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# Evaluating lumbar degenerative disc disease: The role of magnetic resonance imaging

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**Abstract**
**Background:** Degenerative disc disease describes the natural breakdown of an intervertebral disc of the spine. Despite its name, DDD is not considered a disease, nor is it progressively degenerative. On the contrary, disc degeneration is often the effect of natural daily stresses and minor injuries that cause spinal discs to gradually lose water as the annulus fibrosis, or the rigid outer shell of a disc, weakens. As discs weaken and lose water, they begin to collapse. This can result in pressure being put on the nerves in the spinal column, causing pain and weakness.
**Aim:** To evaluate the role of MRI in lumber degenerative disc disease in LS spine.
**Methodology:** A prospective study was conducted on 45 patients with clinical impression of lumbar degenerative disc disease Patients were subjected to MRI scanning studied.
**Result:** Disc bulge were most commonly found in females [55.55%], and also the ratio was close to the males [44.44%]. Bulging of disc in female show most commonly in L4-L5, Bulging of disc in male show most commonly in L3-L4. Lumbar disc abnormality was observed maximum in patients between 46-60 years (20 patients).
**Conclusion:** It was observed that MRI scan may be useful as a complimentary/adjunct modality to increase the diagnostic read of the lumbar disc degeneration in patients with in clinical documented lower back ache and other clinically symptoms. Since this study contains small sample size with possibility of inherent bias.

**Keywords:** Degenerative disc disease, disc Buldge, LS spine, annulus fibrosis, MRI

## Introduction
Degenerative disc disease in the lumbar spine, or lower back, refers to a syndrome in which age-related wear and tear on a spinal disc causes low back pain. Intervertebral discs are tough, fibrous structures that act as ligaments between vertebrae, absorbing pressure and providing cushioning for the spinal column. Discs are flexible yet sturdy enough to facilitate movement such as bending forward, backward, and side to side [1].

## Degenerative disc disease (DDD)
Describes the natural breakdown of an intervertebral disc of the spine. Despite its name, DDD is not considered a disease, nor is it progressively degenerative. DDD can cause acute or chronic low back or neck pain as well as nerve pain depending on the location of the affected disc and the amount of pressure it places on the surrounding nerve roots. The typical radiographic findings in DDD are black discs, disc space narrowing, vacuum disc, end plate sclerosis, and osteophyte formation. DDD can greatly affect quality of life. Disc degeneration is a disease of micro/macro trauma and of aging, and though for most people is not a problem; in certain individuals a degenerated disc can cause severe chronic pain if left untreated [2, 3]. Degenerative disk disease is when normal changes that take place in the disks of your spine cause pain. Spinal disks are like shock absorbers between the vertebrae, or bones, of your spine. They help your back stay flexible, so you can bend and twist. As you get older, they can show signs of wear and tear. They begin to break down and may not work as well [4].

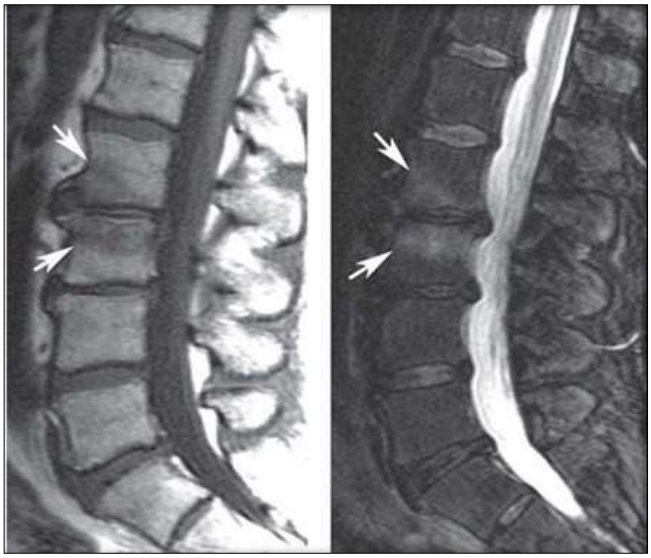

**Fig 1:** Sagittal T1-weighted (A) and fat-suppressed T2-weighted (B) images showing the typical pattern (arrow on each) of decreased signal intensity on the L1-L2 Level

## Causes of Degeneration

The term, degenerative disc disease is a slight misnomer because it is not technically a disease, nor is it strictly degenerative. It is not considered a disease because degenerative changes in the spine are natural and common in the general population [4]. There is a disc between each of the vertebrae in the spine. A healthy, well-hydrated disc will contain a great deal of water in its center, known as the nucleus pulposus, which provides cushioning and flexibility for the spine [5]. However natural daily stresses and minor injuries can cause these discs to gradually lose water as the anulus fibrosus, or the rigid outer shell of a disc, weakens [6]. The low back pain associated with lumbar degenerative disc disease is usually generated from one or both of following sources:

1. **Inflammation:** as the proteins in the disc space irritate the surrounding nerves-both the small nerve within the disc space and potentially the larger nerves that go to the legs (the sciatic nerve).
2. **Abnormal micro-motion instability:** when the outer rings of the disc, called the annulus fibrosis, are worn down and cannot absorb stress on the spine effectively, resulting in movement along the vertebral segment [1].

## Material and Method

This was a quantitative prospective and comparative study in which MRI LS spine was done for 45 patients carried. All the cases were selected at b/w the age group of 01-75years. The sub age ranges with sex details are categorized as per shown in table no-1 & fig no-2.

**Table 1:** Depicting the age & sex wise distribution of the patient

| Age group | Male | | Female | | Total | |
|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % |
| 01-30 | 03 | 15 | 01 | 4 | 04 | 8.88 |
| 31-45 | 01 | 5 | 08 | 32 | 09 | 20 |
| 46-60 | 07 | 35 | 13 | 52 | 20 | 44.44 |
| 61-75 | 09 | 45 | 03 | 12 | 12 | 26.66 |
| Total | 20 | 100 | 25 | 100 | 45 | 100 |

The patients selected for the study were clinically diagnosed cases of lumbar degenerative disc disease. The clinical history noted, duration of illness, trauma and any associated illness. Detailed clinical and neurological examination was done to find any neurological deficit. Based on the clinical history and MRI Scan, a clinic etiological diagnosis was made. All the patients underwent MRI examination on 1.5T GE SIGNA HD 8 CHANNEL UNIT. On the basis of inclusion criteria, all patients presented with clinically diagnosed with lumbar degenerative disc disease, both sexes and IPD & OPD patient were included. The result were made on the basis of statistical analysis by SPSS 19.0 version. The statistical analysis includes, table graph are plotted and by applying chi-square test with p-value and sensitivity, specificity, PPV and NPV has been calculated.

## Result

A total number of 45 cases were included in this study, on these scans, the imaging evaluation in the form of etiological factor for the grading of lumbar degeneration, their location and characteristics. In this study most of the patient was in between age range 46 to 60 years [20patient]. Male patient are mostly present in the age of 61-75years [9patient]. Female patient are mostly in the age group of 46-60years [13patient], Average age of our study are 52 years. The present study included a total number of 45 patients. In this study it was observed that 20 (44.44%) male and female 25 (55.55%) patients.

In this study following observations were made on the basis of radiological assessment:

Interspace observation Grade distribution: on the basis of disc desiccation

**Table 2:** It shows the grade distribution in male & female

| Grade | Male | | Female | |
|---|---|---|---|---|
| | Freq | Percent | Freq | Percent |
| Grade I | 08 | 17.77 | 3 | 6.66 |
| Grade II | 19 | 42.22 | 21 | 46.66 |
| Grade III | 20 | 44.44 | 22 | 48.88 |
| Grade IV | 09 | 20 | 05 | 11.11 |

- This table shows disc desiccation in male & female according to grade.
- In this study grade III is most commonly present in male as well as female.
- Male 44.44% and female 48.88% have degeneration of grade III.
- Grade-I is common in male 08(17.77%) & in female 03(6.66%) patient.

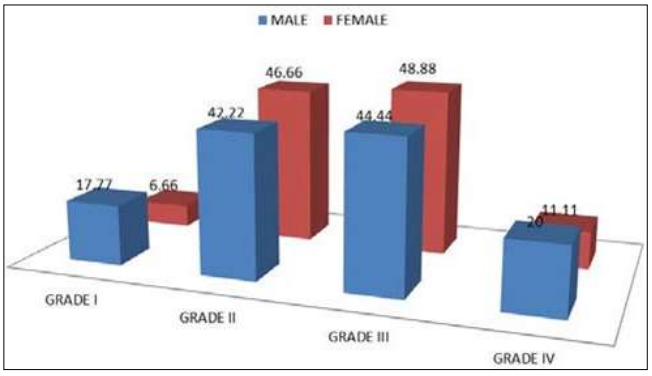


**Fig 3:** This figure shows the disc desiccation grade in male & female

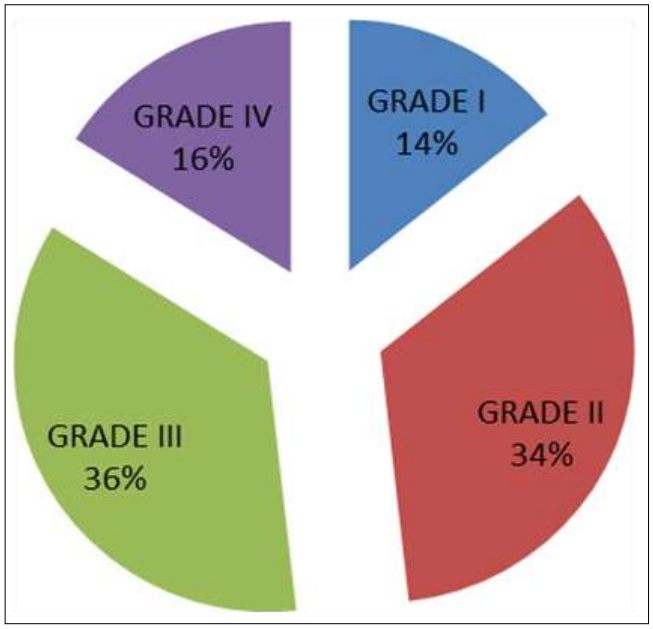


**Fig 4:** This figure shows the disc desiccation grade in male

In this study male patient have most common disc desiccation grade-III in 20(43%) patient, and grade-I found in only 8(6%) patient.

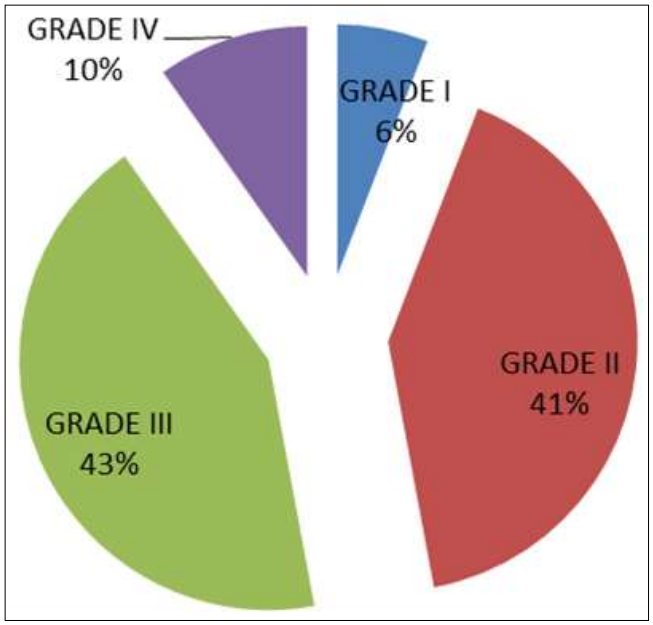


**Fig 5:** This figure shows the disc desiccation grade in female

**Table 3:** On the basis of disc desiccation in grade I*:

| Disc | Male | Female |
|---|---|---|
| D12-L1 | 0 | 0 |
| L1-L2 | 0 | 0 |
| L2-L3 | 2 | 1 |
| L3-L4 | 2 | 1 |
| L4-L5 | 3 | 1 |
| L5-S1 | 1 | 0 |

- Grade I is present most commonly in L4-L5 intervertebral disc.
- D12-L1 and L1-L2 don't have grade I.

**Table 4:** On the basis of disc desiccation in grade II*:

| Disc | Male | Female |
|---|---|---|
| D12-L1 | 09 | 14 |
| L1-L2 | 11 | 12 |
| L2-L3 | 13 | 14 |
| L3-L4 | 10 | 06 |
| L4-L5 | 06 | 04 |
| L5-S1 | 05 | 07 |

- Grade II is present most commonly in L2-L3 [13 patient] intervertebral disc in males.
- Grade II is least common in L5-S1 [5 patient] intervertebral disc in males.
- Grade II is present most commonly in L2-L3 & D12-L1 [14 Patient] intervertebral disc in females.
- Grade II is least common in L4-L5 intervertebral disc in Females.

**Table 5:** On the basis of disc desiccation in grade III*:

| Disc | Male | Female |
|---|---|---|
| D12-L1 | 08 | 07 |
| L1-L2 | 06 | 09 |
| L2-L3 | 08 | 10 |
| L3-L4 | 11 | 16 |
| L4-L5 | 13 | 21 |
| L5-S1 | 09 | 15 |

- Grade III is present most commonly in L4-L5 [21 patient] intervertebral disc in males.
- Grade III is least common in L1-L2 [6 patient] intervertebral disc in males.
- Grade III is present most commonly in L2-L3 & D12-L1 [14 Patient] intervertebral disc in females.
- Grade III is least common in L1-L2 [6 patient] intervertebral disc in Females.

**Table 6:** On the basis of disc desiccation in grade IV*:

| Disc | Male | Female |
|---|---|---|
| D12-L1 | 0 | 0 |
| L1-L2 | 02 | 0 |
| L2-L3 | 02 | 0 |
| L3-L4 | 02 | 01 |
| L4-L5 | 04 | 04 |
| L5-S1 | 07 | 01 |

- Grade IV is present most commonly in L5-S1 [7 patient] intervertebral disc in males.
- Grade IV is least common in D12-L1 [0 patient] intervertebral disc in males.
- Grade IV is present most commonly in L4-L5 [14 Patient] intervertebral disc in females.
- Grade IV is least common among D12-L1, L1-L2, L2-L3 [0 patient] intervertebral disc in Females.

**Table 7:** On the basis of disc buldge

| Disc | Male | Female |
|---|---|---|
| D12-L1 | 03 | 01 |
| L1-L2 | 09 | 04 |
| L2-L3 | 10 | 11 |
| L3-L4 | 18 | 17 |
| L4-L5 | 17 | 24 |
| L5-S1 | 16 | 17 |

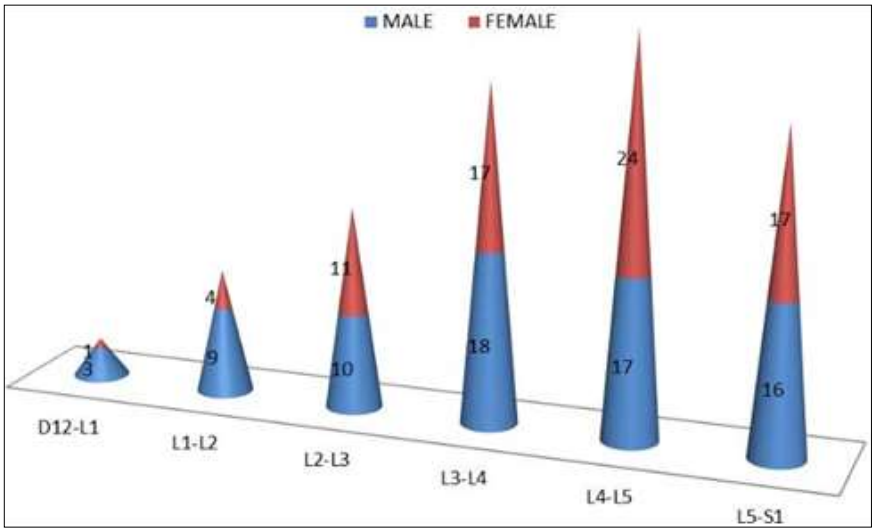


**Fig 6:** On the basis of disc buldge

- Disc bulge were most commonly in female but the ratio is very close to the male.
- Bulging of disc in male show most commonly in L3-L4.
- Bulging of disc in female show most commonly in L4-L5.

In 45 consecutive cases who were diagnosed with lumbar degenerative disc disease. In this 44.44% were male and 55.55% were female.
In the present study female patients (55.55%) showed more abnormality. Lumbar disc abnormality was observed maximum in patients between 46-60 years (20 patients). In our study mostly the male patient present in the age group of 61-75, and female patient 46-60 years.

**Discussion**
Low back pain is most common spine condition in India. Several studies have been done regarding role of MRI in evaluation of LDDD. Most of the studies have been done in general population. In the present study of 45 patients, we found that male 20 (44.44%) and female 25(55.55%) in number male: female ratio of 1:1.2 Intervertebral DD was associated with LBP severity in this population-based birth cohort. Moreover, DD was associated with pain status independently of other imaging findings (disc herniation's, Modic changes, radial tears, and spondylolytic defects). In the earlier studies among adolescents and young adults DD has been found to be associated with LBP.
Modic changes have been associated with LBP among adults.

**MR Imaging evaluation of Lumbar Degenerative Disc Disease**
In present study, MRI was done in 45 (20 males, 25 female) patients, MRI scans were abnormal in female 25 (55.55%) and male 20(44.44%) out of 45 patients. MRI scans were more common in female in the age of 46-60 years.

**Grade-I:** Eleven patients showed evidence of Grade I desiccation condition. Grade I desiccation is more common in male comparison to female. Male 8(17.77%) and female 3(6.66%) have grade I condition. Grade I desiccation is mostly present in L4-L5 lumbar region in male and in female shows in L2-L3, L3-L4, L4-L5 region.

**Grade-II:** Grade II desiccation were present more common in female 21(46.66%) and male 19 (42.22%). Grade II desiccation were mostly present in male at the level of L2-L3 (13patient), and female also shows at the level of L2-L3 region (14patient).

**Grade-III:** Grade III desiccation were present more commonly in female 22 (48.88%) and male 20 (44.44%). Grade III desiccation were mostly shows in male at the level of L4-L5 (13patient) and female also shows at the level of L4-L5 (21 patient).

**Grade-IV:** Grade IV desiccation were present more commonly in male 9 (20%) and female 5 (11.11%). Grade IV desiccation were mostly shows in male at the level of L5-S1 (7patient), and female shows at the level of L4-L5 (4patient).

**On the basis of disc bulge**
In present study L3-L4 were mostly effective in male. In female L4-L5 were mostly effective.

**Conclusion**
MRI scan is reliable and easily reproducible investigation for lumber degenerative disc disease of lumber scan. MRI scan is the investigation of choice in patients with lumbar disc diseases.
The sensitivity of MRI in detecting abnormalities in patients with lower back ache disorder is in part associated to the underlying pathologies and by the MRI techniques.
Accurate diagnosis of the lumbar degenerative disc for finding an effective treatment. MRI scan has emerged as a versatile and reliable tool in the evaluation of patients with lumbar disease including its severity of back ache.

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