2008-5435/14/63-7-11
INTERNATIONAL JOURNAL OF OCCUPATIONAL HYGIENE

IJOH 10: 7-11, 2018

ORIGINAL ARTICLE

# Evaluation of Lumbar Disk Herniation Risk Factors in Patients with Low Back Pain

MOHSEN KOOSHA[1], MASHHOOD AGHAJANLOO[2], SEPIDEH PAYBAST[3], MOHAMMAD EHSAN RAHIMINEJAD[4], AHMAD SOLTANZADEH[5*]

*[1]Neurosurgery Resident, Shahid Beheshti University of Medical Sciences, Imam-Hussein Hospital, Tehran, Iran;*

*[2]Assistant Professor, Neurosurgery Department, Hamedan University of Medical Sciences, Hamedan, Iran;*

*[3]Neurology Resident, Shahid Beheshti University of Medical Sciences, Imam-Hussein Hospital, Tehran, Iran;*

*[4]General Practitioner, Larestan University of Medical Sciences, Imam-Reza Hospital, Fars, Iran;*

*[5]Assistant Professor, Department of Occupational Hygiene Engineering, Faculty of Health and Research Center for Environmental Pollutants, Qom University of Medical Sciences, Qom, Iran.*

Received January 16, 2018; Revised March 09, 2018; Accepted March 15, 2018

This paper is available on-line at *http://ijoh.tums.ac.ir*

## ABSTRACT

Low back pain (LBP) due to lumbar disk herniation could collaborate with various risk factors. In this study, we focused on analysis of lumbar disk herniation risk factors in patients with LBP. This comparative cross-sectional study was conducted in Hamedan-western Iran in 2014-2015. Overall, 58 cases with evidence of lumbar disk hernia were classified as a case group and 47 cases without evidence of lumbar disk herniation were classified as a control group. The data collection was performed by using a questionnaire and the statistical analysis was performed by using SPSS software. The analytic results indicated a meaningful correlation between demographic variables as body mass index (BMI) mean, occupation type and lumbar disk hernia ($P<0.05$). Furthermore, the abdominal circumference and the average heavy load carried by the participants throughout a day had a significant relationship with lumbar disk herniation ($P<0.05$). There are multiple risk factors for lumbar disk hernia regarding a combination of genetics and acquired characteristics and lifestyle.

**KEYWORDS:** *Disk hernia, Low back pain, Risk factor*

## INTRODUCTION

Low back pain (LBP) is the second cause of referral to the clinics and the sixth cause of hospitalization in the United States [1]. The lumbosacral radiculopathy is one of the most common and albeit the important cause of neurology and neurosurgery visit. Intervertebral disk material destruction and protrusion are one of the main causes of this complication [2-3]. The relationship between intervertebral disk disease and lumbosacral radiculopathy was first explained in 1934 [4].

The lumbosacral spinal cord is susceptible to disk hernia due to its range of motion consisting of flexion, extension, and rotation. Therefore, 75% of the spinal cord flexion- extension occurs in the lumbosacral section from that 25% is seen in L4-L5 [5]. Accordingly L4-L5, L5-S1 disks are the most susceptible areas for motor damage. About 90%-95% of compressive radiculopathy occurs in this region [5]. Although our data is limited, the prevalence of lumbosacral radiculopathy in adults is estimated 3%-5% [1, 6]. The diagnosis is based on history and physical examination findings. The

***Corresponding author: Ahmad Soltanzadeh***

***Email:*** ***soltanzadeh.ahmad@gmail.com***

prevalence of the symptoms is respectively paresthesia in the involved dermatome (63%-72%), radiating pain in the lower limbs (35%) and numbness of the involved dermatome (27%) [7, 8].

LBP has imposed a lot cost on health and wellness system including of 200 million cases of absenteeism from work. In 1990, 24 million $ was spent on this dilemma in the U.S including of hospitalization, diagnostic methods, medical therapy cost, etc. [9-10]. In England, LBP was the most common cause of quitting job by the workers. Therefore, in 1987-1988 it was wasted 4.46 million active days of work as a result of low back pain, which this number was equivalent to 12% of other causes [10]. Sudden onset LBP could be related to risk factors as smoking, obesity, female sex, occupation type (including of heavy work or sitting position at work) [11-14]. Familial history, overpressure on lumbosacral spinal cord and heavy work were the most important causes of lumbar disk hernia [15]. Moreover, there was a positive relationship between obesity, smoking and disk hernia [16]. Disk hernia can be related to occupational factors [17].

Regarding high frequency of this disorder and its complication on the society and health and wellbeing system, limited studies on this issue in Iran, this study was designed to evaluate and identify lumbosacral intervertebral disk hernia in patients referring to neurosurgery clinic with a complaint of LBP.

## MATERIALS AND METHODS

This analytical observational case-control study was conducted on patients referring to Neurosurgery Clinic in Hamedan hospital, western Iran in 2014-2015.

Overall, 105 patients were enrolled from whom referring to the Neurosurgery Clinic of Hamedan Hospital with a complaint of LBP. In the following, they went under lumbosacral MRI. Of the 105, 58 patients had evidence of lumbar disk hernia on MRI categorized as case group and 47 patients lacked evidence of hernia on MRI classified as control group.

Data collection was performed using a questionnaire over a verbal interview in both groups. The patients signed the testimonial to participate conversantly in the questionnaire. The variables as age, gender, smoking, familial history and mean heavy load as a risk factor were analyzed in both case and control group.

The exclusion criteria included: Patients older than 65 yr old and younger than 15 yr old, patients with special disease as brain tumor, metastatic tumor to spinal cord, spinal cord deformity, patients in whom the underlying disorder limited their routine physical activity as patients with an old polio, seizure, chronic brain trauma, patients with a vertebral fracture due to direct trauma and patients in whom chronic LBP resulted in limited daily physical activity.

Statistical analysis:

Statistical analysis was performed using SPSS software (ver. 2, Chicago, IL, USA). Normal data distribution was performed by Kolmogorov-Smirnov test. For the comparison of the quantitative variables ' mean between the groups, independent two-sample t-test and for the qualitative variables, Chi-square test was performed. P-value was considered 0.05.

## RESULTS

The descriptive analytic findings of individualized variables including of mean age, body mass index (BMI), gender, level of education and occupation type are presented in Table 1. There was not a meaningful relationship between mean age and disk hernia (P=0.074). However, there was a statistically significant relationship between BMI and disk hernia (P=0.007). There was a higher risk of lumbar disk hernia in patients with higher BMI.

Moreover, the $\chi 2$ test indicated that there was not a meaningful correlation between gender, educational level and disk hernia (P<0.05). However, the prevalence of lumbar disk hernia was higher in men in comparison to women and as the higher educational level, the lower prevalence of disk hernia.

The evaluation of occupation type confirmed the positive relationship (P=0.004). Furthermore, the risk of disk hernia was higher in workers and the farmers.

The descriptive and analytic findings of lumbar disk hernia risk factors are presented in Table 2.

The independent two-sample t-test indicated that there was a noticeable relationship between the risk factors as abdominal circumference, the mean heavy load carried by the patients throughout a day and lumbar disk hernia (P= 0.001). The higher the load the patients carry, the risk of disk hernia increases.

The analysis did not show any significant relationship between the average time interval of carrying weight (minute), the mean work pressure, the mean duration of exposure to heavy load and prevalence of lumbar disk hernia (P<0.05). However, the prevalence of lumbar disk hernia was higher in patients with a history of much more time of carrying weight, higher work pressure and much more exposure to heavy load.

Besides, there was not a considerable relationship between smoking, familial history and lumbar disk hernia (P<0.05).

*Published online: March 20, 2018*

**Table 1.** Descriptive and analytic demographic findings of the studied patients

| Demographic variables | | Lumbar disk hernia | | *P*-value |
|---|---|---|---|---|
| | | Positive (n=58) | Negative (n=47) | |
| Age( Mean ± SD ) | | 45.44±11.82 | 40.95±13.63 | 0.074† |
| BMI( Mean ± SD) | | 27.70±3.49 | 25.43±4.61 | 0.007† |
| Gender | Female | 25 (48.1%) | 27 (51.9%) | 0.172‡ |
| | Male | 33 (62.3%) | 20 (33.7%) | |
| Education | Illiterate | 14 (70.0%) | 6 (30.0%) | 0.053‡ |
| | Under diploma | 25 (65.8%) | 13 (43.2%) | |
| | Diploma | 8 (42.1%) | 11 (57.9%) | |
| | Academic | 11 (39.3%) | 17 (60.7%) | |
| Occupation | Worker | 17 (70.8%) | 7 (29.2%) | 0.004‡ |
| | Farmer | 7 (77.8%) | 2 (22.2%) | |
| | White-color worker | 7 (53.8%) | 6 (46.2%) | |
| | Student | 2 (50.0%) | 2 (50.0%) | |
| | Housewife | 20 (58.8%) | 14 (41.2%) | |
| | Nurse | 0 (0.0%) | 13 (100.0%) | |
| | Market occupation | 3 (60.0%) | 2 (40.0%) | |
| | Driver | 2 (66.7%) | 1 (33.3%) | |

†Independent Sample *t*-test
‡Chi Square test

**Table 2.** Descriptive and analytic findings of the lumbar disk hernia risk factors

| Risk factors | | Lumbar disk hernia | | *P*-value |
|---|---|---|---|---|
| | | Positive (n=58) | Negative (n=47) | |
| Mean abdominal circumference (Mean±SD) | | 95.43±11.34 | 86.68±11.22 | 0.001† |
| Average heavy load carried throughout a day (Kg) | | 32.62±29.80 | 15.76±15.20 | 0.001† |
| Average time of carry weight throughout a day (minute) | | 54.65±82.84 | 38.72±82.87 | 0.330† |
| Average pressure work (hour×kg$^2$) | | $1.90\times10^3\pm5.86\times10^3$ | $3.04\times10^2\pm8.54\times10^2$ | 0.045† |
| Average exposure time to heavy load (month) | | 8.74±3.73 | 7.80±3.45 | 0.192† |
| Familial history | Positive | 24 (55.8%) | 19 (44.2%) | 1.0‡ |
| | Negative | 24 (54.8%) | 28 (45.2%) | |
| Smoking | Positive | 6 (50.0%) | 6 (50.0%) | 0.764‡ |
| | Negative | 52 (55.9%) | 41 (44.1%) | |

†Independent Sample *t*-test
‡Chi Square test

## DISCUSSION

A common view of intervertebral disk degeneration (IDD) has always been that it was considered as a normal process related to aging and physical pressure throughout life. There is not a standard definition of back pain and disk degeneration. The comparison of the studies is difficult [18-19]. Because of the influence of different risk factors, evaluation of all the risk factors in one study is difficult, as the lumbar disk hernia is affected by many factors [18-19].

Few studies have been done on the relationship between educational level and disk hernia. In the current study, there was not a significant relationship between educational level and disk hernia which was compatible with some previous studies [20]. Furthermore, familial history is one of the important factors in disk hernia prevalence. Familial history is considered as the main risk factor for the disease [19, 21]. Familial history was the most important positive factor [21]. Age is another effective factor evaluated in this study. Although there was not a considerable difference between the case and control group, aging was significantly related to L1-L2, L3-L4 and L4-L5 disk degeneration [22].

BMI affected by weight and height is another factor. There was a noticeable difference between case and control group. BMI was considerably related to L1-L2, L3-L4 and L4-L5 disk degeneration [22]. Evaluation of the patients with disk hernia, BMI more than 25.7 was a risk factor for disk hernia [23]. There was no considerable relationship between smoking and

lumbar disk hernia, there was a positive correlation between intervertebral disk thinness and disk hernia [24]. Working on 67 patients who needed surgical intervention, there was no relationship between smoking, economic condition, education, homework physical pressure and risk of lumbar disk hernia surgery. The most probable chance was allocated to positive familial history, physical pressure at work and BMI [23].

Because LBP is considered as work-related musculocutaneous disorder, another important risk factor is the occupation and average work pressure. Accurate retrospective evaluation of occupational exposure is so difficult and in most studies, individual observation is used instead of objective observation [25]. Another problem in evaluation of occupational exposure and disk hernia is the probable asymptomatic duration of disk hernia. The total prevalence of LBP in unexposed patients were respectively 22%, 30% and 34% for <35 yr old, 35-45 yr old and >45 yr old [25]. Heavy load is considered as a risk factor. However, the strength of this correlation in different studies is different [26]. Leino-Arjas et al. worked on the relationship between occupational exposure and care for the hospitalized patients with underlying lumbar disk hernia in Finland hospital [27]. By analyzing multi-variables, physical work pressure, lift weight and malposition at work were correlated with hospitalization due to disk hernia in both men and women [27]. In this study, five-factors consisting of occupation type, average weight carried throughout a day, duration of carrying weight, pressure work and average exposure time to the heavy load have considered occupational factors. Statistical tests showed the occupation type has noticeable bearing on whether or not having a lumbar disk hernia. The farmers, workers, and drivers were the most affected group. Furthermore, average carried weight and pressure work had a significant relationship with lumbar disk hernia which highlights the importance of the occupation type. There was a considerable difference between average pressure work and average load carried throughout a day between case and control group which was compatible with our findings [17]. Moreover, increased risk of low back pain with evidence of disk degeneration was significantly related to the occupational factors [28-29].

Limitations of this study included low sample size due to small size of the community studied, failure to evaluate all types of disk hernia, failure to evaluate all occupational risk factors and failure to assessment specific jobs due to low sample size. We suggest perform more comprehensive studies with more sample size, precise separation of occupation type, focusing on specific jobs, evaluation of different disk hernia and applying other pressure work indexes especially the objective indexes rather than subjective ones.

## CONCLUSION

There are various risk factors for lumbar disk hernia affected by both genetics and environmental characteristics including of lifestyle, occupation type, and its related risk factors. Therefore, evaluation of one-to-one risk factors independently without considering other factors and covert factors which whose effects are not being studied is a matter of hardness and could always be a bias in the study. Principally, it seems no smoking, less weight, exercise that strengthens the paravertebral muscles and applying health ergonomic advice to improve work condition could make a contribution to prevention of spinal cord disease especially intervertebral disk hernia.

## ACKNOWLEDGMENTS

The authors appreciate the hospital officials and all the participants who helped us in this study. The authors declare that there is no conflict of interest.

## REFERENCES

1. Bawab, W., Ismail, K., Awada, S., Rachidi, S., AL Hajje, A.M.A.L. and Salameh, P. Prevalence and risk factors of low back pain among office workers in lebanon. *Int J of Occup Hyg* 2015: 7(1), 45-52.
2. Urban J, Roberts S. Degeneration of the intervertebral disc. *Arthritis Res. Ther* 2003;5(3):120-38.
3. Tarulli, AW, Raynor, EM. Lumbosacral radiculopathy. *Neurol Clin* 2007;25:387.
4. Mixter, WJ, Barr, JS. Rupture of the intervertebral disc with involvement of the spinal cord. *N Engl J Med* 1934;211:210.
5. Weinstein, PR. Anatomy of the lumbar spine. In: Lumbar Disc Disease. 2nd ed, Hardy, RW (Ed), *Raven Press, New Yor*k 1993:5.
6. Deyo, RA, Weinstein, JN. Low back pain. *N Engl J Med* 2001;344:363.
7. BROWN, HA, PONT, ME. DISEASE OF LUMBAR DISCS. TEN YEARS OF SURGICAL TREATMENT. *J Neurosurg* 1963;20:410.
8. Norlen G. On the value of neurological symptoms in sciatica for localization of a lumbar disc herniation. *Acta Chir Sand* 1944;95:7.
9. Bischoff, RJ, Rodriguez, RP, Gupta K ea. A comparison of computed tomography-myelography, magnetic resonance imaging, and myelography in the diagnosis of herniated nucleus pulposus and spinal stenosis. *J Spinal Disord* 1993;6:289.
10. Joel, L, Seres. Approach to the Patient with ChronicPain. In: In H. Richard Winn e, editor.

Youmans NeurologicalSurgery: *5th ed. Philadelphia W.B. Saunders*; 2004. p. 2937-52.
11. Cassidy, JD, Carroll, LJ, Côté, P. The Saskatchewan health and back pain survey. The prevalence of low back pain and related disability in Saskatchewan adults. *Spine J* 1998;23:1860.
12. Croft, PR, Papageorgiou, AC, Ferry S ea. Psychologic distress and low back pain. Evidence from a prospective study in the general population. *Spine J* (1995;20:2731.
13. Katz JN. Lumbar disc disorders and low-back pain: socioeconomic factors and consequences. *JBJS*. 2006; 88:21-4.
14. Skovron, ML, Szpalski, M, Nordin M ea. Sociocultural factors and back pain. A population-based study in Belgian adults. *Spine J* 1994;19:129.
15. Sun ZM, Ling M, Chang YH, Liu ZZ, Xu HH, Gong LQ, Liu J, Zhang YG. Case-control study of the risk factors of lumbar intervertebral disc herniation in 5 northern provinces of China. *J South Med Univ* 2010; 30(11):2488-91.
16. Schumann B, Bolm-Audorff U, Bergmann A, Ellegast R, Elsner G, Grifka J, Haerting J, Jäger M, Michaelis M, Seidler A. Lifestyle factors and lumbar disc disease: results of a German multi-center case-control study (EPILIFT). *Arthritis Res Ther* 2010;12(5): 193.
17. Shimia M, Babaei-Ghazani A, Sadat BE, Habibi B, Habibzadeh A. Risk factors of recurrent lumbar disk herniation. *Asian J Neurosurg* 2013 Apr;8(2):93.
18. Endean A PK, Coggon D. Potential of magnetic resonance imaging findings to refine case definition for mechanical, 25. *Lbpiesasr SPPA*.
19. Osman NM, Fawzy FM, Lateef HM. MRI Evaluation of Lumbar Disc Degenerative Disease. *J Hosp Med* 2017 Jul 30;68(2).
20. Seidler, A, Bolm-Audorff, U, Siol, T, et al. Occupational risk factors for symptomatic lumbar disc herniation; acase-control study. *Occup Environ Med* 2003; 60(11): 821-30.
21. Zhang Y-g, Sun Z, Zhang Z, Liu J, Guo X. Risk factors for lumbar intervertebral disc herniation in Chinese population: a case-control study. *Spine J* 2009;34(25):E918-E22.
22. Hangai M, Kaneoka K, Kuno S, Hinotsu S, Sakane M, Mamizuka N, et al. Factors associated with lumbar intervertebral disc degeneration in the elderly. *Spine J* 2008;8(5):732-40.
23. Saftic, R, Grgic, M, Ebling, B, et al. Case-control study of risk factors for lumbarintervertebral disc herniation in Croatian islandpopulations. *Croat Med J* 2006;47(4):593-600.
24. Schumann B B-AU, Ellegast R, Elsner G, Grifka J, Haerting J, Jäger M, Michaelis M, Seidler A. Lifestyle factors and lumbar disc disease: results of a German multi-centercase-control study (EPILIFT). *Arthritis Res. Ther* 2010; 12: 193.
25. Lötters F, Burdorf A, Kuiper J, Miedema H. Model for the work-relatedness of low-back pain. *Scand J Work Environ Health* 2003:431-40.
26. Battié MC, Videman T, Gibbons LE, Fisher LD, Manninen H, Gill K. 1995 Volvo Award in clinical sciences. Determinants of lumbar disc degeneration. A study relating lifetime exposures and magnetic resonance imaging findings in identical twins. *Spine J*. 1995; 20(24):2601-12.
27. Samaei S, Hasheminejad N, Zolala F. Evaluation of risk factors influencing low back pain in patient transfer tasks. *Int J Occup Hyg* 2015; 7(2): 76-82.
28. Leino-Arjas P, Kaila-Kangas L, Kauppinen T, Notkola V, Keskimäki I, Mutanen P. Occupational exposures and inpatient hospital care for lumbar intervertebral disc disorders among Finns. *Am. J. Ind. Med* 2004; 46(5): 513-20.
29. Luoma K, Riihimäki H, Luukkonen R, Raininko R, Viikari-Juntura E, Lamminen A. Low back pain in relation to lumbar disc degeneration. *Spine J* 2000; 25(4):487-92.
30. Jensen A, Kaerlev L, Tüchsen F, Hannerz H, Dahl S, Nielsen PS, Olsen J. Locomotor diseases among male long-haul truck drivers and other professional drivers. *Int Arch Occup Environ Health 2*008; 81(7):821-7.

*Published online: March 20, 2018*