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Lumbar Spine Degenerative Disease among Young Adults Referred for Lumbar Spine Magnetic Resonance Imaging at Muhimbili Orthopedic Institute

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Abstract

Background
Low back pain and radiculopathy are major global health concerns, with lumbar disc degeneration increasingly prevalent among young adults. However, data on its occurrence in this demographic region is limited, underscoring the need for targeted research.

Objective
To assess the magnitude of spine degenerative disease and identify related risk factors among young adults undergoing lumbar spine MRI at Muhimbili Orthopedic Institute (MOI).

Methods
A hospital-based cross-sectional study was conducted at MOI) from November 2022 to April 2023, enrolling young adults experiencing lower back pain with or without radiculopathy who were referred for lumbar spine MRI. Comprehensive data collection included socio-demographic information, risk factors, and clinical symptoms through structured questionnaires. MRI findings were documented using a specially designed data collection tool. Statistical analysis was performed using SPSS version 23, with Chi-square and Fisher's exact tests used to examine associations between variables.

Results
This study involved 88 patients between the ages of 20 and 39 years (mean age 32.34), with females comprising 54.5% of the study participants. Lumbar spine degenerative disease was identified in 92% of participants. The most prevalent symptom was lower back pain accompanied by radiculopathy (73%), while disc bulge was the most common MRI finding (89.8%). There was a significant association between lower back pain with radiculopathy and lumbar nerve root compression ($P<0.05$), as well as between high BMI and the presence of lumbar spine degenerative disease ($P<0.05$).

Conclusion
Ninety-two percent of young adults referred for lumbar spine MRI at MOI had lumbar spine degenerative disease. The most common symptom was lower back pain with radiculopathy, and the most frequent MRI finding was a disc bulge. The presence of nerve root compression on MRI correlated with lower back pain with radiculopathy, and a high BMI was significantly linked to lumbar spine degenerative disease.

Recommendation
Further studies are needed to explore the progression of degenerative changes over time, as well as preventive strategies and early interventions aimed at high-risk groups, to reduce the burden of lumbar spine degeneration in younger populations.

Keywords: *Lumbar spine degenerative disease, Young adults, Magnetic Resonance Imaging, Lower back pain.*

Introduction

Low back pain is a leading cause of doctor visits, hospital admissions, and surgeries among individuals under 45 years old in the United States (1). The associated morbidity of lumbar disc degeneration contributes to rising healthcare costs and productivity losses each year (1). Research from the United Kingdom has identified a high prevalence of lumbar spine degenerative disease in young adults, with 58.6% of 730 MRI patients showing signs of the condition (2). Similarly, studies from Nigeria and Tanzania report significant prevalence rates among broader age groups, with up to 59.6% and 43%, respectively (3,4). Despite these findings, existing studies have either included a wide age range or focused on different populations. Lower back pain is a symptom frequently brought on by lumbar disc degeneration, which is the focus of both diagnostic testing and surgical treatment. (5)

The current study addressed this gap by targeting young adults aged 20 to 39. This focused approach aimed to provide more precise data on the prevalence and risk factors of lumbar spine degenerative disease in this age group. By highlighting the increased prevalence and associated risk factors, the study emphasizes the need for early intervention and lifestyle modifications to prevent long-term disability.

Degeneration of the intervertebral disc, often beginning in adolescence, can lead to significant health issues as it progresses(5,6). As the disc degenerates, changes in spinal dynamics can accelerate deterioration in adjacent segments and other spinal tissues, potentially leading to serious complications such as spinal canal narrowing and neural tissue compression.

Magnetic Resonance Imaging (MRI) is a crucial tool for early detection of these degenerative changes, including disc degeneration, Modic changes, disc bulges, disc herniation, facet arthropathy, central canal stenosis, and nerve root compression.(4)

This study aimed to bridge the knowledge gap by providing targeted insights into the prevalence, clinical presentation, and risk factors associated with lumbar spine degenerative disease in young adults.

Rationale

Research on lumbar degenerative diseases has largely focused on older adults, with limited attention given to younger populations(7), especially in underdeveloped countries where research and healthcare resources are scarce(4). This study aimed to fill this gap by assessing the prevalence of lumbar spine degenerative disease and associated risk factors. We also sought to investigate the clinical presentation and MRI findings. By identifying key risk factors, our goal was to encourage early lifestyle modifications aiming to prevent early onset of lumbar spine degeneration.

Methodology

Study setting and design

This hospital-based cross-sectional study was conducted for six months, from November 2022 to April 2023, in the MRI unit of the Radiology Department at Muhimbili Orthopedic Institute in Dar es Salaam. The specialized radiology setting, which regularly deals with orthopedic and neurosurgical patients, provided an ideal context for investigating lumbar spine degenerative disease.

Study population, Data collection methods

The study included 88 young adults who consented to participate, all experiencing lower back pain with or without radiculopathy. These participants were selected from 216 patients referred for lumbar spine MRI at the MOI Radiology Department between November 2022 and April 2023. All patients with prior history of spine surgery, trauma, spine tumor, spine infection, or those whose data is incomplete were excluded from the study.

Participants' socio-demographic data, clinical symptoms, and risk factors were collected using self-administered questionnaires. These questionnaires were distributed to participants by the principal investigator who provided instructions on how to fill them and was available to answer any questions. This method ensured that participants could independently complete the questionnaires while maintaining data integrity.

For the purpose of this study, occupations were categorized based on the level of physical activity involved(8). Sedentary workers included those whose jobs required prolonged sitting with minimal physical movement, such as office workers and doctors. The "Teacher" category encompassed individuals whose jobs involve both standing and sitting, such as school teachers and university lecturers. Manual laborers were those engaged in physically demanding work, often in agriculture or construction, requiring significant exertion and bending. The "Student" category included those in educational institutions, and the "Other" category included military and paramilitary personnel.

Once a participant was enrolled in the study, a multiplanar non-contrasted MRI was performed from the first lumbar to the first sacral vertebrae using a 1.5 Tesla (Siemens) scanner. Both sagittal and axial T1 and T2 weighted images were examined. MRI findings, including disc degeneration, Modic changes, disc bulge, herniation, central canal stenosis, and nerve root compression, were recorded using an MRI data collection form. Disc degeneration was categorized based on the classification system established by Dominic et al. (2001)(9), with Grades 1-2 considered normal and Grades 3-5 indicating degeneration. Evaluation of Modic changes followed the system described by Modic(10). Disc bulge was defined as the circumferential enlargement of the disc contour in a symmetric manner in a weakened disc, while disc herniation referred to the local or focal displacement of the disc beyond the intervertebral disc space. Central canal stenosis was determined by the narrowing of the spinal canal's anterior-posterior diameter at any point along its length. The severity of canal stenosis was graded according to Borenstein et al.' criteria(11), distinguishing between mild, moderate, and severe stenosis. Only those with moderate and severe canal stenosis were diagnosed as patients with canal stenosis. Nerve root compression was identified by the presence of a mass effect on the nerve root. Each spinal level and every aspect of degeneration were assessed individually.

Ethical considerations

Ethical clearance was obtained from the Muhimbili University of Health and Allied Sciences (MUHAS) ethical review board with reference number MUHAS-REC-10-2022-1405. Additionally, permission to conduct the study was granted by the Executive Director of Muhimbili Orthopedic Institute. Written informed consent was obtained from each study participant, ensuring their voluntary participation and understanding of the study's purpose. All information gathered was kept confidential and used solely for academic purposes.

Data analysis

Data analysis was conducted using SPSS version 23 and the results were displayed in tables and figures. The Chi-square test was used to assess the relationships between factors like age, BMI, occupation, smoking, family history, symptoms, and MRI findings. When cell counts were below five, Fisher's exact test was applied. A p-value of less than 0.05 indicated statistical significance.

Results

A total of 88 patients who fulfilled the inclusion criteria were included in this study. Their age ranged from 20 to 39 years with a mean of 32.34 years. Females accounted for 48 (54.5%) of the cases. The patients' occupations varied, with sedentary workers comprising the largest group 25 (28.4%)) (Table 1).

Table 1: Percentage distribution of participants by age, sex, and occupation among young adults referred for lumbar spine MRI at MOI from November 2022 to April 2023

Characteristic	Frequency (%)
	Mean (SD)
Age 20-39	32.34 (5.094)
Sex	
Male	40 (45.5)
Female	48 (54.5)
Total	88 (100)
Occupation	
Sedentary worker	25 (28.4)
Manual labour	22 (25.0)
Teacher	20 (22.7)
Student	9 (10.2)
Other	12 (13.6)
Total	**88 (100)**

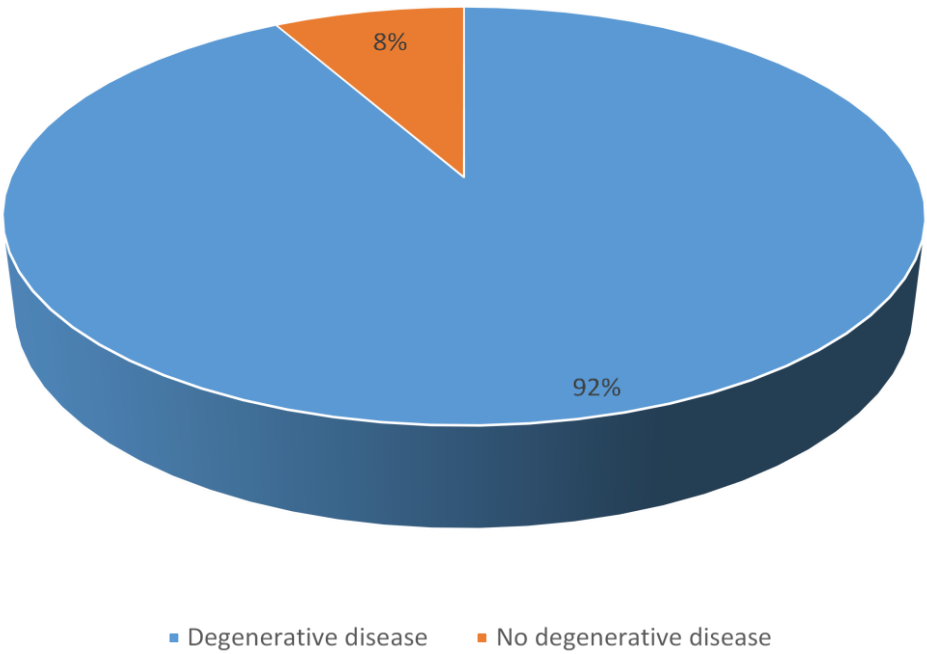

Figure 1. Proportion of lumbar spine degenerative disease among young adults referred for lumbar spine MRI at MOI from November 2022 to April 2023

Ninety-two percent of the patients had lumbar spine degenerative disease. Eight percent of the patients had normal lumbar spine MRI. (Figure 1).
The most common symptom reported was lower back pain with radiculopathy, experienced by 64 patients (73%) (Table 2).

Table 2: Proportion of the clinical presenting symptoms among young adults referred for lumbar spine MRI at MOI from November 2022 to April 2023

Symptoms	Frequency	Percentage
Lower back pain with radiculopathy	64	73
Lower back pain without radiculopathy	24	27

In our study, the most frequent finding was disc bulge, observed in 77 patients (95.1%) and 7 patients (8%) were normal. Some of the patients presented with multiple MRI findings; such as disc bulge and disc degeneration, Disc bulge and spine nerve root compression (Table 3).

Table 3: Proportion of the MRI findings among young adults referred for lumbar spine MRI at MOI from November 2022 to April 2023 (n = 88)

MRI Finding	Frequency	Percentage
Disc degeneration	39	48.1
Modic changes	3	3.7
Disc bulge	77	95.1
Disc herniation	8	9.9
Stenosis of the central canal	6	7.4

Spine nerve root compression	58	71.6

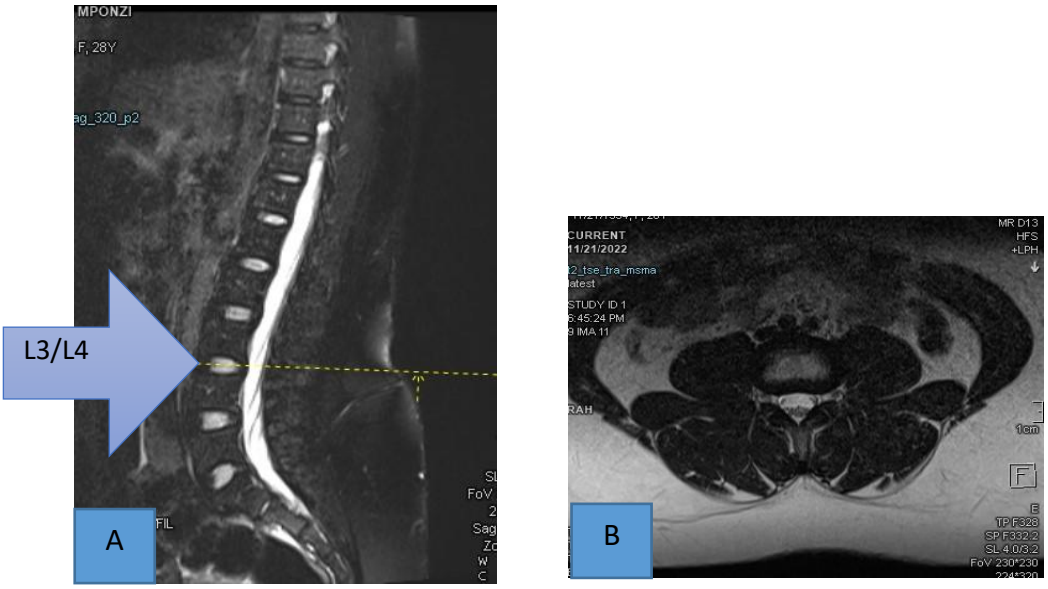

Figure 2. Normal lumbar spine MR image in sagittal T2 fat saturation (A) and axial T2 (B)

The lumbar spine Magnetic Resonance image above shows a normal kidney-shaped disc at L3/L4, hyperintense central nucleus pulposus, and periphery hypointense annulus fibrosus hypointense.

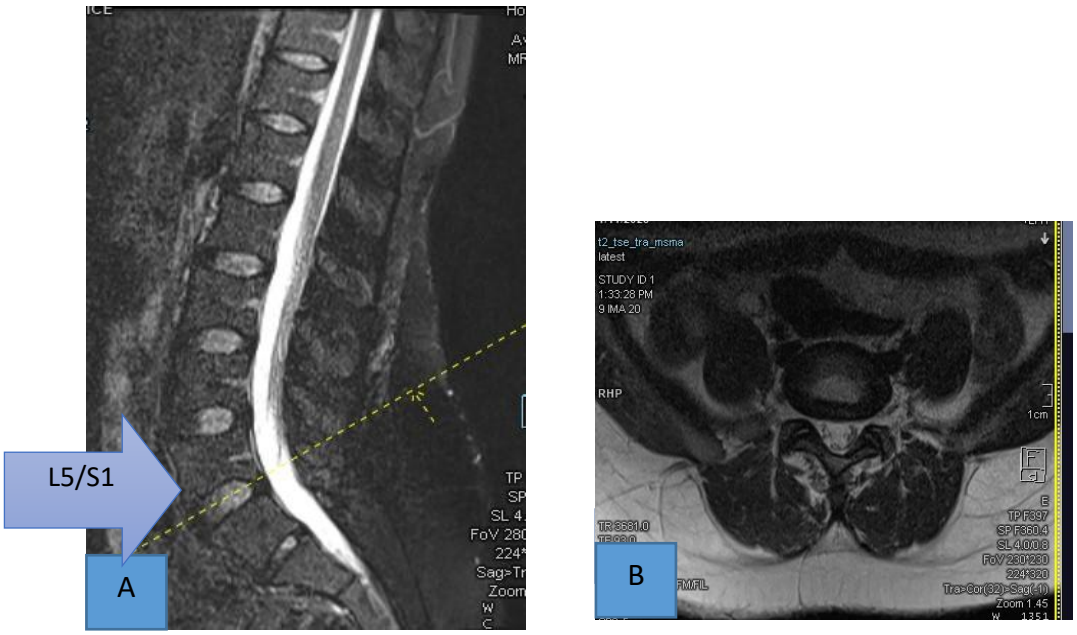

Figure 3. Lumbar spine MRI sagittal T2 fat saturation (A) and axial T2 (B)

The lumbar spine Magnetic Resonance image above shows a broad-based disc bulge at L5/S1 associated with bilateral narrowing of exit neuroforamina.

Table 4: The association between clinical presenting symptoms and MRI findings among young adults referred for lumbar spine MRI at MOI from November 2022 to April 2023

MRI Finding	Lower back pain with radiculopathy (%)	Lower back pain without radiculopathy (%)	P Value
Disc degeneration	39 (48.1)	42 (51.9)	0.510
Modic changes	3 (3.7)	78 (96.3)	0.280
Disc bulge	77 (95.1)	4 (4.9)	0.245
Disc herniation	8 (9.9)	73 (90.1)	0.999
Stenosis of the central canal	6 (7.4)	75 (92.6)	0.999
Nerve root compression	58 (71.6)	23 (28.4)	<0.001

Having a high body mass index (BMI) was also found to be statistically associated with lumbar degenerative disease (P<0.05). Fisher exact test was used (Table 5).

Table 5: The relationship between lumbar spine degenerative disease and, age, occupation, BMI among young adults referred for lumbar spine MRI at MOI from November 2022 to April 2023

Risk factors	Lumbar degenerative disease (%)	No lumbar degenerative disease (%)	P Value
Age			
20 – 29	21 (87.5)	3 (12.5)	0.773
30 -39	60 (93.8)	4 (6.3)	
Occupation			
Sedentary workers	24 (96.0)	1 (4.0)	
Manual labour	20 (90.9)	2 (9.1)	
Teacher	17 (85.0)	3 (15.0)	0.608
Student	9 (100)	0 (0.)	
Other	11 (91.7)	1 (8.3)	
High BMI	54 (66.7)	27 (33.3)	<0.01
Family history	4 (4.9)	77 (95.1)	0.547

Discussion

This study shows different MRI patterns of lumbar degenerative disc disease among young patients with LBP attended at Muhimbili Orthopedic Institute, in Dar Es Salaam, Tanzania. The average age in our study was 32.34 years, which is comparable to a study from Uganda that examined young adults aged 18 to 39 years and reported a mean age of 33 years(12). The majority of our study participants were female, which is contrary to studies from the

United Kingdom and Uganda (2,12) where male participants were more affected. The prevalence of lumbar disc degenerative disease among young adults in our study was high (92%), consistent with findings from studies conducted in the United Kingdom, Kuwait, and Uganda among similar age groups(2,12,13). This suggests that lumbar spine degenerative changes are a common health issue among young adults across different regions.

Most of our study participants presented with lower back pain with radiculopathy, a finding that contrasts with Lukecha et al.'s study in Uganda, where lower back pain without radiculopathy was more common(12). This difference could be attributed to variations in the study populations; our participants were predominantly overweight, possibly leading to more advanced degenerative changes causing nerve root impingement and radiculopathy.

The most prevalent MRI finding in our study was disc bulge, consistent with previous studies conducted in Tanzania, Uganda, and Kuwait.(4,12,13). This suggests that disc bulges may be a common manifestation of lumbar degenerative disease in young adults across different regions.

We also found a statistically significant association between lower back pain with radiculopathy and lumbar spine nerve root compression on MRI, similar to findings from a study done in Sudan(14). This reinforces the clinical relevance of radiculopathy as an indicator of nerve root compression in lumbar degenerative disease.

Moreover, our study identified a significant association between high body mass index (BMI) and the development of lumbar degenerative disease, in line with previous research from India.(7)This highlights the importance of addressing modifiable risk factors, such as BMI, in the prevention and management of lumbar spine degeneration in young adults.

Conclusion

Nearly 92% of young adults referred for lumbar spine MRI at MOI were found to have degenerative disease in the lumbar spine. The most common symptom was lower back pain with radiculopathy, and disc bulge was the most frequent MRI finding. Nerve root compression observed on MRI was linked to lower back pain with radiculopathy. Additionally, there was a significant association between high BMI and the presence of lumbar spine degenerative disease.

Recommendation

Additional research is recommended to explore progression of degenerative changes over time and preventive strategies and early interventions aimed at high-risk groups to reduce the burden of lumbar spine degeneration in younger populations.

Declarations

Acknowledgment

Ministry of Health for providing funds to conduct this study.

Conflict of interest

The authors declare no conflict of interest.

Authors' contribution

GSB was responsible for designing the study, collecting data, and entering the data into SPSS for analysis and interpretation of the results. GSB also contributed to drafting the manuscript. MJ and CVM assisted in the study design, manuscript revision, and in revising and editing the draft manuscript prior to submission.

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