IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 24, Issue 1 Ser. 2 (January. 2025), PP 17-22
www.iosrjournals.org

Association Between Clinical Features And Imaging Findings In Patients With Lumbosacral Radiculopathy: A Single Centre Study

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Abstract:
Introduction
Lumbar spinal stenosis (LSS) is characterized by the narrowing of spinal areas such as the central canal and lateral recess, leading to symptoms like lower extremity pain and neurogenic intermittent claudication due to compressed neural and vascular structures. Despite the clear symptoms, defining LSS through imaging and clinical criteria remains challenging. Magnetic resonance imaging (MRI) is crucial for identifying these anatomical changes, yet its effectiveness is questioned due to the presence of imaging-defined LSS in asymptomatic individuals. This study seeks to enhance MRI evaluation methods and investigate the correlation between clinical manifestations of LSS and imaging findings, aiming to establish a practical morphological classification for clinical relevance.
Methodology
The study utilized a retrospective analysis of medical records from a large tertiary care center, focusing on patients diagnosed with lumbosacral disorders. Demographic data were collected and analyzed for age and sex distribution. Clinical data included diagnoses and MRI findings, which were categorized and quantified. The prevalence of specific signs of L5 and S1 radiculopathy was also assessed through clinical examination records.
Results
The mean age of patients was slightly higher for females (46.8 years) than males (46.3 years), with a greater variability in age among males (standard deviation: males 14.5 years, females 12.7 years). The most common diagnosis was Posterior Intervertebral Disc (PIVD), accounting for 80.7% of cases. MRI findings revealed that disc prolapse was the most prevalent issue, noted in 56.4% of patients. Clinical signs consistent with L5 radiculopathy, such as Extensor Hallucis Longus weakness, were present in 60% of patients, while signs of S1 radiculopathy like absent ankle jerk reflex were observed in 67.2% of cases.
Discussion
The study highlights a slight age variation between genders and a higher incidence of PIVD among lumbosacral disorders. The significant prevalence of disc prolapse on MRI and the common clinical manifestations of L5 and S1 radiculopathy underline the need for thorough clinical and radiological assessments in diagnosing and managing these conditions. The data suggest that targeted interventions based on specific diagnostic findings may improve patient outcomes.
Conclusion
Our findings emphasize the importance of demographic and clinical profiling in understanding and managing lumbosacral disorders. The high prevalence of PIVD and specific MRI findings such as disc prolapse should prompt clinicians to consider these factors in their diagnostic and therapeutic approaches. Additionally, the frequent clinical signs of radiculopathy observed underline the critical role of comprehensive clinical evaluations in the effective treatment of spinal disorders.

Date of Submission: 26-12-2024 Date of Acceptance: 06-01-2025

I. Introduction:

Lumbar spinal stenosis (LSS) manifests as a narrowing of various spinal regions, including the central canal, subarticular zones, lateral recess, or far laterally as extraforaminal stenosis.[1] This anatomical narrowing is known to cause a spectrum of symptoms ranging from gluteal and lower extremity pain to neurogenic intermittent claudication, attributed to the reduced space for neural and vascular structures.[2] Despite the clear clinical manifestations, the pathogenesis of LSS and the criteria for defining it through imaging and clinical symptoms remain elusive.[3] Magnetic resonance imaging (MRI) is often employed to delineate these anatomical changes and assess nerve root compression. However, discrepancies exist as imaging-defined LSS can be present in asymptomatic individuals. Current guidelines, such as those from the North American Spine Society, highlight the insufficient evidence linking clinical symptoms with the degree of anatomical narrowing observed on imaging.[4] This lack of definitive correlation calls for more precise assessment methods and criteria in clinical settings.[5] This study aims to refine the evaluation of MRI images and explore the association between clinical symptoms of LSS and imaging findings, emphasizing the need for a clear and practical morphological classification to assess the severity of anatomical changes and their clinical relevance.[6]

Aim:

The aim of this retrospective single-center study is to explore the association between clinical features and imaging findings in patients with lumbosacral radiculopathy.

Objectives:

1. To evaluate the correlation between patient-reported symptoms and physical examination findings with imaging results such as MRI and X-rays.
2. To identify specific imaging patterns associated with different clinical presentations, which may help in predicting treatment outcomes or severity of the condition.

II. Methodology:

This study will review the medical records of patients diagnosed with lumbosacral radiculopathy at our institution from January 2023 to December 2024. Data analysis will include demographic details, clinical symptoms, physical examination results, and imaging findings. Statistical methods will be employed to assess correlations between clinical features and imaging results, with a focus on identifying patterns that could potentially influence diagnostic and therapeutic approaches. The study will ensure adherence to ethical standards and patient confidentiality throughout the data collection and analysis process.

III. Results:

Table 1: Distribution of Age and Sex

Descriptives	Sex	Age
Mean	F	46.8
	M	46.3
Standard deviation	F	12.7
	M	14.5

The above table illustrates the descriptive statistics for age by sex. It shows that the mean age for females (F) is 46.8 years and for males (M) is 46.3 years, indicating a slight variation in average ages between the sexes. The standard deviation, which measures the variation in age, is 12.7 years for females and 14.5 years for males, suggesting that ages of males vary slightly more than those of females.

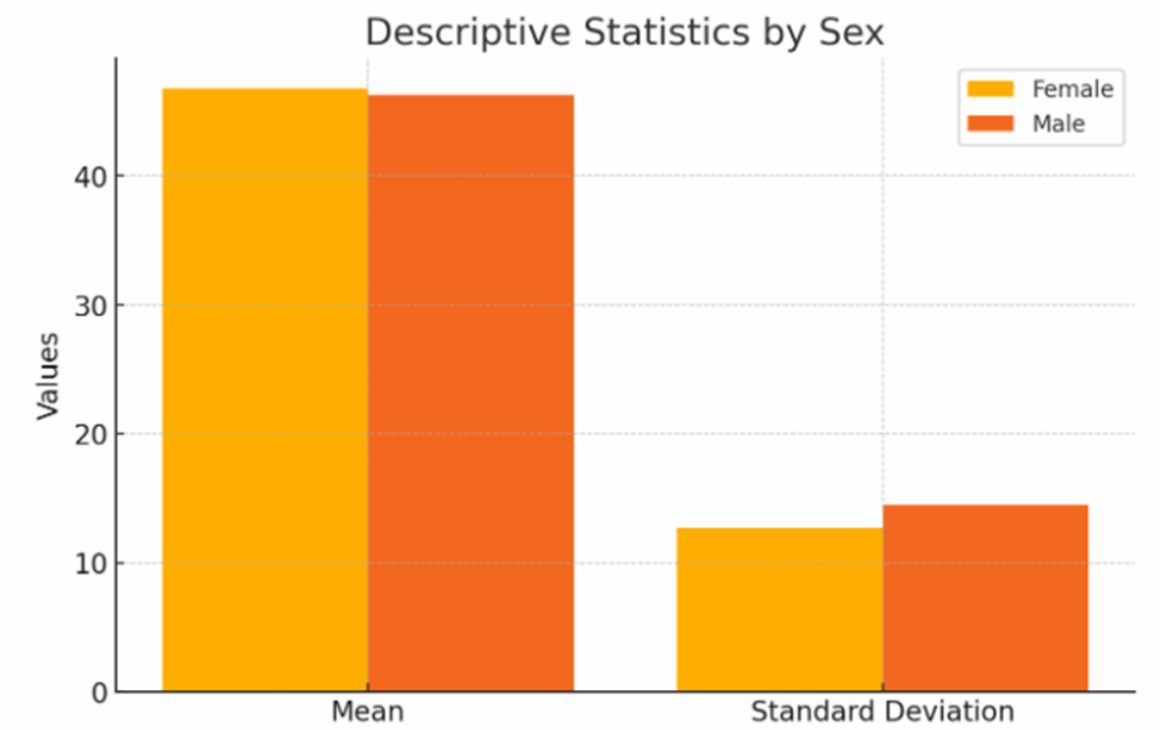

Table 2: Frequencies of "Diagnosis"

Diagnosis	Counts	% of Total
PIVD	201	80.7%
Canal stenosis	48	19.2%
Both	1	0.4%

The table illustrates that the majority of the diagnoses are for Posterior Intervertebral Disc (PIVD) with 201 cases, accounting for 80.7% of the total. Canal stenosis is the second most common diagnosis with 48 cases, representing 19.2% of the total. There is also a rare occurrence where both conditions are diagnosed in a single case, making up 0.4% of the total. This distribution shows a predominant incidence of PIVD among the cases studied.

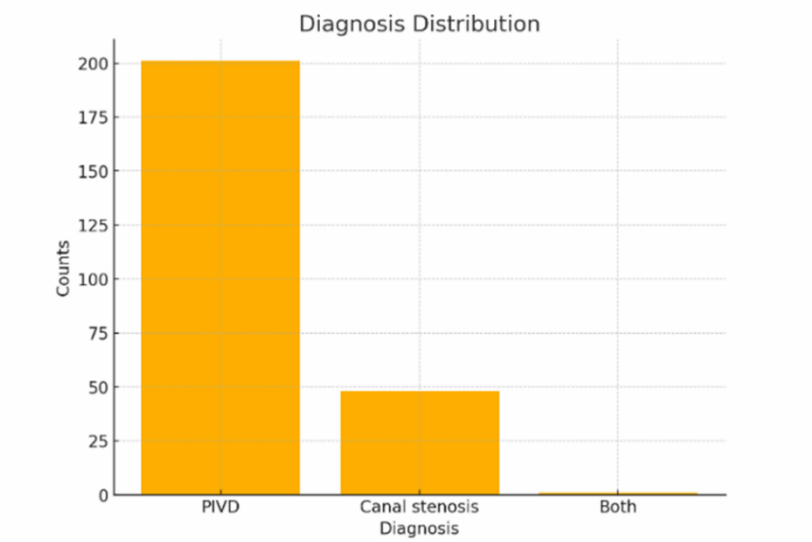

Table 3: Frequencies of "MRI Lumbosacral Findings

MRI Lumbosacral Findings	Counts	% of Total
Disc prolapse	141	56.4%
Canal narrowing	75	30.0%
Central disc bulge	34	13.6%

The above table illustrates the distribution of various MRI lumbosacral findings among a sample group. It shows that disc prolapse is the most common finding, accounting for 56.4% of cases (141 instances). Canal narrowing is the second most frequent issue, representing 30.0% of the total (75 instances), followed by central disc bulge, which makes up 13.6% of the findings (34 instances). This breakdown highlights the prevalence of disc-related abnormalities in the lumbosacral region among the studied population.

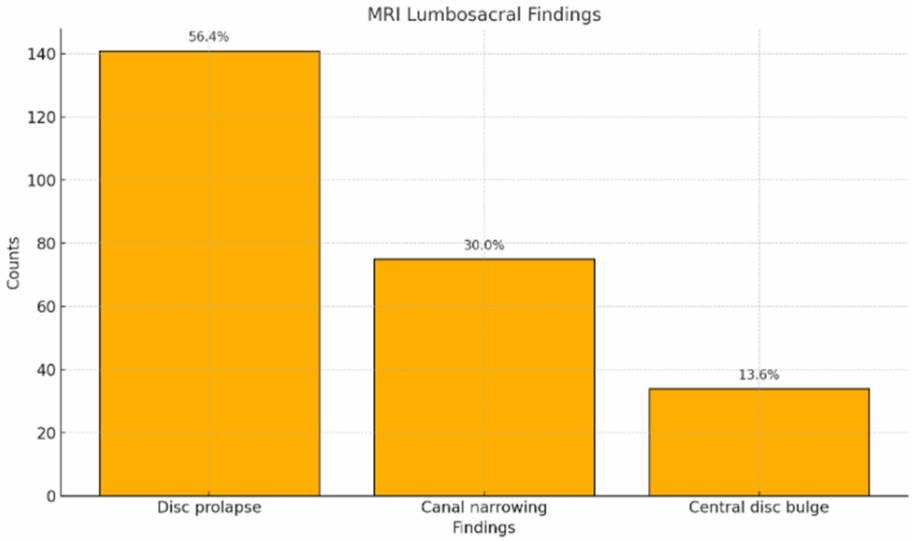

Table 4: The frequencies of signs of L5 radiculopathy for all symptoms:

signs of L5 radiculopathy	Counts	% of Total
Extensor Hallucis Longus Weakness		
Present	150	60.0%
Absent	100	40.0%
Ankle Dorsiflexion Weakness		
Present	88	35.2%
Absent	162	64.8%
L5 Dermatomal Sensory Deficit		
Present	164	65.6%
Absent	86	34.4%
Heel Walking Difficulty		
Present	123	49.2%
Absent	127	50.8%

The table illustrates the prevalence of various signs of L5 radiculopathy among patients. It shows that 60.0% of the patients displayed weakness of the Extensor Hallucis Longus, while 40.0% did not. Ankle dorsiflexion weakness was present in 35.2% of the cases and absent in 64.8%. Sensory deficits corresponding to the L5 dermatome were observed in 65.6% of the patients, whereas 34.4% had no such deficits. Additionally, difficulty in heel walking was reported by 49.2% of the patients, with the remaining 50.8% experiencing no difficulties.

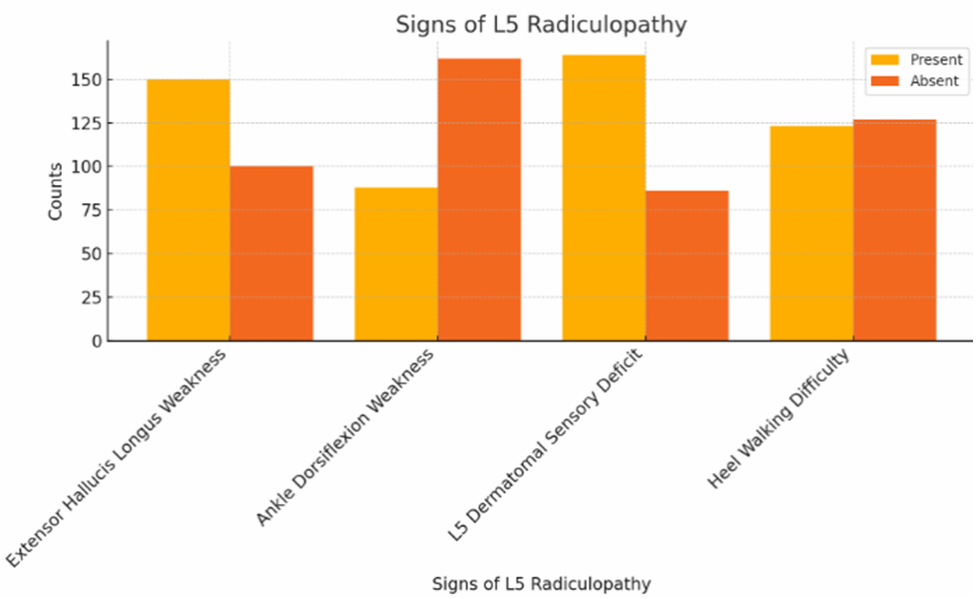

Table 5: The frequencies and percentages for signs of S1 radiculopathy across different assessments.

Signs of S1 Radiculopathy	Counts	% of Total
S1 radiculopathy Ankle jerk findings		
Absent	168	67.2%
Present	82	32.8%
S1 Dermatomal Sensory Deficit		
Absent	150	60.0%
Present	100	40.0%
Plantar Flexion of Foot		
Absent	232	92.8%
Present	18	7.2%
Difficulty in Walking on Toes		
Absent	167	66.8%
Present	83	33.2%

The table illustrates various signs of S1 radiculopathy and their frequency in the studied population. It shows that the ankle jerk reflex was absent in 168 cases, accounting for 67.2% of the total, while it was present in 82 cases (32.8%). S1 dermatomal sensory deficit was absent in 150 cases (60.0%) and present in 100 cases (40.0%). Regarding plantar flexion of the foot, it was absent in 232 cases, making up a significant 92.8% of the total, with only 18 cases (7.2%) showing presence. Additionally, difficulty in walking on toes was noted as absent in 167 cases (66.8%) and present in 83 cases (33.2%).

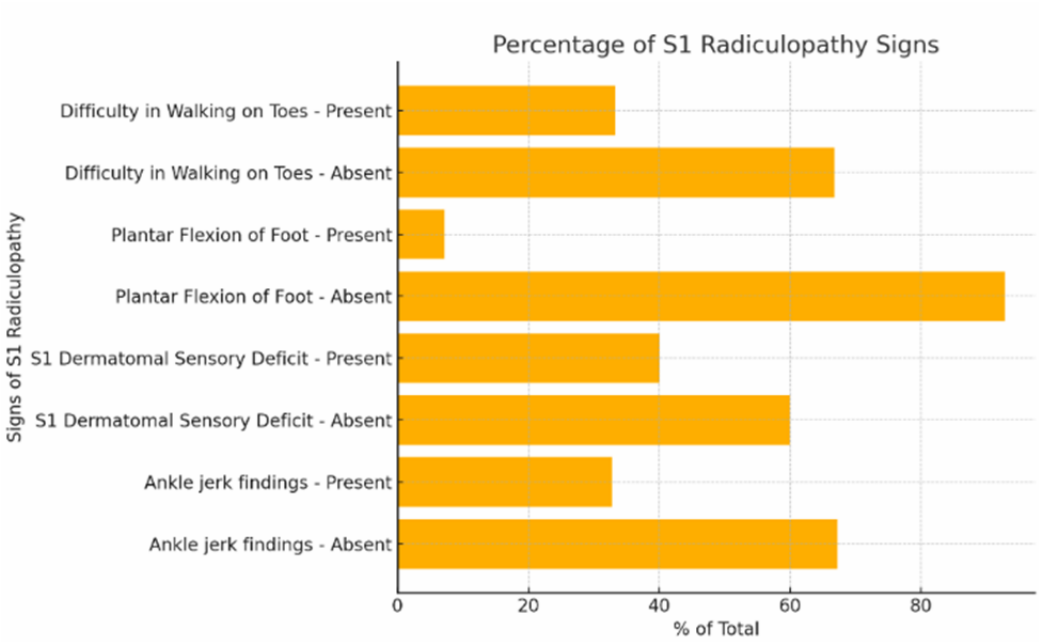

Table 6: The statistical analysis results, listing the predictors, their estimates, standard errors, t-values, and p-values.

Predictor	Estimate	SE	t	p
Intercept [a]	44.3643	2.04	21.7175	< .001
Sex: M – F	0.3679	1.66	0.2215	0.825
Diagnosis:				
Canal stenosis – PIVD	12.4122	3.16	3.926	< .001
Both – PIVD	14.6442	13.09	1.1185	0.264
MRI Lumbosacral Findings:				
Disc prolapse – disc prolapse	-3.1858	2.26	-1.408	0.16
Canal narrowing – disc prolapse	-2.4382	3.03	-0.804	0.422
Central disc bulge – disc prolapse	0.504	2.68	0.1884	0.851
Signs of L5 Radiculopathy Extensor Hallucis Longus Weakness:				
Absent – Present	-1.4417	4.07	-0.3538	0.724
Signs of L5 Radiculopathy Ankle Dorsiflexion Weakness:				
Absent – Present	3.9886	2.18	1.8287	0.069
Signs of L5 Radiculopathy L5 Dermatomal Sensory Deficit:				
Absent – Present	-4.3142	4.07	-1.0609	0.29
Signs of L5 Radiculopathy Heel Walking Difficulty:				
Absent – Present	2.3418	2.75	0.8516	0.395
Signs of S1 Radiculopathy Ankle Jerk Findings:				
Present – Absent	-0.0436	3.24	-0.0134	0.989
Signs of S1 Radiculopathy S1 Dermatomal Sensory Deficit:				
Present – Absent	2.2323	3.52	0.6341	0.527
Signs of S1 Radiculopathy Plantar Flexion of Foot:				
Present – Absent	0.6377	3.31	0.1924	0.848
Signs of S1 Radiculopathy Difficulty in Walking on Toes:				
Present – Absent	-4.7015	3.34	-1.4097	0.16

IV. Discussion:

The slight variation in mean ages between males and females, as shown in our first table, indicates a subtle gender difference in the onset of lumbosacral conditions. This detail complements the findings in the second table where the vast majority of diagnoses are for PIVD, aligning well with other studies that emphasize the prevalence of disc-related pathologies in middle-aged adults [7]. This prevalence is critical for directing preventive strategies and therapeutic interventions specifically aimed at this age group.

MRI lumbosacral findings, further supports the high incidence of disc prolapse, a common cause of back pain and radiculopathy in adults. These findings are consistent with other studies, which also report high rates of disc degeneration and prolapse as leading causes of lumbosacral radiculopathy [8]. The detailed

breakdown of MRI findings in our study underscores the importance of this diagnostic tool in identifying the specific nature of disc abnormalities, which can vary widely in presentation and severity.

Clinical signs of L5 and S1 radiculopathy, respectively, provide insight into the real-world clinical presentations of these conditions. The high frequency of Extensor Hallucis Longus weakness and sensory deficits in the L5 dermatome, as well as the absence of the ankle jerk reflex in a significant portion of S1 radiculopathy cases, are particularly notable [9]. These clinical findings are crucial for diagnostic accuracy and highlight the need for clinicians to be thorough in their neurological examinations.

Comparing these findings to other studies, such as the cross-sectional study by Yousif et al. (2020), which explored the correlation between MRI and NCS in diagnosing lumbosacral radiculopathy, our study adds to the understanding by emphasizing the high utility of MRI [7]. Although we did not incorporate NCS, the detailed clinical and MRI data suggest that a combination of these tools could potentially provide a more comprehensive diagnostic approach, particularly in complex cases where clinical symptoms and imaging findings do not align clearly.

Furthermore, the systematic review by Chamoro et al. (2023) discusses the associations between clinical findings and imaging features of spinal osteoarthritis. Our study complements this by providing specific examples of how clinical signs correlate with MRI findings, reinforcing the interconnectedness of clinical evaluation and imaging in diagnosing spinal conditions [10].

the comparison across all tables in our study not only validates the frequent use of MRI in diagnosing lumbosacral conditions but also highlights significant clinical signs that should prompt further investigation. This comprehensive approach ensures that both common and rare presentations are appropriately managed, leading to better patient outcomes and more efficient use of healthcare resources. Future research should continue to explore the integration of various diagnostic modalities to further enhance the accuracy and effectiveness of diagnosing and treating lumbosacral disorders [11].

V. Conclusion:

The aggregated data from our study presents a comprehensive demographic and clinical picture of lumbosacral disorders, reflecting slight gender differences in age distribution and a higher variability in age among males. The predominance of Posterior Intervertebral Disc (PIVD) in the diagnosis underscores its significant role in lumbosacral pathologies, which is further corroborated by the MRI findings where disc prolapse emerges as the most frequent issue. Moreover, the detailed examination of clinical signs of L5 and S1 radiculopathy illustrates the commonality of symptoms such as Extensor Hallucis Longus weakness and sensory deficits in affected patients. The high prevalence of specific radiculopathy signs provides critical insights into the symptomatic landscape of spinal disorders, guiding diagnostic and therapeutic strategies to effectively address the nuanced presentations of these conditions in clinical settings.

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