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ORIGINAL RESEARCH

Evaluation of the Role of Transperineal Ultrasound in Urinary Stress Incontinence in Women

Dr. Kshitij Sharama

Associate Professor, Department of Radiodiagnosis, Maharishi Vishwamitra Autonomous State Medical College, Ghazipur, India

Corresponding author
Dr. Kshitij Sharama
Associate Professor, Department of Radiodiagnosis, Maharishi Vishwamitra Autonomous State Medical College, Ghazipur, India
Email: stormoffire76@gmail.com

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ABSTRACT

Aim: To evaluate the use of transperineal ultrasonography while diagnosing stress urinary incontinence by comparing the urethral angle. **Methods:** A case-control study including 40 females diagnosed to have stress urinary incontinence and 40 healthy females as their controls. The proximal pubo-urethral distance, the posterior urethro-vesical angle (β-angle) and the angle of urethral inclination (α-angle) were measured at rest and during straining. **Results**: On analyzing the transperineal ultrasound findings, no statistical significant difference was found between cases and controls at rest, but on straining, statistical significant difference was found regarding dynamic posterior urethral angle and dynamic pubo-urethral distance ($p<0.001$) . Of the included 40 cases with SUI, 27 (67.5%) had cysto-urethrocele, and 5 (12.5%) had intrinsic sphincter defect (ISD). Urethral diameter was significantly different in patients with ISD (6.64±1.23 mm) when compared with patients with SUI without ISD (4.83±1.16 mm). Conclusions: Transperineal ultrasound is a simple, noninvasive, and easily conducted examination that can be used in the diagnostic workup of stress incontinence. **Conclusion:** Transperineal ultrasonography is a practical, reliable, non-invasive and comfortable method for evaluation of SUI. It has the advantage of dynamic evaluation during the Valsalva maneuver. Rotation angles and BND have high sensitivity and specificity for detection of SUI. The change in α angle with Valsalva (Rα) can be used as an alternative to Q-tip test.

Keywords: Urinary Incontinence; Stress; Ultrasonography; Urinary Bladder Neck Obstruction.

INTRODUCTION

Female urology is a rapidly evolving ¢eld leaving numerous questions concerning assessment and treatment. Clinicians need to know and apply the various diagnostic procedures to be able to choose the best treatment for the patients. Urinary incontinence (UI) is a very distressing disease affecting the well-being of patients both physically, psychologically and socially. Its overall prevalence is approximately 40% among women.[1] Stress urinary incontinence (SUI) is the comments type with significant impact on women's quality of life. The pathological basis of SUI is the absence of proper anatomical support to the proximal urethra, bladder neck and bladder base leading to their hyper-mobility outside the intra-abdominal transmission zone. Transperineal (TP) ultrasonography seems to be a reliable modality for the assessment of bladder neck mobility and PFM contraction and exercise. It is an easy, inexpensive technique, and is considered comfortable for most patients.[2,3]Nowadays, it has become frequently used as a complementary examination in diagnostic investigations. Yet, this modality still needs further evaluation to reach more standard and objective parameters to be a more efficient diagnostic tool of UI. This work aims to evaluate the findings of TP ultrasonography in female SUI.[4]Urinary incontinence is a common and disturbing condition among women. Incontinence can impair social life, physical activity, sexual activity thus affecting emotional and psychological well being.[5] The most common type of incontinence among younger women is stress urinary incontinence (SUI). Stress incontinence 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]). With an increase in intra-abdominal pressure, bladder pressure exceeds urethral closing pressure and urine leaks.[6] Two

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mechanisms explain SUI; urethral hypermobility and intrinsic sphincter deficiency. Since, hammock-like musculofascial fascia provides a backboard support for the proximal urethra, poor anatomic support contributes to SUI by prohibiting compression of urethra.[7]

On the basis of reviewed literature and experts' opinions, the role of imaging techniques and other investigations will be outlined with regard to diagnosis, measurement of severity, indications for treatment, prognostic value, monitoring and follow-up, cost-effectiveness, outcome evaluation, and research interest. Since the 1980s reports on ultrasound evaluation of the lower urinary tract have indicated that ultrasound is a valuable alternative to radiology. [8]Pelvic floor ultrasound is a frequently used investigational evaluation for the study of female urinary incontinence and prolapse which allows functional and morphological documentation. Nevertheless, measuring bladder neck (BN) position and retro vesical angle does not reliably predict urinary incontinenceby this method in the assessment of the main anatomic and functional alterations of the perineum makes the use of invasive and expensive radiographic techniques unnecessary. Furthermore, its correct use significantly reduces the need for conventional radiography or MR contrast-enhanced examinations which should be regarded as second-line examination tools .[9] In several studies MR imaging has been used to assess female pelvic organ anatomy and prolapses. MR imaging provides a global evaluation of the pelvic contents including the uterus and the pelvic floor muscles with high resolution of soft tissue, but this procedure is still costly and not frequently used for routine examinations .[10] The use of MRI compared to ultrasonography in the study of bladder support was reported by Mouritsen in order to ascertain their relative diagnostic value in different types of urinary incontinence, hypermobility of the BN and urethral wall pathology. In this study the BN hypermobility better correlated to stress incontinence than bladder morphology, diagnosed during static cystography. [11]

METHODS

The current protocol for this study was included women signed an informed written consent after thorough explanation of the procedure and purpose of the studies. 40 women with a diagnosis of primary urodynamic stress urinary incontinence (uSUI) were included; along with 40 continent women as a control group. Both groups of women were recruited from the gynaecological outpatient clinic. Women of the first group were diagnosed to have uSUI when they had a sociallyunacceptable complaint of involuntary leakage of urine on stress (cough, sneezing or certain movements) and had a urodynamic study showing a stable detrusor pressure curve (Pdet) on valsalva or coughing. Women of the control group were age-and BMI-matched nulliparous urine-continent women with no previous pelvic surgery. 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 were not includedAll included women in both groups were subjected to TP ultrasonography using Medison, Sonoscape A6 model with both, 3.5-MHz convex probe and 6.5-MHz endovaginal probe. The endovaginal probe was used for its superior spatial resolution providing more detailed imaging when examining the urethra. For all included women, trans-abdominal sonography was performed before TP scanning to exclude pelvic abnormalities as urethral or urinary bladder diverticulum, lateral cystocele and any pelvic masses. The patient lied supine in lithotomy position while the TP ultrasound is performed with the urinary bladder half full. The 3.5-MHz convex probe was placed on the perineum in sagittal direction and images were recorded at rest and while straining. Then the endovaginal 6.5 MHz probe was placed just beyond the introitus for imaging of the region of interestThe following parameters were measured:

- The proximal pubo-urethral distance was measured at rest and during straining. Measurements greater than 10 mm are indicative of bladder neck hypermobility.
- The posterior urethro-vesical angle 'β-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.
- The angle of urethral inclination 'α-angle; (60-110º)', also called the urethropelvic angle, formed by the urethral axis and the central line of the symphysis pubis, was measured at rest and during straining. Urethral mobility is calculated as the angle during a valsalvamaneuver minus the angle at rest.
- The thickness of the bladder wall was measured at the dome of the urinary bladder.The urethral diameter measurement was performed inside the lumen of the two internal mucous membranes only at rest images. A urethral diameter greater than 6 mm suggests intrinsic sphincter deficiency (ISD).
- At rest and on straining images to obtain maximum descent, the position of the bladder neck, and the leading edge of a cystocele were determined relative to the infero-posterior margin of the symphysis pubis.

Sample size justification Sample size was calculated using Epi Info® version 6.0, setting the power (β) at 80% and the significance level (α) at 0.05. Data from a previous study showed that the mean posterior urethro-vesical angle was 120º±8º and 100º±8º during valsalva in women with SUI and control women, respectively. Calculations according to this value produce a minimal sample size of 40 women in each

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group. Statistical methods Statistical analysis was performed using SPSS for Windows version .0. Data were presented as range, mean±standard deviation (for numeric metric variables); range and median (for numeric discrete variables); or number (percentage) for categorical variables. Difference between women of the same group was analyzed using the paired student's t-test. Difference between women of two different groups was analysed using the unpaired student's t-test. Significance level was set at 0.05.

RESULTS

The study included 40 females having stress urinary incontinence and another 40 females as their controls. The mean age of cases was 46.1±8.06 years, while that of controls was 43.2±5.39 years (p=0.062). Whereas, bodycompared to controls 21.83±5.47 kg/m2 (p=0.535). The median parity of included 40 women with uSUI was 3 (range: 1 - 5); of them 28 (70%) of them delivered vaginally. All included women of the control group were nulliparous. On analysing the transperineal ultrasound findings, no statistical significant difference found between cases and controls at rest, but on straining, statistical significant difference was found regarding dynamic posterior urethral angle and dynamic pubo-urethral distance. with uSUI Table 2. No significant difference was found in resting and straining phases for any of the measured parameters in the control cases.Of the included 40 cases with uSUI, 27 (67.5%) had cysto-urethrocele, and 5 (12.5%) had ISD. Urethral diameter was significantly different in patients with ISD (6.64±1.23 mm) when compared with patients with uSUI without ISD (4.83±1.16 mm) (p=0.03). Figure 1 illustrates a case with ISD and Figures 2 and 3 illustrate a case with SUI.

Table 1: Comparison of trans perineal ultrasound findings in the studied groups.

	Case group (n=40)	Control group (n=40)	p
Bladder wall thickness (mm)	**3.35±1.**	**3.91±1.7**	**0.084**
Urethral diameter (mm)	**4.93±1.32**	**4.49±1.28**	**0.134**
Dynamic posterior urethral angle [β-angle] (degree)0	**185.6±21.7**	**101.7± 21.2**	**< 0.001**
Dynamic angle of urethral inclination [α-angle] (degree)	**119.1±24.3**	**111.8±13.6**	**0.101**
Dynamic pubo urethral distance (mm)	**38.3±5.89**	**26.6±11.4**	**< 0.001**

Data presented as mean±SD; *Analysis using unpaired student's t-test.

Table 2: Transperineal ultrasound dynamic findings among cases with stress incontinence.

	On Straining	On Rest	n*
Dynamic posterior urethral angle [β-angle] (degree)	**185.6±21.7**	**117.4±18.43**	**< 0.001**
Dynamic angle of urethral inclination [α angle] (degree)	**119.1±24.3**	**69.73±12.1**	**< 0.001**
Dynamic pubo urethral distance (mm)	**38.3±5.89**	**18.2±2.29**	**< 0.001**

Data presented as mean±SD; *Analysis using paired student's t test.

DISCUSSION

Urinary incontinence is a bothersome condition for many women; with an overall prevalence of approximately 40%.2 Several imaging techniques may be used to supplement physical examination findings in patients with suspected pelvic floor dysfunction. Bladder neck mobility is essential for the assessment of patients with UI. Modalities used for the assessment of bladder neck mobility as urodynamic study or MRI are considered expensive and might be inconvenient to patients. That is why ultrasonography should be an essential modality in lower urinary tract assessment in patients complaining of UI.10 Together with history, clinical examination and urodynamic; it has been shown to improve the accuracy of the diagnosis of the functional and morphological disorder. The current study was designed to evaluate TP ultrasound findings in females with SUI. The study included 40 females having stress urinary incontinence and another 40 females as their controls. The mean age of cases was 46.1±8.06 years, while that of controls was 43.2±5.39 years. The coordinate system described by Schaer et al was used for its easy repeatability. Measurements are repeated till adequate strain is maintained.

Vertical component of bladder neck mobility was measured in 297 patients where mobility >10 mm was found in 97.1%, whereas mean mobility of 3.2 mm was measured in control subjects. Demirci and Fine compared the vertical component of bladder neck mobility in control and SUI subjects and reported it to be similar at rest but differ significantly on stress. Similar results were reported by other studies.TP ultrasonography showed significant difference between controls and incontinent women regarding alpha, beta angles and bladder neck descent during

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valsalva. 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. On analyzing the TP U/S findings in the current study, no statistical significant difference between cases and controls at rest, but on straining, the dynamic pubo urethral distance (reflecting bladder neck descent) was significantly different between patients with stress urinary incontinence and the control group ($p = 0.04$).The dynamic posterior urethral angle (reflecting urethral mobility) was also significantly different between patients with SUI (185.6 ± 21.7^{o}) and control group (101.7 ± 21.2^{o}) $p<0.001$).There was no significant difference in the dynamic angle of urethral inclination between patients with SUI and control group, yet, the angle of urethral inclinationdiffered significantly in resting and straining phases in SUI patients ($p<0.001$) There was also significant difference in both the posterior urethral angle($p<0.001$)and the proximal pubo-urethral distance ($p<0.001$). during resting and straining phases in patients with SUI. Urethral hypermobility results from weakening of urethra supporting structures leading to down-ward displacement and rotation of the urethra. Intrinsic sphincter deficiency, results from inadequate coaptation and compression due to loss of muscle strength and volume. In intrinsic sphincter deficiency, there is malfunction of the sphincter itself, which leads to an open vesical neck at rest and a low Valsalva leak point pressure.Of the included cases with SUI, 67.5% were found to have cysto-urethrocele, and 12.5% were found to have ISD. Urethral diameter was significantly different in patients with ISD (6.64 ± 1.23 mm) when compared with patients with SUI without ISD (4.83 ± 1.16 mm) ($p = 0.03$). Oliveira et al found significantly wider urethral diameters in SUI subjects with ISD than those without or control subjects (6.38 mm, 4.91 mm and 4.69 mm respectively).Ultrasonography agreed with urodynamic study in the diagnosis of 100% of ISD patients, 66.75% urethral hyper mobility cases, and 71.5% of subjects having both conditions.

CONCLUSION

TP ultrasonography seems to be a simple, easy and non invasive diagnostic tool for the workup of SUI. It showed in this study that the increase in beta and alpha angles (denoting urethral hyper mobility) and the increase of pubo-urethral distance (bladder neck descent) are the main morphological features of SUI. TP ultrasonography seems to be a good diagnostic option for the evaluation of lower urinary tract morphology, and with the introduction of new modalities of software like 3/4 dimensional ultrasonography together with the increased training availability. The acceptance of TP ultrasonography as a standard diagnostic option for SUI seems to be likely.

REFERENCE

1. Novara G, Artibani W. Imaging for urinary incontinence: a contemporary perspective. CurrOpin Urol. 2006;16(4):219-23.
2. McNanley AR, Duecy EE, Buchsbaum GM. Symptom-based, clinical, and urodynamic diagnoses of urinary incontinence: how well do they correlate in postmenopausal women? Female Pelvic Med Reconstr Surg. 2010;16(2):97-101.
3. Abrams P, Blaivas JG, Stanton SL, Andersen JT. The standardization of terminology of lower urinary tract function. The International Continence Society Committee on Standardisation of Terminology. Scand J UrolNephrol Suppl. 1988;114:5-19.
4. Sendag F, Vidinli H, Kazandi M, Itil IM, Askar N, Vidinli B. Role of perineal sonography in the evaluation of patients with stress urinary incontinence. Aust N Z J ObstetGynaecol. 2003;43(1):54-7.
5. Hajebrahimi S, Azaripour A, Sadeghi-Bazargani H. Clinical and transperineal ultrasound findings in females with stress urinary incontinence versus normal controls. Pak J Biol Sci. 2009;12(21):1434-7.
6. Dietz HP, Steensma AB, Vancaillie TG. Levator function in nulliparous women. IntUrogynecol J Pelvic Floor Dysfunct. 2003;14(1):24-6.
7. Dietz HP. Ultrasound imaging of the pelvic floor. Part I: two-dimensional aspects. Ultrasound Obstet Gynecol. 2004;23(1):80-92.
8. Wahba MH, Abdelsayed RF, Mahmoud AAS. The Functional role of transperineal ultrasound in the evaluation of females with urinary incontinence compared to urodynamic studies. Med J Cairo Univ. 2014;8(2):231-7.
9. Dalpiaz O, Curti P. Role of perineal ultrasound in the evaluation of urinary stress incontinence and pelvic organ prolapse: a systematic review. NeurourolUrodyn. 2006;25(4):301-6.
10. Oliveira FR, Ramos JG, Martins-Costa S. Translabial ultrasonography in the assessment of urethral diameter and intrinsic urethral sphincter deficiency. J Ultrasound Med. 2006;25(9):1153-8.
11. Demirci F, Fine PM. Ultrasonography in stress urinary incontinence. IntUrogynecol J Pelvic Floor Dysfunct. 1996;7(3):125-32.