Invasive urodynamics (Evaluation of bladder storage functions- Cystometry)

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Filling Cystometry

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Cystometry- Definition

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

- …Cystometry ends with ‘permission to void’ or with incontinence (involuntary loss) of the (total) bladder content.

Cystometry: Aims

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

- To evaluate lower urinary tract reservoir function for research purposes

Cystometry (clinical relevance)

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

What should be known before starting ?

- Patient's perceived (LUT-) symptoms and signs
  - Symptoms questionnaire (preferable)
  - Voiding diary ('usual' volumes voided)
    - 'Predict'-estimated- cystometric capacity
  - Free uroflowmetry
  - Post void residual urine

ICS Standard:

- Fluid filled: saline solution
- External pressure transducers
- Reference = pressure at the level of the symphysis
- Patient in standing position
- Fill until strong desire to void
- Medium fill-rate (e.g. 10% of expected capacity /minute)
- Indicate end of cystometry on trace
  - Stopping of the pump (and /or)
  - ‘Permission to void’

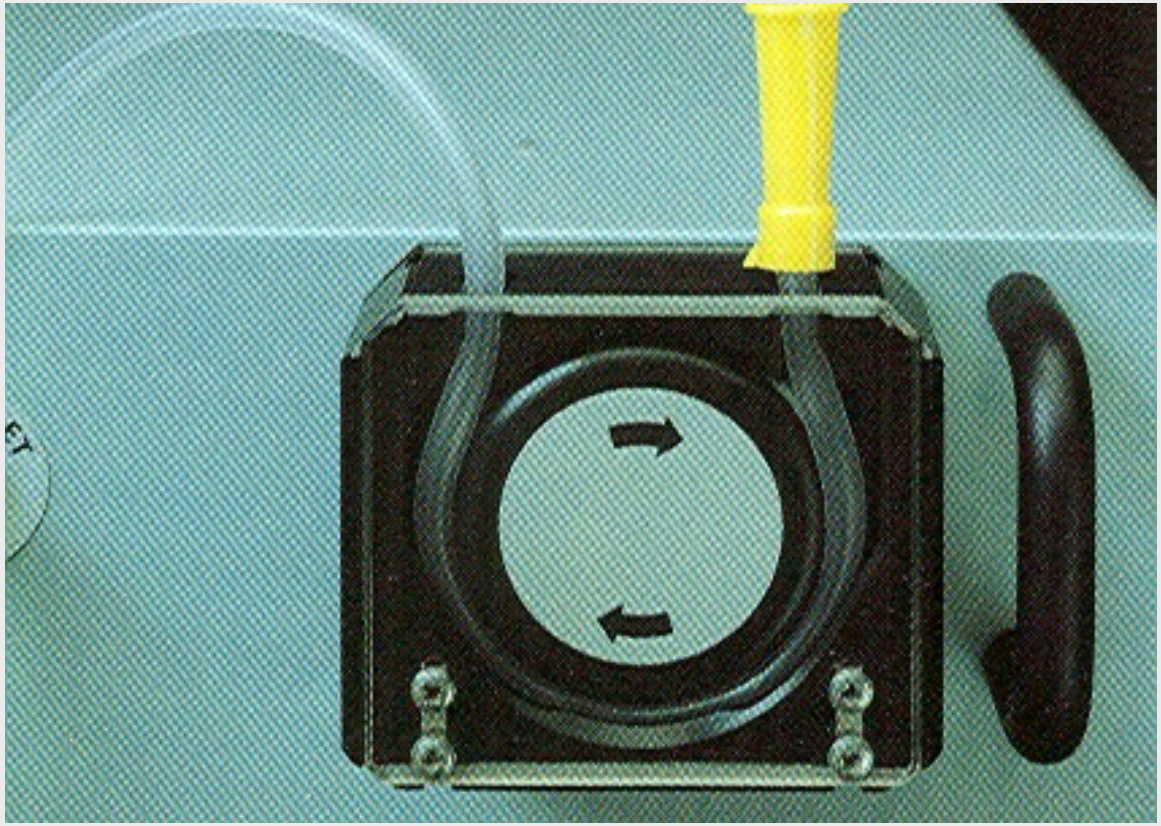
Solution infused

- Saline solution
  - Or contrast
- Temperature
  - Room temperature

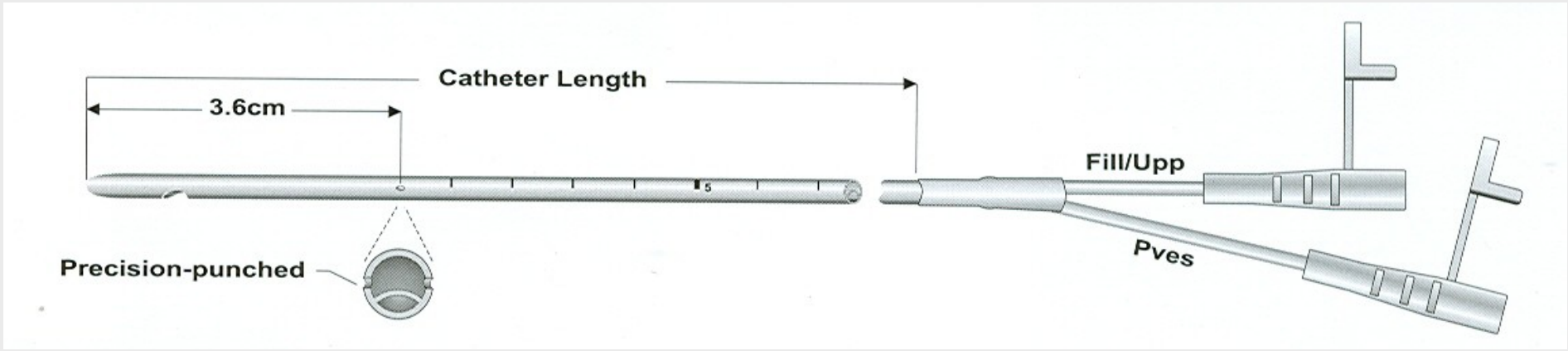
Patient position during cystometry

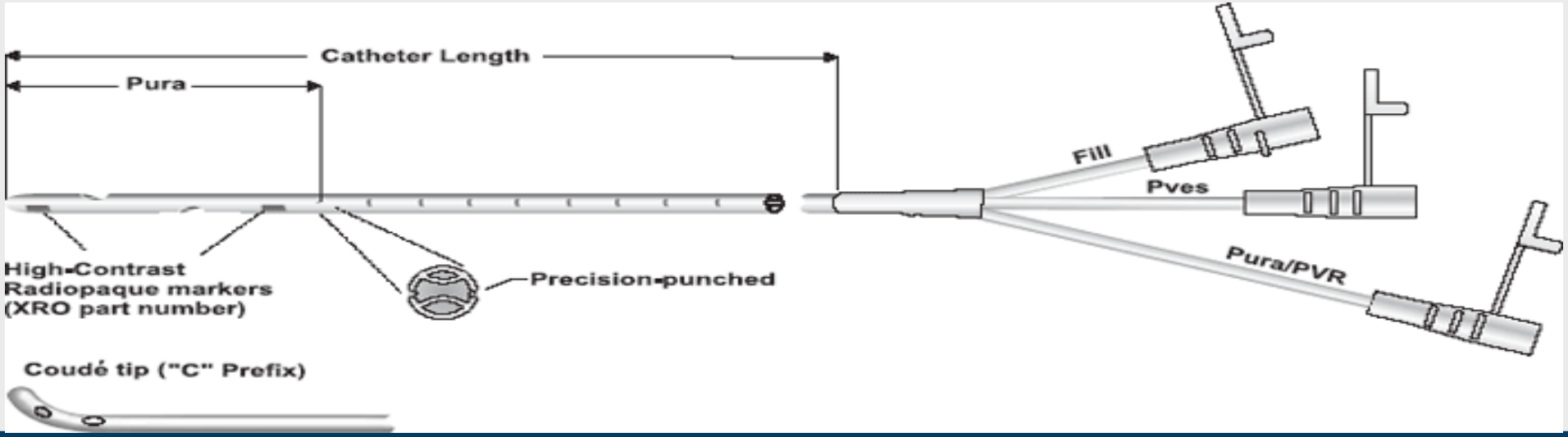
- Sitting (standing) position is more provocative for abnormal detrusor activity (ex. overactivity) than the supine position. At some point in the test, filling might desirably take place with the patient standing.
- Patients unable to sit or stand → supine position.

Infusion Pump



Urethral Catheter





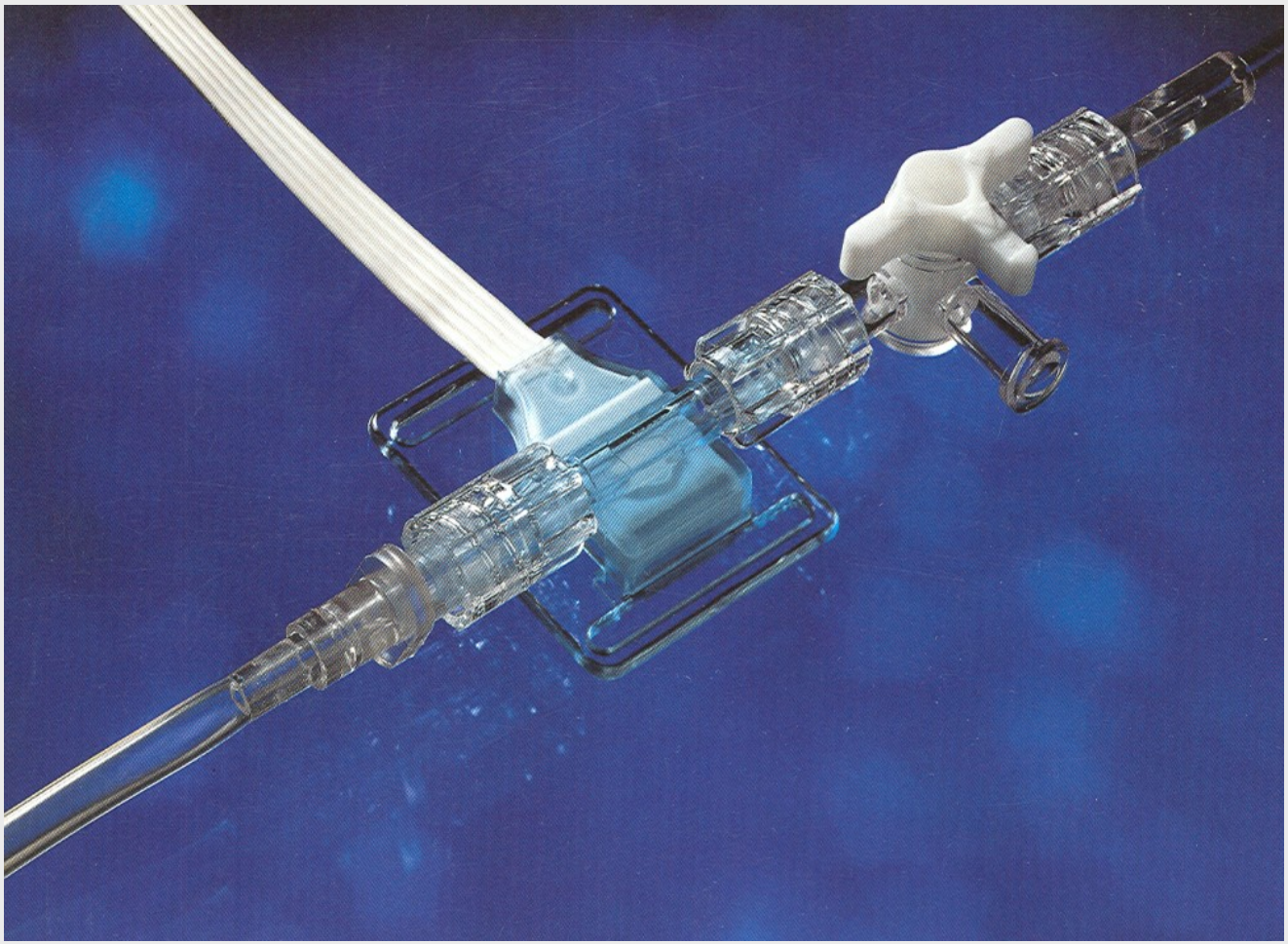
Insert catheters

- Usually lithotomy position
- Sterile catheters
  - Vesical: double lumen (or separate)
    - 6-7F
  - Rectal: catheter with a **punctured** balloon

- Fix the catheters adjacent to the meatus

- Patient in comfortable position
- Cover the patient- ex. with a towel

Transducer



Position of the Transducer

- External tansducer measured at the level of the symphysis pubis
- Equals: Base of the bladder
- Intra rectal and intravesical pressures are assumed to be measured at identical levels

Filling cystometry

- Initial resting pressure
  - Supine 5 -20cmH_2O
  - Sitting 15-40cmH_2O
  - Standing 30-50cmH_2O

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

Bladder sensation- classification

- *Normal bladder sensation*
  - can be judged by three defined points noted during filling cystometry and evaluated in relation to the bladder volume at that moment and in relation to the patient's symptomatic complaints.
- *First sensation of bladder filling*
  - is the feeling the patient has, during filling cystometry, when he/she first becomes aware of the bladder filling.
  - To be separated from the sensation that the catheterisation has caused, that means it disappears after a few minutes.
- *First desire to void*
  - is defined as the feeling, that would lead the patient to pass urine at the next convenient moment, but voiding can be delayed if necessary.
- *Strong desire to void*
  - is defined, as a persistent desire to void without the fear of leakage.
- *Urgency*
  - during filling cystometry, is a sudden compelling desire to void.

- *Increased bladder sensation*
  - is defined, as an early first sensation of bladder filling (or an early desire to void) and/or an early strong desire to void, which occurs at low bladder volume and which persists.
- *Reduced bladder sensation*
  - is defined, as diminished sensation through out bladder filling.
- *Absent bladder sensation*
  - means that, during filling cystometry, the individual has no bladder sensation.
- *Non-specific bladder sensations,*
  - during filling cystometry, may make the individual aware of bladder filling, for example, abdominal fullness or vegetative symptoms.
- *Bladder pain,*
  - is a self explanatory term and is an abnormal finding.
  - Pain may increase with volume, or not, which should be reported.

Filling cystometry- information

- Cystometric capacity (mL)
    - Infused weight and pump-speed helpful during the test
    - And include diuresis (capacity: voided volume + PVR) after the test.
    - Measure PVR after pressure flow via the catheter
- Bladder sensations (mL)
    - Electronic buttons during cystometry do not include diuresis; correct after the test if needed

Bladder filling sensation

- Is a subjective parameter
  - *Depending on interaction /communication with the patient*
- Normal bladder sensation (rule of thumb) of cap.
  - First sensation +/- 175-250mL 33%
  - First desire to void +/- 272-450mL 66%
  - Strong desire to void +/- 429-700mL 100%

Bladder capacity

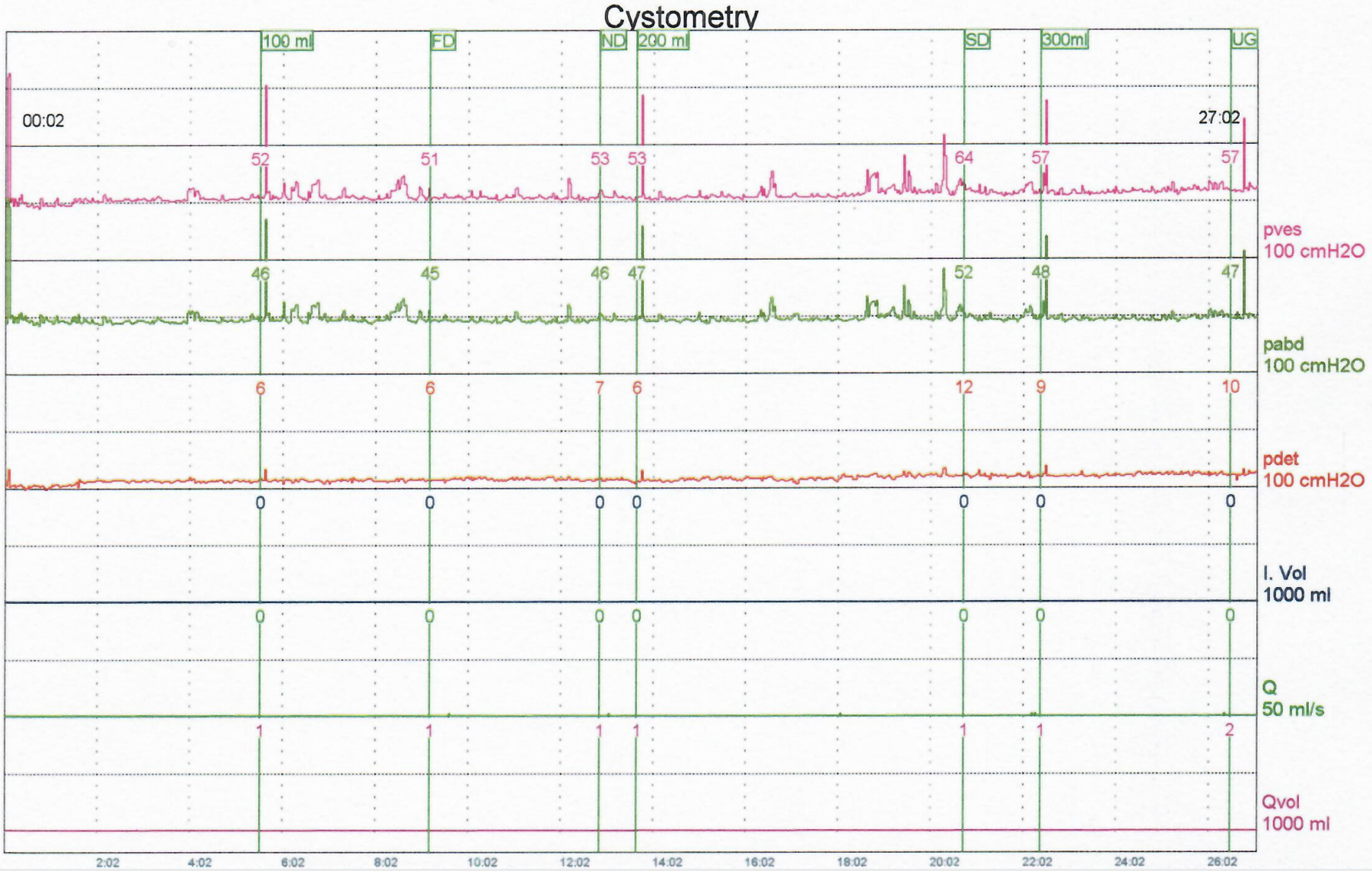
- Cystometric capacity – bladder volume at the end of filling phase
  - Commonly there is no reason to fill more than 800mL e.g. in the absence of sensation and/or contraction
- Maximum cystometric capacity – patient can no longer delay micturition
  - Overfilling hinders subsequent representative voiding
- Maximum anesthetic capacity – volume of bladder without urinary leakage

Detrusor Pressure

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

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

Filling Cystometry



Detrusor function

- Normal detrusor function – little or no changes in pressure
- Detrusor overactivity – ANY amplitude of detrusor pressure raise before permission to void:
  - Neurogenic; when relevant neurological abnormalities are present
  - Idiopathic

Cystometry patterns do not descriminate Neurogenicity: History and clinical exam

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

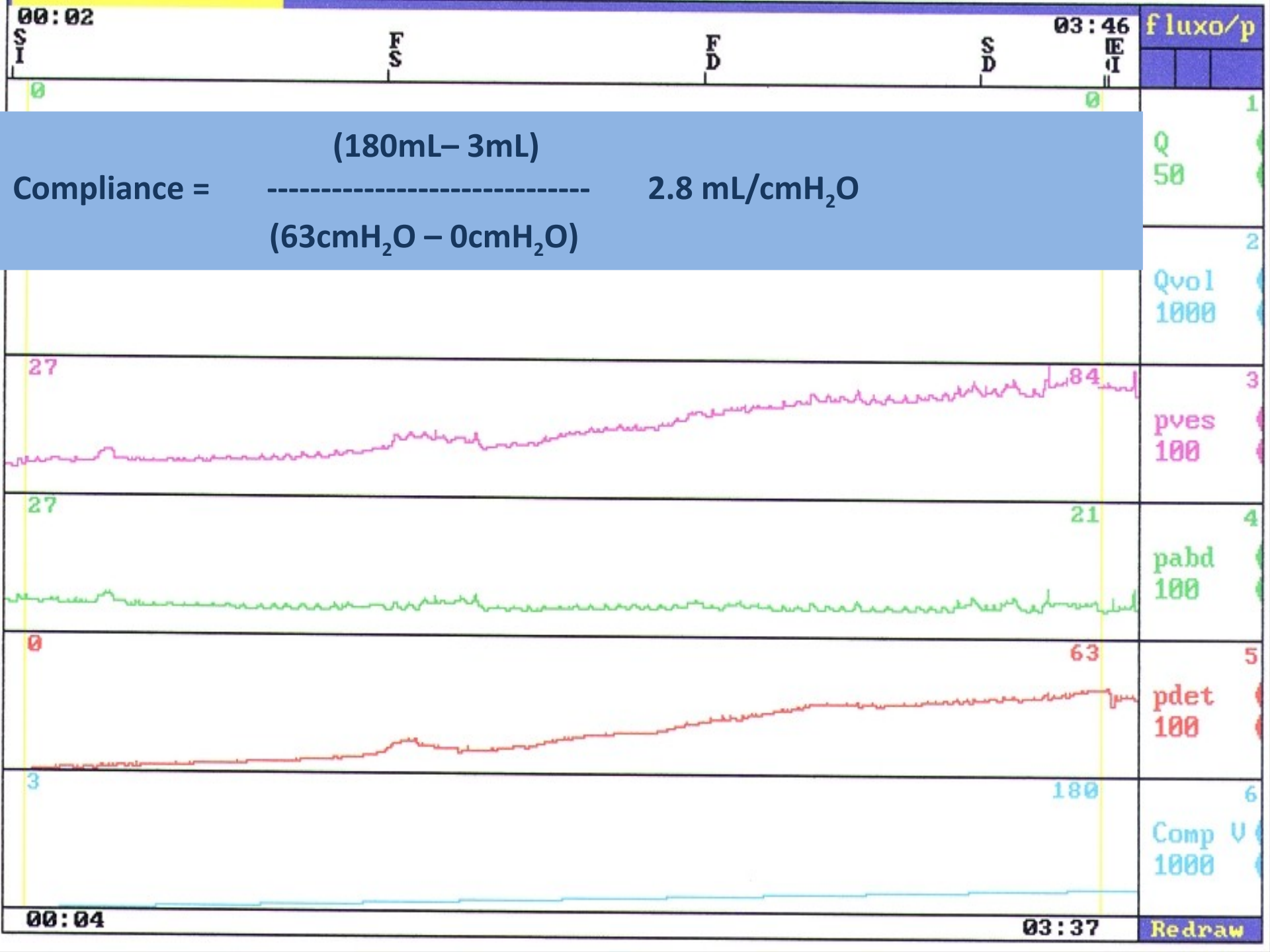
Detrusor overactivity

Bladder Compliance

- Good compliance is large volume and low pressure

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

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

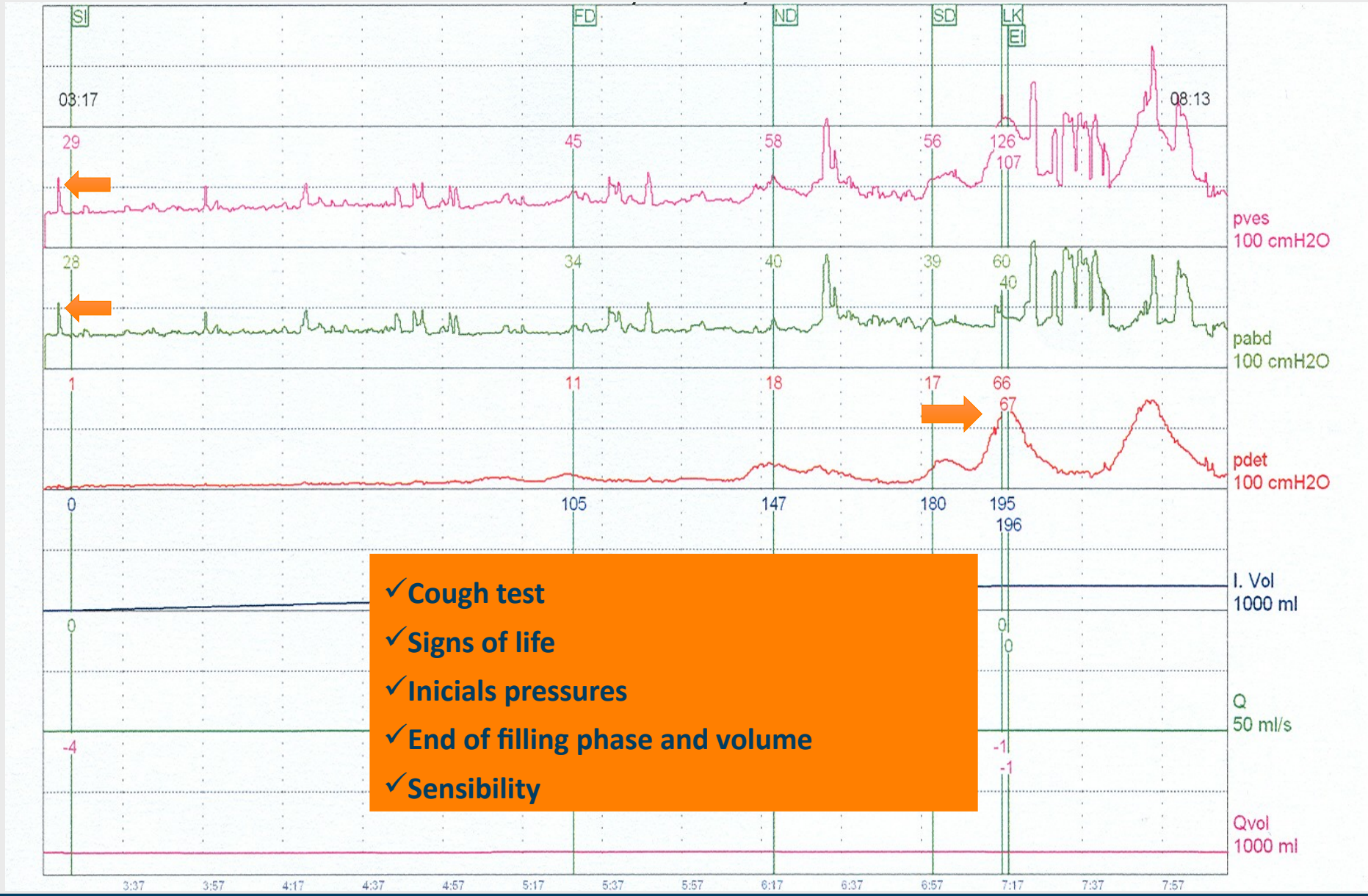


$$\text{Compliance} = \frac{(180\text{mL} - 3\text{mL})}{(63\text{cmH}_2\text{O} - 0\text{cmH}_2\text{O})} = 2.8\ \text{mL/cmH}_2\text{O}$$

Bladder Compliance – Normal Values

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

Filling cystometry



- ✓Cough test
- ✓Signs of life
- ✓Inicials pressures
- ✓End of filling phase and volume
- ✓Sensibility

Cystometry

- Patient should be relaxed and trustful
- Technically adequate
- Observe the pressures ‘as an engineer’
- Perform the test as representative for the usual situation as possible
- Systematically report all observations

Thank You