Clinical and urodynamic analysis of female voiding function and evidence based treatment of female voiding dysfunction

Workshop 23

Monday 23 August 2010, 14:00 – 18:00

Time	Time	Topic	Speaker
14.00	14.15	Introduction	Peter Rosier
14.15	14.50	Fundaments of analysis of voiding Pressure flow (P/q) analysis	Peter Rosier
14.50	15.00	Discussion	
15.00	15.35	Clinical parameters of (female) pressure flow analysis	Jan Groen
15.35	15.45	Discussion	
15.45	16.00	Teabreak	
16.00	16.35	Ineffective emptying in female patients	Victor Nitty
16.35	16.50	Discussion	
16.50	17.30	Management of ineffective voiding	Peter Sand
17.30	17.45	Discussion	
17.45	17.55	Round table	All above
17.55	18.00	Evaluation	

Aims of course/workshop

Analysis of female voiding symptoms and or dysfunction can be done clinically and urodynamically.
Consensus or standards are however lacking and therefore interpretation of signs, symptoms and urodynamics varies:
This workshop will help participants to:

- Further understand the physiology of female voiding (and abnormalities)
- Look at different analysis -methods of female voiding and learn to select appropriate methods
- Explore methods of classifying and quantifying outlet obstruction and detrusor contractility for female patients
- Put (urodynamic) analysis of (ineffective) female voiding in the clinical perspectives of diagnosis and treatment.

(Note: We will not discuss patients with (relevant) neurological abnormalities.)

Educational Objectives

Analysis of female voiding (dysfunction) does not deserve too much attention in the usual textbooks and is partially controversial, which makes the subject ideal for a lively and highly

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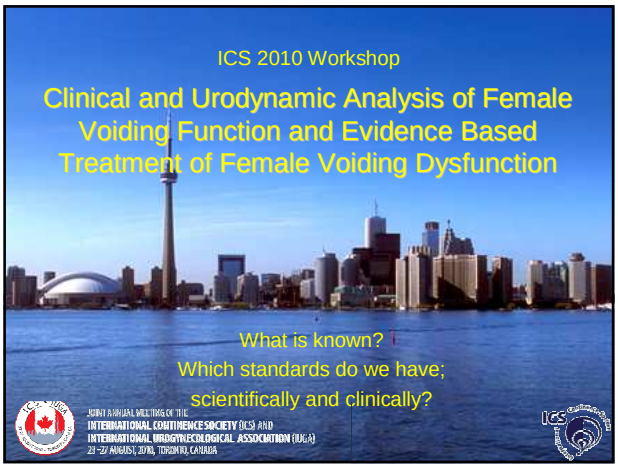
interactive multidisciplinary workshop. The (lively) discussion of the clinical cases in the ICS-SF-2009 workshop was much appreciated and will remain focus of the workshop. We have further improved the workshop by the addition of more clinical cases. We will remain to allocate much time to interaction and discussion. The best available evidence will be the basis for final conclusions and recommendations, provided by the speakers. The workshop will be of value for gynaecologists (in training), urologists (in training) but is of advantage for everyone involved in the treatment of (female) lower urinary tract dysfunction.

Clinical relevance of ineffective female voiding as well as the relevance of the various urodynamic analysis methods will be introduced. Basic guidance for clinical analysis and for (urodynamic) pressure-flow analysis of female voiding in combination with clinical relevance of this analysis will be provided by experts and discussed with the audience. On the basis of real life clinical presentations we discuss clinical diagnosis, urodynamic testing and treatment (results) with the audience.
Key learning points will be: Fundaments of pressure -flow analysis; clinical application of distensible collapsible tube hydrodynamics and hill equation; 'from pressure and flow –over time' to 'pressure -flow plot' clinical parameters of pressure -flow analysis.
Bladder outlet 'quantification'; detrusor contraction 'strength'; 'sense and nonsense' of nomograms and parameters applied for pressure flow analysis in female; 'voiding dynamics; 'dyssynergia' and 'clumsy' or 'dysfunctional' voiding' (two non ICS –defined terms!)
Ineffective emptying in female patients, causes and relevance. Iatrogenic, pharmacologic causes of 'obstruction' and or detrusor underactivity; clumsy voiding, dysfunctional voiding or dyssynergic voiding. Indications for treatment, management and treatment of female ineffective emptying; (In relation to) surgery and/or pharmacotherapy. The urological, as well as the gynaecological point of view will be represented.

Participants are encouraged to discuss their own ideas. The workshop is going to be highly interactive. All participants will receive a CD containing all the powerpoint presentation files.

ICS 2010 Workshop

Clinical and Urodynamic Analysis of Female Voiding Function and Evidence Based Treatment of Female Voiding Dysfunction



What is known?
Which standards do we have;
scientifically and clinically?

JOINT ANNUAL MEETING OF THE
INTERNATIONAL CONTINENCE SOCIETY (ICS) AND
INTERNATIONAL UROGYNECOLOGICAL ASSOCIATION (IUGA)
21–25 AUGUST, 2010, TORONTO, CANADA

Problems:

Analysis of female voiding:

- Standard is lacking (and therefore:)
- Variation in clinical practice exists

- Normal female bladder outlet function is imprecisely defined
- Female bladder outlet during voiding is 'anatomically' more dynamic than in (elderly) men

Problems:

- Female bladder outlet obstruction is 'clinically' relatively rare
  - however postoperative /obstructive treatments?
- (Habitual) straining to empty (or UDI- situative?)
- Normal limits for female detrusor contraction during voiding undefined.
- Post-void residual urine?
- Predictive value of test results unknown?
- Little evidence based treatment

Program

- Introduction — Peter Rosier
- Basics of P/q analysis — Peter Rosier
  - Q & A
- Clinical analysis of voiding — Jan Groen
  - Q & A + discussion
- Female patients — Victor Nitti
  - Q & A + discussion
- Management — Peter Sand
  - Q & A + discussion
- Round the Table Discussion!

What we 'know' / observe

- Some women:
  - consistently, have ineffective emptying
  - have bladder outlet obstruction
  - have consistent interruptive emptying
  - void 'without detrusor contraction'
  - have voiding difficulties after surgery for SUI

And also:

- We observe 'abnormal' (urodynamic) voiding in women without any voiding symptom

What we can measure

- Voided volume, $P_{det,}$ $P_{det(max)}$, Q_{max}, residual vol.
- Flow-curve/ irregularity /intermittency
- Presssure -flow nomogram(s)
- Bladder outlet obstruction index
- Bladder contraction index
- Stopflow: $P_{det(max)\text{-}isovol}$
- ……..

What we discuss today

- Fundaments of voiding physiology and analysis
- Clinical parameters of voiding analysis
  - (how) can we quantify female bladder outlet (obstruction)?
  - (how) can we quantify female detrusor contraction?
- What are types of abnormal female voiding and what evidence do we have for these?
- What should we do when we diagnose abnormal female voiding?
- What should we treat and how?

Fundaments of analysis of voiding Pressure flow (P/q) analysis

Peter Rosier

MD PhD Functional urology and neurourology
Department of Urology University Medical Centre Utrecht

Normal lower urinary tract function

- Bladder filling begins
- Nervous system maintains low detrusor pressure
- Detrusor distension activates stretch receptors
- Perception of fullness develops
- Cortical ‘motivation’ of desire to void
- Voiding
- Bladder filling, again

Normal lower urinary tract function

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

'controlled' autonomic reflex

Normal voiding

- Voiding is desired (convenient moment; relevant for 'socialized animals')
- pelvic floor relaxes and urethral sphincter relax and (antagonistic) detrusor contracts
- detrusor pressure forces the (relaxed) bladder neck and the urethra to open
- urine flow begins
- detrusor contraction ends
- urethral sphincter and pelvic floor contraction resumes

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Principles of urodynamic testing

- Well informed patient
- Appropriate room
- Physical (warm, comfortable positioning...)
- Emotional (adequate draping, private...)

- Appropriate indication
- Appropriate equipment
- Good urodynamic practice

Representative function during test(s)?

- Was the bladder 'comfortably' full?
- Markers on time axis of study (ICS GUP)
  - first sensation of filling
  - normal desire to void
  - strong desire to void
  - end of filling
  - permission to void
- Compare with free (without catheter) flow

Representative function during test(s)?

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Representative function during test(s)?

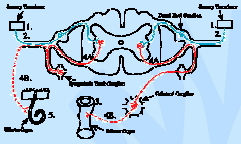
- Ask patient (after voiding)
  - ('Was this -almost- as ususal?')
- Be aware that the transuretral catheter
  - causes passive effect (obstructive)
  - causes active effect (physically) hindering
- Best possible (comfortable for patient) position
- Flowmeter as close as possible to the meatus

Set up for the test

- (ICS-) Good urodynamic practice
- Minimize time delay between flow at meatus and entering flowmeter
- Ensure correction of pressure -tracings for the systematic delay in your system
- Tape catheter as close as possible to the meatus
- Use thin urethral catheter
- Urethral catheter (8F): 'obstructs' ± 10cm H_2O

Mechanics of voiding

- Detrusor and outlet are antagonists
  - Autonomic reflex arc



  - Coordination (synergy)
  - Discoordination (dissynergy)
    - cogwheel phenomenon (Parkinson's disease)

Mechanics of voiding

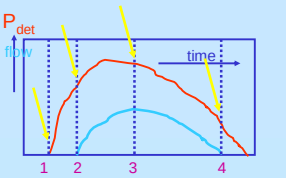
- Detrusor contraction (pressure) generates the flow
- Bladder outlet controls the flow
  - Bladder outlet ≈ Urethra + surrounding structures
    - Tube: distensible and collapsible
- Flow controlling zone (FCZ)
  - is the (by definition!) virtual point in the urethra that gives the highest 'resistance' to flow

Mechanics of voiding: phases

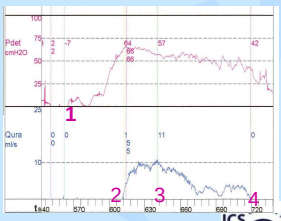
- Pelvic floor relaxation> detrusor contraction + 'bladder base' relaxation:
- Detrusor (intravesical) pressure rises
- Relaxed outlet becomes distended
  - Passive distensible….
- '(Detrusor) opening pressure' when flow starts
- '(Detrusor) increases to maximum pressure'
- 'Maximum flow' when opening of FCZ is maximal
- Steady state /balanced forces
- Outlet collapses
  - … collapsible tube
- '(Detrusor) closing pressure' (end of flow)

Voiding phases

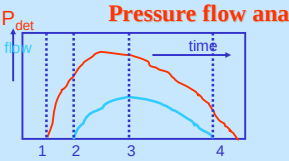
- start of voiding: detrusor pressure rise (see graphs)> 1
- distension of outlet>opening pressure>start of flow> 2
- maximum flow > beginning of 'steady state outlet'> 3
- end of flow; collapse of outlet: closing pressure> 4



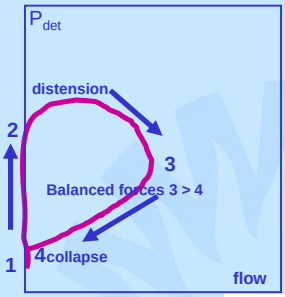
There is a balance between forces outside and inside bladder outlet from 3 to 4.



Pressure flow analysis schematic

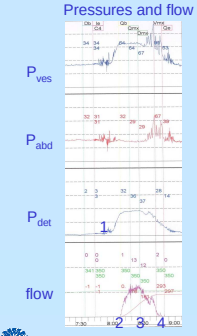


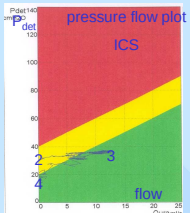
- **PRESSURE AND FLOW (see above) ARE COMBINED IN A PRESSURE FLOW – PLOT (see graph right side)**
- **Over time: Micturition starts at 1 and ends after 4**

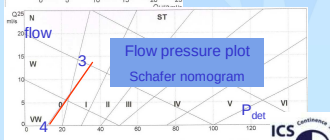


Pressure flow analysis

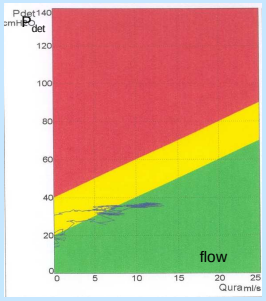
Pressures and flow







Pressure flow plot ICS

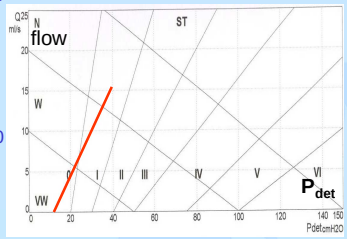


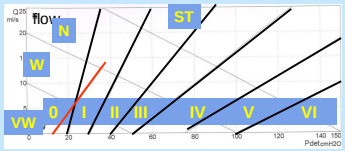
- Pressure and flow combined
- ICS obstruction index:
- 3 Areas:

- Red: Obstructed
- Yellow: Equivocal
- Green: Not Obstructed

Schafer Nomogram

- Connect P_{det} at Q_{max} and P_{det} at termination of flow *with a line*
- Determine grade of BOO: position of the line in (almost) vertical classes (0 –VI)
- Grade contraction: tip of line in diagonal area





Largest part of the line is in (almost) vertical class: Obstruction grade is:

0-I	No obstruction
II	Intermediate
➢III	Obstruction

When tip of the line is in (almost) horizontal' class: Contraction grade is:

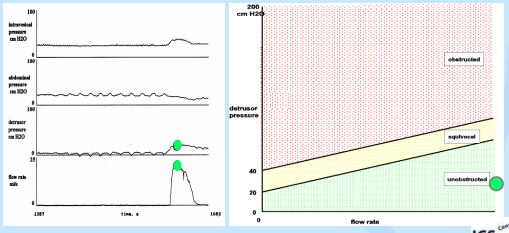
VW	Very weak
W	Weak
N	Normal
St	Strong

ICS obstruction index (A/G* number)

- Easy way to grade pressure-flow result:
- calculate $P_{det}Q_{max}$ - 2*Q_{max}
  - pressure at maximum flow minus 2 times maximum flow rate,
  - using cmH_2O & ml/s
  - 'clinically calibrated' for elderly male patients with enlarged prostate
- if ICS-obs index is < 20: No BOO
- if ICS-obs index >40: BOO
- if ICS-obs index 20 to 40 Equivocal
- In male patients with enlarged prostate:
  - No BOO: 'desobstruction' will not change much
  - BOO: desobstruction will likely be effective
  - Equivocal: the result of 'desobstruction' is not predictable
  - *Abrams –Griffiths Number

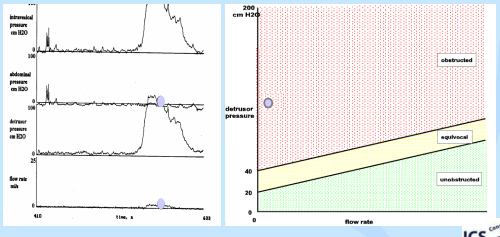
No Bladder outlet obstruction

- (low) P_{det} at Q_{max} (see below: e.g. 30 cm H_2O) and
- (high) Q_{max} (see below: e.g. 22 ml/sec)



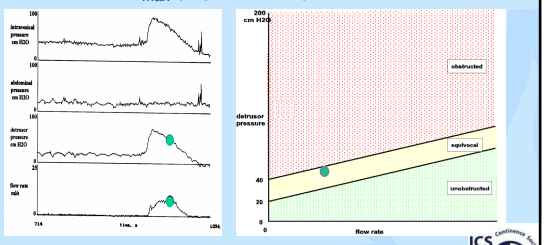
Bladder outlet obstruction

- high P_{det} at Q_{max} (e.g. 100 cm H_2O) and
- low Q_{max} (6 ml/sec)



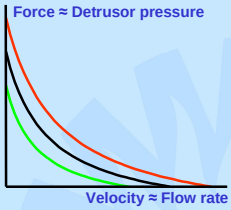
Equivocal (area 'inbetween')

- intermediate P_{det} at Q_{max} (e.g. 45cm H_2O) and
- intermediate Q_{max} (e.g. 9 ml/sec)



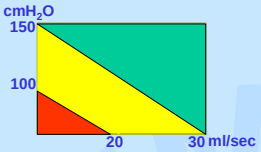
Pressure flow analysis: contraction

- ('Total') Muscle contraction is a 'trade off' between force and velocity >
  - one contraction is either forceful ór fast
- A strong muscle (red) can generate more force and or more speed when compared to a weak muscle.
  - In urodynamic pressure flow analysis
- force ≈ pressure
- (shortening) velocity ≈ flow

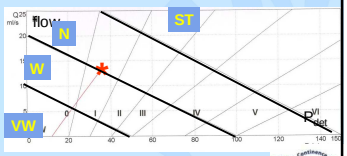


Pressure flow analysis: contraction

- ICS-contraction index:
  - calculate $P_{det}Q_{max}$ + 5*Q_{max}
    - Normal: 100-150
    - Weak: <100
    - Strong: >150



- Schafer nomogram
  - STrong
  - Normal
  - Weak
  - Very Weak



Pressure flow analysis

- Rather straightforeward in elderly male patients with enlarged prostate:
  - Because distension and collapse are determined by the more or less 'stable' properties of the prostate
- However in:
- Younger men, female, children and neurologic:
  - Bladder outlet 'unstability' plays a more important role
    - Pelvic floor muscle activity plays probably a larger role
    - Flow controlling zone (virtual!) is probably more 'dynamic'
  - Scientifically undisputed clinical classification does not yet exist for these groups of patients

P/Q analysis in young men

- Pelvic floor activity
  - Pain
  - Anxiousness / nervousness
- Waxing and waning of contraction
  - on/of switching of voiding reflex
- Bladderneck dynamics
  - no validated method
- Straining

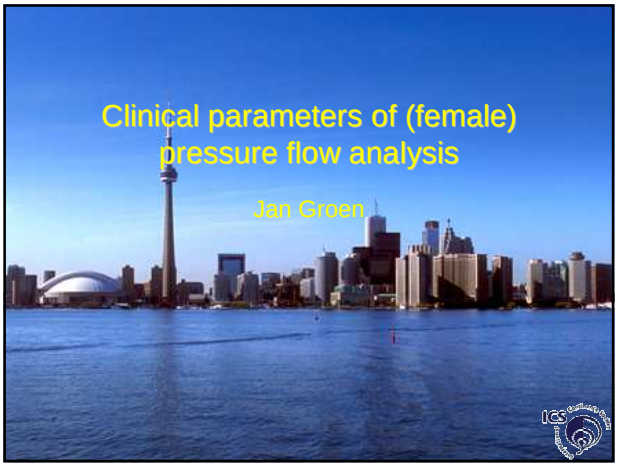
Pressure flow plot looks 'messy' because of 'dynamics'. Nevertheless: outlet obstruction can be determined by observation of the 'estimated' lower border of P/Q plot

P/Q analysis in female

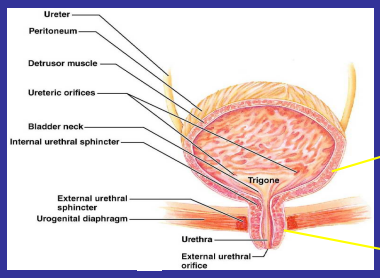
- In female voiding possible observations:
  - *(if voiding was representative !):*
  - High intravesical pressure
  - Low intravesical pressure and high flow resulting in
    - effective (complete) micturition
    - ineffective (incomplete; residual) micturition
  - Low pressure and low flow resulting in
    - effective micturition
    - ineffective micturition
  - Pressure and flow variations during micturition
- However:
- No exact and validated classes for P/Q analysis in female exist!

Questions

- Discussion:
  - Who applies (systematic) analysis of voiding in female patients and why (or why not)?
  - Who applies formal pressure flow analysis in female patients and when or why (or why not)?
  - What should in your opinion be 'clinically relevant' diagnoses on the basis of pressure flow analysis and why?



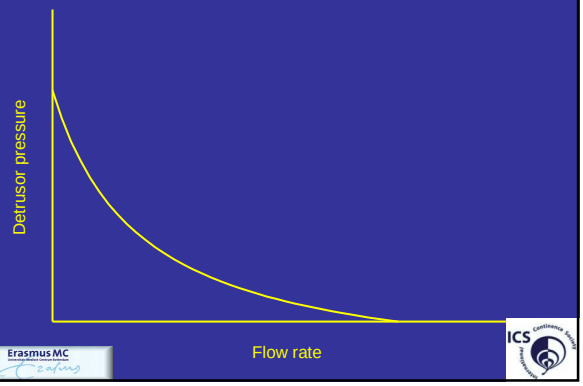
Voiding determined by …



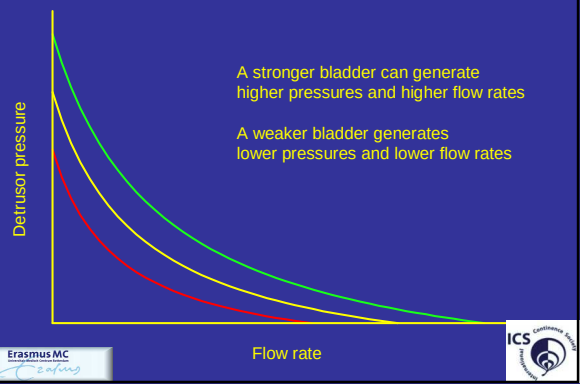
Bladder properties (contraction strength)

Urethra properties (resistance to flow)

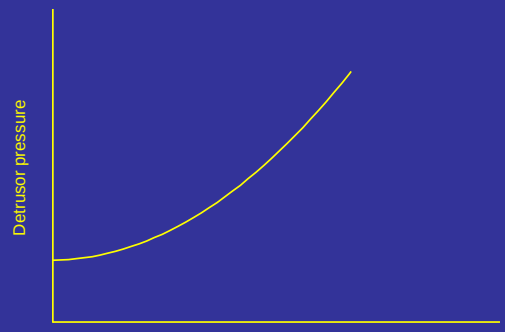
Bladder Output Relation (BOR)



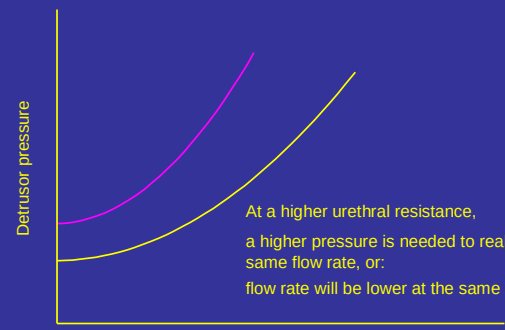
Bladder Output Relation (BOR)



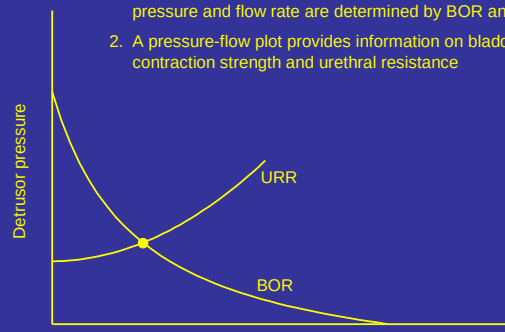
Urethral Resistance Relation (URR)

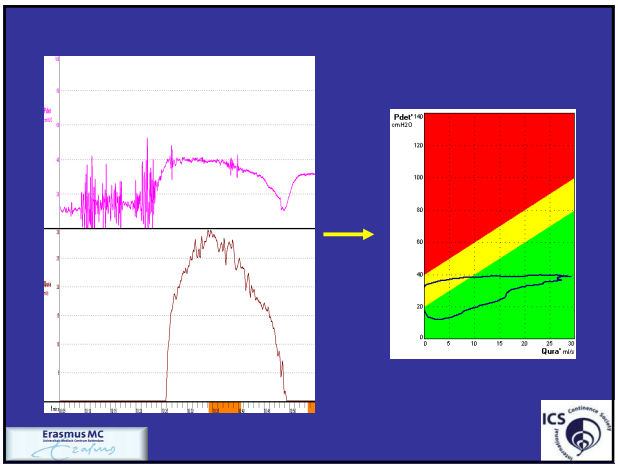


Urethral Resistance Relation (URR)



1. At any moment during voiding:
   pressure and flow rate are determined by BOR and URR
2. A pressure-flow plot provides information on bladder contraction strength and urethral resistance





From:

- Detrusor pressure
- Flow rate

To:

- Urethral resistance
- Bladder contraction strength

Erasmus MC

ICS

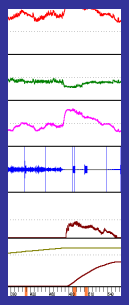
Urethral resistance

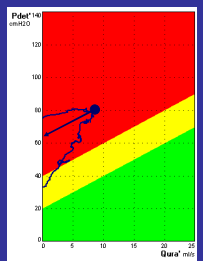
Obstruction

Erasmus MC

ICS

Urethral resistance parameter BOOI
(Bladder Outlet Obstruction Index)





BOOI = pdet.Qmax – 2 x Qmax

>= 40 : obstructed

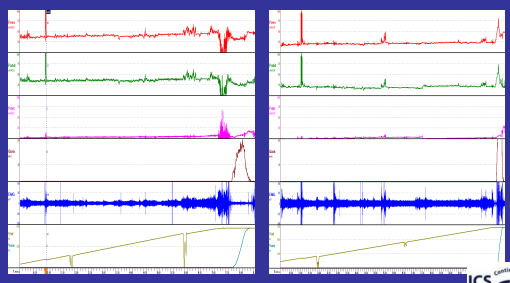
< 40, > 20 : equivocal

<= 20 : unobstructed

BOOI = pdet.Qmax – 2 x Qmax
= 80.4 – 2 x 8.6
= 63

Voiding dynamics are significantly different in women:

- voiding with significantly lower detrusor pressure / higher flow rate
- voiding by relaxation of the pelvic floor
- voiding by abdominal straining



Recent diagnostic definitions and nomograms for BOO in women:

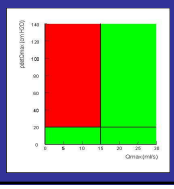
1. Chassagne S, Bernier PA, Haab F, Roehrborn CG, Reisch JS, Zimmern PE
   Proposed cutoff values to define bladder outlet obstruction in women.
   Urology 51:408-411, 1998
2. Nitti VW, Tu LM, Gitlin J
   Diagnosing bladder outlet obstruction in women.
   J Urol 161(5):1535–1540, 1999
3. Lemack GE, Zimmern PE
   Pressure flow analysis may aid in identifying women with outflow obstruction.
   J Urol 163:1823-1828, 2000
4. Blaivas JG, Groutz A
   Bladder outlet obstruction nomogram for women with lower urinary tract symptomatology.
   Neurourol Urodyn 19(5):553–564, 2000
5. Defreitas GA, Zimmern PE, Lemack GE, Shariat SF
   Refining diagnosis of anatomic female bladder outlet obstruction: comparison of pressure-flow study parameters in clinically obstructed women with those of normal controls.
   Urology 64(4):675–679; discussion 679–681, 2004

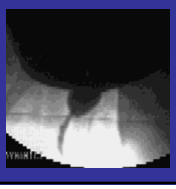
Recent diagnostic definitions and nomograms for BOO in women:

1. Zimmern group 1998: Qmax <= 15 ml/s and pdetQmax >= 20 cm H2O
2. Nitti et al 1999: Radiographic evidence + sustained detrusor contraction (VUDS)
3. Zimmern group 2000: Qmax <= 11 ml/s and pdetQmax >= 21 cm H2O
4. Blaivas and Groutz 2000: Nomogram
5. Zimmern group 2004: Qmax <= 12 ml/s and pdetQmax >= 25 cm H2O

Recommended:

6. Nitti VW (2005) Pressure flow urodynamic studies: the gold standard for diagnosing bladder outlet obstruction. Rev Urol 7 (Suppl 6):S14–S21 [Review]
7. Akikwala TV, Fleischman N, Nitti VW (2006) Comparison of diagnostic criteria for female bladder outlet obstruction. J Urol 176:2093-2097





Construction of Blaivas-Groutz nomogram

Women were considered obstructed if:

1. Free Qmax <= 12 ml/s
   + sustained detrusor contraction with pdetQmax >= 20 cm H2O or
2. Radiographic evidence of BOO
   + sustained detrusor contraction with pdetQmax >= 20 cm H2O or
3. Inability to void with catheter
   + sustained detrusor contraction with pdetQmax >= 20 cm H2O

50 Obstructed women vs 50 non-obstructed women (control group)

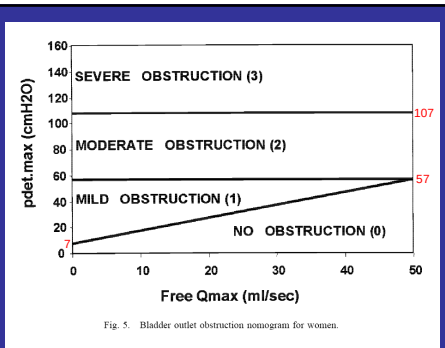


Fig. 5. Bladder outlet obstruction nomogram for women.

Blaivas-Groutz nomogram based on:

- free Qmax (not Qmax from p/Q study)
- pdet.max (not pdet.Qmax)

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Vol. 176, 2093-2097, November 2006

Voiding Dysfunction

Comparison of Diagnostic Criteria for Female Bladder Outlet Obstruction

Tulsi V. Akikwala, Nicole Fleischman and Victor W. Nitti*
From the Department of Urology, New York University School of Medicine, New York, New York

"The Blaivas-Groutz nomogram overestimates obstruction compared to the other criteria. Therefore, it should not be used as the sole or standard definition of obstruction in women."

Neurourology and Urodynamics 24:237–242 (2005)

Application of the Blaivas–Groutz Bladder Outlet Obstruction Nomogram in Women With Urinary Incontinence

Elske T. Massolt,[1]* Jan Groen,[2] and Mark E. Vierhout[3]
[1]Department of Obstetrics and Gynecology, Erasmus Medical Center, Rotterdam, The Netherlands
[2]Department of Urology, Erasmus Medical Center, Rotterdam, The Netherlands
[3]Department of Obstetrics and Gynecology, University Medical Center Radboud, Nijmegen, The Netherlands

- **70% of 109 patients classified as obstructed (58% mildly, 11% moderately, 1% severely)**
- **no significant difference in score on obstruction domain of UDIbetween 'obstructed' and 'unobstructed' patients**

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ICS

Bladder contraction strength

Underactive detrusor

Erasmus MC

ICS

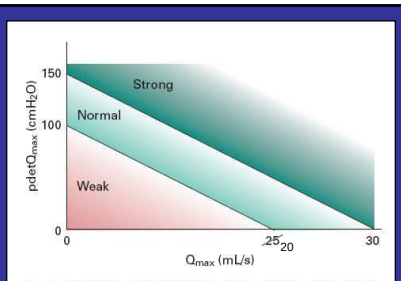
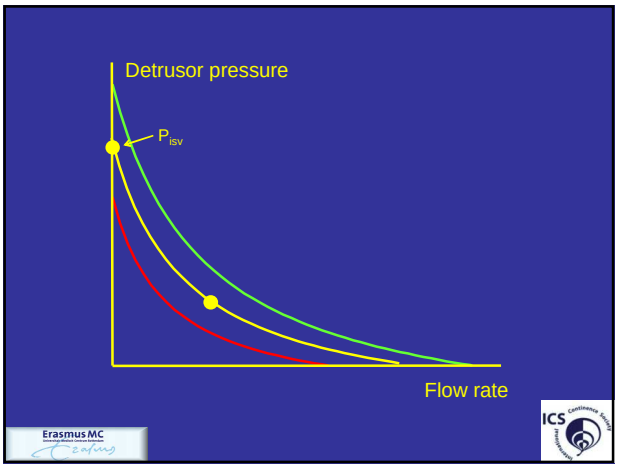


Fig. 2. The bladder contractility nomogram, dividing patients into three categories according to the bladder contractility index ($pdetQ_{max} + 5Q_{max}$). From Schäfer [9]. Green, strong (BCI ⩾150); light green, normal (BCI = 100–150); light red, weak (BCI ⩽100).

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

Erasmus MC

ICS



DJ Griffiths: Detrusor contractility – order out of chaos. Scand J Urol Nephrol Suppl 215: 93-100, 2004.

Comparison of (Qmax, pdetQmax) from pressure-flow study with isovolumetric pressure from stop test

Three stop tests:
a) voluntary (pelvic floor)
b) mechanical (balloon catheter)
c) continuous occlusion (balloon catheter, cuff)

Best result: slope 1 → PIP_1 = pdetQmax + 1 x Qmax

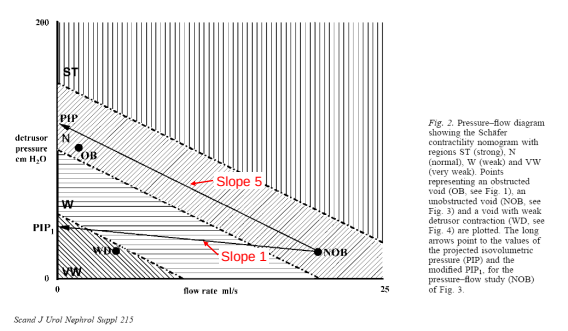


Fig. 2. Pressure–flow diagram showing the Schäfer contractility nomogram with regions ST (strong), N (normal), W (weak) and VW (very weak). Points representing an obstructed void (OB, see Fig. 1), an unobstructed void (NOB, see Fig. 3) and a void with weak detrusor contraction (WD, see Fig. 4) are plotted. The long arrows point to the values of the projected isovolumetric pressure (PIP) and the modified PIP_1, for the pressure–flow study (NOB) of Fig. 3.

Scand J Urol Nephrol Suppl 215

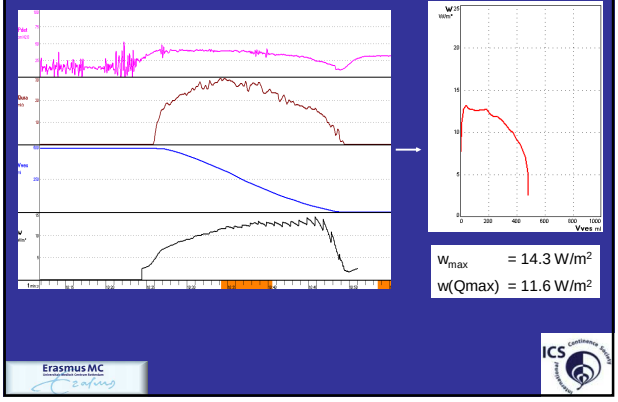
PIP = BCI = pdet.Qmax + 5 x Qmax
PIP_1 = pdet.Qmax + 1 x Qmax

Detrusor contractility has two different aspects:

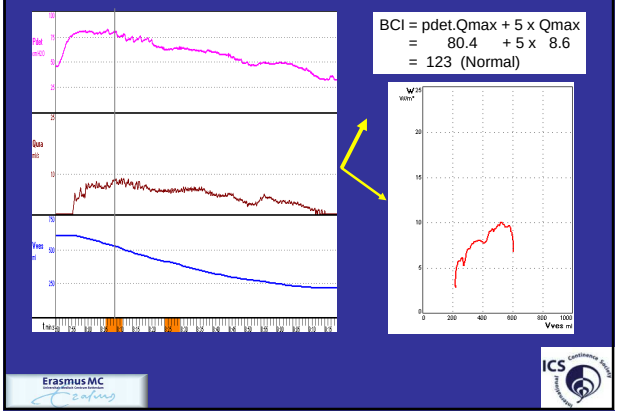
1. The strength of the contraction
   (overcome urethral resistance?)
2. The durability of the contraction
   (sustained long enough to prevent residue?)

Stop test, BCI, PIP_1: one value,
no changes during voiding observed

W: continuous variable,
changes during voiding can be observed,
value depends on residue



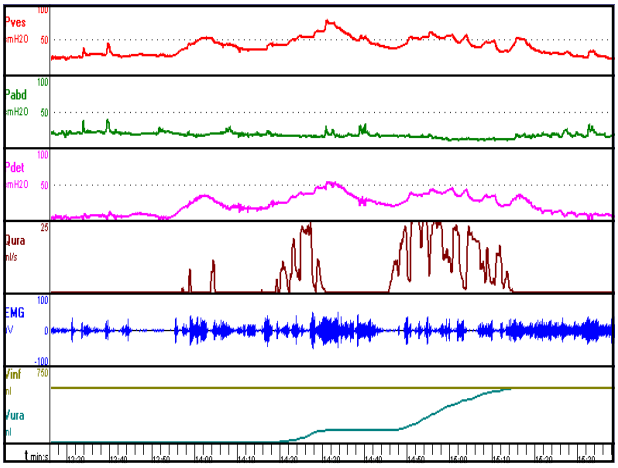
w_{max} = 14.3 W/m²
w(Qmax) = 11.6 W/m²

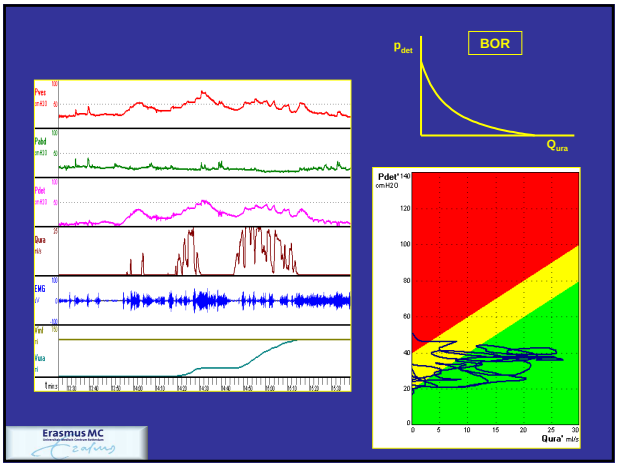


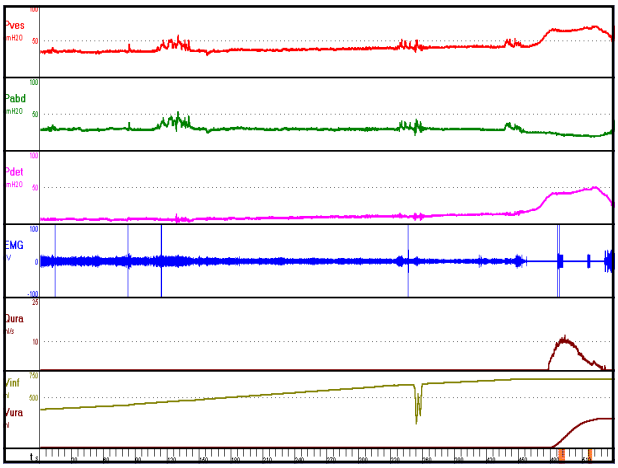
BCI = pdet.Qmax + 5 x Qmax
= 80.4 + 5 x 8.6
= 123 (Normal)

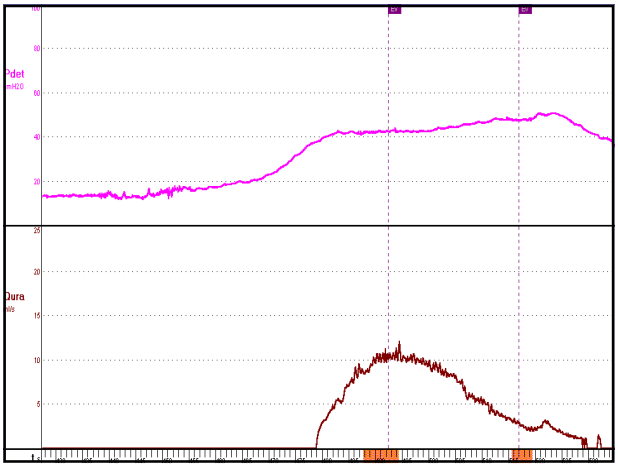
Pelvic floor relaxation

Dysfunctional voiding






Pves
Pabd
Pdet
EMG
Dura
Vinf
Vura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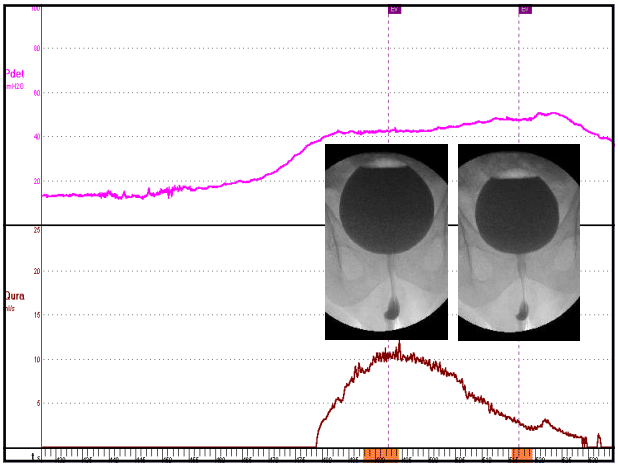
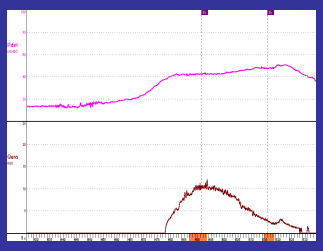
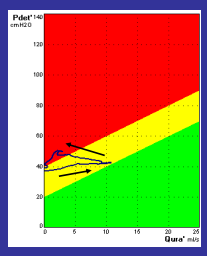

Pdet
Dura





Progressive increase of urethral resistance:

- active (relaxation)
- passive (e.g. urethral diverticulum)

Additional slides

Applications

0022-5347/02/1682-0565/0
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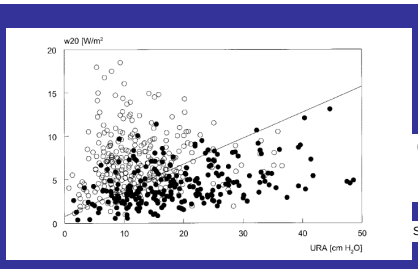
RELATIVE BLADDER OUTLET OBSTRUCTION

RIES KRANSE* AND RON VAN MASTRIGT

From the Department of Urology-Urodynamics, Erasmus University Rotterdam, Rotterdam, The Netherlands



614 Women:

- ○ BVE > 80%
- ● BVE < 80%

Similar plot for 503 men

0022-5347/04/1723-1006/0
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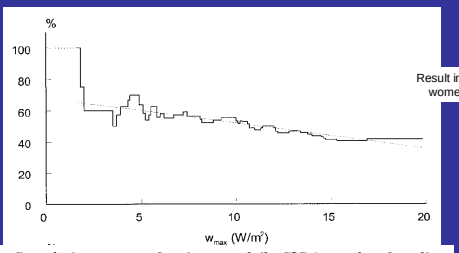
Vol. 172, 1006–1009, September 2004
Printed in U.S.A.
DOI: 10.1097/01.ju.0000135238.006695.e8

BLADDER CONTRACTION STRENGTH PARAMETERS POORLY PREDICT THE NECESSITY OF LONG-TERM CATHETERIZATION AFTER A PUBOVAGINAL RECTUS FASCIAL SLING PROCEDURE

JAN GROEN* AND J. L. H. RUUD BOSCH†

From the Department of Urology, Erasmus Medical Center, Rotterdam, The Netherlands

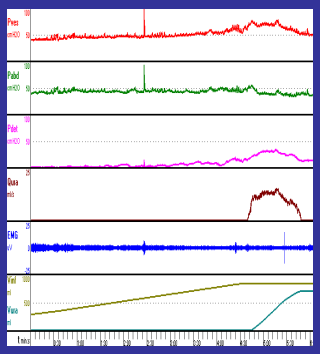


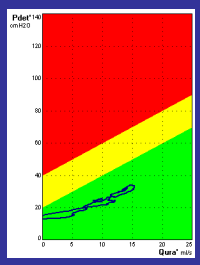
Result in 58 women

Cumulative percent of patients on daily CIC 3 months after sling surgery, and preoperative bladder contraction strength parameters w_{max}, w_{Qmax} and BCI.

Erasmus MC

Urethral resistance parameter URA





URA 15

Erasmus MC

Questions:

- Is it possible to diagnose / quantify / analyse outlet dynamics (variations) during voiding in female patients, on the basis of pressure flow analysis?
- Is it known how 'spontaneous' maximum contraction during voiding relates to stop flow testing of maximum contraction?

Ineffective Emptying

- Bladder
  - Detrusor underactivity
    - Contraction of reduced strength and/or duration, resulting in prolonged bladder emptying and/or a failure to achieve complete bladder emptying within a normal time span
  - Acontractile detrusor
- Outlet
  - Anatomic obstruction
  - Functional obstruction

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Detrusor Underactivity Causes

- Neurogenic
  - Lower motor neuron
  - Decentralization
- Myogenic
  - Chronic obstruction or over distension
  - Diabetes mellitus
- Pharmacologic
  - Anticholinergics
  - Alpha agonists
  - Narcotics
- Aging
- Failure of sphincteric relaxation
  - ? Learned behavior
  - Pain
  - Fowler's syndrome

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Causes of BOO in Females

- *Anatomical*
  - Iatrogenic
    - Incontinence surgery
    - Stricture
  - Pelvic prolapse
  - Extrinsic compression
    - GYN tumors
  - Meatal stenosis
  - Caruncle
  - Skene's gland abscess
  - Urethral diverticulum
  - Urethral carcinoma
  - Ectopic ureterocele
  - Retroverted impacted uterus (1st trimester)
- *Functional*
  - Primary BNO
  - Dysfunctional voiding
  - DESD

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Diagnosing BOO and Detrusor Underactivity in Women

- Unlike in males there is no highly prevalent condition (i.e. BPO) that causes obstruction
- Obstructed women void with higher pressure and lower flow than unobstructed women, but:
  - There a large overlap[1,2]
  - Differences that as dramatic as in men
- Thus an individualized approach is often necessary
  - History, physical exam, non-invasive parameters, UDS

1. Chassagne, et al: Urology 1998; 51:408-11
2. Nitti, et al: J Urology 1999; 161:1535-1540

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Videourodynamic Criteria For BOO

Nitti, et al: J Urol 1999; 161:1535-40

Urodynamic parameter	Obstructed Pts. (n=76)	Unobstructed Pts. (n=185)	p
Q_{max} (mL/s)	9.0 ± 6.2	20.1 ± 10.0	< .00001
$P_{det}@Q_{max}$ (cmH_2O)	42.8 ± 22.8	22.1 ± 11.3	< .00001
PVR (mL)	157 ± 183	33 ± 91	< .00001
Bladder Capacity (mL)	381 ± 170	347 ± 147	0.10
Detrusor overactivity	34 (45%)	76 (41%)	0.62

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Micturition in Women

- Women commonly void with low pressure
  - Some void by pelvic floor relaxation and no significant increase in P_{det}
  - Not uncommon to augment urination with abdominal straining
- A small degree of increased outlet resistance may be enough to disrupt voiding
  - If normal voiding occurs at low P_{det}, the bladder's response to obstruction may not appear as dramatic as in males

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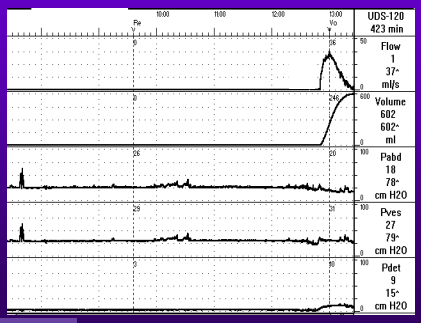
Voiding phase of a multichannel urodynamic study of a 72 year old woman with stress incontinence



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Diagnosing Detrusor Underactivity

- For detrusor underactivity must consider P/F parameters during UDS as well as history, non-invasive flow and PVR
  - At least 25% of women will not void characteristically during UDS study
  - "Rule out obstruction" if possible
- How much Valsalva voiding is "normal" or acceptable?
- Very important to correlate UDS with real life situation
  - Recreate usual voiding if possible

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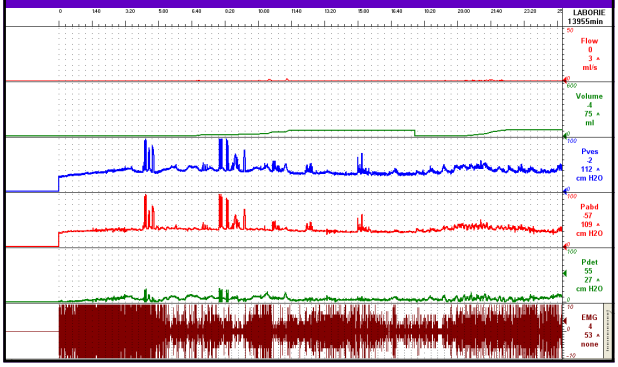
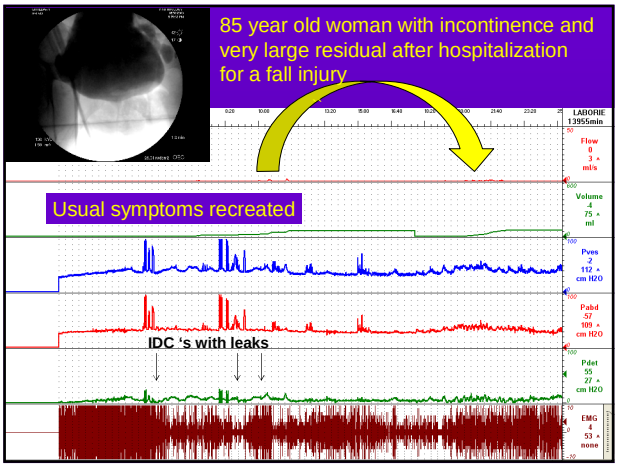
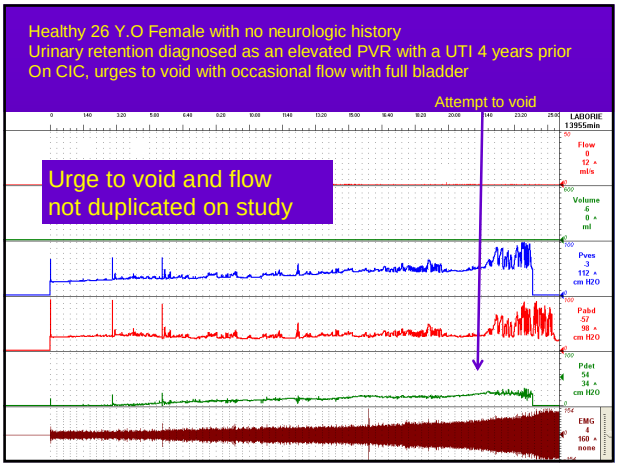
85 year old woman with incontinence and very large residual after hospitalization for a fall injury

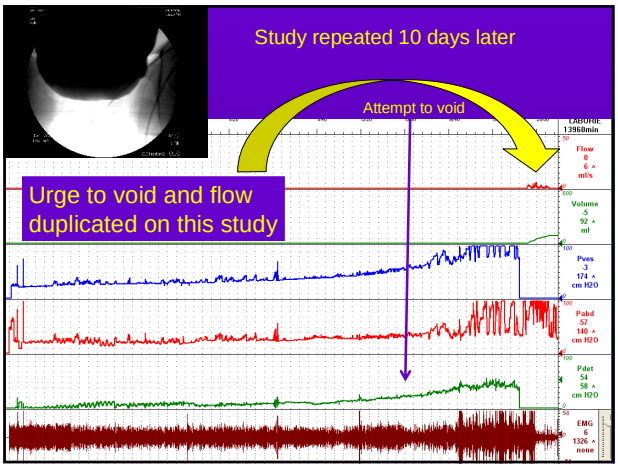


85 year old woman with incontinence and very large residual after hospitalization for a fall injury



Healthy 26 Y.O Female with no neurologic history
Urinary retention diagnosed as an elevated PVR with a UTI 4 years prior
On CIC, urges to void with occasional flow with full bladder





Diagnosing Female BOO

- With anatomic obstruction the diagnosis is often straight forward for example:
  - Stage 4 POP with incomplete emptying
  - Urinary retention after incontinence surgery
- With functional obstruction UDS is more critical

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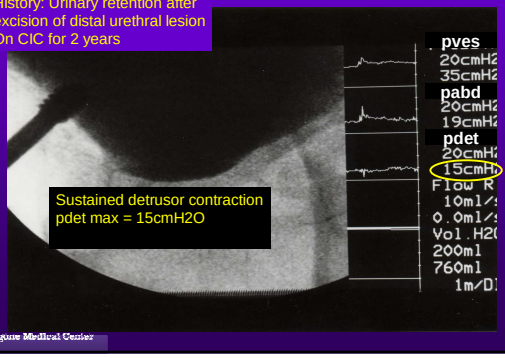
85 year old woman in urinary retention: obstruction or detrusor underactivity?

History: Urinary retention after excision of distal urethral lesion
On CIC for 2 years



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Dysfunctional Voiding

- Increased ext. sphincter activity during voluntary voiding (learned behavior)
- Presenting symptoms[1]
  - storage symptoms - 82%
  - UUI - 23%
  - ≥ 1 episode of AUR - 19%

1. Carlson, et al J Urol 2001;165:143-8

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Dysfunctional voiding cont'd

- UDS Findings[1]

Urodynamic Parameter	Mean	SD (range)
Bladder capacity (ml.)	303	122 (137–548)
End filling pressure (cm. water)	6.5	11.1 (1–50)
Qmax (ml./sec.)	10.4	6.2 (1–22)
pdetQmax (ml./sec.)	50.3	23.5 (11–102)
PVR (ml.)	103	120 (0–460)

1. Carlson, et al J Urol 2001;165:143-8

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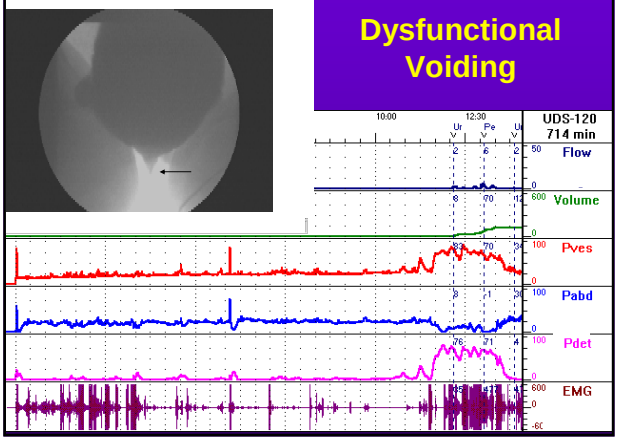
Dysfunctional Voiding



Case Study: 35 year old Female

- Urinary retention after diagnostic laparoscopy for infertility
  - Eventually voided with PVR = 25 ml
- Readmitted 1 week later with urinary retention and azotemia
  - Creatinine = 5.0 (normalized after Foley catheter)
  - Renal ultrasound – bilateral hydroureteronephrosis
- No prior urological or neurological history

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Case Study: 35 year old Female

- PE unremarkable
- Neurological work-up including MRI and spinal tap negative
- Creatinine normalized after Foley catheter placed

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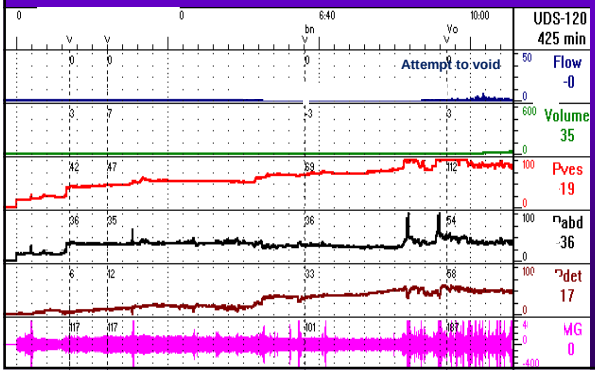
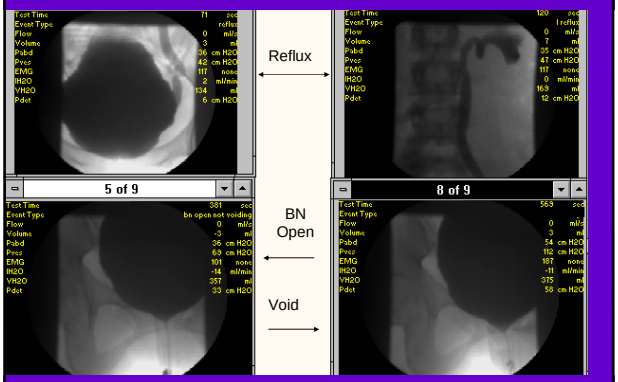
35 Year Old Female: Urodynamic Evaluation



35 Year Old Female



Primary BNO in Women

- Definition – failure of the BN open adequately during voiding, resulting in obstruction of urinary flow in the absence of:
  - other anatomic obstruction (e.g. POP, incontinence surgery)
  - increased striated sphincter activity
- Prevalence – 0.84 – 4.6% in women undergoing UDS (4.5-16% of women with BOO)[1,2]

1. Athanasopoulos et al Int Urogyn J 2009; 20:217-222
2. Nitti, et al J Urol 1999; 161:1535-40

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Primary BNO in Women

- Pressure flow parameters are more dramatic than in dysfunctional voiding
- Mean UDS values in 25 women with PBNO[1] (all obstructed by Blaivas-Groutz nomogram):
  - Qmax (non invasive) = 10.56 ± 0.92 ml/s
  - Qmax = 9.74 ± 1.60 ml/s
  - pdetmax = 99.72 ± 16.94 cmH2O

1. Athanasopoulos et al Int Urogyn J 2009; 20:217-222

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Case Study: 37 year old woman

- 1 year prior to presentation, found to have a distended bladder – asymptomatic retention
- On CIC 3-4 x/day, no spontaneous voiding since
- No neurological history or sx
- No chronic medical problems
- G0P0
- Physical exam unremarkable
- Renal ultrasound WNL
- BUN and creatinine WNL
- Cystoscopy and bladder bx's normal

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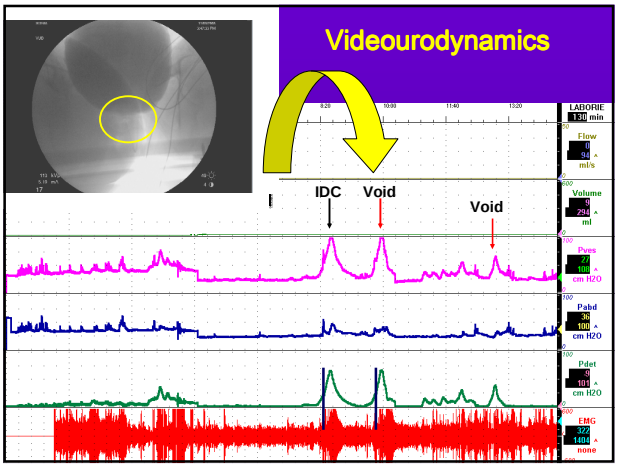
ICS

Videourodynamics



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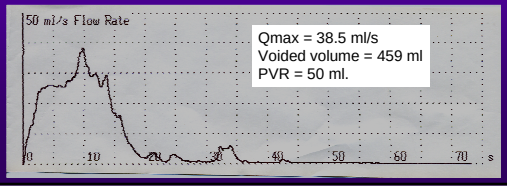

Conclusions

- Because pressure/flow parameters for obstruction and impaired contractility in females are not universal (and may never be because of the multitude of conditions that cause the problems) diagnosis must be made based on a number of factors including: history, physical exam, frequency/volume diaries, non-invasive testing, UDS and imaging.

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Case Study: 35 year old Female

- PE unremarkable
- Neurological work-up including MRI and spinal tap negative
- Creatinine normalized after Foley catheter placed

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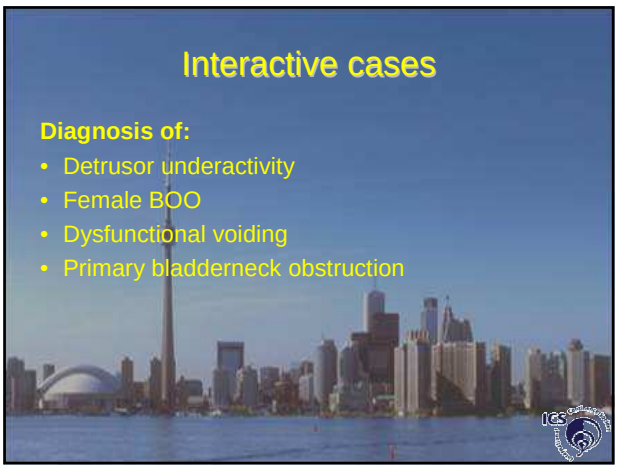
Interactive cases

Diagnosis of:

- Detrusor underactivity
- Female BOO
- Dysfunctional voiding
- Primary bladderneck obstruction



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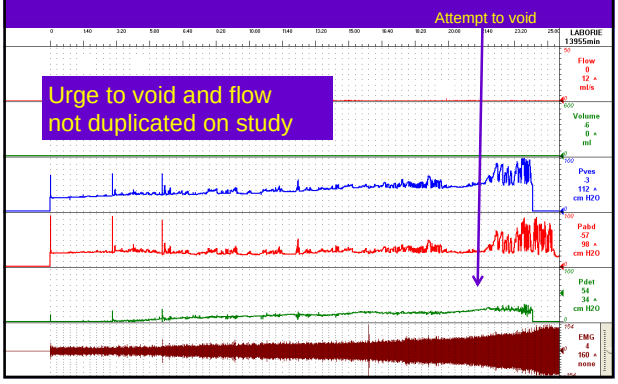

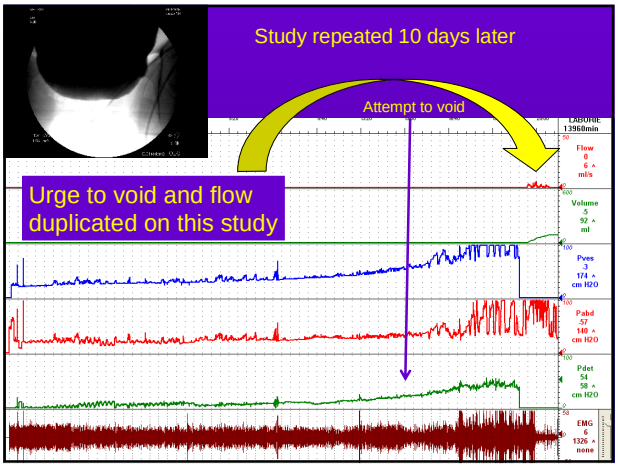

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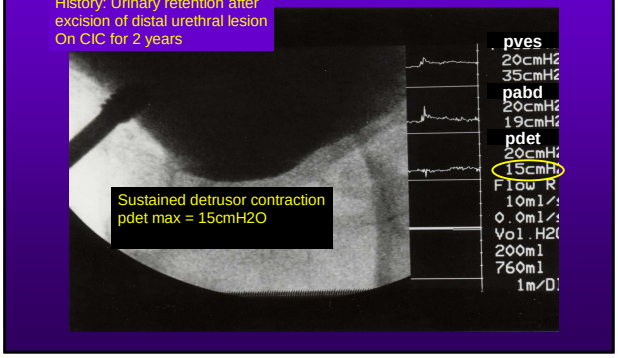
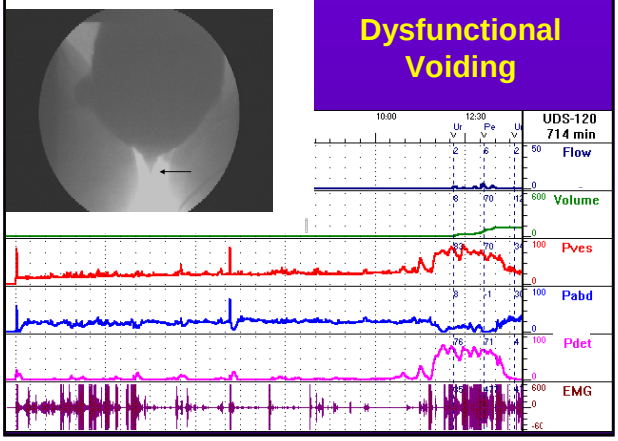


Dysfunctional Voiding



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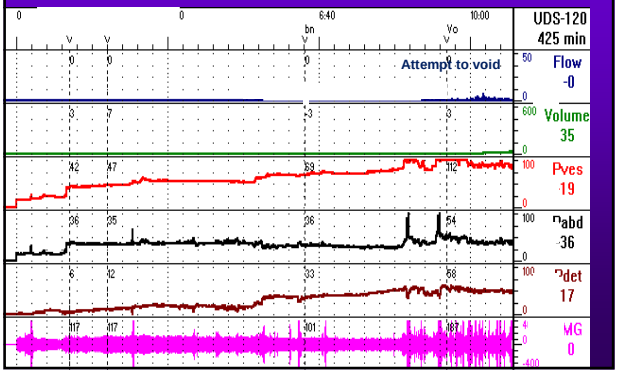
35 Year Old Female: Urodynamic Evaluation



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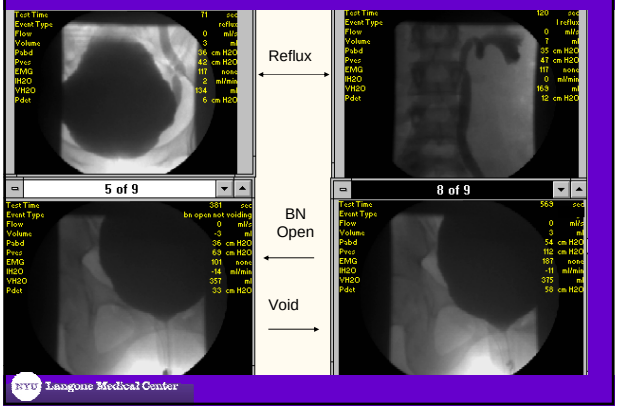

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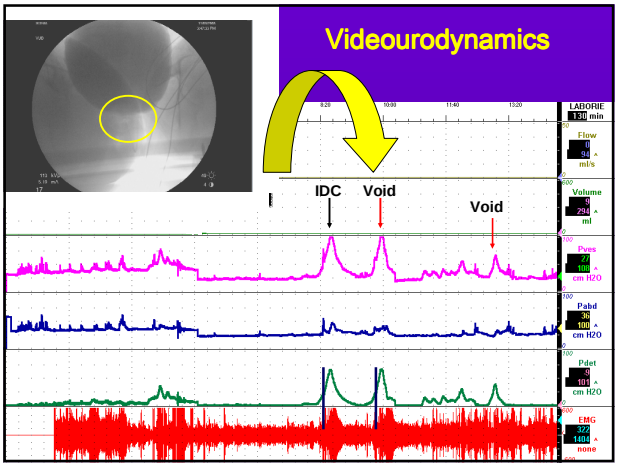

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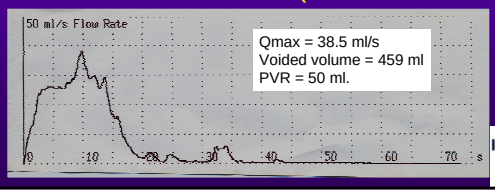

Questions:

- How many flowcurves do you need (recommend) to diagnose dysfunctional voiding?
- Is a (formal ICS- / urodynamical) definition of 'adult dysfunctional voiding' required?
- Can underactive detrusor result in a voiding pattern that 'looks' dysfunctional?

Management of ineffective voiding

Peter Sand

Clinical Professor of Obstetrics & Gynecology
Director, Division of Urogynecology
Director, Evanston Continence Center
NorthShore University HealthSystem
University of Chicago, Pritzker School of Medicine

Management of Ineffective Voiding

- Management Based on Underlying Voiding Dysfunction
- Urodynamic Voiding Pressure Studies with EMG Help Determine the Etiology of Retention and Paruresis

Management of Ineffective Voiding

- Retention vs. Obstructive Voiding
- May Relate to Severity of Underlying Pathophysiology
- Obstructive Voiding, Stranguria, Hesitancy Very Common in Women

Management of Ineffective Voiding

- **Neurogenic:**
  - Detrusor Sphincter Dyssynergia
  - Acontractile Detrusor
- **Idiopathic:**
  - Non-Neurogenic Neurogenic Bladder (Hinman Syndrome)
  - Failure of Pelvic Floor Relaxation
  - Underactive Detrusor

Detrusor Sphincter Dyssynergia

- **Establish Drainage**
- Clean Intermittent Self Cath (CISC)
- Indwelling Catheter
- Valved Catheter Devices

- **Chart Voids & PVRs**
- **Analyze Frequency of CISC**
- **Consider Pharmacotherapy**

Detrusor Sphincter Dyssynergia

- Pharmacotherapy
- Skeletal Muscle Blockade to Relax Sphincter
  - Baclofen 10mg TID & Titrate
- Use of Diazepam NOT Recommended
- Alpha Blockers may be tried

- Neuromodulation ?
- Spinal Nerve Reanastomosis?

Detrusor Sphincter Dyssynergia

- Neuromodulation ?
- Electrical
  - Sacral
  - Posterior Tibial
  - Dorsal Clitoral
- Chemical (Neurolytics)
  - Botox Sphincteric Injections
  - Effective for 3-6 months
  - Hypertonic Saline?

Acontractile Detrusor

- Establish Drainage
- Crede
- Double Voiding
- Decrease Outlet Resistence
  - Alpha Blockers
  - Skeletal Muscle Blockers
  - Botox Bladder Neck Injection

Non-Neurogenic Neurogenic Bladder

- **Hinman Syndrome**
  Probably Better Called “Failure of Pelvic Floor Relaxation” or “Failure of Urethral Relaxation”

Failure of Pelvic Floor Relaxation

- **Etiology**
- Sexual Trauma/Abuse
- Urethral Inflammation/ Atrophy
- Levator Myalgia/Syndrome
- **Key to Treatment**
- Relax Pelvic Floor Musculature

Failure of Pelvic Floor Relaxation

- **Treatment**
- Pelvic Floor Training/Education
- Myofascial Release
- Trigger Point Blocks
- "Biofeedback"
- Treatment of Concomitant Detrusor Overactivity
- Treatment of Urethral Inflammation
- Treatment of Urethral Atrophy

Underactive Detrusor

- Defined as a Detrusor Contraction that is not Strong Enough or of Long Enough Duration to Accomplish Bladder Emptying
- Probably a Misnomer as Detrusor Contractions may be Strong and Long
- Retention tends to be Partial and in the Same Range (100-300 ml)
- Acute Total Retention is Very Rare
- Fairly Common

Underactive Detrusor

Treatment:

- May Not be Necessary Unless Progressive or Associated with UTIs
- Double Voiding
- Reduction of Outlet Resistence
  - Alpha Blockers
  - Skeletal Muscle Blockers
  - Botox Bladder Neck Injection

Interactive cases:

Management of patients with:

- Detrusor underactivity
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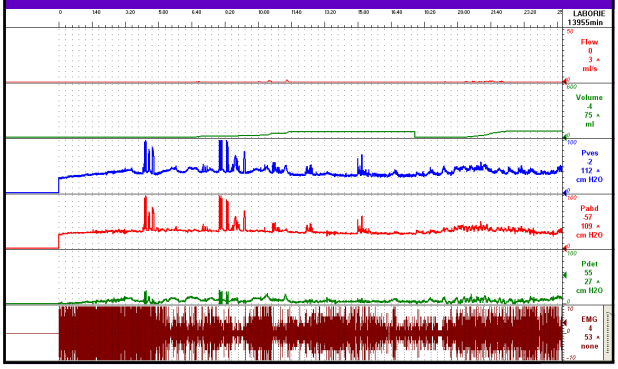
85 year old woman with incontinence and very large residual after hospitalization for a fall injury



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Usual symptoms recreated

IDC 's with leaks

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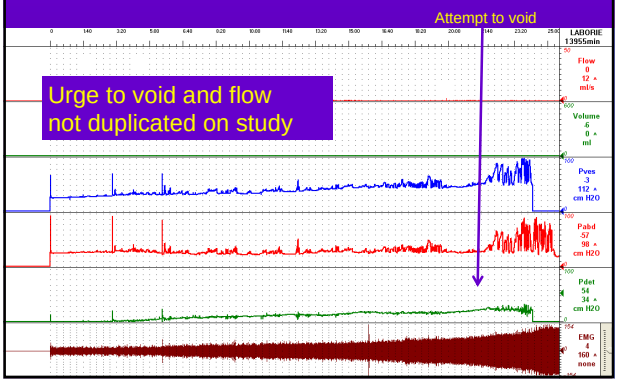

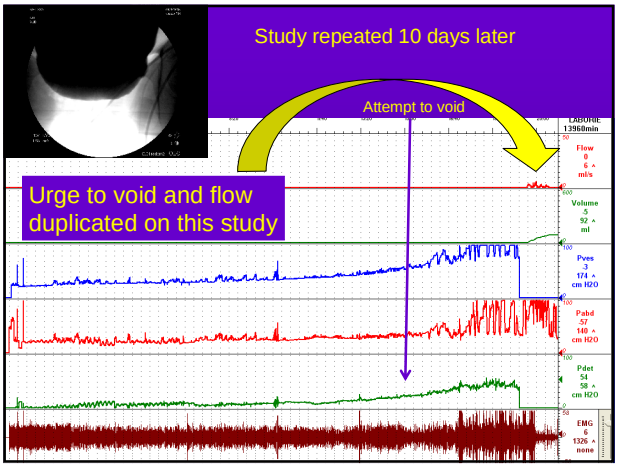

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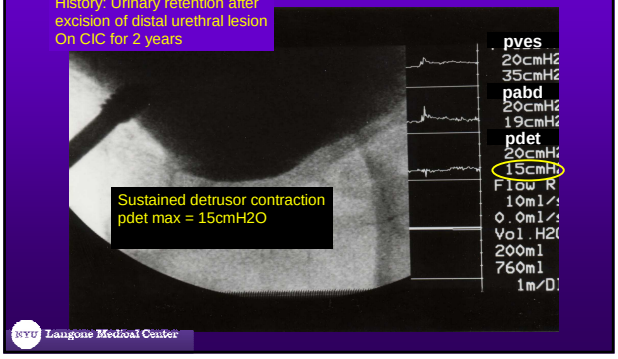

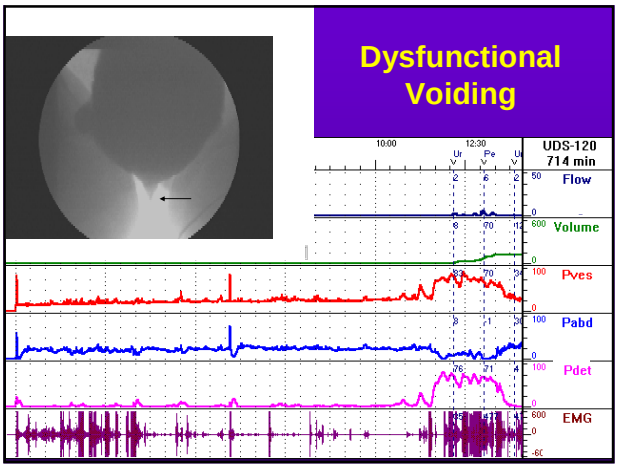

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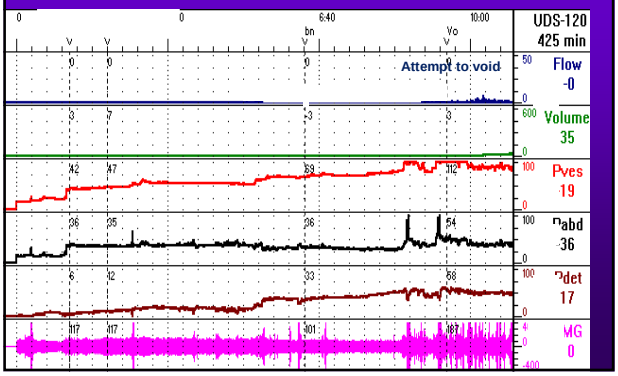

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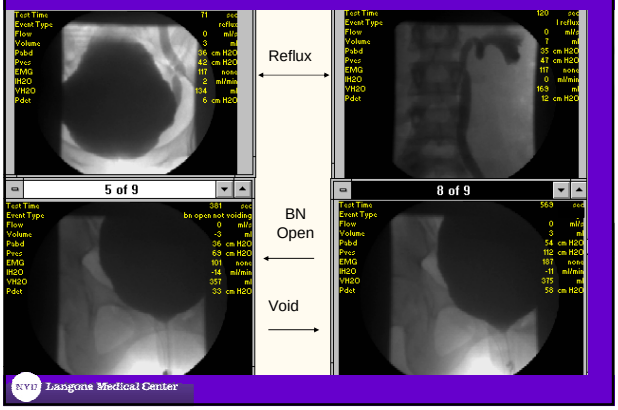

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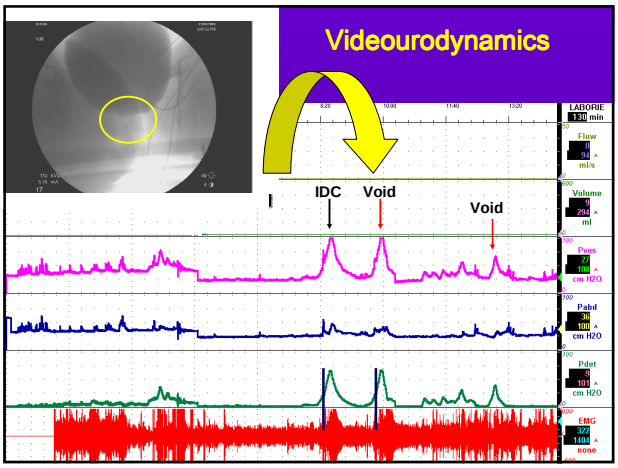

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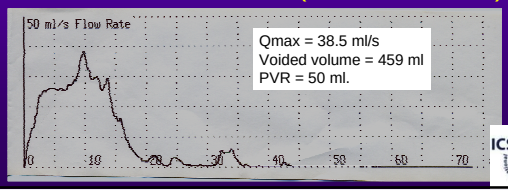

Questions:

- How do you treat and follow-up 'acute' female retention?
  - After delivery or surgery
  - After (inadvertent) catheter blocking to a large volume
- Is it possible to predict 'de novo' female voiding dysfunction after prolapse repair?
- Or after intervention for incontinence?
- How do you treat female 'static' BOO

Round Table Discussion:

- What is your score (00-10) for the value of the following 'parameters' to analyze female voiding?
- What will be in your guideline about the evidence of these parameters?

Parameter	Score
History	
Clinical exam	
Flow	
Detrusor pressure	
(xRay) Shape of bladder	
(xRay) Shape of outlet	
Postvoid residual	
EMG	

JOINT ANNUAL MEETING OF THE INTERNATIONAL CONTINENCE SOCIETY (ICS) AND INTERNATIONAL UROGYNECOLOGICAL ASSOCIATION (IUGA) 23 -27 AUGUST, 2010, TORONTO, CANADA

- Please do not forget the evaluation form!

- Best regards

Peter F.W.M. Rosier
Jan Groen, Victor Nitty Peter Sand