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Risk Factors for Lumbar Intervertebral Disc Herniation

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Abstract: ***Lumbar disc herniation (LDH) is a common spinal disorder that involves rupture of the annulus fibrosus. We conducted a case - control study to investigate various risk factors for LDH in a sample of Iraqi patients aiming to identify better preventive measures for the condition; it included a total of 100 consecutive Iraqi patients who had symptoms and signs of LDH, confirmed by MRI. Other apparently age & sex - matched 100 healthy individuals were recruited to represent control group. Findings revealed: demographic factors associated with increase incidence of LDH include low educational level, high BMI, presence of family history of LDH, low physical activity and using of soft bed. As for work characteristics, manual working, long duration of work, working in bending or twisting posture, lifting heavy weights and the presence of occupational workload are risk factors for LDH. Engaging in hard work, working under time pressure, or under life stressors over a prolonged period of 1 to 10 years can contribute to the development of psychological factors that may predispose individuals to LDH. The presence of comorbidities especially hypertension and history of back trauma significantly contribute in commencing LDH.***

Keywords: Risk Factors, Lumbar Disc Herniation, Case control study, Preventive measures

1. Introduction

Definition

While the terms disc herniation, disc protrusion, and disc bulge are used interchangeably in the literature, according to the combined task forces of the North American Spine Society, the American Society of Spine Radiology, and the American Society of Neuroradiology, these pathologies are not the same; they define a disc herniation as "localized or focal displacement of disc material beyond the limits of the intervertebral disc space. " This distinction is critical because it establishes that diffuse annular expansion extending beyond the disc space (a disc bulge) is not a disc herniation, but rather a form of disc degeneration. A true herniated disc is a focal pathology that affects less than 25% of the intervertebral disc. Herniated discs can be categorized as protrusions, extrusions, or sequestrations. Protrusions are wide - based herniations in which the diameter at the base of the herniation is wider than the diameter of the herniation in the canal. Extrusions have a narrow base, with a large herniation in the canal, and sequestrations are herniations in which there is no continuity between the herniation and the remaining intervertebral disc [1].

Epidemiology

Approximately 403 million people (5.5% of the worldwide population) are estimated to have symptomatic disc degeneration, it was the first serious attempt at defining treatment for most common spine conditions. Compared to patients with spinal stenosis and spondylolisthesis, lumber disc herniation (LDH) patients were significantly younger (mean age 41 years old) and had higher baseline pain ratings, with significant disability and associated healthcare utilization [2], sixty to ninety percent of patients with LHD respond to non - operative treatment; of those who undergo surgery, the risk of LDH recurrence is 9.1%, with 38% recurring within one year of index surgery [3].

Risk factors for Lumber Disc Herniation

Genetic Factors

Many genes are believed to play a part in the processes associated with disc herniation [4].

Sex

Men have a higher risk of developing LDH with sciatica than women [5, 6].

Trauma

Some studies have reported incidents of disc herniation following spinal trauma. However, most disc herniation's are located in the cervical spine, and traumatic lumbar disc herniation is still a rare occurrence [10].

Joint Hypermobility Syndrome

We know that excessive spinal joint laxity under mechanical loading in hypermobility syndrome can lead to torn AF because of abnormal annular collagen alignment in the lumbar spinal discs [11].

Occupation

Heavy physical workload and occupations requiring harder effort are associated with increased occurrence of LDH. Ahsan et al. performed a study in which 400 participants took part (200 in the research sample and 200 in the controls sample). The results showed that the physical workload had the most significant influence. Other factors that affected the appearance of disc herniation were hard work, a working period >8 h, and stress at work [12]. Another study (comprising 267 cases with acute LDH and 197 control subjects) confirmed this statement; the study showed that extreme forward bending, cumulative exposure to the lifting of weights and carrying are associated with LDH [13]. A Dutch study found some indication of a positive association between working ≥10 years in occupations with high

physical workload and LDH [14], while another study found a positive association in women, but no association in men [15]

Obesity
Obesity (particularly the distribution of adiposity in the trunk of the body) is connected with biomechanical changes that cause a range of spinal diseases like disc degeneration, hypertrophy of the spinal ligaments, osteoarthritis, disc herniation, and spinal stenosis [16, 17].

Smoking
Smoking is a risk factor for disc herniation. This was confirmed by a previous study consisting of patients with LDH. The controls group consisted of people without this pathology. The results showed that smoking is an independent risk factor, accelerates disc degeneration, and promotes the development of LDH.

Aging
The process of disc aging is affected by many risk factors, such as genetic inheritance, obesity, nutrition, excessive mechanical loading, trauma, smoking, and inflammation, as well as catabolic cytokines and proteases. Compelling evidence has shown that the occurrence of disc herniation increases with age.

Past Medical History
Comorbidities such as diabetes (DM), hypertension (HTN), and hyperlipidemia, have also been reported as possible risk factors for LDH. While the mechanism by which these comorbidities increase the rate of LDH has yet to be definitively proven, authors have speculated that these comorbidities may either lead to a decrease in the microcirculation to the intervertebral discs or an alteration in the cytokine expression. Either of these mechanisms could then lead to annular degeneration and an increased risk of LDH [21].

Non - occupational lifting, bending, and other activities
Preliminary evidence suggests that out - of - job lifting with the knees straight and back bent where starting and ending lifts at the waist may be positively associated with an increased incidence of LDH with radiculopathy [22].

Time pressure, job control, and other psychosocial factors at work
Studies indicate a link between work under time urgency and hard work and the risk of LDH with radiculopathy, However other study did not confirm that [14].

Diagnosis
The patient often presents with acute sharp or 'electrical - type' low back pain after a lifting and bending incident with or without leg pain down one side (typically on the side of the herniation, which abuts or comes into contact with the nerve root) which can be worse than the low back pain. Any prolonged static positions (sitting or standing) or increasing the intra - abdominal pressure (a sneeze, a cough or laughing), and bending forward will usually increase the symptoms. They may walk with an altered or antalgic gait and are often sensitive to direct percussion at the level of the involved disc [24].

Essential diagnostic tests in patients with a suspected LDH are the evaluation of muscle strength, sensory disturbance, sphincter dysfunction. Visible muscle atrophy may be present if the disc herniation is more chronic, longstanding, and has been there for a while [25]. As well as positive straight leg raise test SLRT (reproduction of same - sided leg pain with the raising of the straight leg with the patient supine), and crossed leg raise test (reproduction of contralateral leg pain with the raising of the straight leg during patient lying in supine position) [26]. There is evidence that sensory and motor testing aids in the diagnosis of LDH: in a study of 52 consecutive patients, the positive predictive value (PPV) of foot dorsiflexion weakness was 69% for a L4 - 5 herniated disk, while the negative predictive value (NPV) was 47% [27].

MRI is recommended if symptoms persist for more than 6 weeks (even without a neurologic deficit); it should be performed earlier if neurologic deficits are present. MRI is the gold standard for imaging to confirm suspected LDH, with reported diagnostic accuracy of up to 97% and high inter - observer reliability [6]. However, diagnostic accuracy values for MRI vary in the literature. A literature review by Wassenaar et al. analyzed 8 MRI studies; find an estimated pooled sensitivity of 75% and specificity of 77% for LDH diagnosis [28].

Aim of study
This study will attempt to search for variety of possible risk factors in a sample of Iraqi patients with lumber disc herniation in order to provide better preventive measures for them.

Patients and methods

Study design and settings
This case - control study was conducted at the Rheumatology Unit of Baghdad Teaching Hospital during the period between February 2024 and September 2024. The study was approved by the Iraqi Council for Medical Specializations.

Sample selection
A total of 100 consecutive patients attending the rheumatology unit at Baghdad Teaching Hospital who had symptoms and signs of LDH were sent for MRI examination and then enrolled in this study after fulfilling inclusion and exclusion criteria. Other age - and sex - matched 100 apparently healthy subjects were recruited from the patient's relatives and hospital staff who had no (history of low back pain at present or more than a month ever, sciatic nerve pain, or neurogenic claudication) were selected to represent the controls group.

Inclusion Criteria
Patients who were more than 18 years old and were confirmed to have LDH based on clinical features and MRI examination.

Exclusion Criteria
1) Patients with lumbar spondylolisthesis or lumbar spinal stenosis caused by factors such as hypertrophy of ligamentum flavum.

2) Patients with long - term low back discomfort and no clear LDH diagnosis
3) Patients with a history of lumbar surgery.
4) Those with incomplete investigation data.
5) Pregnant women.
6) Patients with a history of inflammatory back pain.
7) Patients with other serious systemic diseases like stroke, serious infection, or psychosis.

Ethical Considerations

A written consent from each participant was obtained prior to data collection after explaining for them the aim of the study. The study protocol was approved after review and official permission was obtained from the Iraqi Board for medical specializations according to document number: 642 in 31/1/2024

Data collection and entry

Data were collected from patients and controls using (performed questionnaire, Clinical examination and MRI finding), and it is divided into six main profiles:

- Demographic characteristics of the study population including age, sex, residency, smoking habit and severity (pack/year), educational level, marital status, bed characteristics, and BMI which was calculated using the equation (BMI=weight / height^2) according to World Health Organization (WHO) [29], Family history of LDH (including first - degree relative diagnosed by Rheumatologist and/or MRI), and physical activity according to WHO [30].
- Assessment for presence of comorbidities, previous surgery, and history of back trauma.
- Working characteristics including occupation nature, the number of expending hours in work, frequency of bending or lifting heavy weight in work (two variables extracted from physical workload questionnaire) [31], psycho - social factors of work environment which include 6 subjects (monotonous, boring, time urgency, responsibility, life pressure, hard - working) each subject was divided to score from 1 to 5 then calculating the cumulative number of years of score 4 or 5 to assess the social and psychological pressure of work environment, an occupational workload which includes light work, medium strenuous work, and heavy work.
- Reproductive characteristics of the included women including number of children, mode of delivery, and history of abortions.
- Clinical assessment of patients included duration of back pain, presence of aggravating factors like (prolonged sitting, coughing, and sneezing), presence of radiculopathy, and the result of clinical examination which included (sensory, motor, and tendon reflexes), and provocative tests which included (SLRT, cross leg raise test, femoral stretching test), and screening technique for joint mobility using Beighton score.
- Magnetic Resonance Imaging (MRI) findings for patients after evaluation by an expert Radiologist, then correlated with clinical data.

Statistical analysis

The quantitative data which was expressed as mean ± standard deviation (SD), median, and interquartile range (IQR). Binomial data were presented as frequency percentages. Comparison between quantitative was performed by the parametric Student t - test, while the comparison between binomial data was done by the Chi - square test. All data were analyzed with SPSS for Windows, v.25.0; IBM Corp, Armonk, New York, USA. P - value < 0.05 was considered significant.

2. Results

Demographic Characteristics of Patients and Controls.

Five demographic factors are significantly associated with LDH. As for educational level, in particular, a bachelor's degree and above was significantly less common in patients than controls (11% vs.24%). Similarly, hard bed and physical activity were significantly less frequent among patients (52% and 14%, respectively) than controls (67% and 27%, respectively). In contrast, family history of LDH was more common among patients than controls (36 % and 22%, respectively). Finally, the mean BMI of patients was significantly higher (31.54±5.85 kg/m2) than that of controls (27.82±4.11 kg/m2) (Table 1).

Table 1: Demographic Characteristics of Patients and Controls.

Variables	Patients (n=100)	Controls (n=100)	p - value
Age, years			
Mean±SD	41.98±10.88	42.49±11.32	0.746
Range	24 - 67	22 - 71	
Sex			
Male	44 (44%)	44 (44%)	1
Female	56 (56%)	56 (56%)	
Residency			
Urban	91 (91%)	89 (89%)	0.637
Rural	9 (9%)	11 (11%)	
Smoking			
Never	77 (77%)	80 (80%)	0.687
Current	19 (19%)	18 (18%)	
Ex - smoker	4 (4%)	2 (2%)	
Pack/year			
Median	12	14.5	0.312
IQR	8.7	10.2	
Educational level			
Illiterate	7 (7%)	6 (6%)	**0.019**
Primary	51 (51%)	38 (38%)	
Secondary	27 (27%)	20 (20%)	
Institute	4 (4%)	12 (12%)	
Bachelor and above	11 (11%)	24 (24%)	
Marital status			
Single	11 (11%)	5 (5%)	0.09
Married	83 (83%)	93 (93%)	
Widow/divorce	6 (6%)	2 (3%)	
Bed characteristics			
Soft	48 (48%)	33 (33%)	**0.031**
Hard	52 (52%)	67 (67%)	
BMI			
Mean±SD	31.54±5.85	27.82±4.11	**<0.001**
Range	20 - 49	19 - 39	
Family history			
No	64 (64%)	78 (78%)	**0.029**
Yes	36 (36%)	22 (22%)	
Physical activity			
No	86 (86%)	73 (73%)	**0.023**
Yes	14 (14%)	27 (27%)	

SD: standard deviation, IQR: interquartile range, N: numbers, P - value: probability value (<0.05) significant, BMI: body mass index, % percent

Working Characteristics of Patients and Controls.
All included working characteristics were significantly associated with LDH. Non - manual work was encountered in 20% and 40% of patients and controls, respectively with a significant difference. The median duration of working per day was 8.0 hr among patients and 6.0 hrs among controls with a significant difference. Always bending and always lifting heavy weights during work were more frequent in patients (47 and 30%, respectively) than in control (23% and 7%, respectively) with significant differences. Finally, 44% of the patients had a heavy occupational workload compared with 5% of the controls with a highly significant difference (Table 2).

Table 2: Working Characteristics of Patients and Controls

Variables	Patients (n=100)	Controls (n=100)	p – value
Occupation nature			
Manual	77 (77%)	48 (48%)	**<0.001**
Non - manual	20 (20%)	40 (40%)	
Mixed	3 (3%)	12 (12%)	
Duration of working hours			
Median	8	6	**<0.001**
IQR	5.34	4.11	
Working in bending or twisting posture			
No	17 (17%)	41 (41%)	**<0.001**
Sometimes	19 (19%)	21 (21%)	
Often	17 (17%)	15 (15%)	
Always	47 (47%)	23 (23%)	
Lifting heavy weight in work (25KG)			
No	46 (46%)	57 (57%)	**<0.001**
Sometimes	15 (15%)	22 (22%)	
Often	9 (9%)	14 (14%)	
Always	30 (30%)	7 (7%)	
Occupational workload			
Light	19 (19%)	52 (52%)	**<0.001**
Medium	37 (37%)	43 (43%)	
Heavy	44 (44%)	5 (5%)	

IQR: interquartile range, N: numbers, KG: kilogram, P - value: probability value (<0.05) significant, % percent.

Psycho - Social Factors at Work for Patients and Controls.
The study found significant differences in psychosocial work factors between patients with LDH and control group. LDH patients often faced stressful work conditions for 1 to 10 years. Notably, 11% felt a sense of time urgency, while 29% dealt with considerable life pressure, and 18% experienced hard work conditions. In contrast, only 2% of the controls group reported time urgency, 15% faced life pressure, and 6% encountered hard work conditions. Other psycho - social factors are comparable between the two groups with no significant differences (Table 3).

Table 3: Psycho - Social Factors at Work for Patients and Controls

Variables	Patients (n=100)	Controls (n=100)	p - value
Number of working years classified as monotonous (4 or 5)			
No	71 (71%)	71 (71%)	0.183
1 - 10	19 (19%)	12 (12%)	
>10	10 (10%)	17 (17%)	
Number of working years classified as boring (4 or 5)			
No	75 (75%)	85 (85%)	0.139
1 - 10	19 (19%)	11 (11%)	
>10	6 (6%)	4 (4%)	
Number of working years under time urgency (classified as 4 or 5)			
No	88 (88%)	98 (98%)	**0.021**
1 - 10	11 (11%)	2 (2%)	
>10	1 (1%)	0 (0%)	
Number of working years with too much responsibility (classified as 4 or 5)			
No	35 (35%)	43 (43%)	0.176
1 - 10	36 (36%)	24 (24%)	
>10	29 (29%)	33 (33%)	
Number of working years under life pressure (classified as 4 or 5)			
No	53 (53%)	71 (71%)	**0.023**
1 - 10	29 (29%)	15 (15%)	
>10	18 (18%)	14 (14%)	
Number of hard working years (classified as 4 or 5)			
No	69 (69%)	84 (84%)	**0.02**
1 - 10	18 (18%)	6 (6%)	
>10	13 (13%)	10 (10%)	

N: numbers, P - value: probability value (<0.05) significant, % percent

Clinical Characteristics of Patients and Controls.
About one - fourth of the patients (23%) had HTN compared to (9%) of controls with a significant difference. Furthermore, history of trauma was reported in (18% and 8%) of patients and controls, respectively with significant differences (Table 4).

Table 4: Clinical Characteristics of Patients and Controls.

Characteristics	Patients (n=100)	Controls (n=100)	p - value
Comorbidities			
None	56 (56%)	82 (82%)	
HTN	23 (23%)	9 (9%)	**0.001**
DM	10 (10%)	7 (7%)	

DM+HTN	8 (8%)	1 (1%)	
Others	3 (3%)	0 (0%)	
Previous surgery			
No	49 (49%)	58 (58%)	0.202
Yes	51 (51%)	42 (42%)	
History of back trauma			
No	82 (82%)	92 (92%)	
Yes	18 (18%)	8 (8%)	**0.036**

HTN: hypertension, DM: diabetes mellitus, N: numbers, P - value: probability value (<0.05) significant, % percent.

Reproductive Characteristics of the Included Women for Patients and Controls.

Although women with LDH have more common >5 children, cesarean section (CS), and ≥2 abortion (32.14%, 28.82%, and 16.07%, respectively) than controls (17.86%, 16.34%, and 14.27%, respectively), the differences were insignificant (Table 5).

Table 5: Reproductive characteristics of the Included Women for Patients and Controls.

Characteristics	Patients (n=56)	Controls (n=56)	p - value
Number of children			
None	5 (8.93%)	4 (7.14%)	0.91
1 - 5	33 (58.93%)	42 (75%)	
>5	18 (32.14%)	10 (17.86%)	
Mode of delivery, %			
NVD	71.18%	83.64%	0.171
CS	28.82%	16.34%	
Abortion			
0	28 (50%)	37 (66.07%)	
1	19 (33.93%)	11 (19.64%)	0.211
≥2	9 (16.07%)	8 (14.27%)	

NVD: normal vaginal delivery, CS: cesarean section, N: numbers, P - value: probability value (<0.05) significant, % percent

The Beighton score for joint mobility for patients and controls.

The vast majority of individuals in patient and control groups (85% and 84%, respectively) had zero scores. On the other hand, 11% and 4% of the patients group had 2 and ≥4 scores respectively, compared to 10% and 6% of the controls group who had the same scores respectively. there were no significant differences between patients and controls in the Beighton scores for joint mobility

3. Discussion

Given the prevalence of LDH in daily medical practice, this study aimed to comprehensively assess a wide range of risk factors in diverse populations and both sexes. By identifying modifiable risk factors, the goal is to implement preventive measures and improve overall health quality. This study indicated that several factors could increase the risk of LDH, including physically demanding jobs, long work hours, psychosocial stressors, HTN, a family history of LDH, high BMI, and a history of back trauma. However, the study also found that hard beds, physical activity, and higher education levels were associated with a low risk of LDH.

According to the result of the present study, the lower educational level of patients was significantly associated with LDH. This was in harmony with a study conducted by Guo et al. [32] who found that education level (OR= 0.573, 95% CI: 0.502–0.654) had a protective effect on intervertebral disc degeneration. Another study conducted by Liu et al. [33] from China showed that low educational attainment was a causal risk factor for intervertebral disc degeneration. People with low education levels are more likely to experience musculoskeletal disorders because they usually live in an environment with higher exposure to risk factors like low physical activity, nutritional deficits, and physically demanding jobs [34].

The current study demonstrated that patients with LDH use a hard bed (firm mattress) less frequently than the controls with significant differences. Two Chinese case - control studies investigating the risk factors of LDH revealed a correlation between sleeping on harder surfaces and a reduced likelihood of developing LDH [35, 36]. A medium - firm or firm mattress can be beneficial for individuals experiencing back pain, by providing adequate support and maintaining the spine's natural alignment. In contrast, overly soft mattresses may allow the spine to curve abnormally, potentially exacerbating back pain [37].

The present study documents that high BMI is associated with more LDH. Current literature also demonstrated a strong association between obesity and LDH. An individual with a higher BMI is twofold more prone to low back pain (LBP) as compared with a normal BMI [38, 39]. Individuals with higher BMI experience increased mechanical stress on their spines and greater compressive forces during physical activities. Obesity also predisposes individuals to chronic systemic inflammation and injuries, leading to elevated levels of systemic proinflammatory cytokines like IL - 6 and TNF - α. This inflammatory state can contribute to increased pain and discomfort [40].

Family history of LDH was more common among patients when compared to the controls in the current study, suggesting that genetic factors may play a significant role. This was in line with other studies. A study of 63 patients under the age of 21 with confirmed LDH found 32% to have a positive family history. In contrast, the prevalence among the control group was only 7%, i. e., approximately one - fifth of the patients group with a positive family history [41]. A case - control study of risk factors for LDH was performed on a population from Croatia and found that hereditary factors are strongly associated with disc herniation [42]

Genetic factors appear to play the main role in the pathology of diseases associated with disc degeneration, and they may be influenced by environmental factors such as spine injury, occupation, smoking, or aging [43]. Hereditary factors can influence disc degeneration through various mechanisms, including altering spinal structures and affecting the synthesis and breakdown of disc components [44].

The current study revealed that patients with LDH exhibited lower levels of physical activity. This aligns with the findings of Kara et al. [45], who identified physical inactivity as a risk factor for reoperation in patients undergoing LDH surgery. Additionally, Sun et al. [46] from China have demonstrated a protective association between

physical exercise and a reduced risk of the disease. However, a case - control study that investigated the potential risk factors for elevated LDH levels in adolescents and young adults showed no significant difference in exercise duration between the study group and the control group [47]. These discrepancies in studies can be attributed to variations in exercise protocols, participant characteristics, study methodologies, and outcome measures.

Patients with LBP often have reduced slow muscle fibers in the paravertebral muscles, leading to weakened trunk posture and body position maintenance and it is easy to have lumbar back muscle fatigue [48]. Prolonged muscle fatigue can contribute to dysfunction of the tissue structure that maintains lumbar spine stability, potentially leading to or aggravating LDH [49]. Exercise, however, can positively impact clinical outcomes by reducing pain [50], improving lumbar spine motion [51], and enhancing muscle coordination, flexibility, and balance [52].

The current study showed that manual work were more frequent in patients than in controls. A study conducted by Satific et al. [42] on Croatian populations found that individuals engaged in physically demanding manual labor, such as agriculture, construction, mechanics, or fishing, had a significantly higher risk of developing LDH that required surgical intervention. Additionally, numerous jobs necessitate the sudden or frequent lifting of heavy weights. These activities have been identified as prevalent risk factors for LDH, as highlighted in an Iraqi study [53].

In addition, the current study revealed that patients with LDH have heavier work, always lifting heavy weights, working in bending and twisting postures, and working for longer periods than their control counterparts in this study. This aligns with numerous studies that have established a strong correlation between physical workload LDH. For instance, a retrospective case - control study from Bangladesh found that individuals with cumulative exposure to heavy physical labor are more prone to LDH [12]. Two other studies have linked extreme physical postures, such as forward bending, the lifting of heavy weights, and hard work to increased risk of LDH [54]. Additionally, a local study from Northern Iraq revealed a significant association between extended working hours and LDH [57]

This was attributed to the combined effects of their weight training program, excessive flexion, and extension of the spine under repeated confrontation [45]. Long - term flexion, extension, or rotation can result in the rupture of the AF [58]. Sitting or standing with a forward or backward bend can strain the spine, leading to cumulative damage to the intervertebral discs. Compared to proper posture, the collagen fibers in the spine are subjected to greater stress when maintaining a slouched or lazy posture, increasing the risk of intervertebral disc degeneration [55].

This study provides evidence that exposure to stressful work conditions, including time urgency, life pressure, and hard work is associated with adverse health outcomes in patients with LDH compared to the control group (P= 0.021, 0.023, and 0.020, respectively). These findings underscore the importance of addressing workplace stress to improve patient well - being. In a case - control study conducted in China involving 4180 participants, an investigation into social and psychological factors in the workplace environment revealed that only time urgency and hard work were statistically significant ($P < 0.05$ and $P < 0.01$, respectively) [46].

These findings align with our study. However, unlike our study, no significant difference was observed in working under life pressure. Furthermore, other research supports this connection, highlighting that men experiencing high time pressure at work are more likely to develop an LDH with radiculopathy compared to those without time pressure, while other psychosocial factors appear to have no significant impact [14]

Several factors contribute to the varying findings across studies, including study design, methods, population characteristics, genetic factors, lifestyle choices, and underlying medical conditions that may play a role in how psychosocial factors impact LDH. Seidler et al. [56] hypothesized that mental and psychological factors may contribute to vascular disease, leading to disorders of disc vascularity and subsequent disc disease. Additionally, they suggested that psychological factors could influence nerve root biochemical processes, playing a role in LDH, Furthermore, negative emotions and stress can amplify pain sensitivity, leading to more frequent medical consultations and surgical interventions

Our study revealed a significant association between hypertension and lumbar disc herniation, with 23% of LDH patients being hypertensive compared to 9% of controls. This finding aligns with previous research work such as the Hong Kong Disc Degeneration. Cardiovascular Cohort, which demonstrated a link between disc degeneration severity and hypertension [58]. Additionally, studies have suggested a connection between LBP and cardiovascular disease, especially in elderly women [59].

Cardiovascular risk factors like hypertension, diabetes, and smoking have been implicated in the development of LDH, with hypertension increasing the risk by 25%, diabetes by 52%, and smoking by 40%. These factors may contribute to LDH by causing the occlusion of small blood vessels in the spine [8]. While our study did not find significant associations between diabetes or smoking and LDH, this discrepancy could be due to various factors, including study methodologies, diagnostic criteria, and the interplay between cardiovascular factors and other influencing factors.

The current study documents that history of trauma to the back was significantly associated with LDH. This finding was proved by others. In a Chinese study on 106 patients with LDH, history of low back trauma was significantly present ($p = 0.002$) [49]. A retrospective study by Shimony et al. [60] conducted on 52 adolescent patients revealed that trauma and BMI were risk factors for LDH. Furthermore, Suk et al. [61] reported traumatic events as a risk factor for recurrent LDH. Acute herniation occurs when the NP, the soft, inner part of a disc, is suddenly pushed through a tear in the AF, This can happen due to trauma or injury, causing immediate pain and discomfort [13].

The present study showed no difference in the number of pregnancies and risk of LDH. Many studies were in harmony with our findings. LBP is a frequent symptom during pregnancy that is reported in up to 50% of women, most typically between the 5th and 7th month of pregnancy [62]. A very recent systematic review of 41 studies by Chan et al. [63] from Australia found that while back pain is common during pregnancy, yet it does not inherently increase the risk of LDH. Moreover, symptomatic LDH is far less common, approximately one case per 10, 000 pregnant females [64].

Furthermore, no difference was noted between patients with LDH and controls regarding the mode of delivery. It was reported that the cesarean section seems to be preferred compared to vaginal delivery to avoid worsening symptoms and progression to the cauda equina syndrome but not the production of LDH [65].

4. Conclusions

1) Demographic factors associated with increase the incidence of LDH include low educational level, high BMI, presence of family history of LDH, low physical activity, and using of soft bed.
2) As for work characteristics, manual working, long duration of work, working in bending or twisting posture, lifting heavy weight and the presence of occupational workload are risk factors for LDH.
3) Engaging in hard work, working under time pressure, or under life stressors over a prolonged period of 1 to 10 years can contribute to the development of psychological factors that may predispose individuals to LDH.
4) The presence of comorbidities (especially HTN), and history of back trauma significantly contribute in commencing LDH.

Conflict of interest: the authors declare no conflict of interest

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