

Start	End	Topic	Speakers
09:40	09:50	Introduction from co-chairs	Maki Nakata Peter Rosier
09:50	10:05	LUT function and physiology	Peter Rosier
10:05	10:10	Discussion	All
10:10	10:25	Clinical neuro gynecological examination	Maki Nakata
10:25	10:30	Discussion	All
10:30	10:45	Bladder diary	TBC TBC
10:45	11:00	Break	None
11:00	11:15	Flowmetry	Hikaru Tomoe
11:15	11:20	Discussion	All
11:20	11:35	Post Void Residual	TBC TBC
11:35	11:40	Discussion	All
11:40	11:55	Cystometry	TBC TBC
11:55	12:00	Discussion	All
12:00	12:25	Examples; discussion	Peter Rosier
12:25	12:30	Discussion	All

Aims of course/workshop

This workshop will focus on diagnosis and the use of urodynamics for female patients with symptoms and or signs of lower urinary tract dysfunction, and the topics relevant for gynecologists. According to Dr. Nakata's who is co-chairing the workshop, gynecologists are now increasingly interested in LUT dysfunction related to gynecologic diseases such as pelvic floor relaxation and uterine fibroids, but many of them are not familiar with urodynamics. Thus although the target audience include urologists, gynecologists, physiotherapists and nurses, it is especially attractive to beginner gynecologists, who want to learn urodynamics and understand lower urinary tract function.

Learning Objectives

After this workshop participants should be able to:

1. Learn the practice of clinical evaluation and urodynamics to evaluate female lower urinary tract and pelvic floor dysfunction with the ICS teaching modules.
2. Learn the pathophysiology of lower urinary tract dysfunction.
3. Learn to put evidence regarding lower urinary tract dysfunction into practice

Learning Outcomes

1. Become aware of good urodynamic and clinical practices for women with lower urinary tract dysfunction.
2. Learn the theoretical background of testing for lower urinary tract and pelvic floor dysfunction.

Target Audience

Gynecologists, Urologists, Urodynamicists and those interested in diagnosis of female lower urinary tract dysfunction

Advanced/Basic

Basic

Conditions for learning

The workshop is discussion stimulating and interactive with also time for translation in Japanese language where needed.

Suggested Reading

- 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.
- 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 in lower urinary tract function: report from the standardisation sub-committee of the International Continence Society. *Urology.* 2003 Jan; 61(1):37-49. Review. PubMed PMID: 12559262.

- 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, Hendricksen 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.
- Gammie A, D'Ancona C, Kuo HC, Rosier PF. ICS teaching module: Artefacts in urodynamic pressure traces (basic module). *Neurourol Urodyn*. 2015 Sep 15. doi: 10.1002/nau.22881. [Epub ahead of print] Review. PubMed PMID: 26372678.
- 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.
- 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.

Peter Rosier

LUT function and physiology

This is a new ICS teaching module that educates the pathophysiology of the lower urinary tract.

Maki Nakata

Clinical neuro gynecological examination

The basis of clinical examination of female patients with lower urinary tract dysfunction will be presented.

TBC

Voiding diary

A drinking-voiding diary is a core element of evaluation of patients with lower urinary tract dysfunction.

Peter Rosier

Flowmetry

Flowmetry is an element of evaluation of female patients with lower urinary tract dysfunction its clinical relevance will be presented and discussed on the basis of a systematic analysis of the evidence.

Enrico Finazzi Agro

Postvoid residual

The ICS teaching Module Post Void Residual will be presented.

TBC

Cystometry

The ICS teaching Module Post Void Residual will be presented.



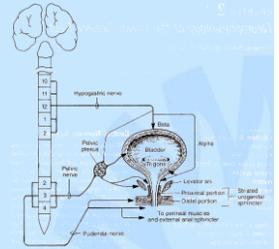
Lower Urinary Tract Function and physiology (& urodynamics)

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



LUT Function

- Storage and voiding
- Muscles
- Sensorimotor (voluntary) system
- Autonomic system
 - Reflexes
 - Storage
 - Voiding

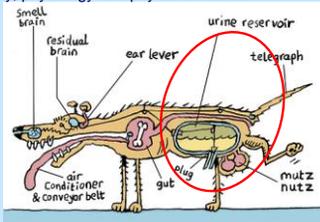


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Anatomy & Physiology

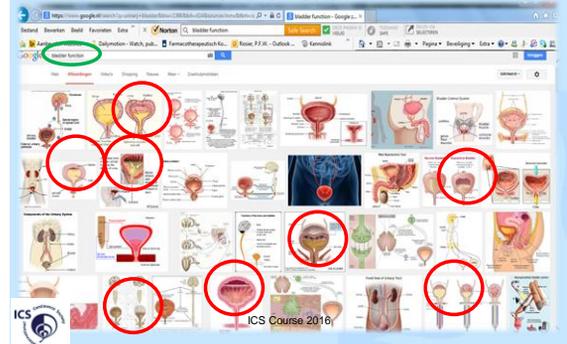
- Who treats lower urinary tract (dis)function should understand anatomy, physiology and physics involved.



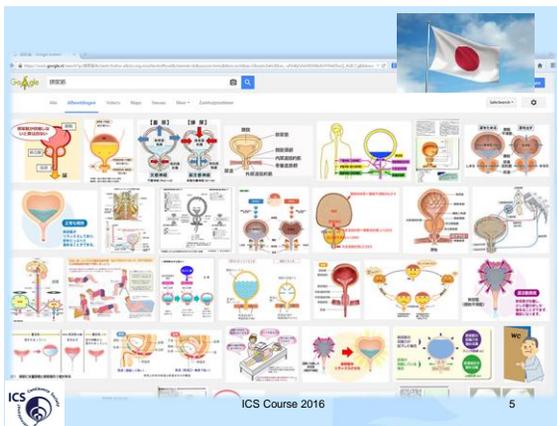
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What your patients Google about LUT function...

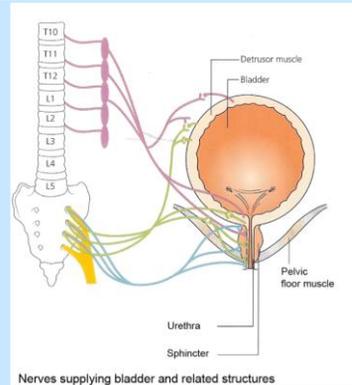


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Nerves supplying bladder and related structures

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Normal lower urinary tract function

- Kidneys produce urine
 - 1,5-2L per day > 1-2 mL /minute
- Urine fills the bladder
 - Bladder is emptied \pm 4-6 times per day
 - \pm 3-400mL per voiding



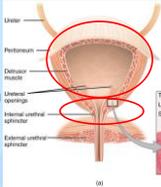
Normal lower urinary tract function

- Storage function
 - (detrusor muscle)
 - Adapts to volume increment
 - Low pressure
 - Signals stretch = 'sensation of filling'
 - Contraction is suppressed
 - Outlet closed (continent)
 - Voiding function
 - At a convenient moment
 - Controllable
 - Pelvic muscle relaxation
 - Detrusor contraction is activated
 - Outlet relaxes
 - Pelvic muscle > Internal sphincter
- Efficient and effective voiding*



Normal storage

- Bladder fills and voiding is inhibited
- Pelvic floor is in 'normal activity' state
 - pelvic floor is set of muscles
 - 'reactive' to physical activity, movements, coughing
 - sub (-sub) maximal contracted
- Detrusor dome contraction is inhibited
- Detrusor base (bladderneck) is contracted
- Volume increment distends the bladder (dome)
 - (muscle) -stretch is perceived (sensation of filling)
 - Starting from a certain volume (\pm 30% of usual capacity)
 - Proprioception



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



LUT function = controlled autonomic reflex

- Detrusor <> Internal sphincter
 - Antagonists
 - Autonomic (automated) at birth
 - Even before birth
- Potty training:
 - Autonomic reflex becomes...
 - ...guided by will through pelvic floor muscle signal
 - (sensorimotor)



'Controlled' autonomic reflex



'Controlled' autonomic reflex

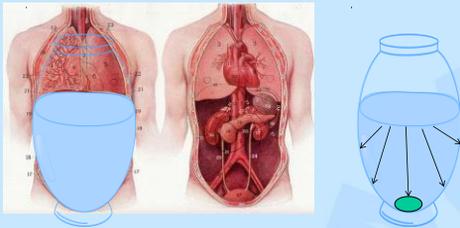
- Somatomotoric (pelvic) control of autonomic reflex
- To void:
 - Shift from 'sympathetic dominance' (storage) to
 - >> Parasympathetic activity
- Requires 'mental relaxation':



Urodynamics (physiology/physics)



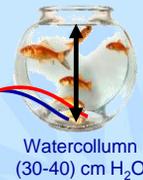
Urodynamics (physics)



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Urodynamics (physics)



Watercolumn
(30-40) cm H₂O

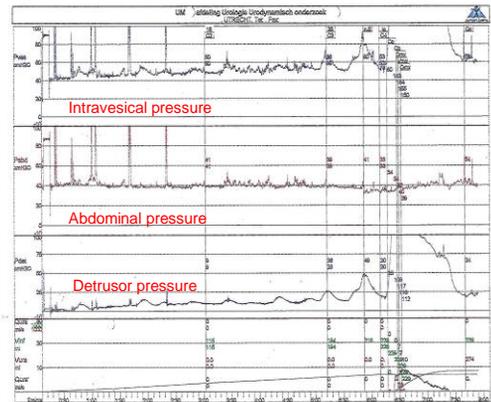


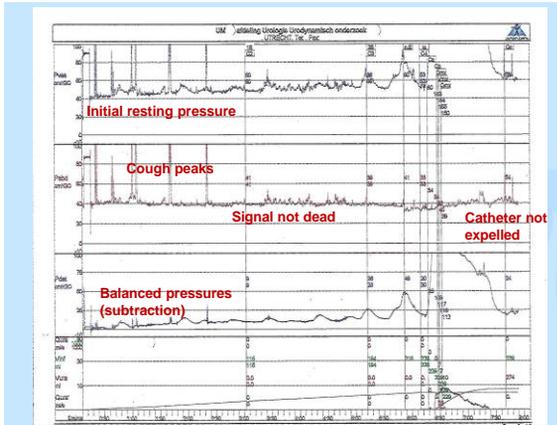
ICS Course Florianopolis

Urodynamics (physics)



ICS Course Florianopolis





Initial resting pressure (urodynam)

- Depends on position
 - Lower in supine position
- Everything inside the abdomen has an average weight equal to water
 - High BMI (overweight persons):
 - predominance of the extra mass is outside the abdominal cavity
 - (not resting on the pelvic floor)
- Abdominal muscle contraction and diaphragm contraction elevate the pressure inside and outside the bladder

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Principles of urodynamics, bladder scans and flow rates

- Lower urinary tract (LUT) function
- Anatomy and physiology of the LUT
- Cooperation, psychology, emotions and social skills
- Patient centred testing
- Urodynamics (=objective)
- Optimal technical results and a reliable diagnostic outcome.



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Maki Nakata



Affiliations to disclose[†]:

I am consultant for Unicharm Corp. in developing their consumer website.

Business operation of Unicharm Corp: Sales of the baby & child care products, feminine hygiene products, diapers, etc.

† 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:

- Self-funded
- Institution (non-industry) funded
- Sponsored by:

Clinical Examination and Assessment

Maki NAKATA
Department of Obstetrics and Gynecology
Mitsui Memorial Hospital



Gynecological setting



- ❖ Female clients in their 30-70s.
- ❖ May be over weight or obese.
- ❖ Mostly with somewhat weakened pelvic floor and squeeze power is not sufficient: weak, absent, or accompanied by substantial straining.
- ❖ Some may present enlarged uterus or overt pelvic organ prolapse.
- ❖ Spinal, hip, or knee problems are not rare.
- ❖ Pain and temperature sensation over the perineum is normal in most of the cases.

Neurological assessment



IN THE GYNECOLOGICAL SETTINGS

- ❖ General understanding of the neurological function is indispensable. HOWEVER,
- ❖ Neurological assessment is not the key examination as long as we receive average independent community-dwelling female clients.

Gynecological cases

Case No1 54ys P-1



Mixed urinary incontinence
voiding difficulty

large uterine fibroid

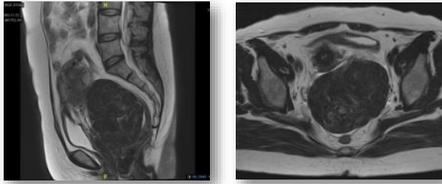
- UDI-6
1. Frequency
 2. UUI
 3. SUI
 4. Undefined leakage
 5. Voiding difficulty
 6. Discomfort over the external genitalia

- ❖ POPDI-6
1-0-1-0-0-0
- ❖ CRADI-8
0-0-0-0-0-0-0-0
- ❖ UDI-6
2-3-3-3-3-0

Case No1 54ys P-1 

Clinical question

- ❖ Is this uterine mass responsible for her FLUTS?



Case No2 69ys P-2 

- # Mixed urinary incontinence
- # Voiding difficulty
- # Vulvar mass, local discomfort

Large uterine cervical fibroid

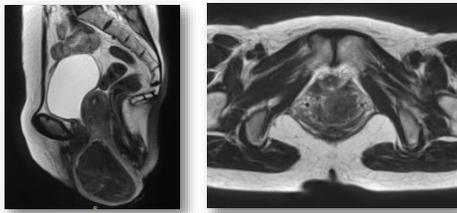


- ❖ POPDI-6
0-0-4-2-3-4
- ❖ CRADI-8
2-2-0-0-3-0-0-0
- ❖ UDI-6
3-3-2-4-3-3

Case No2 69ys P-2 

Clinical question

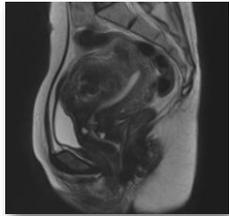
- ❖ Are the uterine mass and/or the pelvic relaxation causes her FLUTS? (UDI-6 3-3-2-4-3-3)



Case No3 44ys P-2 

- # Urinary frequency
- # Voiding difficulty
- # Vulvar mass, local discomfort

large uterine fibroid

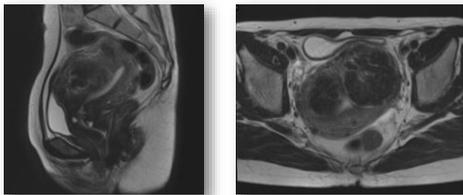


- ❖ POPDI-6
3-3-4-2-2-3
- ❖ CRADI-8
0-0-0-0-0-0-0-0
- ❖ UDI-6
2-0-0-0-2-0

Case No3 44ys P-2 

Clinical question

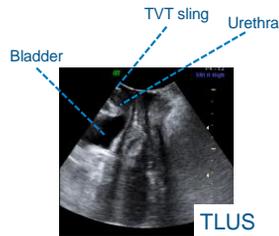
- ❖ The FLUTS (UDI-6 2-0-0-0-2-0) in this patient are the results of the uterine mass and/or hysteroptosis?



Case No3 37ys P-1 

- # Mixed urinary incontinence
- # voiding difficulty

TVT procedure 7 years ago

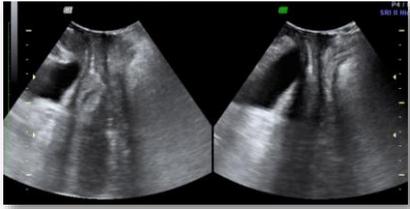


- ❖ POPDI-6
3-3-3-0-3-0
- ❖ CRADI-8
3-3-0-0-0-0-0-0
- ❖ UDI-6
3-0-2-0-3-3
- ❖ Alignment of the pelvic viscera
AH1/L1/Ut1/PH0/L0

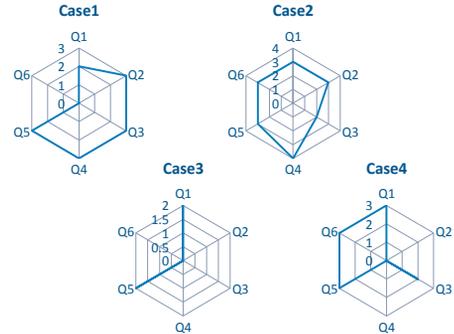
Case No3 37ys P-1 

Clinical question

- ❖ Can the urethral hypermobility explain her FLUTS? (UDI-6 3-0-2-0-3-3)



Discussion UDI-6 



Discussion other evaluation 

Which modality of assessment will be helpful?

- ❖ Detailed medical history.
- ❖ Physical examination with endovaginal and transperineal US.
- ❖ Focused modalities to reveal SUI.
- ❖ Frequency volume chart.
- ❖ Pad test

If we can use urodynamic testing..... 

*We tried no uterine reduction at uroflowmetry.

	UPP	Filling CMG	D O	Uroflow-*metry	PFS WF plot	LinPURR
Case 1	Normal	S1>200mL	-	Missing data	Normal	Obstructed (terminal phase)
Case 2	Normal	Normal	-	Divided in small volumes	Low PIP1=33.0	Normal
Case 3	Normal	S3<300mL	-	Normal	Normal	Equivocal (terminal phase)
Case 4	Normal	Normal	-	Low	Low PIP1=26.9	Weak detrusor

UPP: urethral pressure profile
 CMG: cystometrogram
 DO: detrusor overactivity
 PFS: pressure-flow study

S1: first filling sensation
 S2: strong desire to void

Conclusion 

Case 1: Key problem seems to be a uterine mass impaction during micturition.

Case 2: Deserves removal or reduction of the prolapsed uterus.

Case 3: Accomodation of the bladder is insufficient. Uterine mass impaction is suspected.

Case 4: Key problem seems to be a weak detrusor.

Bladder diaries

Anastasios Athanasopoulos, Michael Guralnick,
Margaret McDougald, Matthew Parsons,
Shen-Mou Hsiao, Michael Guralnick



International Continence Society
Teaching Module

- Introduction
- Definition & rationale for use of bladder diary
- Types of bladder diary
- Paper versus electronic
- Duration
- Instructions
- Interpretation, normative values, reliability & validity

ICS Teaching Module

Full evaluation of urinary function requires:

- Clinical history
- Physical examination
- **Micturition diary** +/- pad test
- Post void residual volume
- Mid- stream clean catch urinalysis
- Serum creatinine
- Urodynamics

ICS Teaching Module

What is a bladder diary?

ICS Teaching Module

What is a bladder diary?

- Variously known as:
 - Frequency – volume chart
 - Bladder diary
 - Voiding diary
- Terms are not synonymous
- F-V chart records:
 - Voided volume
 - Time of micturition day and night for at least 24 hours

ICS Teaching Module



ICS Teaching Module

- Bladder diary records:
 - Times of micturitions
 - Voided volumes
 - Incontinence episodes
 - Pad usage
 - Fluid intake
 - Degree of urgency
 - Degree of incontinence

Abrams P, Cardoza L, Fall M, Griffiths D, Rosier P, Ulmsten U, van Kerrebroeck P, Victor A, Wein A The standardisation of terminology of lower urinary tract function: NeuroUrol urodyn 2002; 21: 167-78

To which can be added

- Episodes of urgency
- Sensation
- Activities performed during or immediately preceding involuntary loss of urine
- Severity of leakage episodes

• Haylen BT, de Ridder D, Freeman RM, Swift SE, Berghmans B, Lee J, Monga A, Petri E, Rizk DE, Sand PK & Schaer GN (2009) IUGA/ICS joint report on the terminology for female pelvic floor dysfunction

Uses of the bladder diary:

- Provides a more objective measure of input, output and frequency
- Compulsive or excessive fluid intake easily identified
 - Diabetes may be identified
- Normal fluid volumes consumed inappropriate times may be identified:
 - E.g bedtime > nocturia
- Excessive intake alcohol or caffeine may exacerbate symptoms
- Learned or habitual frequency may be semi-objectively assessed

Additional factors:

- Adding sensation may help to differentiate small volumes due to OAB versus convenience voids, by recording the degree of urgency
- Documentation of incontinence episodes and concurrent activity

Types of bladder diary

- Paper diaries
 - Sent to patient prior to first consultation
 - In clinical setting, interpretation is simple
- Electronic diaries
 - Available for > decade
 - Used mainly as research tool
 - Have now morphed into apps!

Home uroflowmetry

- Laborie have developed flowmeter which effectively produces F- V to maximum of 14 days.
- Patient receives flowmeter from physician, uses it at home and mails the device back to the doctor.
- Device is then connected by USB to computer and produces timed and dated flow – volume charts.
- Only available for men.
- Single use only!

- Advantages of paper diaries
 - Can be sent by post with full instructions
 - Available for first consultation
 - Analogue, so easily interpreted in clinic
 - Can be used by older, literate patients
 - Often significant proportion of our patient group
- Disadvantages of paper diaries
 - Analysis may be subject to errors in busy clinic
 - less useful in research setting
 - Study by Rabin et al (1993) showed patients felt 7 day computerised diary better reflection of symptoms and found it easier to remember
 - But not directly comparable as computerised diary asked for additional information

Rabin JM, McNett J, Badlani GH Computerised voiding diaries; Neurol. Urodyn 1993;12: 541-53
Discussion ibid 553-4



- Importance of giving good instructions cannot be overstressed
 - Especially waking and sleeping times
- Easier to do face to face



**ICS 24 HOUR
BLADDER DIARY**

24 Hour Bladder Diary			Date ___/___/___		
Time*	Drinks		Urine Amount (ml)	Bladder Sensation (1-5)	Pads
	Amount (ml)	Type			
*Remember to indicate the time you woke and slept					
6 am					
7 am					
8 am					
9 am					
10 am					
11 am					
Midday					
1 pm					
2 pm					
3 pm					
4 pm					
5 pm					
6 pm					
7 pm					
8 pm					
9 pm					
10 pm					
11 pm					
Midnight					
1 am					
2 am					
3 am					
4 am					
5 am					

ICS Bladder Diary

24 Hour Bladder Diary			Date ___/___/___		
Time*	Drinks		Urine Amount (ml)	Bladder Sensation (1-5)	Pads
	Amount (ml)	Type			
*Remember to indicate the time you woke and slept					

**ICS Instructions
Bladder Sensation:**

Use the following codes to describe how your bladder felt when you went to the toilet:

- No sensation of needing to pass urine, but passed urine for 'social reasons' e.g. just before going out, or unsure where the next toilet is.
- Normal desire to pass urine and no urgency
- Urgency but it had passed away before you had to visit the toilet
- Urgency but managed to get to the toilet, still with urgency, but did not leak urine.
- Urgency and could not get to the toilet in time so leaked urine.

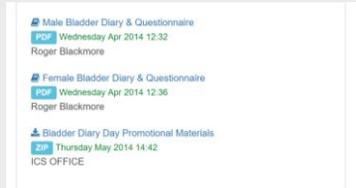
Urgency is different from normal bladder feelings and is the sudden compelling desire to pass urine which is difficult to defer, or a sudden feeling that you need to pass urine and if you don't you will have an accident.

ICS Instructions continued

- Time
 - Indicate the **time you woke and slept**
- When you have a drink or pass urine, write down the volume in the appropriate column against the relevant time



<http://www.ics.org/VSearch.aspx?q=bladder%20diary>



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Reliability and validity

Extensive studies have shown bladder diaries to be a valid and reproducible technique for assessing bladder symptoms

- Wyman et al
- Locher et al
- Brown et al
- Yap et al

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Completion

- The importance of completing the diary must be stressed
- Parsons et al (2004) found that the inclusion of an explanatory letter with the appointment increased numbers completing the diary from 22% to 75.5%.
- But, Non-Caucasian races and patients whose initial complaint was pelvic organ prolapse were significantly less likely to complete the diary, although this was a poor predictor of the absence of urinary symptoms.
- Heit and Brubaker (1996)

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Normative values

- Functional bladder capacity & 24 hour frequency increase with increasing 24 hour voided volume
- Clinically useful reference values need be adjusted for age and 24 hour urine volume
- Tables have been constructed using measurements in asymptomatic males and females:
 - With no disease or mediation which could affect urinary function
 - No history of pelvic or **urinary** tract surgery

Tissot W, Amundsen C L et al Bladder diary measurements in asymptomatic males: frequency, volume per void and 24 hr volume N & U 27: 198-204 (2008)
Amundsen CL, Parsons M et al Bladder diary measurements in asymptomatic females: functional bladder capacity, frequency and 24 hr volume N & N 26: 341-349 (2007)

ICS Teaching Module

Bladder diaries in low resource settings

Yes it is possible! But:

- As majority of patients are illiterate, requires cooperation of health care staff
- Patients are admitted to ward but encourage to mobilise and undertake normal level of activity
 - This is actually quite difficult!
- They have to report desire to void and associated sensation
- They have to void into container, so that volume and time can be recorded
- Input is more easily obtained by offering bottle of cold water and refilling when empty.
- Staff need prompting to achieve accurate handover
- Good to get one member of staff to take overall responsibility
 - Best to have someone who regularly helps in clinic or with urodynamic.

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In low resource setting where patients do not give accurate history, bladder diary actually even more important!

Well worth the effort.

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Conclusion

- Bladder diary very useful adjunct to history, examination, pad test, post void residual volume and MSU in the investigation of LUTS prior to urodynamics.
- May indicate appropriate initial management and may even obviate the need for urodynamics
- Extension of the F-V chart to include other parameters greatly strengthens its utility
- 3-day and 7 day appear equally useful in the clinical setting.
- Important to check that test day is normal
- Use clinical reference values taking account of age, 24 hour volume and volume per void.

Uroflowmetry

International Continence Society
School of Urodynamics



ICS School of Urodynamics

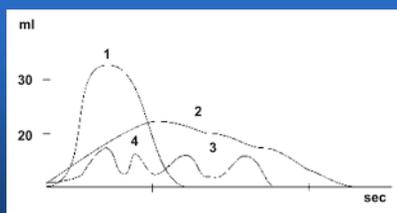
Uroflowmetry

- Measures flowrate in mL/s..
-and volume.
- (should be done in combination with PVR)



ICS School of Urodynamics

Flowmetry



ICS School of Urodynamics

Normal lower urinary tract function

- Bladder filling begins
- Nervous system maintains low pressure
- Distension activates stretch receptors
- Perception of fullness develops
- Cortical determination of desire to void
- Voiding
- Bladder filling, again
- Controlled autonomic reflex



ICS School of Urodynamics

Normal voiding

- Voiding is desired
- Pelvic floor relaxes and urethral sphincter relax and (antagonistic) detrusor contracts
- Detrusor pressure forces the opening of the (relaxed) bladder neck and the urethra
- Urine flow begins
- Detrusor contraction ends
- Urethral sphincter and pelvic floor contraction resumes



ICS School of Urodynamics

Mechanics of voiding

- Detrusor pressure generates flow
 - Flow is limited by the 'flow controlling zone (FCZ)'
- 'Bladder outlet' ≈
 - Urethra and surroundings
 - distend and collapse again
- No detrusor contraction, no voiding



ICS School of Urodynamics

Practice of flowmetry

- Private
- Position
- 'Full bladder'
- Patient decides....
 - (or not?)
 - Influenced by the situation (hurrying)
 - Following on to cystoscopy?



ICS School of Urodynamics

Practice of flowmetry

- Awareness of usual voided volume helps
 - Bladder voiding diary
 - Voiding frequency
- 'Shy voiders'
 - 'parauresis'



ICS School of Urodynamics

Flowmetry practice

- (ICS-) Good urodynamic practice
- Best possible (comfortable for patient) position
- Flowmeter as close as possible to the meatus
- No hindering of stream
 - e.g. voiding through tube
- Minimize time delay between flow at meatus and entering flowmeter



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Flowmetry mL/s

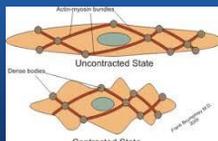
- Maximum flow



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Volume

- Bladder volume zero: can not contract
- Bladder volume low: can not contract very well
- Bladder volume too high: can not contract, or not very well



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Test retest

- At best 2mL/s when adequate volume and good circumstances
- Usually larger in women
- Probably better (smaller) when the prostate is controlling the flowrate
- Larger differences in larger flowrates (>16mL/s) are clinically not very meaningful
- High chance of pathology when <12mL/s



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Patients decide

- On the basis of your instructions!
- Comfortably full bladder
- But you should measure and ask and compare afterwards



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Flowmetry practice

- (ICS-) Good urodynamic practice
- Comfortably full bladder
- Best possible (comfortable for patient) position
- Flowmeter as close as possible to the meatus
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ICS Teaching Module: Measurement of Post-Void Residual Urine

A D Asimakopoulos, C De Nunzio, E Kocjancic, A Tubaro, P Rosier & E Finazzi-Agro



International Continence Society
Teaching Module

1

Definitions

ICS Teaching Module

2

PVR

“The amount of residual urine in the bladder after a voluntary void”

Kaplan SA et al. J Urol. 2008 Jul;180(1):47-54.

Increased in pts with:

1. BOO (BPH, poor sphincter relaxation, urethral/meatal stricture or bladder stones)
2. Detrusor underactivity
3. Bladder diverticulum
4. Large volume vesicourethral reflux → “pseudoresidual”

ICS Teaching Module

3

PVR and BOO

Limits

- I. Can be due to detrusor underactivity
- II. 1/3 of male patients with BPH and bladder outlet obstruction do NOT present PVR

More useful if used in combination with uroflowmetry or other parameters.

Belal M, Abrams P: J Urol 2006

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4

PVR

• *Threshold values delineating what constitutes an abnormal PVR are poorly defined.*

• *Most urologists agree that volumes of 50-100 mL constitute the lower threshold to define an abnormal PVR.*

Abrams PH et al. Br Med J 1978; 2: 1258

ICS Teaching Module

5

Measurement

ICS Teaching Module

6

PVR measurement

- Urethral catheterization has been accepted as the gold standard for PVR measurements, but this may cause discomfort for patients and carries a risk of urinary tract infection and trauma.

Schaeffer AJ, et al. J Urol 1983;130:1096--9.

- Non-invasive ultrasound bladder volume measurement has been used as an alternative to urethral catheterization, as a good compromise between accuracy and patients safety/comfort.

Griffiths CJ, et al. J Urol 1986;136:808-812

PVR measurement by US



Ultrasound bladder volume estimation can be performed in two ways:

1. By a real-time ultrasound to directly visualize the bladder.

Griffiths CJ, et al. J Urol 1986;136:808-812

2. By using a portable bladder scanner to calculate the volume automatically without directly visualizing the bladder.

Hartnell GG et al, Br J Radiol 60 (1987), pp. 1063-1065.

PVR measurement

Bladder scanner advantages:

1. easy to use;
2. requires only basic training;
3. can be carried out on the ward.

Reliability? (Better with additional real-time pre-scan imaging?)

Park YH: Neurourol Urodyn 2011; 30:335-8.

Significance

Significance of PVR PVR and acute or chronic urinary retention

Chronic urinary retention has been widely accepted as corresponding to a PVR of more than 300 mL (nevertheless variable definitions).

Abrams PH, et al. Br Med J 1978; 2: 1258.

(Chronic) PVR does not seem to be a strong predictor of acute urinary retention (AUR).

Roehrborn CG, et al. J Urol, suppl., 2005; 173: 443, abstract 1638.

Significance of PVR BOO

- *It is commonly thought that the increase in PVR indicates the severity of BOO.*
- *However, abnormal measurements of free uroflowmetry or PVR can detect only voiding dysfunction without indicating BOO specifically.*
- *Nevertheless, PVR measurements are used as parameter of efficacy for medical and surgical treatments of BPO.*

Kaplan SA, et al. Eur Urol. 2007 Jun;51(6):1717-23. Epub 2007 Jan 16.

Significance of PVR PVR and clinical progression of BPO

- High PVR is associated with an increased risk of LUTS deterioration and should thus be reconsidered in practice as a predictor of BPO progression.
- According to the EAU guidelines on the Management of Male Lower Urinary Tract Symptoms (LUTS), incl. Benign Prostatic Obstruction (BPO), very large PVRs may herald progression of disease and may indicate bladder dysfunction and predict a less favourable response to treatment.

Oelke M, et al EAU Guidelines on the Management of Male LUTS, incl. BPO

Significance of PVR PVR and clinical progression of BPO

- However, residual urine is not a contraindication to watchful waiting or medical therapy and no level of residual urine mandates invasive therapy and no PVR "cut-point" is yet established for decision-making.

Oelke M, et al EAU Guidelines on the Management of Male LUTS, incl. BPO

Significance of PVR PVR and Antimuscarinics in men

- It is common belief that antimuscarinics should not be used in men with BOO for a potential of AUR.
- Some placebo controlled clinical trial data suggest that antimuscarinics (alone or in combination with an alpha-blocker) do not increase the risk of AUR and do not produce a clinically significant increase of PVR in men, even in presence of BPO.

Roehrborn CG, et al. Urology. 2008 Nov;72(5):1061-7; discussion 1067.
Athanasopoulos A, et al. Eur Urol. 2011 Jul;60(1):94-105.

However, patients with significant PVR were excluded from these studies and the safety of antimuscarinics in men remains to be confirmed.

Significance of PVR PVR and bacteriuria

Large PVRs may be associated with UTIs, especially in persons at risk (children, patients with spinal cord injury or diabetes).

Kelly CE. Rev Urol. 2004;6 Suppl 1:S32-7.

Other studies, however, demonstrated that elevated PVR is not correlated to bacteriuria, incontinence, immobility, impaired cognition, or neurological disease.

Significance of PVR PVR and Chronic kidney disease (CKD)

- Very large PVRs (>300 mL) may be associated with an increased risk of upper urinary tract dilation and renal insufficiency.

Kelly CE. Rev Urol. 2004;6 Suppl 1:S32-7.

- A PVR >100 mL has been associated with CKD, even if other studies do not suggest this association.

Significance of PVR PVR and Female incontinence

Measurement of PVR is recommended in the management of female urinary incontinence.

Thüroff JW, et al. EAU guidelines on urinary incontinence. Eur Urol. 2011 Mar;59(3):387-400.

PVR should be measured during the assessment of women complaining of overactive bladder symptoms to exclude voiding dysfunction and anticholinergic medication should be used if PVR is low.

Milleman M, et al. J Urol. 2004 Nov;172(5 Pt 1):1911-4

Significance of PVR PVR and Children

Assessment of PVR is mandatory in a variety of pediatric patients, such as those with voiding LUTS, UTIs, vesicoureteral reflux, posterior urethral valves or neural tube defects.

Kelly CE. Rev Urol. 2004;6 Suppl 1:S32-7.

Recommendations and evidence summary

PVR Actual recommendations

- The interval between voiding and PVR measurement should be as short as possible (eo). It is advisable to ask the patients if the voiding was similar to a typical micturition in his/her daily life (eo).
- Use preferably noninvasive ultrasound bladder volume measurement instead of urethral catheterization (LE 3).
- Measurement of PVR is recommended at the management of female urinary incontinence (LE 3).
- Assessment of PVR is considered mandatory in a variety of pediatric patients (LE 3).

PVR Evidence summary

- 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).
- Portable bladder scanner may present some advantages over real-time ultrasound, especially if equipped with an 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 relevant (eo).

PVR Evidence summary

- 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).

PVR Evidence summary

- PVR cannot be used as a robust predictor of acute urinary retention (LE 3).
- PVR can detect only voiding dysfunction without indicating BOO specifically (LE 2-3).

PVR Evidence summary

- PVR is not increased significantly in patients treated with antimuscarinic 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 subjects at risk, such as children or patients with spinal cord injury or diabetes (LE 3). This association among adults is far from clear (LE 3).
- Large PVR may be associated with chronic kidney diseases (LE 3).

PVR Conclusions

- Measurement of PVR is recommended in guidelines and recommendations on the management of LUTS and urinary incontinence.
- Increased PVR values may be associated with an increased risk of UTI, risk of upper urinary tract deterioration and renal failure, risk of progression in men with BPO, risk of AUR following antimuscarinic treatment and risk of poor outcome following surgery of BPO.
- Up to now, most of the ominous features associated with PVR are not evidence-based.