# SENILE DEGENERATIVE CHANGES IN ADULT LUMBAR SPINE! - A PROSPECTIVE STUDY

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**ABSTRACT: BACKGROUND:** Low back pain (LBP) is a common presenting complaint affecting mostly middle aged and older person and traditionally considered as ageing process, but now-a-days large number of younger people are also affected by this debilitating chronic disorder. The cause of early onset of degenerative spine disease is multifactorial, but genetical predisposition plays very important role.

**AIMS AND OBJECTIVE:** To find out association between genetic predisposition and degenerative spine disease in adult patients and to assess the pattern of MRI findings of various degenerative diseases in lumbo-sacral spine.

**MATERIAL AND METHOD:** The present cross-sectional study had been performed among 100 selected patients in 1yr period, who presented with chief complaint of chronic low back pain. After taking detailed clinical and professional history, MRI of lumbosacral spine had been performed. Total 100 patients were divided in two groups on the basis of genetical predisposition. Prevalence and spectrum of degenerative changes were compared between both groups.

**RESULTS:** Hundred patients of 20 to 35-year age had been selected with mean age of 27yr. Out of 100 patients; 47 were male and 53 were female. The most common degenerative findings were desiccation of disc (95%) followed by disc bulge, herniation, spinal canal stenosis, ligamentum flavum hypertrophy, facet joint hypertrophy and modic changes. L4-L5 and L5-S1 were the most commonly involved spinal levels for any degenerative pathology.

**CONCLUSION:** Good association is seen between early onset of degenerative spine disease and genetical predisposition in patients who have history of similar type degenerative spine disease in one or more first degree relatives in comparison to those patients who do not have any genetical predisposition. So it can be concluded that heredity play important role in early onset of degenerative spine disease in adults.

**KEYWORDS:** MRI, Low back pain, Genetical predisposition, Early onset, Degeneration.

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**INTRODUCTION:** 'Oh my god' this sentence comes out from mouth when a young looking adult person (sufferer of chronic low back pain) hears from his/her physician after reading his MRI report that he/she is having degenerative spine disease. Low back pain (LBP) is among most common musculoskeletal complaints worldwide due to degenerative spine disease.[1-3] In developed countries, LBP resulting from the degenerative diseases of spine is the most common cause of disability in all ages, predominantly in 4$^{th}$ decade and above and it is second most common cause of visit to physician.[4-6] It is general consensus that degeneration in spine is an ageing process and increased prevalence has been reported with the age. Impairments of the back and spine are ranked as one of the most frequent cause of limitation of physical activity in population of less than 45 years by the National Center for Health Statistics. The incidence of LBP is such that nearly 60% to 80% of people presents with complaint of low backache in a lifetime.[7] Now-a-days low back pain has become a common problem in young adults also (20-35yr age group).

Degeneration of intervertebral disc is complex and begins early in life due to consequences of variety of environmental factors, lifestyle, genetic and also of normal aging process. Mild degree of degenerative changes is physiological and should be considered pathologic only if these abnormalities are causing clinical signs and symptoms. Various structures of the spine are responsible for LBP of degenerative cause including the vertebral periosteum, facet joints, ligaments and disc. The most common location of these changes is the lumbar spine.

The term degeneration includes any one or more among the following changes including desiccation of intervertebral disc, fibrosis, reduction in height of disc space, diffuse bulging of the disc beyond the disc space, extensive fissuring (i.e., numerous annular tears) and mucinous degeneration of the annulus, modic changes, endplates sclerosis and osteophytes at the vertebral apophyses.[8] In magnetic resonance imaging, these changes are manifested as narrowing of disc space, T2 signal loss in intervertebral disc, presence of fissures, air locules, fluid calcification within the intervertebral disc, ligament flavum hypertrophy, altered marrow signal,

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marginal osteophytosis, disc herniation, mal-alignment, and canal stenosis.

Plain x-ray of L-S spine is first line radiological investigation and routinely advised in these patients to identify the gross morphological changes in the disco-vertebral unit, but complete evaluation of the soft tissues, intervertebral disc, ligaments and various structures of spine is not possible. With recent advances in imaging technology magnetic resonance imaging (MRI) has improved the diagnosis and identification of the cause of LBP and it has become the modality of choice for the evaluation of spinal degenerative diseases, as it provides multiplanar imaging capability and provides superior delineation of intervertebral disc, nerves, ligaments, epidural fat, CSF and bone marrow. MRI is most sensitive to disc diseases especially degenerative changes and it provides an excellent tool for evaluation of the extent of disc disease whether it is disc bulge, protrusion, extrusion or sequestration and its effects on spinal cord, nerve roots, foramina and other adjacent structures.

Intervertebral disc degeneration of lumbar spine is a major dominant factor in the etiology of low back pain.[9] Although disc degeneration is an age related process and may arise due to any of several pathological conditions such as spinal trauma or an inflammatory response, but it is influenced by many factors such as genetics and systemic disorders (e.g. atherosclerosis, high cholesterol, diabetes mellitus and inadequate nutrient supply to the disc). Mechanical loading over the spine has been identified as a major extrinsic factor in the onset and progression of intervertebral disc degeneration.[9] In this study, all the patients are less than 35yr of age and sufferer of chronic low back pain. The purpose of this study is to find out the causes of early onset of degenerative changes by detailed history (personal and professional) and to find out spectrum of degeneration by MR imaging.

**AIMS AND OBJECTIVES:**

1. To find out association between genetic predisposition and degenerative spine disease.
2. To assess the pattern of MRI findings of the various degenerative diseases of lumbar spine in group A and B patients.

**MATERIALS AND METHODS: EQUIPMENT:** The patients were examined using Siemens magnetom vision plus 1.5T MRI scanner.

**STUDY DESIGN:** This is an institution based prospective comparative observational study approved by the institutional research committee and ethical committee. A written informed consent was obtained from all the patients prior to imaging and a Performa was filled after discussion with patient. This study includes 100 selected patients of 20-35yr age group those were referred for MRI lumbosacral spine with chief complains of chronic low backache. After taking the detailed history, considering the symptomatology of patients and performing clinical test (e.g., SLR test) in the Department of Orthopedics patients has been referred to Department of Radiodiagnosis, People's Medical College, Bhopal, where they will be evaluated with MRI L-S spine (MRI sequences used- T2, PD Coronal/Sagittal; T2 Axial; T1 SE Coronal/Sagittal; STIR Coronal; STIR Axial). Out of total 100 patients, 50 have genetical predisposition (their one or more I$^{st}$ degree relative had degenerative spine disease) and they were included in group A, while other 50 patients who do not have any genetical predisposition and they were included in group B.

**Inclusion Criteria:** We include the patients with any one or more complaint mentioned as below:

- Patients who clinically present with chronic low back pain.
- Patients presenting with radicular pain radiating to one or both lower limbs.
- Patients with neurological deficits including bowel and bladder disturbances.

**Exclusion Criteria:**

- Patients with ferromagnetic implants, especially steel implants, pacemakers and aneurysm clips.
- Patient with history of trauma or operative intervention for low backache.
- Patients with complaints of non-manageable claustrophobia.
- Chronic low backache due to malignant or infective etiology.

**Statistical Analysis:** Statistical analysis was done using Statistical Package of Social Science (SPSS Version 19; Chicago Inc., USA). Data comparison was done by applying specific statistical tests, i.e., Chi Square test to find out the statistical significance of the comparisons. Qualitative variables were compared using proportions. Significance level was fixed at $P < 0.05$.

**RESULT AND ANALYSIS:** Total 100 patients were selected for the study. Those who are following our inclusion criterion are divided in 2 groups (A and B) on the basis of genetical predisposition and each group had 50 patients. Data of patients and findings of MRI were analysed and categorised as follows:

**Demographics:** (Table 1 and Fig. 1): Mean age of patients in this study was 27 years (20-35years); maximum 47% of study population was in the age group of 31-35 years. Majority of the study population was females (53%) and remaining 47% were males. One noticeable thing is that all patients are adult and majority is females.

**Degenerative Changes:** (Table 4 and Fig. 2): In lumbosacral MRI overall prevalence of lumbar disc degenerative changes was 95%, followed by disc bulge 53%, modic changes 42%, spinal canal stenosis 34% and disc herniation 31%. Minority of participants (5%) do not

show any degenerative change in lumbar MRI; however, straightening of curvature is noted in MRI of few of them which may be due to muscle spasm.

**Disc Degeneration:** (Table 2): Degenerative findings are common in lumbosacral spine than any part of spine due to highest mechanical load; commonest finding is disc degeneration which can be seen at all the levels of lumbar spine. Out of total cases (n=95) of degenerative findings; highest prevalence are cases of L5-S1 level involvement, 27 (28.4%) followed by multiple level 26 cases (27.3%), L4-L5 level 22 cases (23.1%), L3-L4 12 cases (12.6%), L1-L2 5 cases (5.2%) and L2-L3 3 cases (3.1%).

In disc degeneration the prevalence of mild degeneration was 58.8%, moderate degeneration was 36.8% and severe disc degeneration was 4.4%.

Acute posterior peripheral annular tear is observed in 9 cases of our study. Usually focal minor tear does not cause any disc prolapse or spinal canal stenosis, but due to inflammatory process near nerve roots it may precipitate severe low backache.

Increased age had highly significant association with mild-to-moderate disc degeneration (P value is 0.001).

**Disc Bulge and Herniation:** (Table 3):

- Fifty three cases (53%) in the study showed posterior disc bulge; 50 of them had diffuse posterocentral type bulge and 3 of them had posterolateral type bulge. Most of the cases show disc bulge at L4-L5 and L5-S1 level accounting total 49 cases.
- Thirty one cases (31%) of the study had posterior disc herniation, out of them 16 case had protrusion, 13 cases had extrusion, 1 case had extrusion with migration and only 1 case had sequestration.
- Most commonly involved level in protrusion cases was L5/S1 (7 cases), then involving L4/L5 (6 cases). Protrusion was significantly associated with moderate spinal canal stenosis comprising 7 patients (43.7%).
- Among extrusion cases L5/S1 and L4/L5 were among the most involved levels with the frequency of 6 and 4 cases in each. Extrusion was significantly associated with severe spinal canal stenosis comprising 4 patients (30.7%).
- Only 2 cases of extrusion + migration were found at L5/S1 spinal level.
- Only 1 case of sequestration was found involving L4/L5 spinal level.

**TYPES OF DISC HERNIATION:** (Table 3):

- The most common type of disc herniation in this study is protrusion; found in 16 cases and mostly involving L5-S1 and L4-L5 level accounting 7 and 6 cases respectively for each level; 3 cases showed other levels and multiple level involvements. Posterocentral type of disc protrusion was most common type involving 12 patients (75%), followed by posterolateral type involving 2 patients and foraminal type involving only 2 patients accounting 12.5% for each. There were no cases of extraforaminal type of protrusion.
- Extrusion was the second most common type of disc herniation seen in total 13 cases and involving mostly L5-S1 and L4-L5 level accounting 6 and 4 cases respectively for each level. Extrusion with migration of disc fragment is observed in 2 cases in our study.
- Sequestration type of disc herniation is least common among disc herniation and seen in only 1 case of our study.

**Facet Joint Hypertrophy:** (Table 4 and fig. 2):

- Forty two patients (42%) of total (n=100) showed facet joint hypertrophy.
- L4/L5 and L5/S1 were amongst the most involved levels with the frequency of 10 and 12 cases in each in our study. Sixteen cases showed other levels and multiple level involvement.
- The occurrence of facet hypertrophy was significantly associated with increased age. Most common age groups to be affected with this were 31-65yrs.

**Spinal Canal Stenosis:** (Table 3 and Fig. 3):

- Thirty four patients (34%) of total (n=100) had mild-to-severe degree of spinal canal stenosis. Less than 10mm anteroposteior diameter of spinal canal was considered as lumbar canal stenosis.
- Observations showed that spinal canal stenosis was most commonly found at L5-S1 and L4-L5 level, 11 and 9 cases respectively for each level; 7 cases showed multiple level involvements and rest 7 cases had other levels involvements.
- Mild spinal canal stenosis was found to involve total 15 cases, mostly at L5-S1 and L4-L5 level; 3 cases for each level; 6 cases show multiple level involvements and 3 cases had other levels involvement.
- Moderate canal stenosis was found in total 13 cases; most commonly at L5-S1 level accounting 5 cases followed by 4 cases at L4-L5 level; 2 cases showed multiple level involvements and 2 cases had other levels involvement.
- Severe spinal canal stenosis was seen in total 6 cases; most commonly at L4-L5 and L5-S1 level; accounting 2 cases for each level and 2 cases had other level involvement.

**Ligamentum Flavum Hypertrophy:** (Table 4 and Fig. 2)

- Among all non-discogenic causes of spinal canal stenosis; commonest is ligamentum flavum hypertrophy which constitutes almost 90% share.
- In total 48 cases (48%) of ligamentum flavum hypertrophy in our study L4/L5 and L5/S1 were amongst the most involved levels with the frequency of 12 (25%) and 15 cases (31.2%) respectively and rest 21 cases (43.7%) had other levels and multiple level involvement.

- Ligamentum flavum hypertrophy was significantly associated with increased age. Most of the patients (77%) aged between 26 to 35 years had degenerated disc.

**Osteophytes:** (Table 4 and Fig. 2):

- Forty two patients (42%) of total (n=100) patients showed osteophytes formation at anterior, anterolateral or posterior aspect of vertebral body.
- Twenty one cases were having anterior or anterolateral osteophytes at multiple spinal level and 13 patients at L5-S1 spinal level only.
- Eight patients showed posterior osteophytes at multiple spinal levels.

**Modic Changes** (Table 4 and Fig. 2):

- Forty two patients (42%) in this study showed modic changes.
- L4-L5 and L5-S1 level was most commonly involved in all affected patients.
- Type I and type II modic changes were most common and seen in 38 cases.
- Type 3 changes are least common and seen in only 4 cases.

**RADICULOPATHY:**

- In total 25 patients (25%) of radiculopathy, right unilateral involvement was most commonly observed in 15 patients, below knee type in 13 patients followed by above knee type seen in only 2 patients.
- Left unilateral involvement was less commonly observed in 5 cases, in which below knee type present in 4 patients while above knee type was present in only 1 patient.
- Bilateral involvement was uncommon. It was present only in 5 patients. All are below knee type.
- Bowel bladder involvement was seen in 2 patients and postural deformities were seen in 3 patients.
- Neurological deficits was present in 16 patients.

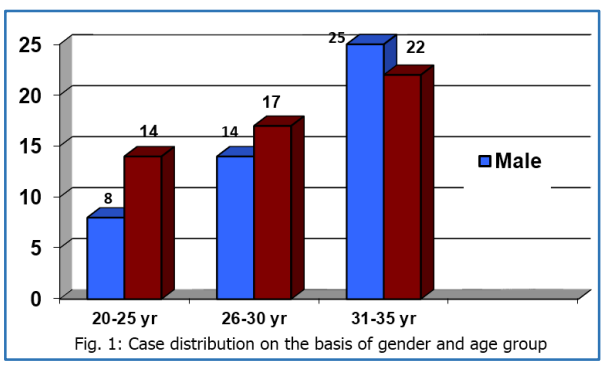

Fig. 1: Case distribution on the basis of gender and age group

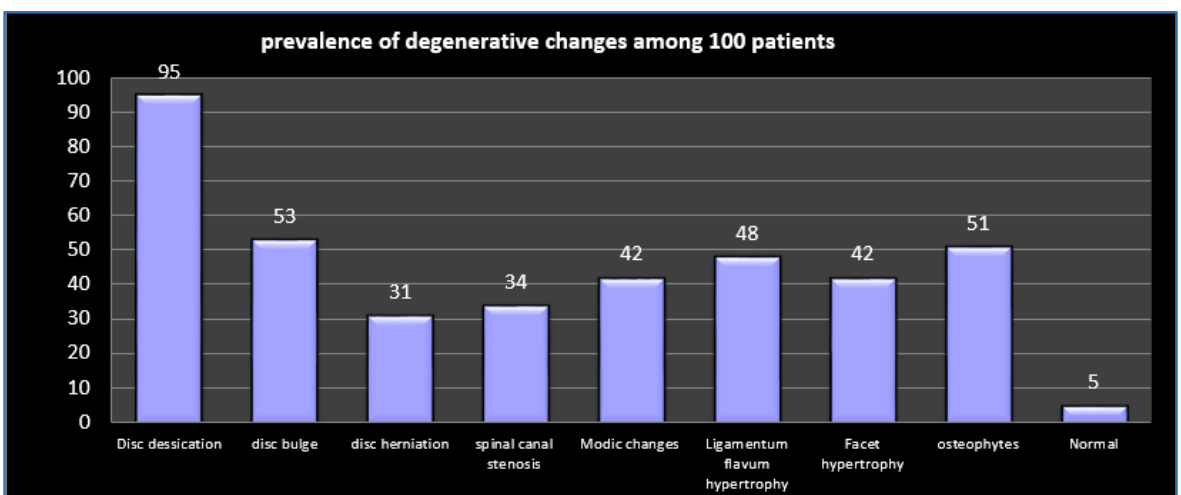

Fig. 2: Number of cases in each diseases type on imaging findings

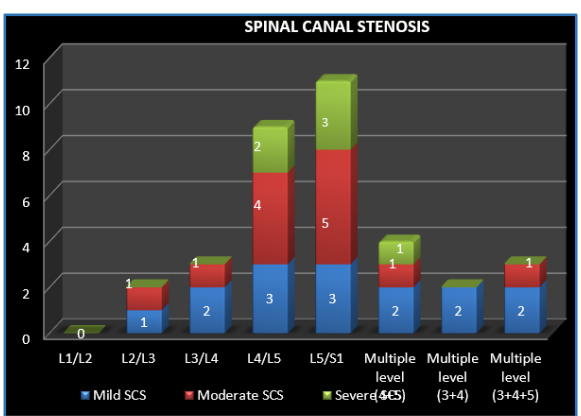

Fig. 3: Distribution of cases according to level and severity of spinal canal Stenosis

| Age Group in yrs. | Male | Female | Total |
|---|---|---|---|
| 20-25 | 8 | 14 | 22 (22.0%) |
| 26 – 30 | 14 | 17 | 31 (31.0%) |
| 31-35 | 25 | 22 | 47 (47.0%) |
| Total | 47 | 53 | 100 |
| Chi Square Value | 1.76 | | |
| P Value | 0.414(NS) | | |

***Table 1: Distribution of Total 100 cases according to age group***

| Level of Involvement | Group A (n=50) | Group B (n=50) | Chi Square Value | P Value |
|---|---|---|---|---|
| L1-L2 | 1 | 1 | 1.41 | 0.966(NS) |
| L2-L3 | 2 | 3 | | |
| L3-L4 | 6 | 7 | | |
| L4-L5 | 11 | 13 | | |
| L5-S1 | 15 | 14 | | |
| Multilevel | 13 | 9 | | |
| Normal (No level involved) | 2 | 3 | | |
| Total | 50 | 50 | | |

***Table 2: Distribution of cases of Disc Degeneration according to level of involvement***

| DISC BULGE AND HERNIATIONS | SPINAL CANAL STENOSIS | | | | |
|---|---|---|---|---|---|
| | Mild | Moderate | Severe | Chi square Analysis | P Value |
| Diffuse disc bulge | 32(64%) | 13(26%) | 5(10%) | 0.361 | 0.835(NS) |
| Asymmetrical disc bulge | 2(66.7%) | 1(33.3%) | 0 | | |
| Disc Protrusion | 8(50%) | 6(37.5%) | 2(12.5%) | 1.08 | 0.897(NS) |
| Disc Extrusion | 6(46.1%) | 4(30.8%) | 3(23.1%) | | |
| Disc Extrusion with migration | 1(50.0%) | 1(50.0%) | 0 | | |

***Table 3: Association of disc bulge and herniation with spinal canal stenosis***

| MRI L-S Spine Finding | Group A (n=50) | Group B (n=50) | Chi Square Value | P Value |
|---|---|---|---|---|
| Disc desiccation | 48 (96%) | 47 (94%) | 1.65 | 0.977(NS) |
| Disc bulge | 29 (58%) | 24 (48%) | | |
| Disc herniation | 18 (36%) | 13 (26%) | | |
| Modic changes | 25 (50%) | 17 (34%) | | |
| Osteophytosis | 29 (58%) | 22 (44%) | | |
| Ligamentum flavum hypertrophy | 27 (54%) | 21 (42%) | | |
| Facet hypertrophy | 22 (44%) | 20 (40%) | | |
| Spinal canal stenosis | 20 (40%) | 14 (28%) | | |

***Table 4: Comparison of degenerative spine Diseases between group A and Group B***

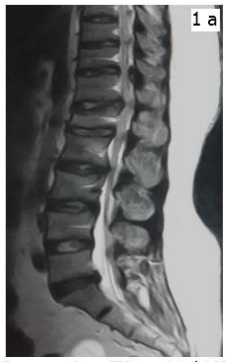


**Image 1 a:** T2 sagittal MRI image of lumbar spine in 35yr old female is showing disc desiccation and marginal osteophytes at multiple levels
**Image 1 b:** T2 sagittal MRI image of lumbar spine in 33yr old male is showing type 1 modic changes and marginal osteophytes in L3, L4 and L5 vertebral body

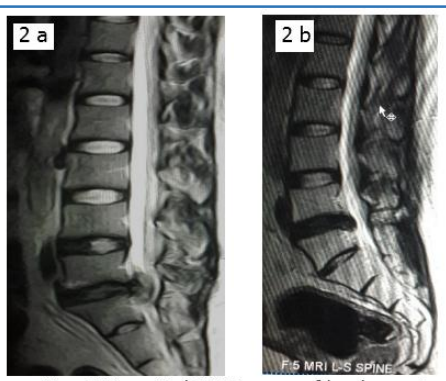


**Image 2 a:** T2 sagittal MRI image of lumbar spine in 28yr old male is showing extruded disc in spinal canal at L5-S1 level
**Image 2 b:** T2 sagittal MRI image of lumbar spine in 22yr old female is showing disc protrusion at L5-S1 level

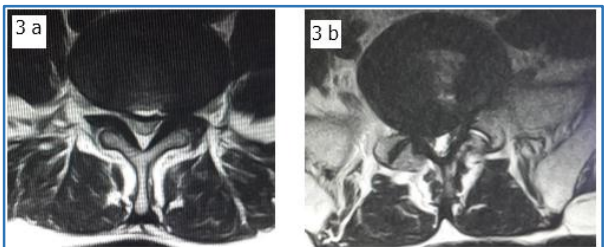


**Image 3 a:** T2 axial MRI image of 23yr old male is showing diffuse posterior disc bulge and acute posterior peripheral annular tear
**Image 3 b:** T2 axial MRI image of 31yr old female is showing left posterolateral asymmetric disc bulge

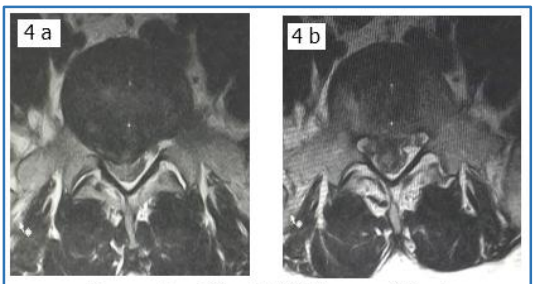


**Image 4 a:** T2 axial MRI image of lumbar spine in 27yr old femaleis showing posterocentral disc protrusion
**Image 4 b:** T2 axial MRI image of lumbar spine in 32yr male is showing extruded disc in spinal canal causing severe spinal canal stenosis

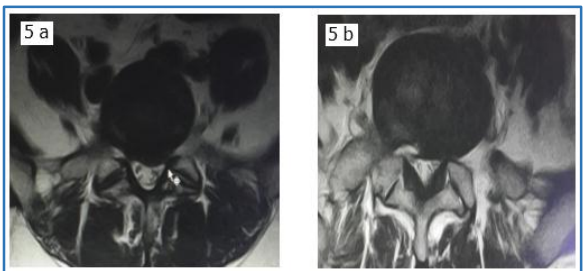


**Image 5a:** T2 axial MRI image of lumbar spine in 33 yr male is showing left posterolateral disc protrusion causing compression over lateral recess
**Image 5b:** T2 axial MRI image of lumbar spine in 30yr male is showing diffuse posterior disc bulge with right Posterolateral annular tear and ligamentum flavum hypertrophy

**DISCUSSION:** Though degeneration of the intervertebral discs begins early in life which is partly a result of ageing, the exact cause/causes is yet unknown, but many factors like autoimmune, genetic, re-absorption and biochemical have been associated in accelerating the process of degeneration.[10] The prevalence of disc degeneration among young individuals (20 to 35 years) can probably be explained as a result of genetic predisposition, but factors like repeated minor trauma and more physical load or exercise can also play an important role in causing disc degeneration. Since lumbo-sacral spine (L-S spine) is subjected to heavy mechanical stress than any other part of spine, it is prone to degenerative changes. This could partly explain such observation in this study.

This prospective cross-sectional observational study used MRI (Magnetic resonance imaging) to diagnose degenerative spine disease in L-S spine as it provides better tissue differentiation and it can show degenerative changes at an early stage in comparison to other imaging techniques (such as CT scan). Despite its high sensitivity, degenerative changes are also observed in MRI scans in many asymptomatic subjects, thus questioning its specificity. That is why MRI is more beneficial in symptomatic patients with chronic disease (chronic low back pain) and those who are being planned for spine surgery.[11]

Degenerative changes can occur at any level of lumbar spine, but more commonly at L4-L5 and L5-S1 level.[12-14] It was observed in various previous studies that older patients had degeneration more often at higher lumbar levels (e.g. L1-L2, L2-L3, L3-L4), whereas younger people had disc degeneration at lower lumbar levels (e.g., L4-5, L5-S1).[15,16] In our study, degenerative changes were observed in majority of patients. Most of these findings were seen at L4/L5 and L5/S1 level. Similar type of findings had been observed in previous studies conducted by Weiler et al., Boden et al., and Okada et al. They found that disc degeneration with diffuse disc bulge was commonly present in lumbar spine, predominantly at L4-L5 and L5-S1 level which had the highest rate of degeneration while L1-L2 level had the lowest rate of involvement.[1,17,18] In this study, only few patients had the disability on a single level and most patients had degeneration on multiple levels. This finding is similar to previous study of Boden et al.[17]

A case control study was undertaken by Simmons et al.[19] to determine if relatives of patients who had been admitted for surgical treatment of degenerative disc related complaints were at increased risk for lower back pain or sciatica? In this study group of 65 patients, they found that 44.6% were noted to have a positive family history, whereas only 25.4% of the patients in the control group had a positive family history; 18.5% of relatives in this study group had history of spinal surgery in comparison to only 4.5% of relatives in the control group. So the conclusion is that a familial predisposition to degenerative disc disease is well existing along with other risk factors. Another case–control study was performed by Kawaguchi et al.,[20] among 64 young women with or without low back pain. MRI was used to evaluate the disc degeneration and herniation. By using MRI findings and a polymerase chain reaction (PCR) assay to find association between aggrecan gene polymorphism and lumbar disc degeneration, this study showed that multilevel and severe disc degeneration was present in the participants who are having shorter variable numbers of tandem repeat length of the aggrecan gene. This suggests that subjects had a risk to develop multilevel disc degeneration at an early age.

It is traditional opinion that the etiology of intervertebral disc herniation is primarily due to increasing age, male predominance gender, occupation, smoking and excessive exposure to vehicle vibration.[21] Multiple recent research indicates that heredity may be largely responsible for degeneration as well as herniation of intervertebral discs. Since 1998, genetic influences on disc degeneration have been confirmed by the identification of several genes. The contribution of other factors such as height, weight and lifestyle is also considered but less certain.[22]

Genetic factors may be largely responsible for the degeneration as well as herniation of intervertebral disc.[23] A study conducted by Ala-Kokko and he concluded in her paper, "Even though several environmental and constitutional risk factors have been implicated in this disease, their effects are relatively minor and recent family and twin studies have suggested that sciatica, disc herniation and disc degeneration may be explained to a large degree by genetic factors."[24] In present era, so many researchers unanimously agree that lumbo-sacral disc degeneration and herniation appears similar to other

complex diseases, whose etiology had environmental and hereditary influence, each has its part of contribution and relative risk.

After the establishment of evidence for familial aggregation of disc degeneration, there was a need to distinguish between genetic and social sources of familial similarity. Sambrook et al.[25] conducted a study among twins to examine the hypothesis that genetic component has a major role in disc degeneration. MRI spine was obtained from 86 pairs of monozygotic twins and 154 dizygotic twins, 80% of subjects were female; significant genetic influence on disc degeneration was found. In the summary of this study they found disc degeneration (which consist of disc height, signal intensity, bulging, herniation and osteophytes formation), heritability estimates were very high, 74% (95% confidence interval, 64%–81%) for L-S spine and 73% (95% confidence interval, 64%–80%) for the cervical spine after adjusting for age, body weight, smoking, occupation, and physical activity of subjects. The analysis of individual MRI scan suggested that disc bulge and height were the primary contributors for genetic determination of the disc degeneration.

There are four major categories of candidate genes those having major role in degenerative disc disease. Category 1 is consisting of genes having association with the construction of the structural component of the intervertebral disc, like aggrecan gene and the collagen IX gene. Category 2 includes genes those responsible for production of degradation enzymes of disc matrix; for example, the matrix metalloprotease-3 gene. Category 3 consists of the genes related to bone structure, e.g. genes responsible for osteoporosis, Vitamin-D receptor and estrogen receptor genes are implicated in lumbar disc disease. Category 4 includes few other genes.[26]

Type IX collagen is an important structural component of nucleus pulpous and annulus fibrosus of intervertebral disc and it is considered to act as a bridge between collagens and non-collagenous proteins of tissues. It is a heterotrimer of three Alpha chains, 1(IX), 2(IX), and 3(IX), encoded by the genes COL9A1, COL9A2, and COL9A3, respectively. It consists of three collagenous (COL 1 to COL 3) and four non-collagenous (NC 1 to NC 4) domains.[27] In 1999, Annunen et al.[28] pointed out that allele of COL9A2 have a significant role in pathophysiology of disc disease. Videman et al.[29] and Kawaguchi et al.[30] reported that subjects with the tt or tt allele of the Vitamin-D receptor gene are frequently associated with severe and multilevel disc degeneration and herniation than ones with TT allele only. They also pointed an increased risk of degenerative disc disease at early age in subjects with the Tt allele in Vitamin-D receptor gene. Vitamin D has major role in proteoglycan synthesis by articular chondrocytes in vitro.,[31] because intervertebral disc is also rich in proteoglycan so that the Vitamin-D receptor may be directly involved in the pathogenesis of intervertebral disc degeneration.

Inflammatory cytokines are well known for their contribution in the genesis of back pain. Interleukin-1 in particular has major contribution in disc degeneration by inducing enzymes those responsible for destruction of proteoglycan and it is also involved in mediation of pain. Solovieva et al.[32,33] demonstrated an association between interleukin-1 polymorphisms and features of disc degeneration in MRI of male subjects. Disc degeneration is not only regulated by multiple genes, few environmental factors, gene-gene interactions and gene-environment interactions also coexist. At present, the study of allele of COL9A2 is more extensive than other genes associated with disc disease.

Disc herniation is commonest in L-S spine of adults with previously reported lifetime occurrence as high as 40%.[34] Adult patients usually present with low backache who usually do not have any history of trauma before the symptoms occur. However, more recent studies hypothesized that instead of being a primary contributory factor, trauma acts as a trigger factor in the exacerbation of the pre-existing disease of discs, e.g. very small damages, degenerative changes, etc. The second generally recognized cause for degeneration is genetic factor. Previous few studies have shown that up to 57% of adolescents presented with lumbar disc herniation have a first-degree relative with the same disorder.

**CONCLUSION:** The study to find out the association between genetical predisposition and early onset of degenerative changes concluded the results as follows:

- There is strong association between genetical predisposition and early onset of senile degenerative changes in adults. Females are more prone to early onset of degenerative changes.
- There is a wide spectrum of degenerative conditions of lumbar spine which show various patterns and variability with age.
- Disc degeneration was the commonest finding in the study and seen in almost all patients (95%) and involving all age groups.
- Disc bulge and herniation were seen commonly involving lower lumbar levels, e.g. L4-L5 and L5-S1.
- Protrusion is commonest type of disc herniation, which is seen increasing with age and more prevalent in males and at L5-S1 level; posterocentral disc herniation was the commonest type.
- Spinal canal stenosis had significant correlation with the level of involvement and it showed significant association with the degree of SLR test.
- MR axial images should be obtained in a contiguous manner (i.e., no skip areas or gaps) in order not to miss any free disc fragment, which is one of the common cause of failed back surgery.

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