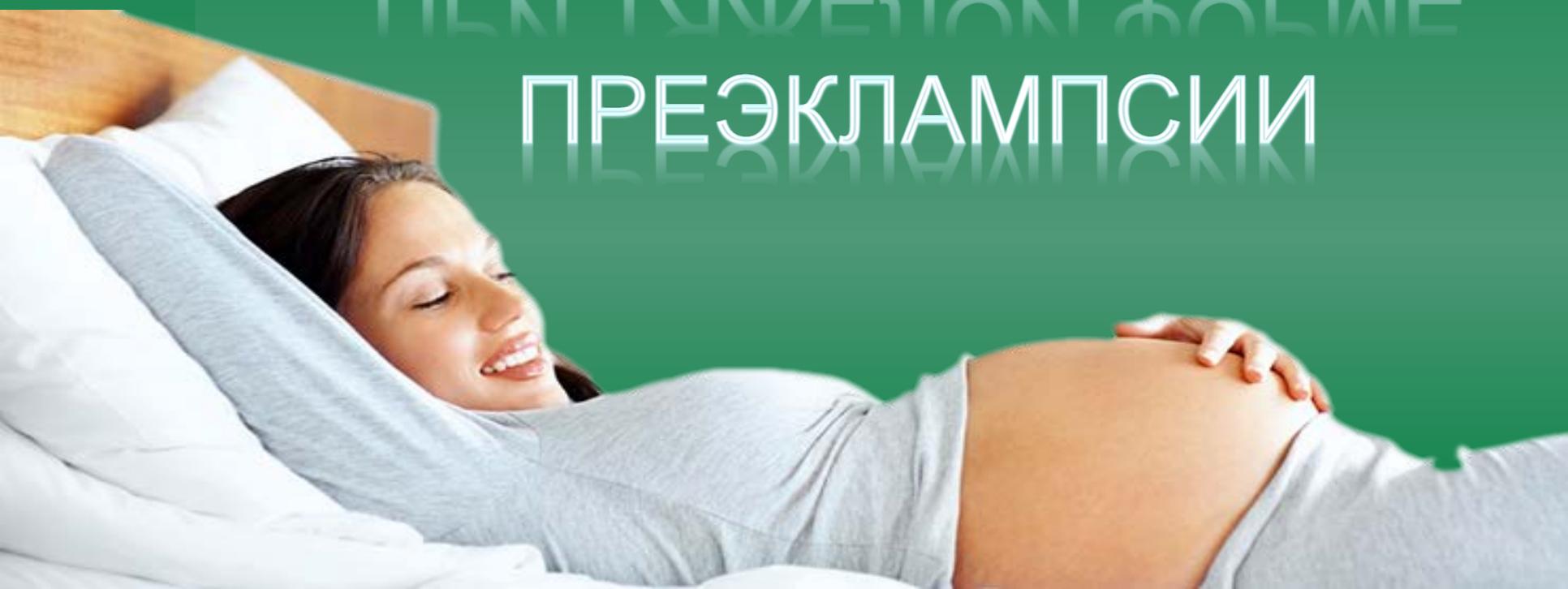




*Е. М. Шифман*

# АНЕСТЕЗИЯ ПРИ ТЯЖЁЛОЙ ФОРМЕ ПРЕЭКЛАМПСИИ



## Births: Preliminary Data for 2012

by Brady E. Hamilton, Ph.D.; Joyce A. Martin, M.P.H.; and Stephanie J. Ventura, M.A., Division of Vital Statistics

- **В США, Европе число родов с применением акушерских щипцов составляют 1% от родов через естественные родовые пути, а число применения вакуум-экстракций – 4% от родов через естественные родовые пути**



## Акушеры готовы приступить



# Спинальная анестезия при тяжелой ПЭ

Что нам известно?



Должна ли СА применяться  
у беременных с тяжелой ПЭ?

Длительно существующие  
страхи и вымыслы...



Занимаясь теоретизированием до выяснения обстоятельств, неизбежно начинаешь подгонять факты для подтверждения теории вместо того, чтобы теорию подтвердить фактами.



*Шерлок Холмс*



# Почему бы не спинальная?

- **Последствия лечения артериальной гипотонии**

- ✓ нагрузка жидкостью
- ✓ Вазопрессоры
  - ❖ отек легких



- **Нарушения коагуляции**

- ✓ тромбоцитопения и другие нарушения гемостаза
- ✓ эпидуральная гематома

# Спинальная анестезия при тяжелой ПЭ

Коагулопатия и риск эпидуральной гематомы



**Severe Neurological Complications after Central Neuraxial Blockades in Sweden 1990-1999**

Vibeke Moen, M.D.,<sup>1</sup> Nils Dahlgren, M.D., Ph.D.,<sup>1</sup> Lars Irestedt, M.D., Ph.D.<sup>2</sup>

**Background:** Central neuraxial blockades find widespread applications. Severe complications are believed to be extremely rare, but the incidence is probably underestimated. **Methods:** A retrospective study of severe neurologic complications after central neuraxial blockades in Sweden 1990-1999 was performed. Information was obtained from a postal survey and administrative files in the health care system. During the study period approximately 1,260,000 spinal blockades and 450,000 epidural blockades were administered, including 200,000 epidural blockades for pain relief in labor. **Results:** The 127 complications found included spinal hematoma (33), cauda equina syndrome (32), meningitis (29), epidural abscess (13), and miscellaneous (20). Permanent neurologic damage was observed in 85 patients. Incidence of complications after spinal blockade was within 1:20-30,000 in all patient groups. Incidence after obstetric epidural blockade was 1:23,000; in the remaining patients it was 1:3600 ( $P < 0.0001$ ). Spinal hematoma after obstetric epidural blockade carried the incidence 1:200,000, significantly lower than the incidence 1:3,600 females subject to knee arthroplasty ( $P < 0.0001$ ).

**Conclusions:** More complications than expected were found, probably as a result of the comprehensive study design. Half of the complications were retrieved exclusively from administrative files. Complications occur significantly more often after epidural blockade than after spinal blockade, and the complications are different. Obstetric patients carry significantly lower incidence of complications. Osteoporosis is proposed as a previously neglected risk factor. Close surveillance after central neuraxial blockade is mandatory for safe practice.

CENTRAL neuraxial blockades (CNB) find widespread application in anesthesia as well as in postoperative and labor analgesia. Recent studies also suggest a reduction in postoperative mortality when CNB are used in major surgery.<sup>1</sup> The use of CNB will probably increase in the future, as serious complications have been reported to be extremely rare.<sup>2</sup> Studies are scarce, and their results

difficult to compare.<sup>3-8</sup> Many complications are known through case reports, and these rare events might not be evenly distributed within the patient population. Because the enormous number of patients needed to perform prospective studies exceeds feasibility, it is important that retrospective studies try to minimize the inherent weakness of such study designs. Underreporting is common in retrospective studies, causing underestimation of risk. In recent years, interest has focused on spinal hematoma after administration of low molecular weight heparin (LMWH).<sup>9-12</sup> To investigate the incidence of serious neurologic complications after CNB in Sweden from 1990 to 1999, all available sources of information were searched. The aim was also to identify subgroups of patients with higher or lower prevalence of risk factors.

**Materials and Methods**

*First and Second Survey*

A first postal survey was sent to head of department in all 85 departments of anesthesia in Sweden. The receivers were asked to report the occurrence of specified complications after CNB from 1990-1999. The complications specified were epidural abscess, meningitis, spinal hematoma, and cauda equina syndrome. Other serious complications could be reported, but patient identity or details regarding the incidents were not warranted.

The respondents were also required to state the number of spinal blockades (SB) and epidural blockades (EB) performed in the department during 1998.

One letter and at least two telephone calls of reminder were directed to late responders. Answers were obtained from 72 of the inquiry receivers (85%), and in 42 of these departments 117 complications were reported to have occurred. The survey was carried out in the fall of 1999, and the results were presented at a national symposium dedicated to the topic of complications after CNB.

A second survey was launched with approval of the ethical committees at the universities in Linköping, Lund and the Karolinska Institute in Stockholm (Sweden). The scope of this second survey was to link each complication previously reported to identified patients. The 42 departments reporting complications in the first survey were thus again contacted as were the 13 nonresponding departments from the first survey. One letter and at least two telephone calls of reminder were directed to late responders.

This article is accompanied by an Editorial View. Please see: Auroy Y, Beaulieu D, Amisbert R. Risk assessment and control require analysis of both outcomes and process of care. ANESTHESIOLOGY 2004; 101:815-7.

\* Senior Consultant, Department of Anesthesiology and Intensive Care, County Hospital, Kalmar, Sweden. † Senior Consultant, Department of Anesthesiology, County Hospital, Landskrona, Sweden. ‡ Head of Department, Department of Anesthesiology and Intensive Care, Karolinska Hospital, Stockholm, Sweden.

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Address reprint requests to Dr. Moen: Department of Anesthesiology and Intensive Care, County Hospital, S-391 89 Kalmar, Sweden. Address electronic mail to: vibekem@kalmar.se. Individual article reprints may be purchased through the Journal Web site, www.anesthesiology.org.

■ N=1.260.000 спинальных + 450.000 эпидуральных

✓ 200.000 родов

■ 127 тяжелых осложнений

✓ 33 спинальных гематомы

❖ 20В = 2 **HELLP** ∑

❖ 1 эпидуральная со смещением катетера (КТ)

"с явными признаками коагулопатии"

✓ 32 конских хвоста ∑, 29 менингитов,

13 эпидуральных абсцессов, 20 –разное



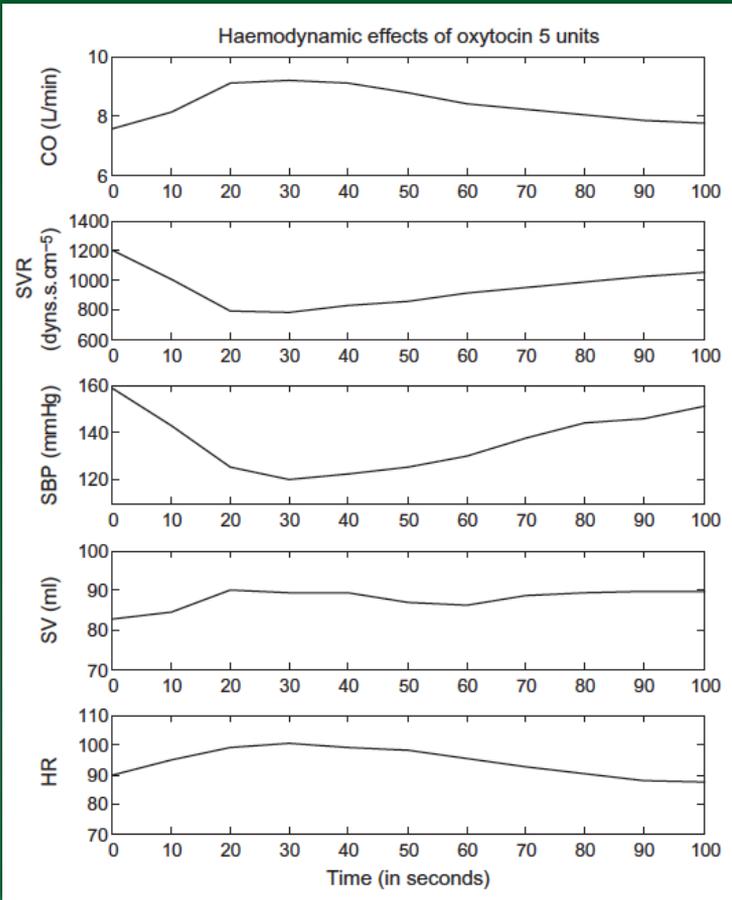
# Тромбоцитопения, низкомолекулярный гепарин и нейроаксиальные методы обезболивания: есть ли магическое число?



Шифман Е. М. д. м. н. профессор

Действительно ли СА приводит  
к тяжелой артериальной  
гипотонии у беременных с ПЭ?





*The haemodynamic effects of 5 IU oxytocin in 18 patients with severe preeclampsia Oxytocin is given at time 0.*

*E. Langesæter, L.A. Rosseland, A. Stubhaug. Haemodynamic effects of oxytocin in women with severe preeclampsia//International Journal of Obstetric Anesthesia (2011) 20, 26–29.*

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doi:10.1016/j.ijoa.2010.10.004



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ORIGINAL ARTICLE

## Haemodynamic effects of oxytocin in women with severe preeclampsia

E. Langesæter, L.A. Rosseland, A. Stubhaug  
Division of Anaesthesia and Intensive Care Medicine, Oslo University Hospital – Rikshospitalet, Oslo, Norway

**ABSTRACT**  
Background: Several previous publications demonstrate the significant haemodynamic effects of oxytocin in healthy pregnant women, but there is only one publication of the oxytocin effects in women with severe preeclampsia. We investigated the haemodynamic effects of oxytocin in women with severe preeclampsia using invasive haemodynamic monitoring.  
Methods: Eighteen women with severe preeclampsia were included in this observational study. All women had continuous invasive haemodynamic monitoring during spinal anaesthesia for caesarean section using the LiDCOplus monitor. Preeclamptic patients were given intravenous boluses of 5 IU oxytocin following delivery.  
Results: Following an intravenous bolus of 5 IU oxytocin all patients had an increase in heart rate, a decrease in systemic vascular resistance and a decrease in blood pressure. Five patients had a decrease in cardiac output due to an inability to increase stroke volume.  
Conclusions: The haemodynamic effects of oxytocin in women with severe preeclampsia may be less predictable compared to findings in healthy pregnant women, suggesting that oxytocin should be given with caution in women with severe preeclampsia.  
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**Keywords:** Severe preeclampsia; Neuraxial anaesthesia; Oxytocin; Cardiac output; Invasive monitoring; LiDCOplus

Introduction

Preeclampsia is a multi-system disease affecting 5–10% of pregnant women.<sup>1</sup> The disorder can result in severe complications including eclampsia, pulmonary oedema, HELLP (haemolysis, elevated liver enzymes, and low platelets) syndrome, or renal failure. Preeclampsia is a major cause of maternal and neonatal morbidity and mortality. Although preeclamptic patients are often hypovolaemic with low cardiac output (CO) and increased systemic vascular resistance (SVR), this patient group is heterogeneous.<sup>2</sup> Increased total vascular resistance, a high relative wall thickness of the left ventricle and a hypertrophied ventricle are independent predictors for developing maternal and fetal complications in preeclamptic pregnancy.<sup>3</sup>

Oxytocin is a vasodilator acting on vascular endothelial receptors producing a calcium-dependent response via stimulation of the nitric oxide pathway.<sup>4</sup> There are several publications on the haemodynamic effects of oxytocin in healthy pregnant women,<sup>5–7</sup> but only one

previous study showing its effects in severe preeclampsia.<sup>8</sup> The aim of our observational study was to examine the haemodynamic response to oxytocin in women with severe preeclampsia.

Methods

Eighteen women with severe preeclampsia were included in this study conducted at Oslo University Hospital, Rikshospitalet from August 2005 to August 2008 (registered with clinicaltrials.gov: NCT00403572). The protocol was approved by The Regional Medical Research Ethics Committee for Southern Norway and women gave oral and written consent to participate. The only exclusion criterion was a contraindication to neuraxial anaesthesia.

Severe preeclampsia was defined as a systolic arterial pressure (SAP) ≥ 160 mmHg with proteinuria, and either headache, visual disturbance, dyspnoea or epigastric pain. Women with a SAP ≥ 160 mmHg and symptoms were given magnesium sulphate (MgSO<sub>4</sub>) 4 g intravenously as a loading dose, followed by an infusion of 1 g/h for 24 h.

After monitoring was established with electrocardiography and pulse oximetry, a 20-gauge cannula was

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Correspondence to: Eldrid Langesæter, Division of Anaesthesia and Intensive Care Medicine, Oslo University Hospital – Rikshospitalet, N-0027 Oslo, Norway.  
E-mail address: eldril.langesaeter@rikshospitalet.no





- Пациентки с тяжелой преэклампсией гемодинамически неоднородны.

Это в большей степени и определяет выраженность изменений сердечного выброса или вазодилатации под влиянием окситоцина.



Eldrid Langesæter. Is It More Informative to Focus on Cardiac Output than Blood Pressure during Spinal Anesthesia for Cesarean Delivery in Women with Severe Preeclampsia? *Anesthesiology* 2008; 108:771–2.

## ◆ EDITORIAL VIEWS

Anesthesiology 2008; 108:771–2

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### **Is It More Informative to Focus on Cardiac Output than Blood Pressure during Spinal Anesthesia for Cesarean Delivery in Women with Severe Preeclampsia?**

SEVERAL authors have focused on change in blood pressure as the key hemodynamic variable during neuraxial anesthesia for cesarean delivery in patients with severe preeclampsia.<sup>1,2</sup> The optimal anesthetic technique for cesarean delivery in women with severe preeclampsia remains controversial.<sup>3,4</sup> A more relevant and interesting problem is how we can improve monitoring of other hemodynamic parameters in preeclamptic patients. The article by Dyer *et al*<sup>5</sup> in this number of *Anesthesiology* introduces two interesting issues.

First, the authors focus on cardiac output as the variable of greater interest for assessment of the circulation. Though often edematous, untreated preeclamptic patients typically have a small plasma volume, reduced diuresis, hypertension, and vasoconstriction compared with healthy parturients.<sup>6</sup> Dyer *et al* find considerable heterogeneity in cardiac output among the patients included in their study, ranging from less than 4 l/min to more than 10 l/min, and a correspondingly large variability in systemic vascular resistance. This could be due to different preoperative treatments and to different responses to treatment. Using pulmonary artery catheters, Visser and Waltenburg<sup>7</sup> found smaller hemodynamic variability in 87 untreated preeclamptic patients compared with treated patients. Dyer *et al* argue that keeping blood pressure at baseline is not an optimal strategy and that maintaining cardiac output is a better approach. They report no measures of uterine circulation in the current study to verify that cardiac output is more important than blood pressure for maintaining uterine blood flow, but other studies have demonstrated that increasing cardiac output is beneficial for uterine blood flow.<sup>8,9</sup> Valensise *et al*<sup>10</sup> showed an inverse correlation between cardiac output and the uterine resistance index in healthy pregnant women. They recently published a study showing increased cardiac output and improved uterine blood flow after plasma volume expansion and a nitric oxide donor

in hypertensive pregnant women. These authors argue that previous studies have focused on blood pressure without sufficiently considering the effects on cardiac output and systemic vascular resistance.<sup>11</sup>

Second, Dyer *et al* use a new minimally invasive technique (the LIDCOplus, LIDCO Ltd., Cambridge, United Kingdom) for hemodynamic monitoring. The LIDCOplus is a cardiovascular monitor, providing continuous measurement of cardiac output and derived variables. This is achieved by two proprietary algorithms: a continuous arterial waveform analysis system (PulseCO) coupled to a single-point lithium indicator dilution calibration system (LIDCO).<sup>12</sup> The technique requires only peripheral arterial and venous cannulation. Although the device has been validated in other patient groups,<sup>13</sup> few data have been published using this device in pregnant women. The impact of delivery on the cardiac output measurements provided by this technology may be substantial. Using this device in pregnant women for the past 3 yr, we have experienced that recalibration is necessary after delivery. The recommendation by the manufacturer to recalibrate every 8 h is, in our opinion, not adequate in pregnant women during delivery.

Compared with previously available invasive techniques (ie, the pulmonary artery catheter), the threshold for using new minimally invasive techniques should be low. Previously, invasive hemodynamic monitoring in severe preeclamptic patients has been recommended only in those patients with complications, such as pulmonary edema and renal failure.<sup>14</sup> With more available invasive techniques, one might reduce the incidence of serious complications by using the hemodynamic information to guide the optimal treatment.

In healthy pregnant women, we found that 5 U oxytocin increased cardiac output and decreased systemic vascular resistance by around 60% and caused a decrease in systolic blood pressure by 35% compared with baseline.<sup>15</sup> Preeclamptic patients may respond differently to oxytocin compared with healthy parturients with smaller compensatory increase in cardiac output as a response to the massive vasodilatation caused by oxytocin. Dyer *et al* found no significant increase in stroke volume in their patients who received 2.5 U oxytocin. There was apparently less increase in cardiac output after oxytocin in patients with low cardiac output compared with those with high values. Controversies about oxytocin use often arise from traditional preferences in

This Editorial View accompanies the following article: Dyer RA, Pirry JL, Ravil AR, Lomhaug CJ, Skovrum LM, James MF. Hemodynamic changes associated with spinal anesthesia for cesarean delivery in severe preeclampsia. *Anesthesiology* 2008; 108:802–11.

Accepted for publication January 29, 2008. The author is not supported by any monetary or non-monetary source. All commercial entities that use the associated with the topic of this article.

# ANESTHESIOLOGY



The Journal of the American Society of Anesthesiologists, Inc.

- Dyer et al. определили, что введение 2,5 ЕД окситоцина не вызывает значимых изменений сердечного выброса у пациенток с преэклампсией

**CLINICAL INVESTIGATIONS**

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### Hemodynamic Changes Associated with Spinal Anesthesia for Cesarean Delivery in Severe Preeclampsia

Robert A. Dyer, F.R.C.A., B.A.S.†, Jenna L. Piercy, F.R.C.A. (S.A.), Anthony R. Reed, F.R.C.A., Carl J. Lombard, Ph.D.,‡, Leann K. Schoeman, F.C.C.O.G. (S.A.),§, Michael F. James, Ph.D.¶

**Background:** Hemodynamic responses to spinal anesthesia (SA) for cesarean delivery in patients with severe preeclampsia are poorly understood. This study used a beat-by-beat measure of cardiac output (CO) to characterize the response to SA. The hypothesis was that CO would decrease from baseline values by less than 20%.

**Methods:** Fifteen patients with severe preeclampsia consented to an observational study. The monitor employed used pulse-wave analysis to estimate aortic stroke volume. Calibration was by lithium dilution. CO and systemic vascular resistance were derived from the measured stroke volume, heart rate, and mean arterial pressure. In addition, the hemodynamic effects of phenylephrine, the response to delivery and oxytocin, and hemodynamics during recovery from SA were recorded. Hemodynamic values were averaged for defined time intervals before, during, and after SA.

**Results:** Cardiac output remained stable from induction of SA until the time of request for analgesia. Mean arterial pressure and systemic vascular resistance decreased significantly from the time of adoption of the supine position until the end of surgery. After oxytocin administration, systemic vascular resistance decreased and heart rate and CO increased. Phenylephrine, 50 µg, increased mean arterial pressure to above target values and did not significantly change CO. At the time of recovery from SA, there were no clinically relevant changes from baseline hemodynamic values.

**Conclusions:** Spinal anesthesia in severe preeclampsia was associated with clinically insignificant changes in CO. Phenylephrine restored mean arterial pressure but did not increase maternal CO. Oxytocin caused transient marked hypotension, tachycardia, and increases in CO.

ONLY since 1995, when the first randomized trial on the use of regional versus general anesthesia for cesarean

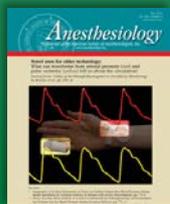
This article is accompanied by the following two Editorial Views. Largest 10. It is more substantive to focus on the effect than blood pressure during spinal anesthesia for cesarean delivery in women with severe preeclampsia. *Anesthesiology* 2008; 108:771–2. Paula M. Pressure wave analysis is useful to understand the pathophysiology of preeclampsia, but perhaps not the rapid change during cesarean delivery. *Anesthesiology* 2008; 108:773–4.

† Associate Professor, ‡ Senior Specialist Anesthesiologist, § Professor and Head, Department of Anesthesia, § Senior Specialist Obstetrician and Gynecologist, Department of Obstetrics and Gynecology, University of Cape Town, † Director, Obstetrics and Gynecology Research Unit, Cape Town, South Africa. Received from the Department of Anesthesia, University of Cape Town, Cape Town, South Africa. Submitted for publication May 9, 2007; accepted for publication October 6, 2007. Support was provided by the South African Medical Research Council. Received in part at the Annual Meeting of the Obstetric Anesthesiology Society, American Society of Anesthesiologists, October 7–8, 2007.

Address correspondence to Dr. Dyer: 321 Department of Anesthesia, University of Cape Town and New Guinea School Hospital, Station Road, Observatory, Cape Town 7926, South Africa. E-mail: robert.dyer@uct.ac.za. This article may be accessed for personal use at no charge through the Journal Web site, www.anesthesiology.org.

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Dyer RA, Piercy JL, Reed AR, Lombard CJ, Schoeman LK, James MF: Hemodynamic changes associated with spinal anesthesia for cesarean delivery in severe preeclampsia. *ANESTHESIOLOGY*. 2008; 108:802–11.

- "применение СА у стабильных, без коагулопатии женщин с ПЭ является разумной альтернативой эпидуральной блокаде, особенно в экстренной ситуации. Важно, если это позволяет избежать ОА..."

## OBSTETRIC ANESTHESIA

Scott G. Katz,  
David J. Borsook

Editorial

### Spinal Anesthesia for Cesarean Delivery in Severely Preeclamptic Women: Don't Throw Out the Baby with the Bathwater!

Alan C. Santos, MD, MPH, and David J. Borsook, MD

Department of Anesthesiology, The Christa Clinic Foundation, New Orleans, Louisiana and the Department of Anesthesiology, the University of Miami School of Medicine, Miami, Florida

The optimal anesthetic technique for cesarean delivery in severely preeclamptic women remains controversial. Recent clinical practice, however, indicates that spinal anesthesia can be, and is, safely used. In the past, there has been concern that intravascular volume contraction related to preeclampsia could result in catastrophic hypotension that would be difficult to treat (1). As a result, epidural anesthesia became the preferred neuraxial technique for cesarean delivery in women with severe preeclampsia because of a more gradual onset of sympathectomy. In fact, we now know that hypotension may occur less frequently when spinal anesthesia is administered to preeclamptic as compared with normotensive women having a cesarean delivery in modern day practice (2). Small-dose spinal as part of a combined spinal-epidural technique with subsequent top-off of the epidural component has also been advocated, but there are many anesthesiologists and obstetricians who are still concerned about the use of spinal anesthesia in preeclampsia (3).

There are now several studies that support the use of spinal anesthesia in the severely preeclamptic (3-6). In the first, a prospective and randomized trial, there was no significant difference in the incidence of hypotension in severely preeclamptic women having spinal as compared with epidural anesthesia for cesarean delivery (4). The findings of this paper resonated among anesthesiologists and obstetricians because it was performed at Parkland Hospital in Dallas, Texas, an institution that for many years taught that spinal

anesthesia was absolutely contraindicated in severely preeclamptic women. The second study, a retrospective review, reported that there was no significant difference in the lowest mean arterial blood pressure (MABP) between severely preeclamptic women having spinal as compared with epidural anesthesia for cesarean delivery (5). Most recently, Aya et al. (2) in a prospective cohort study reported that the incidence and severity of hypotension were in fact less in severely preeclamptic women as compared with normotensive women having a cesarean delivery with spinal anesthesia. In this issue of *Anesthesia & Analgesia*, two more studies weigh in on the subject, one by Vyalysputra et al. (6) and the other, a follow-up study, by Aya et al. (11).

There is good news and bad news. First, the potentially bad news for advocates of spinal anesthesia is that Vyalysputra et al. (6) report that the use of spinal anesthesia for cesarean delivery in severely preeclamptic women was more likely to result in mild hypotension and to require more ephedrine to correct their epidural anesthesia. However—before we throw the baby out with the bathwater—there is also good news if we look at this finding in perspective. The hypotension was mild and the difference in the median lowest MABP measured in the spinal as compared with epidural anesthesia group was small and transient (generally <1 min).

The current study by Vyalysputra et al. (6) selected a group of preeclamptic women who were categorized as "severe" and thus would be at greatest risk to develop hypotension related to sympathectomy. They also excluded women who were in labor because labor can decrease the incidence of hypotension under regional anesthesia (7). Women were prepared for surgery with hydration and hydralazine administration to decrease the diastolic blood pressure to at least 90 mm Hg, and most received magnesium sulfate. The authors attributed to standardize obstetric and

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Address correspondence and reprint requests to David J. Borsook, MD, Professor and Director, Center for Child, Adolescent, and Family Pain, Department of Anesthesiology, University of Miami School of Medicine, 1401 NW 13th Avenue, Miami, FL 33136. Address electronic mail to dborsook@umiami.edu.

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- Стабильная гемодинамика
- Минимальные изменения СВ
- Умеренное снижение постнагрузки
- Низкая потребностью вазопрессорах
- Ударный объем сохраняется при восстановлении после СА

## CLINICAL INVESTIGATIONS

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### Hemodynamic Changes Associated with Spinal Anesthesia for Cesarean Delivery in Severe Preeclampsia

Robert A. Dyer, F.C.A. (S.A.),\* Jenna L. Piercy, F.C.A. (S.A.),† Anthony R. Reed, F.R.C.A.,‡ Carl J. Lombard, Ph.D.,‡ Leann K. Schoeman, F.C.O.G. (S.A.),§ Michael F. James, Ph.D.¶

**Background:** Hemodynamic responses to spinal anesthesia (SA) for cesarean delivery in patients with severe preeclampsia are poorly understood. This study used a beat-by-beat measure of cardiac output (CO) to characterize the response to SA. The hypothesis was that CO would decrease from baseline values by less than 20%. **Methods:** Fifteen patients with severe preeclampsia consented to an observational study. The smallest employed mean pulse wave from analysis to estimate aortic stroke volume. Calibration was by lithium dilution. CO and systemic vascular resistance were derived from the measured stroke volume, heart rate, and mean arterial pressure. In addition, the hemodynamic effects of phenylephrine, the response to delivery and oxytocin, and hemodynamics during recovery from SA were recorded. Hemodynamic values were averaged for defined time intervals before, during, and after SA.

**Results:** Cardiac output remained stable from induction of SA until the time of request for analgesia. Mean arterial pressure and systemic vascular resistance decreased significantly from the time of adoption of the supine position until the end of surgery. After oxytocin administration, systemic vascular resistance decreased and heart rate and CO increased. Phenylephrine, 50 µg, increased mean arterial pressure to above target values and did not significantly change CO. At the time of recovery from SA, there were no clinically relevant changes from baseline hemodynamic values.

**Conclusions:** Spinal anesthesia in severe preeclampsia was associated with clinically insignificant changes in CO. Phenylephrine reduced mean arterial pressure but did not increase maternal CO. Oxytocin caused transient marked hypotension, tachycardia, and increases in CO.

ONLY SINCE 1995, when the first randomized trial on the use of regional versus general anesthesia for cesarean

delivery in severe preeclampsia was published,<sup>1</sup> has spinal anesthesia (SA) been considered an option in this high-risk group of patients. As recently as 1998, an editorial recommended that epidural anesthesia is preferable to SA for cesarean delivery,<sup>2</sup> even if the patient has not received epidural anesthesia in labor. Many recent studies suggest that SA is safe in the absence of contraindications to regional anesthesia.<sup>3-7</sup> Some studies have shown less hypotension and lower vasopressor requirements than during SA in healthy parturients. One investigation found less hypotension during SA in severe preeclampsia than in pregnant women in whom fetal weights were similar.<sup>8</sup> This eliminated the possibility that the more minor degree of hypotension was due to a lower degree of aortocaval compression in preeclamptic patients. Nevertheless, hypotension and placental underperfusion remain a risk, and SA may be associated with more neonatal acidosis than general anesthesia.<sup>9</sup>

Most studies have used heart rate (HR) and blood pressure measurements as surrogate markers of maternal cardiac output (CO). Although pulse and blood pressure measurements are of value in assessing the safety of an anesthetic technique, the true goal of SA for cesarean delivery is to maintain maternal CO and uteroplacental blood flow. In healthy patients, the maximum change in CO has been shown to correlate better with uteroplacental blood flow than upper arm blood pressure.<sup>10</sup> Furthermore, in severe preeclampsia, an increased systemic vascular resistance (SVR) could render blood pressure a poor indicator of CO, but the information available on such patients during SA is scanty. It was therefore decided to investigate CO changes during SA for cesarean delivery in severe preeclampsia. Our hypothesis was that SA would result in a clinically insignificant change in CO in these patients, other than at the time of oxytocin administration. Also studied were the hemodynamic responses to vasopressors and to delivery and oxytocin. In addition, an assessment was made of the hemodynamics of recovery from SA.

Ultimately, a better understanding of the perioperative hemodynamic changes could contribute to a reduction in preoperative pulmonary edema, renal dysfunction, eclampsia, and neonatal mortality.

#### Materials and Methods

Fifteen patients were recruited to this prospective observational study of the hemodynamics of SA for cesar-

This article is accompanied by the following two Editorial Views: Langenhove E. Is it more informative to focus on capillary output than blood pressure during spinal anesthesia for cesarean delivery in women with severe preeclampsia? *Anesthesiology* 2008; 108:771-2; Pines AL. Pressure wave analysis in an effort to understand the pathophysiology of preeclampsia, but perhaps not the rapid changes during cesarean delivery. *Anesthesiology* 2008; 108:773-4.

\* Anesthesia Professor, † Senior Specialist Anesthesiologist, ‡ Professor and Head, Department of Anesthesia, § Senior Specialist Obstetrician and Gynecologist, Department of Obstetrics and Gynecology, University of Cape Town, 1 Thornax, Rondebosch, Cape Town, South Africa; ‡ Senior Specialist Anesthesiologist, Department of Obstetrics and Gynecology, University of Cape Town, 1 Thornax, Rondebosch, Cape Town, South Africa. Submitted for publication May 3, 2007. Accepted for publication December 6, 2007. Accepted for publication December 6, 2007. Address correspondence to Dr. Dyer: D23 Department of Anesthesia, University of Cape Town and New General Hospital, Anson Road, Observatory, Cape Town 7925, South Africa (e-mail: rader@uct.ac.za). This article may be accessed for personal use at no charge through the Journal Web site, www.anesthesiology.org.



## Patients with Severe Preeclampsia Experience Less Hypotension During Spinal Anesthesia for Elective Cesarean Delivery than Healthy Parturients: A Prospective Cohort Comparison

Aya, Antoine G. M. MD, PhD; Mangin, Roseline MD, MSc; Vialles, Nathalie MD; Ferrer, Jean-Michel MD; Robert, Colette MD; Ripart, Jacques MD, PhD; de La Coussaye, Jean-Emmanuel MD, PhD

## Ephedrine requirements are reduced during spinal anaesthesia for caesarean section in preeclampsia☆

[V.A. Clark](#), [G.H. Sharwood-Smith](#)✉, [A.V.G. Stewart](#)

The Department of Anaesthesia, Simpson Centre for Reproductive Health, Edinburgh, UK

Accepted: August 6, 2004;

**V.A. Clark**, MB ChB FRCA, **G.H. Sharwood-Smith**, MB ChB FRCA, **A.V.G. Stewart**, MB ChB DA FRCA, Simpson Centre for Reproductive Health, Edinburgh EH16 4SA, Scotland, UK

## Spinal Anesthesia-Induced Hypotension: A Risk Comparison Between Patients with Severe Preeclampsia and Healthy Women Undergoing Preterm Cesarean Delivery

Antoine G. M. Aya, MD, PhD, Nathalie Vialles, MD, Issam Tanoubi, MD, Roseline Mangin, MD, MSc, Jean-Michel Ferrer, MD, Colette Robert, MD, Jacques Ripart, MD, PhD, and Jean-Emmanuel de La Coussaye, MD, PhD

Division of Anesthesiology, Pain Management, Emergency and Critical Care Medicine, University Hospital, Nîmes, France

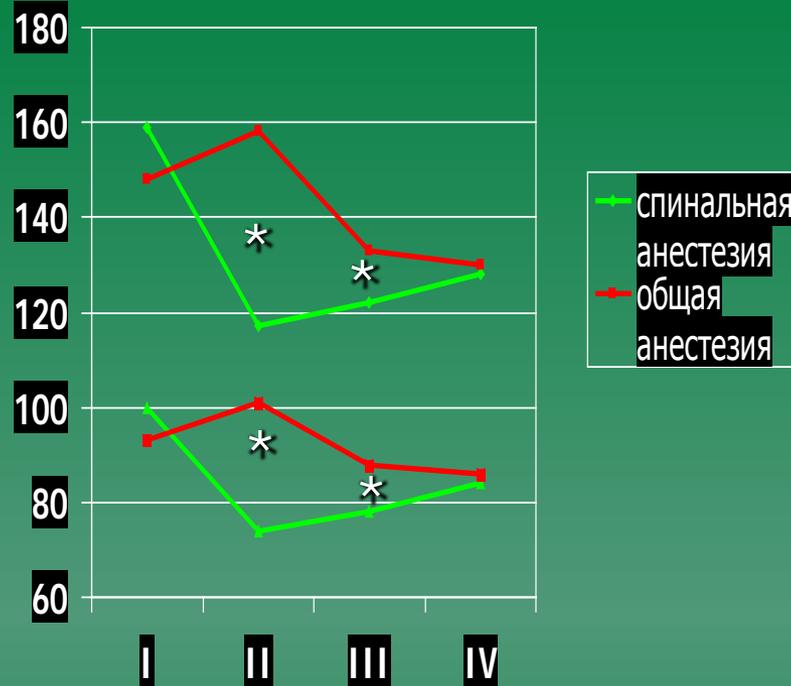
- СА может безопасно применяться у беременных с тяжелой ПЭ
- Артериальная гипотония вследствие СА развивается реже и может быть успешно купирована



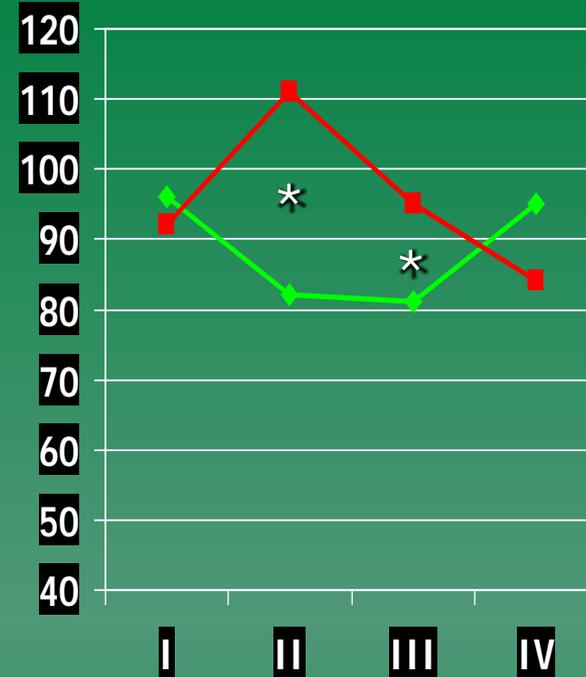
# Динамика артериального давления и частоты сердечных сокращений у пациентов с эклампсией



мм рт. ст.



мин<sup>-1</sup>



Этапы

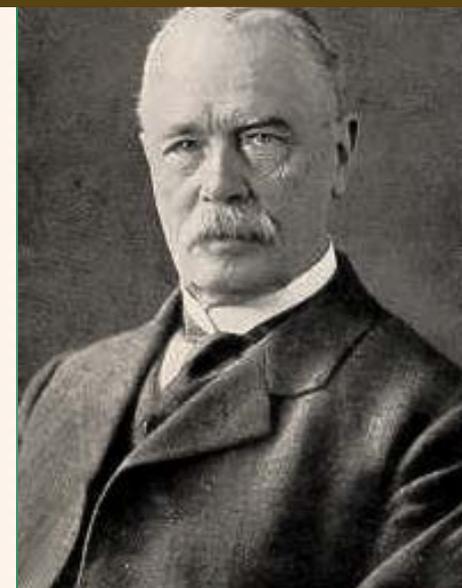
\* –  $p < 0,05$  в сравнении между группами

Белоцерковский В. А., Кириченко А. В., Абрамов Д. Ю. и др. Спинальная анестезия при оперативном родоразрешении у беременных с эклампсией // Регионарная анестезия и лечение острой боли. 2009. Т. III, № 4. – С. 27–30.



## Крутое положение Тренделенбурга

- Управление интратекальным распространением местного анестетика с помощью выбора правильного положения
- Выбрать до достижения сенсорного блока

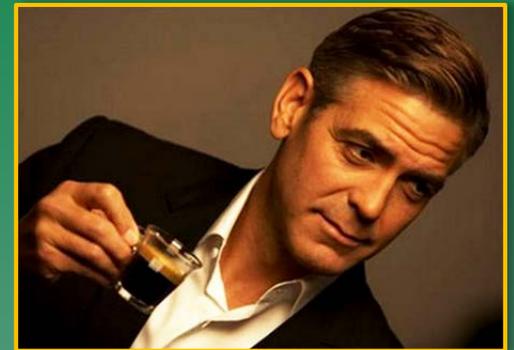


**Friedrich Trendelenburg**  
1844-1924



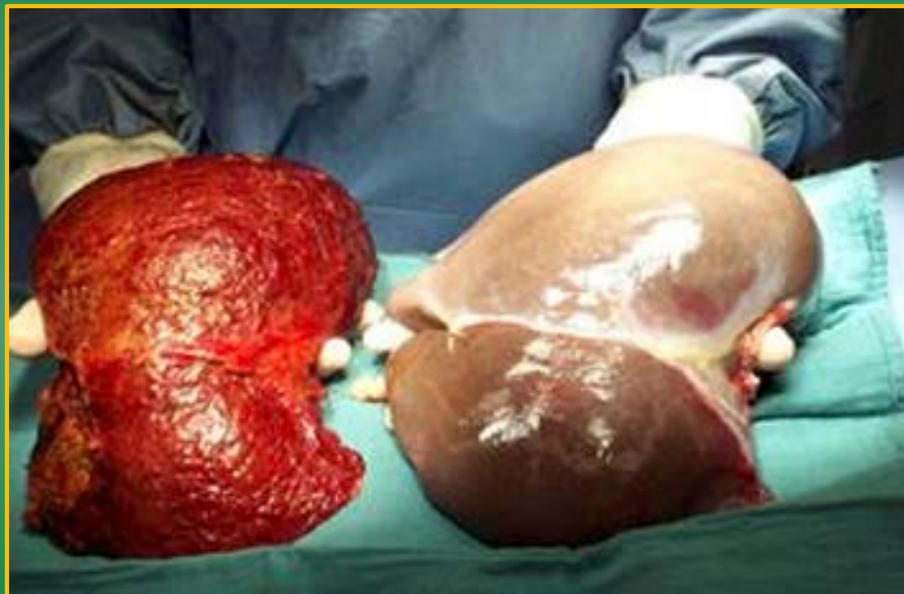
# Если не спинальная – то что?

- **Общая?**
- **Эпидуральная?**
  - ✓ длительная (продолженная) – “золотой стандарт”
  - ✓ стабильная гемодинамика
- **КС**



# Спинальная vs. Эпидуральная

Гемодинамическая стабильность



# Общая анестезия

- **Интубация трахеи**

- ✓ Трудная

- отек дыхательных путей
- кровотечение из дыхательных путей

- **Симпатическая стимуляция**

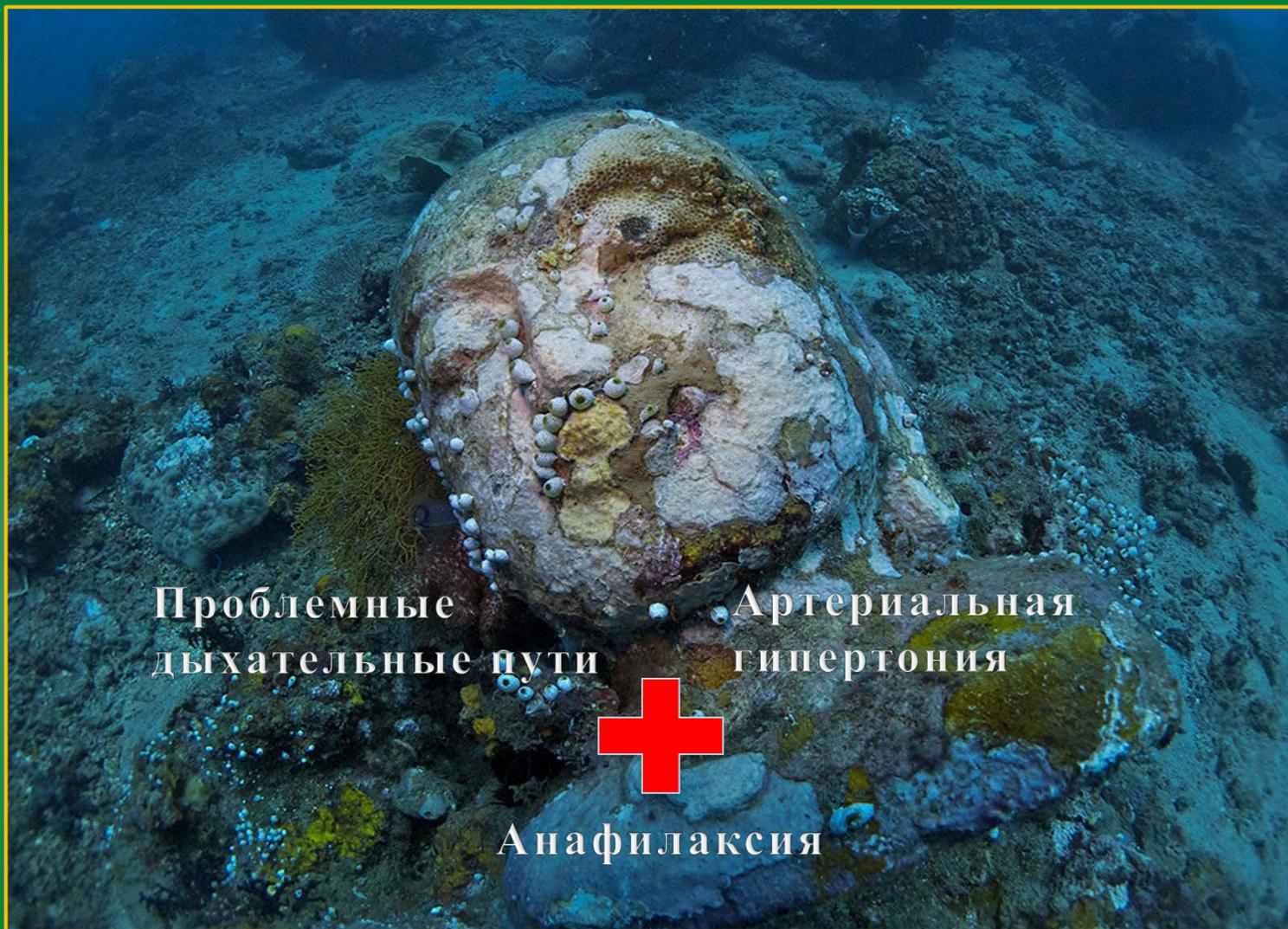
- ✓ Артериальная гипертония
- ✓ Отек легких
- ✓ Внутричерепное кровоизлияние



- Экстренная ситуация
- Противопоказание к РА



# Подводные камни



Проблемные  
дыхательные пути

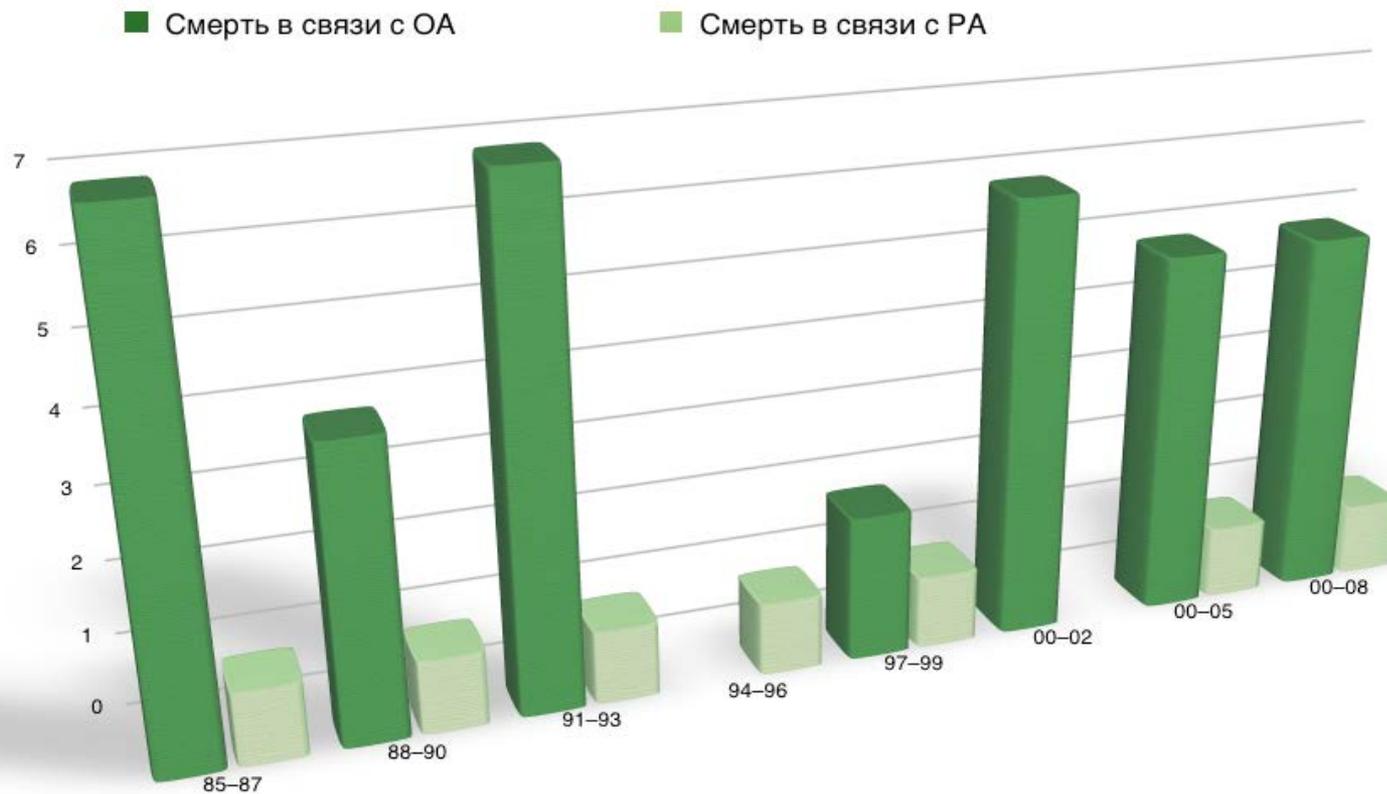
Артериальная  
гипертония



Анафилаксия



# Риск смертности



# Пример практического протокола для внутривенного введения

Медленное внутривенное введение: не менее 30 минут

**Интраоперацион**

**После операции**

НО

**Медленная инфузия<sup>1</sup>**

1 ампула в теч. 30 мин



**Непрерывная инфузия<sup>2</sup>**

4-6 ампул в теч. 24 ч

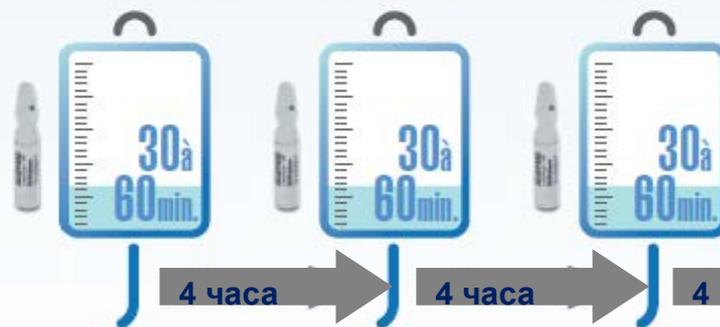


или

**Медленные инфузии с перерывами<sup>1</sup>**

1 ампула в теч. 30-60 мин

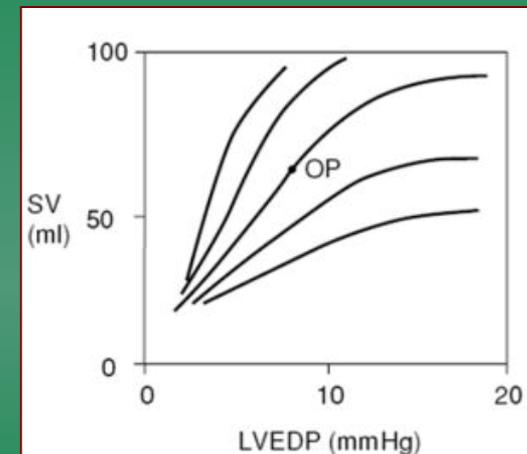
Повторять каждые 4 часа

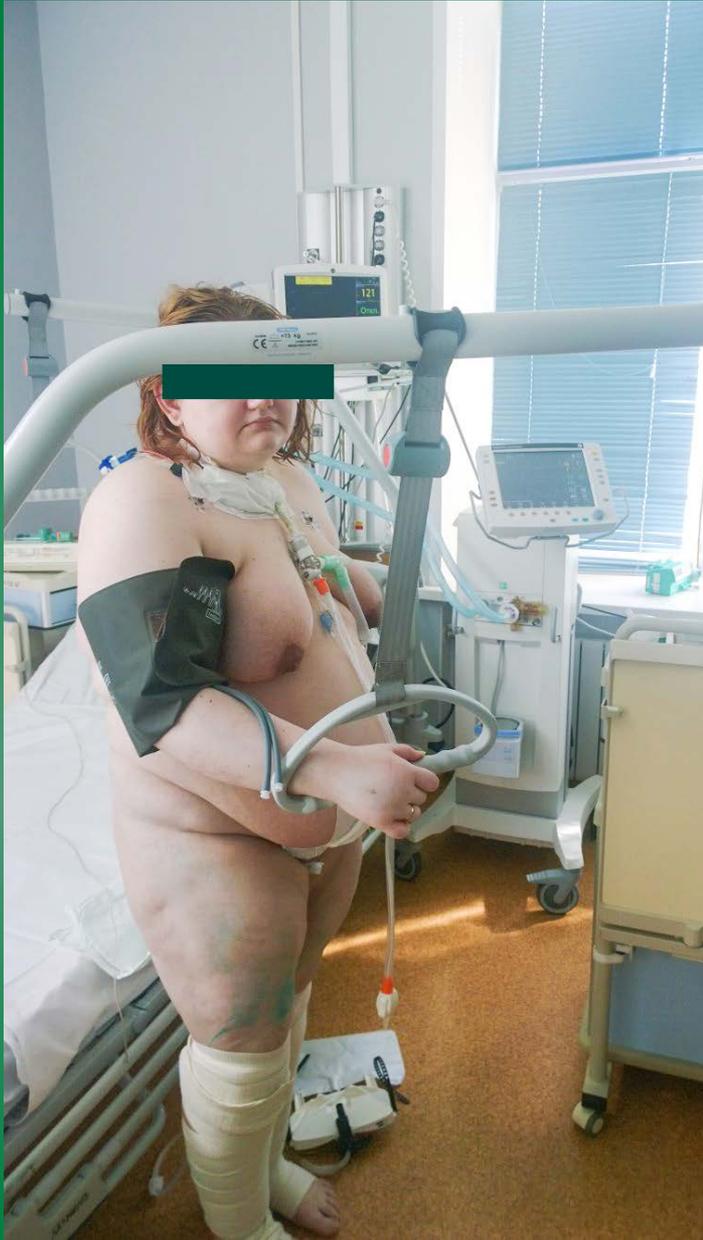


24 h

## Тактика лечения сердечно-легочной недостаточности

- Увеличенный риск ОРДС и/или кардиогенного отека.
- Множественные факторы риска:
  - ✓ изменение сил Старлинга,
  - ✓ высокое легочное капиллярное гидростатическое давление,
  - ✓ эндотелиальная дисфункция,
  - ✓ перегрузка жидкостью,
  - ✓ высокая постнагрузка,
  - ✓ Кардиомиопатия
- Нитраты.
- Управление балансом жидкости.





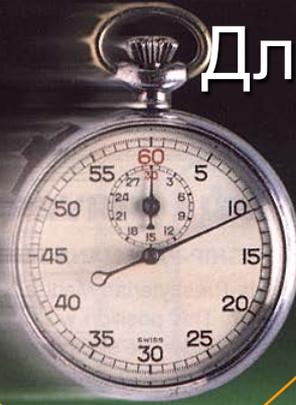
# Спинальная vs. Общая

Исход для матери и плода



Для матери?

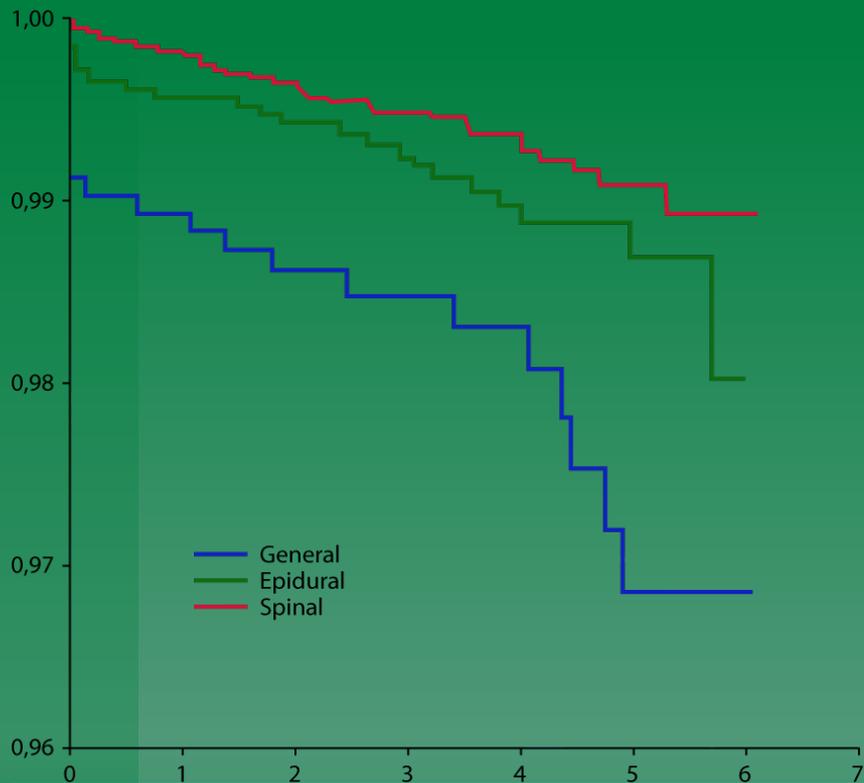
Для ребенка?



СА

Различия в оценке новорожденного по шкале Апгар при общей анестезии и при СА отмечаются только на **1 мин** жизни

## Общее обезболивание и риск инсульта



Относительный риск:  
общее обезболивание  
против регионарной  
анестезии: 2,81 (1,69–4,64)

**Рис. 1.** Частота случаев без инсульта на фоне разных методов обезболивания, оценка по методу Kaplan-Meier у пациенток с преэклампсией перед КС. Общее обезболивание против эпидуральной анестезии,  $P = 0,008$ ; общая анестезия против спинальной анестезии,  $P < 0,001$  согласно long-rank test. Ось у модифицирована, таким образом, что на графике представлены данные выживаемости в пределах 0,96–1,00.



- Неустранённый синдром аорто-кавальной компрессии перед операцией кесарева сечения или во время родоразрешения
- Недостаточная профилактика аспирационных осложнений
- Поверхностный уровень анестезии до извлечения плода
- Недостаточная защита от гемодинамических эффектов, возникающих при ларингоскопии
- Неэффективное обезболивание родов
- Небрежное ведение медицинской документации

Прощайте, эмоции, здравствуй, доказательность!



# ВЫВОДЫ

- Реже артериальная гипотония
- Ниже потребность в вазопрессорах
- Применение вазопрессоров должно быть сдержанным
- Умеренное снижение АД должно восприниматься спокойно
- Не применять профилактически фенилэфрин
- Оптимальное целевое АД и/или СВ?
- Учитывать противопоказания



○ преэклампсия ○ эклампсия ○ HELLP-синдром

**Е. М. Шифман**



пре **ЭКЛАМПСИЯ**  
**ЭКЛАМПСИЯ**  
**HELLP-синдром**

На сегодня это всё

