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Research Article

RELATIONSHIP BETWEEN DISABILITY AND RADIOGRAPHIC FINDINGS OF LUMBAR DISK DEGENERATION IN SAMPLE OF IRAQI PATIENTS WITH MECHANICAL LOW BACKACHE

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ABSTRACT

Objectives: Disability related to chronic low back pain (LBP) is a complex and multidimensional phenomenon all over the world. The prevalence of backache in middle age and elderly is up to 84%. This study aims to evaluate the associations of X-ray features of lumbar disk degeneration with severity of disability among patients with mechanical LBP.

Methods: A cross-sectional study was conducted on a total of 300 patients with chronic mechanical LBP. Severity of disability was measured using Modified Oswestry Disability Index and intensity of backache was assessed using numeric rating scale (0–10). X-ray features of lumbar disc degeneration according to Lane classification and spondylolisthesis were assessed in lateral recumbent lumbar X-rays.

Results: The mean age of our sample was 52.45±7.87 and 71.7% of involved patients were women. Most patients were recorded as overweight or obese. The findings of disk space narrowing were mild in 65.7%, moderate in 28.7%, and severe in 5.6%, where the presence of osteophytes were small in 76.9%, moderate in 20.5%, and large in 2.6%. Regarding disability, two-third of cases were focused on minimal disability, followed by moderate, severe, and crippled as (26%), (6%), and (2%), respectively. There was highly significant association between women and pain radiation to legs (p=0.004). Obesity and overweight had meaningless effects on all markers.

Conclusions: The severity of disability was significantly more in women, high intensity of lower back pain, presence of pain radiating to legs, moderate/severe disk space narrowing on X-ray, and disk degenerative disease score on X-ray, while age, presence of osteophytes and spondylolisthesis, body mass index, and pain duration were not associated with severity of disability.

Keywords: Back pain, Lumbar disk Degeneration, Disability.

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INTRODUCTION

It is estimated that up to 84% of adults have low back pain (LBP) at some time in their lives [1]. Backache classify according to the time into the following:

1. Acute: <4 weeks.
2. Subacute: Lasting between 4 and 12 weeks.
3. Chronic: Persists for ≥12 weeks [2].

Mechanical LBP is usually nonspecific pain worsened by activity and improved partially by rest and recumbency associated with morning stiffness <30 min not associated with constitutional symptoms with or without radiation to lower extremities [3].

Disability

The World Health Organization definition of disability is any restriction or lack (resulting from impairment) of the ability to perform in the manner or within the range considered normal [4].

Disability due to chronic LBP is one of the leading health-care problems in most regions of the world [5]. LBP is now also the number one cause of disability globally [6]. The largest apparent increases in disability caused by LBP in recent decades occurred in low- and middle-income countries including Asia, Africa, and the Middle East, where health and social systems are poorly equipped to deal with this growing burden in addition to other priorities such as infectious diseases [7].

Studies were done in Europe indicate that 10–56% of LBP patients reported significant sick leave days, needed to change jobs or needed retraining on the account of LBP [8].

The Oswestry Disability Index (ODI) is the most commonly used measure to quantify disability for LBP [9]. The patient questionnaire contains ten questions concerning the patient's ability to cope with everyday life. The ODI remains a valid and vigorous measure and has been a worthwhile outcome measure [10].

PATIENTS AND METHODS

Study design and setting

A cross-sectional study was conducted at Baghdad Teaching Hospital, Rheumatology Unit during the period from August 2018 to May 2019, after approval of the study protocol by the University of Baghdad, College of Medicine, Department of Medicine, Rheumatology and Medical Rehabilitation Unit.

Patients' collection

Total of 300 patients (215 women and 85 men) with chronic mechanical LBP, who attended the Rheumatology Unit at Baghdad Teaching Hospital and met the inclusion criteria were recruited in the study after obtaining their verbal consents.

Inclusion criteria

All patients aged ≥40 years, who had chronic mechanical LBP, were included in the study.

Exclusion criteria

Patients with one or more of the following criteria were excluded from the study:

- Patients with inflammatory disease or generalized body ache including back pain, previous surgery of lumbar spines or history of major trauma to the back.
- Spinal deformities.
- Malignancy.
- Infectious diseases of the spine.
- Fractured vertebrae.

Data collection

Data were collected using a special case sheet containing a questionnaire which included:

1. General demographic data: Name, age, gender, employment, smoking status, and marital status.
2. Clinical data include: Height, weight, body mass index (BMI), and presence of pain, and radiation to lower limbs. Intensity of pain was measured using (1–10) numeric rating scale [11] to score the average of pain during the past 7 days, the illiterate patient, who cannot assess his own pain intensity by a specific number, evaluate it on a drawing ruler scale.
3. The findings of lateral lumbosacral X-ray regarding disk space narrowing and osteophytes and presence of spondylolisthesis of lumbar spines and their grading according to lane classification [12].
4. Another sheet contain ODI questionnaire that involves te questions where the patient's answers give us information about how back pain or leg pain is affecting their ability to manage in everyday life. Scores are minimal, moderate, severe disability, and crippled [10].

Clinical methodology

Height was measured in centimeters (cm) using a stadiometer, and weight was measured in kilograms (kg) using a weighing scale. BMI was calculated as weight in kilograms divided by height in meters squared and then was classified into five categories: (underweight ≤18.5 kg/m^2, normal=18.5–24.9 kg/m^2, overweight=25–29.9 kg/m^2, ad obesity ≥30 kg/m^2), in accordance with the international classification system of the World Health Organization [13]. Musculoskeletal and neurological examination was performed including inspection, palpation for tenderness, motor, sensory, and reflexes testing, straight leg raising test, and femoral stretching test to approve mechanical origin of pain.

Radiological methodology

By digital AGFA/DX-D400 made in Belgium lateral lumbar X-rays were obtained from all patients from L1 to S1. A senior radiologist evaluated the images and their X-ray results were recorded as the followings: Disk space narrowing, osteophytes, overall grading of degenerative disk disease, and the presence of spondylolisthesis. The reduction of the height of the disc space compared to the adjacent normal disk space was defined as the disc space narrowing and it was graded as follows: Grade 0=none; Grade 1=definite (mild) narrowing; Grade 2=moderate; and Grade 3=severe narrowing. The presence of bony out-growths of the vertebral body arising from the borders of superior and inferior surfaces extending anteriorly and posteriorly was defined as osteophyte and it was graded as follows: Grade 0=none; Grade 1=small osteophyte; Grade 2=moderate; and Grade 3= large osteophyte. Based on these features, overall grading was given for the lumbar degenerative disk disease (LDD): Grade 0=normal (Grade 0 disk space narrowing and Grade 0 anterior osteophyte); Grade 1=Grade 1 disk space narrowing and/or Grade 1 anterior osteophyte; Grade 2=Grades 2 or 3 disk space narrowing; and/or Grades 2 or 3 anterior osteophyte according to lane classification of degenerative disk disease [12]. Endplate sclerosis was not taken into account due to its low interobserver reliability [14]. A particular grade of disk space narrowing/osteophyteLDD was identified for each of the lumbar levels, and the highest available grade out of the five lumbar levels was used as the final grade for that particular spine. Lumbar spondylolisthesis was defined as the presence of displacement of one vertebral body relative to the next most inferior vertebral body and assessed in lateral recumbent lumbar X-ray [15].

Statistical methodology

The following statistical data analysis approaches were used to analyze and assess the results of the study under the application of the statistical package (SPSS) ver. (22.0):

Descriptive data analysis

a. Tables (Frequencies, and Percentages), as well as mean and standard deviation.
b. Contingency Coefficients (CC) for the association tables.
c. Graphical presentation by using:

- Bar charts.
- Receiver Operation Characteristic (ROC) curve charts.

Inferential data analysis

These were used to accept or reject the statistical hypotheses, which included the following:

a. C.C. test for the cause's correlation ship of the association tables.
b. Binomial test for testing the difference of distribution of the observed frequencies of two categories nominal/or ordinal scale and there is none restricted to expected outcomes at 50%.

The binomial probability, b(x; n, p), is calculated.

c. ROC curve and estimating area, as well as estimating 95% confidence interval, with standard error, asymptotic significant level ROC curve.
d. The CC test is a measure of association ranges between zero and 1, with zero indicating no association between the row and column variables and values close to 1 indicating a high degree of association between the variables. The maximum value possible depends on the number of rows and columns in a table.

For the abbreviations of the comparison significant (C.S.), we used the followings:

- NS: Non-significant at p>0.05
- S: Significant at p<0.05
- HS: Highly significant at p<0.01.

RESULTS

Table 1 shows distribution of elementary parameters. Women were formed 71.7% of our patients. The mean age±SD was 52.45±7.86.

Table 2 shows the distribution of essential markers. Regarding intensity of pain, patients' responses were in two groups, (1–5) which accounted 79 (26.3%) patients and (6–10) which accounted 221 (73.7%)

Table 1: Elementary parameters distribution with comparisons significant

Elementary variables	Groups	No.	%	C.S.
Gender	Woman	215	71.7	Binomial
	Man	85	28.3	p=0.000 (HS)
Age (Years)	40	112	37.3	χ^2=7.120
	50	122	40.7	p=0.000
	60–70	66	22	(HS)
	Mean±SD	52.45±7.86		
BMI (kg/m^2)	Obese	179	59.7	χ^2=7.120
	Over weight	96	32	p=0.000
	Normal weight	25	8.3	(HS)
Duration of pain	<12 months	43	14.3	χ^2=7.120
	1–4 years	143	47.7	p=0.000 (HS)
	5–9 years	58	19.3	
	10 >years	56	18.7	

(*)C.S.: Comparison significant; HS: Highly sig. at p<0.01; SD: standard deviation; Testing based on One-sample Chi-square test, and the Binomial test

Table 2: Essential makers distribution with comparisons significant

Essential variables	Groups	No.	%	C.S.
Intensity of pain	1	1	0.3	χ^2=308.64
	2	3	1	p=0.000
	3	8	2.7	(HS)
	4	8	2.7	
	5	59	19.7	
	(1–5)	79	26.3	
	6	67	22.3	
	7	88	29.3	
	8	46	15.3	
	9	16	5.3	
	10	4	1.3	
	(6–10)	221	73.7	
Radiation of pain	No	32	10.7	p=0.000
	Yes	268	89.3	(HS)
Disc space narrowing	Non	192	(64)	χ^2=272.027
	Mild	71	65.7	p=0.000
	Moderate	31	28.7	(HS)
	Sever	6	05.6	
Osteophyte grade	Non	222	(74)	χ^2=408.59
	Small	60	76.9	p=0.000
	Moderate	16	20.5	(HS)
	Large	2	02.6	
X-ray grading	Non	174	(58)	χ^2=χ^2=90.14
	Score 1	83	65.9	p=0.000
	Score 2	43	34.1	(HS)
Spondylolisthesis	No	284	94.7	p=0.000
	Yes	16	5.3	(HS)

Table 3: Evaluation of disability indicator with comparisons significant

Marker	Groups	No.	%	Cum. %	C.S.
Disability	Minimal	198	66	66	χ^2=308.64
	Moderate	78	26	92	p=0.000
	Severe	18	6	98	(HS)
	Crippled	6	2	100	

C.S.: Comparison significant; HS: Highly sig. at p<0.01; Testing based on One-Sample Chi-square test

patients according to numeric rating scale. Second essential marker was radiation of pain, 268 (89%) respond positively, and 32 (10.7%) respond negatively for radiation. Concerning disk space narrowing, radiographic findings divided into none, mild, moderate, and severe grades. Regarding osteophyte grade, most radiographs were recorded as small osteophyte which accounted 60 (76.9%).

Table 3 shows distribution of disability indicator outcomes, which illustrated by different scales: (Minimal, Moderate, Severe, and Crippled). Results shows that two-third of studied cases was focused in minimal disability, and they are accounted 198 (66%) and only 6 (2.0%) who were cripple. As well as highly significant difference was reported between comparing an observed and expected frequencies at p<0.01.

Table 4 shows relationships between distribution of studied markers (intensity of pain, radiation of pain, disc space narrowing, osteophytes, X-ray grading, spondylolisthesis, and disability) and some elementary parameters and pain radiation, through a CC with their testing significant under null statistical hypotheses which says that no relationships are accounted between preceding factors.

Results show that regarding to a CC and their testing significant (i.e., levels of significant), meaningful relationships were represented, and as follows:

- High significant association (p<0.01) of pain radiation in women, also of disc space narrowing, osteophyte and X-ray grading in old aged patients.
- Significant relationship (p<0.05) between radiation of pain and pain duration, also among osteophyte, spondylolisthesis, and disability with female gender.

Table 5 shows estimation area of trade-off between sensitivity rate and a complement probability level of a specificity rate by plotting sensitivity against specificity to examine that trade-off, which is called a (ROC Curve) for testing disability indicator in light of studied parameters by classified, as different markers as state variables, as well as significant levels for testing area under 50%, with 95% confidence interval of area indicator are illustrated.

Results shows that regarding to area indicator of ROC curve and their testing significant (i.e., levels of significant), in light of disability indicator by different categories of studied parameters, and studied markers, a meaningful discriminate results were represented, and as follows:

- Highly significant p<0.01 with intensity of pain and radiation.
- Significant p<0.05 with female gender, moderate/severe disk space narrowing and with more severe degenerative disc disease on X-ray.
- Non significant p>0.05 with age, duration of pain.
- Non-significant but their relationships should be reported as in BMI, osteophytes, spondylolisthesis.

DISCUSSION

Backache is a common problem that affects daily activity and decreases performance due to disability. In the current study, the disability was worse in women than men and this agree with Biglarian *et al*. [15], Shiri *et al*. [16], Ahdhi *et al*. [17], and Koley and Sandhu [18] studies. This gender difference could be related to gonadal steroid hormones such as estradiol and testosterone which modulate sensitivity to pain and analgesia [19]. LBP related disability affect the productive middle years of adult women life and cause significant disruption of daily activities including sleep and sex [20]. This was also partially related to sex hormones in women and the accelerated lumbar disk degeneration after menopause due to estrogen deficiency [21-23]. A comparative analysis showed statistically significant differences between groups in the physical/psychological variables (p<0.01) and women were more liable to psychological upset [24]. The biological differences between the different gender in vertebral morphology, weight transmission, and degenerative responses might give this gender difference [25]. On the other hand, the current study disagreed with Peterson *et al*. [26] who recorded that no difference between men and women in any of these self-reported scores. This may be due to the difference in the ratio of women in the studied sample; in this study, women were two-third while in Peterson *et al*. study they were <1/2. In our study, disability was worst in those with higher pain intensity and showed a highly significant relationship. This result agreed with Gunnar *et al*. study [27] and Güler *et al*. [28]. We found there was a highly significant association between severity of disability and radiation of pain to the legs. This was agreed with Perera *et al*. [29] and Ren *et al*. study [30], they were reported an association between localized LBP intensity and radiating leg pain in assessing patient functional status. They found that physical functioning, general health perceptions, and disability were most likely to be affected by LBP with radiating leg pain. This relation also agreed with Konstantinou *et al*. (2013, 2015) [31,32] which was a systematic review of LBP alone and LBP with pain radiating to the leg, the second group appeared to be associated with increased pain, disability, poor quality of life, lost workdays, and increased use of health resources compared to those with LBP alone without radiation. The present study showed a significant association between disability and the presence of moderate/severe disk space narrowing and overall radiographic lumbar degeneration. These results agreed with Güler *et al*. [28] and Pye *et al*. [33] who reported a highly significant correlation between disability and disk space narrowing. These findings agreed with many studies considered disk space narrowing as a surrogate

Table 4: Contingency coefficient's relationships between (elementary parameters and duration of pain) and (essentials markers) with significant levels

Elementary variable and pain radiation	Essentials markers													
	Intensity of pain		Radiation of pain		Disk space narrowing		Osteophyte grade		X-ray grading		Spondylolisthesis		Disability	
	C.C.	Sig.	C.C.	Sig.	C.C.	Sig.	C.C.	Sig.	C.C.	Sig.	C.C.	Sig.	C.C.	Sig.
Gender	0.094	0.613	0.164	0.004**	0.097	0.413	0.181	0.017*	0.122	0.102	0.116	0.044*	0.186	0.013*
Age groups	0.048	0.707	0.070	0.473	0.244	0.004**	0.292	0.000**	0.298	0.000**	0.020	0.941	0.157	0.268
BMI	0.081	0.369	0.092	0.276	0.124	0.584	0.194	0.069	0.124	0.323	0.106	0.181	0.157	0.269
Duration of pain	0.143	0.098	0.169	0.032*	0.216	0.098	0.206	0.151	0.169	0.184	0.152	0.069	0.167	0.474

Table 5: ROC curve disability indicator in contrast studied parameters and markers

	Parameters and markers	Area	Std. error	Asymp. sig	Asymptotic 95% C.I.	
					L.b.	U.b
Disability	Female:Male	0.595	0.035	0.010*	0.526	0.664
	Age ≥50 year	0.486	0.035	0.688	0.418	0.554
	BMI >40 kg/m^2	0.590	0.050	0.061	0.493	0.688
	Duration of pain	0.492	0.034	0.824	0.425	0.560
	Intensity of pain (6–10)	0.620	0.035	0.002**	0.552	0.688
	Radiation of pain (Yes:No)	0.642	0.044	0.009**	0.556	0.728
	Disk space narrowing (Mod.+Seve.:Mild)	0.606	0.052	0.036*	0.505	0.708
	Osteophyte (Yes:No)	0.602	0.074	0.148	0.456	0.747
	X-ray grade	0.633	0.064	0.039*	0.508	0.759
	spondylolesthesis	0.625	0.075	0.091	0.478	0.773

* S: Sig. at p<0.05; Non Sig. at p>0.05, **HS: Highly Sig. at p<0.01, U.b.: Upper border; L.b.: Lower border

variable for LDD and found a positive association with the presence of chronic LBP and disability in population-based studies such as de Schepper *et al*. [34], Kettler *et al*. [35], and Goode *et al*. [36]. Our results disagreed with Ashraf *et al*. [37] and Al-Jumaily study [25] that showed no significant correlation between the morphological severity of osteoarthritic changes on X-ray and ODI disability scores. This disagreement may be explained using a different grading system for radiological classification. Regarding the osteophytes grade, no significant relationship was assigned with disability in the present study; this disagreed with Perera *et al*. [29] that had found a statistically significant relation between disability and presence of osteophytes. This disagreement may be due to sampling age, higher frequency of osteophytes formation in old individuals with ages above 65 years while in this study the sample age was restricted to patients below 70 years. In the current study, the severity of disability had no statistically significant correlation with advancing age, which agreed with Peterson *et al*. [26]. These results disagreed with Webb *et al*. [38] as they found the prevalence of spinal pain with disability continued to rise into old ages. This difference might be that in Webb is a general population survey, spinal pain including back and neck pain was reported, adjustment for additional pain site with spinal pain *per se* or with other reported sites may affect the results. Güler *et al*. [28] suggested that degenerative changes became more pronounced as age progresses. In 80 years and older, the rates increased to as much as 90% and this agreed with the current study regarding the association between age and lumbar degeneration on X-ray. In this study, the disability had no statistically significant association with increased BMI; also BMI had not associated with any essential markers such as pain intensity, pain radiation to legs, all features of lumbar degeneration, and spondylolisthesis. This result agreed with Marina *et al*. [39] which was across sectional study including 177 patient with chronic LBP, used ODI for scoring disability, they found statistically not significant relationship between disability and increased BMI. This result disagreed with Shiri *et al*. [16], Gunnar *et al*. [27], and Webb *et al*. [38] that considered obesity (BMI >30) an important predictor of back pain with disability through metabolic syndrome and cytokine release from adipose tissue. The large sample size (ten thousand adults) with both back and neck pain, increasing BMI, increasing deprivation, and living alone, all were adjusted for pain and disability and this could explain the difference with our results. In the current study, spondylolisthesis had an inconclusive relationship with disability. This agreed with Möller and Sundin study [40], who correlate the disability in patients with chronic LBP of nonspecific origin with and without spondylolisthesis, the clinical pattern and functional disability in adult spondylolisthesis and in chronic LBP without spondylolisthesis were similar. Perera *et al*. study disagreed with this study and showed that patients with the presence of lumbar spondylolisthesis had significantly severe disability [29]. This difference might be interpreted in different ways: the patients without spondylolisthesis also had a mechanical origin of pain, or the patients with spondylolisthesis also have nonspecific LBP with uncertain relation to the radiographic finding. Other investigational criteria such as flexion-extension functional radiographs were considered the gold standard for diagnosis of spondylolisthesis but in the current study, we depended on lateral lumbosacral X-ray, so possibly patients with an early mild degree of spondylolisthesis were undiagnosed [41].

CONCLUSION

The severity of disability was significantly higher in women, high intensity of LBP, presence of pain radiating to legs, moderate/severe disk space narrowing, and disk degenerative disease score on X-ray. Age, presence of osteophytes and spondylolisthesis, BMI, and pain duration were found not associated with severity of disability.

ETHICAL APPROVAL AND CONSENT TO PARTICIPATE

Verbal consent of all participate was taken.

CONSENT FOR PUBLICATION

Approval of the study protocol by University of Baghdad, College of Medicine, Department of Medicine, Rheumatology and Medical Rehabilitation Unit.

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AVAILABILITY OF DATA AND MATERIALS

The data kept in the authors.

AUTHORS' CONTRIBUTION

Khudair Al-Bedri was the supervisor. The data were collected by Riyam Ali Meften. The article was arranged by Zainab A. Mahmood.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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