



Review article

European Urogynaecological Association Position Statement: The role of urodynamics in stress urinary incontinence evaluation and treatment decision

Alessandro Ferdinando Ruffolo^{a,*}, Sofia Tsiapakidou^b, Yair Daykan^{c,d}, Stefano Salvatore^e, Stavros Athanasiou^f, Andrea Braga^g, Michele Meschia^h, Christian Phillipsⁱ, Maurizio Serati^{j,k}^a Department of Gynecology, Jeanne de Flandre University Hospital, Lille, France^b 1st Department of Obstetrics and Gynecology Aristotle University of Thessaloniki, "Papageorgiou" General Hospital, Thessaloniki, Greece^c Department of Obstetrics and Gynecology, Meir Medical Center, Kfar Saba, Israel^d School of Medicine, Faculty of Medical and Health Sciences, Tel Aviv University, Tel Aviv, Israel^e Obstetrics and Gynecology Unit, Vita-Salute University and IRCCS San Raffaele Hospital, Scientific Institute, Milan, Italy^f Urogynecology Unit, 1st Department of Obstetrics and Gynecology, National and Kapodistrian University of Athens, Athens, Greece^g Department of Obstetrics and Gynecology, EOC-Beata Vergine Hospital, 6850 Mendrisio, Switzerland^h Co-Chair of Scientific Committee of European Urogynaecological Association (EUGA)ⁱ Basingstoke and North Hampshire Hospital, Urogynaecology, Basingstoke, Hampshire, United Kingdom^j Department of Obstetrics and Gynecology, Del Ponte Hospital, University of Insubria, 21100 Varese, Italy^k President of European Urogynaecological Association (EUGA)

ARTICLE INFO

Keywords:

Urodynamics

Stress urinary incontinence

Incontinence surgery

Suburethral sling

ABSTRACT

Stress urinary incontinence (SUI) is defined as a condition characterized by the involuntary leakage of urine during activities that increase intra-abdominal pressure which may decrease quality of life with a significant economic impact on health systems, necessitating the implementation of cost-effective management plans. Urodynamics (UDS) has been considered during the last decades as the gold standard for assessment of lower urinary tract symptoms (LUTS) due to their high reproducibility. At the same time, concerns about the systematic use of UDS before SUI surgery were raised due to a limited evidenced base to recommend their routine use. In uncomplicated female patients with SUI, UDS can offer further insights into LUTS, potentially assisting the physician in determining the appropriate therapeutic approach. However, it has not been shown that preoperative UDS can directly impact the surgical outcome for continence. Indeed, evidence supports the conclusion that pre-operative UDS in women with uncomplicated, clinically demonstrable, SUI does not improve the outcome of surgery for SUI. Nevertheless, asymptomatic detrusor overactivity (DO) identified by urodynamic testing or pre-existing voiding dysfunction are associated with an increased occurrence of postoperative overactive bladder (OAB) and voiding dysfunction, respectively. The EUGA Working Group concluded that the evidence does not support the systematic preoperative use of UDS for uncomplicated cases. However, in cases where mixed symptoms, voiding dysfunction, previous surgery, or concomitant prolapse are present, preoperative UDS are advised as they can be beneficial in anticipating postoperative outcomes. This aids in conducting comprehensive and thorough preoperative counseling. The Group recommend performing preoperative UDS considering the patient's specific clinical situation and the surgeon's judgment, with consideration given to the potential benefits, risks, and impact on treatment decisions and patient outcomes.

Introduction

Stress urinary incontinence (SUI) is defined as a condition characterized by the involuntary leakage of urine during activities that increase

intra-abdominal pressure, such as coughing, sneezing, laughing, or exercising [1,2], that typically occurs due to weakened or damaged pelvic floor muscles and/or the sphincter mechanism that controls urine flow [2]. It is a common health condition, affecting 5 % up to 35 % of the

* Corresponding author.

E-mail addresses: alesruffolo@gmail.com, af.ruffolo@chu-lille.fr (A.F. Ruffolo).<https://doi.org/10.1016/j.ejogrb.2024.04.024>

Received 12 April 2024; Accepted 19 April 2024

Available online 21 April 2024

0301-2115/© 2024 Elsevier B.V. All rights reserved.

general female population [1], which may decrease quality of life [3] with a significant economic impact on health systems, necessitating the implementation of cost-effective management plans [4].

Fortunately, different treatment options are available to help manage SUI and to improve quality of life. These options include pelvic floor muscle exercises, behavioral modifications to modify confounding factors (weight reduction, smoking cessation, fluid intake management), pessaries, pharmacological treatments, and surgical intervention [5–7].

Primary assessment includes taking a thorough medical history, urinalysis, physical examination, assessment of urethral mobility, measurement of postvoid residual urine volume, and the demonstration of stress incontinence. A cough stress test (done in the lithotomy or standing position), performed with a full bladder, is highly suggestive of SUI (positive predictive value of 78 % to 97 %) [8]. A positive cough test is defined as any volume of observable loss of urine transurethraly with coughing or Valsalva maneuver.

In some cases, urodynamic (UDS) assessment is additionally needed. UDS refers to a set of diagnostic tests used to evaluate the function and performance of the lower urinary tract in order to characterize urinary incontinence subtypes, voiding and bladder function. Urodynamic assessment provides valuable information to understand how the bladder, urethra, and associated muscles work together to store and release urine during both the filling and emptying phases of bladder function and to identify the underlying causes of urinary symptoms, such as SUI, overactive bladder and voiding dysfunction. When performing standard urodynamic testing, the clinician should have a clear understanding of the indications for urodynamics and its results should contribute to therapeutic planning and counselling [9,10]. It can reveal other pathologies that can mimic SUI and should be treated differently.

In addition, SUI can be defined as “uncomplicated” or “index” and “complicated” [3,11]. The current definition of complicated SUI is still debated. The American College of Obstetrics and Gynecology (ACOG) defines complicated SUI as a condition of involuntary loss of urine on effort, physical exertion, sneezing, or coughing associated with symptoms of urgency, recurrent urinary tract infection (UTI), previous extensive or radical pelvic surgery, prior anti-incontinence or urethral procedure, voiding symptoms, neurologic disease, presence of vaginal bulging symptoms or pelvic organ prolapse (POP) [12]. A similar definition has been reported by the International Federation of Gynecology and Obstetrics (FIGO) working group on the “evaluation and surgery for stress urinary incontinence” [13], while the European Association of Urology (EAU) refers to complicated incontinence in case of patients with associated morbidity, a history of previous pelvic surgery, surgery for urinary incontinence, radiotherapy and women with associated POP [14]. This population of women complaining of SUI and referred as complicated represents around two-thirds of women affected by SUI addressed to surgical intervention [15]. In other words, characteristics of uncomplicated patients constitute those without the presence of voiding dysfunction symptoms, recurrent urinary tract infections, and no prior pelvic/incontinence surgery. Indeed, on clinical examination, uncomplicated patients are characterized by a predominance of SUI, post-voiding residue (PVR) less than 150 ml, negative urine culture, evidence of clinical urethral hypermobility, positive stress test, and maximum anterior or apical POP of less than 1 cm to the hymen.

The systematic or individual use of urodynamic evaluation in women affected by stress incontinence, such as its role in SUI management is still debated. For this reason, the European Urogynaecological Association (EUGA) created a Working Group on Urodynamics aiming to produce a position statement concerning the role of UDS in the evaluation and management of women affected by SUI.

Evidence acquisition process for the position statement

The authors of this position statement are urogynecologists and EUGA members with extensive clinical and academic experience in UDS. Three of the authors (AFR, ST, YD) performed independently the study

search for relevant high-impact publications on the topic. The other authors reviewed the selected articles and added additional publications, which they considered relevant. After reviewing the collected literature, the EUGA working group conferred on the significance of the available evidence for clinical practice and thus developed conclusions and recommendations, which are brought forward in this position statement. This position statement focuses on the clinical impact of urodynamic assessment in women affected by pure or prevalent SUI.

The role of urodynamics in stress urinary incontinence

UDS plays an important role in assessing and diagnosing SUI by providing valuable information about the functioning of the lower urinary tract (LUT) [16]. UDS studies help measure the maximum cystometric capacity and the pressure at a strong desire to void or identify any involuntary bladder contractions, detrusor overactivity (DO), provoked DO, which information can determine if the bladder is also overactive, contributing to SUI. Pressure flow study helps identify any weakness or abnormality in the urethral sphincter muscles, which may contribute to SUI as well as determine detrusor hypotonicity or bladder outlet obstruction. Cough stress test and / or pad test during UDS can help evaluate and determine the severity of SUI and whether surgical intervention may be necessary.

It is important to standardize UDS technique to ensure consistency and ensure results that are comparable across different healthcare settings and research studies. While there may be some variations in specific protocols and equipment used, there are some key elements of standardized UDS technique, including: 1. Patient preparation, pre-test frequency volume diaries, instructing the patient to arrive with a comfortably full bladder, and providing information about the procedure and expected sensations, 2. Standardized equipment and calibration procedures help ensure the accuracy and reliability of measurements, 3. Standard UDS tests commonly performed include filling cystometry, uroflowmetry, pressure-flow studies, All these assess parameters such as bladder storage, detrusor pressure, urethral pressure, and pelvic floor muscle activity, 4. Standardized terminology and definitions are crucial for clear communication and accurate interpretation of UDS findings [2], and 5, along with standardized reporting and interpretation of UDS data further ensures comparability and facilitates clinical decision-making. This includes documenting findings, numerical values, and graphical representations in a consistent manner.

An important comment is that specific protocols and techniques may vary and be tailored based on clinical needs, available resources, and local practices. Therefore, it is advisable to stay updated with the latest guidelines and recommendations from professional organizations, consult the relevant guidelines, and seek expert guidance for implementing standardized urodynamic techniques in a particular healthcare setting.

Interpreting UDS results requires a comprehensive analysis of all relevant parameters and findings. It is fundamental to consider the patient's symptoms, past medical history, physical examination, and other additional diagnostic tests alongside the UDS results to arrive at an accurate diagnosis and develop a personalized treatment plan. There are some significant aspects that are typically considered when interpreting urodynamic results in SUI, such as: 1. Urethral function, 2. Bladder function, helping in understanding the bladder's role in SUI, 3. Cough stress test, providing additional information on the degree of SUI, 4. Leak point pressure point, that a low leak point pressure may indicate weaker sphincter or pelvic floor muscle function, contributing to SUI, and 5. Uroflowmetry, may help identify any abnormalities in the voiding pattern, which can be associated with impaired urethral function or incomplete bladder emptying.

The use of preoperative UDS studies in SUI is a topic of debate and clinical practice variation. While some healthcare providers and guidelines recommend preoperative UDS in certain cases, others do not consider it necessary for all patients if they have symptoms of pure SUI with no symptoms of urgency, frequency or voiding disorder [13]. The

decision to perform preoperative UDS depends on several factors, including the patient's clinical presentation, treatment plan, and surgeon's preference. In uncomplicated SUI female patients, UDS can provide additional information regarding LUT function that could guide the physician into making the appropriate therapeutic approach, independently that it has not demonstrated that preoperative UDS can influence the continence surgical outcome. In an increasingly medicolegal environment, many clinicians prefer to perform UDS even in patients with symptoms of uncomplicated SUI.

Here are some points to consider regarding the usefulness of preoperative UDS in SUI: 1. may help confirm the diagnosis of SUI and differentiate it from other types of urinary incontinence and can provide additional data to support the clinical diagnosis, 2. may help make the best-fit treatment planning by identifying underlying factors contributing to SUI, 3. may help in complex or challenging cases to make the right surgical decision-making, 4. may provide any prognostic information by assessing the potential for postoperative success or failure, and 5. can be of great value in patient counseling and setting patient expectations.

The impact of urodynamics on stress urinary incontinence management

UDS has been considered during the last decades as the gold standard for assessment of LUT symptoms due to their high reproducibility [17,18]. At the same time, concerns about the systematic use of UDS before SUI surgery were raised due to a limited evidenced-base to recommend their routine use [19], especially considering the additional time, costs, and invasive nature of the tests [20]. In some conditions, such as complicated SUI, asymptomatic urodynamic DO, and voiding dysfunction without positive PVR, the UDS may introduce new information in comparison with the only clinical examination strategy, with the possibility of modifying the following management.

Uncomplicated and complicated stress urinary incontinence

In the last decade, a few randomized control trials (RCTs) have evaluated the impact of UDS on the diagnosis and management of SUI in relation to the definition of uncomplicated/complicated SUI. A high-quality multicenter RCT, the Value of Urodynamics Evaluation (ValUE) trial, including 630 patients affected by uncomplicated SUI demonstrated non-inferior outcomes at 12-month follow-up in women evaluated only by clinical examination, in comparison with women submitted to UDS assessment [8]. Moreover, a secondary analysis of the ValUE trial concluded that although UDS changed the clinical diagnosis in 56 % of cases, they rarely changed the global treatment plan or influenced surgeons' decision to cancel, change or modify surgical plans [21]. Another multicentric non-inferiority RCT, the Value of Urodynamics prior to Stress Incontinence Surgery (VUSIS1) (which closed after only 59 women were included due to recruitment problems), found that the clinical examination-only strategy was not inferior to UDS in the preoperative work-up of SUI [22]. After a redesign (VUSIS2), 109 patients affected by uncomplicated SUI with discordance between UDS and clinical assessment were randomly allocated to receive either immediate surgery or individually tailored therapy based on UDS [23]. The VUSIS2 concluded that performing immediate surgery, irrespective of the result of UDS, did not result in inferior outcomes. This evidence supports the conclusion that pre-operative UDS in women with uncomplicated, clinically demonstrable, SUI does not improve the outcome of surgery for SUI. Contrary, in women with complicated SUI, UDS may add important information to clinical examination, including a diagnosis of voiding dysfunction [24].

Preoperative urodynamic detrusor overactivity

There are no RCTs that have evaluated the role of preoperative UDS

in predicting postoperative complications such as overactive bladder (OAB) symptoms and urgency urinary incontinence (UUI) after anti-incontinence surgical procedures. Digesu et al., suggest preoperative UDS should be considered even in women complaining of pure uncomplicated SUI, since up to 20 % of them may have DO and might not need surgery as the first line of treatment [25]. Indeed, a preoperative diagnosis of DO has been associated with postoperative UUI [26,27], even if DO did not result in being able to predict the overall failure following SUI surgery [27]. It seems logical in this type of patient to propose different counselling such as alternative treatments since 50 % of women complaining of pure SUI with a diagnosis of urodynamic provoked DO (detrusor contractions produced on provocation such as coughing or jumping) were considered cured at 12-month follow-up after taking antimuscarinics [28]. Moreover, the type of mid-urethral sling (MUS) influenced postoperative results in women complaining of predominant SUI and urodynamic DO; indeed, retropubic transvaginal tape (RP-TVT) has been reported to be associated with a higher persistence of postoperative DO [29], while preoperative urodynamic DO was identity as a risk factor for surgical failure for RP-TVT [30] in comparison to *trans*-obturator tape (TOT).

Preoperative urodynamic voiding dysfunction

Several studies assessed the correlation between urodynamic parameters, such as the preoperative flow rate and PVR, and postoperative voiding dysfunction. Two retrospective studies demonstrated higher postoperative voiding dysfunction in women presenting a lower postoperative flow rate [31,32]. On the other hand, a *post-hoc* analysis of 2 high-quality surgical trials showed that no urodynamic parameter had the possibility to predict post-surgical voiding dysfunction in a population of women with a preoperative negative PVR [33,34]. Moreover, a sub-analysis of patients that showed urodynamic voiding dysfunction included in the ValUE trial presented an inferior (but not-significantly) success rate in comparison with the other patients. This information can be relevant for preoperative counselling. Indeed, the TOMUS trial demonstrated a higher voiding dysfunction rate in women submitted to RP-TVT in comparison with women submitted to TOT [35]. Therefore, TOT should be preferable in women showing a preoperative urodynamic voiding dysfunction.

Position of international scientific societies regarding urodynamic preoperative work-up in women complaining of SUI

EAU Recommendation

The Recommendation by the European Association of Urology stated that in a patient with uncomplicated stress incontinence (no significant postvoid residual, no prior lower urinary tract surgeries, either pure SUI or stress predominant mixed UI, and no high-grade prolapse), performing urodynamics does not improve surgical outcome. However, currently UDS represent the gold standard to evaluate bladder function, and in case of complicated UI and first-line therapies failure, urodynamics may provide valuable information that can guide management and improve both patient and physician confidence in prescribed therapies [36].

FIGO Working group report

In its report, the FIGO Working Group on evaluation and surgery of SUI stated that urodynamic testing is not routinely recommended in all patients and that UDS is not recommended for surgical planning in patients with uncomplicated SUI. However, UDS is recommended in patients with complicated SUI prior to initiating treatment when the underlying diagnosis is yet unknown or concerned with voiding symptoms. The ultimate decision for testing prior to initiating treatment should be individualized and left to the practitioner's clinical judgement

[19].

ACOG and AUGS joint committee opinion

The American College of Obstetricians and Gynecologists and American Urogynecologic Society in a joint committee opinion updated 2020, affirmed that for women with uncomplicated SUI in whom conservative treatment has failed and who desire mid-urethral sling surgery, evidence indicates that the performance of preoperative multichannel urodynamic testing versus a basic evaluation does not affect treatment outcomes. However, women with complicated SUI may benefit from additional diagnostic evaluation with multichannel urodynamic testing, particularly before surgical treatment [37].

NICE guidelines

The NICE do not support the systematic use of UDS before management in women complaining of pure or prevalent SUI, and the committee agreed that it should not be performed. Nonetheless, the NICE decided it was important to illustrate that in some circumstances urodynamic testing may be beneficial and drafted recommendations based on their expertise and experience and by consensus. The NICE noted that urodynamic testing is most likely to be of benefit in situations where the diagnosis was unclear from detailed clinical assessment. This includes when there is urge predominant mixed UI or UI in which the type is unclear; symptoms suggestive of voiding dysfunction; anterior or apical prolapse; and a history of previous surgery for stress UI. In these cases, the NICE considered that urodynamic testing may lead to more precise diagnosis, and the benefits may outweigh the intrusive nature of the test [38].

Analysis of the evidence by the EUGA Working group

The real benefit of UDS in the assessment and pre-surgical work-up of SUI is still debated. A systematic review and *meta*-analysis of six RCTs including 942 women affected by pure or prevalent SUI, that aimed to assess the clinical usefulness of urodynamics guided management versus any kind of alternative work-up to improve patient outcomes, concluded that even if urodynamics is the only method that can specify lower urinary tract dysfunction, and it is undisputed as the gold standard to assess LUTS in many patients, clinical experience teaches us that successful management of women with SUI without other LUTS is possible without urodynamic testing [39]. Indeed, UDS demonstrated to be able to assess high-sensitivity SUI and to differentiate it from other types of incontinence, such as urgency and mixed urinary incontinence, which present different pathophysiological patterns and treatment approaches. Underlying factors, such as urethral sphincter deficiency, or the severity of SUI may be assessed through UDS, helping the physician with the management algorithm. However, the female populations included in these RCTs were highly selected (predominately women with uncomplicated SUI), representing only a small proportion of all women with urinary incontinence. In addition, most trials excluded patients with other concomitant storage symptoms, such as predominant urgency or voiding symptoms. Therefore, generalizability of the findings is very limited [39].

One of the main factors for studies assessing the usefulness of UDS depends on the fact that UDS is already the gold standard for LUTS evaluation, without any available comparator apart from what is known about normal physiology. Therefore, the only way to evaluate the usefulness of UDS is the assessment of whether greater health gain is achieved by management based on UDS findings compared to management based on tests which omit UDS. This kind of approach poses a significant conceptual problem, since it fundamentally bases on the success of treatments in a field where treatment outcomes are rather variable and there are no “standard” treatments, considering that synthetic MUS has been banned in several countries [40].

Moreover, considering the existent literature, the diagnosis reported by UDS often differs from the clinical diagnosis, even in women considered uncomplicated, but evidence that this correlates with better clinical outcomes remains unproven. In the Cochrane review by Clement et al. [41], urodynamics showed to modify treatment choices when compared with women who did not have preoperative UDS, even if the authors did not evidence any impact on postoperative outcomes; however, in some of the included studies, surgery had already been chosen as the management approach, irrespective of UDS findings, and the review was unable to include the outcomes of patients not treated surgically. This led the authors to conclude that larger and more definitive trials are needed. Even in the ValUE trial, 57 % of diagnoses were altered after UDS (detection of unexpected voiding dysfunction or OAB). The paradox posed is that treatment did not change despite the different UDS diagnosis, and most patients still ended up with MUS. Indeed, the 10 % of women where UDS identified pre-existing voiding dysfunction, presented a higher rate of adverse postsurgical results [8]. Despite their considerable controversy and criticism of their design and conclusions, the ValUE and VUSIS-II studies have prompted a drastic reduction in use of UDS prior to surgery for SUI in recent years. Even if RCTs have demonstrated UDS improve surgical outcomes in women with complicated SUI, some high-quality evidence suggests UDS may also be able to predict postoperative complications in apparently uncomplicated cases. Indeed, asymptomatic urodynamically proven latent DO or pre-existing voiding dysfunction are related to a higher incidence of postoperative OAB and voiding dysfunction respectively. Explanation of pathophysiological patterns for under- or over-active bladder are a valuable part of counselling. Indeed, in a population of 50 women with urodynamic under-contraction, the cure rate with MUS was not significantly different from that in the normo-contraction group, even if voiding dysfunctions were statistically significant higher [42]. On the other hand, preoperative urodynamically proven DO may affect postsurgical results implementing OAB symptoms [23]. This information is important for appropriate preoperative counseling, which improves relationships and trust between clinician and patient, patient satisfaction with treatment outcomes, and comprehension in cases where adverse events are experienced [43]. Considering patient's perspective, very few studies in the academic literature have assessed the value of UDS from their viewpoint. A narrative review evaluated several domains related to patient's perspectives on the tolerability and acceptability of the urodynamic procedure, such as pain, physical discomfort, anxiety before and during the procedure and the patient perception of the value of urodynamic studies [44]. Authors concluded that although anxiety, embarrassment, and discomfort can occur, there are simple ways to reduce these experiences, particularly through optimal staff training, and that a 3:1 patient preference in favor of gaining an objective diagnosis before embarking on treatment. Moreover, it was also notable that, after treatment, patients who had chosen to undergo UDS expressed a significantly higher satisfaction rate than the non-UDS group [45].

Further larger studies should be properly designed to legitimately assess the value of urodynamic studies in female urinary incontinence. As reported in a recent expert opinion by Tarcan et al. [46], several issues should be regulated: 1) judging a diagnostic test based on treatment outcomes is controversial and requires very careful trial design to minimize the numerous bias; 2) the study population should be reflective of the real general population; 3) if the study endpoints are clinical, not only incontinence should be assessed but also the other LUTS, risks and costs; 4) the patients in the interventional arm should be submitted to tailored treatment according to the urodynamic results; 5) non interventional arm should be submitted to empiric treatment, even if it is ethically questionable; 6) the follow-up should be long enough to assess long term impact of management, such as new or worsened voiding symptoms or OAB symptoms. We agree with the authors conclusion that “*due to all the methodological issues, a perfect RCT protocol for assessing the value of UDS in female UI does not exist. Nevertheless, much better studies than those that currently exist are certainly achievable*”.

Conclusion

In conclusion, UDS is an essential diagnostic test for the assessment of SUI and for the pre-operative work-up and represent the gold standard for LUTS assessment.

Nowadays, the evidence does not support the systematic preoperative use of UDS for uncomplicated cases. However, in where there are mixed symptoms, voiding dysfunction, previous surgery or concomitant prolapse, preoperative UDS are recommended as may be useful in predicting postoperative results and so to perform complete and adequate preoperative counselling.

Larger and better-designed clinical studies should be promoted to evaluate if appropriate shaped management based on urodynamic findings may influence SUI outcomes at longer follow-up.

Finally, we recommend performing preoperative UDS considering the patient's specific clinical situation and the surgeon's judgment, with consideration given to the potential benefits, risks, and impact on treatment decisions and patient outcomes.

CRedit authorship contribution statement

Alessandro Ferdinando Ruffolo: Conceptualization, Writing – original draft. **Sofia Tsiapakidou:** Methodology, Writing – original draft. **Yair Daykan:** Methodology, Writing – original draft. **Stefano Salvatore:** Supervision, Validation. **Stavros Athanasiou:** Methodology, Supervision. **Andrea Braga:** Investigation, Project administration. **Michele Meschia:** Supervision, Validation. **Christian Phillips:** Supervision, Visualization. **Maurizio Serati:** Conceptualization, Project administration, Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

- [1] Lubner KM. The definition, prevalence, and risk factors for stress urinary incontinence. *Rev Urol* 2004.
- [2] Haylen BT, de Ridder D, Freeman RM, et al. An international urogynecological association (IUGA)/international continence society (ICS) joint report on the terminology for female pelvic floor dysfunction. *Neurourol Urodyn* 2010.
- [3] 4) Committee opinion no. 603: Evaluation of uncomplicated stress urinary incontinence in women before surgical treatment. *Obstetrics and Gynecology* 123.
- [4] Wagner TH, Hu TW. Economic costs of urinary incontinence in 1995. *Urology* 1998;51. [https://doi.org/10.1016/S0090-4295\(97\)00623-7](https://doi.org/10.1016/S0090-4295(97)00623-7).
- [5] Imamura M, Williams K, Wells M, Mcgrother C (2015) Lifestyle interventions for the treatment of urinary incontinence in adults. *Cochrane Database Syst Rev* 2015.
- [6] Nager CW. Midurethral slings: Evidence-based medicine vs the medicolegal system. *Am J Obstet Gynecol* 2016;214. <https://doi.org/10.1016/j.ajog.2016.04.018>.
- [7] Subak LL, Wing R, West DS, et al. Weight Loss to Treat Urinary Incontinence in Overweight and Obese Women. *N Engl J Med* 2009. <https://doi.org/10.1056/nejmoa0806375>.
- [8] Nager CW, Brubaker L, Litman HJ, et al. A Randomized Trial of Urodynamic Testing before Stress-Incontinence Surgery. *N Engl J Med* 2012;366. <https://doi.org/10.1056/nejmoa1113595>.
- [9] Lehnert SM, Clemens JQ. Urodynamics: with a focus on appropriate indications. *Urol Clin North Am* 2013;40(4):545–57. <https://doi.org/10.1016/j.ucl.2013.07.001>.
- [10] Rosier PFWM, Schaefer W, Lose G, Goldman HB, Guralnick M, Eustice S, et al. International Continence Society Good Urodynamic Practices and Terms 2016: Urodynamics, uroflowmetry, cystometry, and pressure-flow study. *Neurourol Urodyn* 2017;36(5):1243–60. <https://doi.org/10.1002/nau.23124>.
- [11] Leandro A, Marta L, Gracia G, et al. Prevalence of “uncomplicated” and “complicated” stress urinary incontinence in Argentinian women: Assessing the role of the urodynamic study. *European Journal of Obstetrics and Gynecology and Reproductive Biology* 2021;256. <https://doi.org/10.1016/j.ejogrb.2020.09.025>.
- [12] Serati M, Braga A, Torella M, Soligo M, Finazzi-Agro E. The role of urodynamics in the management of female stress urinary incontinence. *Neurourol Urodyn* 2019;38 (Suppl 4):S42–50. <https://doi.org/10.1002/nau.23865>.
- [13] Serati M, Topazio L, Bogani G, Costantini E, Pietropaolo A, Palleschi G, et al. Urodynamics useless before surgery for female stress urinary incontinence: Are you sure? Results from a multicenter single nation database. *Neurourol Urodyn* 2016; 35(7):809–12. <https://doi.org/10.1002/nau.22804>.
- [14] Khan MS, Chaliha C, Leskova L, et al. The relationship between urinary symptom questionnaires and urodynamic diagnoses: an analysis of two methods of questionnaire administration. *BJOG* 2004;111:468–74.
- [15] Serati M, Salvatore S, Sisto G, et al. Urinary symptoms and urodynamic findings in women with pelvic organ prolapse: is there a correlation? Results of an artificial neural network analysis. *Eur Urol* 2011;60:253–60.
- [16] Patel AK, Chapple CR. Urodynamics in the management of female stress incontinence-which test and when? *Curr Opin Urol* 2008;18:359–64.
- [17] Ward RM, Hampton BS, Blume JD, et al. The impact of multichannel urodynamics upon treatment recommendations for female urinary incontinence. *Int Urogynecol J* 2008;19:1235–41.
- [18] Committee Opinion No. 603: Evaluation of uncomplicated stress urinary incontinence in women before surgical treatment. *Obstet Gynecol*. 2014 Jun (reaffirmed 2018);123(6):1403-1407. doi: 10.1097/01.AOG.0000450759.34453.31. PMID: 24848922.
- [19] Medina CA, Costantini E, Petri E, Mourad S, Singla A, Rodríguez-Colorado S, et al. Evaluation and surgery for stress urinary incontinence: A FIGO working group report. *Neurourol Urodyn* 2017 Feb;36(2):518–28. <https://doi.org/10.1002/nau.22960>. Epub 2016 Mar 7 PMID: 26950893.
- [20] Burkhard FC, Bosch J, Cruz F, Lemack GE, Nambiar AK, Thiruchelvam N, Tubaro A. Guidelines on Urinary Incontinence. European Association of Urology 2020, Available at: <https://uroweb.org/eau-guidelines/discontinued-topics/urinary-incontinence>.
- [21] Sirls LT, et al. The effect of urodynamic testing on clinical diagnosis, treatment plan and outcomes in women undergoing stress urinary incontinence surgery. *J Urol* 2013;189:204.
- [22] van Leijssen SA, et al. Can preoperative urodynamic investigation be omitted in women with stress urinary incontinence? A non-inferiority randomized controlled trial. *Neurourol Urodyn* 2012;31:1118.
- [23] van Leijssen SA, et al. Value of urodynamics before stress urinary incontinence surgery: a randomized controlled trial. *Obstet Gynecol* 2013;121:999.
- [24] Topazio L, Frey J, Iacovelli V, Perugia C, Vespasiani G, Finazzi AE. Prevalence of ‘complicated’ stress urinary incontinence in female patients: can urodynamics provide more information in such patients? *Int Urogynecol J* 2015;26:1333–9.
- [25] Digesu GA, Hendrickson C, Fernando R, et al. Do women with pure stress urinary incontinence need urodynamics? *Urology* 2009;74:278–81.
- [26] Lee JK, Dwyer PL, Rosamilia A, Lim YN, Polyakov A, Stav K. Persistence of urgency and urge urinary incontinence in women with mixed urinary symptoms after midurethral slings: a multivariate analysis. *BJOG* 2011 Jun;118(7):798–805. <https://doi.org/10.1111/j.1471-0528.2011.02915.x>. Epub 2011 Mar 10 PMID: 21392244.
- [27] Nager CW, et al. Baseline urodynamic predictors of treatment failure 1 year after mid urethral sling surgery. *J Urol* 2011;186:597.
- [28] Serati M, Cattoni E, Sisto G, Braga A, Sorice P, Cantaluppi S, et al. Urodynamic evaluation: can it prevent the need for surgical intervention in women with apparent pure stress urinary incontinence? *BJU Int* 2013 Aug;112(4):E344–50. <https://doi.org/10.1111/bju.12007>. Epub 2013 Feb 20 PMID: 23421421.
- [29] Gamble TL, Botros SM, Beaumont JL, Goldberg RP, Miller JJ, Adeyanju O, et al. Predictors of persistent detrusor overactivity after transvaginal sling procedures. *Am J Obstet Gynecol* 2008 Dec;199(6). <https://doi.org/10.1016/j.ajog.2008.07.059>. 696.e1-7 Epub 2008 Oct 9 PMID: 18845297.
- [30] Houwert RM, Venema PL, Aquarius AE, Bruinse HW, Roovers JP, Vervest HA. Risk factors for failure of retropubic and transobturator midurethral slings. *Am J Obstet Gynecol* 2009 Aug;201(2). <https://doi.org/10.1016/j.ajog.2009.04.009>. 202.e1-8 Epub 2009 Jun 26 PMID: 19560115.
- [31] Dawson T, et al. Factors predictive of post-TVT voiding dysfunction. *Int Urogynecol J Pelvic Floor Dysfunct* 2007;18:1297.
- [32] Hong B, et al. Factors predictive of urinary retention after a tension-free vaginal tape procedure for female stress urinary incontinence. *J Urol* 2003;170:852.
- [33] Abdel-Fattah M, et al. Pelvic pubovaginal sling versus tension-free vaginal tape for treatment of urodynamic stress incontinence: a prospective randomized three-year follow-up study. *Eur Urol* 2004;46:629.
- [34] Lemack GE, et al. Normal preoperative urodynamic testing does not predict voiding dysfunction after Burch colposuspension versus pubovaginal sling. *J Urol* 2008;180:2076.
- [35] Richter HE, Albo ME, Zyczynski HM, et al. Retropubic versus transobturator midurethral slings for stress incontinence. *N Engl J Med* 2010;362:2066–76.
- [36] Nambiar AK, Lemack GE, Chapple CR, Burkhard FC; European Association of Urology. The Role of Urodynamics in the Evaluation of Urinary Incontinence: The European Association of Urology Recommendations in 2016. *Eur Urol*. 2017 Apr; 71(4):501-503. doi: 10.1016/j.eururo.2016.09.045. Epub 2016 Oct 7. PMID: 27726965.
- [37] American Urogynecologic Society and American College of Obstetricians and Gynecologists. Committee opinion: evaluation of uncomplicated stress urinary incontinence in women before surgical treatment. *Female Pelvic Med Reconstr Surg*. 2014 Sep-Oct;20(5):248-51. doi: 10.1097/SPV.0000000000000113. PMID: 25181373.
- [38] National Guideline Alliance (UK). Evidence review for urodynamic assessment prior to primary surgery for stress urinary incontinence: Urinary incontinence and pelvic organ prolapse in women: management: Evidence review A. London: National Institute for Health and Care Excellence (NICE); 2019 Apr. PMID: 35138774.
- [39] Bodmer NS, Wirth C, Birkhäuser V, Sartori AM, Leitner L, Averbeck MA, et al. Randomised Controlled Trials Assessing the Clinical Value of Urodynamic Studies:

- A Systematic Review and Meta-analysis. *Eur Urol Open Sci* 2022 Sep;5(44): 131–41. <https://doi.org/10.1016/j.euros.2022.08.013>. PMID: 36110903; PMCID: PMC9469658.
- [40] Ruffolo AF, Lallemand M, Delplanque S, Cosson M. The transvaginal mesh: an overview of indications and contraindications for its use. *Expert Rev Med Devices* 2023 May;20(5):393–400. <https://doi.org/10.1080/17434440.2023.2199926>. Epub 2023 Apr 9 PMID: 37014111.
- [41] Clement KD, Lapitan MC, Omar MI, Glazener CM. Urodynamic studies for management of urinary incontinence in children and adults. *Cochrane Database Syst Rev* 2013;2013(10):003195.
- [42] Natale F, Illiano E, Zucchi A, et al. Transobturator mid-urethral sling in females with stress urinary incontinence and detrusor underactivity: effect on voiding phase. *Int Urogynecol J* 2019;4 Feb.
- [43] Serati M, Tarcn T, Finazzi-Agrò E, Soligo M, Braga A, Athanasiou S, et al. The bladder is an unreliable witness: The case for urodynamic investigations in female stress urinary incontinence. *Eur J Obstet Gynecol Reprod Biol* 2020 Jan;244:35–7. <https://doi.org/10.1016/j.ejogrb.2019.10.046>. Epub 2019 Nov 7 PMID: 31731022.
- [44] Serati M, Braga A, Rosier PFWM, de Wachter S, Uren A, Finazzi-Agrò E. Acceptability and perceived value of urodynamics from the patient perspective: A narrative review. *Neurourol Urodyn* 2022 Jun;41(5):1065–73. <https://doi.org/10.1002/nau.24932>. Epub 2022 Apr 14. PMID: 35419867; PMCID: PMC9322284.
- [45] Serati M, Cantaluppi S, Coluccia AC, et al. Is urodynamic evaluation able to change and improve the management of women with idiopathic overactive bladder? *Minerva Urol Nefrol* 2021;73:823–30.
- [46] Tarcn T, Finazzi-Agrò E, Kessler TM, Serati M, Solomon E, Rosier PFWM. How should prospective research be designed to legitimately assess the value of urodynamic studies in female urinary incontinence? *Neurourol Urodyn*. 2023 Aug 28. doi: 10.1002/nau.25273. Epub ahead of print. PMID: 37638391.