Original Research

Vertebral Column Height and Predisposition to Low Back Pain: Observational Study

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Abstract

Background and purpose: Research was done to find out the relationship between lumbar lordosis and radiologic variables, lumbar lordosis and clinical variables, which showed that lordosis itself, do not have any predisposition to low back pain. Weak abdominal muscles are also associated with low back pain. As no previous study was done to correlate vertebral column height and low back pain, this study is intended to analyze whether these variables are predisposed to low back pain.

Case description (Subjects): 200 subjects were approached through systematic convenient sampling which included 100 people (50 males and 50 females) with back pain and 100 people (50 male and 50 female without back pain).

Intervention and methods: Subjects for the study were assessed according to the following parameters; vertebral column height, abdominal girth measurement, bilateral SLR, hip waist ratio, VAS scale.

Results: Pain scores correlated significantly to the length of spinal segment mainly cervical spine (p=0.05) and lumbar spine (p=0.01) and also to bilateral SLR hold time (p=0.01). The bilateral SLR correlates significantly to a Total spine length and length of thoracic spine (p=0.01) while there was no correlation between bilateral hold time and length of cervical spine.

Conclusion: This study has found that the length of the spinal column should be given due importance when assessing the risk of developing low back pain.

Keywords: Vertebral column, Low back ache, VAS score, Bilateral SLR.

Introduction

Back pain including neck and lower back pain is common. So it was deemed necessary to reevaluate in depth using more stringent criteria in the evaluation, treatment efficacy as well as for causality and diagnosis.

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The majority of spinal dysfunction is the result of cumulative micro trauma caused by impairments in alignments in stabilization and in movement patterns of the spine. When this dysfunction occurs, the major objective is the identification of the direction of a ligament, stress of movement of the spine that consistently elicits and increases the patient's symptoms.

Movement follows the principle of "law of physics" which states that movement takes place along the resistance. Since the vertebral column is a multi segmented system, the greatest degree of motion occurs at the most flexible segment. Thus most spine dysfunction occurs because of excessive relative flexibility, particularly at specific segment rather than at the segment of reduced flexibility. Once the appropriate trunk muscles control and lower extremity muscle flexibility are achieved, most often back pain subsides without direct treatment to spine itself.

The ideal skeletal alignment used as a standard is consistent with sound scientific principles, involves a minimal amount of stress and strain and is conductive to maximal efficiency of the body. Basmajjaiin states "Among mammals, man has the most economical of antigravity mechanisms, once the upright posture is attained. The Expenditure of muscular energy of what seems to be a most awkward position is actually extremely economical.[6]

The curvature of the vertebral column increases its resistance to axial compression faces. Engineers have shown that the resistance of a curved column is directly proportional to the square of the number of curvatures plus one. The significance of the curvatures can be quantified by the Delmas Index, which can only be measured on a skeleton.

A column with normal curvature has an index of 95 with the limit of normality ranging from 94-96. A column with exaggerated Curvatures has an index smaller than 94 signifying a marked difference between the height of the column and its fully extended length.

On the contrary, a column with attenuated curves i.e. almost straight has an index greater than 96. This anatomical classification has functional significance as Delmashas shown that the column with pronounced curvatures is of the dynamic type, while the columns with attenuated curvatures correspond to the static type. Stabilizing the lumbar spine is an important part of rehabilitation program for the patient with low back pain.

All abdominal muscles have relatively unique role in producing the necessary level of stabilization, and the participation of their muscles needs to be balanced. The patient whose abdominal muscle test at 60% to 70 % of normal strength has sufficient strength to perform most daily activities safely. The focus of a program for this patient is the control of pelvic and trunk motion.

To calculate where the excess fat collects on your body waist hip measurement should be calculated.

1. Find a non-stretchable tape measure.
2. Measure the circumference of your waist between the rib cage and the navel.
3. Measure the circumference of your hip around the buttocks.
4. Divide the Waist measurement by the Hip measurement.

(Wilmore and behnke 1969)

Waist to hip ratio	**Desirable**	**Health risk**
Woman	Less than .80	.80 and above
Men	Less than 1.0	1.0 and above

Low back pain is multi-factorial in its nature and spinal congruity as well as other radiographic finding might explain a part of it. Using recent instruments for pain assessmentsratherthanour4-grade scale should elucidate the influence of spinal congruity on symptomatology in the future.14

METHODS OF COLLECTION OF DATA

The subjects for the study were selected by systematic convenient sampling. There were 200 subjects with 100 experiencing low backache and100 without low backache. Both groups were assessed according to the following parameter.

- Vertebral column height
- Abdominal girth measurement
- Bilateral SLR-300
- Hip-waist ratio
- Visual analogue scale (VAS)

INCLUSIONCRITERIA

- Age group18-25 with or without back pain
- Both sexes 45

EXCLUSIONCRITERIA

- Malignancy
- Inflammatory condition (TB, Osteomyelitis.)
- Spinal cord compression
- Fracture
- Ankylosing
- Spondylitis

Methodology

- Patient consent was taken. A detailed assessment was obtained which includes:-
- Vertebral column height
- Abdominal girth measurements
- Bilateral SLR
- Hip waist ratioVAS

The subjects were made to stand on a firm base and with an inch tape segmental dimension of vertebral column was assessed from sub-occipit to C7,T1-T12, L1-PSIS. The abdominal girth is measured at the level of navel with and without abdomen tucked in. The hip circumference is taken at the level of greater trochanter and hip waist ratio assessed. Then the subject was made to lie on hard surface and to lift both legs 300 from the surface and asked to hold till he/she can and is recorded by a stop watch.1

RESULTS

STATISTICAL ANALYSIS

Descriptive statistics were used and co-efficient of co-relation analyzed for possible pre-disposition.

This study was carried out to 200 participants who did and did not complain of low back pain (male 100 female 100)

The following was the descriptive statistics of various measurements that were taken for the study.

Table 1 : Descriptives

Descriptive Statistics

	N	Mean		Std.Deviation
	Statistic	Statistic	Std .Error	Statistic
Total Spine Length	200	65.5475	.4653	6.5807
Waist-Hip Ratio	200	.8394	6.921E-03	9.788E-02
Bil SLR Hold Time	200	48.7650	3.8522	54.4783
VAS	200	2.8825	.2257	3.1919
Ht. in Meters	200	1.6051	6.679E-03	9.445E-02
Wt.in Kgs	200	62.4750	.7910	11.1868
Length of Cervical Spine	200	12.2175	9.402E-02	1.3296
Length of Thoracic Spine	200	38.2400	.4269	6.0378
Length of Lumber Spine	200	15.0900	.1240	1.7542
Body Mass Index	200	24.2765	.2800	3.9602
Valid N (list wise)	200			

It can be seen that the waist hip ratio and the height in meters were the parameters that showed great standard deviation.

The correlation analysis was done for the predisposition to low back pain with various spinal measurements.

Table 2: Correlation Summary

CorrelationSummaryTable

Correlation Summary Table				
Between	**And**	**KarlPearson'sr**	**p-value**	**Significance**
VAS	Wt.inKgs	-0.089	0.208	NotSignificant
VAS	Waist Hip Ratio	-0.015	0.837	Not Significant
VAS	Body Mass Index	0.004	0.958	Not Significant
VAS	Total Spine Length	0.039	0.294	Not Significant
VAS	Thoracic Spine	-0.032	0.325	Not Significant
BilSLR	C. SpineLength	0.047	0.252	Not Significant
VAS	CervicalSpine	-0.161	0.05	Significant
VAS	LumbarSpine	0.378	0.01	Significant
LBA	CervicalPain	0.870	0.01	Significant
VAS	BilSLRHoldtime	-0.432	0.01	Significant
BilSLR	TotalSpineLength	0.254	0.01	Significant
BilSLR	ThoracicSpine	0.309	0.01	Significant
BilSLR	LumbarSpine	-0.147	0.05	Significant

As it can be seen that in normal individuals there was no correlation between VAS scores and the following variables.

- Weight in Kg
- Waist-hip Ratio
- Body mass index
- Total spine length
- Length of thoracic spine

However it was seen that the pain scores correlated significantly to the length of the spinal segments, which were highly mobile mainly cervical spine (p=0.005) and lumbar spine (p=0.001).

It should be noted that greater significance of lumbar spine correlating with low back pain could be because the VAS scores also correspond to lumbar spine.

It was also seen that there existed a high significance of correlation in the pre disposition of cervical pain associated with low back pain (p=0.01).

Cross correlations were performed for possible influences of other parameters evaluated to the VAS scores, where it was noted that the VAS scores was negatively correlating with a high amount of significance to the bilateral SLR hold time (p=0.001) and the length of the cervical spine (p=0.005). Meaning that the role played by the lower abdominal musculature is important in the predisposition of a person to low back pain.

It is also noted that the bilateral SLR hold time had a negative association with the length of lumbar spine, while the length of lumbar spine itself correlated positively with VAS scores.

The bilateral SLR correlates significantly to the total spine length and length of thoracic spine, (p=0.01), while there's no correlation between bilateral hold time and length of cervical spine.

From these direct correlations and indirect interpretations of the correlative values can be shown that the length of vertebral column significantly affects the predisposition of a person to low back pain and also the strength of abdominal muscle strength.

The other point to be noted is that once there is the presence of dysfunction in the spine (lumbar spine in this area), it predisposes to the pain in other areas. The most commonly affected being the cervical spine.

Discussion

With increase in sedentary life style i.e. devoid of physical exertion and diminishes muscular strength, the occurrence of low back pain because of prolonged postures either maintained abnormally or even normally needs to be evaluated.

The low back pain previously thought to be a musculoskeletal problem alone is now considered on a much larger basis, which includes even psychological aspects. This aspect was used to predict the persistence of pain syndromes of the spine in specified population, and the risk of persistence of pain increased when pain in more than one area of spine is present.[17]

According to Kapandji the ability of the spine to transmit forces is dependent upon its curves, which is measured as Delmas index. In this regard, it was conventional belief that an increased curvatures predisposed to pain in spinal area. This thought was rejected by Korovesis et al (2004),[18] who found that there were no significant predisposition of these individuals to low back pain, however their study had a limitation that the measurements made by surface markings do not represent the values obtained by roentgenographic evaluation.

They also noted that the shorter individuals were predisposed to low back pain than taller individuals. The lumbar spine requires to best analyzed on the pelvis and Kobayashi and associates found that the strongest alignment.[19]

The role-played by abdominal muscles in producing a support to the lumbar spine during flexion activities and their predisposition to low back pain has been researched abundantly in various studies. But most of the studies concentrate on the position of the proximal and distal joints during abdominal muscle action but have not given importance to the status of length of the spine; since it is considered non-modifiable and permanent. Based on the high amount of significance of correlation presented in our study it should be noted that the person with weak abdominal will benefit if the relative length of the lumbar spine be reduced through hip flexion and curling up of the trunk while training for these musculature.[20]

Conclusion

The conventional biomechanics places emphasize on the various kinetic and kinematic predispositions to low back pain, but gives very little importance to the dimensions of spine and its predisposition to low back pain. Through this study we have found that the length of spinal columns should be given due importance when assessing the risk of developing low back pain.

Ethical Clearance: This study was approved by our institutional ethical committee of MM college of Physiotherapy & Paramedical Sciences Jabalpur dated 09/11/2023- MMPP/ADM/2023/932.

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