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Original Research Paper Anatomy

Inclination of the Lumbosacral angle in normal individuals: An MRI study

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ABSTRACT

Back ground
The Lumbosacral angle is the angle between the long axis of the lumbar part of the vertebral column and that of the sacrum.

Materials and method
The subject of this study was the measurement of the inclination of the lumbosacral angle (LSI), by using lumbosacral MRI studies of 50 apperantly normal MRI films (25 males and 25 females) in order to estimate from the pure anatomic point of view if there is a gender difference in different age groups. Electronic Goniometer was used.

Results and discussion:
The ages of male group was ranged from 17-75 years old (mean 43.6), while the females group was from 18-70 years old (mean 43.48). The LSI angle mean for males was 138.56 and that of females group was 141.08. Although the angles measurements were bigger for females than males, the P value = 0.278 (>0.05) indicates that there was no statistical significant difference between the two means

Conclusion:
The lumbosacral angle is simple to be measured radiologically especially by MRI and the results obtained from our population is comparable to those published by other foreign researchers with comparable means, the females have larger angles than males but with no significant statistical difference.

KEYWORDS : Lumbosacral angle, Inclination, Goniometer, Gender difference, MRI.

Introduction:
The Lumbosacral angle is the angle between the long axis of the lumbar part of the vertebral column and that of the sacrum (1). It has been variously called the "sacro-horizontal angle", the "sacral angle", the "sacral LSA.", the "Ferguson's angle", and the "LSA"(2,3). The lumbar spine is convex anteriorly and this curve is known as the lumbar lordosis. The Lumbosacral angle is present since development of the lumbar lordosis begins as an infant starts to stand, usually between 12 and 18 months of age, and it continues to develop until the completion of spinal growth, normally between 13 and 18 years. Children who never assume the erect position still have the angle and develop a lumbar lordosis to the same degree and at the same time as other children. Growth retardation gives a delay in the emergence of the lumbar lordosis and a less lumbosacral angle degree (4,5,6). To quantify this curve, various methods have been used. They include goniometry (7,8), radiography (9,10,11) flexible rulers(12,13,14), software methods (15,16,17), spinal mouse (18) and inclinometer (19,20). Of all these methods, radiography remains the gold standard and lordotic measurement can accurately be measured in a supine lateral lumbosacral spine radiograph (21,22,23). The lumbosacral angle (LSA) is one of the clinically important radiographic angles related to this curve, and frequently measured by the Ferguson's technique is important in the management of patients with low back disorders because it may be affected by disorders such as inflammation, degeneration etc (24). Furthermore, by using MRI studies the determination of age- and gender-specific mean anatomic morphometric values of the lumbosacral angle is possible without the use of cadaver measurements. The measurement values, which originated in the past years particularly from the sectioning of cadavers, were representing actually only one age group, these beyond of 7th decade of life (25).

New diagnostic and therapeutic methods which depends on the LSA were become necessary and minimal invasive neurosurgical procedures have been developed, such as neuroendoscopy and thecaloscopy (3,6).

Little is known about what the normal value of LSA for Iraqi population for males and females and therefore, what constitutes hypo-/hyper-lordosis; most of the data in use in medical practice is based on studies on other races. This study was, therefore, aimed at quantifying the normal value of this angle in our population and if there is gender differences.

Materials and Methods:
During the time period between 01/01/2015 to 31/12/2015 MRI of the lumbosacral region for 50 patients with non-specific back pain were examined in a retrospective study, the study included two groups 25 males ages range from 17 – 75 years old (mean 43.6) and 25 females age ranges from 18 – 70 years old (mean 43.48) cases with no major problem in the lumbosacral region were chosen according to the following inclusion criteria:

(1) presence of five lumbar and five sacral vertebrae in the MRI film (2) progressive increase in vertebral height from L1 to L5, or the height remain the same; (3) anteriorly convex lordotic curve that gives place to a concavity in the sacral region; (4) posterior margins of the vertebral bodies form a smooth curved line but the superior margin of the lower vertebra may often deviate from this line; (5) the corticated endplates of the vertebral bodies is filled by intervertebral discs that increase in thickness from L1 to L5; the relatively narrow L5/S1 disc is wedge-shaped with its anterior vertical height greater than the posterior; (6) no radiographic evidence of disease or congenital abnormality in the lumbosacral spine.

While the exclusion criteria included (1) patients below 15 years of age; (2) poor quality MRI graphs; (3)MRI's showing any evidence of disease or congenital abnormality. Patients below 15 years were excluded to ensure that only those that have attained spinal maturity were studied. The Lumbosacral inclination angle was measured between a line across the anterior border of the lumbar vertebrae and another line across the anterior border of the sacral vertebrae (Figure 1). The measurements of the MRI studies were performed by using the electronic Goniometer. All the measurements were accomplished in degrees. All measurements

were made by the author in order to remove inter-observer error. The statistical analysis performed using the program SPSS 22.0 for Windows. Due to the small sample and to the fact that the variables weren't following the normal distribution, the non-parametric statistics were used to find out if any difference existed or not. The statistical significant level for the tests was p=0.05.

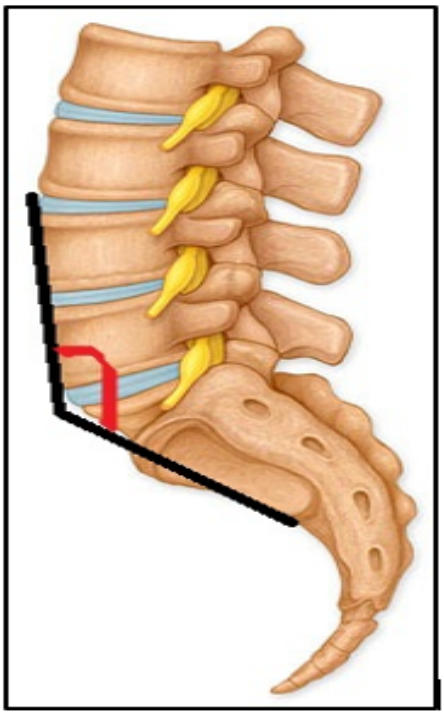

Figure 1: Anterior lumbosacral inclination angle.

Results:

Table 1: Individual ages and distribution:

Gender	Minimal age in years	Maximum age in years	Mean age
Male (n=25)	17	75	43.60
Female(n=25)	18	70	43.48

Table 2: Descriptive values for all parameters (n=50).

	Male lumbosacral inclination angle	Female lumbosacral inclination angle
Number of cases	25	25
Minimum in degrees	116	120
Maximum in degrees	155	162
Mean	138.56	141.08
Std. deviation	7.969	7.654

Table 3: Statistical comparison (paired sample T test).

	Male (n=25)	Female (n=25)	
	Mean (Std.Dev)	Mean (Std.Dev)	P value
Lumbosacral inclination angle in degrees	138.56 (7.969)	141.08 (7.654)	0.278

P value > 0.05 indicates no significant difference

Discussion:

The lumbosacral angle is one of the important normal anatomical parameters, it considered as a theoretical reason for back pain symptomatology, hence its importance emerges in clinical practice (1,2,3,4). In this study two comparable groups in number 50% (25) males, 50% (25) females with comparable ages (mean ages 43.60 and 43.48 respectively) as shown in Table (1) were included in our study, the mean LSI angle for the males was 138.56 and for the females 141.08 which were compared to results published by other authors in which it has been also showed that the mean angle for females is greater than that of males (26,27). However in this study there was no statistical significant difference between the means as shown in table (3) (p value was greater than 0.05), this was also agreed by Güldal Funda Nakipoglu (27) and Mehmet Caglayan etal (28) researches. The lumbosacral inclination angle in our society is similar to that of others so the surgical and medical diseases symptoms and the subsequent procedures are suggested to be the same.

Conclusion:

The lumbosacral inclination angle is simple to be measured radiologically especially by MRI and the results obtained from our population is comparable to those published by other foreign researchers with comparable means, the females has larger angles than males with no significant statistical difference.

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