Correlation between genuine stress incontinence in women and bladder neck mobility as assessed by inter labial ultrasound scan

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Abstract:
Background: genuine stress incontinence is one of the most common disorders among women which is caused by bladder neck hyper mobility. Vaginal ultrasound scan has been used increasingly in predicting women with incontinence by visualization of bladder neck.

Aim of the study: is to assess whether distance between bladder neck to pubic symphsis BN-SP correlate significantly with symptoms of genuine stress incontinence as assessed by inter labial ultrasound scan.

Methods: a total 20 patient with genuine stress incontinence and 23 continent females have bee recruited to study by inter labial ultrasound. All women with genuine stress incontinence have been diagnosed by urodynamic study. For all patients inter labial ultrasound has been done to measure the distance between bladder neck and symphsis pubis.

Results: all continent women have significantly longer bladder neck- symphsis pubis distance than women with genuine stress incontinence; 25.0435±2.0108 versus 20.2000±1.1517 mm; P < 0.0001. All continent women had significantly lower number of births and body mass index

Conclusions: measurement of bladder neck- symphsis pubis distance may be helpful in predicting women with genuine stress incontinence as assessed by inter labial ultrasound.

Key words: vaginal ultrasound, perineal ultrasound, genuine urinary incontinence

Introduction
G enuine stress incontinence is one of the most frequently encountered gynecological problem in practice especially among middle aged and postmenopausal women [1].

It is also well established that bladder neck hyper mobility with descent of the proximal urethra bellow levator ani is the primary cause of continence failure [2].

In recent years vaginal and perennal ultrasound assessments of bladder neck mobility have gained more popularity [3]. The independent parameters assessed in various studies included bladder neck descent, urethral angulations as well as distance between bladder necks to symphsis pubis [4].

Aim of the study
Is to show whether the distance between bladder neck and lower surface of the pubis as measured by inter labial ultrasound differ significantly among healthy continent women versus women with genuine stress incontinence.

Patients & Methods
1-Setting: the study was conducted in AL Elwyia Maternity Teaching hospital starting early in 2004 up to end of 2005. We had great difficulty in collecting patients due to the fact that most Iraqi women are reluctant to vaginal ultrasound as well as to urodynamic studies which were essential components of the study protocol. The study was approved by the local board authority and verbal consent was taken for all women enrolled in this study.

2- Patient's protocol: all the patients chosen to participate in this study were collected from the consultant clinic. During the study period, a total of 20 patients with symptoms suggestive of stress incontinence were chosen for further analysis. Exclusion criteria included women with cesarean section, diabetes, use of diuretics and uterine prolapse. Initially age, body mass index and parity were recorded. In addition, general urine examination with culture and sensitivity were done to exclude infection of urinary tract. That group with urinary symptoms was sent to IBN AL QUFF rehabilitation centre in Baghdad for conducting urodynamic studies. Genuine stress incontinence was diagnosed on basis of normal intra vesical pressure after complete filling with normal saline. Resting intra vesical pressure was 10-15 cm of water, while voiding pressure didn't exceed 15 cm of water. For each patient diagnosed to have genuine stress incontinence, a matched healthy continent woman who's age between 40 - 50 years was chosen as a control to normalize the statistical comparison later on. Finally the incontinent or study group size was 20 patients (N=20), while the continent or control group was 23 women (N=23).

3-Ultrasound scanning protocol: the final step in the patients protocol in this study was conducting inter labial ultrasound scan. All women in both groups were scheduled to (Inter Labial) scan at the Women Health Centre in the hospital, where advanced ultrasound device with different probes is available. First all women were instructed to soft drink until the desire to void is reached. Afterward and before voiding, the patient is put in lithotomy position and a curvilinear 6.5 MHz probe was applied in sagittal position to visualize the urethra (U), bladder neck (BN), urinary bladder (B) and the Symphsis Pubis (SP) as
shown in figure 1. The centre of the probe is placed gently over the external urethral opening to obtain such view. Once a clear picture is obtained, the picture is frozen and the distance between bladder necks (BN) to the lower surface of symphsis pubis (SP) was measured in millimeters. In addition, a photo is obtained and printed for further analysis.

4-Computer analysis of the picture: All photos obtained as mentioned above, were scanned by ordinary computer scanner and further analyzed by Adobe Photo Shop Software, a program which has extraordinary facilities for scaling, measuring and labeling. Through this software a line was drawn between the bladder neck (BN) and the lower surface of symphsis pubis (SP). In addition a second line was drawn from lower point of pubic symphsis to its upper surface. The angle between the two lines was arbitrarily called alpha angle and measured in degree by the angle measuring Icon supplied with software. The new processed photo was printed and labeled with patient name and other related data. Figure 1 shows an example of Alpha angle and BN-SP distance.

5-Statistical analysis: continuous data were presented as mean and standard deviation and compared with t student test. Simple linear regression module was constructed to calculate the coefficient of correlation between Alpha angle and BN-SP distance with scatter diagram. Receiver operator characteristic curve or ROC analysis was used to calculate the cut off values for the BN-SP distance and Alpha angle with their 95% confidence intervals. P values less than 0.05 were considered significant.

Results:
In table 1 the overall epidemiological characteristics of women in both groups are given. Women in the continent groups have a mean age 2 years less than those with genuine stress incontinence group; 44 versus 46 years, P value =0.0013. They were also thinner despite both groups lie in the over weight range; BMI 27 versus 29, P value <0.0001. Women in continent group have an average number of children of 3 versus 6 in the incontinent group, P< 0.0001. More interestingly women in the continent group have significantly longer distance between bladder neck and pubis symphysis than incontinent women, when bladder is filled with urine; 25 mm versus 20 mm, P Value < 0.0001. In addition the angle between the axis of pubis and the line between bladder neck–symphsis pubis was significantly smaller in the continent group versus the incontinent women; Alpha angle 92.17 versus 100.6 degree, P value less than 0.0001.

To show the exact correlation between Alpha angle as the dependent variable and the bladder neck-pubic symphysis distance as an independent variable, a regression line has been created and plotted in figure 2. The coefficient of correlation is -0.80 while the P value is less than 0.0001. Finding this significant correlation between Alpha angle and BN-SP distance would suggest that scanned photos without measurement of BN-SP distance, may be still evaluated for bladder neck descent without need to measure this distance which requires real time ultrasound measurement. Unlike BN-SP distance measured in this study by the ultrasound device, Alpha angle has been measured by scanned photo with Adobe Photo Shop Software. Simply a printed photo of bladder neck may be scanned and labeled appropriately to measure Alpha angle which
correlate well with BN-SP distance or bladder neck descent. Finally to calculate the cut off value associated with BN-PS distance and Alpha angle which is associated with maximum sensitivity and specificity for genuine stress incontinence, receiver operator characteristics curve has been constructed and the values are given in table 2.

In summary, women who have Alpha angle equal or more than 95 degree have 95 % chance to be incontinent, while if BN-PS distances equal or less than 22 mm she is 100 % incontinent.

Table 1 The epidemiological characteristics of the women among the two study groups

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Continent Group (N=23)</th>
<th>Incontinent Group (N=20)</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (Years)</td>
<td>44.3043+2.9145</td>
<td>46.9000+1.7741</td>
<td>P = 0.0013</td>
</tr>
<tr>
<td>Body Mass Index</td>
<td>27.0000+1.5374</td>
<td>29.0500+1.0501</td>
<td>P &lt; 0.0001</td>
</tr>
<tr>
<td>Parity (Mean, SD)</td>
<td>2.9565+1.3973</td>
<td>5.8500+2.2308</td>
<td>P &lt; 0.0001</td>
</tr>
<tr>
<td>BN-SP distance *(millimeters)</td>
<td>25.0435+2.0108</td>
<td>20.2000+1.1517</td>
<td>P &lt; 0.0001</td>
</tr>
<tr>
<td>Alpha angle (In Degree)</td>
<td>92.1739+3.6761</td>
<td>100.6000+3.6620</td>
<td>P &lt; 0.0001</td>
</tr>
</tbody>
</table>

*BN-SP; Bladder Neck to Symphsis Pubis Distance

![Fig 2 The regression line with scatter plot between Bladder Neck – Symphsis Pubis, R² = -0.80, P < 0.0001](image)

Table 2 The cut off values for BN-SP distance and Alpha angle with their sensitivities, specificities and 95 % confidence interval

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Criterion</th>
<th>Sensitivity</th>
<th>95% CI</th>
<th>Specificity</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alpha angle</td>
<td>&gt;95 *</td>
<td>95.00</td>
<td>75.1 - 99.2</td>
<td>86.96</td>
<td>66.4 - 97.1</td>
</tr>
<tr>
<td>BN-SP Distance</td>
<td>&lt;=22 *</td>
<td>100.00</td>
<td>83.0 - 100.0</td>
<td>95.65</td>
<td>78.0 - 99.3</td>
</tr>
</tbody>
</table>

Discussion
It is well known that over 100 different operations have been invented to combat urinary incontinence among females with sphincter weakness [5]. Simply, this reflects our persisting poor understanding to the insight of true nature of this disorder [6]. Those factors have stimulated the gynecologist as well as sonographers to have a more close view to the vesicourethral junction and assessment of bladder neck mobility with modern ultrasound devices [7]. Gabriel et al found significant correlation between perineal ultrasound and lateral chain urethrocytography by X-Ray study with regard to bladder neck descent at rest and with Valsalva maneuver [8]. Minardi et al also found good correlation between perineal ultrasound for bladder neck descent as predictor of genuine stress incontinence and results of urodynamical studies [9]. On the other hand Wise et al studied bladder neck...
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descent among postpartum women and found good correlation between women with symptoms of stress incontinence and profile of bladder neck funneling during cough and straining [10].

In this study all women who have been investigated by inter labial ultrasound scan had full bladder based on the assumption that bladder fullness may affect bladder neck visualization. This assumption was supported by the work of Schaer et al who found that the best visualization of bladder neck movement occurs when bladder is filled with 300 cc normal saline [11]. As far as this study is concerned a significant correlation between bladder necks to pubic symphysis distance was found among women with genuine stress incontinence. Also, a significant correlation between Alpha angle and bladder neck descent was to be significant. These results are consistent with those obtained by Roberto et al [12]. He has found a significant correlation between bladder neck to pubic symphysis distance as well as Alpha angle with symptoms of genuine stress incontinence.

As far as evidence based medicine is concerned, perineal ultrasound assessment for bladder neck descent is still considered far away from being a real alternative to urodynamic studies to diagnose genuine stress incontinence. Orietta et al has made meticulous search in med-line for articles about perineal, vaginal and rectal ultrasound scan for prediction of genuine stress incontinence and detrusor muscle over activity disorders. He concluded that perineal ultrasound scan though indispensable as adjuvant to urodynamic studies in the management of genuine stress incontinence, yet it is still far away from being complete alternative [13].

Also he found that there is no universal agreement among researchers about which parameters that count most in perineal ultrasound scans for diagnosis of bladder neck hyper mobility.

Conclusion

A simple non invasive inter labial scan for bladder neck may yield useful information to help gynecologists in predicting women with genuine stress incontinence. We urge our colleague gynecologists strongly to do similar theses in order to clarify the exact role of vaginal scan in predicting genuine stress incontinence.

References


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