

RELATIONSHIP OF SCHMORL'S NODE AND LUMBAR DISC HERNIATIONS IN LUMBAR DISC DEGENERATIVE DISEASE PATIENTS

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ABSTRACT

Objective: To determine relationship of Schmorl's Nodes and lumbar disc herniations in patients with degenerative disc disease

Study Design: Cross-sectional study.

Place and Duration of Study: Department of Radiology Sughra Shafi Medical Complex Narowal from 16th January 2026 to 15th May 2026.

Methodology: The study was conducted after approval of the Ethical Review Board. A total of 95 individuals were enrolled. Once the informed consent of the participants had been obtained, their demographics as well as medical history were documented. All the participants had magnetic resonance imaging (MRI) conducted on them using the 0.35-Tesla Neosoft scanner. The procedure entailed the sagittal T2-weighted imaging of the lumbar region complemented with sagittal T1-weighted, STIR and axial T2-weighted imaging.

Results: Among the 49 individuals diagnosed with Schmorl's nodes, 40 (81.6%) individuals suffered from lumbar disc herniation whereas 9 (18.4%) individuals did not have disc herniation. Conversely, among the 46 individuals without Schmorl's nodes, 25 (54.3%) individuals suffered from lumbar disc herniation whereas 21 (45.7%) individuals did not have any disc herniation. Pearson's Chi-square test confirmed a statistically significant association between Schmorl's nodes and lumbar disc herniation ($\chi^2=8.175$, $df = 1$, $p = 0.004$).

Conclusion: The meaningful association between Schmorl's nodes and lumbar disc herniation: patients presenting with Schmorl's nodes showed a markedly higher rate of disc herniation compared to those without pointing toward a possible mechanistic or degenerative link between the two conditions.

KEYWORDS: Schmorl's node, Lumbar disc herniation, Lumbar disc degenerative disease

INTRODUCTION

Low back pain continues to be the greatest disability across the globe with serious impacts on health, economy, and society.¹⁻⁴ Among the numerous differentials of low back pain (LBP), the most prevalent etiology of LBP is the degeneration of the intervertebral discs, causing disc herniation and degenerative disc disease.⁵ Degenerative disc disease and lumbar disc herniation rank among the most frequently encountered causes of low back pain, with roughly 95% of herniations localized to the L4-L5 or L5-S1 levels.⁶ Acute muscle strain or ligament strain or intervertebral disc herniation is more common in younger patients whereas degenerative disc disease is seen in older patients.⁷

Herniation of the lumbar intervertebral disc represents the most frequent disorder of the lumbar region and the leading cause of lumbar radiculopathy and surgery among adults. This disease usually occurs with complaints of low back pain, followed by leg pain due to nerve root irritation and/or compression.¹ Schmorl's nodes (SNs) develop when nucleus pulposus material herniates through the vertebral endplate and into the body of the vertebra. While they can arise at any spinal level, SNs are most frequently observed in the lower thoracic and lumbar spine. Prior research has linked their presence to disc degeneration.⁸ Despite the prevalence of SNs in the spine, their importance clinically as a cause of LBP has not been defined.⁹ MRI scan is one of the modalities that are significant in diagnosing the intervertebral discs (IVDs). The changes in signal of the discs on T2 weighted images show age and degeneration for the identification of IVDs degeneration.⁹ The Schmorl's node (SN) is most easily detected in sagittal MRI scans and will have the same signal features as the disc beside it, usually with a ring of sclerosis surrounding it.¹⁰

However, the interaction between disc herniation and multilevel Schmorl's nodes (SN) vertebrae using lumbar spine MRI imaging remains unclear.¹¹ According to the study performed by Abbas et al⁸ 44.4% had at least one Schmorl node along the lumbar spine with predominance in L3-4 segment (10%). The presence of SN was significantly associated with development of DLSS ($P=0.038$). Disc herniation at the L4-5 segment was significantly associated with SN ($P=0.01$). Moreover, the intervertebral disc height at the level of affected segment was significantly decreased in comparison with healthy one ($P<0.05$). Even though there have been studies linking the two conditions, however, there is no concrete evidence on the clinical and radiological importance of Schmorl's

Nodes in the development of lumbar disc herniation, especially in the local population. The purpose of this study is to find out the association between Schmorl's Nodes and lumbar disc herniation so that it will make an important contribution to the local literature. It is hoped that through the identification of the association, those who are predisposed to developing lumbar disc herniation will be detected early on.

MATERIAL AND METHODS

This study was performed after approval by the College of Physicians and Surgeons Pakistan and Institutional Ethical Review Committee. Study was conducted from January 16, 2026 to May 15, 2026. Ninety-five subjects of either sex with age ranging between 17 and 80 years, having degenerative disc disease diagnosed based on MRI, were selected for the study. The patients who had a history of any previous spinal surgery, spinal trauma, spinal infection, spinal malignancy, or were pregnant at the time of recruitment were excluded. Non-probability consecutive sampling method was adopted to recruit the subjects.

Information regarding demographic data and pertinent medical history was obtained through the structured data collection form. Estimation of sample size was done using WinPEPI version 11.15. From an estimated prevalence of 44.4%, confidence interval of 95%, and precision of 10%, a minimum sample size of 95 was determined.

MRI scans were done by Neosoft 0.35 Tesla machine. The MRI technique used consisted of T2-weighted sagittal sequences of the lumbar spine. In addition, T1-weighted sagittal, STIR, and T2-weighted axial sequences were done. MRI revealed Schmorl's nodes and lumbar disc herniation.

All data entry and statistical analyses were carried out using IBM SPSS Statistics, Version 20. Continuous variables age, disease duration, and vertebral body height were summarized as mean $\pm$ standard deviation, while categorical variables gender, Schmorl's nodes, and lumbar disc herniation were presented as frequencies and percentages. The association between Schmorl's nodes and lumbar disc herniation was assessed using the Pearson chi-square test, with statistical significance defined as $p < 0.05$. To account for potential confounders, the sample was stratified by age, sex, and disease duration, and chi-square analysis was repeated within each stratum, again using a significance threshold of $p \leq 0.05$.

RESULTS

The demographics and clinical variables of the 95 patients included in this research study are presented in Table 1. The mean age of participants was 46.47 ± 14.40 years, the mean disease duration was 8.79 ± 10.89 months, and the mean vertebral body height was 23.85 ± 2.68 mm. There were 50 men (52.6%) and 45 women (47.4%) in the study population. In addition, there were Schmorl's nodes among 49 participants (51.6%) and not among 46 patients (48.4%). The lumbar disc herniation was observed among 65 participants (68.4%). Among the total 49 patients with Schmorl's nodes, 40 (81.6%) were having disc herniation in lumbar region while only 25 among the 46 patients (54.3%) did not have Schmorl's nodes. The above difference is indicative of the occurrence of disc herniation significantly more frequently among patients having Schmorl's nodes than those not having Schmorl's nodes (81.6% vs. 54.3%), which has been proved by Pearson's Chi-square test ($\chi^2 = 8.175$, $df = 1$, $p = 0.004$; Table 2).

After stratification for age, Schmorl's node and disc herniation showed an inverse relationship both in younger and in older people, with the former being associated with higher prevalence of disc herniation. However, this trend was seen to be especially significant for those individuals above 41 years old, as 90.0% of Schmorl's node cases had a disc herniation (Table 3). The gender stratified findings (Table 4) revealed a statistically non-significant finding in the male population ($\chi^2 = 3.571$, $df = 1$, $p = 0.059$). Nevertheless, considering the difference in the prevalence of disc herniation between males having Schmorl's nodes (84.0%) and without (60.0%), there appears to be an association that can be proven using future large samples. As for the female group, there was a statistically significant association ($\chi^2 = 4.865$, $df = 1$, $p = 0.027$), with those having Schmorl's nodes experiencing a higher incidence of disc herniation. Table 5 illustrates the breakdown of the association based on disease duration. Among the shorter duration cases of less than 12 months, the association between Schmorl's nodes and disc herniation was statistically significant ($\chi^2 = 4.594$, $df = 1$, $p = 0.032$) implying an increased risk of herniation among those with Schmorl's nodes during the early stage of the disease. Among the cases that were longer than 12 months, there was still an increased incidence of disc herniation among those with Schmorl's nodes, but the association was not statistically significant ($\chi^2 = 3.200$, $df = 1$, $p = 0.074$) probably because of the small number of cases. Table 6 details the spinal-level distribution of Schmorl's nodes across the 49 affected patients. Nodes were found throughout the lumbar spine but clustered more heavily in the upper segments (L1-L2 and L2-L3); L4-L5 and L3-L4 also showed considerable involvement, while L5-S1 had the lowest frequency. Table 7 shows the spinal-level distribution of lumbar disc herniation among the 65 affected patients. Unlike the Schmorl's node pattern, herniation occurred predominantly at the lower lumbar levels (L4-L5 and L5-S1), with the upper segments (L1-L2 and L2-L3) comparatively less involved.

Table 1: Demographic and clinical profile of the study population (n=95)

Variables	Mean	S.D
Age	46.47	14.40
Duration of disease (month)	08.79	10.89
Total vertebral height (mm)	23.85	02.68

Male	50	52.6
Female	45	47.4
Schmorl's nodes	Number	Percentage
Yes	49	51.6
No	46	48.4
Lumbar Disk Herniation		
Yes	65	68.4
No	30	31.6

Table 2: Association between Schmorl's Nodes and lumbar disc herniation

Schmorl's nodes	Lumbar disk herniation				Total	
	Present		Absent			
	No.	%	No.	%	No.	%
Present	40	81.6	9	18.4	49	51.6
Absent	25	54.3	21	45.7	46	48.4
Total	65	68.4	30	31.6	95	100.0

Association assessed using Pearson's Chi-square test ($\chi^2 = 8.175$, df = 1, p = 0.004).

Table 3: Age-stratified association between Schmorl's nodes and lumbar disc herniation

Schmorl's nodes	Lumbar disk herniation				Total	
	Present		Absent			
	No.	%	No.	%	No.	%
Age (≤40 years)						
Present	13	68.4	6	31.6	19	100.0
Absent	05	31.2	11	68.8	16	100.0
Total	18	51.4	17	48.6	35	100.0
Association assessed using Pearson's Chi-square test ($\chi^2 = 4.804$, df = 1, p = 0.028).						
Age (> 41 years)						
Present	27	90.0	03	10.0	30	100.0
Absent	20	66.7	10	33.3	30	100.0
Total	47	78.3	13	21.7	60	100.0

Association assessed using Pearson's Chi-square test ($\chi^2 = 4.812$, df = 1, p = 0.028)

Table 4: Gender-stratified association between Schmorl's nodes and lumbar disc herniation

Schmorl's nodes	Lumbar disk herniation				Total	
	Present		Absent			
	No.	%	No.	%	No.	%
Male						
Present	21	84.0	4	16.0	25	100.0
Absent	15	60.0	10	40.0	25	100.0
Total	36	72.0	14	28.0	50	100.0
Association assessed using Pearson's Chi-square test ($\chi^2 = 3.571$, df = 1, p = 0.059).						
Female						
Present	19	79.2	05	20.8	24	100.0
Absent	10	47.6	11	52.4	21	100.0
Total	29	64.4	16	35.6	45	100.0

Association assessed using Pearson's Chi-square test ($\chi^2 = 4.865$, df = 1, p = 0.027).

Table-5: Duration of disease-stratified association between Schmorl's nodes and lumbar disc herniation

Schmorl's nodes	Lumbar disk herniation				Total	
	Present		Absent			
	No.	%	No.	%	No.	%
Duration ≤ 12 months						
Present	28	75.7	9	24.3	37	100.0
Absent	22	52.4	20	47.6	42	100.0
Total	50	63.3	29	36.7	79	100.0
Association assessed using Pearson's Chi-square test ($\chi^2 = 4.594$, df = 1, p = 0.032).						
Duration ≥ 13 months						
Present	12	100.0	0	0.0	12	100.0

Absent	03	75.0	1	25.0	04	100.0
Total	15	93.8	1	6.2	16	100.0

Association assessed using Pearson's Chi-square test ($\chi^2 = 3.200$, df = 1, p = 0.074).

Table 6: Distribution of spinal levels among patients with Schmorl's nodes (n=49)

Level of lumbar disk	Number	Percentage
L1-L2	21	42.9
L2-L3	19	38.8
L3-L4	16	32.7
L4-L5	17	34.7
L5-S1	08	16.3

The percentages presented in this table were calculated using the 49 patients with Schmorl's nodes, and because several individuals had lesions involving multiple spinal levels, the total number of affected levels exceeds the total number of patients.

Table 7: Distribution of spinal levels among lumbar disc herniations in lumbar disc degenerative disease patients

Level of lumbar disk	Number	Percentage
L1-L2	3	4.6
L2-L3	7	10.8
L3-L4	21	32.3
L4-L5	43	66.2
L5-S1	40	61.5

The percentages were calculated using the 65 patients with disc herniation, and because several patients had herniations involving multiple lumbar levels, the total frequency exceeds the total number of affected individuals.

DISCUSSION

The current study showed a relationship between Schmorl's nodes (SNs) and disc herniation (LDH). From individuals having Schmorl's node, 81.6% were suffering from LDH while only 54.3% from individuals who did not have SN had LDH. The Chi-square test by Pearson for this relationship showed that it was statistically significant ($\chi^2 = 8.175$, df = 1, p = 0.004). These results indicate that an individual having Schmorl's node would also have a higher chance of having LDH. Schmorl's nodes involve the herniation of nucleus pulposus through the vertebral endplate into the vertebral body. These have traditionally been considered incidental radiological findings; however, increasing evidence indicates their potential as a marker of biomechanical strain and disc degeneration. The strong association noted in the present study supports the theory that vertebral endplate failure plays a role in lumbar disc degeneration and subsequently disc herniation. These findings are consistent with those of Ekşi et al¹² examining disc degeneration rather than herniation specifically similarly reported a significant association between Schmorl's nodes and disc pathology concentrated at the upper lumbar levels. The present findings can also be explained in light of the recent developments in the field of spinal imaging studies, which show that the abnormalities of the vertebral endplate contribute significantly to disc degeneration. The recent findings show that endplate abnormalities are responsible for the loss of nutritional and structural stability of the disc, thus hastening the process of degeneration of the disc and increasing the chances of an annular tear and disc herniation.¹³ The percentage of lumbar disc herniation found in the participants with Schmorl's nodes in the current research (81.6%) was significantly higher compared to participants without Schmorl's nodes (54.3%). It can be concluded that Schmorl's nodes can help to diagnose people with an increased risk of lumbar disc diseases. The same results were found in imaging studies where patients with end plate defects had a higher degree of degeneration of discs and more disc anomalies compared to patients without end plate defects. Ekşi et al¹² showed that increased number of Schmorl's nodes is associated with the risk of severe intervertebral disc degeneration and low back pain. A particular strength of this study lies in its direct comparison of herniation frequency between patients with and without Schmorl's nodes. The strong correlation found serves to support existing literature that shows that SNs should not always be considered to be an incidental finding but rather be further analyzed. However, some researches have revealed that Schmorl's nodes can be found in asymptomatic patients and may not always be associated with any kind of pathological process. Population-based MRI studies have revealed that many spine degenerative processes, which include end plate changes, can be seen in asymptomatic patients. So, even though there seems to be an association between Schmorl's nodes and intervertebral disc pathology, their clinical relevance is always to be considered in light of the overall clinical picture of the patient.¹³

Generally, the results of the current study confirm previous literature findings about the connection between Schmorl's nodes and disc degenerative structural problems. The significant connection between Schmorl's nodes and lumbar disc herniation found in this study confirms the idea that endplate damage of the vertebrae is an important factor for lumbar disc disease. Further research is required to clarify the role of Schmorl's nodes in the

process of the development of lumbar disc hernia. However, the available literature on the relationship between Schmorl's node and lumbar disc herniation is scanty. Most of the contemporary literature on Schmorl's nodes deals with the issue of the condition in relation to disc degeneration, end plate pathology, Modic changes, and back pain. Thus, the discussion is based on literature that addresses similar problems. This finding that lumbar disc herniation is more prevalent among the older age group is quite logical from a biological perspective since aging leads to progressive disc dehydration, endplate sclerosis, limited diffusion of nutrients, and increased mechanical load. Such degenerative changes lead to weakening of the vertebral endplate, thus causing Schmorl's nodes, whereas at the same time, make an annular rupture and lumbar disc herniation more likely. The study conducted by Brinjikji et al¹⁴ shows from their systematic imaging review that degenerative MRI findings tend to increase with increasing age, although they can still be seen in asymptomatic young adults, implying that degeneration starts from end plate problems. Therefore, the current results suggest that when Schmorl's nodes are found in young adults, they cannot be simply termed as incidental findings. The results of the stratification by gender in the current study have shown that the association of Schmorl's nodes (SNs) with lumbar disc herniation (LDH) was slightly different in men and women. The insignificant differences found in men with the higher rate of lumbar disc herniation are most probably due to the limited number of subjects rather than the lack of any real association. On the other hand, the presence of the association in female patients is confirmed by recent research findings that support close relationships between vertebral endplate defects and LDH. Ekşi et al¹² found out that patients with Schmorl's nodes had significant degeneration of the intervertebral discs and vertebral endplates compared to patients without Schmorl's nodes.

CONCLUSION

A clear and statistically significant link between the presence of Schmorl's nodes and lumbar disc herniation was noted. Individuals with Schmorl's nodes experienced disc herniation considerably more often than those without, suggesting that Schmorl's nodes may play a contributing role in the degenerative process underlying disc herniation.

Conflict of Interest:

No conflict of interest declared by all authors

Authors Contribution:

JY: Study design, data collection, analysis, interpretation, and drafting of the manuscript

MHB: Revision of the manuscript.

HK: Revision of results

The final manuscript was reviewed and approved by all authors prior to submission.

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