W19: ICS Core Curriculum (Free): Urodynamics – everything you need to know – basic and advanced

Workshop Chair: Enrico Finazzi Agrò, Italy
29 August 2018 08:35 - 11:35

Start	End	Topic	Speakers
08:35	08:40	Session 1 - Basic: Introduction/aims of urodynamics	Enrico Finazzi Agrò
08:40	08:50	Uroflowmetry and PVR	Alexandre Fornari
08:50	09:05	Cystometry	Luis Abranches-Monteiro
09:05	09:15	Pressure/Flow study	Peter Rosier
09:15	09:25	Ambulatory urodynamics	Alex Digesu
09:25	09:35	Discussion	Alexandre Fornari Luis Abranches-Monteiro Enrico Finazzi Agrò Peter Rosier Alex Digesu
09:35	09:40	Session 2 - Advanced: Introduction	Enrico Finazzi Agrò
09:40	09:55	Why I perform an invasive urodynamic test in a female patient with SUI before surgery	Enrico Finazzi Agrò
09:55	10:05	Voiding dysfunction in women: how can we define the obstruction?	Eskinder Solomon
10:05	10:15	Discussion	Enrico Finazzi Agrò Eskinder Solomon
10:15	10:30	Break	None
10:30	10:45	What can I expect from urodynamics in a neurogenic patient?	Tufan Tarcan
10:45	10:50	Discussion	Tufan Tarcan
10:50	11:05	The role of urodynamics in the paediatric population	Jian Guo Wen
11:05	11:10	Discussion	Jian Guo Wen
11:10	11:25	Urodynamics before surgery for BPO and for male incontinence	Paul Abrams
11:25	11:35	Discussion	Paul Abrams

Aims of Workshop

This workshop is split into two sessions- you can join each or both sessions. It will start with content for physicians, nurses who are interested but have no or very initial experience in the subject. The course will provide information about aims and methods of commonly used urodynamic tests. Good Urodynamic Practice and other ICS standardisation of terminology documents will be presented. The second half of the workshop, for experienced professionals, will discuss the limits and potentials of the urodynamic investigations in different indications providing to the audience the best available information to understand the present role of these tests.

Learning Objectives

Basic: To learn the correct terminology, the good urodynamic practices and the methods to perform a correct urodynamic test.
Advanced: Discuss the potentialities of the urodynamic investigations, discuss the limits of the urodynamic investigations and to understand the present role the urodynamic investigations.

Learning Outcomes

Basic: After the course the participants will be able to use the correct terminology, to adhere to the good urodynamic practices and to perform correctly some urodynamic tests.
Advnaced: After the workshop, the audience will have a better comprehension of the role of the urodynamic tests in different conditions with some tips to perform the proper test in the proper patient in the proper way.

Target Audience

Urologists, Urogynaecologists, other Physicians and Nurses already expert in urodynamics but interested to improve their knowledge on potentialities and limits of the urodynamic tests.

Advanced/Basic

Advanced

Conditions for Learning

Interactive- a maximum number of 50 participants is suggested.

Suggested Learning before Workshop Attendance

1: Rosier PFWM, Schaefer W, Lose G, Goldman HB, Guralnick M, Eustice S, Dickinson T, Hashim H. International Continence Society Good Urodynamic Practices and Terms 2016: Urodynamics, uroflowmetry, cystometry, and pressure-flow study. Neurourol Urodyn. 2017 Jun;36(5):1243-1260. doi: 10.1002/nau.23124. Epub 2016 Dec 5. Review. PubMed PMID: 27917521.

2: Gammie A, Clarkson B, Constantinou C, Damaser M, Drinnan M, Geleijnse G, Griffiths D, Rosier P, Schäfer W, Van Mastrigt R; International Continence Society Urodynamic Equipment Working Group. International Continence Society guidelines on urodynamic equipment performance. Neurourol Urodyn. 2014 Apr;33(4):370-9. doi: 10.1002/nau.22546. Epub 2014 Jan 4. PubMed PMID: 24390971.

3: Abrams P, Cardozo L, Fall M, Griffiths D, Rosier P, Ulmsten U, van Kerrebroeck P, Victor A, Wein A; Standardisation Sub-committee of the International Continence Society. The standardisation of terminology of lower urinary tract function: report from the Standardisation Sub-committee of the International Continence Society. Neurourol Urodyn. 2002;21(2):167-78. PubMed PMID: 11857671.

Suggested Reading

Basic: 1: Abrams P, Cardozo L, Fall M, Griffiths D, Rosier P, Ulmsten U, van Kerrebroeck P, Victor A, Wein A; Standardisation Sub-committee of the International Continence Society. The standardisation of terminology of lower urinary tract function: report from the Standardisation Sub-committee of the International Continence Society. Neurourol Urodyn. 2002;21(2):167-78. PubMed PMID: 11857671.

2: Gammie A, Clarkson B, Constantinou C, Damaser M, Drinnan M, Geleijnse G, Griffiths D, Rosier P, Schäfer W, Van Mastrigt R; International Continence Society Urodynamic Equipment Working Group. International Continence Society guidelines on urodynamic equipment performance. Neurourol Urodyn. 2014 Apr;33(4):370-9. doi: 10.1002/nau.22546. Epub 2014 Jan 4. PubMed PMID: 24390971.

3: Rosier PF, Kirschner-Hermanns R, Svihra J, Homma Y, Wein AJ. ICS teaching module: Analysis of voiding, pressure flow analysis (basic module). Neurourol Urodyn. 2016 Jan;35(1):36-8. doi: 10.1002/nau.22660. Epub 2014 Sep 11. PubMed PMID: 25214425.

4: Asimakopoulos AD, De Nunzio C, Kocjancic E, Tubaro A, Rosier PF, Finazzi-Agrò E. Measurement of post-void residual urine. Neurourol Urodyn. 2016 Jan;35(1):55-7. doi: 10.1002/nau.22671. Epub 2014 Sep 22. PubMed PMID: 25251215.

5: Gammie A, D'Ancona C, Kuo HC, Rosier PF. ICS teaching module: Artefacts in urodynamic pressure traces (basic module). Neurourol Urodyn. 2017 Jan;36(1):35-36. doi: 10.1002/nau.22881. Epub 2015 Sep 15. Review. PubMed PMID: 26372678.

6: Tarcan T, Demirkesen O, Plata M, Castro-Diaz D. ICS teaching module: Detrusor leak point pressures in patients with relevant neurological abnormalities. Neurourol Urodyn. 2017 Feb;36(2):259-262. doi: 10.1002/nau.22947. Epub 2015 Dec 23. Review. PubMed PMID: 26693834.

7: D'Ancona CAL, Gomes MJ, Rosier PFWM. ICS teaching module: Cystometry (basic module). Neurourol Urodyn. 2017 Sep;36(7):1673-1676. doi: 10.1002/nau.23181. Epub 2016 Nov 28. Review. PubMed PMID: 27891659.

8: Krhut J, Zachoval R, Rosier PFWM, Shelly B, Zvara P. ICS Educational Module: Electromyography in the assessment and therapy of lower urinary tract dysfunction in adults. Neurourol Urodyn. 2017 Apr 18. doi: 10.1002/nau.23278. [Epub ahead of print] Review. PubMed PMID: 28419532.

9: Schäfer W, Abrams P, Liao L, Mattiasson A, Pesce F, Spangberg A, Sterling AM, Zinner NR, van Kerrebroeck P; International Continence Society. Good urodynamic practices: uroflowmetry, filling cystometry, and pressure-flow studies. Neurourol Urodyn. 2002;21(3):261-74. PubMed PMID: 11948720.

10: Rosier PFWM, Schaefer W, Lose G, Goldman HB, Guralnick M, Eustice S, Dickinson T, Hashim H. International Continence Society Good Urodynamic Practices and Terms 2016: Urodynamics, uroflowmetry, cystometry, and pressure-flow study. Neurourol Urodyn. 2017 Jun;36(5):1243-1260. doi: 10.1002/nau.23124. Epub 2016 Dec 5. Review. PubMed PMID: 27917521.

Advanced

1: Groen J, Pannek J, Castro Diaz D, Del Popolo G, Gross T, Hamid R, Karsenty G, Kessler TM, Schneider M, 't Hoen L, Blok B. Summary of European Association of Urology (EAU) Guidelines on Neuro-Urology. Eur Urol. 2016 Feb;69(2):324-33. doi: 10.1016/j.eururo.2015.07.071. Epub 2015 Aug 22. PubMed PMID: 26304502.

2: Nager CW, Brubaker L, Litman HJ, Zyczynski HM, Varner RE, Amundsen C, Sirls LT, Norton PA, Arisco AM, Chai TC, Zimmern P, Barber MD, Dandreo KJ, Menefee SA, Kenton K, Lowder J, Richter HE, Khandwala S, Nygaard I, Kraus SR, Johnson HW, Lemack GE, Mihova M, Albo ME, Mueller E, Sutkin G, Wilson TS, Hsu Y, Rozanski TA, Rickey LM, Rahn D, Tennstedt S, Kusek JW, Gormley EA; Urinary Incontinence Treatment Network. A randomized trial of urodynamic testing before stress-incontinence

surgery. N Engl J Med. 2012 May 24;366(21):1987-97. doi: 10.1056/NEJMoa1113595. Epub 2012 May 2. PubMed PMID: 22551104; PubMed Central PMCID: PMC3386296.

3: Finazzi Agro E, Iacovelli V, Illiano E, Costantini E. Urodynamics before surgery for stress urinary incontinence in female patients: An open debate. Arch Esp Urol. 2017 Oct;70(8):691-694. PubMed PMID: 28976343.

4: Schurch B, Iacovelli V, Averbeck MA, Stefano C, Altaweel W, Finazzi Agrò E. Urodynamics in patients with spinal cord injury: A clinical review and best practice paper by a working group of The International Continence Society Urodynamics Committee. Neurourol Urodyn. 2017 Aug 1. doi: 10.1002/nau.23369. [Epub ahead of print] Review. PubMed PMID: 28762566.

5: Serati M, Topazio L, Bogani G, Costantini E, Pietropaolo A, Palleschi G, Carbone A, Soligo M, Del Popolo G, Li Marzi V, Salvatore S, Finazzi Agrò E. Urodynamics useless before surgery for female stress urinary incontinence: Are you sure? Results from a multicenter single nation database. Neurourol Urodyn. 2016 Sep;35(7):809-12. doi: 10.1002/nau.22804. Epub 2015 Jun 9. PubMed PMID:
26061435.

6: Drake MJ, Lewis AL, Lane JA. Urodynamic Testing for Men with Voiding Symptoms Considering Interventional Therapy: The Merits of a Properly Constructed Randomised Trial. Eur Urol. 2016 May;69(5):759-60. doi: 10.1016/j.eururo.2016.01.035. Epub 2016 Feb 1. PubMed PMID: 26847139.

7: Solomon E, Yasmin H, Duffy M, Rashid T, Akinluyi E, Greenwell TJ. Developing and validating a new nomogram for diagnosing bladder outlet obstruction in women. Neurourol Urodyn. 2017 Jun 30. doi: 10.1002/nau.23307. [Epub ahead of print] PubMed PMID: 28666055.

Uroflowmetry and PVR
Alexandre Fornari

Uroflowmetry is the non-invasive measure of the urinary flow rate, widely used to identify voiding patterns of man and women. The parameters to be considered have different normality values for man, women or child and the most important are the peak flow, volume voided and the shape of the curve. These parameters represent the combination of detrusor contraction power and urethral resistance (bladder outlet/prostate/pelvic floor/ external sphincter) that produces a flow curve that should have a bell-like shape. Unfortunately, uroflowmetry can`t provide us with complete information about which component is responsible for an abnormal flow curve. We have some patterns of curve shape that suggest Valsalva maneuvers used to produce flow, urethral stenosis and others but no one is diagnostic, only suggestive and this means that we need a pressure/flow study to completely evaluate the lower urinary tract function of this patient. It's considered good practice in urodynamics to provide a quiet and private room to obtain the uroflowmetry and ask for the patient if this flow is representative of their normal pattern of flow.

Post-void residual urine volume is another parameter used to evaluate the voiding function. It can be measured by non-invasive methods such as ultrasonography or bladder scan, but can be measured by inserting a urethral catheter too. The high volume of post-void urine may occur due to decreased detrusor contraction, elevated urethral resistance (bladder outlet/prostate/pelvic floor/ external sphincter) and other situations like bladder diverticulum, large vesicoureteral reflux or other abnormalities of the lower urinary tract. We don't have a clear value of the normality about the volume of the post-void residual urine but most urologist agree that volumes of 50-100 ml constitute the lower threshold to define an abnormal PVR. The relation of elevated PVR with Urinary retention, degree of Bladder outlet obstruction, BPH progression or other outcomes is not so clear.
The combination of these two noninvasive tests may give us a good idea about the voiding function and are recommended for patients with LUTS when the diagnosis is not clear and we intend to avoid a more invasive evaluation.

Cystometry
Luis Miguel Abranches-Monteiro

Cystometry or filling cystometry is the urodynamic investigation of the storage phase of micturition.
It then implies the measurement of several parameters during the filling of the bladder.
ICS recommends that some information is gathered beforehand. A free flowmetry and a voiding diary plus some form of post void residual are helpful data that can tailor the procedure of a Cystometry.

A minimum of measurements is needed. Depending on the urodynamic question, some extra records can be added.
The basic purpose of a Cystometry is an appraisal of the behavior of the bladder and its neural control during the filling phase. Hence bladder pressure must be measured. Yet, bladder pressure can be generated by two major forces: abdominal contraction and detrusor contraction. The only way of distinguishing these two sources of pressure is having a synchronous record of abdominal pressure. When bladder pressure raises but not the abdominal, one assumes that detrusor contraction was the origin.

Rectal pressure is the easier way of measure abdominal activity via a anal route rectal balloon. The algebraic difference between the vesical and the abdominal pressure is then called the detrusor pressure. It is not really measured, but inferred from the former two.

Bladder filling can be artificial or natural. When water or saline is pumped into the bladder and the bladder is emptied beforehand, we can know in every instant what is the approximate liquid volume inside the bladder, obviously taking into consideration the natural filling of urine during the examination.

Since, some leakage can happen, a 5th information is needed: uroflowmetry measurement of the volume leaked. The leaked volume must be subtracted from the infused volume to establish the actual bladder volume.
In summary the basic information is the bladder volume in every instant, bladder and abdominal pressure and its detrusor derivative, and leaked volume. The rate of artificial filling, being an influential parameter is to be known as well.
Having this information, data from the patient is gathered during the examination. The sequence of bladder sensations and it relationship to the actual bladder volume and the occurrence of detrusor contractions, enables us to grade the bladder sensation and describe an overactive bladder or an overactive detrusor.

The visco-elastic properties of the bladder wall, or bladder compliance can be evaluated from bladder pressure development after the infused volume.

Some extra tests can be added to Cystometry depending on the pathology and the questions to be answered. The effort of cough or abdominal strain or Valsalva maneuvers are asked to the patient to perceive the urethral function or the detrusor behavior to effort.

Cystometry ends with 'permission to void' or with incontinence (involuntary loss) of the (total) bladder content.
As volumes and pressures have clear clinical implications, reliability of transducer's signals throughout the exam is paramount. Filling of bladder should start only when all measurements are validated by the examiner. A graphic proof must be clear for others to interpret if needed. Examiners must be aware of good urodynamic practices as ICS has published. Cystometries must be reasonably standardized and therefore be compared among centers.

Pressure/flow study
Peter F.W.M. Rosier

The pressure flow study aims to evaluate micturition. Pressure flow study starts after permission to void during invasive urodynamic testing. Permission to void is given when the patient reports a comfortably full bladder, that would require a toilet visit as immediate as possible. A pressure flow study allows to evaluate bladder outlet conditions and also measurement of detrusor contraction strength. Bladder outflow obstruction can be quantified and also detrusor contraction power, for both gender and all ages. The lesson will teach the basic principles of pressure flow analysis and the clinical relevance of the most commonly occurring features and observations. The learning goal of this element of the curriculum is to make pressure flow analysis understandable and clinically interpretable form presented traces for everyone with basic knowledge of lower urinary tract function. Everyone present is wholeheartedly invited to ask questions to engage in discussion.

Ambulatory urodynamics
Alex Digesu

This teaching module has been developed by the ICS Urodynamics Committee to assist ICS members in their routine clinical practice. A detailed literature search on studies published on the clinical role of AUM as well as expert opinions have been considered.

A slide set on AUM has been developed, approved by all members of the ICS Urodynamics Committee and is available to the ICS membership on the ICS website. The final approved teaching module has been presented at the ICS Annual Scientific Meeting in Brazil 2014.

The scientific evidence on the clinical role of AUM in patients with lower urinary tract symptoms is summarized. The catheters and recording systems used, the patient preparation for the test, the technique, the instructions to the patient, the analysis, interpretation, and quality control assessment of AUM trace as well as the contraindications for AUM are described.
The clinical role of AUM is still controversial. The scientific evidence on the usefulness of AUM is still limited but the ICS Urodynamics Committee recommends its use as a second line diagnostic tool when office laboratory urodynamics have failed to achieve a diagnosis. AUM has been showed to be more sensitive than laboratory urodynamics in diagnosing detrusor overactivity but the level of evidence for this measurement is not high. This manuscript summarizes the evidence and provides practice recommendations on AUM for teaching purposes in the framework of an ICS teaching module.

Why I perform an invasive urodynamic test in a female patient with SUI before surgery
Enrico Finazzi Agrò

The role of urodynamic investigation (UDI) before surgery for stress urinary incontinence (SUI) in female patients has been widely discussed in the last years. Although UDI used to be considered mandatory before surgery in all female patients affected by SUI according to several guidelines or recommendations, there was a lack of clear demonstrations on its role in improving clinical outcomes and clinical decision making.

Two systematic reviews on this subject have been published. In the first one, Clement et al. concluded that while urodynamics may change clinical decision-making, there is "some high quality evidence that this did not result in lower urinary incontinence rates after treatment". In the second one, Rachaneni et al. stated that UDI do not improve outcomes "in women undergoing primary surgery for SUI or stress-predominant MUI without voiding difficulties". These two systematic reviews included few papers and most of the patients analyzed came from the ValUE study.

This sort of conclusions should be properly analyzed focusing on the type of stress incontinence (uncomplicated and complicated). Agur et al. retrospectively analyzed 6276 women with UI, from an electronic database at a tertiary referral center; only 324 (5.2%) women had pure SUI. This was largely confirmed by an Italian multicenter database that showed that only 36% of more 2053 patients could have been diagnosed as having an "uncomplicated" SUI and 64% were "complicated", according to ValUE trial criteria. Furthermore, preoperative UDI led to the diagnosis of different type of urinary incontinence in 74.6% of complicated vs 40% of uncomplicated SUI cases (P = 0.0001). Moreover, a voiding dysfunction on UDI was observed in 13.4% of the uncomplicated cases and in 22.5% of the complicated cases (P = 0.0001).

These considerations lead one to think about two main points. On one hand, the so-called "uncomplicated" SUI patients are a minority. On the other hand, in the majority of "complicated" patients, the urodynamic observation varies from the pre-urodynamic diagnosis much more frequently than in the "uncomplicated" patients. Thus, in ''complicated'' patients, the role of urodynamic seems not to be challenged yet and UDI seems to be highly suggested.

Furthermore, for uncomplicated patients we can say that UDI might not change the outcome but there are other parameters we need to evaluate such as an overlapping voiding dysfunction or an underlying detrusor overactivity. A tailored treatment is an essential target to obtain. UDI may prevent surgical intervention in women without SUI or with prevalent detrusor overactivity incontinence. An accurate assessment of the risks and benefits of surgery is fundamental to facilitate a correct preoperative counseling directed towards appropriate patient expectations, as well as guide the proactive management of postoperative symptoms. In particular, the presence of a pre-existing voiding dysfunction could affect the outcomes.

In conclusion, in the majority of patients (the "complicated" ones) the role of UDI has not been fully evaluated. Maybe UDI itself can expand our knowledge in those conditions where pathology is variable, uncertain and multifactorial and where the "evidence-based" methods are difficult to satisfy.

Voiding dysfunction in women: How can we define the obstruction?
Eskinder Solomon

Bladder outlet obstruction (BOO) in women has an estimated prevalence of between 2.7% and 29%. Despite this reported prevalence, BOO in women has no standard definition, nor well-accepted defining diagnostic criteria. In this talk, we will examine the challenges of defining BOO in women. These include the vast range of causes for the BOO, aspecific presenting symptoms and lack of standardised de-obstructing surgery (such as TURP in men) that may be used to define the boundary between obstructed, equivocal and unobstructed patients. We will also review the role of using modalities complementary to pressure/flow studies such as cystography, pelvic floor EMG as well as urethral pressure profilometry to better diagnose the cause of the BOO.

What can I expect from urodynamics in a neurogenic patient?
Tufan Tarcan

The two main goals of neuro-urological management in neurogenic lower urinary tract dysfunction (NLUTD) include protection of the urinary tract and treatment of symptoms. Protection of the urinary tract requires a proactive management since high intravesical pressure-induced damage to the kidneys and the bladder is often irreversible. The proactive management is based on a risk analysis which aims separation of the high-risk group from the low-risk group. The high-risk group deserves more intense follow up, more effective and more invasive therapies whereas low risk group should be saved from aggressive follow up and therapies.

Urodynamic studies are considered to be the gold standard methods for the evaluation of NLUTD because they are the best and only method to characterize it. Urodynamic findings enable us to classify the NLUTD and further help us to predict the consequent risk for urinary tract damage (UTD). On the other hand, urodynamic studies are prone to artefacts and technical errors and also to clinical misinterpretations. There are important technical principles to follow as reported by the ICS Good

Urodynamic Practice guidelines. Beside of the technical accuracy, " a urodynamic consciousness" is needed to benefit most from urodynamic studies. This consciousness requires a performer who is aware about the clinical information and needs of the patient and understands why the urodynamic study is being done. For example, bladder diaries or CIC volumes must be known prior to urodynamic studies in order to understand how much and how long the bladder is being exposed to intravesical pressures detected in urodynamic studies.

The timing and frequency of urodynamic studies may vary depending on the type of neurological etiology. There is enough evidence indicating that one algorithm will not work for all neurological etiologies including myelodysplasia, spinal cord trauma (SCT) and multiple sclerosis (MS). For example, the risk for upper UTD is higher in SCT or in myelodysplasia compared to MS, even when the detrusor sphincter dyssynergia (DSD) is present. As shown by guidelines, patients with MS require urodynamic studies less frequently compared to other 2 conditions. Children with myelodysplasia constitute a unique group depending on the dynamic character of the disease and associated co-morbidities. A proactive approach in this group is of utmost importance to protect the urinary tract where the risk analysis is based on urodynamic studies.

The presence of DSD, low bladder compliance, high detrusor leak point pressure (DLPP) or high neurogenic detrusor overactivity LPP (N-DO LPP) have been shown to predict UTD in different neurogenic etiologies. The traditional DLPP cutoff level of 40 cmH2O has been applied to different neurological etiologies to predict the upper UTD without a high level of evidence. Recent studies have shown that the cutoff level of 40 cmH2O is not reliable and should not be used as the sole parameter to decide on more invasive therapies since not all children with a DLPP > 40 cmH2O develop upper UTD. On the other hand, many children between 20-40 cmH2O develop upper UTD and a cutoff level of 20 cmH2O appears to be more sensitive.

The role of urodynamics in the paediatric population
Jian Guo Wen

Pediatric voiding dysfunction (PVD) is frequently confronted in clinical practice. However, the subjective bias from both the children and clinician and the considerable overlap between the symptoms from different disorders make it difficult to evaluate the PVD. Pediatric urodynamic studies（PUDS） are well known an objective investigations developed to clarify these symptoms and it has become the gold standard in assessment of PVD.

Filling cystometry is indicated when history and clinical examination raises a suspicion of either anatomic and/or neurologic lower urinary tract dysfunction involving primarily the storage phase, or there is a question that cannot be answered by less invasive testing. Apart from a comprehensive history and complete physical examination, a voiding (or catheterization) diary, uroflowmetry and post-void residual volume, as measured by ultrasonography, are to be conducted before ordering this mini-invasive urodynamic study. Pressure/flow can be obtained following on to cystometry with no specific additional equipment (apart from a flowmeter) or patient preparation needed. Neurogenic bladder, posterior urethral valves, bladder exstrophy, anorectal malfromations are most common confronted during the pediatric urological practice.

It is well known that Neurogenic bladder results from a variety of abnormalities of the central or peripheral nervous systems and contributes to various forms of lower urinary tract dysfunction. In children, the spinal level and extent of congenital lesion are poorly correlated with the clinical outcome. UDS and functional classifications have therefore been more valuable for defining the extent of the pathology and planning treatment in children. The classification of Neurogenic bladder by using UDS has been popularly accepted as a basis for making treatment protocol. UDS can objectively reflect the type and severity of bladder and-urethral dysfunction. Posterior urethral valvesis life-threatening congenital anomalies. Following surgical treatment, patients require close follow-up to detect and monitor for bladder dysfunction that may lead to renal injury by video UDS adds the benefit of fluoroscopy to simultaneously image the urinary system. Bladder exstrophy is characterized by an infra-umbilical abdominal wall defect, incomplete closure of the bladder with mucosa continuous with the abdominal wall, epispadias, and alterations in the pelvic bones and muscles. Even before bladder neck reconstruction, UDS can be predictive for detrusor function and the ability of the bladder to increase in size without high intravesical pressures and also the application of anticholinergic therapy to enhance bladder volume. Following bladder neck reconstruction, urodynamic assessment provides an objective correlation with the clinical assessment of continence. It also helps in planning pharmacotherapy for elimination of uninhibited detrusor contractions, improving bladder compliance and reducing intravesical pressures. Anorectal malformations involves the distal anus and rectum as well as the urinary and genital tracts. Early and repeated UDS is mandatory to detect as earliest as possible the onset of deterioration before irreversible neurological damage has occurred.

Urodynamics before surgery for BPO and for male incontinence
Paul Abrams

UDS are indicated when conservative and medical treatment have failed to adequately improve the symptoms of men with suspected BPO or post prostatectomy incontinence (PPI), and the man and his urologist are considering a surgical solution. Multiple case series have shown that the demonstration of BPO by urodynamics prior to prostatectomy maximises the benefit of prostate surgery.

Before UDS the man should receive a patient information leaflet and complete a 3 day bladder diary and a symptom questionnaire (ICIQ-BD & MLUTS). Men with suspected BPO should also have screening urine flow studies with estimates of post void residual. Flow studies help to validate the pressure flow studies.

Standard UDS (filling cystometry and pressure flow studies) are sufficient to answer the question “is this man obstructed?”. Video urodynamics are desirable in men with PPI, and allow the question “Is this man’s PPI due to urethral sphincter weakness causing stress incontinence?”, to be answered. The demonstration of lower urethral closure pressures is helpful in suggesting the degree of sphincter damage that has occurred and may guide the choice of surgery.
UDS serve to define other relevant lower urinary tract dysfunctions (LUTDs) which may affect the outcome of surgery. The principal LUTDs that may prejudice good outcome, are the pre-operative presence of symptomatic detrusor overactivity during filling, and or detrusor underactivity during voiding.

Quality in the UDS remains a key issue and water-filled catheters are the “gold standard”, and both the obstruction (BOOI) and contractility (BCI) nomograms are entirely based on this methodology. Both technical skills to maintain trace quality, and clinical skills to interpret the main symptoms during UDS, are vital. When both skill sets are employed, UDS are reliable and allow fully informed consent, with respect to both the diagnosis of the primary condition and possible complicating factors.
Surgery for suspected BPO aims to restore voiding to an unobstructed state, and for PPI, to allow the man a full range of physical activities by curing or significantly reducing his urinary stress incontinence. Hence, urodynamic confirmation of BPO or USI is essential prior to surgery for BPO or PPI. Fully informed consent cannot be achieved without the information from well conducted UDS.

In summary, UDS are an essential diagnostic tool for male incontinence and voiding dysfunction. UDS should be carried out to ICS standards, by healthcare professionals with both good technical and clinical skills.

ICS CORE CURRICULUM (FREE): URODYNAMICS – EVERYTHING YOU NEED TO KNOW – BASIC AND ADVANCED

WORKSHOP 19

08:40 **UROFLOWMETRY AND PVR**

ALEXANDRE FORNARI

ICS 2018 PHILADELPHIA

Alexandre Fornari

ICS 2018 PHILADELPHIA

Affiliations to disclose†:

Astellas: speaker

Ipsen: Trial participation

Boston/Jomhedica: Proctor/Trainer

† All financial ties (over the last year) that you may have with any business organization with respect to the subjects mentioned during your presentation

Funding for speaker to attend:

- [x] Self-funded
- [ ] Institution (non-industry) funded
- [ ] Sponsored by:

Definitions:

Non-invasive urodynamics: All urodynamics done without the insertion of catheters: for example, uroflowmetry, PVR, penile compression-release test, penile cuff, urethral connector, condom catheter, or sonography.

International Continence Society Good Urodynamic Practices and Terms 2016: Urodynamics, uroflowmetry, cystometry, and pressure-flow study

WILEY Neurourology and Urodynamics ICS

Peter F.W.M Rosier[2*] | Werner Schaefer[2] | Gunnar Lose[3] | Howard B. Goldman[4] | Michael Gurualnick[4] | Sharon Enstice[4] | Tamara Dickinson[5] | Hashim Hashim[6]

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Definitions:

Uroflowmetry: A test that produces the [Citation from GUP2002]: "… flow rate of the external urinary stream as volume per unit time in millilitres per second (mL/s)." ICS uroflowmetry minimally reports the maximum flow rate and the volume voided and PVR. (GUP2002, not changed.) Other characteristics such as flow pattern (specify) and other parameters may be added but should be specified.

International Continence Society Good Urodynamic Practices and Terms 2016: Urodynamics, uroflowmetry, cystometry, and pressure-flow study

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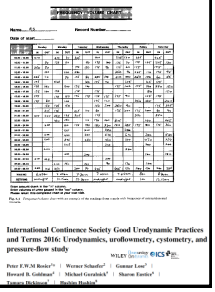
Recommendations for Uroflowmetry:

The WG recommends permitting patients to undergo uroflowmetry in their preferred position and to strive for minimum physical discomfort and anxiety for the patient, as well as ensuring personal dignity.

The WG recommends checking if the voiding is representative, based on the patient's report and also on the association with the patient's FVC or BD volumes.

The position of the patient during voiding studies should be reported.

The WG recommends considering repetition of the uroflowmetry if the result has not been representative for the patient or if the result indicates abnormality. Particularly, if the voided volume and/or flow rate are unexpectedly low or the PVR is (much) larger than expected or explainable in both women and in men.



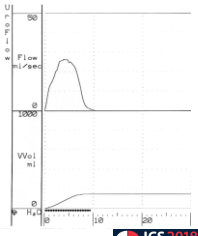
International Continence Society Good Urodynamic Practices and Terms 2016: Urodynamics, uroflowmetry, cystometry, and pressure-flow study

WILEY Neurourology and Urodynamics ICS

Peter F.W.M Rosier[2*] | Werner Schaefer[2] | Gunnar Lose[3] | Howard B. Goldman[4] | Michael Gurualnick[4] | Sharon Enstice[4] | Tamara Dickinson[5] | Hashim Hashim[6]

Uroflowmetry

- Balance between detrusor contraction and urethral resistance.
- Bell shape curve



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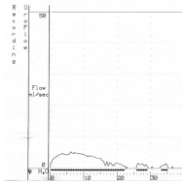

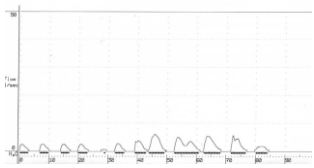

Abnormal Findings are not specific.

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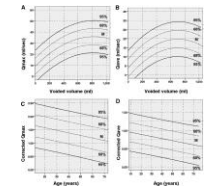
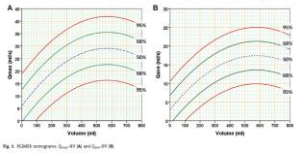


Uroflowmetry in Healthy Women: Development and Validation of Flow–Volume and Corrected Flow–Age Nomograms



Rationalization of Interpretation of Uroflowmetry for a Non-Caucasian (Indian) Population: Conceptual Development and Validation of Volume-Normalized Flow Rate Index

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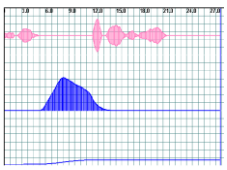
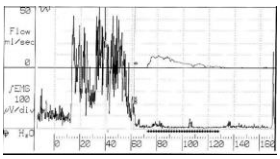
Flow - EMG





Uroflowmetry with pelvic floor electromyography: inter-rater agreement on diagnosis of pediatric non-neurogenic voiding disorders

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Definitions:

Post-void residual volume (PVR): (GUP 2002) The remaining intravesical fluid volume determined directly after completion of the voiding. The technique (eg, ultrasound or catheter) used to measure the volume should be specified.

International Continence Society Good Urodynamic Practices and Terms 2016: Urodynamics, uroflowmetry, cystometry, and pressure-flow study

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Neurourology and Urodynamics 35:55–57 (2016)

Measurement of Post-Void Residual Urine

Anastasios D. Asimakopoulos,[1] Cosimo De Nunzio,[2] Ervin Kocjancic,[3] Andrea Tubaro,[2] Peter F. Rosier,[4] and Enrico Finazzi-Agrò[5]*

- Unrepresentative results may be obtained when voiding has to occur in unfamiliar surroundings or on command with an only partially filled or an overfilled bladder (eo).
- A portable bladder scanner may present some advantages over real-time ultrasound (LE 3), especially if equipped with additional real-time pre-scan imaging (LE 3).
- There is no universally accepted definition of a significant residual urine volume. For clinical practice, PVR <30 ml can be considered insignificant, while residual volumes persistently >50 ml could be regarded as important (eo).
- Large PVR (>200–300 ml) often indicates LUTD and may predispose to unsatisfactory treatment results if invasive BOO treatment is undertaken (LE 3). Nevertheless, no level of residual urine, of itself, mandates invasive therapy and no PVR threshold is yet established for decision-making (LE 3).

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Neurourology and Urodynamics 35:55–57 (2016)

Measurement of Post-Void Residual Urine

Anastasios D. Asimakopoulos,[1] Cosimo De Nunzio,[2] Ervin Kocjancic,[3] Andrea Tubaro,[2] Peter F. Rosier,[4] and Enrico Finazzi-Agrò[5]*

- PVR can detect only voiding dysfunction without indicating BOO specifically (LE 2–3).
- There is no evidence that PVR increases significantly in patients treated with anti-muscarinic drugs (LE 2). However, consider that patients with significant PVR were excluded from studies published up to now.
- PVR may be associated with UTI, especially in persons at risk, such as children or patients with neurogenic dysfunction (LE 3). This association among adults is far from clear (LE 3).
- Large PVR may be associated with chronic kidney diseases (LE 3).

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Conclusions

- Uroflowmetry and PVR measurement are non-invasive methods to evaluate the Lower urinary tract
- Theses evaluations are recommended by some guidelines in patients with LUTS
- They are non specific, but can be important in identifying patients that need additional evaluations.

Thank you for your attention!!!

Luis Abranches-Monteiro

ICS 2018 PHILADELPHIA

Affiliations to disclose†:

Astellas Pharma

IPSEN

† All financial ties (over the last year) that you may have with any business organisation with respect to the subjects mentioned during your presentation

Funding for speaker to attend:

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Filling Cystometry

Luis Abranches-Monteiro
ICS Urodynamics Committee

Cystometry - Definition

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Cystometry = Bladder measurements

Transurethral or suprapubic continuous fluid filling of the bladder, and measurement of vesical and abdominal pressures….

….and volume/sensation evaluation

…Filling Cystometry ends with 'permission to void' or with incontinence (involuntary loss) of the (total) bladder content.

Cystometry: Aims

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1. To evaluate lower urinary tract **reservoir function** and eventually find an explanation for the patients' complaints
2. To evaluate lower urinary tract **reservoir function** for research purposes

Reservoir function:

- Bladder sensation/volume
- Bladder wall compliance
- Detrusor behavior

Cystometry (clinical relevance)

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What should be known before starting ?

Patient's perceived (LUT-) symptoms and signs

- Symptoms questionnaire (preferable)
- Voiding diary ('usual' volumes voided)
  - 'Predict' -estimated- cystometric capacity
- Free uroflowmetry
- Post void residual urine

ICS Standard:

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Fluid filled: saline solution

External pressure transducers

Reference = pressure at the level of the symphysis

Patient in standing/sitting position

Fill until **strong desire to void**

Average fill-rate (e.g. 10% of expected capacity /minute) e.g.:50ml/min

Indicate end of cystometry on trace

- Stopping of the pump (and /or)
- 'Permission to void'

Solution infused

Saline solution

- Or contrast

Temperature

- Room temperature

Patient position during cystometry

Sitting (standing) position is more provocative for abnormal detrusor activity (e.g. overactivity) than the supine position. At some point in the test, filling might desirably take place with the patient standing.

Patients unable to sit or stand → supine position.

Infusion Pump

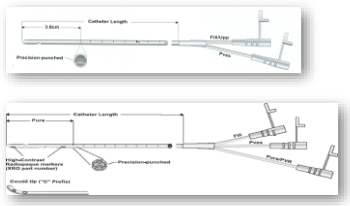
Pump

1. Feedback Pump control
2. Volume by Pump cycle

Weight infusion/volume controller

1. More accurate
2. Independent of catheter resistance

Urethral Catheter



Double lumen with lateral hole for Brown-Wickam profilometry
Triple lumen for urethrocystomanometry

Fluid-filled Catheters

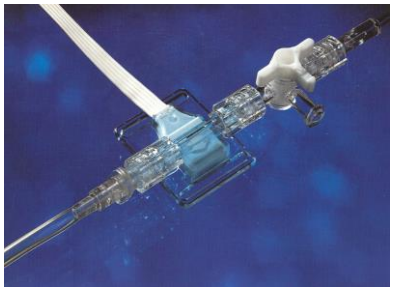
- Current ICS standard cystometry and pressure-flow study requires **fluid-filled catheters** with external pressure transducers to be leveled at the height of the upper edge of symphysis pubis.
- The **urodynamic pressure** is therefore the excess pressure above atmospheric pressure at the hydrostatic level of the upper edge of the symphysis pubis.
- Some studies that have compared fluid-filled catheters with microtip sensor catheters or air-filled catheters have shown that the results of the cystometry using these alternative systems are not interchangeable with the current ICS standard

International Continence Society Good Urodynamic Practices and Terms 2016: Urodynamics, uroflowmetry, cystometry, and pressure-flow study
Rosier, P et al. N&U 2016

Insert catheters

- Usually lithotomy position
- Sterile catheters
  - Vesical: double lumen (can be separate)
    - 6-7F
  - Rectal: catheter with a **punctured** balloon
- Fix the catheters adjacent to the meatus
- Patient in comfortable position
- Cover the patient - ex. with a towel

Transducer



Position of the Transducer

External transducer measured at the level of the symphysis pubis

Equals: Base of the bladder

Intra rectal and intravesical pressures are assumed to be measured at identical levels

Filling cystometry

Initial resting pressure

- Supine 5 -20cmH_2O
- Sitting 15-40cmH_2O
- Standing 30-50cmH_2O

Hogan S. Neurourol & Urodyn 2012, 31: 1104-117

Bladder sensation - classification

Normal bladder sensation

can be judged by 3 defined points noted during filling cystometry and evaluated in relation to the **bladder volume** at that moment and in relation to the patient's **symptomatic complaints.**

First sensation of bladder filling

He/she first becomes aware of the bladder filling.
To be separated from the sensation that the catheterisation has caused, that means it disappears after a few minutes.

First desire to void

is defined as the feeling, that would lead the patient to pass urine at the next convenient moment, but voiding can be delayed if necessary.

Strong desire to void

is defined, as a persistent desire to void without the fear of leakage.

Urgency

during filling cystometry, is a sudden compelling desire to void.

Bladder sensation - classification

Increased bladder sensation

- is defined, as an early first sensation of bladder filling (or an early desire to void) and/or an early strong desire to void, which occurs at low bladder volume and which persists.

Reduced bladder sensation

- is defined, as diminished sensation through out bladder filling.

Absent bladder sensation

- means that, during filling cystometry, the individual has no bladder sensation.

Non-specific bladder sensations,

- during filling cystometry, may make the individual aware of bladder filling, for example, abdominal fullness or vegetative symptoms.

Bladder pain,

- is a self explanatory term and is an abnormal finding.
- Pain may increase with volume, or not, which should be reported.

Filling cystometry - information

Cystometric capacity (mL)

- Infused weight and pump-speed helpful during the test
- And include diuresis (capacity: voided volume + PVR) after the test.
- Measure PVR after pressure flow via the catheter

Bladder sensations (mL)

- Electronic buttons during cystometry do not include diuresis; correct after the test if needed

Bladder filling sensation

Is a subjective parameter

- *Depending on interaction /communication with the patient*

Normal bladder sensation (rule of thumb)		of cap.
• First sensation	+/- 175-250mL	33%
• First desire to void	+/- 272-450mL	66%
• Strong desire to void	+/- 429-700mL	100%

Bladder capacity

Cystometric capacity – bladder volume at the end of filling phase

- Commonly there is no reason to fill more than 800mL e.g. in the absence of sensation and/or contraction

Maximum cystometric capacity – can no longer delay micturition

- Overfilling hinders subsequent representative voiding

Detrusor Pressure - Pdet

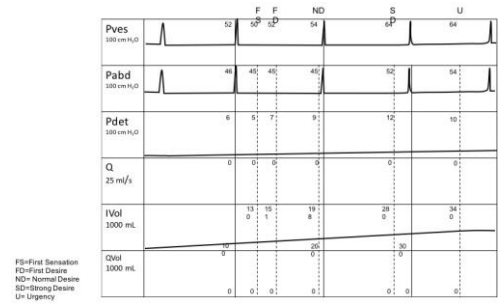
Not really a measured pressure

Pves not shared with Pabd is inferred as promoted by detrusor activity

$$P_{det} = P_{ves} - P_{abd}$$

Schafer W. Neurourol & Urodyn. 2002, 21: 261-74

Filling Cystometry



Detrusor function

Normal detrusor function – little or no changes in pressure

Detrusor overactivity – ANY amplitude of detrusor pressure raise before permission to void:

- Neurogenic; when relevant neurological abnormalities are present
- Idiopathic

Cystometry patterns do not descriminate neurogenicity: History and clinical exam

Abrams P. Urology. 2003, 61: 37-49

Detrusor overactivity

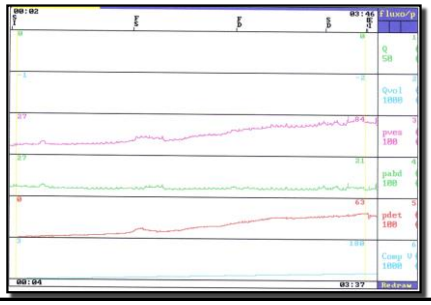
Bladder Compliance

Good compliance is large volume and low pressure

$$C = \frac{(V1 - V0)}{(P1 - P0)}$$

Abrams P. Urology. 2003, 61: 37-49

$$\text{Compliance} = \frac{(180mL - 3mL)}{(63cmH_2O - 0cmH_2O)} = 2.8\ mL/cmH_2O$$



Bladder Compliance – Normal Values

Not well defined

(Neurogenic) LUT dysfunction:

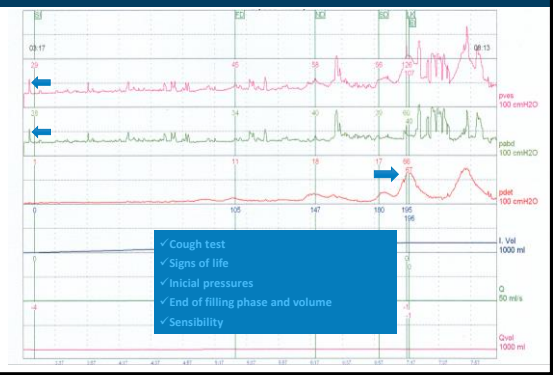
- (low) values 13 – 40 mL/cmH_2O, upper tract risk

Normal >40 mL/cmH_2O

Low <30 mL/cmH_2O

- Relation with sensation, volume and leak point

Cystometry wrap-up



Cystometry Wrap-up

Patient should be relaxed and trustful

Technically adequate

Observe the pressures 'as an engineer'

Perform the test as representative for the usual situation as possible

Systematically report all observations

Thank You

UMC Utrecht

Analysis of voiding: Pressure flow analysis

Dr. Peter F.W.M. Rosier MD, PhD
Senior Lecturer Functional Urology
Department of Urology
University Medical Centre Utrecht
The Netherlands

Peter F.W.M. Rosier

Affiliations to disclose†:

none

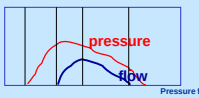
† All financial ties (over the last year) that you may have with any business organisation with respect to the subjects mentioned during your presentation

Funding for speaker to attend:

- [X] **Self-funded**
- [ ] **Institution (non-industry) funded**
- [ ] **Sponsored by:**

Voiding

- Bladder emptying
  - Elements:
    - Rate: millilitres per second
    - Time (sec) and total volume (ml)
    - Pressure (cmH_2O/energy (M. detrusor)
  - Picture:



Normal lower urinary tract function

- Storage function
  - (detrusor muscle)
    - Low pressure
    - Adapts to volume
    - Signals stretch
    - Contraction is suppressed
- Voiding function
  - At a convenient moment
    - Controllable
    - Detrusor contraction is activate
  - Efficient and effective

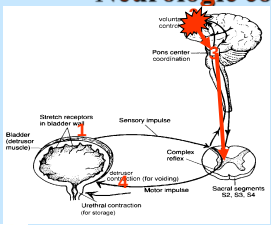
Normal voiding

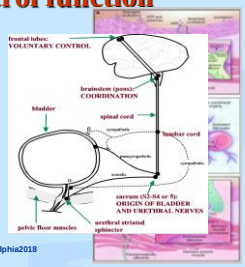
- Voiding is desired (convenient moment)
- pelvic floor relaxes and detrusor base (urethral sphincter) relaxes and (antagonistic) detrusor contracts
- detrusor pressure increase forces the (relaxed) detrusor base / bladder neck and the urethra to open
- urine flow begins
- detrusor contraction ends
- detrusor base (urethral sphincter) and pelvic floor contraction resume > 'storage state'

Normal act of voiding (neurologic)

- Pelvic floor initiates voiding
  - (after permission by frontal brain lobe)
- Detrusor and bladderneck act coordinated
- Detrusor and bladderneck are antagonists
  - Alternate *synergic* contraction-relaxation of detrusor and bladderneck.
    - Holding (storage)
      - » pelvic floor is active
      - » bladderneck is contracted and detrusor remains relaxed
    - Voiding (emptying)
      - » pelvic floor relaxes
      - » **'Causing':**
      - » bladderneck to relax and detrusor to contract

Neurologic control function

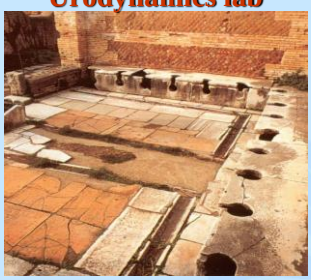




Controlled autonomic reflex

- Somato-motoric (pelvic) control of autonomic reflex
- To void:
  - Shift from sympathetic dominance (storage) to
- >> Parasympathetic activity
- Voiding requires mental relaxation

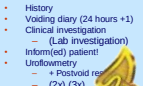
Urodynamics lab



(Before) Urodynamic investigation

- History
- Voiding diary (24 hours +1)
- Clinical investigation
  - (Lab investigation)
- Inform(ed) patient!
- Uroflowmetry
  - + Postvoid re
  - (2x) (3x)
  - Representat
  - etry (fil
- ge function
- analysis (voiding)
  - (X-ray -video)
- 'Urethral' + PF outlet function
- (EMG)
- (Ambulatory)

- Limit the number of persons attending
- Informaton > patients' preparation > cooperation!



Prepare the patient

- Written information that:
  - explains what is going to happen
  - explains that everything is very un-elegant
    - --but that everyone involved is aware of that!
  - asks the patient to arrive with a (comfortably) full bladder, if possible
  - asks to arrive with an empty bowel, if possible
  - advises to drink 1 Litre directly after the test
- No laxatives
- No *standard* antibiotic (prophylaxis)

Good situation for analysis of voiding

- Relaxing surroundings
- Comfortable 'normal' sitting or…
- Standing (male) if preferred
- Support for feet
- Flow-registration as close to meatus as possible
- Reliable not hindering intra-vesical pressure recording

- BOO impossible to determine by X-ray video
- EMG does not play a role in diagnosis of 'static' BOO

Urodynamics of bladder outlet

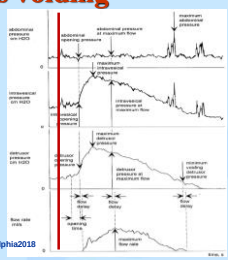
- Bladder outlet behave:
  - Distension (of outlet)
    - Detrusor pressure

Urodynamics of bladder outlet

- Bladder outlet behave:
  - Distension
    - Detrusor pressure
  - Collapse
    - 'outlet' pressure

Urodynamics voiding

- (Static) Bladder Outlet obstruction?
  - X-Ray evidence: no value
  - EMG evidence: no value
  - Cystoscopy evidence: no value
- **Combine:**
- Pressure
- Flow
- After permission to void!
- Representative?
  - (free flow)
- Postvoid residual

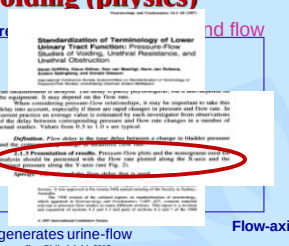


Act of voiding (physics)

Pressure

Flow

Time



Flow-axis

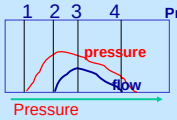
- Intravesical pressure generates urine-flow

Act of voiding (physics)

1 2 3 4

Pressure-axis

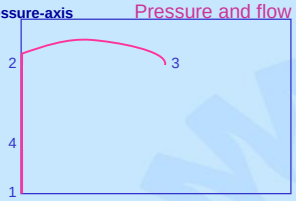
Pressure and flow



Pressure

Flow

Time



Flow-axis

- Intravesical pressure generates urine-flow

Act of voiding (physics)

1 2 3 4

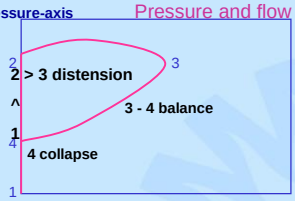
Pressure-axis

Pressure and flow

Pressure

Flow

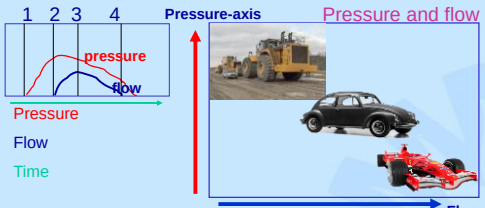
Time



Flow-axis

- Intravesical pressure generates urine-flow

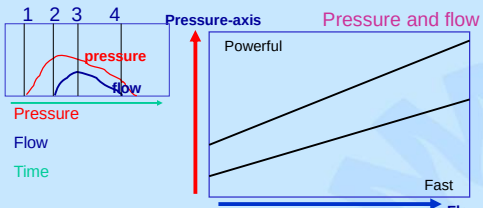
Act of voiding (physics)



- Intravesical pressure generates urine-flow

Pressure flow Philadelphia2018

Act of voiding (physics)

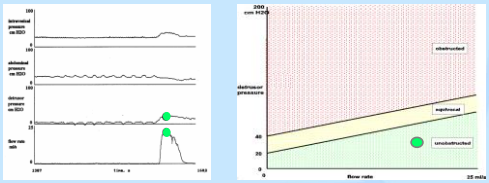


- Detrusor generates urine-flow

Pressure flow Philadelphia2018

Not Obstructed

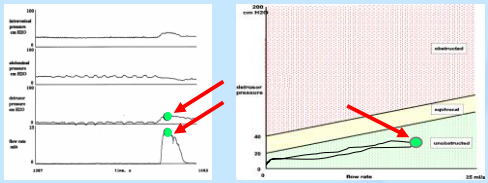
- Low pressure, normal flow



Pressure flow Philadelphia2018

Not Obstructed

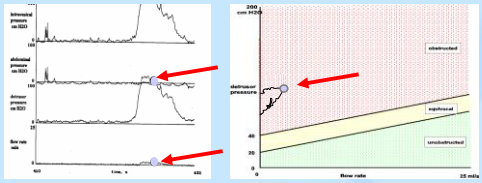
- Low pressure, good maximal flow



Pressure flow Philadelphia2018

Bladder Outlet Obstruction (BOO)

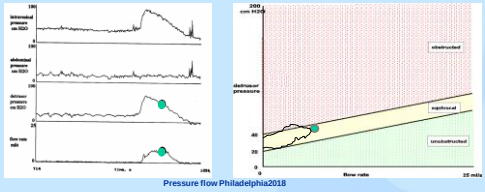
- High pressure, low maximal flow



Pressure flow Philadelphia2018

Intermediate

- Moderate pressure, moderate flow



Pressure flow Philadelphia2018

Analysis BOO

- $P_{det}Q_{max}$
- ICS obstruction index (Abrams Griffiths Number) BOOI:
  - $P_{det}Q_{max} - 2Q_{max}$

- BOOI ≤ 20 no obstruction: 'des-obstruction' will not change much

- BOOI ≥ 40 obstruction: des-obstruction will help improve voiding

- BOOI 20-40 equivocal: result (TURP) is ± 50% success

Detrusor muscle strength

- Power versus velocity; power *or* velocity

Force and velocity

Muscle adapts to:

- force (load)

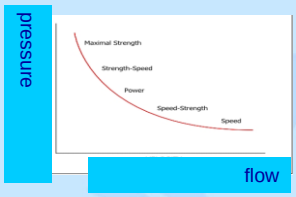
And / Or

- shortening velocity

- Standard force velocity plot

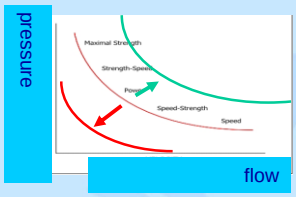
Force and velocity

- Velocity shortening>>>
- ≈ flow
- Force (load) >>> energy
- ≈ pressure

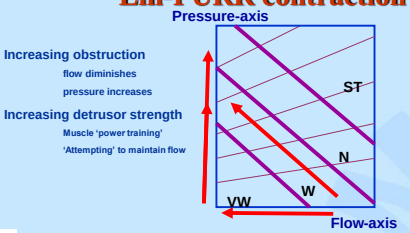


Force and velocity

- Weaker detrusor
- Stronger detrusor



Lin-PURR contraction

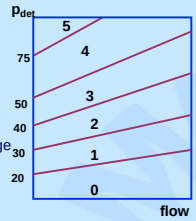


Contraction

- $P_{det}Q_{max} + 5Q_{max}$

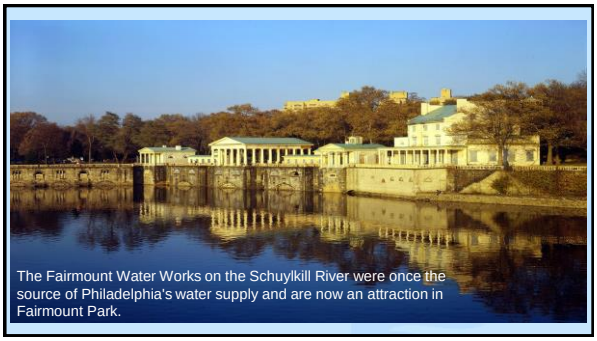
Relevance of clinical BOO class

- Test retest is 1 class width
- Alpha blockers reduce 1 class on average
  - But not proven in patients with <2
- TURP reduces 3 classes on average
  - Not in patients with <2



Summary

- Pelvic floor initiates voiding
- Detrusor 'generates' voiding'energy'
- Especially for analysis of human voiding:
  - (Detrusor contraction)
  - Situative <> representative
- 'Static' bladder outlet obstruction:
  - Distension and collapse
  - High pressure/Low flow > BOO
    - Pressure flow nomogram to classify (and predict)



The Fairmount Water Works on the Schuylkill River were once the source of Philadelphia's water supply and are now an attraction in Fairmount Park.

Ambulatory Urodynamic Monitoring

International Continence Society Urodynamics Committee
ALEX DIGESU
Refers to:
Neurourol Urodyn. 2015 Nov 23. doi: 10.1002/nau.22933

Neurourology and Urodynamics

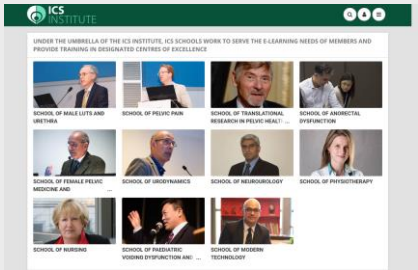
ICS Teaching Module: Ambulatory Urodynamic Monitoring

G. Alessandro Digesu,[1]* Clara Gargasole,[1] Caroline Hendricken,[1] Michelle Gore,[1] Ervin Kocjancic,[2] Vik Khullar,[1] and Peter F. Rosier[3]
[1]Department of Urogynaecology, Imperial College Healthcare NHS Trust, London, United Kingdom
[2]Department of Urology, University of Illinois at Chicago, Chicago, Illinois
[3]University Medical Centre Utrecht—Urology, The Netherlands

ICS Educational module

- To assist clinicians in performing and interpreting AUM
- This educational module should be used together with the manuscript: 'ICS educational module: Ambulatory Urodynamic Monitoring (AUM)'
- This manuscript includes the best available evidence but also contains experts' opinions reported as "eo" if reliable evidence is unavailable
- This module can, only in its complete form, freely be used for teaching purposes

www.ics.org/institute



Introduction

- A summary of the published literature on the role of AUM in clinical and research practice.
- Indications
- Technique and Protocol for AUM
- Troubleshooting
- Interpretation of AUM traces
- Advantages and disadvantages of AUM compared to laboratory cystometry (routine saline urodynamics)

Philosophy & Pathophysiology

- AUM has been recognized by the ICS as a useful tool to investigate LUTS in patients with inconclusive urodynamics diagnoses (19% to 44%)

Philosophy & Pathophysiology

ADVANTAGES

- Natural (orthograde) filling of the bladder
- Less embarrassing test since the patients are fully dressed
- The pressure are recorded for several hours (3-4)
- The patients able to leave the urodynamic room
- Increased diagnostic accuracy in the detection of DO

Philosophy & Pathophysiology

DISADVANTAGES

- Time-consuming test
- It requires trained and dedicated personnel
- It requires specialized equipment
- A high rate of abnormal detrusor contractions using AUM in asymptomatic controls

Catheters

- **Catheter-mounted microtip transducers:**
  - silicone-covered braided metal makes them very flexible
  - low stiffness and the circumferential configuration
  - allow greater patient's mobility
  - low incidence of artifacts (eo)
- **Fluid-filled catheters:** possible but use not yet proven
- **Air - charged catheters:** possible but use not yet proven

Catheters

Catheters

Single use Catheters

- The use of single use catheters would be ideal as:
  - it would reduce the costs
  - save the time needed to reprocess/clean the multi-use electronic microtip transducers catheters
- Although recent studies have shown promising results in performing AUM with water filled catheters (for Pves/Pabd) scientific evidence is still lacking

Pressure sensor systems

- **Tiny airtight capsules** inserted into the bladder and rectum which then communicate with a portable recorder attached to the body to reduce artifacts
- The clinical use has not been proven & validated yet

Recording systems

- **Gaeltec Devices**
  - the oldest systems using electronic catheters-mounted microtip transducers
  - large recorder box which is very awkward to carry around
  - Lack of a patient event-marker capability to capture the patient sensation data and timing for urgency, voids, accidents, etc.

Recording systems

Recording systems

- **Goby, Laborie Medical or Luna, MMS:**
  - Newer systems
  - Small remote control attachment to capture data
  - Compatible with water, air and microtip catheters

Recording systems

Patient preparation

- Information leaflets explaining the test are posted to patients prior to the appointment
- Comfortably full bladder
- A uroflow and a urine analysis are performed
- AUM test can be performed if there are no signs of urine infections (nitrates and leucocytes)
- Wearing comfortable clothes (preferably gown for women)
- Empty bowel if possible

Technique

- Similar to laboratory cystometry
- Catheters are inserted into the bladder and the rectum
- Sufficient catheter length into bladder/rectum
- Catheters should be securely taped adjacent to the anus and external urethral meatus to reduce the risk of catheter's falling out as well as to reduce artifacts
- Transducers set to zero
- The patient can then dress and the catheters can be connected to the AUM recording system

Zero setting: water filled catheters

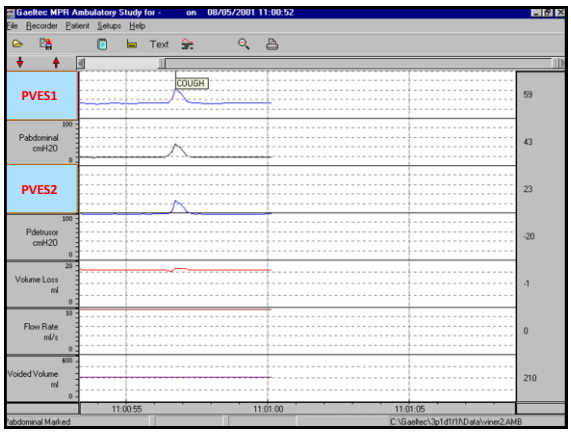
- Transducers must be set to zero at the atmospheric pressure
- Two three-way taps can be attached to the vesical and rectal transducers
- 10 ml syringe is used to flush fluid through the tubing system to eliminate bubbles from the transducers and catheters
- Transducers and the open end of the three-way tap must be at the same horizontal level of the symphisis pubis after having excluded the syringe by closing the tap where the syringe is attached

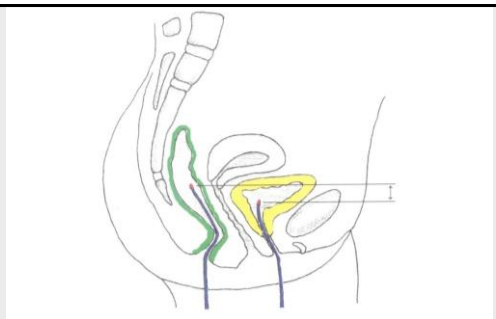
Zero setting: Air-charged & microtip transducers catheters

- Set zero prior to recording
- Before or after insertion into the bladder & rectum
- Not necessarily at the atmospheric pressure

Technique

- Prior to commence recording the patient is asked to cough to check the intravesical, abdominal and subtracted detrusor pressures
- AUM can be started if there is a similar increase of the intravesical and abdominal pressures and the subtracted detrusor pressure does not change
- Any problem must be rectified!





Difference in the vertical height between transducers might results in pressure discrepancy or negative pdet

Technique

- Before the patient leaves the urodynamic room it is mandatory to ensure that the patient:
  1. Understands and is able to follow instructions
  2. Records on a diary all the urinary symptoms reported during AUM test

Since symptoms are compared against the pressures recorded, an accurate recording of symptoms and the times when they occur is essential for the final AUM diagnosis

Instructions to the patient

- To record episodes of urgency, incontinence, pain, voluntary voids, time and volume of fluid intake, feeling of catheter displacement, any provocative maneuvers (running, washing hands, coughing etc)
- How to use the event buttons on the AUM device
- To drink about 200-400 ml/hour or a fluid load up to 1 litre drunk over 30 minutes (unless a fluid load is contraindicated the AUM time would take longer eo)

Instructions to the patient

Instructions to the patient

- **To return to the urodynamic room:**
  - Every hour to check the system is recording the pressures correctly and subtraction is accurate
  - If need to void
  - If one of the catheter falls out (if a diagnosis has not be revealed the pressure transducers would need to be re-inserted, re-zeroed and the test will be re-started thus the length of the test will be altered from the suggested standard)
  - If the patient needs to defecate the catheter would need to be removed and reinserted accordingly

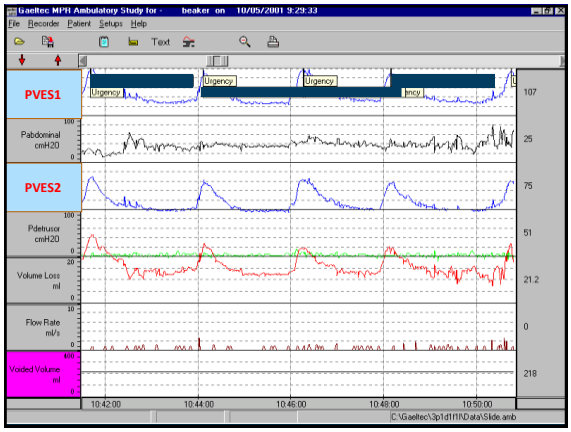
Quality control assessment

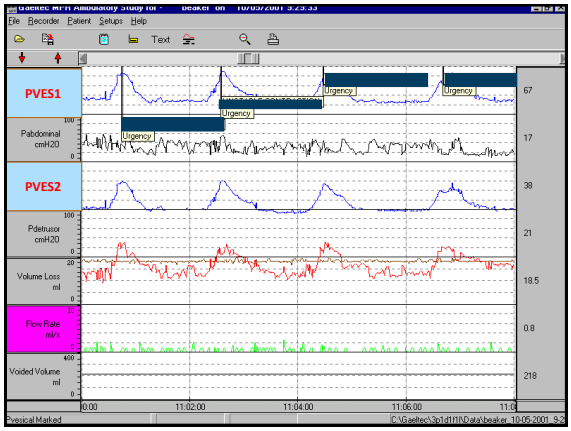
To ensure a good quality control it is important to check the signal quality by:

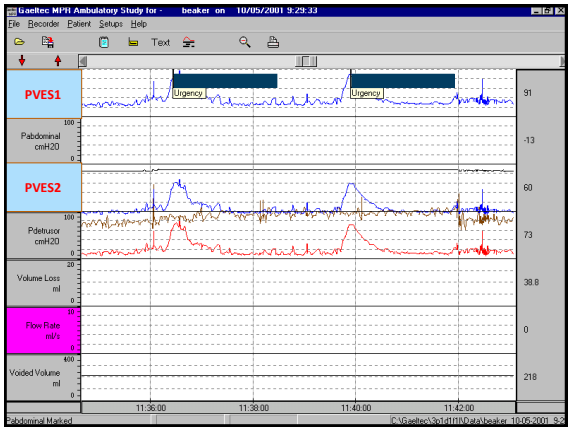
- Setting each transducer to zero prior to commencing to record the pressures or during the test if needed;
- Ensure that the intravesical/abdominal pressures are similar by asking the patient to cough prior to commencing the test and every hour
- Asking the patient to cough before and after each void when pressure flow studies are recorded (LE 2a)

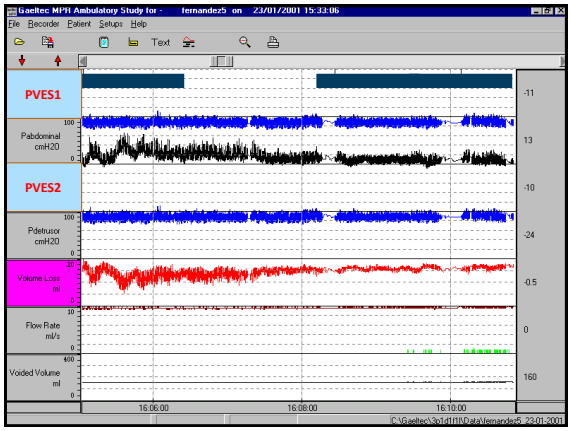
Quality control assessment

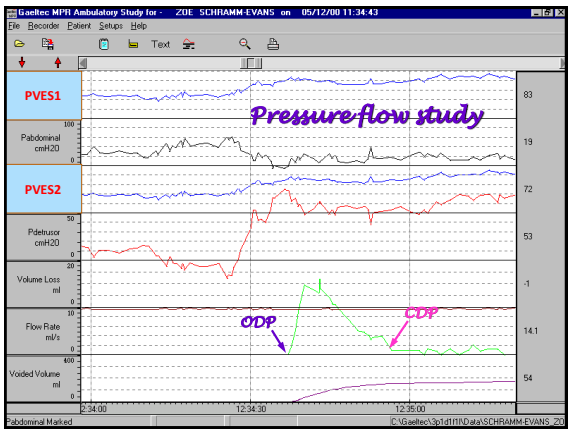
- Ensure that all the catheters are securely taped on the patient's thigh, the catheter's length is reduced to the shortest length possible to avoid accidental displacement during the test
- If filled fluid catheters are used, ensure that there is no air in the system that may affect the quality control
- Provide information to patients advising to attend the appointment with an empty bowel if possible

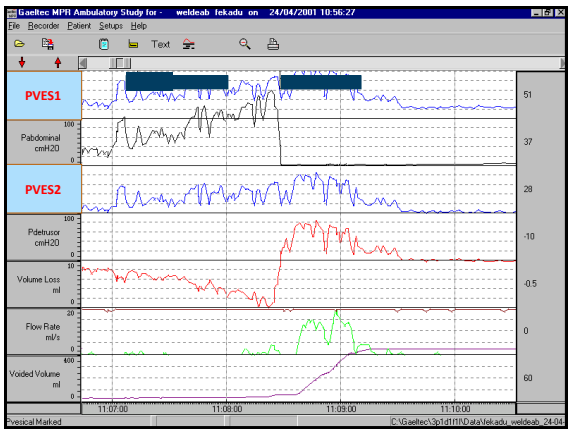

Gaeltec MPH Ambulatory Study for - beaker on 10/05/2001 9:29:33
PVES1
PVES2
Pabdominal cmH2O
Pdetrusor cmH2O
Volume Loss ml
Flow Rate ml/s
Voided Volume ml
Urgency
10:42:00
10:44:00
10:46:00
10:48:00
10:50:00


PVES1
PVES2
Pabdominal cmH2O
Pdetrusor cmH2O
Volume Loss ml
Flow Rate ml/s
Voided Volume ml
Urgency


Gaeltec MPH Ambulatory Study for - beaker on 10/05/2001 9:29:33
PVES1
PVES2
Pabdominal cmH2O
Pdetrusor cmH2O
Volume Loss ml
Flow Rate ml/s
Voided Volume ml
Urgency
11:36:00
11:38:00
11:40:00
11:42:00


Gaeltec MPH Ambulatory Study for - fernandez5 on 23/01/2001 15:33:06
PVES1
PVES2
Pabdominal cmH2O
Pdetrusor cmH2O
Volume Loss ml
Flow Rate ml/s
Voided Volume ml
16:06:00
16:08:00
16:10:00


Gaeltec MPH Ambulatory Study for - ZOE SCHRAMM-EVANS on 05/12/00 11:34:43
Pressure flow study
PVES1
PVES2
Pabdominal cmH2O
Pdetrusor cmH2O
Volume Loss ml
Flow Rate ml/s
Voided Volume ml
ODP
CDP
12:34:00
12:34:30
12:35:00


Gaeltec MPH Ambulatory Study for - weldeab fekadu on 24/04/2001 10:56:27
PVES1
PVES2
Pabdominal cmH2O
Pdetrusor cmH2O
Volume Loss ml
Flow Rate ml/s
Voided Volume ml
11:07:00
11:08:00
11:09:00
11:10:00

Contraindications

- Poor patient mobility
- Cognitive impairment
- Inability to follow instructions
- Severe constipation
- Active urinary tract infection
- Medical conditions which limit patient's participation (clinician's discretion)

Recommendations

- AUM is most sensitive for the detection or exclusion of detrusor overactivity compared to laboratory cystometry (LE 2a16)
- AUM is valuable when all other diagnostic tests have failed to detect the underlying cause of LUTS and/or LUTS do not correlate to laboratory cystometry diagnosis (LE 2a)
- Stress urinary incontinence is better detected by laboratory cystometry than AUM (15) (LE1B)
- UTI must be excluded prior to commencing the test

Scientific Evidence

- No scientific evidence demonstrating that routine antibiotic cover before and after the test is needed
- Post procedure broad spectrum antibiotic cover may be considered in patients with:
  - Diabetes
  - Recurrent urinary tract infections
  - High post micturition residual eo
  - Although there is no scientific evidence supporting the use of routine bowel evacuation agents before AUM test (as they can cause rectal activity and/or abdominal discomfort) an impacted bowel should be avoided
  - To date there is no clear LE about AUM role in the assessment of neurogenic LUTS

Conclusions

- AUM is a valuable and effective second line test where laboratory cystometry has failed to give a satisfactory diagnosis (LE2a)
- AUM improves the outcome of continence surgery by unmasking preoperative underlying DO (eo, unpublished data)
- AUM is a more time consuming test than laboratory cystometry
- AUM requires expertise as well as specialised equipment
- To make the most of its diagnostic capability and to avoid over diagnosis of DO, a detailed record of urinary symptoms during the test is always recommended

ICS 2018 PHILADELPHIA

WHY I PERFORM AN INVASIVE URODYNAMIC TEST IN A FEMALE PATIENT WITH SUI BEFORE SURGERY

PROF. ENRICO FINAZZI AGRÒ

DEPT. OF EXPERIMENTAL MEDICINE AND SURGERY
TOR VERGATA UNIVERSITY
UOSD FUNCTIONAL UROLOGY
TOR VERGATA UNIVERSITY HOSPITAL
NEURO-UROLOGY UNIT, FONDAZIONE S. LUCIA, ROME, ITALY

Recommendations	GR
(NB: These refer only to neurologically intact adults with urinary incontinence)	
Clinicians carrying out urodynamics in patients with urinary incontinence should: • Ensure that the test replicates the patient's symptoms. • Interpret results in context of the clinical problem. • Check recordings for quality control. • Remember there may be physiological variability within the same individual.	C
Advise patients that the results of urodynamics may be useful in discussing treatment options, although there is limited evidence that performing urodynamics will alter the outcome of treatment for urinary incontinence.	C
Do not routinely carry out urodynamics when offering conservative treatment for urinary incontinence.	B
Perform urodynamics if the findings may change the choice of invasive treatment.	B
Do not routinely carry out urethral pressure profilometry.	C

Guidelines on
Urinary
Incontinence

AUA/SUFU

"Physicians may omit urodynamic testing for the index patient desiring treatment when SUI is clearly demonstrated"

Kobashi KC et al. Surgical treatment of female stress urinary incontinence: AUA/SUFU Guideline. *J Urol* 2017; 198, 875-883.

Systematic review

Does preoperative urodynamics improve outcomes for women undergoing surgery for stress urinary incontinence? A systematic review and meta-analysis

"Urodynamics does not have any add-on value as long as detailed office evaluation is carried out prior to primary SUI surgery in women with isolated SUI or stress-predominant MUI who have a normal bladder capacity and PVR."

HOW MANY UNCOMPLICATED PATIENTS DO WE SEE?

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

A Randomized Trial of Urodynamic Testing before Stress-Incontinence Surgery

4083 Women with urinary incontinence were screened for eligibility

urodynamic testing

264 Were included in the per-protocol analysis with primary outcome data

only office evaluation

259 Were included in the per-protocol analysis with primary outcome data

A Randomized Trial of Urodynamic Testing before Stress-Incontinence Surgery

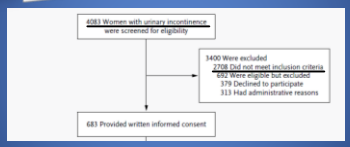
Inclusion criteria:

- history of symptoms of SUI for at least 3 months
- stress or mixed incontinence (if SUI prevalent)
- a post-voiding residual urine volume of less than 150 ml
- a negative urinalysis or urine culture
- a clinical assessment of urethral mobility
- a desire for surgery for SUI
- a positive provocative stress test

Exclusion criteria:

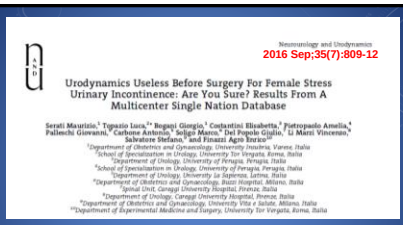
- previous surgery for incontinence
- history of pelvic irradiation
- pelvic surgery within the previous 3 months
- anterior or apical pelvic-organ prolapse of 1 cm or more distal to the hymen

A Randomized Trial of Urodynamic Testing before Stress-Incontinence Surgery



2708/4083 (66,3%): complicated patients

1375/4083 (33,7%): uncomplicated patients



Neurourology and Urodynamics
2016 Sep;35(7):809-12

Urodynamics Useless Before Surgery For Female Stress Urinary Incontinence: Are You Sure? Results From A Multicenter Single Nation Database

Serati Maurizio,[1] Tiganio Luca,[1]* Bogani Giorgio,[2] Costantini Elisabetta,[3] Pietropaolo Amelia,[4] Pallechi Giovanni,[5] Carbone Antonio,[6] Seligo Mauro,[7] Del Popolo Giulio,[8] Li Marzi Vincenzo,[9] Salvatore Stefano,[10] and Finazzi Agro Enrico[10]

[1]Department of Obstetrics and Gynaecology, University Insubria, Varese, Italia
[2]School of Specialization in Urology, University Tor Vergata, Roma, Italia
[3]Department of Urology, University of Perugia, Perugia, Italia
[4]School of Specialization in Urology, University of Perugia, Perugia, Italia
[5]Department of Urology, University La Sapienza, Latina, Italia
[6]Department of Obstetrics and Gynaecology, Bazzi Hospital, Milano, Italia
[7]Spinal Unit, Careggi University Hospital, Firenze, Italia
[8]Department of Urology, Careggi University Hospital, Firenze, Italia
[9]Department of Obstetrics and Gynaecology, University Vita e Salute, Milano, Italia
[10]Department of Experimental Medicine and Surgery, University Tor Vergata, Roma, Italia

740/2053 (36%) patients considered "uncomplicated" according to the definitions used in the VALUE trial

A Randomized Trial of Urodynamic Testing before Stress-Incontinence Surgery

1375/4083 (33,7%): uncomplicated patients

740/2053 (36%) uncomplicated patients

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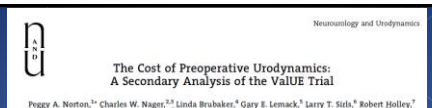
Uncomplicated patients are a minority

(probably around 1/3 of the patients we see)



Neurourology and Urodynamics

The Cost of Preoperative Urodynamics: A Secondary Analysis of the ValUE Trial

Peggy A. Norton,[1]* Charles W. Nager,[2,3] Linda Brubaker,[4] Gary E. Lemack,[5] Larry T. Sirls,[6] Robert Holley,[7] Toby C. Chai,[8] Stephen R. Kraus,[9] Halina Zyczynski,[10] Bridget Smith,[11] and Anne Stoddard,[11] for the Urinary Incontinence Treatment Network

"We emphasize that the ValUE data should be considered as applicable only to adult women with uncomplicated stress predominant UI planning to undergo surgery, and do not affect recommendations for UDS in the setting of complicated incontinence and voiding dysfunction"

AUA/SUFU

"Physicians may omit urodynamic testing for the index patient desiring treatment when SUI is clearly demonstrated"

Kobashi KC et al. Surgical treatment of female stress urinary incontinence: AUA/SUFU Guideline. *J Urol* 2017; 198, 875-883.

66% of SUI pts are not index patients

WHY DOES INVASIVE URODYNAMIC INVESTIGATION SEEM PARTICULARLY RELEVANT IN COMPLICATED PATIENTS?

The Effect of Urodynamic Testing on Clinical Diagnosis, Treatment Plan and Outcomes in Women Undergoing Stress Urinary Incontinence Surgery

Larry T. Sirls,* Holly E. Richter,† Heather J. Litman, Kimberly Kenton, Gary E. Lemack,‡ Emily S. Lukacz,§ Stephen R. Kraus,‖ Howard B. Goldman,¶ Alison Weidner,** Leslie Rickey,†† Peggy Norton, Halina M. Zyczynski‡‡ and John W. Kusek for the Urinary Incontinence Treatment Network

Table 1. *Clinical diagnoses after OE and UDS*

Clinical Diagnosis*	No. After OE/Total No. (%)	No. After OE/No. with UDS (%)	No. After OE + UDS (%)	p Value (McNemar test)†
SUI	315/315 (100)	294/294 (100)	292/294 (99.3)	>0.99
OAB:				
Wet	131/315 (41.6)	124/294 (42.2)	74/294 (25.2)	<0.001
Dry	99/315 (31.4)	90/294 (30.6)	61/294 (20.8)	0.007
Voiding phase dysfunction	7/315 (2.2)	7/294 (2.4)	35/294 (11.9)	<0.001
Suspected ISD	61/314 (19.4)	57/293 (19.5)	36/292 (12.3)	0.003

* Patient could have more than 1 clinical diagnosis.
† Calculated in patients with UDS.

Neurourology and Urodynamics

Urodynamics Useless Before Surgery For Female Stress Urinary Incontinence: Are You Sure? Results From A Multicenter Single Nation Database

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- Voiding dysfunction
  - in 13.4% of uncomplicated patients (similar to the 11.9% reported in the ValUE trial)
  - In 22.5% of complicated patients

Table 2. *Surgical and nonsurgical treatment plan after OE and UDS*

	No. After OE/Total No. (%)	No. After OE + UDS/Total No. (%)
Planned treatment		
Surgical*		
RMUS	206/315 (65.4)	192/289 (66.4)
TMUS	86/315 (27.3)	78/289 (27.0)
Mini-sling	8/315 (2.5)	7/289 (2.4)
Fascial pubovaginal sling	11/315 (3.5)	9/289 (3.1)
Retropubic urethropexy	1/315 (0.3)	0
Urethral bulking injection	3/315 (1.0)	3/289 (1.0)
Additional nonoperative treatment planned after OE:	52/315 (16.5)†	40/294 (13.6)‡
Pharmacotherapy	29/50 (58)	25/39 (64.1)
Pelvic floor therapy	27/51 (52.9)	19/39 (48.7)
Other	13/51 (25.5)	14/39 (36.0)
Specific UDS driven changes to surgical plan		
Surgery canceled		4/294 (1.4)
Surgical procedure changed:		16/294 (5.4)
RMUS to TMUS		8
TMUS to RMUS		5
RMUS to fascial pubovaginal sling		1
Fascial pubovaginal sling to RMUS		1
Retropubic urethropexy to RMUS		1

* Total of 315 patients had surgical treatment plan after OE, 294 had complete data after OE and UDS, and 289 had surgical treatment plan after OE and UDS (4 surgeries canceled and no data on 1).
† Total of 28 patients had additional nonoperative treatment planned after OE that was changed to no additional treatment after UDS.
‡ Total of 20 patients had UDS driven, additional nonoperative treatment plans that had not been planned after OE.

Neurourology and Urodynamics

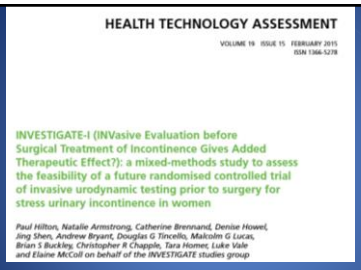
Urodynamics Useless Before Surgery For Female Stress Urinary Incontinence: Are You Sure? Results From A Multicenter Single Nation Database

Serati Maurizio,[1] Topazio Luca,[2]* Bogani Giorgio,[3] Costantini Elisabetta,[3] Pietropaolo Amelia,[4] Palleschi Giovanni,[5] Carbone Antonio,[6] Soligo Marco,[6] Del Popolo Giulio,[7] Li Marzi Vincenzo,[8] Salvatore Stefano,[9] and Finazzi Agro Enrico[10]

- Management strategy modified
  - in 11% of uncomplicated patients (not far from the 6.8% reported in the ValUE trial)
  - In 23.8% of complicated patients

IN COMPLICATED PATIENTS

- More informations by the urodynamic investigations
  - Voiding dysfunction
- Therapeutical strategy more ofter modified

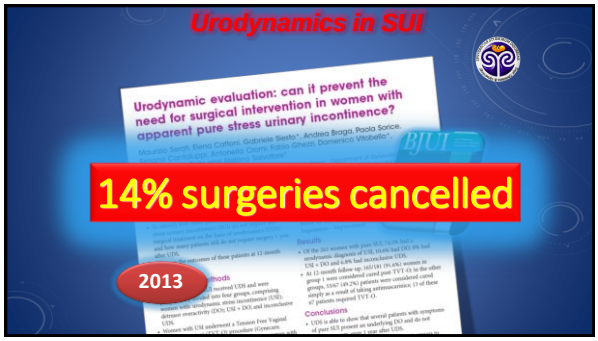

HEALTH TECHNOLOGY ASSESSMENT

VOLUME 19 ISSUE 15 FEBRUARY 2015
ISSN 1366-5278

INVESTIGATE-I (INVasive Evaluation before Surgical Treatment of Incontinence Gives Added Therapeutic Effect?): a mixed-methods study to assess the feasibility of a future randomised controlled trial of invasive urodynamic testing prior to surgery for stress urinary incontinence in women

Paul Hilton, Natalie Armstrong, Catherine Brennand, Denise Howel, Jing Shen, Andrew Bryant, Douglas G Tincello, Malcolm G Lucas, Brian S Buckley, Christopher R Chapple, Tara Homer, Luke Vale and Elaine McColl on behalf of the INVESTIGATE studies group

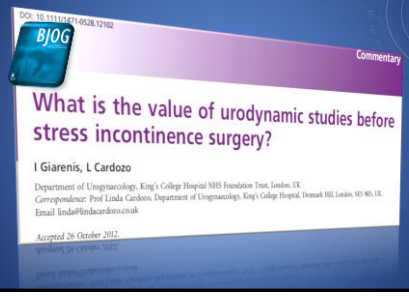
Management strategy modified in 19% of pts after UDS



Data from «real life» seem more similar to those observed in complicated patients, because these patients are more common…

Cost savings may be higher if urodynamic investigations performed… (investigate-I)

ARE INVASIVE URODYNAMIC INVESTIGATIONS REALLY USELESS IN UNCOMPLICATED PATIENTS?



CHOICE OF OPERATION/SURGICAL TECHNIQUE

RPTS > TOTS IN PATIENT WITH ISD AT 6 MONTHS AND AT 3 YEARS.

cut-off of:
20 cm H2O for maximum urethral closure pressure (MUCP)
60 cm H2O for valsalva leak point pressures (VLPP)

Schierlitz L, et al. Three year follow-up of tension free vaginal tape compared with transobturator tape in women with stress urinary incontinence and intrinsic sphincter deficiency. Obstet Gynecol 2012;

TOTS > RPTS IN PATIENT WITH VD

Richter HE,et al. Retropubic versus transobturator Midurethral slings for stressincontinence. N Engl J Med 2010;

TOTS > RPTS IN PATIENT WITH DO, URGE AND UI

Houwert RM,et al. Risk factors for failure of retropubic and transobturator midurethral slings. Am J Obstet Gynecol 2009;
Camble TL, et al. Predictors of persistent detrusor overactivity after transvaginal sling procedures. Am J Obstet Gynecol 2008;

PREDICTION OF POSTOPERATIVE URGENCY,URGENCY INCONTINENCE AND VOIDING DYSFUNCTION

Low peak urinary flow rate has been identified as an independent predictor of urinary retention after RPT. Cut-off was suggested 15 ml/s for a sensitivity of 47% and a specificity of 89%.

Hong B, et al. Factors predictive of urinary retention after a tension-free vaginal tape procedure for female stress urinary incontinence. J Urol 2003;

There are several preoperative urodynamic variables associated with persistent U/UUI,such as DO, lower cystometric capacity, lower bladder volume at the first uninhibited detrusor contraction and higher opening detrusor pressure.

Jain P,et al. Effectiveness of midurethral slings in mixed urinary incontinence: systematic review and metaanalysis. Int Urogynecol J 2011;

Lee JK, et al. Persistence of urgency and urge urinary incontinence in women with mixed urinary symptoms after midurethral slings: a multivariate analysis. BJOG 2011;

Regarding de novo U and UUI, pre-existing PSD and DO were independent predictors in a large retrospective study

Lee JK, et al. Which women develop urgency or urgency urinary incontinence following midurethral sling? Int Urogynecol J 2012

Urodynamics

PREDICTION OF FAILURE

The TOMUS trial showed that lower VLPP and MUCP were variables associated with objective failure 1 year after MUT on multivariate analysis.

Women with preoperative DO are more likely to experience treatment failure following MUT.

Nager CW,et al. Baseline urodynamic predictors of treatment failure 1 year after mid urethral sling surgery. J Urol 2011;

Stav K, et al. Risk factors of treatment failure of midurethral sling Procedures for women with urinary stress incontinence. Int Urogecol J 2010;

The Effect of Urodynamic Testing on Clinical Diagnosis, Treatment Plan and Outcomes in Women Undergoing Stress Urinary Incontinence Surgery

Larry T. Sirls,* Holly E. Richter,† Heather J. Litman, Kimberly Kenton, Gary E. Lemack,‡ Emily S. Lukacz,§ Stephen R. Kraus,‖ Howard B. Goldman,¶ Alison Weidner,** Leslie Rickey,†† Peggy Norton, Halina M. Zyczynski‡‡ and John W. Kusek for the Urinary Incontinence Treatment Network

Table 1. Clinical diagnoses after OE and UDS

Clinical Diagnosis*	No. After OE/Total No. (%)	No. After OE/No. with UDS (%)	No. After OE + UDS (%)	p Value (McNemar test)†
SUI	315/315 (100)	294/294 (100)	292/294 (99.3)	>0.99
DAB:				
Wet	131/315 (41.6)	124/294 (42.2)	74/294 (25.2)	<0.001
Dry	99/315 (31.4)	90/294 (30.6)	61/294 (20.8)	0.002
Voiding phase dysfunction	7/315 (2.2)	7/294 (2.4)	35/294 (11.9)	<0.001
Suspected ISD	61/314 (19.4)	57/293 (19.5)	36/293 (12.3)	0.003

* Patient could have more than 1 clinical diagnosis.
† Calculated in patients with UDS.

NAGER CW

RE TO:

Voiding Dysfunction

29 vs 230 pts
62,1 vs. 78,3% success rate

p=0,06…

TABLE 2
Urodynamic evaluation data of voiding trial failure of cases and controls

Variable	Case	n	Control	n	P value	OR (95% CI)
Uroflowmetry						
Normal voiding pattern	54 (73%)	54	218 (78%)	218	.562	na
Voided volume, mL	177 (116, 270)	77	150 (90, 267)	315	.157	na
Postvoid residual, mL	10 (5, 29)	84	10 (0, 25)	320	.189	na
Maximum flow rate, mL/s	17.9 (11.6, 25.2)	74	18.1 (13.0, 25.4)	295	.717	na
Cystometrogram						
Bladder capacity, mL	374 (300, 476)	90	370 (304, 450)	343	.542	na
Detrusor overactivity	28 (29%)	28	75 (22%)	75	.136	na
Valsalva leak point pressure, cm H_2O	90 (66, 131)	87	95 (70, 122)	320	.940	na
Cough leak point pressure, cm H_2O	94 (74, 142)	70	113 (87, 143)	268	.029	
Urethral pressure profile						
Maximum urethral closure pressure, cm H_2O	53 (42, 73)	65	56 (41, 75)	245	.870	na
Pressure flow study						
Abnormal voiding type*	31 (37%)	31	72 (25%)	72	.027	1.79 (1.06–3.00)
Voided volume, mL	351 (257, 459)	86	320 (273, 427)	313	.475	na
Postvoid residual, mL	0 (0, 50)	82	0 (0, 43)	308	.367	na
Maximum flow rate, mL/s	18.4 (13.2, 22.7)	87	18.9 (13.0, 25.9)	308	.611	na
Maximum detrusor pressure, cm H_2O	22 (16, 32)	75	25 (15, 38)	290	.248	na




Serati M., Finazzi Agrò E: ICS 2018 preview…

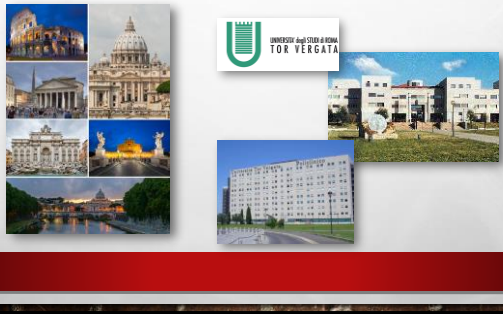
- 60/192 consecutive uncomplicated patients (31,2%) using abdominal straining during voiding phase
- Preop. Qmax not different from the other patients (20,5 vs. 19,5 ml/s, p=0,76)

At minimum follow up of 5 years

- Higher risk of episodes of urinary retention or voiding dysfunction (15% vs. 6%), p=0,056 and of OAB (38,3% vs 19,7%), p=0,007

CONCLUSIONS

- Use extensively non invasive urodynamics
  - Bladder diaries, UF, PVR
- Urodynamics may be omitted in selected uncomplicated patients
  - Data from studies on uncomplicated patients should be used only for decision making in these patients' group
- Relevant informations from invasive urodynamic studies to modify the choice of treatment in complicated patients
- Some important infos (at least for couseling) from invasive urodynamic studies also in uncomplicated patients



Voiding dysfunction in women: How can we define the obstruction?

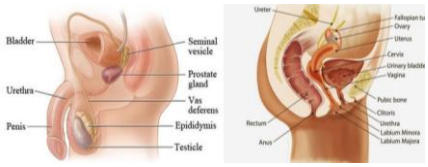
Eskinder Solomon
Guy's and St Thomas' NHS Trust
London, UK

Female BOO: Prevalence

- Reported prevalence: 3% to 29% women undergoing urodynamic evaluation for LUTS

Why can't we use the male BOO nomograms?

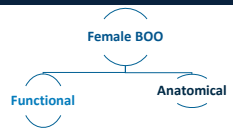
- Female and male urethra anatomical differences



$$R \propto \frac{l}{r^4}$$

$$P = \frac{Q}{R}$$

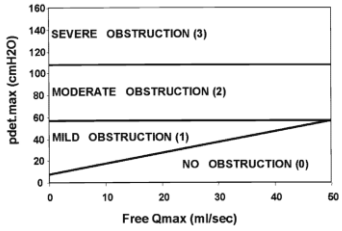
Aetiology



Definitions of female BOO

BOO criteria	Definition
Farrar et al/Bass et al	Q_{max} <15 ml/s voided volume <200 ml/100 ml

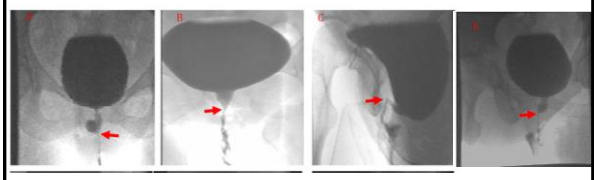
Blaivis-Groutz nomogram



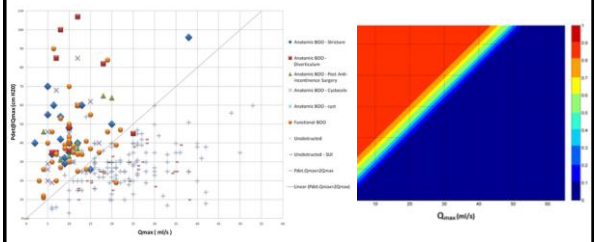
- Pdet.Qmax > Qmax + 7
- Massolt et al (2005): 109 women with SUI → 70% BOO

Video cystometrogram

Nitti et al: "Radiographic evidence of obstruction between the bladder neck and distal urethra in the presence of a sustained detrusor contraction"



Solomon-Greenwell nomogram



Solomon et al, Neurourol Urodyn. 2018, 37(1):368-378

Functional obstruction

Detrusor-sphincter dyssynergia or Dysfunctional voiding

Assessed by:

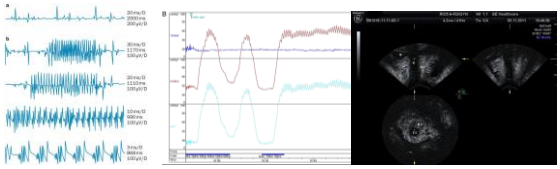
- In patients able to void: P/F and/or VCMG

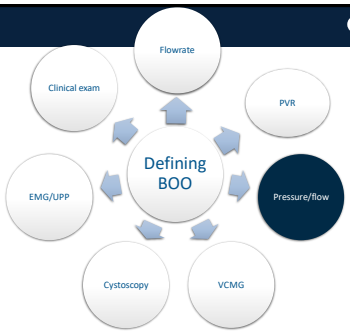
Functional obstruction

Detrusor-sphincter dyssynergia or Dysfunctional voiding

Assessed by:

- In patients able to void: P/F and/or VCMG
- Retention: Sphincter EMG, urethral pressure profilometry, sphincter volume





Tufan Tarcan, MD, PhD

ICS 2018 PHILADELPHIA

Affiliations to disclose†:

Speaker or advisory board member for:

Pierre Fabre, Astellas, Recordati, Santa Farma

† All financial ties (over the last year) that you may have with any business organization with respect to the subjects mentioned during your presentation

Funding for speaker to attend:

- ☐ Self-funded
- ☐ Institution (non-industry) funded
- ☒ Sponsored by: *Abdi Ibrahim Pharmaceutical Company*

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WHAT CAN I EXPECT FROM URODYNAMICS IN A NEUROGENIC PATIENT?

Tufan Tarcan, MD, PhD
Professor of Urology
@
Marmara University School of Medicine
&
Koç University School of Medicine
Istanbul-Turkey

Main goals of UDS

ICS 2018 PHILADELPHIA

- To predict the risk for urinary tract damage
  - Upper
  - Lower
- To plan symptomatic management
  - Especially, for urinary incontinence
- To decide on invasive therapies
  - BoNTA vs augmentation

When and how often to do UDS?

ICS 2018 PHILADELPHIA

- There is no single recipe that works for all neurogenic LUTD
  - Spina bifida
  - MS
  - SCI
  - Parkinson
  - Diabetes
  - .....

There is no single recipe that works for all neurogenic LUTD

ICS 2018 PHILADELPHIA

The risk for urinary tract damage and prognosis varies.

- Age: Children vs adults
- Natural history: MS vs SCI vs Spina bifida
- Severity: in progressive diseases
  - MS
- Dynamic character
  - Spina bifida

Prognosis: MS vs SCI and SB

ICS 2018 PHILADELPHIA

»Patients with spina bifida and those with spinal cord injury have a higher risk of developing UUTD and kidney function impairment than those with MS»

What is the utility of urodynamics, including ambulatory, and 24 h monitoring, in predicting upper urinary tract damage in neuro-urological patients and other lower urinary tract dysfunction? ICI-RS 2017

High risk groups (AUA guidelines)

Spina bifida

SCI

High burden of spinal cord disease

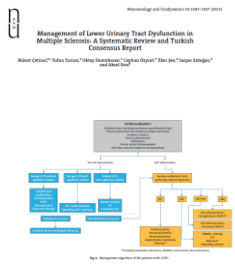
- (a de facto SCI due to demyelinating disease, tumor burden, infarction, or other causes)

Transverse myelitis

Men with multiple sclerosis (MS)

UDS in MS

MS can be followed up after an initial UDS, with non-invasive means such as PVR, uroflowmetry and bladder diary, in a selected group of patients.



Management of Lower Urinary Tract Dysfunction in Multiple Sclerosis: A Systematic Review and Turkish Consensus Report

In Sina Bifida, Proactive Management is based on UDS.

UDS are shown to decrease:

-UTI

Wide et al, J Pediatr Urol, 2012

-UUT deterioration

Edelstein et al, J Urol, 1995

-VUR

Wide et al, J Pediatr Urol, 2012

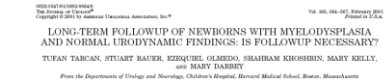
-Need for surgery

Filler et al, Int Urol Nephrol, 2011

-End stage renal disease

Torre et al, J Pediatr Urol, 2011

Re-Tethered Cord Syndrome



LONG-TERM FOLLOWUP OF NEWBORNS WITH MYELODYSPLASIA AND NORMAL URODYNAMIC FINDINGS: IS FOLLOWUP NECESSARY?

TUFAN TARCAN, STUART BAUER, EZEQUIEL OLMEDO, SHAHRAM KHOSHBIN, MARY KELLY, AND MARY DARBEY

- Up to 32%, even in children with initially normal neuro-urological findings
- Early Dx is based on urodynamic deterioration
  - Only 50% will improve after a secondary untethering surgery

Kaplan et al, J Urol, 1988
Balkan et al, Eur J Ped Surg, 2001
Tarcan et al, J Urol, 2006

DLPP

McGuire, 1981

- Observations of videourodynamic studies of children with MMC and UI secondary to impaired bladder compliance
- DLPP was found to predict the upper urinary tract deterioration (UUTD)*

Further applied to different etiologies of neurogenic lower urinary tract dysfunction (N-LUTD) in adults

*McGuireMcGuire EJ, Woodside JR, Borden TA. Upper urinary tract deterioration in patients with myelodysplasia and detrusor hypertonia: a followup study. J Urol 1983;129:823-6.

The ICS definition of DLPP

The lowest detrusor pressure at which urine leakage occurs in the absence of either a detrusor contraction or increased abdominal pressure*

*Abrams P, Cardozo L, Fall M, Griffiths D, Rosier P, Ulmsten U, van Kerrebroeck P, Victor A, Wein A; Standardisation Sub-committee of the International Continence Society. The standardisation of terminology of lower urinary tract function: report from the Standardisation Sub-committee of the International Continence Society. Neurourol Urodyn. 2002; 21:167-78.

DLPP: Controversies

The exact value of DLPP to predict UUTD is debatable

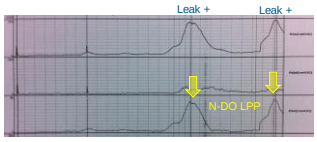
Measuring DLPP lacks standardization and carries pitfalls

A common mistake:

- Using DLPP in N-LUTD during detrusor contractions (neurogenic detrusor overactivity) instead of reduced bladder compliance

N-DO LPP

refers to the detrusor pressure that belongs to a spontanous N-DO leading to leakage during cystometry



DLPP

Is 40 cm H_2O Detrusor Leak Point Pressure Cut-Off Reliable for Upper Urinary Tract Protection in Children With Myelodysplasia?

Tufan Tarcan,* Gagri Akin Sekeci, Cem Akbal, Ilter Tinay, Yüsrev Tarakli, Ahmet Sahan, Bahadir Tuncay Tep, and Perihsh Simsek

- 193 children with myelodysplasia at age 3
- A cut off value of 20 cmH2O is more sensitive in predicting UUT damage

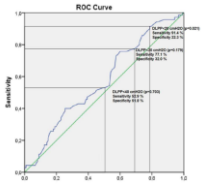


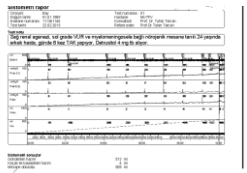
Fig. 1. UUT damage in three different DLPP cut-off values with their sensitivity and specificity is shown in ROC curve analysis.

DLPP	Percentage of patients with UUT deterioration (%)	P-value
>40 cm H_2O	87.8 (97/98)	0.510
20–40 cm H_2O	43.5 (27/62)	
20–40 cm H_2O	43.5 (27/62)	0.014
<20 cm H_2O	18.1 (6/33)	

H.B.U.: Cystometry

DLPP: 33 cm H2O

How much and how long is the urinary tract exposed to high pressure?



DLPP

Neurourology and Urodynamics 36:259–262 (2017)

ICS Teaching Module: Detrusor Leak Point Pressures in Patients With Relevant Neurological Abnormalities

Tufan Tarcan,[2]* Oktay Demirkesen,[3] Mauricio Plata,[4] and David Castro-Diaz[4]

A part of cystometric evaluation of children and adults with N-LUTD to help predicting (and preventing) UUTD (Grade B/C)

DLPP, cannot precisely discriminate high-risk patients for UUTD (Grade B/C).

DLPP

Other factors to predict UUTD in N-LUTD

- Bladder compliance
- Volume where leakage occurs
- Duration and amplitude of detrusor contractions
- Volume which obtained by CIC

DLPP should not be used as the sole decider for invasive therapies.

To decide on invasive therapies: Role of bladder compliance

The Journal of Urology
THE VALUE OF URINARY BDNF LEVELS ON ASSESSMENT OF THE BOTULINUM TOXIN TYPE A TREATMENT FOR NEUROGENIC DETRUSOR OVERACTIVITY IN CHILDREN WITH MYELODYSPLASIA
Sekerci CA et al, in publication

- Urine samples of 23 children with NDOA due to myelodysplasia
  - before and after iBoNT-Ai (first and third months)
  - urodynamics before and 6 week after iBoNT-Ai.
- Predictors of fibrosis and treatment failure:
  - - cut-off of 5 mL/cm bladder compliance
  - - high urine BDNF

N- DO is a risk factor for UUT

Significant association with hydronephrosis in patients with N-DO >75 cmH2O*

The total duration of N-DO contractions**

- The only statistically significant urodynamic variable for upper tract dilatation or VUR in spinal cord lesion patients

*Ozkan B, Demirkesen O, Durak H, Uygun N, Ismailoglu V, Cetinel B. Which factors predict upper urinary tract deterioration in overactive neurogenic bladder dysfunction? Urology. 2005 Jul;66(1):99-104.
**Linsenmyer TA, Bagaria SP, Gendron B et al. The impact of urodynamic parameters on the upper tracts of spinal cord injured men who void reflexly. J Spinal Cord Med 1998; 21:15-20

Conclusion

(Video) UD parameters of clinical significance in N-LUTD:

- Bladder compliance
- DLPP
- N-DO
- Detrusor-sphincter dyssynergia

Conclusion

UDS are:

- Best predictors of urinary tract damage
- Reliable guides in further decision-making
- Good follow-up tools, especially for dynamic conditions

- Should be combined with other clinical features for a best clinical practice

FUTURE RESEARCH (ICI 2017, Rantell et al)

- Prospective studies to assess distinct DLPP cut offs for both children and adults with NLUTD.
- Evaluation of different urodynamic parameters and their association with bladder capacity, frequency of catheterisation, and fluid intake in neuro-urological patients.
- Prospective studies to validate standardised urodynamic follow-up strategies for neuro-urological patients with and without risk factors for UUTD.
- Identification of neuro-urological patients who would benefit the most from special urodynamic techniques (such as video-urodynamics, ambulatory, and 24 h).

Thank you !

Jian Guo Wen

Affiliations to disclose[+]:

[+] All financial ties (over the last two years) that you may have with any business organization with respect to the subjects mentioned during your presentation

Funding for speaker to attend:

- [X] Self-funded
- [ ] Institution (non-industry) funded
- [ ] Sponsored by:

ICS Teaching Module

W19: ICS Core Curriculum (Free): Urodynamics- everything you need to know –basic and advanced

HE ROLE OF URODYNAMICS IN THE PAEDIATRIC POPULATION

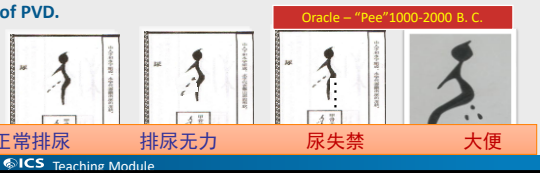
Jian G Wen MD, Ph.D, Prof.

Pediatric UD Center, First Affiliated Hosptial Zhengzhou University; Pediatric Urology, Shenzhen Children Hospital; China

ICS International Continence Society Teaching Module

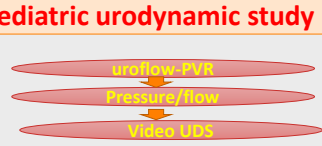
Pediatric urodynamic study

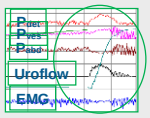
- Subjective bias from both the children and clinician, overlap between the symptoms from different disorders.
- Pediatric urodynamic studies（PUDS）are objective investigations and it has become the gold standard in assessment of PVD.



ICS Teaching Module

Pediatric urodynamic study



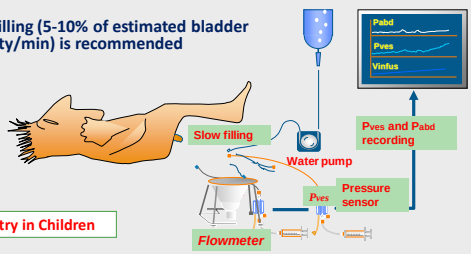


Cystometry, Pressure/flow study

ICS Teaching Module

Technique: recording the pressure

- Slow filling (5-10% of estimated bladder capacity/min) is recommended



Cystometry in Children

ICS Teaching Module

Indications

1. Suspicion of, or overt neuropathic voiding dysfunction, LUT obstruction, DSD. etc
2. Profound non-neuropathic detrusor-sphincter dysfunction (ie.,dilating ureter(s), high grade vesicoureteral reflux, valve bladder syndrome)
3. Significant PVR with no apparent reason
4. Congenital malformations of the lower urinary tract (ie., exstrophy, epispadias, multiple bladder diverticula)

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Indications and preparation

5. The procedure is assumed to effect treatment strategies & for evaluating the treatment response or follow up
6. It is undertaken after history taking, physical examination, voiding diaries & uroflow patch EMG recordings do not answer the questions related to causes, nor provide management schemes for LUTD

Preparation

- Empty the rectum. Enema Glycerini is recommended. Severe constipation may need cleaning enema

Cleaning enema

Technique: insert the catheter

- A 6Fr double-lumen catheter is inserted transurethrally using lubricant or anaesthetic gel
- Alternatively, a similar catheter is inserted suprapubically
- Rectal catheter: An 8-Fr. feeding tube or a small rectal balloon catheter is inserted to record abdominal pressure changes

Transurethral catheter

Suprapubic catheter
(from Aarhus University Hospital)

Cooperation: during filling

- To build the lab looks like a kindergarten, animation wall with TV
- Employ dedicated & knowledgeable staff able to give children an explanation of the procedure and aim of the urodynamic study. If possible, engage the infants to cooperate
- Have a well cleansed rectum
- After inserting the catheter in the bladder, if the child is still agitated, engage parents to help to keep him/her calm

Animation wall

To avoid cry

Start until calm

Cooperation: during filling

- The urodynamic evaluation approach should start minimally involved tests as possible, ending up with the invasive investigations, if needed
- Toys, eating or drinking, reading, allow mother to be present, during the examination
- Apply 1% lidocaine jelly or other topical anesthetic solution instilled into the urethra to aid in catheter passage
- Administer sedative if necessary but not an anesthetic, & document if child is very fearful

toys

Drinking

Mother with child

Application

- Neurogenic Bladder
- Posterior Urethral Valves
- Lower urinary tract symptoms
- Refractory bedwetting

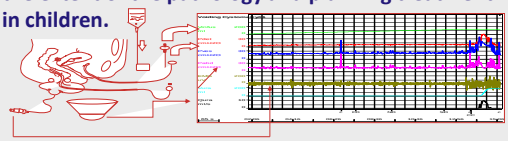
Neurogenic Bladder (NB)

- NB results from a variety of abnormalities of the central or peripheral nervous systems contributes to various forms of lower urinary tract dysfunction.
- Myelodysplasia is common reason.

Spinal Dysraphism

NB

- The spinal level and extent of congenital lesion are poorly correlated with the clinical outcome
- *Urodynamic studies* are very valuable for defining the extent of the pathology and planning treatment in children.



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NB

Guidelines for urodynamics and uroneurophysiology tests in NB-EAU

Guidelines for urodynamics and uroneurophysiology tests	GR
Urodynamic investigation is necessary to document the (dys-)function of the LUT [10].	A
The recording of a bladder diary is advisable.	B
Noninvasive testing is mandatory before invasive urodynamics are planned.	A
Video-urodynamics are currently the preferred method for invasive urodynamics in patients with NLUTD. If this method is not available, then a filling cystometry continuing into a pressure–flow study should be performed.	A
For standard urodynamic testing, a physiologic filling rate (see Table 1; eg, not faster than 20 ml/min) and body-warm fluid must be used.	A
Specific uroneurophysiologic tests and provocative manoeuvres (eg, fast-filling cystometry with cooled saline [the ice-water test], coughing, tapping, and anal stretch) are elective procedures [10,12].	C

GR = grade of recommendation; LUT = lower urinary tract.

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NB

- Important urodynamic parameters
  - Bladder capacity and intravesical filling pressure;
  - Intravesical pressure at the moment of urethral leakage;
  - Presence or absence of reflex detrusor activity;
  - Competence internal and external sphincteric mechanisms;
  - Degree of coordination detrusor and sphincteric mechanisms;
  - Voiding pattern and post-voiding residual urine volume;

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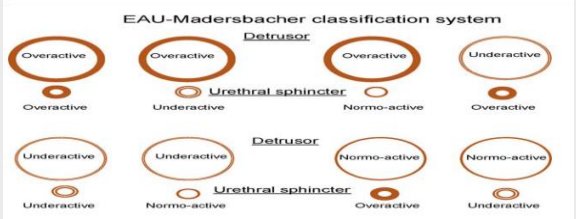
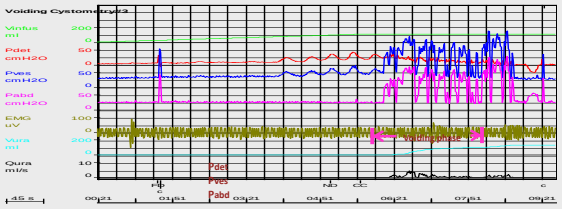
NB

The European Association of Urology (EAU)–Madersbacher classification system.



ICS Teaching Module

NB



Acontractile detrusor in a child with neurogenic bladder; urination achieved by abdominal pressure

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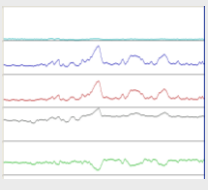
NB

Video UDS provides more information of function and morphology.



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NB

All procedures, before and after, need evaluation by PUDS

- anticholinergic drugs
- Electrical stimulation
- Management guided by UD
- Injection of botulinum toxin
- Toilet training
- *clean intermittent catheterization*
- Surgical procedures

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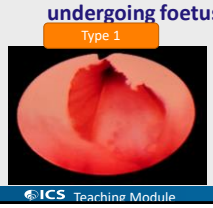
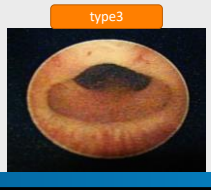
Posterior urethral valves (PUV)

- PUV is life-threatening congenital anomalies.
- PUV are found in 1 in 1,250 in a population undergoing foetuses in US





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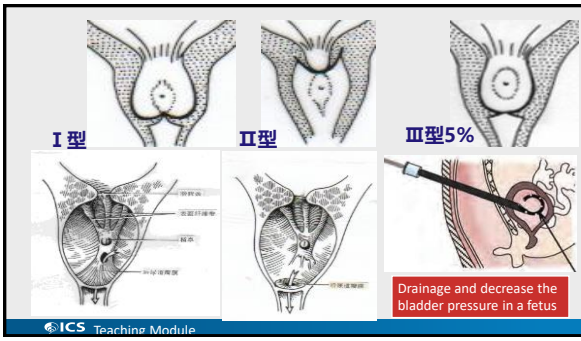

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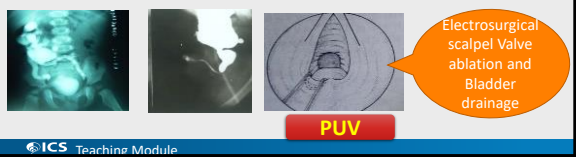
PUV: Diagnosis and Treatment

- Bilateral hydroureteronephrosis distended bladder, a thick-walled bladder and a dilated posterior urethra are suspicious signs of PUV.
- Voiding cystourethrogram (VCUG) is common used, but video urodynamic study (VUDS) is recommended to confirms PUV.
- A secondary reflux is observed in at least 50% of patients.



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PUV: Follow up by VUDS

- Following surgical treatment, close follow-up to detect and monitor the bladder dysfunction that may lead to renal injury.
- The synchronous evaluation of structure and function of VUDS provides insight into the correlation and causation of detected anomalies.

VUDS for PUV cases during follow up

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LUTS and OAB in children

- Lower urinary tract symtoms (LUTS) in children is encountered frequently in clinical practice, which needs to be evaluated by UDS
- The aim of UDS is to reproduce symptoms, to identify the underlying causes for symptoms, and to quantify underlying pathophysiological processes
- Pediatric OAB is defined as voiding dysfunction with frequency, urgency and/or incontinence in children

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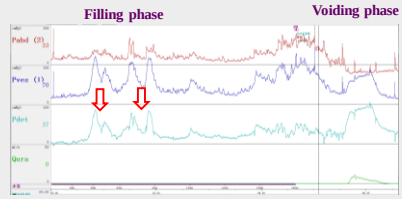
LUTS

Storage symptoms	Voiding symptoms	Post micturition symptoms
• Increased daytime frequency • Nocturia • Urgency • Urinary incontinence • pain	• Slow stream • Splitting or spraying • Intermittent stream • Hesitancy • Straining • Terminal dribble • Retention	Feeling of incomplete emptying Post micturition dribble

Cystometry



The arrow show overactive of bladder in filling phase which causes patient increased daytime frequency

Yang, girl, 11 y, daytime frequency and urgency more than six months

LUTS

Urodynamic indication → **Symptoms**

- Voiding diary → Increased daytime frequency, Nocturia
- Uroflowmetry:
  - reduced urine flow → Slow stream
  - urine flow curve flatness → Straining
  - urine flow curve delayed → Hesitancy
- Postvoid residual urine(PVR) → Retention

LUTS

Urodynamic indication	Symptoms
Cystometry indicates detrusor overactive in filling phase	Urgency Increased daytime frequency pain Urinary incontinence
Synchro Cystourethralmetry shows detrusor-sphincter dyssynergia,(DSD)	Increased daytime frequency Nocturia Urgency Urinary incontinence
Video Urodynamics show Bladder outlet obstruction	Slow stream Straining

Evaluation

- Detailed history taking
- Validated questionnaire on voiding and defecation
- Voiding and bowel diary
- Urinalysis, screening ultrasound
- Uroflowmetry and post-void residual(PVR) measurement
- Cystometry and (Vedio)-Urodynamics
- Synchro Cystourethralmetry

Synchro Cystourethralmetry

Next treatment

⇩

Neuromodulation

Urethral pressure decrease suddenly while no obvious detrusor pressure increase in filling phase which cause urgency or incontinence, indicating the dysfunction of urethral sphincter

Parasacral transcutaneous electrical nerve stimulation

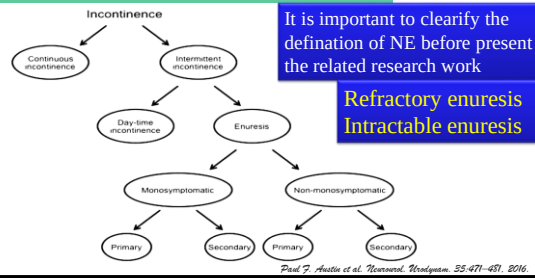
Two surface electrodes placed on both sides of between the anus and urethra.
Setting stimulation mode: EMEM1，20HZ，200us，15min, work 5s, rest 5s, accelerating 2s, persisting twice a day.



Nocturnal enuresis (NE)

- NE is a special type of urinary incontinence. Children with enuresis always void in bed during sleep, which can be divided into nocturnal enuresis and daytime enuresis.
- Epidemiological surveys show that the probability of a bedwetting at least once a month for children aged 7 r the


Incontinence subtypes

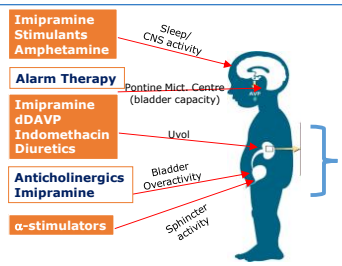


Paul J. Austin et al. Neurourol. Urodynam. 35:471–481. 2016.

It is important to clearify the defination of NE before present the related research work

Refractory enuresis
Intractable enuresis

Management of enuresis



Voiding diary
Uroflowmetry+PVR
Cystometry,
Pressure/flow study
Video urodynamics

Summary

- UDS can objectively reflect the type and severity of bladder and-urethral dysfunction.
- The voiding patterns of NB, PUV,LUTS, bladder exstrophy, anorectal malformations classified by UDS is useful to guide treatment protocol making and follow up.
- Following treatment require close follow-up to detect and monitor the bladder dysfunction that may lead to renal injury by using UDS.

Thanks for Your time!

Bristol Urological Institute | North Bristol NHS Trust | University of Bristol

Urodynamics prior to Surgery for Suspected BPO and Post Prostatectomy Incontinence

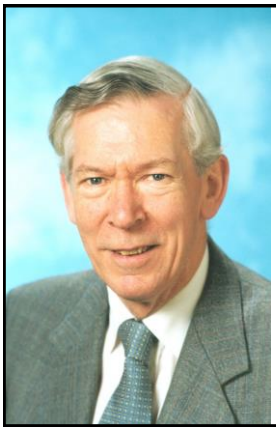
Paul Abrams
Professor of Urology
Bristol Urological Institute

ICS 2018

Disclosures
Paul Abrams

Consultant: Pfizer, Astellas, Ferring, Ipsen,

Lecturer: Astellas, Pfizer, Ferring, Sanofi, Sun Pharma: and Pierre Fabre and Coloplast on Leadership



Prof Roger Feneley 1933-2018

- Urodynamic pioneer
- In the 1970s questioned the term "prostatism"
- Developed the concept of the nurse continence advisor
- Developed the first nurse led continence service
- Innovated catheter design
- Published >100 papers, four after his 80th birthday!

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BMJ LONDON, SATURDAY 9 APRIL 1994

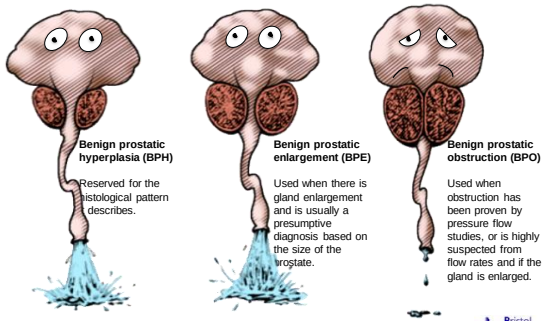
New words for old: lower urinary tract symptoms for "prostatism"

Avoids spurious suggestion of diagnostic accuracy

Paul Abrams, BMJ 1994

LUTS' 21st Birthday: April 2015

Terminology



Benign prostatic hyperplasia (BPH)

Reserved for the histological pattern describes.

Benign prostatic enlargement (BPE)

Used when there is gland enlargement and is usually a presumptive diagnosis based on the size of the prostate.

Benign prostatic obstruction (BPO)

Used when obstruction has been proven by pressure flow studies, or is highly suspected from flow rates and if the gland is enlarged.

1.Abrams P BMJ 1994
2.McVary KT, et al. American Urological Association Guideline: Management of Benign Prostatic Hyperplasia (BPH). 2010. Available at: https://www.auanet.org/common/pdf/education/clinical-guidance/Benign-Prostatic-Hyperplasia.pdf. Accessed June 2016.

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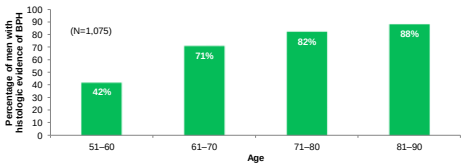
Epidemiology of Histological BPH

- The prevalence of histological BPH rises markedly with age[1]
- Autopsy studies have observed a prevalence of pathological BPH in 8%, 50% and more than 70% of men in their 30s, 50s and 60s, respectively[2]
- Approximately 90% of men will develop histologic evidence of BPH after age 80[1]



Data are from a survey of the literature on the growth of the human prostate and prevalence of histologically recognizable BPH. Five studies provided a total of 1,075 autopsy specimens used to determine the prevalence of pathological BPH with age.[2]

Adapted from Berry SJ, et al.

1. Lepor H. *Rev Urol* 2005;7(Suppl 4):S3-S12; 2. Berry SJ, et al. *J Urol* 1984; 132:474-479.

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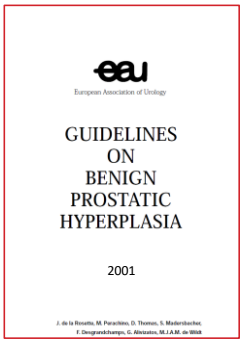

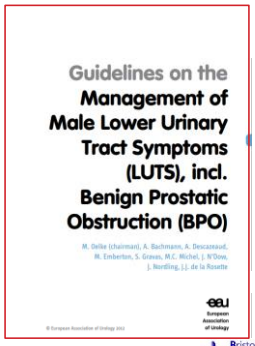

AUA 2018 Guidelines on Benign Prostatic Hyperplasia /Lower Urinary Tract Symptoms

- Benign prostatic hyperplasia (BPH) is a histologic diagnosis that refers to the proliferation of smooth muscle and epithelial cells within the prostatic transition zone.
- BPH or histological hyperplasia in itself does not require treatment and is not the target of therapeutic intervention.
- BPH does, however, in many men lead to an enlargement of the prostate called benign prostatic enlargement (BPE).
- Not all men with BPH will develop any evidence of BPE.
- The prostate gland may cause eventually obstruction at the level of the bladder neck, which in turned is termed benign prostatic obstruction (BPO),
- Not all men with BPE will develop obstruction or BPO, just as not all men with BPH will have BPE.
- Obstruction may also be caused by other conditions referred to as BOO. Thus, BPO is a subset of BOO.

AUA 2018 Guidelines on Benign Prostatic Hyperplasia /Lower Urinary Tract Symptoms

Then why would you call them BPH Guidelines?

- Benign prostatic hyperplasia (BPH) is a histologic diagnosis that refers to the proliferation of smooth muscle and epithelial cells within the prostatic transition zone.
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- Obstruction may also be caused by other conditions referred to as BOO. Thus, BPO is a subset of BOO.

AUA 2018 LUTS Guidelines

- Traditionally, the primary goal of treatment has been to alleviate bothersome LUTS that result from BPO.
- More recently, treatment has also been focused on the alteration of disease progression and prevention of complications that can be associated with BPH/LUTS, such as acute urinary retention.
- A variety of pharmacologic classes of medications are employed to treat LUTS attributed to BPH,

3. Clinicians should perform a PVR assessment prior to surgical intervention for LUTS attributed to BPH. (Clinical Principle)

- While the evidence base is limited, multiple organizations and their guidelines generally include PVR measurement as part of the basic evaluation of LUTS.
- Arising PVR can indicate medication failure and the need for surgical intervention, or further workup may be warranted.
- A "large" PVR (>300 mL) is worth monitoring, at the very least.
- Patients with symptoms from an elevated PVR (i.e. overflow incontinence, bladder stones, UTI, upper tract deterioration), may need to proceed on to surgery or for further urodynamics testing.
- To fully determine the etiology of an elevated PVR, formal urodynamics testing with a pressure flow study would need to be performed.
- While a clinically useful test that may drive management choices, PVR does not seem to be a strong predictor of acute urinary retention.

4. Clinicians should consider uroflowmetry prior to surgical intervention for LUTS attributed to BPH. (Clinical Principle)

- The generally accepted minimum threshold voided volume for adequate interpretation is 150 cc, and patients should be instructed not to Valsalva void.
- In addition to the flow rate, the shape of the curve and duration of voiding provide useful information as a screening tool for LUTS.
- These results can help to characterize the voiding dysfunction and are useful in counselling patients regarding surgical outcomes and expectations.
- In patients with catheter-dependent urinary retention who may have underactive detrusor function, a pressure flow study is advised; however, clinicians should be aware that there are such patients (e.g., those with bladder diverticulum) in whom studies inaccurately indicate a lack of detrusor contractility.

AUA 2018 LUTS Guidelines: Uroflowmetry

- Uroflowmetry is a simple and risk-free office-based procedure that can be an important adjunct in the evaluation of LUTS.
- Flow rates of <10 mL/s have shown a specificity of 70%, a positive predictive value of 70%,and a sensitivity of 47% for BOO.
- If the patient's condition is not sufficiently suggestive of obstruction(e.g., peak urinary flow [Qmax] >10 mL/sec), pressure-flow studies are optional as treatment failure rates are somewhat higher in the absence of obstruction.
- If interventional therapy is planned without clear evidence of the presence of obstruction, the patient needs to be informed of possible higher failure rates of the procedure.

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Positive predictive value (PPV) of 70%

PPV is the probability that subjects with a **positive** screening test truly have the disease.

So, for 100 men with Qmax<10 ml/s

- 70% have BPO
- 30% do not have BPO and, according to the 2018 AUA Guidelines these men will have a less good result

- Is only 70% accuracy good enough for you?
  Is 30% inaccuracy acceptable?

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5. Clinicians should consider pressure flow studies prior to surgical intervention for LUTS attributed to BPH when diagnostic uncertainty exists. (Expert Opinion)

- Pressure flow studies are the most complete means to determine the presence of BOO.
- Non-invasive tools provide useful information, but only pressure flow studies can determine bladder function or lack thereof.
- The likelihood of obstruction is greatly increased in patients with a Qmax <10mL/s.
- A large volume PVR may indicate poor detrusor contractility, but correlation with obstruction is weak.
- Most patients can likely be managed and treated surgically without pressure flow studies; however, certain circumstances dictate more complex evaluation.
- OAB symptoms and incontinence can be sequelae of obstruction or secondary to non-obstructive etiologies. …… Surgery in these individuals may not lead to meaningful improvement, subject patients to unnecessary surgery, and carry increased risks for incontinence and exacerbated voiding symptoms.

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PFS predicts outcome after prostatectomy

Abrams and Griffiths	BJ Urol 1979
Neal et al	BJ Urol 1987
Speakman et al	BJ Urol 1987
Jensen	Neurourol. Urodyn 1989
Schafer et al	World J Urol 1989
Rollema and van Mastrigt	J Urol 1992
Van Venrooij et al	J Urol 1995
Robertson et al	J Urol 1996
Jensen et al	BJ Urol 1996

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PFS predicts outcome after prostatectomy

Jaole P et al	J Urol 1998
Florates and de la Rosette	Eur Urol 2000
Rodriques et al	J Urol 2001
Machimo et al	NUU 2002
Van Venrooij el al	J Urol 2002
De Lima and Netto	Int. Braz J Urol 2003
Hakenburg et al	BJU Int 2003
Thomas et al	BJU Int 2004

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PFS Predicts Outcome after Prostatectomy: Recent Evidence

- Men without BPO do worse: Harding 2007, Masurmori 2010, Qi 2012, Losco 2013
- Men with DU do worse: Seki 2009, Blatt 2012
- Men with DO do worse: Zhoa 2014

:

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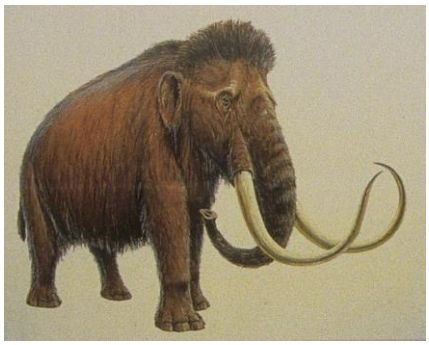

Are the AUA guilty of "Wooly Thinking"?

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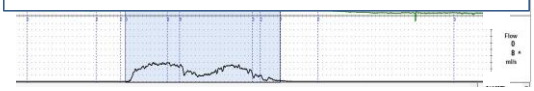
Would you offer this man a TURP?



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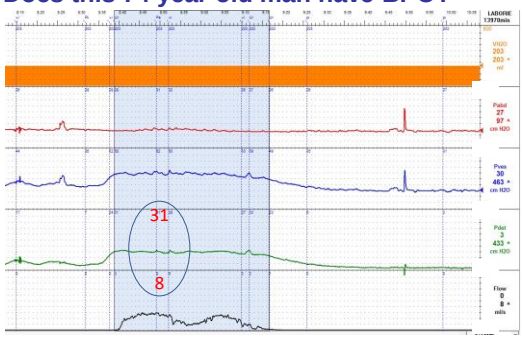
Does this 74 year old man have BPO?



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Bladder Voiding Function

Three simple indices :

- BOOI (bladder outlet obstruction index)
- BCI (bladder contractility index)
- BVE (bladder voiding efficiency)

Abrams P. Bladder outlet obstruction index, bladder contractility index and bladder voiding efficiency: **three** simple **indices** to define bladder voiding function. BJU Int. 1999 Jul;84(1):14-5

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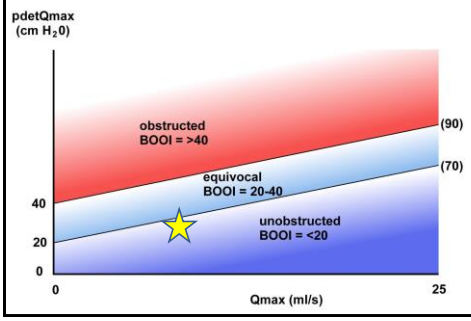
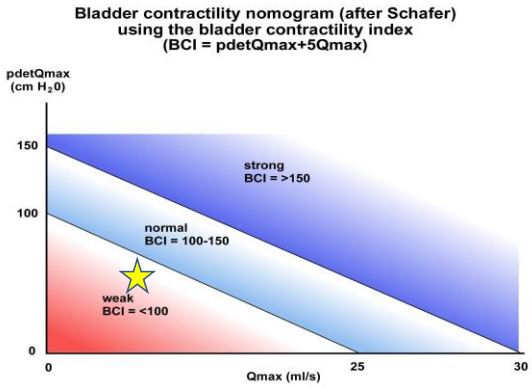
ICS pressure-flow nomogram using Bladder Outlet Obstruction Index (BOOI = pdetQmax - 2Qmax)





What does a man with LUTS want to know before prostate surgery?

He may ask the question: "Will I do less well than the average man?"

The answer will be "Yes", if:

- You do not have Obstruction
- You have significant DO causing OAB symptoms
- You have Detrusor Underactivity
- You are unlucky enough to get complications of surgery: stricture or incontinence"

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PUMP – PIPE – VALVE

- If you were a hydraulic engineer asked to sort out a PUMP – PIPE – VALVE problem (bladder-prostate-sphincter)
- If flow from pipe was reduced, what do you do, replace the pump, or the valve, or both, or do you test the system?
- You would test the system
- Urologists are hydraulic engineers
- Hence, an "a priori argument", in favour of UDS, exists, even without Level 1 evidence

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UPSTREAM

Urodynamics for **P**rostate **S**urgery **T**rial; **R**andomised **E**valuation of **A**ssessment **M**ethods (**UPSTREAM**) for diagnosis and management of bladder outlet obstruction in men

A randomised controlled trial to determine the clinical and cost effectiveness of invasive urodynamic studies for diagnosis and management of bladder outlet obstruction in men in the National Health Service (NHS)

University of Bristol · Bristol Randomised Trials Collaboration · North Bristol NHS Trust · Bristol Urological Institute · NHS National Institute for Health Research

Urodynamics Prior to Prostatectomy for BPO: Why?

Be

- There are no symptoms diagnostic of BPO
- There are no signs diagnostic of BPO
- Urine flow studies are unable to distinquish BPO from DU as the cause of low flow/raised PVR
- ONLY pressure-flow studies can diagnose BPO
- SURGERY IS DESIGNED TO RELIEVE BPO

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"Before somebody treats me for the rest of my life with a pill or decides to heat laser or vaporise my prostate, I would like to know if I really need it. In fact I would like to know whether or not I'm obstructed.

The point is, a pressure flow study or voiding profile, reliably and conclusively, identifies patients with obstruction, and the other methods do not."

Dr Edward McGuire, NAU 1996

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Conclusions: Are PFS needed prior to Surgery for MLUTS suggestive of BPO?

- YES, for most men with bothersome LUTS
- If the Qmax is < 10 ml/s then there is only a 70% chance the man has obstruction
- If the Qmax is > 10 ml/s then there should be a full discussion with the patient (AUA guidelines)
- Are you giving fully informed consent?
- All urologists need to understand urodynamics
- Should urologists without the facilities for urodynamics do TURPs for symptoms?

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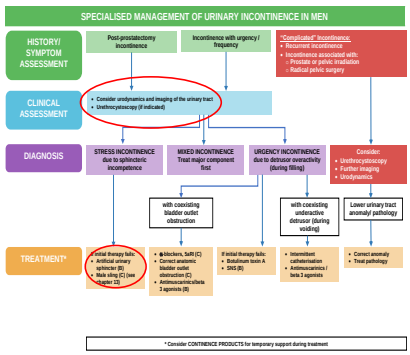

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What does a patient want to know before surgery for PPI?

He may ask the question: "Will I do less well than the average man?"

The answer will be "Yes", if:

- You have no Urodynamic Stress Incontinence
- You have significant Detrusor Overactivity
- You have Detrusor Underactivity

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UDS in PPI: Aims

- To confirm USI
- To assess urethral function
  - how bad is urethral function?
- To assess the storage phase
  - is DO a significant problem?
- To assess the voiding phase
  - is there BOO or DU?

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UDS in PPI: Before UDS

Has bladder neck contracture/stricture been excluded?

1. History of flow better than before prostatectomy
2. Qmax and PVR studies
3. Cystoscopy if necessary

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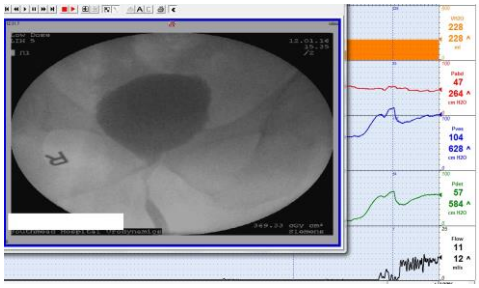
UDS in PPI: Methodology

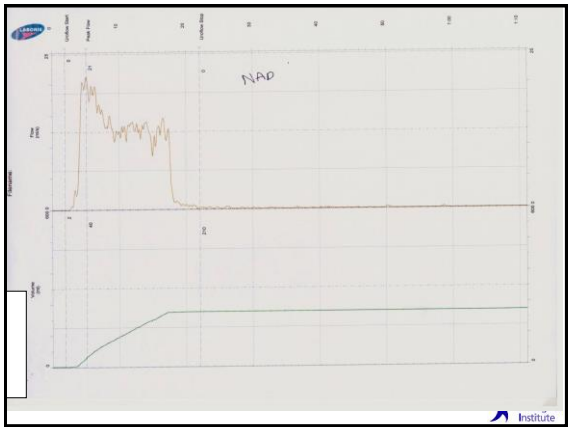
- Free flow rates
- Urethral function studies
- Video-urodynamics

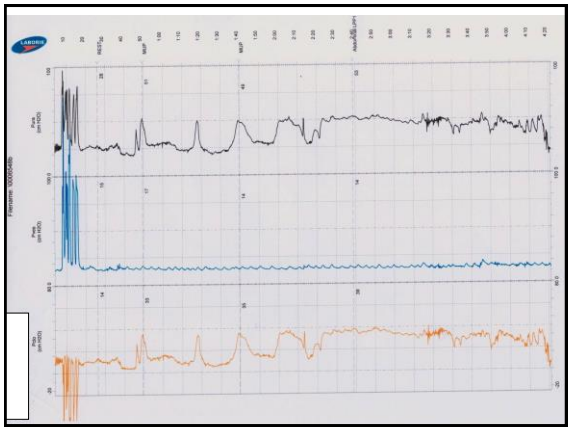
Void with image

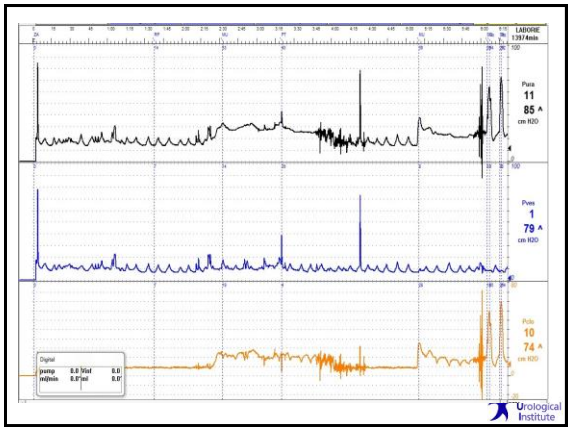


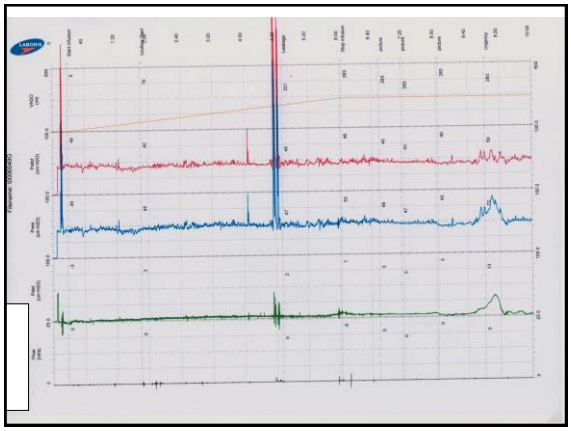
75 Year Old Man

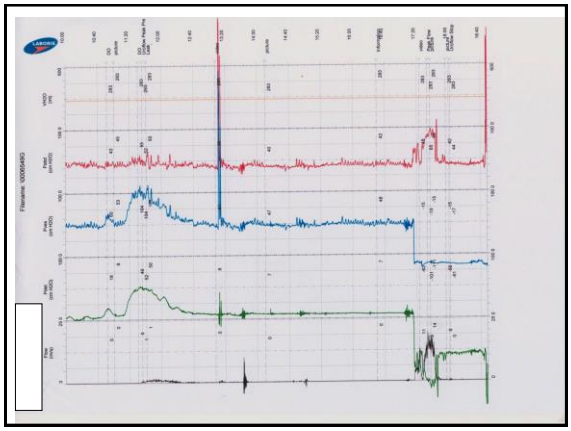
- Radical Prostatectomy 2003
- AUS 2006- working well until 12 months ago
- Now leakage on coughing and straining
- Urinary frequency, urgency and urgency incontinence with some improvement on solifenacin











Urodynamics

- Normal free flow
- Detrusor overactivity with DOI on filling
- “Mild” stress incontinence on coughing with cuff inflated

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UDS in PPI: Problems during UDS

1 Can’t catheterise the patient
- can use flexi to introduce the catheter

2. DOI may prevent filling so cannot confirm USI
- may help to lie the man down

3. Continuous leakage due to poor urethral function
- fill using penile clamp

4. Failure to confirm USI despite full bladder
- remove filling catheter and retest
- ask the man to relax the pelvic floor

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UDS in PPI: Conclusions

Should be performed in all cases (ICI Recommendation)

1. Needed to confirm USI
2. Can assess USI severity
3. To determine whether DO and/or DU coexists
4. May be able to determine the choice of surgery
5. Can be use to give fully informed consent

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CHaRT
Centre for Healthcare Randomised Trials

MASTER
Male synthetic sling versus Artificial urinary Sphincter Trial

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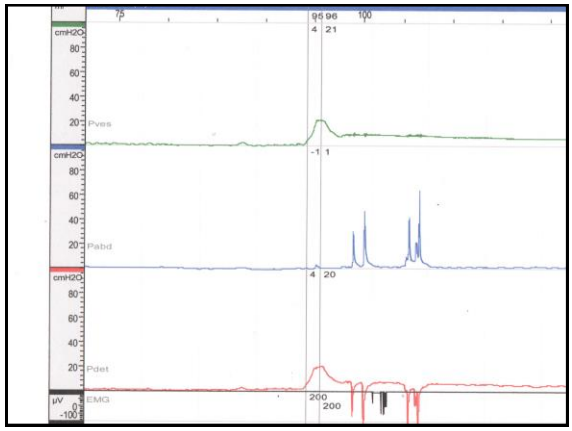
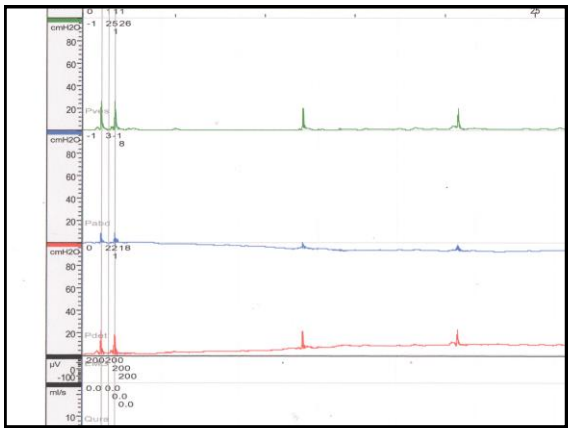
United Kingdom Continence Society: Minimum Standards for Urodynamics, 2018

Abrams P (Chair); Eustice S; Gammie A; Harding C; Kearney R; Rantell A; Reid S; Small D; Toozs-Hobson P Woodward M, the Working Group, appointed by the **UKCS**



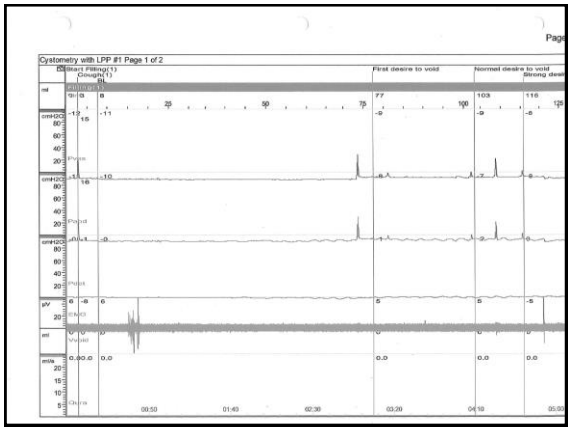


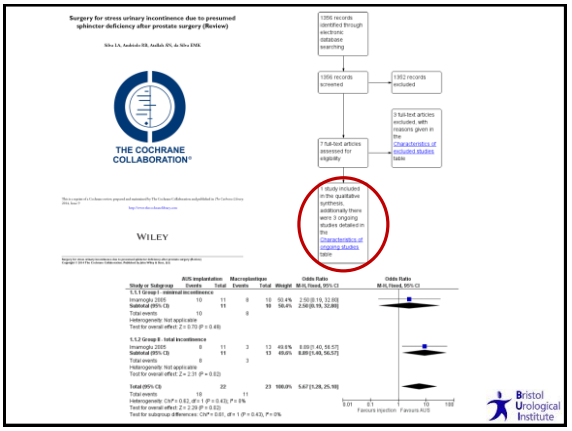
Technical and Clinical Skill Sets

- Two different skill sets are required by the personnel performing UDS, in order to deliver a safe and clinically effective service to patients.
- Each skill set needs to be considered and defined separately.
- Technical skill set is used to deliver technical excellence in UDS
- Clinical skill set is used to deliver clinical excellence in UDS, for example to ensure that the urodynamic questions are answered during the test

Conclusions

- Quality Control is the key to good urodynamic studies (UDS)
- Urodynamacists need formal urodynamic education
- There should be documented “Urodynamic Questions” to justify every referral
- UDS should be audited to ensure ongoing good quality
- These standards are as important to women as they are to men with LUTS considering invasive therapy
- Regulation of Urodynamic units seems essential for ensure good patient care
- ICS Good Urodynamic Practice recommendations should be followed





Effect of preoperative urodynamic detrusor overactivity on post-prostatectomy incontinence: a systematic review and meta-analysis.

METHODS

- The period of search: January 1989 to December 2014.

RESULTS:

- A total of nine articles met the eligibility criteria for this systematic review.
- The eligible studies included a total of 457 patients with a median number of 58 patients per study (range 17-92). Of the nine studies, five conducted open retropubic radical prostatectomy (RRP), two performed robot-assisted laparoscopic prostatectomy (RALP), and two others utilized multiple modalities.
- **PPI was more likely to occur in patients with preoperative DO [pooled odds ratio (OR) 2.30**; 95 % confidence interval (CI) 1.39-3.82; studies 9; participants 419], as compared to patients who were DO negative.

CONCLUSIONS:

- Meta-analysis results suggest that preoperative DO is another possible underlying mechanism for PPI.
- Urodynamic detrusor overactivity (DO) contributes to post-prostatectomy incontinence (PPI).

Int Urol Nephrol. 2015 Oct 27. [Epub ahead of print]
Kim M[1], Park M[2], Shim M[1], Choi SK[1], Lee SM[1], Lee ES[2], Song C[1], Choo MS[1], Ahn H[2].

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