Original Article

MRI Grading of Lumbar Spine Degenerative Disc Disease using a Modified Pfirrmann Grading System

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ABSTRACT

OBJECTIVE: To evaluate the extent of involvement and severity of intervertebral degenerative disc disease on MRI lumbar spine by using a modified pfirrmann grading system in patients with low back pain.

METHODOLOGY: This cross-sectional study was conducted at the radiology department of GMC hospital Sukkur from August 2021- January 2022. T2 weighted images of the MRI lumbar spines of 460 consecutive patients were retrospectively reviewed, and the severity of degeneration was assessed using a modified pfirrmann grading system. Patients with imaging features of degenerative disc disease on MRI lumbar spine were included in the study. Patients with a history of trauma, surgery and infection of the lumbar spine were excluded from the study. Data was collected and analyzed using SPSS version 21.

RESULTS: Disc degeneration was classified by a modified pfirrmann grading system score from 1-8, with no disc score in grades 1, 2 and 3. Other discs score were 13(2.82%), 41(8.9%), 187(40.6%), 125 (27.1%) and 94(20.4%) in grade 4,5,6,7 and 8 respectively.

CONCLUSION: This study concludes that a modified pfirrmann grading system is helpful in the assessment of the severity of lumbar spine intervertebral disc degeneration. It is an easy and reliable method and can be easily applicable for better correlation between radiological findings and clinical diagnosis. This grading helps in early detection and decides the mode of treatment; there is a lack of precise knowledge and data available in our country.

KEYWORDS: MRI lumbar spine, low back pain, intervertebral disc degeneration, intervertebral disc scoring system, modified pfirrmann grading.

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INTRODUCTION

Lumbar intervertebral disc degeneration is considered a significant risk factor for lower back pain besides reducing bone density, muscular spasm and spondylolisthesis and becoming a significant health issue[1,2].

Disc herniation, spinal canal stenosis and facet joint arthrosis are different forms of degenerative disc disease of the lumbar spine[3]. Protrusion of the central part of the disc due to disc thinning and annular tear results in disc herniation. Displacement of the annulus fibrous outer border outside the outlines of the vertebral body represents disc bulge[4]. Narrowing the spinal column, lateral recess, or neural foramina refers to spinal canal stenosis that causes nerve root compression and low back pain[5,6].

On the T2 W sequence of MRI, the degenerative Changes in the disc appear as a gradual loss of standard high signal of the nucleus pulposus[7]. Pfirrmann CW 2001[7] proposed a grading system and classification based on signal intensity of disc morphology, differentiation between annulus fibrosus and nucleus pulposus and height of the disc, labelled as grade I-V[8,9]. Another system of grading was modified Pfirrmann system assigns grades 1-8[10].

The modified Pfirrmann grading system is a convenient and valuable semi-quantitative evaluation of disc degeneration with good reproducibility[11].

In this study, we evaluate the extent of involvement and severity of intervertebral degenerative disc disease on MRI lumbar spine using a modified pfirrmann grading system.

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METHODOLOGY

This cross-sectional study was performed at the Radiology department of Ghulam Muhammad Mahar Medical College Hospital Sukkur from August 2021-January 2022. Non-probability consecutive sampling technique was used. A total of 460 cases with imaging features of degenerative disc disease on MRI lumbar spine were included in the study after taking informed consent. Patients with a history of trauma, surgery and infection of the lumbar spine were excluded from the study.

MRI lumbar spine screening includes T2 axial and sagittal sequences obtained on a 0.35 Tesla open

MRI machine. Two independent radiologists reviewed T2 sagittal sequences with five-year experience.
The intervertebral disc signal intensity changes were assessed at each level on the sagittal T2 weighted sequence of MRI lumbar spine using Modified Pfirrmann grading systems. Results were expressed as grades 1-8. Data was collected and analyzed using SPSS version 21.

RESULTS

Of 460 MRI lumbar spine T2 sagittal images, 267 (58%) were male, and 193(42%) were female. The ages of patient range from 25-65 years. The mean age was 45 years, and the most common age group was 30-55. Degenerated lumbar spine discs were graded using a modified pfirrmann Grading system. Grading by modified pfirrmann shows no disc score in grades 1, 2 and 3. Other discs score 13(2.82%), 41 (8.9%), 187(40.6%), 125(27.1%) and 94(20.4%) in grade 4,5,6,7 and 8 respectively. **Table I**

TABLE I: MODIFIED PFIRRMANN GRADES OF THE LUMBAR SPINE ON MRI

Modified Pfirrmann Grades	Score (%)
I	0
II	0
III	0
IV	13(2.82%)
V	41(8.91%)
VI	187(40.65%)
VII	125(27.17%)
VIII	94(20.43%)
Total	460(100%)

DISCUSSION

At different ages, low back pain is the primary health issue affecting two-thirds or 50-80% of the population worldwide[12,13]. MRI is considered a baseline radiological investigation with better resolution and lack of radiation in diagnosing lumbar spine degeneration, and it allows early identification and thus prevents long-term neurological complications[14,15].
Another benefit of MRI is better identifying soft tissue detail like discs, nerves and para-spinal muscles responsible for causing low back pain[16].
Pfirrmann grading systems score the signal intensity and morphology of the disc on T2 weighted sagittal sequence into five grades. Grades I and II saw as average central bright signal intensity. Grade III appears as a disc with decreased signal intensity. Grade IV and V show increasing disc height loss and additional degenerative changes. Grade III disc labelled as dehydrated or desiccated is of clinical importance as it depicts early changes and is suitable for less invasive medical treatment. This grading distinguishes it from grade IV, which needs surgical intervention[17,18].
Kettler A 2006[19] reviewed that the modified pfirrmann grading system was the only MR grading system with good inter and intra-reader reliability with kappa values of > 0.6.
Grading and incidence of disc degeneration were affected by age and sex in older age groups and is a natural phenomenon after 30 years[20]. Pfirrmann grade IV (Moderate disc degeneration) in lower lumbar levels predisposes herniation of disc and indication of surgery after spinal stenosis[21]. Schneiderman G et al.[23] proposed a modified grading system for better evaluation of intervertebral disc degeneration comprised of 1-8 grades.
Grades 1-3 build on the intensity of signals returning from the nucleus pulposus and inner fibres of the annulus. Grades 4 and 5 showed indistinct borders between the outer and inner fibres of the posterior annulus. Grade 6-8 shows, in addition, progressive reduced disc height [10].
MRI is considered the best imaging modality for diagnosing and evaluating disc degeneration in the lumbar spine. Quantitative classification can also be performed according to the changes in signal in the nucleus pulposus[22]. The first classification of disc degeneration was Schneiderman G et al.[23] based on indications of intervertebral discs on T2-weighted sequence classified into four grades. Quantitative classification of relative signal intensity (RSI) of nucleus pulposus was utilized by Luoma K 2001[24] and his colleagues in their study.
Our results were similar to those of Yu LP 201225, which showed Modified pfirrmann grades scores of 1.85%, 14.82%, 39.81%, 29.63%, and 13.89% for grades 4, 5, 6, 7 and 8, no grade score for 1-3. Another study shows similar results by Alkhasawneh MH 2021[26].

CONCLUSION

This study concludes that the Modified pfirrmann grading system is helpful in the assessment of the severity of lumbar spine intervertebral disc degeneration. It is an easy and reliable method and can be easily applicable for better correlation between radiological findings and clinical diagnosis. This grading helps in early detection and decides the mode of treatment. Lack of precise knowledge and data available in this context in our country.

Ethical Permission: Ghulam Muhammad Mahar Medical College Sukkur, ERC letter No. 121/22/ ERC/04, dated 10.08-2021.

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AUTHOR CONTRIBUTIONS

Hafeez R: Manuscript Writing, Data Collection, Analysis
Memon I: Data collection

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