e-ISSN: 0975-1556, p-ISSN:2820-2643

Available online on www.ijpcr.com

International Journal of Pharmaceutical and Clinical Research 2024; 16(5); 929-933

Original Research Article

The Role of Transperineal Ultrasound for Evaluation of Stress Urinary Incontinence

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Received: 25-02-2024 / Revised: 13-03-2024 / Accepted: 20-03-2024

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Conflict of interest: Nil

Abstract:

Introduction: Urinary incontinence is a distressing condition among women. Incontinence can impair social life, physical activity, sexual activity thus affecting emotional and psychological well-being of women. The most common type of incontinence among younger women is stress urinary incontinence (SUI)**.** The aim of present study was to determine how accurately transperineal ultrasound can be used to detect stress urinary incontinence as compared to control group.

Material and Methods: This prospective observational study was conducted with a total of 40 patients, including 20 patients with stress urinary incontinence (Group I) and 20 age matched control (Group II). Women of the cases group were diagnosed to have SUI when they had a complaint of involuntary leakage of urine on stress (cough, sneezing or certain movements) and had a urodynamic study showing a stable detrusor pressure curve on Valsalva or coughing. The ultrasound readings were noted and data was analyzed using SPSS version 25.0.

Results: The mean (SD) α angle at rest of the SUI group was 49.0 (±13.3)°, which was slightly higher than the α angle in the control group: 48.6 (±9.7)° and the difference was not statistically significant. The α angle at straining was significantly higher in the SUI group versus the control group, 61.0 (±15.5)° versus 54.8 (±15.6)°. The mean (SD) β angle in the SUI group at rest was 115.6 (±28.5)°, which was not significantly higher than that of the control group at 114.0 (±22.5)°. The mean (SD) β angle at straining was significantly higher in the SUI group versus the control group: 151.8 (±90.6) versus 136.0 (±27)°. Comparing the BND between the two groups it was significantly higher in SUI Group (16.6±4.22 vs.6.53±1.69) (p=0.000).

Conclusion: Present study suggest that transperineal ultrasonography can be considered as a non-invasive, easily conducted, and accurate modality in early diagnosis of female SUI. It can be used as useful investigation in addition to urodynamic study. However, the role of TPUS in assessment of SUI severity remains to be studied with a larger sample size.

Keywords: Transperineal, Stress Urinary Incontinence, Transvaginal.

Introduction

Urinary incontinence is a distressing condition among women. Incontinence can impair social life, physical activity, sexual activity thus affecting emotional and psychological well-being of women. The most common type of incontinence among younger women is stress urinary incontinence (SUI). It is defined as the complaint of involuntary loss of urine on effort or physical exertion, sneezing, or coughing in the absence of bladder contraction [1]. The prevalence of SUI is approximately 40% among women [2].

Several diagnostic modalities have been used to diagnose SUI, the gold standard method for diagnosis and differentiation between different types of SUI is the urodynamic study. This diagnostic study, however, lack universal availability in all institutes. Moreover, it is quite discomforting for some women. Other imaging modalities such as transperineal ultrasonography (TPU), cysto-urethrography and magnetic resonance imaging (MRI) have also been used to evaluate patients with SUI [3].

Transperineal ultrasonography has been used to evaluate the mobility of the bladder neck and proximal urethra as bladder neck mobility assessment is a part of evaluation of SUI. The majority of the prior studies concentrated on the degree of urethral angle (α), posterior

urethrovesical angle (β), and bladder neck descent (BND) however there is limited studies about rotation angles. [3-13].

In this study we aimed to evaluate the use of transperineal ultrasonography for diagnosing stress urinary incontinence (SUI) by comparing the urethral angle(α), posterior urethrovesical angle (β), and bladder neck descent (BND) during the Valsalva maneuver and resting in continent women and women with stress urinary incontinence.

Materials and Methods

This prospective observational study was conducted with a total of 40 patients, including 20 patients with stress urinary incontinence (Group I) and 20 age matched control (Group II). The study group was selected from stress incontinence patients visiting the gynecology and surgery outpatient department(OPD). The control group was selected from volunteers from gynecology OPD, who did not have urinary incontinence complaints and those who fulfilled the inclusion criteria.

Women of the cases group were diagnosed to have SUI when they had a complaint of involuntary leakage of urine on stress (cough, sneezing or certain movements) and had a urodynamic study showing a stable detrusor pressure curve on valsalva or coughing [14]. Women of the control group were age-and BMI-matched multiiparous urine-continent women with no previous pelvic surgery.

Exclusion criteria- Pregnant women, those who had mixed or urge urinary incontinence, those who had recurrent SUI after a previous anti-incontinence procedure, or previous pelvic surgery, and those who had urinary tract anomalies.

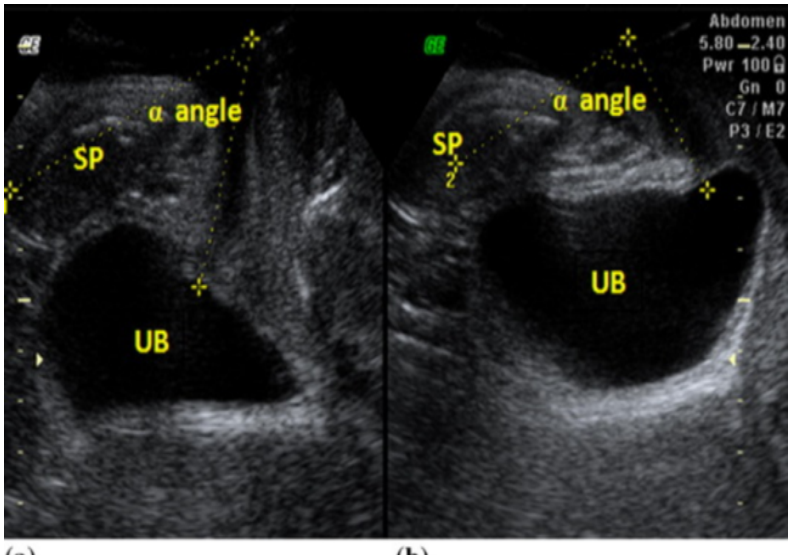
All included women in both groups were subjected to Transperineal ultrasonography using 3.5-MHz convex probe and 6.5-MHz endovaginal probe. The endovaginal probe was used for its better spatial resolution which provide more detailed imaging when examining the urethra. For all included women, trans-abdominal sonography was performed before transperineal scanning to exclude any pelvic abnormalities. The patient lied supine in lithotomy position while the Transperineal ultrasound is performed with the urinary bladder partially full. The 3.5-MHz convex probe was placed on the perineum in sagittal direction and images were recorded at rest and while straining (Valsalva manoeuvre). Then the endovaginal 6.5 MHz probe was placed just beyond the introitus for imaging of the perineum.

The following calculations were made

•Bladder neck descent (BND), the distance between the location of the bladder neck and the horizontal axis passing through the distal end of the symphysis was measured on the images taken during rest and Valsalva, the difference was labelled as BND.

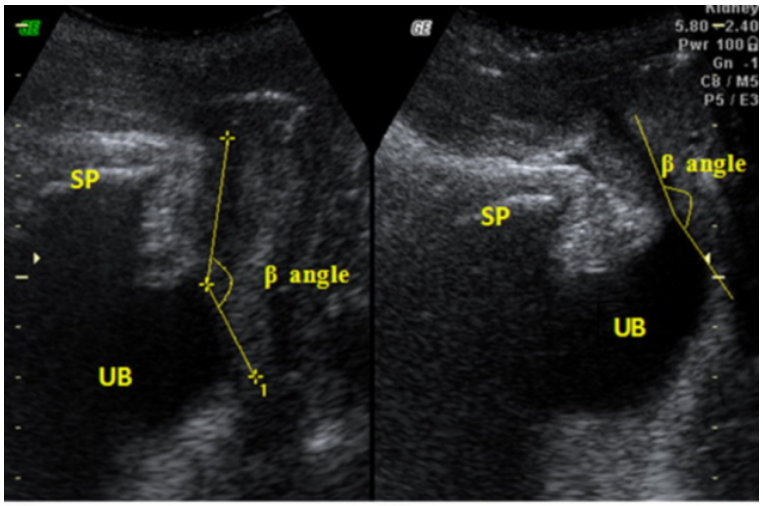
• α-angle (angle of urethral inclination)(60- 110º)', -defined as angle formed by the urethral axis and the central line of the symphysis pubis, was measured at rest and during straining.15(figure1)

• β-angle (posterior urethro-vesical angle)(90-120º) - defined as the angle formed by the urethral axis and a line drawn tangent to the posterior edge of the bladder base near the bladder neck, was measured at rest and during straining. 16(figure2)



(a) (b)

Figure1 TPUS for the assessment of α angle at rest (a) and straining (b). SP, symphysis pubis; UB, urinary bladder.



(a) (b)

Figure 2: TPUS for the assessment of the β angle at rest (a) and straining (b). SP, symphysis pubis; UB, urinary bladder

Statistical Analysis

Statistical analysis was performed using SPSS for Windows version 25.0. Descriptive data were presented as range, mean±standard deviation, range and median. Difference between women of the same group were analyzed using the paired student's t-test. Difference between women of two different groups wereanalyzed using the unpaired student's t-test. Significance level was set at 0.05.

Results

The study included 30 women having stress urinary incontinence and another 30 women as their controls. The mean age of cases was 46.78 ±6.06 years, while that of controls was 45.3±4.39 years (p=0.747). Whereas, body mass index (BMI) was 24.68±5.19 kg/m^2 for cases compared to controls 23.45±4.47 kg/m^2 (p=0.345) Table 1. There was no statistically significant difference between study and control groups in terms of age and BMI.

Table 1

Charactristics	Group I (SUI) (n=20)	Group II (n=20)(Control)	p
Age	46.78 ±6.06	45.3±4.39	0.747
BMI (kg/m²)	24.68±5.19	23.45±4.47	0.345
Ultrasonographic measurements			
α angle (rest) (°)	49.0 (±13.3)°	48.6 (±8.7)°	0.234
α angle (valsalva) (°)	61.5 (±15.5)°	54.8 (±15.6)°	0.002
β angle (rest) (°)	115.6 (±28.5)°	114.0 (±22.5)°	0.135
β angle (Valsalva) (°)	151.8 (±90.6)	136.0 (±27)°	0.001
BND(mm)	16.6±4.22	6.53±1.69	0.000

The mean (SD) α angle at rest of the SUI group was 49.0 (±13.3)°, which was slightly higher than the α angle in the control group: 48.6 (±9.7)° and the difference was not statistically significant. The α angle at straining was significantly higher in the SUI group versus the control group, 61.0 (±15.5)°versus 54.8 (±15.6)°. The mean (SD) β angle in the SUI group at rest was 115.6 (±28.5)°, which was not significantly higher than that of the control group at 114.0 (±22.5)°. The mean (SD) β angle at straining was significantly higher in the SUI group versus the control group: 151.8 (±90.6) versus 136.0 (±27)°. Comparing the BND between the two groups it was significantly higher in SUI Group (16.6±4.22 vs.6.53±1.69) (p=0.000) (Table-1).

Discussion

A reliable, non-invasive, and cost-effective method is required for the evaluation of SUI cases. In present study, we did transperineal ultrasound and we measured bladder and urethra angles and BND during rest and Valsalva maneuver in patients and controls. [14,15]

In cases of stress urinary incontinence the proximal urethra will rotate more postero-inferiorly and the bladder neck will move more lower during Valsalva. Fixed bony landmark of longitudinal axis

of the symphysis pubis bone is used as a reference line during Valsalva for α angle measurement, and a horizontal line crossing the posteroinferior margin of the symphysis pubis is used to assess the descent of the bladder neck during Valsalva. [16]

Bladder neck descent, urethra-symphysis pubis angle (α angle), posterior urethrovesical angle (β angle) are the commonly measured parameters in cases of SUI. However location of probe, status of bladder fullness, and the intensity of the Valsalva maneuver were not standardized, resulting in no consensus about the cut-off values for SUI differential diagnosis. [17]

The present study was designed to evaluate TP ultrasound findings in females with SUI and control group. This study included 20 women with stress urinary incontinence and 20 women as their controls. The mean age of cases was 46.78 ±6.06 years, while that of controls was 45.3±4.39 years.

In our study transperineal ultrasonography showed significant difference between cases and control regarding BND, alpha and beta angles during valsalva. [17] Another study found beta angle to be significantly wider in SUI patients, when compared to controls, both at rest and during straining, while, the alpha angle varied significantly only during Valsalva same finding as our study. [3] Our study showed no statistical significant difference between alpha and beta angle between cases and controls at rest.

Dietz et al. found that the full bladder is less mobile than the empty bladder leading to lower BND and smaller alpha and beta angles. Thus they emphasized that bladder fullness should be stated in studies [18]. So we chose full bladder cases in our study.

Xiao et al. studied the role of transperineal 3D ultrasonography in the evaluation of stress urinary incontinence cases. In this study they determined threshold value of BND as 24mm (66.4% sensitivity, 84.5% specificity). This study showedtransperineal ultrasonography as inadequate imaging modality forpredicting SUI. However, it could be used to reduce need for unnecessary urodynamics and further treatment by identifying cases without SUI [9]. Another study by Naranjo-Ortiz et al. found that BND >25mm favorurethral hypermobility (58% sensitivity, 60% specificity) [19].

In another study by Hajebrahimi et al. BND was recorded as 15.64±9.65mm in the SUI group and 8.13±9.16mm in the control group (p value <0.01) [3]. Li et al. also studied the use of transperineal ultrasonography for SUI evaluation. BND, α, and β angles were significantly higher in the SUI group compared to the control group. They observed the mean BND value in the SUI group as 2.19 (±0.80) cm and the BND value in the control group as 1.14 (±0.66) cm (p <0.001) [10]. In this study, the mean BND value of the SUI group (16.6±4.22mm), the mean BND value of the control group (6.53±1.69mm), and the threshold was determined as 11.2mm.

Yang et al. similarly reported higher resting and straining angles in the SUI group compared to the controls [13]. Sendag et al. also reported higher β angles at rest and Valsalva in the SUI group, whereas they reported α angle to be higher only at Valsalva similar to our study [6]. In this study, the mean α and β angles at rest were not statistically different between the cases and control group. This could result from different demographics characteristic of control group.

In SUI group mean α and β angles measured during the Valsalva maneuver were significantly higher in our study. This measurements are consistent with existing literature, however the angle measurements vary, probably due to choice of different methodology. The demographic characteristics of the groups that may affect resting anatomy such as parity and BMI were not compared in the study by Al-Saadi et al. therefore the difference during rest may be a result of the choice of the control group in that study. Yang et al. stated that it is not possible to select a threshold value for the angles due to the wide range of overlap between groups in their study, whereas Al-Saadi et al. suggested a threshold of 58.5° for α angle Valsalva with a high sensitivity and specificity (≈97%). The same study suggested that the difference between Valsalva and resting α and β angles was significantly higher in the SUI group. [8, 13]

Conclusion

Our study suggest that transperineal ultrasonography can be considered as a non-invasive, easily conducted, and accurate modality in early diagnosis of female SUI. It can be used as complementary investigation in addition to urodynamic study. However, the role of TPUS in assessment of SUI severity remains to be studied probably with a larger sample size.

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