

Variation of Spinal Curvatures as a Predictor for the Development of Female Pelvic Organ Prolapse

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ABSTRACT

*This study was conducted to establish the relation between spinal curvatures and the occurrence of female uterine prolapse. Forty women were participated in this study. They were recruited from the inpatients department and outpatients clinic of the Obstetric and Gynaecologic department of Kasr El-Aini University Hospital. They were divided into two groups (patients & normal) equal in number. Twenty of them were diagnosed with second degree uterine prolapse (patients group), while the remaining twenty were normal and healthy ladies (normal group). **Evaluation:** All women in both groups were enrolled to be examined by lateral views of x-rays for the spine and pelvis. **Results:** of this study showed a statistical significant increase in the thoracic kyphosis and pelvic inlet angles, whereas the lumbar lordotic angles were statistically significantly decreased for the patients group compared to the normals group. Accordingly, it can be concluded that significant variation of spinal curvatures could consider as a predictor for the development of 2nd degree uterine prolapse.*

Key words: Pelvic organ prolapse, Genital prolapse, uterine prolapse, pelvic relaxation, spinal curvatures.

INTRODUCTION

Pelvic organ prolapse, is one of the common conditions affecting, many adult and elderly women today, in which there is descent of the pelvic organs into the vagina, often accompanied by urinary, bowel, sexual or local pelvic symptoms^{1,6}.

There is considerable individual variability in the predisposition to prolapse as young nulliparous women occasionally develop genital prolapse whereas, some multiparous women bear many children with no clinically significant pelvic relaxation⁴.

This problem results from weakness of the pelvic support, including musculature, ligaments and fascia. In adults, the condition usually results from obstetrical trauma and lacerations sustained during labour and delivery. In virgins it is secondary to

congenital weakness in the pelvic musculature or to defect in innervations³.

Genital atrophy and hyperoestrogenism also, play an important contributory role in the pathogenesis of prolapse. Other medical conditions that may result in prolapse are those associated with increase in intra-abdominal pressure (e.g. obesity, chronic pulmonary diseases and constipation)¹⁰.

Uterine prolapse is the most troubling type of pelvic relaxation because it is often associated with defects of the vagina in the anterior, posterior and lateral compartments⁸.

The normal spinal curvature appears to protect the pelvic cavity from direct upper abdominal forces, so that variations in spinal curvatures may alter these force vectors and possibly potentate the development of pelvic organ prolapse⁸.

It was proposed that forward lumbar curvature and orientation of the pelvis help in

supporting the abdominal viscera which deflect or absorb a fraction of the downward intra-abdominal forces before they reach the pelvic floor. This protective effect of the spinal column and the bony pelvis may be lost as the woman ages. These changes may result in a higher proportion of downward intra-abdominal prolapse⁹.

Also, with advancing age, there is accentuation of the thoracic kyphosis². When kyphosis is advanced, the position of the rib cage over the abdomen, changes in such a way to increase the intra-abdominal pressure⁷.

Although the relation between the thoracic kyphosis, lumbar lordosis, pelvic inlet changes, and pelvic organ prolapse have been established in very few studies, the researchers have studied these changes, with advanced pelvic prolapse, and the selected patients's samples their age sometimes was over 50 years old, so the effect of osteoporosis would be apparent and might lead to certain changes in the spinal curvatures which are the main point of their researches⁹.

The purpose of the present study was to detect the relation between spinal curvatures and female uterine prolapse to reduce its incidence of occurrence.

SUBJECTS, MATERIAL AND METHODS

I- Subjects

Forty women were participated in this study, they were recruited from the Inpatients Department and Outpatients Clinic of the Obstetric and Gynaecologic Department of Kasr El-Aini University Hospital. Their age ranged from 30 – 45 years old, and parity was 3 times or more. Subjects were classified into two groups (patients & normal) equal in number.

All participants were non pregnant, had no congenital abnormalities related to the spine, pelvis or to the lower extremities. Also, women with pulmonary diseases associated with chronic coughing, pelvic masses, and connective tissue diseases were excluded from this study.

Informed consent form had been signed from each subject before starting the study indicating her voluntary participation in this study.

Patients group:

Composed of twenty patients diagnosed as having second degree uterine prolapse.

Normal group:

Composed of twenty healthy normal ladies.

Summary of subjects physical characteristics summarized in table (1).

Table (1): Physical characteristics of both groups (Patients & Normals).

	Group	Range		Mean	SD	P value	Significance
		Min.	Max.				
Age (year)	Patients	30.00	41.00	37.20	± 3.59	> 0.05	NS
	Normals	30.00	45.00	35.98	± 3.23	> 0.05	
Weight (Kg)	Patients	59.00	88.00	75.30	± 8.09	> 0.05	NS
	Normals	59.00	89.00	76.50	± 7.04	> 0.05	
Height (cm)	Patients	144.00	172.00	158.50	± 7.46	> 0.05	NS
	Normals	152.00	168.00	160.45	± 4.15	> 0.05	
BMI (Kg/m ²)	Patients	26.13	36.89	31.37	± 3.28	> 0.05	NS
	Normals	23.93	34.76	29.94	± 2.98	> 0.05	
Parity	Patients	3.00	8.00	4.35	± 1.60	> 0.05	NS
	Normals	3.00	7.00	3.75	± 1.12	> 0.05	

The results showed that there was non significant difference between patient and normal group in physical characteristics of subjects.

II- Instrumentations

- 1- Siemens x-ray machine model Gigantos 1012 MP was used to have lateral spine/pelvic x-ray to measure the curvatures of the thoracic, lumbar and pelvic inlet regions according to the following parameters. The average distance from the subject to the source of the x-ray was about 100 to 115 cms, the tilting of the machine was erect, the dose was ranged from 85 to 95 KV, and the exposure time was ranged from 80 to 120 ml/sec.
- 2- A protractor.
- 3- A ruler and a pencil.

III- Procedures

a- Evaluate procedures:

- 1- Personal data: Data and information of each participant in this study were recorded in a recording sheet.
- 2- History taking: A detailed medical, obstetrical as well as, gynaecological history were taken from each participant.
- 3- Weight- height scale was used to measure the weight and height of each subject to calculate BMI.

$$\text{BMI} = \text{Weight (Kg)} / \text{Height (m}^2\text{)}.$$

b- Measurement Procedures:

Lateral spine /pelvic x-ray was done for every participant from standing in erect loaded posture. All subjects were instructed to evacuate their bladders before starting the measurement procedures and to wear their usual feet wear during x-ray to avoid altering the existing angles during day time. Once x-ray was taken from each subject the angles of thoracic kyphosis, lumbar lordosis and pelvic inlet were measured by using a protractor and ruler, as follows: Thoracic kyphotic angle was measured by a modification of the cobb technique². The upper and lower vertebral bodies defining the curve (first and twelfth vertebrae) were selected and lines were drawn, extending along the inferior border of the upper end of the first vertebra as well as, along the inferior border of the lower end of the twelfth vertebra. Perpendicular were drawn from these two lines and the angle was measured at the intersection by an angle ruler. The lumbar lordotic angle was measured from the intersection of lines drawn across the tops of the first and the fifth lumbar vertebrae and the pelvic inlet angle was measured as an angle between a line drawn from the sacral promontory to the top of the pubic bone and the vertical line.

c- Statistical analysis:

Descriptive statistics was used for the collected data to calculate the mean and the standard deviation. Inferential statistical analysis was used in the form of independent t-test for comparing between the patients and normal groups. Significance level of 0.05 was used throughout all the statistical tests within this study, P-value < 0.05 indicated a significant result⁵.

RESULTS

In the present study, the thoracic kyphosis, lumbar lordosis and pelvic inlet changes in both groups (Patients & Normals) were investigated. As shown in table (2) and fig. (1), the mean values of thoracic kyphotic angles were (31.80 ± 13.94) for the patients group, while it was (23.15 ± 5.94) for the normal group with an increase in the mean difference of 8.65 and a percentage of difference of 37.36%. Comparing between the mean values of both groups, the difference between them showed that the thoracic kyphotic angles of the patients group were statistically ($P < 0.05$) increased.

Table (2): Comparison between the mean values of thoracic kyphotic angles for both (Patients and Normals) groups.

	Patients Group	Normal Group
Mean	31.80	23.15
SD	± 13.94	± 5.94
Mean difference	8.65	
Percentage of difference (%)	37.36	
P. Value	< 0.05	

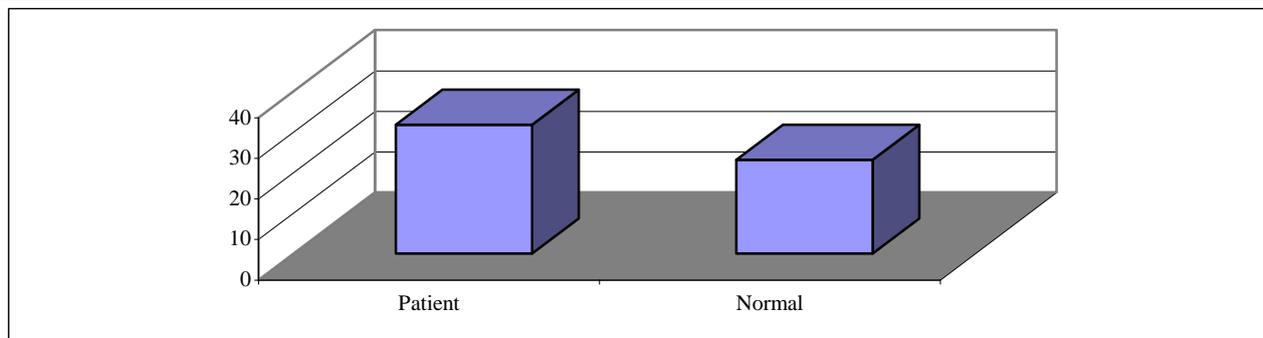


Fig. (1): Mean values of thoracic kyphotic angles for both (Patients & Normals) groups.

As shown in table (3) and fig. (2), the mean values of lumbar lordotic angles were (29.60 ± 8.13) for the patients group, while it was (37.85 ± 5.59) for the normal group with a decrease in the mean difference of 8.25 and a percentage of difference of 21.79%.

Comparing between the mean values of both groups, the difference between them showed that the lumbar lordotic angles of the patients group were statistically significantly ($P < 0.05$) decreased.

Table (3): Comparison between the mean values of the lumbar lordotic angles for both (Patients & Normals) groups.

	Patient Group	Normal Group
Mean	29.60	37.85
SD	± 8.13	± 5.59
Mean difference	- 8.25	
Percentage of difference (%)	21.79 %	
P. Value	< 0.05	

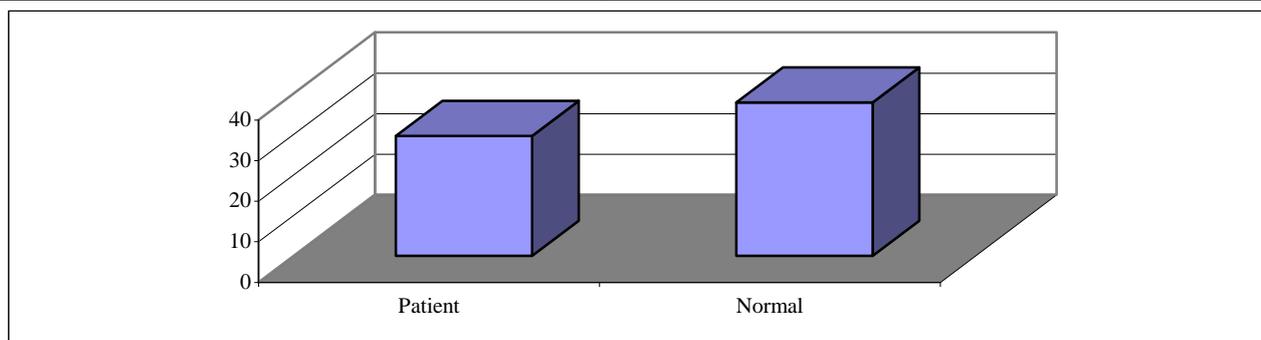


Fig. (2): Mean values of the lumbar lordotic angles for both (Patients & Normals) groups.

As shown in table (4) and fig. (3), The mean values of pelvic inlet angles were (35.15 ± 6.33) for the patients group while, it was (28.65 ± 4.65) for the normal group with an increase in the mean difference of 6.5 and a percentage of difference of 22.68%.

Comparing between the mean values of both groups, the differences between them showed that the pelvic inlet angles of the patients group were statistically significantly ($P < 0.05$) increased.

Table (4): Comparison between the mean values of pelvic inlet angles for both (Patients & Normals) groups.

	Patients Group	Normal Group
Mean	35.15	28.65
SD	± 6.33	± 4.65
Mean difference	6.5	
Percentage of difference (%)	22.68 %	
P. Value	< 0.05	

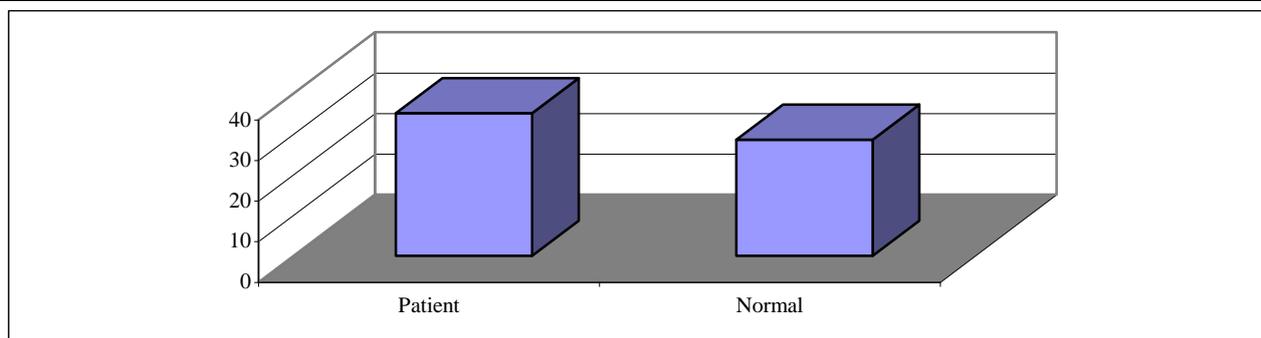


Fig. (3): Mean values of pelvic inlet angles for both (Patients & Normals) groups.

DISCUSSION

Genital prolapse is a dynamic condition; regression of prolapse occurs at the same or higher rate as incidence, hence it was recommended that further studies are needed to investigate the factors that are related to the progression and remission of pelvic organ prolapse¹¹.

Accordingly, one of the most activating factors that predispose to the building up of the intra-abdominal pressure and hence to genital prolapse, is the alterations of the spinal curvatures mainly the thoracic kyphosis, lumbar lordosis and the inclination of the bony pelvis⁹.

In this study, we tried to detect a sound relation between variation of the female spinal curvatures mainly the thoracic kyphosis, lumbar lordosis as well as, the pelvic inlet angles, and the development of uterine prolapse.

So, the results of the present study revealed a significant increase in the mean values of the thoracic kyphotic angles in the patients group compared to the normal subjects. This result confirmed the previous study done by Lind et al., (1996)⁷. They noticed a higher degrees of thoracic kyphosis was associated with pelvic organ prolapse. Also, they added that the increased thoracic kyphosis appeared to be associated with an incremental higher occurrence of uterine prolapse. This could be attributed to, changes in the position of the rib cage over the abdomen in such a way that increase the intra-abdominal pressure, when the thoracic kyphotic angle is increased. Hence, these changes may result in a higher proportion of downward intra- abdominal forces, exerted on the pelvic floor and potentiate the development of pelvic organ prolapse⁹.

The results of the current study showed a significant decrease in the mean values of the lumbar lordotic angles in the patient group, compared to the normal. The findings of this study is in agreement with Nguyen et al., (2000)⁹ who concluded that the mean lumbar lordotic angles in women with pelvic organ prolapse was highly significantly decreased than that of the normal subjects. Similar findings was reported by Mc Copy (2002)⁸, who concluded that abnormal changes in spinal curvature, specifically a loss of lumbar lordosis appears to be a significant risk factor in the development of pelvic organ prolapse. Nguyen et al., 2000⁹ attributed the development of pelvic organ prolapse to the variations of the spinal curvatures which alter the force vectors of the direct upper abdominal forces to a higher proportion of downward intra – abdominal forces exerted on the pelvic floor and so potentiate the development of pelvic organ prolapse⁹.

Also, the results of this study showed a significant increase of the pelvic inlet angles in the patients group compared to the normal. Zacharian, (1985)¹² proposed that the orientation of the pelvic inlet has a supportive roles for the pelvic organs by absorbing inferiorly the directed vector forces. So, the results of this study is in agreement with that of Nguyen et al., 2000⁹ who reported that women with advanced uterine prolapse have a pelvic inlet angle that is oriented less vertically than women without uterine prolapse.

Lind et al., 1996⁷ stated that the forward curve of the lower dorsal and lumbar vertebrae, which is unique in man, with the forward jutting sacral promontory, forms an upper shelf under the abdominal viscera, absorbing inferiorly the directed force vectors. They added that this in turn reflects the pressure waves backwards and downwards

against the front of the sacrum. Therefore, the bony structures may be important in preventing pelvic organ prolapse by protecting the pelvic floor from downward force vectors.

Accordingly, it was found that significant changes in the female spinal curvatures could be a serious predisposing factor in developing uterine prolapse.

Conclusion

It can be concluded that significant variation of the female spinal curvatures could be considered as an early predictor for developing uterine prolapse or play an effective role in its occurrence.

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Recommendations

The obtained results would encourage the need for careful assessment of the spinal curvatures for the young girls, to prevent and / or correct early deviations and encouragement of postural correction exercises in the primary schools that play an important role in normalizing and preventing any abnormal spinal deviations in young girls. Also, more studies are required to set standards for the spinal curvature angles in the Egyptian women.

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المخلص العربي

التغير في انحناءات العمود الفقري كمؤشر لحدوث سقوط في أعضاء الحوض الأثوي

أجريت هذه الدراسة لإيجاد علاقة بين انحناءات العمود الفقري وحدوث السقوط الرحمي لدى الإناث ، حيث شاركت في هذه الدراسة أربعون سيدة ، تم اختيارهن من القسم الداخلي والعيادة الخارجية لأقسام النساء والتوليد بمستشفى قصر العيني . تم وضعهن في مجموعتين "المرضى والأصحاء" متساويتين في العدد . وقد تم تشخيص عشرين منهن ، بسقوط رحمي من الدرجة الثانية "مجموعة المرضى" بينما كانت العشرين الباقيات سيدات أصحاء "مجموعة الأصحاء" . تم اختبار كل سيدة في المجموعتين عن طريق أخذ صور جانبية بالأشعة السينية للعمود الفقري لمنطقة الظهر والمنطقة القطنية وزاوية ميل الحوض . وقد أسفرت نتائج هذه الدراسة عن وجود زيادة ذات دلالة معنوية في تحذب الفقرات الظهرية وزاوية ميل الحوض بينما كان هناك انخفاضاً ذو دلالة معنوية في نقص تقوس الفقرات القطنية ، في مجموعة المرضى مقارنة بمجموعة الأصحاء . وهكذا ، يمكن أن نستخلص أن التغيرات الجوهرية في زوايا انحناءات العمود الفقري يمكن أن تزيئ بحدوث السقوط الرحمي لدى الإناث .

الكلمات الدالة : سقوط أعضاء الحوض ، سقوط الأعضاء التناسلية ، السقوط الرحمي ، استرخاء الحوض ، انحناءات العمود الفقري .