



Correlation Between Lumbar Spine Posture and Disc Prolapse: A Radiographic Analysis

1) Dr.Divya Gohil^{1*} 2) Dr. Gaurang Baxi² 3) Dr. Tushar Palekar³ 4)Dr. Amit Kharat⁴
5) Dr. Mitsu Desai⁵ 6) Dr. Amit chaube⁶

1- Associate Professor, Dr. D.Y.Patil college of Physiotherapy

2- Professor, Dr.D.Y.Patil college of Physiotherapy

3- Principal and Professor, Dr.D.Y.Patil college of Physiotherapy

4- Professor, Dept.of Radiology, Dr.D.Y.Patil Medical College Hospital and
Research Centre, Pimpri, Pune.

5- Resident, Dr. D.Y.Patil college of Physiotherapy

6- Consultant, Dept.of Radiology, Dr.D.Y.Patil Medical College Hospital and
Research Centre, Pimpri, Pune.

Abstract:

Background:Lumbar spine is the primary weight bearing column with altered posture it puts pressure on these intervertebral discs and it can lead to weak core muscles eventually leading to altered lumbo-pelvic angle and that might result in disc prolapse. **AIM:** To find correlation between lumbar spine posture and disc prolapse using radiographic analysis.

Methods: Study design was Co-relational study and sampling method was Random sampling, Samples were taken from Radiology Department at Dr D Y Patil Medical college and research center, Pimpri. **Outcome measure** taken was Cob's angle.

Procedure: Ethical permission was obtained from the institutional sub-ethics committee. MRI from Radiology department were reviewed. The Cob's angle / lumbar lordosis was calculated using the available film records, and correlated with incidence of disc prolapse.

DATA ANALYSIS: The statistical analysis was done and box plot was plotted to find correlation between lumbopelvic angle and disc prolapse. **RESULTS:** As ($p=0.1731$)

There exists mild correlation between Lumbopelvic angle and incidence of severe disc prolapse with extrusion and sequestrum stage. **CONCLUSION:** Thus we can conclude that there exists mild correlation between lumbopelvic angle and disc prolapse at extrusion and sequestrum level and hence, measurement of lumbopelvic angle can be used as a useful indicator for the diagnosis and treatment of individuals with low back pain. **Keywords:** Cob's angle, lumbar lordosis. lumbar spine vertebrae, MRI.

Introduction

The spine's natural curves enable it function as a shock absorber by reducing its longitudinal stiffness (by a similar method, a metal rod can absorb shock if it is bent to form a helical spring). In addition to stabilising the spine, posture and the loading apophyseal joints shield the disc from excessive flexion and axial rotation.¹ They also significantly contribute to the resistance to compressive and shear stresses. Even though posture has a big impact on this.

The lumbar spine is the primary weight-bearing column which is made up of the intervertebral discs and vertebral bodies. Although it has minimal impact on the size of the loads, posture has an impact on how well this column resists them.²

According to Horst and Brinckmann (1981), an unwedged disc has a propensity to act like a hydrostatic body when under load, compressing the vertebral end plates uniformly. Wedging a disc causes this to become significantly more complicated: young, non-degenerate discs maintain hydrostatic pressure, whereas mature, degenerate discs maintain pressure gradients.³ When a developed disc is trapped in the upright position, this is what it indicates. According to Horst and Brinckmann (1981), the posterior annulus transmits compressive stresses at a higher rate than the anterior annulus.

Pressure variations on the disc are the cause of fluid flow. When under low pressure (as in supine lying), the proteoglycans in the disc can absorb fluid from the surrounding tissue while under high pressure, fluid is forced out of the disc. Flexed postures results in more fluid being ejected from the disc than erect positions do, which increases this fluid exchange (Adams and Hutton 1983).⁴ The nucleus pulposus experiences the effect most noticeably.

Corelation between Posture and Muscle Activity:(According to Morris, Lucas, and Bresler 1961)To maintain spinal stability and keep it from buckling, trunk muscles must be active. Therefore, when the spine is vertical, stability is most necessary, and when it is horizontal, stability is least necessary.This explains why the activity of the back muscles is reduced when the backrest of a chair is made to incline more (Andersson et al. 1975).⁵

The mechanical characteristics of intervertebral discs, along with the interaction of the vertebral spine's curvature with the ligaments and musculature that support it, contribute to a resilience that is crucial for defending the vertebral column against compressive forces experienced in different postures.²

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.³ Various studies have proven that increased or

decreased lumbar lordosis can affect the intervertebral stress, disc properties and ligament laxity or hypertrophy. Which can lead to disc prolapse. Its measurement is affected by a number of factors, including age, gender, pelvic bend, and thoracic curvature, among others, as demonstrated by numerous researchers. Its angle was discovered to rise with ageing, without a difference between men and women, and has since been linked to facet angle and orientation, intervertebral stress distribution, and an imbalance in the trunk muscles.⁶ Hence the aim of the study was to find the Co-relation between Lumbar Spine Posture and Disc Prolapse. with objective to find the lumbar spine lordotic angle and to correlate it with incidence of disk prolapse.

NEED OF STUDY

Altered lumbar posture may alter the loading on the intervertebral disk, leading to an increased risk of disk prolapse / herniation, and disc degeneration. There exists very little to no evidence between the correlation of altered lumbar spine posture and disc prolapse or ligamentum flavum hypertrophy. This study aims to find the correlation between Lumbar Spine Posture and Disc Prolapse, by doing an analysis of radiographic films available with radiology department.

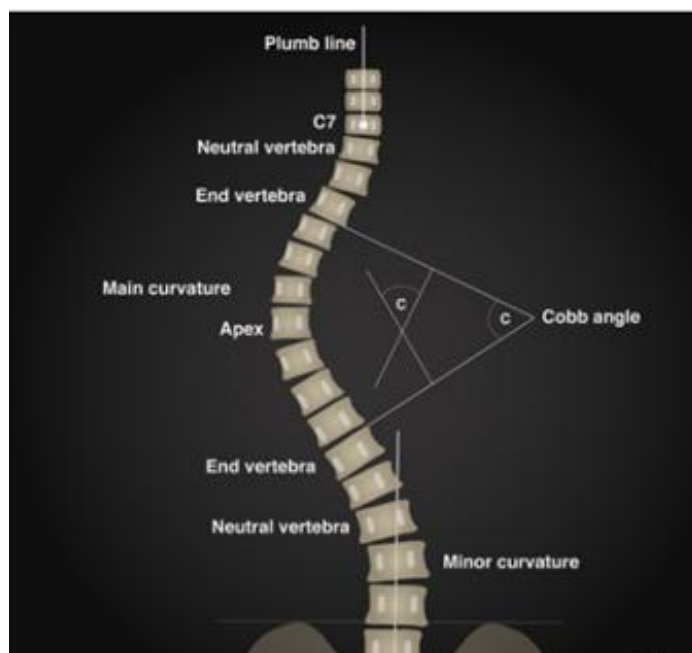
MATERIALS & METHODOLOGY

After ethical committee approval reference number DYPCPT/ISEC20/2020, from institutional ethical committee. Study design selected was Co-relational study, with simple random sampling method. Screening was done for 200 patients and out of them total 80 samples with altered lumbar spine posture were taken from Radiology department of Dr. D.Y. Patil college of Physiotherapy who fit in to the inclusion criteria which are as follow 1. Hypomobility of lumbar spine. 2. NPRS severity of 3-7 with mild and moderate pain level. 3. Pain radiating to lower limb. 4. Lower limb tension test positive for sural, peroneal, femoral or Tibial nerve. and Exclusion criteria were 1. Individuals who are having any Spinal fracture 2. Individuals who are having any other structural deformity. 3. Ankylosing spondylosis, Tuberculosis of spine 4. Individuals who are having other systemic disorders. Outcome measure taken was Cobb's Angle- The measurement of Cobb angle involves estimating the angle between the two tangents of the upper endplate of L1 vertebrae and lower endplates L5 vertebrae, respectively.

PROCEDURE

1. Ethical permission was obtained from the institutional sub-ethics committee.
2. MRIs of lumbar spine of patients diagnosed with disc herniation, available with Radiology Department was reviewed.
3. The Cob's angle / lumbar lordosis was calculated using the available film records, and

correlated with incidence of disc prolapse.



DATA ANALYSIS

The data analysis was done by comparing the lumbo-pelvic angle with presence or absence of Disc prolapse, Ligamentum Flavum hypertrophy, foraminal diameter and Facet joint arthropathy.

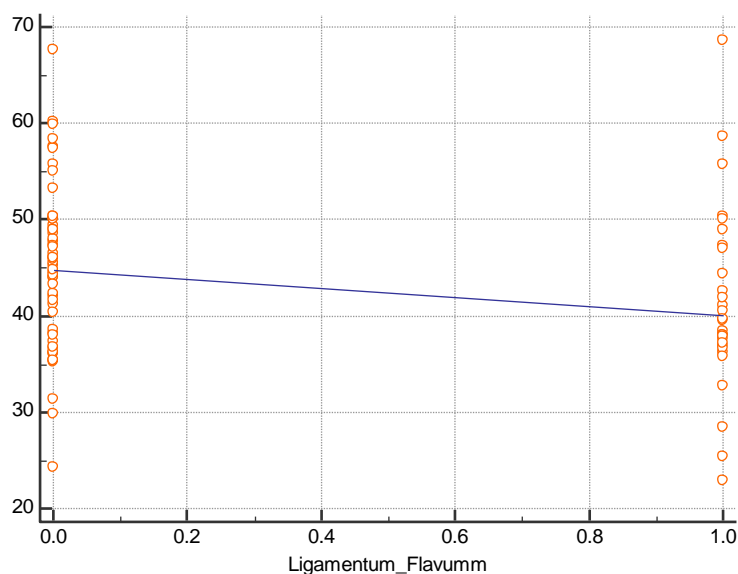
Summary of statistical analysis;

Variable	Lumbo_pelvic_angle
Sample size	80
Lowest value	<u>22.9000</u>
Highest value	<u>68.6000</u>
Arithmetic mean	43.7663
95% CI for the Arithmetic mean	41.8135 to 45.7190
Median	43.9000
95% CI for the median	40.5585 to 45.9903
Variance	79.9737
Standard deviation	8.9428
Relative standard deviation	0.2043(20.43%)
Standard error of the mean	0.9816
Coefficient of Skewness	0.3103(P=0.2309)
Coefficient of Kurtosis	0.4324(P=0.3424)
Shapiro-Francia test for Normal distribution	W'=0.9793 accept Normality (P=0.1745)

Percentiles		95% Confidence interval
25	37.3750	36.1790 to 38.6888
75	48.9750	47.1622 to 50.4000

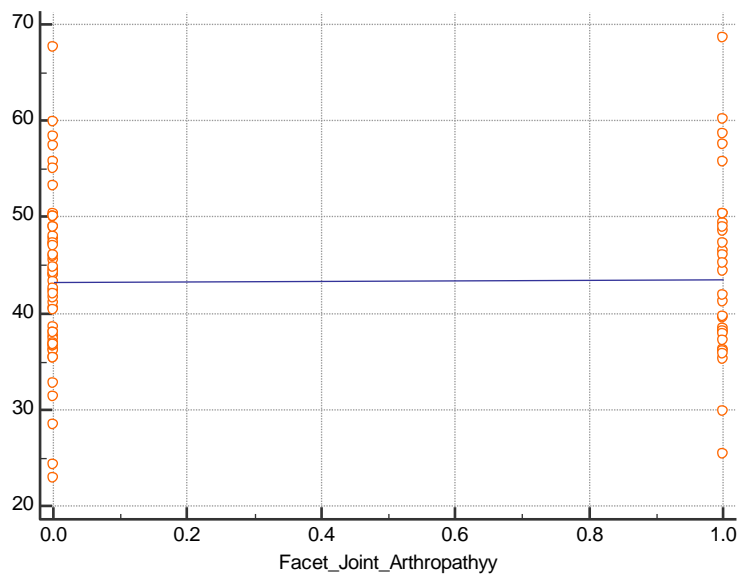
1. Correlation between Lumbo-pelvic angle and ligamentum flavum.

Variable Y	Lumbo_pelvic_angle
Variable X	Ligamentum_Flavumm
Sample size	100
Spearman's coefficient of rank correlation (rho)	-0.216
Significance level	P=0.0502
95% Confidence Interval for rho	-0.412 to -0.0000312



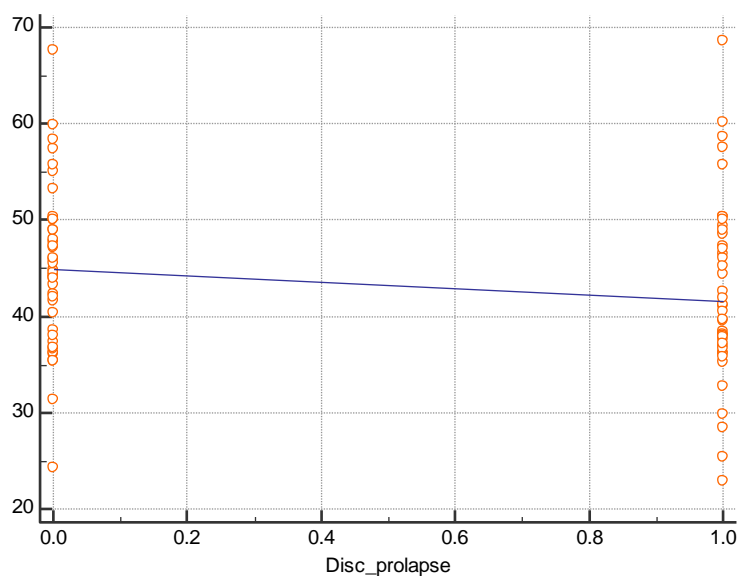
2. Correlation between lumbo-pelvic angle and facet joint arthropathy.

Variable Y	Lumbo_pelvic_angle
Variable X	Facet_Joint_Arthropathy
Sample size	100
Correlation coefficient r	0.04235
Significance level	P=0.7038
95% Confidence interval for r	-0.1749 to 0.2557



3. Correlation between Lumbo- pelvic angle and Disc prolapse.

Variable Y	Lumbo_pelvic_angle
Variable X	Disc_prolapse
Sample size	83
Correlation coefficient r	-0.1510
Significance level	P=0.1731
95% Confidence interval for r	-0.3551 to 0.06691



DISCUSSION

Low back pain has long been the most common reason for lost of work as well as the main catalyst for medical rehabilitation. Each year, this is the reason for around half of the patients who go to orthopaedic outpatient clinics. All age groups can have low back pain. It manifests in several ways; sometimes there is localised waist discomfort, and other times the pain spreads to the buttock or a lower limb.³

The sports and lifestyles of young people have significantly changed due to the advancement of science and technology, and the prevalence of low back pain from lumbar disc herniation has gradually increased. This has had a significant negative influence on their quality of life, wellbeing and life. The most common herniation stages among the 80 individuals in this study with lumbar disc herniation were L4-L5 and L5-S1.⁷ This finding is in line with the findings of earlier research on sciatica which claim that at least 95% of lumbar disc herniations happen at the L4-L5 or L5-S1 segment.

The shearing strain or stress in the anterior direction increases proportionally as the lordotic angle increases, and the centre of gravity moves anteriorly. Some people believe that this increased angle and tension are connected to bad posture and back pain.⁸ The enhanced lumbar lordosis is linked to a higher prevalence of low back pain from a biomechanical perspective. However, a number of research have come to the conclusion that lumbar hyperlordosis is not a direct cause of low back pain.⁷

Discogenic pain, which is believed to start in the nucleus pulposus, was eventually caused by intervertebral disc degeneration and its inflammatory microenvironment. The nucleus pulposus in the intervertebral disc loses water and loses flexibility as a result of bad posture or excessive weight bearing, which increases its susceptibility to wedge change. The height of the anterior and posterior borders of the vertebral body will shift as a result of this intervertebral disc wedge alteration, altering the lumbar lordosis (LL) as well. Physiological lordosis occurs in the lumbar spine.⁹

The results of this study showed that Lumbar lordosis in lumbar disc prolapse individuals was significantly smaller indicating that the physiological curvature of the lumbar spine in patients with lumbar disc herniation changed and LL became smaller.¹⁰ Young patients with low back pain may adjust their posture to relieve pain due to severe pain. In the long term, due to improper posture, the stability of the lumbar spine will be affected, resulting in LL becoming smaller, which will occur or aggravate lumbar disc prolapse.

Many factors can reduce the height of lumbar intervertebral space, but lumbar disc degeneration leading to disc prolapse is the most important reason. The intervertebral disc itself is a structure

with high water content, which acts as a buffer against pressure. When it undergoes degeneration, the water content decreases due to the reduction of hydrophilic matrix such as proteoglycan in the nucleus pulposus.⁷

The Lumbo-pelvic angle also called as Intervertebral angle (IVA) is the angle between the lower endplate of the upper vertebral body and the upper endplate of the lower vertebral body. With the protrusion of the lumbar disc, the relative position of the upper and lower vertebrae changes, and the vertebral angle also changes.¹¹ In this study, Lumbo-pelvic angle of each segment in Lumbar disc prolapse individual was smaller than that of the corresponding segment. But not much difference was appreciated in individuals with mild to moderate disc prolapse.

The lumbosacral angle (LSA) is the normal inclination of the sacrum caused by the physiologically lordotic structure of the lumbar spine. Lesions around the lower waist and biomechanical abnormalities to the spine are brought on by the aberrant LSA changes. The principle of mechanics states that the component force's size is influenced by both the inclined plane's angle and the gravity's overall strength.¹²

Lumbar disc degeneration is mildly linked to abnormal changes in Lumbo-pelvic angle, and an increase in Lumbo-pelvic angle may exacerbates lumbar disc degeneration in some individuals, which may be brought on by congenital development and learned poor posture. Along with a relative strengthening of the abdominal muscles, which can pull on the pelvis and sacrum, the equilibrium between spinal flexion forces and stability is upset. This causes a rise in Lumbo-pelvic angle, which in turn causes disc degeneration and ultimately lumbar disc prolapse.

In conclusion, lumbar disc prolapse is negatively correlated with Lumbar lordosis and lumbo-pelvic angle in young patients with low back pain. Young patients are in a poor posture of bending down for a long time, such as long-term desk work, frequent bending activities and other reasons, which make young people more likely to suffer from lumbar disc herniation. But the study has shown mild to fewer evidences which shows that if lumbar lordosis is increased then it might create changes in the foraminal diameter of the spine. Which leads to pulling of the abdominal muscles and weakning of core muscles which may lead to ligamentum flavum hypertrophy. All these factors as explained above is responsible for the herniation of disc which might lead to disc prolapse.

Conclusion

According to the findings from these studies, we can conclude that there is mild correlation between lumbo-pelvic angle and disc prolapse at extrusion level or sequestration level as (P=0.1731). However, there is a slight decline curvature seen on the graph in correlation between lumbopelvic angle and disc prolapse which suggest that Lumbo-pelvic angle can be used as reference indicators to guide the diagnosis and treatment of patients with low back pain after detailed radiological examination.

LIMITATION

Only increased lumbar lordosis patients were assessed during study. And Only Cob's angle was used for the assessment.

FUTURE SCOPE

Same study can be done on individuals with flat back or any other postural problems. And Functional quality of life can also be added for co-relation.

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