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Changes in Lumbosacral Angles in Patients with Chronic Low Back Pain: A Prospective Study

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Abstract **Objective:** A prospective study of several radiographic parameters of sagittal profile of the spine was conducted to determine the clinical values of these parameters. **Methods:** The lumbar lordotic curve was measured as Lumbar Lordotic Angle (LLA), Lumbosacral Angle (LSA), Sacral Horizontal Angle (SHA) and our suggested new parameter, Lumbar Sagittal Balance Axis (LSBA). We compared the association between LLA, LSA, SHA and LSBA in 100 patients with chronic low back pain (LBP) and 100 control group. **Results:** LSA was statistically significant in male ones in patients and control group (P=0.0001) but this angle didn't showed a significant difference without the effect of gender. SHA angle didn't show any statistical significance in patients with LBP. A significant correlation was observed between LSBA increase and LBP (P=0.001). **Conclusion:** Measurement of LSAs and LSBAs may provide orthopedic surgeons some appropriate parameters to predict acute to chronic LBP transformation risks.

Keywords: *Lumbar Lordotic Angle, Lumbosacral Angle, Sacral Horizontal Angle, Lumbar Sagittal Balance Axis, Low Back Pain*

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1. Introduction

Low back pain (LBP) is one of the most important groups of disorders and complains related to musculoskeletal problems. [1] Diagnosis and treatment of this kind of disorder comes so expensive and it leads to loss of workforce. [2] LBP is a common disorder with high rate of prevalence and incidence, however many of its etiologies are yet to be known. [3] Some special conditions like smoking, stress, poor posture driving for long time, carrying heavy objects and inactive work life may cause LBP; [4] however, both congenital abnormalities like spina bifida, transitional vertebrae, an uneven number of lumbar vertebrae, scheuermann's disease and developmental abnormalities like spondylolysis, spondylolisthesis and slight to moderate disc degeneration have become questionable or of no clinical value for predicting back problems. [5,6,7,8] Different clinical observations have suggested that normal curvature and lordosis of lumbar region play an important role in carrying body weight and have associations with the prevention of spinal disorders. [9] Measurement of lumbar curvature is essential for diagnosis and clinical decisions. [10] Different studies show that biomechanical changes in the lumbar curvatures and vertebral column can change the tension and compression in vertebral ligament and muscles which may lead to LBP. [11]It has been found that changes in lumbar lordosis and thoracic kyphosis may affect the biomechanic features of vertebral column, ligaments and muscles which can result in LBP. [12]

The purpose of this study was to asses lumbosacral angle (LSA), lumbar lordosis angle (LLA), sacral horizontal angle (SHA) and determine a new distance in lumbosacral reagion as lumbar sagittal balance axis (LSBA) in patients with LBP, and investigate their association with LBP patients.

2. Methods

A Total of 100 patients (60 females and 40 males) who presented to the outpatient clinic of Akhtar hospital with complaint of chronic LBP (at least 12 weeks of LBP defined as chronic) were included in patient group and 100 age and sex matched healthy patients (63 females and 37 males) were included in healthy normal control group. Patients with history of pelvis surgery, spinal surgery, spinal fracture, radiculopathy symptoms and patients with inflammatory rheumatic disease such as rheumatoid arthritis and ankylosig sponclylitis along with patients with metabolic bone disease and tumors and also patients with scholiosis, kyphosis, spondylolysis and spondylolisthesis were excluded from this study. Standing lateral lumbosacral X – ray was taken with a distance of 100cm to the tube; and LLA, LSA, SHA and LSBA noted for every patient. LLA is the angle where the line is tangential to the intersection between upper end plate of the first lumbar vertebrae and lower end plate of the last lumbar vertebrae.

LSA is defined as angle where the line is tangential to the intersection between lower endplate of the fifth lumbar vertebrae and upper endplate of sacral vertebrae. SHA is the angle where the line is tangential to the intersection between upper endplate of sacral vertebrae and horizontal plane. In addition, LSBA represents a horizontal distance front vertical line that dropped from middle of first lumbar vertebral body and anterior to the corner of sacrum.

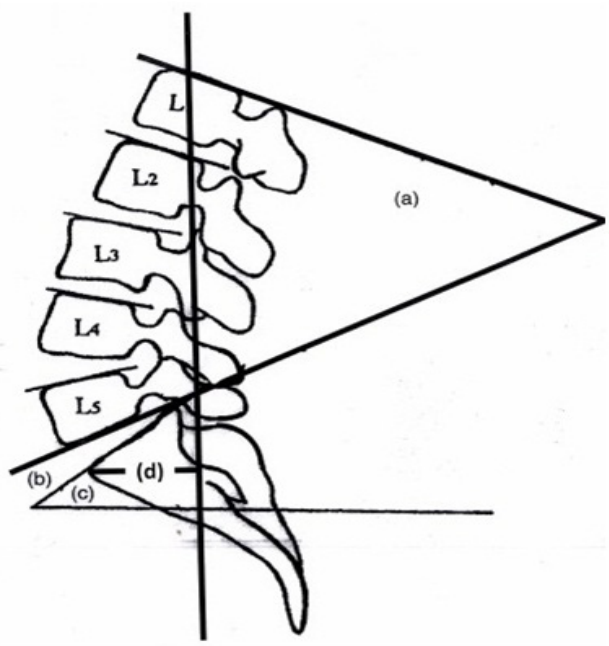

Figure 1. Defined angles as (a) lumbar lordosis angle (LLA), (b) lumbosacral joint angle (LSA), (c) sacral horizontal angle (SHA), (d) lumbar sagittal balance axis (LSBA)

Statistical analyses were performed by means of statistical package for social sciences (SPSS) version 15 (SPSS Inc, Chicago, IL, USA). Chi-square test and student t-test were used for statistical analyses. A P value below 0.05 was considered statistically significant.

Written informed consent was obtained from the patient with ethical approval of Ethics Committee of Akhtar Hospital.

3. Results

The mean age of 100 LBP patients (60 females and 40 males) and 100 control cases without LBP (63 females and 37 males) was 45 years and there was no statistically significant age difference between patients and control group. (P value: 0.613).

LLA differences in patients and control group was not statistically significant in female (P value: 0.526), but this angle showed it significant difference in male ones. (P value: 0.02) Totally, LLA differences were not statistically significant in patients and control group. (P value: 0.8) LSA differences didn't showed it significance in female subjects, (P value: 0.59) however, this measure was statistically significant in male ones in patients and control group (P value: 0.0001) but this angle failed to demonstrate a significant difference without the effect of gender. (P value: 0.03) SHA neither showed any significant difference in both female (P value: 0.516) and male subjects (P value: 0.205) nor without effect of gender. (P value: 0.597) We found that differences of LSBA were statistically significant in both female (P value: 0.001) and male subjects (P value: 0.001) and also this measure was statistically significant without the effect of gender in both groups. (P value 0.001).

Effects of LLA, LSA, SHA, LSBA, age, and gender on LBP were investigated and it was found that an increase in LSA and LSBA strongly promotes LBP risk in both female and male patients; also increase in LLA may increase LBP risk in male subjects. Our results showed that LSA parameter doesn't have any significant effect on severity of LBP.

4. Discussion

In this study we found that LSA was lower in patient with LBP compared with control group and we found a significant strong relation slip between LSBA and LBP that an increase in LSBA increase the risk of developing LBP and the LSBA was higher in patient with LBP in compare with control group. Multiple studies showed positive association between vertebral column deviations in sagittal plane with incidence of LBP. Too many different factors like abnormal posture can affect the lumbar spine curvature [13].

Vialle R et al found that a decrease in lumbar lordosis provides a better biomechanical loading position which may decrease the risk of LBP. Different studies show that no significant differences were found between patients with LBP and control group regarding LSA. Caglayan M et al found that an increase in LLA increased the risk of LBP by approximately 1.04 folds whereas no such association was found with the other angles at the other hand in present study we found that LSBA is higher in patients with LBP and increase in LSBA increased the risk of LBP. Chernukha et al found that maintaining a normal range of LLA is associated with preventing spinal disorders. In the review of literature we foun that lumbar lordosis is measured in different ways and from different levels. Measurement from L1 to L5 is not uncommon. Andersson et al measured total lordosis from the top of L_1 to the top of S_1 by using the Cobbs method. Benhardt and Bridwell used a modified Cobbs method but again included the L5-S1 level for their segmental lordosis measured from L1 thruogh S1. In this study we measured from top of L1 as a angle till to lower plate of L5 and because of these different method of measurement Differences in results might have been caved but in this study we provide a new parameter, LSBA, as this new parameyer to determines the lubmosacral lordosis. Kendall et al determined that, because of the muscle balance between back and hip muscles and abdominal muscles in standing position, lumbar lordosis should be associated with pelvic inclination. [14,15] In contrast, Walker et al found a weak relationship between lumbar lordosis and pelvic inclination in standing position in asymptomatic patient. [16] Youdas et al observed that gender correlated highly with pelvic inclination and lumbar lordosis but found no correlation of lumbar lordosis with abdominal muscle performance in either males or females. They examined chronic LBP patients and reported an association between lumbar extension and lumbar lordosis in males. [17] Some researchers compared

lordotic measurements of normal, chronic, and acute LBP patients and reported that patiens with chronic LBP had hypo-lordosis, whereas the acute back pain group was hyper-lordotic, with the largest L1-L5 Cobbs angle. [18,19] Jackson et al reported that lumbar lordosis was significantly lower and not age or gender-related in chronic back pain patients. [20]

One of the main results of this study that we can emphasize on is the new parameter mentioned as LSBA and the relation between increasing this parameter and risk of LBP which is significant. Two limitations of this study are patients were not classified according to their occupations and were not classified according to the etiological causes which might affect the risk of LBP.

5. Conclusion

Various methods have been used to investigate the status of sagittal spine in patients with low back pain and in healthy in making a comparison between the methods. Radiological evaluation seems to be superior to external evaluation methods. Changes in LSAs and LSBA may cause LBP. Therefore measurement of LSAs and LSBA may guide the orthopedic surgeons who are to make clinical decisions in examination of patients with LBP, and these measurements may provide good parameters to predicted the risk of changing an acute LBP to a chronic one, which may help to predict the incidence of chronic LBP in some important workers like miners, soldiers and who working in abnormal postures for prolonged time. This description of the physiological and pathological spinal sagittal balance should serve as a baseline in the evaluation of pathological conditions associated with abnormal angular parameter values. The correlations between angular parameters may also be useful in the method of treatment which is selected by the surgeons.

References

[1] Urwin, M., Symmons, D., Allison, T., Brammah, T., Busby, H., Roxby, M., Simmons, A., "Williams, G., "Estimating the burden of musculoskeletal disorders in the community: the comparative prevalence of symptoms at different anatomical sites, and the relation to social deprivation," *Annals of the rheumatic diseases*, 57(11):649-55. 1998.

[2] Amonoo-Kuofi, US., "Changes in the lumbosacral angle, sacral inclination and the curvature of the lumbar spine during aging," *Acta Anat (Basel)*, 145(4):373-7. 1992.

[3] Pope, M.H., Novotny, J.E., "Spinal biomechanics," *J Biomech Eng*, 115(4B):569-74. 1993.

[4] Tüzün, C., Yorulmaz, I., Cindaş, A., Vatan, S., "Low back pain and posture," *Clin Rheumatol*, 18(4):308-12. 1999.

[5] Pincus, T., Burton, A.K., Vogel, S., Field, A.P., "A systematic review of psychological factors as predictors of chronicity/disability in prospective cohorts of low back pain," *Spine*, 27(5):E109-20. 2002.

[6] Koyama, K., Nakazato, K., Min, S.K., Gushiken, K., Hatakeda, Y., Seo, K., Hiranuma, K., "Radiological abnormalities and low back pain in gymnasts. International journal of sports medicine," 34(03): 218-22. 2013.

[7] Tsuji, T., Matsuyama, Y., Sato, K., Hasegawa, Y., Yimin, Y., Iwata, H., "Epidemiology of low back pain in the elderly: correlation with lumbar lordosis," *J orthop Sci*, 6(4):307-11. 2001.

[8] Romero-Vargas, S., Zárate-Kalfópulos, B., Otero-Cámara, E., Rosales-Olivarez, L., Alpízar-Aguirre, A., Morales-Hernández, E., Reyes-Sánchez, A., "The impact of body mass index and central obesity on the spino-pelvic parameters: a correlation study," *European Spine Journal*, 22(4):878-82. 2013.

[9] Chen, Y.L., "Vertebral centroid measurement of lumbar lordosis compared with the Cobb technique," *Spine*, 24(17):1786. 1999.

[10] Chernukha, K.V., Daffner, R.H., Reigel, D.H., "Lumbar lordosis measurement: a new method versus Cobb technique," *Spine*, 23(1):74-9. 1998.

[11] Jackson, R.P., McManus, A.C., "Radiographic Analysis of Sagittal Plane Alignment and Balance in Standing Volunteers and Patients with Low Back Pain Matched for Age, Sex, and Size: A Prospective Controlled Clinical Study," *Spine*, 19(14): 1611-8. 1994.

[12] Murrie, V.L., Dixon, A.K., Hollingworth, W., Wilson, H., Doyle, T.A., "Lumbar lordosis: study of patients with and without low back pain," *Clin Anat*, 16(2):144-7. 2003.

[13] Vialle, R., Levassor, N., Rillardon, L., Templier, A., Skalli, W., Guigui, P., "Radiographic analysis of the sagittal alignment and balance of the spine in asymptomatic subjects," *J bone Joint Surg Am*, 87:260-207. 2005.

[14] Nourbakhsh, M.R., Arab, A.M., "Relationship between mechanical factors and incidence of low back pain," *J Orthop Sports Phys Ther*, 32(9):447-60. 2002.

[15] Nikouei, A., Seddighi, A., Seddighi, A.S., "The Results of Image Guided Surgery Using Neuronavigation in Resection of Cerebral Gliomas in Eloquent Cortical Areas," *Arch Phys Med Rehabil*, 97(10):e69-70. 2016.

[16] Walker, M.L., Rothstein, J.M., Finucane, S.D., Lamb, R.L., "Relationships between lumbar lordosis, pelvic tilt and abdominal muscle performance," *Phys ther*, 67:512-516. 1987.

[17] Youdas, J.M., Garrett, T.R., Harmsen, S., Suman, V.J., Carey, J.R., "Lumbar lordosis and pelvic inclination in adults with chronic low back pain," *Phys ther*, 80:261-275. 1996.

[18] Horrison, D.D., Calliet, R., Janik, T.J., Troyanovich, S.J., Harrison, D.E., Holland, B., "Elliptical modeling of the sagittal lumbar lordosis and segmental rotation angles as a method to discriminate between normal and low back pain subjects," *J spinal Disord*, 11:430-439. 1998.

[19] Seddighi, A., Seddighi, A.S., Nikouei, A., Mohseni, G., "NS-06 IMAGE GUIDED SURGERY USING NEURONAVIGATION SYSTEM IN RESECTION OF CEREBRAL GLIOMAS INVOLVING ELOQUENT CORTICAL AREAS IN PEDIATRIC POPULATION," *Neuro-Oncology*, 18(Suppl 3):iii128. 2016.

[20] Jackson, R.P., Mc Manus, A.C., "Radiographic analysis of sagittal plane alignment and balance in standing volunteers and patients with low back pain matched for age, sex and size. A pros pective controlled clinical study," *Spine*, 19:1611-1618. 1994.