

Urodynamics for Part 2

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OXCOG Course
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Overview

- What are Urodynamics?
- Flowmetry
- Cystometry
- Pressure Flow Studies
- Specialist tests
- In clinical practice
- Traces
- Questions

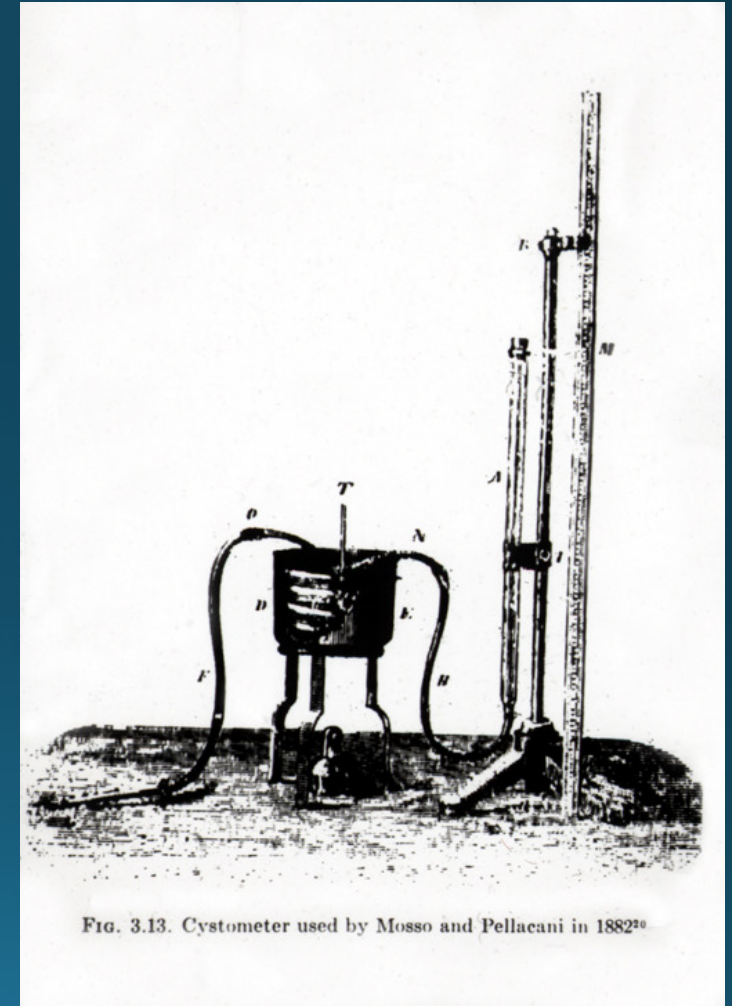
History

- The bladder is an 'unreliable witness'

Bates and Whiteside, 1970

- Poor correlation of symptoms and urodynamic diagnosis

Cardozo 1980, Jarvis 1980, Versi, 1991



What are Urodynamics?

- The term 'Urodynamic studies' (UDS) was defined by the ICS in 1988 and involves the assessment of the function and dysfunction of the urinary tract by any appropriate method

Abrams 1988

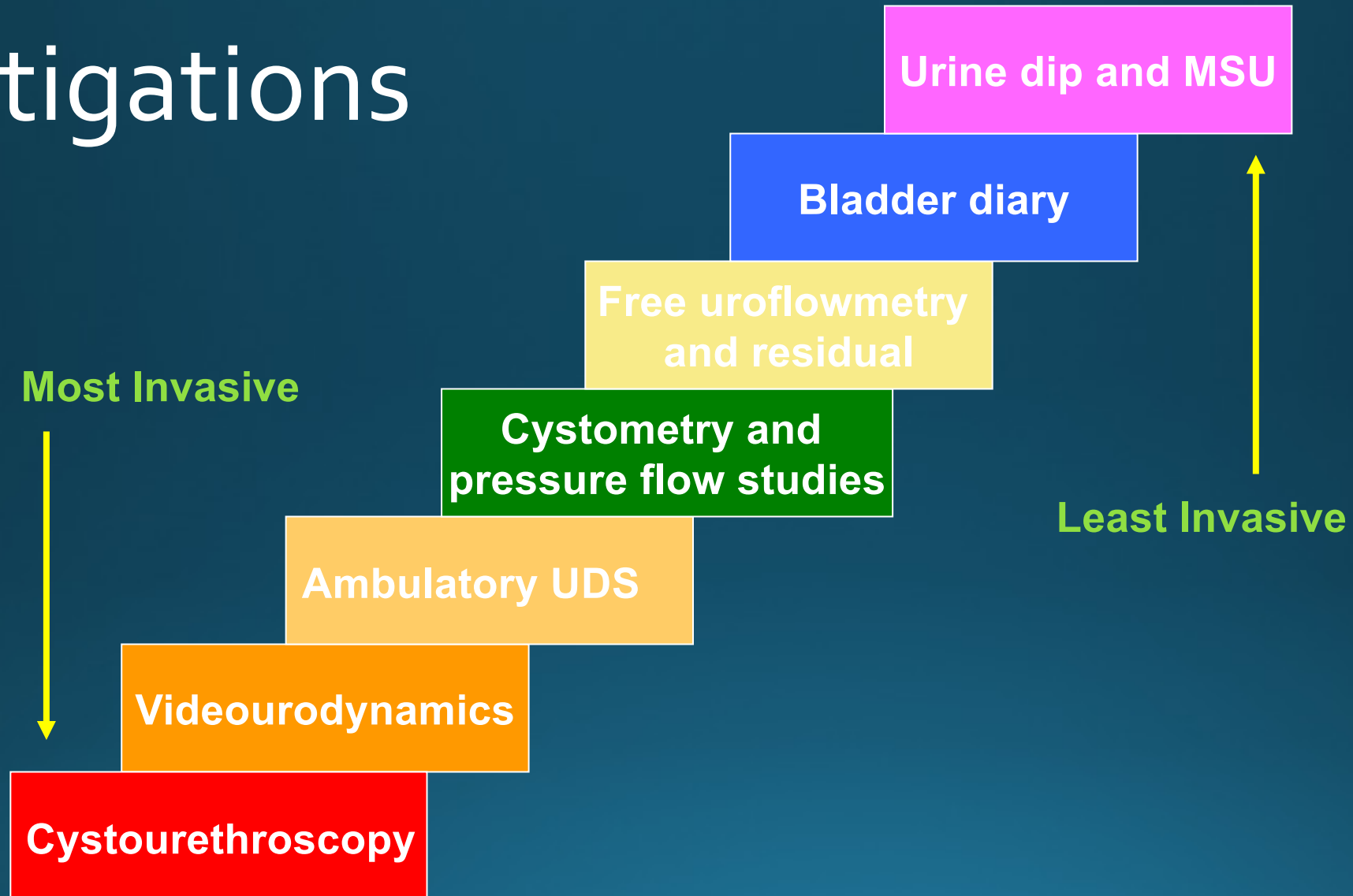
- “The study of storage and emptying phases of the lower urinary tract”

Davis 1953

- “Measurements to quantify the ability of the bladder to store and expel urine”

Hosker 2003

Spectrum of investigations



Urodynamics

3 parts:

- Uroflowmetry
- Cystometry
- Pressure flow studies

Flowmeters – Weight Transducing

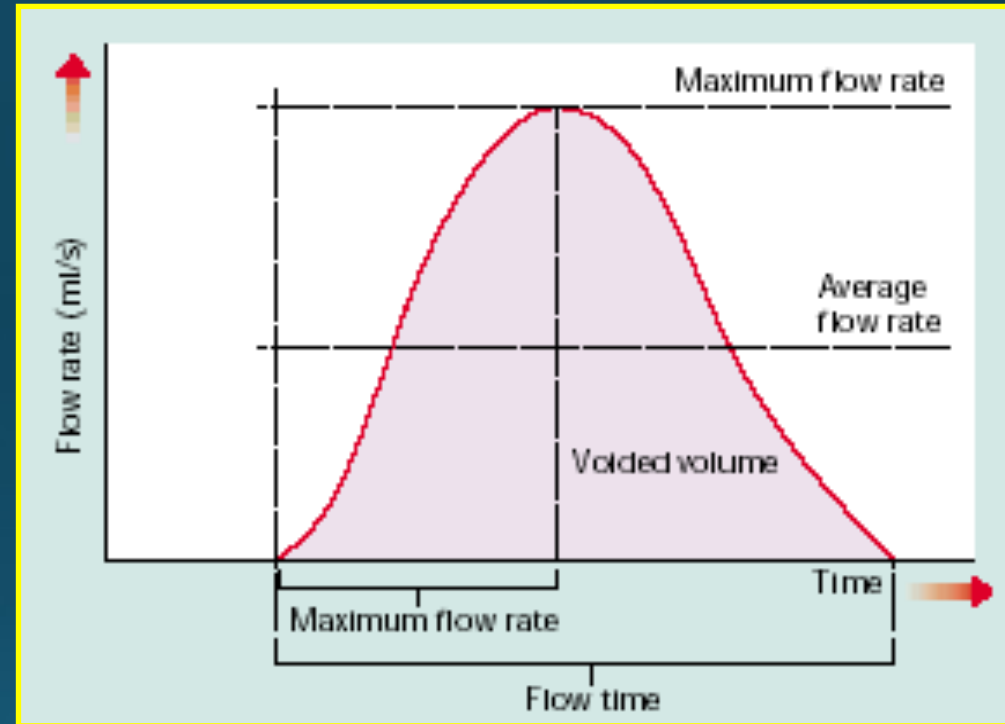


- Rate of change of the weight of the voided volume converted into flow rate

Uroflowmetry

- Measures

- Volume voided – ml
- Flow rate – ml/sec
- NORMAL >15ML/SEC
(IF VOIDED >150ML)



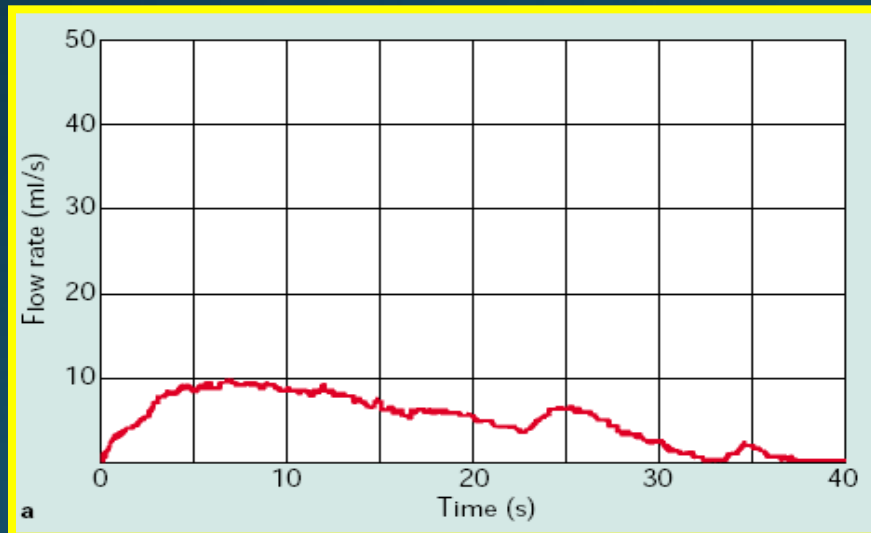
**NORMAL BELL
SHAPED CURVE**

Uroflowmetry

Abnormal flow curves not specific for a certain disease

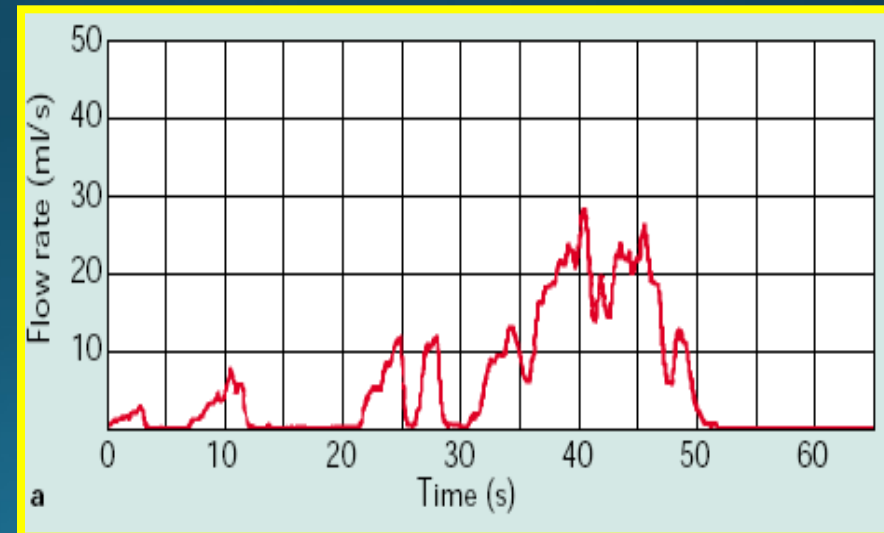
Plateau like curve

Urethral strictures
Eroded vaginal tape



Complex flow patterns

Straining/intermittent
Fluctuating detrusor contractility
Urethral sphincter activity



Limitations

- “Performance anxiety”
- ‘Normal’ bell shaped curve does not rule out female voiding dysfunction

Pauwels et al 2005

- Abnormal flow curves not specific for a certain disease

Smooth flat curve

Detrusor hypotonia

Increased urethral pressure

Plateau like curve

Urethral strictures

Perforated vaginal tape

Complex flow patterns

Straining

Fluctuating detrusor contractility

Urethral sphincter activity

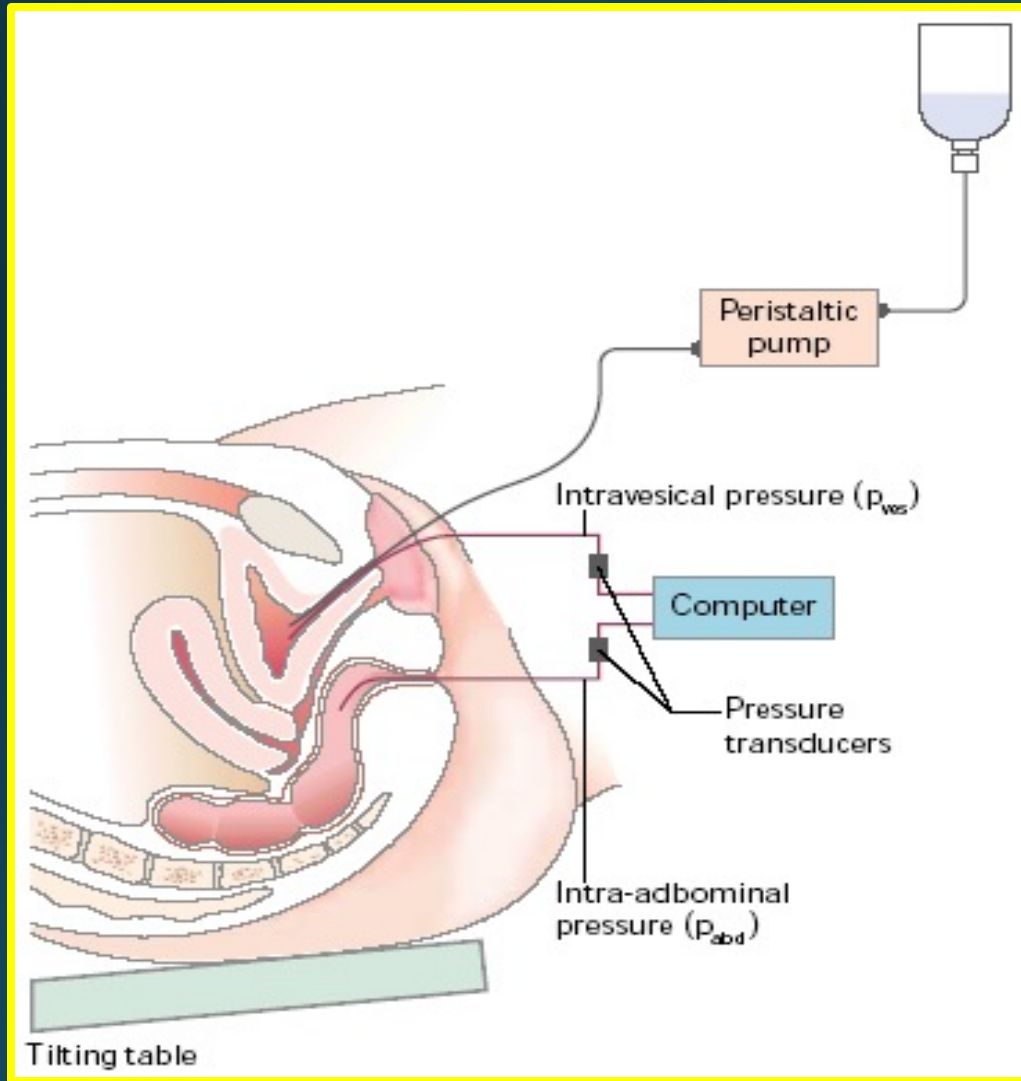
Artefacts

Patient movement or

Interference between flowmeter and urinary stream

- Low voided volume <150ml can lead to erroneous results

Subtracted Cystometry



Measures pressure volume relationship

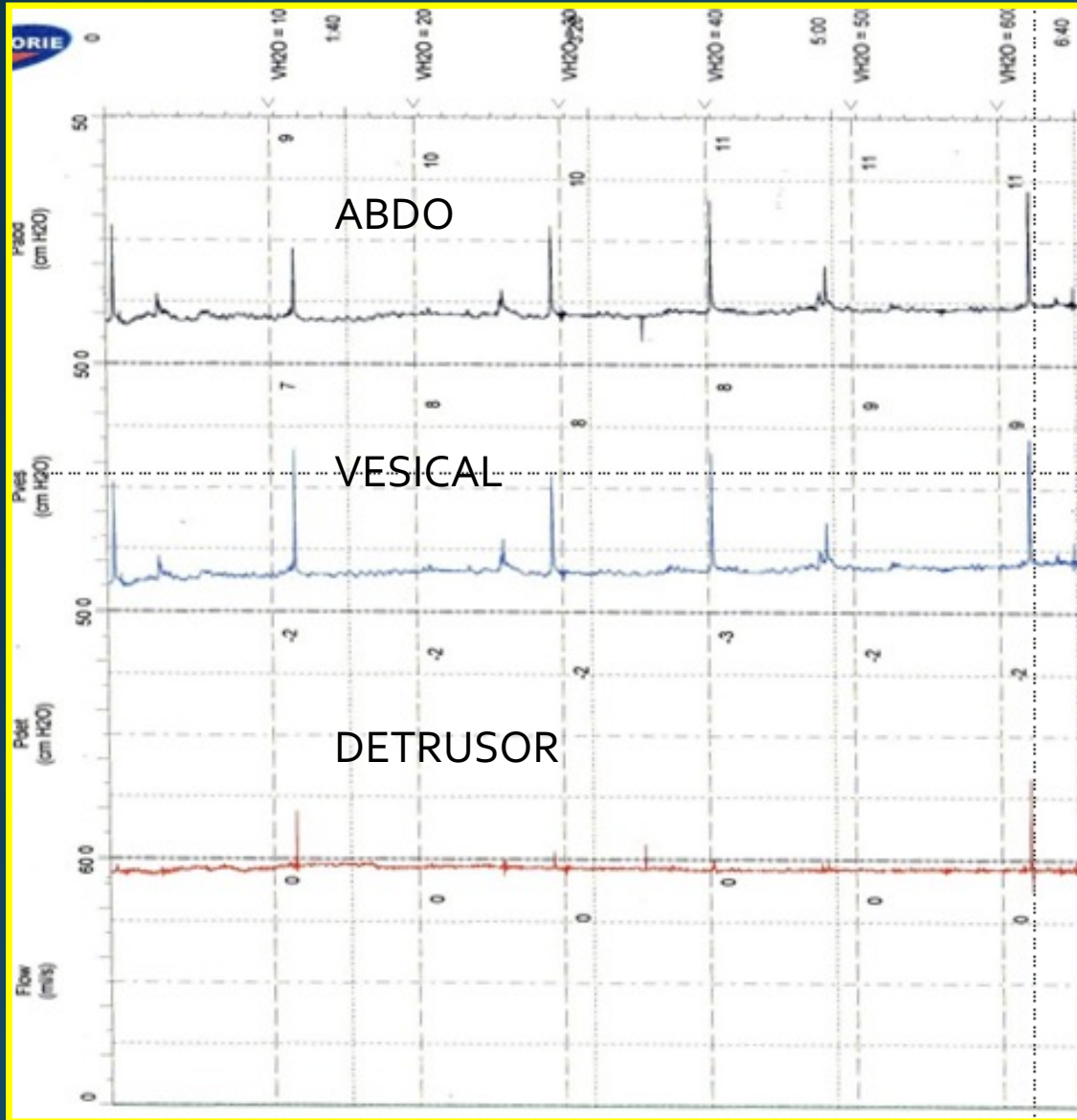
- Pressure transducer
in bladder
in rectum
- Pressures measured via microtip or external transducers (via a manometer system)
- Real-time subtraction of intra-abdominal pressure from intra-vesical pressure

Cystometry



- **pDet = pVes – pAbd**
DVLA
- **pDet = pVes less pAbd**
- Cystometry performed supine, sitting or standing
- Retrograde filling of bladder at constant rate
- Physiological filling: 1ml/min
- Medium/Fast fill cystometry: 100ml/min
- The filling line allows measurement of post void residual after the uroflowmetry

Cystometry



Filling phase

- First sensation
- Strong desire
- Maximum cystometric capacity
- Measure detrusor compliance ($\leq 3\text{cm}/100\text{ml H}_2\text{O}$)
- Look for detrusor overactivity

Pressure flow studies

- Performed as part of voiding cystometry
- Measure the relationship between detrusor function and peak urinary flow
- High pressure ($>50\text{cmH}_2\text{O}$) with a poor flow ($<15\text{mls/sec}$) indicates obstruction
- Low detrusor pressure ($<20\text{cmH}_2\text{O}$) with a poor flow indicates underactive detrusor function

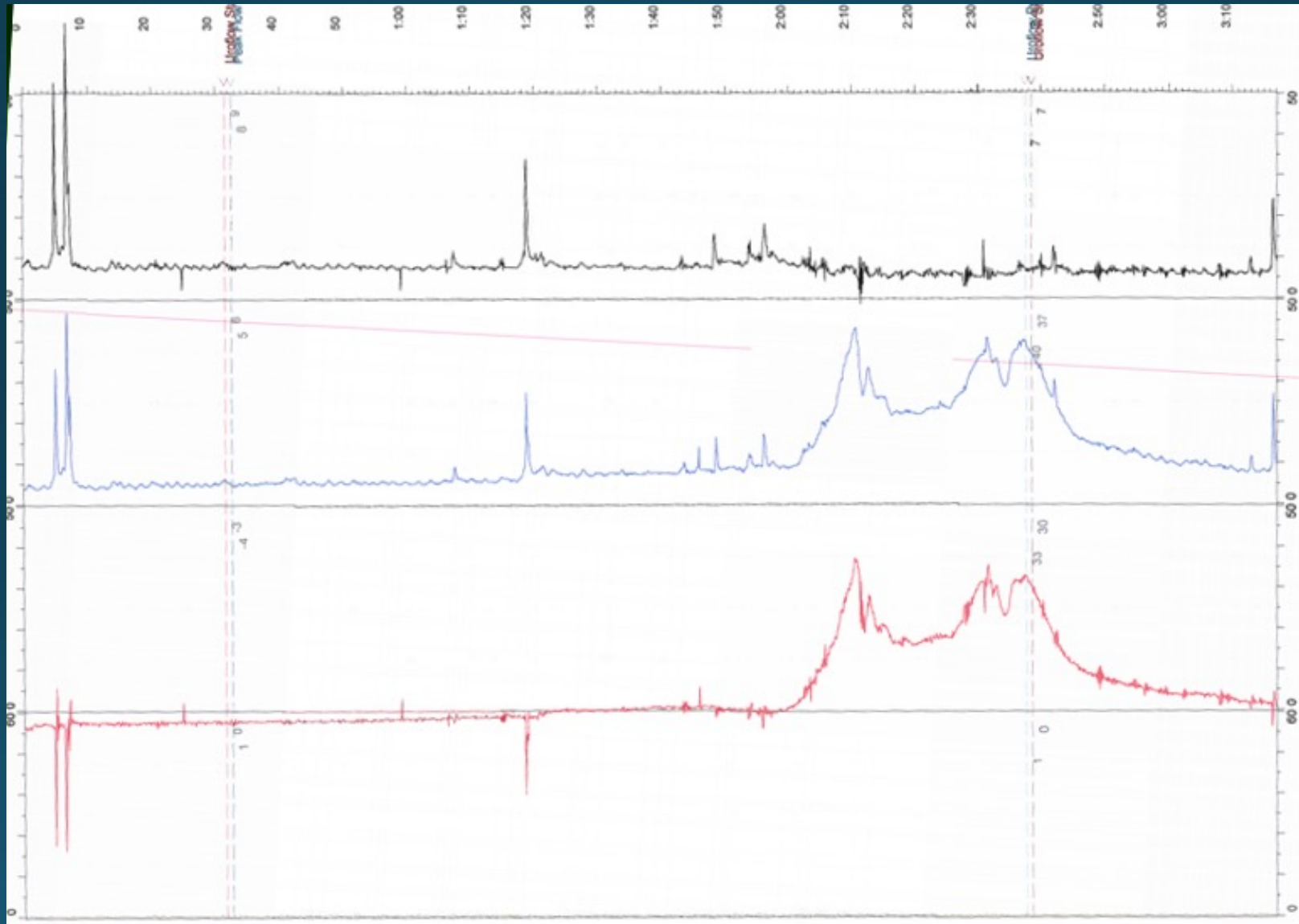
At the end...

- Measure post void residual either with in-and-out catheter or ultrasound

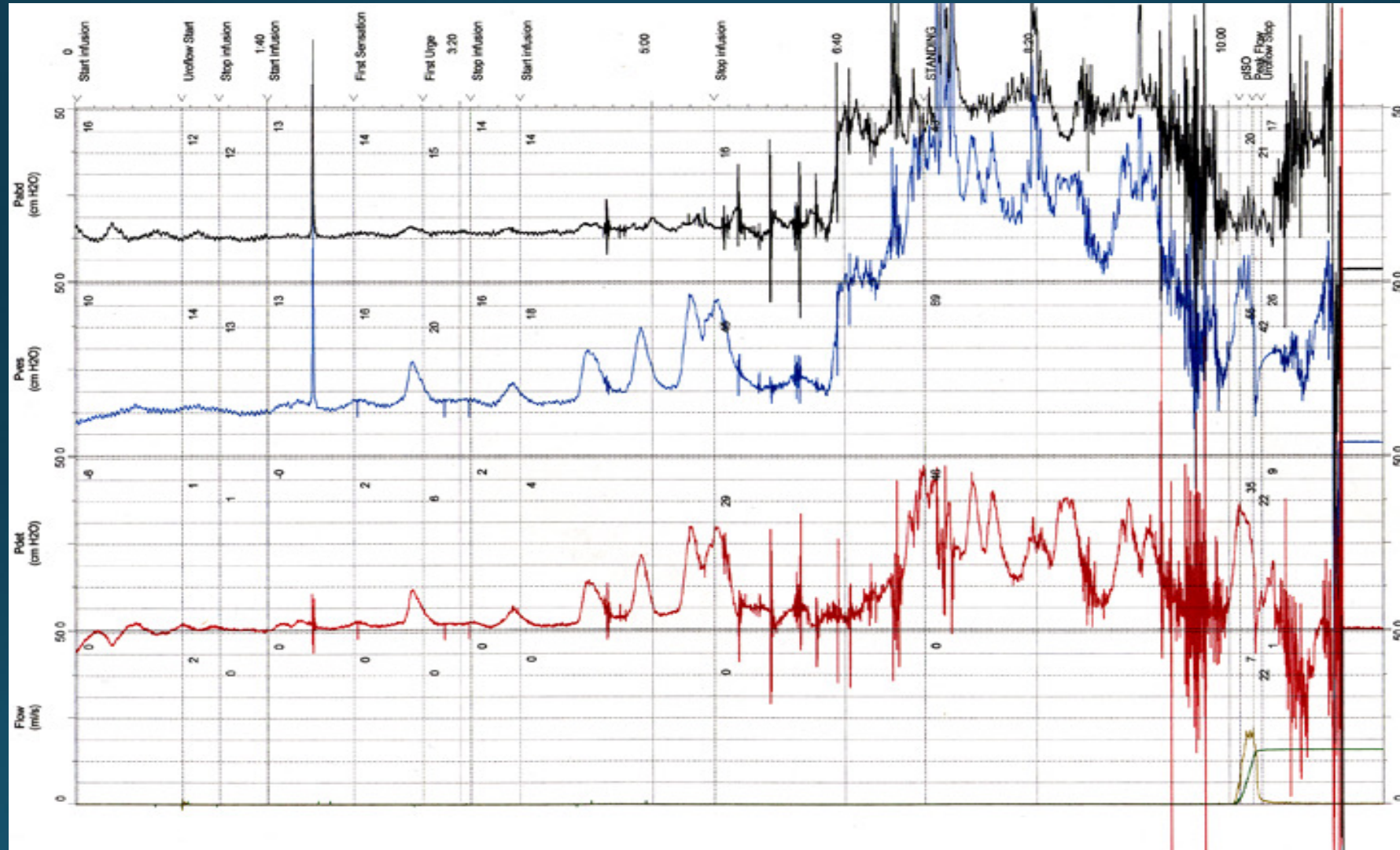
Normal cystometric values

- Residual urine < 100ml
- FDV between 150-250ml
- Capacity 400-600ml
- Detrusor pressure rise on filling $\leq 3\text{cm} / 100\text{ml}$
- No detrusor contraction during filling
- No leakage on coughing
- No detrusor contraction on provocation
- Qmax (flow rate) >15ml/sec

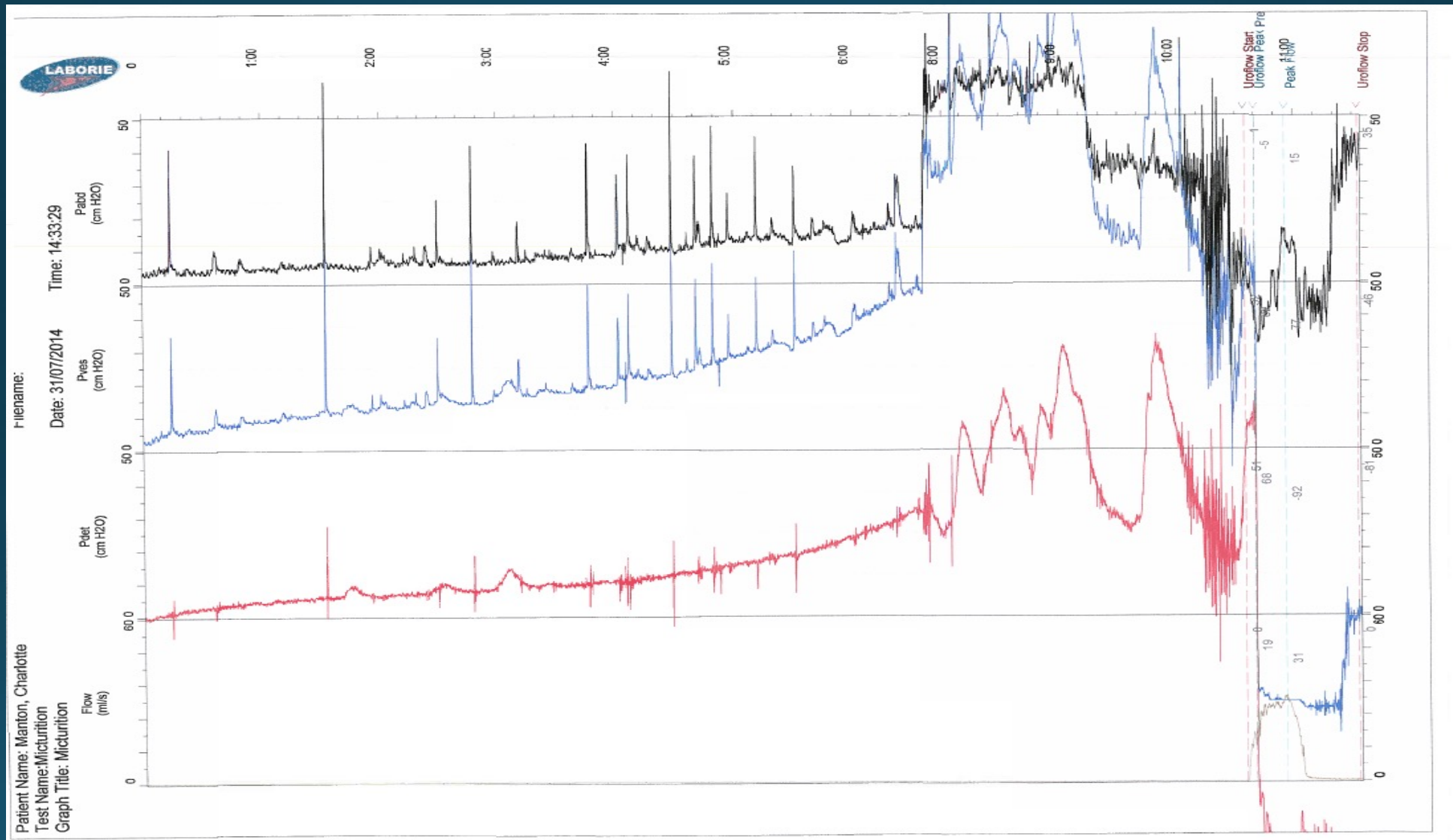
Systolic Detrusor Overactivity



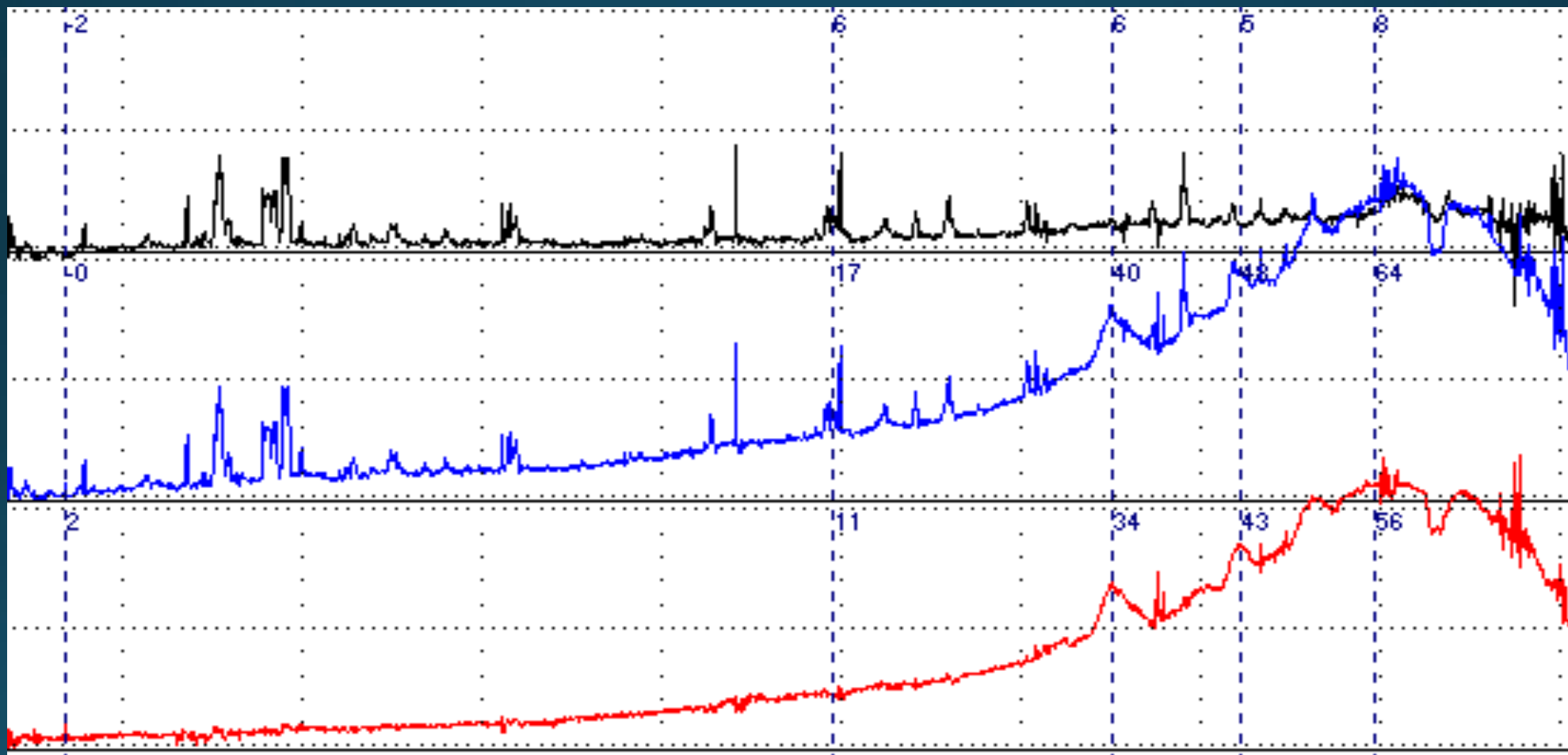
Systolic and Provoked Detrusor Overactivity



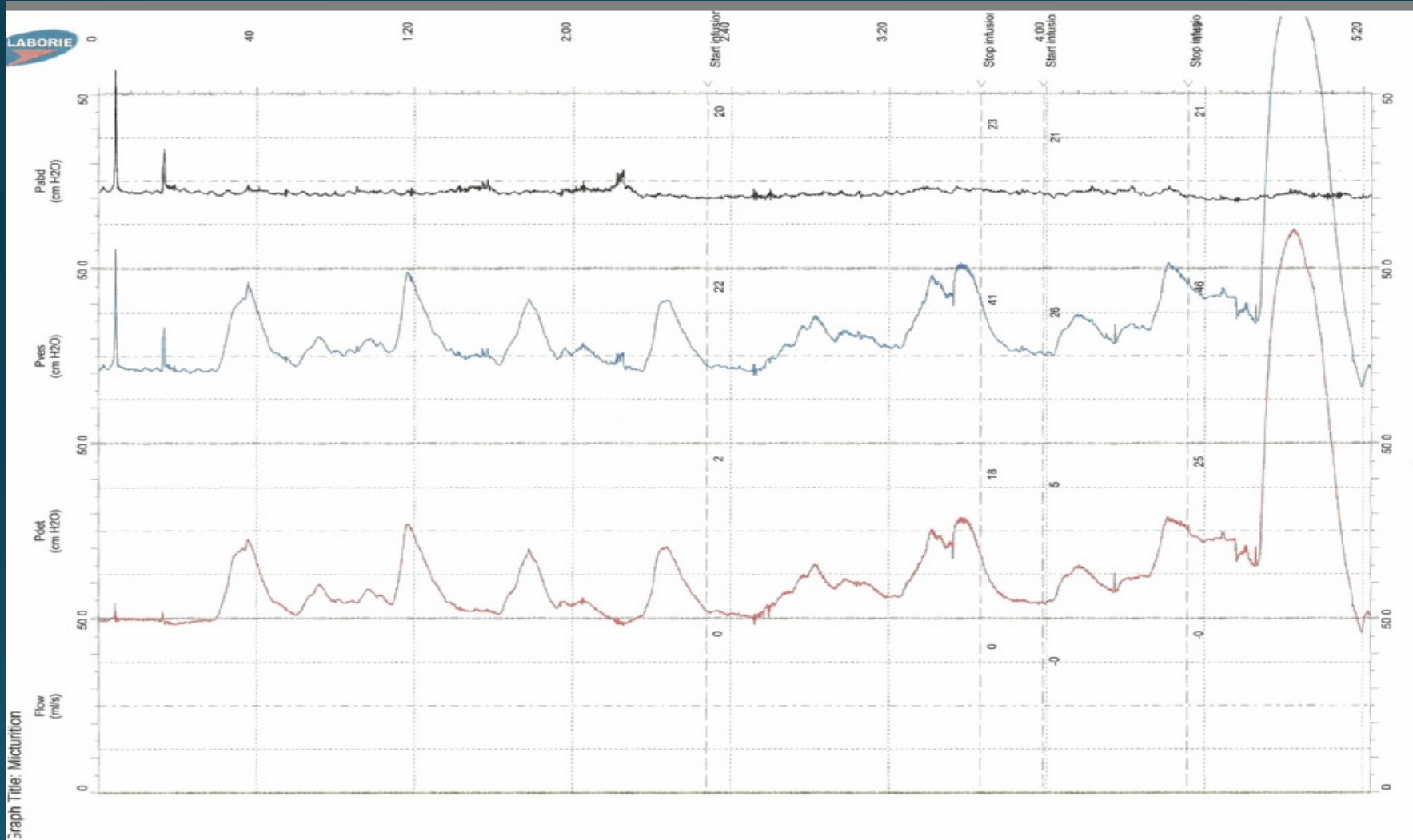
Low compliance, Systolic and Provoked Detrusor Overactivity



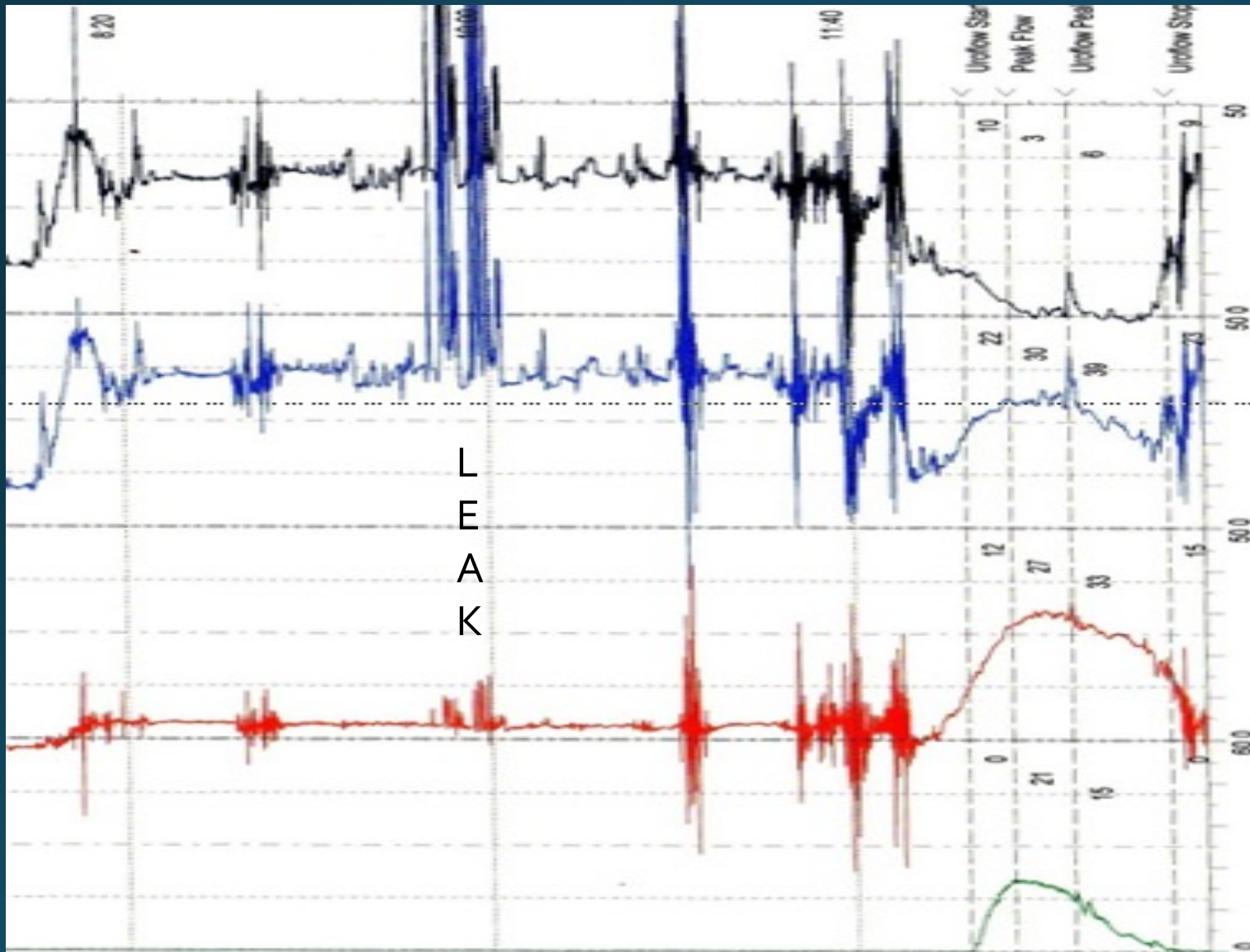
Low compliance and Systolic DO



Neurogenic DO

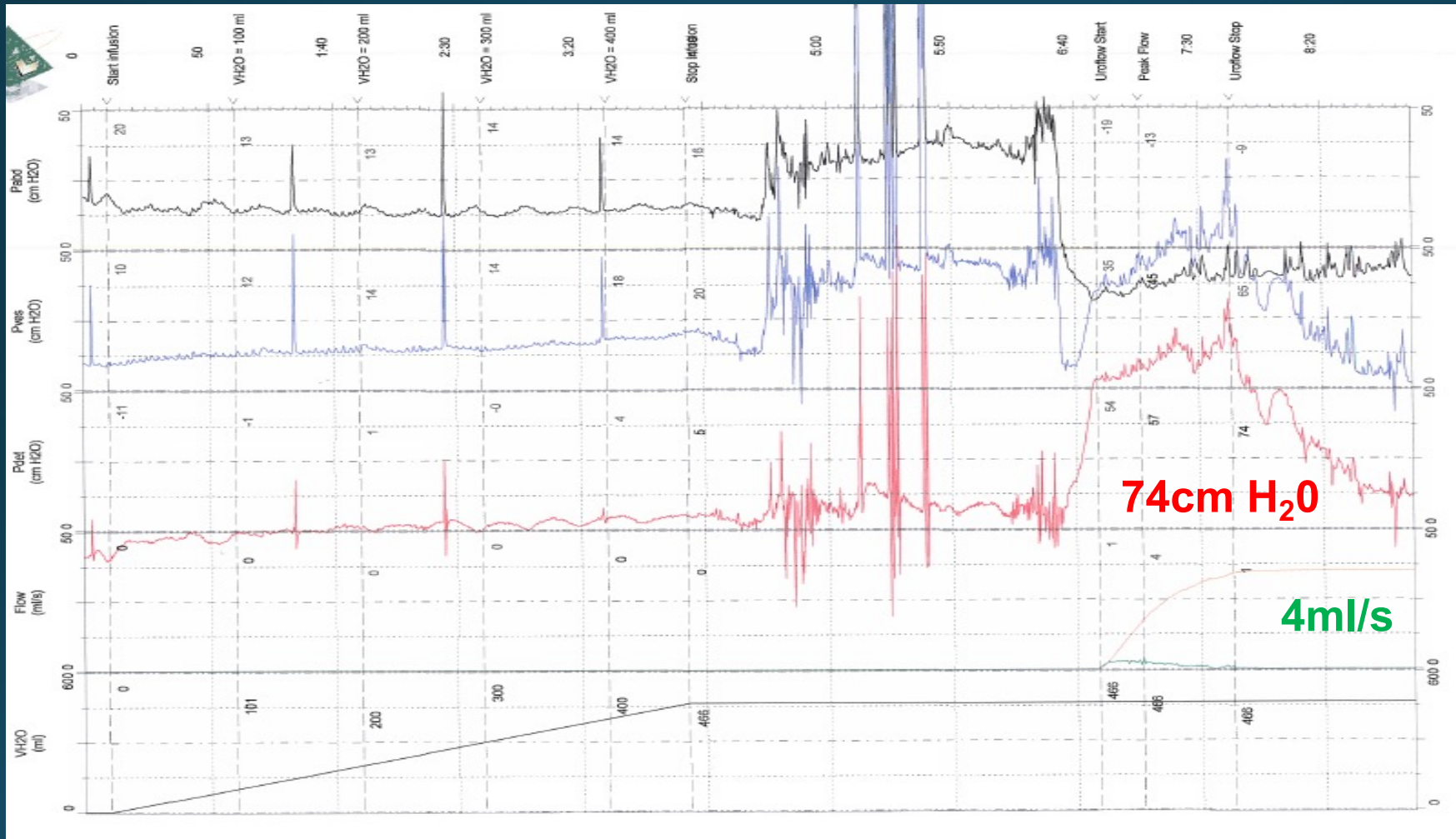


Urodynamic stress incontinence



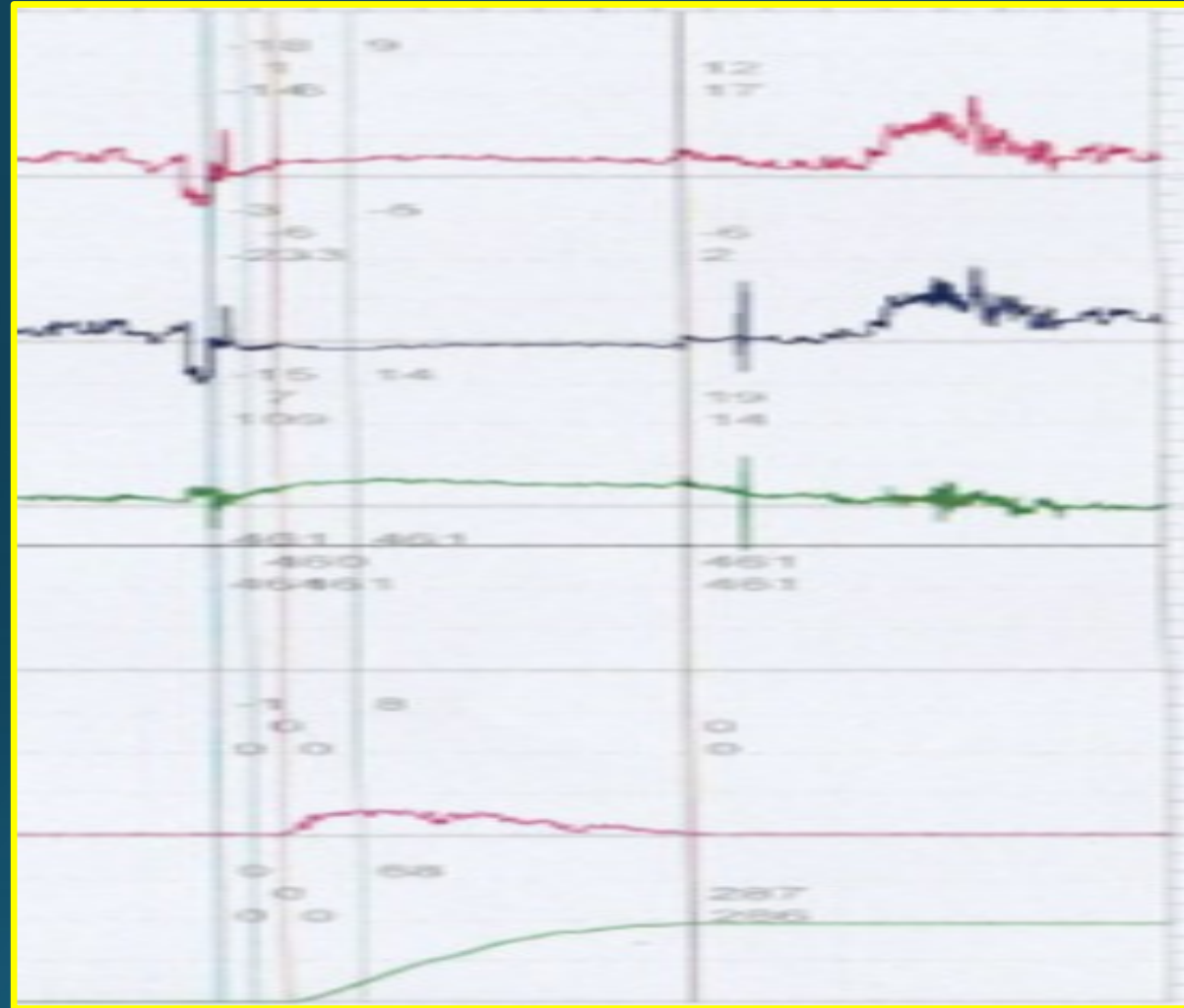
- 1 cough –severe
- 3 coughs – moderate
- 5 coughs - mild

Urethral Stricture



High pressure low flow

Detrusor Underactivity



14 cmH₂O

8 ml/sec

Low pressure void with low flow

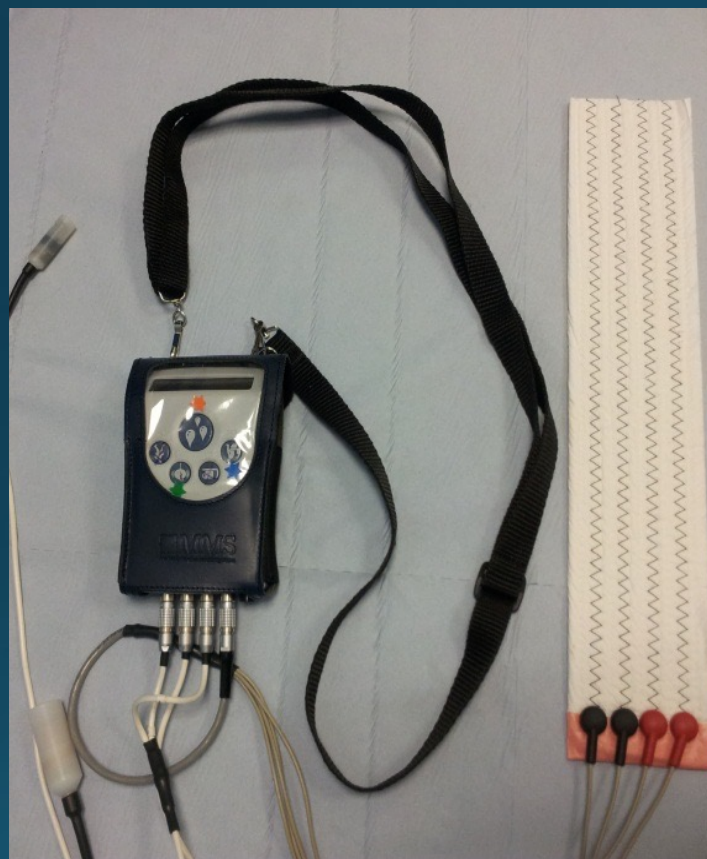
Limitations

- Invasive test
- Discomfort during the procedure
- Transient bleeding following procedure
- Theoretical risk of infection: 2-4% risk of UTI
- Important to exclude UTI as this may falsely result in:
Increased bladder sensation Poor compliance
- Prophylactic antibiotics may play a role in patients with recurrent UTIs

Limitations

- Failure to provide a diagnosis
- May not reproduce patient's symptoms
- Poor subtraction may lead to errors
- Air bubbles in the system or leaks may lead to errors of measurement
- Rectal contractions may be misinterpreted as DO

Ambulatory UDS



Videocystourethrography

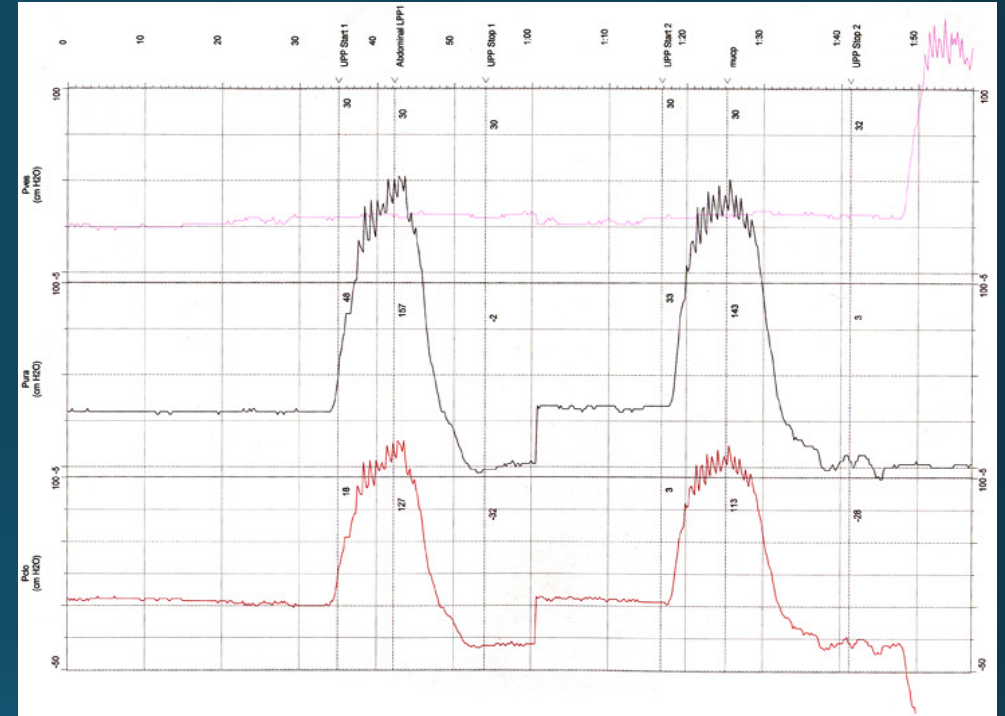
- Incorporates screening fluoroscopy with the recording of a cystometrogram
- Beneficial when simultaneous evaluation of physiology and anatomy is required
- Allows detailed assessment of lower urinary tract morphology and functional anatomy



Urethral pressure profilometry

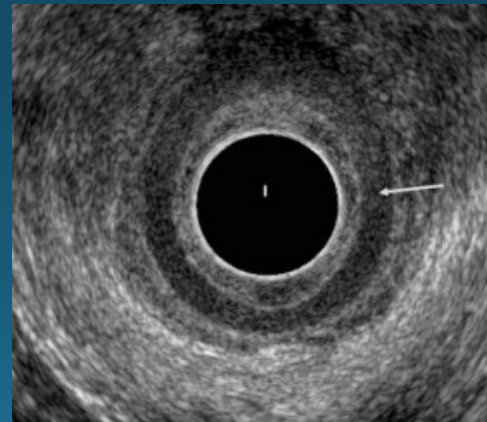
Uses of Urethral Pressure Profilometry:

- Voiding difficulties
 - Urethral stricture
 - Failed continence surgery
 - Urethral diverticula
 - Prognosis following continence surgery
-
- Not diagnostic of Urodynamic Stress Incontinence



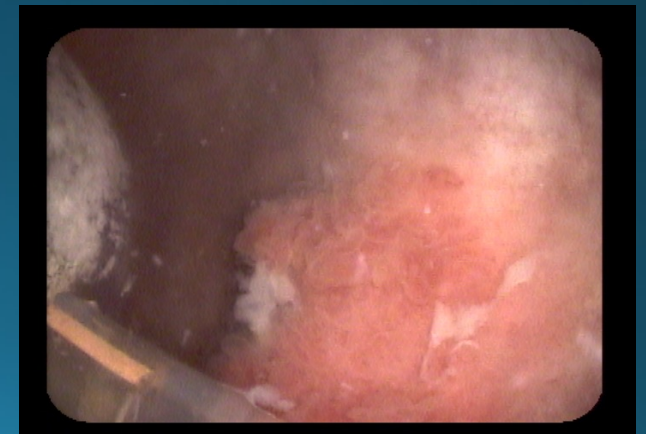
Ultrasound and Radiological Imaging

- Post-micturition residual
- Bladder wall thickness
- Upper renal tracts
- Urethral sphincter
- Pelvic floor



Cystourethroscopy

- Rigid (GA) or flexible (LA)
- Confirmation of anatomy
- Visualisation of anomalies : bladder calculi, tumours, diverticula etc
- Biopsy of endothelium to assess for chronic inflammation, cystitis cystica, interstitial cystitis



In clinical practice

Urinary incontinence and pelvic organ prolapse in women: management

NICE guideline

Published: 2 April 2019

Last updated: 24 June 2019

www.nice.org.uk/guidance/ng123

UDS and OAB

- For women with OAB not responding to non-surgical management and wishing further treatment, offer UDS to look for DO

Invasive procedures for overactive bladder

1.4.43 For women with overactive bladder that has not responded to non-surgical management or treatment with medicine and who wish to discuss further treatment options:

- offer urodynamic investigation to determine whether detrusor overactivity is causing her overactive bladder symptoms **and**
- if detrusor overactivity is causing her overactive bladder symptoms, offer an invasive procedure in line with the recommendation on bladder wall injection in the section on botulinum toxin type A and the recommendation in the section on urinary diversion **or**
- if there is no detrusor overactivity, seek advice on further management from the local MDT in line with the recommendation on considering treatment with botulinum toxin type A in the section on botulinum toxin type A. **[2013, amended 2019]**

UDS and SUI

- Do NOT perform UDS if clinically demonstrated SUI or stress predominant MUI
- Do consider UDS in women who have failed non-surgical management and have

Voiding dysfunction

Anterior/apical prolapse

Prev surgery for SUI

Urodynamic testing

- 1.3.15 Do not perform multichannel filling and voiding cystometry before primary surgery if stress urinary incontinence or stress-predominant mixed urinary incontinence is diagnosed based on a detailed clinical history and demonstrated stress urinary incontinence at examination. [2019]
- 1.3.16 After undertaking a detailed clinical history and examination, perform multichannel filling and voiding cystometry before surgery for stress urinary incontinence in women who have any of the following:
- urge-predominant mixed urinary incontinence or urinary incontinence in which the type is unclear
 - symptoms suggestive of voiding dysfunction
 - anterior or apical prolapse
 - a history of previous surgery for stress urinary incontinence. [2019]

UDS and SUI

Urodynamic testing

Recommendations 1.3.15 and 1.3.16

Why the committee made the 2019 recommendations

The evidence did not show any benefit from urodynamic testing to assess stress urinary incontinence or stress-predominant mixed urinary incontinence in women who have demonstrable stress urinary incontinence before primary surgery. The committee concluded that urodynamic testing is not necessary for most women in this situation.

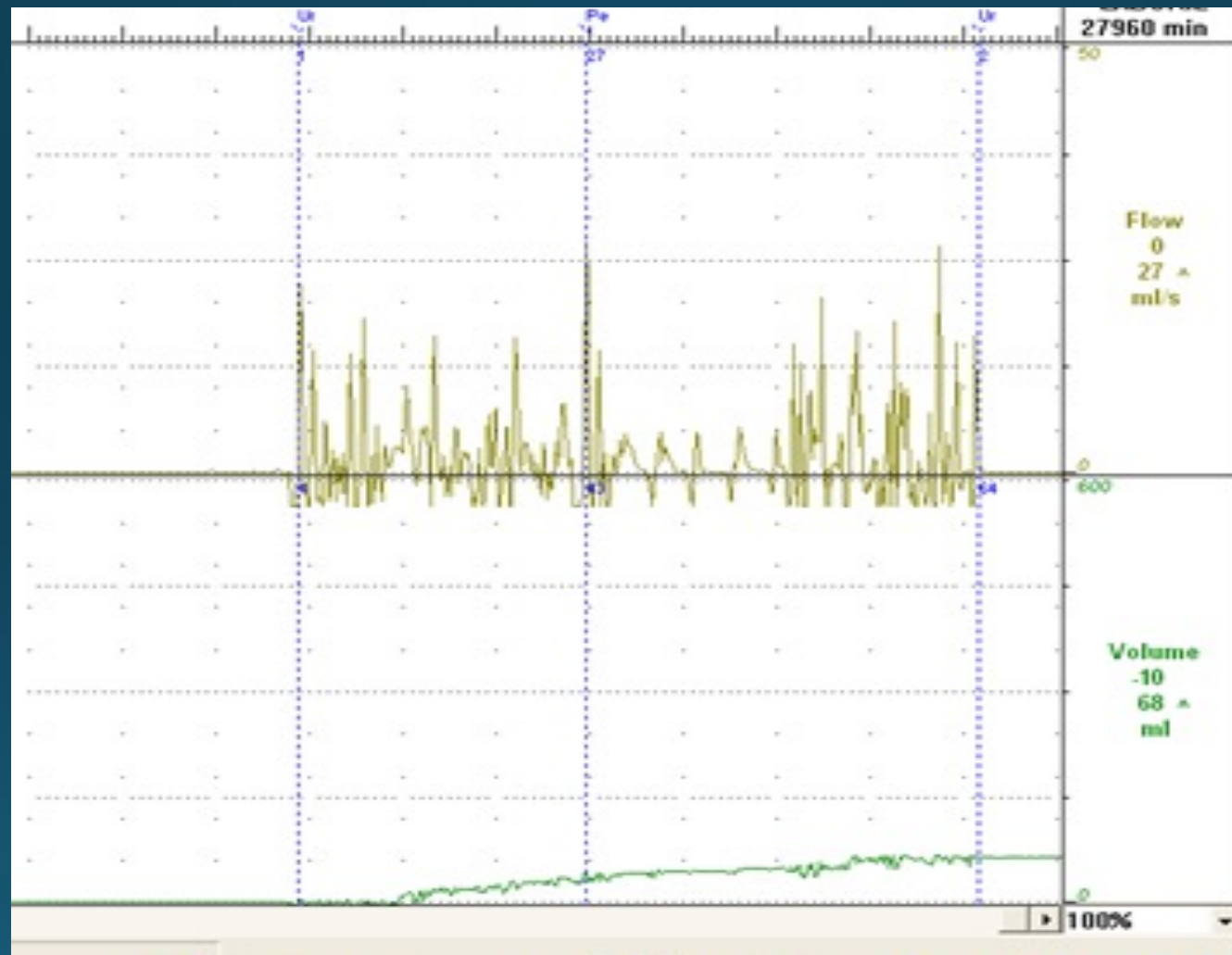
However, based on their experience the committee agreed that urodynamic testing can be beneficial if the diagnosis is unclear or if the woman has symptoms of voiding dysfunction, anterior or apical prolapse, or a history of surgery for stress urinary incontinence.

How the recommendations might affect practice

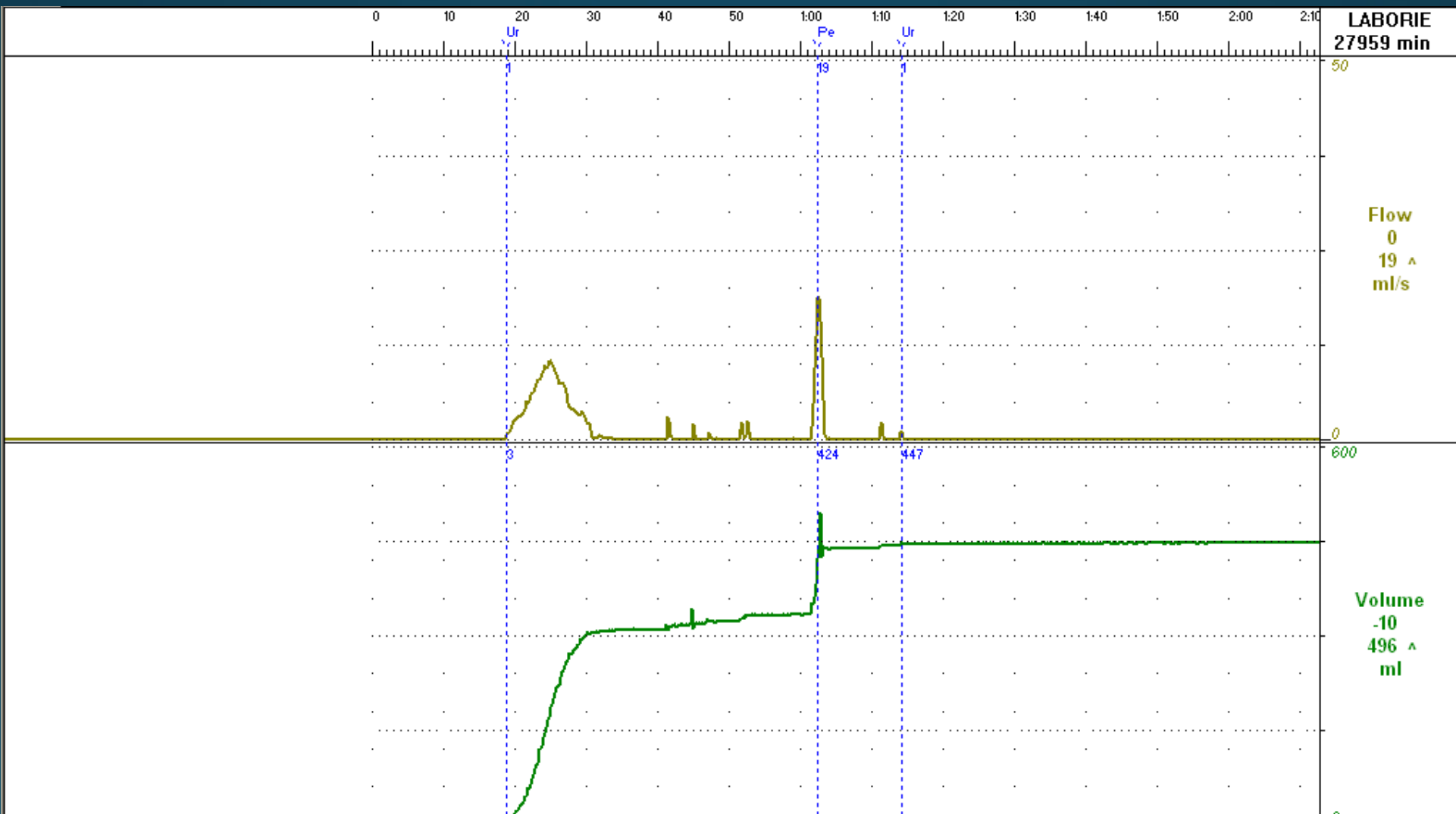
The recommendations are likely to reduce variation in practice, which is largely caused by uncertainty about the clinical value of urodynamic testing before surgery. They are also expected to reduce the number of women having urodynamic testing before surgery, and avoid unnecessary use of a procedure that some women find unpleasant.

- No evidence for benefit from UDS prior to SUI surgery
- Acknowledge that UDS can be beneficial if diagnosis unclear

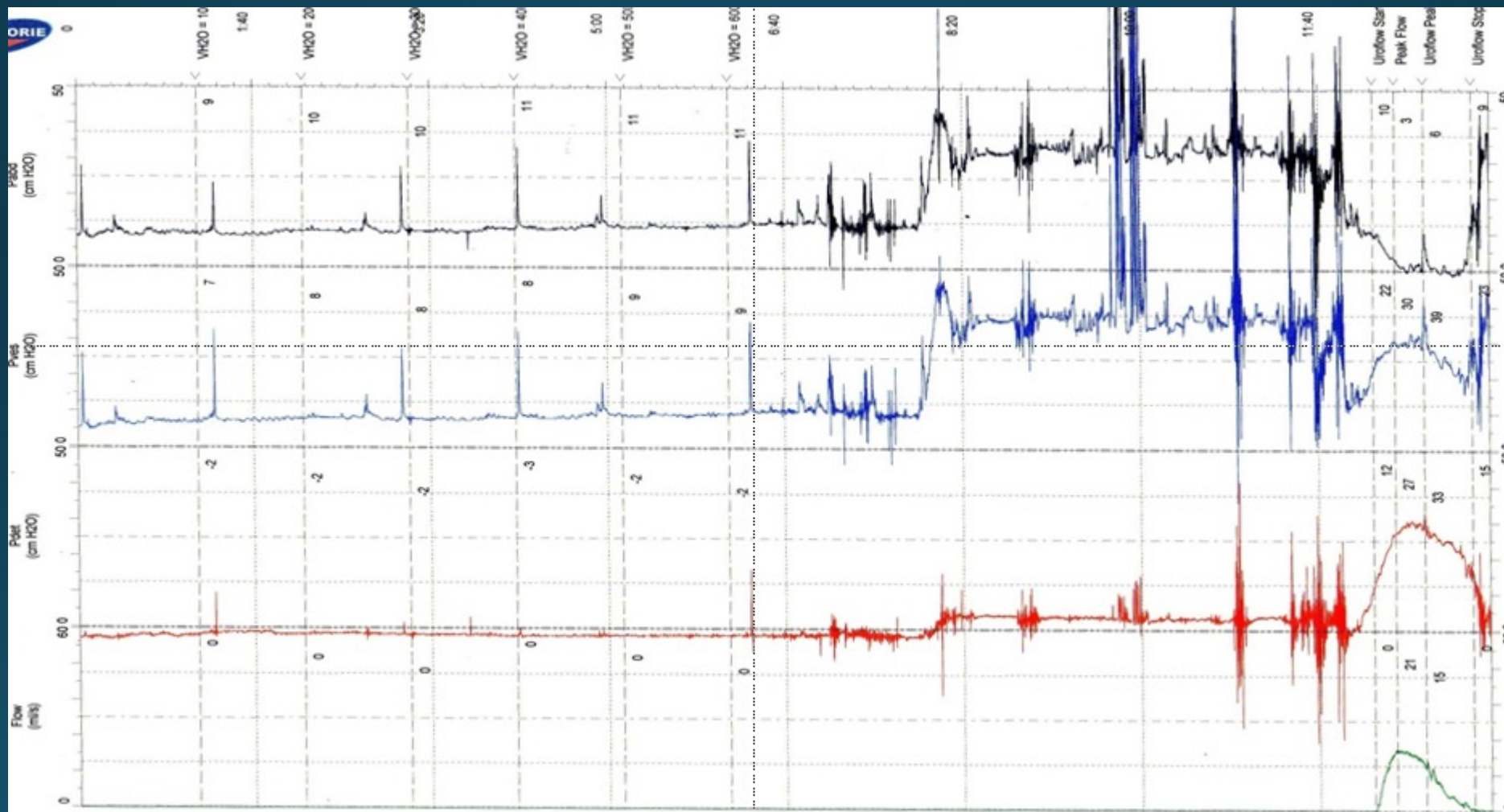
Diagnosis



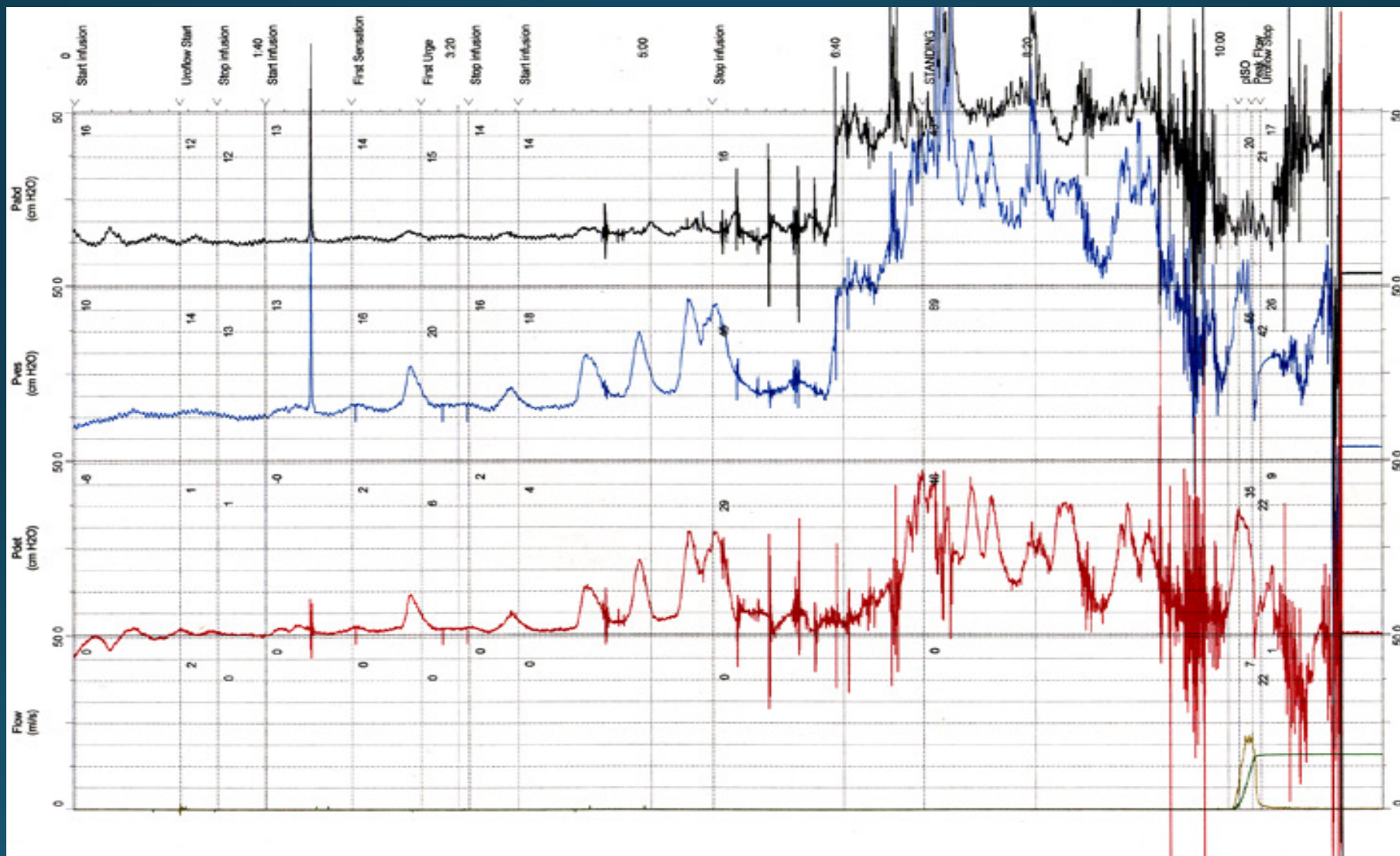
Diagnosis



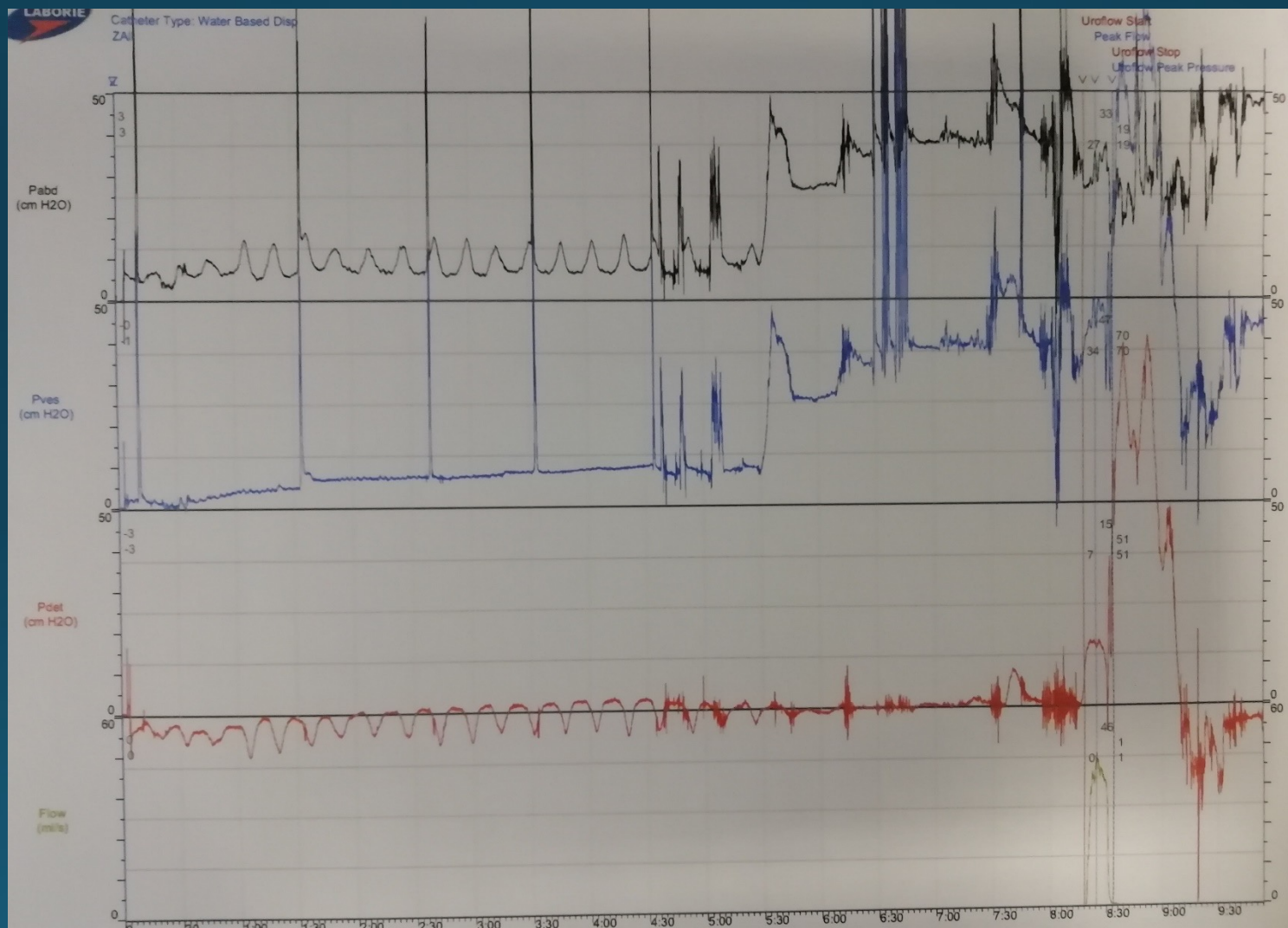
Diagnosis



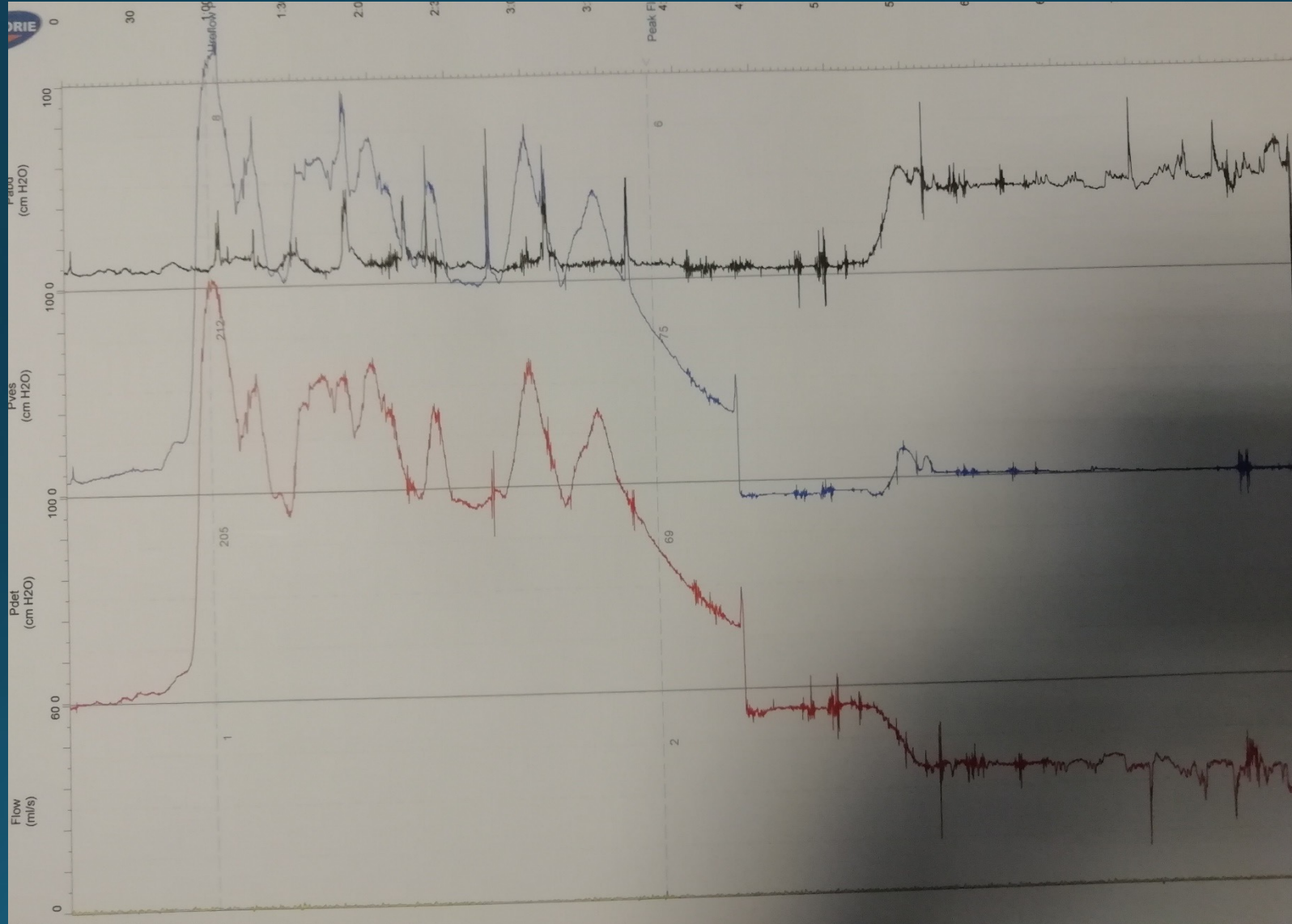
Diagnosis



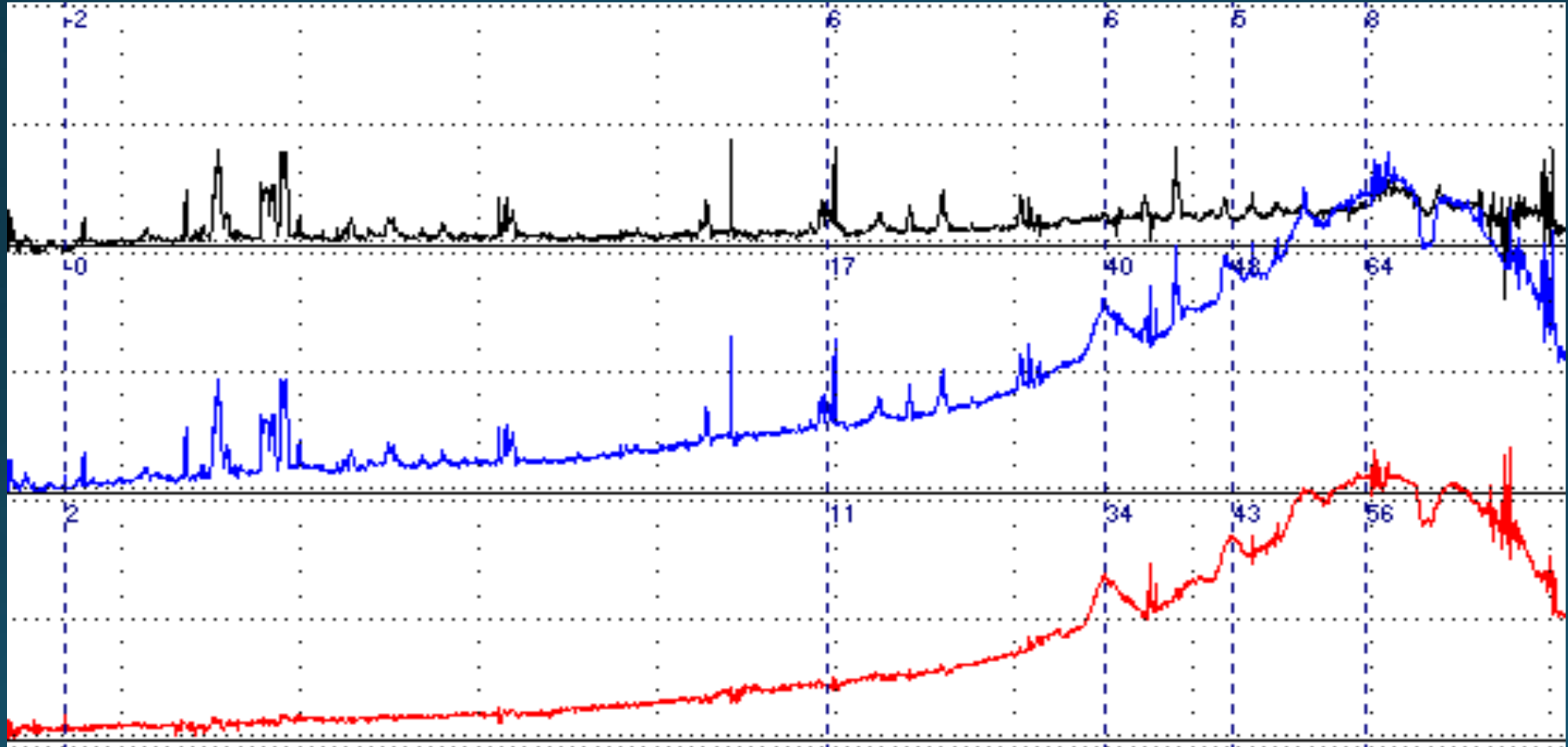
Diagnosis



Diagnosis



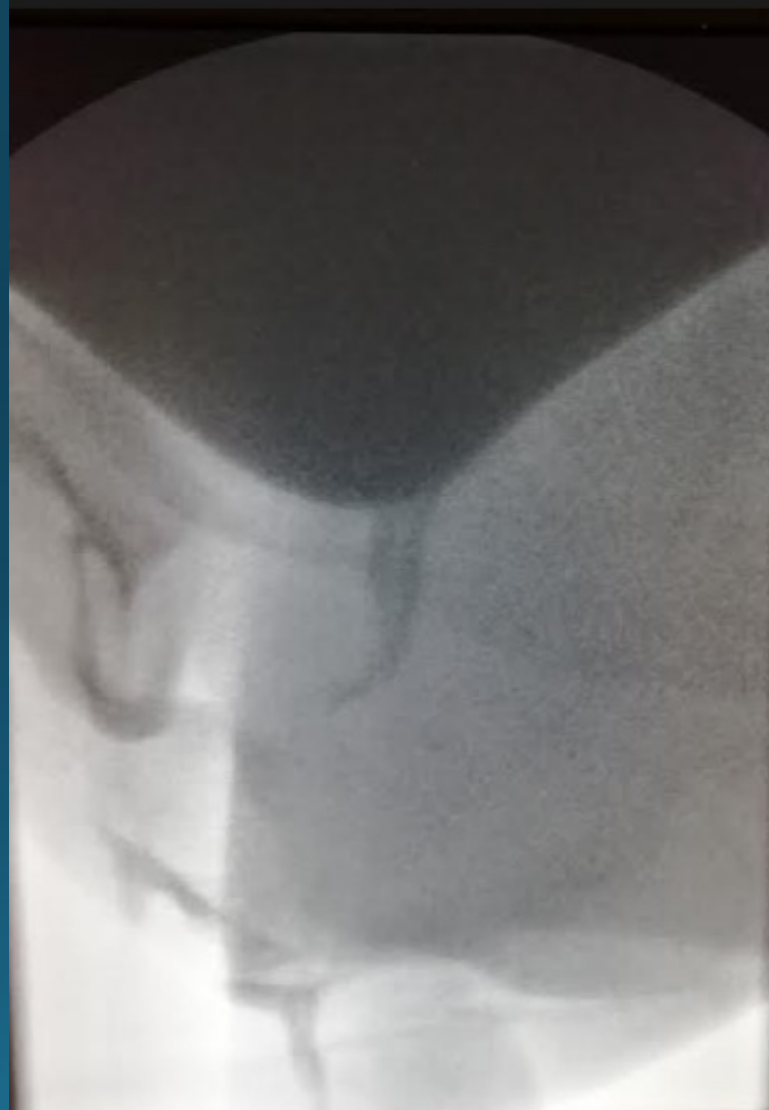
Diagnosis



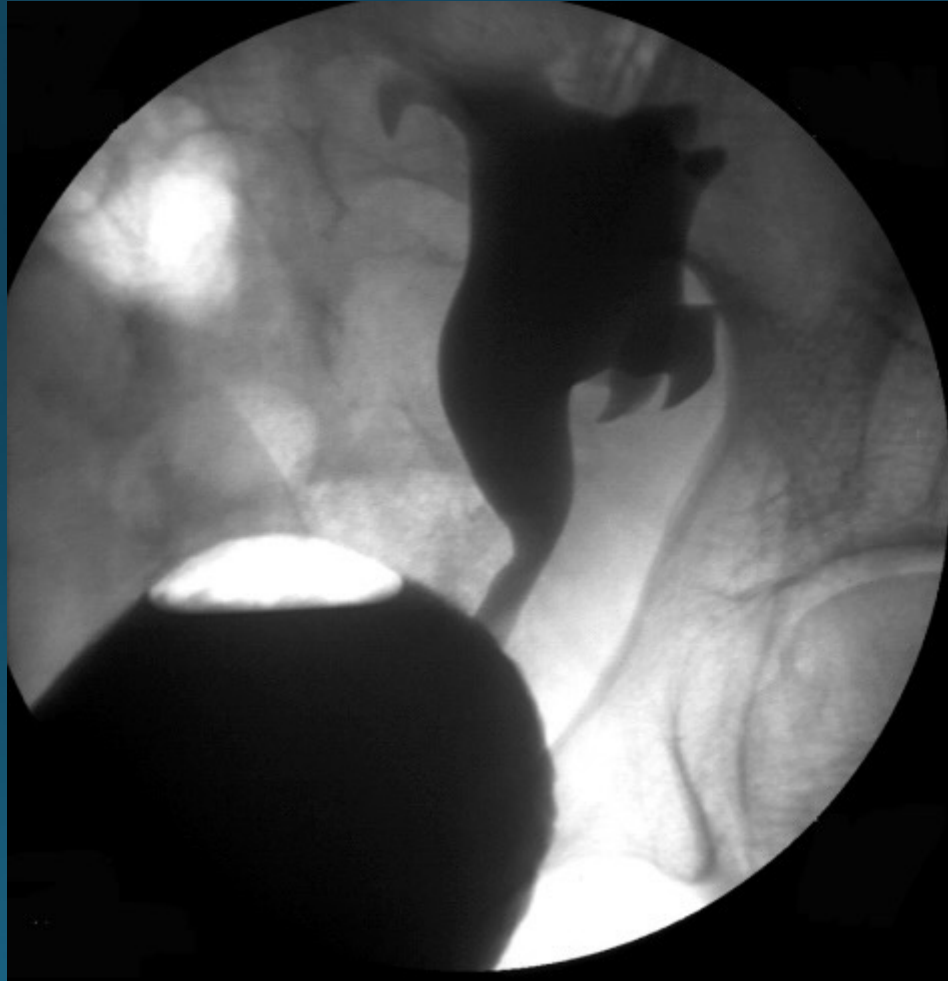
Diagnosis



Diagnosis



Diagnosis



Diagnosis



Summary

- Urodynamics is a specialist test which can help give objective findings for subjective conditions
- It should be carried out prior to any invasive treatment for OAB
- Do not need to perform UDS for invasive treatment of pure SUI or stress predominant MUI (but should consider if any complicating factors such as anterior prolapse)
- Traces are not as complex as they look! Take your time and work them out from first principles (use the history too!)

Thank you

- Any questions?
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