

Anesthésie pour cœliochirurgie chez la femme enceinte



Chirurgie non obstétricale chez la femme enceinte

Chirurgie pendant la grossesse: 0,15 à 2 %

Grossesses non connues (0,3 à 2,4 %)

6 000 et 80 000 patientes en Europe bénéficient
d'un acte opératoire non obstétrical sous anesthésie

1 200 à 16 000 femmes en France

Krzysztof M, Arch Gynecol Obstet 2007/Données INSEE 2011

Plusieurs niveaux de difficultés

Répercussions de la cœlioscopie

Répercussions de la grossesse

Répercussions de la cœlioscopie au cours
de la grossesse

effets chez la mère

effets chez le fœtus

Répercussions de la pathologie

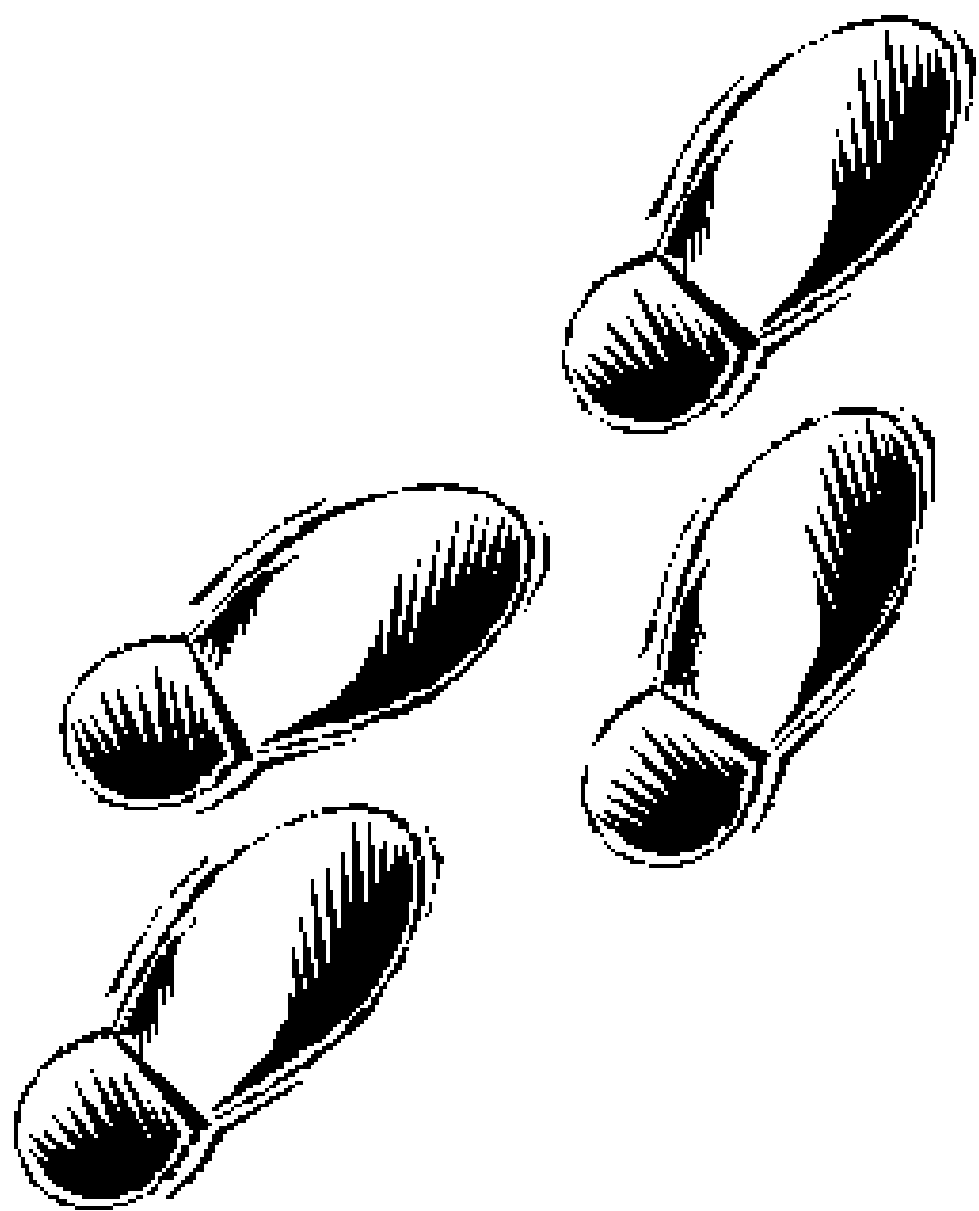


Plusieurs niveaux de difficultés

Dissociation entre les données
expérimentales/travaux initiaux



Les études épidémiologiques, études de
cohortes qui regroupent maintenant des
dizaines de milliers de parturientes



Chirurgie sous anesthésie pendant la grossesse (registre suédois n = 5405/720 000)

Mazze RI, Am J Obstet Gynecol 1989; 161: 1178-85

Evolution	3-13 SA	14-27 SA	28 SA-terme	Total
Morts nés	1,1	1,7	1,5	1,4
Morts < 7 jours	1,4	3,2 *	1,9	2,1*
Malformations	1	0,9	1,5	1,1
PN < 1500 g	1,7 *	3,2 *	1,5	2,2 *
PN < 2500 g	1,4 *	1,8 *	2,2 *	2,0 *

RR (observé / attendu)

Brodsky JB, AJOG 1980; 138: 1165-7

Dunkan PG, Anesthesiology 1980; 64: 790-4

Diagnosis and laparoscopic treatment of surgical diseases during pregnancy: an evidence-based review

**Heidi Jackson · Steven Granger · Raymond Price · Michael Rollins ·
David Earle · William Richardson · Robert Fanelli**

Based on a review of the literature, we believe that the fetal outcome is adversely affected by the type of infection during pregnancy and the misdiagnosed disease, rather than the laparoscopic procedure itself.

Anesthésie générale et fœtus

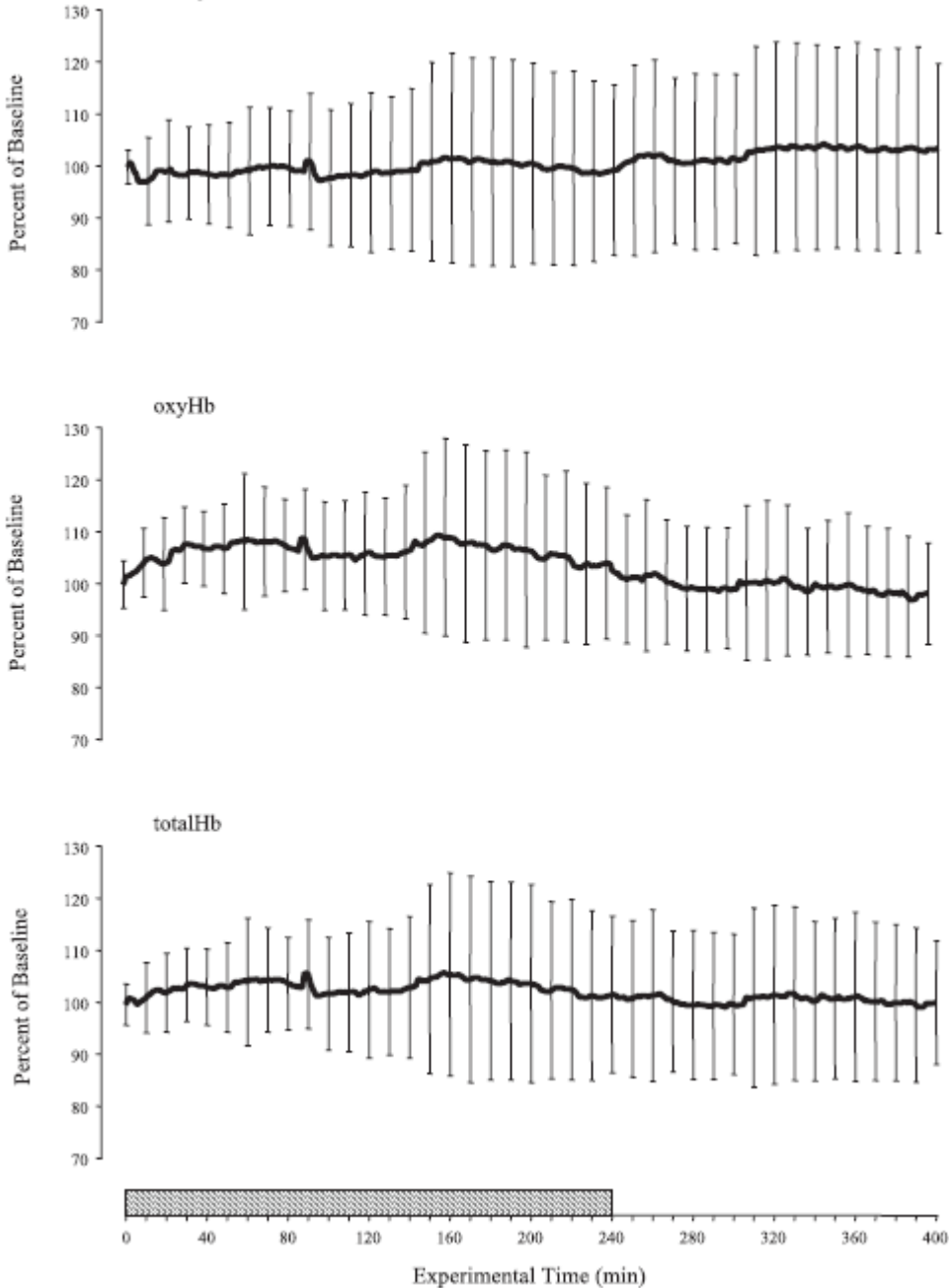
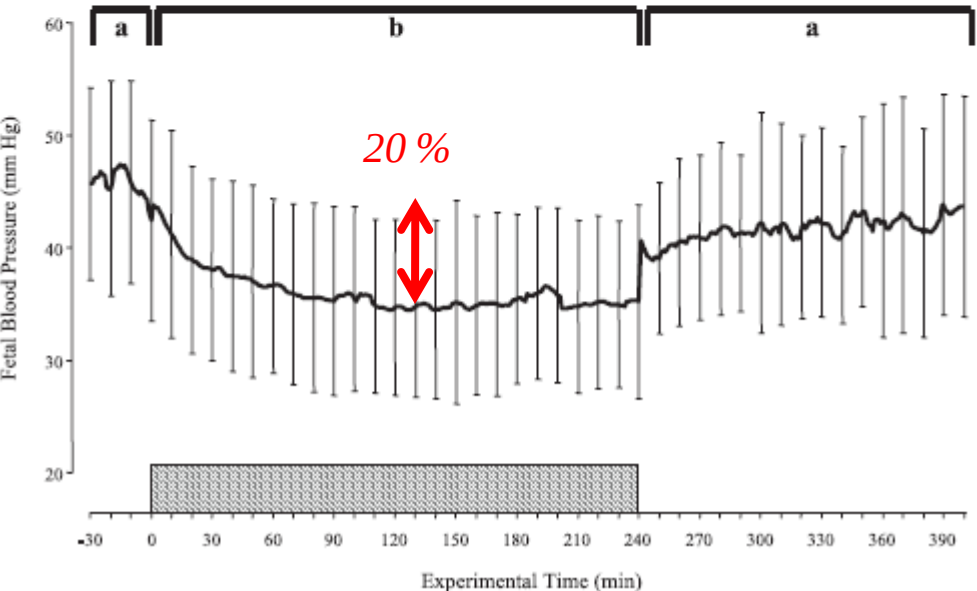
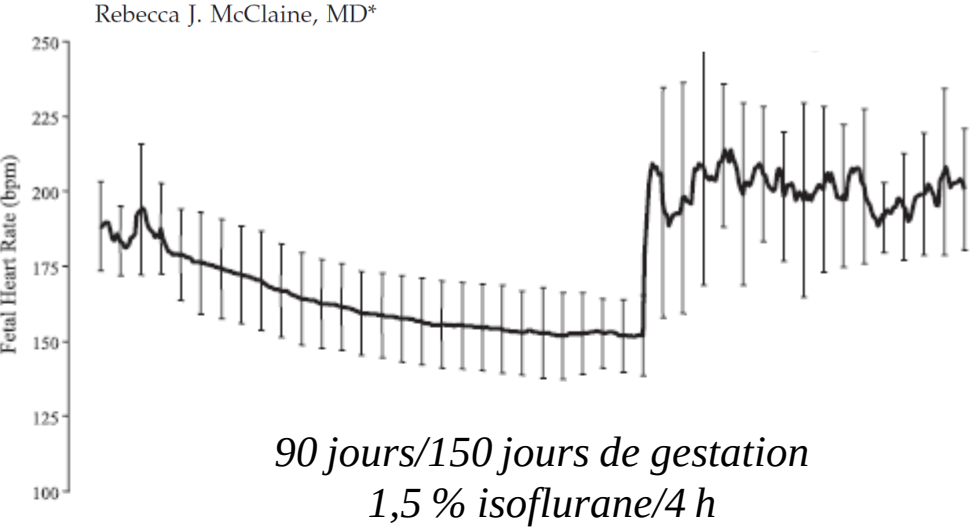
Il n'existe aucune preuve clinique d'une quelconque action délétère fœtale des médicaments d'anesthésie générale utilisés dans le cadre d'une anesthésie pour chirurgie coelioscopique (idem antibiotiques)



A Description of the Preterm Fetal Sheep Systemic and Central Responses to Maternal General Anesthesia

Anesth Analg 2007;104:397-406

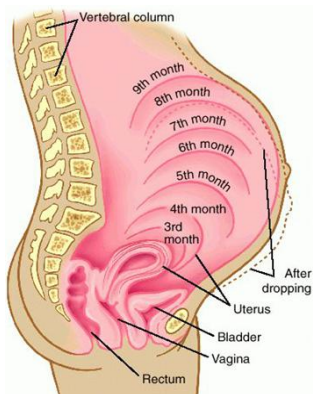
Oxygénation cérébrale fœtale



De quoi doit on avoir peur ?



- Complications maternelles
- Hypoxie fœtale
- Accouchement prématuré



Anaesthesia for non-obstetric surgery during pregnancy

Nina Kylie Dorothy Walton MBChB, FRCA

Venkata Krishnaker Melachuri FRCA, MD

Continuing Education in Anaesthesia, Critical Care & Pain | Volume 6 Number 2 2006
© The Board of Management and Trustees of the British Journal of Anaesthesia [2006].

Table 1 Physiological and anatomical changes associated with pregnancy

Systems	Anatomical	Physiological
Cardiovascular	Supine hypotensive syndrome	↑ Plasma volume 50% ↑ RCV volume 15% ↑ Cardiac output 40% (↑ HR and SV) ↓ Diastolic BP ↓ SVR 15% Basal crackles, gallop rhythm, systolic flow murmur, axis deviations, atrial and ventricular ectopics
Respiratory	↑ Thoracic circumference (5–7 cm) Elevation of diaphragm (3–5 cm) Upper airway calibre ↓ (Capillary engorgement and oedema of the airway)	↑ MV 45% (mainly ↑ tidal volume) ↓ FRC 10–25% (↓ ERV and RV) ↑ Oxygen consumption 20% ↓ Pa_{CO_2} ↓ MVO_2 ↓ MAC 20–30% ↓ ED of IV sedatives and hypnotics
CNS		↑ GFR (leads to ↓ plasma creatinine and urea) Renal glucosuria
Renal	Minimal renal enlargement Dilated calyceal system and ureters ↓ bladder capacity	
Gastrointestinal	Decreased lower oesophageal sphincter tone Elevation of stomach (enlarging uterus)	↑ Gastric volume and acidity Delayed gastric motility and food absorption
Coagulation		↑ Activity of coagulation factors (fibrinogen, vii, viii, ix, x); ↑ platelet count
Endocrine		Insulin sensitivity during first trimester but later ↑ insulin resistance

RCV, red cell volume; HR, heart rate; SV, stroke volume; BP, blood pressure; SVR, systemic vascular resistance; MV, minute volume; FRC, functional residual capacity; Pa_{CO_2} , arterial carbon dioxide tension; MVO_2 , mixed venous oxygen; MAC, minimum alveolar concentration; ED, effective dose; GFR, glomerular filtration rate.

1^{er} trimestre de la grossesse (> 6-8 SA)

↑ VO₂ (30-60%) *Hypoxie (tolérance apnée)*

↓ CRF (20% / > 50%) *Préoxygénation (> FeO₂)*

Diaphragme/diamètres thoraciques

Œdème des VAS/volume des seins

Contrôle des VAS

V_t ↑ > 10^e semaine PaCO₂ = 30 mmHg

Tableau 3. Gazométrie sanguine maternelle

	Non enceinte	Premier trimestre	Deuxième trimestre	Troisième trimestre
PaCO ₂ (mmHg)	40	↓ 30 ↑	30	30
PaO ₂ (mmHg)	100	107	105	103
pH	7,40	↑ 7,44 ↓	7,44	7,44
HCO ₃ (mEq.L ⁻¹)	24	= 21 =	20	20

The Effect of Changes in Maternal pH and P_{CO₂} on the P_{O₂} of Fetal Lambs

Etsuro K. Motoyama, M.D., Guy Rivard, M.D.,† Fiona Acheson, F.F.A.R.C.S.I.,‡
Charles D. Cook, M.D.§*

Anesthesiology, 1967

Hypocapnie

hypoxémie/acidose fœtale

Hypercapnie

acidose fœtale

Alcalose

↓ DUP & ↑ affinité Hb/O₂

Effets en fonction de l'âge de la grossesse

PaCO₂ entre 30 et 34 mmHg

Arterial to End-tidal Carbon Dioxide Pressure Difference during Laparoscopic Surgery in Pregnancy

Kodali Bhavani-Shankar, M.D.,* Richard A. Steinbrook, M.D.,† David C. Brooks, M.D.,‡
Sanjay Datta, F.F.A.R.C.S.§

Anesthesiology
2000; 93:370-3

Conclusions: Capnography is adequate to guide ventilation during laparoscopic surgery in pregnant patients. Respiratory acidosis did not occur when PET_{CO₂} was maintained at 32 mmHg during carbon dioxide pneumoperitoneum.

Paramètres	Pré-insufflation	Insufflation	Post-insufflation
PTECO ₂ (32)	32,1 (1,6)	32,4 (1,1)	32,7 (1,4)
PaCO ₂	34,5 (2,6)	35 (1,7)	34,6 (2,5)
PaCO ₂ - PTECO ₂	2,4 (1,5)	2,6 (1,2)	1,9 (1,4)
pH	7,42 (0,02)	7,41 (0,02)	7,41 (0,03)
VM (l/mn)	5,6 (1,2)	7,2 (1,2)*	5,8 (1,2)
Pip (cm H ₂ O)	19,5 (4,6)	24,6 (5)*	19,8 (4,2)

N=8/17-30 SA/cholécystectomie/PIP 11,7 ± 1,3 mm Hg (CO₂)/durée: 83,7 min (36,3 min)

≥ 2^e trimestre de la grossesse

Modifications hémodynamiques

Modifications du SNC

Modifications de la fonction digestive

Modifications de la coagulation



**Prévention de
l'hypotension**

**réduction MAC (20 à 30%)
titration iv**

Prévention de l'hypotension

Toute hypotension retentit sur le DUP et donc sur le fœtus dès qu'elle se prolonge **PNI/2-3 min**

Remplissage (transport d'O₂) ++

L'éphédrine est le produit qui classiquement préserve le mieux le DUP **PAS < 95-100 mmHg**

 **20-25% valeur contrôle**
Phenyléphrine (Néosynéphrine®) 50 µg/ml

à utiliser rapidement si échec

A Review of the Impact of Phenylephrine Administration on Maternal Hemodynamics and Maternal and Neonatal Outcomes in Women Undergoing Cesarean Delivery Under Spinal Anesthesia
Anesth Analg 2012;114:377-90

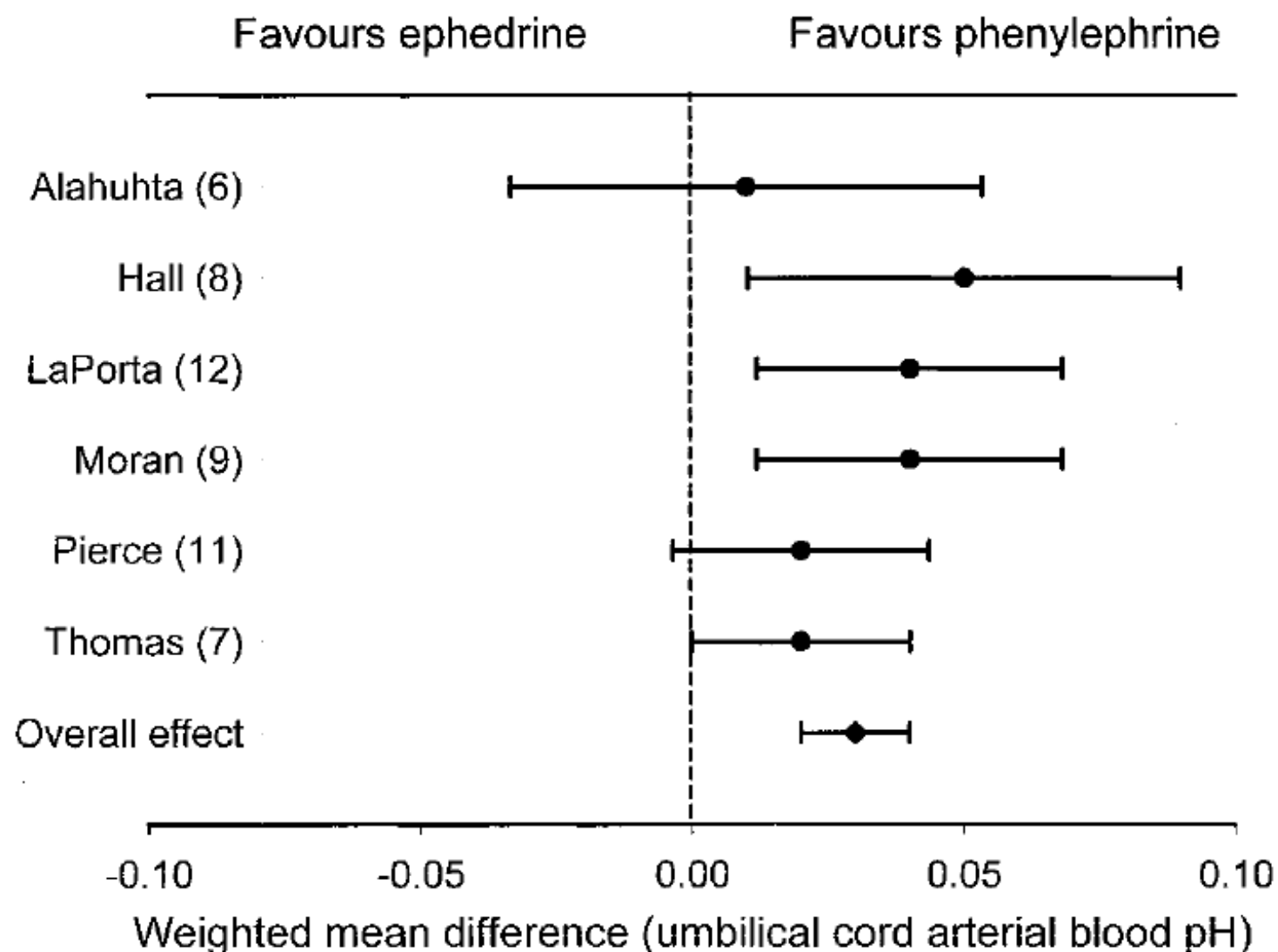


Figure 1. Meta-analysis of trials. The effect of phenylephrine versus ephedrine on umbilical cord arterial blood pH. Data are mean difference with 95% confidence intervals.

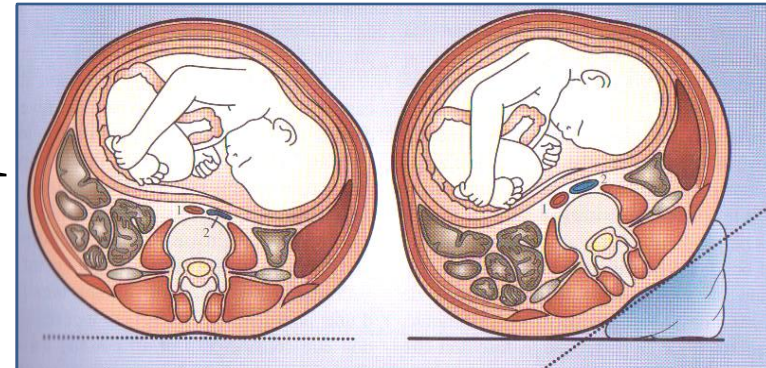
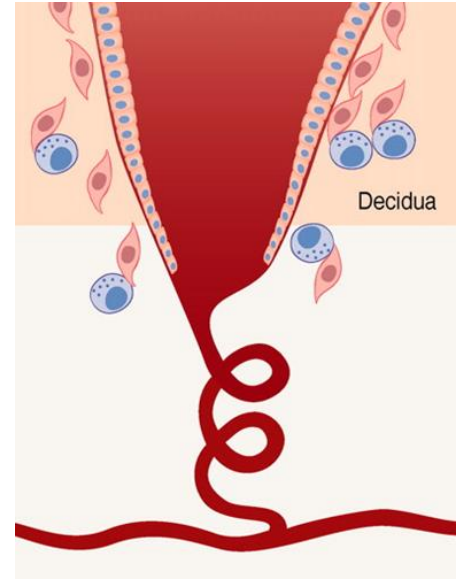
Compression utérocave

Relatif état de dépendance passive
du débit cardiaque maternel/DUP

-30 à 50 %/-20 à 30 %

Le DUP est altéré même si PA normale

DLG de 10-15° après 18-20 SA



Hemodynamics During Laparoscopic Surgery in Pregnancy

Richard A. Steinbrook, MD, and Kodali Bhavani-Shankar, MD

Table 1. Hemodynamics During Laparoscopic Cholecystectomy in Four Pregnant Patients (17, 20, 23, 24 SA)

Time	T1 (preinduction)	T2 (preinsufflation)	T3 (insufflated 5 min)	T4 (insufflated 15 min)	T5 (postextubation)
CI ($\text{L} \cdot \text{min}^{-1} \cdot \text{m}^{-2}$)	5.2 (0.4)	4.8 (0.7)	3.8 (0.6)*†	4.1 (0.6)*	5.8 (1.5)*‡
MAP (mm Hg)	86 (16)	70 (14)*	81 (7)†	83 (7)†	89 (10)†
SVR ($\text{dynes} \cdot \text{s} \cdot \text{cm}^{-5}$)	1324 (381)	1197 (162)	1384 (133)†	1319 (184)	1046 (311)‡
HR (bpm)	74 (8)	68 (7)	70 (8)	68 (3)*	111 (15)*‡

Values are mean (SD).

CI = cardiac index; MAP = mean arterial blood pressure; SVR = systemic vascular resistance; HR = heart rate.

* $P < 0.05$ with respect to T1; † $P < 0.05$ with respect to T2; ‡ $P < 0.05$ with respect to T4.

In conclusion, during laparoscopic cholecystectomy in four pregnant women, we observed hemodynamic changes similar to those in nonpregnant patients, i.e., decreases in CI together with increases in MAP and SVR.

Modifications de la fonction digestive

Tableau 9. Modifications gastro-intestinales

	Premier trimestre	Deuxième trimestre	Troisième trimestre	Travail
Pression de fermeture	Diminuée	Diminuée	Diminuée	Diminuée
Vidange gastrique	Inchangée	Inchangée	Inchangée	Diminuée
Sécrétion gastrique acide	Diminuée	Diminuée	Inchangée	?
% de femmes avec vol. gast. > 25 mL	Inchangé	Inchangé	Inchangé	Augmenté
% de femmes avec un pH > 2,5	Inchangé	Inchangé	Inchangé	Augmenté

Anti-acide non particulière per os

AG à séquence rapide (> 14^e SA)

De quoi doit on avoir peur ?



↪ Complications maternelles
Hypoxie fœtale
Accouchement prématuré

Hypoxie maternelle

Hyperventilation maternelle

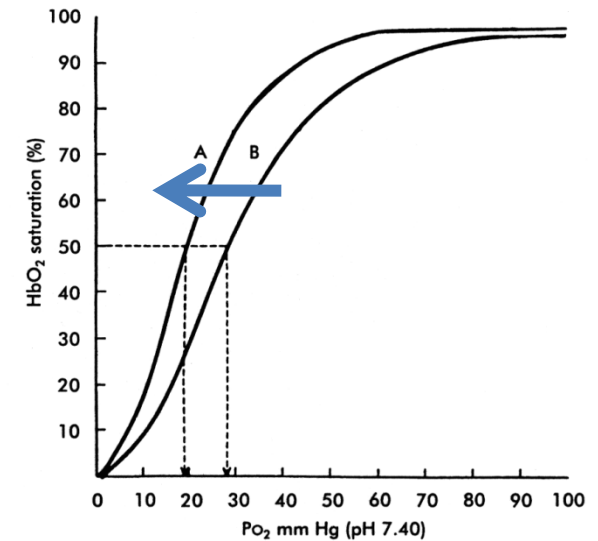
hypocapnie

vasoconstriction AO

↓ débit cardiaque maternel

↓ DUP

Pneumopéritoine ?



Débit Utéro Placentaire (DUP):
10 % du débit cardiaque à terme
 $DUP = (pa - pv)/R = 700 \text{ ml/min}$

Pas d'autorégulation

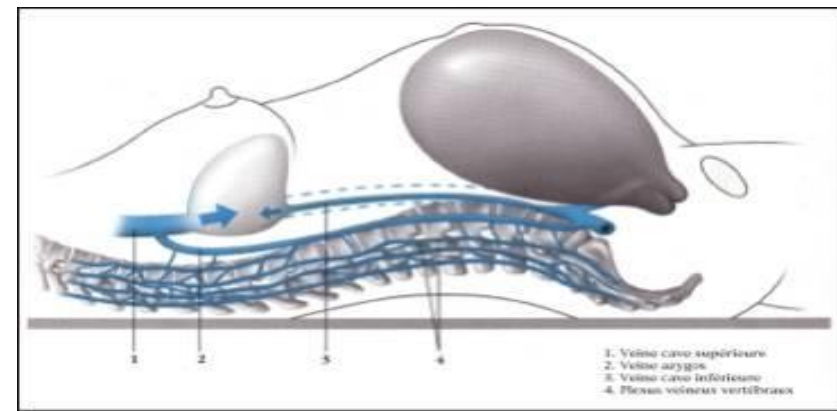
Dépend directement de pression de perfusion systémique

Diminution du DUP:

⬇ Pression artérielle utérine : **hypotension artérielle maternelle, compression aortocave, ...**

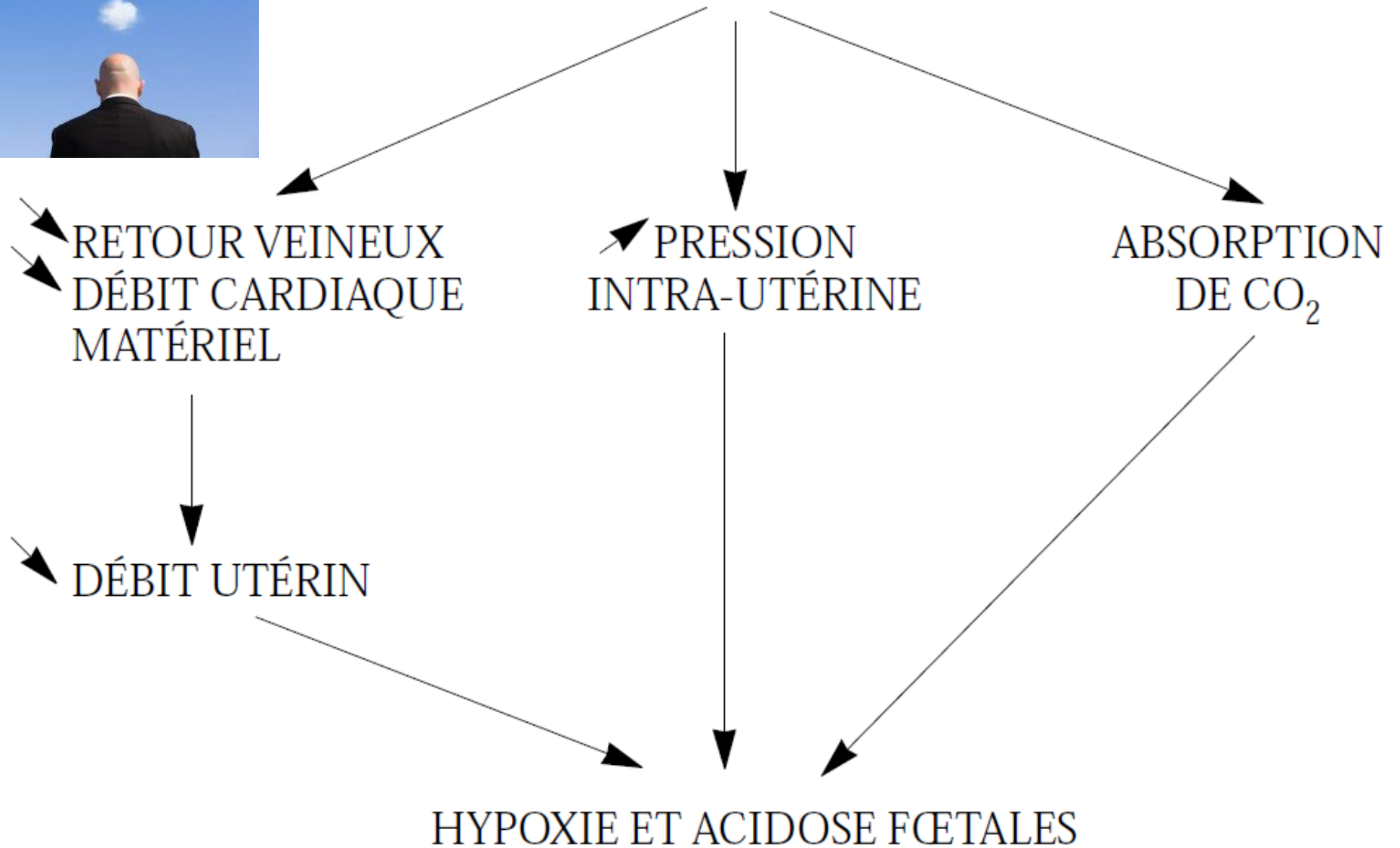
⬆ Pression veineuse utérine : contractions, hypertonie, **ventilation contrôlée, ...**

⬆ Résistances utérines : **vasoconstricteurs exo et endogènes (laryngoscopie), hypocapnie maternelle, ...**



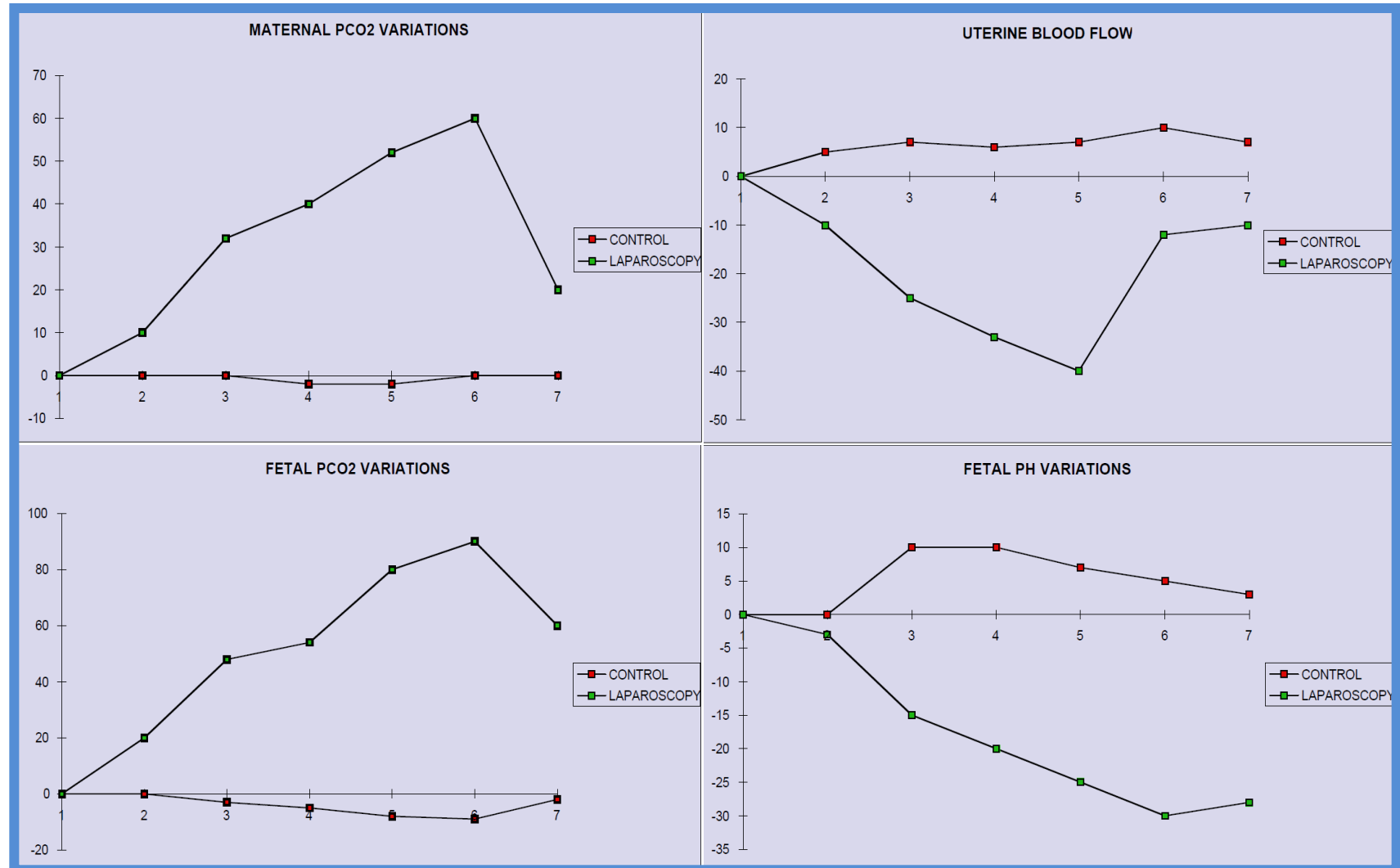


PNEUMOPÉRITOINE



Pneumopéritoine CO2 (PIA 15 mmHg/30 minutes)

Sans modification des paramètres ventilatoires



Curet MJ, Effects of CO2 pneumoperitoneum in pregnant ewes. *J Surg Res* 1996; 63: 339-44.

Une heure de pneumopéritoine à 20 mmHg chez des brebis gravides avec adaptation de la ventilation maternelle pour maintenir constante la PETCO₂ à 37 mmHg (35-40 mmHg)

Barnard JM. Fetal response to carbon dioxide pneumoperitoneum in the pregnant ewe. Obstet Gynecol 1995 ; 85 : 669-74.

Chute de 39 % du DUP

Maintien de la pression de perfusion placentaire

Equilibre acidobasique fœtal n'est pas affecté

Cruz AM. Intraabdominal carbon dioxide insufflation in the pregnant ewe. Anesthesiology 1996 ; 85 : 1395-402.

Pas d'effets délétères fœtaux sur le plan métabolique et PAM

Pas d'altérations du DUP



Laparoscopy during pregnancy: A study of five fetal outcome parameters with use of the Swedish Health Registry

September 1997
Am J Obstet Gynecol

Mark B. Reedy, MD,^a Bengt Källén, MD, PhD,^d and Thomas J. Kuehl, PhD^{a, b, c}

College Station and Temple, Texas, and Lund, Sweden

Table I. Infant survival data comparing laparoscopy and laparotomy

Outcome	Laparoscopy (n = 2181)				Laparotomy (n = 1522)			
	Observed	Expected	RR	CI	Observed	Expected	RR	CI
Live-born	2152	2154	—	—	1496	1502	—	—
Stillborn	7	9.3	0.75	0.30-1.55	8	6.6	1.21	0.52-2.39
Death 0-7 days	9	7.8	1.15	3.53-2.19	6	5.6	1.07	0.39-2.33
Death 8-28 days	2	1.6	1.25	0.15-4.52	1	1.2	0.83	0.02-4.64
Death 29-365 days	9	4.4	2.05	0.93-3.88	7	3.1	2.26	0.91-4.65
Death >1 yr	2	3.8	0.53	0.06-1.90	4	2.7	1.48	0.40-3.78

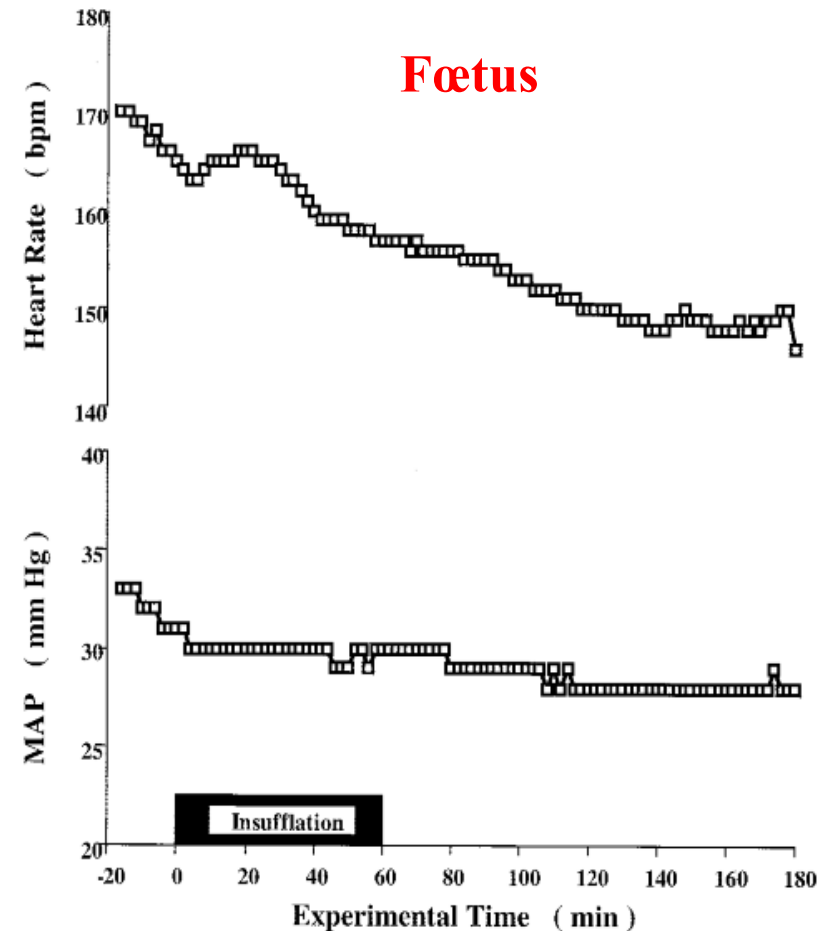
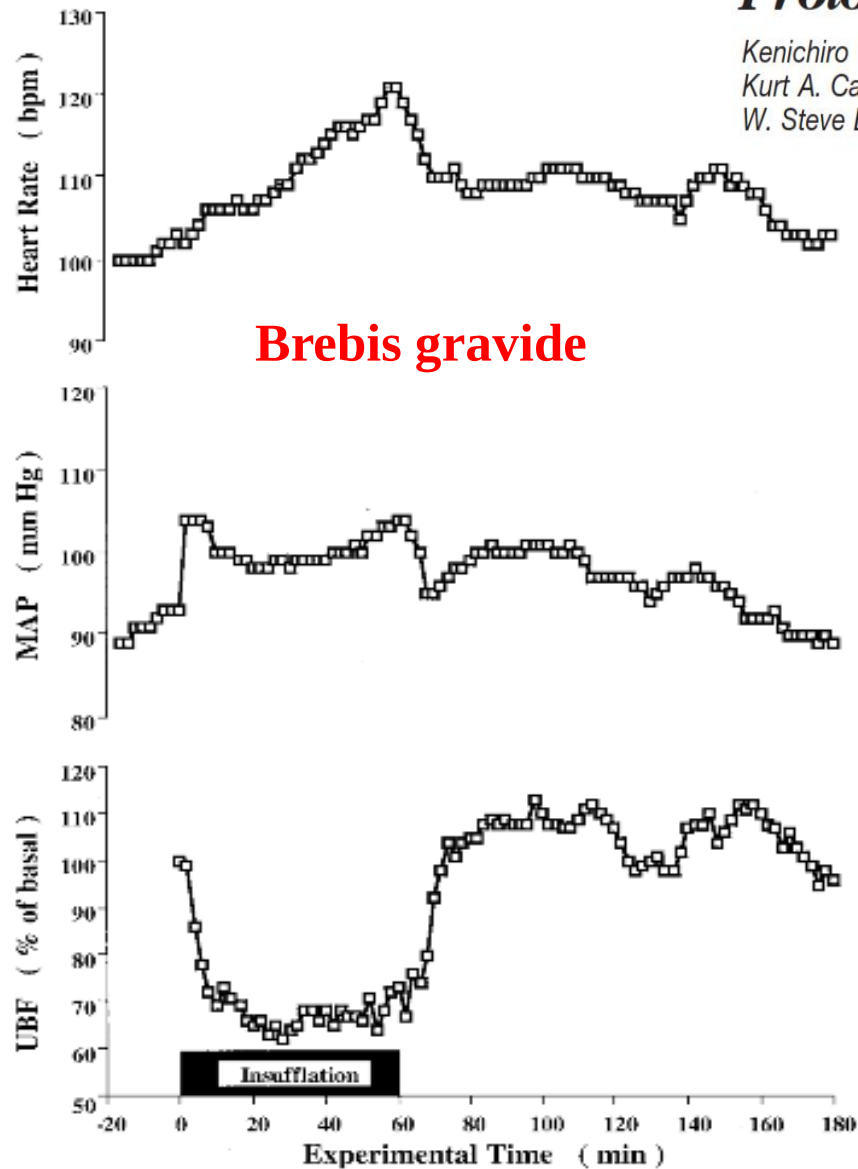
RR, Risk ratio; CI, 95% confidence interval.

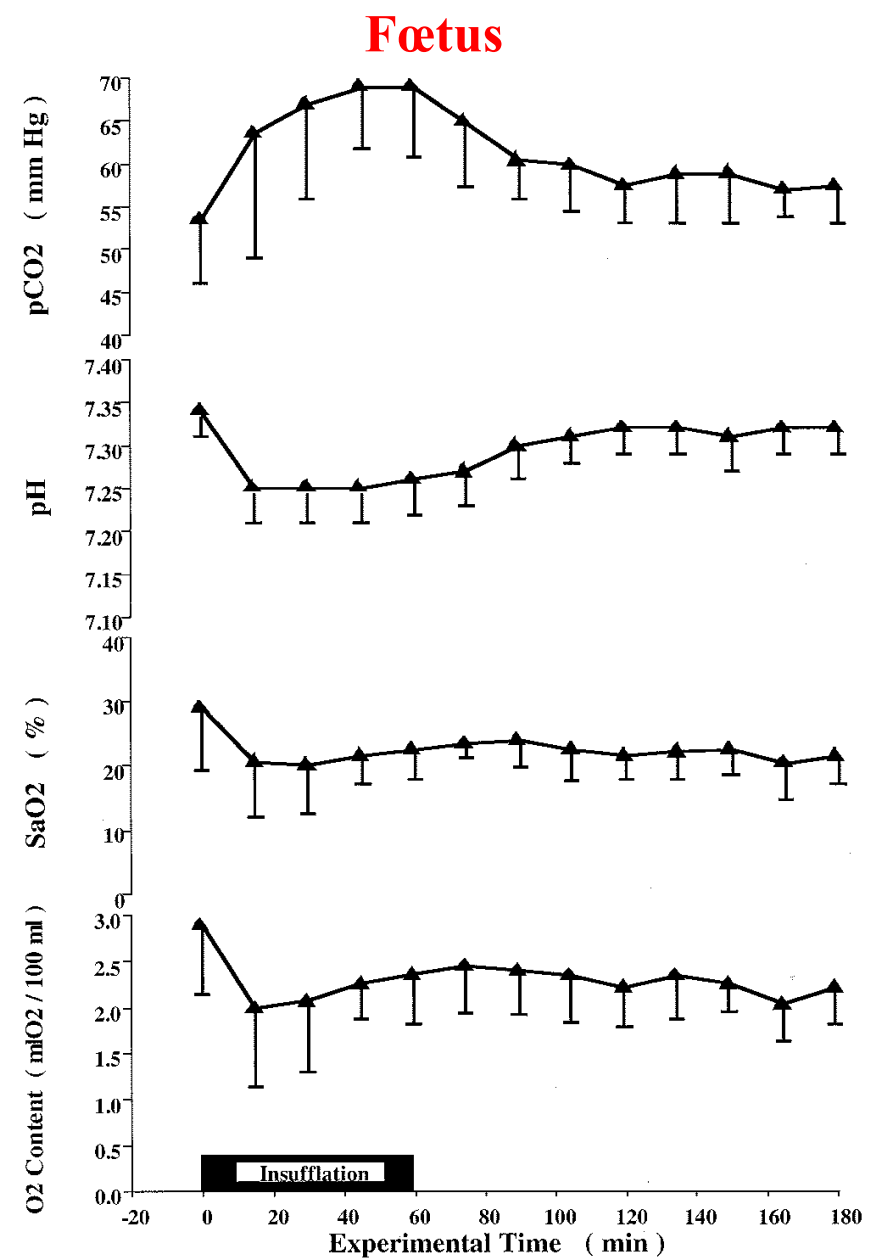
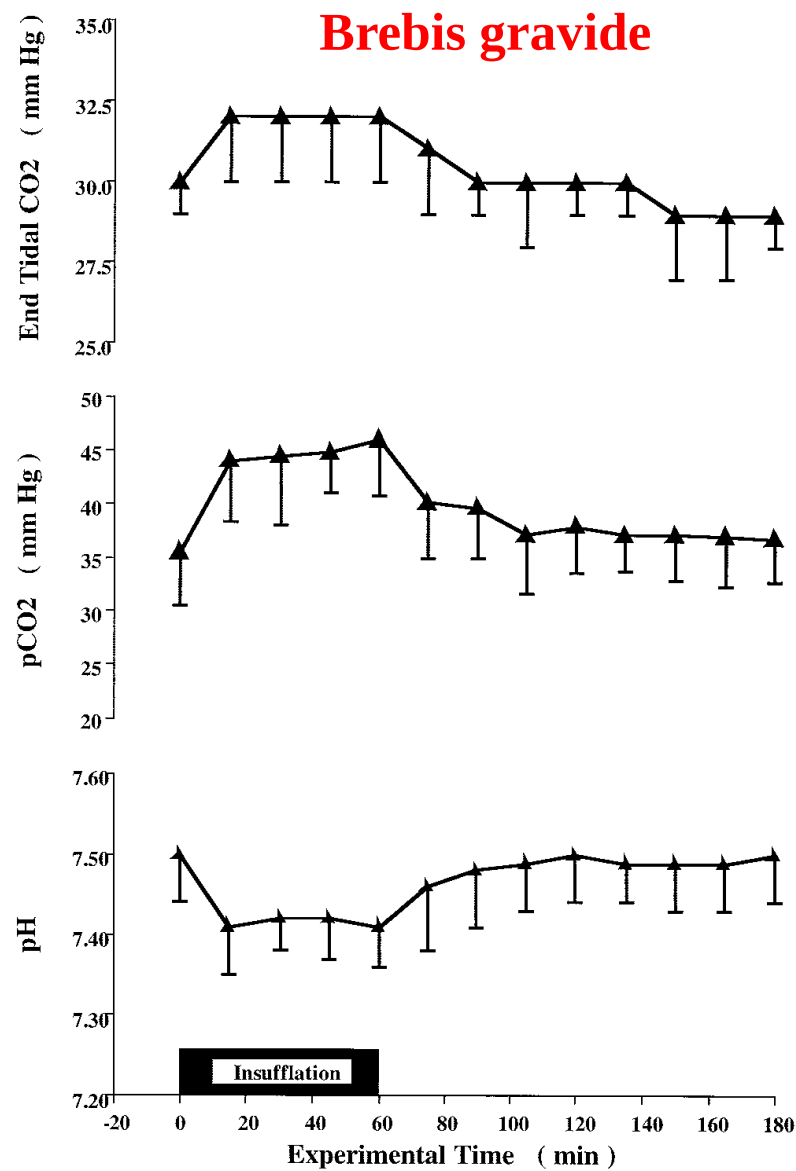
Pas de différence entre cœliochirurgie et laparotomie

Isoflurane 1,5 %
PIA 15 mmHg
PEt CO₂ 35 mmHg

Maternal Insufflation during the Second Trimester Equivalent Produces Hypercapnia, Acidosis, and Prolonged Hypoxia in Fetal Sheep

Kenichiro Uemura, M.D.,* Rebecca J. McClaine, B.S.,† Sebastian G. de la Fuente, M.D.,‡ Roberto J. Manson, Kurt A. Campbell,§ Deborah J. McClaine, B.S.,|| William D. White, M.P.H.,# Jonathan S. Stamler, M.D.,** W. Steve Eubanks, M.D.,†† James D. Reynolds, Ph.D.‡‡





In conclusion, maternal carbon dioxide pneumoperitoneum during the second trimester equivalent produces significant hypercapnia and acidosis, along with prolonged hypoxia.

Guidelines for Diagnosis, Treatment, and Use of Laparoscopy for Surgical Problems during Pregnancy

Practice/Clinical Guidelines published on: 01/2011

by the Society of American Gastrointestinal and Endoscopic Surgeons (SAGES)

Guideline 7: Diagnostic laparoscopy is safe and effective when used selectively in the workup and treatment of acute abdominal processes in pregnancy (Moderate/Strong).

Guideline 8: Laparoscopic treatment of acute abdominal disease has the same indications in pregnant and non-pregnant patients (Moderate/Strong).

Guideline 9: Laparoscopy can be safely performed during any trimester of pregnancy (Moderate/Strong).

Guideline 12: CO₂ insufflation of 10-15 mmHg can be safely used for laparoscopy in the pregnant patient (Moderate/Strong).



De quoi doit on avoir peur ?



↪ Complications maternelles
Hypoxie fœtale
Accouchement prématuré

Prévention de l'accouchement prématuré

Monitoring fœtal

Pathologie infectieuse (péritonite)

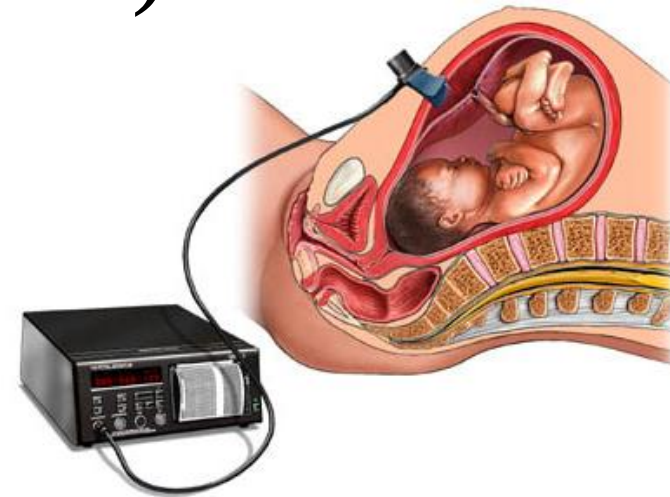
Vérification de la bonne viabilité fœtale
avant et après le geste ($> 25-27$ SA)

Prophylaxie tocolytique ?

Tocolytiques si MAP

Grossesse gémellaire: atosiban

Analgésie PO ++ (<http://www.lecrat.org/>)



Guidelines for Diagnosis, Treatment, and Use of Laparoscopy for Surgical Problems during Pregnancy

Practice/Clinical Guidelines published on: 01/2011

by the Society of American Gastrointestinal and Endoscopic Surgeons (SAGES)

Guideline 21: Fetal heart monitoring should occur pre and postoperatively in the setting of urgent abdominal surgery during pregnancy (Moderate/Strong).

Guideline 22: Obstetric consultation can be obtained pre- and/or postoperatively based on the severity of the patient's disease and availability (Moderate/Strong).

Guideline 23: Tocolytics should not be used prophylactically in pregnant women undergoing surgery but should be considered perioperatively when signs of preterm labor are present (High/Strong).



Guidelines for Diagnosis, Treatment, and Use of Laparoscopy for Surgical Problems during Pregnancy

Practice/Clinical Guidelines published on: 01/2011

by the Society of American Gastrointestinal and Endoscopic Surgeons (SAGES)

Grossesse: 0,1 – 0,2 % de TVP & ↑ pneumopéritoine/stase

PIA 12 mmHg ↔ compression pneumatique intermittente

Jorgensen JO. Surg Laparosc Endosc 1994

Pathologie sous-jacente ++

Risque faible/modéré

BAT/ HBPM en prophylaxie (?)

Guideline 14: Intra & postoperative pneumatic compression devices and early postoperative ambulation are recommended prophylaxis for deep venous thrombosis in the gravid patient (Moderate/Strong)



Pour conclure

Situation fréquente

Pathologie sous-jacente (péritonite)

La cœliochirurgie est une technique sûre/efficace
(opérateur)

Connaître et prendre en compte les particularités
de la femme enceinte

Hypotension et  DUP, hypoxie

PEC obstétricale périopératoire (niveau III)

Bénéfices pour la femme enceinte ++