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Detection of Lumbar Spine Degenerative Alterations in Low Back Pain Patients with Varying Ages – A Comprehensive Study

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Abstract

AIM: Low back pain in the lumbar spine causes a serious impact in the health-care systems. This study was undertaken to detect disc degenerative alterations in different age group patients suffering from low-back pain.

METHODS: This study was conducted on 199 patients (153 males and 46 females) suffering with low-back pain. Lumbar spine magnetic resonance imaging (MRI) 1.5T was applied and the patients with varying ages were studied on the basis of detection of degenerative alterations in the lumbar segments and the findings were compared in both genders.

RESULTS: The MRI-based detection showed that 55.3% of patients were affected with single desiccation (DS), 46.7% of patients with disc bulging, 42.2% of patients with desiccation with bulging (DB), 44.7% of patients were affected with desiccation at multiple levels (DML), and 40.7% of patients were desiccation and bulging at multiple levels (DBML). Interestingly, the detection of disc degeneration was almost the same in both genders ($p > 0.05$). The DS and disc bulging at single level were more prevalent in both genders with age<40 years. Interestingly, the DML and DBML were more prevalent in patients 40−60 years old in both genders. Importantly, the DML was found to be statistically higher in both genders with age ≥ 40 years as compared with patients with age < years ($p < 0.05$). The DBML level was also higher in both genders with age≥40 years but it was statistically insignificant ($p > 0.05$).

CONCLUSION: This study determined that the disc degenerative alterations in the lower lumbar spine appear at all age levels. Interestingly, there was no difference in the prevalence of disc degenerative alterations in both genders. The data also concluded that age advances the progressive occurrence of degenerative alterations at multiple levels in the lower lumbar spine.

Introduction

Low back pain has now been considered a major health issue in every population in all of the globe and its prevalence is reported to be more common in developed countries [1]. Low back pain is defined in several ways such as muscular tension and stiffness localized in below region of costal margin, the inferior gluteal folds with or without pain in the legs or simply defined as pain [2]. Pain and disability are considered to be well known symptoms for non-specific low pain. Different health-care professionals such as orthopedicians, general practitioners, and other specialists therapeutically handle patients with low back pain in varying ways depending on populations, regions, and also with other health morbidities [2], [3]. Number of etiological factors associated with low back pain has now been well defined such as paravertebral muscular atrophy, lordosis in lumbar, degeneration of disc, edema in end-plate, facetal joint degeneration, spondylolisthesis, and so on [1], [2], [3]. It has now been well established that degeneration in the disc is associated with low back pain and age is also reported to play a major role in the onset of severe low back pain injuries including muscular atrophy and degeneration in spine [4]. Not only aging, there are a number of biochemical or general factors such as alterations in body mass index, overweight, obesity, high low density cholesterol, sports activities, and types of occupations that are also caused in the occurrence of low back pain injuries [5]. There are a number of imaging techniques used for the detection of pathological alterations in intervertebral disc but the most common and widely used technique is the magnetic resonance imaging (MRI) [6], [7]. MRI is a well-known technique for the detection of disc degeneration in an early phase, which also detects loss of water, and alterations in the levels of proteoglycan in the nucleus pulpous and also perfectly used in the detection of disc desiccation [8]. Moreover, the herniation due to the alterations in the disc bulging can also be perfectly detected by the use of MRI [6], [7], [8]. This study was designed to detect the occurrence of disc degenerative alterations in the lower lumbar spine of patients with low back pain from the central region of Saudi Arabia. The analysis showed that the disc degenerative alterations in the lower lumbar spine appear at all age levels. There was no difference in the prevalence of disc degenerative

alterations in both genders. Interestingly, the outcome of this study also points out that age advances the prevalence of disc degenerative alterations at multiple levels in the lower lumbar spine.

Methods

Low back pain patients' recruitments

A total of 199 patients suffering from low back pain were recruited from the radiology clinics in the Qassim University affiliated hospitals. The average (±SD) age of recruited patients was 42.2 ± 10.8 years. Out of them, 153 patients were males with the average (±SD) age of 41.0 ± 9.95 years and 46 patients were females with the average (±SD) age of 46.0 ± 12.6 years. Ethical approval of the study was taken from Qassim University and written informed consent was obtained from all recruited patients. All patients reported lower back pain and pain in the legs were included in this study. However, patients with a history of myeloma, spinal surgery, or any other spinal pathology and trauma were not included in this study.

Magnetic resonance imaging and the data collection

The MRI procedure with 1.5 T parameter was used for the detection of degeneration in the disc as described previously [9], [10]. Briefly, several sequences of pulse were applied such as T1, T2, and STIR in multiple planes including sagittal, axial, or coronal during imaging examination of the whole spine to detect the specific degeneration. Specifically, the common detail about the tissue anatomy was collected by T1 sequence, whereas T2 sequence was applied for tissues with high water content, edema, and demyelination. Moreover, the overall impression IN THE marrow/soft-tissue edema was detected by STIR sequence. Importantly, the patients with low back pain were categorized on the basis of the progressive changes in the lumbar disc and the obtained data were compared with sex and age.

Characterization of patients on the basis of MRI findings

Based on the MRI investigations, the lumbar patients were characterized into five groups such as desiccation at single level (DS), disc bulging, desiccation with bulging (DB), desiccation at multiple levels (DML), and desiccation and bulging at multiple levels (DBML) as described previously [8], [11].

Statistical analysis

The relation of varying age and sex groups with degenerative disc was calculated by social science statistical online calculator https://www.socscistatistics.com/tests/ztest/default2.aspx using the Z Scores followed by two tailed analysis. The data were also further analyzed by statistical software Prism GraphPad version 5 (San Diego, CA, USA) and also by Statistical Package for the Social Sciences (SPSS, version 21) as described previously [12], [13].

Results

Age- and gender-wise distribution of patients suffering from low back pain

A total of 199 patients (42.2 ± 10.8 years) suffering from low back pain were divided into three age groups, namely, Group 1 (age < 40 years), Group 2 (age = 40−60 years), and Group 3 (age > 60 years). The patients in these groups were further characterized on the basis of gender. The complete age-wise distribution of studied patients with males and females characterization is summarized in Table 1. The results were further validated by regrouping of patients into two age groups, the patients with lower ages (patients < 40 years), and patients with higher ages (patients ≥ 40 years). The prevalence of lumbar spine degenerative alterations was measured using MRI imaging in these distributed patients below.

Table 1: Age-wise distribution of subjects suffering from low back pain

Age groups	Males	Females	Total subjects
Group 1, < 40 years			
Number of subjects	77	14	91
Mean age ± SD, years	33.2 ± 4.22	32.4 ± 5.03	27.5 ± 4.35
Group 2, 40–60 years			
Number of subjects	68	23	91
Mean age ± SD, years	47.5 ± 6.10	47.8 ± 6.10	47.6 ± 6.10
Group 3, > 60 years			
Number of subjects	08	09	17
Mean age ± SD, years	65.0 ± 2.61	67.0 ± 3.65	66.1 ± 3.21
All groups			
Number of subjects	153	46	199
Mean age ± SD, years	41.03 ± 9.95	46.04 ± 12.6	42.2 ± 10.8

SD: Standard deviation.

Desiccation at single level (DS) in the lower lumbar spine of patients with low back pain

The MRI-based detection of DS in 199 patients suffering with low back pain was first measured into three age groups, Group 1 (age < 40 years), Group 2 (age = 40−60 years), and Group 3 (age > 60 years) and the comparative data among these groups are summarized in Table 2. In lower age group patients (Group 1), 72.7% of males and 64.3% of females were found to be affected with DS. Whereas, middle age group (group 2), 44.1% of males and 47.8% of females were DS affected. However,

Table 2: Desiccation at single level among varying age groups subjects suffering from low back pain

Age groups	Males	Females	Total subjects
Group 1, < 40 years			
Subjects with DS	56/77	9/14	65/91
Percentage prevalence of DS	72.7	64.3	71.4
Group 2, 40–60 years			
Subjects with DS	30/68	11/23	41/91
Percentage prevalence of DS	44.1	47.8	45.0
Group 3, > 60 years			
Subjects with DS	3/8	1/9	4/17
Percentage prevalence of DS	37.5	11.1	23.5
All groups			
Subjects with DS	89/153	21/46	110/199
Percentage prevalence of DS	58.2	45.7	55.3

Males' groups: Males – Group 1 versus Group 2, p = 0.0091, Z = +2.61; Males – Group 1 versus Group 3, p = 0.190, Z = +1.31; Males – Group 2 versus Group 3, p = 0.826, Z = +0.22; Males – Group 1 versus all groups, p = 0.077, Z = +1.77; Males – Group 2 versus all groups, p = 0.180, Z = −1.34; Males – Group 3 versus All Groups, p = 0.478, Z = −0.71. Females' groups: Females – Group 1 versus Group 2, p = 0.459, Z = +0.74; Females – Group 1 versus Group 3, p = 0.303, Z = +1.03; Females – Group 2 versus Group 3, p = 0.478, Z = +0.71; Females – Group 1 versus All Groups, p = 0.352, Z = +0.93; Females – Group 2 versus All Groups, p = 0.912, Z = +0.11, Females – Group 3 versus All Groups, p = 0.496, Z = +0.68. Males versus Females: Males versus Females – Group 1; p = 0.603, Z = +0.52; Males versus Females – Group 2; p = 0.834, Z = −0.21; Males versus Females – Group 3; p = 0.298, Z = +1.04; Males versus Females – All Groups, p = 0.298, Z = +1.04. DS: Desiccation at single level.

the higher age group patients (Group 3) showed that 37.5% of males and 11.1% offemales were affected with DS. To validate these data statistically, the patients were further characterized into two age-wise groups in the lower ages (patients < 40 years) and the higher ages (patients ≥ 40 years) and the data are presented in Figure 1. In males, the data showed that the lower age group patients showed higher DS prevalence as compared with the DS prevalence in higher age group patients (p = 0.006; Z = 2.75). Whereas in females, the data showed a similar pattern as the DS prevalence was higher in the lower age group as compared with higher age group but it was not statistically significant

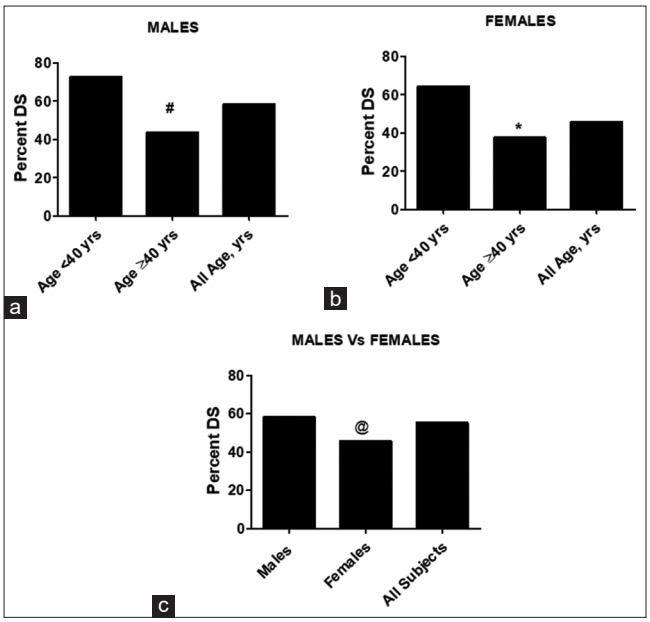

Figure 1: Desiccation at single level (DS) in patients of low back pain. (a) DS in males with varying age groups, Patients Age < 40 years versus #, p < 0.05; All Age patients versus #, p > 0.05; Patients Age ≥ 40 years versus All Age patients, p > 0.05. (b) DS in females with varying age groups, Patients Age < 40 years versus #, p > 0.05; All Age patients versus #, p > 0.05; Patients Age ≥ 40 years versus All Age patients, p > 0.05 (c) DS comparison in males and females patients groups. Patients Age < 40 years versus #, p > 0.05; All Age patients versus #, p > 0.05; Patients Age ≥ 40 years versus All Age patients, p > 0.05.

(p = 0.222; Z = 1.21). In total, the MRI findings of lumbar spine showed that 55.3% of studied patients showed DS and the prevalence of DS was higher in males as compared to females but it was not statistically significant (p > 0.05) (Table 2).

Disc bulging in lumbar spin of subjects suffering from low back pain

The bulging in studied individuals suffering with low back pain was also measured in three age groups, Group 1 (age < 40 years), Group 2 (age = 40−60 years), and Group 3 (age > 60 years) and the comparative data among these groups are summarized in Table 3. In the lower age group patients (Group 1), 66.2% of males and 64.3% of females were found to be affected with bulging. In the middle age group patients (Group 2), 33.8% of males and 26.1% of females were affected with bulging. Whereas the higher age group patients (Group 3) showed, only 12.5% of males and 11.1% of females were affected with bulging. The levels of prevalence of bulging in these groups in both males and females are presented in Table 3 and the data from all groups were also compared with the total number of studied individuals. The MRI findings of lumbar spine showed that 46.7% of studied patients had bulging and the prevalence of bulging was higher in males as compared to females but it was not statistically significant (p > 0.05). To further verify these data, the studied patients were further characterized into two age-wise groups in the lower ages (patients < 40 years) and the higher ages (patients ≥ 40 years). In males, the data showed that the lower age group patients showed higher prevalence of bulging as compared with higher age group patients (p = 0.008; Z = 2.67). Whereas in females, the data showed a similar pattern as the bulging was higher in the lower age group as compared with higher age group but it was not statistically significant (p = 0.091; Z = 1.69). These data are summarized in Figure 2.

Table 3: Disc bulging among varying age groups of subjects with low back pain

Age groups	Males	Females	Total subjects
Group 1, < 40 years			
Subjects with bulging	51/77	9/14	60/91
Percentage prevalence of bulging	66.2	64.3	65.9
Group 2, 40–60 years			
Subjects with bulging	25/68	6/23	31/91
Percentage prevalence of bulging	33.8	26.1	34.1
Group 3, > 60 years			
Subjects with bulging	1/8	1/9	2/17
Percentage prevalence of bulging	12.5	11.1	11.8
All groups			
Subjects with bulging	77/153	16/46	93/199
Percentage prevalence	50.3	34.8	46.7

Males' groups: Males – Group 1 versus Group 2, p = 0.007, Z = +2.67; Males – Group 1 versus Group 3, p = 0.263, Z = +1.12; Males – Group 2 versus Group 3, p = 0.660, Z = +0.44; Males – Group 1 versus all groups, p = 0.075, Z = +1.78; Males – Group 2 versus all groups, p = 0.150, Z = −1.46; Males – Group 3 versus all groups, p = 0.149, Z = −1.44. Females' groups: Females – Group 1 versus Group 2, p = 0.147, Z = +1.45; Females – Group 1 versus Group 3, p = 0.303, Z = +1.03; Females – Group 2 versus Group 3, p = 0.741, Z = +0.32; Females – Group 1 versus all groups, p = 0.156, Z = +1.42; Females – Group 2 versus all groups, p = 0.697, Z = −0.39, Females – Group 3 versus all groups, p = 0.624, Z = −0.49. Males versus Females: Males versus females – Group 1; p = 0.912, Z = +0.11; Males versus females – Group 2; p = 0.719, Z = +0.36; Males versus females – Group 3; p = 0.976, Z = +0.03; Males versus females – All groups, p = 0.259, Z = +1.13.

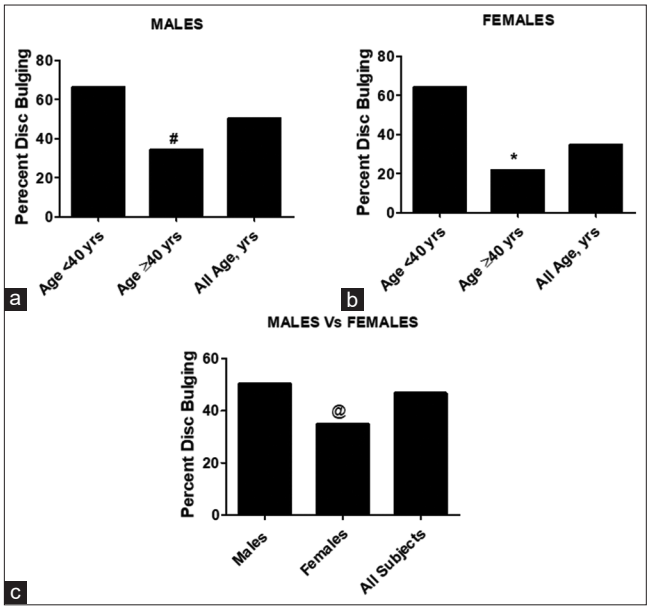

Figure 2: Disc bulging in patients of low back pain. (a) Disc bulging in males with varying age groups, Patients Age < 40 years versus #, p < 0.05; All Age patients versus #, p > 0.05; Patients Age ≥ 40 years versus All Age patients, p > 0.05. (b) Bulging in females with varying age groups, Patients Age < 40 years versus #, p > 0.05; All Age patients versus #, p > 0.05; Patients Age ≥ 40 years versus All Age patients, p > 0.05 (c) Bulging comparison in males and females patients groups. Patients Age < 40 years versus #, p > 0.05; All Age patients versus #, p > 0.05; Patients Age ≥ 40 years versus All Age patients, p > 0.05.

Desiccation with bulging (DB) in subjects with low back pain

The prevalence of DB in studied individuals suffering with low back pain was also quantified in age groups, Group 1 (age < 40 years), Group 2 (age = 40−60 years), and Groups 3 (age > 60 years) and the comparative data among these groups are summarized in Table 4. In the lower age group patients (Group 1), 58.4% of males and 64.3% of females were found to be affected with DB. In the middle age group patients (Group 2), 32.3% of males and 26.1% of females were affected with DB. Whereas the higher age group patients (group 3) showed, only 12.5% of males and 11.1% of females were affected with DB. The levels of prevalence of DB in these groups in both males and females are presented in Table 4 and the data from all groups were also compared with the total number of studied individuals. The findings of lumbar spine showed that 42.2% of studied patients had DB and the prevalence of DB was slightly higher in males as compared to females (p > 0.05). To further verify these data, the studied patients were further characterized into two age-wise groups in the lower ages (patients < 40 years) and the higher ages (patients ≥ 40 years). In males, the data showed that the lower age group patients showed higher prevalence of DB as compared with higher age group patients (p = 0.028; Z = 2.19). Whereas in females, the data showed that a similar pattern as the DB was higher in the lower age group as compared with higher age group but it was not statistically significant (p = 0.091; Z = 1.69). These data are summarized in Figure 3.

Table 4: Desiccation with bulging among varying age groups subjects suffering from low back pain

Age groups	Males	Females	Total subjects
Group 1, < 40 years			
Subjects with DB	45/77	9/14	54/91
Percentage prevalence of DB	58.4	64.3	59.3
Group 2, 40–60 years			
Subjects with DB	22/68	6/23	28/91
Percentage prevalence of DB	32.3	26.1	30.8
Group 3, > 60 years			
Subjects with DB	1/8	1/9	2/17
Percentage prevalence of DB	12.5	11.1	11.8
All groups			
Subjects with DB	68/153	16/46	84/199
Percentage prevalence of DB	44.4	34.8	42.2

Males' groups: Males – Group 1 versus Group 2, p = 0.044, Z = +2.01; Males – Group 1 versus Group 3, p = 0.358, Z = +0.92; Males – Group 2 versus Group 3, p = 0.674, Z = +0.42; Males – Group 1 versus All Groups, p = 0.144, Z = +1.45; Males – Group 2 versus all groups, p = 0.317, Z = −1.00; Males – Group 3 versus all groups, p = 0.522, Z = −0.64. Females' Groups: Females – Group 1 versus Group 2, p = 0.147, Z = +1.45; Females – Group 1 versus Group 3, p = 0.019, Z = +2.33; Females – Group 2 versus Group 3, p = 0.741, Z = +0.32; Females – Group 1 versus all groups, p = 0.156, Z = +1.48; Females – Group 2 versus all groups, p = 0.696, Z = −0.39. Females – Group 3 versus All Groups, p = 0.624, Z=-0.49. Males versus females: Males versus Females – Group 1; p = 0.928, Z = −0.09; Males versus females – Group 2; p = 0.772, Z = −0.29; Males versus females – Group 3; p = 0.977, Z = +0.03; Males versus females – All Groups, p = 0.483, Z = +0.69. DB: Desiccation with bulging.

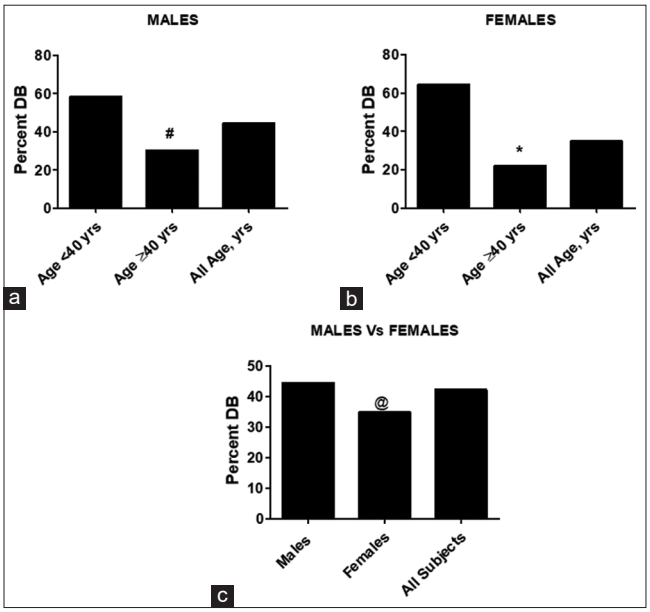

Figure 3: Desiccation with bulging (DB) in patients of low back pain. (a) Bulging in males with varying age groups, Patients Age < 40 years versus #, p < 0.05; All Age patients versus #, p > 0.05; Patients Age ≥ 40 years versus All Age patients, p > 0.05. (b) DB in females with varying age groups, Patients Age < 40 years versus #, p < 0.05; All Age patients versus #, p > 0.05; Patients Age ≥ 40 years versus All Age patients, p > 0.05 (c) DB comparison in males and females patients groups. Patients Age < 40 years versus #, p > 0.05; All Age patients versus #, p > 0.05; Patients Age ≥ 40 years versus All Age patients, p > 0.05.

Desiccation at multiple levels (DML) in subjects suffering with low back pain

The DML in studied individuals was also quantified in age groups, Group 1 (age < 40 years), Group 2 (age = 40−60 years), and Group 3 (age > 60 years) using MRI imaging and the comparative data among these groups are summarized in Table 5. In the lower age group patients (Group 1), 27.3% of males and 35.7%

Table 5: Desiccation in multiple levels among varying age group subjects with low back pain

Age groups	Males	Females	Total subjects
Group 1, < 40 years			
Subjects with DML	21/77	5/14	26/91
Percentage prevalence of DML	27.3	35.7	28.6
Group 2, 40–60 years			
Subjects with DML	40/68	14/23	54/91
Percentage prevalence of DML	58.8	60.9	59.3
Group 3, > 60 years			
Subjects with DML	3/8	6/9	9/17
Percentage prevalence of DML	37.5	66.7	52.9
All groups			
Subjects with DML	64/153	25/46	89/199
Percentage prevalence of DML	41.8	54.3	44.7

Males' groups: Males – Group 1 versus Group 2, p = 0.019, Z = −2.34; Males – Group 1 versus Group 3, p = 0.711, Z = −0.366; Males – Group 2 versus Group 3, p = 0.471, Z = −0.72; Males – Group 1 versus all groups, p = 0.234, Z = −1.19; Males – Group 2 versus all groups, p = 0.09, Z = +1.69; Males – Group 3 versus all groups, p = 0.881, Z = −0.15. Females' groups: Females – Group 1 versus Group 2, p = 0.332, Z = +0.97; Females – Group 1 versus Group 3, p = 3.030, Z = +1.02; Females – Group 2 versus Group 3, p = 0.802, Z = −0.246; Females – Group 1 versus all groups, p = 0.447, Z = +0.76; Females – Group 2 versus all groups, p = 0.689, Z = −0.04. Females – Group 3 versus all groups, p = 0.582, Z = −0.55. Males versus females: Males versus females – Group 1; p = 0.711, Z = −0.37; Males versus females – Group 2; p = 0.889, Z = +0.14; Males versus females – Group 3; p = 0.407, Z = −0.83; Males versus females – all groups, p = 0.289, Z = +1.06. DML: Desiccation in multiple levels.

of females were found to be affected with DML. In the middle age group patients (Group 2), 58.8% of males and 60.9% of females were affected with DML. Whereas the higher age group patients (Group 3) showed 37.5% of males and 66.7% of females were affected with DML. The levels of prevalence of DML in these groups in both males and females are presented in Table 4 and the data from all groups were also compared with the total number of studied individuals. The MRI findings of lumbar spine showed that 44.7% of studied patients had DML and the prevalence of DML was lower in males as compared to females but it was not statistically significant (p > 0.05). To further verify these data, the studied patients were further characterized into two age-wise groups in the lower ages (patients < 40 years) and the higher ages (patients ≥ 40 years). In males, the data showed that the lower age group patients showed significantly less prevalence of DML as compared with higher age group patients (p = 0.027; Z = −2.20). Whereas in females, the data showed a similar pattern as the DML was low in the lower age group as compared with higher age group but it was not statistically significant (p = 0.2801; Z = −1.081). The data of DML in studied males and females are given in Figure 4.

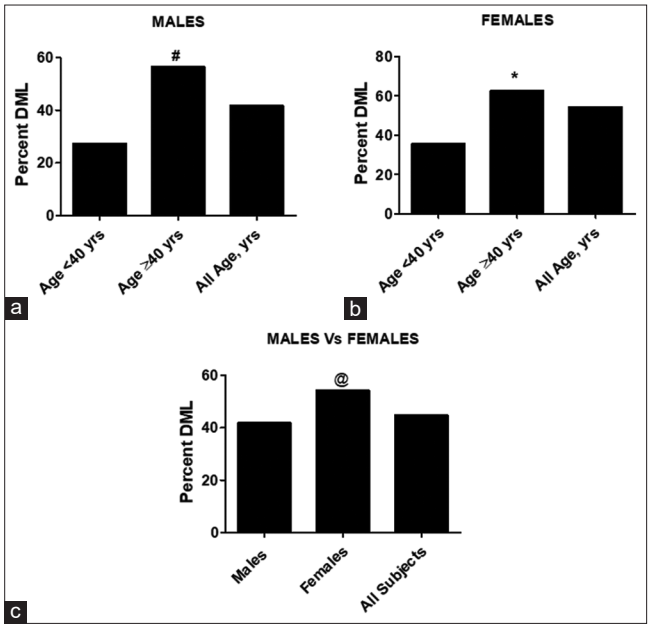

Figure 4: *Desiccation in multiple levels (DML) in patients of low back pain. (a) DML in males with varying age groups, Patients Age < 40 years versus #, p < 0.05; All Age patients versus #, p > 0.05; Patients Age ≥ 40 years versus All Age patients, p > 0.05. (b) DML in females with varying age groups, Patients Age < 40 years versus #, p < 0.05; All Age patients versus #, p > 0.05; Patients Age ≥ 40 years versus All Age patients, p > 0.05 (c) DML comparison in males and females patients groups. Patients Age < 40 years versus #, p > 0.05; All Age patients versus #, p > 0.05; Patients Age ≥ 40 years versus All Age patients, p > 0.05.*

Desiccation and bulging at multiple levels (DBML) in subjects suffering with low back pain

The occurrence of DBML in studied individuals was also quantified by MRI technique in age groups, Group 1 (age < 40 years), Group 2 (age = 40−60 years), and Group 3 (age > 60 years) and the comparative data among these groups are summarized in Table 6. In the lower age group patients (Group 1), 24.7% of males and 35.7% of females were found to be affected with DBML. In the middle age group patients (Group 2), 51.5% of males and 60.9% of females were affected with DBML. Whereas the higher age group patients (Group 3) showed, 37.5% of males and 55.5% of females were affected with DBML. The levels of prevalence of DBML in these groups in both males and females are presented in Table 6 and the data from all groups were also compared with the total number of studied individuals.

Table 6: Desiccation and bulging at multiple levels among varying age groups subjects with low back pain

Age groups	Males	Females	Total subjects
Group 1, < 40 years			
Subjects with DBML	19/77	5/14	24/91
Percentage prevalence of DBML	24.7	35.7	26.4
Group 2, 40-60 years			
Subjects with DBML	35/68	14/23	49/91
Percentage prevalence of DBML	51.5	60.9	53.8
Group 3, > 60 years			
Subjects with DBML	3/8	5/9	8/17
Percentage prevalence of DBML	37.5	55.5	47.1
All groups			
Subjects with DBML	57/153	24/46	81/199
Percentage prevalence of DBML	37.2	52.2	40.7

Males' groups: Males – Group 1 versus Group 2, p = 0.056, Z = −1.90; Males – Group 1 versus Group 3, p = 0.638, Z = −0.47; Males – Group 2 versus Group 3, p = 0.596, Z = +0.52; Males – Group 1 versus all groups, p = 0.317, Z = −0.99; Males – Group 2 versus all groups, p = 0.178, Z = +1.35; Males – Group 3 versus all groups, p = 0.992, Z = +0.01. Females' Groups: Females – Group 1 versus Group 2, p = 0.332, Z = −0.97; Females – Group 1 versus Group 3, p = 0.523, Z = −0.63; Females – Group 2 versus Group 3, p = 0.833, Z = +0.21; Females – Group 1 versus all groups, p = 0.501, Z = −0.67; Females – Group 2 versus all groups, p = 0.604, Z = +0.52. Females – Group 3 versus all groups, p = 0.895, Z = +0.13. Males versus females: Males versus Females – Group 1; p = 0.624, Z = −0.49; Males versus females – Group 2; p = 0.548, Z = −0.59; Males versus females – Group 3; p = 0.548, Z = −0.59; Males versus females – All groups, p = 0.211, Z = −1.25. DBML: Desiccation and bulging at multiple levels.

To further verify these data, the studied patients were further characterized into two age-wise groups in the lower ages (patients < 40 years) and the higher ages (patients ≥ 40 years). In males, the data showed that the lower age group patients showed significantly less prevalence of DBML as compared with higher age group patients (p = 0.067; Z = 1.83). Whereas in females, the data showed that a similar pattern as the DBML was low in the lower age group as compared with higher age group but it was

not statistically significant (p = 0.3421; Z = −0.947). Figure 5 is presented as a thorough summary of DBML data in the studied subjects. In short, the MRI findings of lumbar spine showed that 40.7% of studied patients were affected with DBML and the prevalence of DBML was higher in females as compared to males but it was not statistically significant (p > 0.05).

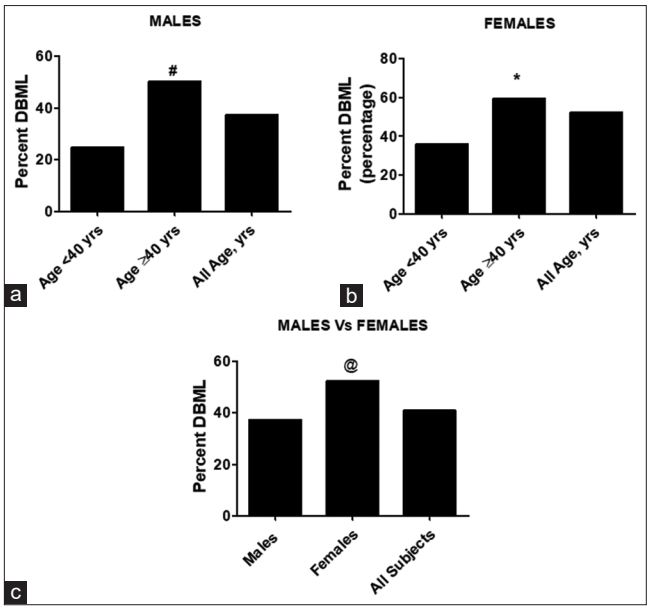

Figure 5: Desiccation and bulging at multiple levels (DBML) in patients of low back pain. (a) DBML in males with varying age groups, Patients Age < 40 years versus #, p > 0.05; All Age patients versus #, p > 0.05; Patients Age ≥ 40 years versus All Age patients, p > 0.05. (b) DBML in females with varying age groups, Patients Age < 40 years versus #, p > 0.05; All Age patients versus #, p > 0.05; Patients Age ≥ 40 years versus All Age patients, p > 0.05 (c) DBML comparison in males and females patients groups. Patients Age < 40 years versus #, p > 0.05; All Age patients versus #, p > 0.05; Patients Age ≥ 40 years versus All Age patients, p > 0.05.

Discussion

This study detected the disc degenerative alterations in the lower lumbar spine segments in different age groups of patients suffering from low back pain. Low back pain due to the onset of degenerative disc disorders causes a serious impact on the social and economic life of patients [14]. The complementary medicines and traditional approaches only provide symptomatic relief in the spine [15]. Advancement in the technology has developed several novel treatment strategies such as stem cells therapy, therapies involving growth factors, and genes which somewhat have provided theoretical prevention of the disc degeneration [15], [16]. However, the pathological and physiological understanding of the process of degeneration of lumbar disc is extremely important for the generation of novel strategies to slow down the process of degeneration. Importantly, the current treatment strategies are somewhat useful to reduce the process of disc degeneration but available approaches are still limited and none of them has provided a complete cure [15], [16]. In this study, the lumbar spine disc degeneration at varying stages was detected using the MRI scanning. The imaging through MRI is a highly sensitive, non-invasive and a widely used technique in all of the world for the detection of disc degenerative alterations in the lumbar spine [17]. The desiccation is one the main features in the early stage detection of disc degeneration and desiccation with disc bulging at single or multiple levels all been easily detected using the MRI scanning [17], [18]. This study determined the MRI-based detection of lumbar spine degeneration in 199 patients with the lower back pain. The patients were divided into three age groups, Group 1 (age < 40 years), Group 2 (age = 40−60 years), and Group 3 (age > 60 years). The results from these were further characterized on the basis of gender as well. The MRI-based detection of desiccation at single site indicated that the lower age patients showed higher desiccation as compared with higher age group patients in both genders. The data of lumbar spine also concluded that about half of the studied patients had desiccation and the prevalence of desiccation was higher in males as compared to females but it was statistically insignificant. To investigate more disc degeneration process, the bulging in lumbar spine was also studied in the studied subjects, the MRI findings were almost same as of desiccation. Both genders showed that the lower age patients showed higher prevalence of bulging and the occurrence of bulging was in almost half of the studied subjects. To study these degenerative changes in more detail, the desiccation with bulging was investigated. Interestingly the findings of desiccation with bulging were same as of desiccation in single and the findings of bulging alone. These findings clearly indicated that the disc degenerative process at the levels of desiccation alone, bulging alone, and desiccation with bulging was higher in the lower age patients and it remains the same in both genders. To study the process of disc degenerative alterations in depth, the desiccation alone at multiple levels and the desiccation with bulging at multiple levels were studied in the same group of patients suffering with low back pain. In contrast to the findings of desiccation alone, bulging alone, and desiccation with bulging at single levels, the findings of DML and DBML at multiple levels were different. The levels of lumbar disc degeneration at the level DML and DBML were found to be higher in higher age patients in both genders. These novel findings clearly indicate that lumbar disc degeneration was more in aged individuals and it was same in both males' and females' patients. These findings have also been fully supported by a number of several previously published studies mentioning that degeneration of the lumbar disc gradually increases after the age of 40 years [19]. The findings obtained at the levels of desiccation, bulging at single levels, and at multiple levels have also been supported by previously published studies mentioned that MRI-based detection

of an early degenerative alterations in the lumbar spine in terms of their frequency, pattern, and sequence suggested that the degenerative alterations were more pronounced after the adolescent growth spurt and they were more common in symptomatic adolescents at an earlier age [20]. The findings obtained in the study also suggested that at a single level of disc desiccation, there is a chance for the onset of second stage degeneration in future. Therefore, an early detection of desiccation is always a better option to prevent the progress of degeneration of lumbar disc. This conclusion has also been well supported by a number of studies mentioning that the degenerative progress in the lumbar disc initiated as early as 20 years of age has been potentially detected by MRI scanning technique [21], [22], [23]. In regards to the onset of degenerative disc disorders, the findings of this study have also been supported by a number of the previous studies which point out that age is one of the most important factors that directly link with the disc degenerative disorders in the lower lumbar spine [24], [25], [26], [27]. As age of an individual increases, the progress for the onset of disc degenerative alterations has also been increased in the lower lumbar spine.

Conclusion

The findings of this study indicate that the disc degenerative alterations in the lower lumbar spine were started in the individuals below 40 years of age and these destructive alterations in the lower spine were progressively more pronounced in individuals with age of 40−60 years. The frequency, pattern and sequence of disc degenerative progression in the lower lumbar spine were same in both genders.

Availability of Data and Materials

The data sets used in this study are available with corresponding author and will be provided on a reasonable request.

Ethical Approval

This study was approved by the Bioethical Committee at the College of Medicine, Qassim University, Nov. 25, 2018 (Approval no. 20180009) and was performed in accordance with the principles outlined in the Declaration of Helsinki.

Consent

Written consents were taken from all studied subjects.

Author's Contribution

FA performed conceptualization, design, data analysis, and manuscript drafting. A similarity check was also performed using iThenticate software. The author has critically reviewed and approved the final draft and is responsible for the content and similarity index of the manuscript.

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