Explorations Urodynamiques. Analyse et traitement du signal. Interprétations des données

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Neurourology and Urodynamics 21:261–274 (2002)

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

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

International Continence Society Office, Southmead Hospital, Bristol, BS10 5NB, United Kingdom

This is the first report of the International Continence Society (ICS) on the development of comprehensive guidelines for Good Urodynamic Practice for the measurement, quality control, and documentation of urodynamic investigations in both clinical and research environments. This report focuses on the most common urodynamics examinations; uroflowmetry, pressure recording during filling cystometry, and combined pressure–flow studies. The basic aspects of good urodynamic practice are discussed and a strategy for urodynamic measurement, equipment set-up and configuration, signal testing, plausibility controls, pattern recognition, and artifact correction are proposed. The problems of data analysis are mentioned only when they are relevant in the judgment of data quality. In general, recommendations are made for one specific technique. This does not imply that this technique is the only one possible. Rather, it means that this technique is well-established, and gives good results when used with the suggested standards of good urodynamic practice. *Neurourol. Urodynam. 21:261–274, 2002.* © 2002 Wiley-Liss, Inc.

Key words: urodynamics; standardisation; uroflowmetry; cystometry; pressure-flow studies

RECOMMANDATIONS

Progrès en Urologie (2006), 14, 1103-1111

Terminologie des troubles fonctionnels du bas appareil urinaire : adaptation française de la terminologie de l'International Continence Society

François HAAB (1), Gérard AMARENCO (2), Patrick COLOBY (3), Philippe GRISE (4), Bernard JACQUETIN (5), Jean-Jacques LABAT (6), Emmanuel CHARTIER-KASTLER (7), François RICHARD (7)

Journal of Medical Engineering & Technology, Volume 11, Number 2 (March/April 1987), pages 57–64

Urodynamic equipment: technical aspects

Produced by the International Continence Society* Working Party on Urodynamic Equipment

Chairman: David Rowan†
Members: E. Douglas James, August E. J. L. Kramer, Arthur M. Sterling and Peter F. Suhel
† *International Continence Society, Department of Clinical Physics & Bio-Engineering, 11 West Graham Street, Glasgow G4 9LF, UK*

taining compatibility between the various components in the overall system. Processors can be used to:

(1) Amplify the signal.
(2) Filter the signal.
(3) Differentiate the signal.
(4) Integrate the signal.
(5) Convert the analogue signal into digital form.

Introduction

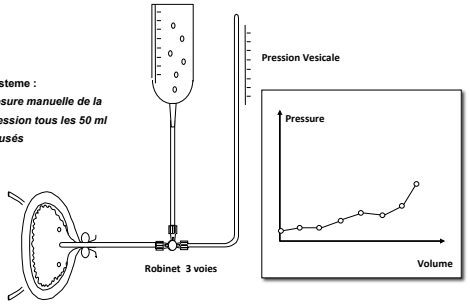
Neurourology and Urodynamics 21:258–260 (2002)

Standardisation of Urethral Pressure Measurement: Report from the Standardisation Sub-Committee of the International Continence Society

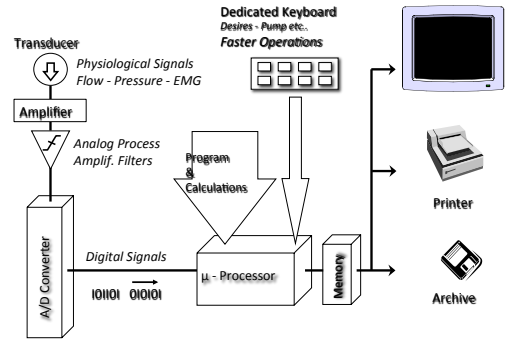
Gunnar Lose,[1] Derek Griffiths,[2] Gordon Hosker,[3] Sigurd Kulseng-Hanssen,[4] Daniele Perucchini,[5] Werner Schäfer,[6] Peter Thind,[7] and Eboo Versi[8]

URODYNAMIQUE *Colonne d'eau - Budge (1872)*

Systeme :
Mesure manuelle de la Pression tous les 50 ml infusés

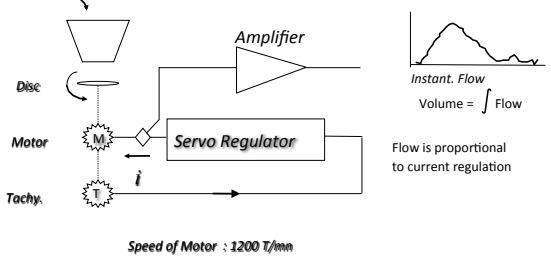


Equipment



Uroflowmeter *Spinning Disk System*

Accuracy 3%, Linearity 3 to 120 ml/s
Insensitivity to Waterfall

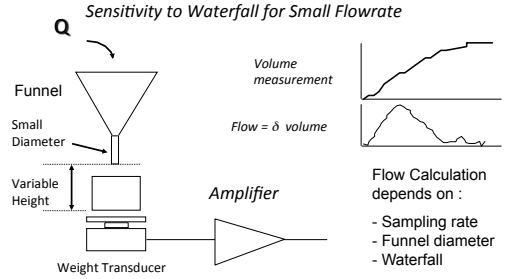


Flow is proportional to current regulation

Speed of Motor : 1200 T/mn

Uroflowmeter *Weight Cell System*

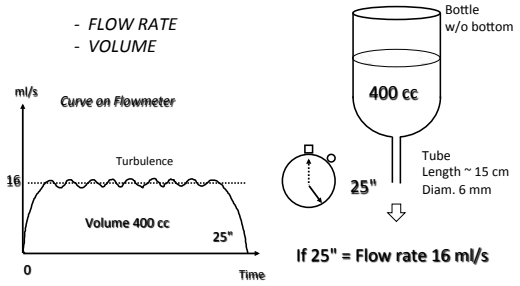
Accuracy 5%, Linearity 8 to 60 ml/s
Sensitivity to Waterfall for Small Flowrate



Flow Calculation depends on :
- Sampling rate
- Funnel diameter
- Waterfall

Uroflowmeter *Controls*

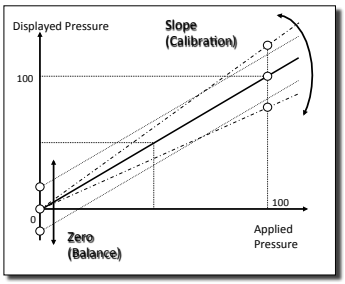
- *FLOW RATE*
- *VOLUME*



If 25" = Flow rate 16 ml/s

Pressure Calibration

Always Start by Balancing !



10% Error on Balance
Give 10 % Error on Full Scale.

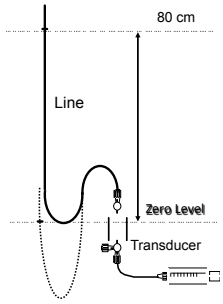
10% Error on Slope
(i.e. 100 cmH2O)
Give 5% Error mid-scale
(i.e. 50 cmH2O)

Pressure Control

Unstable pressures ?

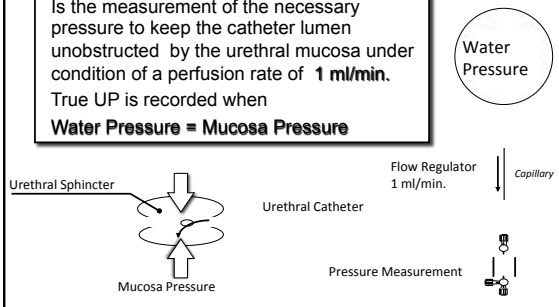
Perform this test :

1. Line at Zero Level, read 0.0 cmH_2O on Equipment
2. Line at 80 cm, Value must be 80 cmH_2O (+/- 2 cm H_2O) and stable. If not :
   - Leak in setup
   - Water in connector
   - Change transducer



Urethral Pressure Measurement *Principle*

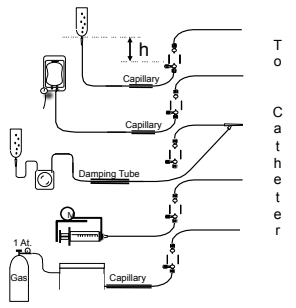
Is the measurement of the necessary pressure to keep the catheter lumen unobstructed by the urethral mucosa under condition of a perfusion rate of **1 ml/min.**
True UP is recorded when
Water Pressure = Mucosa Pressure



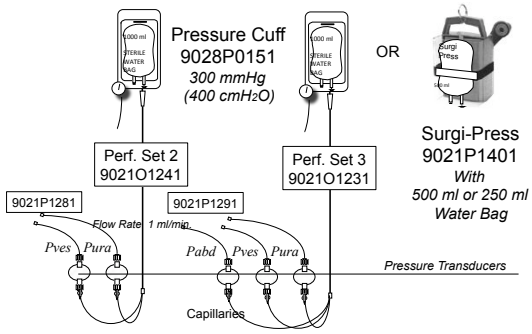
U.P.M. *5 Methods or Perfusion*

Water Pressure = At least 3 times Maximum Urethral Pressure

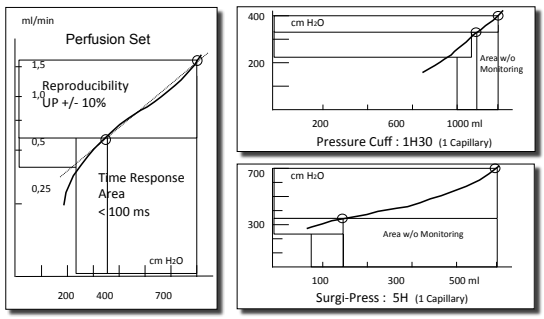
- Gravity
  UPmax. depends on h
- Pres. Cuff
  Max. Pressure 400 cmH2O
  Monitoring of Pressure
- Water Pump
  Damping Tube
  Change Montage for Test
- Syringe Driver
  Small Volume
- Arndorfer Pump
  Big - Expensive



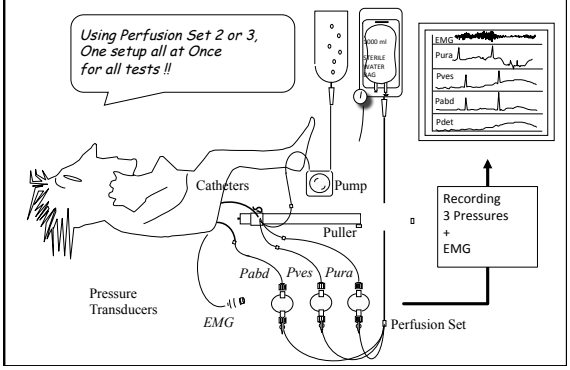
Transducer Perfusion



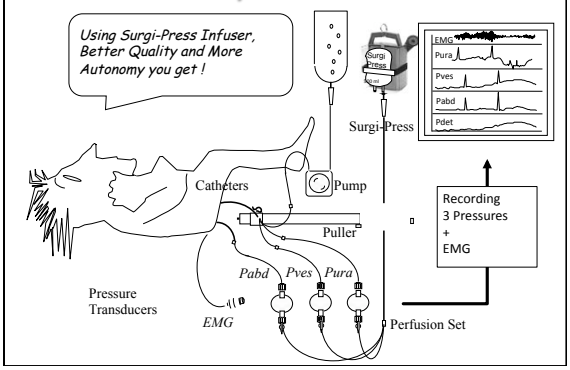
Cuff or Surgi-Press



Urethra-Cysto + EMG + UPP



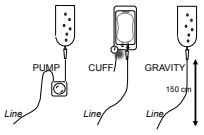
Urethro-Cysto + EMG + UPP



Infusion Rate *Versus Equipment / Catheters*

Even if Water Pump is correctly calibrated, Infusion Rate depends on:

- Length/diameter of the line
- Diameter/length of catheter



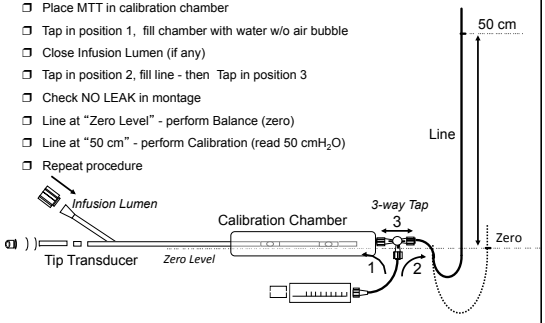
For Your Guide Lines, Infusion rate max. ml/mn :

	Pump* (set at 100ml/mn)	Cuff (400cmH2O)	Gravity (150cmH2O)
1 lumen cath. 5F	70	60	15
1 lumen cath. 8F	90	200	20
1 lumen cath. 10F	100	300	45
2 lumen cath. 8F	65	50	15
3 lumen cath. 10F	70	70	15

* Infusion rate limited to specifications of the pump.

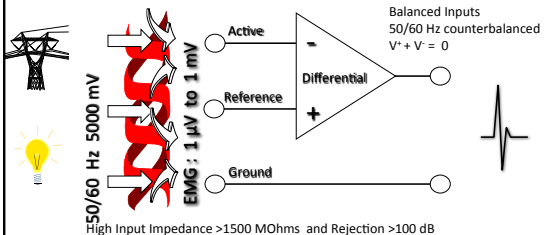
Micro-Tip Transducer *Calibration*

- ❒ Place MTT in calibration chamber
- ❒ Tap in position 1, fill chamber with water w/o air bubble
- ❒ Close Infusion Lumen (if any)
- ❒ Tap in position 2, fill line - then Tap in position 3
- ❒ Check NO LEAK in montage
- ❒ Line at "Zero Level" - perform Balance (zero)
- ❒ Line at "50 cm" - perform Calibration (read 50 cmH2O)
- ❒ Repeat procedure



EMG Amplifiers *Environment*

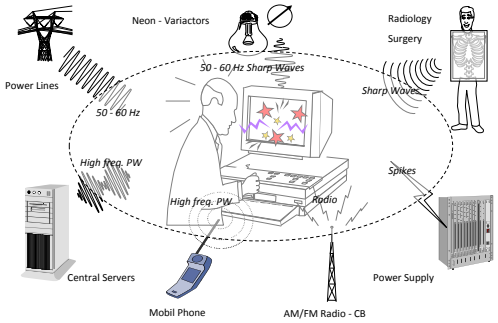
Environmental Interference penetrates Patient
Patient Must Be Grounded



High Input Impedance >1500 MOhms and Rejection >100 dB

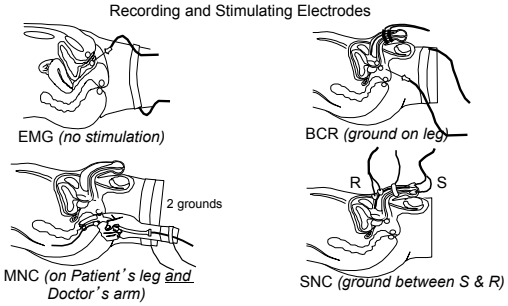
Environmental Artifacts

In EMG Patient is Antenna
Artifacts are transferred



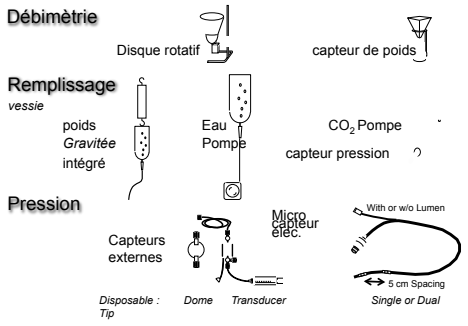
Grounding *in Uro-Neuro Tests*

To Reduce Stimulation Artifact - Place Ground between Recording and Stimulating Electrodes



Les techniques d'explorations urodynamiques

Techniques Urodynamiques *(Methodes)*



Les conditions d'enregistrement

CYSTOMETRIE

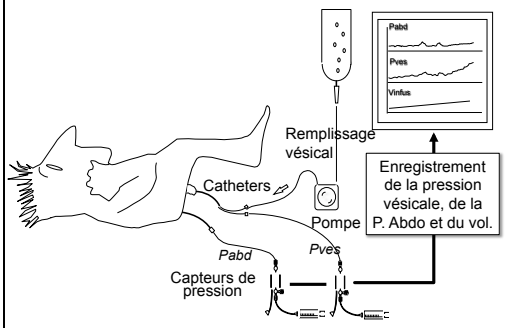
Patient

- vessie vide
- Catheters en place et purgés
- réponses OK en pression (élévation à la toux)
- EMG réponse OK
- Information du patient sur le « besoin d'uriner »
- Patient relaxé

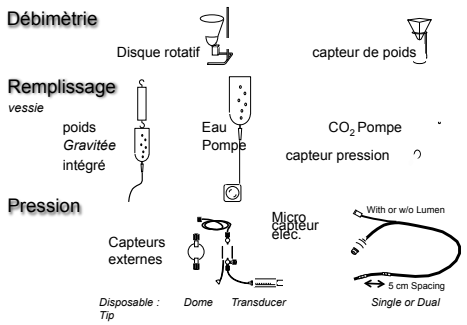
Equipement

- Vitesse remplissage 50 ml/min.
- fenêtre analyse 1 min./Div.
- Amplitude pression 20 cmH_2O/Div.

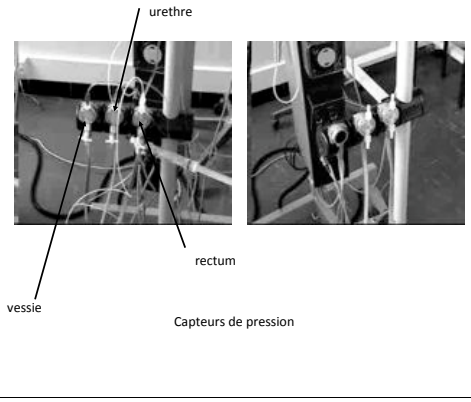
CYSTOMETRIE à eau



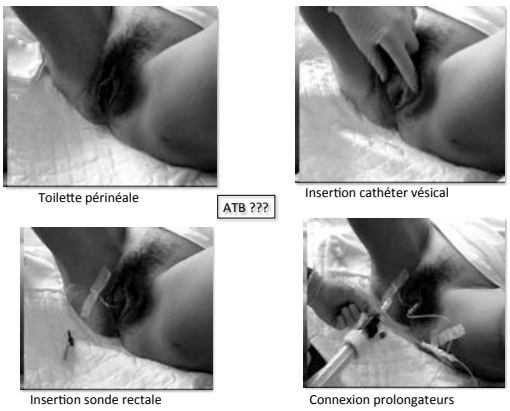
Techniques Urodynamiques *(Methodes)*



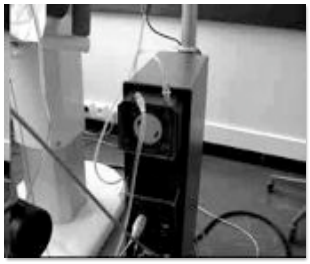
Préparation cystométrie : perfusion



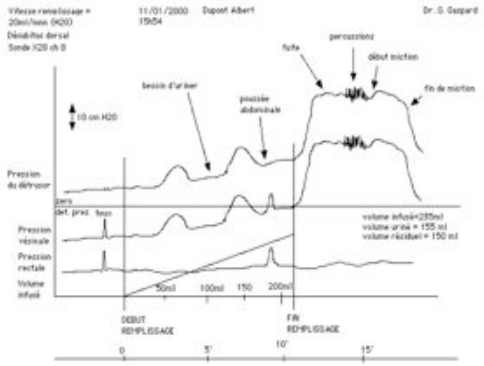
Capteurs de pression

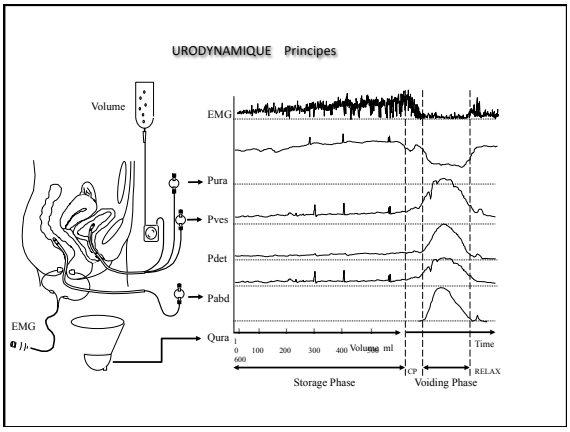


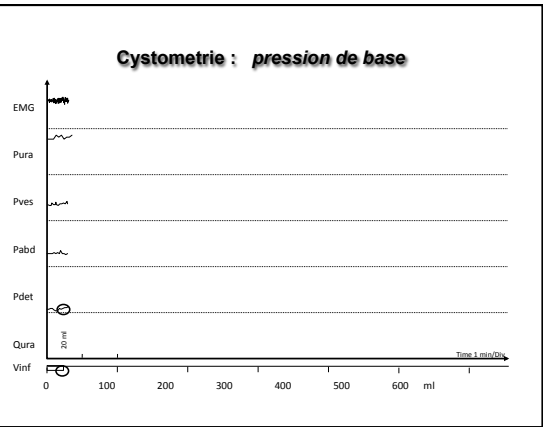
Insertion aiguille emg

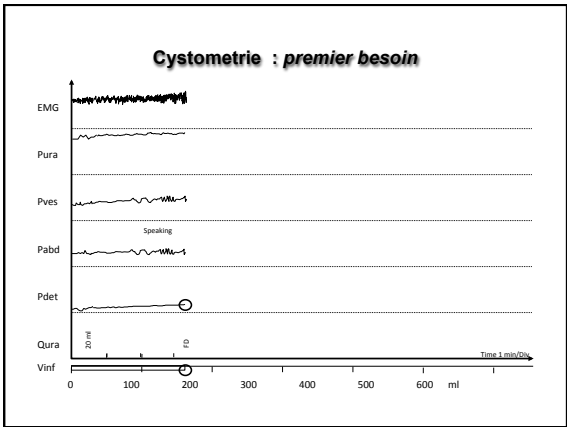


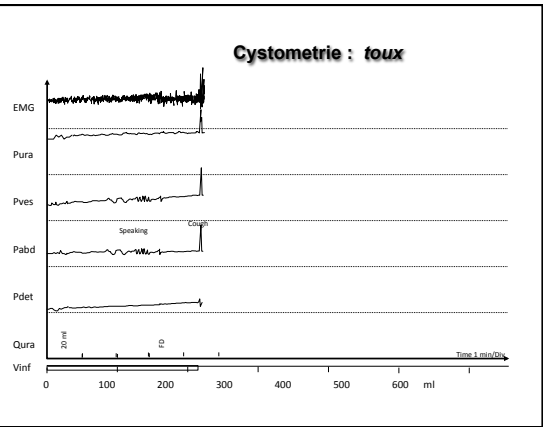
Remplissage vésical

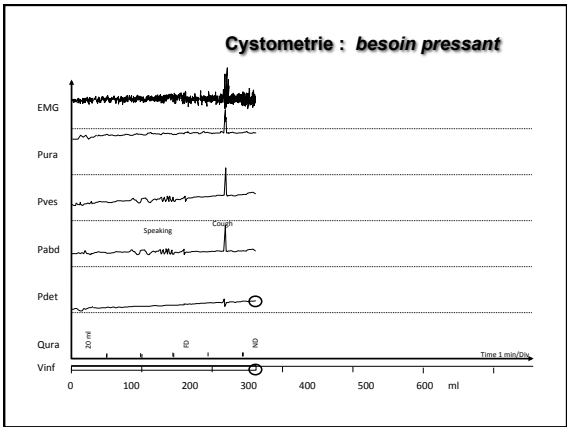


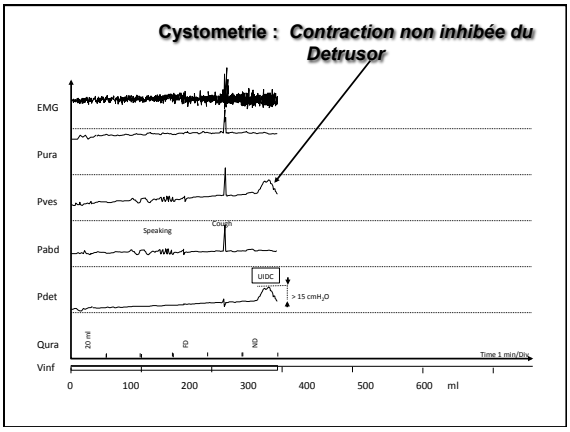


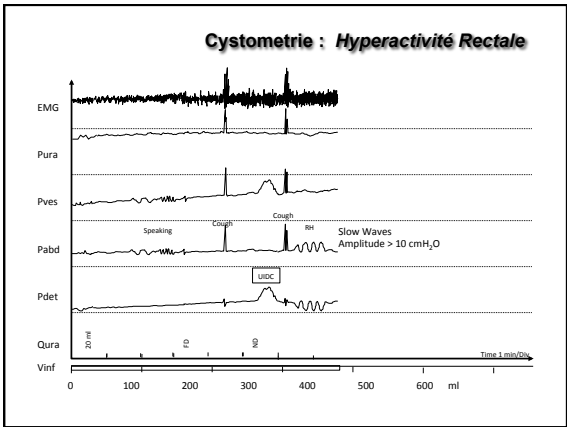


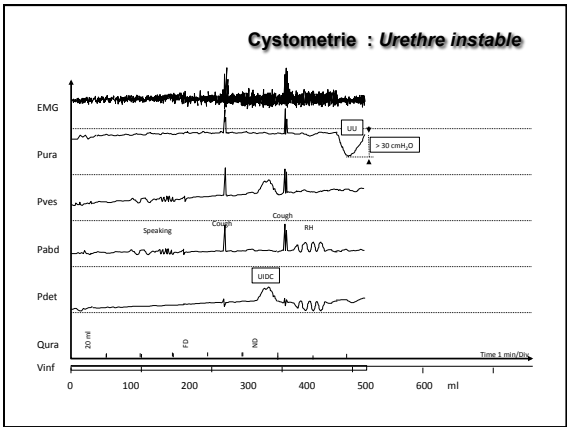


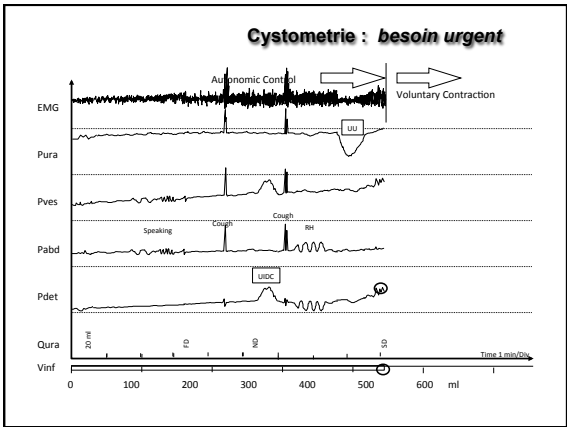


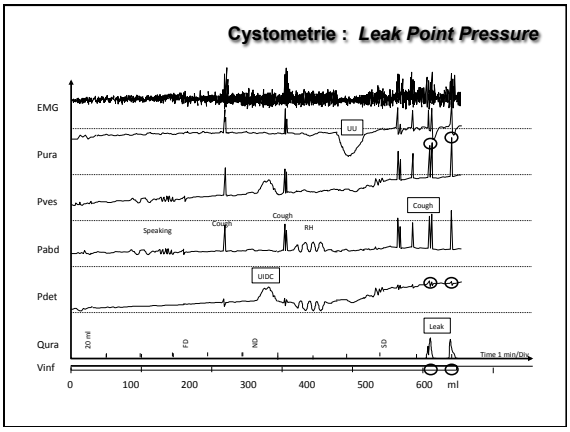

Cystometrie : besoin pressant
EMG
Pura
Pves
Pabd
Pdet
Qura
Vinf
Speaking
Cough
20 ml
FD
ND
Time 1 min/Div
0 100 200 300 400 500 600 ml


Cystometrie : Contraction non inhibée du Detrusor
EMG
Pura
Pves
Pabd
Pdet
Qura
Vinf
Speaking
Cough
UIDC
> 15 cmH2O
20 ml
FD
ND
Time 1 min/Div
0 100 200 300 400 500 600 ml

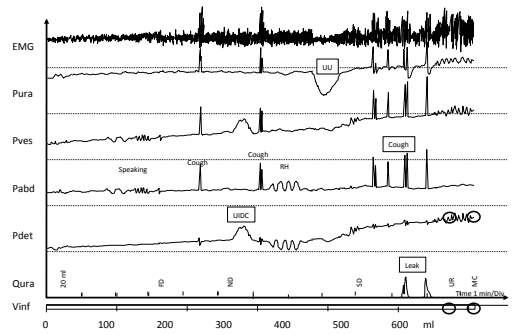

Cystometrie : Hyperactivité Rectale
EMG
Pura
Pves
Pabd
Pdet
Qura
Vinf
Speaking
Cough
RH
Slow Waves
Amplitude > 10 cmH2O
UIDC
20 ml
FD
ND
Time 1 min/Div
0 100 200 300 400 500 600 ml


Cystometrie : Urethre instable
EMG
Pura
Pves
Pabd
Pdet
Qura
Vinf
UU
> 30 cmH2O
Speaking
Cough
RH
UIDC
20 ml
FD
ND
Time 1 min/Div
0 100 200 300 400 500 600 ml

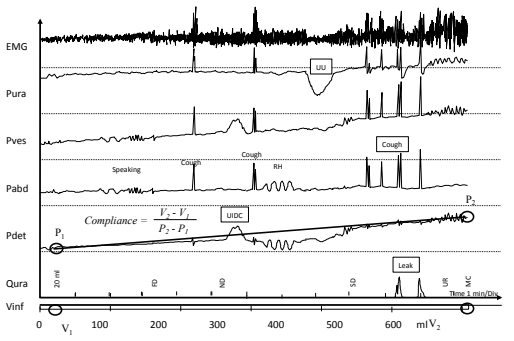

Cystometrie : besoin urgent
Autonomic Control
Voluntary Contraction
EMG
Pura
Pves
Pabd
Pdet
Qura
Vinf
UU
Speaking
Cough
RH
UIDC
20 ml
FD
ND
SD
Time 1 min/Div
0 100 200 300 400 500 600 ml


Cystometrie : Leak Point Pressure
EMG
Pura
Pves
Pabd
Pdet
Qura
Vinf
UU
Cough
Speaking
RH
UIDC
Leak
20 ml
FD
ND
SD
Time 1 min/Div
0 100 200 300 400 500 600 ml

Cystometrie : *Capacitée Maximum*



Cystometrie : *Compliance du Detrusor*

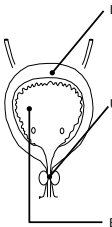


Resultats *Cystométrie*

Storage phase

Evenements		Pdet	Volume	Compliance
		cmH_2O	ml	ml/cmH_2O
Pression base	BP	3	20	
1er besoin	FD	7	160	*35*
B. Pressant	ND	12	270	*22*
B. impérieux	SD	21	440	*19*
Urgency	UR	30	575	*15*
Capacité Max Cysto.	CC	32	610	20 *18*

ICS *Bladder & Urethral Function & Dysfunction*



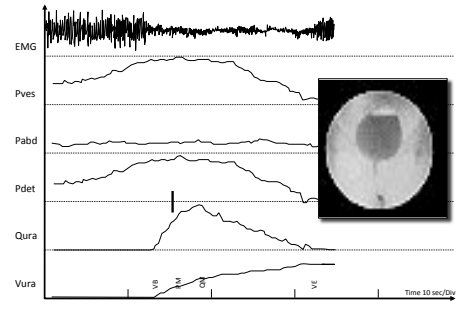
Storage Phase Voiding Phase

DETRUSOR Normal (Stable) Normal
Overactive (Unstable) Underactive
Hyperreflexia Acontractile
Areflexia
Decentralised

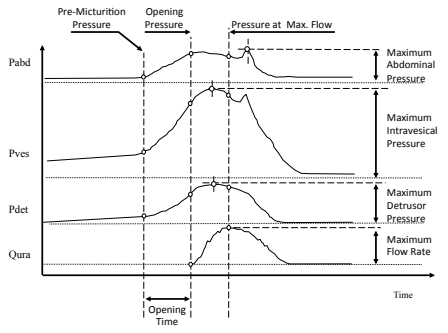
URETHRA Normal (Stable) Normal
Incompetent Obstructive
Urinary incontinence *Mechanical (anatomy)*
Sphincter areflexia *Overactive (function)*
Bladder neck
Dyscoordination
Dyssynergia
Hyppereflexia

BLADDER Normal Sensation
Increased (Hypersensitive)
Reduced (Hyposensitive)
Absent

Uro - Video

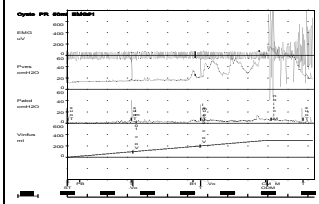


Cystometrie permictionnelle *Parametres*

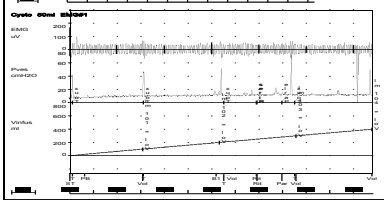


Les courbes

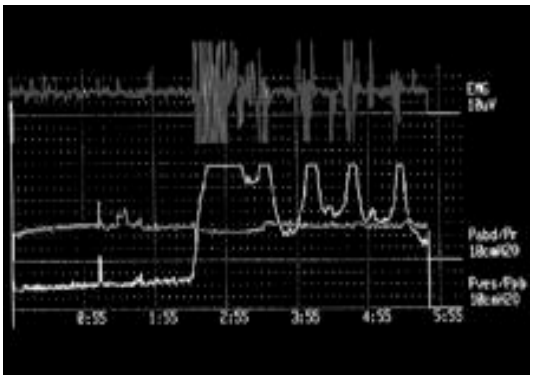
Hyperactivité vésicale : urodynamique

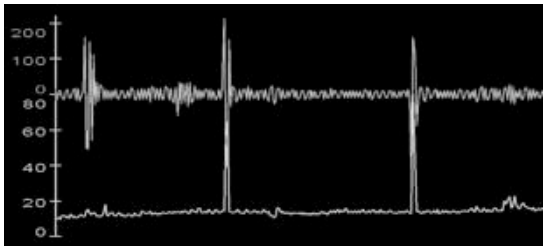


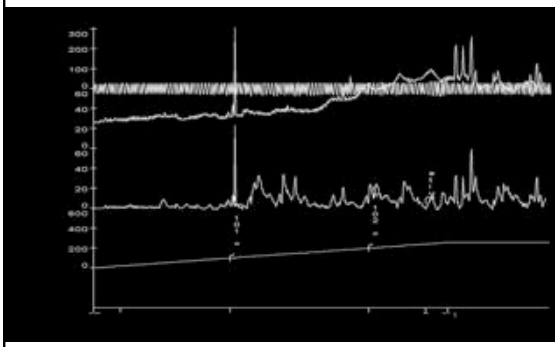
détrusor hyperactif à faible capacité.



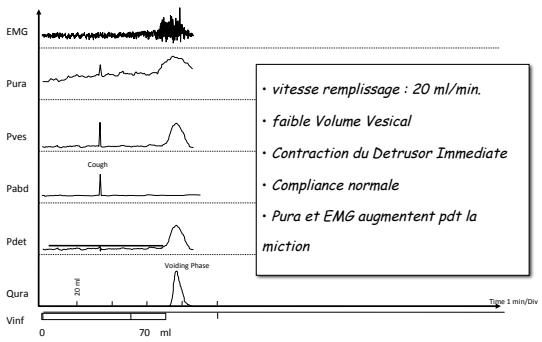
détrusor stable à capacité normale.





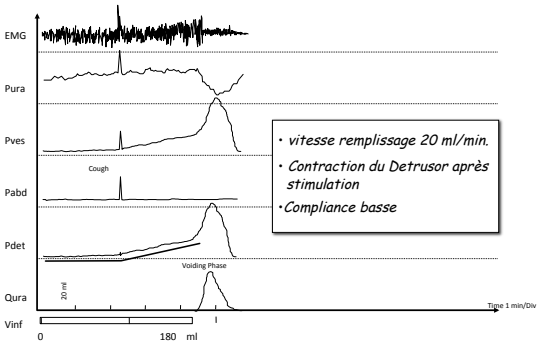


Cas : *vessie hyperactive neurogène*

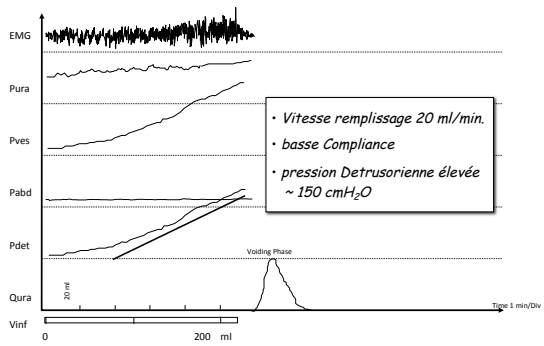


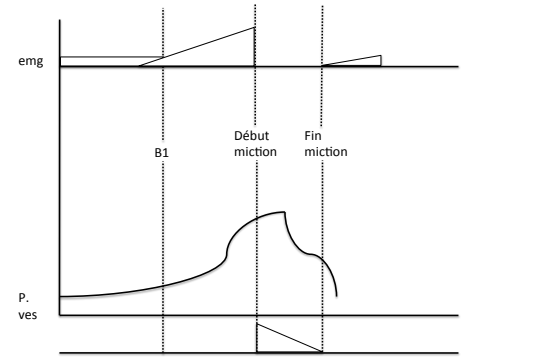
- *vitesse remplissage : 20 ml/min.*
- *faible Volume Vesical*
- *Contraction du Detrusor Immediate*
- *Compliance normale*
- *Pura et EMG augmentent pdt la miction*

Cas : *Instabilité idiopathique Detrusor*

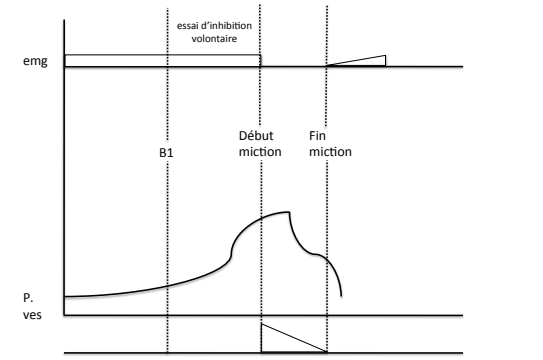


Cas : *défaut de compliance Post Radiotherapie*



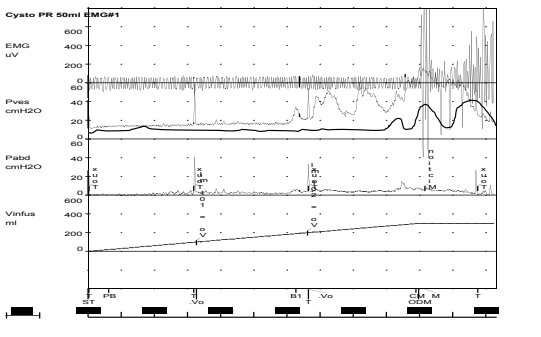


Vessie neurologique : hyperactivité d'origine détrusorienne

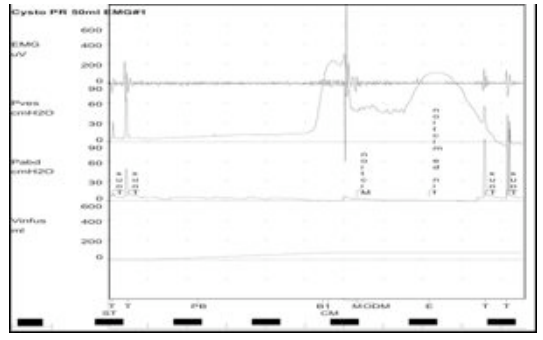


Vessie non neurologique : hyperactivité par défaut périnéo-sphinctérien pro-inhibiteur

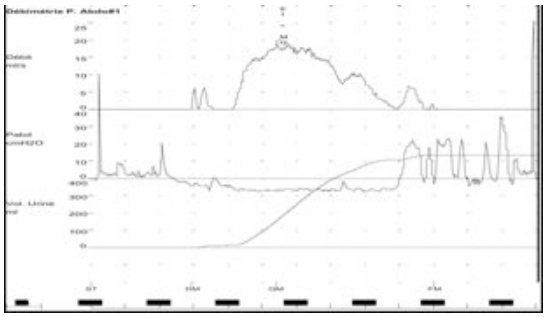
hyperactivité vésicale et BUD: rouge < noir ?

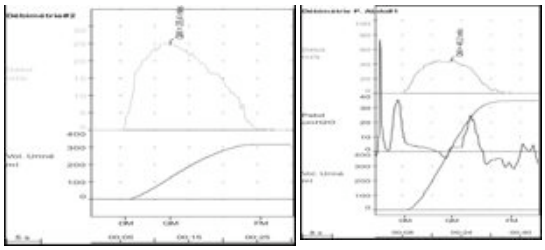


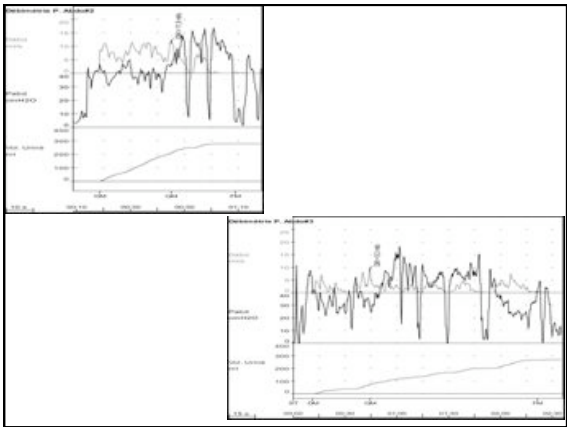
After contraction

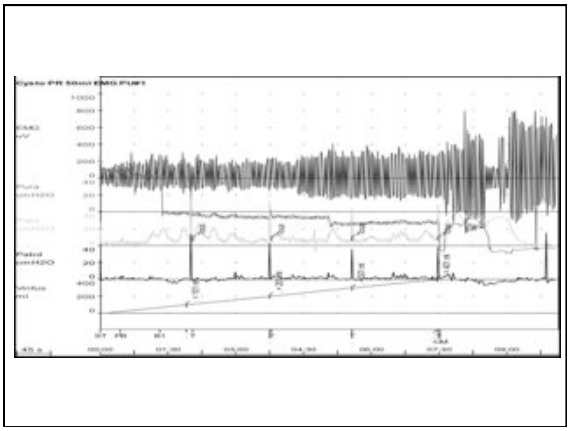


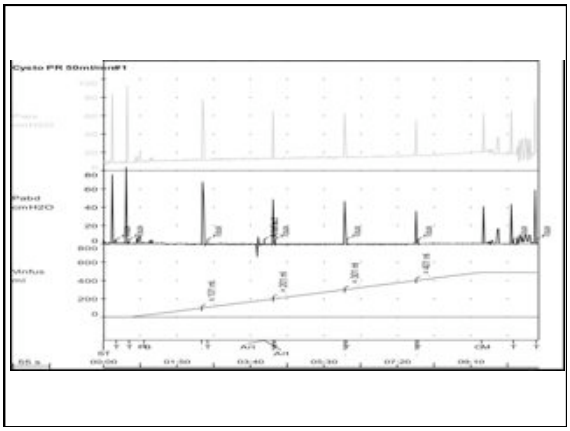
Debit P Rectale

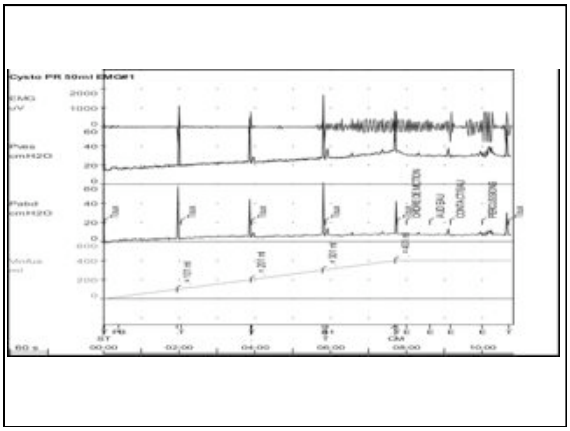


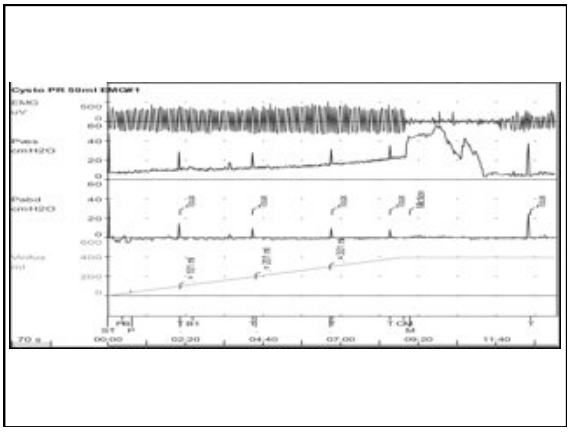


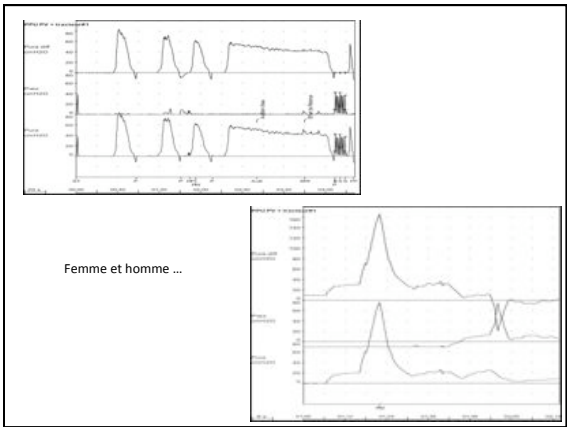




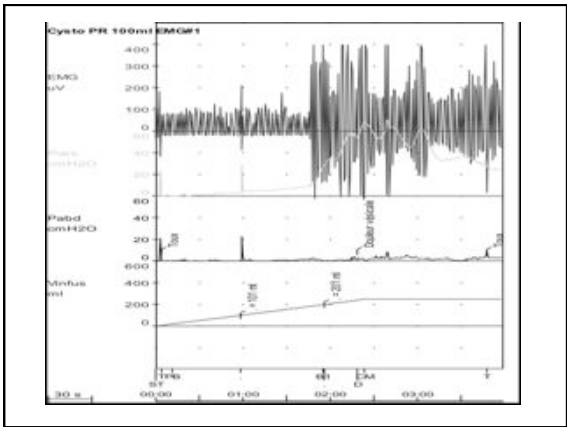


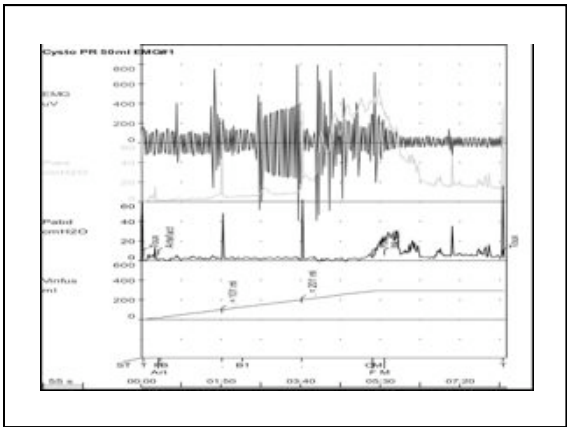


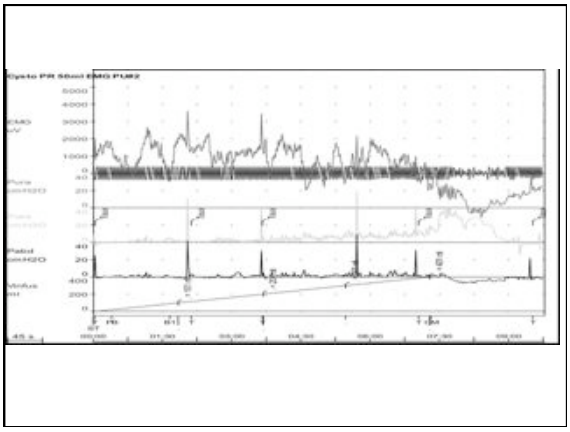


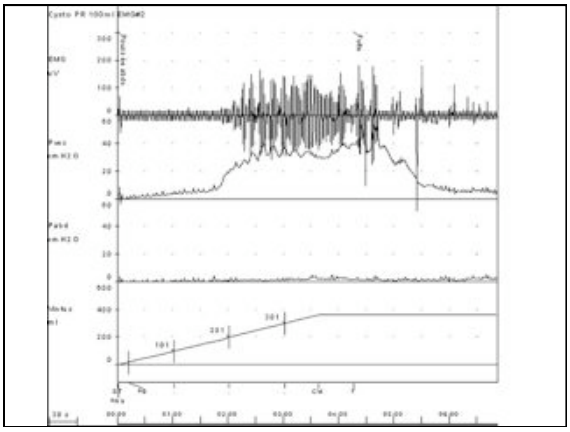


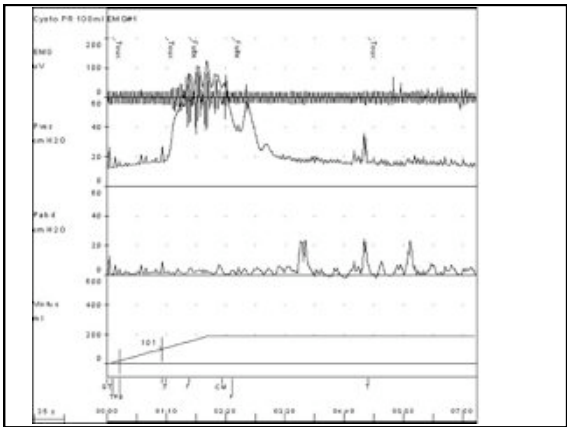
Femme et homme …

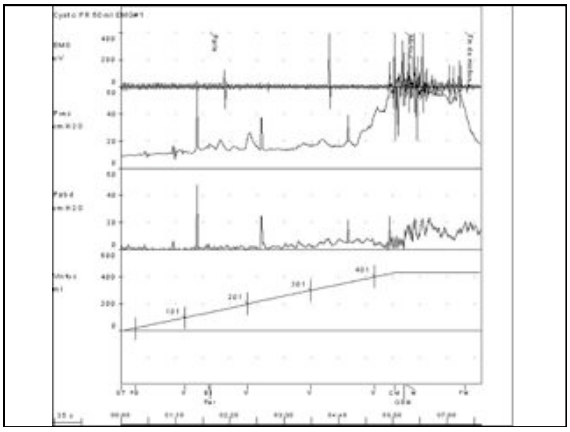


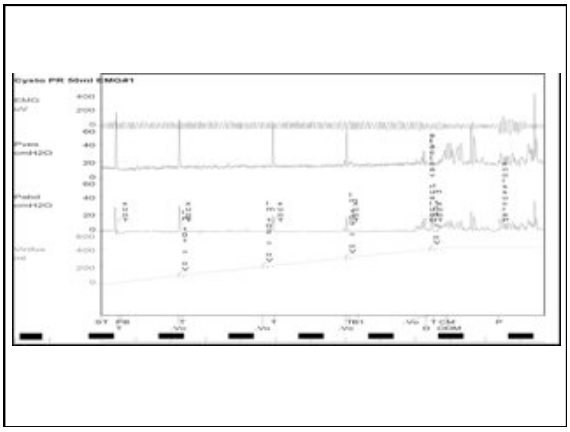


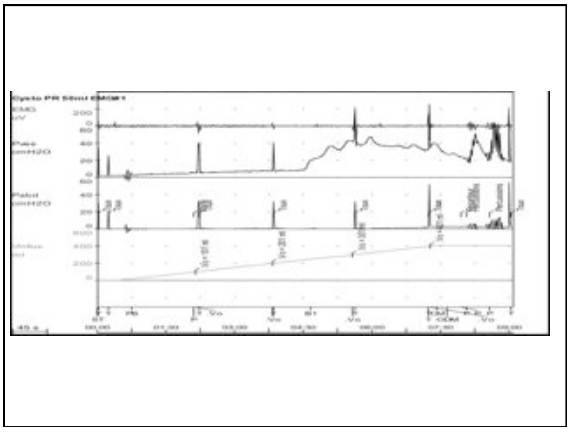


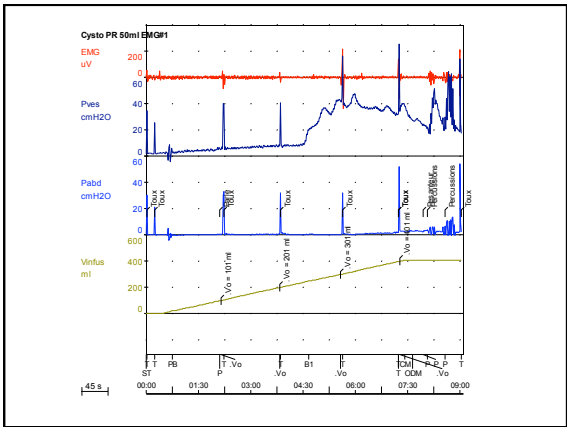


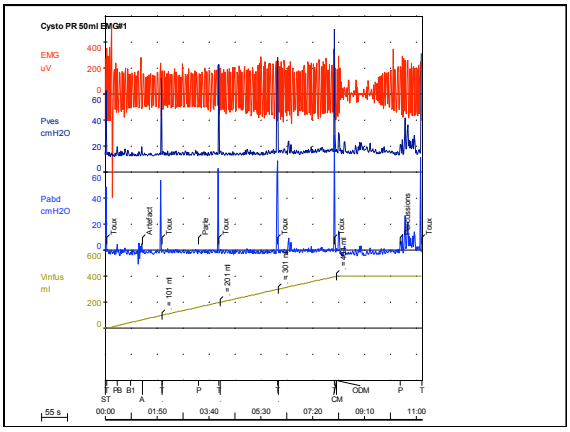


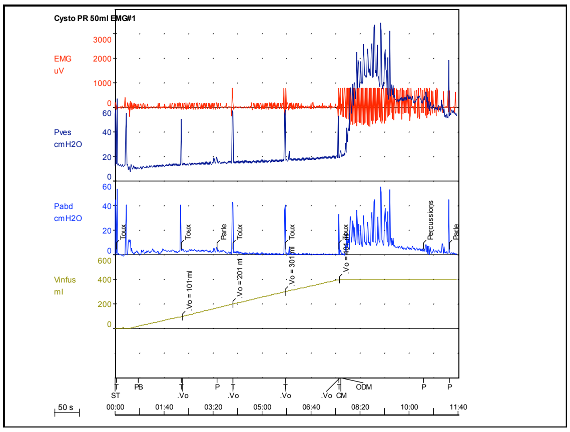


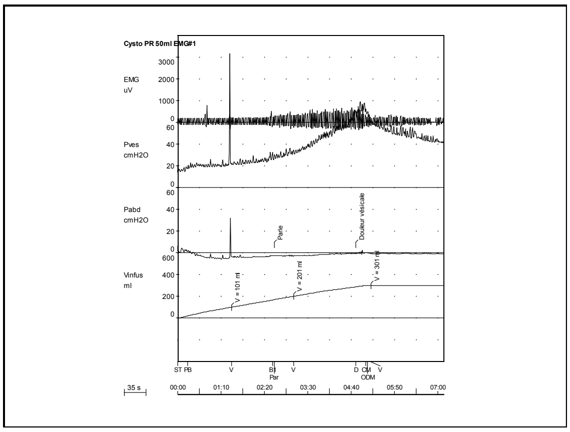


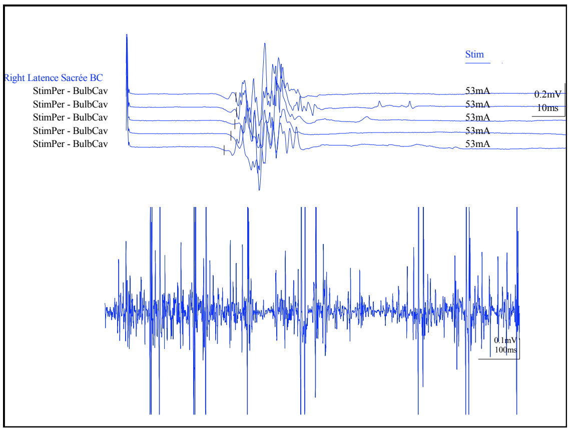


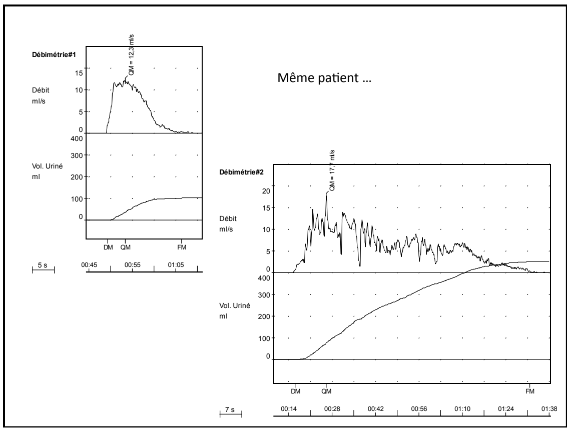

Cysto PR 50ml EMG#1
EMG
uV
Pves
cmH2O
Pabd
cmH2O
Vinfus
ml
45 s

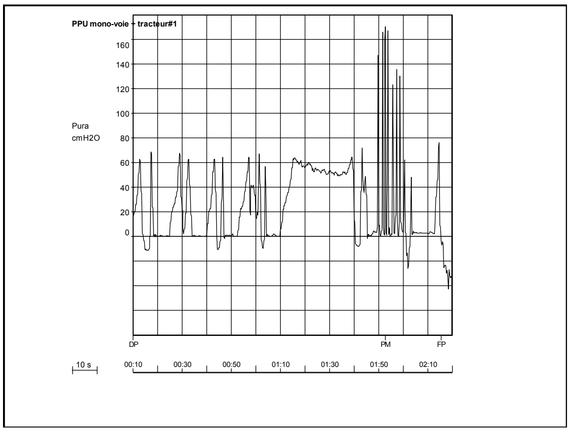

Cysto PR 50ml EMG#1
EMG
uV
Pves
cmH2O
Pabd
cmH2O
Vinfus
ml
55 s

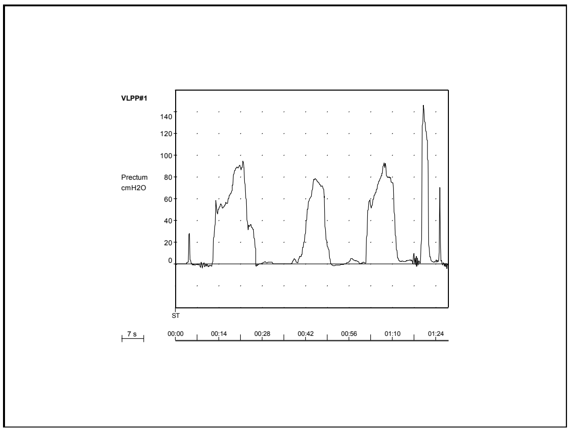

Cysto PR 50ml EMG#1
EMG
uV
Pves
cmH2O
Pabd
cmH2O
Vinfus
ml
Toux
Parle
Percussions
.Vo = 101 ml
.Vo = 201 ml
.Vo = 301 ml
ODM
50 s

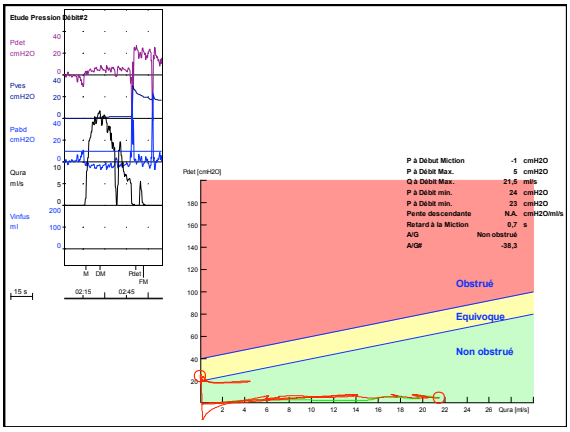

Cysto PR 50ml EMG#1
EMG
uV
Pves
cmH2O
Pabd
cmH2O
Vinfus
ml
Parle
Douleur vésicale
V = 101 ml
V = 201 ml
V = 301 ml
ODM
35 s

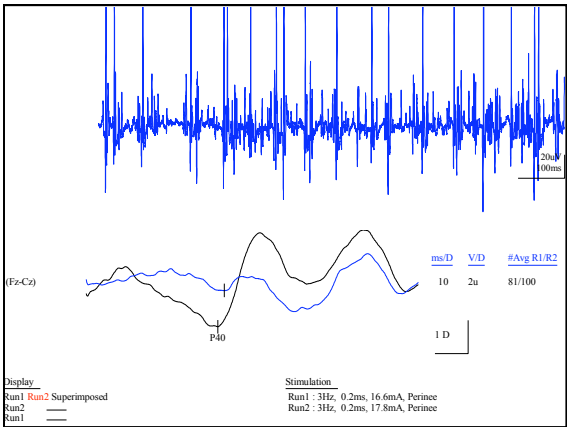

Stim
Right Latence Sacrée BC
StimPer - BulbCav
StimPer - BulbCav
StimPer - BulbCav
StimPer - BulbCav
StimPer - BulbCav
53mA
0.2mV
10ms
0.1mV
100ms

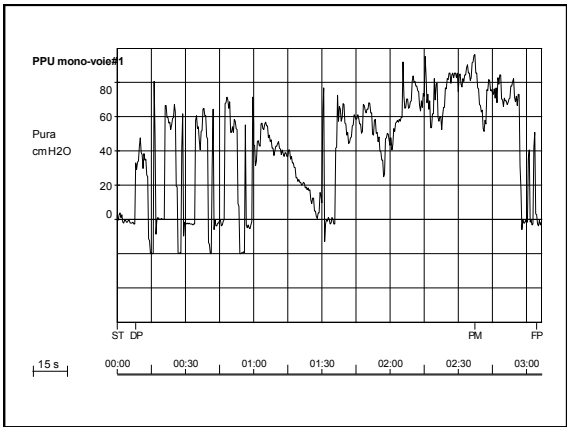

Débimétrie#1
QM = 12,3 ml/s
Débit
ml/s
Vol. Uriné
ml
Même patient …
Débimétrie#2
QM = 17,7 ml/s
Débit
ml/s
Vol. Uriné
ml

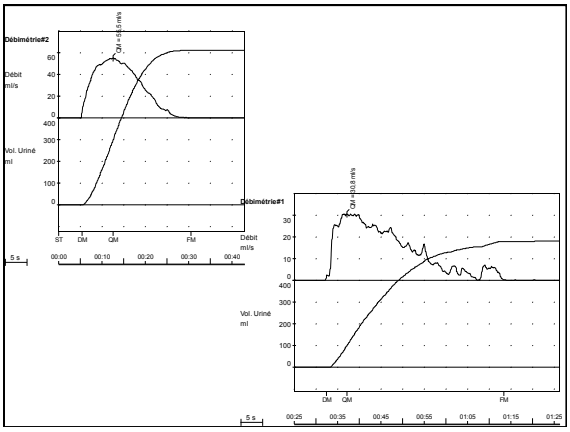

PPU mono-voie + tracteur#1
Pura
cmH2O
10 s

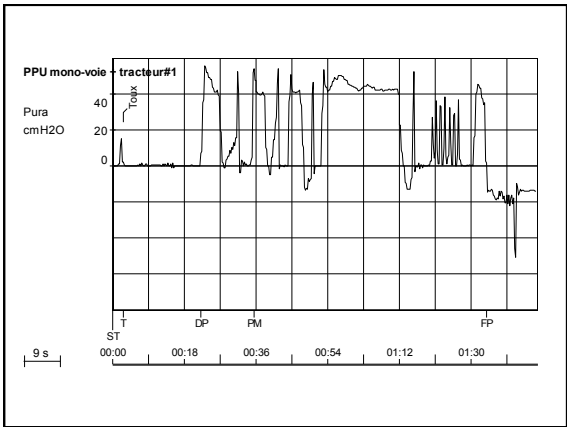

VLPP#1
Prectum
cmH2O
7 s

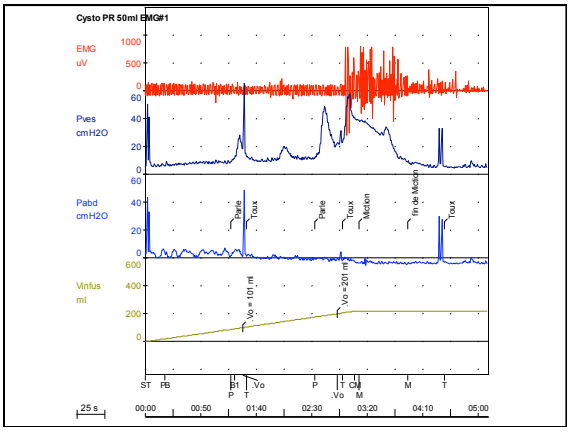

Etude Pression Débit#2
Pdet cmH2O
Pves cmH2O
Pabd cmH2O
Qura ml/s
Vinfus ml
Pdet [cmH2O]
Qura [ml/s]
P à Début Miction -1 cmH2O
P à Débit Max. 5 cmH2O
Q à Débit Max. 21,8 ml/s
P à Débit min. 24 cmH2O
P à Débit min. 23 cmH2O
Pente descendante N.A. cmH2O/ml/s
Retard à la Miction 0,7 s
A/G Non obstrué
A/G# -38,3
Obstrué
Equivoque
Non obstrué

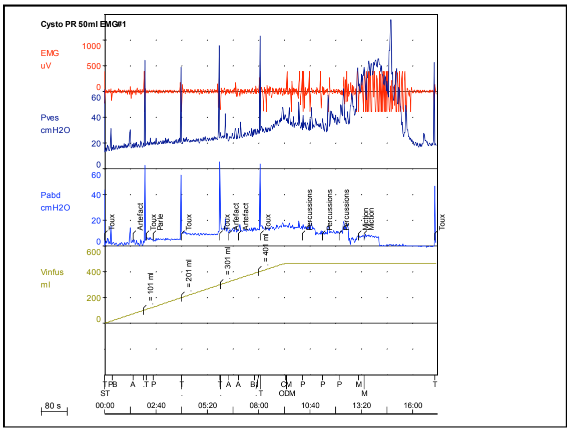

20uV
100ms
(Fz-Cz)
P40
ms/D V/D #Avg R1/R2
10 2u 81/100
1 D
Display
Run1 Run2 Superimposed
Run2
Run1
Stimulation
Run1 : 3Hz, 0.2ms, 16.6mA, Perinee
Run2 : 3Hz, 0.2ms, 17.8mA, Perinee


PPU mono-voie#1
Pura cmH2O
ST DP PM FP
15 s
00:00 00:30 01:00 01:30 02:00 02:30 03:00


Débimétrie#2
Débit ml/s
Vol. Urine ml
Débimétrie#1
5 s


PPU mono-voie + tracteur#1
Pura cmH2O
Toux
T ST DP PM FP
9 s
00:00 00:18 00:36 00:54 01:12 01:30


Cysto PR 50ml EMG#1
EMG uV
Pves cmH2O
Pabd cmH2O
Vinfus ml
Vo = 101 ml
Vo = 201 ml
Parle
Toux
Miction
fin de Miction
ST PB P T Vo P T Vo CM M M T
25 s
00:00 00:50 01:40 02:30 03:20 04:10 05:00


Cysto PR 50ml EMG#1
EMG
uV
1000
500
0
Pves
cmH2O
60
40
20
0
Pabd
cmH2O
60
40
20
0
Toux
Artefact
Toux
Parle
Toux
Toux
Artefact
Artefact
Toux
Percussions
Percussions
Percussions
Miction
Miction
Toux
Vinfus
ml
600
400
200
0
= 101 ml
= 201 ml
= 301 ml
= 401 ml
TPB A .T P T T A A B1 CM P P P M T
ST .T ODM M
80 s
00:00
02:40
05:20
08:00
10:40
13:20
16:00