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FEMALE UROLOGY
Original Article

Comparison of translabial ultrasonographic and urodynamic data of female patients with urinary incontinence: Importance of translabial ultrasonography in the diagnosis of incontinence

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ABSTRACT

Objective: To explore the diagnostic importance of translabial ultrasonographic data in incontinence, for comparison with urodynamic data.

Material and methods: The study was performed between January and May 2017 on 64 patients aged between 40 and 65 years with complaints of mixed type incontinence. The patients were separated into two groups according to their urodynamic data. Translabial ultrasonography was performed in both groups.

Results: Mean age of the patients was 51.19±7.01 years, and mean body mass index was 26.69±2.02 kg/m^2. The patients were separated into two groups as those with (n=33) or without (n=31) stress urinary incontinence based on urodynamic findings (despite the presence of mixed urinary incontinence complaints, stress urinary incontinence and detrusor overactivity associated with incontinence could not be detected in the urodynamic study). Average x descend, y descend and bladder neck mobilization values detected with translabial ultrasonography were found to be statistically significantly higher in the urodynamic stress incontinence group. There was an opposite-directional, 37.6% and statistically significant relation between maximum cystometric capacity and x descend parameters. Y descend values and bladder neck mobilization of females with negative Q-tip test were found to be statistically significantly lower than females with positive Q-tip test.

Conclusion: As a complementary examination tool in the evaluation of urinary incontinence translabial ultrasonography may become one of the main diagnostic evaluation tools in the future.

Keywords: Bladder neck mobilization; mixed urinary incontinence; stress urinary incontinence; translabial ultrasonography; urodynamics.

Introduction

The prevalence of urinary incontinence (UI) among women ranges from 16.1% to 68.8%.[1] Specifically, the prevalence of UI ranges from 20.5% to 68.8% among females 15 years of age, and 2/3 among menopausal and postmenopausal women.[2] The main types of UI include stress UI (SUI), urge, and mixed UI (MUI). SUI occurs when the bladder neck and proximal urethra fail to provide adequate support under increased intraabdominal pressure due to urethral hypermobility and/or insufficient intrinsic sphincter.[3] Incorrect diagnosis, and the inability to distinguish between UI subtypes are most important reasons for the failure of UI treatment. The error margin for easily applicable diagnostic tools, such as medical history review, physical examination, urinalysis, and Q-tip test, is quite high. Thus, highly sensitive and specific tools are critically needed for the correct diagnosis of UI.[4] Among UI diagnostic tools, urodynamic study (UDS) provides the highest sensitivity and specificity. UDS, however, is an invasive procedure that cannot be performed under polyclinic conditions. Moreover, UDS requires specially-trained auxiliary staff, such as urodynamics technicians. Translabial ultrasonography (US) is a diagnostic tool that can be used to evaluate the pelvic floor anatomy of

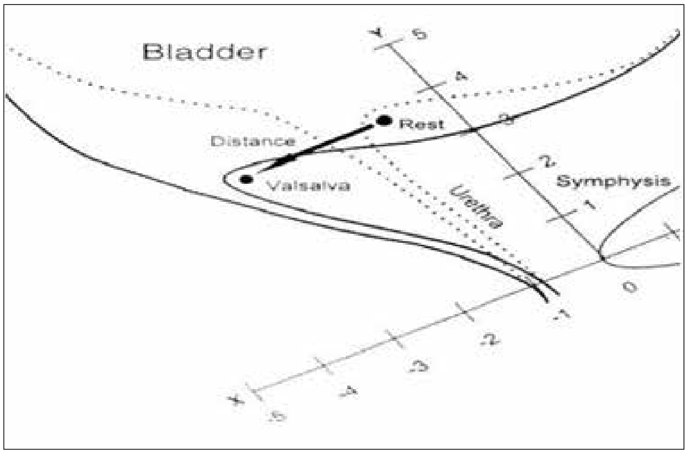

Figure 1. The coordinate system standardized by Schaer et al.[6] for bladder neck localization and measurements, bladder neck x axis (ventrodorsal) and y axis (cephalocaudal) and vectoral movements were calculated in translabial US

the patient. Moreover, it is an affordable, easily applied, comfortable, and noninvasive test. UDS is planned for patients with UI to aid diagnosis and treatment after review of the medical history and physical examination. Moreover, it can be applied with translabial US. In this study, we investigated the effectiveness of translabial US in the diagnosis of UI.

Material and methods

We initially screened 161 patients with complaints of incontinence who were referred to our center between January to May 2017. The patients' medical histories were recorded, and then physical examination, routine urinalysis, stress test, and biochemical examinations were performed. The patients were asked to complete a validated questionnaire (ICIQ-SF), and to keep a bladder diary as well. If required, the patients underwent urinary system imaging. Patients were excluded if they have been diagnosed with neurological and/or psychiatric disease; senile dementia and mental cognitive disorders; diabetes mellitus; or severe cardiac, lung, liver and kidney dysfunctions. Patients with a present or past history of any previous medical or surgical treatment for UI; ultrasonographically detected vesical/supravesical pathology; body mass index (BMI) of ≥30 kg/m^2; urodynamically detected detrusor overactivity (DO); pelvic organ prolapsus (according to the POP-Q classification, grades 2, 3 and 4), and any known gynecological surgical procedure (such as a hysterectomy). As a result, 64 volunteers aged 40 to 65 who fulfilled the inclusion criteria and diagnosed with MUI on the basis of dominant complaints and responses to validated questionnaire were included in this study.

Age, complaints, physical examination findings, stress test results, urodynamic findings, (+) or (–) result for Q-tip test, and UDS and translabial US parameters of all participants were recorded.

Patients were separated into groups with (USUI) and without (UNI) urodynamic stress incontinence groups. Despite complaints of MUI, SUI and DOI were not detected using UDS in any patient. Given the lack of a clear definition for this group in the International Continence Society (ICS) terminology, we used the term "no incontinence" that Brucker et al.[5] used for the same group in their study. The USUI and UNI groups comprised 33 and 31 patients, respectively.

All patients underwent translabial US. The procedure was performed by a senior uroradiologist. A 3.5 mHz US probe was used with the patient in the lithotomy position and residual urine of approximately 50-100 mL using the coordinate system standardized by Schaer et al.[6] for bladder neck localization and measurements, bladder neck x-axis (ventrodorsal) and y-axis (cephalocaudal), and vectoral movements were calculated using translabial US (Figure 1). Bladder neck-symphysis-pubis distance was measured. A minimum of three Valsalva maneuvers were performed, and the measurements made during Valsalva maneuvers yielding the highest values for bladder neck and posterior urethral descent were used. Urethral length was quantified by measuring the distance between the external urethral meatus, and bladder neck along the median sagittal plane during rest and maximum Valsalva maneuvers. Urethral diameter was measured as the luminal distance between two urethral mucous membranes during rest. Rhabdosphincter thickness was calculated by measuring the urethral striated muscle thickness in the median urethra along the sagittal plane. Bladder wall thickness was quantified by measuring the hypoechoically visible part of the whole wall thickness from the trigonal area. All these parameters were compared between the two groups.

Institutional review board (IRB) approval was acquired from our university's ethics committee in Istanbul, Turkey with the IRB number of "FSM EAH KAEK 2016/55." Informed consent was obtained from all study participants.

Statistical analysis

The study was planned as a prospective study. IBM Statistical Package for the Social Sciences Statistics 22 (IBM SPSS Corp.; Armonk, NY, USA) program was used for statistical analyses. The compatibility of the parameters with the normal ranges was evaluated with Shapiro-Wilks test. Along with definitive statistical methods (average, standard deviation), Student's *t*-test was used to compare two groups of normally distributed quantitative data, and Mann-Whitney U test for the comparison between two groups with parametres without normal distribution. Paired sample *t*-test was used to compare normally distributed parameters, and Wilcoxon sign test to compare parameters without nor-

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mal distribution in the same group. Pearson correlation analysis was used to analyze relationships between normally distributed parameters. Statistical significance was evaluated at p<0.05.

Results

The study included 64 females aged 40 to 64. The patients had a mean age of 51.19±7.01 and mean BMI of 26.69±2.02 kg/m^2. The patients were separated into the USUI and UNI groups in accordance with their urodynamics findings. The USUI and UNI groups comprised 33 and 31 patients, respectively (Table 1).

The UDS-related PMR, MCC and Valsalva leak point pressure (VLPP) parameters, and Q-tip test results of the groups are presented in Table 2.

Comparing the UDS-related PMR, MCC and VLPP parameters, and Q-tip test results revealed that PMR and MCC parameters were not significantly different between groups (p>0.05). The Q-tip positivity ratio of the patients in USUI group (72.7%) was significantly higher than that of the UNI group (38.7%) (p=0.013; p<0.05).

Comparative values for ultrasonographic data for x-and y-axis descent averages, bladder neck mobilization, bladder neck-symphysis-pubis distance, trigonal thickness, rhabdosphincter thickness, urethral diameter, urethral length, and vaginal wall thickness are presented in Table 3. The x-axis descent averages of the USUI group were significantly higher than those of the UNI group (p=0.001; p<0.05). The y-axis descent averages of the USUI group were significantly higher than those of the UNI

Table 1. Distribution of demographic data

		Min-Max	Mean±SD
USUI (n=33)	Age (year)	41-64	50.85±6.52
	BMI (kg/m2)	23-29.8	26.91±2.05
	Parity	0-6	2.79±1.22
	Gravidity	1-6	3.36±1.29
	Duration of complaint (year)	1-10	2.85±1.94
	Menopause (year) (n=17)	0.5-8	2.62±2.09
	Menopause n, %		
	Yes	17	51.5
	No	16	48.5
UNI (n=31)	Age (year)	40-64	51.55±7.58
	BMI (kg/m^2)	23.2-29.8	26.46±1.99
	Parity	0-5	2.48±1.06
	Gravidity	0-6	3.23±1.38
	Duration of complaint (year)	1-8	3±1.67
	Menopause (year) (n=17)	0.5-12	3.82±3.32
	Menopause n, %		
	Yes	17	54.8
	No	14	45.2
Total (n=64)	Age (year)	40-64	51.19±7.01
	BMI (kg/m^2)	23-29.8	26.69±2.02
	Parity	0-6	2.64±1.15
	Gravidity	0-6	3.3±1.33
	Duration of complaint (year)	1-10	2.92±1.8
	Menopause (year) (n=34)	0.5-12	3.22±2.8
	Menopause n, %		
	Yes	34	53.1
	No	30	46.9

USUI: urodynamic stress urinary incontinence; UNI: urodynamic no incontinence; BMI: body mass index; Min: minimum; Max: maximum; SD: standard deviation group (p=0.047; p<0.05). The bladder neck descent averages of the USUI group were significantly higher than those of the UNI group (p=0.001; p<0.05). The bladder neck-symphysis-pubis distance averages of the USUI group were significantly higher than those of the UNI group (p=0.001; p<0.05). The trigonal thickness averages of the USUI group were significantly higher than those of the UNI group (p=0.029; p<0.05). The mean urethral diameters of the USUI group were significantly higher than those of the UNI group (p=0.048; p<0.05).

Table 2. Distribution of urodynamic data in groups

	Urodynamic parameters	Min-Max	Mean±SD
USUI (n=33)	PMR (mL)	5-45	15.76±9.77
	MCC (mL)	200-650	472.73±99.54
	VLPP (cmH_2O)	36-152	97.39±28.89
	VLPP n, %		
	Low	13	39.4
	High	20	60.6
	Q-tip test n, %		
	Negative	9	27.3
	Positive	24	72.7
UNI (n=31)	**PMR (mL)**	5-50	18.71±12.65
	MCC (mL)	240-600	439.68±102.26
	Q-tip test n, %		
	Negative	19	61.3
	Positive	12	38.7

USUI: urodynamic stress urinary incontinence; UNI: urodynamic no incontinence; Min: minimum; Max: maximum; SD: standard deviation; PMR: post micturition residue; MCC: maximum csytometric capacity; VLPP: Valsalva leak point pressure

A difference of 37.6% and statistically significant correlation existed between MCC, and x-axis descent parameters (p=0.031; p<0.05) (Table 4).

The UDS and US parameters of the UNI group were not correlated (Table 5).

Evaluation of US parameters related to Q-tip test results did not reveal any significant difference in x-axis descent values among Q-tip − and + females (p>0.05). The y-descent values of Q-tip − patients were significantly lower than those of Q-tip + patients (p=0.014; p<0.05). The bladder neck mobilization values of Q-tip − patients were significantly lower than those of Q-tip + patients (p=0.049; p<0.05). The trigonal thickness of Q-tip − patients were significantly lower than those of Q-tip + patients (p=0.020; p<0.05). The parameters of the UNI group were not significantly different.

Discussion

Urinary incontinence can be permanent or temporary in accordance with its etiological and pathophysiological characteristics. Temporary UI is due to etiological factors, such as delirium, infection, atrophic vaginitis, urethritis, pharmacological agents, psychological problems, pollakiuria, limited mobility, and constipation. Temporary UI can recover spontaneously after the underlying problem is solved.[7] Permanent UI does not recover spontaneously and has five subtypes: SUI, urgent urinary incontinence, MUI, overflow, and functional UI.[8]

Current methods for UI diagnosis include medical history review, physical examination (stress and Q-tip tests), 24 h pad test, urinalysis, and PMR measurements using US. Patients are also diagnosed with UI on the basis of their responses to

Table 3. Distribution and evaluation of US parameters between groups

US parameters	USUI Mean±SD (Min-Max)	UNI Mean±SD (Min-Max)	p
x descend (mm)	15.52±7.56 (0-31)	7.42±5.67 (1-24)	0.001*
y descend (mm)	8.58±4.3 (3-19)	6.35±4.45 (0-17)	0.047*
Bladder neck mobilization (mm)	18.24±7.4 (4-36.3)	10.44±6.12 (2-29.4)	0.001*
Bladder neck symphysis pubis distance (mm)	5.33±7.77 (-10-17)	-0.68±3.58 (-7-6)	0.001*
Trigonal thickness (mm)	6.24±0.83 (4.4-7.4)	5.78±0.79 (4-7.1)	0.029*
Rhabdosphincter thickness (mm)	5.43±0.73 (3.6-7)	5.55±0.82 (4-7.3)	0.524
Urethral diameter (mm)	7.21±1.58 (4.3-10)	6.44±1.5 (3.7-9.7)	0.048*
Urethral length (mm)	31.55±4.32 (22-42)	30.23±3.6 (24-37)	0.191
Vaginal wall thickness (mm)	4.82±0.99 (3.2-8)	4.95±0.96 (3-6.5)	0.594

Student t Test, *p<0.05. USUI: urodynamic stress urinary incontinence; UNI: urodynamic no incontinence; Min: minimum; Max: maximum; SD: standard deviation; US: ultrasonography

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validated questionnaires (ICIQ-SF and IIQ) and information provided through a bladder diary covering 3 days.

The UI 2017 European Association of Urology guideline does not recommend routine UDS. The same guideline recommends the use of urethral pressure profile and incontinence point pressures for evaluating severity of incontinence or treatment success.[9] Although UDS decreases the likelihood of diagnosing DO and sphincter deficiencies and increases the likelihood of diagnosing urinary dysfunction, it does not change the diagnosis of SUI. Globally, in one study UDS caused modification of the treatment, and procedure, and also cancellation of the surgical treatment plan in 14, 5.4, and 1.4% of the cases respectively [10] UDS improves the confidence of the operator during the decision-making stage.[10] Based on a meta-analysis of 368 articles, Rachaneni et al.[12] stated that urinary dysfunction in SUI or stress-induced MUI can be excluded only through uroflowmetry and invasive UDS.

The symphysis pubis, bladder, vesicoureteral junction, proximal urethra, and other pelvic organs can be visualized without urethral catheterization through translabial US. This method provides the advantages of bladder neck immobilization during Valsalva manoeuvre, the mobilization of the bladder neck, and the topographic representation of anatomical structures. The use of translabial US to evaluate bladder neck position and mobility in females with UI, prolapsus, or defecation disorders has become increasingly popular given its high confidence level.[13] Moreover, this method allows for the measurement of urethral length, urethral diameter, rhabdosphincter thickness, BWT, and trigonal thickness. Translabial US can also be used not only for the diagnosis of UI but also for posttreatment follow-up.[14]

Schaer et al.[6] standardized a coordinate system for the localization and measurement of the bladder neck. In this system, bladder neck mobility is determined by calculating the cephalocaudal and ventrodorsal movement of the bladder neck and the vector length between these two positions. In translabial US, the bladder neck is located in a relatively lower position during rest, and a descent of 1 cm or more during straining is used as a criterion for bladder neck hypermobility in SUI.[15] Posteroinferior rotation of the bladder neck and proximal urethra, and widening of the rotation angle also constitute characteristic diagnostic parameters.

Stress UI and midurethral hypermobility are strongly related.[4] Johnson et al.[16] explored the correlation between incontinence and the vertical component of bladder neck movement in 297 patients. They found that this movement exceeds 10 mm in patients with SUIC and 3.2 mm in the control group.

Table 4. Evaluation of the correlation between urodynamic and US parameters in the USUI group

Group			PMR (mL)	MCC	VLPP (cmH_2O)
USUI (n=33)	x descend	r	0.333	-0.376	-0.118
		p	0.058	0.031*	0.513
	y descend	r	-0.107	0.083	-0.036
		p	0.552	0.646	0.842
	Bladder neck mobilization	r	0.247	-0.312	-0.128
		p	0.166	0.077	0.479
	Bladder neck symphysis pubis distance	r	0.282	-0.086	-0.138
		p	0.111	0.634	0.443
	Trigonal thickness	r	0.138	-0.015	-0.169
		p	0.444	0.936	0.347
	Rhabdosphincter thickness	r	0.143	-0.075	-0,02
		p	0.426	0.677	0.912
	Urethral diameter	r	0.194	0.290	0.102
		p	0.280	0.101	0.572
	Urethral length	r	-0.277	-0.269	-0.051
		p	0.119	0.130	0.780
	Vaginal wall thickness	r	0.126	0.150	-0.073
		p	0.484	0.406	0.688

Pearson correlation analysis, *p<0.05. PMR: post micturition residue; MCC: maximum csytometric capacity; VLPP: Valsalva leak point pressure; USUI: urodynamic stress urinary incontinence

Demirci et al.[17] reported similar results when they evaluated the correlation between the vertical movement of the bladder neck and perineal muscles on US. Yalcin et al.[18] and Sendag et al.[19] emphasized the correlation between SUI and the vertical movement of the bladder neck. Another study exploring the place of translabial US in the diagnosis of SUI evaluated bladder neck mobilization (3 cm or more), urethral rotation, and retrovesical angle in 209 patients. This study showed that maximal urethral closure pressure, and bladder neck descent are significantly correlated.[20] In the present study, we found that the x-axis (ventrodorsal) descent averages of the USUI group were significantly higher than those of the UNI group. Moreover, the y-axis (cephalocaudal) descent averages of the USUI group were significantly higher than those of the UNI group. Furthermore, we found that the bladder neck mobilization averages of the USUI group were significantly higher than those of the UNI group. The bladder neck-symphysis-pubis distance averages of the USUI group were significantly higher than those of the UNI group. The results of our study showed that USUI is correlated with the vertical and horizontal axis movement of the bladder neck. We did not detect a cut-off value for the x-and y-axes. Bladder neck mobility was measured on the basis of x-and y-axis descent and the bladder neck mobility = $\sqrt{(\Delta Dx)^2 + (\Delta Dy)^2}$] formula and it was 18.24 mm in the USUI, and 10.44 mm in the UNI groups. Selection criteria of participants in our study were more stringent because we took the age and BMI of the patients into consideration. For example, in one study, the age and BMIs of the patients varied between 18-86 years and 17.3-50.1 kg/m^2, respectively. In our study, the age and BMIs of the patients changed between 40-64 years and 23-29.9 17.3-50.1 kg/m^2, respectively.

Table 5. Evaluation of the correlation between urodynamic and US parameters in the UNI group

Group			PMR (mL)	MCC (mL)
UNI (n=31)	x descend	r	0.015	-0.135
		p	0.937	0.468
	y descend	r	0.18	-0.142
		p	0.333	0.447
	Bladder neck mobilization	r	0.112	-0.193
		p	0.549	0.299
	Bladder neck symphysis pubis distance	r	-0.049	0.039
		p	0.792	0.833
	Trigonal thickness	r	0.038	-0.166
		p	0,84	0.373
	Rhabdosphincter thickness	r	-0.136	-0.079
		p	0.464	0.672
	Urethral diameter	r	0.188	-0.281
		p	0.311	0.125
	Urethral length	r	-0.114	-0.070
		p	0.541	0.707
	Vagina wall thickness	r	-0.001	-0.099
		p	0.995	0.598

Pearson correlation analysis, *p<0.05. PMR: post micturition residue; MCC: maximum csytometric capacity; UNI: urodynamic no incontinence

A review of studies conducted over the period between 1990 and 2012 revealed that bladder wall thickness (BWT) measured using three-dimensional US was correlated with urodynamic DO.[21] Given that we did not include a DO group, not BWTs of all patients were measured, and only thickness of the trigone was checked. We suggest that higher trigonal thickness in the USUI group relative to the UNI group may be attributed to the smooth muscle structure of the internal sphincter and the reflexive hypertrophy of its extension to the trigone.

The Q-tip test shows urethral hypermobility. Nevertheless, this test has low reliability.[22] In our study, the rate of Q-tip test positivity in the USUI group (72.7%) was significantly higher than that of the UNI group (38.7%). The rate of Q-tip test positivity remained at 72.7% even in USUI group. Our results showed that the values of y-axis descent and bladder neck mobilization detected using translabial US are more reliable for the establishment of the diagnosis of SUI than those detected using the Q-tip test.

Filling cystometry and pressure flow studies are applied in SUI patients for whom conservative treatments have failed and surgical treatment is planned. The principle behind these applications is to rule out the presence of DOI, which cannot be detected clinically, and the possible obstruction of the bladder outlet.[23] In 2009, ICS released the Joint Report on the Terminology for Female Pelvic Floor Dysfunction where they used the novel term insensible UI (II) to describe "the complaint of urinary incontinence where the woman has been unaware of how it occurred."[24] II is distinct from continuous UI or the continuous involuntary loss of urine and cannot be observed through physical examination. Moreover, II symptoms often coexist with SUI or UUI symptoms. Brucker et al.[5] reported that the prevalence of SUI was 52%. For these reasons, UDS would be beneficial in patients with SUI.

In urology practice, similar to the insensible incontinence group of patients described in the literature, patients with complaints of MUI constitute a challenging group to evaluate and diagnose. In our study, SUI was detected in approximately 51.5% of the patients with complaints of MUI, and SUI or DOI was not detected in the remaining 48.5% of the patients. We based our study on the following questions: 1) Do patients who present with complaints of

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MUI have USUI and/or DOI? 2) What type of incontinence is dominant? 3) As an alternative to the invasive UDS test, can the noninvasive translabial US test be used to diagnose USUI or DOI among patients who present with complaints of MUI?

This study is limited by its small sample size. However, we screened the large pool of potential participants by using the exclusion criteria detailed in the Materials and Methods section. We selected a refined group of patients aged 40-64 years, and with BMIs of 23-29.9 kg/m^2 who exhibited MUI, those with severely deteriorated quality of life in accordance with the ICIQ-SF scale scores, and UI treatment-naive people without any comorbidity. Thus, we excluded variables that might affect the study results.

Translabial US should be provided as a complementary examination for evaluation of UI given its potential as a major evaluation tool. It has become highly popular among professionals given its characteristics of easy manageability, affordability, comfort, applicability in polyclinic conditions, and low complication risk. Moreover, it does not require ionizing radiation. The visualization of bladder/urethral anatomy with translabial US is a promising development for the future.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Fatih Sultan Mehmet Training and Research Hospital (FSM EAH KAEK 2016/55).

Informed Consent: Written informed consent was obtained from all participants who participated in this study.

Peer-review: Externally peer-reviewed.

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References

1. Cerruto M, D'Elia C, Aloisi A, Fabrello M, Artibani W. Prevalence, incidence and obstetric factors' impact on female urinary incontinence in Europe: a systematic review. Urol Int 2012;3:1-9. [CrossRef]
2. Topazio L, Frey J, Iacovelli V, Perugia C, Vespasiani G, Finazzi Agrò E. Prevalence of "complicated" stress urinary incontinence in female patients: can urodynamics provide more information in such patients? Int Urogynecol J 2015;26:1333-9.
3. Gary E. Lemack, Jennifer Tash Anger. Urinary Incontinence and Pelvic Prolapse: Epidemiology and Pathophysiology. Campbell-Walsh Urology, 11. edition. Philadelphia. 2016;74:1743-60.
4. Pirpiris A, Shek KL, Dietz HP. Urethral mobility and urinary incontinence. Ultrasound Obstet Gynecol 2010;36:507-11. [CrossRef]
5. Brucker BM, Fong E, Kaefer D. Urodynamic findings in women with insensible incontinence. Int J Urol 2013;20:429-33. [CrossRef]
6. Schaer GN, Koechli OR, Schuessler B, Haller U. Perineal ultrasound for evaluating the bladder neck in urinary stress incontinence. Obstet Gynaecol 1995;85:220-4. [CrossRef]
7. Dowling-Castronovo A, Specht JK. How to try this: Assessment of transient urinary incontinence in older adults. Am J Nurs. 2009;109:62-71. [CrossRef]
8. Khandelwal C, Kistler C. Diagnosis of urinary incontinence. Am Fam Physician 2013;87:543-50.
9. Burkhard FC, Bosch JLHR, Cruz F, Lemack GE, Nambiar AK, Thiruchelvam N, et al. EAU Guidelines on Urinary Incontinence in Adults. 2017.
10. Lapitan MC, Omar MI, Glazener CM. Urodynamic studies for management of urinary incontinence in children and adults. Cochrane Database Syst Rev 2013;29:10.
11. Zimmern P, Litman H, Nager C, Sirls L, Kraus SR, Kenton K, et al. Urinary Incontinence Treatment Network. Pre-operative urodynamics in women with stress urinary incontinence increases physician confidence, but does not improve outcomes. Neurourol Urodyn 2014;33:302-6. [CrossRef]
12. Rachaneni S, Latthe P. Does preoperative urodynamics improve outcomes for women undergoing surgery for stress urinary incontinence? A systematic review and meta-analysis. BJOG 2015;122:8-16. [CrossRef]
13. Dietz HP. Pelvic floor ultrasound in incontinence: what's in it for the surgeon? Int Urogynecol J 2011;22:1085-97.
14. Tunitsky-Bitton E, Unger CA, Barber MD, Goldman HB, Walters MD. Ultrasound Evaluation of Midurethral Sling Position and Correlation to Physical Examination andPatient Symptoms. Female Pelvic Med Reconstr Surg 2015;21:263-8. [CrossRef]
15. Hol M, van Bolhuis C, Vierhout ME. Vaginal ultrasound studies of bladder neck mobility. Br J Obstet Gynaecol 1995;102:47-53. [CrossRef]
16. Johnson JD, Lamensdorf H, Hollander IN, Thurman AE. Use of transvaginal endosonography in the evaluation of women with stress urinary incontinence. J Urol 1992;147:421-5. [CrossRef]
17. Demirci F, Fine PM. Ultrasonography in stress urinary incontinence. Int Urogynecol J Pelvic Floor Dysfunct 1996;7:125-32. [CrossRef]
18. Yalcin OT, Hassa H, Ozalp S. Effectiveness of ultrasonographic parameters for documenting the severity of anatomic stress incontinence. Acta Obstet Gynecol Scand 2000;79:421-6. [CrossRef]
19. Sendag F, Vidinil H, Kazandi M. Role of perineal sonography in the evaluation of patients with stress urinary incontinence. Aust NZ J Obstet Gynaecol 2003;43:54-7. [CrossRef]
20. Dietz HP, Nazemian K, Shek KL, Martin A. Can urodynamic stress incontinence be diagnosed by ultrasound? Int Urogynecol J 2013;24:1399-403.
21. Oelke M, Khullar V, Wijkstra H. Review on ultrasound measurement of bladder or detrusor wall thickness in women: techniques, diagnostic utility, and use in clinical trials. World J Urol 2013;31:1093-104. [CrossRef]

22. Caputo RM, Benson T. The Q-tip test and urethrovesical junction mobility. Obstet Gynecol 1993;82:892-6.
23. Cassadó Garriga J, Pessarrodona Isern A, Rodríguez Carballeira M, Pallarols Badia M, Moya Del Corral M, Valls Esteve M, et al. Three-dimensional translabial ultrasound assessment of urethral supports and the urethral sphincter complex in stress urinary incontinence. Neurourol Urodyn 2017;36:1839-45. [CrossRef]
24. Haylen BT, de Ridder D, Freeman RM, Swift SE, Berghmans B, Lee J, et al. An International Urogynecological Association (IUGA)/ International Continence Society (ICS) joint report on the terminology for female pelvic floor dysfunction. Neurourol Urodyn 2010;29:4-20.