W10: Advanced Clinical Urodynamics

Workshop Chair: Werner Schaefer, United States

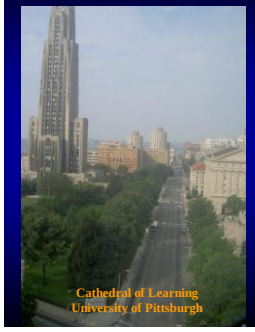
26 August 2013 14:00 - 18:00

Start	End	Topic	Speakers
14:00	14:15	Good Urodynamic Practice - Storage Function	• Werner Schaefer
14:15	14:30	CMG and Compliance	• Jeffrey Weiss
14:30	14:45	CMG with Assessing Urethral Pressure	• Werner Schaefer
14:45	15:00	CMG and Pain	• Christopher Payne
15:00	15:30	Panel Presentation of Clinical Cases and Discussion	All
15:30	16:00	Break	None
16:00	16:15	Good Urodynamic Practice - Voiding Function	• Werner Schaefer
16:15	16:30	Patterns of Voiding Dysfunction in Men and Women	• Jose Batista
16:30	16:45	Bladder Outflow Obstruction in Men	• Karl Kreder
16:45	17:00	Bladder Outflow Obstruction in Women	None
17:00	17:15	UDS in women with SUI and/or POP	• Christopher Payne
17:15	17:30	UDS in women with endometriosis and before and after radical surgery	• Montserrat Espuna
17:30	17:45	Urodynamics in Neurogenic Lower Urinary Tract Dysfunction	• Antony Stone
17:45	18:00	Role of Video Urodynamics in NGB	• Liao Limin
18:00	18:30	Panel Presentation of Clinical Cases and Discussion	All

Aims of course/workshop

This workshop will offer a comprehensive overview of urodynamics. Starting with ICS standards of Terminology and Good Urodynamic Practice, we then step by step present theory and practice, from the storage phase with “overactive bladder” symptoms and detrusor overactivity to voiding dysfunction in males and females, with outflow obstruction and/or detrusor underactivity, and finally neurogenic lower urinary tract dysfunction, including a whole range of actual clinical urodynamic examples.

Good Urodynamic Practice



Measurement strategies,

Quality control and identification & avoidance of artifacts

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Good Urodynamic Practice:
Uroflowmetry, Filling Cystometry, and Pressure-Flow Studies

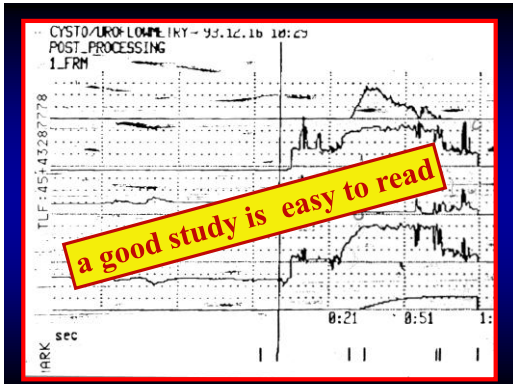
Werner Schäfer*, Arthur M.Sterling, Limin Liao, Anders Mattiasson,Francesco Pesce, Anders Spangberg, Norman R.Zinner, Paul Abrams, Philip van Kerrebroeck

Neurourology and Urodynamics 21/3:261-274 (2002)

or on the www.ICSoffice.org website under documents

SchaeferW@dom.pitt.edu

and also you can watch the webcast on ICS website



The aim of clinical urodynamics is:

- to reproduce symptoms under the condition of in order
- to identify the underlying causes for the symptoms.....

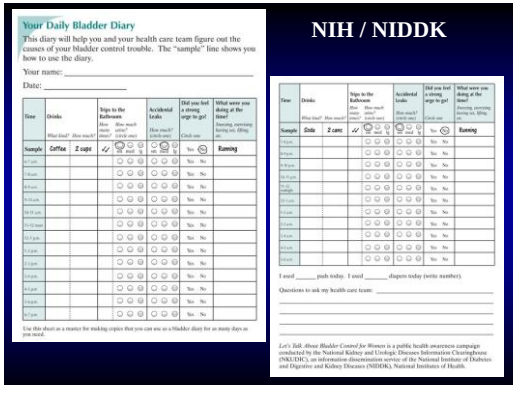
Urodynamics is the key to:

- understanding symptoms & LUT function
- provide methods for assessment/measurement
- developing better and less invasive methods
- developing pertinent precise terminology
- understanding clinical relevance
- developing and testing optimal therapies

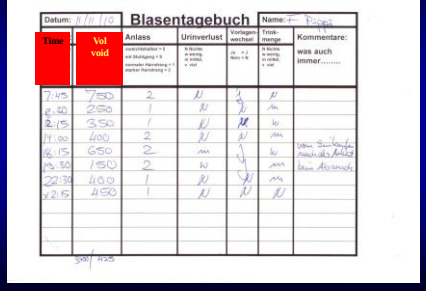
Micturition Time Chart: this records only the times of micturitions, day and night, for at least 24 hours.

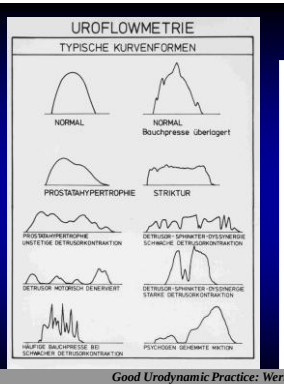
Frequency Volume Chart (FVC): this records the volumes voided as well as the time of each micturition, day and night, for at least 24 hours.

Bladder Diary: this records the times of micturitions and voided volumes, incontinence episodes, pad usage and other information such as fluid intake, the degree of urgency and the degree of incontinence



Polyuria, no frequency, large bladder





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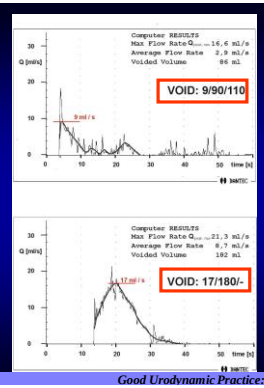

Physiological model and technical limitations:

The limited accuracy and the physiology of micturition suggests to exclude high frequencies and to smooth the flow rate curve.

This can have a strong impact on the maximum flow rate value

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ICS Standardization **"GOOD URODYNAMIC PRACTICE, GUP"**

RECOMMENDATION:

We recommend to report the voiding function by: maximum flowrate with volume voided and post-void residual volume in the format:

VOID = $Q_{max}/V_V/V_{RU}$

Q_{max} rounded to full number, e.g. 11 ml/s, and the volumes rounded to the nearest 10 ml, e.g. 320 ml, or 90 ml.

e.g.: VOID = 11/320/90

Undetermined values are substituted by a hyphen -, e.g. VOID = 11/320/-

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Good Urodynamic Practice

- patients history, understand symptoms
- clinical investigation, understand problem

- define the ***urodynamic question***
- identify suitable urodynamic test(s)
- perform study adequately until you can
- give the ***urodynamic answer***

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The Urodynamic Questions

Storage Dysfunction:
VD = (voided) Volume, Frequency, Leakage & Sensation
UD = pressure, compliance, involuntary detrusor contraction (DO?); unvoluntary sphincter relaxation; urethral closure pressure

Voiding Dysfunction:
VD = voided Volume, Frequency, Leakage & Sensation
non-invasive UD = uroflow, sono post-void residual (PVR)
UD = pressure/flow-relationship; Bladder Outflow Conditions (BOO? anatomical, functional); Detrusor Contractility (normal, poor?)

Good Urodynamic Practice

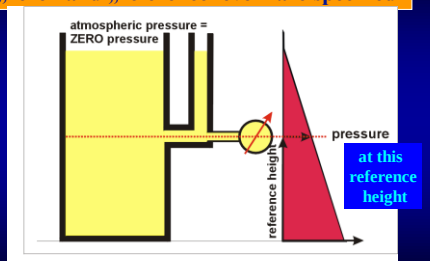
detrusor pressure, p_{det}

***p_{det}** is the most relevant parameter to understand bladder function, and is defined as:*

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

We can only subtract pressures recorded to the same zero and reference level

A fluid pressure is only then defined when „zero“ and „reference level“ are specified



Good Urodynamic Practice

Signal Quality Control

- **pressure cannot be negative anywhere in the urinary tract**
- **pressure depends on patient´s position** *(hydrostatic component)*
- **pressure is never perfectly constant**
- *("live" signal show fine structure - "noise")*
- **smooth changes from smooth muscle**
- **rapid changes from striated muscle**
  - *(but never step-like changes)*

Good Urodynamic Practice

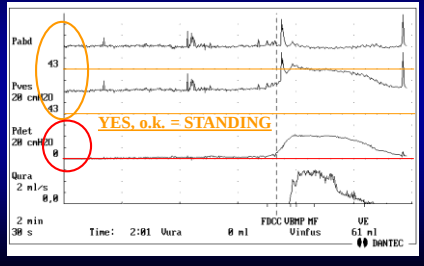
Typical Signal Values

***Initial** ("resting") pressures pves and pabd depend on patients´ position* *(and size and weigth)*:

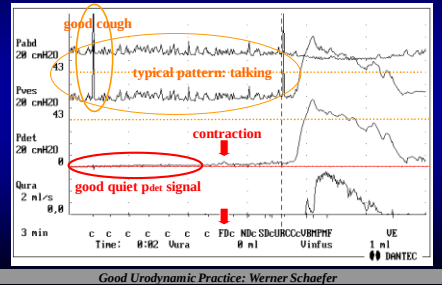
supine: 5-15 cmH_2O
sitting: 10-30 cmH_2O
standing: 25-50 cmH_2O

- ***initial** ("resting") **detrusor** pressure is close to zero (p_{det} = 0-5 cmH_2O)*

First steps: data plausibility and quality control
1) realistic initial resting values?
2) typical pattern for pves,pabd and pdet?



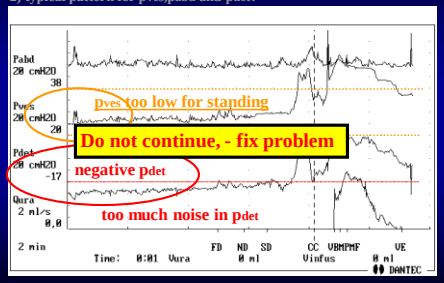
Data plausibility and quality control
1) realistic initial resting values? Yes = pt standing
2) typical pattern for pves,pabd at cough and when pt is talking, - pdet quiet.



Data plausibility and quality control

1) realistic initial resting values? NO= pves too low for standing pt. - results in negative pdet

2) typical pattern for pves,pabd and pdet?



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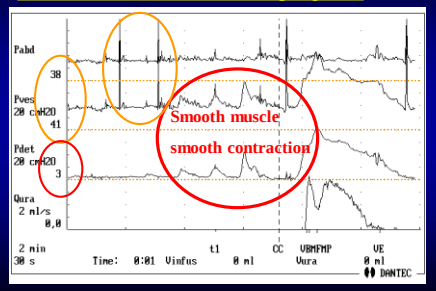
Plausibility and quality control

1) realistic initial resting values? YES

2) typical pattern for pves,pabd and pdet? YES: typical unstable contractions with increasing amplitude



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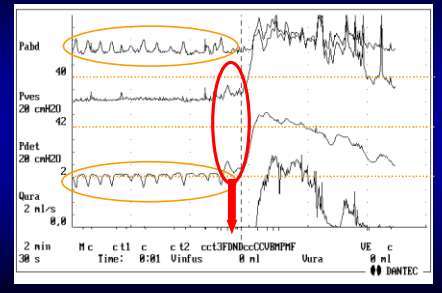
Plausibility and quality control

1) realistic initial resting values?

2) typical pattern? Yes, rectal activity and detrusor instability?



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Good Urodynamic Practice

- **Continuous Conscientious Observation** with determination of
- **Qualitative** *(signal pattern)* &
- **Quantitative** *(typical values)*

Plausibility checks

while the signals are recorded

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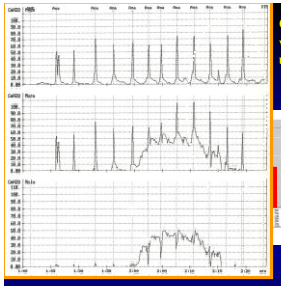
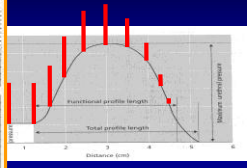


classical artefacts in pura

with „cough"-signals in distal urethra or even outside the urethra



These unavoidable artefacts in the Stress-UPP can be explained - but not corrected.

Stress-UPP, „pressure transmission", et cetera are not/hardly interpretable!

Biomechanics of Continence Function

Conclusions:

1) Measure pves/pabd and pura
2) Measurement of pura at rest shows the strenght of bladder closure
   without stress, =
   thus also without incontinence
3) Measurement under load/stress, - when incontinence occurs,
   or actually we should measure the impact of stress on bladder closure function!
4) Measurement of pura
   under slow load/stress difficult,
   under fast load/stress not possible!

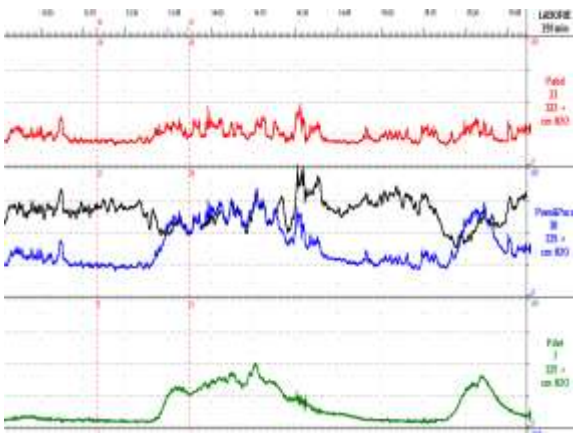
Urodynamics Workshop BARCELONA ICS 2013

Hand-out print: Werner Schaefer

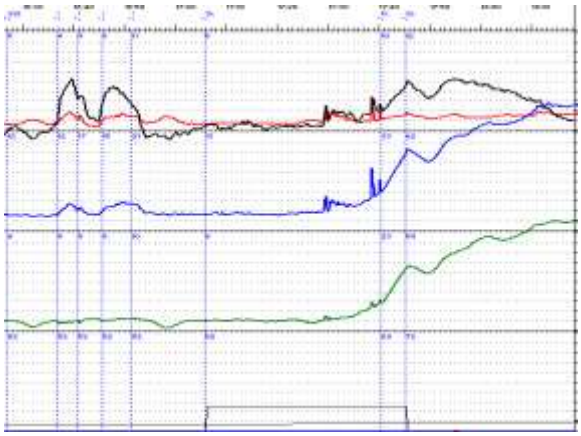
1) Good Urodynamic Practice – Storage Function will refer to the published ICS Guidelines

2) CMG with Assessment of Urethral Pressure

Filling cystometry is the standard urodynamic examination (UDS) to study bladder storage function e.g. in patients with overactive bladder (OAB) symptoms. Attention is on detection of involuntary detrusor contraction, labeled detrusor overactivity (DO), as the urodynamic correlate of urgency and the presumed cause of urge incontinence (UUI). However, the rate of DO observation (approx. 50%) as well as the correlation between urodynamics and OAB symptoms has been poor. Obviously in this standard urodynamics the sphincter function is widely ignored. For some time now we are combining the measurement of detrusor pressure with urethral closure pressure. We use a triple lumen 7 F transurethral catheter for filling and recording of intravesical (pves) and urethral pressure (pura) with the Brown/Wickham technique, and a rectal balloon for abdominal pressure recording. After the maximum urethra pressure had been established by repeated urethral pressure profiles (UPP) the catheter was positioned and fixed via a holder to record pura,max continuously during bladder filling. There are some technical challenges. Only during the initial filling phase of our study with the patient in a stable immobile position it is possible to record a reliable pura,max including performing potential controls for artifacts. During this resting period it is difficult to elicit urgency with DO and UI, which limits the number of our reliable recordings of changes in detrusor and urethral pressure. Variations in urethral pressure were observed more frequently without any detrusor pressure changes. DO was always accompanied by a decline in pura which often started before any detrusor pressure increase could be observed. Almost all patients could inhibit the involuntary detrusor by voluntary sphincter contraction.



Detrusor contraction with drop in urethral pressure, detrusor inhibition by sphincter contraction.



Patient with good sphincter control cannot inhibit the involuntary detrusor contraction.

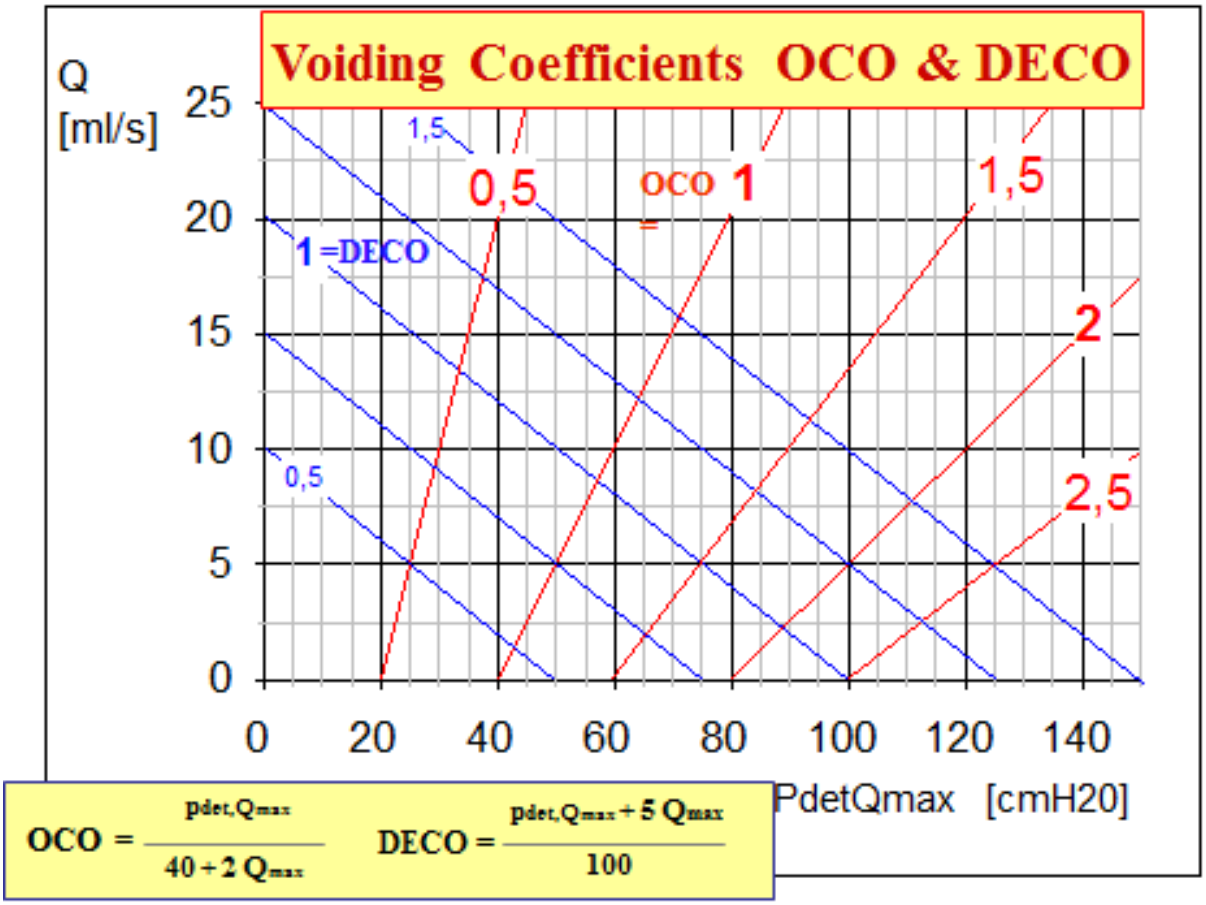
It is not always possible to establish a clear sequence of events, as the time differences are small. While it is reasonable to assume that the pura will immediately drop when the sphincter relaxes, it is not clear how fast a pressure rise will be detectable after the detrusor starts contracting. Nevertheless, an increase of detrusor activity occurs with a decrease in sphincter activity and all these patients can inhibit the detrusor by voluntary sphincter contraction. The term “detrusor overactivity” is clearly misleading here when a detrusor contracts while the sphincter relaxes and when a detrusor is inhibited when a sphincter contracts. This in fact appears to reflect more a “normal” detrusor activity, as seen during voiding. When it occurs involuntarily is it not more active as during voluntary voiding and thus is adequately described by the old term “involuntary detrusor contraction” but not by “detrusor overactivity”. Only a very small number of patients show

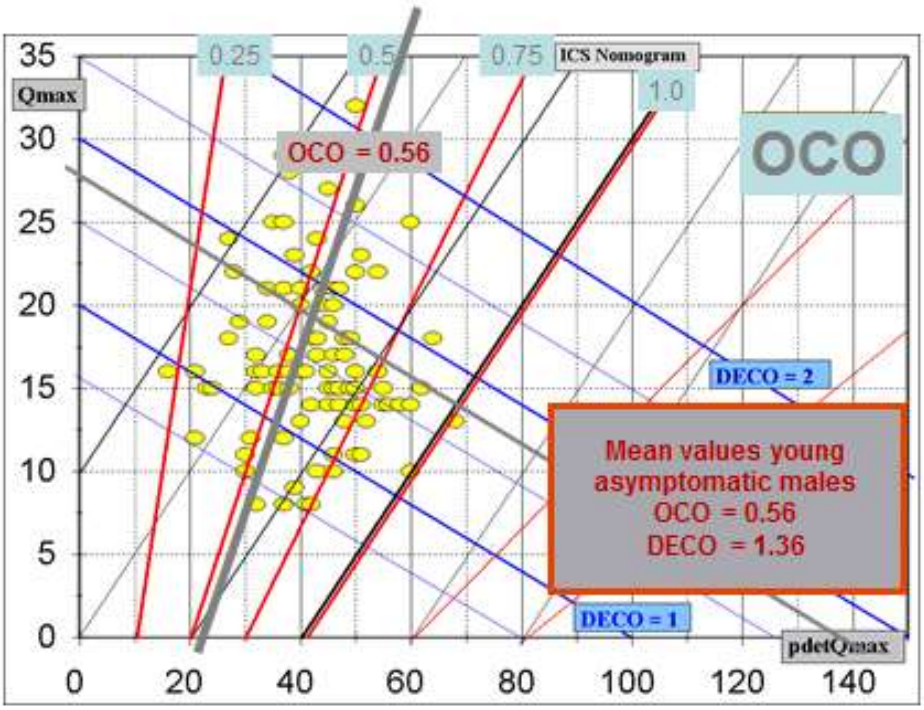
prolonged detrusor contraction which cannot be inhibited by even a strong sphincter contraction. Such a behavior may be suitably described as DO, and is currently described as “terminal DO”. However, the usual “phasic DO” by itself actually reflects the fact that detrusor activity starts involuntary but can be inhibited. Taking into consideration that this involuntary detrusor contraction may be initiated or at least is associated with sphincter relaxation, the use of the term “detrusor overactivity, DO” is clearly misleading. This urodynamic pattern rather shows a lack of central control properly described by the term “involuntary”.

Concluding message

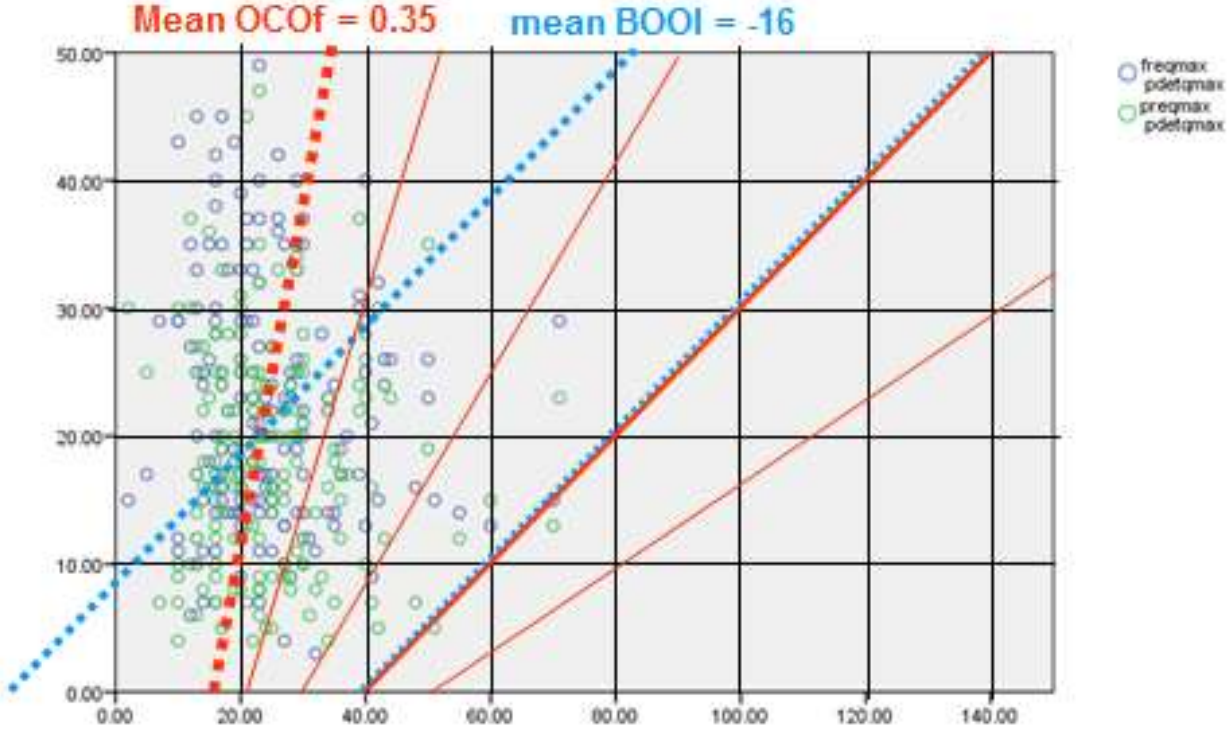
Comprehensive urodynamics in patients with urgency and urge incontinence shows that these findings cannot be adequate described by our current standardized terminology. In the vast majority of patients there is no urodynamic proof that the detrusor is “overactive”. This indicates that our current terminology as well as popular pathophysiologic concepts which have led to this terminology need to be reconsidered.

3) Good Urodynamic Practice – Voiding Function will refer to the published ICS Guidelines plus recent modifications and updates, using the Schaefer Nomogram with Coefficients





Women > 60 y with UUI, 300 voids



mean opening pressure: measured 15.9 cmH2O; OCO = 14.9 cmH2O; BOOI = - 16 cmH2O

Bladder Compliance

Jeffrey P. Weiss, MD, FACS

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Urodynamic Diagnoses associated with Upper Tract Deterioration

- Detrusor overactivity
  - Neurogenic
    - Detrusor-sphincter dyssynergia
  - Nonneurogenic
- Low bladder compliance
- Urethral obstruction

Stress Incontinence in Men

- Intrinsic Sphincter Deficiency (3 Major Causes):
- 1. post-prostatectomy
- 2. post-abdominoperineal resection
- 3. neurologic conditions (Shy-Drager, thoracolumbar spinal cord lesions)
- Diminished bladder compliance

Low Bladder Compliance

- Normally during bladder filling at physiologic rates, detrusor pressure remains nearly constant because of accommodation
- Accomodation is due to the vesicoelastic properties of the bladder, based on its composition of smooth muscle, collagen, and elastin.
- When accommodation is impaired, low bladder compliance ensues.

Bladder compliance

- Defined as $\Delta V / \Delta P$
- Normal is >20 ml/cm H2O
- Low compliance seen in radiation cystitis, post radical prostatectomy, chronic indwelling catheters, myelomeningocele, chronic bladder outlet obstruction

Bladder compliance: Risk factors

- Seen in a variety of neurologic conditions
  - Especially lower motor neuron lesions
- Bladder wall fibrosis such as after multiple bladder and/or pelvic surgeries
- Bladder outlet obstruction
- Radiation cystitis

Bladder compliance: Consequences

- LUTS
- Stress, unaware incontinence
- Hydronephrosis
- Renal failure

Causes of Low Bladder Compliance

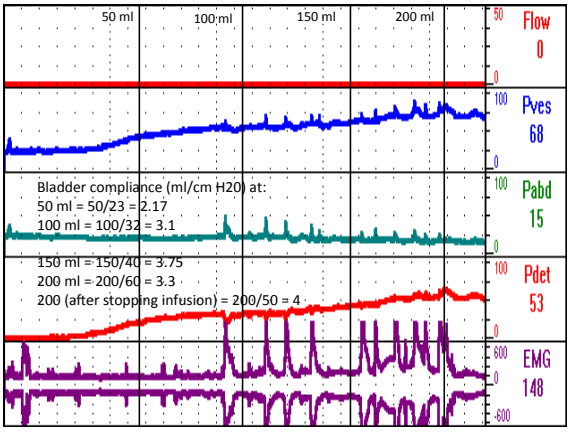
- I. Neurogenic
  - Myelodysplasia
  - Shy-Drager Syndrome
  - Suprasacral spinal cord injury/lesion
  - Radical hysterectomy
  - Abdominoperineal resection of the rectum

Causes of Low Bladder Compliance

- II. Non-Neurogenic
  - Bladder outlet obstruction
  - Multiple bladder surgeries
  - Chronic cystitis (interstitial, radiation, tuberculous)
  - Chronic indwelling catheter

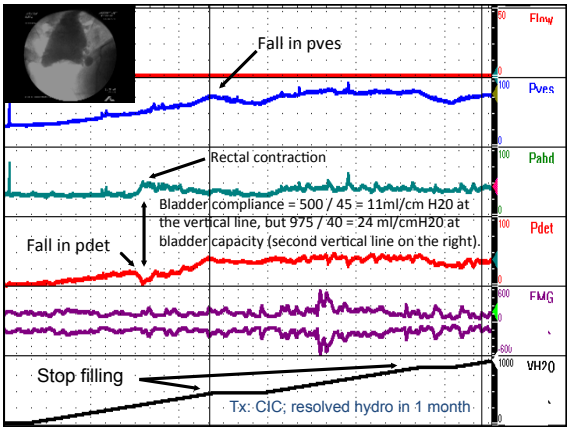
Low bladder compliance in a 43 year old paraplegic (T10 – 11) 11 years after injury.

- Managed by a condom catheter and intermittent catheterization BID (He was advised to catheterize himself at least 4 times a day, but refused because of social reasons).
- He has bilateral hydronephrosis and chronic pyelonephritis.



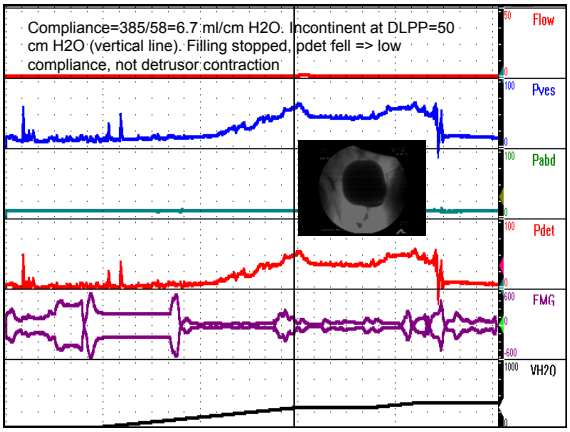
Effect of volume on compliance

- Low bladder compliance in an 86 year old man with a long history of LUTS (urinary frequency Q2H, daily urgency and urge incontinence).
- Upon referral, he had a palpable bladder and was catheterized for over two and a half liters and taught intermittent self-catheterization.
- Renal and bladder ultrasound showed bilateral hydronephrosis and a huge bladder.
- He had been treated empirically for years with doxazosin for "prostatism."

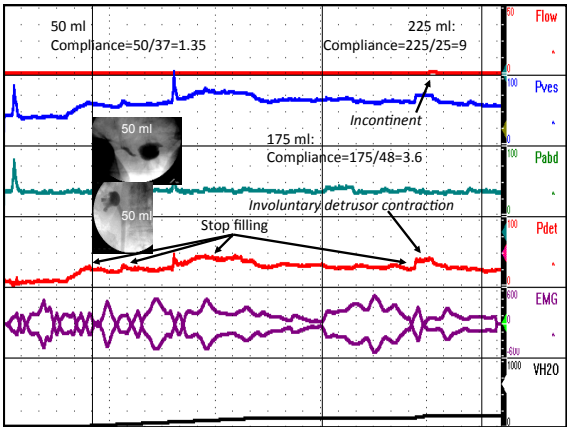


Low bladder compliance in a 60-year-old man 3 months after APR

- Treated with foley catheter ever since failing multiple voiding trials



Low bladder compliance in a 70 year old woman who underwent multiple surgeries after she developed a colovesical and vesicovaginal fistula after synthetic pubovaginal sling.

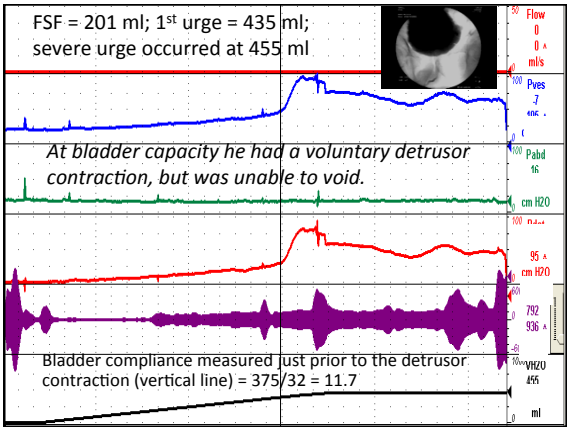


Low bladder compliance due to longstanding Schafer grade 5 prostatic obstruction

- 57-year-old man referred because of "voiding dysfunction" of at least 20 years duration.
- Chief complaint: "weak stream, incomplete emptying and it's getting worse...and if I don't do something, it could get very serious," or so he's been told by his doctors.
- Ordinarily voids every two hours during the day and has nocturia x1.

Low bladder compliance due to longstanding Schafer grade 5 prostatic obstruction

- Usually has to push and strain to void.
- AUA symptom score is 22.
- Prior Rx: a variety of alpha adrenergic antagonists without effect.
- Multiple bladder diaries:
  - MVV = 180 ml
  - 24 hour volumes ranging from 1200 – 1500 ml.
  - Qmax = 3 ml/S
  - PVR = 350 ml.



Case Studies in Bladder Compliance

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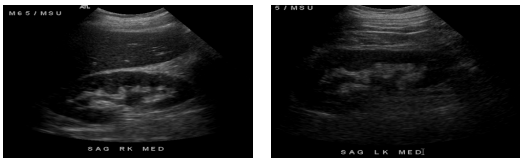
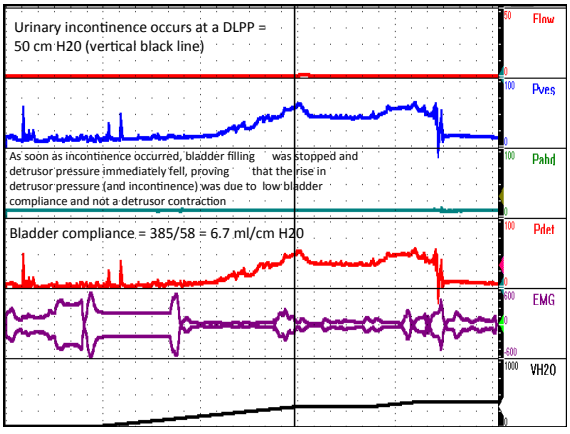
Case: Low bladder compliance

- Low bladder compliance in a 60-year-old man 3 months after AP resection of the rectum
- Bilateral hydronephrosis
- He' d been treated with a Foley catheter ever since failing multiple voiding trials

Case: Low bladder compliance

Bilateral hydronephrosis





Case: Low bladder compliance

- Xray obtained at pdetmax shows leakage of contrast into the urethra, but no voiding or incontinence
- Tx: CIC, anticholinergics, "tincture of time"

PV, 75 yo retired tailor

- History: Frequency, urgency, straining, nocturia x3
- S/P XRT for B2 Gleason 4, PSA 6.2, CaP; PSA 29, 8 yrs after XRT
- AUA Sx Score: 30

PV, 75 yo retired tailor

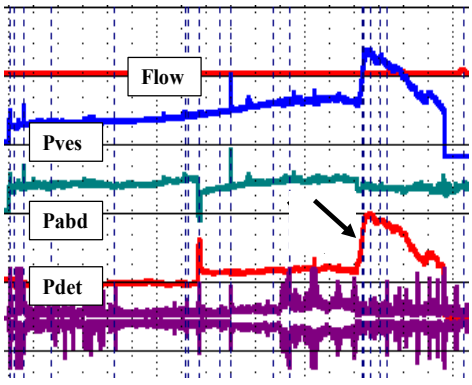
- Prostate exam: 15 grams, hard
- NeuroUro: Normal
- Labs: PSA 29
- Uroflow: Qmax = 6 ml/sec; voided volume = 215 ml; pattern: plateau
- PVR = 0 ml

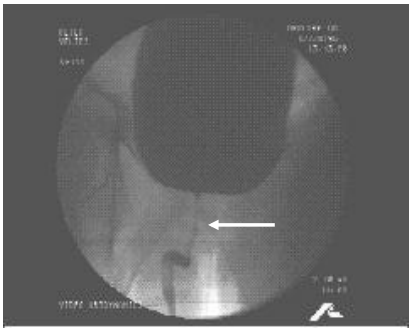
PV, 75 yo retired tailor

- Cystoscopy: Prostate appears nonobstructive; prostatic mucosa reveals spidery vessels; similar appearance to bladder mucosal vasculature with otherwise pale mucosa.

PV, 75 yo: Initial Voiding Diary

24 hour voided volume	2430 ml
Usual voided volume	150 ml
Functional bladder capacity (FBC)	240 ml
Awake hours: # voids	10
Sleep hours: # voids	3
Nocturnal urine volume (NUV)	780 ml
Nocturia index (NUV/FBC)	3.25
Nocturia polyuria index (NUV/Total)	32%
NBC index	0





PV: Videourodynamic Data

Qmax	**1 ml/sec**
Pdet Qmax	**109 cm H2O**
Capacity	**433 ml**
PVR	**25 ml**

PV: Urodynamic Dx

- Prostatic obstruction due to locally advanced adenocarcinoma
- Tx: Lupron + Casodex

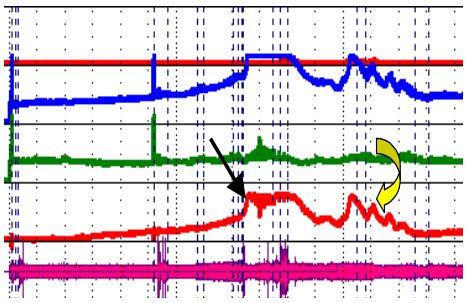
PV: Followup

- 1 year later: AUASS = 10 (was 30), noct x3, PSA = 0.44
- 2 years: PSA = 0.12, AUASS = 14, nocturia x2
- 2 1/2 years: PSA = 0.75, AUASS = 9, nocturia x2, Qmax = 14.2 ml/sec
- 3 years: PSA = 22.3, AUASS = 30

PV: Voiding Diary Lupron + 3 years, XRT + 11 years

- 24 hour voided volume 2250 ml
- Usual voided volume 150 ml
- MVV 270 ml
- Awake hours: # voids 13
- Sleep hours: # voids 3
- Nocturnal urine volume (NUV) 735 ml
- Nocturia index (NUV/FBC) 2.7
- NUV/Total 33%
- NBC index 1

PV: Followup UDS



PV: Followup UDS Data

Qmax	1.7 ml/sec
PdetQmax	61.4 cm H2O
Capacity	349 ml
PVR	142 ml

PV: Followup UDS Dx

- Diminished bladder compliance
- Prostatic obstruction

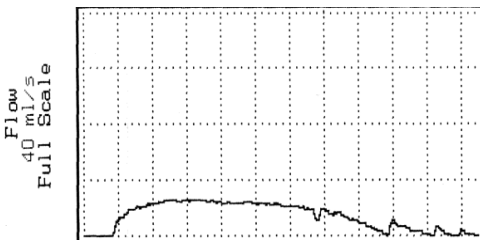
PV: Followup Clinical Dx

- Radiation-induced bladder scarring
- Recurrent prostatic obstruction due to hormone-refractory adenocarcinoma + underlying radiation prostatitis

PV: Followup Treatment

- tamsulosin 0.4 mg po daily

PV: Followup Uroflow

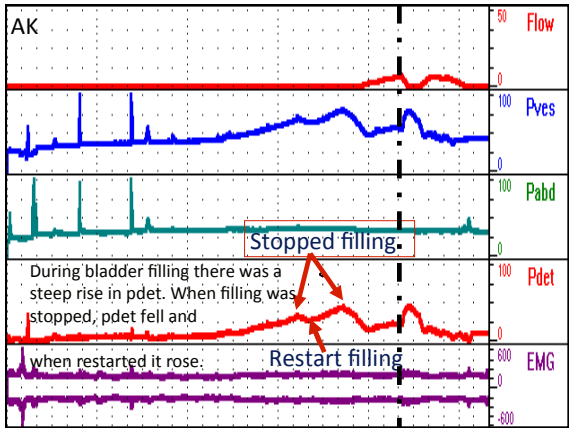


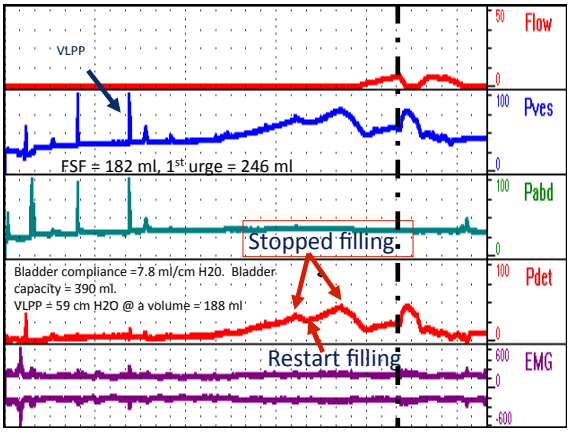
PV: Voiding Diary tamsulosin + 3 Months

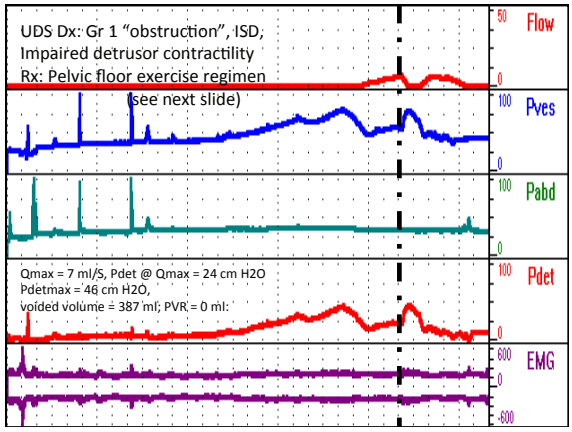
- 24 hour voided volume 2580 ml
- Usual voided volume 240 ml
- MVV 360 ml
- Awake hours: # voids 10
- Sleep hours: # voids 2
- Nocturnal urine volume (NUV) 780 ml
- Nocturia index (NUV/FBC) 2
- NUV/Total 30%
- NBC index 1

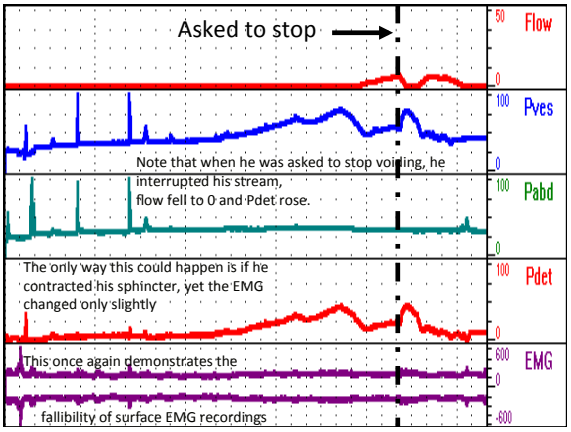
Post-prostatectomy sphincteric incontinence and low bladder compliance

- 75 year old man who underwent radical retropubic prostatectomy three years earlier
- He developed postoperative stress incontinence immediately after removal of the catheter, but never underwent Tx for this







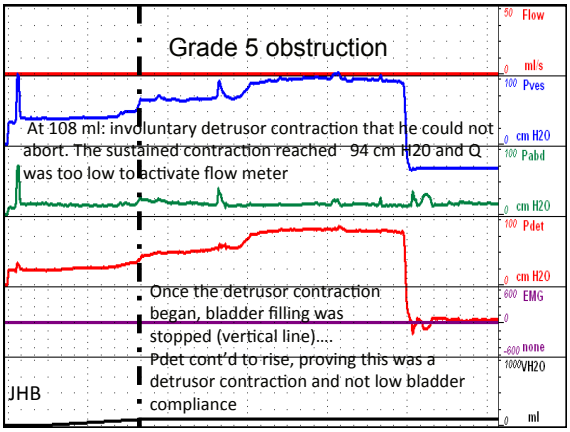


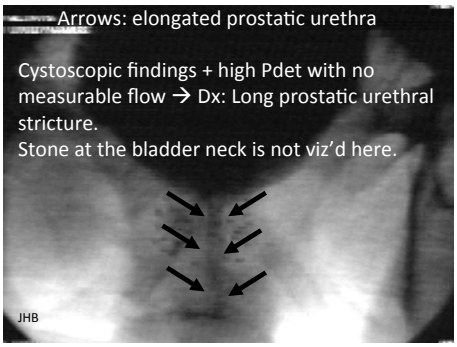
Prostatic stricture and stone after brachytherapy for prostate cancer: Distinguishing low compliance from detrusor overactivity

- 77-year-old man who underwent brachytherapy 10 years ago because of T1c prostate cancer.
- He developed incontinence and 1 ½ years ago underwent TUR bladder neck contracture. Since then, the incontinence worsened.
- He's never able to void easily "I can squirt about a tablespoon full and then I do that over and over again." Ordinarily voids every hour during the day.

Prostatic stricture and stone after brachytherapy for prostate cancer

- Wears pads day and night and they are usually soaked.
- He was empirically treated with Ditropan and found that made it even more difficult to void.
- Cystoscopy showed a tight bladder neck contracture with an adherent stone.
- Subsequent to this study, he underwent KTP laser ablation of the stricture and removal of stone. Thereafter, he had severe sphincteric incontinence





PM, 75 yo man

- Chief complaint stress + urge incontinence, nocturia x2-3
- S/P radical retropubic prostatectomy for stage B2 adenocarcinoma prostate Gleason 4 in November,1991
- Implantation of AUS 3/1/93 using a 4.5 cm cuff at 61-70 cm H2O

PM, 75 yo man

- Recurrent incontinence lead to replacement of the pressure regulating balloon (71-80 cm H2O), 9/93
- 4.5 cm cuff was downsized to 4.0 cm 1/18/94
- 1994 and 1998: Mild sphincteric incontinence managed with one pad per day

PM, 75 yo man

- Nocturia (due to third spacing in the legs accompanied by nocturnal polyuria) was his greater complaint, treated with afternoon diuretics, compressive lower extremity garments and a transient course of DDAVP

PM, 75 yo man

- Worsening incontinence due to intrinsic sphincter deficiency plus low bladder compliance in 1998 resulted in placement of a tandem (second 4 cm) cuff 11/98

PM, 75 yo man

- Subsequently: Incontinence has remained unchanged, most of his incontinence occurring after a 4 PM dose of lasix 40 mg.
- Anticholinergics and alpha agonists failed to impact his incontinence

PM, 75 yo man

- PSA: 0
- AUA Sx Score: 20
- Qmax = 20 ml/sec
- VV = 215 ml
- PVR: 23 ml

PM, 75 yo man

- Rectal exam: Empty prostatic fossa
- Cystoscopy: Bulbar urethral ‘tic between tandem cuffs.

PM, Diary

- 24 hour voided volume = 1440 ml
- Usual voided volume = 120 ml
- FBC = 240 ml
- Awake hours: # voids = 11
- Sleep hours: # voids = 2

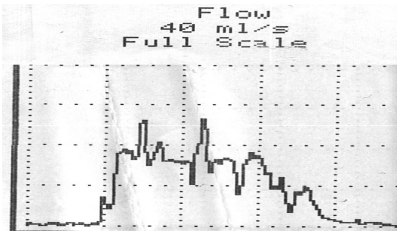
PM, Diary

- Noct. volume (NUV) = 240 ml
- Nocturia index (NUV/FBC) = 1
- NUV/total = 17%
- NBC index = 2

PM, Pad test

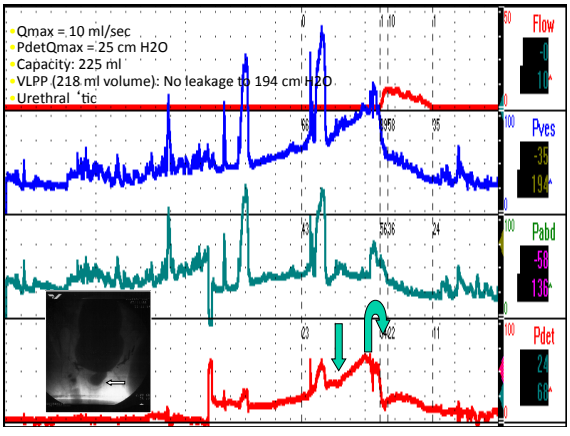
- 40 grams urine loss/24 hours

PM, S/P RRP: Qmax = 20 ml/sec



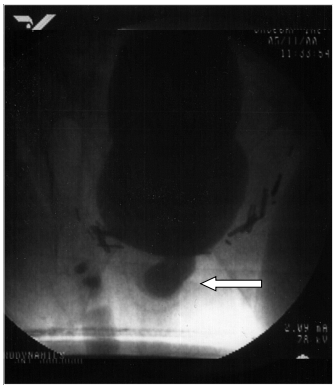
PM, Comment

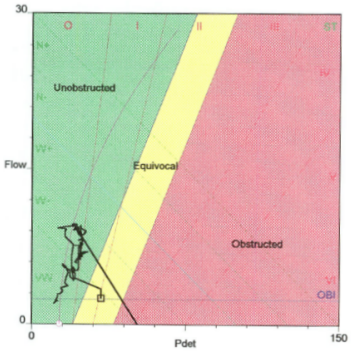
- PM has had extensive medical and surgical treatments for intrinsic sphincter deficiency
- Despite these efforts, he remains wet, while his nocturia has responded to measures focussing upon his third spacing (edema state) and secondary nocturnal polyuria



PM:UDS Data

- Qmax = 10 ml/sec
- PdetQmax = 25 cm H2O
- Capacity: 225 ml
- VLPP (218 ml volume): No leakage to 194 cm H2O
- Urethral 'tic





PM, 75 yo man

- Urodynamic Dx: Low bladder compliance

PM, Comment

- Despite lack of leakage with catheter in place and while in seated position during UDS, patient had obvious stress incontinence upon removal of the catheter, with a full bladder and while standing

PM, Comment

- Urodynamic demonstration of low bladder compliance + observed stress incontinence suggests subsequent treatment must impact both his urethra and bladder

PM, Rx

- 10/2000: Replacement double cuffs with single 4.5 cm cuff using tunica albuginea anteriorly; concurrent repair urethral diverticulum

PM, Followup

- Patient transiently continent
- Currently has severe stress incontinence…? Role of low bladder compliance
- Future….?? Continent diversion vs no additional Tx

Discussion

CMG with Urethral Pressure

Werner Schaefer
Continence Research Lab
Division of Geriatric Medicine,
University of Pittsburgh, Pittsburgh PA USA

University of Pittsburgh
affiliated with
University of Pittsburgh Medical Center

Bladder Storage Dysfunction: *(ICS 2002)*

Symptoms OAB + Urodynamics DO

***Urgency* is the complaint of a sudden compelling desire to pass urine which is difficult to defer**

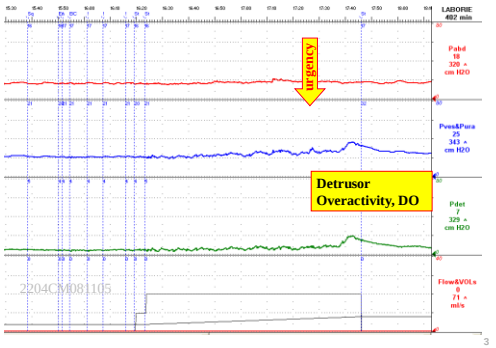
Urgency, with or without urge incontinence, usually with frequency and nocturia, can be described as the **overactive bladder syndrome**, **urge syndrome** or **urgency-frequency syndrome**.

These symptom combinations are suggestive of urodynamically demonstrable **detrusor overactivity** …

***Detrusor overactivity incontinence* is incontinence due to an involuntary detrusor contraction. … with normal sensation, urgency is likely to be experienced just before the leakage episode.**

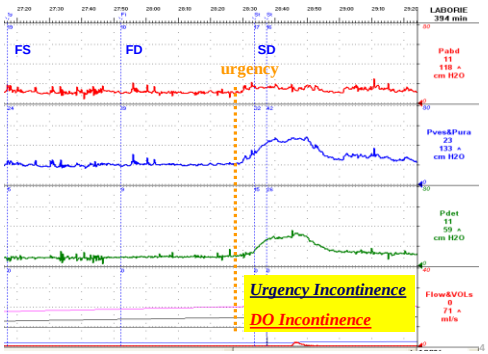
2

UDS examples from our study in women > 60y with UUI



3

UDS study in women > 60y with UUI



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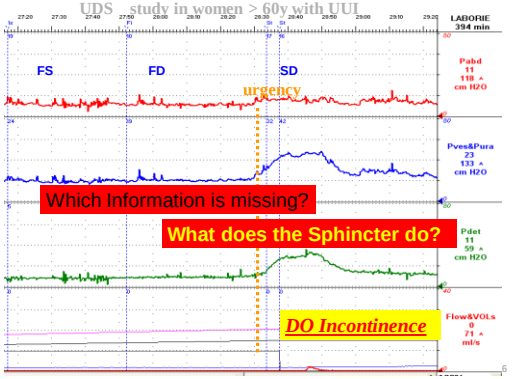
UDS study in women > 60y with UUI 2167RS140904

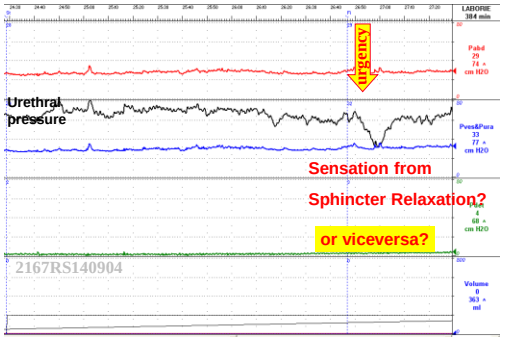
5

UDS study in women > 60y with UUI

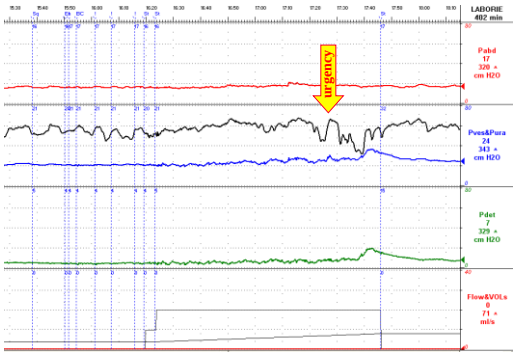


6

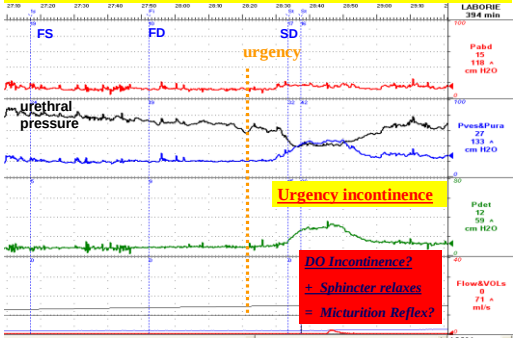
Pronounced drop of urethral pressure p_{ura} with urgency



drop in p_{ura} before/at DO 2204CM081105



Incontinence occurs only when the sphincter relaxes !



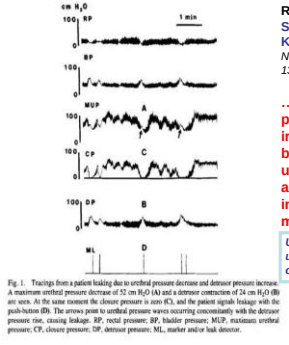


Fig. 1. Tracings from a patient leaking due to urethral pressure decrease and detrusor pressure increase. A maximum urethral pressure decrease of 52 cm H_2O (A) and a detrusor contraction of 24 cm H_2O (B) are seen. At the same moment the closure pressure is zero (C), and the patient signals leakage with the push-button (D). The arrows point to urethral pressure waves occurring concomitantly with the detrusor pressure rise, causing leakage. RP, rectal pressure; BP, bladder pressure; MUP, maximum urethral pressure; CP, closure pressure; DP, detrusor pressure; ML, marker and/or leak detector.

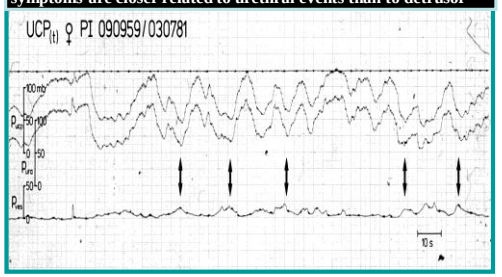
Ambulatory Urethro-Cysto-Rectometry: A New Technique
S. Kulseng-Hanssen and B. Klevmark
Neurourology and Urodynamics 2119-130 (1988)

… leakage mechanism in patients complaining of urge incontinence … proved to be a combination of a urethral pressure decrease and a detrusor pressure increase, as in normal micturition. ….

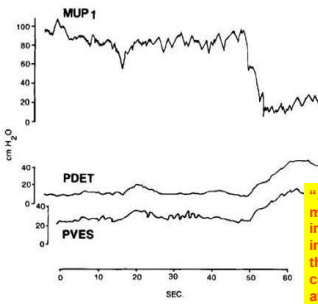
Urethral instability is actually the urethral component of a bladder contraction. Comment E. McGuire

Thus, it is not the bladder/detrusor alone which is "overactive", but actually it goes together with an involuntary sphincter relaxation = an "involuntary void" = loss of central control of the LUT

Urethral pressure drops before detrusor pressure waves and symptoms are closer related to urethral events than to detrusor



Urethral Pressure and Pressure Variations in Stress Incontinent Women and Women with Unstable Detrusor
S. Sørensen, **Neurourology and Urodynamics 10:483-492 (1991)**



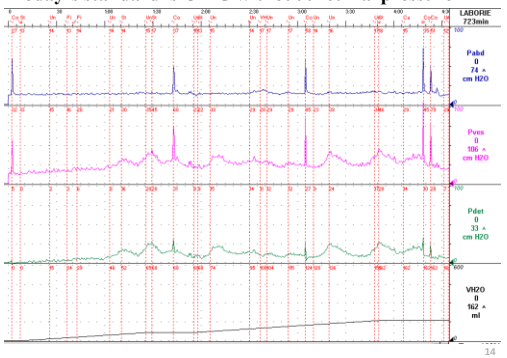
"…urethral pressure drops may be an essential factor in the so-called motor urge incontinence and may in the future change the whole concept and treatment attitude to this disease…"

ICS Standard 2002 Terminology also says:

- ***… it may be simplistic to relate urgency just to the presence or absence of detrusor overactivity when there is usually a concomitant fall in urethral pressure.***

but this is usually ignored and everybody just talks about "overactive bladder"

Today's standard is CMG without urethral pressure



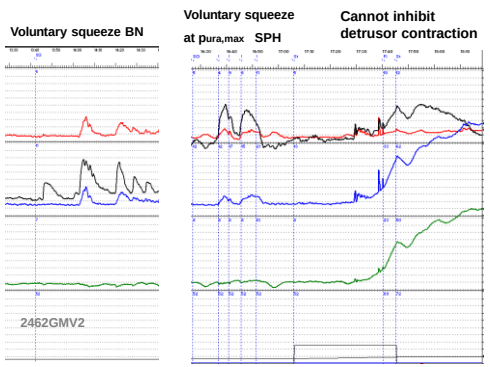
14

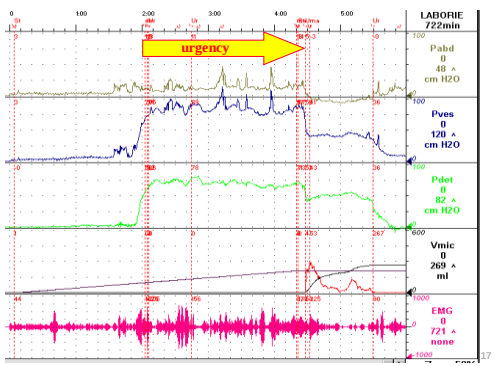
phasic Detrusor Overactivity (pDO)

urodynamic observations

- **Involuntary detrusor contraction, usually with sensation of urge(ncy);**
- **Phasic contraction(s), different amplitude, length;**
- **Amplitude proportional to pressure gradient = strength of contraction;**
- **pDO is inhibited by sphincter contraction** (*p_{ura} increases before/when p_{det} decreases*)
- **pDO indicates short term loss of control**

15





17

terminal Detrusor Overactivity (tDO)

urodynamic observations

- **Involuntary detrusor contraction, usually with sensation of urge(ncy);**
- **Continuous contraction, usually high amplitude;**
- **With sphincter contraction;** (*pura increase*)
- **DO is not inhibited by sphincter contraction** (*p_{ura} increases more than p_{det}*)
- **DO ends with leakage/void when sphincter relaxes**

18

Cystometry (and Urodynamics) for patients with Pelvic Pain

Christopher K. Payne, MD
Professor of Urology
Stanford University Medical School

Decades of routine urologic investigation of patients with chronic pelvic pain have failed to produce evidence for the value of routine urodynamic studies (or cystoscopy). The cost, morbidity, and poor predictability of urodynamic studies argue against the use of such tests except in refractory cases or when specific clinical questions can be answered (Payne 2011). The 2011 American Urological Association Guideline on diagnosis and treatment if IC/BPS (http://www.auanet.org/common/pdf/education/clinical-guidance/IC-Bladder-Pain-Syndrome.pdf) recommends an initial assessment of voiding symptoms be performed through a frequency-volume chart and validated symptom scores. A post-void residual is also recommended for all patients. These simple, non-invasive measures are also useful for the long-term follow-up and evaluation of response to treatment. The Guideline specifically states that "Cystoscopy and/or urodynamics should be considered when the diagnosis is in doubt; these tests are not necessary for making the diagnosis in uncomplicated presentations. (*Expert Opinion)*" Essentially the same recommendations come from the Bladder Pain Syndrome committee of the International Consultation on Incontinence (Hanno 2010).

The European Society for the Study of Interstitial Cystitis (ESSIC) emphasizes "confusable diseases as the cause of the symptoms must be excluded" (van de Merwe 2008). The document is vague in this area and leaves the threshold for investigation up to the clinician. The accompanying chart (Appendix 1) suggests uroflometry if bladder-neck obstruction and neurogenic outlet obstruction are suspected, a post-void residual urine if incomplete emptying/retention is suspected, uroflometry and pressure-flow studies if benign prostatic obstruction is suspected and medical history and urodynamics if overactive bladder is suspected. Of course these alternative diagnoses might be considered in almost every patient with pain and some have so argued that urodynamics should be done routinely to rule out other diagnosable conditions (Blaivas 2010). Nevertheless, it is the clear intent of the ESSIC report that most patients can be adequately initially evaluated with simple non-invasive means. My initial evaluation largely follows the AUA Guideline Algorithm (Appendix 2):

- History and Physical exam with pain mapping
- Urinalysis with culture if indicated
- Post-void residual
- Frequency-volume chart
- Uroflometry for men (and women with prominent emptying symptoms)

I recommend urodynamic studies when:

- Patients fail standard oral and intravesical therapy, prior to sacral nerve implant and/or Botox
- Patients have clinically significant urinary incontinence
- Patients have abnormal uroflow studies and voiding symptoms suggesting outlet obstruction
- Patient preference

When urodynamic studies are considered for the patient with pelvic pain it is important to remember that:

1. There are no accepted urodynamic criteria for a diagnosis of IC/BPS
2. Painful stimuli (catheterization) are amplified in patients with chronic pain and this may affect the outcome of the study—it is more difficult to assess bladder sensation, the catheter may provoke detrusor overactivity, and voiding may be artifactually impaired.
3. The most common "confusable disease"—overactive bladder—is not well differentiated by urodynamics. Unstable contractions are found in 12-20% of patients with IC/BPS and the sensitivity of cystometry for detrusor overactivity is only about 50%. There is as yet no evidence that patients with pain and unstable contractions should be treated differently than other pain patients.

Still, it is clear that urodynamic studies may be useful for certain patients with urological pelvic pain. Urodynamic studies can:

1. Conclusively identify patients with important bladder outlet obstruction (including bladder neck dysfunction, benign prostatic hyperplasia, dysfunctional voiding, and other uncommon causes)
2. Diagnose and evaluate the severity of associated urinary incontinence; this may impact treatment decisions.
3. Identify patients who have pain only with high pressure unstable contractions and not purely related to bladder volume.
4. Suggest the diagnosis of pelvic floor dysfunction in patients with high urethral pressures, larger bladder capacities, and inefficient voiding.

Finally, when urodynamic studies are obtained, the study should be tailored to the patient and the specific clinical question at hand. The study must be guided by the patient's frequency-volume chart and pain symptoms. Some hints.

1. Reproduce the symptoms, do not overfill. Use the maximum functional capacity on bladder diary as a goal.
2. Fill more slowly than usual; our default is 25cc/hour unless the bladder diary shows a good functional capacity.
3. Record pain level on a VAS scale with bladder filling; compare this to the patient's maximum daily pain. This is often more useful than the typical level of urge recorded in a urodynamic study.
4. The pressure-flow study should correlate with a good free-flow study to be reliable. Catheterization can introduce significant artifact in the pain population.

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Hanno P, Lin A, Nordling J, Nyberg L, van Ophoven A, Ueda T, Wein A; Bladder Pain Syndrome Committee of the International Consultation on Incontinence.
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Payne C. Urodynamics for the evaluation of painful bladder syndrome/interstitial cystitis. J Urol. 2010 Jul;184(1):15-6

Van De Merwe J, Nordling J, Bouchelouche K, et al. Diagnostic criteria, classification, and nomenclature for painful bladder syndrome/interstitial cystitis: An ESSIC proposal. Eur Urol 2008;53:60–7.

Appendix 1

ESSIC Evaluations for "Confusable Diseases"

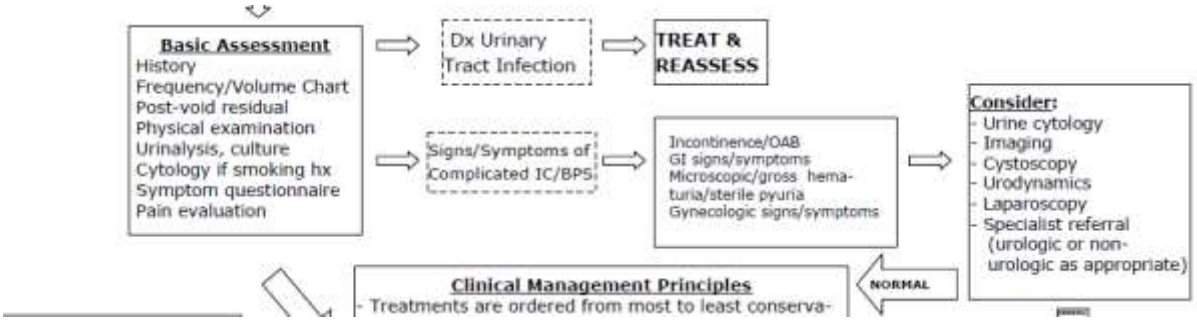
Table 1 – Confusable diseases for bladder pain syndrome

Confusable disease	Excluded or diagnosed by[a]
Carcinoma and carcinoma in situ	Cystoscopy and biopsy
Infection with	
Common intestinal bacteria	Routine bacterial culture
Chlamydia trachomatis, Ureaplasma urealyticum	Special cultures
Mycoplasma hominis, Mycoplasma genitalium	
Corynebacterium urealyticum, Candida species	
Mycobacterium tuberculosis	Dipstick; if "sterile" pyuria culture for *M. tuberculosis*
Herpes simplex and human papilloma virus	Physical examination
Radiation	Medical history
Chemotherapy, including immunotherapy with cyclophosphamide	Medical history
Anti-inflammatory therapy with tiaprofenic acid	Medical history
Bladder-neck obstruction and neurogenic outlet obstruction	Uroflowmetry and ultrasound
Bladder stone	Imaging or cystoscopy
Lower ureteric stone	Medical history and/or hematuria: upper urinary tract imaging such CT or IVP
Urethral diverticulum	Medical history and physical examination
Urogenital prolapse	Medical history and physical examination
Endometriosis	Medical history and physical examination
Vaginal candidiasis	Medical history and physical examination
Cervical, uterine, and ovarian cancer	Physical examination
Incomplete bladder emptying (retention)	Postvoid residual urine volume measured by ultrasound scanning
Overactive bladder	Medical history and urodynamics
Prostate cancer	Physical examination and PSA
Benign prostatic obstruction	Uroflowmetry and pressure-flow studies
Chronic bacterial prostatitis	Medical history, physical examination, culture
Chronic non-bacterial prostatitis	Medical history, physical examination, culture
Pudendal nerve entrapment	Medical history, physical examination, nerve block may prove diagnosis
Pelvic floor muscle-related pain	Medical history, physical examination

CT = computed tomography; IVP = intravenous pyelogram; PSA = prostate-specific antigen.
[a] The diagnosis of a confusable disease does not necessarily exclude a diagnosis of BPS.

Appendix 2

Diagnostic Algorithm taken from AUA Guideline for IC/BPS

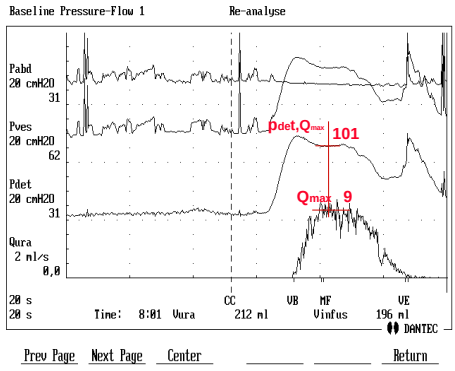


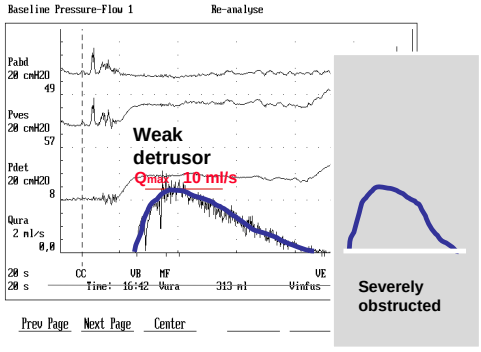
Good Urodynamic Practice Voiding Function: male & female

Werner Schaefer,
Division of Geriatric Medicine, University of Pittsburgh, Pittsburgh PA;

- We propose a robust but sensitive format of grading outflow conditions in females on a continuous scale consistent with males.

University of Pittsburgh
affiliated with
University of Pittsburgh Medical Center





DJ Griffiths (1973)

The mechanics of the urethra and of micturition.
Brit J Urol 45:497-507

(a), the Bladder Output Relation,

+

(b), the Urethral Resistance Relation:

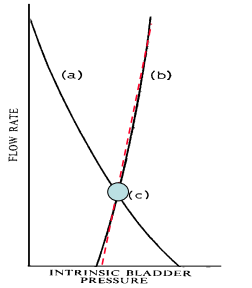
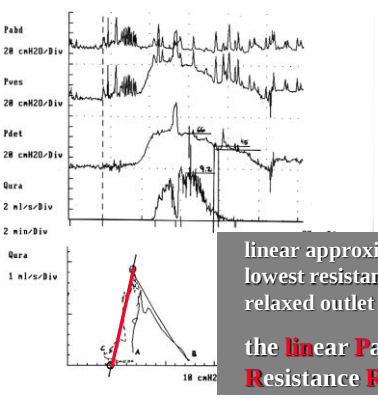


Fig. 4. (a). The bladder output relation: schematic dependence of intrinsic bladder pressure on flow rate. (b). The urethra resistance relation: schematic dependence of flow rate on intrinsic bladder pressure. (c). The flow rate and intrinsic bladder pressure as fixed by the intersection of curves (a) and (b).



linear approximation of the lowest resistance, reflecting relaxed outlet morphology

the linear Passive Urethral Resistance Relation

3rd ICS report 1980 suggests as standard for catagorizing data a different orientation of axes, with pressure on the y and flow rate on the x-axis. Reasons for change in axes is unclear.

This diagram serves only for classification p/Q-points, and not for the complete p/Q-relation as in the PURR. PURR is obtained originally by regression analysis requiring definition of dependent and independent variable, which defined the original position with pressure on x ad flow on y.

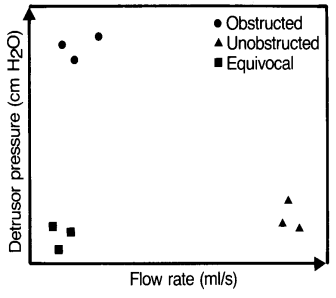
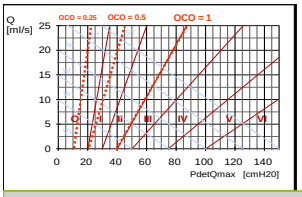


Fig. 5. Diagram illustrating the presentation of pressure flow data on individual patients in three groups of 3 patients: obstructed, equivocal and unobstructed.

Bates et al 1980



$$OCO = \frac{pdet,Qmax}{40 + 2\ Qmax}$$

Obstruction Coefficient

and

$DECO = (pdet,Qmax + 5\ Qmax)/100$

Detrusor Contractility Coefficient

Nomograms with grading and/or continuous scale

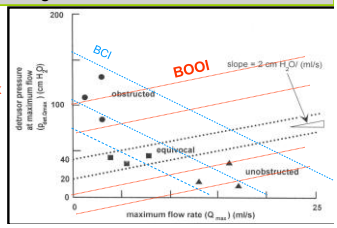
BOOI = pdet,Qmax – 2 Qmax

Bladder Outlet Obstruction Index

and

BCI = pdet,Qmax + 5 Qmax

Bladder Contractility Index



DJ Griffiths 1980
Urodynamics
Medical Physics Handbook
Adam Hilger Ltd

The Griffiths-Nomogram relies on the correlation of urodynamics with the clinical judgment of degree of obstruction.

Effect of a urethral catheter

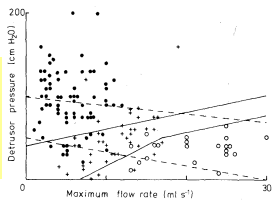


Figure 9.5 Values of maximum flow rate and detrusor pressure at *maximum flow for a group of older males. Open circles, full circles* and crosses, judged clinically to be unobstructed, obstructed and doubtful, respectively. The full lines divide the graph into three regions in which, on urodynamic grounds, the unobstructed obstructed and borderline cases might lie. The borderline region between the lines contains most of the crosses, as one would expect. Between the *broken* lines lies the region where the pressure/max. flow points should fall for bladders of normal contractility, provided the initial bladder volume is between 100 and 400 ml (see §10.3). With this proviso, points lying above and below this region correspond to hyper- and hypocontractile bladders, respectively. Many of the obstructed cases have hypercontractile bladders. (After Abrams and Griffiths 1979.)

AG = ICS = obstructed

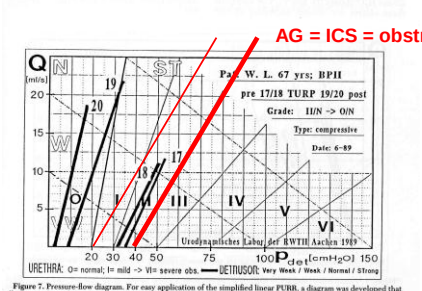
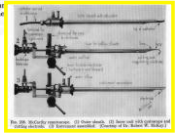
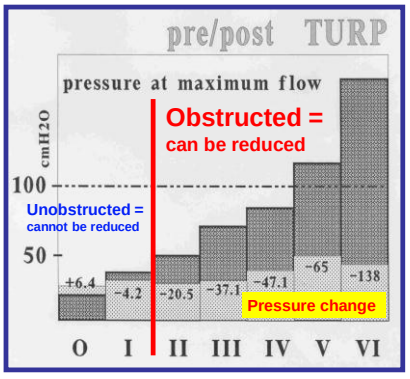
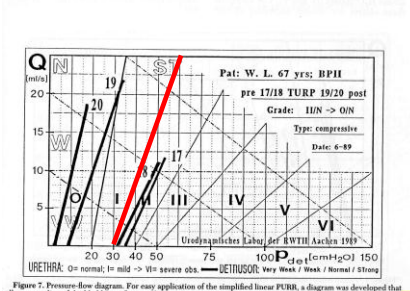


Figure 7. Pressure-flow diagram. For easy application of the simplified linear PURR, a diagram was developed that allows a grading of the bladder outflow condition (seven classes) as well as crude judgment of detrusor strength (four classes). This simple form of graphical data analysis yields, for the voiding studies in Figure 6, essentially the same result as the computerized PURR and provides all the information that is of clinical relevance.







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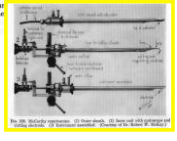
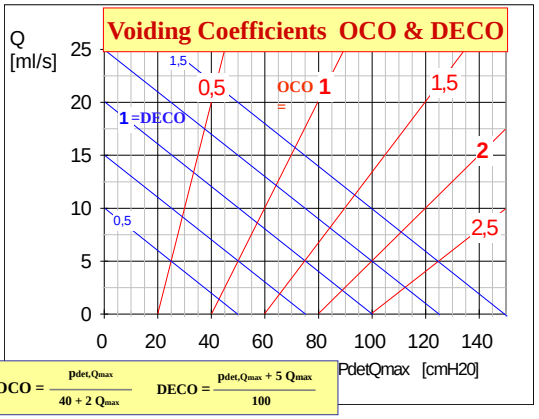
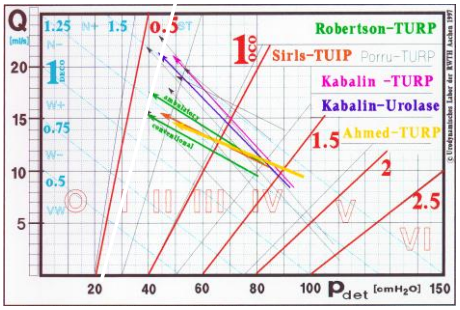
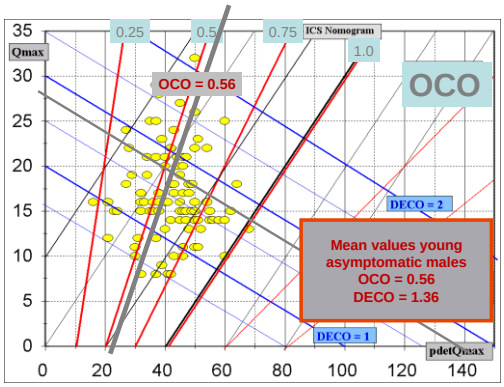




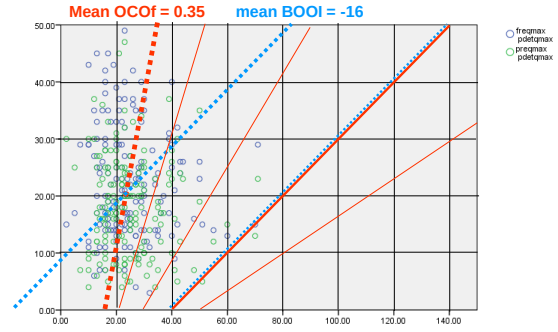
$$OCO = \frac{pdet,Qmax}{40 + 2\ Qmax} \qquad DECO = \frac{pdet,Qmax + 5\ Qmax}{100}$$

Mean value after TURP OCO = 0.58





Women > 60 y with UUI, 300 voids

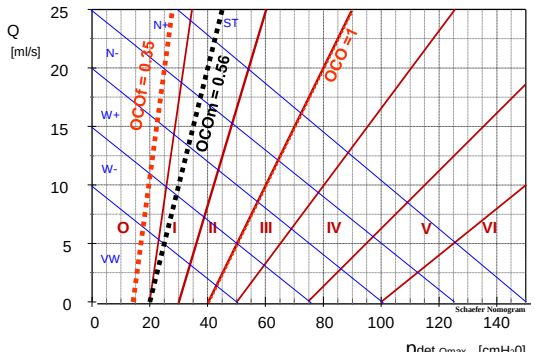


mean opening pressure: measured 15.9 cmH2O; OCO = 14.9 cmH2O; BOOI = - 16 cmH2O

Grading of Outflow Conditions

The use of nomograms/obstruction numbers require good understanding of the urodynamics of micturition and the analytical models, In men with proximal obstruction (BPH/BPO) the flow is driven by p_{det}. In many women flow is driven by the p_{ves}, and straining is very effective to enhance Q_{max}.

The Obstruction Coefficient OCO is not sensitive to artifacts and allows grading on a continuous scale, consistent with commonly used nomograms.

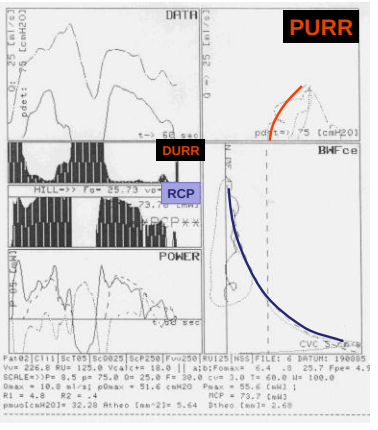


Unobstructed women OCOf = 0.35
Unobstructed men OCOm = 0.56

Advanced Computerised Voiding Analysis (1980)

the Outflow Resistance, PURR and its relative Changes, DURR

and Detrusor Power and its relative changes RCP



PRESSURE/ FLOW STUDIES:

qualitative analysis and voiding patterns

J.E. BATISTA

Urologist.
Urodynamics coordinator
URD / Centro Médico Teknon
Barcelona

With the technical assistance of Anais Bassas, physiotehrapist and urodynamics technician.

Pressure / flow studies

Complete dynamic parameter assesment during voiding phase

Direct pressure measurement: invasive

Pressure / flow studies

Direct pressure measurement: invasive

Most Units: transurethrally

Rarely: suprapubically

P / F

Complete dynamic parameter assesment during voiding phase

Mostly quantitave analysis (AG, Shaefer, Chess etc)

i.e. relation between 2 parameters

in a given second (Qmax)

1 second will condition the patient´s life !

P / F

Complete dynamic parameter assesment during voiding phase

This talk will cover CUALITIATIVE analysis

i.e. mechanisms of micturition

P/F: qualitative analysis. Goals

- **ASSES VOIDING MECHANISM**
- **COMPARE TO FREE FLOW**
- **RULE OUT ARTIFACTS**

P/F: qualitative analysis.

Trace review methodology

- MALES / FEMALES.
- EXPAND THE SCALE (in different graph / page)
- ASSES AUTOMATIC VALUES OF EVENTS

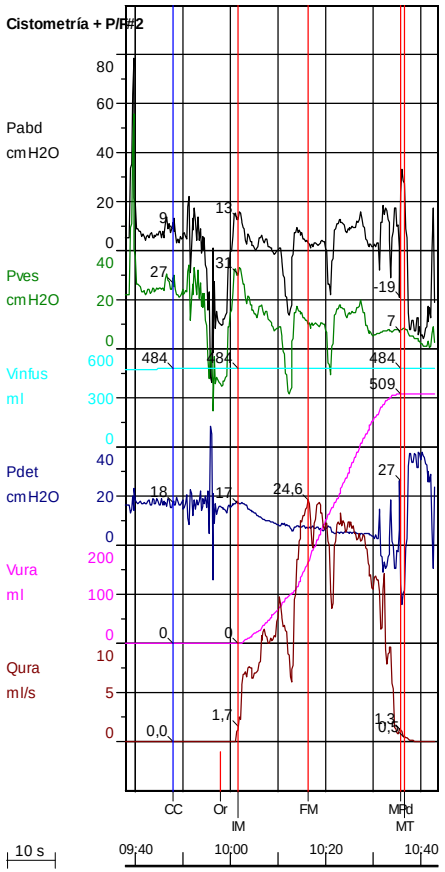
- COMPARE TO FREE FLOW

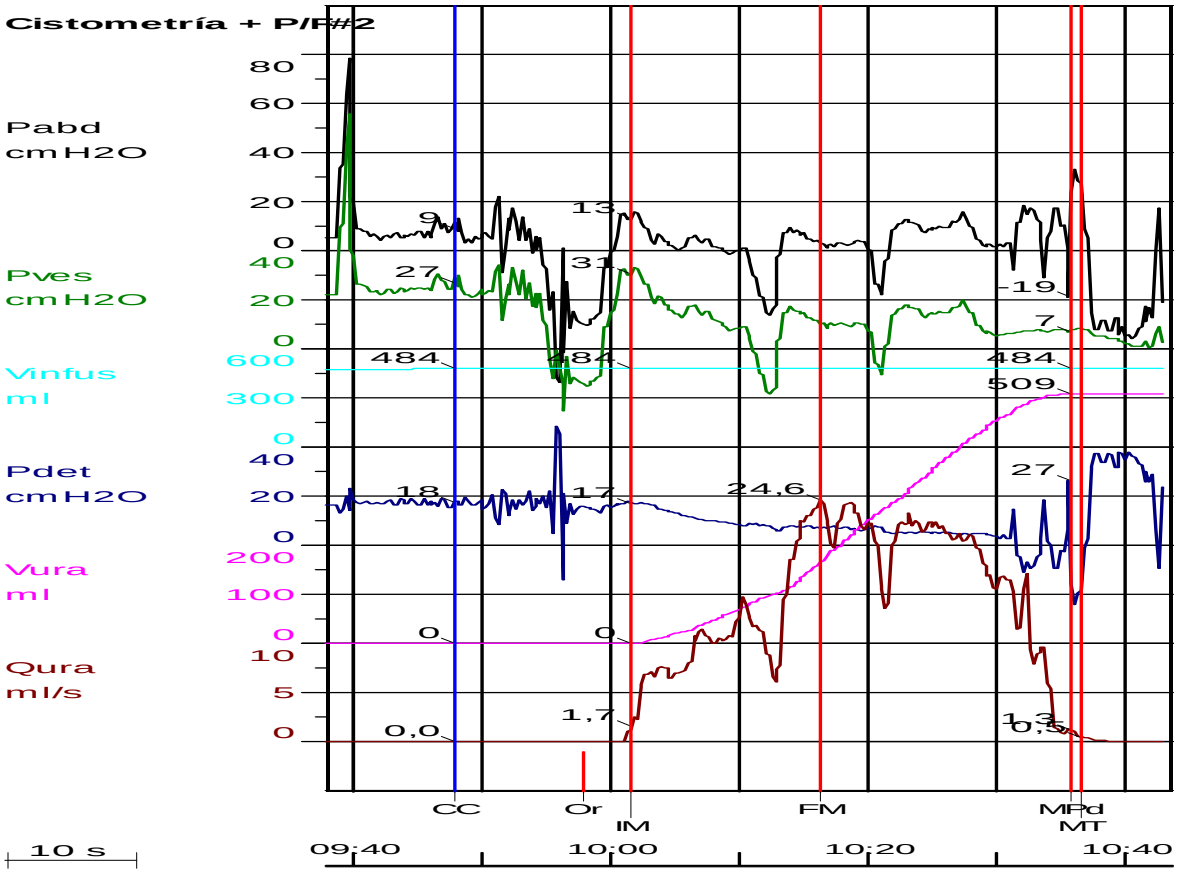
    *¿are they consisntent?

    * if not, consider an “inconstant pattern”

P/F: qualitative analysis. Trace review

EXPAND THE TIME SCALE !





P/F: qualitative analysis

How does voiding ideally start:

-After cystometry

- **Infussion stopped**
- **Instruct patient to be calm**
- **Patient in his / her usual position**
- **Check lines !**
- **Cough before void, if possible**
- **Micturition order**

P/F: qualitative analysis

After voiding:

- **Repeat cough**
- **Check “final” residual again**

Final residual: Vol Infus – Void Vol

(Voidign efficiency)

P/F: qualitative analysis

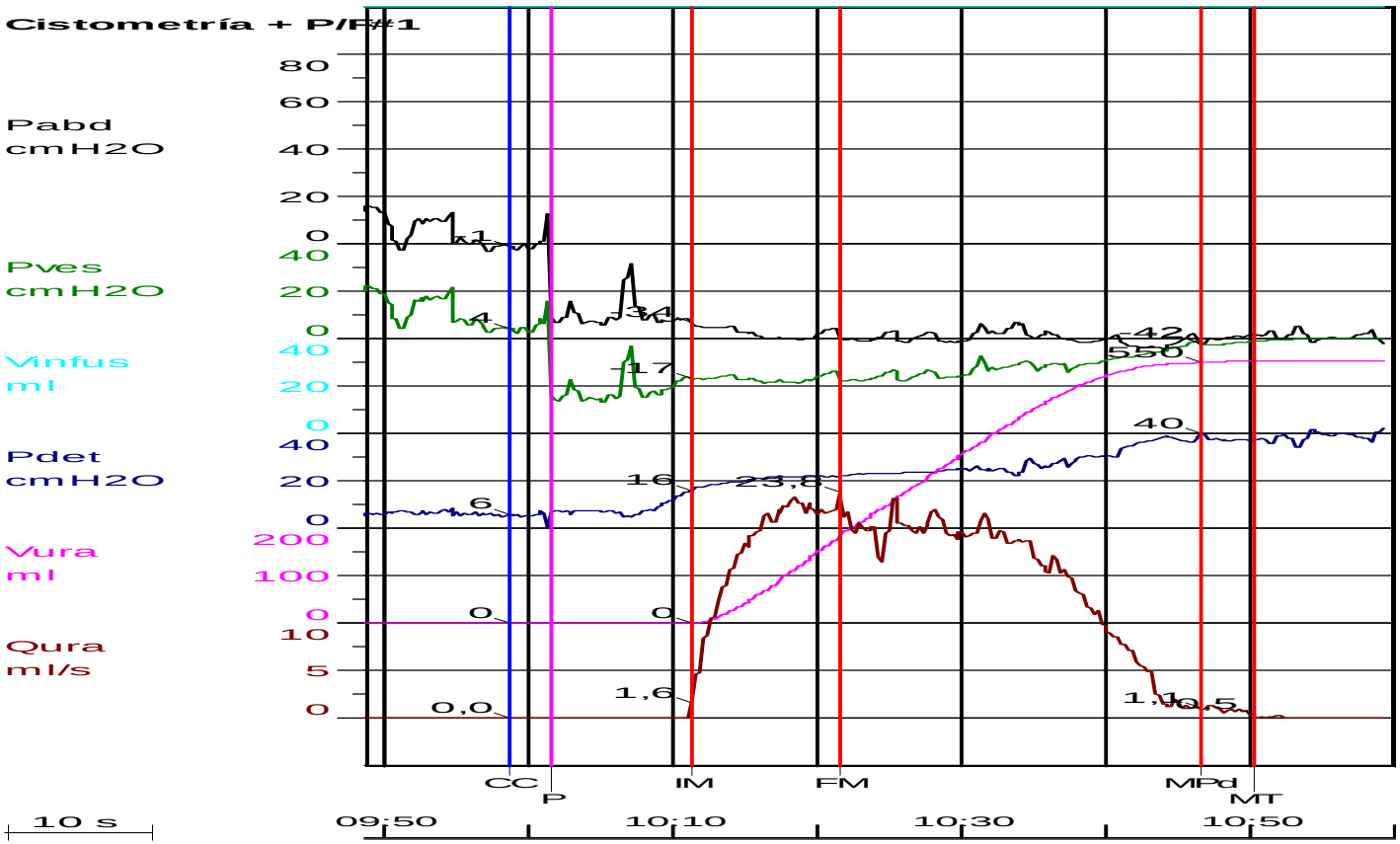
Voding mechanism does not imply:

- **Normality / obstruction**
- **Voidign efficiency**

- **Same voiding mechanisms can have different “outcomes” in respect to diagnosis.**

P/F: qualitative analysis. Voiding mechanisms in women

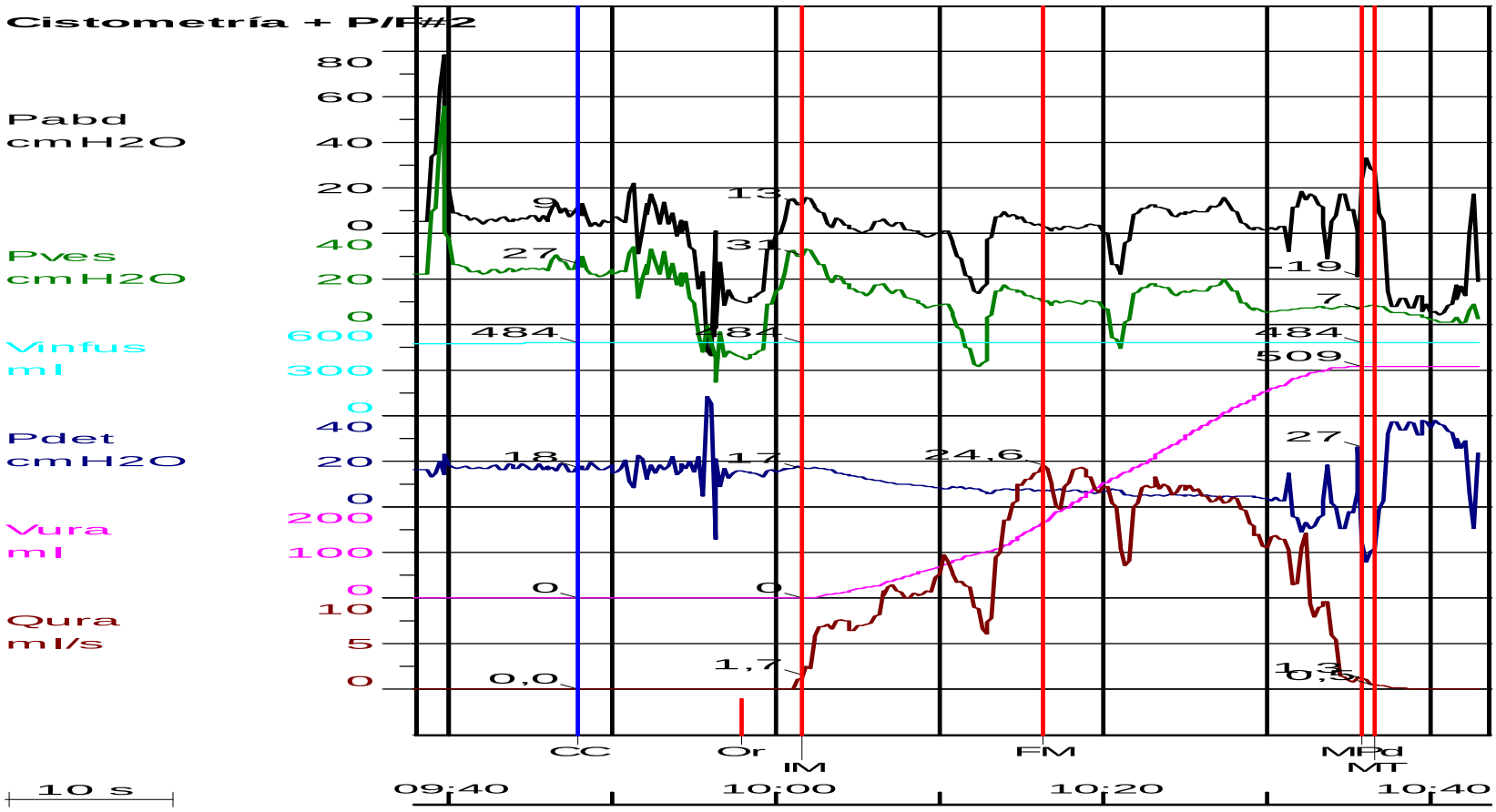
Un-obstructed voiding with detrusor contraction



P/F: qualitative analysis. Voiding mechanisms in women

Intermittent abdominal straining; no detrusor contraction.

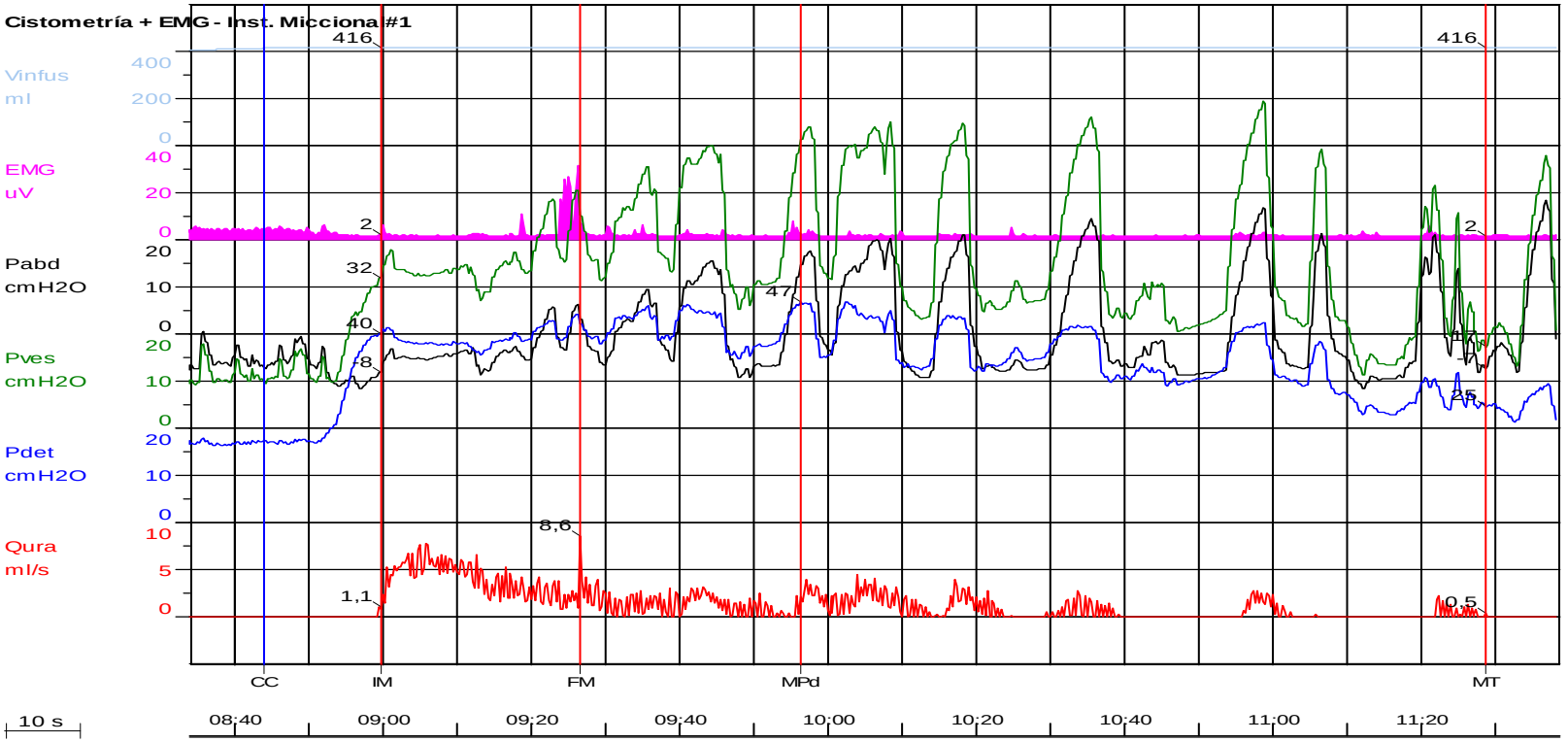
Efficient voiding



P/F: qualitative analysis. Voiding mechanisms in women

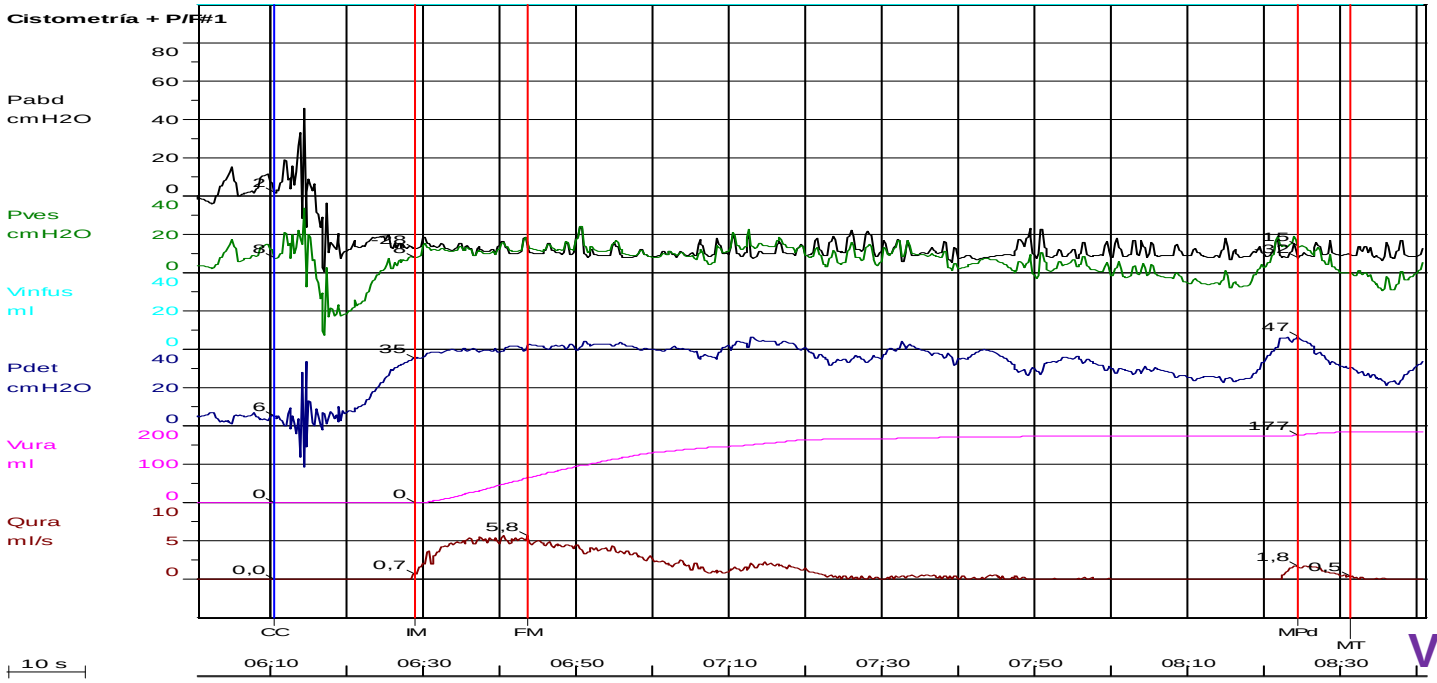
Intermittent abdominal straining; no detrusor contraction.

Non- efficient voiding



P/F: qualitative analysis. Voiding mechanisms in women

Obstructed voiding with continuous detrusor contraction
76 y-o woman , referred by other urologist



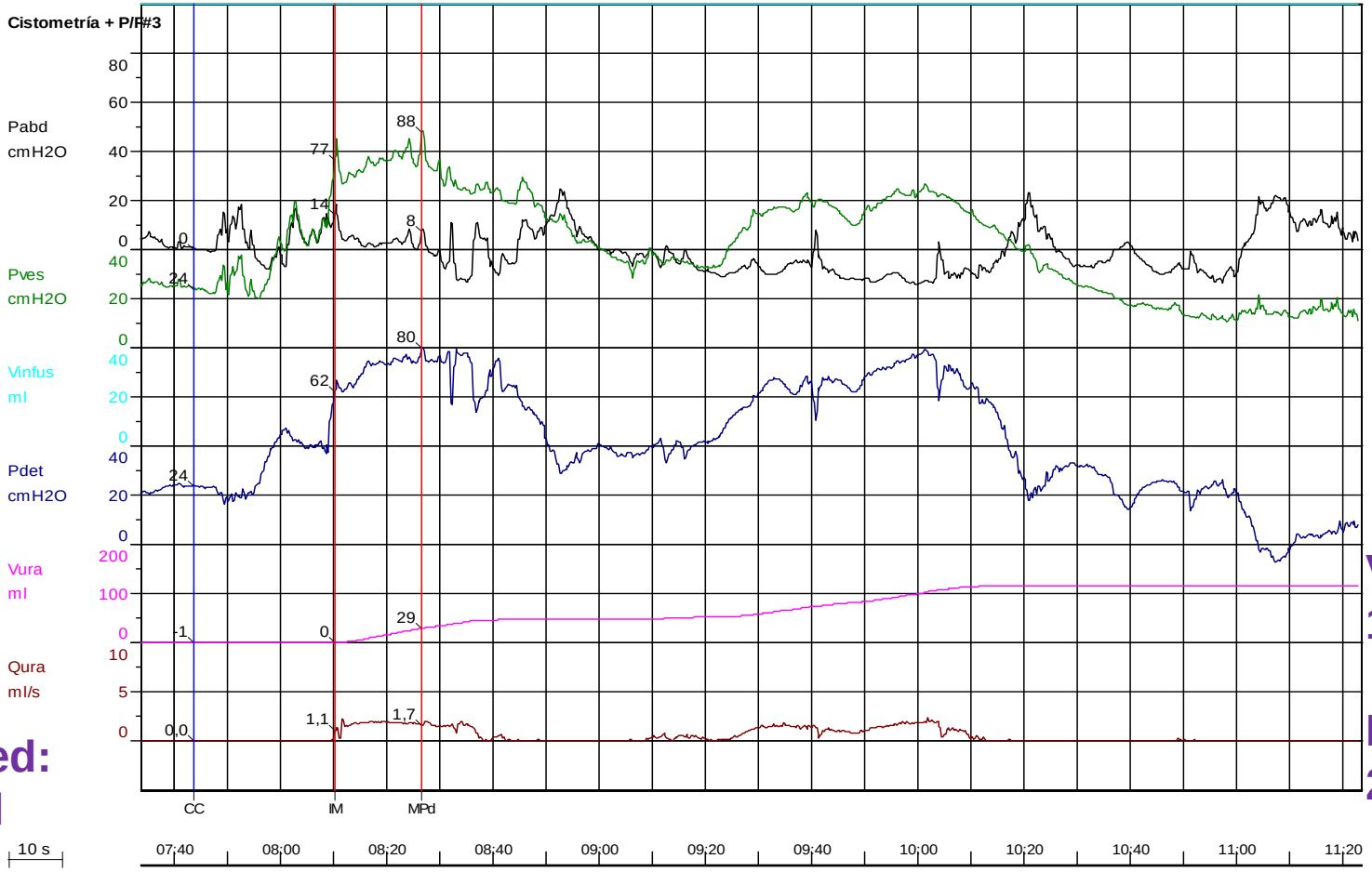
Voided: 180ml

Infused: 290ml

FINAL PVR: 110ml

P/F: qualitative analysis. Voiding mechanisms in women

Obstructed voiding with intermittent detrusor contraction



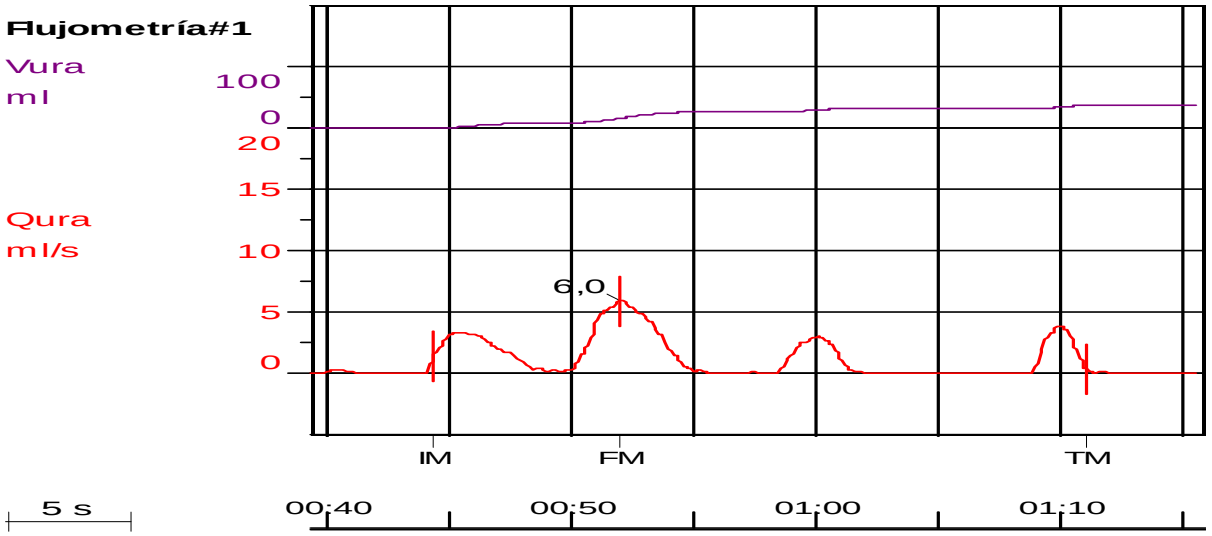
Infused: 350ml

Voided: 110ml

FINAL PVR: 240ml

P/F: qualitative analysis. Voiding mechanisms in women

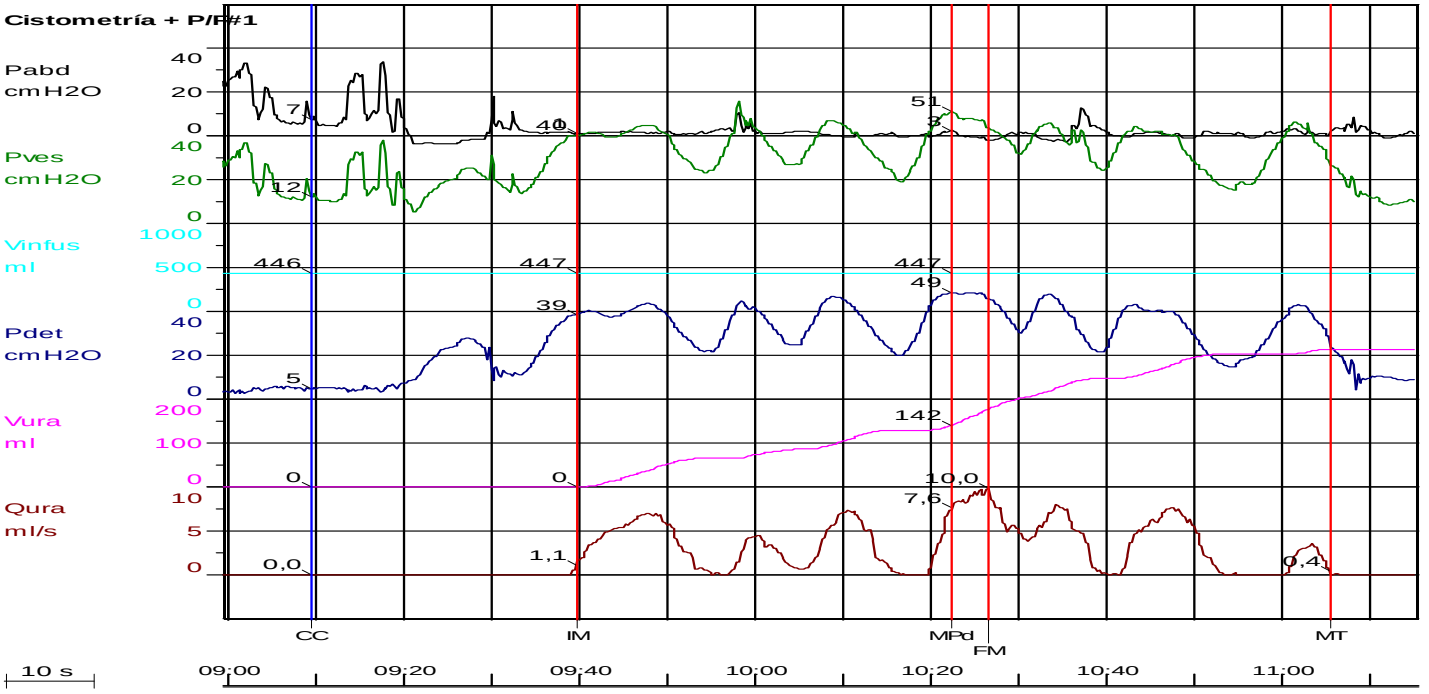
Un-obstructed voiding with intermittent detrusor contraction (36 y-o woman, urgency, intermitency)



Voided: 40ml
Qmax: 6 ml/s
PVR: 100ml

P/F: qualitative analysis. Voiding mechanisms in women

Un-obstructed voiding with intermittent detrusor contraction (36 y-o woman, urgency, intermitency)



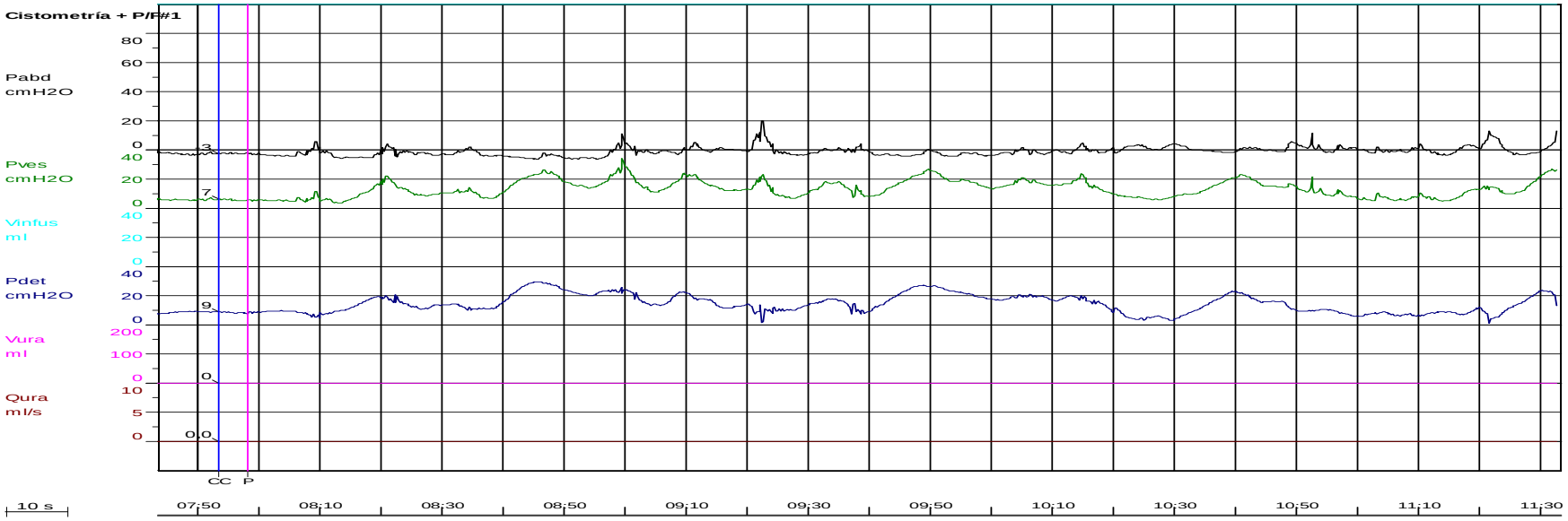
Infused: 446ml

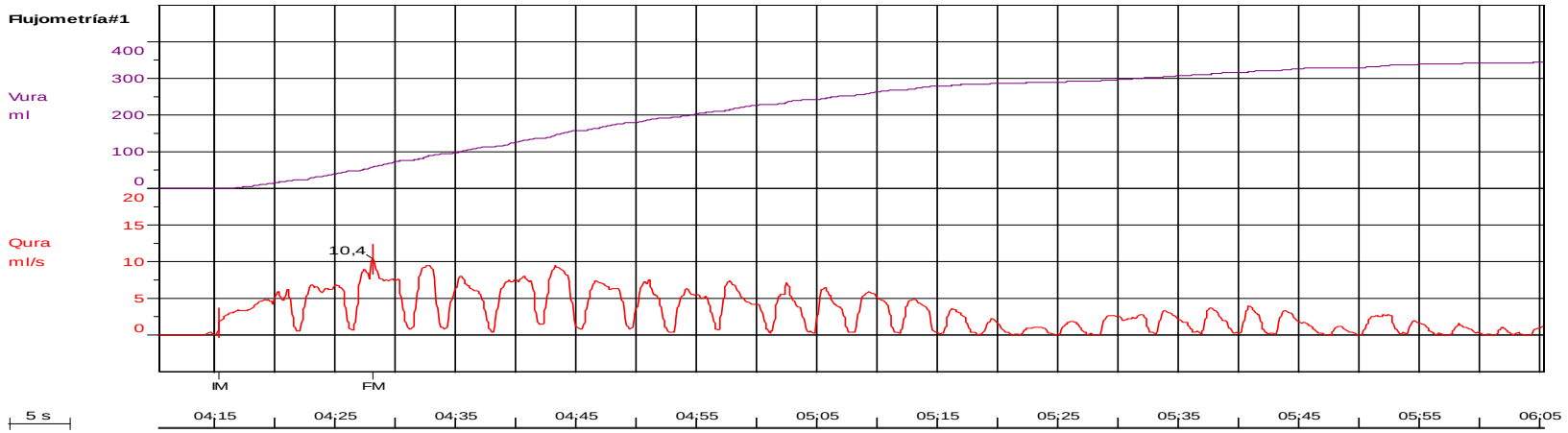
Voided: 315ml

FINAL PVR: 131 ml

P/F: qualitative analysis. Voiding mechanisms in women

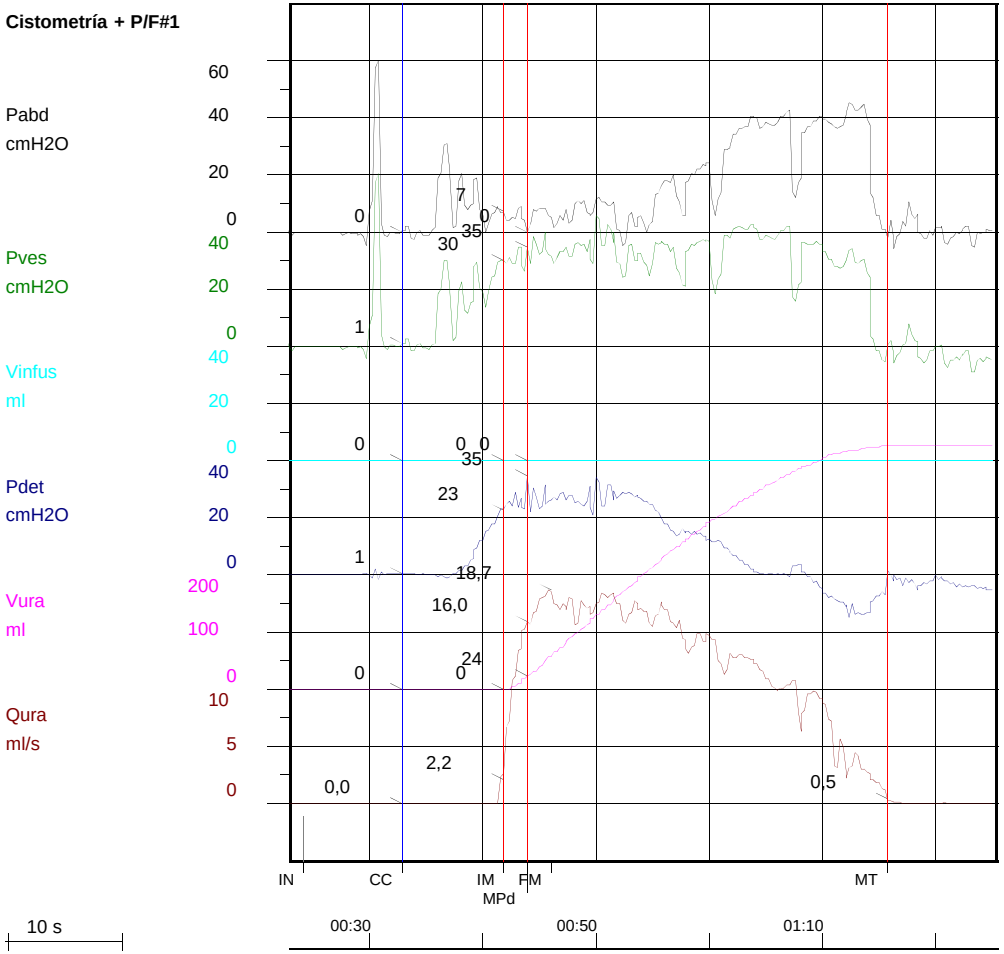
Inhibited micturition during P/F: patience





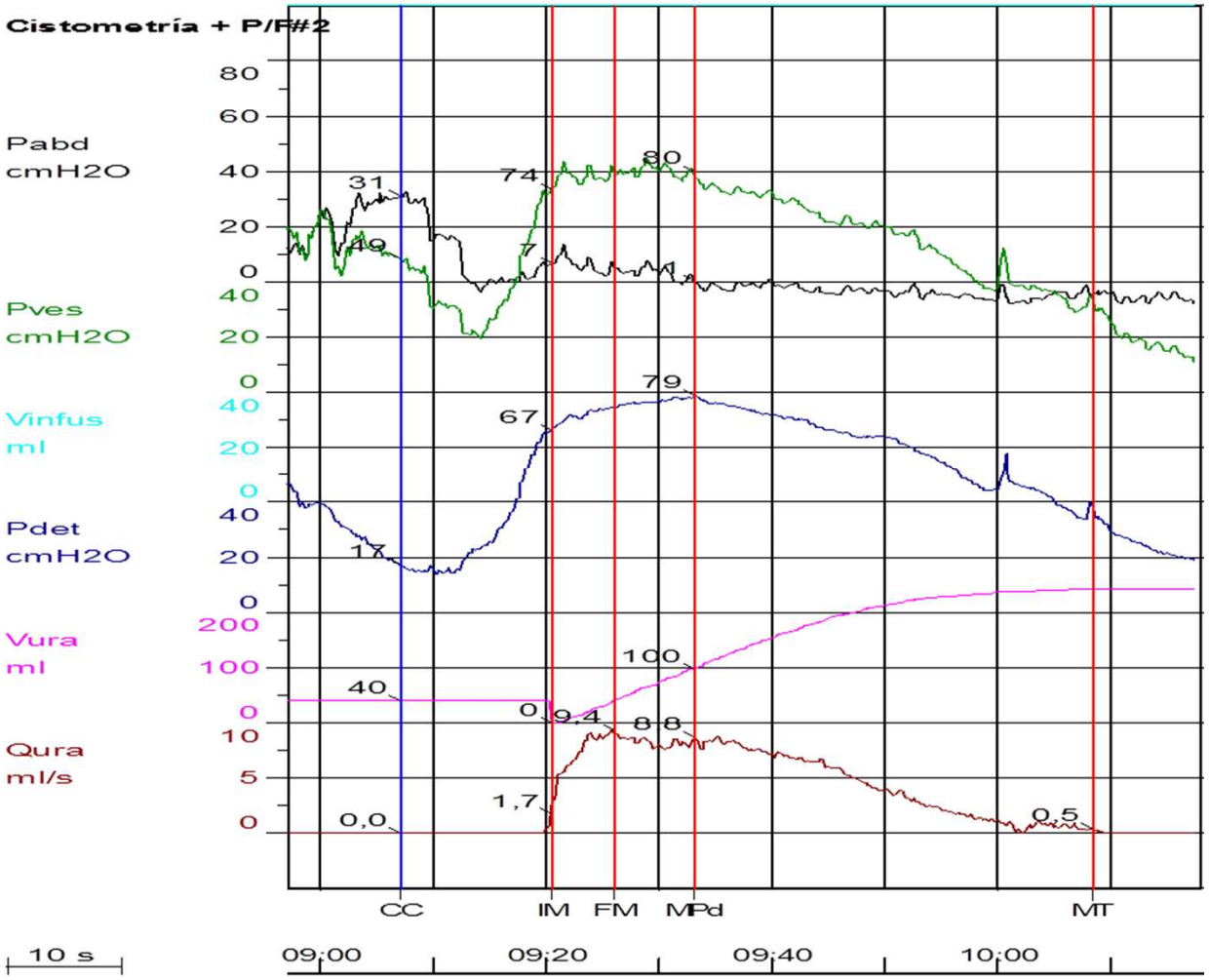
P/F: qualitative analysis. Voiding mechanisms in men

Normal detrusor contraction



P/F: qualitative analysis. Voiding mechanisms in men

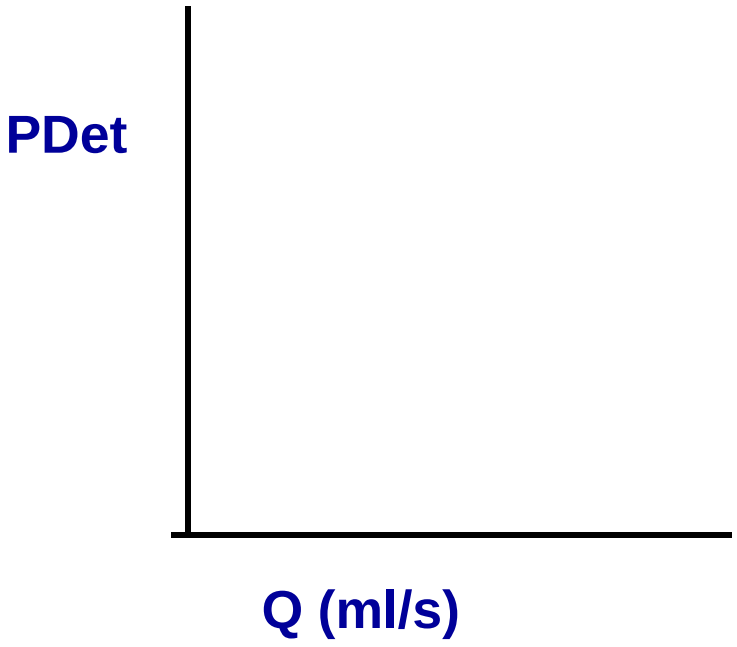
High pressure / low flow: obstruction



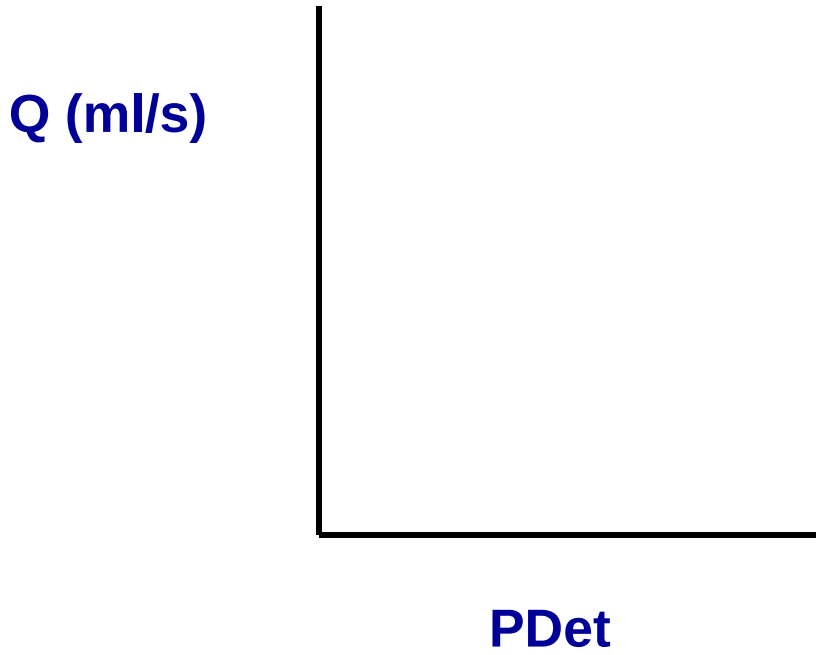
P/F: p/Q plot anlysis in males

Pressure flow relation in each moment of micturition (no time scale) .

Abrams/ Griffiths

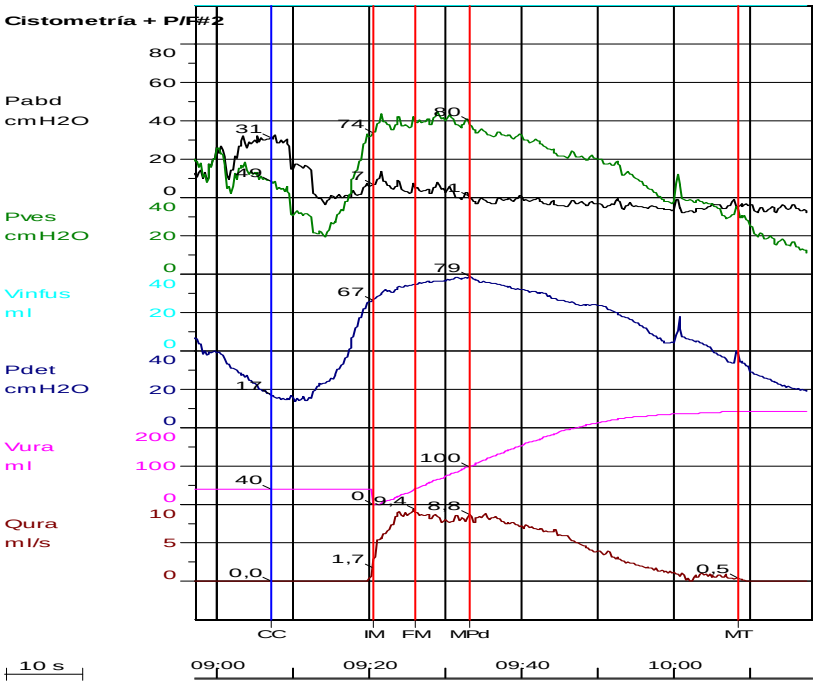


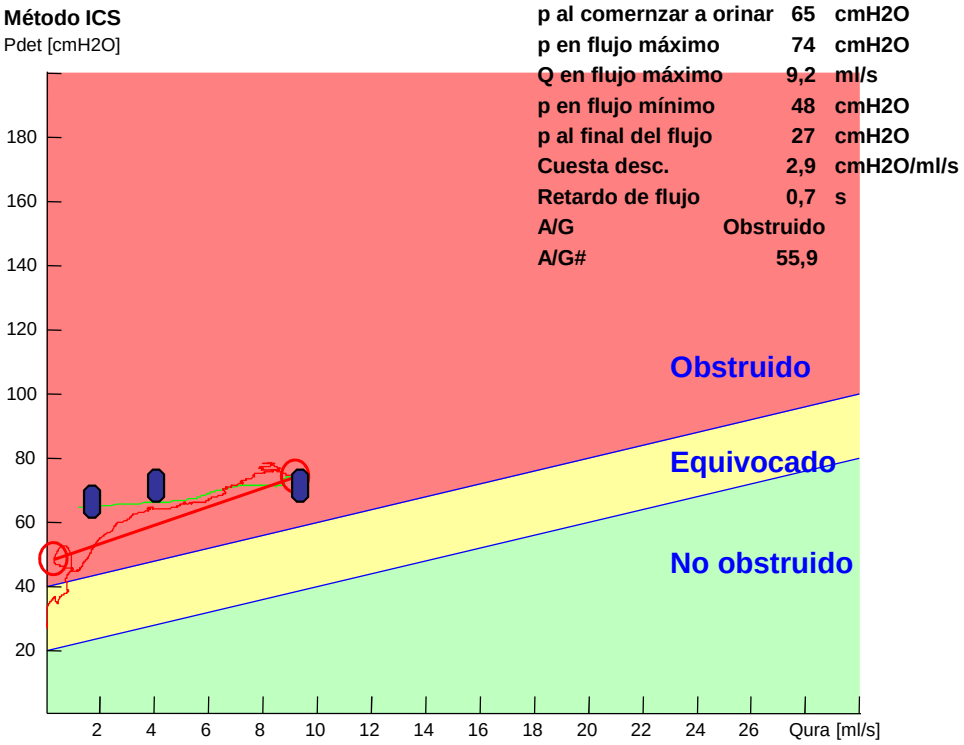
Schaefer



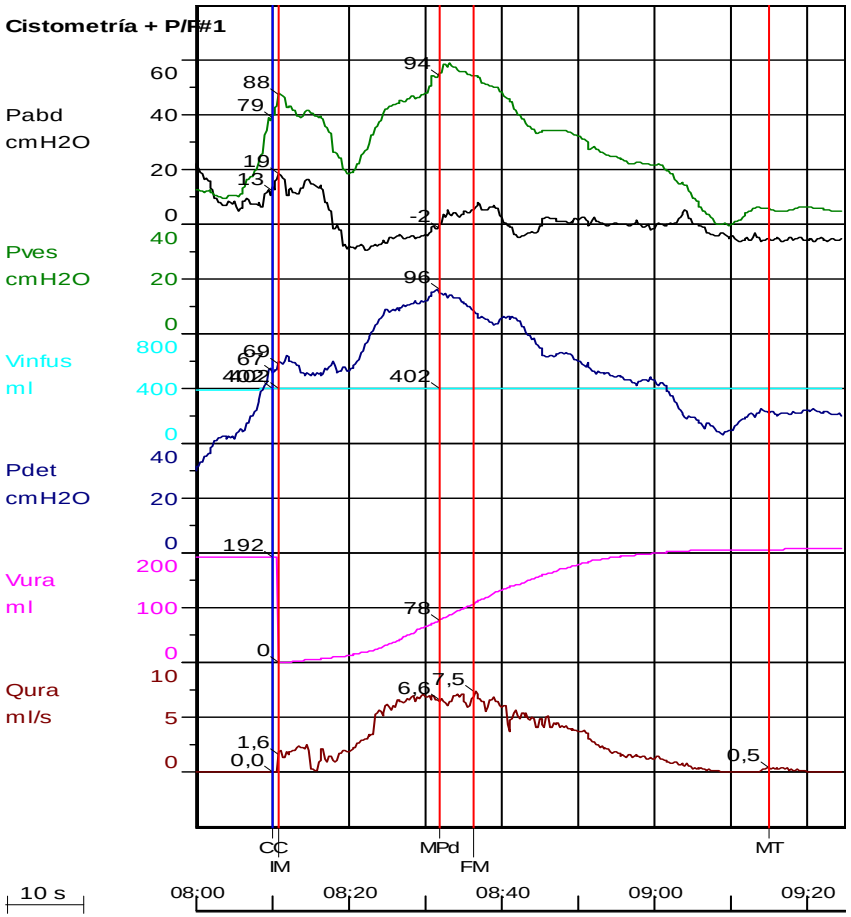
How a p/q plot is made

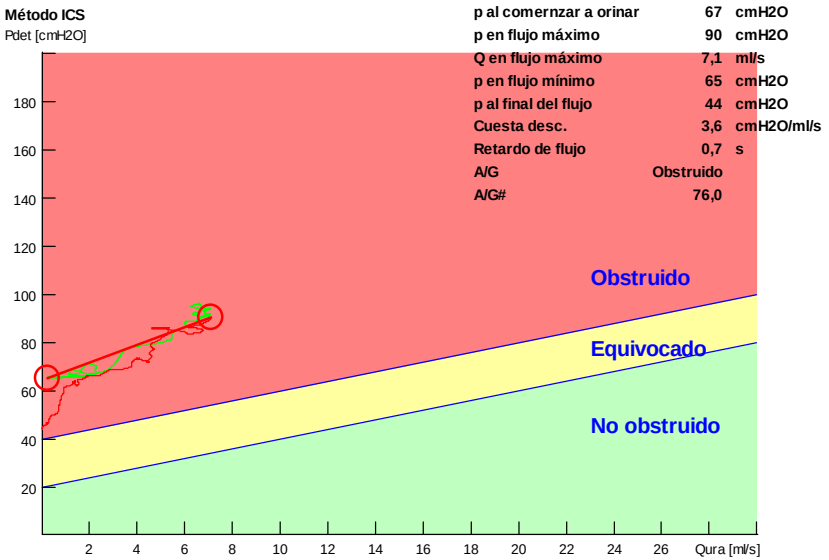
Obstruction





P/q plot


Cistometría + P/F#1
Pabd
cmH2O
Pves
cmH2O
Vinfus
ml
Pdet
cmH2O
Vura
ml
Qura
ml/s
88
79
94
19
13
-2
96
69
67
402
192
78
0
6,6
7,5
1,6
0,0
0,5
CC
IM
MPd
FM
MT
10 s
08:00
08:20
08:40
09:00
09:20


Método ICS
Pdet [cmH2O]
p al comernzar a orinar 67 cmH2O
p en flujo máximo 90 cmH2O
Q en flujo máximo 7,1 ml/s
p en flujo mínimo 65 cmH2O
p al final del flujo 44 cmH2O
Cuesta desc. 3,6 cmH2O/ml/s
Retardo de flujo 0,7 s
A/G Obstruido
A/G# 76,0
Obstruido
Equivocado
No obstruido
Qura [ml/s]

P/F: qualitative analysis. Voiding mechanisms in men

Hypo- contractility

- in magnitude (absolute values) Pdet< 40 ; qMax < 10ml/s
- in time (no sustained contraction is achieved; hence, no complete voiding is produced)

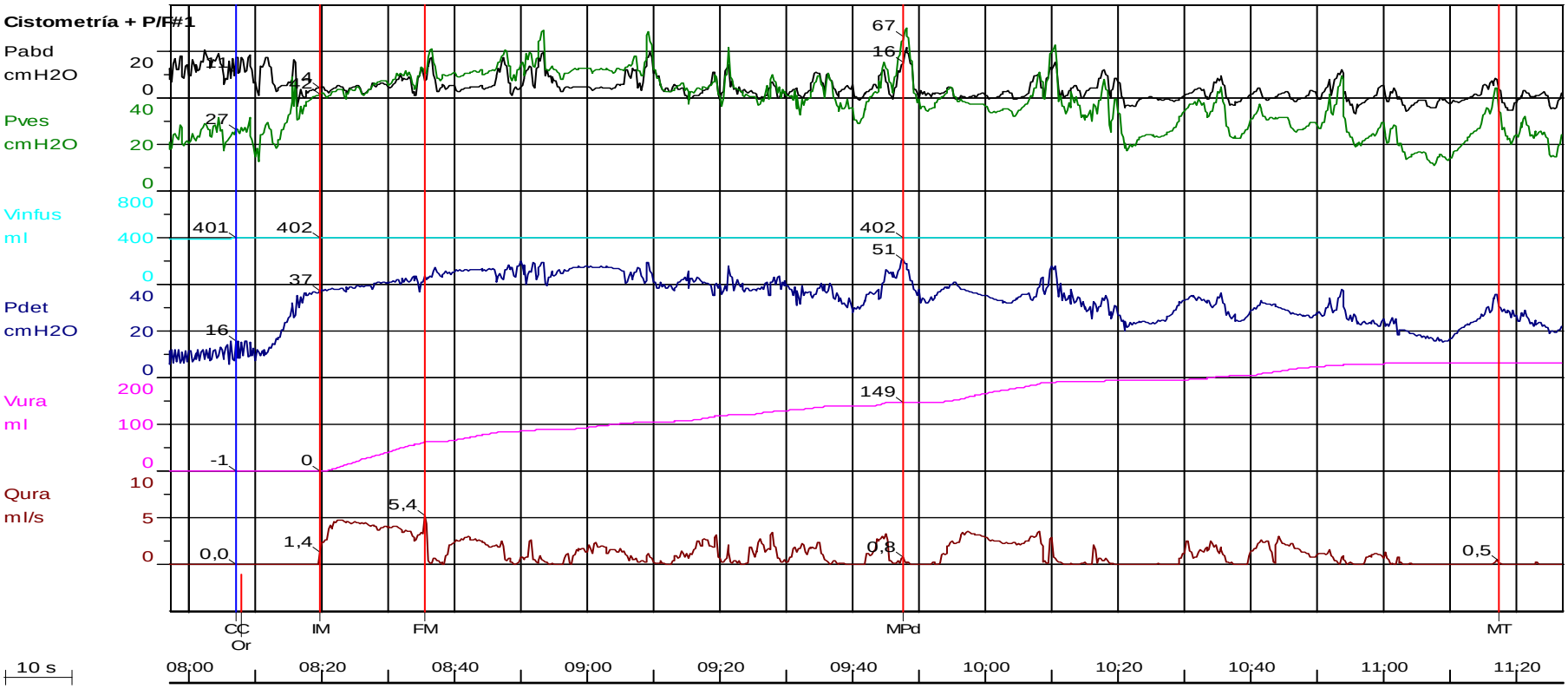
A contractility:

- Very rare without previous surgery

P/F: qualitative analysis. Voiding mechanisms in men

Hypo- contractility in magnitude (absolute values)

Pdet < 50 cm H2O, Qmax 5ml/s,

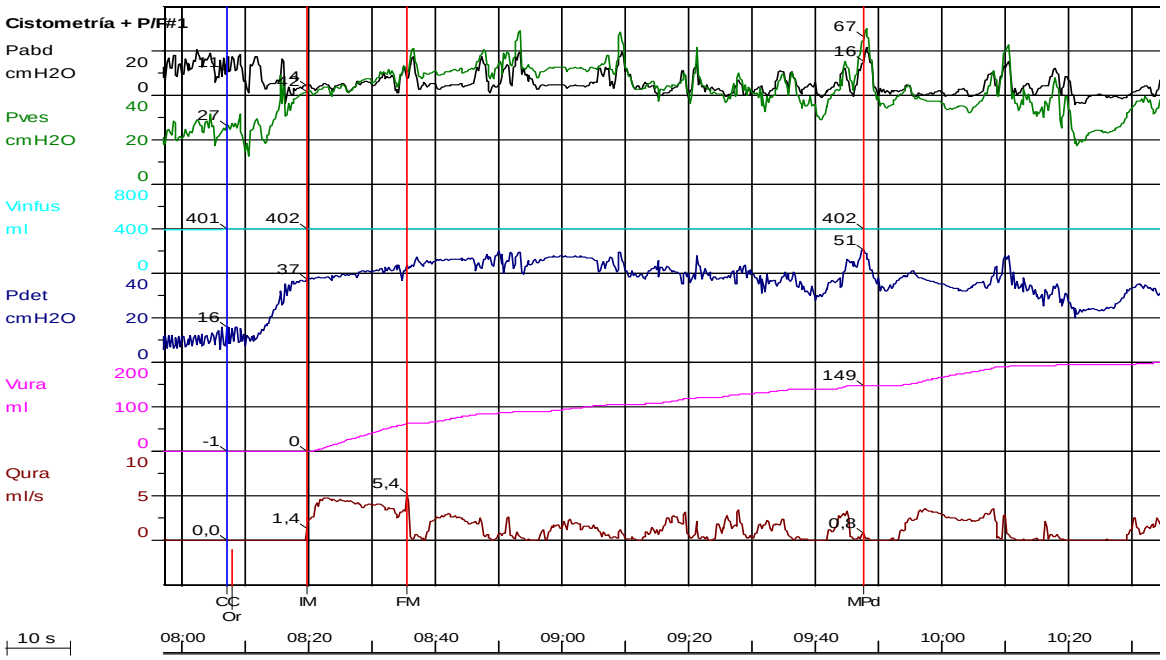


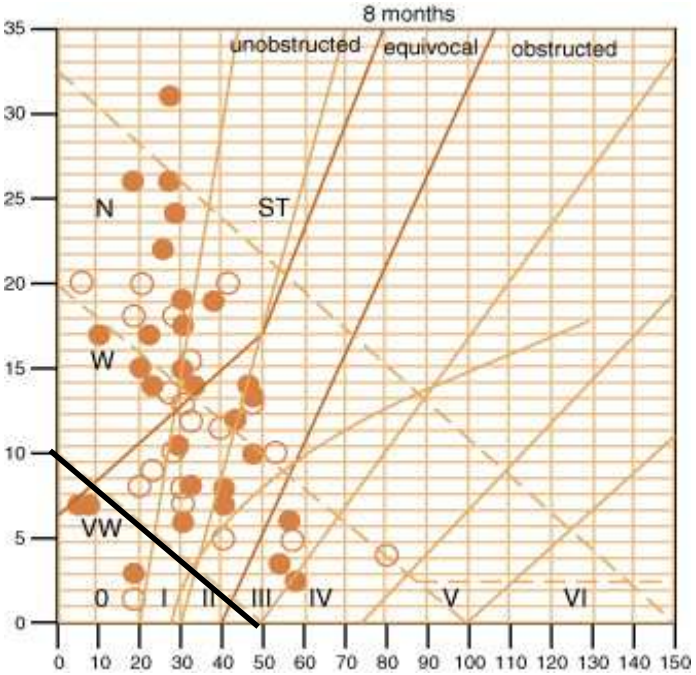
P/F: qualitative analysis. Voiding mechanisms in men

Hypo- contractility in magnitude (absolute values)

Pdet< 50; Q max < 10ml/s; (residual)

No abdominal straining





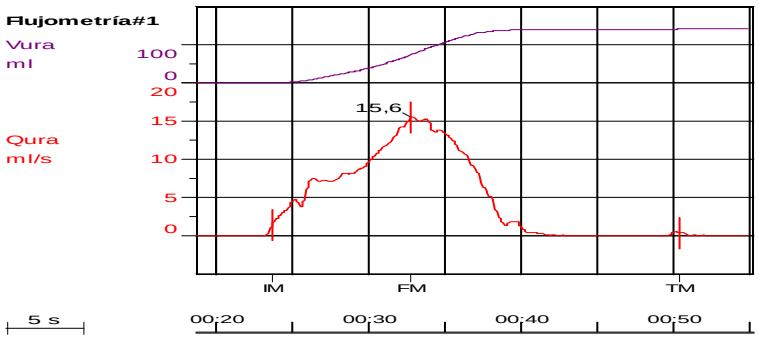
P/F: qualitative analysis. Voiding mechanisms in men

Q max 15 ml /s PVR: 0 ml)

54 yo

Frequency

UTI´s



P/F: qualitative analysis. Voiding mechanisms in men

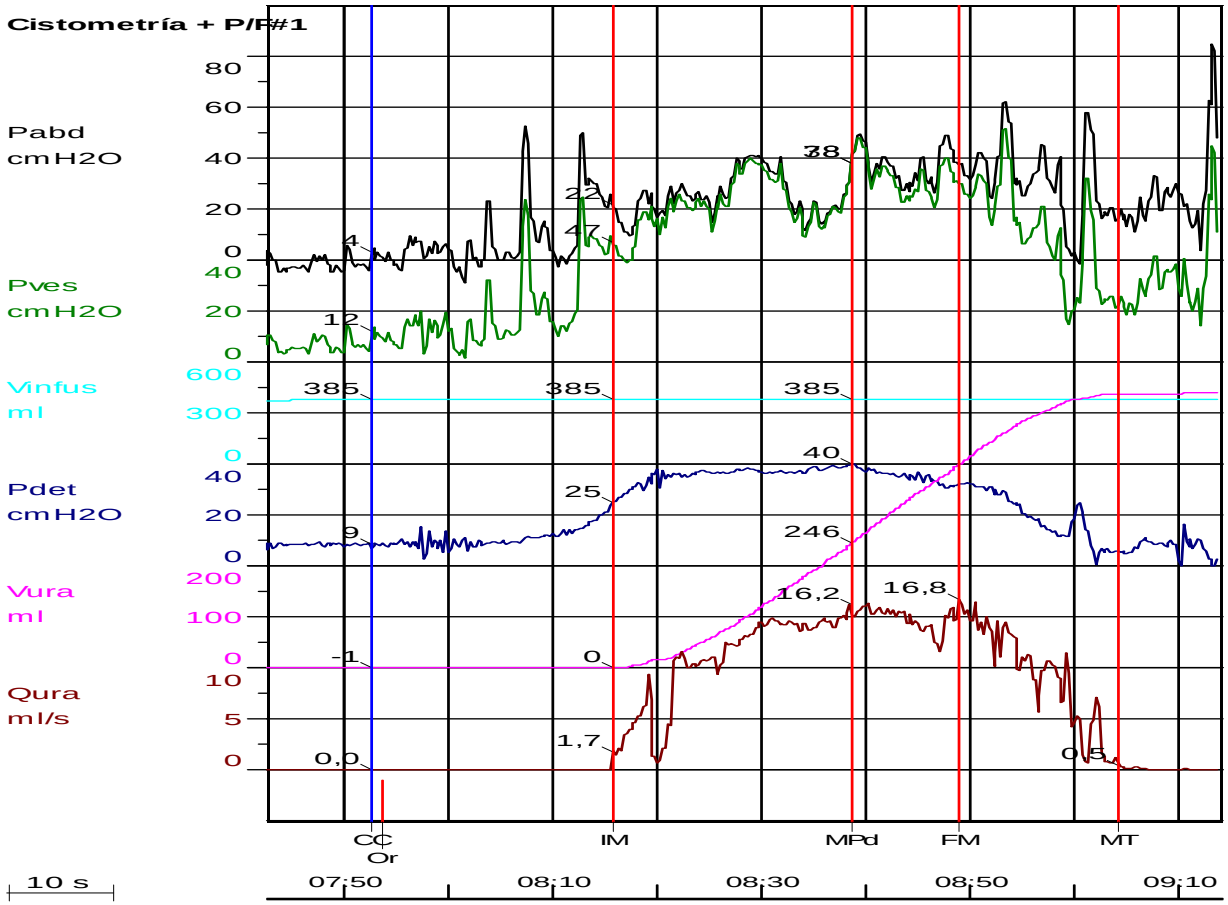
Hypo- contractility successfully compensated by

abdominal straining (PVR: 0 ml)

54 yo

Frequency

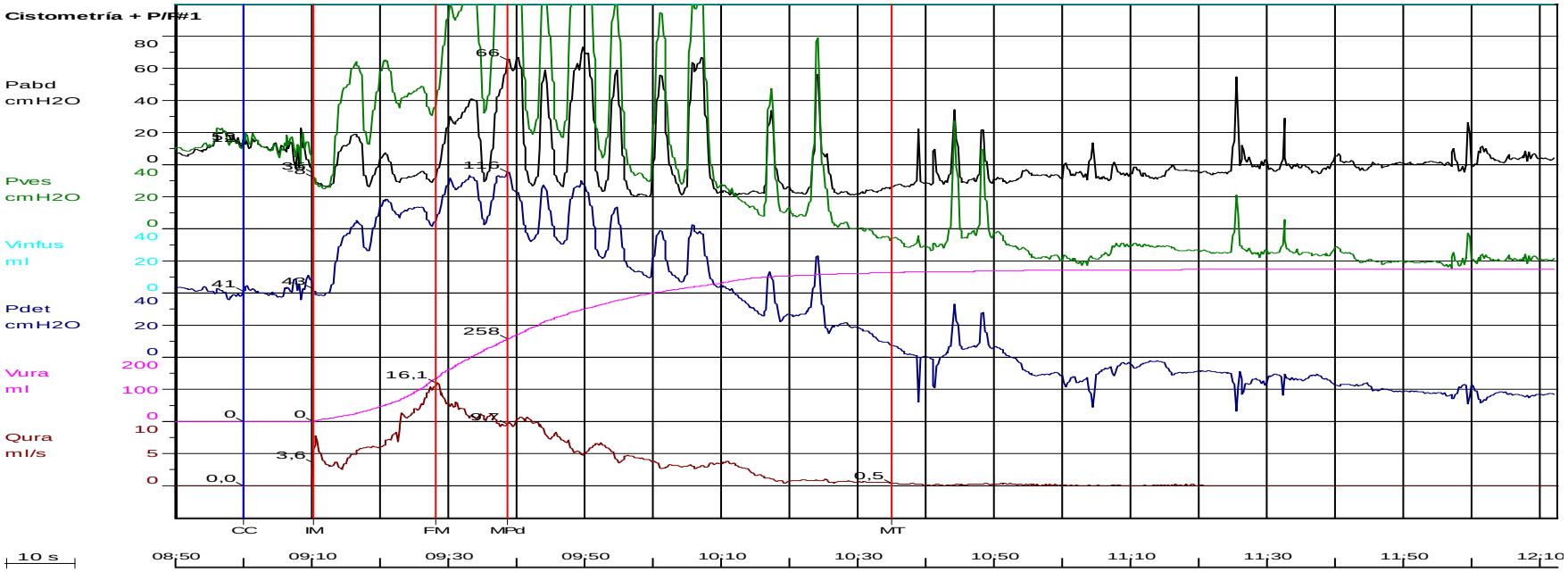
UTI´s



P/F: qualitative analysis. Voiding mechanisms in men

Hypo- contractility successfully compensated by

Un-effective abdominal straining (PVR: 80 ml)



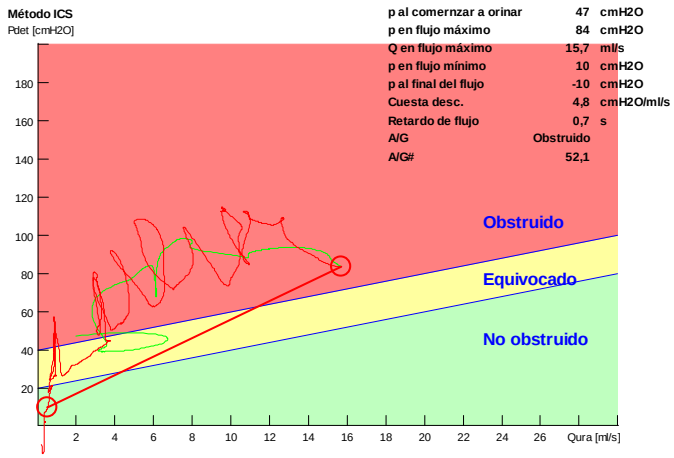
P/F: qualitative analysis. Voiding mechanisms in men

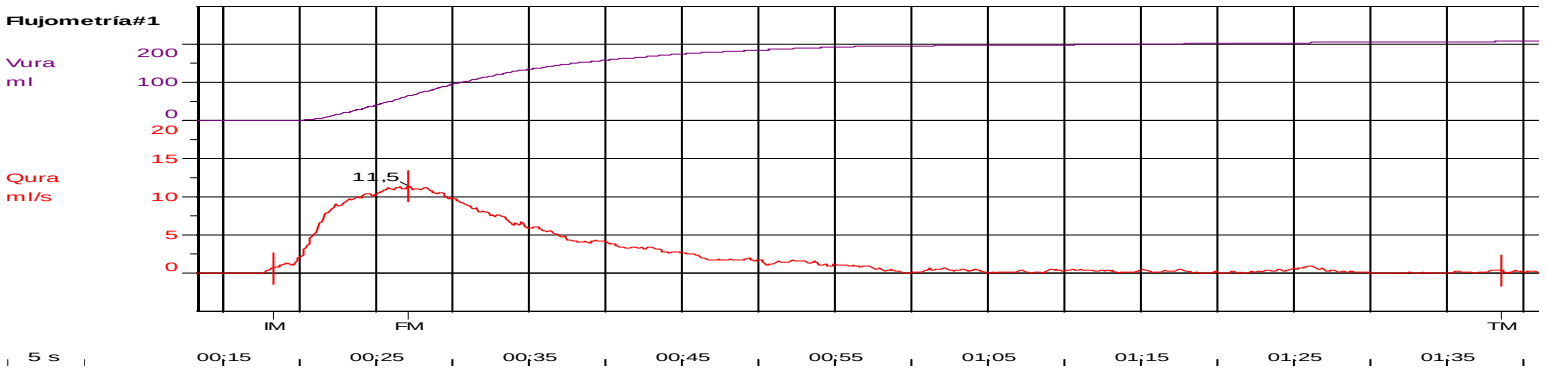
Hypo- contractility successfully compensated by

Un-effective abdominal straining (PVR: 0 ml)

54 yo

Retention

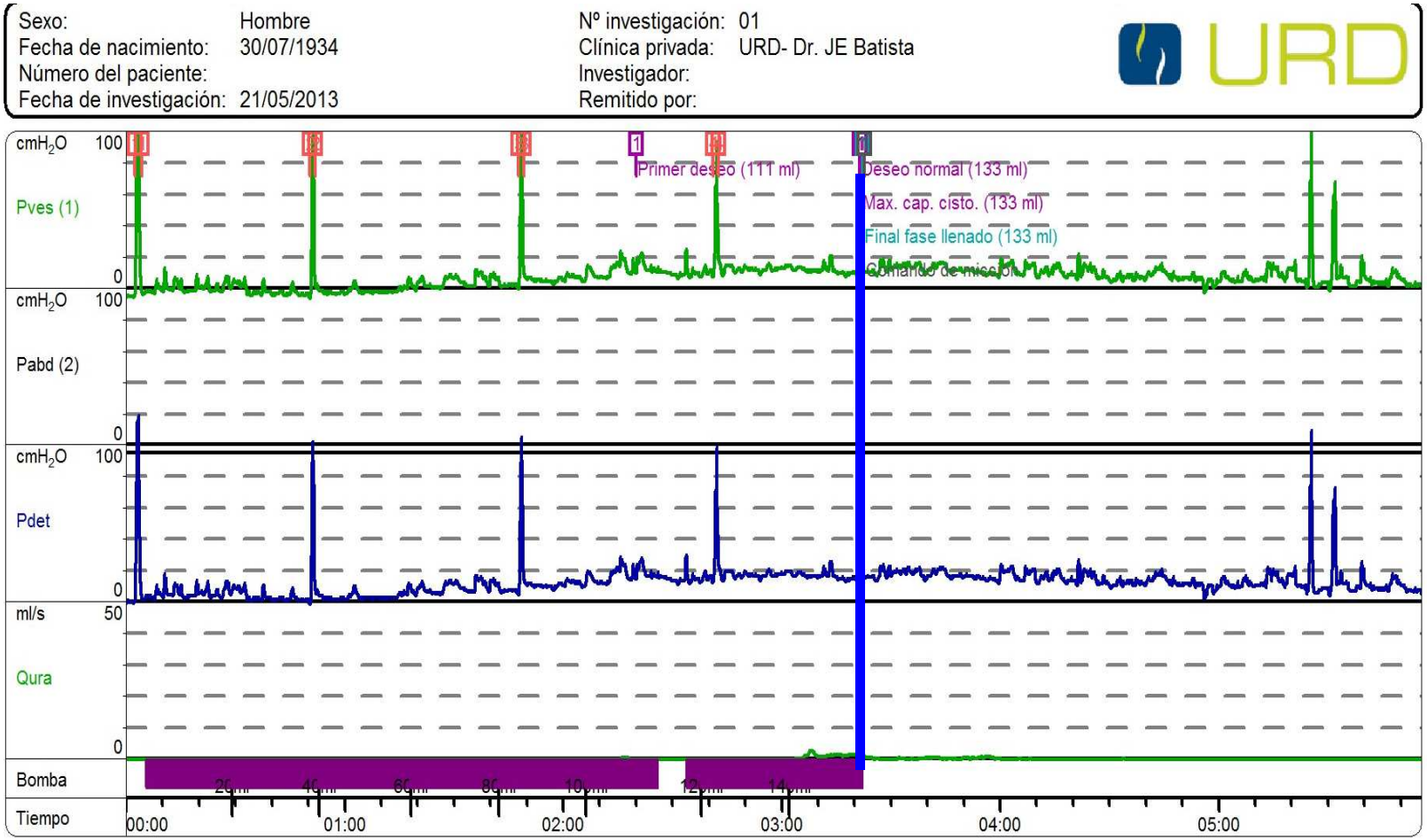




P/F: qualitative analysis. Voiding mechanisms in men

A contractility:

- 78 y-o male, previus brachytherapy and TURP; in retention



P/F: qualitative analysis. Voiding mechanisms in men

Hypo- contractility

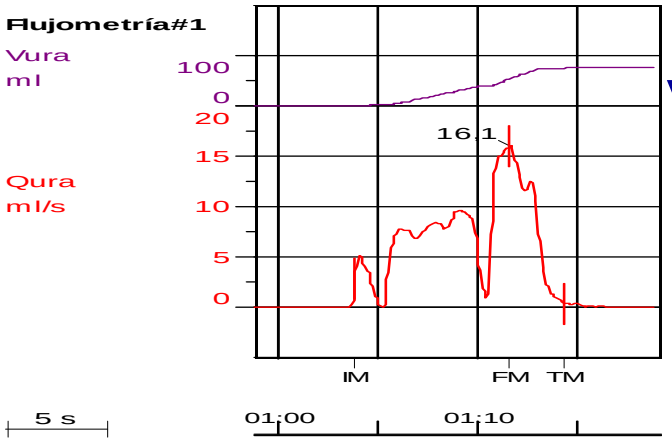
- in time (no sustained contraction is achieved; hence, no complete voiding is produced)

A contractility:

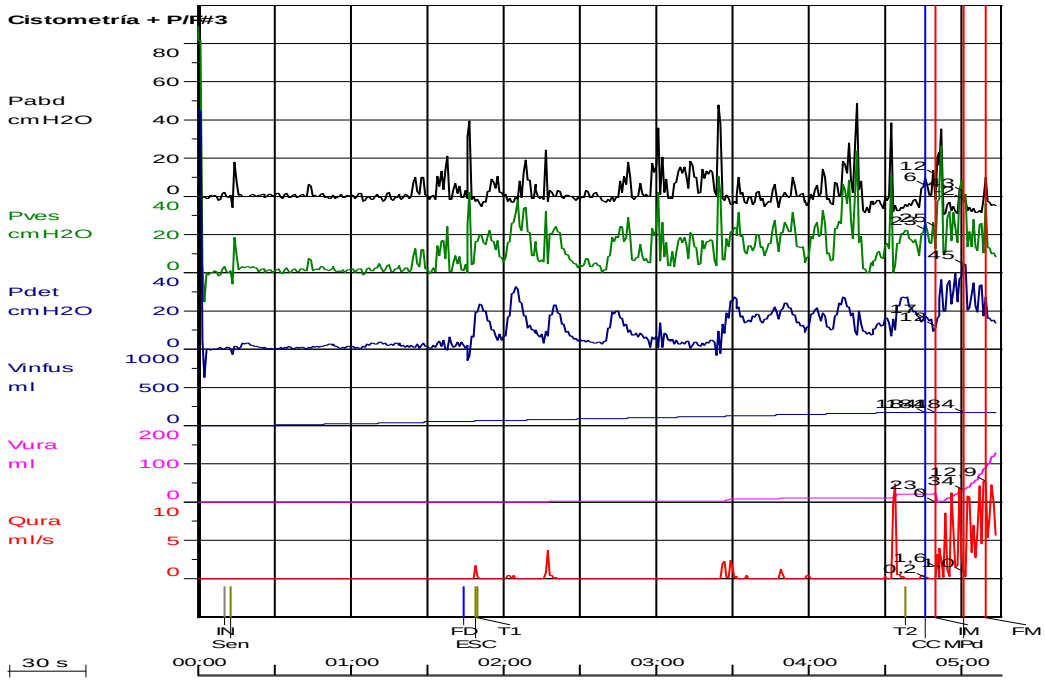
- Very rare without previous surgery

P/F: qualitative analysis. Voiding mechanisms; neurogenic

38 y-o female with MS; mixed incontinence and UTI´s



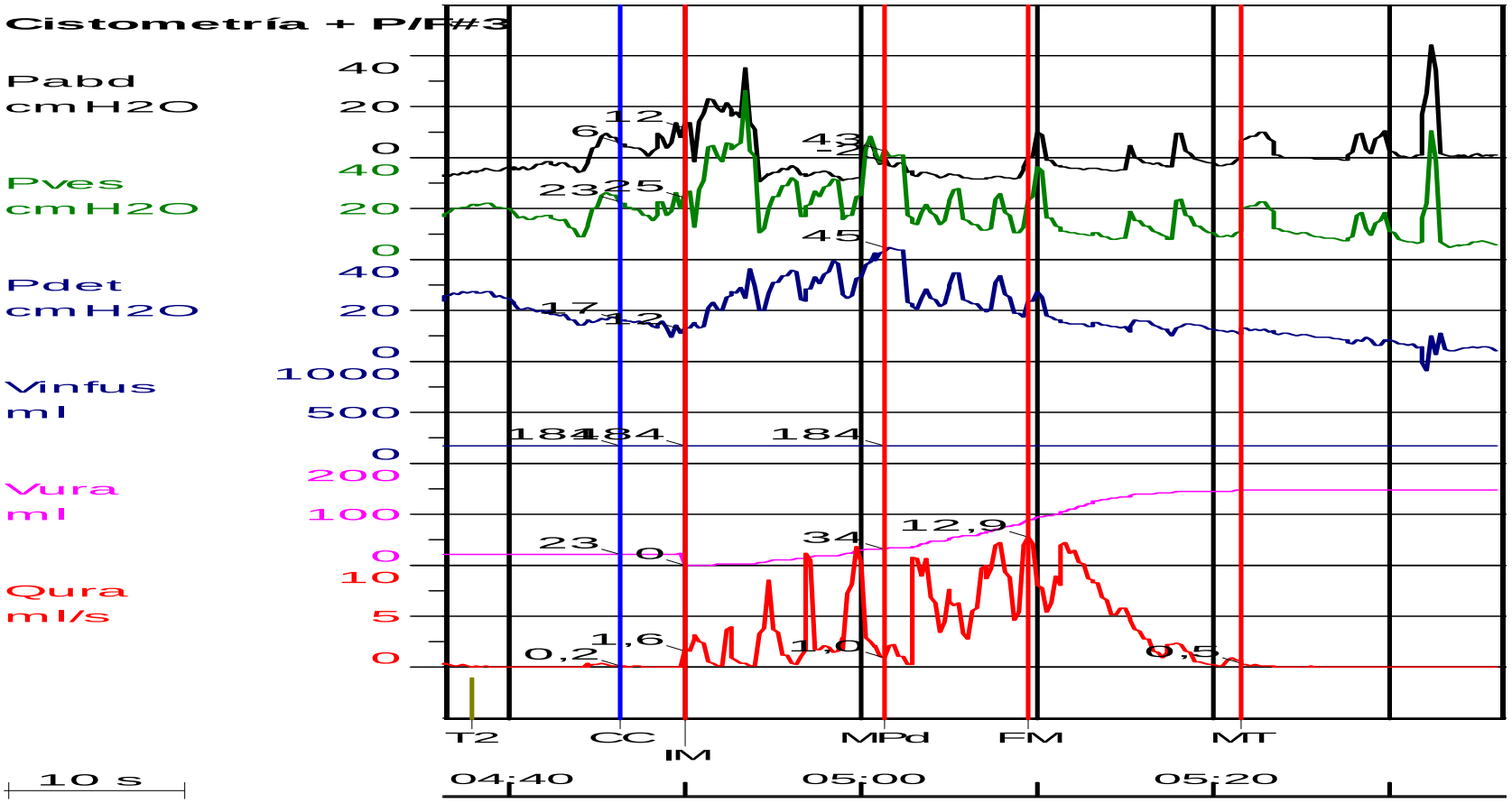
V Vol 76ml; PVR: 280ml



P/F: qualitative analysis. Voiding mechanisms; neurogenic

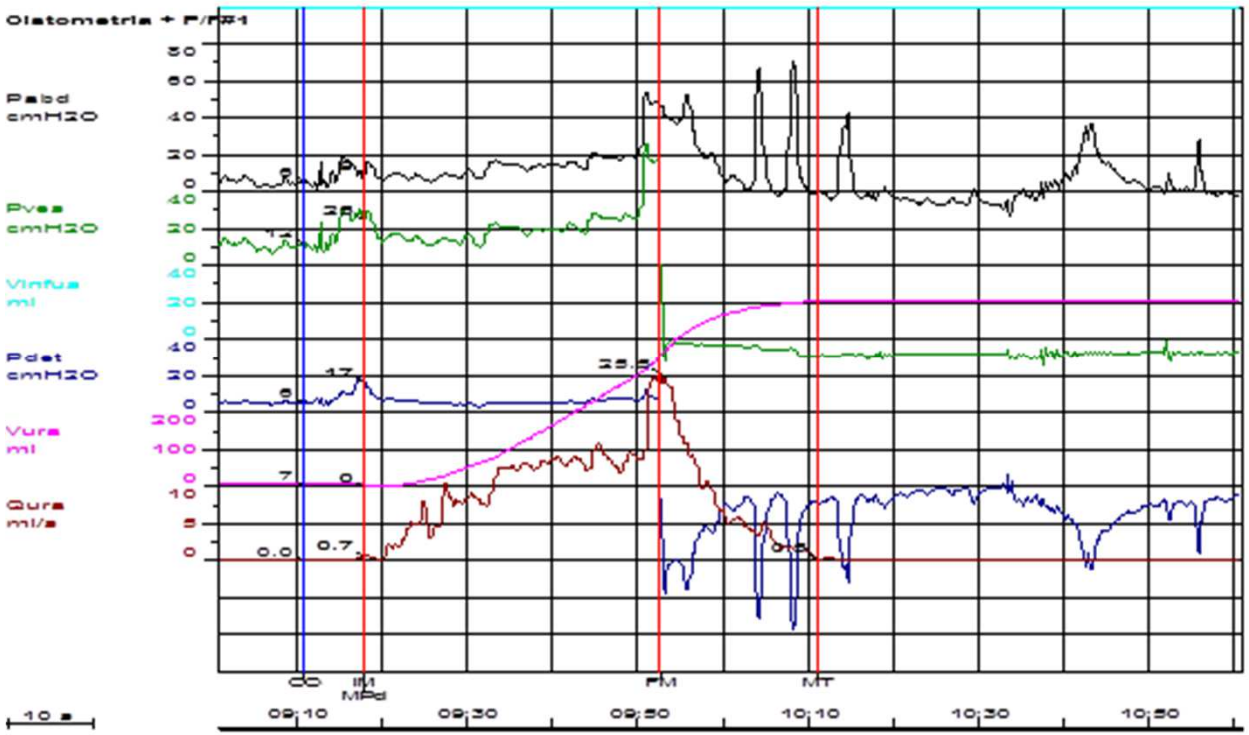
38 y-o female with MS; mixed incontinence and UTI´s

Detrusor /sphicter dyssinergia



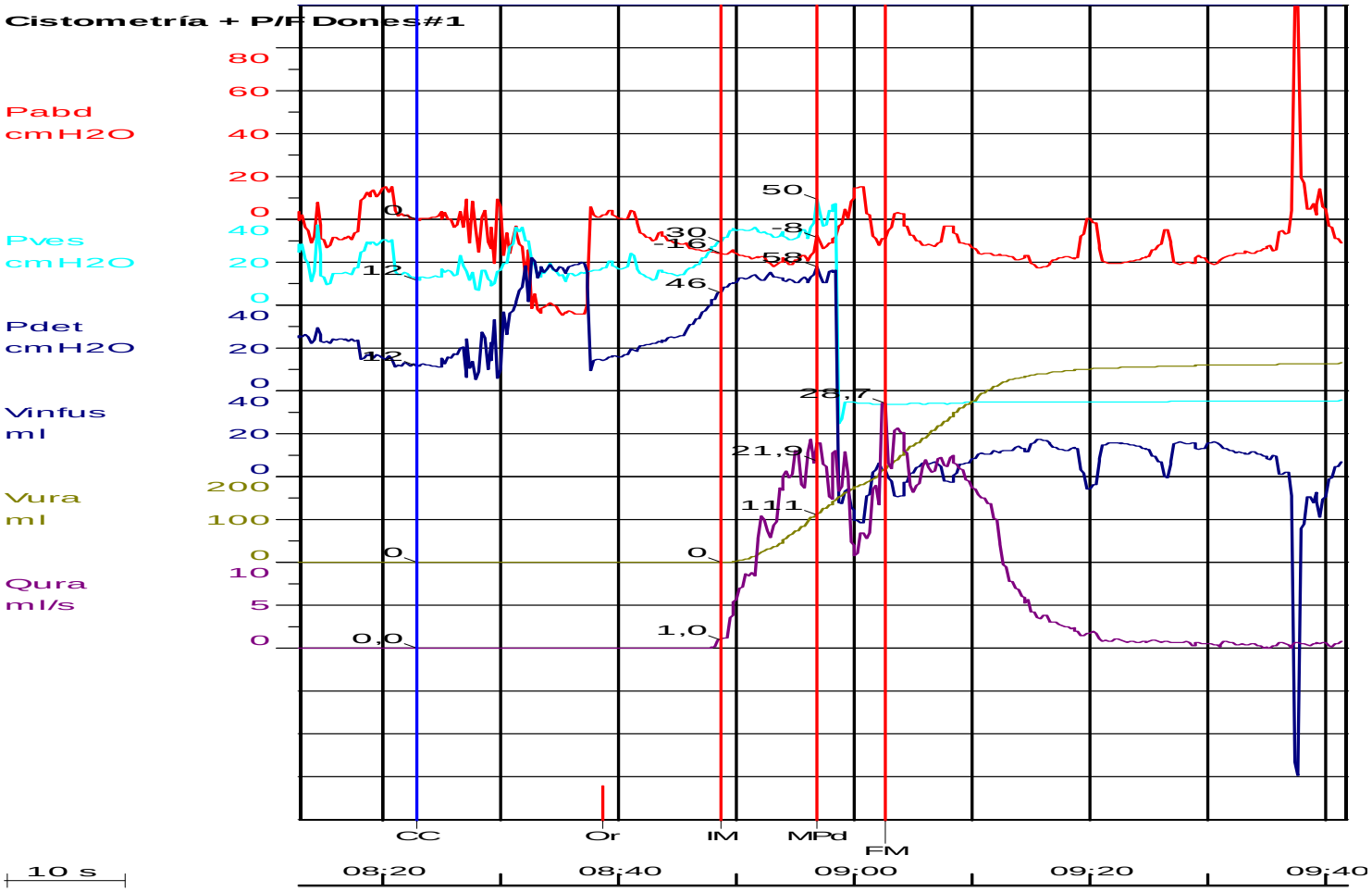
P/F: qualitative analysis. Artifacts

- P ves catheter displacement (fall !)
- P abd catheter



P/F: qualitative analysis. Artifacts

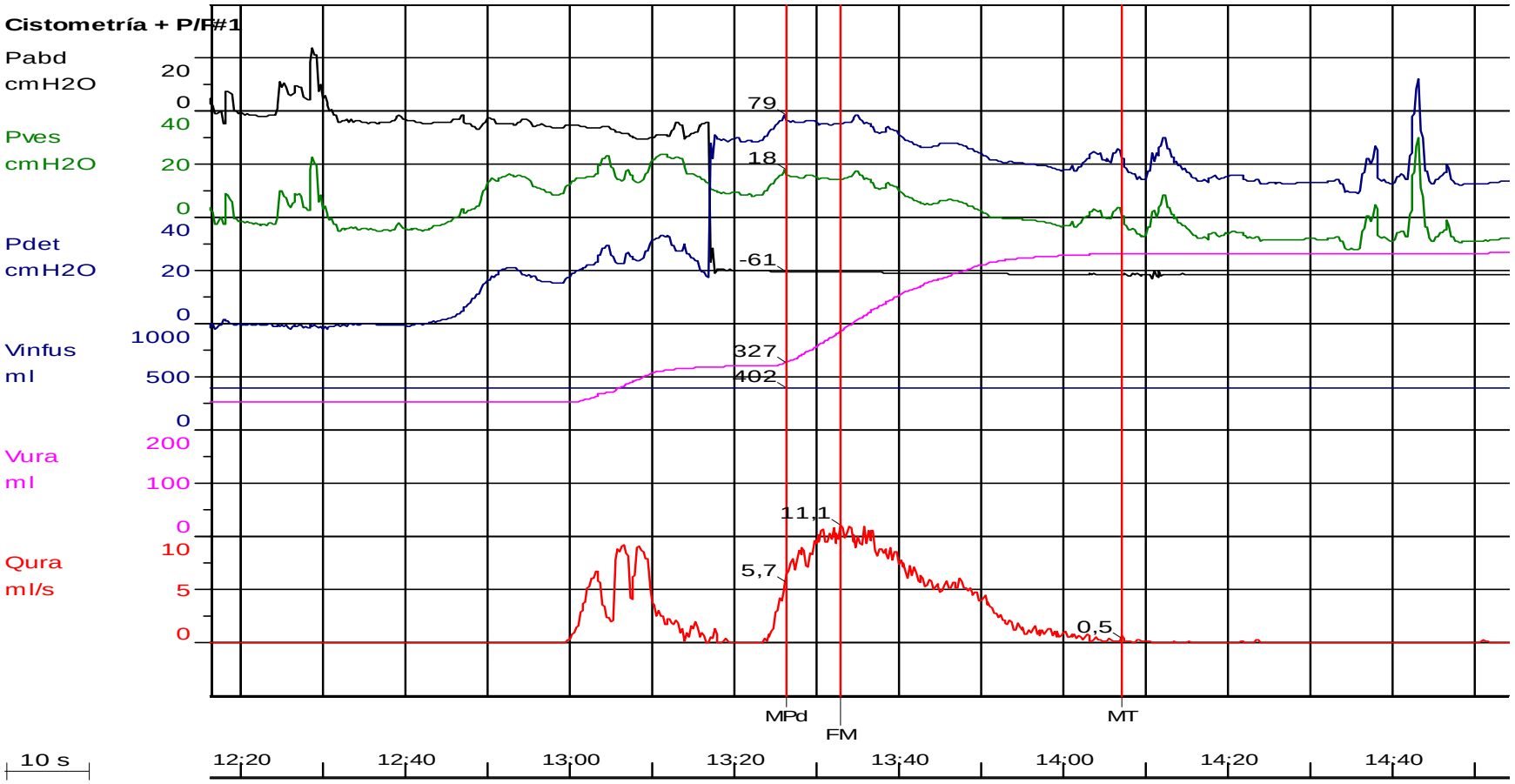
- **P ves catheter displacement (fall !)**



P/F: qualitative analysis. Artifacts

P abd catheter falls

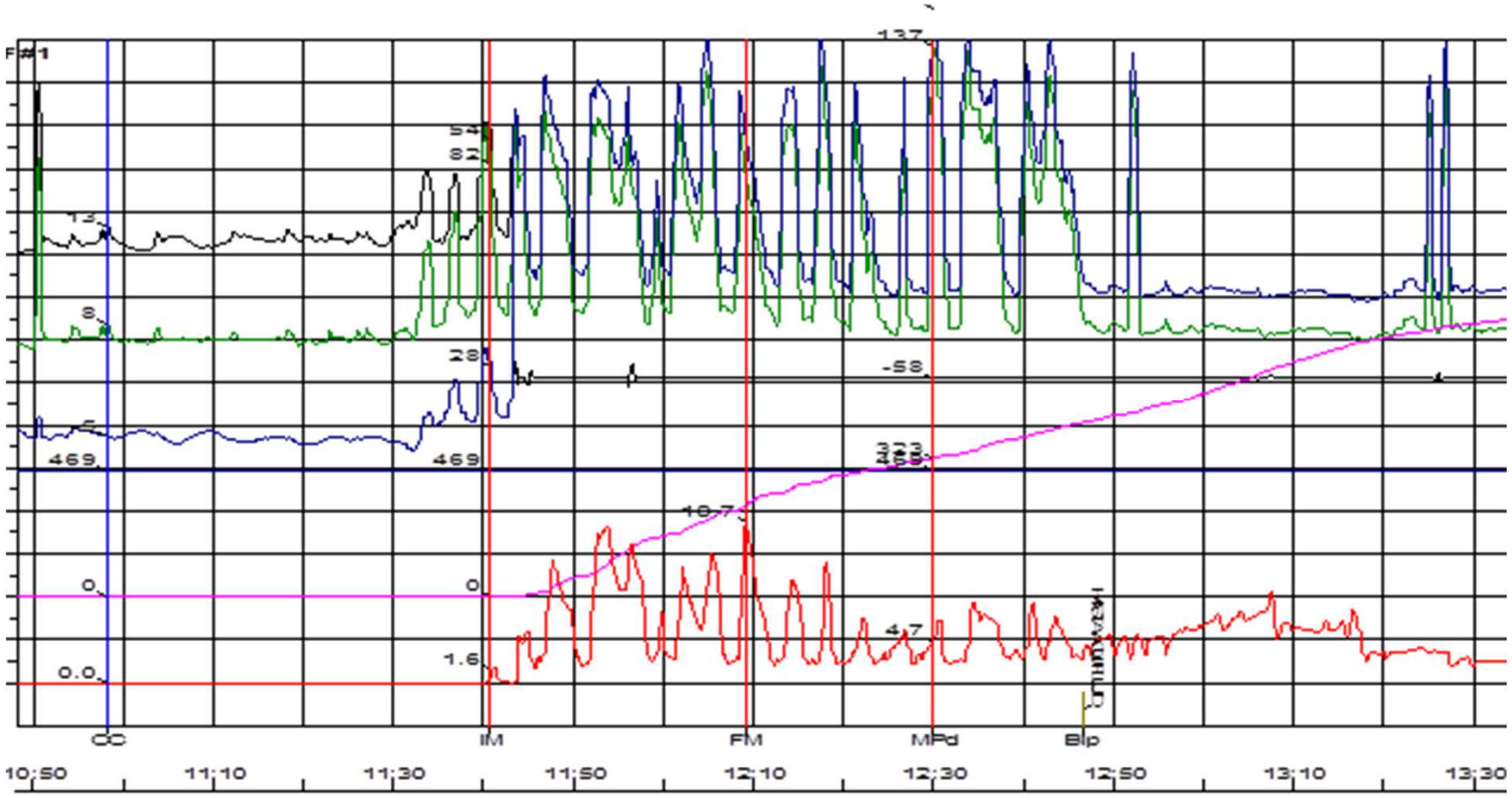
(rotating disc flowmeter: artifact in voided volume)



P/F: qualitative analysis. Artifacts

P abd catheter falls

(rotating disc flowmeter: artifact in voided volume)



P/F: qualitative analysis. Summary

- Review carefully expanded traces
- Rule out artifacts
- Compare to free uroflowmetry
- Describe voiding mechanism and efficiency
- Repeat if not satisfactory

Urodynamics Workshop

Karl J. Kreder, MD

Professor and Head, Rubin H. Flocks Chair
University of Iowa Department of Urology

Overview

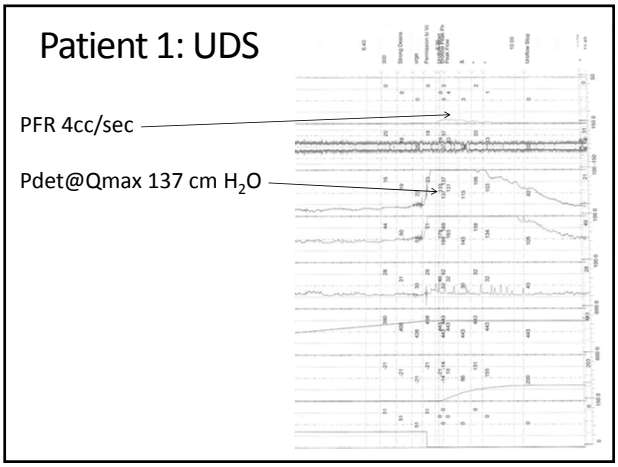
- Male LUTS
- Female LUTS
- Post Prostatectomy Incontinence
- Female Incontinence
- Neurogenic Bladder

Patient 1: Presentation

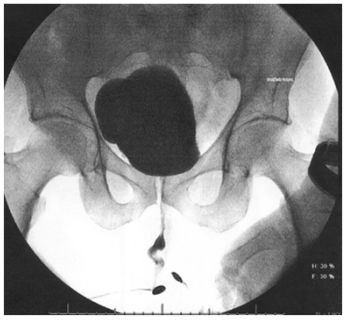
58-year-old man complaining of LUTS

- Nocturia 3-4 times per night
- Decreased urinary flow rate
- No UTI, hematuria or daytime frequency
- AUA Symptom Score 26
- PSA 2.95

Patient 1: UDS



Patient 1: Fluoroscopy



Patient 1: Findings and Plan

Findings

- Severe bladder outlet with non-draining diverticulum
- Cystoscopy: trilobar hypertrophy, high bladder neck and large narrow neck diverticulum

Plan

- Patient not interested in surgical therapy; opts for trial of alpha-blocker and 5 ARI

Patient 1: Follow-up

He returns 6 months later

- AUA symptom score is 13
- PSA is almost 50% less than baseline value prior to starting 5 ARI
- Has decreased ejaculate and decreased libido
- Obstructive symptoms have improved but still has bothersome irritative symptoms
- Wants to know what he should do ….

but he's not ready for surgery

Can Alpha-Blockers be Stopped?

- Multicenter open label study
- 9 months of combination therapy followed by 9 months of monotherapy with finasteride
- Primary outcome: maintenance of IPSS response after stopping alpha-blocker

Nickel JC et al. CUAJ 2008;1:16

Can Alpha-Blockers be Stopped?

- Results showed that IPSS scores after 3 months of monotherapy with finasteride were equivalent to 9 months of combination therapy and the effect was sustained at 9 months with monotherapy

Nickel JC et al. CUAJ 2008;1:16

Patient 1: Further Follow-up

He returns 3 months later

- AUA symptom score is 12
- Decreased ejaculate has improved but he still has decreased libido
- Obstructive symptoms have not worsened but he still has bothersome irritative symptoms
- Wants to know what he should do…

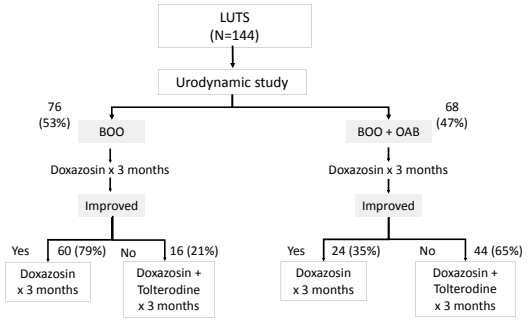
but he's not ready for surgery

Detrol did not Increase Incidence of Urinary Retention

	Placebo (n=72)	Detrol (n=149)
Micturition disorder	2 (2.8%)	7 (4.7%)
Urinary tract infection	3 (4.2%)	6 (4.0%)
Dysuria	1 (1.4%)	3 (2.0%)
Micturition frequency	2 (2.8%)	3 (2.0%)
Micturition urgency	1 (1.4%)	2 (1.3%)
Strangury	0	2 (1.3%)
Acute urinary retention	1 (1.4%)	1 (0.7%)
Bladder discomfort	0	1 (0.7%)
Urethral disorder	0	1 (0.7%)
Urinary incontinence	2 (2.8%)	0
Overall	9 (12.5%)	19 (12.8%)

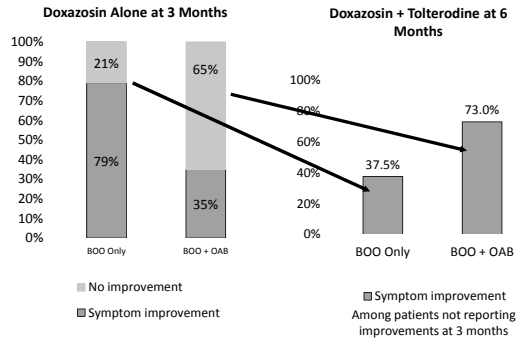
Abrams P et al. Neurourol Urodyn 2001;20:547

Doxazosin with or without Tolterodine in Men with Symptomatic BOO and OAB



Lee JL et al. BJU Int 2004;94:817

Symptom Improvement: Doxazosin with and without Tolterodine



Lee JL et al. BJU Int 2004;94:817

Patient 1: Further Follow-up

- Started on an anticholinergic medication
- Returns for f/u 3 months later: AUA symptom score is now 9
- BVI is 40 cc
- Has some dry mouth but is most bothered by decreased libido

Patient 1: Final Outcome

- Ultimately decides to have a TURP and coagulation of diverticulum
- 6 months later his AUA symptom score is 8
- Urgency and frequency are his most bothersome symptoms; BVI is 36 cc
- An anticholinergic is added and his AUA symptom score decreases to 2
- He is off his 5 ARI; decreased libido is a little better

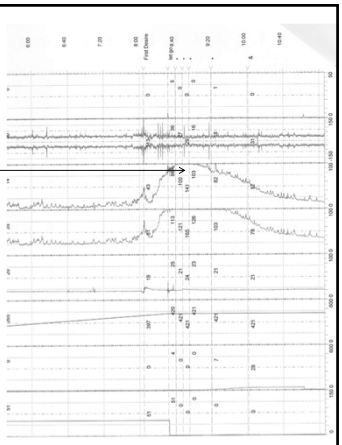
Patient 2: Presentation

73-year-old man presenting for evaluation of urinary retention

- Previous urologist told him he had a "twisted" bladder
- Since then, self-cathing 6-7 times per day
- No frequency, urgency, hematuria, stones, or neurologic injury
- Nocturia 1x night
- Taking Avodart and doxazosin

Patient 2: UDS

- Unstable contraction
- Max Pdet 141 cm H_2O
- Cystoscopy: obstructing 40 gm prostate
- Bladder capacity 397 cc



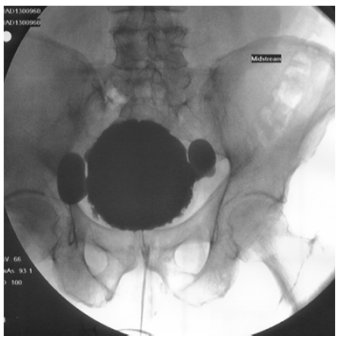
Bladder Outlet Obstruction in Males in the Setting of Voluntary vs. Involuntary Detrusor Contractions

- 24 males had UDS for suspected BOO had detrusor pressure and simultaneous uroflow measured during both a voluntary and involuntary detrusor contraction in the course of a single UDS study

Measurement	Mean Difference	SD	P-value (p≤0.05)
Opening pressure	20.9	25.2	0.0005
Pressure at peak flow rate	11.8	25.2	0.0320
PURR category	0.875		0.0017
Peak flow rate	1.0	4.47	0.2756

Allen VJ, Kreder KJ. AUA 1995

Patient 2: Fluoroscopy



Patient 2: Findings and Plan

Findings
- Detrusor overactivity
- Elevated voiding pressures/low flow = severe bladder outlet obstruction
- Incomplete bladder emptying
- Bladder diverticula

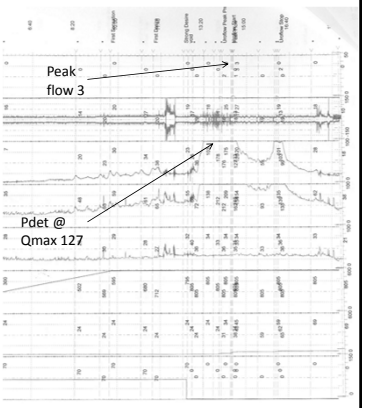
Options
- ? risk of incontinence
- Continue CIC
- TURP
- Open prostatectomy
- Patient electsedTURP

Patient 3: Presentation

60-year-old male referred for evaluation of LUTS
- Was undergoing preop for possible TURP
- Nocturia/nocturnal enuresis
- Dribbling, frequency, urgency
- Usually voids by straining

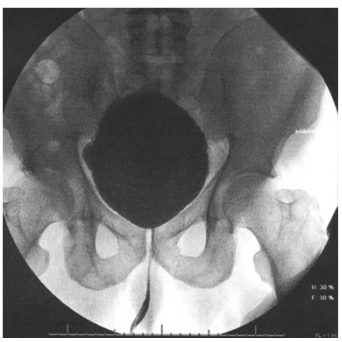
Patient 3: UDS

- Large capacity hyposensitive bladder
- Bladder diverticulum
- Detrusor overactivity
- Elevated pressures with low flow consistent with severe outflow obstruction
- Incomplete bladder emptying
- PVR 750 mL
- Voided volume 50 mL



Patient 3: Fluoroscopy

Cystoscopy demonstrates high bladder neck and mild prostate enlargement



Patient 3: Findings and Plan

Options
- Medical therapy
- CIC
- Outlet procedure
- Patient elected bladder neck incision
- At 6 mos follow-up, PVR <30 mL
- Retrograde ejaculation

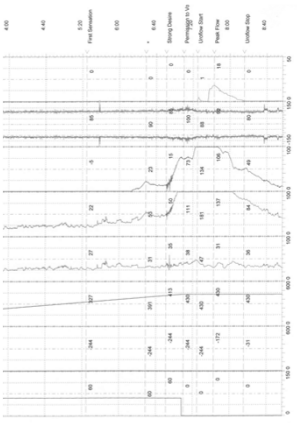
Patient 4: Presentation

70-year-old male with history of bladder cancer

- Reports bladder pressure and urinary frequency/urgency
- Nocturia x1-2
- Rarely experiences incontinence
- No dysuria, hematuria or UTI

Patient 4: UDS

- Bladder capacity 425ml
- Detrusor overactivity first at 380 ml
- Voided 325 ml with post-void residual of 100 ml
- Unstable voiding contraction was present
- Peak flow rate 18 ml/sec
- Detrusor pressure max flow rate 106 cmH_2O



Patient 4: Findings and Plan

- High pressure/high flow and detrusor overactivity
- Medical therapy for BPH +/- anticholinergic
- Surgical therapy +/- anticholinergic, Botox, InterStim
- Patient elected trial medical therapy, had symptomatic improvement and did not need anticholinergics

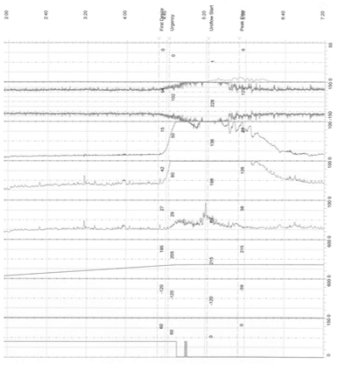
Patient 5: Presentation

68-year-old male initially seen as inpatient consult for acute urinary retention requiring indwelling catheterization

- Patient has left frontal anaplastic astrocytoma
- Reported having “slow but adequate” urine stream prior to retention
- After hospital discharge, patient calls to report inability to void more than very small amounts

Patient 5: UDS

- Bladder capacity 225 ml
- Detrusor overactivity first seen at 150 ml
- Urge incontinence seen first at 200 ml with detrusor pressure of 136 cmH^2O
- Voided 125 ml with post-void residual of 100 ml
- Unstable voiding contraction was present
- Peak flow was 6 ml/sec with detrusor pressure at max flow rate of 88 cmH_2O
- Opening pressure was 136 cmH_2O
- Urethral sphincter was active



Patient 5: Findings and Plan

- High pressure detrusor hyperreflexia
- Obstruction at least in part related to sphincter dyssynergia
- Patient was treated with anticholinergic medications + Mirabegron and CIC

The Role of Urodynamics in Female Stress Incontinence & Pelvic Organ Prolapse

55 yo F

- G3P3, all uncomplicated vaginal deliveries
- No other medical problems
- Chief complaint leakage with coughs, sneeze, sports, lifting grandchildren
- Frequency q3 hours, nocturia 1
- Occasional "key in the door urgency", rare urgency incontinence
- Desires Surgery

Same patient

- Chief complaint is vaginal bulge
- Normal voiding pattern
- Occasional leaks with coughing
- No pads
- Exam cervix and bladder at +1

Question

- Is there a role for UDS prior to surgery?

Fourth International Consultation on Incontinence

"The committee recommends urodynamic studies are carried out in all women prior to surgical intervention for stress urinary incontinence."

EAU recommendation

6.2.1. Assessment

Women with complicated incontinence requiring specialised management usually require additional testing (ie, cytology, urethrocystoscopy, or urinary tract imaging) to exclude any other underlying pathology. If these tests reveal no further pathology, the patient should be treated for UI by initial or specialised management options, as appropriate.

Women who have failed initial management and are bothered by their symptoms and an impaired QoL are likely to request further treatment. If initial management has

Urodynamic testing to diagnose the type of UI is highly recommended prior to intervention if the results are likely to influence the choice of treatment. It may also be helpful

Historical beliefs about Urodynamics and Female Reconstructive Surgery

- UDS will uncover detrusor overactivity
  - predisposes to a bad surgical outcome
- UDS diagnoses SUI and its severity
  - may influence procedure type
- UDS identifies voiding problems/weak detrusor
  - These patients at risk for post-op retention
  - may influence procedure type

However, Urodynamics Are:

- Uncomfortable
- Associated with risk of infection
- Costly
  - $350-375 for Medicare
  - $600-1000 for private insurance
  - If assume $500 per study, and 130,000 patients receive UDS preop, total cost = $65,000,000

Urodynamic studies should improve outcomes

Prospective Trials Don't Support Routine Urodynamic Studies

- SISTEr
- CARE
- TOMUS
- VALUE

Urodynamic Measures Do Not Predict Stress Continence Outcomes After Surgery for Stress Urinary Incontinence in Selected Women

Charles W. Nager,* MaryPat FitzGerald, Stephen R. Kraus,† Toby C. Chai,‡ Halina Zyczynski, Larry Sirls, Gary E. Lemack,§ L. Keith Lloyd, Heather J. Litman, Anne M. Stoddard, Jan Baker‖ and William Steers¶ for the Urinary Incontinence Treatment Network

- Multicenter, randomized trial evaluating prognostic value of preop UDS for Burch versus bladder neck sling in 655 women
- Inclusion
  - Predominate SUI symptoms on MESA
  - + cough stress test
  - Bladder capacity > 200cc
  - Urethral hypermobility
- Exclusion
  - Obstructed voiding without prolapse
  - Previous pelvic surgery
  - Cancer treatment known to affect bladder/urethra
- Previous incontinence surgery allowed, present in 14%

SISTEr outcome measure

- Success defined as:
  - negative pad test (15ml/24hr)
  - no incontinence on 3 day diary
  - negative stress test
  - no SUI on self report
  - no retreatment from 6 to 24 months post op

SISTEr Results

TABLE 1. *Subjects with successful overall or stress specific outcomes by USI status*

	Overall Success*		Stress Specific Success†	
% USI (frequency/total No.)	37	(171/464)	53	(257/484)
% No USI (frequency/total No.)	19	(9/47)	40	(20/50)
OR controlling only for treatment group (95% CI)	2.49 (1.17–5.29)		1.74 (0.95–3.16)	
p Value	0.02		0.07	
Multivariable OR‡	2.26 (0.99, 5.17)		1.45 (0.74, 2.85)	
p Value	0.05		0.28	

TABLE 2. *Subjects with successful overall or stress specific outcomes by DO status*

	Overall Success*		Stress Specific Success†	
% No DO (frequency/total No.)	37	(171/468)	53	(257/487)
% DO (frequency/total No.)	28	(13/46)	47	(23/49)
OR (95% CI)	1.46 (0.75–2.85)		1.26 (0.70–2.28)	
p Value	0.35		0.62	

* Of 655 women 520 had 24-month overall outcome results, and of these women 514 had DO status recorded (468 without DO and 46 with DO).
† Of 655 women 543 had 24-month stress specific outcome results, and of these women 536 had DO status recorded (487 without DO and 49 with DO).

TABLE 3. *$VLPP_{max}$ by surgical procedure and treatment outcome*

	Burch	Pubovaginal Sling
Mean cm H_2O (SD)/No. overall outcome:		
Success	115 (40)/ 57	117 (33)/ 71
Failure	115 (37)/104	121 (39)/105
Mean cm H_2O (SD)/No. stress specific outcome:		
Success	116 (40)/ 80	117 (34)/109
Failure	114 (37)/ 87	125 (41)/ 72

Weak trend toward better overall success in women with urodynamic SI compared to those without (p=0.28)

Subjects with DO did not have a significant worse outcome than those without DO (p =0.35)

VLPP did not predict failure

Conclusions

- In this randomized prospective study with blinded pre-operative urodynamics, there was no indication that the urodynamic results were able to predict surgical failure or complications

Colpopexy and Urinary Reduction Efforts trial (CARE)

- Similar trial looking at benefit of UDS prior to surgery for two prolapse surgeries
  - Patients still chosen clinically
- Surgeons blinded to preop UDS results.
  - Utilized UDS preoperatively to help define occult SUI.

Int Urogynecol J (2008) 19:607–614

CARE

- Standardized preoperative assessment:
  - Prolapse by POPQ
  - Urethral mobility by Q-tip testing (hypermobility >20°)
  - Multichannel urodynamic
- Surgeons were blinded to results of urodynamic testing,
- UDS + if leaked at 300ml prolapse reduction

Colpopexy and Urinary Reduction Efforts trial (CARE)

- Found that continence was improved with SUI procedure regardless of urodynamic findings
- Urodynamics again unable to predict complications (retention)

Int Urogynecol J (2008) 19:607–614

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Retropubic versus Transobturator Midurethral Slings for Stress Incontinence

Holly E. Richter, Ph.D., M.D., Michael E. Albo, M.D., Halina M. Zyczynski, M.D., Kimberly Kenton, M.D., Peggy A. Norton, M.D., Larry T. Sirls, M.D., Stephen R. Kraus, M.D., Toby C. Chai, M.D., Gary E. Lemack, M.D., Kimberly J. Dandreo, M.Sc., R. Edward Varner, M.D., Shawn Menefee, M.D., Chiara Ghetti, M.D., Linda Brubaker, M.D., Ingrid Nygaard, M.D., Salil Khandwala, M.D., Thomas A. Rozanski, M.D., Harry Johnson, M.D., Joseph Schaffer, M.D., Anne M. Stoddard, Sc.D., Robert L. Holley, M.D., Charles W. Nager, M.D., Pamela Moalli, M.D., Ph.D., Elizabeth Mueller, M.D., Amy M. Arisco, M.D., Marlene Corton, M.D., Sharon Tennstedt, Ph.D., T. Debuene Chang, M.D., E. Ann Gormley, M.D., and Heather J. Litman, Ph.D., for the Urinary Incontinence Treatment Network*

ABSTRACT

BACKGROUND
Midurethral slings are increasingly used for the treatment of stress incontinence, but there are limited data comparing types of slings and associated complications.

METHODS
We performed a multicenter, randomized equivalence trial comparing outcomes with retropubic and transobturator midurethral slings in women with stress incontinence. The primary outcome was treatment success at 12 months according to both objective criteria (a negative stress test, a negative pad test, and no retreatment) and subjective criteria (self-reported absence of symptoms, no leakage episodes recorded, and no retreatment). The predetermined equivalence margin was ±12 percentage points.

TOMUS

- Multicenter randomized equivalence trial in 597 women comparing retropubic to transobturator midurethral slings
- Similar inclusion criteria
- Success defined as negative stress test, pad test, and self reported absence of symptoms
- UDS performed prior to surgery and 12 months after

Results

- 80.8% and 77.7% success in retropubic versus transobturator groups.
- No difference in postoperative urge incontinence, satisfaction with procedure or quality of life.

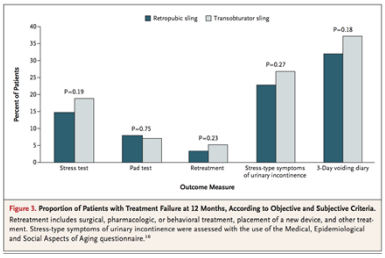


Figure 3. Proportion of Patients with Treatment Failure at 12 Months, According to Objective and Subjective Criteria. Retreatment includes surgical, pharmacologic, or behavioral treatment, placement of a new device, and other treatment. Stress-type symptoms of urinary incontinence were assessed with the use of the Medical, Epidemiological and Social Aspects of Aging questionnaire.[16]

UDS measures

Table 1. (Continued.)

Characteristic	Retropubic Sling (N=298)	Transobturator Sling (N=299)
Urodynamic measures		
Urodynamic stress incontinence — no./total no. (%)	246/291 (85)	259/298 (87)
Valsalva leak-point pressure — cm of water††	114.4±43.1	124.2±41.4
Maximum urethral closure pressure — cm of water‡‡	66.6±34.0	69.3±31.1
Detrusor overactivity — no./total no. (%)	38/292 (13)	32/297 (11)

Tomus UDS results

- Severe urethral dysfunction was no more likely to have treatment failure with the transobturator sling than with the retropubic sling
  - retropubic-sling patients had lower baseline VLPPs but this did not influence the relationship between the treatment and the outcome.
  - Number of women with Valsalva leak-point pressure of 60 cm of water or less = **???**
  - maximal urethral closure pressure of 20 cm of water or less = **???**
- Both slings had similar efficacy regardless of sphincteric function.

UDS Conclusions

- UDS data shows equivalent success rates between the two groups
  - transobturator and retropubic sling had equal failure rates in severe urethral dysfunction (lower VLPP and low maximal urethral closure pressures)

VALUE Trial

ORIGINAL ARTICLE

A Randomized Trial of Urodynamic Testing before Stress-Incontinence Surgery

Charles W. Nager, M.D., Linda Brubaker, M.D., Heather J. Litman, Ph.D., Halina M. Zyczynski, M.D., R. Edward Varner, M.D., Cindy Amundsen, M.D., Larry T. Sirls, M.D., Peggy A. Norton, M.D., Amy M. Arisco, M.D., Toby C. Chai, M.D., Philippe Zimmern, M.D., Matthew D. Barber, M.D., Kimberly J. Dandreo, M.Sc., Shawn A. Menefee, M.D., Kimberly Kenton, M.D., Jerry Lowder, M.D., Holly E. Richter, Ph.D., M.D., Salil Khandwala, M.D., Ingrid Nygaard, M.D., Stephen R. Kraus, M.D., Harry W. Johnson, M.D., Gary E. Lemack, M.D., Marina Mihova, B.S., Michael E. Albo, M.D., Elizabeth Mueller, M.D., Gary Sutkin, M.D., Tracey S. Wilson, M.D., Yvonne Hsu, M.D., Thomas A. Rozanski, M.D., Leslie M. Rickey, M.D., David Rahn, M.D., Sharon Tennstedt, Ph.D., John W. Kusek, Ph.D. and E. Ann Gormley, M.D., for the Urinary Incontinence Treatment Network*

ABSTRACT

BACKGROUND

Urodynamic studies are commonly performed in women before surgery for stress urinary incontinence, but there is no good evidence that they improve outcomes.

VALUE Trial

- Multicenter, randomized noninferiority trial
- 630 women with uncomplicated SUI
- Inclusion criteria:
  - > 21 years and SUI for > 3 months,
  - MESA stress score > urge score
  - PVR < 150cc,
  - Urethral mobility
  - Positive provocative stress test at any volume
- Exclusion criteria
  - Previous incontinence surgery (#3)
  - Pelvic irradiation
  - Anterior/apical pelvic organ prolapse > +1cm

VALUE outcome measures

- Primary outcome: success at 12 months
  - Reduction in urogenital distress inventory of 70% or greater
  - "much" or "very much better" on Patient Global Impression of Improvement

Surgical treatments performed UDS versus non UDS groups

- Retropubic midurethral sling 65% / 65%
- Transobturator midurethral sling 29% / 28%
- Mini-sling 2% / 1.4%
- Traditional bladder neck sling 3.4% / 4.9%
- Retropubic uerthropexy 0% / 0.7%
- Urethral bulking 1% / 0.4%

Success of PGII

"How is your urinary tract condition now, as compared to with how it was before you received treatment for your urinary leakage?"

1. Very much better
2. Much better
3. A little better
4. No change
5. A little worse
6. Much worse
7. Very much worse

Results

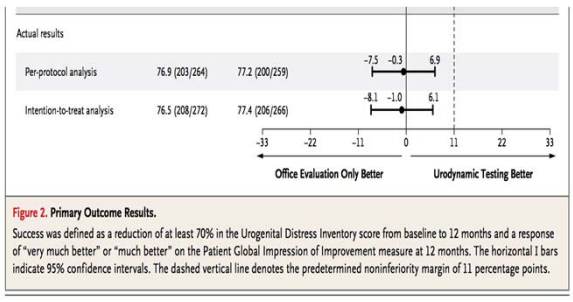
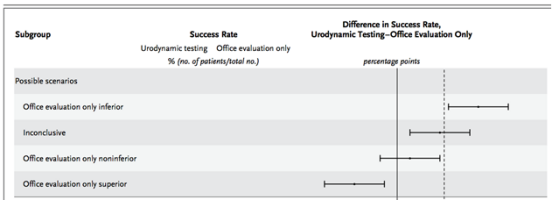


Figure 2. Primary Outcome Results.

Success was defined as a reduction of at least 70% in the Urogenital Distress Inventory score from baseline to 12 months and a response of "very much better" or "much better" on the Patient Global Impression of Improvement measure at 12 months. The horizontal I bars indicate 95% confidence intervals. The dashed vertical line denotes the predetermined noninferiority margin of 11 percentage points.

Subgroup of VALUE



Results

Table 2. Outcomes.*

Outcome	Urodynamic Testing (N = 272)	Office Evaluation Only (N = 266)	P Value
Primary			
70% reduction in Urogenital Distress Inventory score — no. (%)	210 (77.2)	210 (78.9)	0.63
"Very much better" or "much better" on Patient Global Impression of Improvement — no./total no. (%)†	248/270 (91.9)	238/262 (90.8)	0.68
Secondary			
Change in Urogenital Distress Inventory score	−100.2±50.1	−98.4±51.4	0.68
Change in Incontinence Severity Index score‡	−6.0±3.3	−5.7±3.4	0.40
Change in MESA score			
Stress incontinence	−61.5±22.0	−60.2±24.7	0.50
Urgency incontinence	−19.7±21.4	−22.2±22.4	0.19
Change in Incontinence Impact Questionnaire score	−35.9±23.2	−37.3±23.7	0.49
Change in SF-12 score§	5.0±10.8	7.3±12.0	0.02
Change in Patient Global Impression of Severity score¶	−1.8±0.9	−1.8±0.9	0.68
Score of moderate or severe on the Patient Global Impression of Severity at 12 mo — no./total no. (%)‖	19/271 (7.0)	15/266 (5.6)	0.51
Overall patient satisfaction score at 12 mo**	79.5±30.4	82.2±28.6	0.28
Positive provocative stress test at 12 mo — no./total no. (%)††	36/225 (16.0)	26/222 (11.7)	0.19

Conclusion

- Success was found in 77% in patients with preoperative UDS and 77% in patients with office evaluation only.
- Office evaluation is not inferior to UDS for uncomplicated SUI at 1 year
- For uncomplicated SUI UDS is not necessary

Secondary Analysis

- 50% of diagnoses changed in the UDS group
- No significant change in global treatment plan
- No significant difference in patient outcomes
- Supports main outcome of UDS not needed

Big Picture

- Routine pre-op UDS are not indicated for the majority of women with SUI and POP
- We will discuss specific cases that illustrate where UDS may still have a role

Impact of the radical surgery for cervical cancer on bladder and urethal function.

LOWER URINARY TRACT SYMPTOMS AND URODYNAMIC OBSERVATIONS

Montserrat **Espuña-Pons**
ICGON. Hospital Clínic
University of Barcelona
SPAIN

Impact of the radical surgery for cervical cancer on bladder function

- **Surgery remains the preferred primary treatment option for cervical cancer.**
- **Radical hysterectomy** (RH) is the standard treatment of **early-stage cervical carcinoma**.

Impact of the radical surgery for cervical cancer on bladder function

- Standard RH with pelvic lymphadenectomy can be accompanied by early and late postoperative morbidity , particularly to the **pelvic floor.**

Impact of the radical surgery for cervical cancer on bladder function

- The published prevalence of some degree of bladder dysfunction ranges from 8 to 80%.

Impact of the radical surgery for cervical cancer on bladder function

Women after RH had significantly more :

- **voiding dysfunction**
- **urinary incontinence**

Impact of the radical surgery for cervical cancer on bladder and urethal function.

LOWER URINARY TRACT SYMPTOMS AND URODYNAMIC OBSERVATIONS

VOIDING DYSFUNCTION

Early postoperative SYMPTOMS of voiding dysfunction

- 15 % of patients after RH requiere urethral **catheterization for more than 30 days.**

- Manchana et al (2009)

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the Journal of Cancer Surgery
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EJSO 32 (2006) 445–449

Urogynaecological dysfunction after radical hysterectomy

S.M. Axelsen*, L.K. Petersen

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Accepted 26 January 2006
Available online 3 March 2006

SYMPTOMS OF *"DIFICULT VOIDING"* AFTER SURGERY

- 123 /333 **(36%)**

Gynecologic Oncology 117 (2010) 281–286

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journal homepage: www.elsevier.com/locate/ygyno

Long-term cervical cancer survivors suffer from pelvic floor symptoms: A cross-sectional matched cohort study

M.H. Hazewinkel [a,*], M.A.G. Sprangers [b], J. van der Velden [a], C.H. van der Vaart [c], L.J.A. Stalpers [d], M.P.M. Burger [a], J.P.W.R. Roovers [a]

A cross-sectional matched cohort study.
Cervical Cancer Survivors (CCS), treated in the Academic Medical Center, Amsterdam between 1997 and 2007, were machet to a random **female population** sample aged **20 to 70 years (reference group).**

The two cohorts, CCS and reference group, both comprised **242 women each.**

1. **146** CCS had been treated with radical hysterectomy and pelvic lymph node dissection (RH and LND).
2. **49** underwent surgery and adjuvant radiotherapy (SART).
3. **47** underwent primary radiotherapy (PRT).

Gynecologic Oncology

Long-term cervical cancer survivors suffer from pelvic floor symptoms: A cross-sectional matched cohort study

Proportions (%) of CCS with distressing pelvic floor symptoms (i.e., scoring above 90th percentile of domain scores of reference group) and odds ratios (95% CI) of every treatment group compared to their matched references.

	RH and LND ($N=146$)			SART ($N=49$)			PRT ($N=47$)		
	%	OR	(95% CI)	%	OR	(95% CI)	%	OR	(95% CI)
UDI domains									
Urinary incontinence	24	3.5	(1.8-7.1)	29	4.5	(1.4-14.9)	30	6.1	(1.6-22.9)
Overactive Bladder	6	0.6	(0.2-1.4)	18	3.5	(0.9-14.0)	47	7.2	(2.4-21.5)
Obstructive voiding	36	5.3	(2.8-10.2)	35	4.7	(1.6-14.0)	28	5.8	(1.5-21.9)
Pain (bladder/pelvis)	15	4.9	(1.8-13.3)	6	0.7	(0.2-3.5)	26	3.7	(1.1-12.4)

Int Urogynecol J (2010) 21:95–101
DOI 10.1007/s00192-009-0996-5

ORIGINAL ARTICLE

Long-term lower urinary tract dysfunction after radical hysterectomy in patients with early postoperative voiding dysfunction

Tarinee Manchana · Chalisa Prasartsakulchai · Apirak Santingamkun

Before : 3/25 (12%)
After : 14/30 (47%)

Thirty patients, at least **2 years after** radical hysterectomy, were evaluated with **multichannel urodynamic studies.**

Int Urogynecol J (2010) 21:95–101
DOI 10.1007/s00192-009-0996-5

ORIGINAL ARTICLE

Long-term lower urinary tract dysfunction after radical hysterectomy in patients with early postoperative voiding dysfunction

Urethral catheterization > 30 days

Tarinee Manchana · Chalisa Prasartsakulchai · Apirak Santingamkun

To **compare long-term** lower urinary tract dysfunction after radical hysterectomy in patients:

(A) with early postoperative voiding dysfunction.
(B) without **early postoperative voiding dysfunction.**

URODYNAMIC OBSERVATION

DECRESEAD DETRUSOR PRESSURE

Manchana et al. Int Urogynecol J (2010) 21:95–101

- **Detrusor pressure** at maximum flow significantly **decreased** in patients **after surgery**, but *without a difference between groups A and B.*

Impact of the radical surgery for cervical cancer on bladder and urethal function.

LOWER URINARY TRACT SYMPTOMS AND URODYNAMIC OBSERVATIONS

STRESS URINARY INCONTINENCE

ELSEVIER
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Urogynaecological dysfunction after radical hysterectomy

S.M. Axelsen*, L.K. Petersen
Department of Gynaecology and Obstetrics, Skejby Hospital, Aarhus University Hospital, Brendstrupgaardvej, DK-8200 Aarhus N, Denmark

Accepted 26 January 2006
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Symptoms of STRESS URINARY INCONTINENCE.

- Before: 20/333 **(6%)**
- After: 65/333 **(19.5 %)**

Symptoms of STRESS URINARY INCONTINENCE: 53-76 %

- Patients treated **with RH and LND and adjuvant radiotherapy** had ***significantly higher risk*** than the reference group.
- ***OR 3.5*** *(1.5-8.2).*

URODYNAMIC INVESTIGATIONS after radical hysterectomy for cervical cancer

A REVIEW ***Plotti et al 2011***

- *The search identified 477 papers.*
- **19 studies** spanned the years of 1980–2010, with an overall sample size of 652 patients, met all the eligibility criteria for a **systematic review .**
- **In 16 out of 19 studies**, urodynamic assessment was performed **prior and after surgical procedure.**
- Only 15 were prospective.
- Only 4 of 15 had more than 50 patients.

- **The overall incidence of lower urinary tract dysfunctions detected by urodynamic investigations : 72%**

URODYNAMIC OBSERVATIONS

URODYNAMIC STRESS URINARY INCONTINENCE (USUI)

Plotti et al 2011

- The incidence of USUI after radical hysterectomy, in these studies, ranges from 10% to 81%.

URODYNAMIC OBSERVATIONS

DECRESEAD URETHRAL CLOSURE PRESSURE

Plotti et al 2011

- Eight out of 19 studies have shown a **decrease of the maximal urethral clossure pressure (MUCP)** between the preoperative analysis vs. postoperatively.

Neurourology and Urodynamics 26:794–799 (2007)

Urodynamic and Ultrasound Characteristics of Incontinence After Radical Hysterectomy

Susanne Maigaard Axelsen,* Karl Moeller Bek, and Lone Kjeld Petersen

- 100 women after radical hysterectomy
- A case control study (with and without UI)
- Urodynamic and ultrasound evaluation

Neurourology and Urodynamics 26:794–799 (2007)

Urodynamic and Ultrasound Characteristics of Incontinence After Radical Hysterectomy

Susanne Maigaard Axelsen,* Karl Moeller Bek, and Lone Kjeld Petersen

TABLE III. Observations From Urodynamics Used in the Characterization of a Cohort of 100 Women Operated on With Radical Hysterectomy, Matched in Two Groups: Urinary Incontinence and Urinary Continence. (Standard Error)

Observations	Urinary incontinence	No urinary incontinence	P values for comparison of groups
Maximum flow rate (ml/sec)	Mean: 15.12 (1.14)	Mean: 15.50 (0.98)	0.60
Post-void residual urine (ml)	Mean: 92.66 (15.59)	Mean: 77.78 (14.59)	0.42
Maximum cystometric capacity (ml)	Mean: 416.08 (20.49)	Mean: 411.50 (16.87)	0.94
Maximum detrusor pressure (cmH_2O)	Mean: 38.04 (2.29)	Mean: 40.58 (5.74)	0.67
Urethral pressure, resting phase (cmH_2O)	Mean: 64.90 (2.84)	Mean: 73.66 (3.51)	0.02
Urethral pressure, contraction (cmH_2O)	Mean: 77.44 (3.47)	Mean: 89.20 (3.49)	0.01
Leakage	6 = yes, 44 = no	5 = yes, 45 = no	0.76
Detrusor overactivity	13 = yes, 37 = no	13 = yes, 37 = no	1.00

Detrusor overactivity = involuntary detrusor contractions during the filling phase which may be spontaneous or provoked, more than 5 cm water.

M.Espuña-Pons

URODYNAMIC OBSERVATIONS

DECRESEAD URETHRAL CLOSURE PRESSURE

Axelsen et al . Neurourology and Urodynamics 26:794–799 (2007)

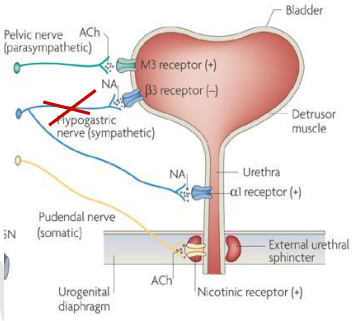
- No differences were observed between the two groups, except for an **overall difference in the intra-urethral pressure.**

M.Espuña-Pons

URODYNAMIC OBSERVATIONS

LOW COMPLIANCE BLADDER

- The incidence of low compliance ranges from 15 % to 57%



M.Espuña-Pons

ORIGINAL STUDY

(*Int J Gynecol Cancer* 2011;21: 167–172)

Risk Factors for Persistent Low Bladder Compliance After Radical Hysterectomy

Yasunari Oda, MD, Yukiharu Todo, MD, PhD,† Sharon Hanley, MA (Hon),‡ Masayoshi Hosaka, MD,* Mahito Takeda, MD, PhD,* Hidemichi Watari, MD, PhD,* Masanori Kaneuchi, MD, PhD,* Masataka Kudo, MD, PhD,* and Noriaki Sakuragi, MD, PhD**

Cves 1, mL/cmH_2O	1 mo (n = 113)	3 mo (n = 113)	6 mo (n = 113)	12 mo (n = 113)
0–20	87 (77.0)	56 (49.6)	39 (34.5)	34 (30.0)
20–40	17 (15.0)	23 (20.4)	35 (31.0)	23 (20.4)
40–60	4 (3.5)	12 (10.6)	9 (8.0)	17 (15.0)
60-	5 (4.4)	22 (19.4)	30 (26.5)	39 (34.5)
Median (range)	8.3 (0.2–251.0)	20.7 (2.1–506.0)	27.4 (1.0–292.5)	36.0 (3.4–723.0)

Cves, bladder compliance; #, months after surgery.

ORIGINAL STUDY

(*Int J Gynecol Cancer* 2011;21: 167–172)

Risk Factors for Persistent Low Bladder Compliance After Radical Hysterectomy

Yasunari Oda, MD, Yukiharu Todo, MD, PhD,† Sharon Hanley, MA (Hon),‡ Masayoshi Hosaka, MD,* Mahito Takeda, MD, PhD,* Hidemichi Watari, MD, PhD,* Masanori Kaneuchi, MD, PhD,* Masataka Kudo, MD, PhD,* and Noriaki Sakuragi, MD, PhD**

- **Radical hysterectomy with a <u>non nerve-sparing</u>** procedure : **OR 3.4 (**1.1-11.0).
- **<u>Adjuvant radiation therapy :</u> OR 10** (2.5- 43.5).

ORIGINAL STUDY

(*Int J Gynecol Cancer* 2011;21: 167–172)

Risk Factors for Persistent Low Bladder Compliance After Radical Hysterectomy

Yasunari Oda, MD, Yukiharu Todo, MD, PhD,† Sharon Hanley, MA (Hon),‡ Masayoshi Hosaka, MD,* Mahito Takeda, MD, PhD,* Hidemichi Watari, MD, PhD,* Masanori Kaneuchi, MD, PhD,* Masataka Kudo, MD, PhD,* and Noriaki Sakuragi, MD, PhD**

voiding with abdominal pressure at 3 months after surgery :

(OR, 2.9; 95% CI, 1.1-7.2)

Impact of the radical surgery for cervical cancer on bladder function

- Most physicians are not able to provide accurate counseling and follow-up as far as pelvic floor function is concerned.

Impact of the radical surgery for cervical cancer on bladder function

CONCLUSIONS:

- LUTS and urodynamic dysfunctions are common after radical surgery for cervical cancer.
- **Assessment in the pre and posttreatment is important** for detect *distressing symptoms and dysfunctions*, which will likely enhance patients' quality of life.

Impact of the radical surgery for cervical cancer on bladder function

CONCLUSIONS:

- Pre- and post-operatively, patients must get information about **how reducing risks of LUTS** (*loosing weight, emptying the bladder appropriately, and exercising the pelvic floor muscles).*

M.Espuña-Pons

CLÍNIC BARCELONA Hospital Universitari

Urodynamics in children: Neurogenic Bladder

- Spina bifida
- Spinal cord injury
- Spinal 'anomalies'
  - Spondylolisthesis
  - Tethered cord
- 'Occult neurogenic bladder

Neurogenic Bladder

- Goals of management
  - Preserve renal function
  - Improve continence
    - *Urine and feces*
  - Allow *appropriate* bladder emptying
  - Improve QOL

Urodynamicsin children: Neurogenic

- Patient considerations
  - When after diagnosis?
  - History/complaints/diary?
  - What am I looking for
  - Voider v. non-voider
  - Seated v. supine
  - BP/pulse monitoring (autonomic dysreflexia)
  - Treat UTI

Urodynamics: Neurogenic

- Clinical indications
  - Initial evaluation
  - Surveillance
  - 'Ad hoc' repeat studies

Urodynamics: Neurogenic

- Initial evaluation
  - Aims
  - Diagnosis of neurogenic bladder
  - Level of lesion
  - Balance of detrusor/sphincter dysfunction
  - Severity of dysfunction
  - Associated functional disability
  - Management decisions

Urodynamics: Neurogenic

- Surveillance
  - Aims
    - Change in detrusor/outlet characteristics
    - Monitor treatment
    - Prevent associated upper tract changes
      - Spina bifida child/adolescent
      - Hostile bladder characteristics on treatment
  - Ad hoc repeat studies
    - New clinical event
      - Incontinence, recurrent infection, upper tract changes
    - Assess treatment efficacy

Urodynamics: Neurogenic

- Patient considerations
  - When after diagnosis?
  - History/complaints/diary?
  - What am I looking for
  - Voider v. non-voider
  - Seated v. supine
  - BP/pulse monitoring (autonomic dysreflexia)
  - Treat UTI

Urodynamics: Neurogenic, Spina Bifida

- Patient considerations
  - When?
    - ASAP after back closure
    - Regular FU (surveillance): yearly?
  - History/complaints/diary?
    - Depends on age
    - Continence between caths, 'compliance'
    - UTIs
    - Renal US
    - Bowel care

Urodynamics: Neurogenic, SCI

- Patient considerations
  - When?
    - UMNL: when reflexes return, incontinence
    - FU (surveillance): ? When bladder behavior changes
  - History/complaints/diary?
    - Depends on age
    - Continence between caths, 'compliance'
    - UTIs
    - Renal US
    - Bowel care

Urodynamics: Neurogenic

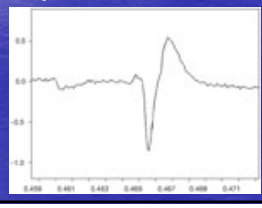
- Patient considerations
  - What am I looking for?
    - Detrusor characteristics
    - Leak point pressure (Detrusor and/or VLPP)
    - Fluoro
  - Voider v. Non voider?
  - Seated or supine?

Urodynamics: Neurogenic

- Urodynamic considerations
  - Slow fill
    - Neonates , infants: adjust for age
      - 16 mls/min to 8 years
      - 20mls/min to puberty
      - 30mls/min thereafter
  - Filling volume
    - Expected capacity: age +2 in ozs (x30)
    - > 8 years: reasonable volume to give c.4 hours between caths
  - Repeat filling cycles?

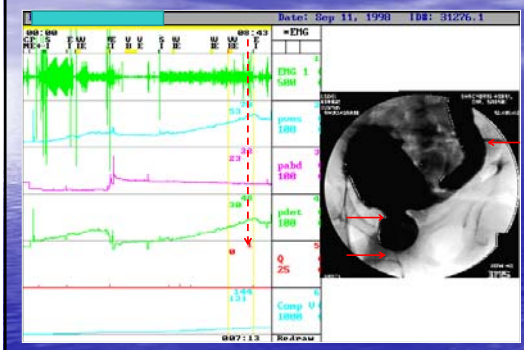
Urodynamics: Neurogenic

- Urodynamic considerations
  - EMG?
    - Patch v. needle
    - Anal sphincter v. levator v. striated ext sphincter
    - EMG activity v MUAP



Urodynamics: Neurogenic

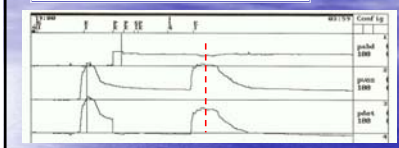
- Urodynamic considerations
  - Fluoroscopic appearance
    - Shape
    - Bladder wall thickness
    - Trabeculation, saccules
    - BN open/close
    - Outlet appearance (voiding, leaking, assoc contraction)
    - Associated VU Refux



Urodynamics: Neurogenic

- Urodynamic considerations
  - Filling study
    - Sensation
    - Detrusor overactivity
      - Amplitude
      - Filling volume
      - Sphincter/BN behaviour
      - Associated leak
      - Associated reflux

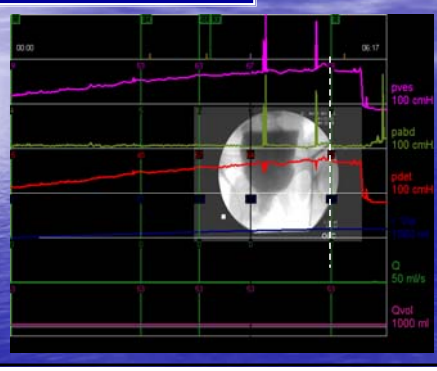
Urodynamic Update

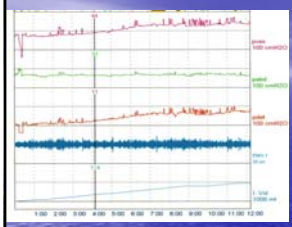


Urodynamics: Neurogenic

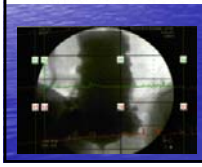
- Urodynamic considerations
  - Filling study
    - Compliance
      - Early v. late onset
      - At expected capacity
      - Associated leak
        - Detrusor LPP

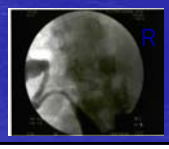
Urodynamic Update

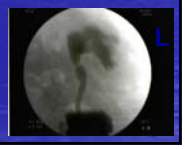




- Impaired bladder compliance
  - 35 cm/water after 300cc of filling
  - 40cm/water at 475cc capacity
- Early bilateral VUR
- DLPP 40cms
- No detrusor overactivity
- Christmas tree shaped bladder







Urodynamics: Neurogenic

- Urodynamic considerations
  - Autonomic dysreflexia
    - Monitor BP/pulse during study

Autonomic Dysreflexia

- Suprasacral lesions above T4-T6
- Symptoms
  - Pounding headache (caused by hypertension)
  - Goose Pimples
  - Sweating above the level of injury
  - Nasal Congestion
  - Bradycardia
  - Blotching of the Skin
  - Restlessness

Autonomic Dysreflexia

- Causes
  - Bladder
    - Overdistention, UTI, stones, urodynamics, cysto
  - Bowel
    - Distention, impaction
  - "Inflammatory conditions"
    - Pressure sores, burns, appendicitis etc
  - Misc'
    - Electroejaculation, pregnancy

Autonomic Dysreflexia

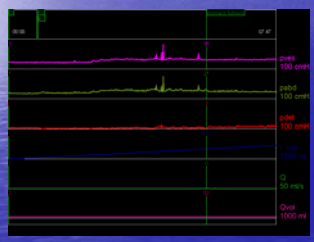
- Management
  - Acute
    - Reverse stimulus (empty bladder etc)
    - Sublingual nifedipine
    - alpha blockers, chlorpromazine, Na nitroprusside, diazoxide, hydralazine

Urodynamics: Neurogenic

- Filling study
  - Provocative maneuvers
    - SP tapping
      - SCI
    - Cough/valsalva
      - VLLP/ALLP

Urodynamics: Neurogenic

- **Urodynamic considerations**
  - Spinal shock v. LMN lesion
    - Ice water test?



Urodynamics: Neurogenic

- **Urodynamic considerations**
  - Voiding study
    - Presently 'voiding'
      - MS, Parkinsons, stroke, ? Incomplete SCI
    - Prestudy residual urine
    - Sitting/comfortable position
    - Fluoro v. EMG
    - Standard urodynamic voiding parameters
      - Maximum voiding pressure, average VP etc/etc
      - Nomogram
    - Pattern, abdo strain, efficiency

The Role of Video-Urodynamics

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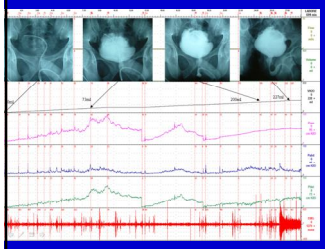
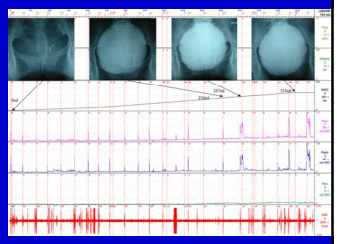
Video-Urodynamics (VUDS)

- VUDS is narrowly defined as a combination of conventional urodynamics and lower urinary tract (LUT) imaging by X-ray and ultrasound.
- It is broadly defined as a combination of above-mentioned VUDS and upper urinary tract (UUT) imaging by Urography, CT reconstruction and MUR.
- To consider urinary tract as a whole, VUDS including LUT and UUT imaging can provide with more comprehensive and clinically useful information.

VUDS with LUT imaging by X-ray

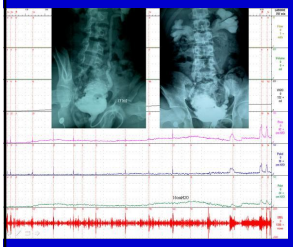


Detrusor-sphincter dyssynergia (DSD)



Detrusor areflexia

VUDS with UUT imaging by X-ray, MUR and CT reconstruction



Vesico-ureteric reflux (VUR) by X-ray

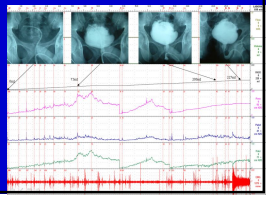
UUT dilation by MUR

UUT dilation by CT reconstruction

VUDS Lab at CRRC

What is the role of VUDS

- Overall, VUDS can:
  - reveal the pathophysiological mechanism of urinary tract dysfunction
  - guide further treatment
  - follow-up after treatment



Basic knowledge of VUDS

I. Cystourethrography in Female

1. Posterior urethrovesical angle（PUV）:
   - angle between the straight line of proximal urethral and bladder base, normally >115°
2. Urethral tilt angle（UI）:
   - angle between proximal urethral axis and vertical axis, normally 45°
3. Urethral pelvic angle（UP）:
   - angle between urethral axis and symphysis pelvis axis when voiding, normally <70°.
4. Symphysis ossium pubis（SO）:
   - distance of symphysis pubis and internal urethral meatus, normally <20mm.

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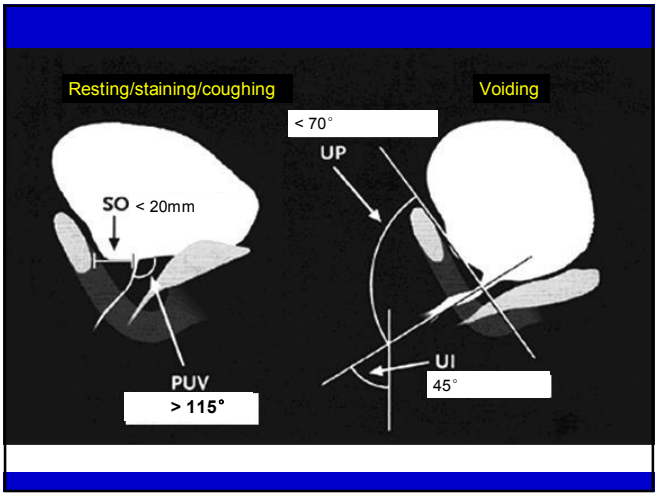
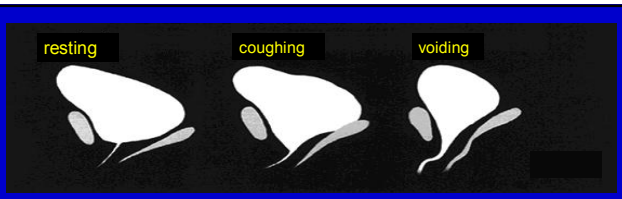
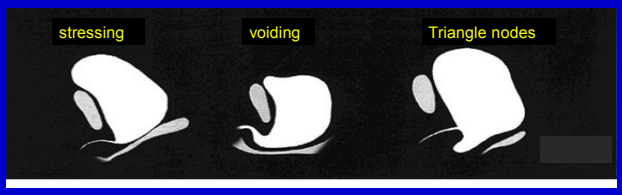


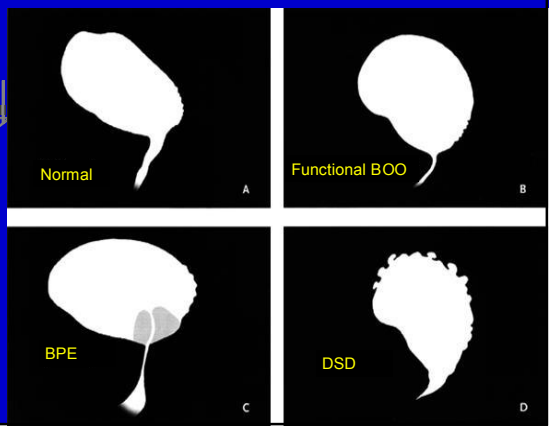


Green type I
Anterior wall suspension defects



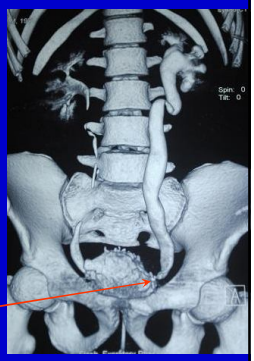
Green type II
Posterior wall suspension defects

II. Cystourethrography in Male



III. Upper Urinary Imaging

- UDS is the base for classification of LUTD;
  - To reveal terms of upper/lower urinary tract.
    - vesico-ureteric reflux
- Upper Urinary Imaging reveal
  - Detrusor fibrosis induced hydronephrosis and ureter dilation could contribute to *vesicoureteral obstruction.*



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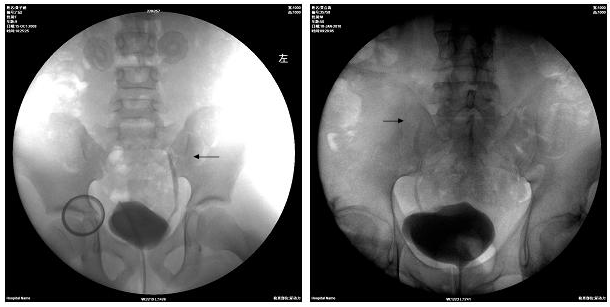
(a) International vesico-ureteric reflux classification



Grade I - Reflux into the ureter only

Grade II - Reflux into the collecting system, without dilatation

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Grade III - Reflux into the collecting system with mild dilatation

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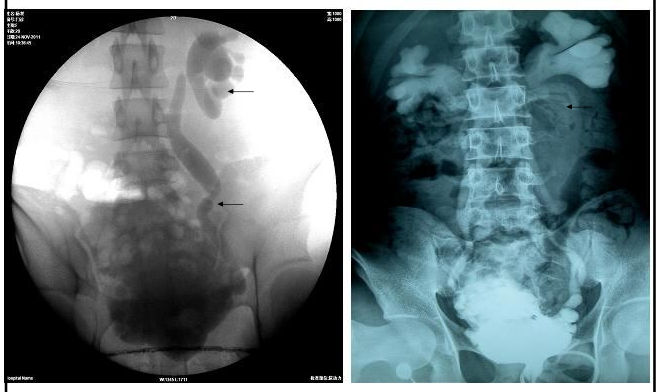

Grade IV - Moderate dilatation of the ureter and renal pelvis.

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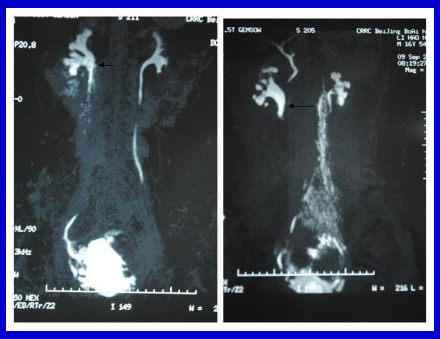
Grade V - Gross dilatation and tortuosity of the ureter with gross dilatation of the renal pelvis

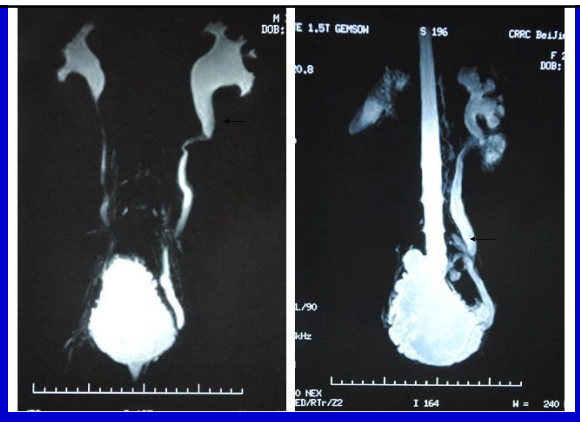
(b) Dilation of Upper Urinary Tract Classification

-- from Limin Liao



Degree 1: Mild dilatation of renal pelvis, no ureter dilation

Liao LM. Chinese J. Rehabilitation Theory and Practice. 2010.12.



Degree 2: Moderate dilatation of renal pelvis, mild ureter dilation

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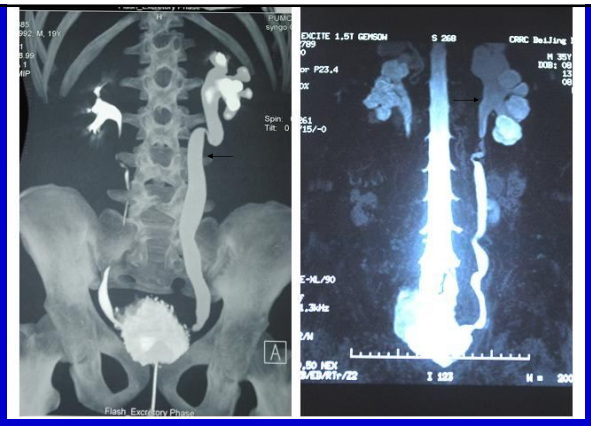

Degree 3: Moderate dilatation of renal pelvis, moderate ureteral dilation and tortuosity

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Degree 4: gross dilatation of the renal pelvis, gross ureteral dilation and tortuosity

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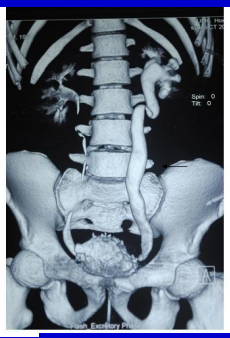

Right degree 3, left degree 4

Right stricture, left degree 3

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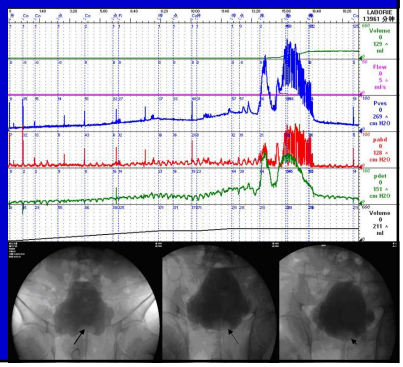
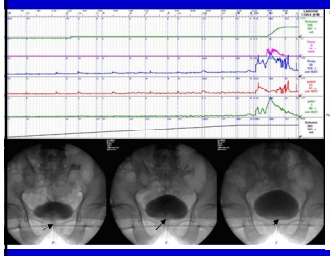
The roles and advantages of VUDS ---- Clinical Cases

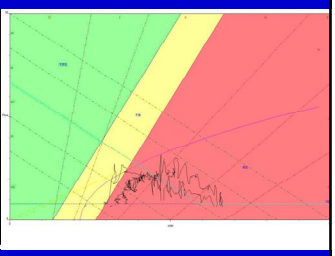
1. Record bladder outflow obstruction (BOO).

- **Case I**: Male, 63 yo. Frequency, urgency, dysuria for 6 years. Cystomstomy at 2008.
- VUDS: Detrusor pressure increased with infusion, bladder compliance decreased, filling defect (3X4cm) at bladder neck (prostate)；Filling defect revealed better at voiding phase.



- **Case II**: Male, 77 yo. Dysuria, hesitancy for 5 years. Ultrasound shows prostate size as 4.9x3.6x4.0cm。





VUDS: Filling defect at bladder neck during filling phase.

Pressure-flow analysis indicates BOO (IV), normal detrusor contraction.

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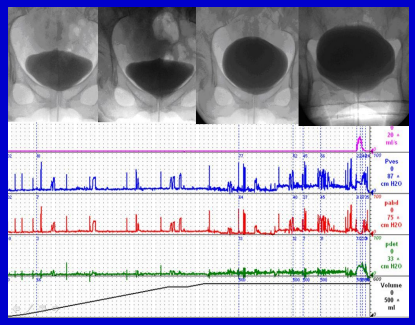
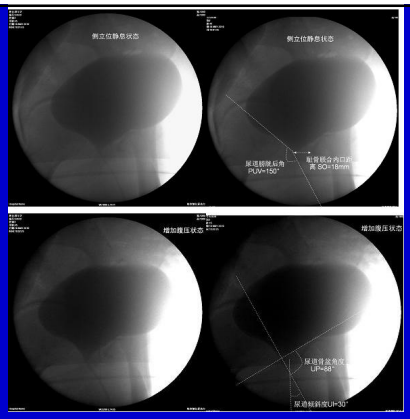
2. Record bladder neck and urethral dysfunction during storage phase

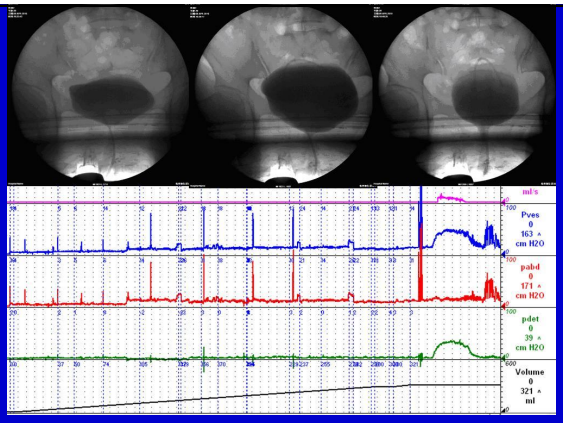
Case I: Female, 45 yo. Leak when moving, coughing and jumping for 5 years



VUDS：(1) cystometry (below), leak when coughing at 500ml, CILPP 77cmH2O; bladder neck is above pubic in resting phase; open when stressing and descend < 2cm, Blaivas type I SUI.



(2) Standing when resting cystography (above). PUV=150°, SO=18mm.
(3) Standing when stressing cystography (under). UI=30°, UP=88°, indicate that patient's bladder anterior wall suspension defects (Green type Ⅰ SUI).



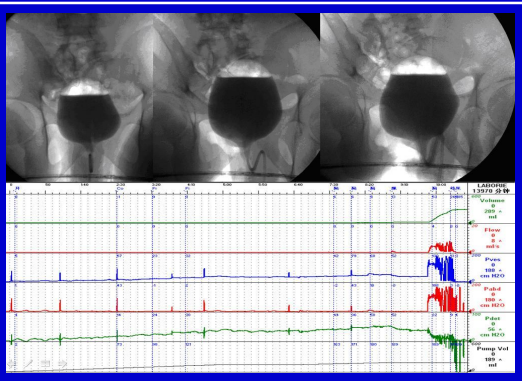
Case II: Female, 39 yo, leak when coughing, jumping and Moving, with urgency.

VUDS: Bladder neck is close and under the pubic (left), bladder neck/posterior urethral open and descend when stressing, leak at 285ml (middle), Bladder neck and urethral sphincter synergic open in voiding phase (right). Type II SUI.

Case III: Female, 41 yo, received cervical laminectomy 3 years ago, leak when coughing and moving PO, with frequency and urgency.

VUDS: Bladder neck and proximal urethral open and descend when resting (left); leak when coughing at 210ml (middle), Pves/VLPP 58cmH2O (right). Type III SUI.

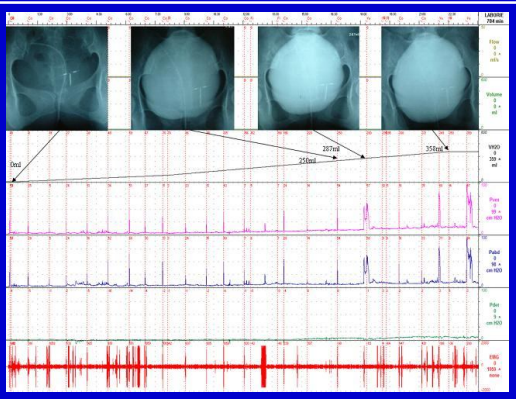
3. Record leak point pressure to identify incontinence



Case: Male, 26 yo, leak when jumping and Moving, diagnosed as MMS.

VUDS: Bladder neck and proximal urethral open when resting (left); leak when coughing at 171ml (middle), leak at 189ml, Pves/VLPP 44cmH2O (right). Type III SUI.

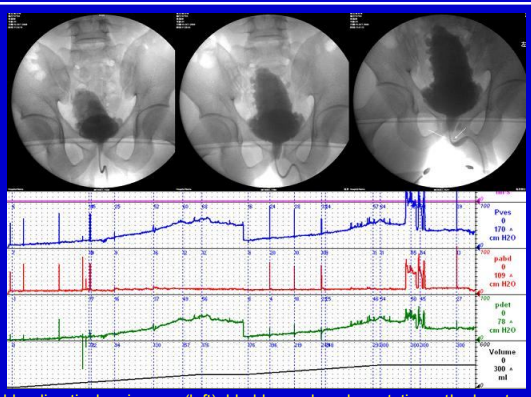
4. Identify bladder neck close or open



Case: Female, 28 yo, 3 years post SCI.

VUDS: Detrusor pressure was low, bladder compliance increased and bladder neck close during filling. Detrusor areflexia.

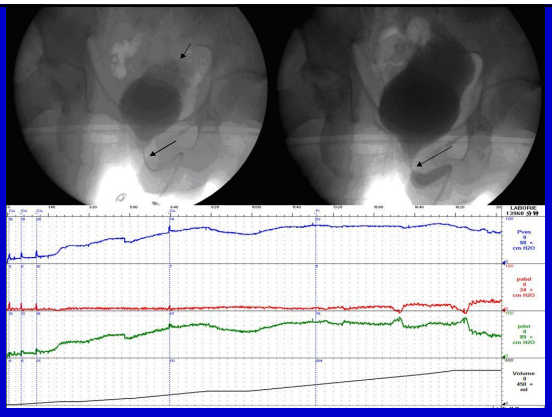
5. Identify detrusor-sphincter dyssynergia (DSD)



Case I: Male, 24 yo, dysuria, void 100ml each time, with frequency, urgency and UI, hydronephrosis.

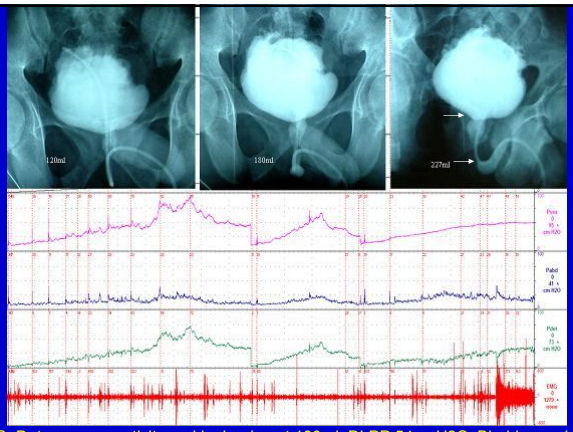
VUDS: Bladder diverticulum in apex (left), bladder neck and prostatic urethral part open and leak urine. Detrusor overactivity occurred (middle); urethral stricture was observed at voiding phase (right). Detrusor sphincter dyssynergia (DSD).

Case II: male, 24 yo, T10 SCI 3 years ago.



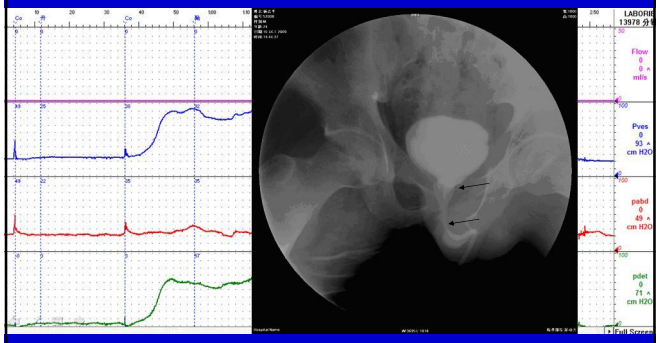
VUDS: Detrusor pressure increased as filling and bladder compliance was low. Bladder diverticulum was observed. Leak at 179ml, DLPP 73cmH2O. Filling stopped at 450ml. Voiding phase Pdet 54cmH2O, bladder neck and prostatic urethral opened. membranous urethral was stricture. DESD, PVR 300ml.

Case III: Male, 44 yo, T8 SCI 5 years ago.



VUDS: Detrusor overactivity and leak urine at 130ml, DLPP 54cmH2O. Bladder neck did not open, prostatic urethral opened, membranous urethral was stricture. Detrusor bladder neck dyssynergia (DBND), detrusor external sphincter dyssynergia (DESD).

Case IV: Male, 24 yo, T10 SCI 3 years ago.



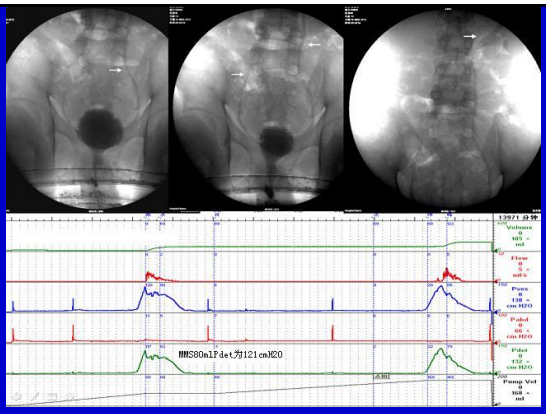
VUDS: Detrusor pressure increased at 100ml, detrusor overactivity, bladder neck partially opened, prostatic urethral dilated. Membranous urethral stricture. Leak at 130ml, DLPP 57cmH2O. Detrusor external sphincter dyssynergia (DESD), detrusor bladder neck dyssynergia (DBND).

6. Identify VUR, diverticulum or other abnormal changes

T6SCI 104ml Pdet8cmH2O **Case I**: Male, 64 yo, T6 SCI 2 years ago

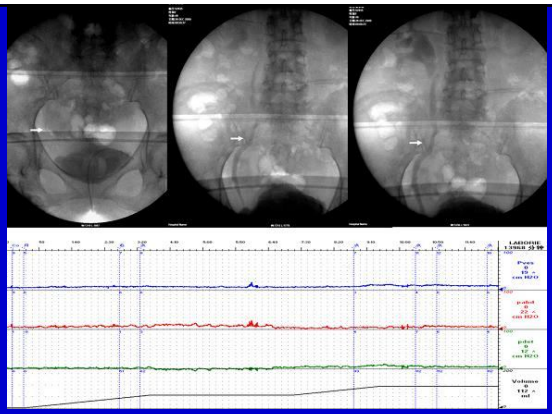
VUDS: Left VUR at 104ml, Pdet 8cmH2O (low pressure VUR). Reflux into the ureter only. Detrusor areflexia Grade I VUR.

Case II: Male, 14 yo, dysuria, hydronephrosis.



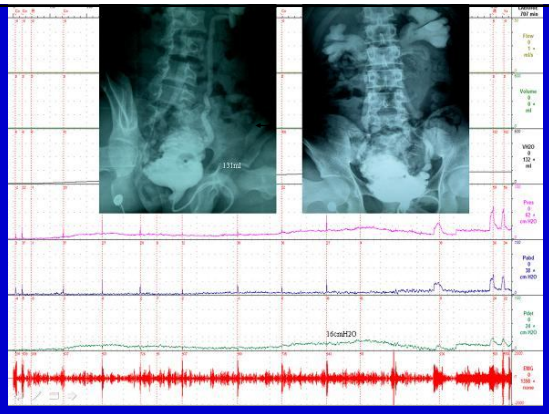
VUDS: Detrusor contracted and leak urine at 80ml, bilateral VUR, Pdet 121cmH2O (high pressure VUR). Reflux into the collecting system, without dilatation. Filling stopped at 168ml. Grade II VUR, DO, DESD.

Case III: Female, 50 yo, C8 SCI.



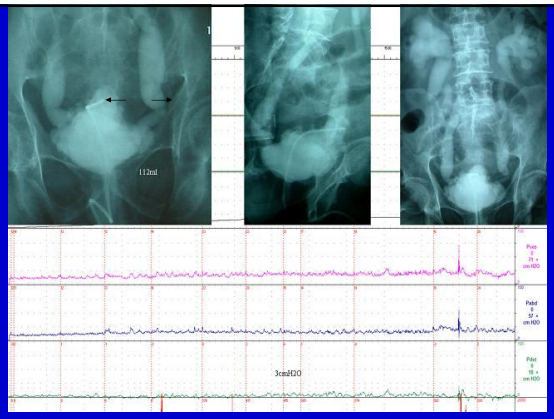
VUDS: Right VUR at 100ml, right ureter, renal pelvis and calyces mild dilation, VUR at low pressure (Pdet=1cmH2O). Filling stopped at 212ml. Grade III VUR, detrusor areflexia.

Case IV: Male, 19 yo, dysuria, diagnosed as MMS, hydronephrosis.



VUDS: Right VUR at 90ml, detrusor pressure was 16cmH2O (left), filling stopped at 131ml. Bilateral moderate dilatation and tortuosity of the ureter, moderate dilatation of the renal pelvis and calyces (right). Grade IV VUR.

Case V: Male, 34 yo, dysuria, diagnosed as MMS, hydronephrosis.



VUDS: Bilateral VUR at 80ml, detrusor pressure was 3cmH2O, filling stopped at 112ml. Gross dilatation and tortuosity of bilateral ureter, renal pelvis and calyces. No maintained papillary impressions. Grade V VUR.

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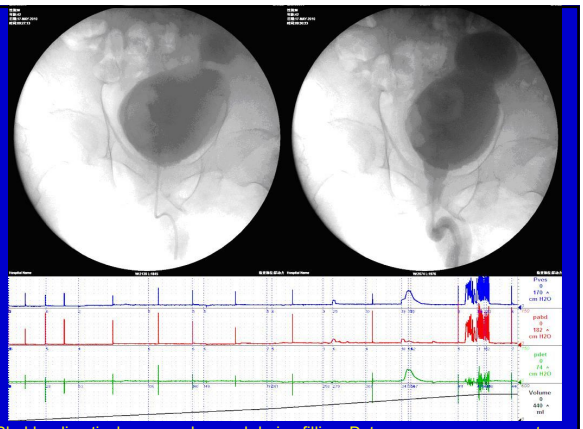
Case VI: Male, 42 yo, T5 SCI for 23 years. Ultrasound Shows hydronephrosis, ureteric dilation, bladder Diverticulum and stone.



VUDS: Bladder diverticulum was observed during filling; Detrusor pressure was not increasing in voiding phase due to released by diverticulum expanding; proximal urethral stricture was observed (DESD).

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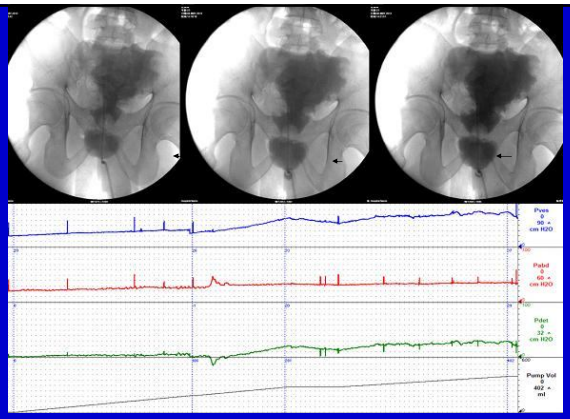
7. Identify calculi and other complications

Case I: Male, 19 yo, MMS, UI

VUDS: Failure of catheterizing, X-ray shows prostate stone 5X4cm (left). Consist with cystourethrography result 3 years ago (right). Patient received lithotripsy.

LM Liao

The same case received SCCP after lithotripsy.



VUDS: One month PO, VUDS: First sensation at 281ml, stop filling at 402ml. Filling phase shows increased bladder capacity, prostate area is full of filling media.

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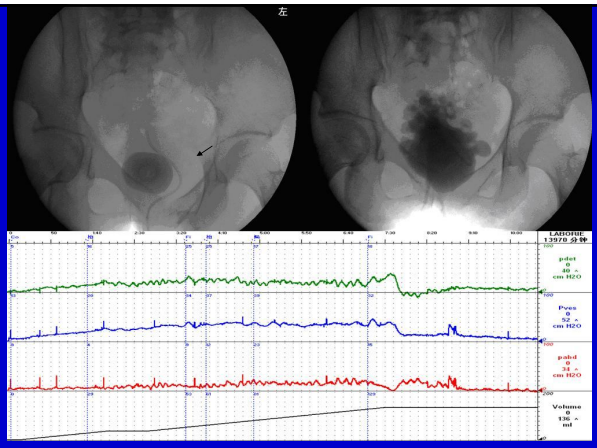
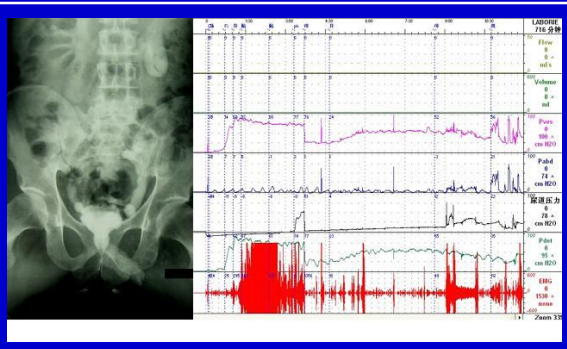
Case II: Female, 26 yo, Dysuria, MMS.



UDS: X-ray shows bladder stone in suit with 8X6 cm (can be easily misread as filling media) ; leak at 81ml, DLPP: 6cmH2O，MBC:136ml, PVR: 100ml.

8. Treatment assessment

Case: Male, 33 yo, dysuria, diagnosed as MMS, received SCCP in our unit.



VUDS: Pre-operation VUDS: DO, VUR, DSD, low bladder capacity and compliance.

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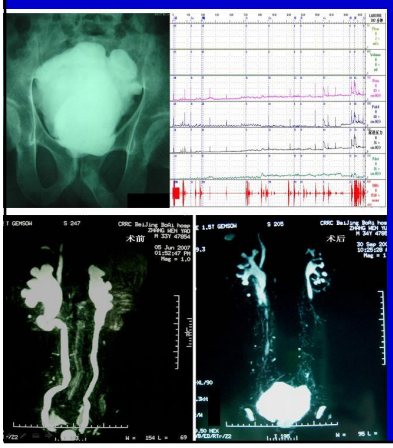
SCCP PO assessment



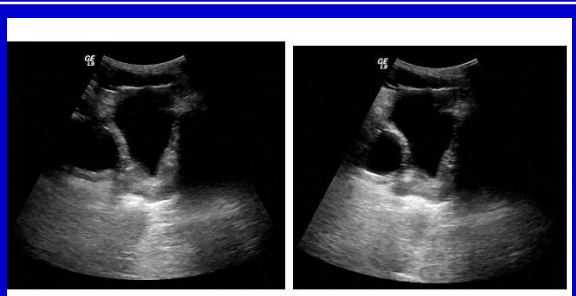
VUDS:

3 months PO, bladder capacity 480ml, bladder compliance back to normal. No VUR and DO.

MUR:

Pre-op (Left) PO (right)

Ultrasound imaging



- **Case**：Male, 26 yo, abnormal urinary pattern, leak when jumping and running. Diagnosis as NB\MMS. VUDS: type III SUI. Received AUS implantation in our unit. PO: totally dry.
- Ultrasound image shows cuff close urethral during storage phase.

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Ultrasound bladder capacity scanner

For testing bladder capacity, post voiding volume et al., non-invasive

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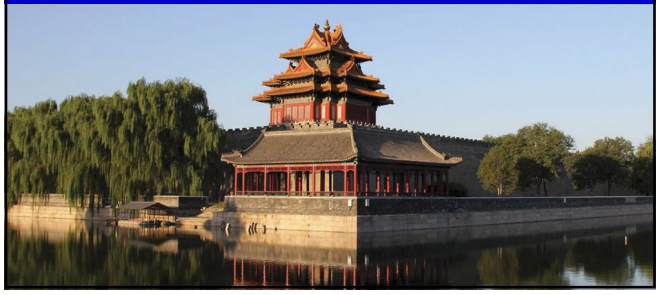
Thank you very much!



Notes