The Top Ten Publications since 2015 in Obstetric Anesthesia.

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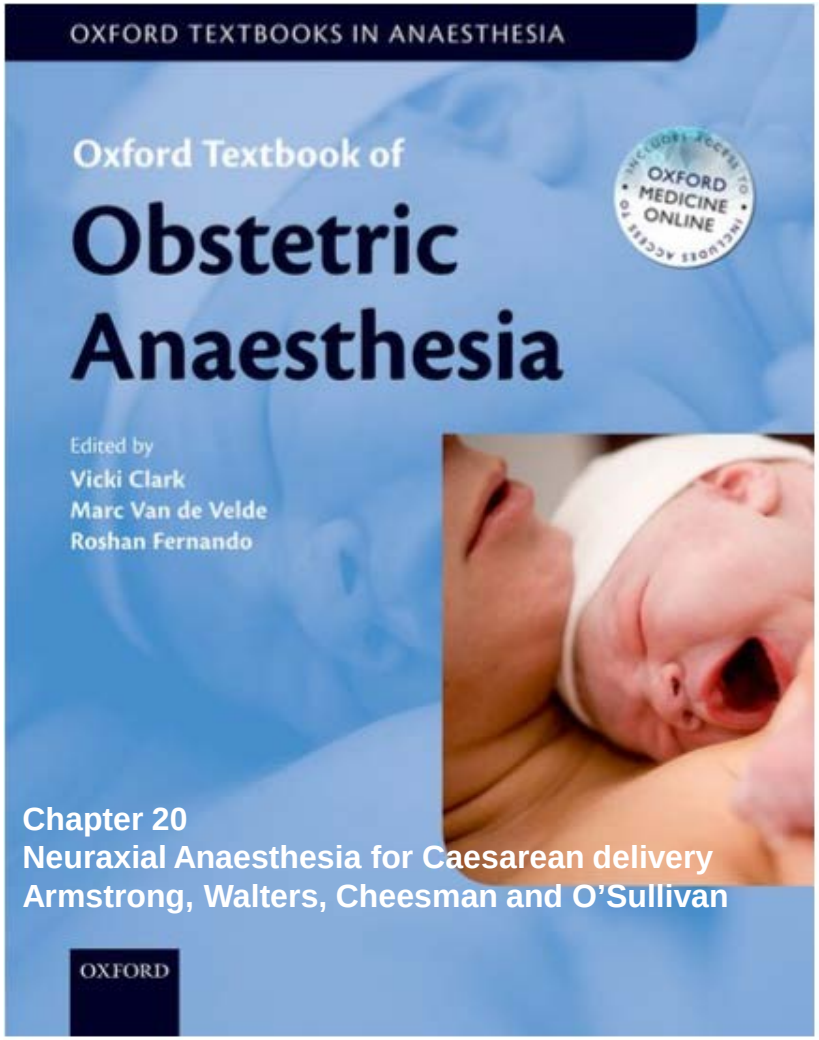
Conflicts of Interest

- Holder of the “Baxter UZLeuven Anaesthesia Research Chair 2012 – 2014”
- Co-Holder of the “Noble Gas research fund” supported by Air Liquide.
- Received financial support of the following companies for either research, consultancy or lectures **(Active = current or within the last 3 years):**
  - **Smiths Medical (active).**
  - **Sintetica (active).**
  - **Grunenthal (active).**
  - **Nordic Pharma (active).**
  - **MSD (active).**
  - **Janssens Pharmaceutics (active).**
  - **Heron (active).**
  - **Halyard (active).**
  - **Aquettant (active).**
  - **Aspen (active).**
  - AstraZeneca.
  - Glaxo Smith Kline.
  - BBraun.
  - Abbvie.
  - Fresenius.
  - GE.



Outline.

- Select 10 papers.
- Go over each paper and situate within already available literature.

- Finally make a ranking and declare a winner.

- It is of course a very personal choice.

Outline.

- Select 10 papers ➔ **16 papers.**
- Go over each paper and situate within already available literature.

- Finally make a ranking and declare a winner.

- It is of course a very personal choice.

Lecture Outline

- **Topic 1:** Remifentanil PCIA for labour analgesia.

International Journal of Obstetric Anesthesia (2016) 25, 66–74
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http://dx.doi.org/10.1016/j.ijoa.2015.12.004

REVIEW ARTICLE

ELSEVIER
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Remifentanil for labor analgesia: an evidence-based narrative review

M. Van de Velde,[a] B. Carvalho[b]

What do we know ?

- **Moderate analgesia, worse then epidural, similar then other opioids.**
- **High risk of respiratory problems:**
  - **25% reported incidence of hypoventilation, apnea, etc….**
  - **Several case reports on CPR, perimortem C-section.**
  - **High risk of medication errors.**

A Randomized Controlled Trial of the Efficacy and Respiratory Effects of Patient-Controlled Intravenous Remifentanil Analgesia and Patient-Controlled Epidural Analgesia in Laboring Women

Daniel Stocki, MD,*† Idit Matot, MD,† Sharon Einav, MD,† Smadar Eventov-Friedman, MD,§ Yehuda Ginosar, MBBS,* and Carolyn F. Weiniger, MB ChB*‖

27 apneas in remi-group
9 resulted in saturation < 90%

Hypoxemia alarm (Sao2 <94%) triggered (*n*, (%))[e]	13 (68.4%)	3 (15.8%)	0.17 to 0.74	0.003
Number of hypoxemia alarms triggered per woman (Sao_2 <94%)[c]	4;0–18[0–9]	0;0–23[0]		0.002[b]
Apnea alarm triggered (>20 s of zero respiratory rate) (*n*, (%))[e]	5 (26.3%)	0	−0.0038 to 0.51	0.046
Number of apnea alarms triggered per woman (> 20 s of zero respiratory rate)[c]	0;0–2[0–0]	0		0.018[b]

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REVIEW ARTICLE

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Remifentanil for labor analgesia: an evidence-based narrative review

M. Van de Velde,[a] B. Carvalho[b]

2 papers

Anesth Analg. 2016 Nov 18. [Epub ahead of print]

1 **Analysis of Physiological Respiratory Variable Alarm Alerts Among Laboring Women Receiving Remifentanil.**

Weiniger CF[1], Carvalho B, Stocki D, Einav S.

Anesth Analg. 2016 Sep 20. [Epub ahead of print]

2 **A Survey of Intravenous Remifentanil Use for Labor Analgesia at Academic Medical Centers in the United States.**

Aaronson J[1], Abramovitz S, Smiley R, Tangel V, Landau R.

Anesth Analg. 2016 Nov 18. [Epub ahead of print]

Analysis of Physiological Respiratory Variable Alarm Alerts Among Laboring Women Receiving Remifentanil.

Weiniger CF[1], Carvalho B, Stocki D, Einav S.

- **Secondary analysis of the 2014 paper.**

- **Analysis of RR, $etCO_2$, Pulseoximetry, heart rate and the IPI (integrated pulmonary index: score from 1 - 10).**
- ***Ability to predict apnea !!***

- **Immediate Early Warning Alerts:**
  Value below a predetermined threshold >15 seconds.
  RR < 8 bpm
  $etCO_2$ < 15 mmHg
  Saturation < 92 %
- **Sustained Early Warning Alerts: if value remained below for a further 10 seconds.**
- **IPI < or = 4: Immediate attention required.**
  IPI = 1: dire condition.
- **Apnea: $etCO_2$ < 5 mmHg for 30 seconds.**

Anesth Analg. 2016 Nov 18. [Epub ahead of print]

Analysis of Physiological Respiratory Variable Alarm Alerts Among Laboring Women Receiving Remifentanil.

Weiniger CF[1], Carvalho B, Stocki D, Einav S.

- **19 women; 160 ± 132 minutes.**

- **62 apneas !!!!**
- **331 immediate alerts.**
- **271 sustained alerts.**

- **Low positive predictive value for all parameters:**
  MANY FALSE POSITIVES

- **High sensitivity (100%) of RR and IPI to detect apnea.**
- **Good sensitivity (75%) of $etCO_2$ to detect apnea.**

- **LOW sensitivity (15%) of pulseoximetry to detect apnea.**

Retrospective, small study from The Netherlands

Acta Anesthesiologica Belgica 2016; 67, 151.

High % of apneas and desaturation not observed by midwifery staff !

Engelen, Derks, Beenakkers.

Table 2: Number of patients with desaturations and respiratory depressions

	SpO2 <80% n (%)	SpO2 <94% n (%)	RR <8/min n (%)
Standard monitoring	1 (1%)	22 (25%)	0
Continuous monitoring	20 (33%)	58 (97%)	38 (63%)
P-value	0.000	0.000	0.000

During defense:
I would no longer offer this as a routine analgesia technique

Anesth Analg. 2016 Sep 20. [Epub ahead of print]

A Survey of Intravenous Remifentanil Use for Labor Analgesia at Academic Medical Centers in the United States.

Aaronson J[1], Abramovitz S, Smiley R, Tangel V, Landau R.

- **Remifentanil PCIA in academic centers in the US:**
  - **36%**
  - **Occasional use !**
- **9 cases of serious respiratory depression / arrest.**
- **2 cases resulting in Cardiac Arrest !!**

Remifentanil PCIA: conclusions

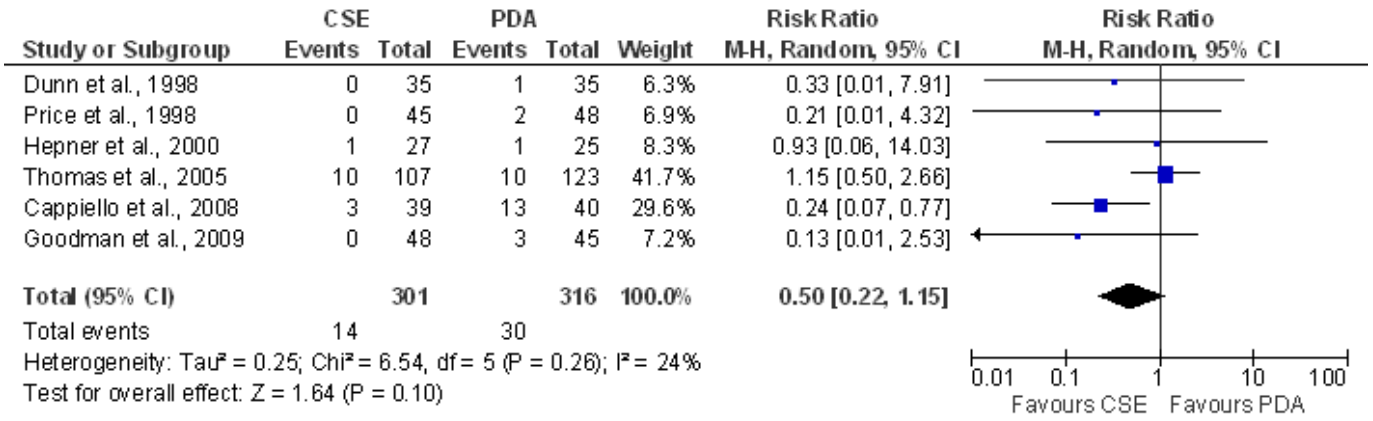
- Risks of respiratory depression are real.
- How many more data do we need before the “believers” are convinced it is a potentially lethal strategy ?!
- Saturation monitoring is of limited value.

Lecture Outline

- **Topic 1:** Remifentanil PCIA for labour analgesia.
- **Topic 2:** New data on CSE/DPE Labour analgesia.

CSE for labour analgesia: what do we know ?

Heesen et al. Anaesthesia 2014.

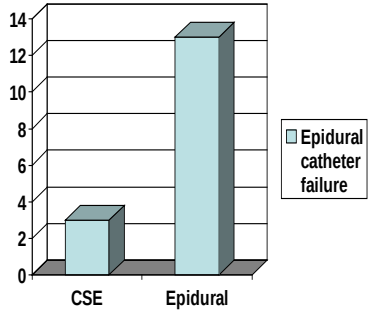


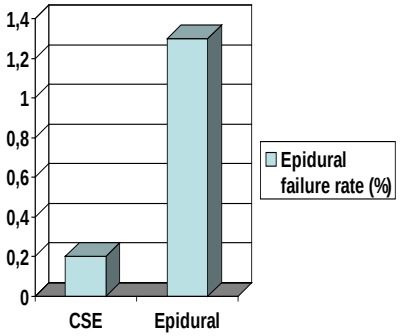
Study or Subgroup	CSE Events	CSE Total	PDA Events	PDA Total	Weight	Risk Ratio M-H, Random, 95% CI
Dunn et al., 1998	0	35	1	35	6.3%	0.33 [0.01, 7.91]
Price et al., 1998	0	45	2	48	6.9%	0.21 [0.01, 4.32]
Hepner et al., 2000	1	27	1	25	8.3%	0.93 [0.06, 14.03]
Thomas et al., 2005	10	107	10	123	41.7%	1.15 [0.50, 2.66]
Cappiello et al., 2008	3	39	13	40	29.6%	0.24 [0.07, 0.77]
Goodman et al., 2009	0	48	3	45	7.2%	0.13 [0.01, 2.53]
Total (95% CI)		**301**		**316**	**100.0%**	**0.50 [0.22, 1.15]**
Total events	14		30			

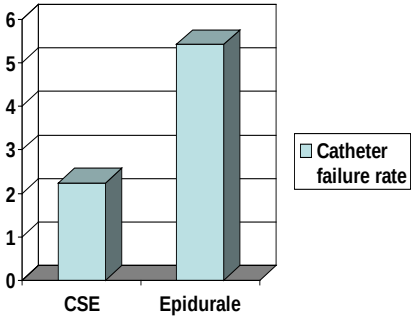
Heterogeneity: $Tau^2 = 0.25$; $Chi^2 = 6.54$, df = 5 (P = 0.26); $I^2 = 24\%$
Test for overall effect: Z = 1.64 (P = 0.10)

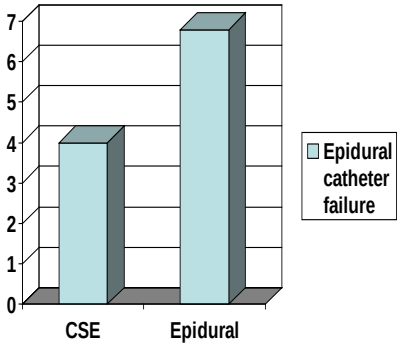
- **Advantages:**
  - Fast onset analgesia.
  - Less local anaesthetic consumption.
  - Less motor block.
  - Better quality analgesia: less epidural catheter failures (?) and less breakthrough pain + better sacral spread.
- **Disadvantages:**
  - Location of epidural catheter is not verified !
  - FHR changes.
  - Damage to the conus if not careful.

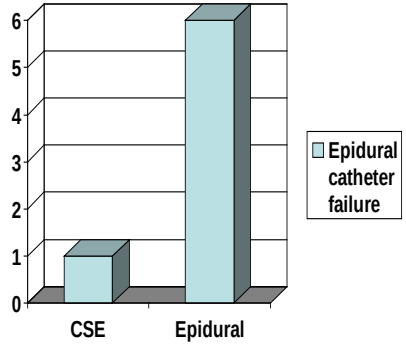
Reliability epidural catheters.

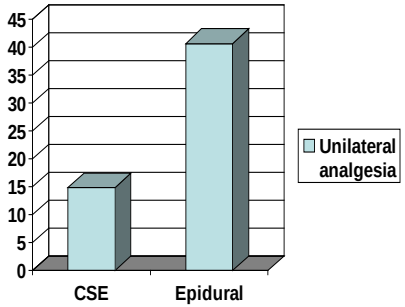


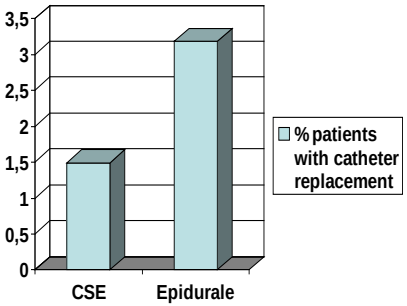


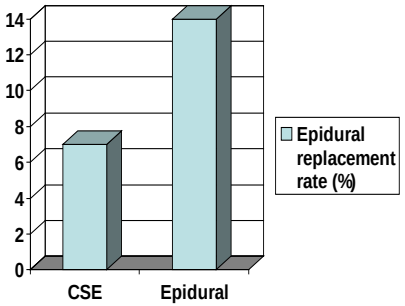


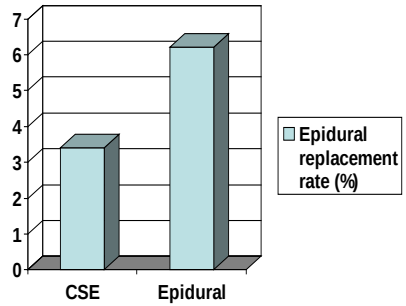












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CSE for labour analgesia: new data

2 papers

3

Combined Spinal Epidural Technique for Labor Analgesia Does Not Delay Recognition of Epidural Catheter Failures

A Single-center Retrospective Cohort Survival Analysis

Jessica M. Booth, M.D., Joshua C. Pan, B.S., Vernon H. Ross, M.D., Gregory B. Russell, M.S., Lynne C. Harris, B.S.N., Peter H. Pan, M.D., M.S.E.E.

(ANESTHESIOLOGY 2016; 125:516-24)

4

Dural Puncture Epidural Technique Improves Labor Analgesia Quality With Fewer Side Effects Compared With Epidural and Combined Spinal Epidural Techniques: A Randomized Clinical Trial

Anthony Chau, MD, MMSc, FRCPC,*†‡ Carolina Bibbo, MD,§ Chuan-Chin Huang, ScD,†
Kelly G. Elterman, MD,|| Eric C. Cappiello, MD,†‡ Julian N. Robinson, MD,‡§ and Lawrence C. Tsen, MD†‡

(Anesth Analg 2017;124:560–9)

Combined Spinal Epidural Technique for Labor Analgesia Does Not Delay Recognition of Epidural Catheter Failures

A Single-center Retrospective Cohort Survival Analysis

Jessica M. Booth, M.D., Joshua C. Pan, B.S., Vernon H. Ross, M.D., Gregory B. Russell, M.S., Lynne C. Harris, B.S.N., Peter H. Pan, M.D., M.S.E.E.

- **Retrospective analysis of anesthesia records over a 6 month period: 2395 recodrs included.**

- **Two types of epidural catheter failure:**
  - **Inadequate analgesia/anesthesia.**
  - **Technical failure: obstruction, kinking, etc….**

Conclusions: In this cohort, CSE has a significantly lower risk of overall epidural catheter failures than EPID and does not delay recognition of epidural catheter failures. Choice of CSE *versus* EPID should be based on overall risk of failure, efficacy, and side effects. **(ANESTHESIOLOGY 2016; 125:516-24)**

Combined Spinal Epidural Technique for Labor Analgesia Does Not Delay Recognition of Epidural Catheter Failures

A Single-center Retrospective Cohort Survival Analysis

Jessica M. Booth, M.D., Joshua C. Pan, B.S., Vernon H. Ross, M.D., Gregory B. Russell, M.S., Lynne C. Harris, B.S.N., Peter H. Pan, M.D., M.S.E.E.

Table 2. Descriptive Statistics of Overall Outcomes

Outcome Statistics	CSE	EPID	*P* Value
No. of all catheters placed	1,440	955	
Survival duration (min) of all catheters, median (IQR)	290 (151–496)	302 (151–559)	0.18
Failed catheters among all catheters	95/1,440 (6.6)	111/955 (11.6)	0.001
Duration (min) to failure, median (IQR)	41 (7–267)	75 (15–324)	0.048
Nontechnical failures among all those failed	47/95 (49.5)	77/111 (69.4)	0.006
Technical failures among all those failed	48/95 (50.5)	34/111 (30.6)	
Failures *during* first 30 min after placement	46/95 (48.4)	34/111 (30.6)	0.009
Failures *after* first 30 min from placement	49/95 (51.6)	77/111 (69.4)	
Nontechnical failures *during* first 30 min after placement	4/46 (8.7)	3/34 (8.8)	0.31
Technical failures *during* first 30 min after placement	42/46 (91.3)	31/34 (91.2)	
Nontechnical failures *after* first 30 min from placement	43/49 (87.8)	74/77 (96.1)	0.06
Technical failures *after* first 30 min from placement	6/49 (12.9)	3/77 (3.9)	
Catheters needed for CD	113/1,440 (7.9)	165/955 (17.3)	0.00001
Survival duration (min) of catheters needed for CD, median (IQR)	606 (407–862)	437 (234–760)	0.001
Failures among catheters needed for CD	3/113 (2.7)	17/165 (10.3)	0.03

Data are expressed as number, n/N (%) or median (interquartile range [IQR]). n is the number of events of concern, and N is the number of total events (denominator) in the corresponding category. Nontechnical failure = no block or inadequate analgesia; technical failure = inadvertent intravenous or intrathecal catheter or other technical failures such as obstructed or dislodged catheter.

CD = cesarean delivery; CSE = combined spinal epidural technique; EPID = traditional epidural technique.

Dural Puncture Epidural Technique Improves Labor Analgesia Quality With Fewer Side Effects Compared With Epidural and Combined Spinal Epidural Techniques: A Randomized Clinical Trial

Anthony Chau, MD, MMSc, FRCPC,*†‡ Carolina Bibbo, MD,§ Chuan-Chin Huang, ScD,†
Kelly G. Elterman, MD,|| Eric C. Cappiello, MD,†‡ Julian N. Robinson, MD,‡§ and Lawrence C. Tsen, MD†‡

- **3 groups: Epidural, Dural Puncture Epidural and CSE**

GROUP EPL

Epidural space ⇨ **Dura NOT perforated** ⇨ **Insertion of Epidural catheter** ⇨ **Epidural dose**

GROUP DPE

Epidural space ⇨ **Dura perforated; NO DRUGS Intrathecal** ⇨ **Insertion of Epidural catheter** ⇨ **Epidural dose**

GROUP CSE

Epidural space ⇨ **Dura perforated; DRUGS Intrathecal** ⇨ **Insertion of Epidural catheter** ⇨ **NO epidural dose**

Dural Puncture Epidural Technique Improves Labor Analgesia Quality With Fewer Side Effects Compared With Epidural and Combined Spinal Epidural Techniques: A Randomized Clinical Trial

(Anesth Analg 2017;124:560–9)

Anthony Chau, MD, MMSc, FRCPC,*†‡ Carolina Bibbo, MD,§ Chuan-Chin Huang, ScD,†
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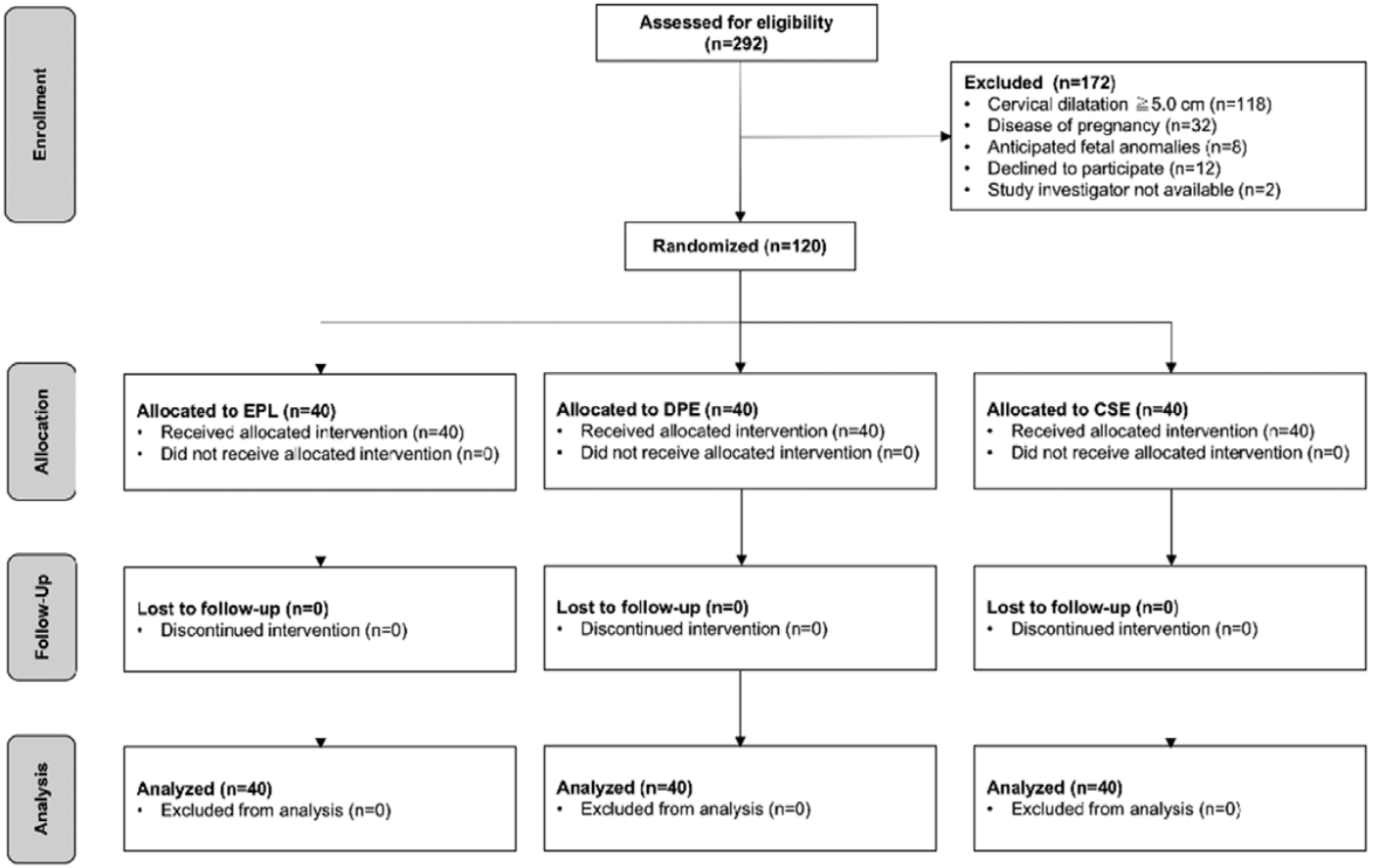

Figure 2. Consort diagram.

Dural Puncture Epidural Technique Improves Labor Analgesia Quality With Fewer Side Effects Compared With Epidural and Combined Spinal Epidural Techniques: A Randomized Clinical Trial

(Anesth Analg 2017;124:560–9)

Anthony Chau, MD, MMSc, FRCPC,*†‡ Carolina Bibbo, MD,§ Chuan-Chin Huang, ScD,†
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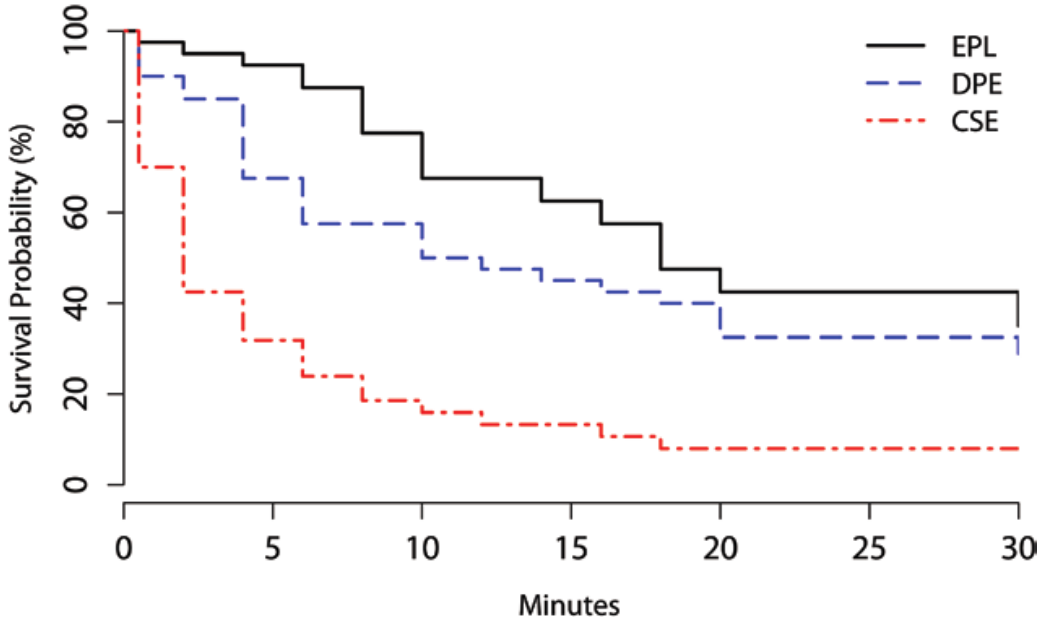


Figure 3. Kaplan-Meier curves for time to achieving NPRS ≤ 1 following initial bolus dosing by CSE, DPE, or EPL analgesia techniques. Survival probability indicates probability of subjects surviving with NPRS > 1 at given time. CSE indicates combined-spinal epidural; DPE, dural-puncture epidural; EPL, standard epidural; NPRS, numeric pain rating scale.

Dural Puncture Epidural Technique Improves Labor Analgesia Quality With Fewer Side Effects Compared With Epidural and Combined Spinal Epidural Techniques: A Randomized Clinical Trial

Anthony Chau, MD, MMSc, FRCPC,*†‡ Carolina Bibbo, MD,§ Chuan-Chin Huang, ScD,†
Kelly G. Elterman, MD,‖ Eric C. Cappiello, MD,†‡ Julian N. Robinson, MD,‡§ and Lawrence C. Tsen, MD†‡

(Anesth Analg 2017;124:560–9)

In summary, analgesia onset was most rapid with the CSE technique, with no difference between the DPE and EPL techniques; however, the DPE technique has fewer maternal and fetal side effects compared with the CSE technique, and improved block quality when compared with the EPL technique. We conclude that the DPE appears to offer a favorable risk-benefit ratio for initiating and maintaining analgesia in laboring parturients.

Table 3. Neuraxial Block Quality Parameters and Maternal Outcomes

	EPL (n = 40)	DPE (n = 40)	CSE (n = 40)
Duration of epidural infusion (min)	450 (200)	407 (275)	314 (189)
Sensory block height			
Highest level first 30 min	T4 [T2-T9]	T4 [T3-T8]	T4 [T2-T6]
Highest level any time	T4 [T2-T8]	T4 [T2-T8]	T4 [T2-T6]
Onset of analgesia			
NPRS ≤1 achieved at 0.5 min	1 (2.5)	6 (15)	14 (35)
NPRS ≤1 achieved at 10 min	16 (40)	20 (50)	35 (87.5)
NPRS ≤1 achieved at 20 min	30 (75)	32 (80)	38 (95)
NPRS ≤1 achieved at 30 min	31 (77.5)	35 (87.5)	38 (95)
Thoracic sensory block			
Bilateral T10 at 0.5 min	6 (15)	6 (15)	20 (50)
Bilateral T10 at 10 min	30 (75)	38 (95)	40 (100)
Bilateral T10 at 20 min	40 (100)	40 (100)	40 (100)
Bilateral T10 at 30 min	40 (100)	40 (100)	40 (100)
Sacral sensory block			
Bilateral S2 at 0.5 min	0 (0)	3 (7.5)	11 (27.5)
Bilateral S2 at 10 min	15 (37.5)	32 (80)	38 (95)
Bilateral S2 at 20 min	25 (62.5)	40 (100)	40 (100)
Bilateral S2 at 30 min	34 (85)	40 (100)	40 (100)
No S2 block entire duration	2 (5)	0 (0)	0 (0)
Asymmetric blocks			
First 30 min	23 (57.5)	16 (40)	8 (20)
After 30 min	21 (52.5)	4 (10)	4 (10)
Number of physician top-up interventions			
None	20 (50)	31 (77.5)	20 (50)
One or more	20 (50)	9 (22.5)	20 (50)
Time to first physician top-up (min)	207 (133)	250 (163)	132 (85)
Intervention			
Catheter adjustment	4 (10)	2 (5)	3 (7.5)
Catheter replacement	0 (0)	0 (0)	0 (0)
Motor block			
Bromage score, median [range]	0 [0–3]	0 [0–2]	0 [0–3]
Presence of motor block	15 (37.5)	6 (15)	3 (7.5)
Adverse effects			
Nausea	4 (10)	1 (2.5)	1 (2.5)
Pruritus	4 (10)	4 (10)	27 (67.5)
Hypotension	5 (12.5)	5 (12.5)	13 (32.5)
Postdural puncture headache	0 (0)	0 (0)	0 (0)
Mode of delivery			
Vaginal	28 (70)	31 (77.5)	35 (87.5)
Instrumental (vacuum or forceps)	1 (2.5)	5 (12.5)	3 (7.5)
Cesarean	11 (27.5)	4 (10)	2 (5)

Values are mean (SD), n (%), or median [range].
Abbreviations: CSE, combined spinal epidural; DPE, dural puncture epidural; EPL, epidural.

Lecture Outline

- **Topic 1:** Remifentanil PCIA for labour analgesia.
- **Topic 2:** New data on CSE Labour analgesia.
- **Topic 3:** Programmed Intermittent Epidural Bolus.

UZ LEUVEN

PIEB for maintenance of labour analgesia: what do we know ?

Anesth Analg. 2016 Oct;123(4):965-71. doi: 10.1213/ANE.0000000000001407.

Implementation of Programmed Intermittent Epidural Bolus for the Maintenance of Labor Analgesia.

Carvalho B[1], George RB, Cobb B, McKenzie C, Riley ET.

- Better sacral spread.
- Less local anesthetic consumption.
- Less motor block.
- Higher patient satisfaction.
- Less breakthrough pain.

PIEB for labour analgesia.

2 papers

5

International Journal of Obstetric Anesthesia (2016) xxx, xxx–xxx

http://dx.doi.org/10.1016/j.ijoa.2015.11.005

www.obstetanesthesia.com

ORIGINAL ARTICLE

Programmed intermittent epidural boluses for maintenance of labor analgesia: an impact study

C.P. McKenzie, B. Cobb, E.T. Riley, B. Carvalho
Department of Anesthesia, Stanford University School of Medicine, Stanford, CA, USA

6

Programmed Intermittent Epidural Bolus for Labor Analgesia During First Stage of Labor: A Biased-Coin Up-and-Down Sequential Allocation Trial to Determine the Optimum Interval Time Between Boluses of a Fixed Volume of 10 mL of Bupivacaine 0.0625% With Fentanyl 2 μg/mL

Anesth Analg 2017; 124: 537 – 541.

Marcelo Epsztein Kanczuk, MD,* Nicholas Martin Barrett, MB BCh,* Cristian Arzola, MD, MSc,* Kristi Downey, MSc,* Xiang Y. Ye, MSc,† and Jose C. A. Carvalho, MD, PhD*

International Journal of Obstetric Anesthesia (2016) xxx, xxx–xxx

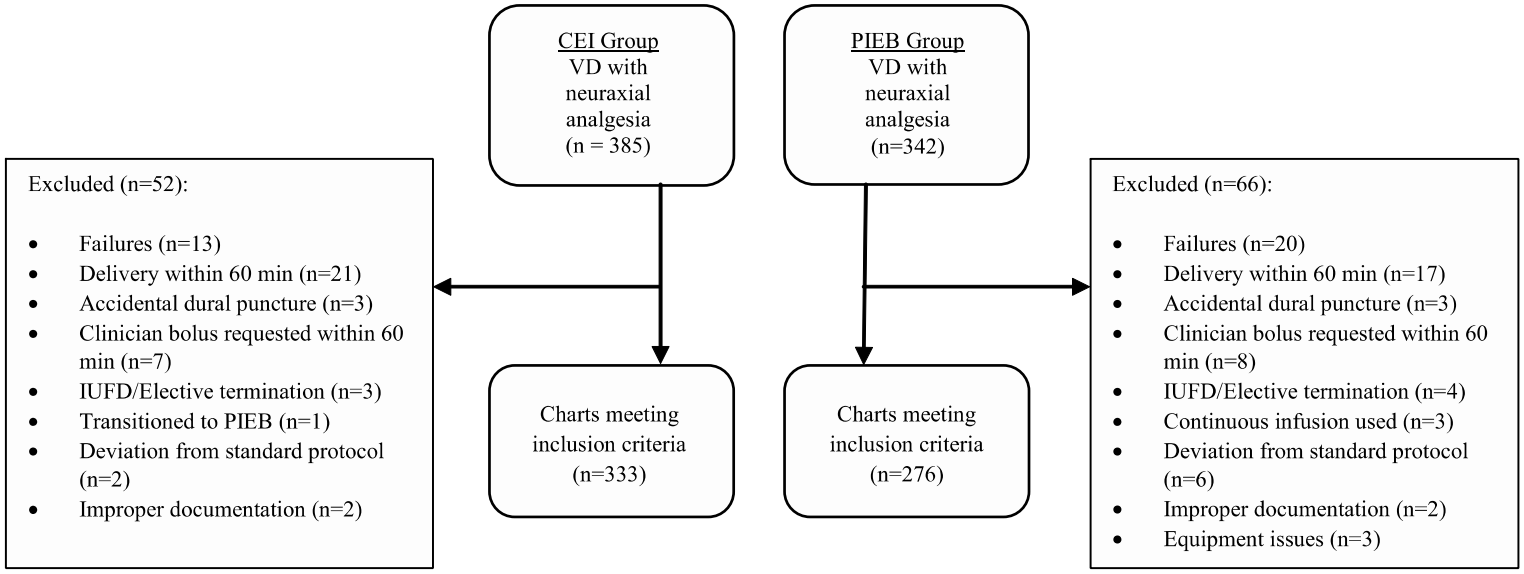
http://dx.doi.org/10.1016/j.ijoa.2015.11.005

ORIGINAL ARTICLE

ELSEVIER
www.obstetanesthesia.com

Programmed intermittent epidural boluses for maintenance of labor analgesia: an impact study

C.P. McKenzie, B. Cobb, E.T. Riley, B. Carvalho
Department of Anesthesia, Stanford University School of Medicine, Stanford, CA, USA



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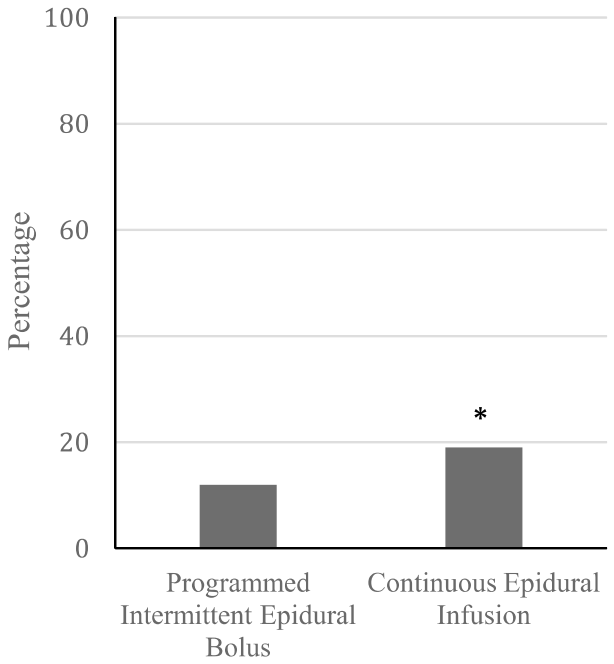

Programmed Intermittent Epidural Bolus for Labor Analgesia During First Stage of Labor: A Biased-Coin Up-and-Down Sequential Allocation Trial to Determine the Optimum Interval Time Between Boluses of a Fixed Volume of 10 mL of Bupivacaine 0.0625% With Fentanyl 2 μg/mL

Anesth Analg 2017; 124: 537 – 541.

Marcelo Epsztein Kanczuk, MD,* Nicholas Martin Barrett, MB BCh,* Cristian Arzola, MD, MSc,* Kristi Downey, MSc,* Xiang Y. Ye, MSc,† and Jose C. A. Carvalho, MD, PhD*

METHODS: We conducted a double-blind sequential allocation trial with a biased-coin up-down design to obtain the effective interval 90% for the PIEB regimen. We included American Society of Anesthesiologists physical status 2–3 nulliparous women at term undergoing spontaneous or induced labor requesting epidural analgesia. An ultrasound-assisted epidural catheter placement was performed at L2/3 or L3/4. A test dose of 3 mL of bupivacaine 0.125% plus fentanyl 3.3 μg/mL was followed by a loading dose of 12 mL of the same solution. PIEB was then started in women whose pain scores achieved Verbal Numerical Rating Score ≤1/10 within 20 minutes after the end of the loading dose. In all subjects, the programmed bolus dose was fixed at 10 mL of bupivacaine 0.0625% with fentanyl 2 μg/mL. The first bolus was delivered 1 hour after the loading dose. The PIEB interval was set at 60 minutes for the first patient and at varying time intervals (60, 50, 40, and 30 minutes; groups 60, 50, 40 and 30, respectively) for the subsequent patients, according to a biased-coin design. The primary outcome was effective analgesia, defined as no requirement for a patient-controlled epidural analgesia or a manual bolus for 6 hours after the initiation of the epidural analgesia or until the patient presented with full cervical dilatation, whichever event occurred first. Pain scores, sensory block levels to ice, degree of motor block, and blood pressure were assessed hourly.

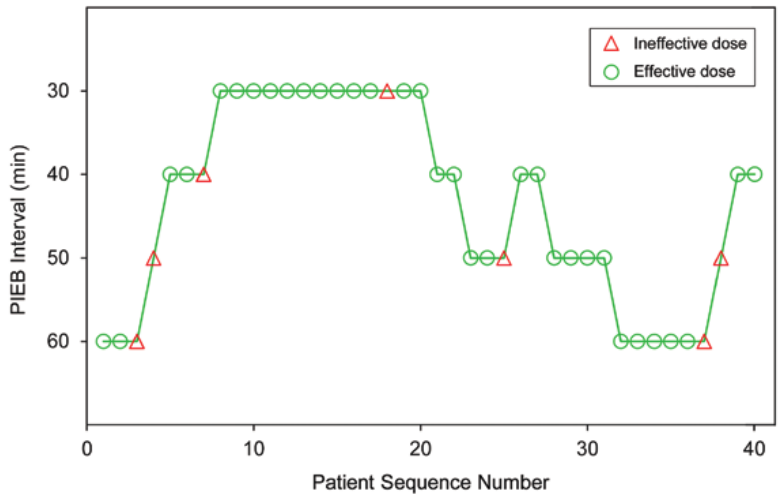

Figure. The patient allocation sequence and response to the assigned PIEB interval times. The patient sequence number (x-axis) is ordering of patient exposures using the bias coin up-and-down design. The assigned PIEB interval times (y-axis) are 60, 50, 40 and 30 min. An effective PIEB interval time is denoted by a circle, while an ineffective one is denoted by a triangle.

Programmed Intermittent Epidural Bolus for Labor Analgesia During First Stage of Labor: A Biased-Coin Up-and-Down Sequential Allocation Trial to Determine the Optimum Interval Time Between Boluses of a Fixed Volume of 10 mL of Bupivacaine 0.0625% With Fentanyl 2 μg/mL

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Table 4. Sensory Block Levels, Hypotension, and Motor Block

	PIEB Interval			
	30 min (n = 13)	40 min (n = 9)	50 min (n = 9)	60 min (n = 9)
Highest sensory block (n, %)				
T2	3 (23.1)	1 (11.1)	0 (0.0)	0 (0.0)
T3	1 (7.7)	0 (0.0)	1 (11.1)	0 (0.0)
T4	1 (7.7)	0 (0.0)	0 (0.0)	0 (0.0)
T5	4 (30.8)	3 (33.3)	1 (11.1)	1 (11.1)
T6	0 (0.0)	2 (22.2)	5 (55.6)	3 (33.3)
T7	2 (15.4)	2 (22.2)	1 (11.1)	2 (22.2)
T8	2 (15.4)	1 (11.1)	0 (0.0)	3 (33.3)
T9	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
T10	0 (0.0)	0 (0.0)	1 (11.1)	0 (0.0)
Degree of motor block (n, %)				
0	8 (61.5)	9 (100.0)	9 (100.0)	9 (100.0)
1	3 (23.1)	0 (0.0)	0 (0.0)	0 (0.0)
2	1 (7.7)	0 (0.0)	0 (0.0)	0 (0.0)
3	1 (7.7)	0 (0.0)	0 (0.0)	0 (0.0)
Hypotension (n, %)	1 (7.7)	1 (11.1)	2 (22.2)	0 (0)
Patients requiring vasopressor therapy (n, %)	0	0	0	0

Note: Sensory block and degree of motor block refer to the greatest/densest level of block over the entire study period. Hypotension was defined as the decrease in systolic blood pressure >20% from baseline occurring at any time during the study period.

Abbreviations: PIEB, programmed intermittent epidural bolus.

Ideal Timing: 40 min

Lecture Outline

- **Topic 1:** Remifentanil PCIA for labour analgesia.
- **Topic 2:** New data on CSE Labour analgesia.
- **Topic 3:** Programmed Intermittent Epidural Bolus.
- **Topic 4:** Blood pressure management during CS.

Blood pressure managment: what do we know?

- Crystalloid pre-loading has no effect !
- Crystalloid co-loading has a minimal beneficial effect.
- Phenylephrine is the vasopressor of choice.
- A continuous infusion of PE is the prophylactic strategy of choice.

Blood pressure managment and C-section.

3 papers

7

Randomized Double-blinded Comparison of Norepinephrine and Phenylephrine for Maintenance of Blood Pressure during Spinal Anesthesia for Cesarean Delivery

(Anesthesiology 2015; 122:736-45)

Warwick D. Ngan Kee, M.B.Ch.B., M.D., F.A.N.Z.C.A., F.H.K.A.M.,
Shara W. Y. Lee, B.Sc.(Hons.), M.Sc., Ph.D., Floria F. Ng, R.N., B.A.Sc.,
Perpetua E. Tan, B.Sc., M.Phil., Kim S. Khaw, M.B.B.S., M.D., F.R.C.A., F.H.K.A.M.

8

Colloids *versus* crystalloids in the prevention of hypotension induced by spinal anesthesia in elective cesarean section. A systematic review and meta-analysis

J. RIPOLLÉS MELCHOR [1, 2], Á. ESPINOSA [2, 3], E. MARTÍNEZ HURTADO [1, 2],
R. CASANS FRANCÉS [2, 4], R. NAVARRO PÉREZ [1, 2], A. ABAD GURUMETA [2, 5],
J. M. CALVO VECINO [1, 2]

(Minerva Anestesiol 2015;81:1019-30)

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- **PE: vasopressor of choice but bradycardia and decrease in CO.**
- **Norepinephrine: weak Beta-adrenergic receptor effects: CO better ?**

Methods: In a randomized, double-blinded study, 104 healthy patients having cesarean delivery under spinal anesthesia were randomized to have systolic blood pressure maintained with a computer-controlled infusion of norepinephrine 5 μg/ml or phenylephrine 100 μg/ml. The primary outcome compared was cardiac output. Blood pressure heart rate and neonatal outcome were also compared.

(ANESTHESIOLOGY 2015; 122:736-45)

Randomized Double-blinded Comparison of Norepinephrine and Phenylephrine for Maintenance of Blood Pressure during Spinal Anesthesia for Cesarean Delivery

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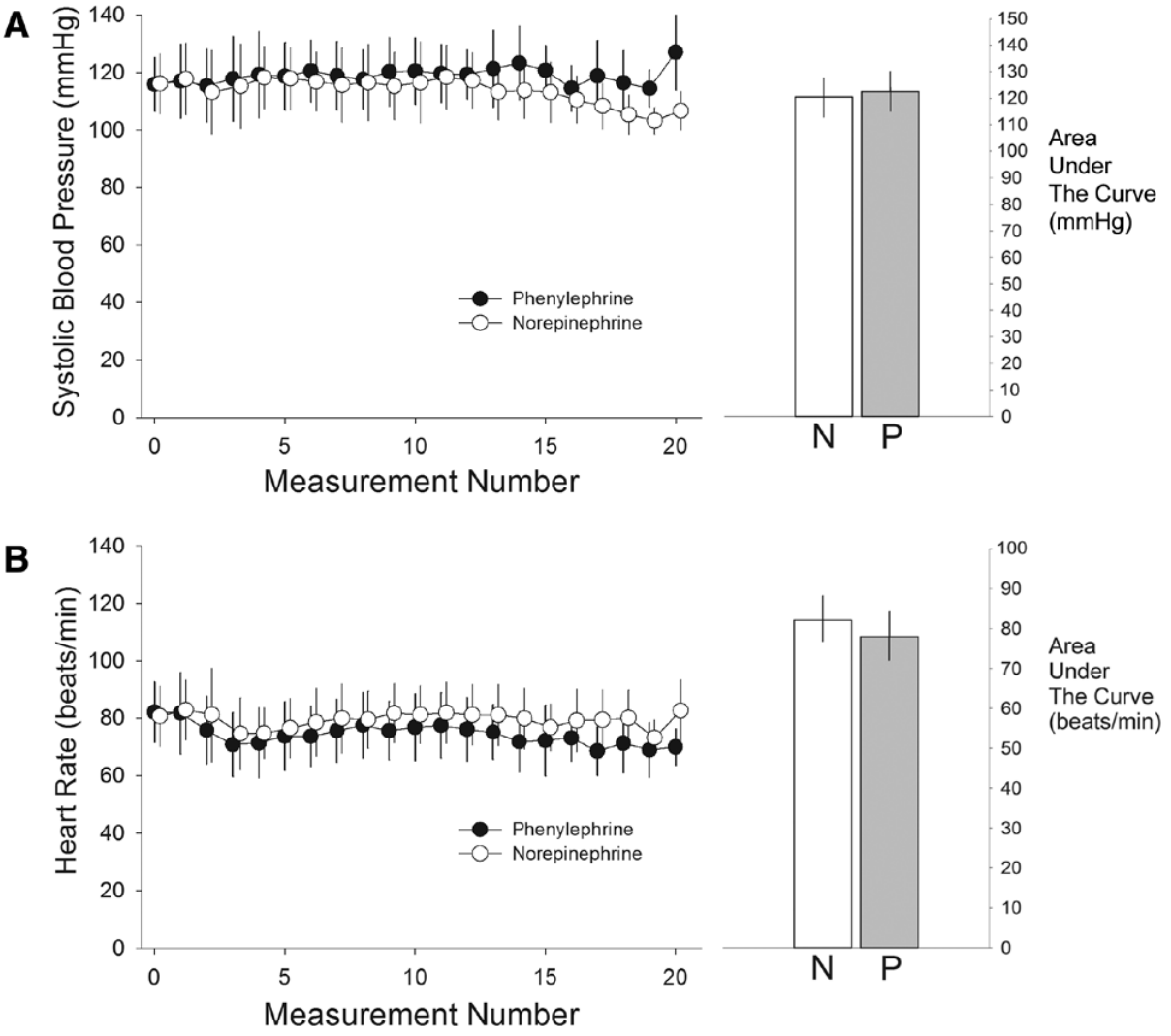
P < 0.05 for Heart Rate



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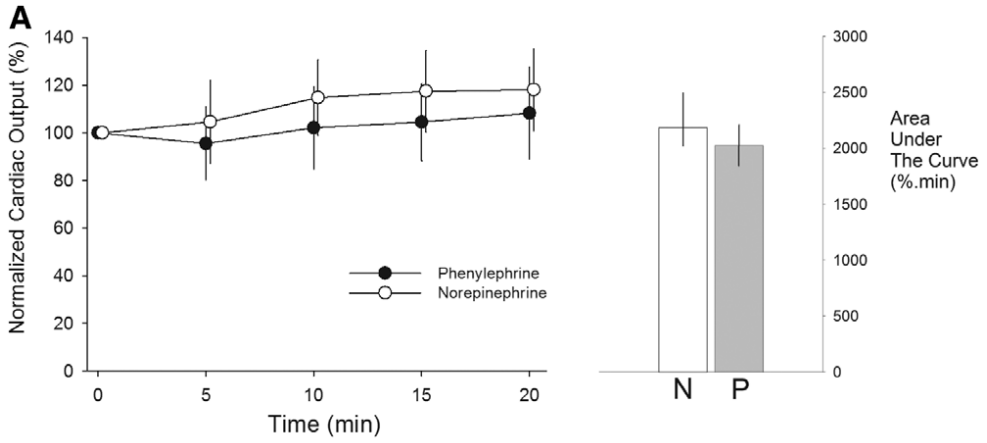

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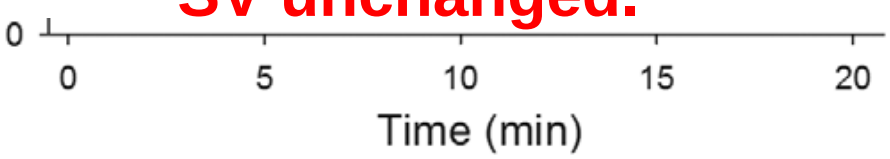
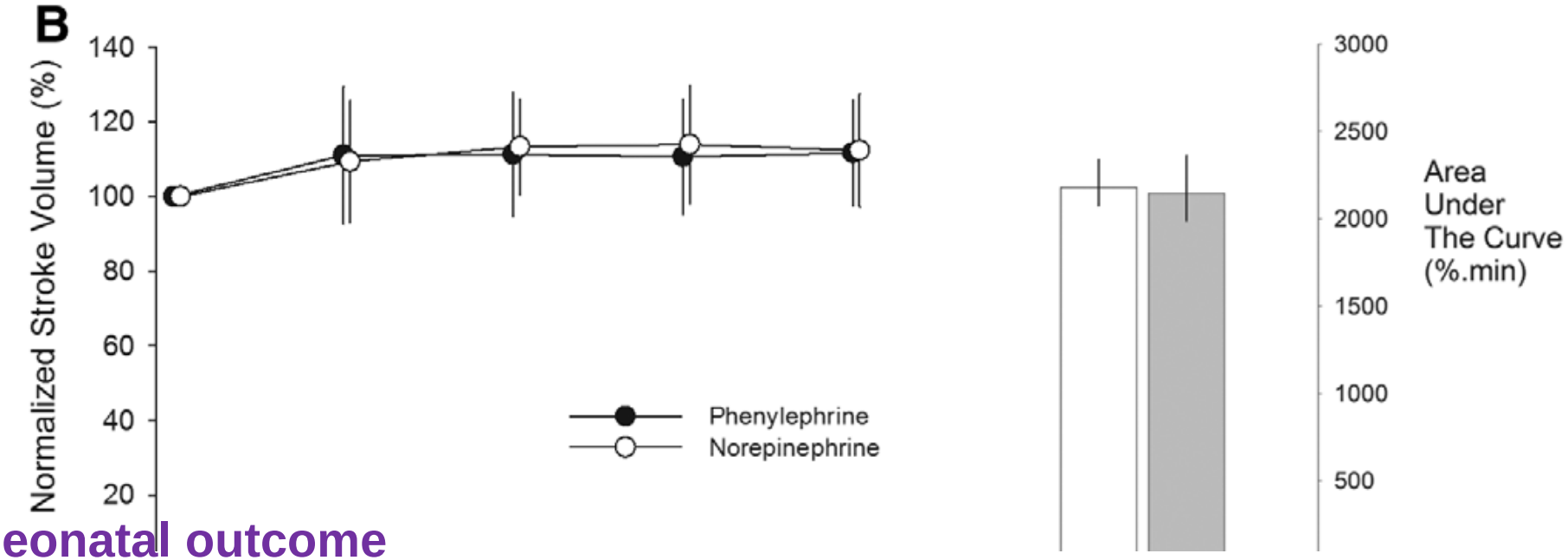




Similar neonatal outcome

J Clin Monit Comput. 2016 Apr 30. [Epub ahead of print]

Performance of a closed-loop feedback computer-controlled infusion system for maintaining blood pressure during spinal anaesthesia for caesarean section: a randomized controlled comparison of norepinephrine versus phenylephrine.

Ngan Kee WD[1], Khaw KS[2], Tam YH[2], Ng FF[2], Lee SW[3].

Colloids *versus* crystalloids in the prevention of hypotension induced by spinal anesthesia in elective cesarean section. A systematic review and meta-analysis

J. RIPOLLÉS MELCHOR [1, 2], Á. ESPINOSA [2, 3], E. MARTÍNEZ HURTADO [1, 2], R. CASANS FRANCÉS [2, 4], R. NAVARRO PÉREZ [1, 2], A. ABAD GURUMETA [2, 5], J. M. CALVO VECINO [1, 2]

(Minerva Anestesiol 2015;81:1019-30)

- **11 trials included, 990 patients.**

- **Less hypotension with colloid (RR 0.70 (0.53 – 0.92).**
- **No difference in intraoperative nausea and vomiting.**

Lecture Outline

- **Topic 1:** Remifentanil PCIA for labour analgesia.
- **Topic 2:** New data on CSE Labour analgesia.
- **Topic 3:** Programmed Intermittent Epidural Bolus.
- **Topic 4:** Blood pressure management during CS.
- **Topic 5:** General Anesthesia for CS.

General Anesthesia and C-section.

2 papers

9

Low-Dose or High-Dose Rocuronium Reversed with Neostigmine or Sugammadex for Cesarean Delivery Anesthesia: A Randomized Controlled Noninferiority Trial of Time to Tracheal Intubation and Extubation

Petr Stourac, MD, PhD,* Milan Adamus, MD, PhD,† Dagmar Seidlova, MD, PhD,‡ Tomas Pavlik, MSc, PhD,§ Petr Janku, MD, PhD,‖ Ivo Krikava, MD, PhD,¶ Zdenek Mrozek, MD, PhD,† Martin Prochazka, MD, PhD,# Jozef Klucka, MD,* Roman Stoudek, MD,* Ivana Bartikova, MD,¶ Martina Kosinova, MD,¶ Hana Harazim, MD,¶ Hana Robotkova, MD,‡ Karel Hejduk, MSc,§ Zuzana Hodicka, MD, PhD,‖ Martina Kirchnerova, MD,† Jana Francakova, MD,† Lenka Obare Pyszkova, MD,† Jarmila Hlozkova, MD,† and Pavel Sevcik, MD, PhD**

(Anesth Analg 2016;122:1536–45)

Anaesthesia 2015, 70, 1286–1306 doi:10.1111/anae.13260

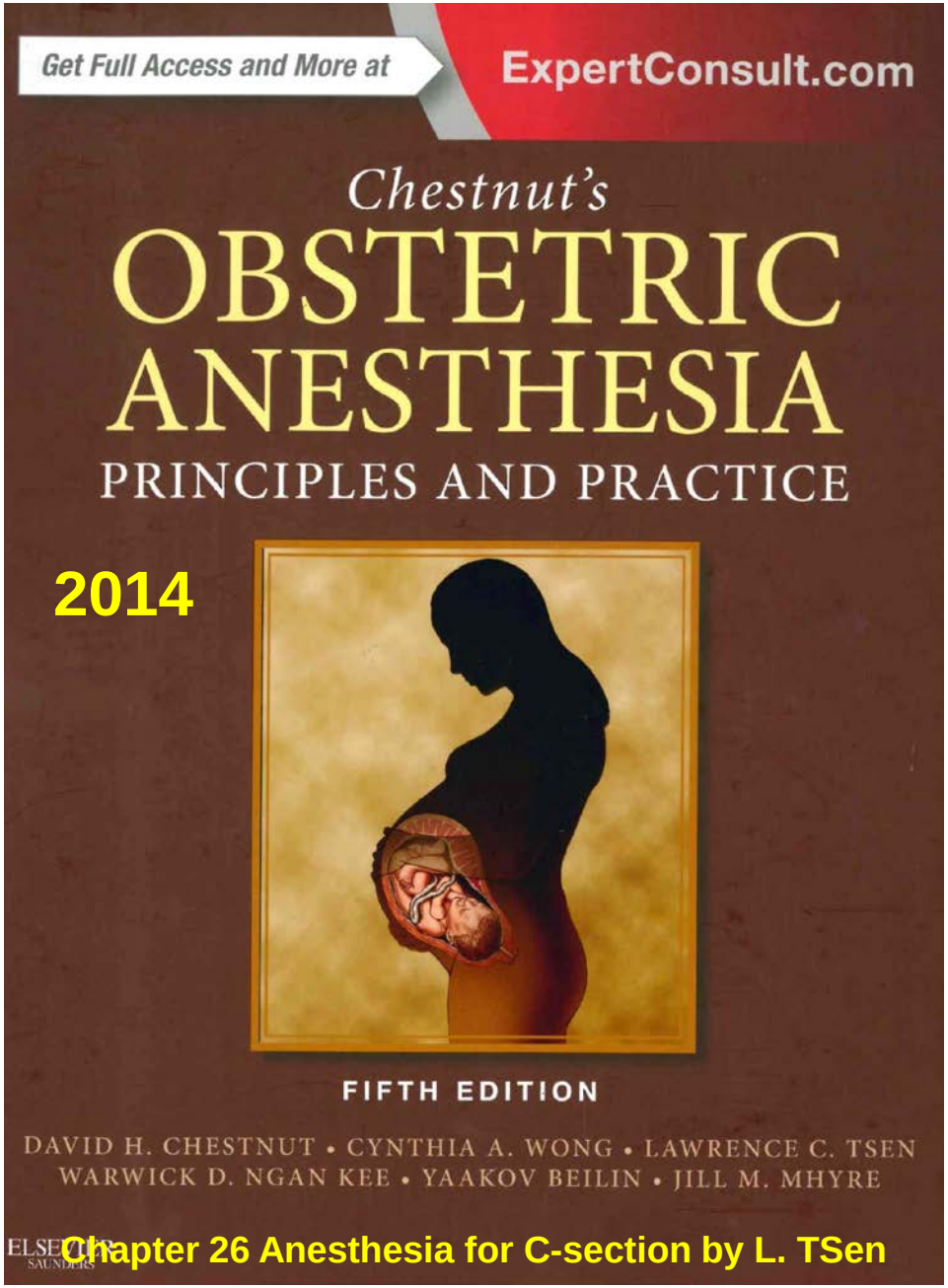
10

Guidelines

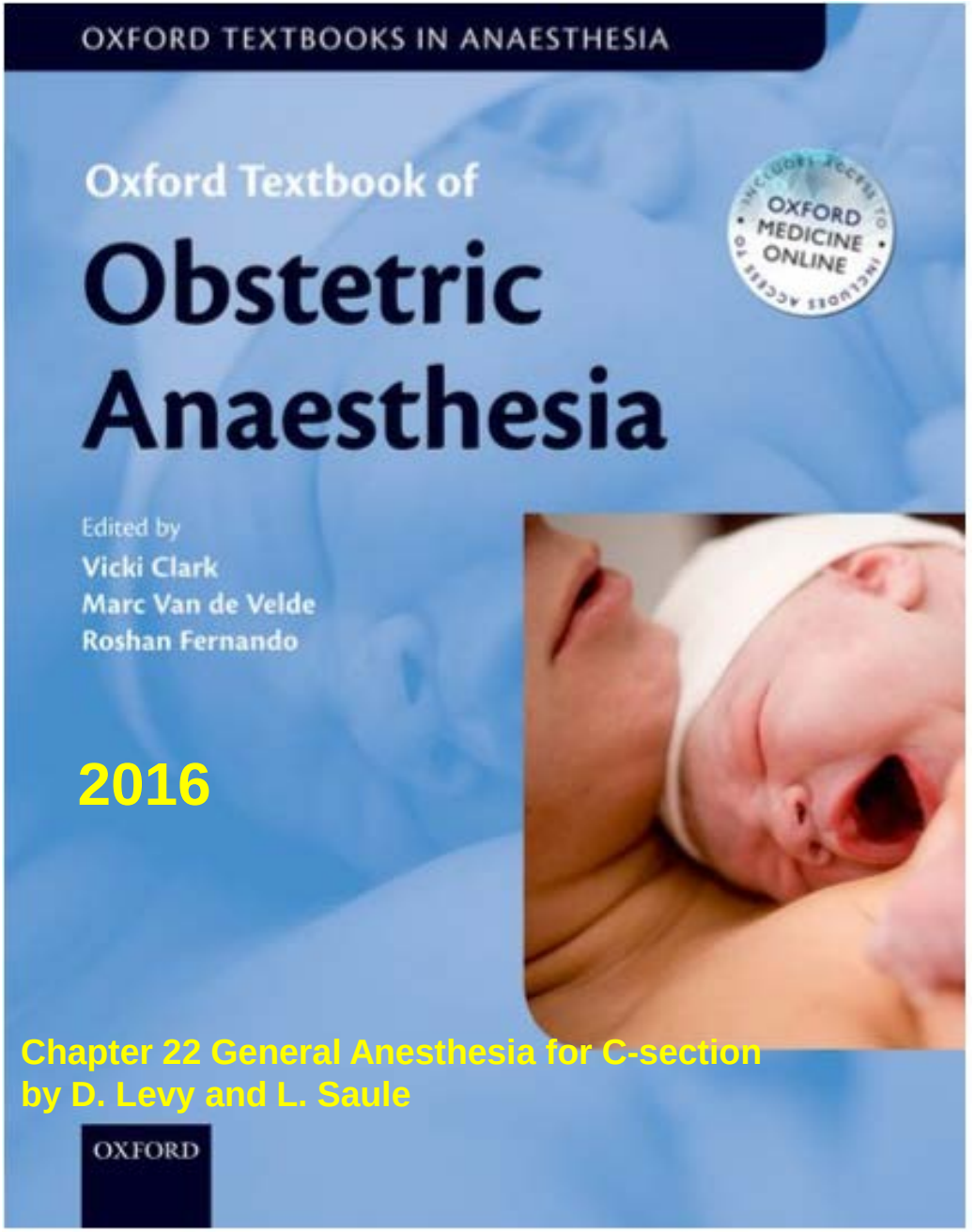
Obstetric Anaesthetists' Association and Difficult Airway Society guidelines for the management of difficult and failed tracheal intubation in obstetrics*

M. C. Mushambi,[1] S. M. Kinsella,[2] M. Popat,[3] H. Swales,[4] K. K. Ramaswamy,[5] A. L. Winton[6] and A. C. Quinn[7,8]

Conventional Textbook Technique of GA



Chapter 26 Anesthesia for C-section by L. TSen



Chapter 22 General Anesthesia for C-section by D. Levy and L. Saule

Conventional Textbook Technique of GA

- Pre-anesthetic assessment, plan and get informed consent.
- Prepare medication and equipment.
- Supine with left uterine displacement.
- Secure IV access.
- Aspiration prophylaxis: metoclopramide, ranitidine, sodium citrate 30' before surgery or ASAP.
- Monitoring.
- Antibiotic prophylaxis.
- Time out.
- Preoxygenation/denitrogenation.
- Draping and surgeon ready for surgery.
- Rapid Sequence Induction:
  - Cricoid pressure: 10 => 30 N.
  - Thio/Sux or propofol/Sux. NO opioid
  - No mask ventilation.
- Tracheal intubation.
- Low MAC inhalational anesthesia (maximum 1 MAC) + or – Nitrous Oxide.
- Manage hypotension.
- Additional muscle relaxant if required (ROC, VEC, ….)
- Delivery.
- Adminster oxytocin slowly.
- Administer opioid, reduce MAC to 0.5 – 0.75.
- Extubation after full reversal of NMB – pain relief

Box 22.2 Key steps in rapid sequence induction of general anaesthesia for caesarean delivery

- ◆ WHO surgical safety checklist
- ◆ Left lateral table tilt to reduce aortocaval compression in association with (~25°) head-up ('reverse Trendelenburg') position to ensure stomach is below the level of the head
- ◆ Graduated compression stockings fitted, and (if used) pneumatic calf-compression system functional
- ◆ Large gauge IV access secured and patency verified
- ◆ Suction device immediately available and suction system working
- ◆ Physiological monitoring systems functioning
- ◆ Preoxygenation (denitrogenation)
- ◆ IV antimicrobial prophylaxis—ideally should be administered before skin incision
- ◆ IV induction of anaesthesia: precalculated doses of (traditionally) thiopental 7 mg/kg (maximum 500 mg) and succinylcholine (maximum 150 mg)
- ◆ Application of cricoid pressure (still taught to UK trainees) 10 N awake, increased to 30 N on loss of consciousness
- ◆ Intubation of the trachea with a cuffed tube, usually one size smaller than in the non-pregnant population (i.e. 7.0 mm internal diameter)
- ◆ Delivery of volatile agent (initially with overpressure) in nitrous oxide or air and oxygen
- ◆ Permission to obstetrician to start surgery
- ◆ After delivery: oxytocic agent, IV opioid, and antiemetic
- ◆ Emergence and tracheal extubation: woman positioned semi-recumbent/upright and awake

MODIFICATIONS

Technique

Pre-oxygenation.

Cricoid Pressure or not ?

Mask ventilation or not ?

ETT or LMA ?

Videolaryngoscopes.

Airway algorythm

Drugs

Propofol or Thiopental

TIVA/TCI or Volatile based ?

Rocuronium or Sux ?

Opioid prior to delivery ?

Low-Dose or High-Dose Rocuronium Reversed with Neostigmine or Sugammadex for Cesarean Delivery Anesthesia: A Randomized Controlled Noninferiority Trial of Time to Tracheal Intubation and Extubation

Petr Stourac, MD, PhD,* Milan Adamus, MD, PhD,† Dagmar Seidlova, MD, PhD,‡
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Lenka Obare Pyszkova, MD,† Jarmila Hlozkova, MD,† and Pavel Sevcik, MD, PhD**

(Anesth Analg 2016;122:1536–45)

- Non-inferiority trial
- 240 patients
- ROC: 1 mg/kg versus SUX: 1 mg/kg.
- Similar intubation times.
- Less myalgia, better intubation conditions and less subjective complaints with ROC.

Table 3. Evaluation of Intubating Conditions

	ROC group (n = 120)		SUX group (n = 120)		
	n	%	n	%	P^a
Resistance to laryngoscopy					0.019
None	105	88	89	74	
Mild (slight)	14	12	25	21	
Severe (active)	1	1	6	5	
Position of vocal cords					0.48
Medial	38	32	47	39	
Paramedial	11	9	8	7	
Partially abducted	12	10	15	13	
Fully abducted	59	49	50	42	
Laryngoscopic view (Cormack-Lehane)					0.30
I and II	116	97	110	92	
IIIA and greater	4	3	10	8	
Response to intubation attempt					0.26
None	71	59	70	58	
Cardiovascular[b]	42	35	36	30	
Limb movement or cough	7	6	14	12	

Anaesthesia 2015, 70, 1286–1306 doi:10.1111/anae.13260

Guidelines

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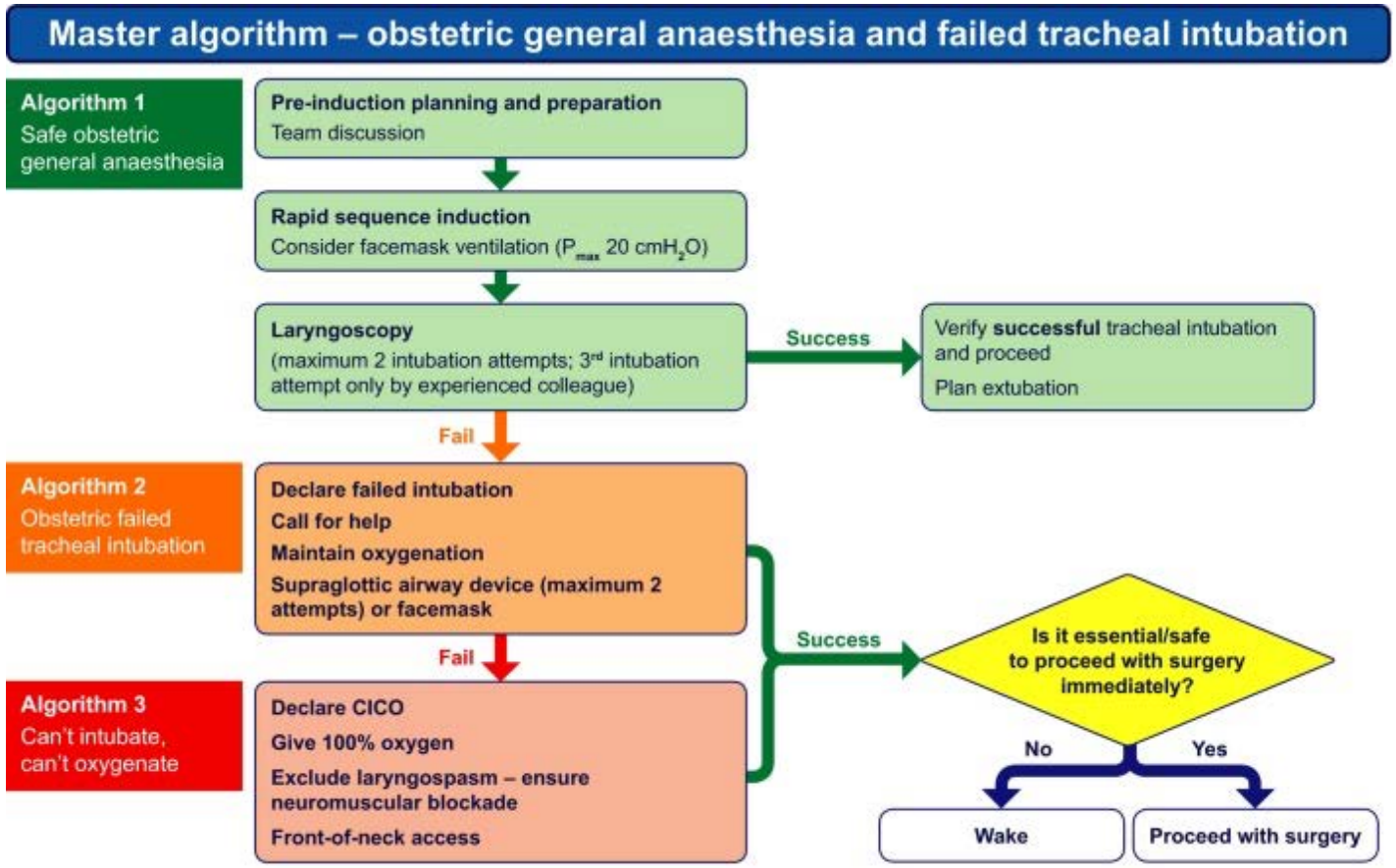

UZ LEUVEN

Table 1 – proceed with surgery?

	Factors to consider	WAKE			PROCEED
Before induction	**Maternal condition**	• No compromise	• Mild acute compromise	• Haemorrhage responsive to resuscitation	• Hypovolaemia requiring corrective surgery • Critical cardiac or respiratory compromise, cardiac arrest
	Fetal condition	• No compromise	• Compromise corrected with intrauterine resuscitation, pH < 7.2 but > 7.15	• Continuing fetal heart rate abnormality despite intrauterine resuscitation, pH < 7.15	• Sustained bradycardia • Fetal haemorrhage • Suspected uterine rupture
	Anaesthetist	• Novice	• Junior trainee	• Senior trainee	• Consultant/specialist
	Obesity	• Supermorbid	• Morbid	• Obese	• Normal
	Surgical factors	• Complex surgery or major haemorrhage anticipated	• Multiple uterine scars • Some surgical difficulties expected	• Single uterine scar	• No risk factors
	Aspiration risk	• Recent food	• No recent food • In labour • Opioids given • Antacids not given	• No recent food • In labour • Opioids not given • Antacids given	• Fasted • Not in labour • Antacids given
	Alternative anaesthesia • **regional** • **securing airway awake**	• No anticipated difficulty	• Predicted difficulty	• Relatively contraindicated	• Absolutely contraindicated or has failed • Surgery started
After failed intubation	**Airway device/ ventilation**	• Difficult facemask ventilation • Front-of-neck	• Adequate facemask ventilation	• First generation supraglottic airway device	• Second generation supraglottic airway device
	Airway hazards	• Laryngeal oedema • Stridor	• Bleeding • Trauma	• Secretions	• None evident

Lecture Outline

- **Topic 1:** Remifentanil PCIA for labour analgesia.
- **Topic 2:** New data on CSE Labour analgesia.
- **Topic 3:** Programmed Intermittent Epidural Bolus.
- **Topic 4:** Blood pressure management during CS.
- **Topic 5:** General Anesthesia for CS.
- **Topic 6:** Complications.

Complications.

3 papers

11

International Journal of Obstetric Anesthesia (2016) 25, 58–65
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http://dx.doi.org/10.1016/j.ijoa.2015.09.003

ORIGINAL ARTICLE

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Intracranial subdural haematoma following neuraxial anaesthesia in the obstetric population: a literature review with analysis of 56 reported cases

V. Cuypers, M. Van de Velde, S. Devroe
Department of Anaesthesiology, University Hospitals Leuven, Katholieke Universiteit Leuven, Leuven, Belgium

12

Acta Anaesthesiol Scand. 2016 Jul;60(6):810-20. doi: 10.1111/aas.12702. Epub 2016 Feb 15.

Full Text Online Library

Nationwide incidence of serious complications of epidural analgesia in the United States.

Rosero EB[1], Joshi GP[1].

13

DOI: 10.1111/1471-0528.14521
www.bjog.org

General obstetrics

The CAPS Study: incidence, management and outcomes of cardiac arrest in pregnancy in the UK: a prospective, descriptive study

Subdural hematoma Following ADP and PDPH

Subdural haematoma and cerebral venous sinus thrombosis are well recognised complications of dural puncture and pregnancy, respectively. Both should always be included in the differential diagnosis of persistent headache after dural tap or after post-dural puncture headache.

Any woman who suffers a dural tap or post-dural puncture headache must be notified to her GP and routine follow-up arranged.

Any pregnant or recently pregnant woman with serious neurological symptoms/signs requires urgent appropriate early referral/ imaging.

Inter-hospital transfer of a high-risk and/or a woman with a reduced level of consciousness requires appropriate medical (usually anaesthetic) involvement (Association of Anaesthetists of Great Britain and Ireland 2009).

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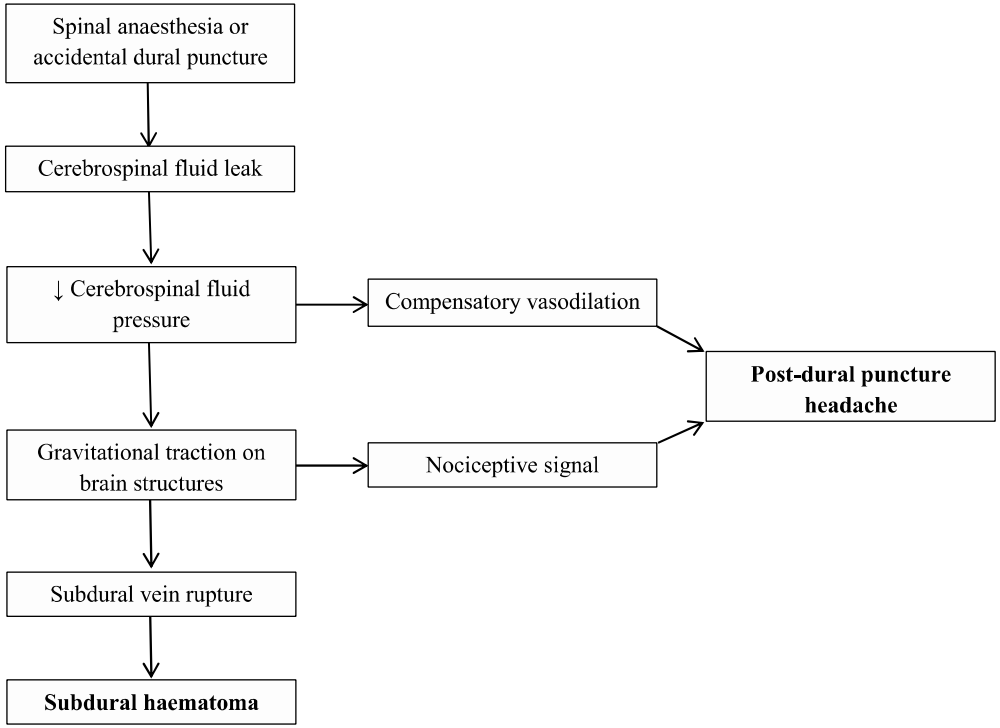

tracranial subdural haematoma

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Table 1 Reported cases of subdural haematoma following neuraxial anaesthesia

	Epidural (n=34)	Spinal (n=20)
Age (years)	29 [15–46]	28.5 [20–39]
Mode of delivery		
Vaginal delivery	30 (88%)	3 (15%)
Caesarean section	4 (12%)	17 (85%)
Risk factors present	2 (6%)	1 (5%)
Spinal needle size*		
26–27 gauge		6 (31%)
24–25 gauge		10 (53%)
<24 gauge		3 (16%)
Symptoms		
Post-dural puncture headache	31 (91%)	12 (60%)
Focal neurological signs	24 (71%)	13 (65%)
Time until diagnosis		
<1 week	9 (26%)	11 (55%)
>1 week–<1 month	18 (53%)	8 (40%)
>1 month	7 (21%)	1 (5%)
Management		
Conservative	15 (44%)	6 (30%)
Surgery	17 (50%)	13 (65%)
Blood patch	18 (53%)	1 (5%)
Outcome		
Death	3 (9%)	1 (5%)
Neurological deficit	1 (3%)	5 (25%)
Recovery	30 (88%)	14 (70%)

Data are median [range] and number (%).
*Data not available for one patient.

International Journal of Obstetric Anesthesia (2016) 25, 58–65
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http://dx.doi.org/10.1016/j.ijoa.2015.09.003

ORIGINAL ARTICLE

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Intracranial subdural haematoma following neuraxial anaesthesia in the obstetric population: a literature review with analysis of 56 reported cases

V. Cuypers, M. Van de Velde, S. Devroe
Department of Anaesthesiology, University Hospitals Leuven, Katholieke Universiteit Leuven, Leuven, Belgium

Table 2 Symptoms and signs of subdural haematoma

	Epidural (n=34)	Spinal (n=20)	Total
Post-dural puncture headache	31 (91%)	12 (60%)	43 (77%)
Persistent, non-postural headache	29 (85%)	16 (80%)	45 (83%)
Dizziness, nausea, vomiting	14 (41%)	8 (4%)	22 (41%)
Seizures	4 (12%)	1 (0.5%)	5 (9%)
Paresis	5 (15%)	10 (50%)	15 (28%)
Paraesthesia/numbness	3 (9%)	3 (1.5%)	6 (11%)
Aphasia/dysarthria	4 (12%)	3 (1.5%)	7 (13%)
Blurred vision/diplopia	9 (26%)	2 (1%)	11 (20%)
Drowsy/disorientation	8 (23%)	2 (1%)	10 (18%)
Depressed level of consciousness	4 (12%)	5 (2.5%)	9 (17%)
Comatose	3 (9%)	4 (2%)	7 (13%)

Data are number (%).

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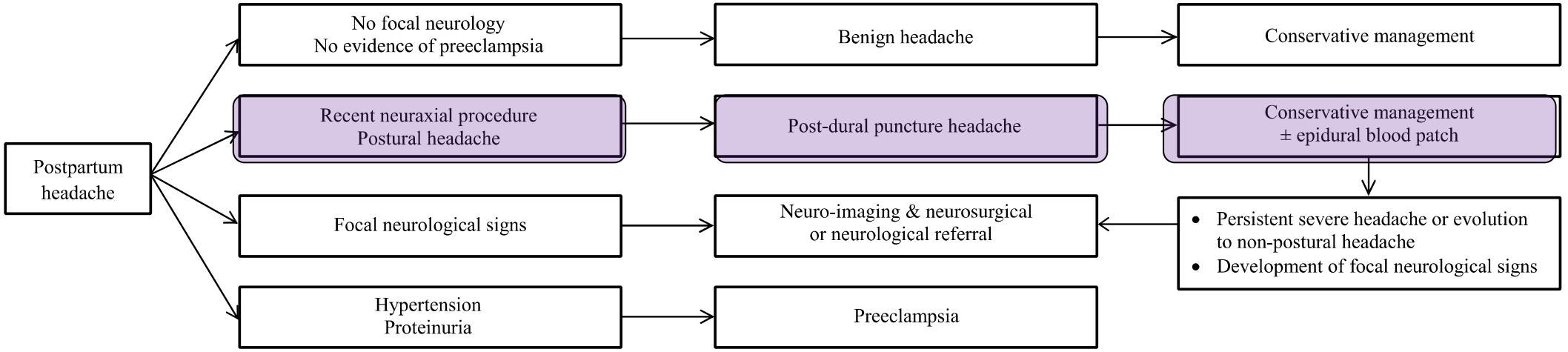

Fig. 3 Assessment of postpartum headache

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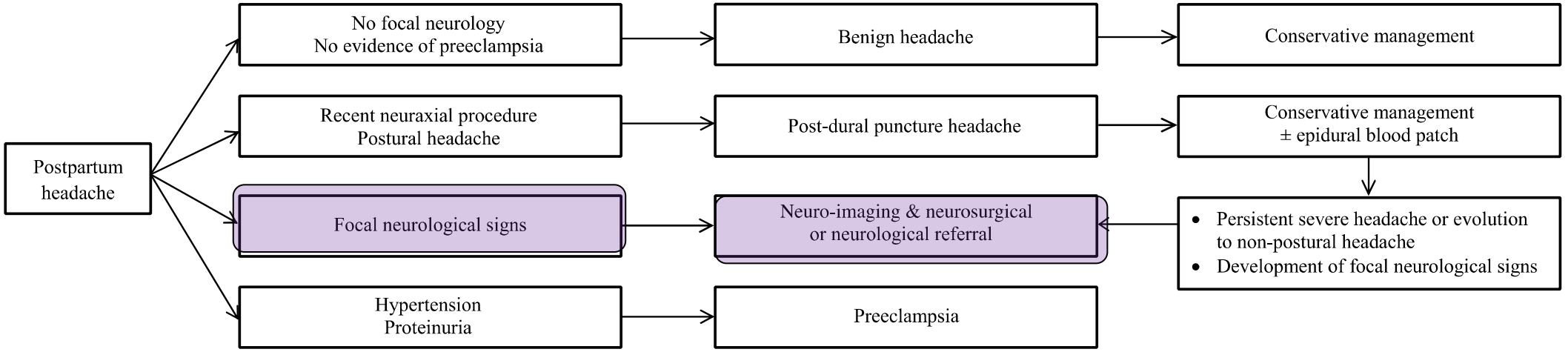

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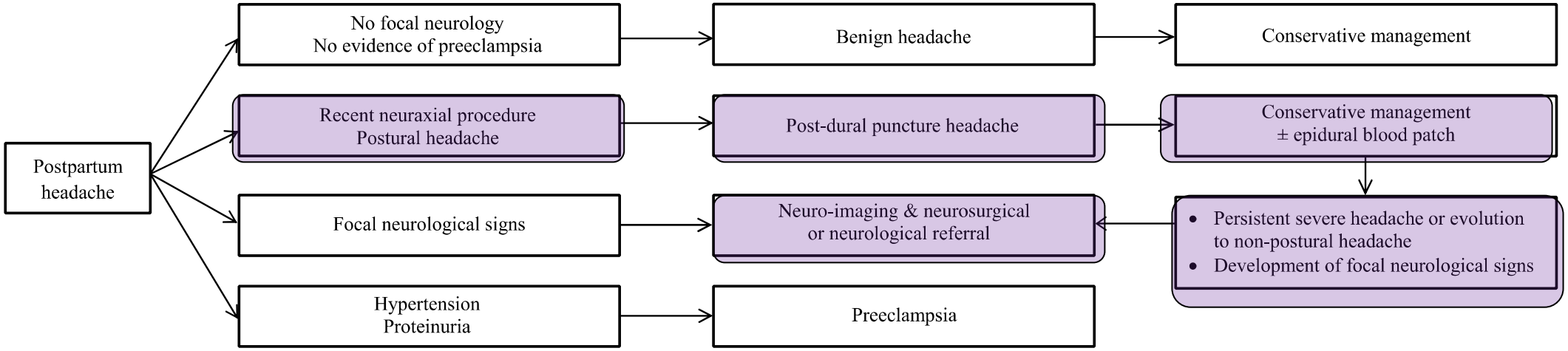

Fig. 3 Assessment of postpartum headache

Nationwide incidence of serious complications of epidural analgesia in the United States

E. B. Rosero and G. P. Joshi

Acta Anaesthesiologica Scandinavica **60** (2016) 810–820

Background: This study aimed to describe the incidence and risk factors of in-hospital spinal hematoma and abscess associated with epidural analgesia in adult obstetric and non-obstetric populations in the United States.

Methods: The Nationwide Inpatient Sample was analyzed to identify patients receiving epidural analgesia from 1998 to 2010. Primary outcomes were incidence of spinal hematoma and epidural abscess. Use of decompressive laminectomy was also investigated. Regression analyses were conducted to assess predictors of epidural analgesia complications. Differences in mortality and disposition of patients at discharge were compared in patients with and without neuraxial complications. Obstetric and non-obstetric patients were studied separately.

Non-obstetric, n = 1,382,805

Obstetric, n = 2,320,950

Epidural hematoma

NON-OB: 18.5/100.000

OB: 0.6/100.000

Epidural Abcess

NON-OB: 7.2/100.000

OB: 0.0/100.000

Table 2 Complications associated with epidural analgesia in non-obstetric and obstetric patients, United States 1998–2010.

Complication	Frequency	Incidence per 100,000 epidurals	95% CI for incidence per 100,000 epidurals	Probability per procedure	95% CI of probability per procedure
Non-obstetric patients					
Epidural hematoma	256	18.5	16.3–20.9	1:5401	1:6129–1:4778
Abdominal/pelvic surgery	56	13.6	10.2–17.6	1:7354	1:9736–1:5663
Thoracic surgery	26	22.9	14.9–33.6	1:4362	1:6677–1:2977
Open cardiac surgery	0	0	0–77.4	0	0–1:1286
Vascular surgery	60	99.6	76.0–128.2	1:1003	1:1315–1:780
Orthopedic surgery	39	13.2	9.7–17.5	1:7576	1:10,275–1:5714
Other	30	15.1	11.7–19.3	1:6598	1:8550–1:5177
Epidural abscess	99	7.2	5.8–8.7	1:13,968	1:17,185–1:11,473
Abdominal/pelvic surgery	19	4.6	2.8–7.2	1:21,677	1:35,997–1:13,881
Thoracic surgery	11	9.7	4.8–17.3	1:10,311	1:20,653–1:5763
Open cardiac surgery	0	0	0–77.4	0	0–1:1286
Vascular surgery	15	24.9	13.9–41.1	1:4014	1:7172–1:2434
Orthopedic surgery	20	5.5	3.3–8.5	1:18,183	1:29,771–1:11,773
Other	20	8.1	5.6–11.3	1:12,255	1:17,593–1:8812
Decompressive laminectomy	122	8.8	7.3–10.5	1:11,334	1:13,648–1:9493
Obstetric patients					
Epidural hematoma	15	0.6	0.3–1.0	1:154,730	1:276,243–1:93,808
Epidural abscess	0	0.0	0.0–0.1	0.0	0–1:628,930
Decompressive laminectomy	*	0.2	0.0–0.5	1:46,4190	1:1,428,571–1:198,807

*Individual cell count is <10 as per data user agreement with Healthcare Cost and Utilization Project - Agency for Healthcare Research and Quality.

DOI: 10.1111/1471-0528.14521
www.bjog.org

The CAPS Study: incidence, management and outcomes of cardiac arrest in pregnancy in the UK: a prospective, descriptive study

VA Beckett,[a] M Knight,[b] P Sharpe[c]

DOI: 10.1111/1471-0528.14521
www.bjog.org

The CAPS Study: incidence, management and outcomes of cardiac arrest in pregnancy in the UK: a prospective, descriptive study

VA Beckett,[a] M Knight,[b] P Sharpe[c]

ta

were missing for two cases of PMCS). $P < 0.001$ chi-square test.

DOI: 10.1111/1471-0528.14521
www.bjog.org

The CAPS Study: incidence, management and outcomes of cardiac arrest in pregnancy in the UK: a prospective, descriptive study

VA Beckett,[a] M Knight,[b] P Sharpe[c]

Table 3. Factors and decisions concerning perimortem caesarean section, all groups

PMCS factor	Number of women (n = 49)
Decision made by	
Obstetrician	43
Anaesthetist	1
Other clinician	2
Missing	3
Operation performed by	
Obstetrician	46 (26 by Consultant grade)
Other clinician	1
Missing	2
Aseptic precautions	
None	12
Skin preparation	11
Sterile drapes	6
Sterile gloves	11
Full scrub	8
Sterile gown	4
Antibiotics	5
Time from arrest to PMCS	
Less than 5 minutes	30/49 (61%)
5 minutes or more	17/49 (35%)
Not known	2/49 (4%)
Scalpel available on resuscitation trolley	
Yes	27/49 (55%)
No	14/49 (29%)
Not known	8/49 (16%)

Data are presented as number of reports or percentage of all perimortem caesarean sections performed.

Table 4. Suspected and confirmed (at post mortem) causes for women who died and women who survived

Cause	Women who survived (n = 37)	Women who died (n = 22)
Presumed premortem causes (n = 59)		
Cardiac tamponade	1	0
Hypoxia	4	0
Hypovolaemia	5	8
Venous thromboembolism	1	7
Toxic drug cause	1	0
Anaphylaxis	1	0
Sepsis	0	1
Anaesthetic cause	17	0
Amniotic fluid embolism	5	3
Cardiac cause	5	1
Intracerebral bleed	0	3
Aortic dissection	0	2
Asthma	0	1
Pulmonary artery rupture	0	1
Postmortem causes of collapse (n = 19)		
Amniotic fluid embolism		6
Vessel bleed/rupture		5
Thrombembolic		3
Cardiomyopathy		2
Other		3

Data were available for 59 women. Some women were suspected of having more than one cause, where this is the case both causes have been recorded.

Lecture Outline

- **Topic 1:** Remifentanil PCIA for labour analgesia.
- **Topic 2:** New data on CSE Labour analgesia.
- **Topic 3:** Programmed Intermittent Epidural Bolus.
- **Topic 4:** Blood pressure management during CS.
- **Topic 5:** General Anesthesia for CS.
- **Topic 6:** Complications.
- **Topic 7:** Transfusion and blood management.

Tranexamic Acid:

Effect of early tranexamic acid administration on mortality, hysterectomy, and other morbidities in women with post-partum haemorrhage (WOMAN): an international, randomised, double-blind, placebo-controlled trial

WOMAN Trial Collaborators*

www.thelancet.com Published online April 26, 2017 http://dx.doi.org/10.1016/S0140-6736(17)30638-4

	Tranexamic acid group (n=10 036)	Placebo group (n=9985)	RR (95% CI)	p value (two-sided)
Bleeding	155 (1·5%)	191 (1·9 %)	0·81 (0·65–1·00)	0·045
Pulmonary embolism	10 (0·1%)	11 (0·1)	0·90 (0·38–2·13)	0·82
Organ failure	25 (0·3%)	18 (0·2%)	1·38 (0·75–2·53)	0·29
Sepsis	15 (0·2%)	8 (0·1%)	1·87 (0·79–4·40)	0·15
Eclampsia	2 (0·02%)	8 (0·1%)	0·25 (0·05–1·17)	0·057
Other	20 (0·2%)	20 (0·2%)	0·99 (0·54–1·85)	0·99
Any cause of death	227 (2·3%)	256 (2·6%)	0·88 (0·74–1·05)	0·16

Data are n (%), unless otherwise indicated. RR=risk ratio.

Table 2: **Effect of tranexamic acid on maternal death**

Tranexamic Acid:

Effect of early tranexamic acid administration on mortality, hysterectomy, and other morbidities in women with post-partum haemorrhage (WOMAN): an international, randomised, double-blind, placebo-controlled trial

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www.thelancet.com **Published online April 26, 2017 http://dx.doi.org/10.1016/S0140-6736(17)30638-4**

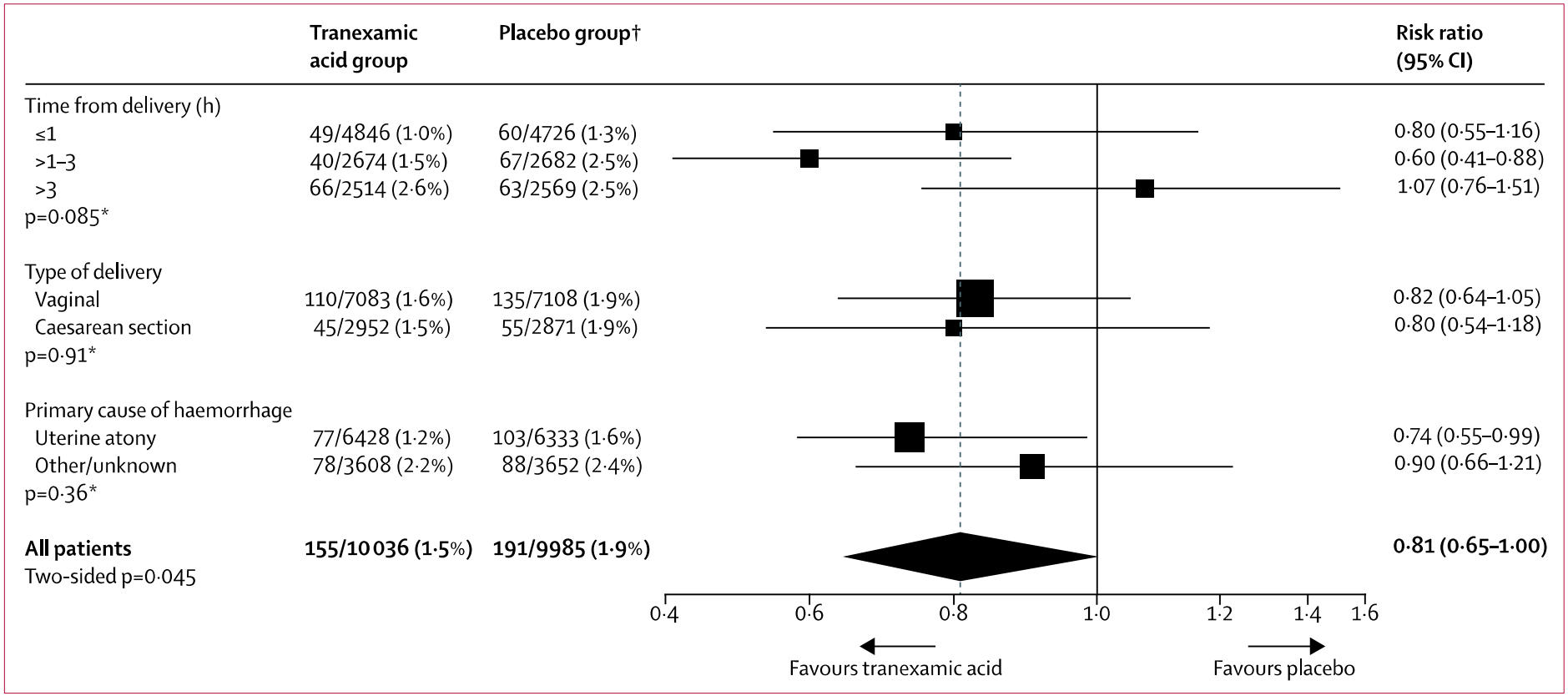

Figure 3: **Death from bleeding by subgroup**

*Heterogeneity p value. †One patient excluded from subgroup analysis because of missing baseline data.

Tranexamic Acid:

Effect of early tranexamic acid administration on mortality, hysterectomy, and other morbidities in women with post-partum haemorrhage (WOMAN): an international, randomised, double-blind, placebo-controlled trial

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www.thelancet.com **Published online April 26, 2017 http://dx.doi.org/10.1016/S0140-6736(17)30638-4**

	Tranexamic acid group	Placebo group	Risk ratio (95% CI)
Time from delivery (h)			
≤1	253/4844 (5·2%)	229/4726 (4·9%)	1·08 (0·91–1·28)
>1–≤3	122/2672 (4·6%)	154/2682 (5·7%)	0·80 (0·63–1·00)
>3	159/2514 (6·3%)	161/2569 (6·3%)	1·01 (0·82–1·25)
p=0·11*			
Type of delivery			
Vaginal	255/7080 (3·6%)	288/7108 (4·1%)	0·89 (0·75–1·05)
Caesarean section	279/2951 (9·5%)	257/2873 (9·0%)	1·06 (0·90–1·24)
p=0·15*			
Primary cause of haemorrhage			
Uterine atony	249/6426 (3·9%)	274/6333 (4·3%)	0·90 (0·76–1·06)
Other or unknown	285/3606 (7·9%)	272/3652 (7·5%)	1·06 (0·90–1·24)
p=0·15*			
All patients	534/10 032 (5·3%)	546/9985 (5·5%)	0·97 (0·87–1·09)
Two-sided p=0·65			

Data are n (%) unless otherwise indicated. *p value from likelihood ratio test.

Table 3: **Effect of tranexamic acid on composite primary endpoint (death or hysterectomy) by subgroup**

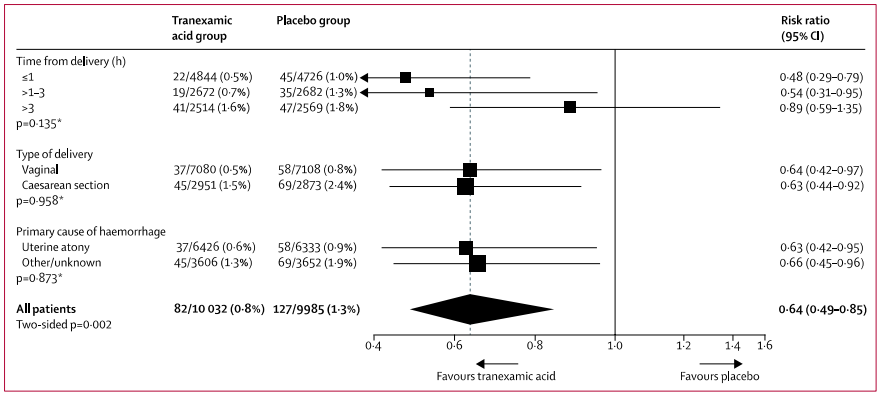

Figure 4: **Laparotomy for bleeding by subgroup**
*Heterogeneity p value.

Cell Salvage

- **What we know:**
  - **Cell Salvage is safe for mother and child.**
  - **It helps in high risk, major hemorrhage cases.**

A randomised controlled trial and economic evaluation of intraoperative cell salvage during caesarean section in women at risk of haemorrhage: the SALVO (cell SALVage in Obstetrics) trial

Khalid S Khan, Philip Moore, Matthew Wilson, Richard Hooper, Shubha Allard, Ian Wrench, Tracy Roberts, Carol McLoughlin, Lee Beresford, James Geoghegan, Jane Daniels, Sue Catling, Vicki A Clark, Paul Ayuk, Stephen Robson, Fang Gao-Smith, Matthew Hogg, Louise Jackson, Doris Lanz and Julie Dodds on behalf of the SALVO study group

HEALTH TECHNOLOGY ASSESSMENT

VOLUME 22 ISSUE 2 JANUARY 2018
ISSN 1366-5278

Objectives: To determine if routine use of cell salvage during caesarean section in mothers at risk of haemorrhage reduces the rates of blood transfusion and postpartum maternal morbidity, and is cost-effective, in comparison with standard practice without routine salvage use.

Design: Individually randomised controlled, multicentre trial with cost-effectiveness analysis. Treatment was not blinded.

Setting: A total of 26 UK obstetric units.

Main outcome measures: Primary – donor blood transfusion. Secondary – units of donor blood transfused, time to mobilisation, length of hospitalisation, mean fall in haemoglobin, fetomaternal haemorrhage (FMH) measured by Kleihauer–Betke test, and maternal fatigue. Analyses were adjusted for stratification factors and other factors that were believed to be prognostic a priori. Cost-effectiveness outcomes – costs of resources and service provision taking the UK NHS perspective.

Khan SK, Moore P, Wilson M, Hooper R, Allard S, Wrench I, *et al*. A randomised controlled trial and economic evaluation of intraoperative cell salvage during caesarean section in women at risk of haemorrhage: the SALVO (cell SALVage in Obstetrics) trial. *Health Technol Assess* 2018;**22**(2).

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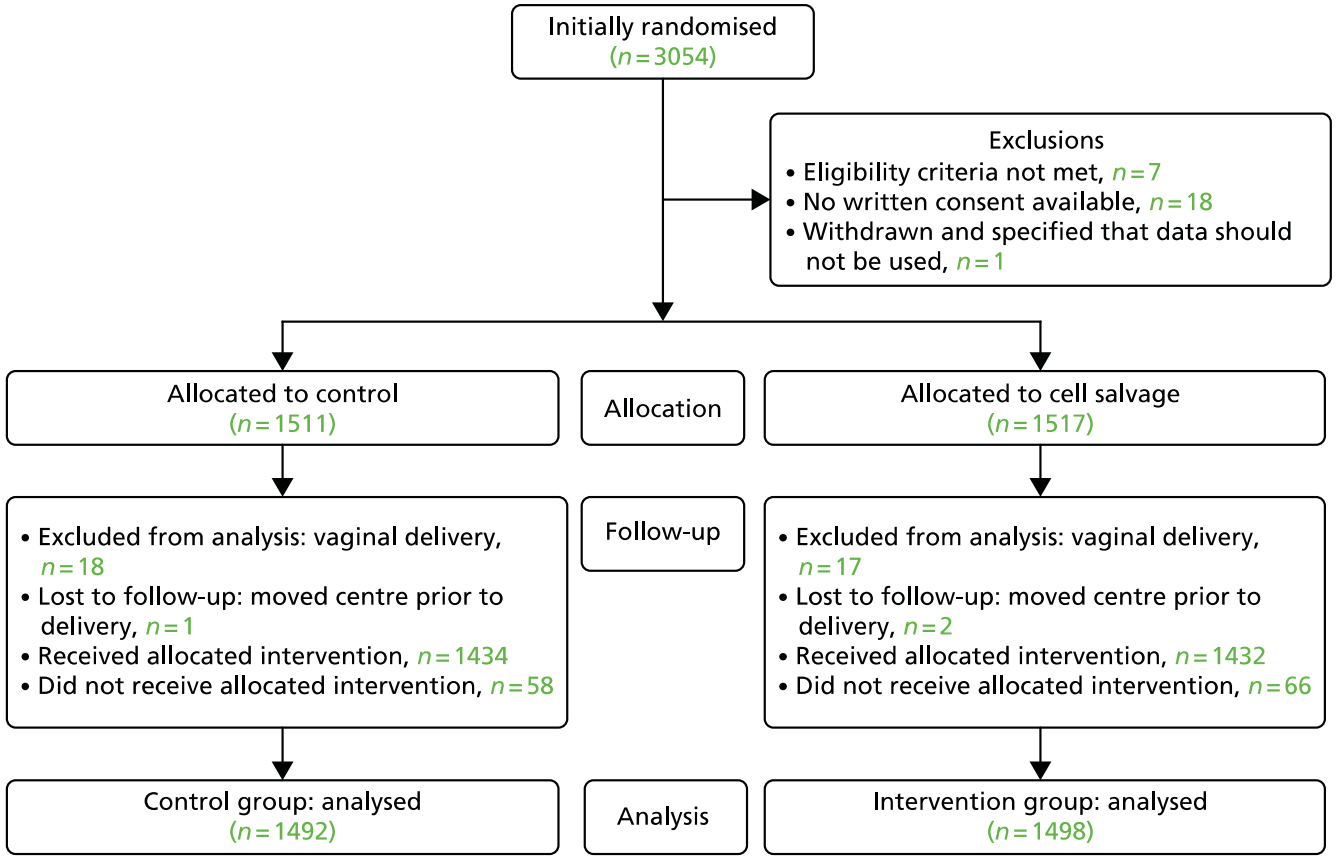

FIGURE 2 Participant enrolment and follow-up. Reproduced from © 2017 Khan *et al.*[72] This is an open access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Khan SK, Moore P, Wilson M, Hooper R, Allard S, Wrench I, *et al*. A randomised controlled trial and economic evaluation of intraoperative cell salvage during caesarean section in women at risk of haemorrhage: the SALVO (cell SALVage in Obstetrics) trial. *Health Technol Assess* 2018;**22**(2).

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TABLE 4 Effect of intervention on donor blood transfusion

Analysis	Control (N = 1492), n (%)	Cell salvage (N = 1498), n (%)	Crude risk difference % (95% CI)	Crude intervention OR (95% CI)	p-value: crude analysis	Adjusted[a] intervention OR (95% CI)	p-value: adjusted analysis
Primary analysis							
Overall	52 (3.5)	37 (2.5)	–1.0 (–2.2 to 0.2)	0.70 (0.46 to 1.08)	0.10	0.65 (0.42 to 1.01)	0.056
Subgroup analysis							
Emergency caesarean (n = 1641)	37 (4.6)	25 (3.0)				0.58 (0.34 to 0.99)	
Elective caesarean (n = 1349)	15 (2.2)	12 (1.8)				0.83 (0.38 to 1.83)	
p-value for interaction							0.46
Sensitivity analysis							
Assumption: return of cell-salvaged blood in the control group avoided transfusions	83 (5.6)	37 (2.5)	–3.1 (–4.5 to –1.7)	0.43 (0.29 to 0.64)	< 0.001	0.39 (0.26 to 0.59)	< 0.001
Excluding participants with placental abruption (cell salvage group: n = 2, control group: n = 3)	51 (3.4)	37 (2.5)	–1.0 (–2.2 to 0.3)	0.72 (0.47 to 1.10)	0.13	0.67 (0.43 to 1.03)	0.071

a Adjusted for stratification factors [elective vs. emergency caesarean section, presence of abnormal placentation, singleton vs. twins or multiple births, recruitment centre (as a random effect)] and other factors believed to be prognostic a priori (known placenta praevia, pre-eclampsia).

Khan SK, Moore P, Wilson M, Hooper R, Allard S, Wrench I, *et al*. A randomised controlled trial and economic evaluation of intraoperative cell salvage during caesarean section in women at risk of haemorrhage: the SALVO (cell SALVage in Obstetrics) trial. *Health Technol Assess* 2018;**22**(2).

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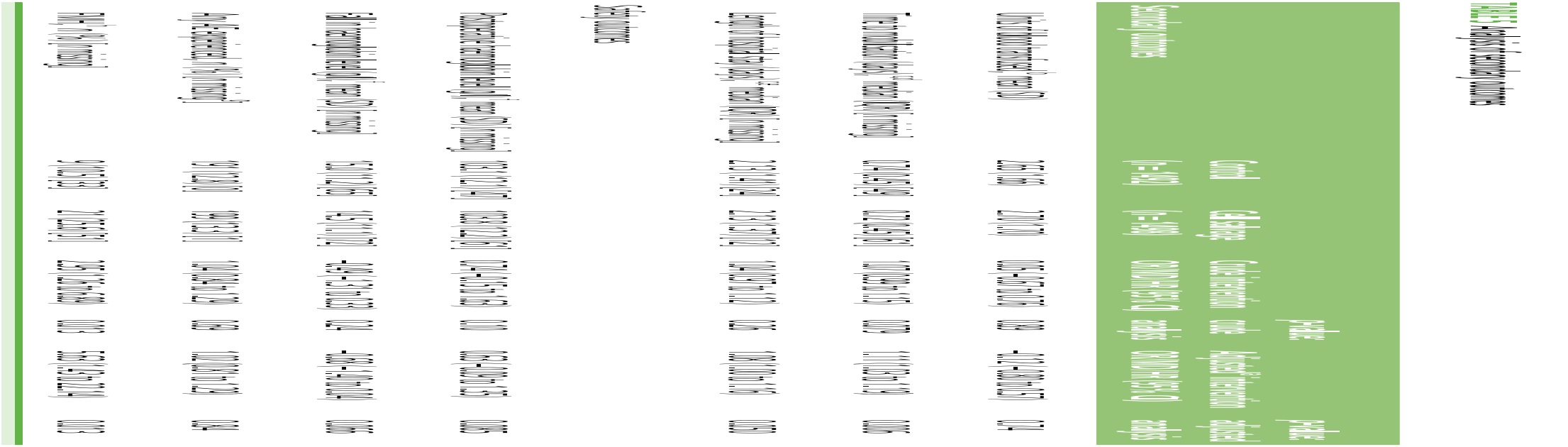

Conclusions: The modest evidence for an effect of routine use of cell salvage during caesarean section on rates of donor blood transfusion was associated with increased FMH, which emphasises the need for adherence to guidance on anti-D prophylaxis. We are unable to comment on long-term antibody sensitisation effects. Based on the findings of this trial, cell salvage is unlikely to be considered cost-effective.

Khan SK, Moore P, Wilson M, Hooper R, Allard S, Wrench I, *et al*. A randomised controlled trial and economic evaluation of intraoperative cell salvage during caesarean section in women at risk of haemorrhage: the SALVO (cell SALVage in Obstetrics) trial. *Health Technol Assess* 2018;**22**(2).

Anaesthesia 2018, 73, 71–92 doi:10.1111/anae.14080

Guidelines

International consensus statement on the management of hypotension with vasopressors during caesarean section under spinal anaesthesia

S. M. Kinsella,[1] B. Carvalho,[2] R. A. Dyer,[3] R. Fernando,[4] N. McDonnell,[5] F. J. Mercier,[6] A. Palanisamy,[7] A. T. H. Sia,[8] M. Van de Velde[9,10] and A. Vercueil[11]

Table 1 Comparison of commonly used vasopressors.

	Ephedrine	Phenylephrine	Metaraminol	Noradrenaline	Adrenaline	Mephentermine
Receptor	β1, β2, weak α	α1	α1, weak β	α1, β	α1, β	α1, β
Mechanism	Indirect, weak direct	Direct	Direct and indirect	Direct	Direct	Indirect
Onset	Slow	Immediate	1–2 min	Immediate	Immediate	Immediate
Duration	Prolonged	Intermediate	Prolonged	Short	Short	Prolonged

Anaesthesia 2018, 73, 23–31 doi:10.1111/anae.14040

UZ LEUVEN

Original Article

Maternal cardiac output response to colloid preload and vasopressor therapy during spinal anaesthesia for caesarean section in patients with severe pre-eclampsia: a randomised, controlled trial

R. A. Dyer,[1] A. Daniels,[2] A. Vorster,[3] A. Emmanuel,[3] M. J. Arcache,[3] S. Schulein,[3] A. R. Reed,[3] C. J. Lombard,[4] M. F. James[5] and D. van Dyk[3]

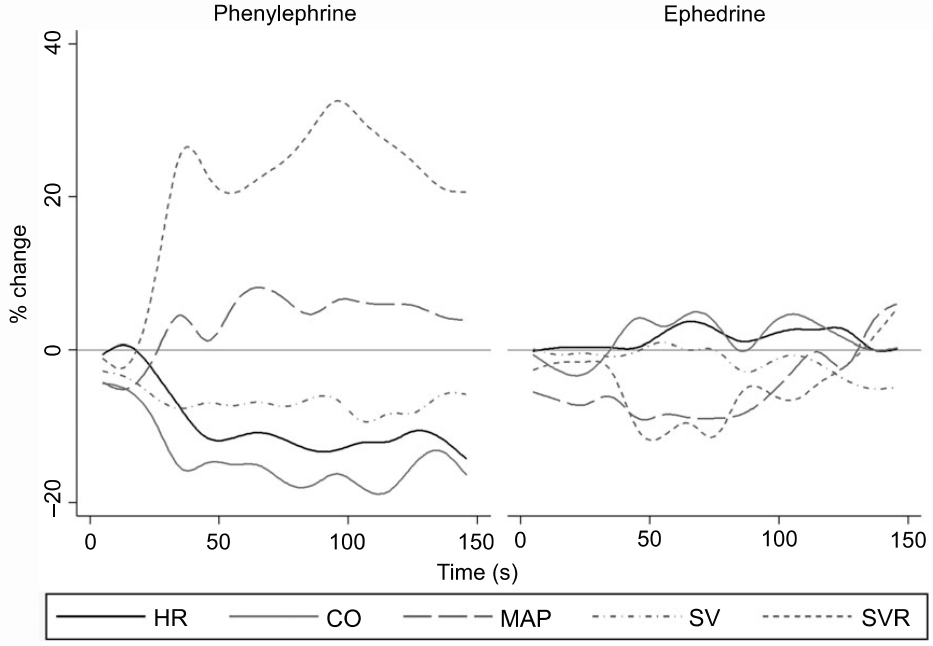

Figure 4 Median percentage change in haemodynamic variables over 150 s after administration of phenylephrine or ephedrine. HR, heart rate; CO, cardiac output; MAP, mean arterial pressure; SV, stroke volume; SVR, systemic vascular resistance.

In conclusion, we found that cardiac output increased in response to spinal anaesthesia in women with severe early onset pre-eclampsia, and that a small dose of phenylephrine reversed the haemodynamic changes more effectively than ephedrine. Phenylephrine is an effective vasopressor in the management of spinal hypotension in patients with severe pre-eclampsia and preserved left ventricular systolic function. Colloid preload for spinal anaesthesia for caesarean section in treated severe pre-eclampsia was associated with a mean increase in cardiac index, but considerable variability in stroke volume responsiveness, suggesting that fluid restriction is preferable in the absence of cardiac output monitoring.

Conclusions.

- Additional data that remifentanil PCIA cause respiratory depression when used in labour.
- DPE is a novel technique with potential.
- CSE results in more reliable EPIDURAL catheters.
- PIEB is there to stay !
- Vasopressor of choice: Norepinephrine ? (higher CO).
- Colloids result in less hypotension.
- Rocuronium is the muscle relaxant of choice.
- Airway algorithm of OAA and DAS.
- Subdural hematoma is a risk after PDPH.
- Epidural hematoma risk in OB patients is 0.6/100.000.

The podium: the winners

Anesth Analg. 2016 Nov 18. [Epub ahead of print]

Analysis of Physiological Respiratory Variable Alarm Alerts Among Laboring Women Receiving Remifentanil.

Weiniger CF[1], Carvalho B, Stocki D, Einav S.

Anaesthesia 2015, 70, 1286–1306 doi:10.1111/anae.13260

Guidelines

Obstetric Anaesthetists' Association and Difficult Airway Society guidelines for the management of difficult and failed tracheal intubation in obstetrics*

M. C. Mushambi,[1] S. M. Kinsella,[2] M. Popat,[3] H. Swales,[4] K. K. Ramaswamy,[5] A. L. Winton[6] and A. C. Quinn[7,8]

(Anesth Analg 2017;124:560–9)

Dural Puncture Epidural Technique Improves Labor Analgesia Quality With Fewer Side Effects Compared With Epidural and Combined Spinal Epidural Techniques: A Randomized Clinical Trial

Anthony Chau, MD, MMSc, FRCPC,*†‡ Carolina Bibbo, MD,§ Chuan-Chin Huang, ScD,† Kelly G. Elterman, MD,|| Eric C. Cappiello, MD,†‡ Julian N. Robinson, MD,‡§ and Lawrence C. Tsen, MD†‡

(ANESTHESIOLOGY 2015; 122:736-45)

Randomized Double-blinded Comparison of Norepinephrine and Phenylephrine for Maintenance of Blood Pressure during Spinal Anesthesia for Cesarean Delivery

Warwick D. Ngan Kee, M.B.Ch.B., M.D., F.A.N.Z.C.A., F.H.K.A.M., Shara W. Y. Lee, B.Sc.(Hons.), M.Sc., Ph.D., Floria F. Ng, R.N., B.A.Sc., Perpetua E. Tan, B.Sc., M.Phil., Kim S. Khaw, M.B.B.S., M.D., F.R.C.A., F.H.K.A.M.

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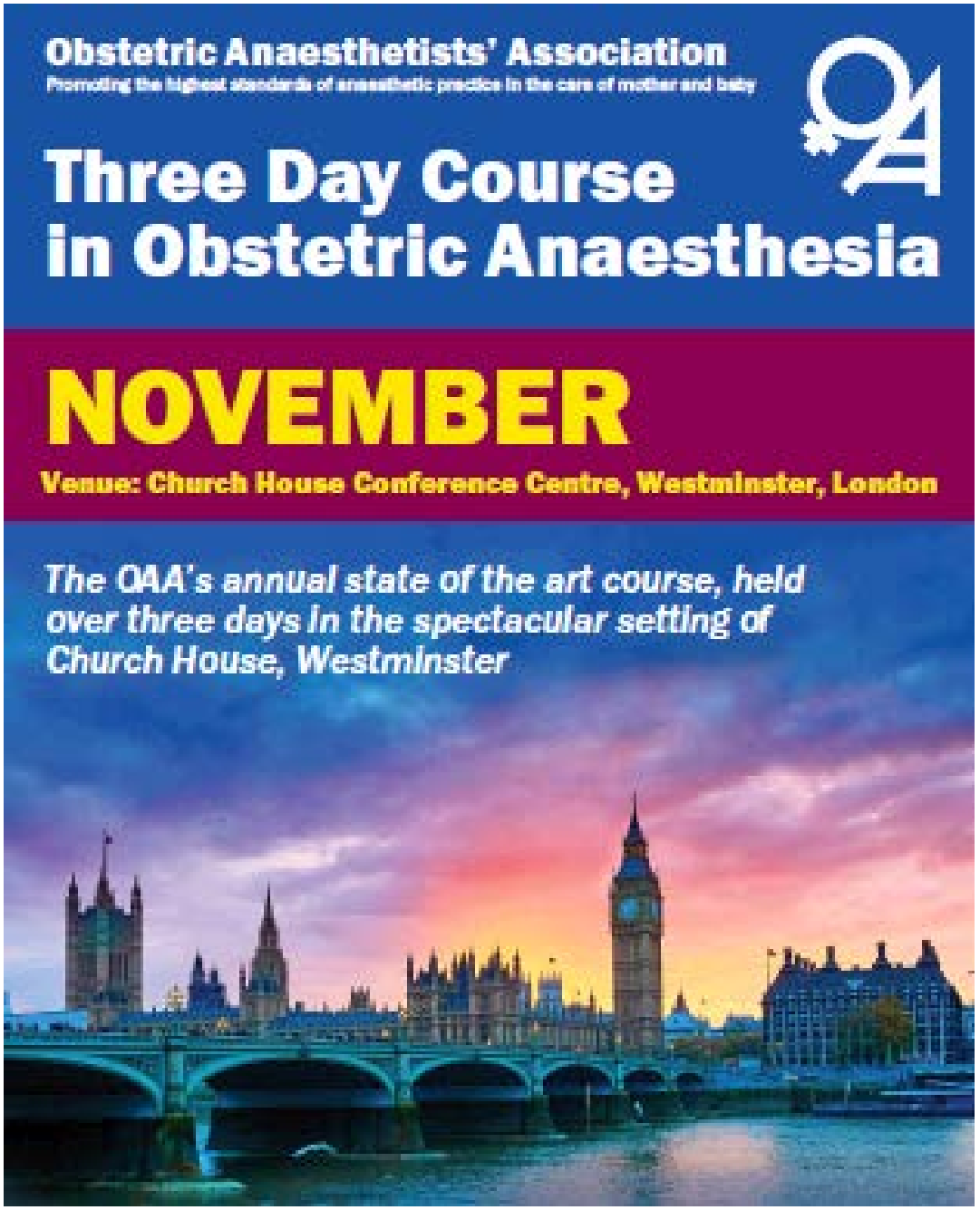

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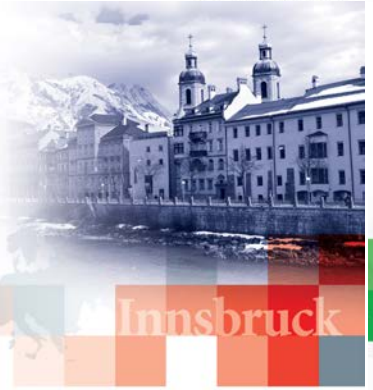

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