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Abnormal Spinal Curvature as a Risk Factor for Pelvic Organ Prolapse

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Abstract: To determine the relationship between pelvic organ prolapse and spinal curvature changes, a cross-sectional study was done in Gynecologic and Obstetrics educational hospitals and clinics in North West of Iran. One hundred patients were classified as cases based on the presence of abnormality at the spinal curvature and 100 patients classified as controls with no abnormality. The POP-Q (pelvic organ prolapse quantitation) staging system was used for assessment of prolapse stage and a flexi-curve malleable rod for measurement of thoracic and lumbar length and width, respectively. Main outcome was the stage of prolapses. The stage of prolapse was higher in cases compared to controls. There was a significant statistical difference between prolapse stage in two groups (p-value = 0.035). Among cases, grade II prolapse was the most prevalent abnormally (56%) and the grade III, I and IV were observed in 32, 5 and 7%, respectively. These observations underline the importance of taking into account the abnormal changes in spine curvature of patients when investigating risk factors for development of pelvic organs prolapse.

Key words: Prolapses, uterine prolapse, vaginal prolapse, spinal curvature, curvatures spinal, kyphosis, lordosis, scoliosis

INTRODUCTION

Pelvic organ prolapse is one of the important issues in gynecology and associated with complications in women. The exact incidence of relaxed vaginal outlet is unknown because not all patients are symptomatic; however, it is thought to be quite common (Swift *et al*., 2005). According to the Bump and Norton (1998), the Pelvic organ prolapse affects between 5-10% of women.

Prolapse is the protrusion of a pelvic organ beyond its normal anatomical confines. In the normal situations, mechanical strategies prevent downward descent of pelvic organs (Rovner, 2000). Damage to the levator ani muscles and endopelvic fascia at the time of vaginal birth and the deterioration that occur in these tissues with advancing age are two major predisposing factors (Norton, 1993). Bradley *et al*. (2007), in a prospective observational study showed that the prolapse progresses and regresses in older women. In addition, they showed a role for obesity as a risk factor for progression of vaginal descent. Women with a higher body weight are even more likely to experience recurrent prolapse after vaginal repair (Diez-Itza *et al*., 2007). In the other studies (Klingele *et al*., 2005; Arya *et al*., 2005), defecatory disorders, predominantly obstructed defecation was a risk factor for pelvic floor injury and pelvic organ prolapse. In addition, there may be a familial predisposition toward developing this condition (Buchsbaum *et al*., 2006). Pregnancy may also affect the pelvic organ supports. In the study of O'Boyle *et al*. (2005), the results show that POPQ stage during pregnancy in nulliparous pregnant women has been increased, but did not change significantly following delivery. In the postpartum, POPQ stage may be higher in women delivered vaginally compared to women delivered by cesarean.

Pelvic organ prolapse arises due to a combination of neuromuscular and connective tissue injury of the pelvic organs in their normal position (Kapoor *et al*., 2005).

The normal position and support of the uterus, bladder and rectum rely on an interdependent system of bone, muscular and connective tissue elements (DeLancey, 1993a). This entire system of support is three-dimensional, such that even subtle alternations in one part may lead to stresses in other parts (Boreham *et al*., 2002). Therefore, pelvic organ prolapse may be considered as a hernias because these displacements are each associated with a defect in supporting structures (DeLancey and Hurd, 1998).

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Whereas the anatomic factors are important, the intra-abdominal forces that create prolapse are poorly understood. It is not the weight of the uterus that is critical in the development of prolapse, but rather the force placed on the pelvic floor by an increase in abdominal pressure. (Roussouly *et al*., 2005; DeLancey, 1993b). One study showed that pelvic organ prolapse may be even developed after colposuspension (Auwad *et al*., 2006).

Normal spinal curvature protects the pelvis from direct intra-abdominal forces. Normal spinal curvature deflects force onto the anterior abdominal wall and symphysis pubis (Hoyte *et al*., 2001; Nguyen *et al*., 2000).

The vagina lies between high intra-abdominal pressure and low atmospheric pressure where it must be held in place by ligaments. The ligaments can sustain these loads for short periods. If the pelvic floor muscles do not close the pelvic floor, then the connective tissue will likely become damaged and eventually fails to hold the vagina in place (Norton *et al*., 1992; Wong *et al*., 2003). The same is true for the urethra and anus.

In females, lordosis of the lumbosacral portion of the spine places the pelvic inlet in a position reminiscent of the posture of a quadriplegic. The physical result of this shift is that the arch of the pelvic inlet is approximately 60 degree above the anterior arch (Singh *et al*., 2002). To evaluate a woman's spine, it is necessary to examine the entire spinal column radiologically. Radiological examination is not cost-effective and also increases the patient's exposure to X-ray (Lind *et al*., 1996). It is thus worthwhile to use a less costly and non-invasive method to assess the supine curvature together with a detailed pelvic examination.

Mattox *et al*. (2000), showed that any deviation in the supine curve may exert high pressure on the pelvic supportive tissue. Similar pressure and stretch occurs during labor (Wall, 1999). Lind *et al*. (1996), also showed that excessive thoracic kyphosis, may be a contributing factor in some women for pelvic organ prolapse. There may be an ethnic difference with this regard. As Seo and Kim (2006), are showing in their study, vaginal size in Korean women differs from that in Western women. In their study, the prevalence of any degree of prolapse was approximately 31.7%. Whereas, in a cross-sectional study from Iran, the overall rate of prolapse was 53%. Altered spinal inclination leads to prolapse or prolapse changes spinal curve, both need further clarification. According to these authors and others (Woodman *et al*., 2006) and because of ethnic, job and socioeconomic differences, multiethnic populations researches to confirm these observations or further research involving another ethnic population is justified.

The purposes of this study were to determine the stage of prolapse in cases and controls and to elucidate relationship between pelvic organ prolapse and spine curvature abnormalities.

MATERIALS AND METHODS

Two hundred women who were either referred to clinics or hospitalized in gynecologic teaching hospitals of Tabriz University of Medical Sciences, East Azarbayejan Province, North West of Iran, consecutively selected for a case-control cross-sectional from March 2001 to April 2003.

The study was reviewed and approved by the University Research Review Board. All participants were given adequate information and consent was obtained from each participant.

A comprehensive history was obtained, which included age, gravidity, parity, history of operative delivery, medical and surgical history, menopausal status, weight of largest neonate and a history of pelvic or abdominal surgery. Patients who had congenital spine abnormality, collagen disorders and a history of pelvic relaxation were excluded. The physical examination included Body Mass Index (BMI), detailed pelvic examination according to the Pelvic Organ Prolapse Quantitation (POPQ) system and measurement of spinal curvature. Examination of the spinal curvature were carried out according to published method (Mattox *et al*., 2000).

A semi-flexible rod was used for measurement of spinal curvature. Patients were asked to stand in a fully erect position. A rod was then pressed against the spinal contour in midline. This instrument consists of a strip of flexible metal covered with plastic (architecture's rod) 60 cm in length and can be bent easily (Fig. 1). It retains the shape into which it is bent, outlining any curved surface. Measurements were taken from the C7 spinous process down to the level of the lumbosacral joint space (L5), closely adhering to the midline of the back. The instrument was then removed and traced onto graph paper and the thoracic length and width, lumbar length and width were measured (Fig. 2). A case was defined when the thoracic kyphosis was less than lumbar lordosis or when the lumbar width was equal to zero, or when the lumbar length and width were equal to zero. A control was defined when the thoracic kyphosis exceeded lumbar lordosis.

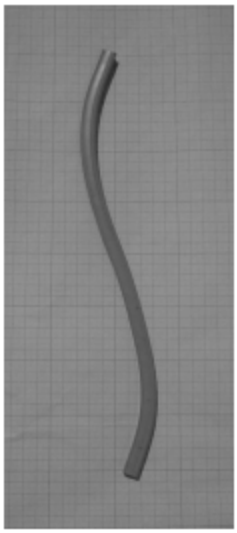

Fig. 1: Semi-flexible rod on graph paper

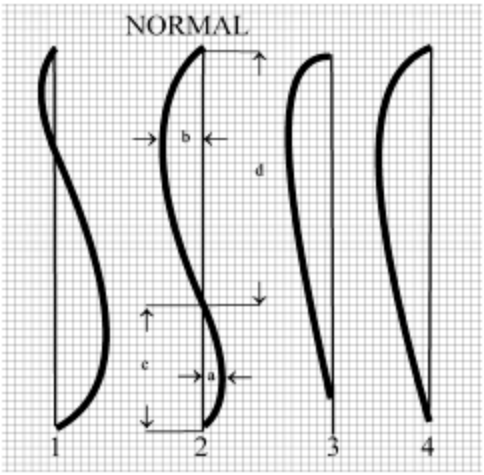

Fig. 2: Types of spinal curvature with flexible rod. Basic curve types are as follows, 1: thoracic kyphosis is less than lumbar lordosis (abnormal), 2: thoracic kyphosis exceeds lumbar lordosis (normal), 3: lumbar width = 0 (abnormal) and 4: lumbar length and width = 0 (abnormal), a: lumbar width, b: thoracic width, c: lumbar length and d: thoracic length

Stages 0 and 1 were considered normal and stages II or greater were considered abnormal. Data including history, clinical and pelvic examination were gathered using a form.

Student t-test was used to compare the means. Comparisons of the qualitative variables were done using chi-square test. The significance level was 0.05.

Table 1: Age distribution of patients with pelvic organ prolapse

	Prolapse stage			
	I	II	III	IV
Age	n (%)			
20-39	15 (16.1)	52 (55.9)	26 (27.9)	0 (0.0)
40-59	8 (8.1)	48 (53.9)	30 (33.7)	2 (3.3)
≥60	0 (0.0)	10 (55.5)	1 (5.5)	7 (38.8)

Table 2: Distribution of different pelvic organ prolapse stages according to the number of vaginal deliveries

	Prolapse stage			
	I	II	III	IV
NVD	n (%)			
≤2	5 (17.2)	16 (55.1)	7 (24.1)	1 (3.4)
3-5	13 (12.6)	64 (62.1)	23 (22.3)	3 (2.9)
≥6	1 (1.4)	35 (51.4)	27 (39.7)	5 (7.3)

Table 3: Severity of pelvic organ prolapse among cases and controls

Prolapse stage	Cases	Controls
	n (%)	
I	5 (5)	16 (16)
II	56 (56)	54 (54)
III	32 (32)	28 (28)
IV	7 (7)	2 (2)

n = number, p = 0.03

RESULTS

A total of 200 women participated in the study. The age distribution of patients with pelvic organ prolapse is shown in Table 1. There was no significant difference among patients with different stages of prolapse according to the number of vaginal deliveries (Table 2). Between the two groups, i.e., case group and control group, there were no significant differences in age of patients (mean age in cases was 41.7 years vs. 41.9 years in controls; (p-value = 0.9), number of vaginal deliveries (mean±SD: 7.8±3.86 vs. 8.5±3.21; p = 0.2), age of women at first pregnancy (mean±SD 18.5±3.2 vs. 18.8±3.8; p = 0.6), birth weight of largest infant (3.4 kg vs. 3.5 kg; p = 0.7) and BMI (mean±SD: 26.8±4.1 vs. 27.6±4.2; p = 0.3). Also, history of using forceps or vacuum application during delivery in the two groups were not significantly different (p = 0.6). Further delineation of data compares the stage of prolapse on the basis of POPQ grading system in Table 3. In patients with abnormal spinal curvature, the rate of pelvic organ prolapse was higher (p = 0.035). Table 3 shows the severity of pelvic organ prolapse between cases and controls.

DISCUSSION

Enhancing quality of life and psychological well-being is an important issue from the standpoint of life expectancy. The impact of pelvic organ prolapse on the quality of life is obvious. Women who seek treatment for

pelvic organ prolapse strive for an improvement in quality of life. Body image has been shown to be an important component of differences in quality of life. Worsening body image correlated with lower quality of life. According to Jelovsek and Barber (2006), women seeking treatment for advanced pelvic organ prolapse have decreased body image and overall quality of life. Although mortality is not affected, significant morbidity may be observed. Prolapse of genital organs has direct effects on urinary, gastrointestinal and sexual functions (Marinkovic and Stanton, 2004; Burrows *et al*., 2004). Anatomical, physiological and biomechanical principles are involved in prolapse (Handa *et al*., 1996). In advanced cases the patients may need surgical intervention. In the study of Hullfish *et al*. (2007), colpocleisis in patients with pelvic organ prolapse resulted in improved quality of life.

Mattox *et al*. (2000), presented a study of abnormal spinal curvature and its relationship to pelvic organ prolapse. This study was a follow-up to a study by Lind, Lucente and Kohn and Milne and Lauder, showing a relationship between thoracic kyphosis and prolapse (Lind *et al*., 1996; Milne and Lauder, 1974). Mattox *et al*. (2000), stated that pelvic organ prolapse was abnormal if it was classified as stage II or greater according to the pelvic organ prolapse grading system. They showed that with increase in the grade of the prolapse, spinal curvature increases. Similar to this study, most patients with abnormal spine had grade II prolapse (33 and 56%, respectively).

In the present study, results were in line with Mattox's study and there were no statistically significant differences between the groups in the number of vaginal deliveries ($p = 0.20$) and birth weight of the largest infant ($PV = 0.7$). The data from this study show an increased rate of pelvic organ prolapse in cases compared to controls ($p = 0.03$).

In the vast majority of women who develop pelvic organ prolapse, the process begins with their first vaginal delivery and after each subsequent vaginal delivery, the likelihood of prolapse increases. The effect of labor and delivery on the female pelvis has not been more completely objectified.

Fortunately, most women who bear children will not suffer a significant, symptomatic degree of prolapse. Compared to the study of Chiaffarino *et al*. (1999), there was no significant difference in the number of deliveries between the two groups in the present study ($PV = 0.2$).

Estrogen receptors are present in the pelvic area and the atrophic changes that occur in the absence of estrogen are a contributing cause for prolapse (Haadem *et al*., 1991; Longcope and Johnson, 1988; Smith *et al*., 1990).

Aging and a prolonged hypoestrogenic state cause osteoporosis. The kyphotic changes in the spine that result from osteoporosis displace the pelvic inlet into a more horizontal plane. These changes in the pelvic inlet allow the weight of the abdominal contents to act more directly on the pelvic floor and urogenital hiatus.

Forceps delivery is a risk factor for pelvic floor injury. Other risk factors include, episiotomy and prolonged second stage of labor (Wall, 1999). In this study, no statistically significant difference was found between the groups with forceps or vacuum delivery ($PV = 0.6$). Bone mass density was not determined in this study and thus this risk factor was not included.

In conclusion, the findings of this study suggest that there is possibly a relationship between spinal curvature, both excessive thoracic kyphosis and loss of lumbar lordosis, to potentate pelvic organ prolapse. The normal spinal curvature appears to protect the pelvic from direct intra-abdominal forces. Variations in spinal curvature may exert more direct abdominal forces onto the pelvic floor, initiating or exacerbating pelvic organ prolapse.

It is to be mentioned that most etiologies of pelvic prolapse are preventable. prevention of future prolapse is more important than treatment modalities.

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