

Radiological Evaluation of the Lumbar Lordosis Angle in Adult Bangladeshi People of Different Body Weight

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Abstract

Background: Overweight and obesity are related with the degeneration of lumbar disc, lumbar lordosis, low back pain and other higher risk problems of spine. Radiology is the gold standard method by which the lumbar lordosis angle (LLA) can be measured for diagnosis and treatment.

Objective: The present study was carried out to find out the effect of overweight and obesity on lumbar lordosis angle radiologically in both sexes of adult Bangladeshi people.

Materials and Methods: This cross sectional analytical study was conducted at Department of Anatomy of Rangpur Medical College, Rangpur from a period of July 2018 to June 2019. One twenty four (124) digital radiographs of both sexes, age ranging from 20 to 45 years were taken. LLA was measured in lateral view of lumbar spine. Body mass index was calculated and subjects were grouped according to BMI into group A-normal weight, group B-overweight, group C-obese. The data were analyzed and comparison between three group of both sexes was done.

Result: The mean value of LLA was gradually decreased in overweight and obese than normal weight in both sex. In female statistically significant lower value was found in obese group than normal weight group.

Conclusion: Study findings reveal that high BMI causing losses of natural resilience and flexibility of lumbar spine.

Key words: Bodyweight, radiograph, lumbar lordosis

Introduction

Lumbar lordosis is defined as the curvature assumed by the intact lumbar spine to compensate for the inclination of sacrum, restore an upward spinal orientation and consequently to avoid a forward inclination.¹ The curvature of the lumbar spine (lumbar lordosis) and the role it plays in the transmission of body weight have been studied.² It is clear that excessive body weight adversely affects almost all diseases of the musculoskeletal system. It is believed that the relationship between obesity and musculoskeletal diseases is complex. Excess body weight has long been claimed to be related to many symptoms and diseases of muscle and bone.³ The interplay between the curvature and the ligaments

that maintain it imparts a resilience that is important in protecting the vertebral column against compression and strain in various positions and during movements. It has been noted that some cases of low back pain and sciatica are attributes to abnormal alteration of the curve.⁴ An increase in lordosis angle proportionally increase the shearing strain or stress in anterior direction and shifts the center of gravity anteriorly. Both mechanics will increase the shearing stain at the lumbosacral junction. This increase angle and stress is associated with poor posture and back pain leading subsequently to a decrease in the lumbar lordosis angle. Lumbar lordosis is one of the most important parts of the spine due to its unique position and direct contact with the pelvis. Lumbar lordosis serves to provide strengths against the compression forces of gravity.⁵ Increased lordosis is advocated as a major cause of postural pain, radiculopathy and facet pain.^{6,7}

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Materials and Methods:

This cross sectional analytical study was conducted at the Department of Anatomy, Rangpur Medical

College, Rangpur from a period of one year (July 2018 to June 2019). The patient who came for another cause rather than musculoskeletal system was requested to do an X-ray of lumbar spine. 124 plain digital X-ray were collected from the Radiology Department of a wellknown diagnostic center of Lalmonirhat. The lumbar lordosis angle was measured on lateral view of lumbar spine. Informed written consent was obtained from the subjects informing details of the purpose of the study. Subjects age ranging from 20 to 45 years were chosen by convenient sampling. Before taking radiograph body mass index (BMI) were calculated and subjects were grouped according to BMI into group A-normal weight, group B-overweight and group C-obese. Among them twenty two, twenty and twenty subjects of both sex were included in group A, B and C respectively. According to WHO normal weight, overweight and obesity are defined as BMI 20–24.9 kg/m², 25– 29.9 kg/m² and 30–39.9 kg/m² respectively.⁸ All the measurements were done with the help of 30 cm long transparent ruler and protractor directly on a well illuminated view box and findings were recorded in millimeters. The study was approved by the ethical review committee of Rangpur Medical College, Rangpur.

Lumbar lordosis angle is the angle between the line across the plane of the upper surface of the first lumbar vertebra and the upper surface of the first sacral vertebra (Figure 1A). It was measured on lateral

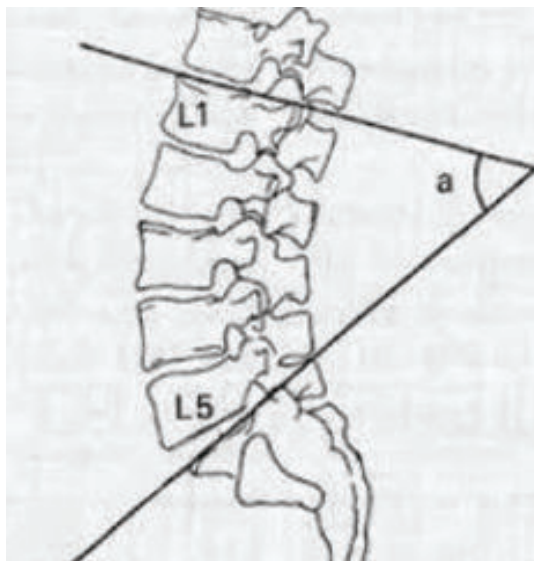


Fig.-1A: Schematic diagram of lumbar lordosis angle 'a'

radiograph with the transparent ruler. Line for the measurement of the angle were drawn with a pencil, using appropriate landmarks. The angle was measured in degrees using a protractor (figure B).⁹



Fig.-1B: Photograph showing procedure of measurement of lumbar lordosis angle of male in lateral view

Statistical processing of data

The data collected were processed according to their distributions, central tendencies, and dispersions. Results were prepared in terms of ranges, frequency distributions, mean values, standard deviations (SD), percentage value etc. as applicable. Mathematical relationships for measurements of two groups were calculated by unpaired students 't' test. The level of significance was set as $p \leq 0.05$ at 95% confidence intervals. The Statistical analyses were done by using the SPSS software package for windows version 16.

Result:

Table I shows the lumbar lordosis angle (LLA) in both sex in three weight groups. It was observed that mean value of LLA was gradually decreased from normal weight to overweight and obese subjects in both sex. Although in male the difference did not reach statistically significant level in all groups but in female significantly lower value was found in obese group when compared to normal weight group.

In all groups of both sex, highest mean value of LLA was found in normal weight in female and lowest value was found in obese in female.

Table I
Comparison of Lumbar lordosis angle (in degree) in between normal weight, overweight, obese in both sexes

Gender	Normal weight (A) Mean ± SD (Range)	Over weight(B) Mean±SD (Range)	Obese(C) Mean±SD (Range)	p value (p≤0.05)
Male n=62	50.14 ± 7.97 (41-68)	49.80 ± 7.39 (42-70)	48.10 ± 8.11 (37-63)	A vs B= ns A vs C= ns B vs C= ns
Female n=62	51.36 ± 8.08 (38-65)	47.85 ± 9.02 (37-73)	46.70 ± 6.63 (40-63)	A vs B= ns A vs C= s B vs C= ns

n=Number of participants s = Significant ns = Non-significant

When comparison was done between male and female of three weight groups, it was observed that males had higher value in overweight and obese group, but female had higher value in normal weight group. However no statistically significant difference was found (Table II).

Table II
Comparison between normal weight, overweight, obese subject regarding lumbar lordosis angle (in degree) in male and female

Gender	Normal weight (A) Mean± SD	p value	Over Weight (B) Mean ± SD	p value	Obese (C) Mean ± SD	p value
Male(n=62)	50.14±7.97	.615 ^{ns}	49.80±7.39	.748 ^{ns}	48.10±8.11	.554 ^{ns}
Female (n=62)	51.36± 8.08		47.85± 9.02		46.70±6.63	

n=Number of participants ns = Non-significant

Discussions:

The study revealed some statistically important findings about the effect of overweight and obesity on lumbar lordosis angle radiologically in both sexes. But there is no published work on radiological evaluation of effect of BMI on lumbar lordosis angle in our country. So, present study could not be compared with any previous similar study of Bangladesh. Hence a comparative discussion on the results of different variables of measurement of LLA related with age and gender were done with that of different authors and researchers of the other countries.

Fernand and Fox,⁸ done research work on population age ranging from 17 to 84 years. Their findings showed that mean value of LLA is higher in female than male. And the difference was

statistically significant. In the present study, female value is more than male in group A age ranging from 20 to 45 years. But the difference was statistically non-significant. It may be due to age variation. Racial and geographical factors may also play role in this regard.

In present study, LLA was decreased gradually in overweight and obese than normal group in both sex. Here the mean value of male is non significantly higher than female in case of overweight and obese group. Studies done by Amonoo-Kuofji¹⁰, Damasceno et al¹¹, Gasparotto¹², Okpala¹³ and Atta-Alla et al¹⁴ showed that mean value of LLA was significantly higher in female than male. There was no study related with BMI, so cannot compare the value of overweight and obese group with other published work.

Morphometric studies done by Bailey et al¹⁵ revealed that females have greater lordosis than males and these differences would be accentuated when standing but not when supine. Furthermore, sex differences in the lumbar spine appear to be supported by postural differences in sacral orientation and morphological differences in the vertebral body wedging.

The study reported by Skaf et al¹ concluded that LLA and age can be predictors of the level of lumbar disc herniation. Disc herniation was found to occur at higher level of the spine as age increased and LLA decreased. The finding might be due to flattening of spine which begins in the fourth decades and continue till the six decades. So, LLA decrease might show a change in morphometric change in lumbar spine, that also seen in present study.

Bailey et al¹⁵ also suggested that, sex differences in lumbar lordosis could indicate that females and males might be differently predisposed to certain lumbar conditions (risk of degenerative spondylolisthesis, which is five times higher for females than males).

Conclusion

In the present study statistically significant ($p \leq 0.05$) difference was found only between A and C group in female. Also, this study shows the lordosis angle was decreased gradually in overweight and obese than normal weight in both sex. It indicates high BMI affecting the morphometric changes causing the loss of natural resilience and flexibility of lumbar spine.

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