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Evaluation of Lumber Lordotic Angle in Patients with Inter Vertebral Disc Prolapse using Cobb's Method

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Abstract

This study was done to evaluate the lumbar lordotic angle (LLA) in patients with inter vertebral disc prolapse examined by magnetic resonance imaging (MRI) using Cobb's method.This study was conducted at Antalya Medical center and Elnilin Medical Center and extended from November 2012 up to March 2013.Total sample of 62 Sudanese subjects were included in the study, with ages ranging between (24-80 years), 50 of the total sample were 25 males and 25 females underwent MR lumbar scan and were diagnosed to have inter vertebral disc prolapse at different vertebral levels, the remaining 12 were diagnosed as normal lumbar spine and they were considered as control group.Measurement of (LLA) was done from the mid-sagittal slice of T2 MRI lumbar spine using Cobb's method; by drawing a perpendicular line to a line drawn across the superior endplate of first lumbar vertebra and the superior endplate of first sacral vertebra; the angle formed by the intersection of the two perpendicular lines is the Cobb angle or lumbar lordotic angle.

Index terms— cobb, inter vertebral disc, MRI.

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Measurement of (LLA) was done from the midsagittal slice of T2 MRI lumbar spine using Cobb's method; by drawing a perpendicular line to a line drawn across the superior endplate of first lumbar vertebra and the superior endplate of first sacral vertebra; the angle formed by the intersection of the two perpendicular lines is the Cobb angle or lumbar lordotic angle.

The Cobb angle and inter vertebral disc prolapse level were then correlated with Gender, age, weight, height, body mass index (BMI) and jobs to demonstrate if there is any degree of association.

The study concluded that Cobb angle and Disc prolapse levels have no significant relation with job, height, weight, age and BMI, no significant difference was detected between Cobb angle of the normal subjects and patients with prolapsed disc and the results did not differ among male and female patients.

Using MRI in the detection of vertebral morphological changes and end plates degeneration is recommended since it involves no ionizing radiation and has excellent demarcation of disc prolapse. The dependence upon the Cobb angle in diagnoses of disc prolapse is of no significant value.

1 Introduction

he spine is an elastic rod structure, loading of the spine leads to its deformity, strengthening its physiological S-shaped lordosis and kyphosis [1][2][3].During loading; the disk becomes dehydrated causing the accompanying ligaments to become loosened, the disk-height is reduced and the spine loses its homogenous elasticity. In turn, localized overloading of the disk and subchondral spinal endplates may take place.

In the last few decades, MRI has become the standard imaging method; it allows direct visualization of the disk and because of its high water content, the nucleus pulposus is bright on T2-weighted images. With aging and degeneration, the size, character and height of the disk decline continuously [4,5] MRI can diagnose degenerative changes within the bony endplates. This border region is damaged during overloading. This results probably in pain and activation of fibrovascular tissue ending in neovascularization of the disk, particularly at the anterior and posterior part [1,6] producing degeneration. The endplate fails before the injured annulus fails. Endplate failure seems to be the precursor to disk degeneration, which means they are correlated to each others.

The first signs of degeneration may be localized malalignments with or without rotation of the vertebral body. The evaluation of lumber attitude is commonly assessed to help guide diagnosis and plan treatment [7,8]During an examination of spinal posture; lumbar lordosis should be assessed. It has been suggested that its deviation may increase a person's risk of developing low back pain [9,10,11] Lumbar lordosis is defined as the curvature assumed by the intact lumbar spine to compensate for the inclination of the sacrum, restore an upward spinal orientation, and consequently avoid a forward inclination. Its measure, is influenced by various parameters, including age, gender, pelvic bend, and thoracic curvature, among others [12,13].

Value of sagittal curves measurements on spine; present great variability in normal individuals with a wide variation range for those, within normality limits.

That great measurements variation must be considered as physiological, indicative, but not normative [14] Several different methods are used to measure lumber lordosis including Centroid, Cobb, Trall, and Harrison posterior tangent method. Cobb's method is commonly used for curvature analysis on lateral lumber radiograph, whereas the Centroid, Trall, and Harrison posterior tangent method are not widely used **??**15] Normal lordosis may range from 31 to 50 according to Cobb's method. The Cobb technique based on measurement of vertebral endplates is the method most frequently adopted for clinical diagnosis. However, because of the variation in the vertebral endplate architecture, the vertebral surface angle is difficult to identify. In this method, the angle of interception sustained by the most tilted upper and lower vertebrae of the lumber curvature is measured [16] To our knowledge, no reliable measurements were done to the lumber lordotic curve for Sudanese patients in the open literature which may aid in the early diagnosis and management of spine conditions before irreversible neurologic change ensues.

So this study is to evaluate lumbar lordotic angle by magnetic resonance imaging using Cobb's method in patients with inter vertebral disc prolapse. To determine the effect of inter vertebral disc prolapse on the lumber lordotic curve as well as to investigate whether the angle changes according to age, weight, height, BMI and job for Sudanese.

2 II.

3 Materials and Methods

The study was carried out during the period from November 2012 up to March 2013 in Antalya Medical Center and Elnilin Medical Center.

4 a) Study population

Total sample of 62 subjects were included in the study, the average age ranging between (24-80 years), 50 of the total sample were 25 males and 25 females underwent MR lumbar scan and diagnosed with inter vertebral disc prolapse, the remaining 12 were diagnosed as normal lumbar spine MRI and they are the control group.

5 b) Machines used

General Electric. Signa. HD. 1.5 tesla MRI machine in Antalya medical center, Semiens. Magnetom. CI. 0.35tesla. Open MRI machine in Elnilin Medical Center.

6 III.

7 Lumbar mri Technique

Axial and sagittal slices of lumbar spine obtained with T2 weighted images while the patients in supine position with their knees elevated over a foam bad , the patient positioned so that the longitudinal alignment light lies in the midline, and the horizontal alignment light passes just below the lower costal margin.

8 a) Image interpretation

Measurement of lumbar lordotic angle (LLA) was done from the mid-sagittal slice of lumbar spine MRI using Cobb's method. By drawing a perpendicular line to a line drawn across the superior endplate of (L1) and the superior endplate of (S1); the angle formed by the intersection of the two perpendicular lines is the Cobb angle.

IV.

9 The study Variables

The mean of the angles was correlated with variables which are: age, height, weight, body mass index (BMI), job, and the level of inter vertebral disc prolapsed. The data were analyzed through the statistical method (SPSS programme) version 16.0 and included frequency tables, percentages, correlations, cross tabulation. P-Value is significant at 0.05.

V.

10 Results

The Following tables and figures presented the data obtained from 25 males and 25 females came to MRI department for lumbar spine examination as they all were complaining of Lower backache, the Cobb angle was measured to study the relations regarding the Cobb angle variations. Discussion 50 patients were examined by MRI, (25 males and 25 females), their ages ranged between 24-80 years old as seen in table [1], all were complaining of Lower backache and were diagnosed to have intervertebral disc prolapsed at different levels. The males and the females mean age, weight, height; BMI and Cobb angle were presented in table [2] The mean Cobb angle was measured from the superior end plate of L1 to the superior end plate of S1, The level where the disc prolapse was taken place had been evaluated, and the mean Cobb angle was found to be 38.8±9.96. For the female patients the mean Cobb angle was 40.8±8.80, where the mean Cobb angle for male patients was 36.9±10.84. It is higher in female than male but the difference is not significant, similar findings was found by [17] The disc prolapse may affect one or more inter vertebral disc, the study showed that the most affected level was between L4 and L5 in both gender as presented in table [3] The largest Cobb angle was found when the level of disc prolapse affected more than three vertebral disc at the level of (L2 L3, L4, L5) where the higher mean age of the patients affected with disc prolapse was found at the level of (L3, L4, L5) and it was found to be greater than the other above or below levels. But the Cobb angle was neither correlated significantly with the patient age nor the level of prolapse (p-value=90.385, 0.360) respectively [table4], reverse results were found by Ghassan [17] who had mentioned that the age can be predictors of the level of lumbar disc herniation.

The association between the levels of inter vertebral disc prolapse with weight, height, BMI was found to be insignificant at P-value, 0.272, 0.930, 0.270 correspondingly as presented in table [4] Cobb angle in cases with intervertebral disc prolapse was found to have insignificant relation with the Sudanese patients characters including age, weight, height and BMI at P value (0.309, 0.402, 0.599, 0.206), in respectively as seen in table [5] but different findings were found by Khodadad et al who found that obesity, gender, body mass index have significant effects on low back pain and lumbar total and segmental lordosis [18] According to the job classification, the largest Cobb angle was found in the unemployed patients followed by the workers then the employee as presented in table [6]. Our study showed that Lumbar lordosis Cobb angle has insignificant correlation (P-value=0.439)with the job as Sudanese may do different work load related physical activity in their residence, that lifestyle might cause lower back pain and may affected the lumbar lordosis angle [19] From table [7] there is no association (P-value =0.244) with the different level of inter vertebral disc prolapse and the patients jobs.

Different results were found in the Cobb angle difference related gender and age; Amonoo-Kuofi [20], Guigui et al. [21], Gellb et al [22] and Damasceno et al [14] By testing the correlation between Cobb angles in cases with inter vertebral disc prolapse and the control group as presented in table [8]; the study showed that there was no significant difference between Cobb angle measured in patients with inter vertebral disc prolapse and the control group.

MRI is a valuable tool to demonstrate the vertebral body end plate borders which have value in applying the Cobb method as well as to diagnose inter vertebral disc prolapse at the same level of measurement. The study concluded that Cobb angle has no significant relation with height, weight, age and BMI. Disc prolapse levels have no association with, work intensity, age, weight, height, BMI and Cobb angle.

The study recommend to use MRI in detecting and monitoring vertebral morphological changes and end plates degeneration since it involve no ionizing radiation and has excellent demarcation of disc prolapse. More studies are needed in this area with bigger sample to determine the normal range of lumbar lordotic angle in normal Sudanese individuals. [1] [2] [3]

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[3] ( )

Abstract-This study was done to evaluate the lumbar lordotic angle (LLA) in patients with inter vertebral disc prolapse examined by magnetic resonance imaging (MRI) using Cobb's method.
This study was conducted at Antalya Medical center and Elnilin Medical Center and extended from November 2012 up to March 2013.

Figure 1:

1

Age Classes Male	Frequency And percentage	Age Classes Female	Frequency And percentage	Age Classes Total Sample	Frequency And percentage
24-34	4(16%)	27-35	3(12%)	24-34	7(14%)
35-45	9(36%)	36-44	6(24%)	35-45	17(34%)
46-56	7(28%)	45-53	5(20%)	46-56	12(24%)
57-67	3(12%)	54-62	8(32%)	57-67	10(20%)
68-78	1(4%)	?62	3(12%)	68-78	3(6%)
?78	1(4%)	-	-	?78	1(2%)
Total	25(100%)	-	25(100%)	-	50(100%)

Figure 2: Table 1 :

2

Variables	Age	Weight	Height	BMI	Cobb Angle*
Male	46.96±12.8	74.88±12.2	171.32±8.4	25.50±3.79	36.9±10.84
Female	48.71±7.5	73.44±16.87	160±6.7	28.53±5.1	40.8±8.80
Total	48.4±12.4	74.12±5.4	165.64±9.5	27.02±4.7	38.8±9.96
	Min:24.0	Min:55.0	Min:145.0	Min:19.7	Min:20.0
	Max:82.0	Max:127.0	Max:198.0	Max:41.5	Max:60.0

BMI = Body Mass Index, Min=Minimum, Max=Maximum.* Cobb's angle in the cases of disc prolapsed an
(P-value = 0.172)

Figure 3: Table 2 :

3

Diagnosis/ intervertebral disc prolapse level	Gender		Total
	Male	Female	
L2,L3	1.0(4.0%)	0.0(0.0%)	1.0(2.0%)
L3,L4	1.0(4.0%)	2.0(8.0%)	3.0(6.0%)
L4,L5	7.0(28.0%)	9.0(36.0%)	16.0(32.0%)
L5,S1	4.0(16.0%)	5.0(20.0%)	9.0(18.0%)
L1,L2,L3	1.0(4.0%)	0.0(0.0%)	1.0(2.0%)
L3,L4,L5	1.0(4.0%)	1.0(4.0%)	2.0(4.0%)
L4,L5,S1	9.0(36.0%)	6.0(24.0%)	15.0(30.0%)
L2,L3,L4,L5	0.0(0.0%)	2.0(8.0%)	2.0(4.0%)
L3,L4,L5,S1	1.0(4.0%)	0.0(0.0%)	1.0(2.0%)
Total	25.0(100.0%)	25.0(100.0%)	50.0(100.0%)

Diagnosis stands for all cases examined by MRI and diagnosed to have intervertebral disc prolapse at different levels by the expertise Radiologist.

Figure 4: Table 3 :

4

Diagnosis/ intervertebral disc prolapse level	Age	Weight	Height	BMI	Cobb's angle
L2,L3	43.0 ± 0.0	66.0 ± 0.0	167.0 ± 0.0	23.7 ± 0.0	38.0 ± 0.0
L3,L4	50.7 ± 17.5	61.7 ± 11.5	159.7 ± 16.8	24.2 ± 1.8	30.0 ± 8.0
L4,L5	52.9 ± 11.0	76.3 ± 18.3	167.8 ± 12.8	27.1 ± 5.8	41.6 ± 10.0
L5,S1	40.4 ± 11.5	83.0 ± 15.8	166.2 ± 8.8	30.0 ± 5.0	38.9 ± 9.4
L1,L2,L3	37.0 ± 0.0	73.0 ± 0.0	164.0 ± 0.0	27.1 ± 0.0	31.0 ± 0.0
L3,L4,L5	59.5 ± 0.7	62.5 ± 10.6	165.5 ± 6.4	22.7 ± 2.1	37.5 ± 6.4
L4,L5,S1	48.0 ± 13.4	69.6 ± 8.1	164.6 ± 5.7	25.8 ± 3.4	38.0 ± 10.8
L2,L3,L4,L5	47.0 ± 12.7	81.0 ± 1.4	160.0 ± 0.0	31.7 ± 0.5	48.5 ± 0.7
L3,L4,L5,S1	42.0 ± 0.0	85.0 ± 0.0	171.0 ± 0.0	29.0 ± 0.0	23.5 ± 0.0
P-value	.360	.272	.930	.270	.385

Values are express as Mean ± SD

Figure 5: Table 4 :

5

Cobb's angle	Age	Weight	Height	BMI
Correlation Coefficient	.147	.121	-.076	.182
P-value	.309	.402	.599	.206

Figure 6: Table 5 :

6

Occupation	Mean ± SD
Employee	37.0 ± 12.8
Worker	37.6 ± 9.2
Unemployed	41.0 ± 8.3

Figure 7: Table 6 :

7

	Occupation			Total
intervertebral disc prolapse level	Employee	Worker	Unemployed	
L2,L3	0.0(0.0%)	1.0(6.3%)	0.0(0.0%)	1.0(2.0%)
L3,L4	0.0(0.0%)	1.0(6.3%)	2.0(10.0%)	3.0(6.0%)
L4,L5	5.0(35.7%)	3.0(18.8%)	8.0(40.0%)	16.0(32.0%)
L5,S1	1.0(7.1%)	3.0(18.8%)	5.0(25.0%)	9.0(18.0%)
L1,L2,L3	1.0(7.1%)	0.0(0.0%)	0.0(0.0%)	1.0(2.0%)
L3,L4,L5	1.0(7.1%)	0.0(0.0%)	1.0(5.0%)	2.0(4.0%)
L4,L5,S1	6.0(42.9%)	7.0(43.8%)	2.0(10.0%)	15.0(30.0%)
L2,L3,L4,L5	0.0(0.0%)	0.0(0.0%)	2.0(10.0%)	2.0(4.0%)
L3,L4,L5,S1	0.0(0.0%)	1.0(6.3%)	0.0(0.0%)	1.0(2.0%)
Total	14.0(100.0%)	16.0(100.0%)	20.0(100.0%)	50.0(100.0%)

Figure 8: Table 7 :

8

	Correlations		
	Cobb angle in cases with inter vertebral disc prolapse		Cobb angle in the Control Group
Cobb angle in cases with inter vertebral disc prolapse	Pearson Correlation	1	-.132-
	Sig. (2-tailed)		.683
	N	50	12
Cobb angle in Control Group	Pearson Correlation	-.132-	1
	Sig. (2-tailed)	.683	
	N	12	12

VI.

Figure 9: Table 8 :

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