Programme Master ReClip,
UE5, Recherche clinique, périnée, grossesse et accouchement
Tenon, Paris 21 novembre 2014, France

# L’enregistrement continu des pressions intra-pelviennes per-partales

Prof.tit. S. Meyer, Dr. Ch. Achtari, MER
Unité d’Urogynécologie , DGO
ChUV/EHC, Lausanne, Suisse
Prof. F.Salchli, HEIG, Dépt. micro-nanotechnologies,
Institut of Applied Sciences,Yverdon, Switzerland

- Un  accouchement par voie basse : risque de souffrances des structures pelviennes…souffrances pouvant être objectivées  anamnestiquement, cliniquement et fonctionnellement

- Il n’existe pas forcément de corrélations entre ces trois paramètres.

# PREVENTION DE L'EFFET « BIRTH TRAUMA »

- Le prix d'un premier accouchement par voie basse :
- - 15-30 % d'incontinence urinaire
- - 3-5 % d'incontinence ano-rectale
- - 10-15 % ( ? ) modifications de la qualité de la réponse orgasmique

Comment prévenir les troubles fonctionnels du plancher pelvien de manière à éviter les éventuelles catastrophes post-partales pouvant handicaper significativement la vie de jeunes femmes…et de leur couple !

-Random sample of 4458 women aged 25-84 years, using the validated Epidemiology of Prolapse and Incontinence Questionnaire

- 7% prolapse, 15% stress urinary incontinence, 13% overactive bladder,
25% anal incontinence, and 37% for any one or more pelvic floor disorders.

(Parity, mode of delivery, and pelvic floor disorders.,
Lukacz ES, Lawrence JM, Contreras R, Nager CW, Luber KM Obstet Gynecol. 2006;107(6):1253 )

- No significant differences in the prevalence of disorders between the cesarean delivery and nulliparous groups.

- The adjusted odds of each disorder increased with vaginal parity compared with cesarean delivery: prolapse = 1.82 (95% CI 1.04-3.19), stress urinary incontinence = 1.81 (95% CI 1.25-2.61), overactive bladder = 1.53 (95% CI 1.02-2.29), anal incontinence = 1.72 (95% CI 1.27-2.35),
and any one or more pelvic floor disorders = 1.85 (95% CI 1.42-2.41).

(Parity, mode of delivery, and pelvic floor disorders.,
Lukacz ES, Lawrence JM, Contreras R, Nager CW, Luber KM Obstet Gynecol. 2006;107(6):1253 )

# Epidémiologie du « Birth Trauma »

- To estimate the prevalence of stress urinary incontinence 4 years after the first delivery and analyze its risk factors.
- Prevalence of stress urinary incontinence was 29%
- The independent risk factors were urine leakage before the first pregnancy [odds ratio (OR) 18.7; 95% confidence interval (CI) 3.6-96.4], urine leakage during the first pregnancy (OR 2.5; 95% CI 1.3-4.8), duration of first labor ≥ 8 h (OR 3.1; 95% CI 1.7-5.7), mother's age > 30 years at the first delivery (OR 2.4; 95% CI 1.4-4.2) and cesarean section at the first delivery (OR 0.3; 95% CI 0.1-0.9)
- (Fritel et al, Acta Obstet Gynecol Scand 2004: 83: 941)

Aims

Our aim was to study risk factors associated with prevalence, incidence, and remission of UI 4 and 12 years after first delivery.

Methods

Seven hundreds twenty-four nulliparous women who gave Birth in1996 received a questionnaire about their urinary symptoms in 2000 and again in 2008

Increasing BMI, UI during first pregnancy, and heavy first child reduce the likelihood of UI remission (0.37 [0.20–0.68], 0.11[0.02–0.63], and 0.73[0.59–0.91],respectively).

Conclusions

UI during first pregnancy could be indicative of individual susceptibility to UI. Obesity appears to be a modifiable factor for remission of UI in women.

Fritel and Co  Neurourol. Urodynam. 33:1229–1234, 2014

# Epidémiologie du « Birth Trauma »

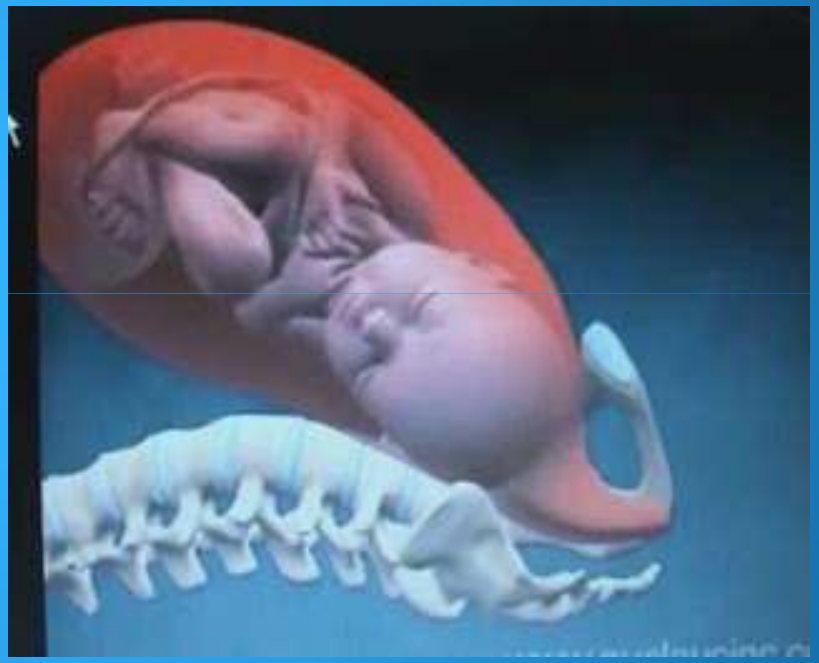
Vaginal birth is responsible of higher rates of urinary incontinence (1.2 versus 0.4 percent) and prolapse surgery (2.2 versus 0.2 percent) ( 13 ) in a follow-up of 90 000 women comparing vaginal deliveries to caesarean deliveries,

(Leijonhufvud A., Am J Obstet Gynecol, 2011: 204, 70,el)

- and of an even higher rate of SUI (OR: 2.7) and prolapse to or beyond the hymen (OR 5.6) in a follow up (5-10 years) of 1011 women with vaginal delivery only compared with cesarean delivery before active labor only
- (Handa , Obstet Gynecol.2011,118:777 )

# Mechanisms of second phase of labor

- Head engagement with a rotation – flexion mechanism :
- Anterior rotation : about 97 % / deliveries
- Posterior rotation : about 3-4 %/deliveries
- Flexion due to the effect of vertical vector of forces
- « Clapper bell » movements of the head

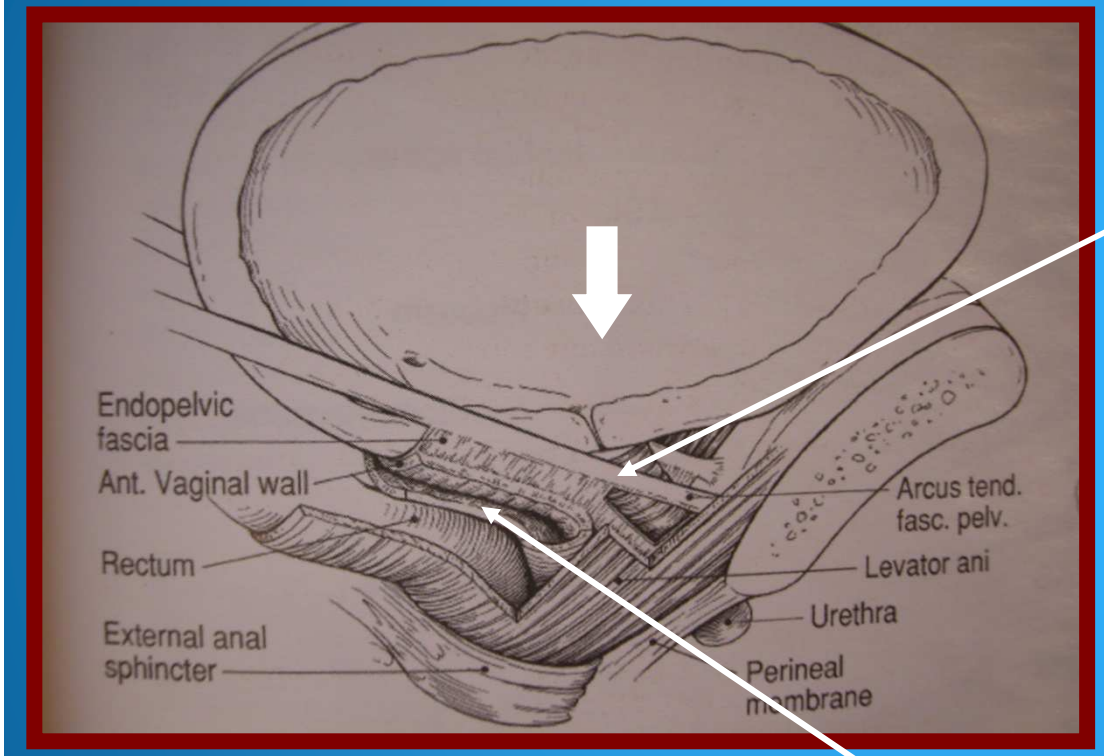


# Effet Birth Trauma : quels sont les paramètres menacés par un accouchement par voie basse ?

- L’ancrage du col vésical à la face postérieure de ly symphyse pubienne
- L’intégrité du sphincter urétral externe
- L’intégrité des faisceaux musculaires des releveurs
- La conduction par les nerfs honteux
- La qualité des tissus collagène et élastiques assurant les ancrages des structures de la filière génitale.

# Effects on Bladder Neck Structures: Anchorage Structures and Urethral Sphincter Structures

# Effects on Bladder Neck Anchorage Structures

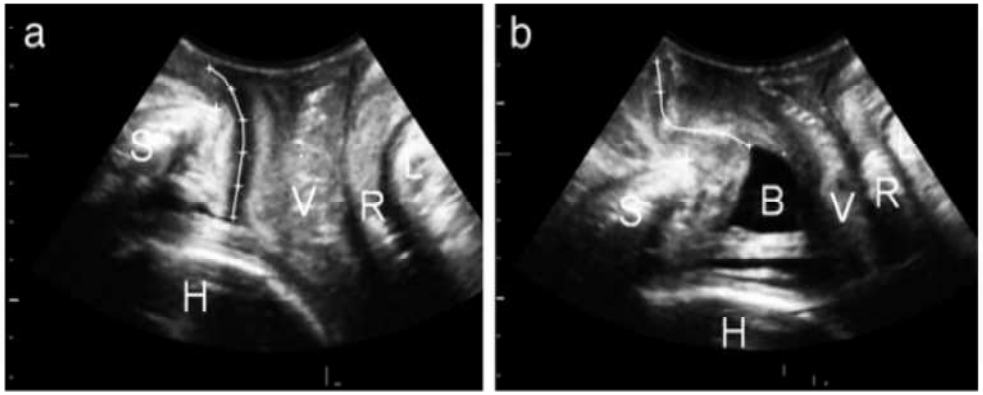



(From De Lancey )

Downwards traction on bladder neck structures with flexion-rotation engagement movements of the baby's head : tearing of endopelvic fascia insertion on arcus tendinae fasciae pelvis.: especially at the level Of the bladder neck

Distension of vaginal wall by baby's head

# Urethral Mobility is increased after Delivery, when Urethral Mobility is calculated in 6 Points from Bladder Neck to External Urethral Meatus




K L Shek, HP Dietz, A Kirby,
J Urol, 2010; 184 (2): 620-634

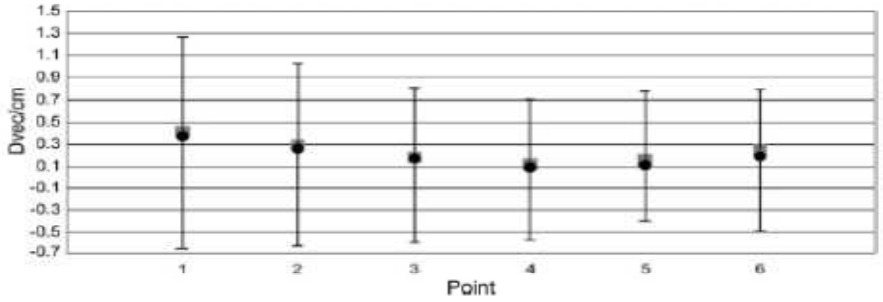



**Figure 3.** Peripartum change in segmental urethral mobility in 26 women with (squares) and 161 without (circles) de novo SUI, excluding those with urge incontinence (each p >0.64). Bars indicate SD.

# Urethral Mobility is increased after Delivery, especially after Vacuum/Forceps Assisted Deliveries

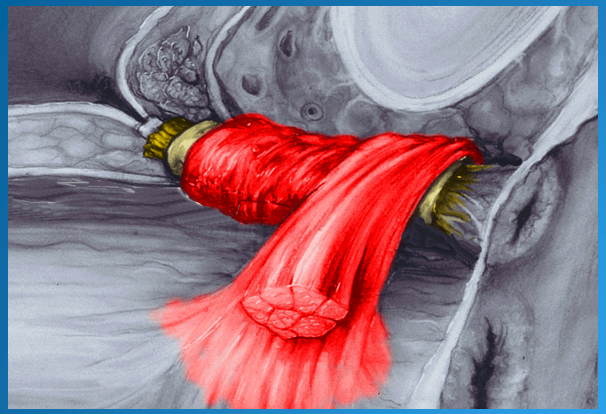
**Table 1.** *Peripartum urethral mobility vector length change before and after childbirth by delivery group*

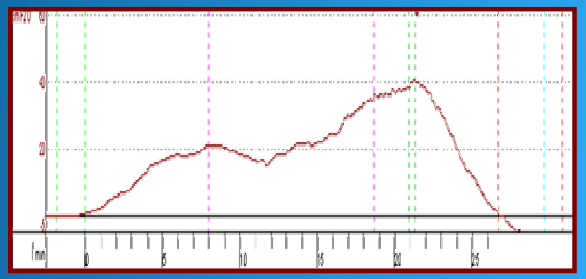
| Delivery | Unadjusted/Adjusted* Dvec Point No. (cm) | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| Cesarean section: | | | | | | |
| Before labor | 0.18 | 0.13 | 0.03 | −0.01 | 0.06 | 0.09 |
| Stage 1 | 0.06 | 0.01 | −0.03 | −0.02 | 0.06 | 0.18 |
| Stage 2 | 0.23/−0.14 | 0.19/−0.06 | 0.18/−0.001 | 0.21/0.06 | 0.27/0.11 | 0.30/0.16 |
| Normal vaginal | 0.45/0.55 | 0.30/0.37 | 0.18/0.23 | 0.1/0.14 | 0.11/0.15 | 0.22/0.25 |
| Vacuum | 0.75/0/71 | 0.56/0.54 | 0.40/0.38 | 0.29/0.27 | 0.26/0.25 | 0.27/0.26 |
| Forceps | 0.906/0.65 | 0.64/0.46 | 0.37/0.24 | 0.23/0.12 | 0.23/0.12 | 0.27/0.18 |
| p Value (ANOVA F test) | 0.003/1.83 | 0.02/0.1 | 0.06/0.33 | 0.17/0.62 | 0.38/0.79 | 0.82/0.94 |
| Common SD | 1.95/1.83 | 1.45/1.25 | 1.07/0.78 | 0.78/0.48 | 0.60/0.34 | 0.42/0.24 |

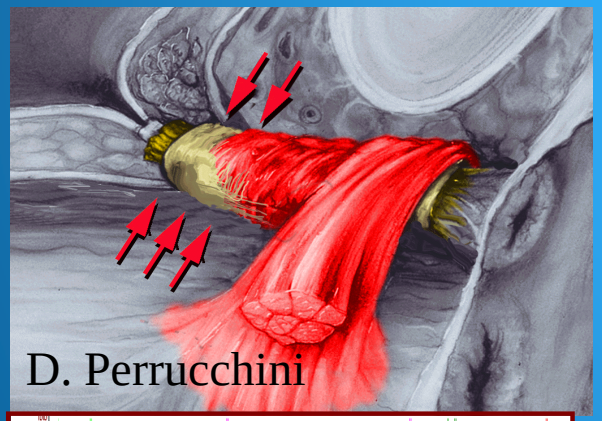
* Adjusted for stage 2 duration.

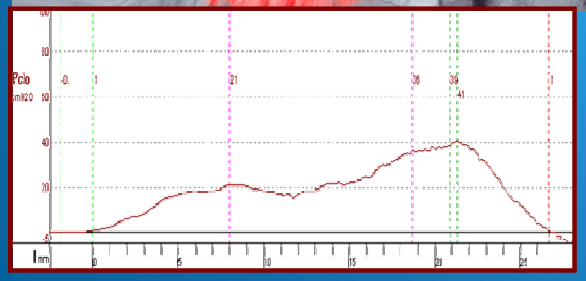
K L Shek, HP Dietz, A Kirby, J Urol, 2010; 184 (2): 620-634

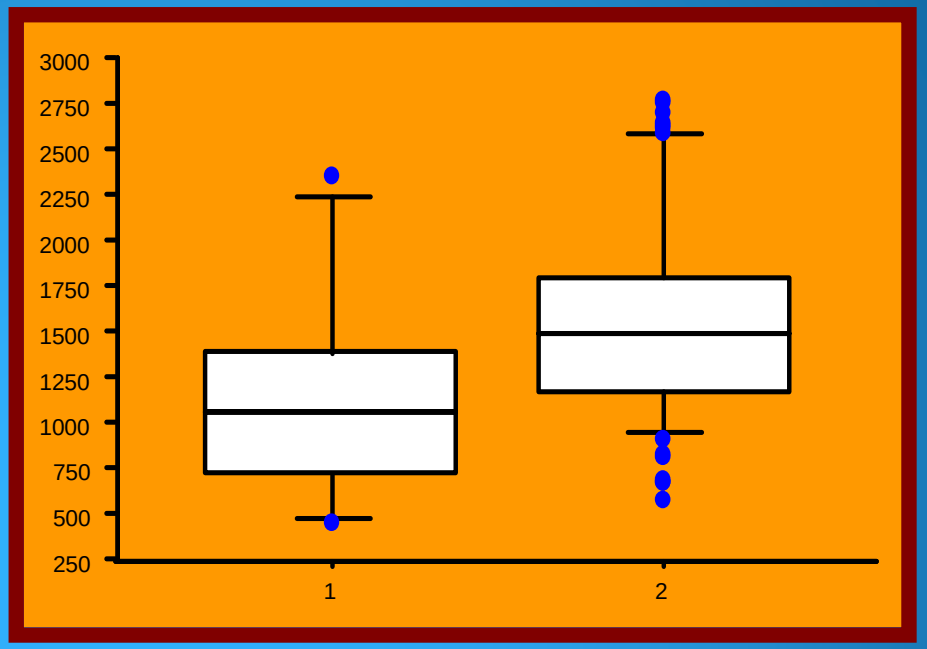
# Direct Trauma to Urethral Sphincter







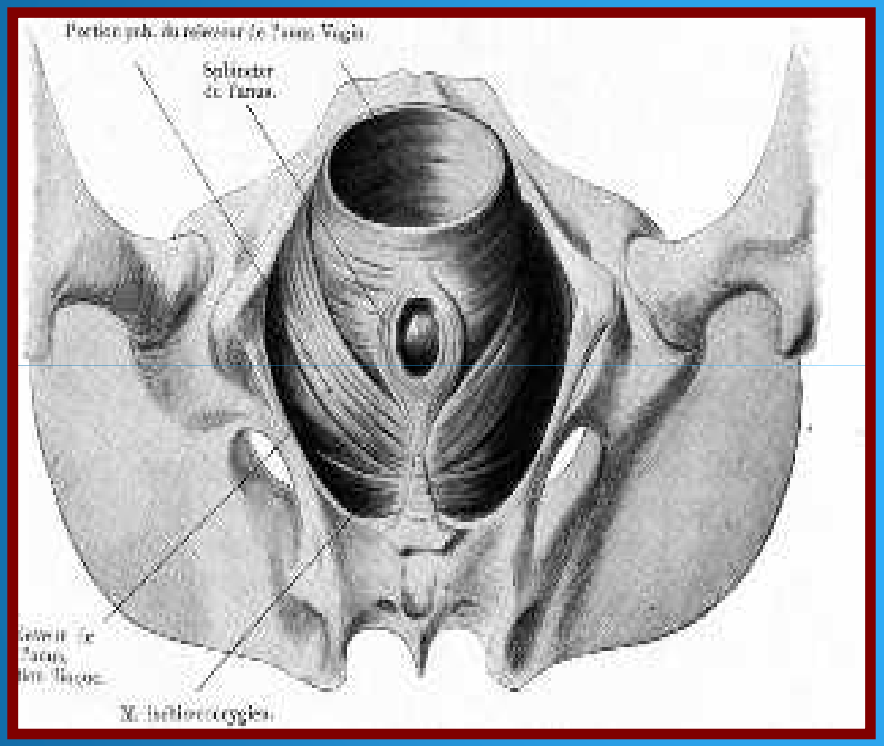



Area of continence at rest in the standing position 10 months after delivery :
Gr 1: (N:11) stress incontinent women: 1179±629 mm2
Gr. 2: (N:70) without incontinence: 1553±555 mm2 P:0.04

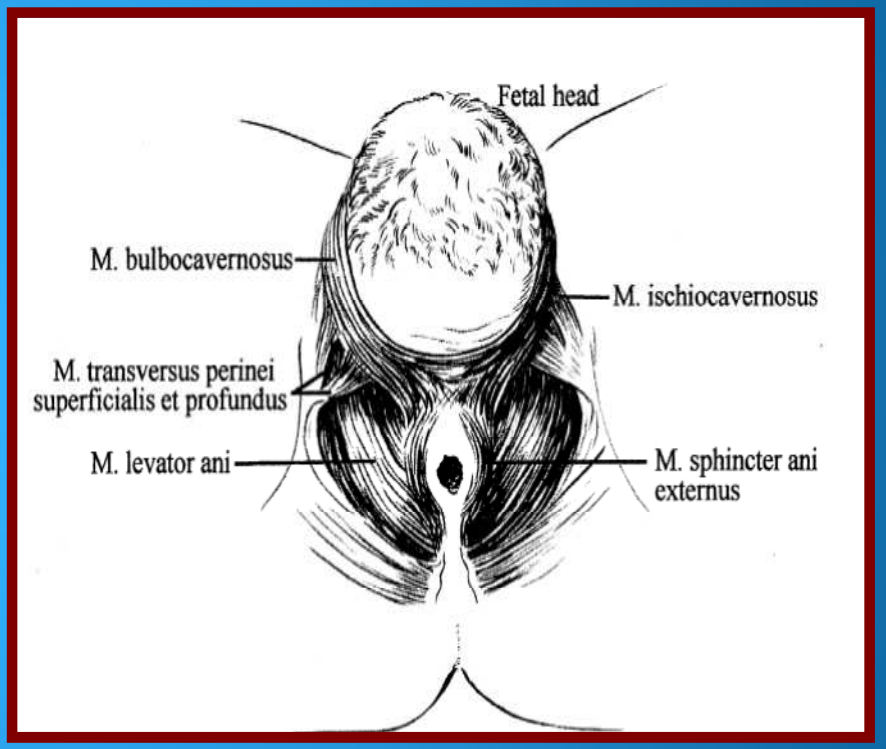
Meyer/Achtari. Urogyn DGO CHUV 2013

# Effects on levator muscle

# Distension of Pelvic Floor Muscle during Second Phase of Delivery : Stretching of Levator Ani and Transverse of Perineum Muscle Bundles

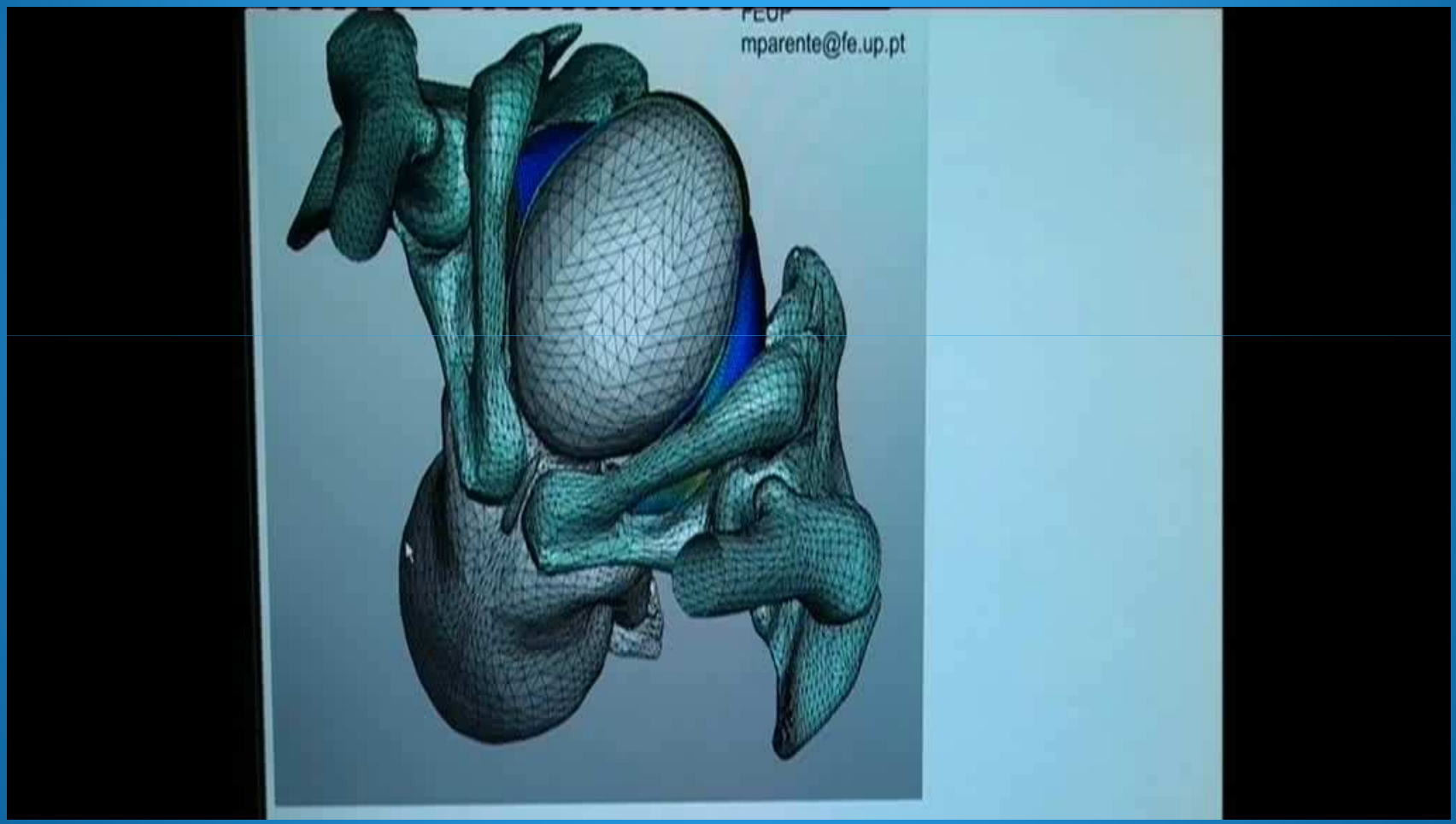


Obstetric Textbook : Bumm, 1912 !!!




(B. Schuessler, K. Baessler Pregnancy, Childbirth and Pelvic Floor, in Pelvic Floor Disorders, Elsevier, 2004)

Parente MP, Natal Jorge RM, Mascarenhas T, et al. Computational modeling approach to study the effects of fetal head flexion during vaginal delivery : anterior and posterior rotation of the head




Meyer/Achtari. Urogyn DGO
CHUV 2013

Parente MP, Natal Jorge RM, Mascarenhas T, et al. Computational Modeling approach to study the Effects of Fetal Head Flexion during Vaginal Delivery. Am J Obstet Gynecol 2010;203:217.e1-6.

# Correlations between levels and importance of PF muscle stretching

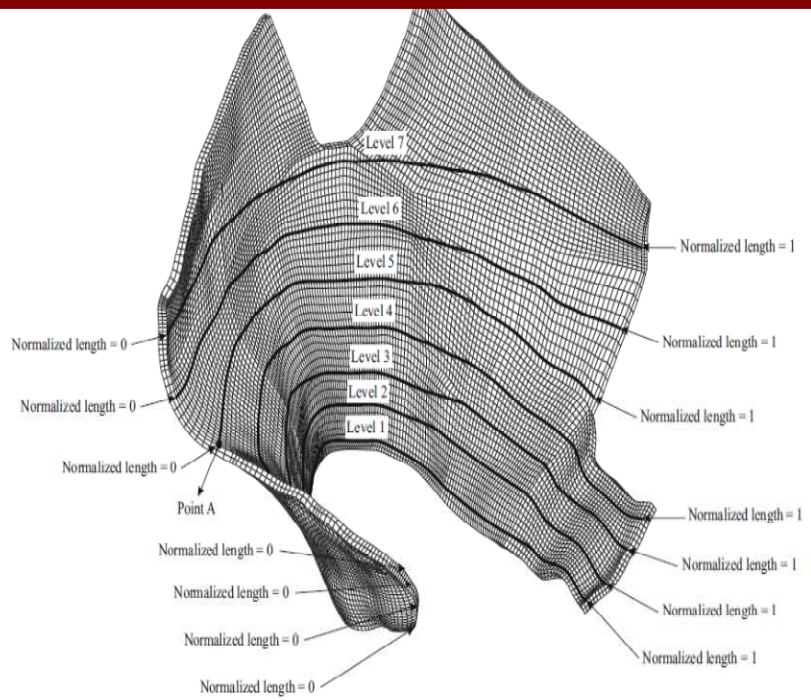



Fig. 3 Levels used to evaluate the stretch and their initial lengths

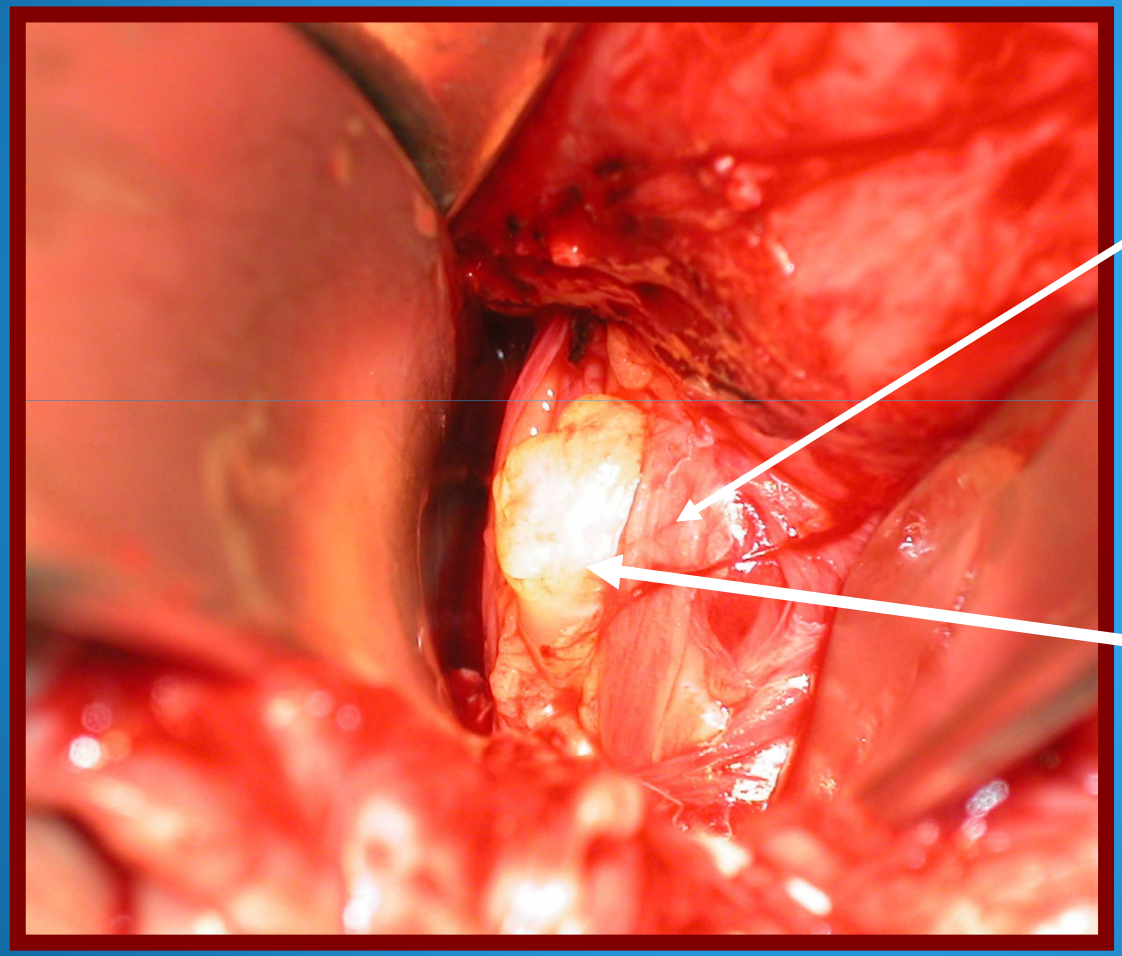
| Level | Initial length | Length at 60 mm descent |
|---|---|---|
| Level 1 | 18.1 cm | 22.1 cm |
| Level 2 | 19.2 cm | 23.9 cm |
| Level 3 | 20.6 cm | 25.1 cm |
| Level 4 | 22.1 cm | 25.8 cm |
| Level 5 | 13.6 cm | 16.2 cm |
| Level 6 | 13.9 cm | 15.7 cm |
| Level 7 | 14.5 cm | 15.8 cm |

# Trauma to Levator ani muscle after forceps delivery

- forceps delivery is the riskiest type of delivery for pelvic floor pathology and its recovery.
- Major defect rates were: 42% for forceps and short second stage; 63% for forceps and second stage arrest; and 6% for spontaneous delivery (Int J Gynaecol Obstet. 2010 Oct;111(1):19-22 )
- Levator ani avulsion was diagnosed in 59.5% of forceps deliveries . Levator hiatal area was significantly higher after forceps delivery

  (Int Urogynecol J Pelvic Floor Dysfunct. 2011 Apr 6)

# Rupture of Levator Ani after a forceps delivery



Muscle bundles of levator ani

Place of levator muscle rupture : fat appearing from left ischio-rectal excavation

Meyer/Achtari. Urogyn DGO CHUV 2013

# Effects on pudendal nerve

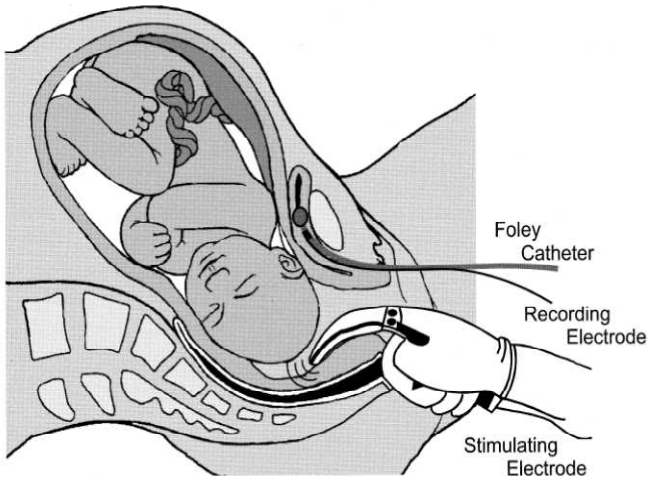



**Figure 1.** Transvaginal stimulation of the pudendal nerve with a St. Mark's electrode during the second stage of labor.

Monitoring pudendal nerve function during labor *Matthew H. Clark, MD, Mattie Scott, MD, Val Vogt, MD, and J. Thomas Benson, MD*
Obstet Gynecol 2001;97:637–9.

Decrease in amplitude : due to the loss in axonal function caused by ischemia

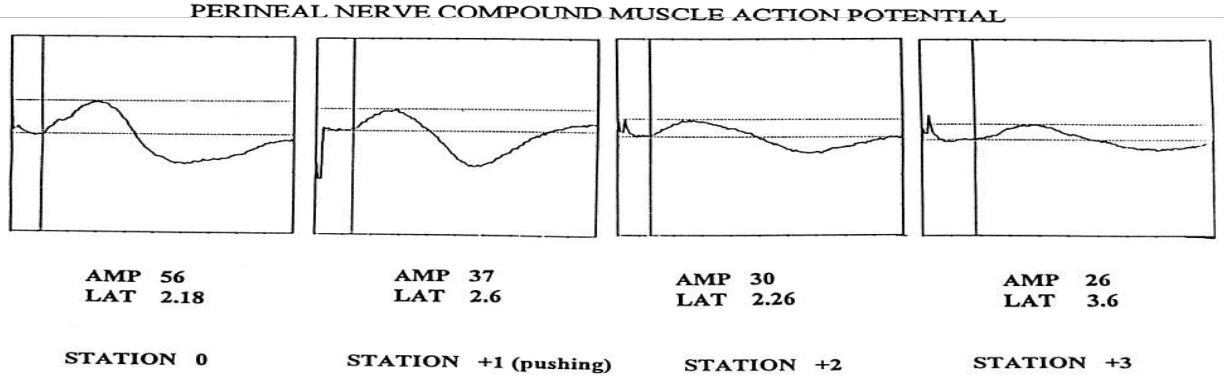
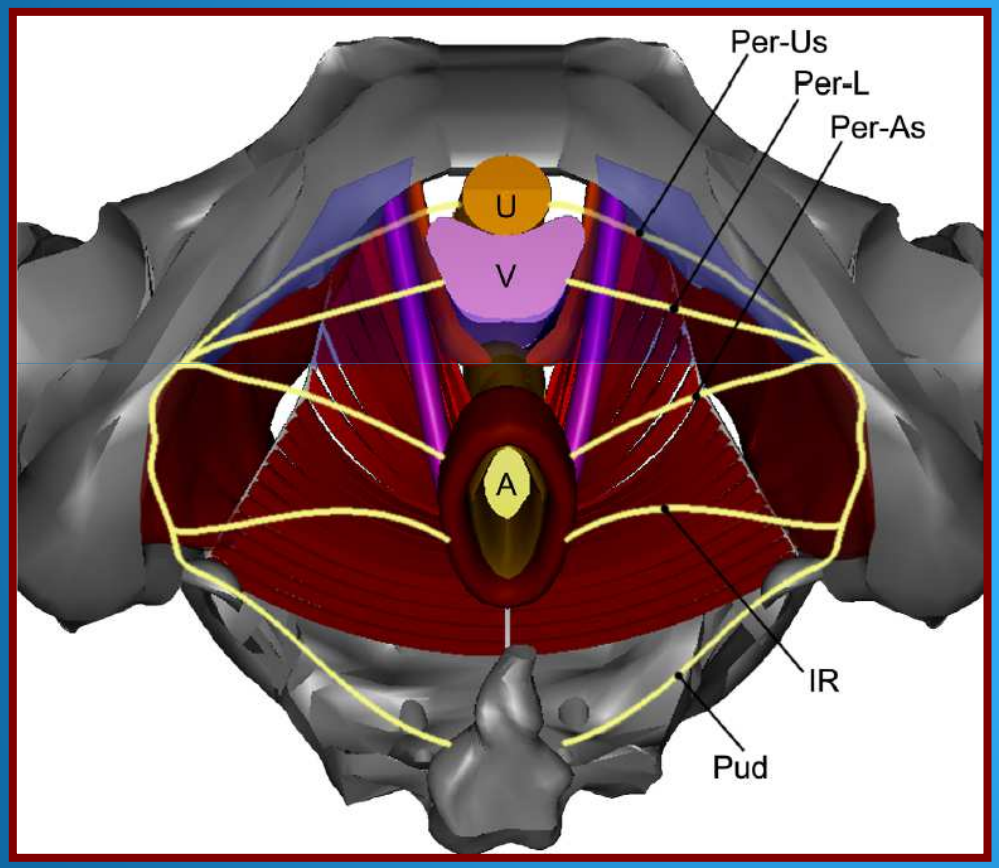



**Figure 2.** An example of the compound muscle action potential obtained during the second stage of labor with intermittent stimulation.

Increase of latencies: due to a decrease of the speed of nerve transmission with slowing or loss of transmission of the larger myelinated fibers.

# Pudendal nerve stretch during vaginal birth:

A 3D computer simulation, K. Lien, J. O. L. Delancey, J. A. Ashton-Miller, American Journal of Obstetrics and Gynecology (2005) 192, 1669–76



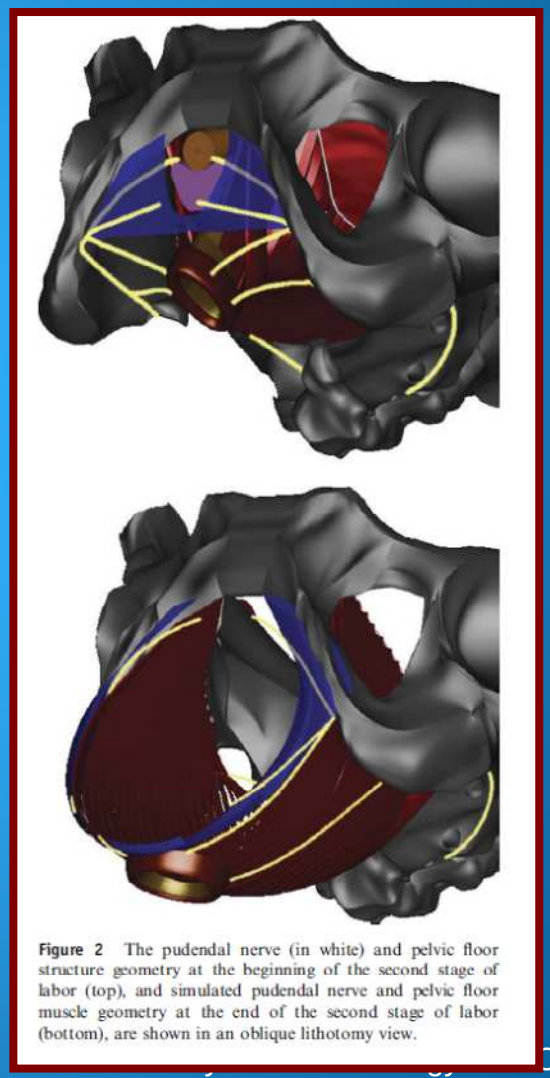



**Figure 2** The pudendal nerve (in white) and pelvic floor structure geometry at the beginning of the second stage of labor (top), and simulated pudendal nerve and pelvic floor muscle geometry at the end of the second stage of labor (bottom), are shown in an oblique lithotomy view.

Pudendal nerve stretch during vaginal birth:
A 3D computer simulation, K. Lien, J. O. L. Delancey, J. A. Ashton-Miller,
American Journal of Obstetrics and Gynecology (2005) 192, 1669–76

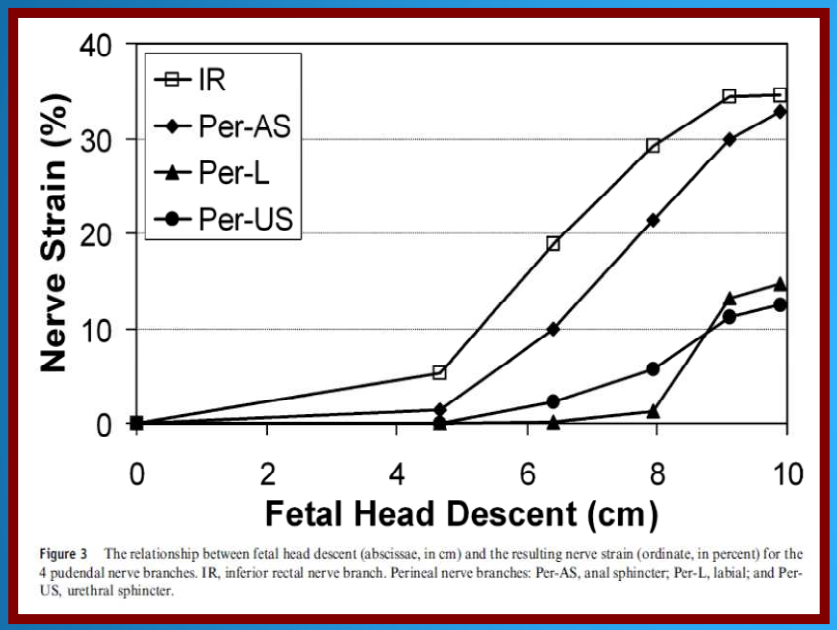


Figure 3 The relationship between fetal head descent (abscissae, in cm) and the resulting nerve strain (ordinate, in percent) for the 4 pudendal nerve branches. IR, inferior rectal nerve branch. Perineal nerve branches: Per-AS, anal sphincter; Per-L, labial; and Per-US, urethral sphincter.

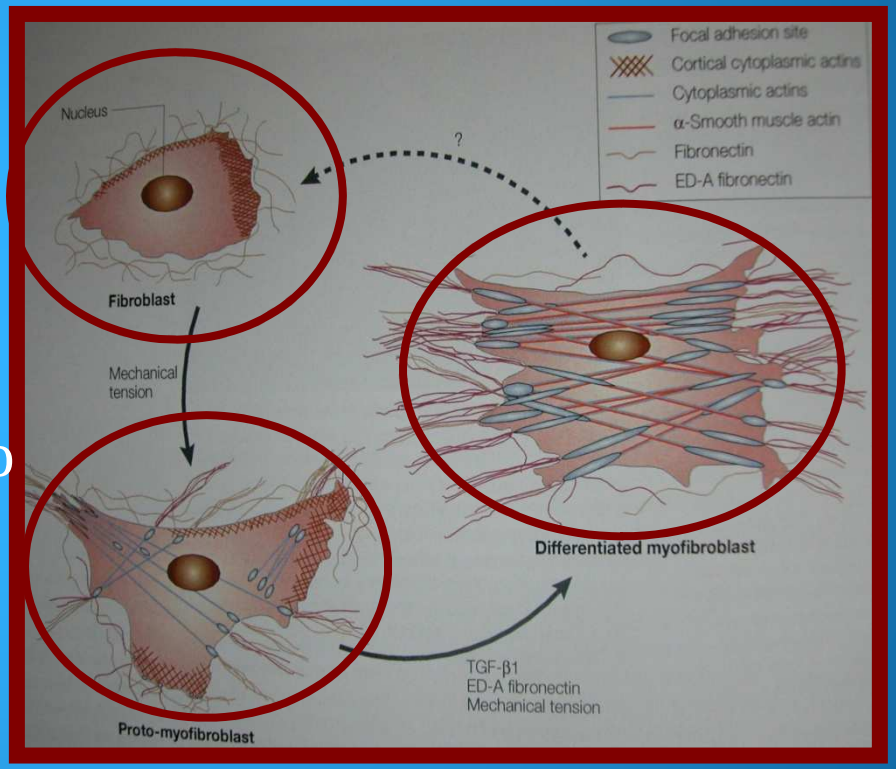
- Inferior rectal nerve: 35 %
- Br. To Anal sphincter: 33 %
- Br. To Labia : 15 %
- Br to Urethral Sphincter : 13 %

Conclusions : during the second stage: (1) nerves innervating the anal sphincter are stretched beyond the 15% strain threshold known to cause permanent damage in appendicular peripheral
nerve, and (2) the degree of perineal descent is shown to influence pudendal nerve strain.

# Effects on connective pelvic floor tissues

The factors affecting healing process on
connective pelvic floor
tissues after the « birth trauma » show great variations from one women to another :
genetic disorders ( chomosome 9 involved)

Importance of the « quality » of the connective tissues cells, especially fibroblasts-myo-fibroblasts for a good
or « bad » tissue healing leading to utero-vaginal prolapse




Meyer/Achtari. Urogyn DGO
CHUV 2013

# Risk of uterovaginal prolapse compared to cesarean delivery

- 7% prolapse : adjusted odds ratio increased with vaginal parity compared with cesarean delivery: prolapse = 1.82 (95% CI 1.04-3.19) ( Obstet Gynecol. 2006 Jun;107(6):1253-60.)
- Pelvic Organ Support Study : each VD increased the risk of prolapse by 1.2
- Women with two VDs : 8.4 times the risk of developing prolapse,
- Turkish study : 12-fold increase in risk in women with four or more VDs. (Dis Colon Rectum 2009; 52: 1186Y1195)

# Alors…césarienne pour tout le monde ?

-Number-needed-to-treat analysis revealed that 7 women would have to deliver only by cesarean delivery to prevent one woman from having a pelvic floor disorder.

(Parity, mode of delivery, and pelvic floor disorders., Lukacz ES, Lawrence JM, Contreras R, Nager CW, Luber KM Obstet Gynecol. 2006;107(6):1253 )

**Risk of placenta previa and accreta according to number of previous cesarean deliveries**

| Number of cesareans | Previa (percent) | Accreta (percent) | Accreta in patients with previa (percent) |
|---|---|---|---|
| Two | 1.33 | 0.31 | 11 |
| Three | 1.14 | 0.57 | 40 |
| Four | 2.27 | 2.13 | 61 |
| Five | 2.33 | 2.33 | 67 |
| Six or more | 3.37 | 6.74 | 67 |

The baseline risk of placenta previa in the general obstetrical population is one in 200 deliveries. Placenta accreta occurs in fewer than one in 500 deliveries.

*Adapted from Silver, RM, Landon, MB, Rouse, DJ, et al. Obstet Gynecol 2006; 107:1226.*

UpToDate®

1.- Qu’avons-nous à proposer aux futures parturientes pour leur éviter une péjoration de leurs fonctions urinaires, ano-rectales et sexuelles lors de leurs accouchements

2.- En d’autres termes sommes-nous honnêtes avec les futures mères en omettant plus ou moins volontairement de leur parler des risques de lésions neuro-musculaires et des tissus collagène-élastiques de leur plancher pelvien lors d’un accouchement par voie basse ?

3.- Quels sont nos moyens de prévention pour éviter des séquelles fonctionnelles secondaires à l’accouchement par voie basse ?

Quels sont actuellement nos moyens de prévention pour éviter les séquelles fonctionnelles définitives et invalidantes secondaires à l'accouchement par voie basse ?

# Moyens de prévention actuels

- Anamnèse soigneuse lors des consultations de grossesse débutante : incontinence urinaire présente avant et pendant la grossesse ?
- Une obstétrique soigneuse et « raisonnable »: éviter les poussées fundiques, éviter si possible les forceps et leur préférer la ventouse, ne pas forcer un enfant dans la filière pelvienne.

# Moyens de prévention actuels

- Un brillant obstétricien de la voie basse « à tout prix » n’est pas forcément le garant d’un plancher pelvien en bon état

# Etudes préalables publiant des pressions intra-utérines lors de l'accouchement

- Schatz, in the 1880s, was the first author to describe direct intrauterine pressure measurements during labour.

- Many years later, some obstetric teams have used intra-uterine catheter for similar research with the aim of studying kinetic of head-to-cervix pressure during contractions

(Allman ACJ, Genevier ESG, Johnson MR, Steer PJ, Head-to-cervix force: an important physiological variable in labour.1. The temporal relation between head-to-cervix force and intra-uterine pressure during labour, Br J Obstetrics and Gynecology, 1996;103:763-768

Allman ACJ, Genevier ESG, Johnson MR, Steer PJ, Head-to-cervix force: an important physiological variable in labour.2. Peak active force, peak active pressure and mode of delivery. Br J Obstetrics and Gynecology, 1996;103:769-775.)

# Etudes avec enregistrements des pressions intra-utérines

- Measuring intra-vesical and intra-uterine pressures, Amarenco et al.found similar increases of intra-uterine pressures of 50 ±20 mmHg with increases of intra-vesical pressures reaching 31± 6 mmHg.
- (Demaria F , Porcher R , Sheik-Ismael S, Amarenco G, Benifla JL. Recording expulsive forces during childbirth using intercostal muscle electromyogram: a pilot study. Gynécologie Obstétrique & Fertilité 2005 ; 33 : 299–303 )

# Etudes avec capteur intra-utérin : capteurs à H2O

- Buhimschi et al : found increasing pressures amplitude of 65 mmHg in women bearing with spontaneous or enhanced contractions and of 99 mmHg in women bearing down with Valsalva efforts, the basic intra-uterine pressure being 25 mmHg.
- They concluded that women in labor increase their intra-uterine basal pressure 62% by actively pushing with a contraction, by 86% when using valsalva and fundal pressure simultaneously
- still higher when a Mc Roberts manoeuver ((legs hyperflexed by 135 degrees) was used.
- This increase showed great variation when compared from one woman to another, with a range varying from 0% to 192%

( Buhimschi CS, Buhimschi IA, Malinow AM, Kopelman JN and Weiner CP. Am J Obstet Gynecol 2002;186:1339-44. BJOG: an International Journal of Obstetrics and Gynaecology 2002;109: 520–526.19. Lancet 2001; 358: 470–71.)

# Wellborn Study : a « multispeciality » collaboration

S. Meyer *, F. Salchli **, H. Bettaieb***, P. Hohlfeld*, Ch Achtari*

* Urogynecology Unit, Dept of Gynecology and Obstetrics, CHUV, Lausanne, Switzerland

**Micro-Nanotechnology Dept., Inst. of Applied Sciences, Yverdon-les-Bains Switzerland

*** Math. Micro-Nanotechnology Dept., Inst. of Applied Sciences, Yverdon-les-Bains Switzerland

Connection with Industry (Microbonding Inc. CH 2103 Noiraigue/ Switzerland)

# Concept de l'étude « Wellborn » Study

- 1.- Créer une technique non invasive capable de calculer et quantifier pendant l'accouchement l'importance des pressions dévelopées par la tête du bébé contre les structures neuro-musculaires du plancher pelvien
- 2.- Déterminer si l'on peut établir des corrélations entre ces mesures de pressions et :
- A.- les paramètres obstétricaux
- B.- les troubles fonctionnels du plancher pelvien observés dans le post-partum, soit 6 mois au moins après l'accouchement ?

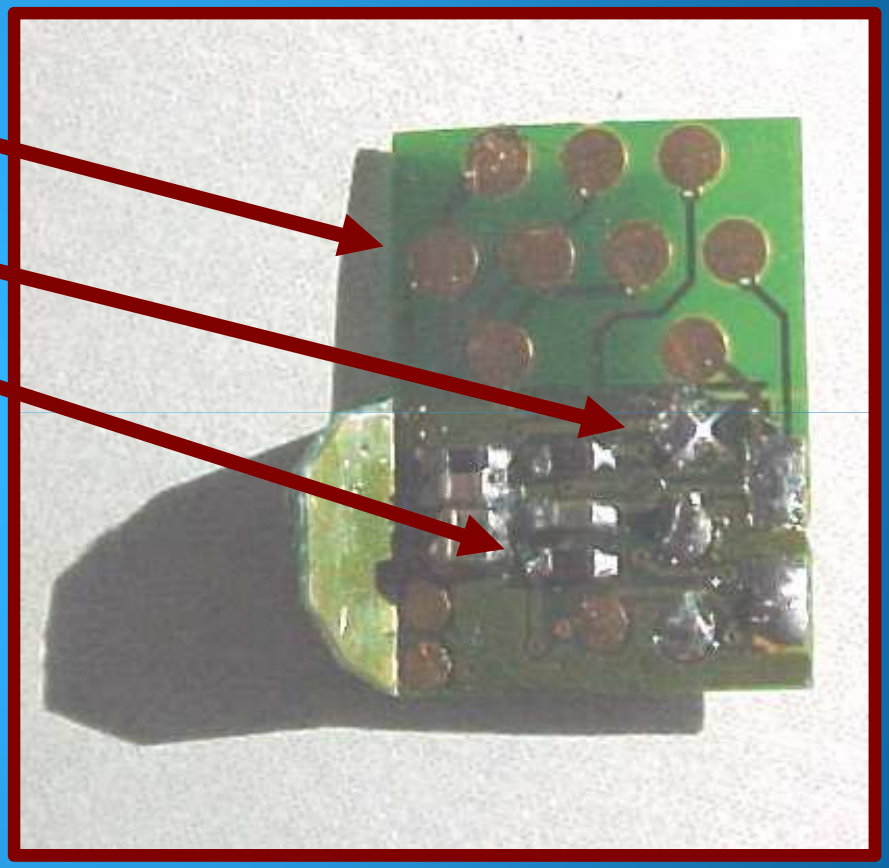
# Originalité de l'étude « wellborn »

- Pas d'études ayant utilisé un enregistrement continu des pressions intra-rectales pendant l'accouchement
- Pas d'études ayant établi des corrélations avec les paramètres obstétricaux habituels
- Pas d'étude ayant établi des corrélations avec les troubles fonctionnels du plancher pelvien une année après un premier accouchement

Un **microsystème** est un assemblage de dispositifs de taille micrométrique. Un microsystème peut contenir un capteur de ttempérature, de l'électronique analogique pour la conversion des valeurs du capteur et de l'électronique numérique pour l'interfaçage avec d'autres puces, le tout intégré dans un seul composant électronique

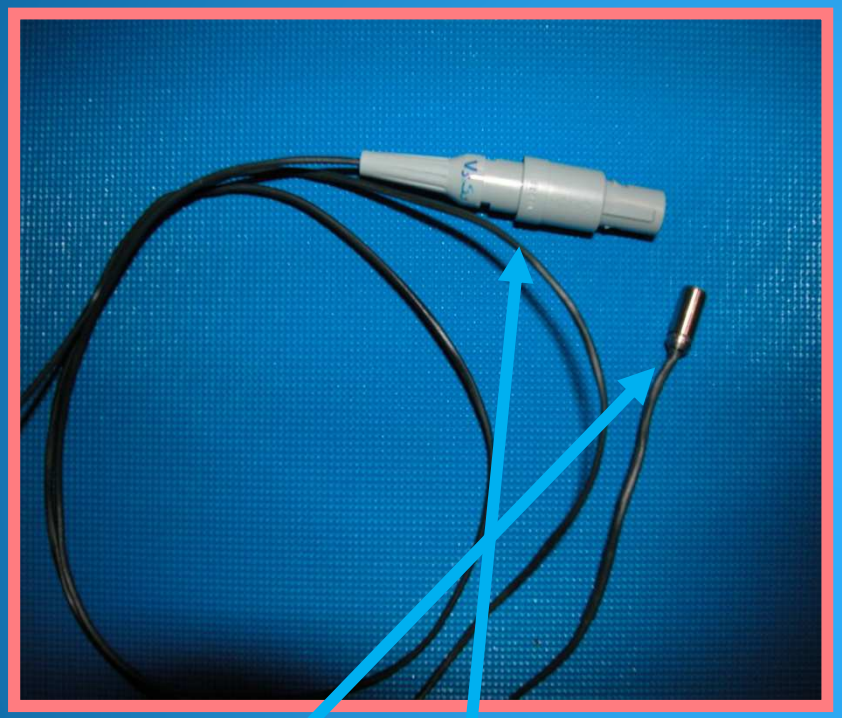
# Material and Methods (3)

PCB: printed circuit board
Microcontroler
EEPROM
Pressure sensor



Units expressed : LSB (least square bit)
Conversion: 8150 LSB = 1000 cmH2O

# Material and Methods (2)

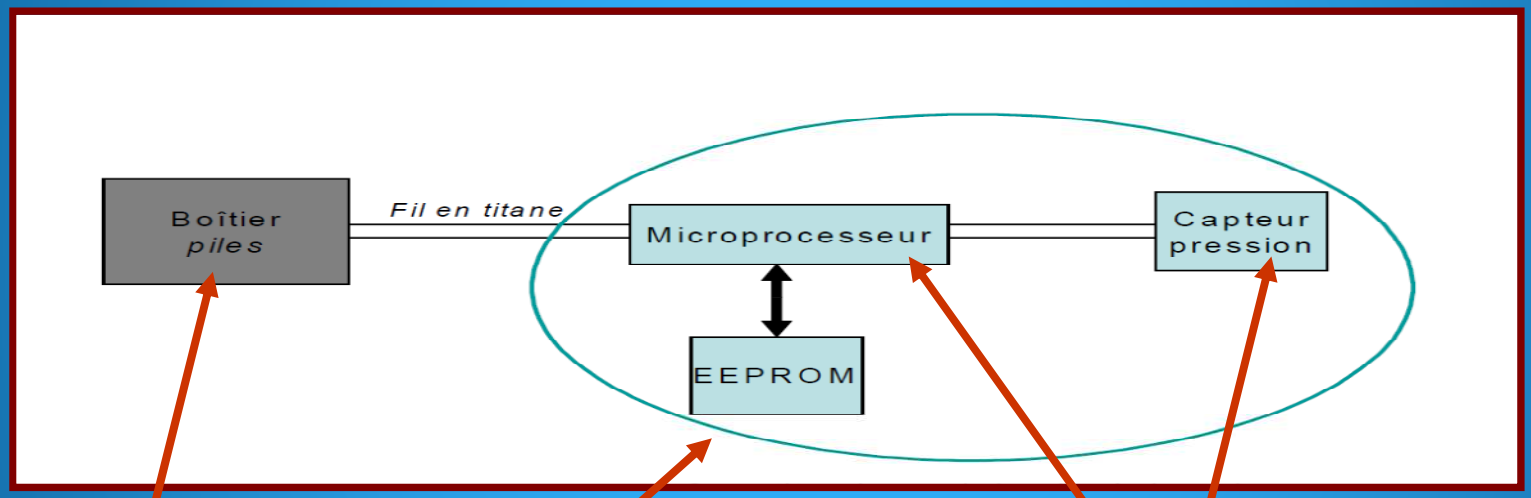


Microsystem connected to a battery by a cable

Microsystem inserted in a titanium capsule of 6 / 11 mm

# Wellborn study

Using a microsystem device, intra-rectal pressures during the second phase of labor were continuously recorded in 59 nulliparae women




Battery

Storing the datas in EEPROM

Pressure membrane with a Wheatstone bridge..connected To microprocessor

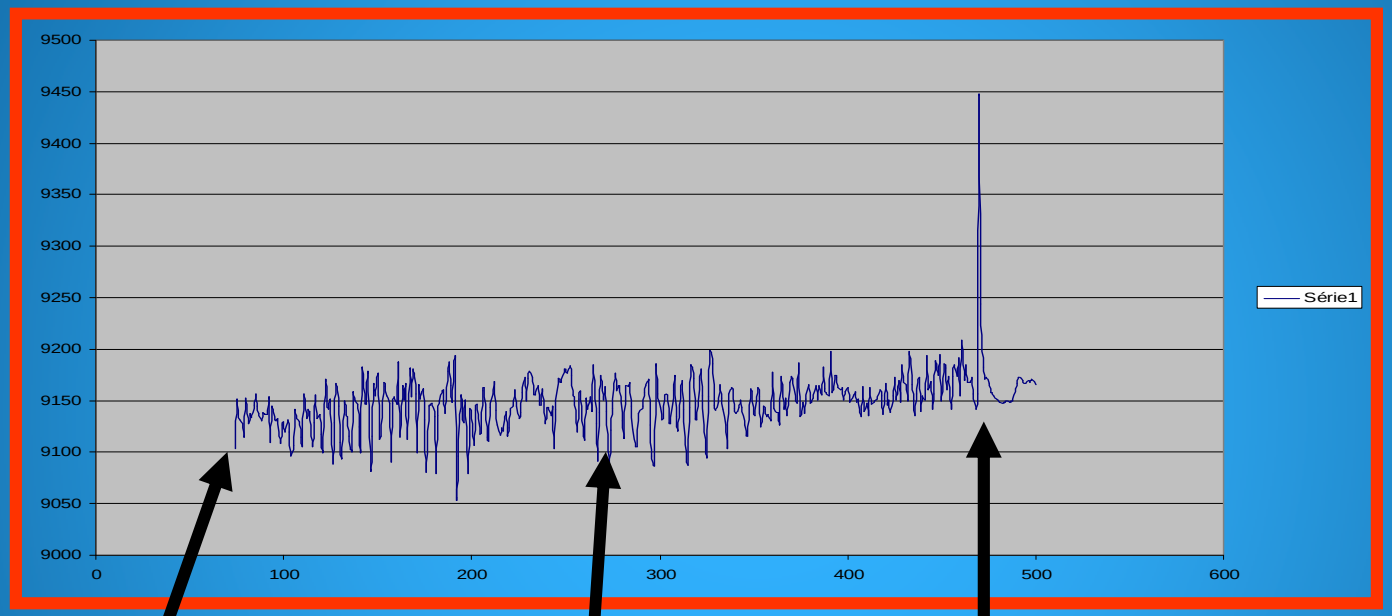
# Material and Methods (3)

- This micro system device was inserted :
- into the vagina during a one-hour ICS pad test done after a conventional urodynamic examination in a group of 23 women ( 58±10 years old) investigated for urinary stress and mixed incontinence (group 1)
- into the rectum during the first and second phase of labor of primiparae women (group 2).

# Results of group 1: continuous recording during one-hour ICS pad test

- the medium-pressure into the vagina was 1001±78 cm H2O = 735 mmHg, pression atmosphérique
- there was a continuous basal muscular activity of pelvic floor musculature with irregular contractions: their medium value was 9.4±4 cm H2O
- the medium value of the maximum pressure observed was 59±39 cm H2O.
- the medium value of the number of pressure measurements recorded during the one-hour pad test was 2880±1940
- there were no correlations with age or body mass index.

# One-Hour ICS pad test:example of a detailed sequence of 7 minutes

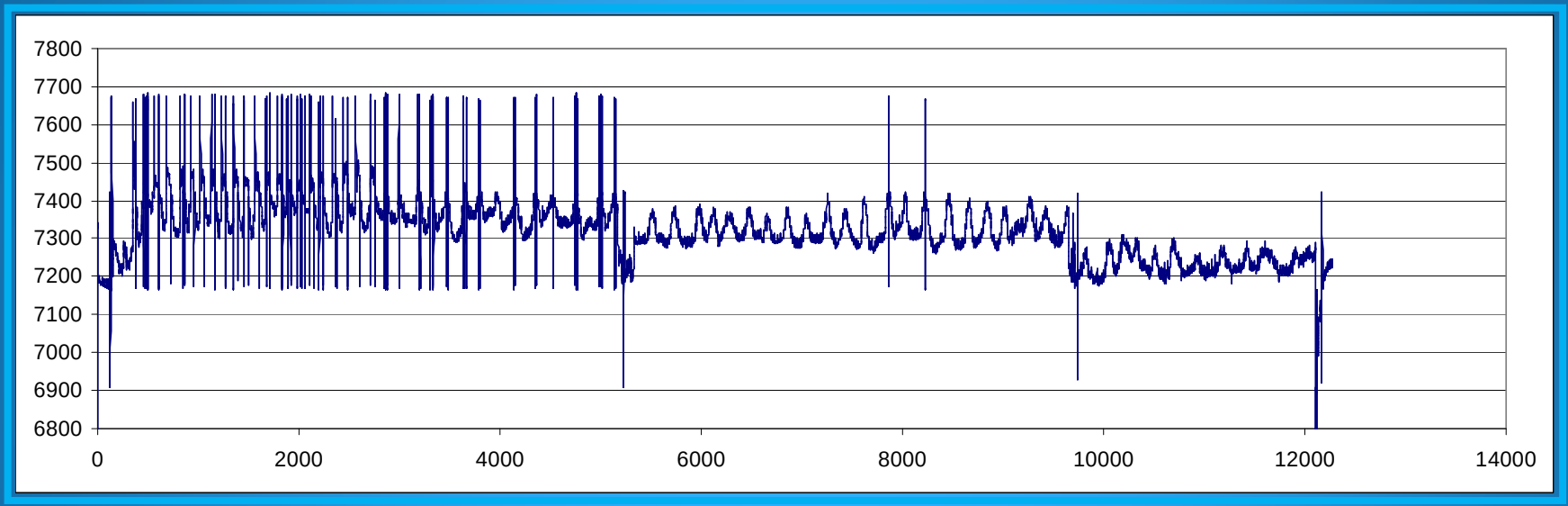



Basal intra-vaginal pressure:1113 cmH2O, i.e.819 mmHg

Variations of pressure during walking: between 3 and 11 cmH2O

Coughing: 37 cmH2O

# G T T, 28 years : phase I of labor : recording during 200 min (i.e.3.3 hours): cesarean section at full dilatation for NPP, baby 2960 g

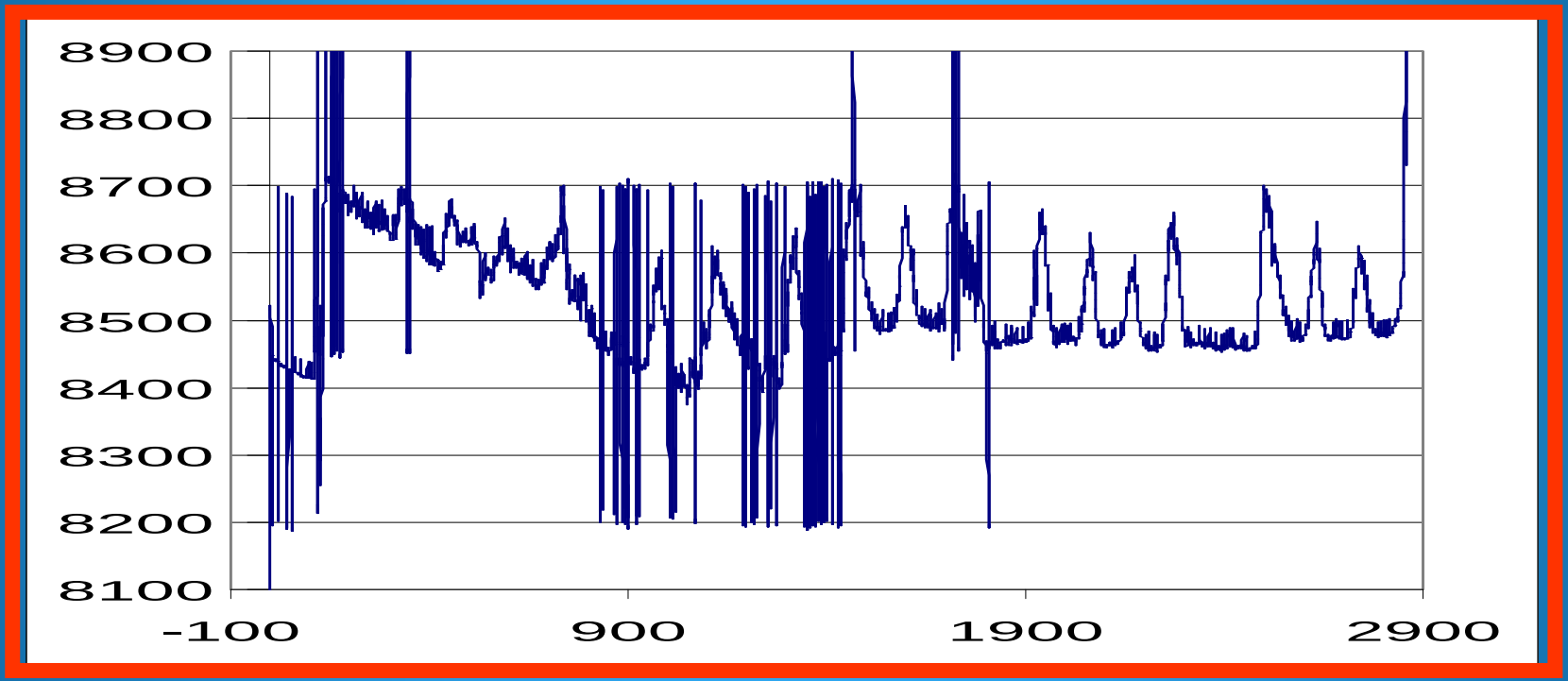



Basal intra-rectal pressure : between 876 cm H2O (i.e. 644 mmHg) and 891 cmH2O (i.e. 655 mmHg)

Duration of contractions: between 110-130 sec. : pressure increase between 9 - 15 cm H2O

Duration of this Iphase : 12000 seconds i.e. 200 minutes, i.e. 3 hours 30

# B V, 34 years,spontaneous « easy » delivery, with med-lat episiotomy,  3550 gr

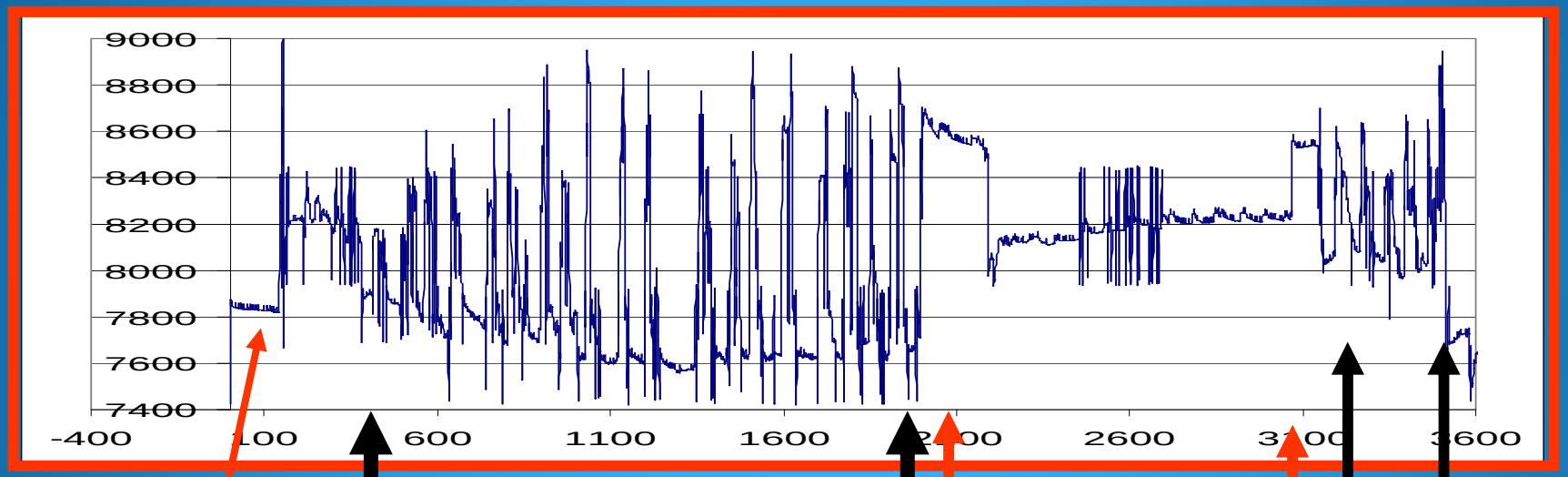



Basal intra-rectal pressure : between 1025 cm H2O (i.e. 754 mmHg)-1060 cm H2O (i.e. 780 mmHg)

13 expulsive efforts : between 21-25 cm H2O

Duration of this IIphase : 2800 seconds i.e. 46 minutes

# A C, 28 years, elective induction with misoprostol for macrosomy, spontaneous delivery in LAO, without episiotomy, baby 3850 gr




Intra-rectal pressure: 955 cmH2O i.e. 703 mmHg

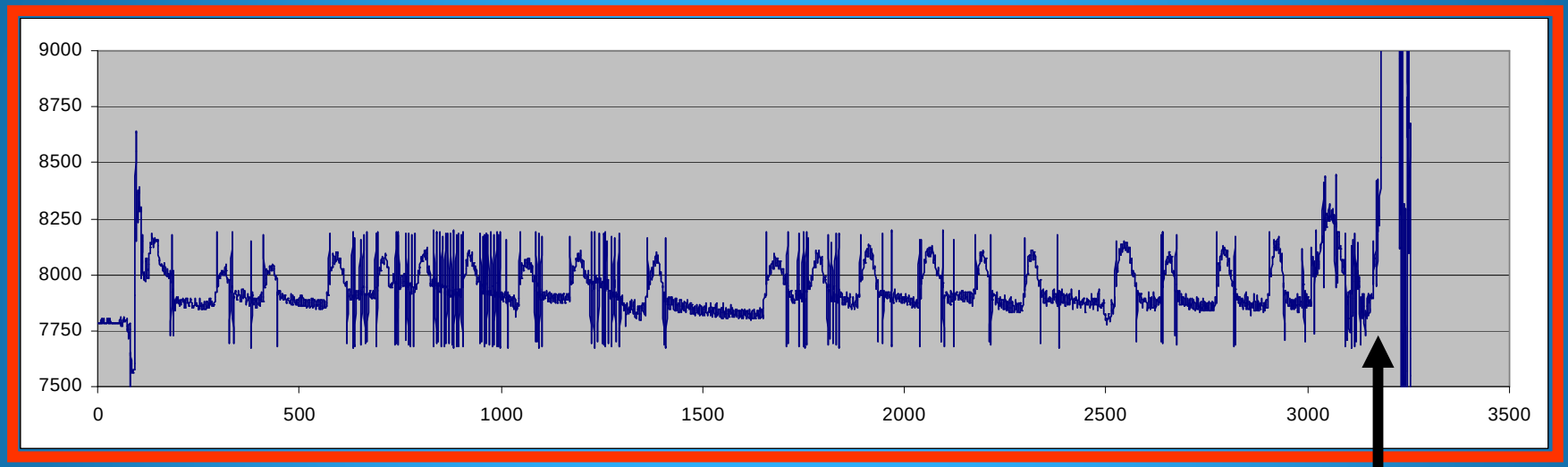
17 bearing efforts : between 100 – 150 cm H2O, Head at station +2

Stop bearing: intra-rectal pressure : 1005-1048 cm H2O, i.e. 739-771 mmHg

Last 5 bearing efforts: between 65-100 cm H2O

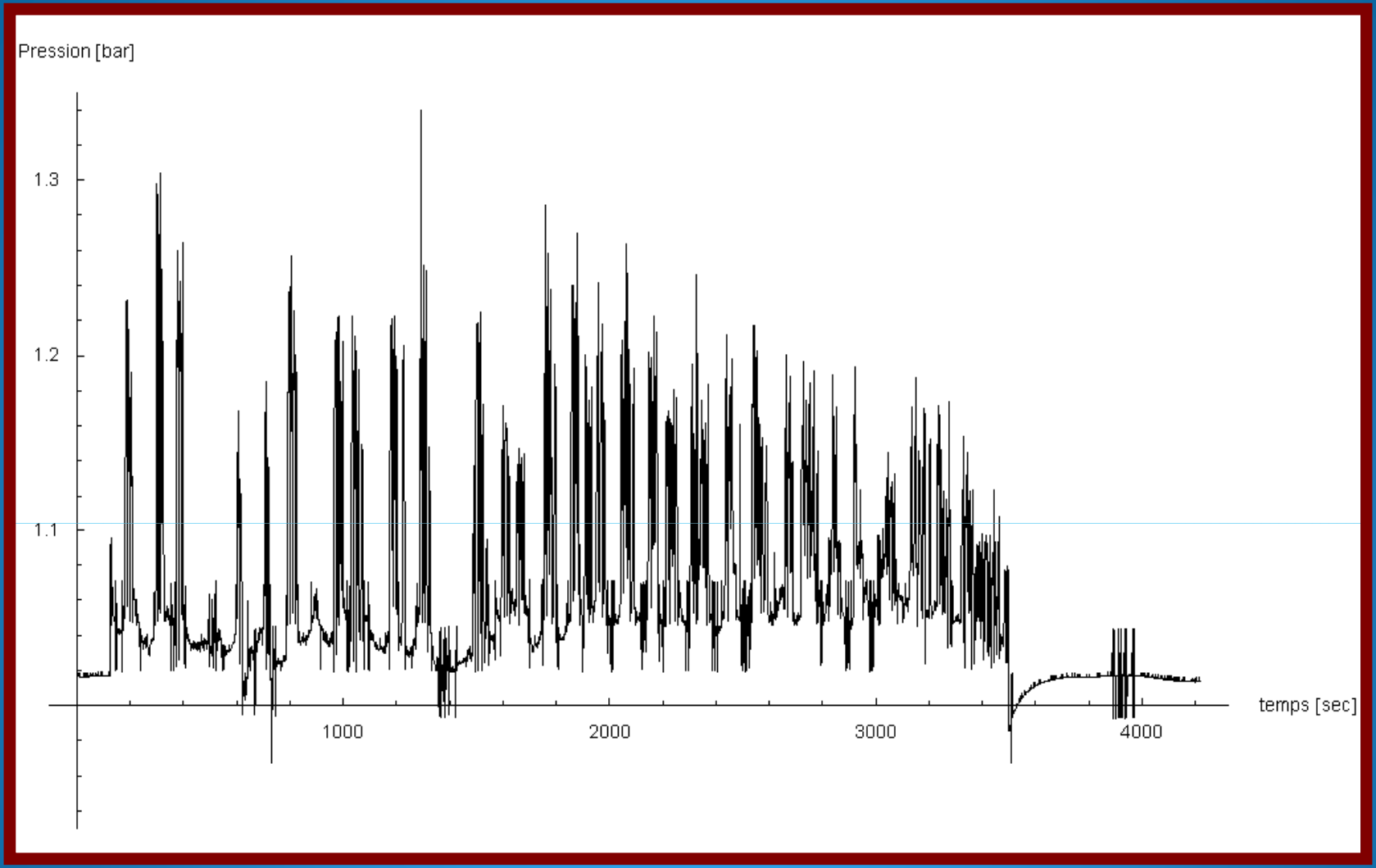
Duration of this IIphase : 3600 seconds i.e. 60 minutes

# C L, 31 years, vacuum for NPP, without episiotomy, baby 3750 gr

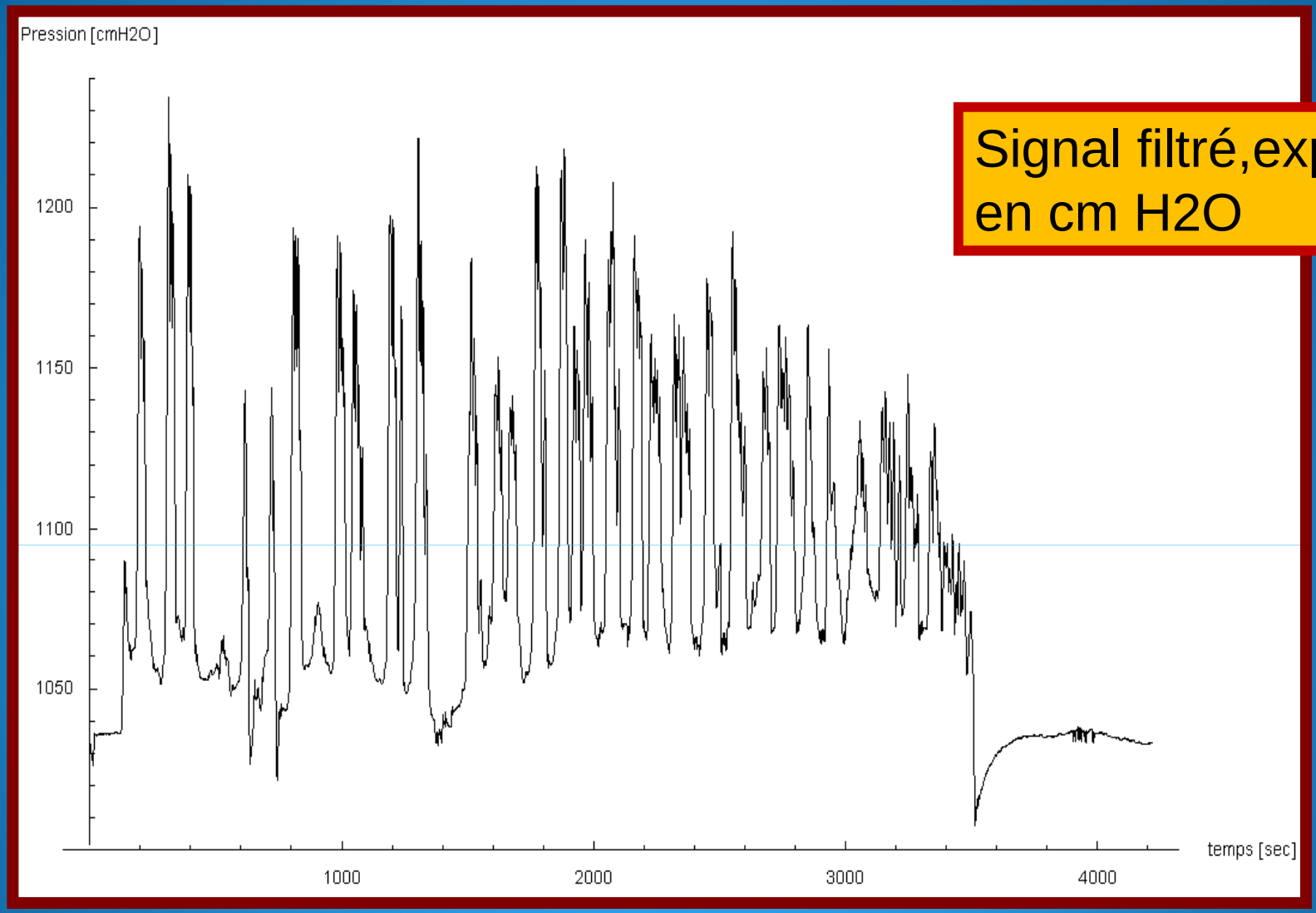



Vacuum extraction

Basal intra-rectal pressure : 958 cm H2O (i.e. 704 mmHg)
21 expulsive efforts : between 21-51 cm H2O
Pressure during vacuum extraction : 128 cmH2O
Duration of this IIphase : 3200 seconds i.e. 53 minutes




Après 6 séries de prototype…différents avatars ..
Dernière série de prototype… V7 : excellente régularité dans le fonctionnement : résultat sans filtrage du signal




Signal filtré,exprimé en cm H2O

Accouchement en OIGA, 50 minutes de poussées, enfant de 3850 gr : poussées entre 50 et 150 cm H2O

**Continuous recording intrarectal pressures during the second phase of labor**

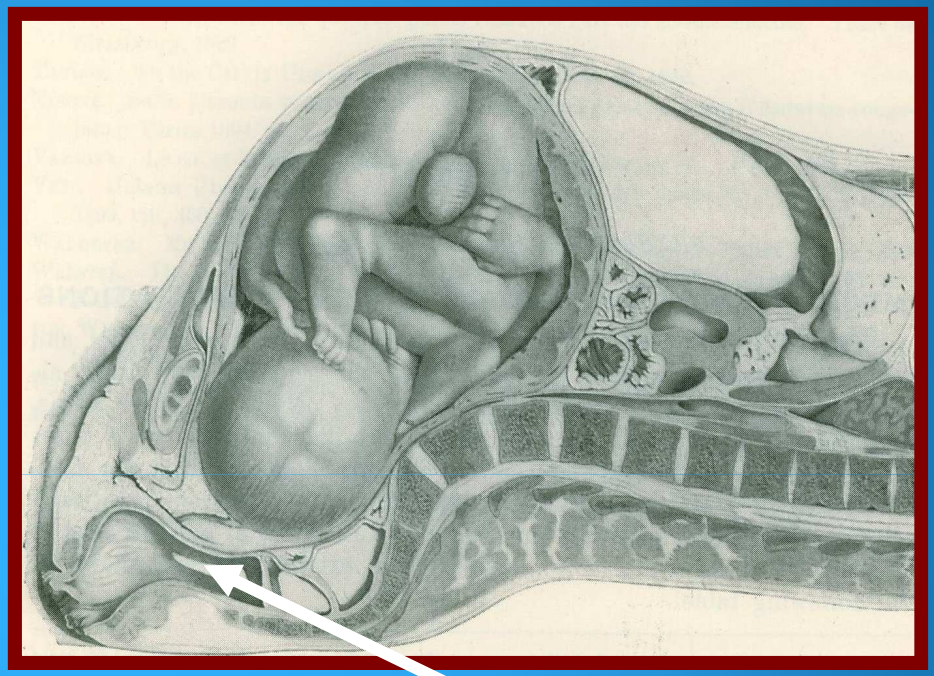
L'enregistrement continu de la pression intra-rectale pendant la phase expulsive de l'accouchement

**S. Meyer, F. Salchli , H. Bettaieb, P.Hohlfeld,C. Achtari**

Progrès en urologie (2012) **22, 487—494**

# Dernier prototype : V 7
# Avec EEPROM hors de la capsule + capsule jetable

# CONTINUOUS RECORDING INTRA-RECTAL PRESSURE DURING SECOND PHASE OF LABOR: IS IT PREDICTIVE OF POST-DELIVERY PELVIC FLOOR PROBLEMS ?



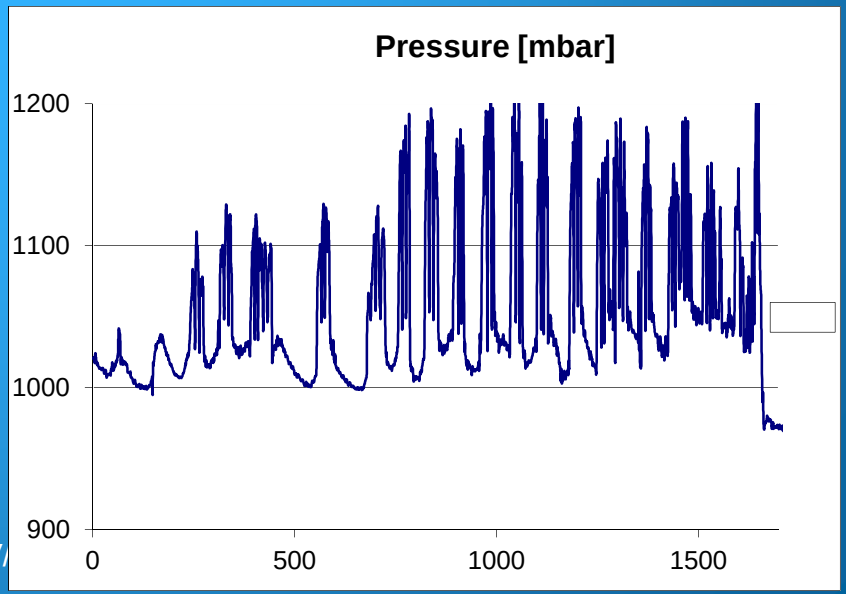

Disposable device:
- placed into the rectum during II phase of labor
- after connection to a battery

# In the recorded curves, three parameters were calculated

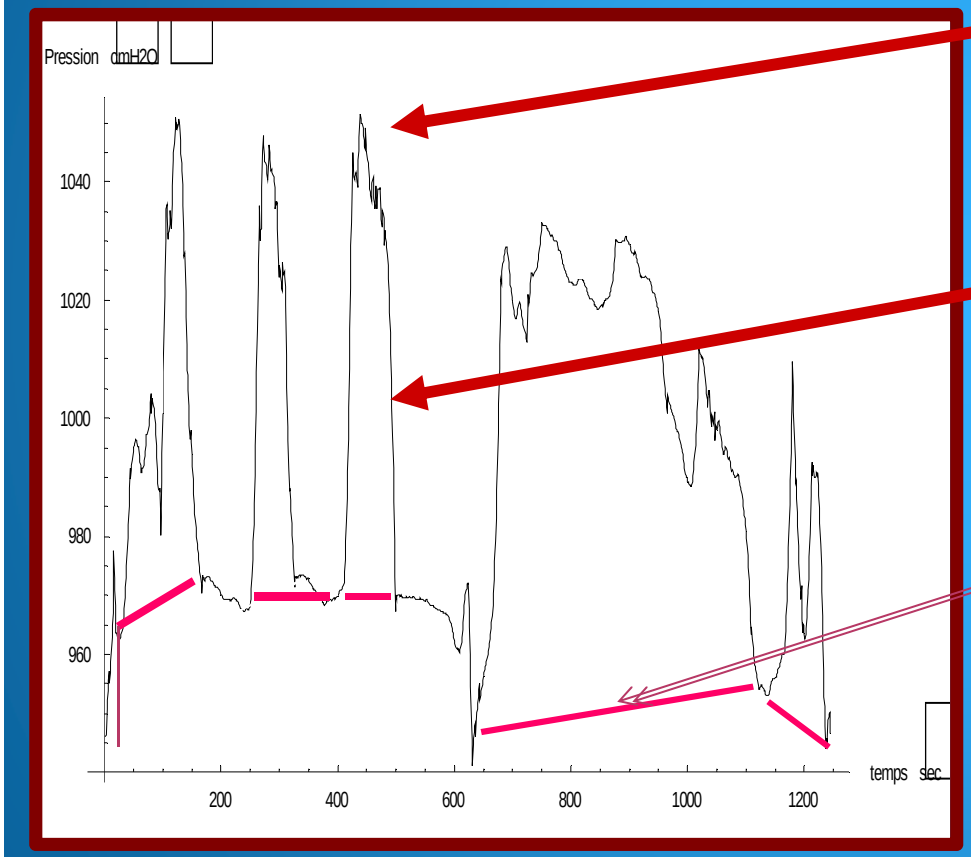
1.- the duration of the bearing efforts,

2.- the surface area under the pressure curve

3.- the peak pressure at the nadir of the bearing efforts.

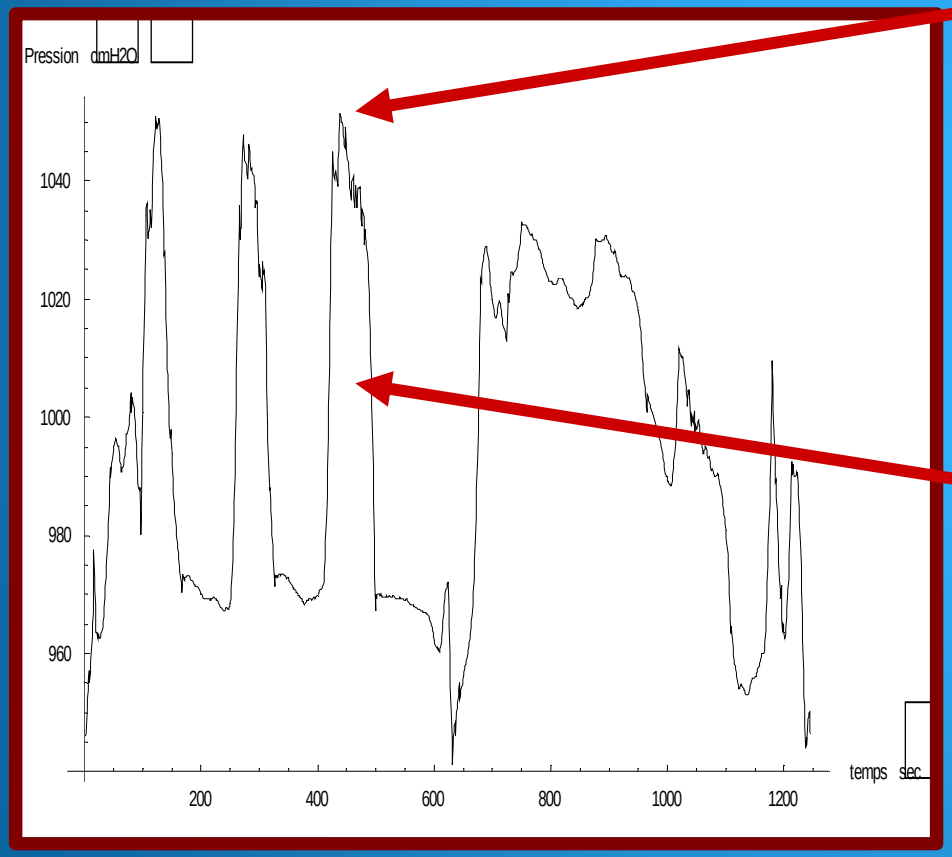


# Parameters assessed during analysis of the intra-rectal pressures recordings



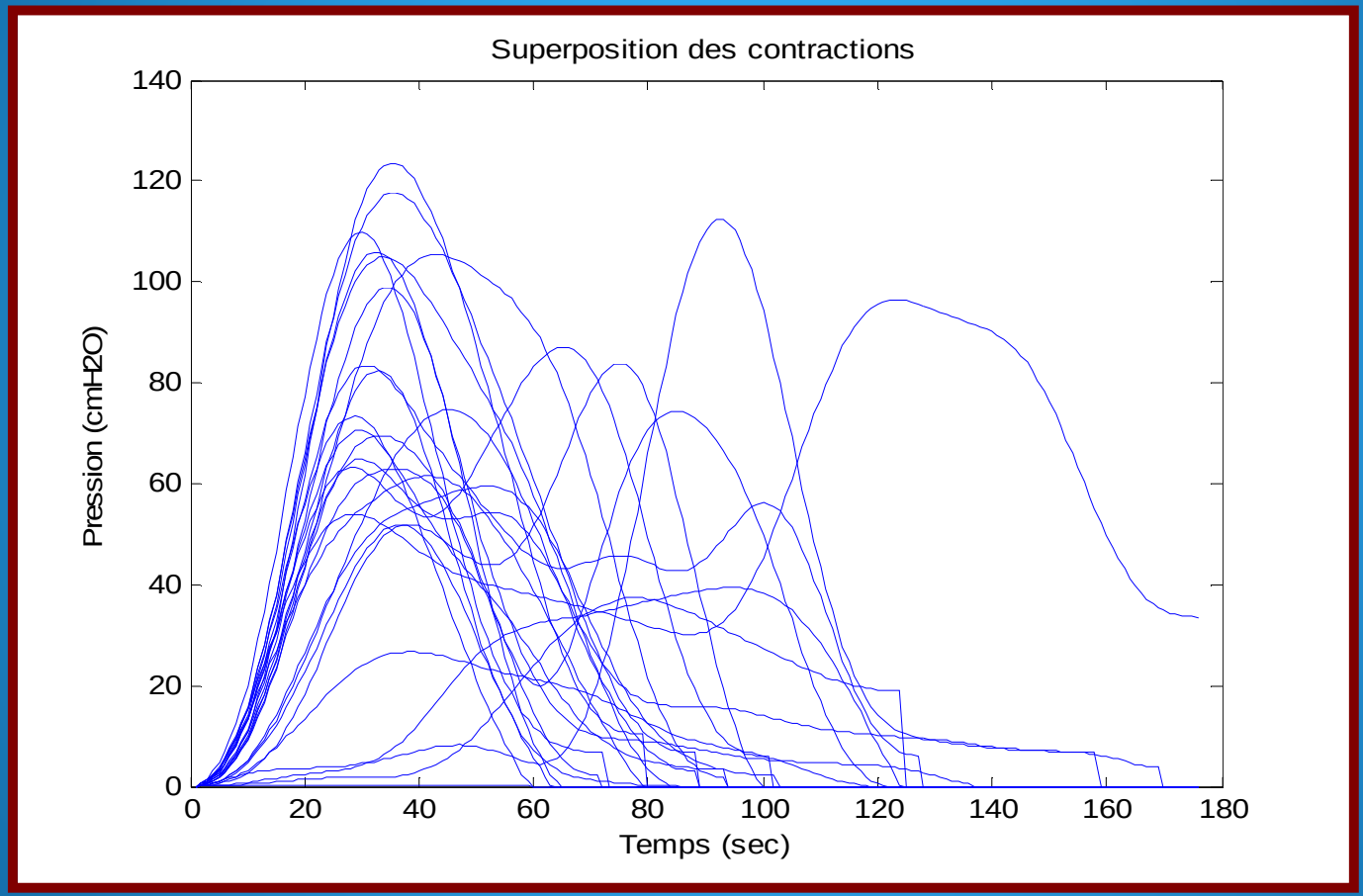

- Highest pressure of the different spikes :i.e acute forces (cmH2O)
- Area of the « pressure spikes » (cm H20* sec): i.e. long-lasting forces
- Duration of the bearing efforts (sec)

# Calculation of the curve of the continuous pressure recorded during IIphase of labor

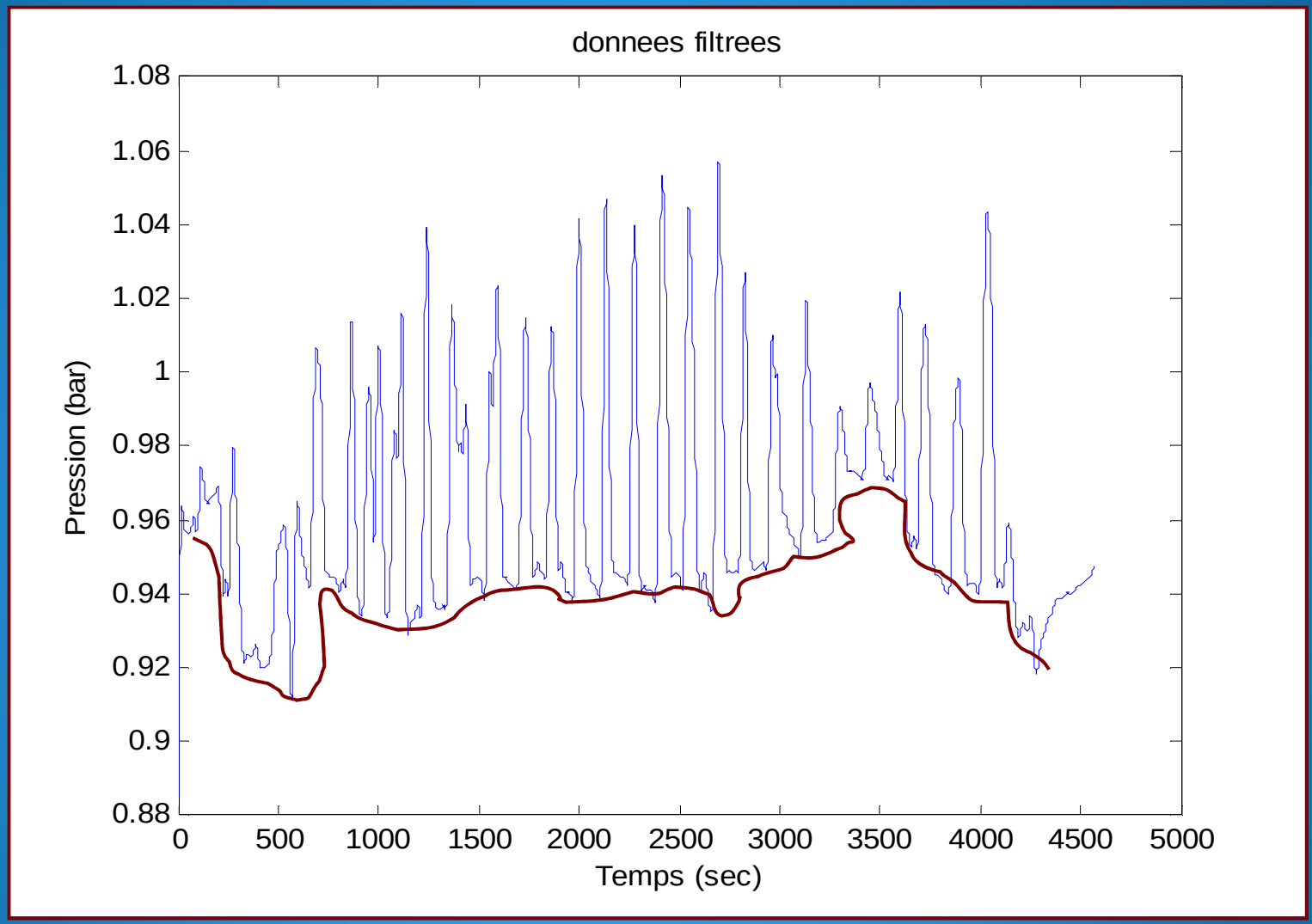



- Highest pressure of the different spikes :i.e acute forces (cmH2O)
- Area of the « pressure spikes » (cm H20* sec): i.e. long-lasting forces

MAPPING OF THE DIFFERENT AREAS AND PEAK PRESSURES RECORDED DURING THE SECOND PHASE OF DELIVERY:  NUMBER OF BEARING EFFORTS : 28, DURATION OF SECOND PHASE : 75 MIN, BABY'S WEIGHT: 3500 GR



# HIGH FREQUENCY FILTERED PRESSURE MEASUREMENT

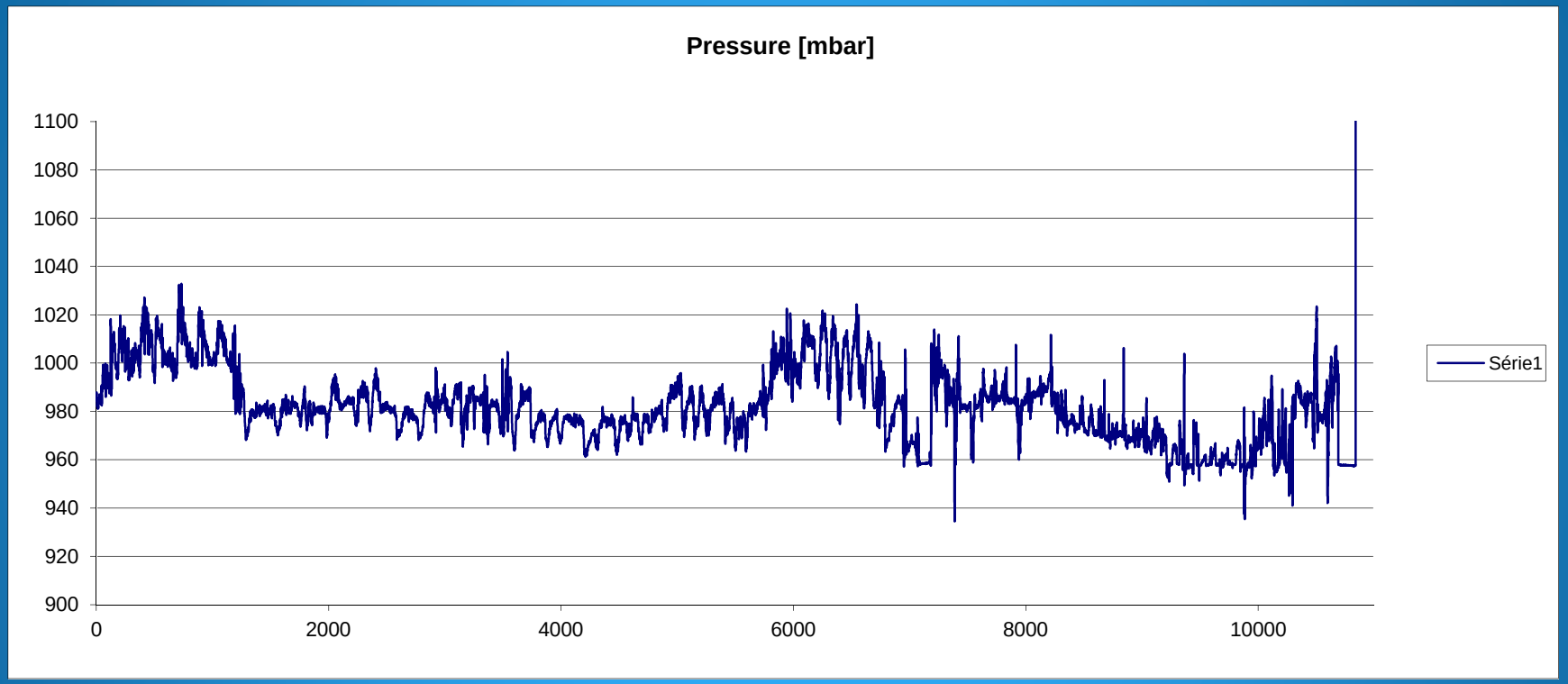



CASE 1

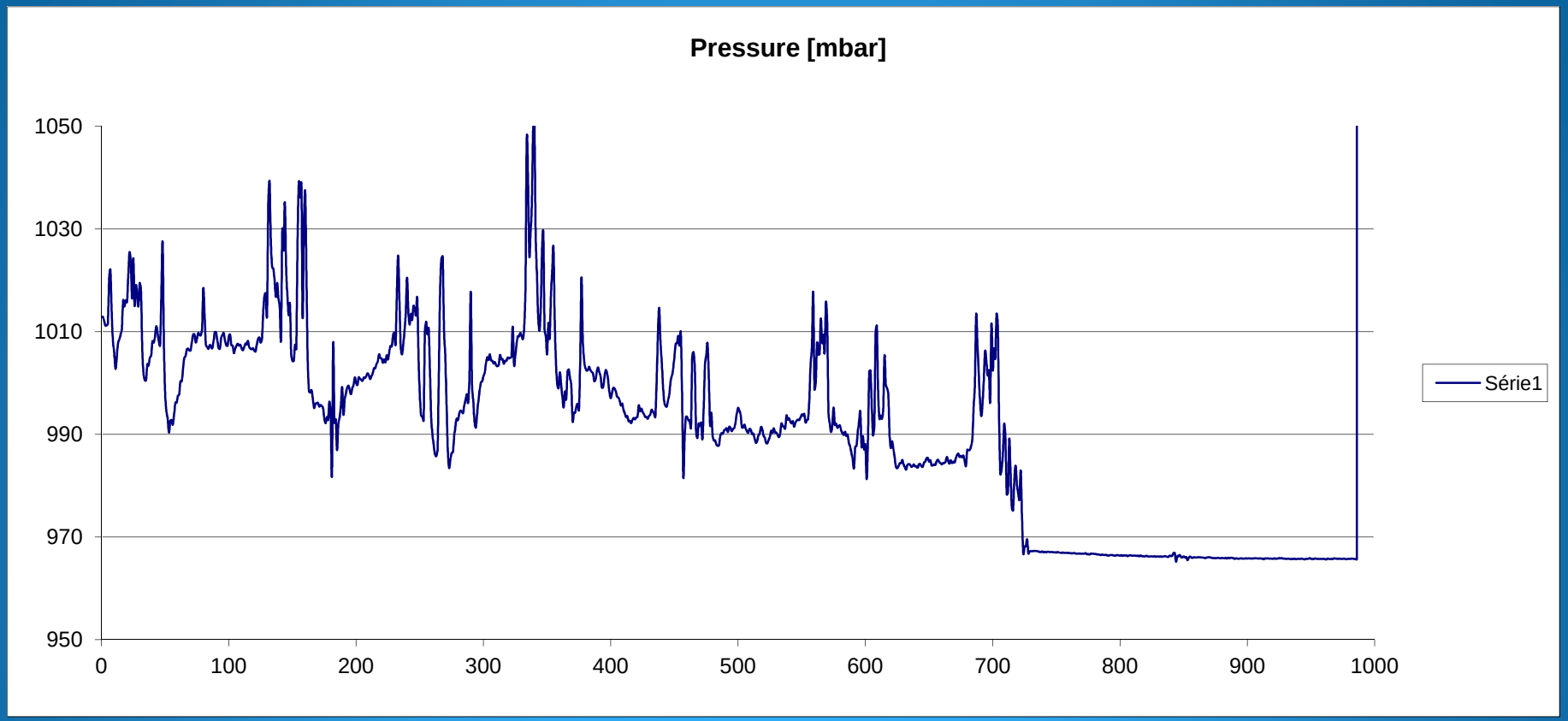
IIphase : 75 min OIGA 3500 gr

CONTRACTION NUMBER : 28

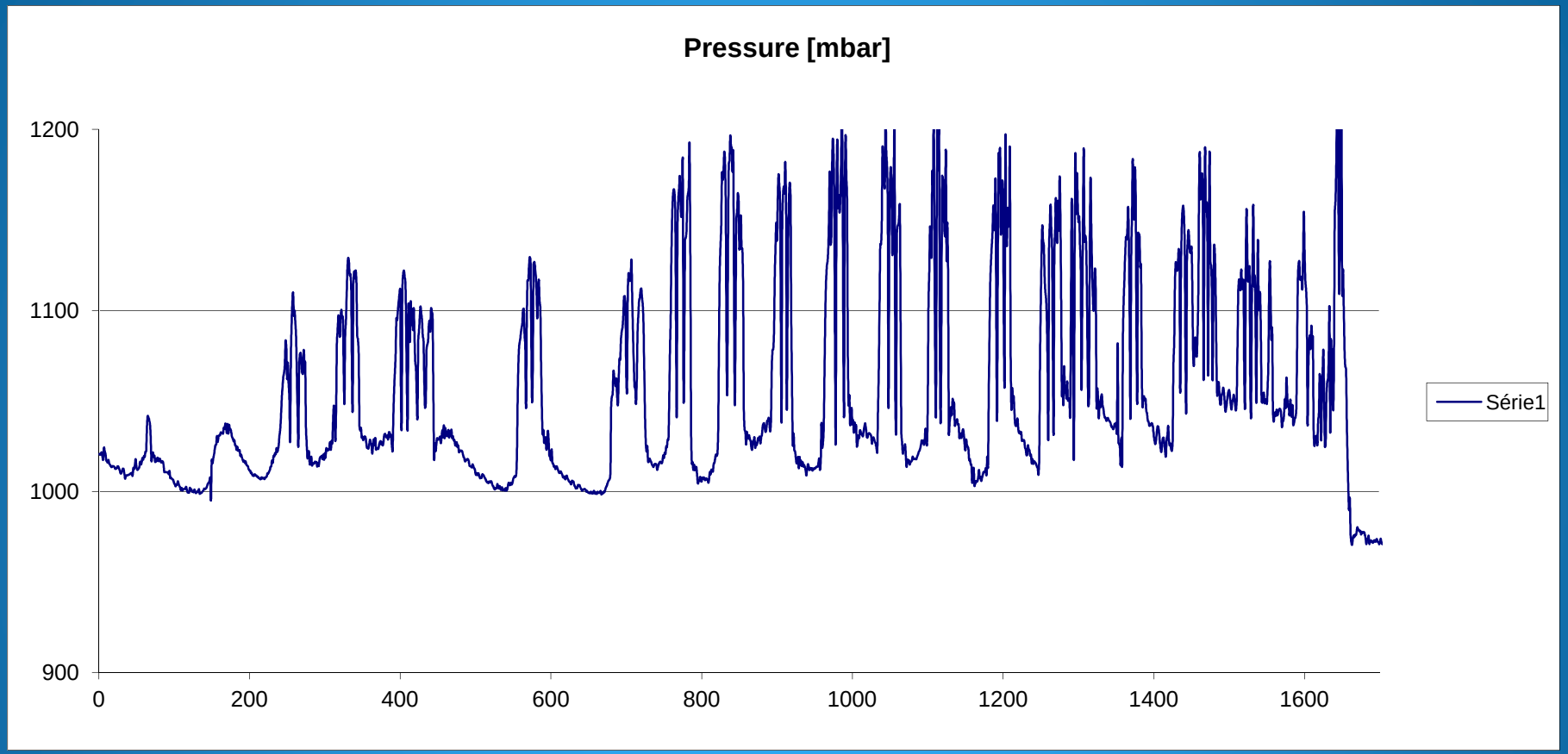
Les résultats de ces enregistrements
Montrent une extrême variation
d’une parturiente à l’autre
dans les « profils de pressions »
enregistrées



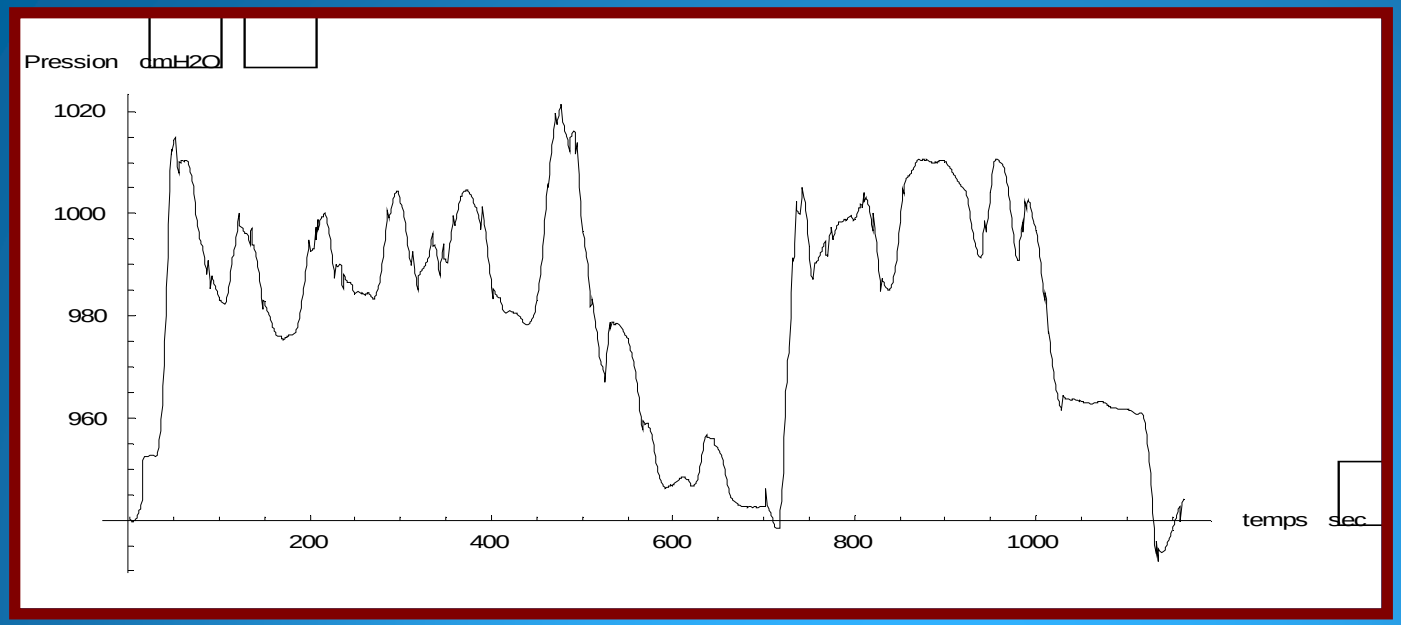

Parturiente 33 ans, durée dilatation 285 min, durée phase expulsive 38 min, poids enfant 3170 gr



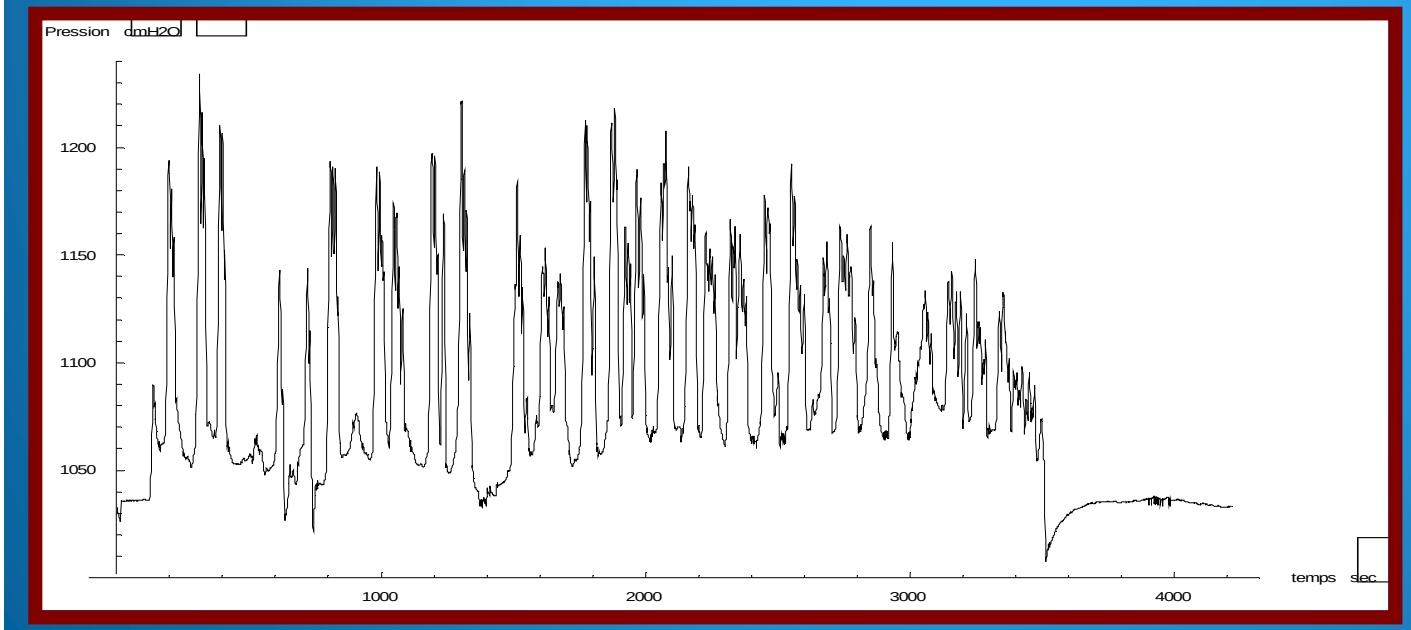

accouchement spontané, durée dilatation : 560 min,
durée phase expulsive : 35 min. Poids enfant 3880 g,




30 ans, accouchement spontané, phase dilatation 300 min
Phase expulsive : 27 min, poids de l'enfant : 3630 gr

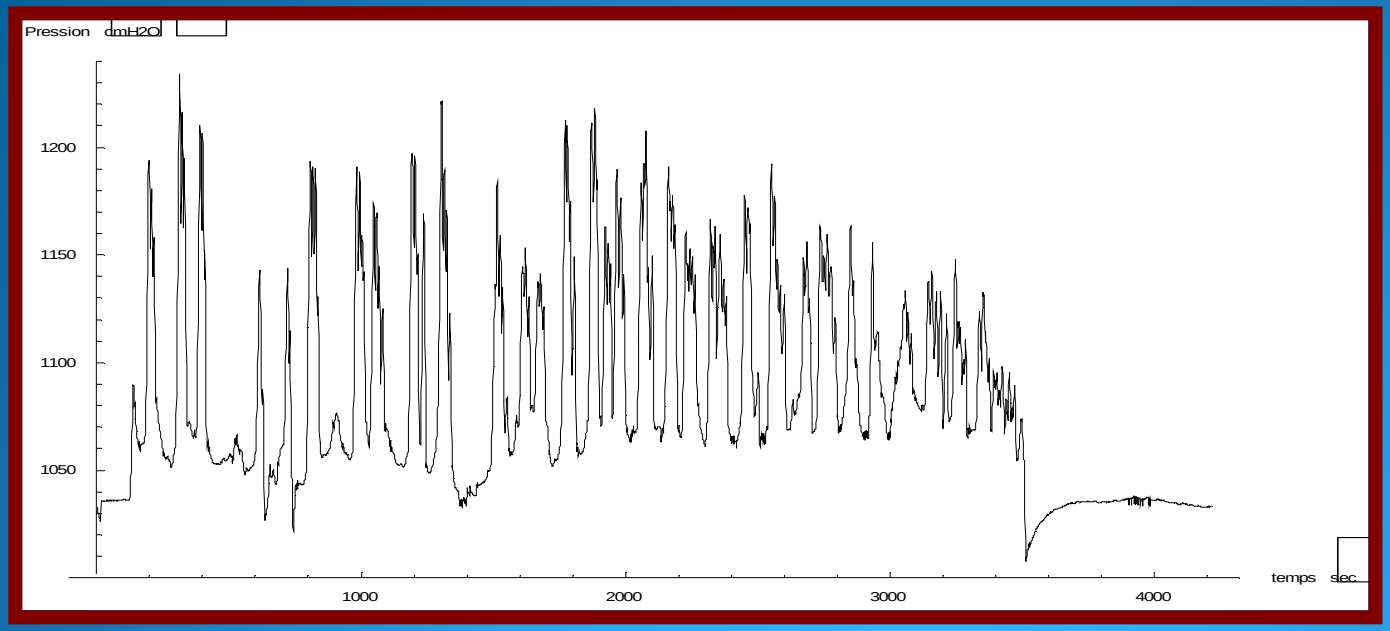



OIGA 2870 gr
Pression moyenne:
20±9 cmH2O

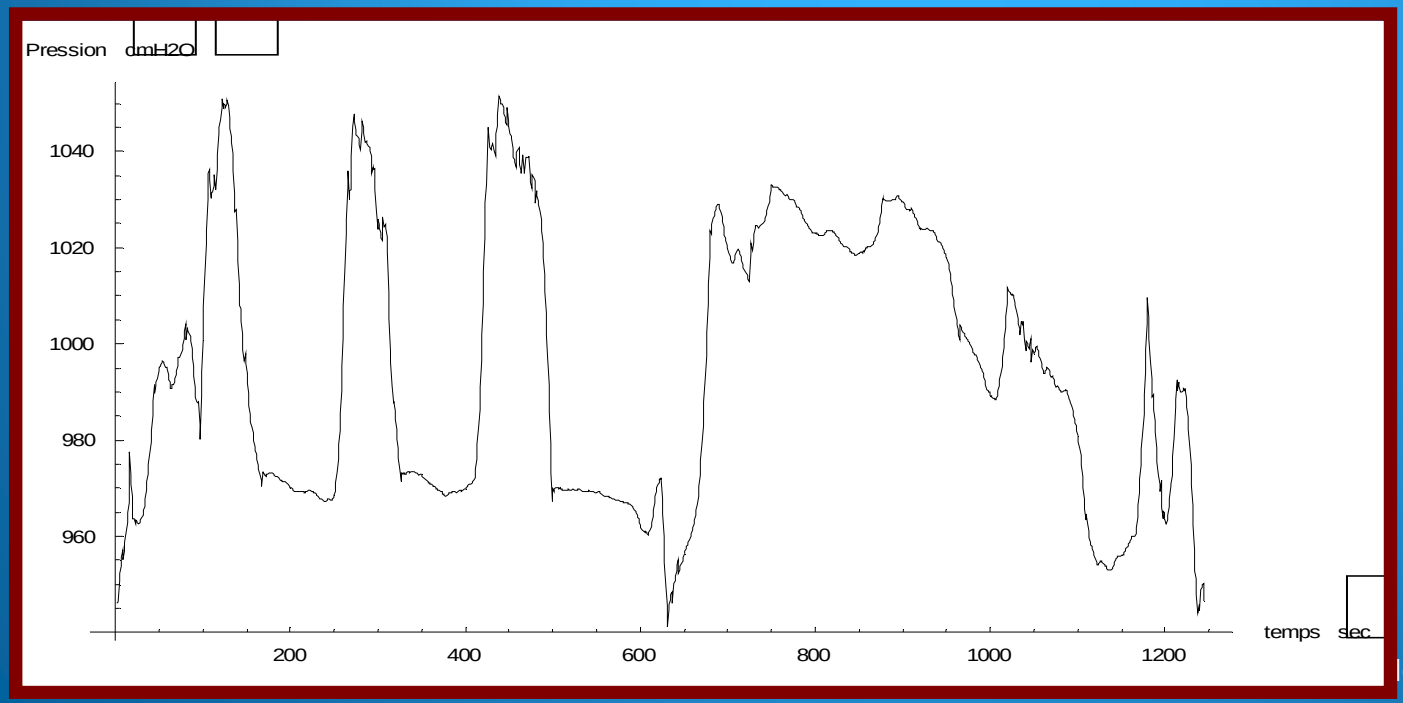



OIGA 3840 gr
Pression Moyenne:
116±36 cmH2O

Meyer/Achtari. Urogyn DGO
CHUV 2013




OIGA 3840gr
Pression moyenne: 116±36 cmH2O




OIGA 3870 gr
Pression Moyenne: 35±27 cmH2O

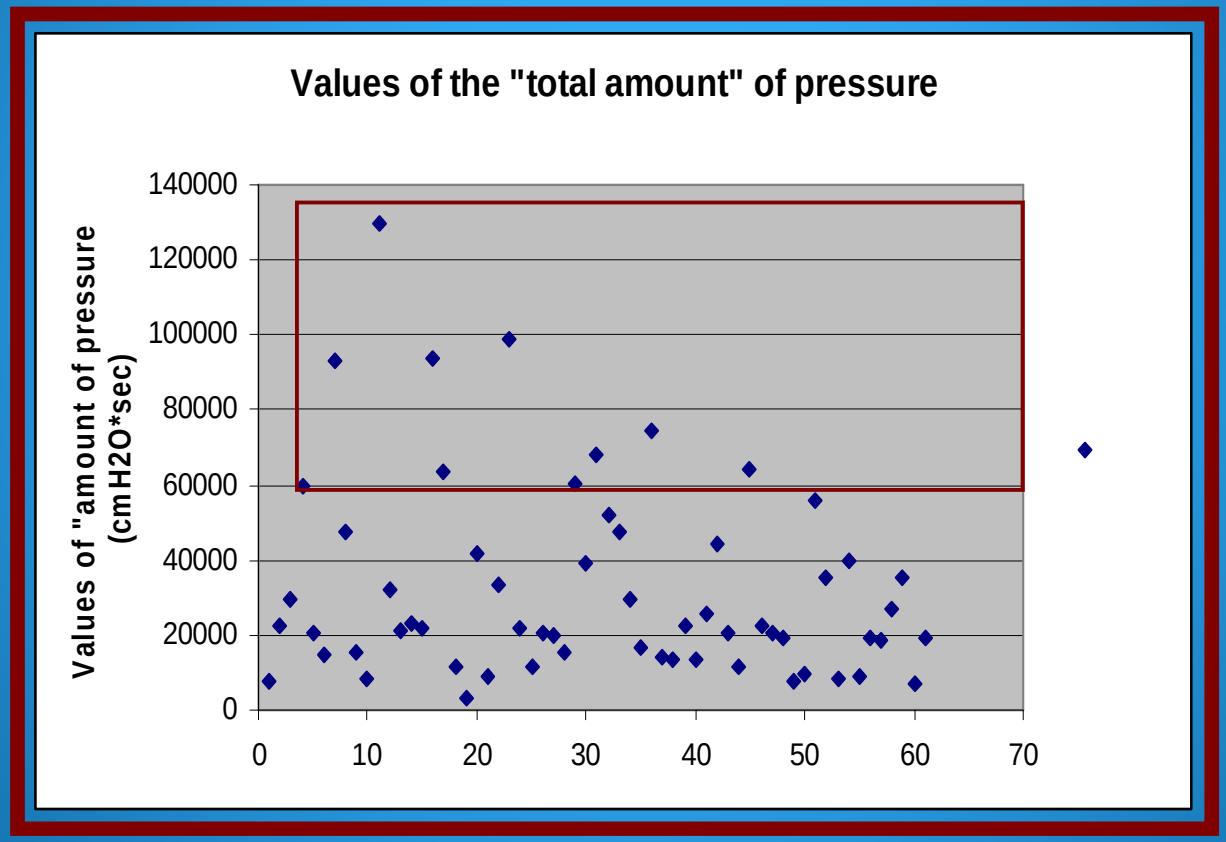
# Results

- Durée de la phase II : 44±25 minutes pendant lesquelles le microsystème a enregistré 11.9± 8 efforts de poussée de 96± 23 secondes de durée.
- 73% des patientes ont accouché spontanément , 23 % par forceps bas d'expulsion, 4 % par ventouse , avec bébés de poids 3278±400gr.
- Analgésie épidurale : 95 %

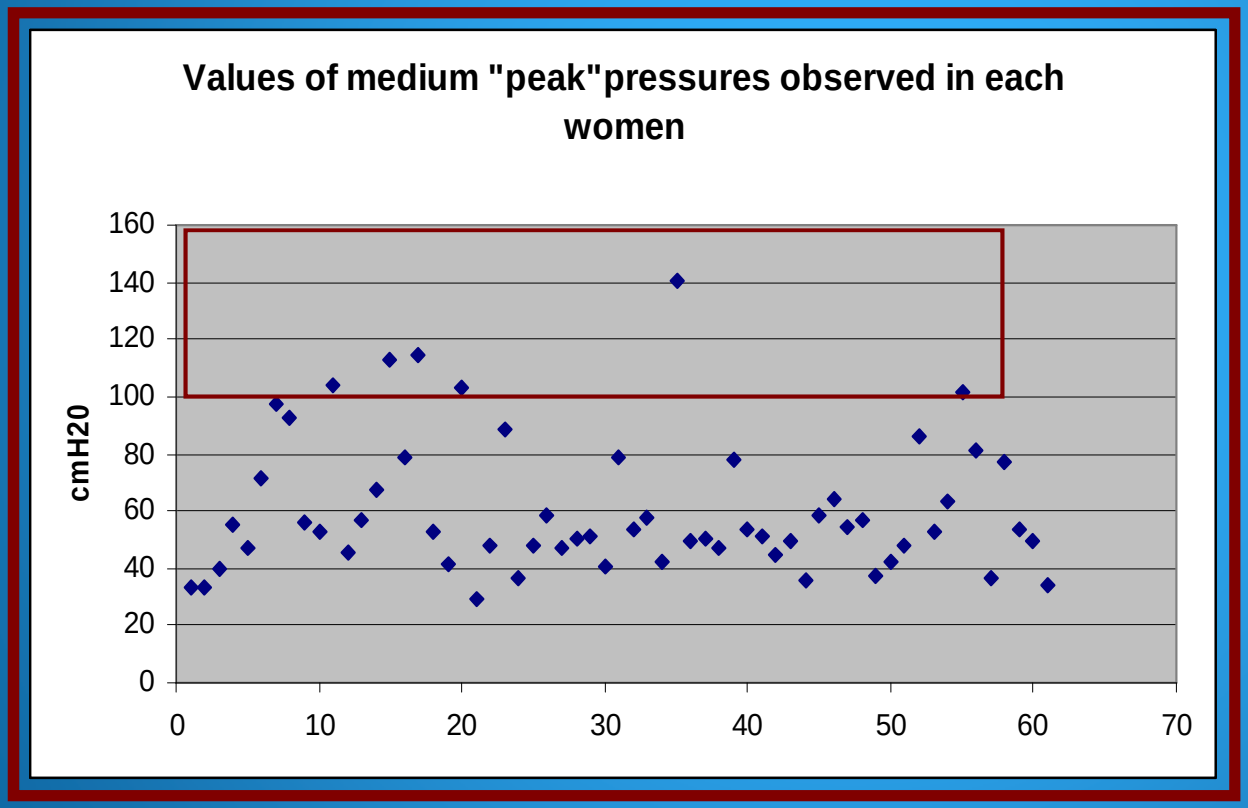
# Results 2

- Valeur moyenne de la surface sous la courbe de poussée : 32362± 26300 cmH20*sec avec une grande variation d'une femme à l'autre
- Valeur moyenne des pics de poussée : 61 ±23 cmH20, dépassant 100 cm H20 chez 8.5 % des patientes.

Scatterplot showing the distribution of the mean values of the areas of pressu
(cmH2O*sec) calculated by the microsystem  in each of the 59 primiparae wo
17 % of the women have higher values



Scatterplot showing the distribution of the mean values of the peak pressure calculated by the microsystem in each of the 59 primiparae women : 10 % of the women have Peak values > 100 cm H2O



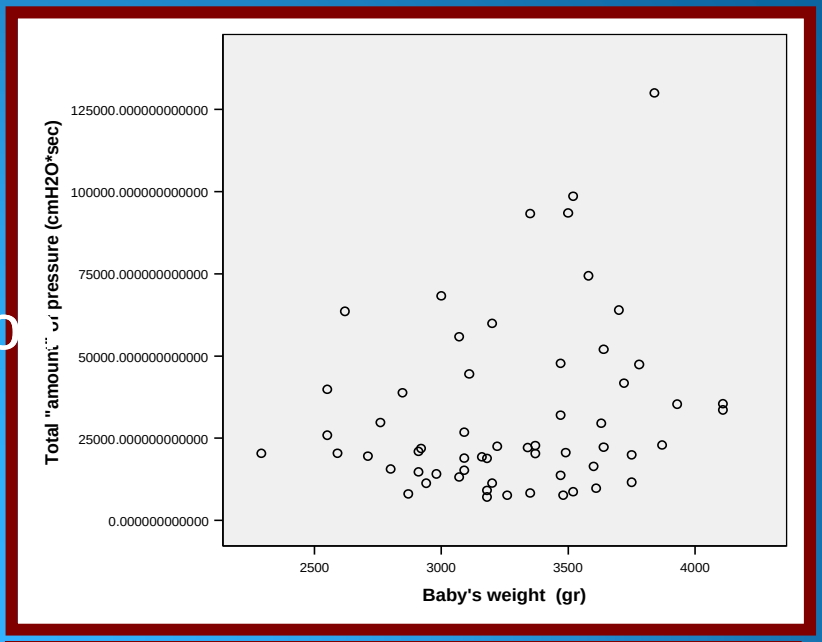
Pas de corrélations entre le poids des bébés et

Surface sous la courbe de pressio

(cm H20* sec):

i.e. forces de longue durées

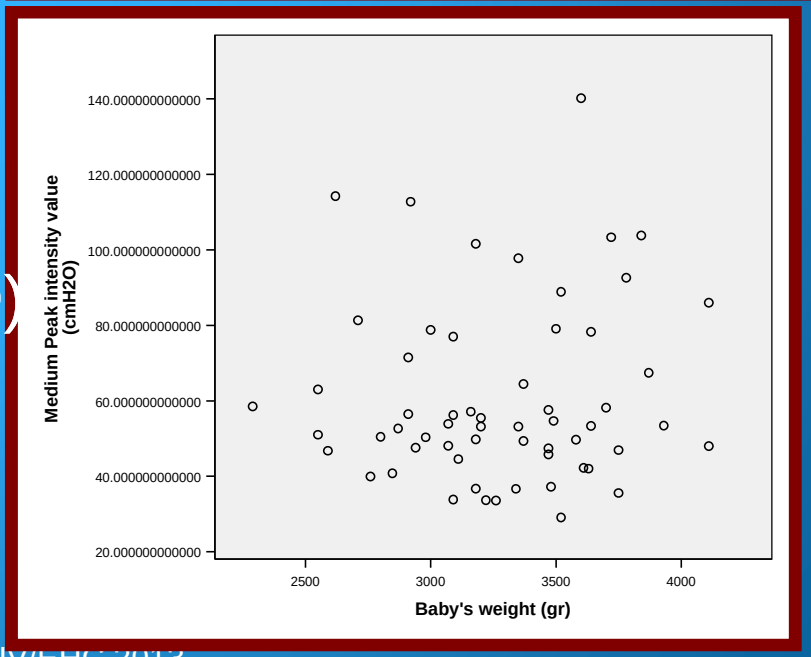
R: 0.19, P:0.15




Valeurs des pics de pression :i.e

Forces de courtes durée (cmH2O)

R: 0.05, P: 0.7



# Correlations avec les plaintes des patientes (Phase II)

Questionnaires remplis et retournés : 14 ± 5 mois après l'accouchement

| Wexner Score | Spontaneous deliveries (N :43) | Forceps deliveries (N:17) | P values CHI square |
|---|---|---|---|
| Gas Incontinence | 37%: never<br>25%: rarely ( < 1 month)<br>14%: sometimes (<1 week)<br>19%: usually (< 1 day)<br>5%:always (> I day ) | 47% : never<br>47%: rarely ( < 1 month)<br>6%: sometimes (<1 week)<br>0: usually (< 1 day)<br>0:always (> I day ) | 0.043 |
| Liquid stools incontinence | 95% : never<br>3% : sometimes (<1 week)<br>2%: usually (< 1 day) | 94% : never<br>6%: sometimes (<1 week) 0: usually (< 1 day)<br>0: always (> I day ) | 0.84 NS |
| Solid stools incontinence | 93%: never<br>7%: sometimes(<1 week) | 100%: never | 0.36 NS |
| Female Sexual Function Index (FSFI) | Spontaneous deliveries (N :41) | Forceps deliveries (N:16) | |
| How often did you reach orgasm (climax) over the past four weeks | 37 %: Almost always or always<br>22%: Most times (more than half the time)<br>24 %: Sometimes (about half the time)<br>12 % : A few times (less than half the time)<br>5 % : Almost never or never | 44 %: Almost always or always<br>12 % : Most times (more than half the time)<br>12 % : Sometimes (about half the time)<br>26 %: A few times (less than half the time)<br>6 %: Almost never or never | 0.77 NS |
| How difficult was it for you to reach orgasm (climax) over the past four weeks (N :55) | 52 %: not difficult<br>30 %: slightly difficult<br>18 %: difficult<br>0: very difficult | 50 % : not difficult<br>19 %: slightly difficult<br>12: difficult<br>19 %: very difficult | 0.21 NS |

Table of symptoms present in the population of women with spontaneous deliveries (N:43) and in the population of women with forceps deliveries (N:17)

| UDI-6 | Spontaneous deliveries (N:43) | Forceps deliveries (N:17) | P values CHI square |
|---|---|---|---|
| Frequent urination? | 63% : Not at all<br>19% : a little bit<br>14%: moderately<br>4% : greatly | 58 %: Not at all (0.16)<br>23%: a little bit<br>19 %: moderately<br>0 : greatly | 0.91 NS |
| Urine leakage related to the feeling of urgency? | 77%: Not at all<br>16%: a little bit<br>5%: moderately<br>2%: greatly | 82 %: Not at all<br>12%: a little bit<br>6 %: moderately<br>0: greatly | 0.89 NS |
| Urine leakage related to physical activity, coughing or sneezing | 63%: Not at all<br>23 %: a little bit<br>14 %: moderately<br>0: greatly | 76%: Not at all<br>12 %: a little bit<br>12 %: moderately<br>0: greatly | 0.25 NS |
| Small amounts of urine leakage (that is drops)? | 81 : Not at all<br>12%: a little bit<br>7%: moderately<br>0: greatly | 82 %: Not at all<br>12 %: a little bit<br>6 %: moderately<br>0: greatly | 0.80 NS |
| Stress incontinence and/or drops escape | 56%: Not at all<br>30 %:a little bit<br>7%: moderately<br>7%: greatly | 71 %: Not at all<br>12%:a little bit<br>12%: moderately<br>5 %: greatly | 0.29 NS |
| Difficulty emptying your bladder? | 84%: Not at all<br>9 %: a little bit<br>2 %: moderately<br>5 %: greatly | 71%: Not at all<br>24 %: a little bit<br>5% : moderately<br>0 : greatly | 0.34 NS |
| Pain or discomfort in the lower abdominal or genital area | 77% : Not at all<br>9%: a little bit<br>7%: moderately<br>7 %: greatly | 71%: Not at all<br>24 %: a little bit<br>5%: moderately<br>0: greatly | 0.27 NS |
| UDI-6 Score | 0 : 39 %<br>1-2: 26%<br>3-4: 14 %<br>> 4 : 21 % | 0 : 35 %<br>1 - 2: 36 %<br>3-4: 18 %<br>>4 : 11 | 0.77 NS |

Table of symptoms present in the population of women with spontaneous deliveries (N:43) and in the population of women with forceps deliveries (N:17)

| Duration of bearing efforts correlated with | Spontaneous deliveries (N :43) | Outlet forceps deliveries (N :17) |
|---|---|---|
| | R Spearman ( P) | R Spearman ( P ) |
| UDI-6 : Feeling of urgency to void | 0.114 (0.46) | -.252 (0.328) |
| UDI-6 : Urge incontinence | 0.142 (0.365) | -0.170 (0.515) |
| UDI-6 : Stress incontinence | 0.116 (0.45) | -.026 (0.920) |
| **UDI-6 :** Drops escape | -0.090 (0.56) | -.465 (.060) |
| **UDI-6 :** Stress incontinence + drops escape | 0.133 ( 0.40) | -.232 (.371) |
| **UDI-6 :** Difficulties for voiding | 0.336 (0.027) | -.130 (.618) |
| **UDI-6** : Lower abdominal discomfort | 0.446 (0.004) | -.399 (.112) |
| **UDI-6 :** Scoring | 0.210 ( 0.176) | -.319 (.212) |
| **Wexner :** Gas incontinence | -0.044 ( 0.78) | -.007 (.979) |
| **Wexner "total"scoring** | - 0.06 (0.69) | -.007 (.979) |
| **FSFI:** Frequency of orgasm | -.224 (0.15) | -.129 (.635) |
| **FSFI:** Difficulties for reaching orgasm | - 0.17 (0.28 ) | -.092 (.735) |

La durée des poussées présente une corrélation significative avec la présence de troubles mictionnels et de troubles statiques dans le groupe de femmes avec accouchements spontanés

| Surface area under the pressure curve correlated with | Spontaneous deliveries (N :43) | Outlet forceps deliveries (N :17) |
|---|---|---|
| | R Spearman ( P) | R Spearman ( P ) |
| UDI-6 : Feeling of urgency to void | -.081 (.607) | .524 (0.03)* |
| UDI-6 : Urge incontinence | -.044 (.779) | .482 (**.050**) |
| UDI-6 : Stress incontinence | -.090 (.565) | .337 (.186) |
| **UDI-6 :** Drops escape | .007 (.964) | .541 (**.025**) |
| **UDI-6 :** Stress incontinence + drops escape | -.118 (.450) | .446 (.072) |
| **UDI-6 :** Difficulties for voiding | -.283 (**.066**) | .069 (.792) |
| **UDI-6** : Lower abdominal discomfort | -.302 (**.049**)* | .078 (.765) |
| **UDI-6 :** Scoring | -.159 (.310) | .355 ( 162) |
| **Wexner :** Gas incontinence | -.396 (**.008**) | .253 (.327) |
| **Wexner "total"scoring** | -.371* (**.014**) | .253 (.327) |
| **FSFI:** Frequency of orgasm | .147 (.360) | .527(**.036**)* |
| **FSFI:** Difficulties for reaching orgasm | .136 (.403) | .613 (**.012**)* |

La surface sous la courbe de pressions lors des poussées présente une corrélation significative avec la présence d'urgences mictionnelles, d'incontinence d'urgence, de pertes de gouttes d'urine et de troubles dysorgastiques vaginaux dans le groupe forceps.

| Peak pressure during bearing efforts correlated with | Spontaneous deliveries (N :43) | Outlet forceps deliveries (N :17) |
|---|---|---|
| | R Spearman ( P) | R Spearman ( P ) |
| UDI-6 : Feeling of urgency to void | -.054 (.731) | .068 (.795) |
| UDI-6 : Urge incontinence | .074 (.638) | -.194 (.456) |
| UDI-6 : Stress incontinence | -.154 (.326) | -.186 (.474) |
| **UDI-6 :** Drops escape | .267 (**.084)** | .161 (.538) |
| **UDI-6 :** Stress incontinence + drops escape | -.081 (.606) | -.014 (.958) |
| **UDI-6 :** Difficulties for voiding | -.190 (.223) | -.187 (472) |
| **UDI-6** : Lower abdominal discomfort | -.074 (.636) | -.097 (.712) |
| **UDI-6 :** Scoring | -.250 (.334) | -.161 (.536) |
| **Wexner :** Gas incontinence | -.219 (.397) | -.188 (.469) |
| **Wexner "total"scoring** | -.268 (.082) | -.188 (.469) |
| **FSFI:** Frequency of orgasm | -.144 (.368) | .215 (.423) |
| **FSFI:** Difficulties for reaching orgasm | -.158 (.330) | .176 (.515) |

La valeur des pics de pression à l'acmé de la poussée ne présente aucune corrélation significative avec les diverses fonctions du plancher pelvien


Surface Area under the « pressure curve » (cm H20* sec): i.e. long-lasting forces +
Duration of the bearing efforts (sec)

PARAMETRES ENREGISTRES PAR LE MICROSYSTEME :

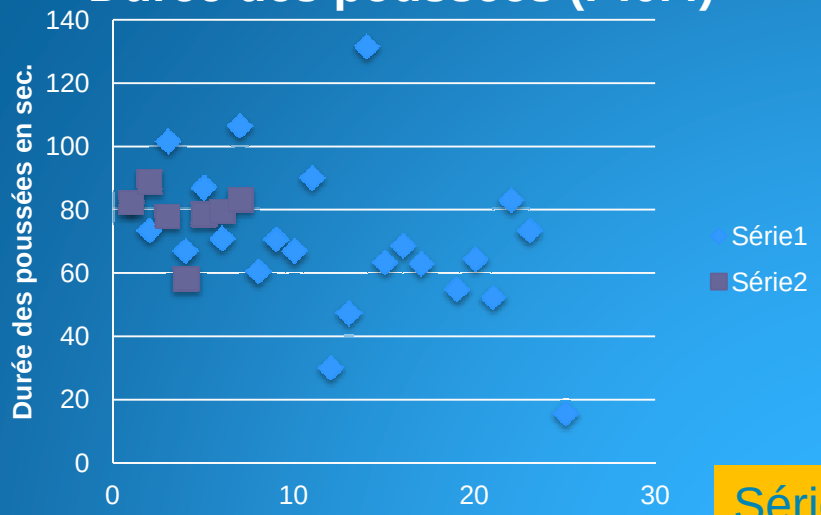
COMPARAISONS EN FONCTION DES SYMPTÔMES URINAIRES, ANO-RECTAUX ET SEXUELS

SERIE 1 : PAS DE SYMPTOMATOLOGIE

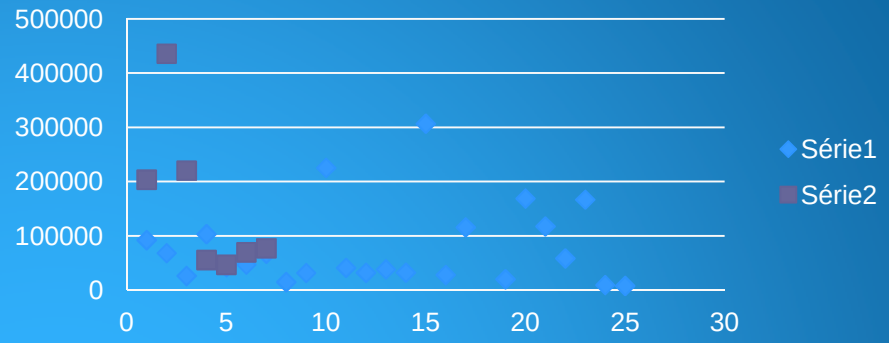
SERIE 2 : SYMPTOMATOLOGIE IMPORTANTE

# REPONSE SEXUELLE

## Durée des poussées (P:0.4)

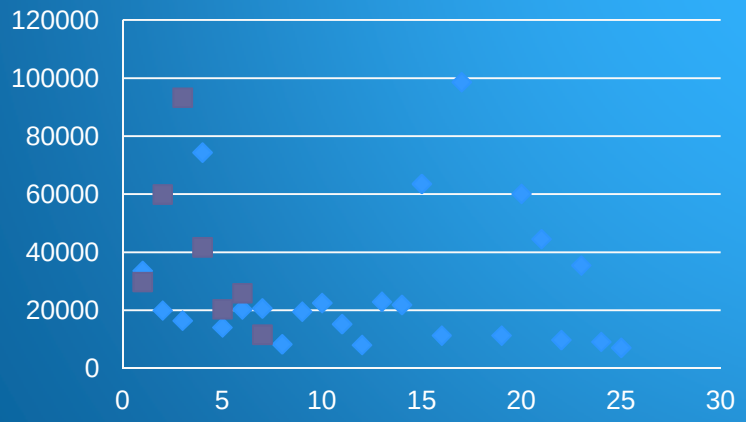



## Surface totale sous la courbe (P:0.05)

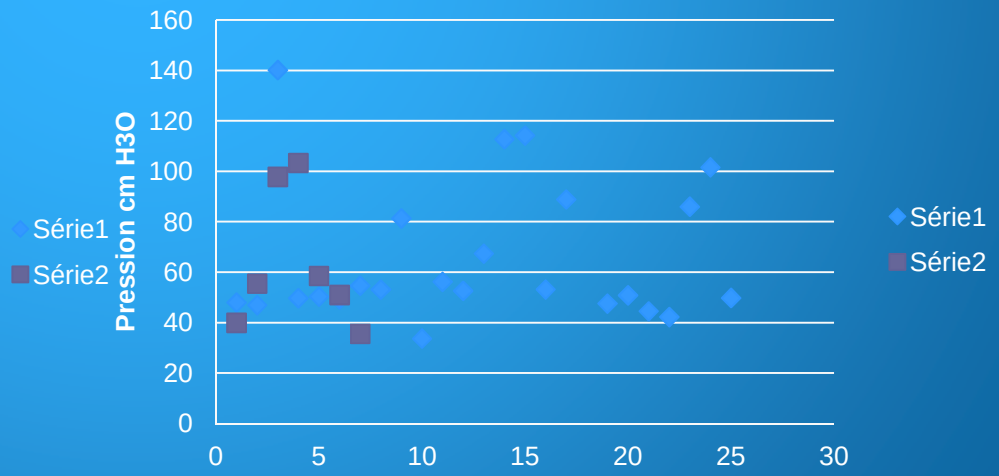



Série 1 : pas de changement réponse orgasmique (N:25)
Série 2 : absence de réponse orgasmique (N:7)

## Surface sous la courbe a la poussée (P:0.15)

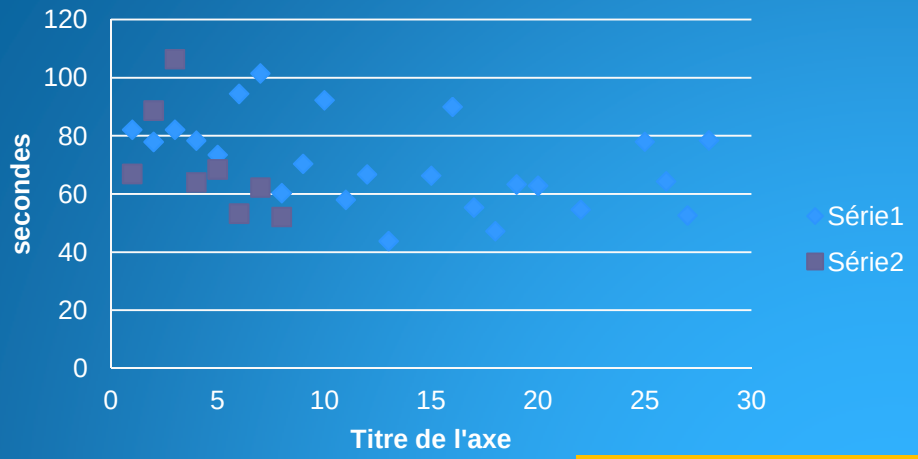



## Pics de pressions P:0.8

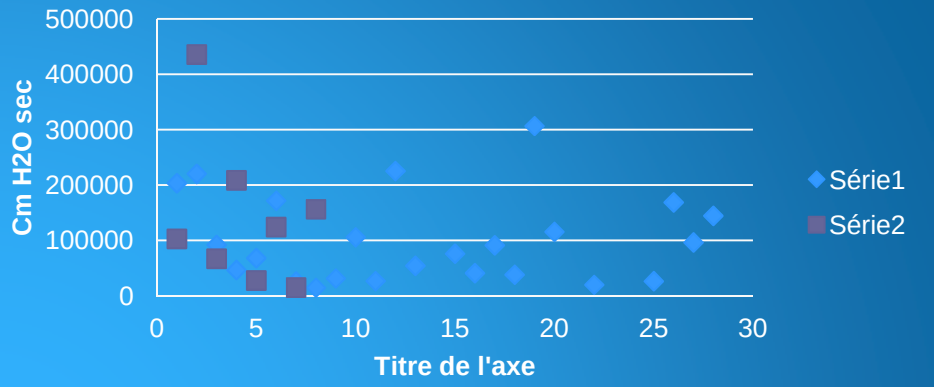


# INCONTINENCE URINAIRE A L'EFFORT

## Durée des poussées (P:0.9)

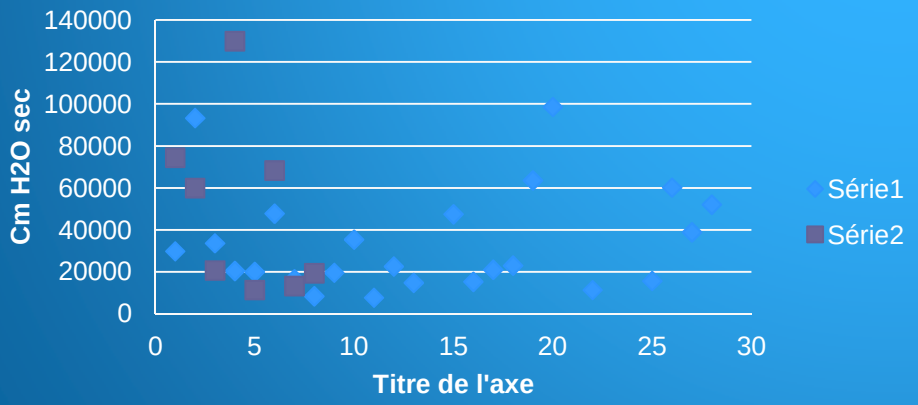



## Surface totale sous la courbe (P:0.29)

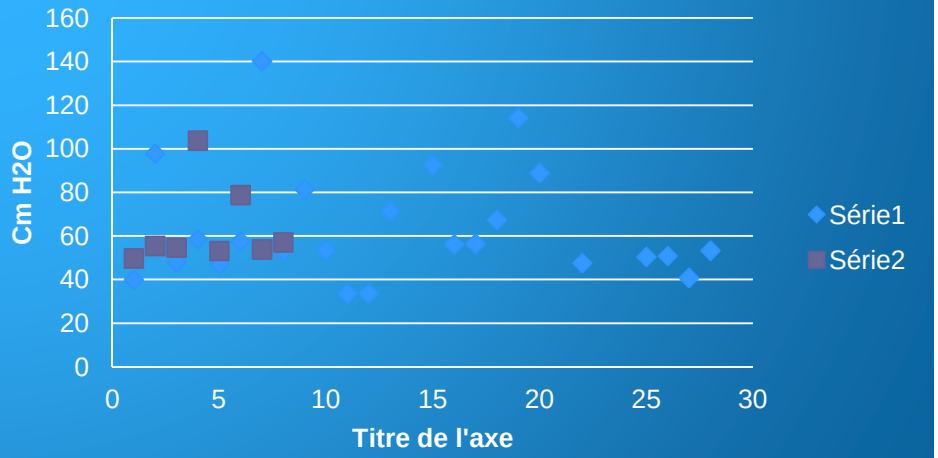



Série 1 : pas d'incontinence a l'effort(N:24)
Série 2 : incontinence à l'effort (N:8)

## Surface sous la courbe a la poussée (P:0.20)

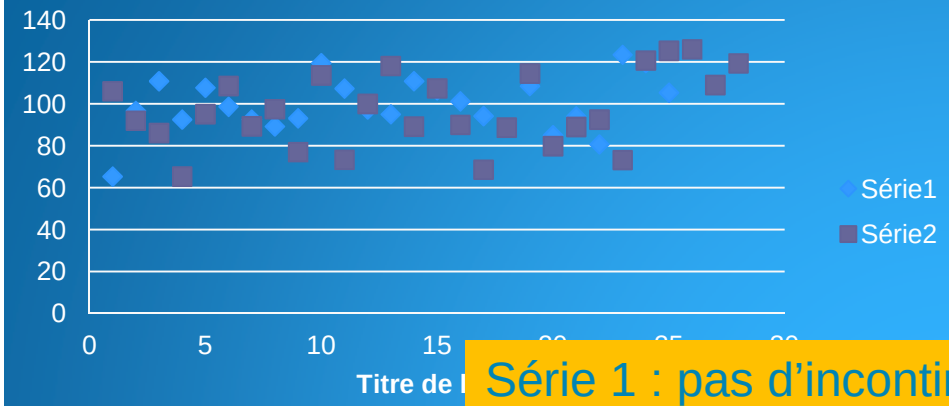



## Pics de pression (P:0.9)

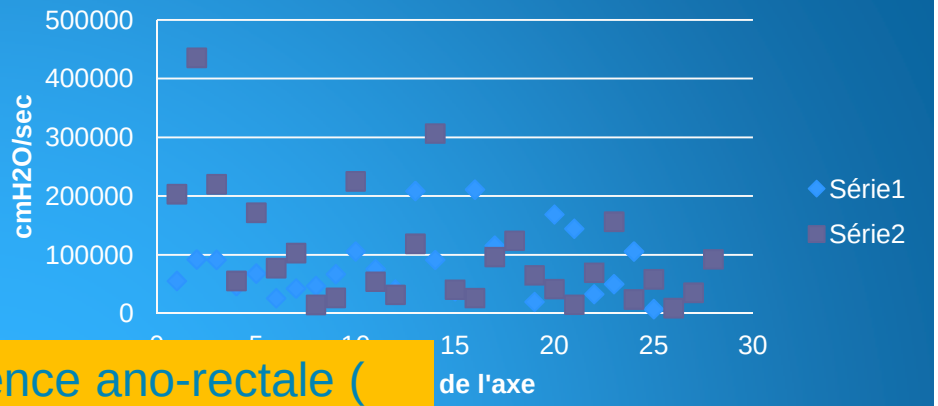


# INCONTINENCE ANO-RECTALE

## Durée des poussées (P:0.5)

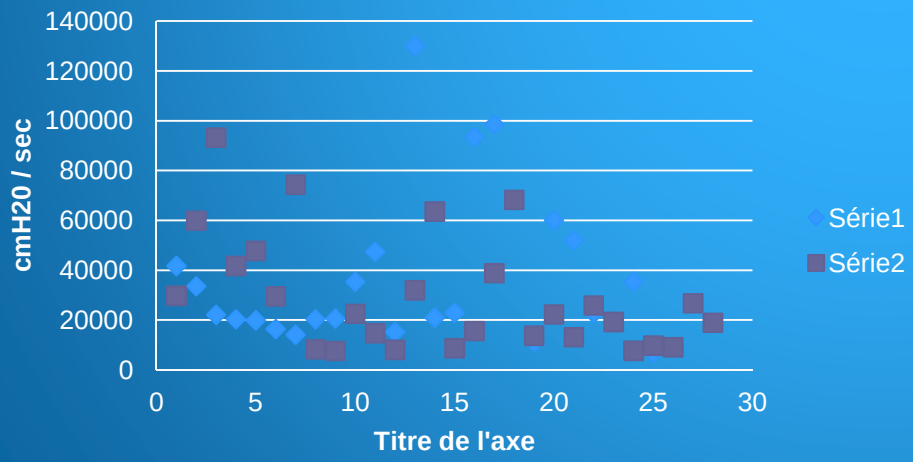



## Surface tot. sous la courbe (P:0.3)

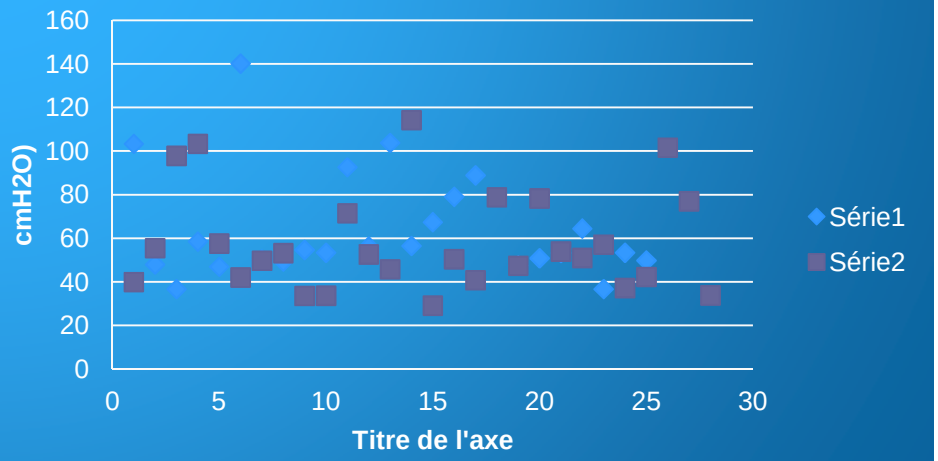



Série 1 : pas d'incontinence ano-rectale ( N:24)
Série 2 : incontinence ano-rectale (N:28)

## Surface sous la courbe (P:0.35)




## Pics de pression (P:0.4)



# Conclusions (1)

- L’enregistrement des pressions intra-rectales pendant la phase expulsive montre d’importantes variations d’une parturiente à l’autre .
- Les paramètres enregistrés (durée des poussées, surfaces sous la courbe et pics de pressions ) ne montrent pas de corrélation avec le poids du bébé.

# CONCLUSIONS (2)

- Corrélations significatives entre la durée des poussées et certains paramètres de la fonction urinaire (troubles mictionnels et prolapse)
- Pas de corrélations entre les pics de pressions et les troubles urinaires, sexuels ou ano-rectaux (pertes de gouttes d'urine : P:0.08)

# Conclusions (3)

- Corrélations significatives entre les surfaces sous la courbe et certains troubles fonctionnels urinaires, ano-rectaux et sexuels : ceci dans le groupe forceps uniquement : il ne semble pas que ce soit  dû à la pose des cuillères du forceps...mais plutôt à la plus longue durée de la phase de dilatation ( 314± 112 vs 256 ±107min (P:0.07))  et de la phase expulsive ( 52 ±21 vs 39.9 ± 26.2, (P:0.09)) dans le groupe forceps

# Conclusions (4)

- Lorsque l'on « isole » les symptômes urinaires, ano-rectaux et sexuels et que l'on compare les paramètres enregistrés par la capsule dans un groupe avec symptômes et un groupe sans symptômes, les pressions se « chevauchent » dans les deux groupes et ne montrent pas de différence significative (Student T test)

# Conclusions (5)

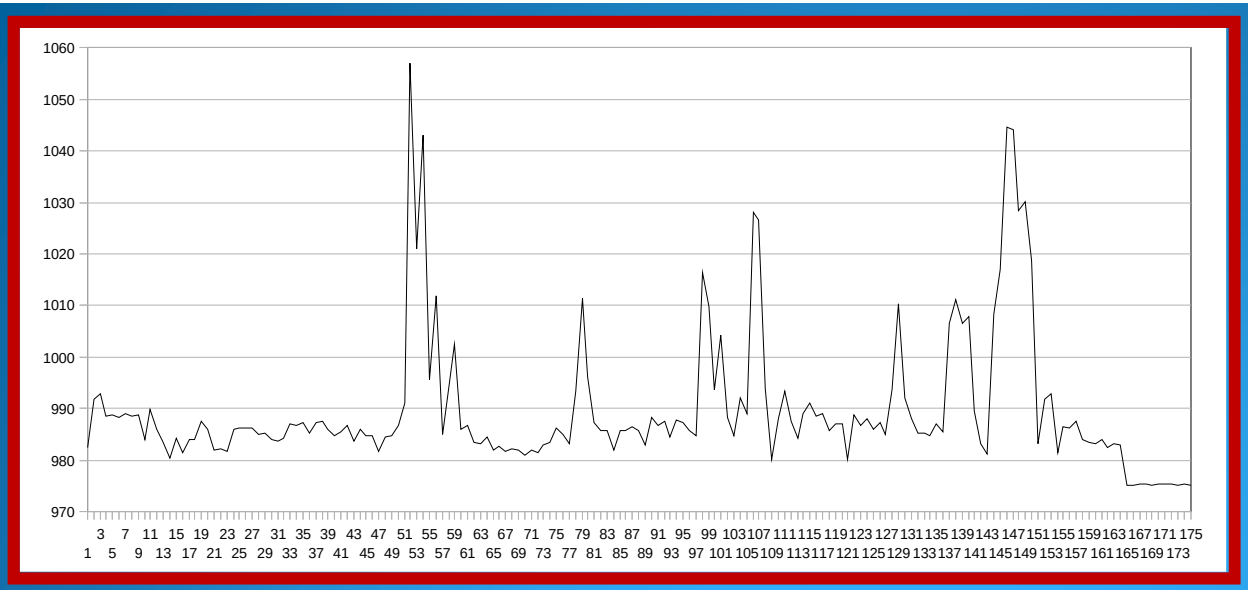
- Cette conclusion montre que les paramètres biologiques ( résistance à l'effet « stretch injury » des structures neuro-musculaires du plancher pelvien) varient d'une parturiente à l'autre et que le paramètre « pressions élevées » n'est pas déterminant dans l'apparition d'un trouble fonctionnel du plancher pelvien.
- Futur : augmenter notre casuistique par une étude multicentrique dans le but de trouver une « break zone »….au-delà de laquelle les lésions neuro-musculaires sont irréversibles …..si cela est démontrable !

# Conclusions (6)

- Les valeurs de pressions intra-pelviennes enregistrées par la capsule sont supérieures à la moyenne chez 8-10 % des parturientes.
- Les valeurs des pics de pressions intra-pelviennes sont similaires à celles enregistrées à l'intérieur de la cavité utérine

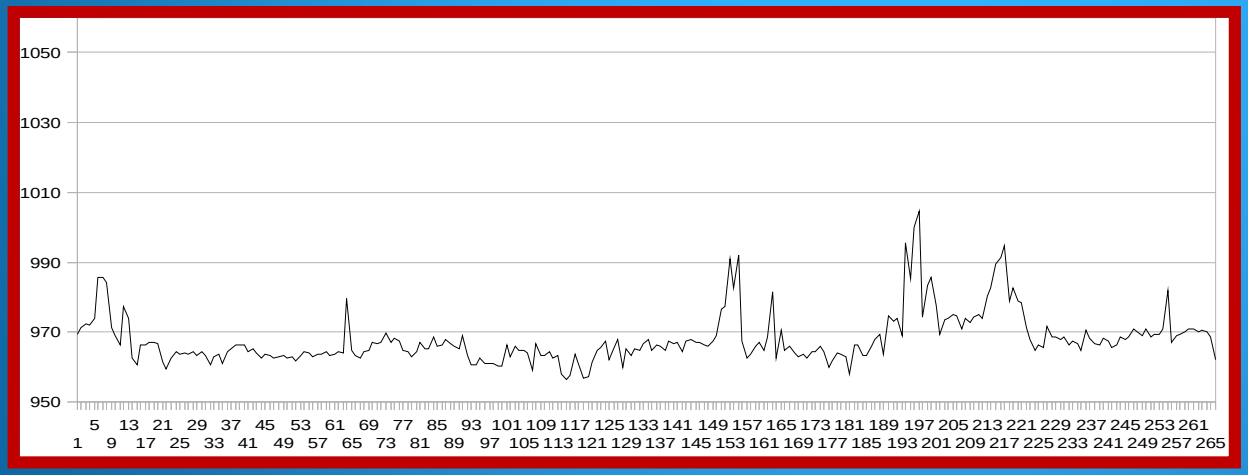
# Upgrade du microsystème : financement obtenu et idées folles

- batterie + programme lecteur –calculateur de l'enregistrement du tracé on-line
- possibilité de lecture directe on-line sur un écran de PC ou sur un smartophone
- idée folle : une capsule reliée à un petit fil sortant de l'anus, capsule émettrice sans fil : impossibilité d'utilisation des Radio-fréquences : destructions cellulaires  possibles voire certaines du tissu cérébral du fœtus…transmission par US émetteur dans la capsule et récepteur hors de la mère : possible mais encore à faire….financement ?




# Does th G-Spot really exists

Fig 1a ***(Patient No 1: 32 years old, para 1, baby 3800 g, clin.exam: no prolapse, levator contraction Oxford scale 4)*** : intra-vaginal pressures during a clitoral stimulation only : time three minutes with two orgasms waves : the first one with an intra-vaginal pressure of 73 cm H2O, then after five attempts, a second orgasm is reached inducing an intra-vaginal pressure of 63 cm H2O




## Utilisation des capsules Wellborn

Fig 1b : intra-vaginal pressures recorded during a G-spot stimulation only : time four minutes and half with three orgasms waves inducing intra-vaginal pressures between 20-30 cm H2O

Meyer/Achtari. Urogyn DGO
CHUV 2013

# Utilisation du wellborn

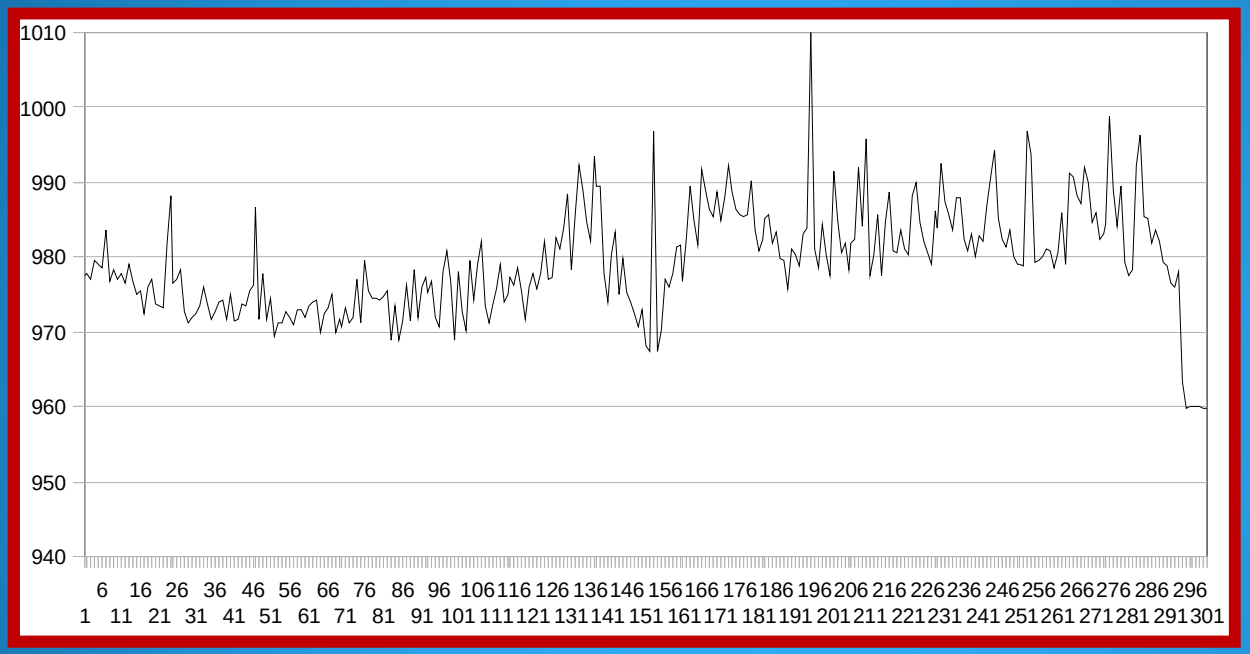



Fig. 2 a ***( Patient No 2: 55 years old, para 1, baby 3200 g, clin.exam: no prolapse, levator contraction Oxford scale 4)*** :
intra-vaginal pressures during a clitoral stimulation only :
time: five minutes with numerous orgasms waves : the highest one inducing an intra-vaginal pressure of  30 cm H2O ( after 206 seconds)

Meyer/Achtari. Urogyn DGO
CHUV 2013

MICROSYSTEME « WELLBORN » : FUTUR ?

1.- ENREGISTREMENT PRESSIONS INTRA-PELVIENNES PENDANT L' ACTIVITE SEXUELLE : INVESTIGATIONS DES TROUBLES SEXUELS POST-ACCOUCHEMENT,

2.- ENREGISTREMENT PENDANT LA REALISATION DES PAD TEST : FONCTION SPHINCTERIENNE EN FONCTION DES PRESSIONS ENREGISTREES

3.- QUANTIFICATION DE L'ACTIVITE PHYSIQUE, etc……

…

Produit Suisse:


SUISSE GARANTIE

SWISS MADE