Postural and Musculoskeletal Disorders in Women with Urinary Incontinence: A Research Report

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Introduction: To investigate and compare the prevalence of some postural and musculoskeletal disorders in women with and without Urinary Incontinence (UI). Urinary Incontinence (UI) is one of the most important social and health problems in women. Limited studies have shown that UI prevalence is around 35%-55% in Iran. Nevertheless, to the best of our knowledge, there is no exact and reliable data reported in the literature on the prevalence of musculoskeletal, postural, or other related disorders in UI patients in Iran. **Methods and Materials:** The current study was conducted based on the data obtained from 166 incontinent and 90 continent women attending Vali-e-Asr University Hospital between 2010 and 2012. After collecting participants' demographic information, postural status was assessed. In addition, we measured values for pelvic inclination and lumbar lordosis angles. Finally, vaginal tone and pelvic floor muscle strength and endurance were evaluated. Kolmogorov-Smirnov (K-S) goodness-of-fit, Independent t, X^2, and Pearson correlation tests were used for the purposes of data analysis. **Results:** The prevalence of low back pain, chronic pelvic pain, and pelvic asymmetry were significantly higher in incontinent women compared with that in continent women ($p<0.05$). It was found that lumbar lordosis was significantly different between the two groups ($P=0.021$); however, no significant difference was observed regarding pelvic inclination ($P=0.20$). **Conclusion:** The present study confirms the hypothesis that incontinent women have higher prevalence of low back and pelvic pain and pelvic asymmetry. It is recommended that further epidemiologic and comprehensive etiologic investigations be conducted on these findings.

Keywords: Urinary Incontinence, Posture, Musculoskeletal Disorders, Women

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Introduction

Urinary incontinence (UI) is among the most common lower urinary tract and Pelvic Floor (PF) disorders, which is defined as the inability to control urination or unwanted leakage of urine (1, 2). According to the terminology of International Continence Society (ICS), UI is detected as combination of subjective and objective symptoms and signs, which can be the result of Pelvic Floor Muscles (PFM) dysfunction (2). This condition is more prevalent among women compared with that in men and can affect both genders at all age groups (1, 3, 4). The prevalence rates of UI reported in the literature differ widely in different studies. As a case in point, it was reported 43%-77% in nursing home residents and 35% in women aged≥18 years (3, 4).

A variety of potential risk factors have been reported for UI including aging, hormonal status, mechanical factors, such as vaginal delivery, obesity, parity, fetal weight, hysterectomy, physical work load, and carrying or lifting heavy objects (1, 3, 5). However, it was also found that in middle-aged women, mechanical factors are more effective in causing UI, compared with hormonal changes (5).

In addition to some defecation problems, Pelvic Organ Prolapse (POP), and sexual dysfunction, which are known to be associated with UI (5, 6), there are data suggesting the relationship between UI and musculoskeletal problems (7, 8). Eisenstein et al discussed a hypothetic relationship between Low Back Pain (LBP) and UI and emphasized on recognition of this association (7). Eliasson *et al.* demonstrated that 78% of the women with LBP also reported UI (8). Bush *et al.* reported higher rate of Stress Urinary Incontinence (SUI) in women who had chronic back pain (9). In addition, it was reported that any malalignment in the lumbar and pelvic regions leads to inadequate PFM activity and force distribution in these areas, which might be connected to UI (10, 11). Along with these findings, there is evidence supporting the effects of Global Postural Re-education as an alternative method to treat SUI in women (12). These findings point to a possible link

between posture and symptoms of UI. Nonetheless, to the best of our knowledge, there is no study reported in the literature describing the occurrence of postural and musculoskeletal disorders in women with UI. In addition, the values of lumbar lordosis and pelvic inclination angles have not been taken into account in the patients studied in the above-mentioned studies.

The present study was carried out in order to compare the prevalence of some postural and musculoskeletal problems between two groups of Iranian women with and without UI. In addition, the values of lumbar lordosis and pelvic inclination were compared between the two groups.

Methods and Materials

Participants

The current cross-sectional comparative study was carried out in both continent and incontinent women between 2010-2012. Using convenient sampling, participants were selected from among women referring to gynecology clinic of Vali-e-Asr University Hospital, Tehran University of Medical Sciences, Tehran. Inclusion criteria were diagnosis of UI for the case group and absence of any type of incontinence for control group. In addition, women in both groups were matched regarding mode of delivery. Exclusion criteria for both groups were previous history of cancer and radiotherapy, any disease that could interfere with the participation, lower urinary tract infections, and the participants' reluctance to sign the informed consent (1, 2). The Ethics Committee of Shahid Beheshti University of Medical Sciences, Tehran, the approved study protocol.

Participants were required to fill out a questionnaire on the symptoms of urinary continence. Patients with UI were identified according to any involuntary leakage of urine (1, 2, 4). The type of the UI was determined as "Stress" when it was associated with maneuvers that increased Intra-Abdominal Pressure (IAP) (i.e. coughing, sneezing, laughing, and lifting heavy objects), "Over Active Bladder" (OAB), when it was associated with a strong desire and urgency for urination, and "Mixed" UI, when there was a combination of the two conditions (1, 2, 4). Additional diagnostic tests such as stress test and/or single channel cystometry were performed when needed (1, 2). All examinations for definite diagnosis of UI and its types were performed by a urogynecologist.

From among 103 continent women, 13 withdrew from the study at the time of physical examination. Eventually, 166 women diagnosed with UI and 90 women with no UI were registered in the study. Data collection and measurement tools used in the study included socio-demographic data form, questionnaire to record self-reported low back and pelvic pain, measuring tape, goniometer, flexible ruler, and pelvic inclinometer. The pelvic inclinometer is identified as a useful measurement device to assess postural problems related to both pelvic inclination angle and static pelvic symmetry. Clinical applicability of the pelvic inclinometer was already shown in the previous studies (13-15).

Data Collection

After the research protocol was explained, the basic demographic information of the participants in both groups, such as age, number of pregnancy and delivery, and history of doing regular exercise, such as hiking or participating in physical fitness classes, were elicited. All the women underwent a standardized physical examination, including measurement of height and weight. Body Mass Index (BMI) was calculated as weight in kilograms/ (height in meters) (Table 1) (2).

Next, all the participants were asked if they had any pain at lower abdominal or pelvic sites and low back region that made the participant look for medical care or significant restriction of normal physical activity for a duration of one week or more during the six months prior to the study (16, 17). Also, the presence of Chronic Pelvic Pain (CPP) was detected, as a non-menstrual lower abdominal pain, lasting for at least six months (18). The answers were then translated as scores for self-reported pain (16, 17).

Finally, clinical examination was performed in order to determine the following indices, respectively:

The positions of head, neck, and shoulders in sagittal view were evaluated based on plumb-line passage through the predestinated points (19, 20). The presence of the round back in the thoracic region was examined from lateral view while the participant was standing up straight looking forward with her feet slightly separated and her hands on the sides (19, 20).

- Resting shoulder and pelvic posture in coronal plane was assessed using a goniometer consisting of a fixed horizontal part and two mobile arms (16, 19). The acromioclavicular joints and posterior superior iliac spines were the landmarks for assessing static symmetry of shoulders and pelvis, respectively (19, 20).

Pelvic sagittal inclination angle was measured in the standing position on the floor using an inclinometer to determine the angle formed with a horizontal line drawn between the anterior superior iliac spine and the posterior superior iliac spine (13, 14, 15, 19).

In order to measure the lumbar lordosis, the participants were asked to stand up with their hands on both sides and their feet separated 10-15 cm. Then, a flexible ruler was placed over the spinous processes of the lumbosacral spine and shaped to fit the curvature. T12, L4, and S2 spinous processes were marked using a color pen. Afterwards, the instrument was carefully removed and the shape of the ruler was copied on a white paper. We connected the distance between the two ends of the curve by a straight line (total length of curvature/L-Line, in mm), then drew a line perpendicular to its center passing the curve (H-Line, in mm). Finally, lumbar lordosis was calculated by replacing these values in the following equation: $\Theta=4$ [arc tan (2h/L)] (15).

The reliability and validity of this instrument in measuring lumbar lordosis have thoroughly been shown in the previous studies (13, 15).

To evaluate PFM function, the participant was placed at the standard lithotomic position and the examiner inserted her index

Table 1: Demographic characteristics of the two groups (MEAN±SD)

Group	Incontinent women(n=166)	Continent women(n=90)
Age (year)	45.3±7.9	38.2±8.4
Height (m)	1.56±0.05	1.58±0.05
Weight (kg)	72.3±11.6	66±9.7
BMI (kg/m2)	29.3±4.4	26.1±4
Pregnancy No.	4.4±2.2	2.8±1.8
Delivery No.	3.8±1.9	2.4±1.5

Table 2: Comparison of some variables between the two groups (MEAN±SD)

Variables	Incontinent women(n=166)	Continent women(n=90)	*P*-value
Pelvic Inclination(°)	10.7±4.3	10.9±3	0.20
Lumbar Lordosis(°)	49.8±15.3	44±11	0.021*
Strength of PFM	2.17±0.99	3.01±0.96	0.023*
Endurance of PFM	3.8±1.9	2.4±1.5	0.001*

Table 3: Comparison of the prevalence rates of some postural & musculoskeletal disorders between the two groups

Postural&Musculoskeletal disorders	Incontinent women(n=166)	Continent women(n=90)	X^2	*P*-value
Forward Head Position	56(36%)	6(30%)	0.0001	1
Shoulder Asymmetry	64(41%)	10(50%)	0.205	0.65
Rounded Shoulder	80(52%)	10(50%)	1.17	0.27
Rounded Back	77(49%)	5(25%)	0.767	0.38
Pelvic Asymmetry	28(18%)	2(10%)	5.303	0.020*
Low back pain	103 (62%)	36 (40%)	7.0	0.002*
Pelvic pain	86 (52.1%)	29 (2.32%)	23.0	0.002*
Chronic pelvic pain	79 (48%)	15 (7.16%)	65.6	0.0001*

and middle fingers 3-4 cm inside the patient's vagina. First, the examiner assessed vaginal rest tone as normal, decreased, and increased (21). Then, she asked the participant to contract and move her vagina to medial and superior directions so that she could keep the examiner's fingers inside the vagina. Scoring was doneusing the Modified Oxford Scale (21). PFM endurance was evaluated, from one to ten seconds, as the length of the time the participant was able to sustain the contraction (pressure to the examiner's finger) (21). Interviews and questionnaire completion and all physical examinations were performed by an experienced physiotherapist (the corresponding author). Taking part in the study took approximately 35 minutes for each participant.

Data Analysis

Statistical analyses were performed using SPSS (v. 16). The Kolmogorov-Smirnov (K-S) goodness-of-fit test was run to evaluate the normality of the distributions of quantitative variables by comparison against normal standard distribution. Independent t-test, non-parametric Mann-Whitney U test, and X^2 were run to compare variables between the two groups. In addition, Pearson and Spearman tests were used to study the relationship between the variables. Statistical significance was set at $P<0.05$.

Results

A total of 166 women with UI were evaluated: 53.7% were found to have SUI, 35.2% had OAB, and 11.1% were diagnosed with the mixed type. In terms of occupation, 84% of the incontinent and 68% of the continent women were housewives and the remainders were employed. History of regular exercise was positive in 22.4% of incontinent and 18% of continent women. Some characteristics of the two groups are compared in Table 2. Accordingly, pelvic inclination was not significantly different between the two groups ($P=0.20$); however, the mean value of lumbar lordosis differed significantly between groups ($P=0.021$). In the incontinent group, 18.1% of the women had normal vaginal tone which was significantly lower when compared with that in the continent group (52%) ($P<0.001$). In addition, strength and endurance of PFM were both significantly lower in women with UI when compared with those in controls ($P<0.05$). Prevalence of some UI-associated problems is compared between the two groups in Table 3. It is demonstrated that LBP, present pelvic pain, and CPP were significantly more prevalent among women with UI in comparison with those in the continent group ($P<0.05$). Comparison of the prevalence of postural disorders between the two groups revealed that only pelvic asymmetry was significantly different ($P=0.020$). No statistically significant difference was demonstrated for other postural disorders ($P>0.05$). Moreover, the possibility of pelvic asymmetry and LBP was found to be higher in women with the history of CPP ($P<0.05$).

Discussion

The present study was carried out in order to compare the prevalence of some postural and musculoskeletal problems among a group of women with and without UI. We did not

observe a significant difference of pelvic inclination angle between incontinent and continent participants. Nevertheless, lumbar lordosis was found to be statistically higher in incontinent women compared with that in continent women (49.8°±15.3 vs. 44°±11, respectively).

Mattox et al, in a study on 363 women with complaints of POP and UI, showed that women with abnormal spinal curvature, both hyper- and hypolordosis, are 3.2 times more at the risk of POP in comparison with women with normal spinal curve (22). Theoretically, it is believed that normal spinal curves are essential to support pelvic organs against increased IAP by absorption of forces at the level of pubis bone (23). So, no additional loads are applied on endopelvic fascia and PFM. It can be concluded that any changes in spinal alignment and curves might disarrange the vector of IAP and increase the possibility of POP11 (22). Considering the clinical relationship between UI and POP6, changes in lumbar lordosis might also have an impact on UI.

In a study on 8 women with SUI and 9 healthy controls, Sapsford (2008) reported a significantly lower lumbar lordosis in women with SUI in comparison with that in healthy women (10). In fact, when women with SUI moved from a slumped sitting posture to upright sitting, they did not display the same degree of lumbar lordosis as did the asymptomatic controls (10). These results may appear to be in conflict with the findings of the present study, where the mean of lumbar lordosis in UI patients was higher than that in continent women. We measured lumbar lordosis in upright standing position, which normally involves a greater depth compared with that in sitting position (24). Also, because of the small sample size in the Sapsford's study and the fact that she excluded participants who had acute or chronic low back pain, these studies are not identical. Therefore, we recommend caution when comparing findings of these two studies. There is, however, another study suggesting that lumbar lordosis and pelvis position do not interfere in SUI25.

Higher prevalence of LBP, CPP, and pelvic asymmetry in incontinent women compared with that in controls is the main finding of the current study, which confirms findings of the previous studies (7-9). PFM are known as a component of abdominal capsule and sacroiliac joint surrounding muscles (9), (10, 26). They play an important role in producing stability and establishing normal posture of lumbosacral region and sacroiliac joints (26-28). The effect of feed-forward responses of these muscles to fast, sudden, or pendulous movements of limbs has been shown in women without chronic pain in lumbosacral region (28, 29). Changes in the level of PFM motor control might result in a decrease in the stability of lumbosacral region and pain (28). Thus, dysfunction or decreased strength and endurance of PFM might attenuate their role in establishing force closure in sacroiliac joints and finally lead to reduction in their stability (30).

It is obvious that reduced joint stability increases its vulnerability and hence the possibility of pain (30). This pathologic mechanism might be involved in increasing the rate of CPP in women with UI. Hungerford, in a case-control study on women with and without posterior pelvic pain, found that pelvic movement during weight bearing is different between the two groups (31). In other words, innominate bone rotated posterior in the control group and anteriorly in the case group. This movement pattern is unfavorable and might cause articular or neuro-fascial injuries by increasing the load transferred through the pelvic (31). To put it differently, continuity of pelvic pain leads to adoption of undesired movement strategies (neuro-muscular) for daily activities and postural control. This can result in incompetency in transference of loads through pelvis and accordingly pathologic changes in myofascial structures of the PF (32). It is clear that damage to myofascial system, as a part of PF supporting system, leads to loss of its normal function and incidence or exacerbation of functional disorders such as UI (32). In addition, Haugstad *et al.* described instability in both global and pelvic postures in CPP patients (33). These findings correspond to our findings, which showed higher rate of pelvic asymmetry in women with CPP.

In recognition of the relationship between LBP and UI, a recent study showed that lateral abdominal wall muscles control continence via stabilizing bladder and increasing intra-urethral pressure (34).

Also, it is noticeable that a lot of musculoskeletal components in back region and lower extremities have common innervations with urogenital structures (S2-S4) and some of the functional PF disorders are caused by neural damage and denervation (6, 30). Therefore, the possibility of the occurrence of musculoskeletal disorders such as LBP and pelvic pain concomitant with UI does not seem far-fetched. Observing a significant difference between the two groups regarding weight and BMI confirmed the studies that demonstrated these two as risk factors for UI (3, 5, 6).

Lack of an organized referral system to introduce participants in both groups was the main limitation of the present study, which caused the mismatch of case and control numbers and prolonged study period.

Conclusion

Our study confirms the hypothesis that incontinent women have higher prevalence of LBP, CPP, and pelvic asymmetry. Further comprehensive etiologic research is needed to investigate which UI-related musculoskeletal changes are involved in prognosis of the UI treatment outcomes.

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All authors made substantial contributions to conception, design, acquisition, analysis and interpretation of data.

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