



MORPHOMETRIC ANALYSIS OF RADIOLOGICAL LUMBO SACRAL ANGLES IN PUNJABI POPULATION-A CROSS SECTIONAL STUDY.

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ABSTRACT

Introduction- Radiological lumbosacral angles namely lumbar lordotic angle (Cobb angle) (LLA), lumbosacral angle (LSA) and sacral inclination angle (SIA) are the anatomical indicators of the curvature of vertebral column. Lumbar lordotic angle (LLA) is the angle between the tangent drawn along the superior border of L1 and other drawn along the superior border of S1 vertebra. Lumbosacral angle (LSA) is the angle between plane of lower surface of L5 and plane of upper surface of the sacrum. Sacral inclination angle (SIA) is the angle between line along the posterior border of body of S1 vertebra and reference vertical line. **Aim And Objectives-** The aim is to study various radiological lumbosacral angles in Punjabi population with low back pain and to correlate them with their age. **Material And Methods-** The present study was done on one hundred symptomatic patients (50 males and 50 females) with low back pain of age group of 18-45 years from Punjab. Patients with history of trauma or any spinal abnormality were excluded. The digital lateral view radiographs of subjects with low back ache were evaluated for these lumbosacral angles using Radiant Dicom Software. The statistical analysis was done using SPSS Version 20. Unpaired student t test was used to analyse the data. P-value of <0.05 was considered as statistically significant. **Results-** In the present study mean lumbar lordotic angle was 49.50 ± 3.5 , mean lumbosacral angle was 36.38 ± 7.5 and mean sacral inclination angle was 39.30 ± 6.7 . LLA and SIA had statistically significant higher values in females as compared to males. **Conclusion-** Lumbar lordotic angle, lumbosacral angle and sacral inclination angle are commonly used for diagnosis and treatment of low back ache. The present study can also help in designing spinal instruments and implants for Punjabi people with low back ache.

KEYWORDS : Sacrum, Lordotic, Anthropometric, Radiographs.

INTRODUCTION

The main function of the lumbosacral curvature is weight bearing and mobility of spine[1]. Lumbosacral curvature can be affected by age, race, ethnicity, degenerative changes and posture[2]. Low back ache is a common disorder in persons with inactive life style, poor posture, carrying heavy weights, pregnancy and obesity [3]. Any change in lumbar lordosis due to increased body mass index or degenerative changes due to old age may cause low back ache and poor posture [4]. Lumbar lordosis may also be influenced by various congenital abnormalities of spine, trauma and inflammation [5]. Lumbosacral angles are critically important in physically active life of an individual [6, 7]. Less data is available about values of lumbosacral region angles in Punjabi population with low back ache. This study can help to design spinal instruments and implants for Punjabi population. Aim of the present study is to measure lumbosacral region angles and to correlate them with other factors like age and gender.

MATERIAL AND METHODS-

One hundred (50 males and 50 females) radiographs of patients presented in outdoor orthopaedic department of our hospital with low back ache for last three months with age group 18-45 years were included. Morphological characteristics like age and gender were noted. Patients with history of trauma or spinal deformity were excluded. In routine the digital X ray of lumbosacral spine in left decubitus position is done. After collecting the radiographs, lumbar lordotic angle (Cobb's method) [8] was measured by drawing a tangent line along the superior border of L1 and another one along the superior end of S1 vertebra. Perpendicular lines to each of the tangential lines were drawn to form the lumbar lordotic angle. Lumbosacral Angle is the angle between plane of inferior surface of L5 vertebra and plane of upper surface of the sacrum (Ferguson's Technique) [9]. Sacral inclination angle is the angle between the line along the posterior border of S1 vertebra and the reference vertical line. The angles were taken thrice by the same author. The present data was taken as mean and standard deviation with a Radiant DICOM software. Student t test unpaired was done to analyse the data. P value to <0.05 was considered as significant value.

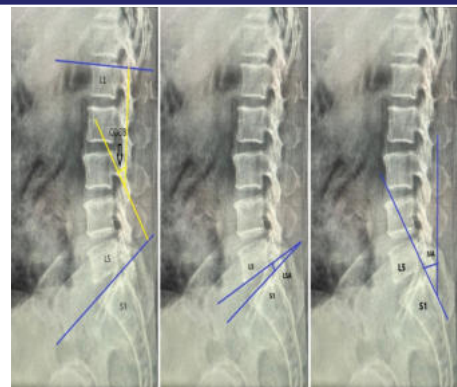


Fig 1- Lateral Radiographs showing measurement of LLA (Cobb angle), LSA and SIA.

RESULTS

Mean lumbar lordotic angle (LLA) in the present study was $49.5 (30.2-55.3)$. It was 40.06 in males and was 53.5 in females. The mean values of LLA were significantly higher in females as compared to males. Mean lumbosacral angle (LSA) in the present study was $36.38 (29.43-45.12)$ and was 35.01 in males and 41.78 in females and no statistically significant gender difference was seen. Mean sacral inclination angle (SIA) as $39.3 (30-49.5)$ with 32.31 in males as compared to 47.22 in females. There was statistically significant higher SIA in females as compared to males.

Table 1- Showing Distribution Of Mean Values Of Lumbosacral Angles In Different Age Groups Of Patients.

Age Group (Yrs)	Number of subjects with low back ache			LLA	LSA	SIA
	Sex	Number	Total			
18-25	Males	01	03	48.06	28.56	30.41
	Females	02		53.5	31.22	48.87
26-30	Males	03	05	46.44	31.50	32.32
	Females	02		51.09	37.18	43.87
31-35	Males	11	16	49.80	35.36	39.09

36-40	Females	05	28	51.45	40.22	46.76
	Males	13		48.22	38.11	38.21
41-45	Females	15	48	52.54	41.87	47.41
	Males	23		49.99	41.43	40.76
	Females	25		54.02	45.81	48.32

DISCUSSION

Mean lumbar lordotic (LLA) angle in the present study was 49.5+ - 3.5. It was given as 42.0 given by Farhan et al [10] but Onyemaechi [1]and Thakur et al [11] gave the value almost same as present study. However it was given as higher as 58.78+ - 9.51 by Singh R et al [12] In the present study mean LLA was significantly higher in females as compared to males with low back ache Mean LSA in the present study was 36.3+ - 7.5 which was close to 37.70 given by Thakur [11]but was higher than 31.70 reported by Kim et al[13] 32.40 given by Chung et al[14]34.0 as given by Jha and Ravi[15] and 10.56 as given by Singh et al[12]. But the present values were however lower than given by Fernard and Fox [16], (46.50), Middleditch and Oliver [17], (42.50), Lackum [18], (42.5) and Splithoff [19], (40-44). Ferguson et al [9] reported that if lumbosacral angle exceeds 34 degrees instability exists between lumbar and sacral spine. The present study showed mean LSA values significantly higher in females than males. It could be due to hormonal changes during pregnancy and reproductive life [20]. Same findings were also noted by Bryan [21]; and Vaille et al [22]. LSA was seen to increase with age between 21-45 years [23] but no statistically significant relationship was noted between age and lumbosacral angle in the present study and also by Kuo et al [24]. An increased LSA suggests an increase in shearing and compressive forces on the articular facets and causes low back ache. Sacral inclination angle in the present study was 39.3+6.7 which was very close to Thakur et al [11] and Onyemachi [1] with statistically significant higher values seen in females than males. But it was low as compared to angle given as 48.62 + -6.62 by Singh et al [12]. The position of the sacrum affects pelvic dimensions and particularly in females it is more inclined to create larger pelvic outlet during child birth. This may explain higher values of mean SIA in females as compared to males. There was no significant association of SIA with age in present study.

Table 2- Comparison Of LLA, LSA And SIA Values Of Other Studies With The Present Study.

S No	Lumbar Lordotic Angle (LLA)			Lumbo sacral Angle (LSA)			Sacral Inclination Angle (SIA)		
	Author	Year	Angle	Author	Year	Angle	Author	Year	Angle
1	Farhan	1972	42.0	Ferguson	1949	34.0	Yochum	2005	46
2	Fernard and Fox	1985	29.96+-0.74	Hellens and Keats	1971	41.1	Nakipoglu et al	2008	45
3	Lord MJ et al	1997	49	Fernard and Fox	1985	42.0	Caglayan et al	2013	46.9+-8.5
4	Chemukha	1998	52	Bean E et al	2007	51	Onyemaechi	2016	38.7+-8.9
5	Endo et al	2010	36.7+-14.5	Madufoora et al	2013	36	Singh et al	2018	48.62+-6.62
6	Onyemaechi	2016	40.4	Okpala	2014	44.5	Shortz and Haas	2018	52.7+-7.8
7	Okpala and Okpala	2018	49.9	Jha and Ravi	2015	34.0	Thakur et al	2021	38.5+-7.7
8	Shortz and Haas	2018	43.3+-11.0	Shortz and Haas	2018	14.5+-5.0			

9				Issahaku et al	2023	34.3			
10	Present Study	2025	49.5	Present Study	2025	36.3	Present Study	2025	39.3

CONCLUSION

Mean lumbar lordotic angle, lumbosacral angle and sacral inclination angle in the present study were 49.5, 36.3 and 39.3 respectively. LLA and SIA were seen to be significantly higher in females than males. These angles can help the orthopaedic surgeons to evaluate spinal deformities and help in designing spinal instruments and implants. These values can be used as reference value for Punjabi population.

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