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ICS Educational Module: Cough stress test in the evaluation of female urinary incontinence: Introducing the ICS-Uniform Cough Stress Test

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Introduction: A cough stress test (CST) is recommended in the evaluation of the uncomplicated female patient with the complaint of stress urinary incontinence (SUI) to identify the sign of SUI, and is often used as an outcome measure following SUI treatment. However, there has been no standardization of the performance or reporting of CST. A working group of the International Continence Society (ICS) has developed an educational module, comprising a Powerpoint™ presentation and evidence base manuscript, to instruct on the performance, interpretation, and reporting of the CST in a standardized manner: the ICS-Uniform Cough Stress Test (ICS-UCST).

Methods: The working group performed a PUBMED literature search of articles (observational/experimental and reviews) published prior to 2017 that mentioned a CST. The evidence base examined various variables in performing a CST as well as sensitivity/specificity and positive/negative predictive values of CST.

Results: The variables involved in performing/interpreting an ICS-UCST include: patient positioning, degree of bladder filling, number, and forcefulness of coughs, and method of SUI detection. For the ICS-UCST it is recommended that the patient be in a supine/lithotomy position with 200-400 mL of fluid in the bladder. She coughs forcefully 1-4 times and the examiner directly visualizes the urethral meatus for the presence of leakage. Leakage of fluid from the urethral meatus coincident with/simultaneous to the cough(s) is considered a positive test.

Conclusion: This module provides instructions to educate a uniform CST (the ICS-UCST), with the aim of improving the clinical practice of cough stress testing in female patients with urinary incontinence.

KEYWORDS
cough stress test, stress urinary incontinence

1 | INTRODUCTION

The cough stress test (CST) is a clinical test used in the evaluation of urinary incontinence (UI). The patient coughs

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and the visualization of urine loss synchronous with the cough confirms the presence of stress urinary incontinence (SUI).[1] CST is used to objectively make the diagnosis of SUI[2] and assess the outcome of treatment for SUI.[3,4] Its use in the evaluation of UI (when symptoms of SUI are expressed; the SUI syndrome: SUI-S[5]) has been endorsed by several societies including the French College of Gynecologists and Obstetricians; International Federation of Gynecology and Obstetrics (FIGO); International Urogynecological Association (IUGA), and American College of Obstetricians and Gynecologists.[2,6–8] Although the European Association of Urology guideline is brief about this test, the recent American Urological Association guideline considers it a sine- qua-non for the diagnosis of SUI.[9,10] Based on their review, the FIGO working group recommended all patients being evaluated for SUI-S should have a CST (Grade A)[8] and in a research context, CST has been the most commonly used measure for evaluating the outcome of SUI surgery.[3,4] Despite the support for the CST, standardization of how to perform a CST does not exist. The ICS Urodynamics Committee presents the teaching module "Cough stress test in the evaluation of female urinary incontinence" to serve as a standard for educating a CST for the evaluation of female UI and/or SUI-S.

A new ICS term for the CST is introduced: ICS Uniform Cough Stress Test (ICS-UCST) because the secondary aim of this module is to uniformize, by teaching, CST for clinical routine and research. This manuscript provides the evidence base for the ICS educational PowerPoint™ presentation that accompanies this module as well as the arguments for the uniformization. The aim of this module is to educate the utilization and interpretation of the CST which will hopefully improve and facilitate the clinical diagnosis of SUI and the assessment/reporting of SUI treatment outcomes.

2 | METHODS

The working group for this module did an extensive literature review of more than 200 articles published prior to 2017 that mention a cough stress test, via a PUBMED online search using the terms "cough and stress test and incontinence." These included observational/experimental studies as well as review articles. References used specifically for this manuscript are provided at the end and a full references list in an accessory file on the publisher's website.

2.1 | The evidence base for standardization of CST

There is general consensus that the CST in combination with the SUI-S is reliable in confirming that the pathophysiology of the UI is SUI.[11–18] In a review of the literature to determine the predictive value of the clinical evaluation of SUI (history, physical exam with CST) using multichannel UDS as the comparator, it was found that for the diagnosis of genuine SUI, the CST alone had sensitivity (sens:) 57%, specificity (spec:) 71%, positive predictive value (PPV) of 55% and negative predictive value (NPV) of 73%.[15] However, when other UDS diagnoses (eg, mixed incontinence) were included, the PPV was 91%, indicating that CST had been demonstrating UI but not "uncomplicated SUI" in all patients. When combined with the symptoms of SUI-S, the CST had a PPV of 78-97%.[15] A randomized trial of UDS prior to SUI surgery observed that an office evaluation including a CST correctly identified 97% of women found to have SUI on UDS and the demonstration of SUI during UDS subsequent to a positive CST did not improve the treatment success of SUI surgery.[12] In a prospective study, when CST was compared to multichannel UDS and 24 h pad testing the agreement between UDS and CST was 89% ($k = 0.51$), whereas agreement between UDS and 24 h pad test was only 60% ($k = 0.08$) and agreement between the CST and 24 h pad test was only 67% ($k = 0.26$).[16] Using UDS as the reference, the sens, spec, PPV and NPV of the CST were 90%, 80%, 98%, and 44% respectively. CST during single channel cystometry was compared to CST during multichannel UDS in another prospective study[13] that alternated the gold standard for diagnosing SUI (a cough UPP during multichannel UDS versus CST and simple CMG). No significant difference between the two methods was seen with both having sens, spec, PPV, and NPV between 80% and 87%. In a similar study, when CST with simple bladder filling was compared to CST during multichannel UDS (using CST during UDS as the gold standard),[14] for the diagnosis of SUI the CST with simple bladder filling had a sens 88%, spec 77%; PPV 82% and NPV 84%. It was concluded that CST with simple bladder filling is a reliable method of diagnosing SUI and can replace complex UDS which is in keeping with an assessment of AHCPR criteria for predicting SUI clinically (using UDS as the gold standard) that found that the most helpful criterion was the CST which had sens 93%; spec 56%; PPV 68% and NPV 89%.[17]

Despite the evidence supporting the use of CST there has not been any standardization of the performance or reporting of CST. In fact, in reviewing 208 studies that make mention of a CST (outcome assessment studies, test evaluation studies) we found that only 62% specified the patient positioning, 71% the bladder volume, 45% the method of filling, 17% the number of coughs and 38% the method of SUI determination (Figures 1 and 2). The lack of standardization makes every statement about the predictive value of (history and) clinical examination (and CST) on the outcome of management for UI difficult to evaluate and/or impossible to extrapolate.

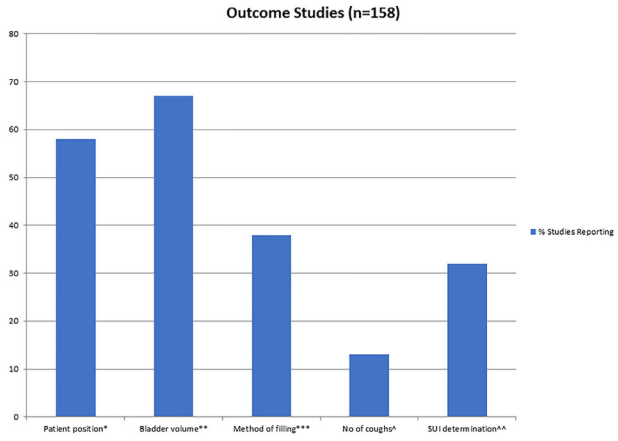

FIGURE 1 Studies assessing the outcome of a treatment intervention that mentioned using a CST (references online). *Positioning included: supine/lithotomy, semi-lithotomy, seated, standing. **Bladder volumes included "empty," "comfortably/symptomatically full," "full," 100-700 mL. ***Natural fill or retrograde fill via catheter (often done during UDS). ^Number of coughs ranged from 1 to 10 or reported as "a series of coughs." ^^Direct visualization of incontinence or pad testing

2.2 | Educating the ICS-UCST

From the available evidence we have selected the elements of CST: (1) preparation for the test; (2) performing the test: (a) patient positioning; (b) bladder volume; (c) number of coughs; (d) leakage detection; and (3) interpretation and reporting of the test. On the basis of our review of the evidence, we propose, to educate the elements of the CST to be performed in a standard manner, the ICS-UCST (Figure 3).

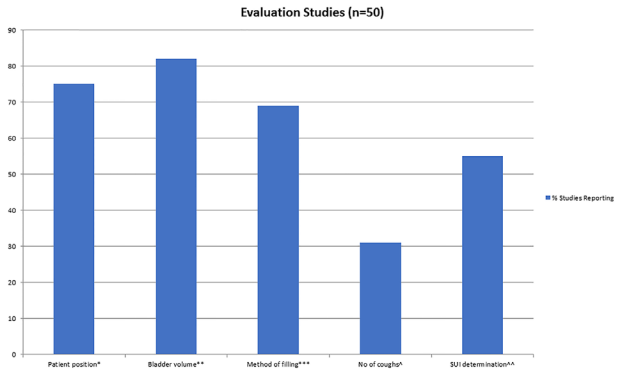

FIGURE 2 Studies looking at the evaluation of incontinence (e.g. studies assessing clinical factors contributing to incontinence, studies evaluating the performance of UDS, that mentioned using a CST (references online). *Positioning included: supine/lithotomy, semi-lithotomy, seated, standing. **Bladder volumes included "empty," "comfortably/symptomatically full," "full," 100-700 mL. ***Natural fill or retrograde fill via catheter (often done during UDS). ^Number of coughs ranged from 1 to 10 or reported as "a series of coughs." ^^Direct visualization of incontinence or pad testing

The education of the ICS-Uniform Cough Stress Test includes the explanation of the instructions:

The physician should:

- *Explain to the patient before or during clinical exam in lithotomy position that the ICS-UCST is one of the tests that is used to unravel the nature/origin of the urinary incontinence*
- *That the test may be embarrassing, however considered valuable and necessary*
- *Ask the patient about bladder fullness (see below)*
- *Be aware of the usual voided volumes (and frequency)*

The physician:

- *Has instructed the patient to be in supine/lithotomy position and is able to observe the meatus*
- *Considers likelihood that the present intravesical volume, during the test, is representative for this patient and between 200 and 400mL*
- *Asks the patient to cough as forceful as possible and if no leakage is observed, asks to cough 3 more times, as forceful as possible*

The physician:

- *Objectively determines what the intravesical volume is or has been during the CST*
- *Reports that the ICS-UCST has been 'positive with ***mL' or 'negative'*
- *Considers repeating CST (up to 4 coughs) in standing position and reports the standing accessory CST to be positive or negative*
- *Considers complimentary or accessory evaluation to determine the pathophysiology as the cause of the UI**

** In a patient with UI or more specifically with SUI-S, a negative ICS-UCST and a negative accessory CST, an ICS standard pad test[39] and/or (full) urodynamic testing may be considered to evaluate the complete lower urinary tract function, as per current practice guidelines.*

FIGURE 3 Educating the ICS-UCST

2.2.1 | Preparation

A cough stress test is typically performed during the physical examination of the patient in the outpatient clinic, but can be done at the time of a procedure or during urodynamic testing. The last being a urodynamic stress test and/or leak point pressure (LPP) determination. Practice and validity of (UDS-) LPP testing are not further discussed but are summarized, for example, in the ICI-consultation report.[18]

We believe that before the ICS-UCST the patient should be informed about the relevance and rationale for performing the test and also the potential embarrassing nature of the test. Apart from undressing the lower part of the body and some issues mentioned below, the patient does not have to prepare herself specifically for the test.

2.2.2 | Technique

Patient position

A CST can be performed in the supine, semi supine, standing, sitting, or lithotomy positions. In the supine position (using pads to measure the leakage), it was noted that only 49% of women leaked during the cough stress test (when floor and trampoline jumping were used as the comparator).[19] In addition, CST was negative when done in a semi-supine position in 14% of patients who complain of SUI in another study on the effects of a UDS catheter on the diagnosis of SUI.[20] Furthermore, it has been noted that during LPP testing (done during CMG with a catheter in place), both Valsalva LPP and CLPP are significantly lower when the patient is standing versus supine.[21]

However, probably the most convenient time to do a CST is when the patient is undergoing a vaginal exam in the supine/lithotomy position (legs either in stirrups or abducted in a "frog-leg" position), when one assesses vaginal anatomy and pelvic floor function. This positioning allows for relatively easy visualization of the urethral meatus for the occurrence of urine leakage.

Because of the observed potential for a false negative in the supine position, reported in some cohort studies, it has been recommended that patients undergo a CST in the upright position, especially if they had a negative test in the supine position.[7,8] However, having the patient stand for the CST requires more effort on the examiner's part to expose the urethral meatus for visualization of the leakage. As well, not all patients are able to stand on their own, and testing in the standing position may therefore be less relevant and/or representative in these patients. Furthermore, it is currently unknown if the pathophysiology of a patient who has a positive CST in the upright position but negative in the supine/lithotomy position is comparable to a patient who has a positive CST in the supine position.

Conclusion for the purposes of uniformized practice of the ICS-UCST, we recommend that the CST be done in the supine/lithotomy position at the time of vaginal examination (LoE 1b, GoR A). If the test is negative (ie, no leakage detected), then accessory stress testing such as repeating the test in the upright position should be considered. When reporting the results of an ICS-UCST, it can be assumed that the test was done in the supine/lithotomy position. A patient with a negative test in the supine/lithotomy position and a positive accessory stress test in the upright position should be reported as: "ICS-UCST negative, accessory (upright CST) positive."

Bladder volume

A spectrum of CST bladder volumes has been used in the literature from empty to 700 mL, including a "comfortably full" or a "symptomatically full" bladder. No consensus exists regarding the bladder volume for CST and to our knowledge no one has evaluated CST at differing bladder volumes in the same patient. The effect of differing bladder volumes has been evaluated in the context of LPP testing during UDS: Valsalva LPP was lower when bladder volumes were larger and the detection of SUI on LPP testing increased with increased bladder volumes.[22–25] During (cystometry-) LPP testing in women with SUI-S, leakage was not detected in any patient with a bladder volume <100 mL while leakage was detected in 19% of patients with a volume of 150 mL, 58% with a volume of 200 mL and 95% with a volume of 250 mL.[26] It seems reasonable to extrapolate this to the CST done in the clinic: a larger bladder volume may be more likely to elicit a positive test. On the other hand, one wants to avoid overfilling the bladder and elicit results that are not representative. Some patients may not routinely store more than 250-300 mL and it may be unrealistic for them to be filled to a larger volume. The use of a "comfortably full bladder might remedy this because one presumes that the patient's bladder volume will be close to their functional capacity but this reported sensation may be affected by anxiety level. Basing the CST volume on a percentage of the patient's bladder (maximum) capacity seems logical and this concept was used in the context of pad weight testing using a bladder filled to a volume of 50% of cystometric capacity.[27] It was concluded that this type of standardization reduced test retest variation in the quantifying of UI volume. However, determining cystometric capacity requires the patient undergo UDS first. Another option is to base the CST volume on a percentage of the capacity/maximum voided volume on a frequency-volume chart, or use the "usual/average voided volume" avoiding the need for urethral instrumentation/UDS. To our knowledge this has not been studied in the context of a CST and therefore requires additional evaluation. For the purposes of standardization for the ICS-UCST, we recommend that the patient has a bladder volume in the range of 200-400 mL, and to ensure that this volume is not exceptional (far too low or far too high) for this patient (LoE 2, GoR B).

How one achieves/determines the bladder volume is also up for debate. Natural bladder filling or retrograde filling with a catheter can be used. Retrograde bladder filling allows for filling to a preset amount independent of patient activity. This requires catheterization which carries a small risk for infection and a potential to irritate/injure the urethral mucosa which could affect the results.[28] Natural bladder filling avoids urethral instrumentation albeit with lesser control over the actual bladder volume. One may determine the patient's bladder volume at the time of CST via an ultrasound bladder scan prior to or immediately after a CST or one could do a CST then have the patient void and add the voided volume to the postvoid residual volume (via bladder scanner or catheterization) to calculate the bladder volume retroactively.

For the ICS-UCST we recommend the patient be asked about their sense of bladder fullness and the time since the last micturition to get an idea of the degree of fullness with natural filling. We propose the test be performed in a target range of bladder volumes between 200 and 400 mL with the frequency volume chart serving as a guide for usual normal desire to void. We recommend furthermore that a more precise determination of the bladder volume during the test, using one of the aforementioned methods, be reported (in mL) when reporting the results of the ICS-UCST. (eg, "ICS-UCST 380 mL positive")

Number/Forcefulness of coughs

The goal of a CST is to reproduce the patient's UI or at least to determine the likelihood that SUI is a cause of the UI. The CST, therefore, should ideally reproduce the kinds of

provocative maneuvers that are experienced by the patient on a day to day basis. In addition, the test must be easy to perform and interpret (ie, it should be of minimal burden to the patient and provide clear, easy to interpret results). While it has been demonstrated that with greater exertional effort (eg, jumping), SUI will be more likely to be elicited,[19,29] many women do not routinely subject themselves to such exertion and furthermore, it may be unrealistic, or too risky, to expect women to do such strenuous maneuvers in the clinic. Hence, on the basis of the available evidence as well as practicality, we propose that coughing be the provocative maneuver within the ICS-UCST.

In many reports that used a CST there was no mention of the number of times the patient was asked to cough (Figures 1 and 2). There is some evidence that, during UDS, multiple coughs are more likely to elicit leakage as was demonstrated during a "1-3-5" cough test.[30] The patient initially coughs once and if no SUI is noted then coughs three times and again if no SUI is noted then coughs five times. The "severity" of SUI was graded based on the occurrence of SUI after fewer coughs (more severe) versus many coughs (more mild). When compared with patient-perception questionnaires (eg, ICIQ-FLUTS, King's Health Questionnaire, UDI-6, and UIQ-7), statistically significant associations of higher grades of SUI (based on the 1-3-5 CST) with higher scores of incontinence domains on the questionnaires were noted. Others have speculated that (pelvic) muscular fatigue may have a role in SUI and its diagnosis: by having patients cough repeatedly (up to seven times), a greater than 20% decrease in MUCP was measured in almost a quarter of patients with SUI-S.[31]

While standardization of cough effort/force has been attempted using an audiometer as a gauge (to measure audible cough strength),[32] it has been suggested that it is rather difficult to achieve reliable standardization of coughing force/effort[33] and for the purposes of a routine office visit it is impractical. Rather, the recommendation of three coughs "as hard as possible" seems reasonable.[34]

Taking all of this together, we recommend that for the ICS-UCST: The patient should cough as forceful as possible. If no leakage is seen after the first cough, coughing should be repeated three more times (ie, total of four coughs) before calling the test negative (LoE 2, GoR B). If no leakage is seen after four forceful coughs, accessory stress testing (eg, greater number of coughs; upright testing; alternative provocations; ICS standard pad testing or UDS) can be performed, with no evidence based preference for any of these. We recommend this however to be reported specifically, especially for scientific purposes.

Determination of SUI/Interpretation

Most reports that describe the method of CST use direct visualization of incontinence that occurs simultaneous with a cough as the definition of a positive CST.[7,8,34] Incontinence occurring subsequent to a cough (ie, after a brief delay) or incontinence that persists after the cough has subsided is reported to be indicative of a concurrent detrusor contraction and usually referred to as cough induced DO[2] or cough associated DO.[35]

While some have used pads to capture the incontinence, avoiding the need for direct visualization of the incontinence,[29,32] the lack of direct visualization of the moment of the incontinence could call into doubt whether one is dealing with actual SUI versus cough associated DO. For the ICS-UCST therefore, we recommend that a positive test requires direct visualization of the efflux of urine from the urethral meatus synchronous with the cough.

2.2.3 | Accessory stress tests

Upright CST

As previously noted, a negative CST in the supine/lithotomy position does not necessarily rule out the presence of SUI. It has therefore been recommended that a patient with the complaint of SUI who has a negative CST in the supine/lithotomy position undergo a repeat test in the upright position.[7] This can be done in the same fashion as the standard ICS-UCST (bladder volume of 200-400 mL), up to four forceful coughs. If the upright CST is positive and the ICS-UCST (supine/lithotomy) is negative, the patient should be reported as having ICS-UCST negative, accessory (upright CST) positive.

Supine empty stress test (SEST)

A positive CST performed in the supine position with an "empty" bladder (volume <100 mL) has been suggested to indicate the presence of intrinsic sphincter deficiency (ISD). In a prospective series it was noted that a positive SEST was associated with a lower MUCP (mean, 20 vs 36 cm H_2O) and SEST had sens: 65-70% and spec: 67-76% for predicting ISD using low MUCP to diagnose ISD.[36] A positive SEST was also associated with a low LPP (40% of women with a positive SEST had a LPP of 60 cm H_20 or less versus 10% with negative SEST) with sens: 93.5%, spec: 90%, PPV 96.7% and NPV 81.8% for detecting ISD using ALPP to define ISD.[37] The IUGA suggests that SEST could be used as a simple test to be reasonably assured that ISD is not present (without resorting to multichannel UDS)[2] If a SEST is done as an accessory to (or preceding) an ICS-UCST, the results of each should be specified and reported.

In a patient with UI or more specifically with SUI-S, a negative ICS-UCST and a negative accessory CST, an ICS standard pad test[38] and/or (full) urodynamic testing may be considered to evaluate the complete lower urinary tract function, as per current practice guidelines.

3 | CONCLUSION

This module has introduced and provided the evidence base for the International Continence Society-Uniform Cough Stress Test (ICS-UCST) to standardize the performance and reporting of the cough stress test used in the clinical and outcomes assessment of women with urinary incontinence.

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