

## PROSPECTIVE STUDY OF CORRELATION OF MRI FINDINGS AND CLINICAL SYMPTOMS IN LUMBAR SPINE DEGENERATIVE DISEASE

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### Abstract

**Introduction:** Degenerative disease of the lumbar spine is a broad terminology which includes disc degeneration, Modic changes, disc displacement, facet joint arthropathy and associated complications. The modality of choice for imaging degenerative disease of lumbar spine is Magnetic Resonance Imaging (MRI) due to excellent soft tissue spatial resolution and better tissue segregation. The aim of this study was to establish correlation of MRI Findings and Clinical symptoms in lumbar spine degenerative disease.

**Material and Methods:** This descriptive cross-sectional study involved 100 patients; lumbar MRI scans were performed through L1 to S1 Intervertebral disc spaces. Clinical presenting symptoms of the patients were noted, followed by MRI in which mainly six degenerative findings were looked at which were disc degeneration, Modic changes, disc bulge, disc herniation, central canal stenosis and nerve root compression.

**Results:** Most frequent degenerative finding on MRI, in markedly symptomatic patients was disc degeneration seen in 100% of patients, followed by diffuse disc bulge (92.5%) and nerve root compression (82.5%). The least common finding was Facet Joint Hypertrophy seen in 22.9% of patients. In Degenerative imaging findings there was no significant sex difference. Degenerative findings were more common at lower lumbar levels (L4/L5&L5/S1). Disc degeneration, disc herniations, central canal stenosis and nerve root compression were common in patients with radiculopathy than in patients with low back pain only. In Minimally symptomatic patients disc herniation was not seen in any patient.

**Conclusion:** The most frequent degenerative finding in markedly symptomatic patients was disc degeneration followed by diffuse disc bulge and nerve root compression. Posterolateral was the most common location for disc herniation. Disc herniation, disc degeneration, canal stenosis and nerve root compression were significantly seen in patients with radiculopathy. There were no sequestered discs found in the studied patients. All degenerative findings excluding disc herniation were also seen in lesser prevalence in minimally symptomatic patients.

**Keywords:** Degenerative Disease, Lumbar Spine, MRI, Disc Degeneration, Disc Herniation, Modic Changes, Clinical Symptoms, Back pain

### Introduction

Lower back pain (LBP) is a major public health problem<sup>1</sup>. Around 10% of persons with LBP become chronically disabled<sup>1</sup>. Patients with LBP may also present with sciatic symptoms. The quality of life and hence productivity is reduced due to LBP and sciatica for a significant proportion of population affected<sup>1</sup>. The primary disorder in Lumbar Spine Degenerative Disease is disc degeneration<sup>2</sup>. The degenerated disc is weakened hence causing instability of the spine, which may result in modic changes, disc displacement, nerve root compression and canal stenosis<sup>2</sup>. This disorder is common among middle-aged individuals, who are usually the working population hence an enormous economic burden may be created in the society<sup>1</sup>. Before surgery, MRI is recommended in patients with severe symptoms, as it has better tissue segregation than other imaging modalities<sup>3</sup>.

The aim of this study was to establish pattern of lumbar spine degenerative disease among patients with symptoms of marked or minimal back pain with or without radiculopathy, referred for lumbar spine MRI at Sahyog Imaging Center, Sir T Hospital Bhavnagar. The results of this study can be used as baseline data for comparison with other studies elsewhere, and assist in planning for further research areas on lumbar spine degenerative disease.

### MATERIAL AND METHODS

The data for the study was collected from patients referred for Lumbar spine MRI scan at Sahyog Imaging Center, Sir T Hospital Bhavnagar from April 2018 to March 2019. A cross sectional observational descriptive study design was carried out on patients visiting the OPD/IPD referred for MRI scan to Sahyog Imaging Center, Sir T Hospital Bhavnagar from April 2018 to March 2019.

The patients above age of 20 years present with Low Back Pain of various intensity with/without radiculopathy and clinically suspected as a case of lumbar spine degenerative disease were noted with the details of clinical presentation or symptoms and then were investigated with MRI. The study group included a sample size of 100 patients selected by a purposive sampling. The data was analyzed by a descriptive analysis. A complete detailed clinical history of the patient was taken with particular reference to the Low back pain with/without radiculopathy.

Patient with history of acute trauma, surgical intervention, infection, tumors and tumors like conditions, patients of age below 20 year and patients with metallic implants were excluded from study. GE 1.5 TESLA MRI machine was used for lumbar spine MRI scan. Standard surface coils and body coils were used for Lumbar spine for acquisition of images. Data was entered into a MS Excel spread sheet and was exported further into statistical software for further analysis. The frequency distribution of categorical variables and proportion for continuous variables were determined.

## RESULTS

The study included 100 patients; the age range was 20-80 years. Overall mean age was 42 years and mean age for males and females were 43 years and 41 years respectively. There was no significant difference in the distribution of males and females by age categories. Out of 100 patients, 54 (54%) were males and 46 (46%) were females. Out of 100 patients 80 patients were having marked low back pain with or without radiculopathy, while 20 patients were having minimal or very mild low back pain without radiculopathy.

On lumbar spine MRI, in markedly symptomatic patients most frequent degenerative findings was disc degeneration seen in 100% of patients, followed by diffuse disc bulge (92.5%) and nerve root compression (82.5%). The least common finding was Facet Joint Hypertrophy seen in 22.9% of patients.

In Minimally symptomatic patients disc herniation was not seen in any patient.

**Table 1:** Percentage distribution of MR imaging degenerative findings in markedly symptomatic patients (n=80).

| Degenerative Findings         | Percentage of patients |
|-------------------------------|------------------------|
| Disc Degeneration             | 100%                   |
| Modic Changes                 | 50%                    |
| Disc Bulge                    | 92.5%                  |
| Disc Herniation               | 58.7%                  |
| Central Canal Stenosis        | 45%                    |
| Nerve Root Compression        | 82.5%                  |
| Ligamentum Flavum Hypertrophy | 40 %                   |
| Facet Joint Hypertrophy       | 22.9%                  |

**Table 2:** Percentage distribution of degenerative imaging findings correlated with symptoms (% in parenthesis).

| Findings                      | Markedly symptomatic patients (n=80) | Minimally symptomatic or Asymptomatic patients (n=20) | Total (N=100) |
|-------------------------------|--------------------------------------|---|---------------|
| Disc Degeneration             | 80 (100%)                            | 5 (25 %)  | 85            |
| Modic Changes                 | 40 (50%)                             | 4 (20 %)  | 44            |
| Diffuse Disc Bulge            | 74 (92.5%)                           | 6 (30%)   | 80            |
| Disc Herniation               | 48 (58.7%)                           | 0 (0 %)   | 48            |
| Central Canal stenosis        | 36 (45%)                             | 1 (5 %)   | 37            |
| Nerve Root Compression        | 66 (82.5%)                           | 2 (10%)   | 68            |
| Ligamentum Flavum Hypertrophy | 32 (40%)                             | 7 (35%)   | 39            |
| Facet Joint Hypertrophy       | 28 (22.9%)                           | 4 (20%)   | 32            |

Most of the degenerative findings were seen at lower lumbar levels i.e. L4/L5 and L5/S1. At L4/L5 and L5/S1 the prevalence of disc degenerative findings were more and were significant whereby these findings at L1/L2, L2/L3 and L3/L4 were comparatively were less and in most cases not significant.



**Figure 1:** Axial T2-weighted image of intervertebral disc show diffuse disc bulge with left paracentral disc protrusion (arrow).



**Figure 2:** Type I Modic Change-Sagittal T2-weighted image show high signal intensity at L5-S1 level.

Disc protrusions were more common than disc extrusion. 94.3% of herniated disc were protrusion and only 5.7 % of herniated disc were extrusion. Most common location of herniated disc was posterolateral. 82.7% of herniated discs were posterolateral and only 17.3 % of herniated disc were posterocentral. Most common level of disc herniation was level 4-5 (45.7%) and least common level was L1-2 (3.7%).

Disc degeneration, disc herniations, central canal stenosis and nerve root compression were common in patients with radiculopathy than in patients with low back pain only.

Among minimally symptomatic patients most common degenerative finding was Ligamentum flavum hypertrophy (35 %), followed by diffuse disc bulge (30% ), Modic changes and Facet joint hypertrophy were also found in 20% cases. Nerve root compression was seen in only 10 % cases.

## DISCUSSION

All recruited patients after getting detailed clinical history were underwent MRI of the lumbar spine and both sagittal and axial views of all images were interpreted to locate the degenerative findings. MRI findings in Patients who were more symptomatic or markedly symptomatic shows marked degenerative changes of various types , however MRI in few minimally symptomatic patients also revealed few degenerative changes. Degenerative changes were searched for in all patients examined. Most of these degenerative findings were seen at L4/L5 (37.2%) and L5/S1 (26.2%). Though a degenerative change of the disc begins early in life and is partly a consequence of aging, the actual cause is not known but many factors (autoimmune, genetic, re-absorption and biochemical) have been implicated in accelerating the process. Since lumbar spine is subjected to heavy mechanical stress, it is a common area affected by degenerative changes<sup>4</sup> this could partly explain such observation in this study group. The mean age of this study group is 43 years , could be another explanation, as degenerative changes is common in individuals above 40 years of age and its prevalence increases progressively to over 90% by 50 to 55 years of age<sup>5</sup>.

Disc degeneration was the most frequent finding observed in 85% of patients in this study. The prevalence was observed to increase with age. The difference observed between the age groups was significant and compares well to the findings of other previous studies<sup>5</sup>.

The prevalence of Modic changes (44%), was higher compared to 23% found by Kuisma et al (2009)<sup>6</sup> and similar to, 43% found by Jensen et al (1994)<sup>7</sup>. In this study, it was observed that Modic changes progressively increased with spine level. Lower the spine level higher the prevalence and the most common location were L4/L5 and L5/S1. This

observation is consistent with previous study by Kuisma et al (2009)<sup>6</sup>.

Disc displacement is also a common finding in lumbar spine degenerative disease. The displaced disc can be just a simple bulge or herniation; herniated disc can be protrusion, extrusion or sequestration. In this study disc bulges were more common than disc herniation (80% and 48% respectively); and this is similar to the findings reported by Sivas et al (2009)<sup>8</sup> and Ong et al (2003)<sup>9</sup>. The prevalence of disc herniation was lower than what was reported by Modic et al (2005)<sup>10</sup>, Shobeir et al (2009)<sup>3</sup> and Siddique et al (2005)<sup>11</sup>.

Various studies have reported that disc herniation is common at L4/L5 and L5/S1 and the frequency at these levels is ranging from 30% to over 90%<sup>9,12</sup>. This was also reflected in this study as 80% of the herniated disc were at L4/L5 and L5/S1, this can be due to the large work load causing stress at lower lumbar levels of the spine. The most common location for disc herniation was posterolateral, seen in 82.7%. Posterocentral disc herniations seen in 17.3%. This finding is similar to previous report<sup>12</sup>. The intraspinal disc herniations were the most common, and this is similar to the findings seen by Takarad et al (2008)<sup>13</sup>.

The prevalence of disk degeneration in asymptomatic individuals increased from 37% of 20-year-old individuals to 96% of 80-year-old individuals. Disk bulge prevalence increased from 30% of those 20 years of age to 84% of those 80 years of age. Disk protrusion prevalence increased from 29% of those 20 years of age to 43% of those 80 years of age. <sup>12</sup> However Takatalo et al <sup>14</sup> found that disk herniations were strongly associated with low back pain severity among young adults, similarly in present study disc herniation was only seen in markedly symptomatic patients.

## CONCLUSION

The role of diagnostic imaging is to provide accurate anatomic information and to guide decision making. This cross-sectional hospital based study used MRI to diagnose spine degenerative changes as it has better tissue segregation and it can show degenerative changes at an early stage as compared to other imaging techniques such as CT scan. Other advantage of MRI includes having no known side effects or morbidity, no radiation exposure and is noninvasive. Despite its high sensitivity, degenerative changes are also observed on many MRI scans in asymptomatic subjects, thus somehow questioning its specificity. So probably MRI is more beneficial to patients with chronic clinical symptoms and those who are being planned for spine surgery.

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