W34: ICS Core Curriculum (Free): Urodynamics Modules

Workshop Chair: Roman Zachoval, Czech Republic
15 September 2017 14:00 - 15:30

Start	End	Topic	Speakers
14:00	14:05	Introduction	Roman Zachoval
14:05	14:25	ICS Cystometry	Enrico Finazzi Agrò
14:25	14:40	Pad Testing	Roman Zachoval
14:40	14:55	ICS Pressure Flow Analysis	Carlos D'Ancona
14:55	15:10	Break	All
15:10	15:25	ICS Good Urodynamic Practices 2016	Peter Rosier
15:25	15:30	Questions	All

Speaker Powerpoint Slides

Please note that where authorised by the speaker all PowerPoint slides presented at the workshop will be made available after the meeting via the ICS website www.ics.org/2017/programme Please do not film or photograph the slides during the workshop as this is distracting for the speakers.

Aims of Workshop

The workshop is largely based on the published and evidence based ICS teaching modules. The workshop is intended to educate the fundamentals of urodynamics for the beginner and includes the newly published ICS 'Good Urodynamic Practices and Terms'.

Learning Objectives

- To learn the terms used for objective lower urinary tract dysfunction.
- To learn the basic principles of objective testing of lower urinary tract function.
- To learn to systematically analyse and evaluate test results and to apply standard terms in the reporting.

Learning Outcomes

Understand that a variety of symptoms can lead to a variety of dysfunctions when function is objectively tested.
The student will also understand that although the tests give objective results, the tests have a certain biological inherent variability and are also influenced by the circumstances during the test.
The student will furthermore be able to improve testing quality evaluation skills.

Target Audience

Everyone involved in indication performing and evaluating urodynamics

Advanced/Basic

Basic

Conditions for Learning

There is no restriction on delagates for this course with the intention to be very interactive, nevertheless.

Suggested Learning before Workshop Attendance

Reading of the ICS good urodynamic practices and the teaching modules publicatons will help interaction and raise the level of the discussion.

Suggested Reading

Rosier PF, 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. 2016 Dec 5. doi: 10.1002/nau.23124. [Epub ahead of print] Review. PubMed PMID: 27917521.
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.
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. Review. PubMed PMID: 26372678.
D'Ancona CA, Gomes MJ, Rosier PF. ICS teaching module: Cystometry (basic module). Neurourol Urodyn. 2016 Nov 28. doi: 10.1002/nau.23181. [Epub ahead of print] Review. PubMed PMID: 27891659.
Rosier PF, Hermanns RK, Svihra J, Homma Y, Wein A. Authors' response: Re: Rosier PFWM, Kirschner-Hermanns R, Svihra J, Homma Y, Wein AJ. ICS teaching module: Analysis of voiding, pressure flow analysis (basic module). Neurourol Urodyn. 2014 Sep 11. doi: 10.1002/nau.22660. Neurourol Urodyn. 2016 Apr;35(4):542-3. doi: 10.1002/nau.22748. PubMed PMID: 25728171.

Schaefer W. Re: Rosier PFWM, Kirschner-Hermanns R, Svihra J, Homma Y, Wein AJ. ICS teaching module: Analysis of voiding, pressure flow analysis (basic module). Neurourol Urodyn. 2014 Sep 11. doi: 10.1002/nau.22660. Neurourol Urodyn. 2016 Apr;35(4):539-40; discussion 541. doi: 10.1002/nau.22746. PubMed PMID: 25727905.
Schaefer W. Response to authors; Re: Rosier PFWM, Kirschner-Hermanns R, Svihra J, Homma Y, Wein AJ. ICS teaching module: Analysis of voiding, pressure flow analysis (basic module) Neurourol Urodyn. 2014 Sep 11. doi: 10.1002/nau.22660. Neurourol Urodyn. 2016 Apr;35(4):538; discussion 541. doi: 10.1002/nau.22744. PubMed PMID: 25727689.
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. PubMed PMID: 25251215.
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. PubMed PMID: 25214425.
Tarcan T, Demirkesen O, Plata M, Castro-Diaz D. ICS teaching module: Detrusor leak point pressures in patients with relevant neurological abnormalities. Neurourol Urodyn. 2015 Dec 23. doi: 10.1002/nau.22947. [Epub ahead of print] PubMed PMID: 26693834.
Digesu GA, Gargasole C, Hendricken C, Gore M, Kocjancic E, Khullar V, Rosier PF. ICS teaching module: Ambulatory urodynamic monitoring. Neurourol Urodyn. 2015 Nov 23. doi: 10.1002/nau.22933. [Epub ahead of print] PubMed PMID: 26594872.
Krhut J, Zachoval R, Smith PP, Rosier PF, Valanský L, Martan A, Zvara P. Pad weight testing in the evaluation of urinary incontinence. Neurourol Urodyn. 2014 Jun;33(5):507-10. doi: 10.1002/nau.22436. Review. PubMed PMID: 23797972.

Other Supporting Documents, Teaching Tools, Patient Education etc

ICS teaching module: Cystometry (basic module)

D'Ancona CA(1), Gomes MJ(2), Rosier PF(3).

(1)Division of Urology, University of Campinas School of Medicine, Campinas, Sao Paulo, Brazil. (2)In remembrance: Hospital Santo Antonio, Porto, Portugal. (3)Department of Urology, University Medical Center Utrecht, The Netherlands.

AIMS: To summarize the evidence background for education of good urodynamic practice, especially cystometry.

METHODS: A search was done in PubMed for the last 5 years of publications selecting only clinical studies, utilizing the following keywords: cystometry 133 articles and filling cystometry 53 articles.

RESULTS: The evidence with regard to clinical setting and cystometry technique, as well as for catheters and transducers type, infused solution and patient position is presented with recommendations. Also the practice of determining bladder filling sensation and capacity and the basis of detrusor storage function diagnosis is educated.

CONCLUSIONS: This module provides the evidence background for the practice of cystometry.

Pad weight testing in the evaluation of urinary incontinence

Krhut J(1), Zachoval R(2), Smith PP(3), Rosier PF(4), Valanský L(5), Martan A(6), Zvara P(7).

1 Department of Urology, Ostrava University, University Hospital,, Ostrava, Czech Republic
2 Department of Urology, Thomayer Hospital Prague, Czech Republic
3 Department of Surgery, University of Connecticut Health Center, Farmington, CT
4 Department of Urology, University Medical Centre Utrecht, Utrecht, The Netherlands
5 Department of Urology, PJS University, Košice, Slovak Republic
6 Department of Gyneacology, Charles University, Prague, Czech Republic
7Division of Urology, Department of Surgery, University of Vermont, Burlington, VT

AIM: To present the teaching module "Pad Weight Testing in the Evaluation of Urinary Incontinence." This teaching module embodies a presentation, in combination with this manuscript. This manuscript serves as a scientific background review; the evidence base made available on ICS website to summarize current knowledge and recommendations.

METHODS: This review has been prepared by a Working Group of The ICS Urodynamics Committee. The methodology used included comprehensive literature review, consensus formation by the members of the Working Group, and review by members of the ICS Urodynamics Committee core panel.

RESULTS: The pad test is a non-invasive diagnostic tool for urinary incontinence. It is an easy to perform, inexpensive test with utilization in both the daily patient care and clinical research. Despite it is clear value in initial diagnosis, selection of treatment, and follow-up evaluation, only less than 10% of urologists perform the test routinely. A number of testing protocols with varying lengths of recording time exist, however, only a 1-hr pad test has been standardized. One-hour pad tests are most suitable in establishing initial diagnosis, the 24-hr test serves most often for evaluation of treatment outcomes, and longer pad tests are

used in clinical studies.

CONCLUSIONS: The pad test is clearly underutilized. Well-designed studies providing level one evidence are lacking. Numerous variations in how the test is performed by individual urologists make the evaluation of published literature difficult. Future research goals should include randomized studies leading to establishment of optimal protocols of testing for clinical research and daily care.

ICS teaching module: Analysis of voiding, pressure flow analysis (basic module)

Rosier PF(1), Kirschner-Hermanns R(2), Svihra J(3), Homma Y(4), Wein AJ(5).

(1)University Medical Centre Utrecht - Urology, The Netherlands. (2)University Clinic, Rheinisch Friedrich-Wilhelms University - Clinic of Urology/Neuro-Urology Bonn, Germany. (3)School of Medicine - Department of Urology, Slovakia. (4)University of Tokyo - Department of Urology, Bunkyoku, Tokyo, Japan. (5)University of Pennsylvania Health System - Division of Urology, Philadelphia, Pennsylvania.

AIMS: To present the evidence background for an ICS teaching module for the urodynamic analysis of voiding.

METHODS: Literature analysis and expert opinion are combined to collate an outline and explanation of a preferred and good urodynamic practice.

RESULT: Patient's preparation, pathophysiology, technique and principles of pressure flow analysis are summarized in this manuscript.

CONCLUSIONS: This module serves as scientific background for teaching the basic and practical elements of pressure flow analysis.

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

Rosier PF(1), Schaefer W(2), Lose G(3), Goldman HB(4), Guralnick M(5), Eustice S(6), Dickinson T(7), Hashim H(8).

(1)Department of Urology, University Medical Center Utrecht, Utrecht, The Netherlands. (2)Department of Medicine (Geriatrics), University of Pittsburgh, Pittsburgh, Pennsylvania. (3)University of Copenhagen Herlev Hospital, Herlev, Denmark. (4)Glickman Urologic and Kidney Institute Cleveland Clinic, Lerner College of Medicine, Cleveland, Ohio. (5)Medical College of Wisconsin, Milwaukee, Wisconsin. (6)Peninsula Community Health, Cornwall, UK. (7)UT Southwestern Medical Center, Dallas, Texas. (8)Bristol Urological Institute, Bristol, UK.

AIMS: The working group initiated by the ICS Standardisation Steering Committee has updated the International Continence Society Standard "Good Urodynamic Practice" published in 2002.

METHODS: On the basis of the manuscript: "ICS standard to develop evidence-based standards," a new ICS Standard was developed in the period from December 2013 to December 2015. In July, a draft was posted on the ICS website for membership comments and discussed at the ICS 2015 annual meeting. The input of ICS membership was included in the final draft before ICS approval and subsequent peer review.

RESULTS: This evidence-based ICS-GUP2016 has newly or more precisely defined more than 30 terms and provides standards for the practice, quality control, interpretation, and reporting of urodynamics; cystometry and pressure-flow analysis. Furthermore, the working group has included recommendations for pre-testing information and for patient information and preparation. On the basis of earlier ICS standardisations and updating according to available evidence, the practice of uroflowmetry, cystometry, and pressure-flow studies are further detailed.

CONCLUSION: ICS-GUP2016 updates and adds on to ICS-GUP2002 to improve urodynamic testing and reporting both for individual care and scientific purposes.

Urodynamic Committee

- **former School of Urodynamics of ICS (2005-2010)**

Urodynamic Committee

Aims of Urodynamic Committee

- **sequential production of teaching/educational modules on all urodynamic tests**
  - by collecting as much information as posible according to the Evidence Based Medicine (indicated in the texts)
- **release modules to the public**
  - in English version
  - in national languages if there is a demand

Teaching/educational modules

- **design:**
  - to address the method in a very specific manner
    - a narrow field rather then a very extensive information
  - example
    - Filling cystometry:
      - basic
      - advanced:
        - in children, in elderly, …
        - principles, technique, equipement, …

Process of production

- **Member od Urodynamic Committee:**

  = leader/manager of working group

  - formation of working group on specific topic
  - production of module
  - approval of module by Urodynamic Committee and ICS authorities (peer review standards)

Final product

- **Manuscript published in Neurourology and Uronydamics**
- **Slide Set posted on ICS websites**

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ICS International Continence Society
Teaching Module

ICS teaching module: Cystometry (Basics)

Carlos D'Ancona
Mário João Gomes (in remembrance)
Peter F.W.M. Rosier

ICS International Continence Society
Teaching Module

Cystometry - Definition

- Transurethral or suprapubic continuous fluid filling of the bladder, and measurement of intravesical and abdominal pressures …..
- … cystometry ends with 'permission to void' or with incontinence (involuntary loss) of the (total) bladder content.

ICS Teaching Module

Cystometry: Aim

- To diagnose lower urinary tract reservoir function and find an explanation for the patients' complaints
- To evaluate lower urinary tract reservoir function for research purposes

ICS Teaching Module

Cystometry (clinical relevance)

- Demonstrate the reservoir function of the bladder relevant to the signs and symptoms that the patient perceives

What should be known before starting ?

- Patient's symptoms and signs of lower urinary tract dysfunction
  - Symptoms questionnaire (preferable)
  - Voiding diary; FVC-BD (≈usual volumes voided)
    - To predict -estimated- cystometric capacity
  - Free uroflowmetry
  - Post void residual urine

ICS Teaching Module

ICS Standard:

- Fluid filled >
- External pressure transducers
- Reference = pressure at the level of the symphysis
- Patient in vertical position
- Fill until strong desire to void
- Continuous medium fill-rate
  - (e.g. 10% of expected capacity /minute)
- Room temperature saline
- Indicate end of cystometry on trace
  - Stopping of the pump (and /or)
  - 'Permission to void'

ICS Teaching Module

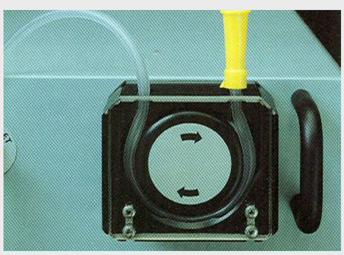
Specify (when reporting)

- Fluid type
- Fluid temperature
- Filling method and rate
- Catheter sizes
- Pressure recording technique
- Patient position
- Sensations (at volumes)
- Observations during cystometry

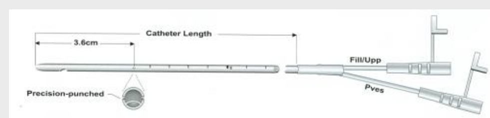
Solution infused

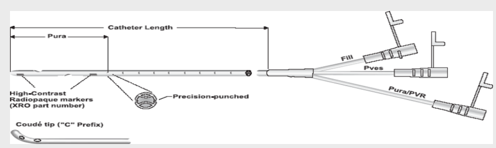
- Saline solution
  - Or contrast
- Temperature
  - Room temperature

Infusion Pump



Urethral Catheter

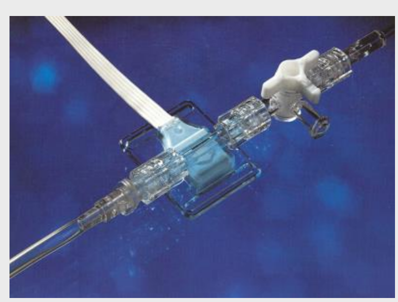




Insert catheters

- Usually lithotomy position
- Sterile catheters
  - Vesical: double lumen (or separate)
    - 6-7F
  - Rectal: **punctured** balloon or open tube
- Fix adjacent to the meatus
- Patient in comfortably seated position
- Cover the patient e.g. with a towel

Transducer



Position of the Transducer

- External pressure measured at the level of he symphysis pubis
- Equals: Base of the bladder
- ICS standard urodynamic pressure, is the excess pressure above atmosphere at the hydrostatic level of the upper edge of the symphysis pubis.
- Intra rectal and intravesical pressures are assumed to be measured at identical levels

ICS Teaching Module

Filling cystometry

- Transducers zero set to atmospheric pressure
- Transducers placed at the level of upper edge of pubic symphysis
- Initial resting pressure
  - Supine 5 -20cmH_2O
  - Sitting 15-40cmH_2O
  - Standing 30-50cmH_2O

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

ICS Teaching Module

Bladder sensation – ICS classification

- *Normal bladder sensation*
  - can be judged by three 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*
  - is the feeling the patient has, during filling cystometry, when he/she first becomes aware of the bladder filling.
  - To be separated from the sensation that the catheterisation has caused, that means off in the first minutes.
- *First desire to void*
  - is defined as the feeling, during filling cystometry, 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, during filling cystometry, as a persistent desire to void without the fear of leakage.

ICS Teaching Module

- *Increased bladder sensation*
  - is defined, during filling cystometry, 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, during filling cystometry, as diminished sensation throughout bladder filling.
- *Absent bladder sensation*
  - means that, during filling cystometry, the individual has no bladder sensation.

ICS Teaching Module

- *Non-specific bladder sensations,*
  - during filling cystometry, may make the individual aware of bladder filling, for example, abdominal fullness or vegetative symptoms.
- *Bladder pain,*
  - during filling cystometry, is a self explanatory term and is an abnormal finding.
  - Pain may increase with volume, or not, which should be reported.
- *Urgency,*
  - during filling cystometry, is a sudden compelling desire to void.

ICS Teaching Module

Communicate with patient:

- The bladder is filling from now on; from the kidneys as usual, but also slowly dripping from the urodynamic machine via the catheter:
- 'Tell me at the moment that you perceive that the bladder is not empty anymore':
  - First sensation of filling
    - *not in the urethra; not the sensation that the catheter causes.*
- *(subsequently)* 'Tell me when you have the sensation that normally tells you to go to the toilet, without any hurry, at the next convenient moment':
  - First desire to void
- *(subsequently)* 'Tell me at the moment that you, without any pain, will not likely postpone the voiding any more, and or will visit the nearest restroom e.g. while shopping:
  - Strong desire to void
    - *May associate with the largest voided volume on FVC-BD*
- Cystometric capacity (mL)

ICS Teaching Module

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.

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

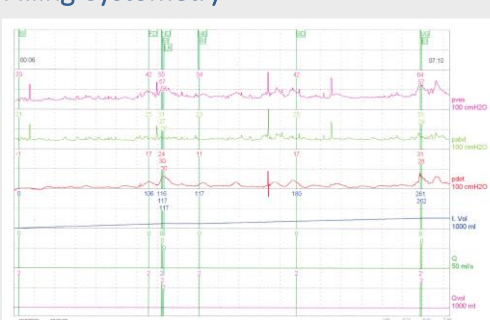
- Cystometric capacity – bladder volume at the end of filling phase
  - Commonly there is not much reason to fill more than 800mL e.g. in the absence of sensation and or contraction and or incontinence
- Maximum cystometric capacity – patient can no longer delay micturition
  - Overfilling hinders subsequent (representative) voiding
- Maximum anaesthetic capacity – volume of bladder without urinary leakage

Detrusor Pressure

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

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) detrusor pressure rise before permission to void:
  - Neurogenic; when relevant neurologic abnormalities are present
    - NDO
  - Idiopathic
    - DO

Cystometry patterns are not discriminating
Neurogenicity: Depends on history and clinical exam

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

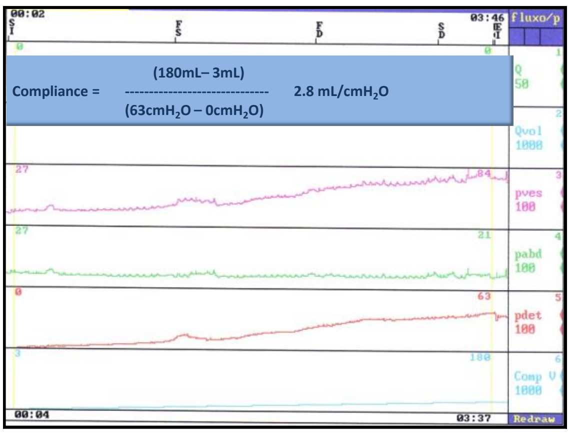
Detrusor overactivity

Bladder Compliance

- Good compliance is large volume and low pressure

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

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



Bladder Compliance – Normal Values

- Not well defined
- (Neurogenic) LUT dysfunction:
  - (low) values 13 – 40 mL/cmH_2O, uppertract risk
- Normal >40 mL/cmH_2O
- Low <30 mL/cmH_2O
  - Relation with sensation, volume and leakpoint

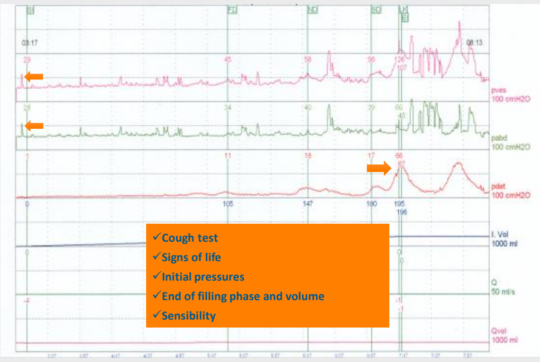
- Bladder compliance (mL/cmH_2O) volume/pressure increment
  - Does not automatically include diuresis (correct when needed)
  - Be aware: If end fill pressure is low, large differences are clinically meaningless:
    - 400/1 = **400** mL/cmH_2O
    - is clinically equal to 400/2 = **200** mL/cmH_2O
    - is equal to 400/4 = **100** mL/cmH_2O
    - and equal to 400/10 = **40** mL/cmH_2O

Filling cystometry

- Important points:
- All negatives values should be corrected
  - Usually self limiting after some filling
  - Use punctured –leaking rectal balloon
- Abdominal pressure is to identify the artifacts on P_{ves}
  - Cough tests > balanced response
- P_{det} cannot be negative (agreed limit is 10cmH_2O)
  - Fine structure pressure variations in both pressures (signal alive)
  - Talking patient: lively signal in p_{ves} and p_{abd}

Hogan S. Neurourol & Urodyn 2012, 31: 1104-1117

Filling cystometry



Cystometry

- Patient centred and patient friendly
- Technically adequate
- Observe the pressures 'as an engineer'

- Perform the test as representative for the usual situation as possible
  - Reproduce the dysfunction that leads to, or is an explanation for, the signs and the symptoms that the patient perceives
- Systematically report all observations

Thank You

Roman Zachoval

ICS 2017 FLORENCE

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:

Pad weight tests

ICS working group:
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P. Zvara, Burlington, U.S.

Aim of the pad weight test

- Qualitative assessment (continent vs. incontinent)
- Quantitative assessment (how much)

Principle of the pad weight test

- weight of the pads before and after test
- weight gain in g = urine loss in mLs

Duration of the pad weight test

Short term tests	*Long term tests*
20 min. – 2 hrs	12 hrs – 72 hrs
qualitative assesssment	quantitative assessment

ICS pad weight test

- Only 1 hr standardized pad weight test[1]

0-15 min: drinking of 500 ml sodium-free liquid, resting
15-45 min: walking, including stars climbing to one flight up and down
45-60 min: standing up from sitting (10 times)
coughing vigorously (10 times)
running on the spot (1 min)
bending to pick up small object from the floor (5 times)
washing hands in running water (1min)

[1]Seventh report on the standardisation of terminology of lower urinary tract function: lower urinary tract rehabilitation techniques. International Continence Society Committee on Standardisation of Terminology. Scand J Urol Nephrol, **26:** 99, 1992

Preparation of the patient

- *Short term tests*
- without retrograde filling
- with retrograde filling[1]
  (200-300 ml)
  (50-75% of the bladder capacity)

- *Long term tests*
- without retrograde filling

Lose, G., Rosenkilde, P., Gammelgaard, J. et al.: Pad-weighing test performed with standardized bladder volume. Urology, **32:** 78, 1988

Perfoming of the pad weight test

- *Short term tests*
- set of standardized activities

- *Long term tests*
- Normal daily activity

Cut-off values

- *Short term tests*
- weight gain > 1g[1]

- *Long term tests*
- weight gain > 4g/24hrs[1]

[1]Staskin D, Kelleher C, Bosch R, Coyne K, Cotteril N, Emmanuel A, Yoshida M, Kopp Z: Initial assessment of urinary and faecal incontinence in adult male and female patients. In: Incontinence. Ed.:Abrams P, Cardozo L, Khoury S, Wein A. 4th Ed. Health Publ.Ltd, Paris 2OO9, pp 333-412

Is leak of 1 mL significant ?

1 mL of fluid = 25 drops

Is leak of 1 mL significant ?

- 1mL of fluid absorbed by pad
- 1 mL of fluid leaked into the clothing

Is leakage of 5 mL of fluid significant ?

- 5 mL of fluid absorbed by pad
- 5 mL of fluid leaked into the clothing

Sensitivity and specificity

- *Short term tests*
- sensitivity: 34-83%[1,2]
- specificity: 65-89%[2]

- *Long term tests*
- sensitivity: no sufficient data
- specificity: no sufficient data

[1]Wu, W.Y., Sheu, B. C., Lin, H. H.: Twenty-minute pad test: comparison of infusion of 250 ml of water with strong-desire amount in the bladder in women with stress urinary incontinence. Eur J Obstet Gynecol Reprod Biol, **136:** 121, 2008

[2]Costantini, E., Lazzeri, M., Bini, V. et al.: Sensitivity and specificity of one-hour pad test as a predictive value for female urinary incontinence. Urol Int, **81:** 153, 2008

Limitations I.

- lack of standardization
- results of the long term tests may be influenced by:
  - fluid intake
  - increased voiding frequency
  - sweating
  - vaginal discharge (up to 7g/24 hrs)[1]
  - patient compliance
- no value in determining incontinence etiology

[1]Karantanis E, O´Sullivan R, Moore KH: The 24-hour pad test in continent women and men: normal values and cyclical alterations. BJOG 2003; 110: 567-571

Limitations II.

- weak correlation with the degree of patient´s bother

Clinical conclusions

- pad –test can provide additional information about degree of patient´s incontinence
- easy to perform, inexpensive, risk-free
- could be influenced by many factors, therefore outcomes should be interpreted in context of other diagnostic instruments

Recommendation for clinical use of the pad weight test

- detailed instruction and patient motivation are crucial to achieve valid results
- use short term test for qualitative evaluation of incontinence
- in case of retrograde filling, bladder should be filled to 50-75% of bladder capacity
- use long term test for quantitative evaluation of incontinence
- the test results should be always interpreted in conjunction with other relevant assessments (self-assessment, questionaires, physical examination, etc.)
- pad weight test result does not always correlate with patient´s bother

ICS Pressure Flow Analysis

Carlos D'Ancona
Professor of Urology
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Carlos D'Ancona

Affiliations to disclose:

Astellas – clinical reserarch
No disclosure related to the presentation

Funding for speaker to attend:

Enter X in appropriate box

- [ ] Self-Funded
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Normal Voiding

- Voiding is desired (and socially acceptable)

Pelvic floor relaxes by will..

- ...subsequently and autonomically the..:

...urethral sphincter relaxes and (antagonistic) detrusor-dome contracts;

Detrusor pressure forces the (relaxed) bladder neck, the urethra and pelvic floor to open;

Urine flow begins;

Detrusor contraction ends;

Urethral sphincter and pelvic floor contraction resume.

ICS standard urodynamic protocol

Optimally informed patient

Clinical history

Systematic symptoms and scores

Laboratory and clinical exams

Bladder diary (3 days)

Free flowmetry

Post void residual urine

ICS – standard urodynamic test

Uroflowmetry
Filling cystometry
Pressure-flow study

All test are performed in the patient's preferred or most usual position

Rosier PF, et all. ICS teaching module: Analysis of voiding, pressure flow analysis. Neurourol Urodyn. 2016, 35: 36-8.

Pressure-flow study

- Begins immediately after permition to void
- Ends when the pressure has returned to the base line value and/or the flow rate to zero and/or the patient considers the micturation completed

Rosier PF, et all. ICS teaching module: Analysis of voiding, pressure flow analysis. Neurourol Urodyn. 2016, 35: 36-8.

Recommendation

- A shorter possible meatus-to flowmeter distance, adjusted to voiding position
- Correct the delay between pressure and flow

ICS

Update of terms

Bladder Outflow Obstruction (BOO) a cut-off of bladder outflow resitance based on the pressure flow relation that is considered clinical relevant (not define cut-off value)

Rosier PF, et all. ICS teaching module: Analysis of voiding, pressure flow analysis. Neurourol Urodyn. 2016, 35: 36-8.

ICS

Update of terms

- Normal voiding function – flow and pressure are within normal limits
- Situational inability to void and situational inability to voids as normal – when the opinion of the patient performing the test, the attempted voiding has been not representative.

Rosier PF, et all. ICS teaching module: Analysis of voiding, pressure flow analysis. Neurourol Urodyn. 2016, 35: 36-8.

ICS

Update of terms

- Detrusor voiding contraction – any analysis of pressure and flow
- Detrusor contratility – any method that quantify detrusor muscle properties (ex. stop test, graphical analysis)

  unsustained contraction or fading contraction

Rosier PF, et all. ICS teaching module: Analysis of voiding, pressure flow analysis. Neurourol Urodyn. 2016, 35: 36-8.

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Voiding: pressure flow test

Negative influence on voiding:

- Over distended bladder
- Very unrepresentative urgency at the beginning of voiding
- Extreme inhibition of overactive detrusor contractions before the beginning of voiding
- Rectal catheter hindering pelvic muscle relaxation

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Voiding: pressure flow test

Be aware of the transurethral catheter:

- Slips out – worst scenario
- Causes (some) passive effect
  - May be obstructive (ex. urethral stricture)
  - There may 'stent' kinking of the catheter
- Causes active effect (hinders normal behaviour)
  - alters voiding sensation
    - Anaesthetic (lidocaïne) gel
  - fear of pain during voiding

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Set Up For The Test

Already done to perform filling cystometry:

- balanced intravesical and intra abdominal pressure

Cough (position of the catheter) check before and after voiding.

Ensure correction of flow curve for the systematic delay between flow and pressure.

- depending on the meatus to flowmeter distance
- before a pressure flow analysis is done

Care For The Test

Best possible (= most comfortable for patient), position during voiding.

Flowmeter as close as possible to the meatus.

- Minimize time delay between flow at meatus and entering flowmeter

No hindering of stream between funnel and beaker or spinning disk.

- (ex. No (long) tube between funnel and beaker or disk.)

Use thin transurethral catheter.

Use thin rectal catheter.

Tape catheters alongside meatus / anus.

Mechanics of Voiding

Detrusor pressure (cmH_2O) generates flow (ml/s)

- Pdet = Pves - Pabd

Urethra (normally) functions as a tube…"distensible"

- with passive distension (until Q_{max})
- and passive collapse (after Q_{max})

Flow (Q_{max}) is limited by the 'flow controlling zone' (FCZ)

- The FCZ is the virtual (by definition) point in the urethra that gives the highest resistance to flow
- Increased resistance drives detrusor to higher pressures to generate flow

Urethral catheter (8F) causes ±10cm H_2O increase of detrusor pressure

Schaefer W. et all. Good Urodynamic Practices: Uro£owmetry, Filling Cystometry, and Pressure-Flow Studies. Neurourol Urodyn. 2002, 21:261-74.

Before the Voiding Phase – check list

The patient was already well informed

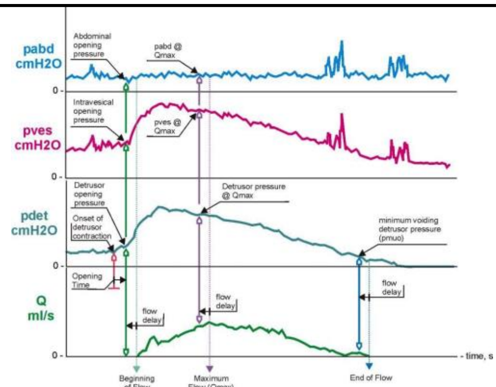
All technical procedures are observed

Appropriate enviroment – physical and emotional

A physician/nurse has already tranquilized the patient

The bladder is confortably full

Let's start !!!



ICS Terms

Quality Control

- Before:

Is the patient adequately informed and instructed?

Has anything changed after the indication for UDI testing was settled?

- During:

Are sterile catheters and filling medium used?

Are antiseptic procedures applied?

Is the patient clothed/covered as much as possible?

Is the patient comfortably positioned?

- (Especially if male:) Preferred position for voiding?

Has everyone, who is unnecessary, left the site of testing?

- After:

Is the patient instructed to drink ± 0,5-1liter immediately after the test?

Quality Control (P/Q analysis)

Ask the patient:

- Was this voiding more or less as usual / as at home?
  - If not: clinical urodynamic diagnosis may be irrelevant
    - Ex: Not being able to void does frequently (but not always) not represent the real function and is therefore situate during UDI

Observe the tracings (of the entire exam)

- Are the pressures in the physiological range
- Are the intravesical and intra abdominal pressures reacting synchronous on patients' movements and coughing (balanced pressures), also after the voiding?
- Is permission to void adequately marked /indicated?

Rosier PF, et all. ICS teaching module: Analysis of voiding, pressure flow analysis. Neurourol Urodyn. 2016, 35: 36-8.

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Clinical Quality

Patients unable to void *because of the test situation*:

- It can be unexpected ('shy voiders / shy bladder/ paruresis')
  - Allow more time; assure absolute privacy; dim the lights
  - Allow something (cold water) to drink
  - Sound of running tap –water
- Some contraction is seen but no, or very little, voiding:
  - not acontractility, not representative, BOO impossible to 'calculate'*
- No contraction is observed and no voiding:
  - If patient is usually able to void:
    - not definite acontractility; not representative*

**patients tend to start straining; usually not productive and not representative!*

Formal pressure flow analysis and diagnosis (outlet or contractility) of voiding (other than 'shy') is impossible in this situation.

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Clinical Quality: pressure flow analysis

For (elderly) men (with an enlarger prostate):

- Pressure flow (relation and) analysis is straightforward
- Clinically applicable limits for grading of outlet properties exist

For young men, women and children:

- Basic principles of voiding and p/Q analysis are known and applicable
- Universally agreed clinical grading of outlet properties does not exist

Neurogenic dyssynergia or neurogenic dynamic outlet obstruction:

- No standard grading is available
- No urodynamic pressure flow relation criteria
  - *However Detrusor Leak Point Pressure is relevant*

Rosier PF, et all. ICS teaching module: Analysis of voiding, pressure flow analysis. Neurourol Urodyn. 2016, 35: 36-8.

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Pressure Flow Analysis: concluding

Flow relates to pressure and is determined (or limited) by outlet properties

- Representative voiding and clinically relevant pressure flow analysis depends on good urodynamic practice and properly ascertained patient cooperation
- A very unrepresentative voiding and/or significant underactive detrusor contraction limits the validity of the pressure flow analysis

Pressure flow starts: after permission to void

Bladder outlet obstruction can be graded by:

- *provisional-ICS-method* = $P_{det}Q_{max} - 2 \times Q_{max}$

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Outlet Resistance or Degree of Obstruction

- P-Q curves, are still the mainstay of obstruction assessment
- In male population the ICS nomogram or BOOI
- Schaeffer nomogram using linearized Passive Urethral Resistance Relation (LinPURR)
- The Bladder Contractility Index (BCI)

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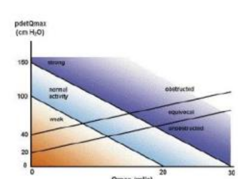
PRESSURE/ FLOW ANALYSIS-Male

ICS Nomograms



BOO Index: *pdetMax-2Qmax*

- >40 obstructed
- 20-40 equivocal
- <20 unobstructed

BC Index: *pdetMax+5Qmax*

- 150 strong
- 100-150 normal activity
- <100 weak

Abrams P, 1999

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Interpretation of Pressure Flow

- Analysis of bladder outlet obstruction is done on the second passive phase of micturation
- After maximum flow the true passive outlet resistance is obtained
- Pdet.Qmax in combination with Qmax gives the clinically relevant grading of bladder outlet obstruction (Pdet.Qmax – 2.Qmax)

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Limitations of Pressure Flow

- Very low pressure
- Inability to void
- Inability to initiate a full voiding reflex
- Shy voiders

Limits the applicability of pressure flow analysis

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Conclusions

- Pressure flow study is the golden standard for the analysis of voiding
- For male – precise limits of BOO are avaible
- For female and children – the limits are less precise

Rosier PF, et all. ICS teaching module: Analysis of voiding, pressure flow analysis. Neurourol Urodyn. 2016, 35: 36-8.

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University Medical Center Utrecht

Laborie/MMS/Tdoc/Andromeda	Research protocol support

Funding for speaker to attend:
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Quality in Urodynamics: The ICS documents on good urodynamic practice and on urodynamic equipment performance

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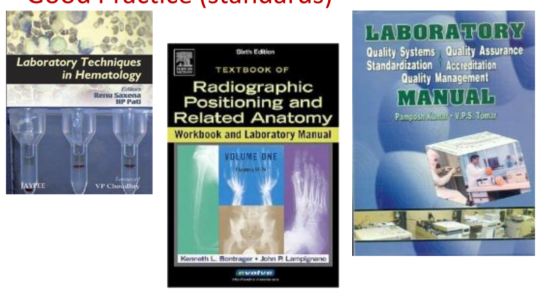
Good Practice (standards)



Urodynamics practice and evaluation should be as standardized as other diagnostics and medical techniques, and be equally trustworthy

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International Continence Society Good Urodynamic Practices and Terms 2016.

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REVIEW ARTICLE

WILEY Neurourology Urodynamics ICS SUFU

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

Peter F.W.M Rosier[1]* | Werner Schaefer[2] | Gunnar Lose[3] |
Howard B. Goldman[4] | Michael Guralnick[5] | Sharon Eustice[6] |
Tamara Dickinson[7] | Hashim Hashim[8]

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AIMS: The working group initiated by the ICS Standardisation Steering Committee has updated the International Continence Society Standard "Good Urodynamic Practice" published in 2002.
METHODS: On the basis of the manuscript: "ICS standard to develop evidence-based standards," a new ICS Standard was developed in the period from

ICS

Neurourology and Urodynamics 33:370–379 (2014)

International Continence Society Guidelines on Urodynamic Equipment Performance

Andrew Gammie,[1]* Becky Clarkson,[2] Chris Constantinou,[3] Margot Damaser,[4] Michael Drinnan,[5] Geert Geleijnse,[6] Derek Griffiths,[2] Peter Rosier,[7] Werner Schäfer,[2] Ron Van Mastrigt,[6]
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These guidelines provide benchmarks for the performance of urodynamic equipment, and have been developed by the International Continence Society to assist purchasing decisions, design requirements, and performance checks. The guidelines suggest ranges of specification for uroflowmetry, volume, pressure, and EMG measurement, along with recommendations for user interfaces and performance tests. Factors affecting measurement relating to the different technologies used are also described. Summary tables of essential and desirable features are included for ease of reference. It is emphasized that these guidelines can only contribute to good urodynamics if equipment is used properly, in accordance with good practice. *Neurourol. Urodynam. 33:370–379, 2014.* © 2014 Wiley Periodicals, Inc.

Key words: urodynamics; specification; standardization

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Commercially available equipment usually complies with these criteria:

TABLE I. Essential Requirements for Uroflowmetry

Parameter	Guideline value
Accuracy for flow rate	±1 ml/sec
Accuracy for voided volume	The greater of ±3% of true value or ±2 ml
Range for flow rate	0–50 ml/sec
Range for voided volume	0–1,000 ml
Maximum duration of flow recordable	≥120 sec
Minimum flow recordable	≤1 ml/sec
Bandwidth of flow measurement	0 to between 1 and 5 Hz

TABLE V. Essential Requirements for Pressure Measurement

Parameter	Guideline value
Accuracy	The greater of ±3 % of true value or ±1 cmH_2O
Range	−30–250 cmH_2O (water-filled systems) [illegible] cmH_2O (other systems)
Bandwidth of pressure measurement (whole system)	0 to ≥3 Hz, equal on both channels
Required feature when water filled catheters are used and patient positions are changed during the test	Equipment must allow reference levels to be reset

Neurourology and Urodynamics DOI 10.1002/nau

Machine and physician, technician and or nurse…..

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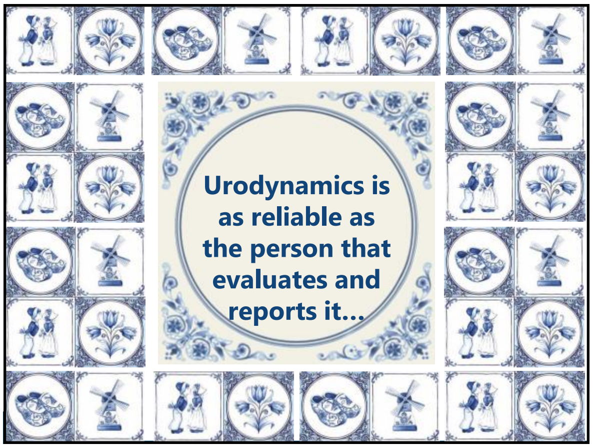
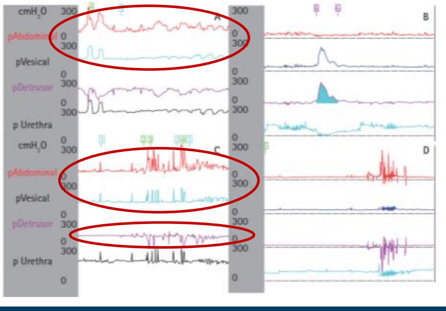


Varese 2

FIG. 3. (A) a 3-min section of CUM recording from a 39-year-old woman with suspected detrusor acontractility after receiving the micurition command. (B) a 3-min section of AUM (micturition phase) recording in the same patient showing a clear detrusor contraction at home. (C) a 15-min section of CUM (filling phase) recording from the same patient. D, a 15-min section of AUM (filling phase) recording in same patient.



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2280
THE TECHNICAL QUALITY OF URODYNAMIC GRAPHS PUBLISHED IN OUR JOURNALS
Peter Rosier*, Utrecht, Netherlands

Filling cystometry	
Item	Explained:
p_{det}	Was the detrusor (subtracted) pressure graph shown?
p_{ves}	Was the intravesical pressure graph shown?
p_{abd}	Was the intra-abdominal pressure graph shown?
Fill Volume	Was the (intravesical filled) volume shown/indicated?
Sensation	Was the (patient reported) sensation (perception) of filling indicated?
Permission	Was 'permission to void' indicated?
Scale	Was the scale size indicated (vertical axis)?
Overlapping	Were the traces *not* overlapping (and therefore difficult to analyse)?
Physiological	Were the pressures in the 'physiological range' (indicated in the GUP)?
Zero	Were the p_{ves} and the p_{abd} 'zeroed in the patient'?
Detrusor	Was the detrusor pressure in the physiological range (indicated in the GUP)?
Cough	Are cough -tests done (visible in the figure)?
Symmetry	Were couch tests or (patient movements) identical / 'balanced' in both (p_{ves} and p_{abd}) pressure graphs?
EMG	Was an EMG shown (not mentioned in the GUP)?
Vertical scale	Was the vertical scale size as recommended in the GUP?
Horizontal vcale	Was the horizontal (time) scale size as recommended in the GUP?

P_{det}	P_{ves}	P_{abd}	Fillvol	Sens	perm	scale	ov[illegible]	Phys	[illegible]o	Detr	Cough	Symm	EMG	Ver	Hor
86	87	86	46	27*	25*	89	[illegible]	46	[illegible]	70	35	46	49	32	32

Source of Funding: None

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'Good urodynamic practices' for your practice?

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Paragraphs: GUP2016

REVIEW ARTICLE

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

Peter F.W.M Rosier | Werner Schaefer | Gunnar Lose | Howard B. Goldman | Michael Guralnick | Sharon Eustice | Tamara Dickinson | Hashim Hashim

Introduction

Definition of **terms**

Patient information and preparation (for invasive UDI)

Urodynamic practice protocols

Pre- testing information

Practice of uroflowmetry

Practice of cystometry

- Filling rate; Sensations; Transducers and catheters; Abdominal pressure; Position; Repeat tests

Practice of pressure flow studies

- 'suggested' terms

Technical and clinical quality control

Urodynamic graphs and report

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Terms:

ICS Standard Urodynamic Test (ICS-SUT):
- Uroflowmetry and PVR plus transurethral cystometry and pressure-flow study plus PVR:
  - All performed in the patient's preferred or most usual position; usually comfortably seated and or standing if physically possible. The patient(s) may be reported as having had an ICS standard urodynamic test'.

  ICS-SUT may be supplemented
  - with EMG
  - with imaging (VIDEO)
  - with continuous urethral pressure(s)
  - with urethral pressure profile measurement
  - Cystometry may be done via a suprapubic catheter
- specify supplements.

ICS Standard Urodynamics Protocol (ICS-SUP) includes:
- An ICS-SUT plus clinical history (a valid symptom and bother score), relevant clinical exam and a (3 days-) bladder diary.

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Patient information and preparation of the patient for invasive urodynamics

Conclusions

Some evidence … iamic investigations a…

Young adults a… have a relatively negat… n.

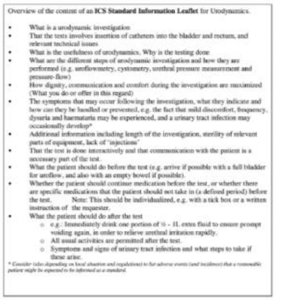
Conflicting evid… information to give patients … ce distress.

Recommendati…

Providing qualit… ents so that they become a… elivery.

A leaflet with th… d decision making.

The WG sugge… hat an explanatory lea… s positive words will be a… d should include the iten… leaflet content:


Overview of the content of an **ICS Standard Information Leaflet** for Urodynamics.

- What is a urodynamic investigation
- That the tests involves insertion of catheters into the bladder and rectum, and relevant technical issues
- What is the usefulness of urodynamics. Why is the testing done
- What are the different steps of urodynamic investigation and how they are performed (e.g. uroflowmetry, cystometry, urethral pressure measurement and pressure-flow)
- How dignity, communication and comfort during the investigation are maximized (What you do or offer in this regard)
- The symptoms that may occur following the investigation, what they indicate and how can they be handled or prevented, e.g. the fact that mild discomfort, frequency, dysuria and haematuria may be experienced, and a urinary tract infection may occasionally develop*
- Additional information including length of the investigation, sterility of relevant parts of equipment, lack of "injections"
- That the test is done interactively and that communication with the patient is a necessary part of the test.
- What the patient should do before the test (e.g. arrive if possible with a full bladder for uroflow, and also with an empty bowel if possible).
- Whether the patient should continue medication before the test, or whether there are specific medications that the patient should not take in (a defined period) before the test. Note: This should be individualized, e.g. with a tick box or a written instruction of the requester.
- What the patient should do after the test
  - e.g.: Immediately drink one portion of ½ - 1L extra fluid to ensure prompt voiding again, in order to relieve urethral irritation rapidly.
  - All usual activities are permitted after the test.
  - Symptoms and signs of urinary tract infection and what steps to take if these arise.

*Consider (also depending on local situation and regulations) to list adverse events (and incidence) that a reasonable patient might be expected to be informed as a standard.

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Leaflet contents:

What is a urodynamic investigation

What is the usefulness of urodynamics; why is it done

What are the different steps of urodynamic investigation and how they are performed (e.g. uroflowmetry, cystometry, urethral pressure measurement and pressure-flow)

Additional information including length of the investigation, sterility of relevant parts of equipment, lack of 'injections'

How are dignity, communication and comfort during the investigation maximized

What are the symptoms that may occur following the investigation, what do these indicate and how can they be handled or prevented; e.g. the fact that mild discomfort, frequency, dysuria and haematuria may be experienced; and a urinary tract infection may rarely develop

What the patient should do before the test (e.g. arrive, if possible, with a full bladder for uroflow if possible and an empty bowel.)

Whether the patient should **continue medication** before the test, or (what) not.
- *Note: **This should be individualized**, e.g. with a tick box or a written instruction of the requester.*

What the patient should do after the test
- e.g: Immediately drink one portion of ½ - 1L extra fluid to ensure prompt voiding again, thus to rapidly relieve the urethral irritation.
- And also: All usual activities are permitted again.

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Urodynamic practice /accreditation

Conclusions

Published evidence to support implementation of practice standards is scarce and the conclusion on the basis of simple implementation strategies towards the achievability of practice improvement is not very encouraging.

Recommendations

We recommend that departments develop urodynamic practice protocols on the basis of the best available standards and facilitate specific training in and evaluation of urodynamic practice.

We recommend that centres should –ideally on a nationwide level- decide on individual accreditation and (re)certification (e.g. required minimum number of tests) as well as the level of authority and autonomy to perform urodynamic tests.

Società Italiana di Urodinamica
Continenza Neurourologia Pavimento Pelvico

SIU SOCIETÀ ITALIANA di UROLOGIA FONDATA NEL 1908

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Clinical practice: pre-testing information

Conclusion

We conclude that clinical practice guidelines and expert 'first principles' agree that prior to invasive urodynamics, history, physical exam and urinalysis should be completed.

The usefulness of a FVC-BD to help anticipate cystometric capacity and appropriate fill rate has never been formally investigated.
- It is however the WG's conclusion that the FVC-BD voided volumes should be considered relevant to evaluate the representativeness of the cystometry volumes (see GUP2002).

Recommendation

The WG advises that apart from the routine clinical information, the information from the (3-day) FVC or BD and the uroflowmetry and PVR are utilized while performing invasive urodynamics.

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Technical and clinical quality control during invasive urodynamics.

Conclusions

Expert evidence confirms that recognition, prevention and management of artefacts are important elements of urodynamic quality control.

Urodynamic quality management, including plausibility is relevant before, during and after the test as well as while reporting the test.

Recommendations

The WG recommends that everyone performing or evaluating urodynamics is able to recognize usual pressure patterns and is able to perform continuous quality control during the test.

The WG recommends that training and a process of continuous knowledge maintenance as the base for performing (standard good-) urodynamic practice should be established.

Terms related to the cystometry observations and evaluation.

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Terms related to cystometry observations and evaluation

Most common features, artefacts and errors:

Initial Resting Pressure (NEW)

- Is the p_{ves} and the p_{abd} pressure at the beginning of the cystometry.
- To prevent reading measurements from a kinked catheter in an empty bladder with the catheter holes blocked with (insertion) gel and or pushed against the bladder surface the WG recommends (GUP2002) gentle flushing and or filling 20-30mL, before the initial resting pressures are considered to be 'established'.
- Initial resting pressures should be within the physiological limits specified in previous ICS documents (GUP2002) and subsequently the pressures should show good and balanced cough/effort pressure response.

Poor Pressure Transmission (NEW)

  - Poor pressure transmission has occurred when the cough/effort pressure peak signals on pves and pabd are unequal.
- Note: The WG does not define a new limit for 'unequal', or for not 'almost identical' (GUP2002).
- Note: Pressure drift and or dead signal are associated with poor pressure transmission.

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Features and artefacts

Dead Signal (NEW)

  - A signal that is not showing small pressure fluctuations and is not adequately responding on coughing is reported as a dead signal.
- Previously (ST2002): 'In principle, a good p_{det} signal requires only that p_{ves} and p_{abd} show the same fine structure and quality of signals before filling, during filling, and after voiding'.

Pressure Drift (NEW)

  - Continuous slow fall or rise in (one of either) pressure, that is physiologically inexplicable indicates an artefact.

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Expelled Catheter (NEW)

  - When a catheter is expelled this is observed as a sudden drop in either p_{ves} or p_{abd}, usually to zero (or below zero if the catheter- end drops below the external pressure sensor).
- Previously published definition: 'If a sudden drop or increase occurs in either p_{ves} or p_{abd} signal, the usual cause is movement, blockage, or disconnection of a catheter.'
- Expelled catheter is usually simply visible during the test and should provoke correction or repetition of the test however this term is to be used in reporting or during post-test evaluation.

Catheter Flush (NEW)

- A catheter flush is not always necessary after a careful performed set-up but suggested in GUP2002.
- Flushing of the catheter measuring channel may be considered necessary to wash away entrapped air, or the gel used during insertion or other debris, from the measuring hole.
- The rectal catheter can only be flushed when an open catheter is used. If done, it is characterized by an abrupt and large increase in a single pressure trace, maintained for some seconds, when the lines are being flushed with fluid, followed by a normalisation of pressure.
- A catheter flush should be marked accordingly but flushes are normally unnecessary after the cystometry has continued after the first mL of filling.

Tube Knock (NEW)

  - Tube Knock is observable as high frequency, short duration spikes visible in p_{ves}, p_{abd}, or both and if tubes move asynchronous, with spikes usually visible in p_{det} also.

Pump Vibrations (NEW)

  - Pump vibrations are visible as stable frequency oscillations of small but constant amplitude, visible on the p_{ves} (and p_{det}) traces.
- Pump vibrations may be visible if the filling tube rests on a pressure connecting tube and the pump is switched on (switching of the pump can ascertain the situation).
- Note: ICS standard is double lumen catheter, and despite that the channels are side by side with the usual filling rate and measuring scale, oscillations are not observable.

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Cough pressure peak (NEW)

  - A cough pressure peak is recognizable during post-test evaluation as a phasic positive pressure change observed in p_{ves} and in p_{abd}.

Urodynamic stress test (NEW)

  - Urodynamic stress test is used for any physical effort of the person tested, to elevate abdominal pressure, during cystometry with the aim to test for (urodynamic) stress urinary incontinence.
- ICS has defined urodynamic stress incontinence.
  - Evidence with regard to the preferred technique of stress testing is lacking.
- Note: The provocation method, the pressure measuring catheter(-size) and method, the leak detection method as well as the absolute or relative (percentage of cystometric capacity) intravesical volume(s) while testing may be reported.

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Leak point pressure (NEW)

  - The leak point pressure is the pressure (spontaneous or provoked) that has caused fluid to be expelled from the bladder at the moment that it is visible outside the urethra (may also be used for extra-urethral urine loss or stoma).
  - This may be Abdominal, Cough or Valsalva LPP or Detrusor LPP:
    - See ST2002; ICS/IUGA2009 and AUA-SUFU.
  - Provocation and pressure recording ('type of LPP') should be reported.
- Diverse methods of leak point pressure measurement are published with a variety of combinations of provocation or pressure recording site/type and or technique.
  - Detrusor and Valsalva LPP are defined in ST2002.
  - No standard technique or protocol is however available and a variety of terms and techniques are used.
    - (Counts in PubMed (April 2015): Cough LPP: 21; Valsalva LPP: 226; Detrusor LPP: 64; Abdominal LPP: 98; Overactivity LPP: 1.)

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Stress induced urge

Cough associated detrusor overactivity (NEW)

  - Cough associated DO is reported when the onset of the DO (with or without leakage) occurs immediately following the cough pressure peak.
- No precise definition of cough associated detrusor activity is available, however 'cough induced DO' is sometimes reported however its pathophysiology remains speculative.
- Since the urodynamic observation is that the cough is immediately followed by DO and because the (patho-) physiology has remained unclear, the WG presents a descriptive definition.

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Position Change (NEW)

- A change in patient position, either active or passive (e.g. tilting), is visible on the cystometry trace by a lasting change of equal magnitude in both p_{ves} and p_{abd}.
- Notes: A position change should be (is readily) noted during the test and followed by a readjustment of the external pressure sensors height to the standard so that the physiological p_{ves} and p_{abd} are observed again.
- A position change should not affect p_{det}.
- The Position Change -pattern should be recognized during post-test evaluation of the cystometry.

Rectal Contractions (NEW)

- Rectal contractions are temporary phasic increases in p_{abd} without synchronous change in p_{ves} (resulting in negative deflections of p_{det}).
- Published description GUP-2002: 'Rectal activity' or 'Rectal contractions are usually of low amplitude and may or may not be felt by the patient'.

Dropped p_{abd} at Void (NEW)

- A drop in p_{abd} during voiding, is reported when during the voiding time, p_{abd} decreases below the previous resting pressure.
- Note: The WG considers that this phenomenon will affect pressure-flow analysis result. This observation should be differentiated from expelled catheter.

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Straining (NEW)

- Straining is observable as a temporary increase in both p_{ves} and p_{abd} pressure. Straining may be associated with (patient -active) position change (like repositioning from leaning backward to upright).
- Note: A short abdominal strain peak may in retrospect be indistinguishable from a position change or a cough and v.v.

After-contraction (NEW)

- An after-contraction, is a continued or new detrusor pressure rise immediately after flow ended.
- Note: Cough checking of (intravesical) catheter position is always required after pressure-flow (GUP2002). To separate the after-contraction -pattern from catheter slipping out or catheter tip (with measuring hole) bending in the outlet when the bladder empties, this cough check is specifically important when a p_{ves} increment after voiding is observed.
- Previously published description: A pressure increase after flow ceases at the end of micturition.

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The urodynamic graphs and the urodynamics report

Recommendations

The WG recomm
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example in ST1

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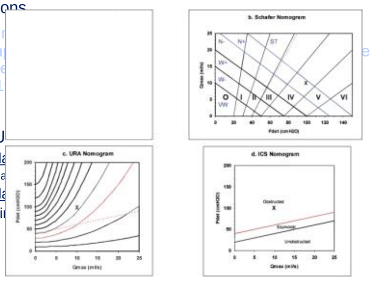

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The WG recommends furthermore to report:

Uroflowmetry: **Voiding position and representativeness** as reported by the patient (especially if not).

Introduction of catheters: sensation; (if occurring; pain), **muscular (pelvic or adductor) defence** and -perceptible unusual- **obstruction(s)** during insertion.

Position during cystometry.

Patient's **ability to report filling sensations** and or urgency and or urine loss.

Method of urodynamic stress test (if applicable).

Pressure-flow: position and **representativeness** as reported by the patient.

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Accessory tests or measurements (if applicable -no further standard).

Overall judgement of **the technical quality** and the **clinical reliability** of the test as judged by the investigator.

Representativeness of the test protocol to reflect the 'usual LUT behaviour' as reported by the patient.

Filling **sensation** diagnosis or urodynamic condition (ST2002).

Cystometry (detrusor) **pressure pattern** diagnosis.

Pressure-flow diagnosis (compared with uroflowmetry) includes:

- **Bladder outlet function, or (grade of) outflow obstruction**
- **Detrusor contraction**,

Voiding efficiency diagnosis (**Void%**).

The WG recommends development of an

ICS standard urodynamics report -template.

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Conclusion

The Working Group initiated by the ICS Standardisation Steering Committee has updated the International Continence Society Good Urodynamic Practice.

This evidence based ICS GUP2016 has defined terms and standards for the practice of urodynamics labs in general as well as for the (individual) practice of quality control during and after cystometry and pressure-flow analysis as well as for the reporting.

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Conclusion

Furthermore the working group has included recommendations for pretesting information and for patient information and preparation.

On the basis of earlier ICS standardisations and the available evidence, the practice of uroflowmetry, cystometry and pressure-flow study are further detailed.

The WG expresses the hope that implementation of this Good Urodynamic Practices helps to increase the individual clinical, as well as the research quality of urodynamics.

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