

# Diabetes Mellitus: A Risk Factor for the Development of Lumbar Disc Herniation

Ali Falah Zbala<sup>1</sup>, Mohammed A. Ameer Muhieldeen<sup>2</sup> and Haider Omran Hayat Ali<sup>3</sup>

## ABSTRACT

**Objective:** To investigate the relationship between diabetes and lumbar disc herniation and also the potential of long-term complications that may develop in these patients.

**Study Design:** A retrospective observational study

**Place and Duration of Study:** This study was conducted at the Al-Kindi Teaching Hospital Baghdad, Iraq from 1<sup>st</sup> November 2024 to 30<sup>th</sup> April 2025.

**Methods:** A total 150 patients with lumbar disc patients who also had diabetes were enrolled.

**Results:** Statistically significant relationship between type 2 diabetes mellitus and the presence of multilevel disc herniation, as well as increased rates of neurological complications such as foot drops and saddle numbness. Patients with poorly controlled diabetes and receiving insulin therapy were particularly prone to multilevel spinal injury and higher rates of surgical intervention. Most lumbar disc herniation cases occurred in weight-bearing lumbar areas, especially L3-L5, and were associated with higher pain scores and increased dependence on daily life in diabetics.

**Conclusion:** The Iraqi patients with lumbar disc herniation had high levels of glucose in their blood, and this is a clear indication of the impact of glucose on LDH, especially type 2 diabetes, where they were found to be the most affected or exposed to multilevel disc disease with more severe neurological consequences such as foot drop and saddle numbness.

**Key Words:** Lumbar disc herniation (LDH), Diabetes mellitus, Obesity, Lumbar disc

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## INTRODUCTION

Lumbar disc herniation is a common disease, especially in the elderly, and is a common cause of low back pain in addition to other neurological diseases.<sup>1</sup> 70% of people have a lifetime related to this type of disease that they will develop at some point in their lives.<sup>2</sup> Most important symptom of intervertebral disc degeneration is low back pain and may lead to a herniated disc.<sup>3</sup> It is possible to know that the disc is a very complex structure and the reasons that lead to the acceleration of disc degeneration include several factors, including age,

genetic factors, mechanical stress, as well as other lifestyles such as smoking and weight gain.<sup>2</sup>

People with chronic type 2 diabetes are more likely to develop lumbar disc herniation due to its potential role as a systemic factor in intervertebral disc degeneration through several factors, as high sugar can make the metabolism of collagen less effective, which is an essential substance in the structure of the disc, and therefore this structure will weaken by increasing the level of sugar, and it can also cause inflammation in the disc tissues, and as a result, triple will occur in the tiny blood vessels that supply the disc with nutrients.<sup>4</sup> It is important to understand how diabetes, which is one of the most common diseases worldwide, can affect the pathophysiology of lumbar disc herniation and this will help us develop prevention and treatment plans. It is also possible that the genetic factor plays an important role as one of the causes of disc degeneration and this topic should receive great attention through several studies and thus their accumulation leads to a theory of adding the genetic factor as one of the causes of this disease and based on previous studies.<sup>5</sup>

People with a genetic causative factor may be more likely than the general population to develop disc degeneration.<sup>6</sup> It also looked at how physical stress at work affects disc degeneration, as there is also research that has found a link between manual labor and an increased risk of disc degeneration, and therefore unstable lifestyles may lead to disc herniation due to

<sup>1</sup>. Department of Internal Medicine, Alkindy College of Medicine, Baghdad University, Iraq

<sup>2</sup>. College of Medicine, Department of Internal Medicine, Jabir Ibn Hayyan University for Medical & Pharmaceutical Sciences, Najaf Iraq

<sup>3</sup>. College of Medicine, Department of Surgery, Alkindy College of Medicine, Baghdad University, Iraq

Correspondence: Ali Falah Zbala, Department of Internal Medicine, Alkindy College of Medicine, Baghdad University, Iraq.

Contact No: +9647832534807

Email: ali.f@kmc.uobaghdad.edu.iq

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static axis overload, and conversely, other studies have shown that there is a weak or non-existent relationship between physical stress and disc degeneration.<sup>7</sup> For obesity, overweight, and metabolic syndrome, these conditions were found to be systemic conditions that promote arch degeneration by intensifying inflammation and altering disc metabolism.<sup>8</sup> Other changes related to age and environmental factors as well as excessive exercise may be a factor that negatively affects disc balance.<sup>9</sup> Inflammation is associated with degenerative disc disease; however, its role in disc pain and hernia regression is still controversial.<sup>10</sup>

## METHODS

This study was conducted in Baghdad, Iraq, Al-Kindi Teaching Hospital from 1<sup>st</sup> November 2024 to 30<sup>th</sup> April 2025 vide letter No. 4545/QM/Approval/SJKDH379 dated 9<sup>th</sup> March 2024. This retrospective observational study to elucidate the concept of the effect of hyperglycemia on patients with lumbar disc herniation as well as to elucidate DM effect mechanism on LDH and its prevalence among individuals with Lumbar disc herniation and to help identify possible clinical associations. The study focused on the validity of diagnoses using clinical and radiological evaluations of 150 patients who attended the rheumatology outpatient clinic. Where the inclusion criteria ensure that the study focused on adult patients with LDH confirmed disease and complete medical records. The age of patients diagnosed with LDH patients aged from 18 to 100 years through clinical assessment. The data was entered and analyzed through SPSS-25.

## RESULTS

The most frequent anatomical levels were 20.67% L3-L5 followed by 16.67% L2-L5 and 16% L3-L4 other recurrent anatomical levels were L4-L5 with 11.33% and L1-L3 4%, it was observed that there was high prevalence of L4-S1 17.33% levels but that L5-S1 5.33% with low levels. 2% for L3-S1 and 6.67% L2-L4, 23 patients (15.33%) had foot drop, 17 patients (11.33%) developed incontinence, and 16 patients (10.67%) developed saddle anaesthesia as a result of LDH problems. Thirty-three patients (22%), who have a history of Disc surgery, there must be a subgroup of patients living with recurrent or severe spinal diseases. the level of L3-L5 was determined as the most frequent area (20.67%) and this may be mainly due to its poor biomechanics and ability to bear weight in addition to the ability to increase mobility, L2-L5 and L4-S1 hernia was also remained in 16.67%, 17.33 respectively of the participating patients, which confirms the high prevalence of hernia in the lumbar disc while 16% L3-L4 and L4-L5 saw 11.33%. These levels occur in classical disc degeneration syndromes and nerve compression and are often associated with radiculopathy where the most rarely affected levels were found to be

L1-L3 (4%) and L5-S1 (5.33%), 6.67% agreed with L2-L4 and the lowest observed level (2%) L3-S1 (Table 1). A slight inverse association was suggested by the slightly lower chance of single-level herniation presentation in T2DM patients ( $\phi=-0.25$ ). Through the results of a moderate positive association between patients with type 2 diabetes and multilevel disc herniation, these patients are more likely to have a multi-level Disc injury so that there is a strong association in the three-level group ( $\phi=0.36$ ) and also the results showed that the two-level discs herniation is slightly positive, indicating a weak but positive relationship between type 2 diabetes and bi level disc disease ( $\phi=0.18$ ). T2dM patients show weak positive impact of high glucose levels on LDH complications represented as Foot drop, a common consequence of nerve involvement ( $\phi=0.19$ ). Thus, T2DM patients with multi-level disease may be at a slightly higher risk of foot drop compared to those without diabetes. Additionally, patients with uncontrolled high glucose levels exhibited a modest correlation with an elevated necessity for surgical intervention ( $\phi=0.21$ ), indicating that patients with diabetes and greater disc involvement may necessitate more surgical procedures (Tables 2-3, Fig. 1).

Patients with multi-level disease had a higher prevalence of type 2 diabetes mellitus (T2DM) (47 in three-level, 40 in single-level, and 26 in two-level). Diabetes and LDH were statistically significantly correlated ( $p=0.026$ ), and more severe herniation was strongly correlated with type 2 diabetes. In terms of pharmacological management, most diabetic patients across all groups used oral hypoglycemic agents (OHAs); however, patients with multi-level herniation were significantly more likely to use insulin ( $p=0.002$ ). The two-level group consisted primarily of insulin-dependent patients (29 patients), indicating that patients with more severe spinal involvement may also be those with more advanced disease or poorly managed diabetes (Table 4).

Most common symptoms in patients with disc herniation are root pain or irradiation in 67 cases (44.67%) and SLR-positive in 92 patients (61.33%) We also find that 77 patients (51.33%) suffer from paraesthesia and 74 patients (49.33%) have FST positive while 52 patients (34.67%) have fall symptoms and 45 patients (30%) have a feeling of weakness For most people, we find the emergence of clinical results that support the high frequency of nerve wall irritation or compression of the vertebrae that causes paraesthesia or abnormal sensation such as tingling or numbness Table five shows that more than 50% of the population has involvement in sensory fibers. Other symptoms were segmental focal tenderness (FST), radiation (sharp, radiant pain along the skin), muscle weakness, walking and falling, associated with both gait instability and neuropathy and motor disorders (Table 5, Fig. 2).

**Table No. 1: Lumbar disc herniation (LDH) characteristics**

LDH	No.	%
L3-L4 L4-L5	31	20.67
L4-L5 L5-S1	26	17.33
L2-L3 L3-L4 L4-L5	25	16.67
L3-L4	24	16
L4-L5	17	11.33
L2-L3 L3-L4	10	6.67
L5-S1	8	5.33
L1-L2 L2-L3	6	4.0
L3-L4 L4-L5 L5-S1	3	2.0

**Table 2: Frequency of complications**

Variable	No.	%
LDH Complications		
Foot drop	23	15.33
Incontinence	17	11.33
Saddle anaesthesia	16	10.67
History of spinal surgery	33	22.0

**Table 3: Correlations of LDH levels according to DM disease**

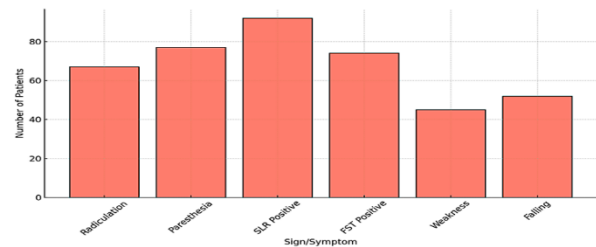
LDH Level	Correlation	Strength	Interpretation
Single-Level (L4-L5, L5-S1, etc.)	$\phi = -0.25$	Weak (-)	T2DM patients are slightly less likely to have single-level LDH.
Two-Level (e.g., L3-L4 & L4-L5)	$\phi = 0.18$	Weak (+)	Mild association with two-level involvement.
Three-Level (e.g., L2-L3, L3-L4, L4-L5)	$\phi = 0.36$	Moderate (+)	T2DM patients are more likely to have multi-level spinal involvement.
Foot Drop (Yes/No)	$\phi = 0.19$	Weak (+)	Slightly higher risk of foot drops in T2DM with multi-level LDH.
Surgical Intervention (Yes/No)	$\phi = 0.21$	Weak (+)	T2DM with multi-level LDH may require more surgical treatment.

**Table 4: Distribution of lumbar disc herniation (LDH) by diabetes mellitus type and treatment**

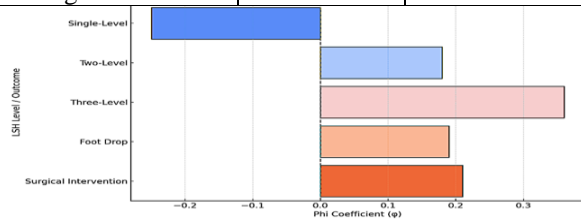
LDH in DM patients	Single Level	Three Levels	Two Levels	Chi <sup>2</sup>	df	p
DM type						
Non-DM	7	2	23	11.03	4	0.026
T1DM	2	0	3			
T2DM	40	26	47			
Drug						
No	7	2	23	16.48	4	0.002
OHA	24	19	21			
Insulin	18	7	29			

**Table No. 5: Signs and symptoms of LDH patients of the studied groups**

Signs & symptoms	No.	%
Radiculation	67	44.67
Paraesthesia	77	51.33
Straight leg raise	92	61.33
Femoral nerve stretch test	74	49.33
Weakness	45	30
Falling	52	34.67



**Figure No.. 2: Histogram of signs and symptoms in LDH patients**



**Figure No. 1: Correlations of LDH according to DM**

## DISCUSSION

Anatomically, the lumbar disc herniation in this Iraqi population predominantly involved multi-level segments, with L3-L4, L4-L5 (20.67%), L2-L3, L3-L4, L4-L5 (16.67%), and L4-L5, L5-S1 (17.33%) being the most frequent sites, while upper lumbar involvement L1-L2, L2-L3 was rare (4%). This multi-segmental involvement correlates with biomechanical principles describing the lumbar Disc's segmental load distribution; the middle to lower lumbar levels bears the greatest axial loads and demonstrate increased mobility

that predisposes these segments to disc degeneration and herniation. These findings are consistent with global imaging and pathological studies showing the L4-L5 and L5-S1 levels as the most common sites for lumbar disc herniation.<sup>11</sup> Although in our cohort L3-L5 had highest prevalence, possibly reflecting regional lifestyle or occupational factors. Regionally, similarly high rates of multi-level lumbar disc lesions have been reported. A study by Hmood<sup>12</sup>, assessing lumbar disc herniation in young and middle-aged patients in Erbil (Northern Iraq), documented that multi-level lumbar disc disease was commonly seen with predominant involvement of lower lumbar segments (L4-L5 and L5-S1), corroborating our anatomical distribution findings. In terms of clinical repercussions, 22% of patients in this study reported previous spinal surgery, indicating the chronic and recurrent nature of lumbar herniation in this cohort. This aligns with the clinical reality globally where lumbar disc herniation is a leading indication for disc surgery, especially when conservative treatments fail or neurological deficits progress.

In Iraqi tertiary care centres report similar rates of surgical intervention among lumbar disc patients, emphasizing surgical need in advanced cases.<sup>13</sup> The results substantiate a strong association between T2DM and more severe multi-level herniation in specific (L2-L3), (L3-L4) and (L4-L5), in concordance with large-scale epidemiological studies.<sup>14,15</sup> T2DM patients were significantly more likely to have multi-level herniation and related neurological complications such as foot drop and saddle anaesthesia. This is consistent with nationwide cohort studies demonstrating that individuals with DM have a more than twofold increased risk of developing lumbar disc disease.<sup>16</sup>

The mechanisms linking diabetes to lumbar Disc degeneration include chronic hyperglycemia-induced oxidative stress, systemic inflammation, impaired microcirculation, and disruption of extracellular matrix metabolism within the intervertebral disc.<sup>17,18</sup> Through previous studies, it has been shown that the deterioration of the disc matrix and the resulting programmed cell death in individuals with diabetes is consistent with the positive relationship shown in the results of this study between the duration and severity of diabetes and lumbar disc disease, thus these results confirm the importance of controlling blood sugar for the health of the disc.<sup>19</sup> The results also show that diabetic patients who use insulin are the most likely to develop multiple hernias.<sup>20</sup>

## CONCLUSION

The Iraqi patients with lumbar disc herniation had high levels of glucose in their blood, and this is a clear indication of the impact of glucose on LDH, especially

type 2 diabetes, where they were found to be the most affected or exposed to multilevel disc disease with more severe neurological consequences such as foot drop and saddle numbness. Most of the injuries occur in the weight-bearing parts of the lower back, especially L3-L5, and this is shown in the anatomical distribution of the lumbar that closely follows biomechanical principles. Diabetic patients with lumbar disc herniation showed suboptimal functional outcomes of higher pain scores, increased ADL dependence, and a higher incidence of surgical interventions that necessitated severe symptoms and heat resistance.

### Author's Contribution:

Concept & Design or acquisition of analysis or interpretation of data:	Ali Falah Zbala, Mohammed A. Ameer Muhieldeen,
Drafting or Revising Critically:	Haider Omran Hayat Ali
Final Approval of version:	All the above authors
Agreement to accountable for all aspects of work:	All the above authors

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