its correlation between various demographic data.

## Methods

This cross-sectional and observational study was conducted between January 2016 and December 2017 at the Department of Imagery in the University Hospital Center 'Mother Theresa'. The study included 342 patients firstly presented in neurology, orthopedic, and rheumatology unit with the main complain for diagnosis is LBP. Those patients are referred for further evaluation to the department of imagery with the MRI examination. The patients involved have no other proven diseases related to LBP. During the presentation visit to the imagery department, all patients were examined and their findings are analyzed. For all patients, details such as gender, age, mode of onset, duration, LBP attack, and occupation, and if these have preceding trauma, were collected. All MRI scans were obtained with 1.5 tesla MRI machine (General Electric and Magnetom, Siemens medical system). The patients were placed in supine position with their head toward the magnet. The studies consisted of three spin-echo sequences: The sagittal T1W- and T2W-images and transverse T2W-images. The slice thickness was 3 mm for all sagittal and axial sequences. The radiologists record the types of disk herniation such as bulging, protrusion, extrusion, or sequestration identify by the MRI images. Diseases excluded by diagnostic radiologists were degenerative disk disease.

Data analysis was carried out with SPSS software for Windows version 20.0 (SPSS Inc., Chicago, IL, USA). Continuous variables are presented as mean  $\pm$  SD, frequency or percentage, as appropriate. Chi-square test is used to establish data correlation. Standard Student's t-test and Mann-Whitney U-test for paired samples or one-way ANOVA performed for group comparisons or comparing data, as needed.  $p < 0.05$  was considered to be statistically significant.

## Results

During January 2016 to December 2017 in the department of imagery are presented 342 patients suspected for LDH. Patients with continuous LBP resulted 60.5% (207/342) and those with intermittent LBP 39.5% (135/342). Regarding the deterioration of pain by the activity, 65.2% (223/342) had LBP during walking, 45.3% (155/342) during standing, 23.7% (81/342) during lifting, 55% (188/342) during sitting, 14.9% (51/342) during driving, 74.3% (254/342) during bending, and 11.4% (39/342) during resting. Table 1 shows the characteristic of LBP.

**Table 1: Characteristics of low back pain**

Variable	Frequency (%)
Low back pain	342
Continuous	207 (60.5)
Intermittent	135 (39.5)
Deterioration of pain by the activity	
Walking	223 (65.2)
Standing	155 (45.3)
Lifting	81 (23.7)
Sitting	188 (55)
Driving	51 (14.9)
Bending	254 (74.3)
Resting	39 (11.4)

Patients (342 in total) presented to the department of imagery with LBP complaint underwent to MRI for diagnosis. After MRI evaluation, the prevalence of lumbar disk herniation was 31.9% (109/342). According to demographic characteristics of patients with LBP, females were 42.4% (154/342) of participant, while males were 57.6% (197/342). LBP patients' predominance appeared in the age groups 40–49 years old in 28.9% (99/342) and 50–59 years old in 36.9% (126/342). Furthermore, the average age of patients with lumbar disk herniation was 51.12 years old with minimum 32 years and maximum 74 years old. The ratio male: female of patients with LDH in this study resulted 1.4, so the males were the most predominant gender compared to females. The demographic characteristics of participant patients in this study are presented in Table 2. Based on the multivariate regression analyses, male resulted 1.1 time in risk for LDH compare to female. There was no found a significant association between gender and presence of LDH. Importantly, there was a significant association between the age groups 50–59 years old and presence of LDH. This category of age resulted 2.1 time in risk for LDH, for 95% CI (1.00–4.5),  $p = 0.04$  (Table 2). The frequency of 109 patients with LDH according to the age

**Table 2: Demographic characteristics of patients with lumbar disk herniation and low back pain**

Variables	Patients with LBP (342), n (%)	Patients with LDH (109), n (%)	OR p
Gender			
Female	145 (42.4)	44 (40.4)	1 reference
Male	197 (57.6)	65 (59.6)	1.1 (0.7–1.79) 0.6
Age groups (years old)			
30–39	45 (13.1)	12 (11)	1.4 (0.4–4.5) 0.59
40–49	99 (28.9)	27 (24.8)	1.15 (0.38–3.4) 0.8
50–59	126 (36.9)	55 (41.3)	2.1 (1.00–4.5) 0.04
60–69	48 (14.1)	10 (18.3)	1.9 (0.59–6.02) 0.27
$\geq 70$	24 (7.0)	5 (4.6)	1 reference

LBP: Low back pain, LDH: Lumbar disc herniation, OR: Odds ratio.

groups and gender female/male is as below (Figure 1). As you seen, the age group 50–59 years old presented the higher number of patients in this study with a distribution between gender females versus males in 18 and 27, respectively, followed by the age group 40–49 years old with 12 females and 15 males.

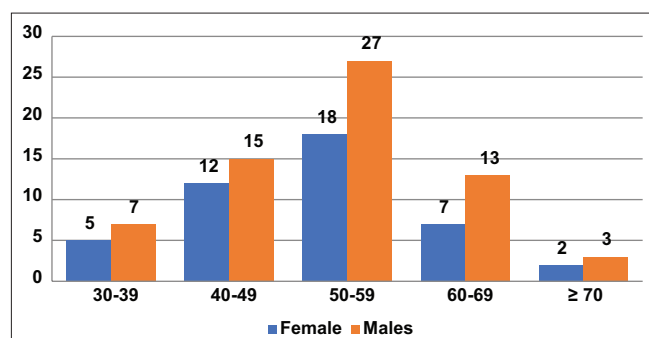


Figure 1: The frequency of age groups according to the gender female/male in patients with LDH

Analysis related to occupation is almost focused on LDH cases where whose latest LBP episode began in their current/most recent job. Table 3 shows a multivariate regression analysis of patients with LBP and confirmed with LDH according to their occupation. In this study, the occupations found are office workers, health workers, machine drivers, transport workers, miners, carpenters, agricultural workers, and sportsman. Category “Others” included cases that referred heavy workers. In the overall multivariate regression analysis, a significant relation between lumbar disk herniation and some of occupation was found ( $p < 0.05$ ). Carpenters appeared 3.07 times in risk for LDH, for CI 95% (1.04–9.07),  $p = 0.041$ .

Table 3: Multivariate regression analysis of patients with low back pain and lumbar disk herniation according to occupation

Variables	Total number with LBP	Total number with LDH	P
Office workers	39	9	Reference
Health worker	32	11	1.74 (0.6–4.9) $p = 0.29$
Machine drivers	67	15	1.19 (0.46–2.6) $p = 0.9$
Transport workers	79	17	1.09 (0.43–2.7) $p = 0.84$
Miners	8	4	3.3 (0.69–16.07) $p = 0.13$
Carpenters	25	12	3.07 (1.04–9.07) $p = 0.041$
Agricultural workers	29	15	3.5 (1.26–10.1) $p = 0.01$
Sportsman	12	4	1.67 (0.4–6.8) $p = 0.47$
Others	51	22	2.6 (1.03–6.64) $p = 0.04$

LBP: Low back pain, LDH: Lumbar disk herniation.

Agricultural workers appeared 3.5 times in risk for LDH, for CI 95% (1.26–10.1),  $p = 0.01$  and other occupations (heavy workers) appeared 2.6 times in the risk for CI 95% (1.03–6.64),  $p = 0.04$ . While for other occupations such as health workers, machine drivers, transport workers, and miners does not appear a significantly related LDH ( $p > 0.05$ ) (Table 3).

Out of 31.9% (109/342) patients diagnose with LDH by MRI, 6.4% (7/109) appeared LDH at L1–L2

level; at L2–L3 was appeared 11% (12/109), while at L3–L4 was about 26.6% (29/109) of them. The most predominant herniation was appeared at L4–L5 with 37.6% (41/109) of patients, while only 18.34% (20/109) had involvement at level L5–S1. Based on the type of the herniation, the prevalence of Bulging resulted 5.5% (6/109), protrusion 63.3% (69/109), extrusion 21.1% (23/109), and sequestration only 10.1% (11/109). The prevalence of herniation type according to the disk level location of patients is presented in Table 4.

Table 4: Magnetic resonance imaging observation regarding to localization and type of lumbar disk herniation

Disk level and location	Bulging	Protrusion	Extrusion	Sequestration	Total
L1/L2	3	4	-	-	7
L2/L3	2	8	2	-	12
L3/L4	1	18	8	2	29
L4/L5	-	27	9	5	41
L5/S1	-	12	4	4	20
Total	6	69	23	11	109

## Discussion

LBP refers to pain and discomfort affecting the lumbar and/or sacral regions of the spine. LBP is one of the most common reasons patients present to primary care practices and is a leading cause of job-related disability in the United States [15]. Clinically, the natural progression of LDH is generally satisfactory and most patients spontaneously recover within about 4–6 weeks with only conservative treatment [16], [17]. LDH is a major cause of LBP and results in a complex picture of symptoms and signs [18].

During 2 years, in the imagery department are presented for LDH diagnosis with MRI 342 patients with LBP. Determining whether a patient has constant or intermittent LBP during an initial assessment is important because with constant LBP, there is always the possibility of a more sinister pathology, whereas intermittent pain rules out several serious conditions such as a spinal metastasis and directs clinicians toward a benign, mechanical cause [19], [20]. The prevalence of intermittent LBP among patients ranges from 33% to 65% [21], [22], [23]. The prevalence of intermittent LBP found in this study resulted 39.5%, which is within the range reported in the previous study [21], [22], [23]. The occurrence of LBP is a multifactorial, debilitating, and highly prevalent condition that create huge problems during the activities of daily living (ADL).

ADL is various functional activities that may range from basic ones, such as walking or bending, to more complex activities, such as cooking, bathing or getting dressed, in other words activities which enable independent living [24], [25], [26]. Repetitive activities such as lifting, pulling, pushing, bending, and twisting also increase risk of a lumbar herniated disk [27], [28]. In this study is seen the consequences that LBP cause on various aspects of functional ability, especially in

reduction of ADL, and work ability. Deterioration of LBP in this study was more aggravated during bending (74.3%), walking (65.2%), and sitting (55%) agreeing with other studies [27], [28].

As stated by Telli *et al.*, the prevalence of LBP, which affects approximately 50% to 80% of people in industrialized Western societies at certain periods of their lives and that is one of the main causes of workforce losses, medical costs, and disability, is between 15% and 30% [29]. The prevalence of lumbar disk herniation in 342 patients presented with LBP complaint and undergo to MRI for diagnosis resulted 31.9%.

Approximately 2–3% of all LBP are those developing in association with LDH. LDH in seventy percent of cases occurs in the 30–50 age group, while 10% appear after 60, while in childhood is very rare [30]. The findings of this study regarding the prevalence of LBP for the age groups from 30 to 50 years old are almost the same with the previous study [30].

According to Saleem *et al.*, gender comparison revealed that significantly men were more prone to suffered from disk degeneration as main cause of LDH, an alarming problem for society [31]. This result reinforces the general perception that men are more susceptible to disk degeneration than women, most likely due to increased mechanical stress and injury [32]. The findings of this study were consistent with other studies [31], [33].

In this study, gender and almost all age groups (except 50–59) fail to show an association with presence of LDH. Jeon *et al.* arrived at a similar conclusion in their study [34]. Controversy still exists between the relationship of occupational load and LBP [35]. Furthermore, heavy occupational activities have long been suspected of increasing spine problems. However, inconsistencies between study findings, with some supporting this association and other not, have led to controversy and uncertainty about the relationship between LBP, physical loading, and lumbar spine degeneration [36]. This point is emphasized by the subjective nature of pain evaluation and the high prevalence of back pain in general. Studies depicting the association between pain and occupation load always have large room for bias [37]. Many studies had been found a significant association between disk herniation and some occupations [36], [37], [38], [39]. Similarities regarding the presence of LDH and association with occupation are observed in this study.

According to data obtained by MRI in this study, most cases of LDH were observed in L4–L5 followed by those in L3–L4 level and were significantly much higher than cases with herniation observed at L1–L2, L2–L3, and L5–S1 level. Disk herniation in more than half of patients with LDH had the features of disk protrusion. Furthermore, there are patients that had the features of disk, extrusion, sequestration, and bulging in this study. It was also revealed that protrusion and extrusion were higher at level LDH L3–L4 and L4–L5. Very few patients

had the disability on multiple levels; these findings were also consistent with past studies [32]. There was not significant association between disk type and LDH.

## Conclusions

Biologically, the lumbar herniation disk is a potential contributor to LBP. The prevalence of LDH among patients with LBP resulted 31.9%, and men were more prone to suffered from disk herniation than women, due to increased mechanical stress and injury. Most cases of disk herniation were observed in active age in 4<sup>th</sup> and 5<sup>th</sup> decade of life in this study. The lumbar disks most often affected and leads to herniation are L3–L4, and L4–L5, most probably due to a combination of long-standing degeneration and subsequent change in the ability of the disk to resist applied stress. The awareness of stakeholders is needed of this very common problem and proper protective measures can be taken to prevent the disease in early and active age.

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