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Updates in Obstetric Anesthesia

Association des Anesthèsiologistes du Quèbec

April 2014

Cynthia A. Wong, MD

Disclosures

Off-label use of drugs may be discussed

Objectives

By the end of this lecture, participants should be able to

- Cite current knowledge regarding use of oxytocin for postpartum hemorrhage prophylaxis, including dose and side effects.
- Examine the reasoning behind choice of vasopressors (ephedrine and phenylephrine) for the treatment of neuraxial-anesthesia induced hypotension during cesarean delivery.

Objectives

- Explain the benefits and limits of crystalloid and colloid administration for the prevention of hypotension during spinal anesthesia for cesarean delivery.
- Examine current knowledge regarding risk of neuraxial infections associated with neuraxial procedures, and recommended techniques to minimize the risk of infection.
- Cite current evidence regarding neuraxial anesthesia/analgesia for external cephalic version of breech presentation.

- Oxytocin
- Phenylephrine vs. ephedrine
- Crystalloid vs. colloid
- Neuraxial infections
- External cephalic version

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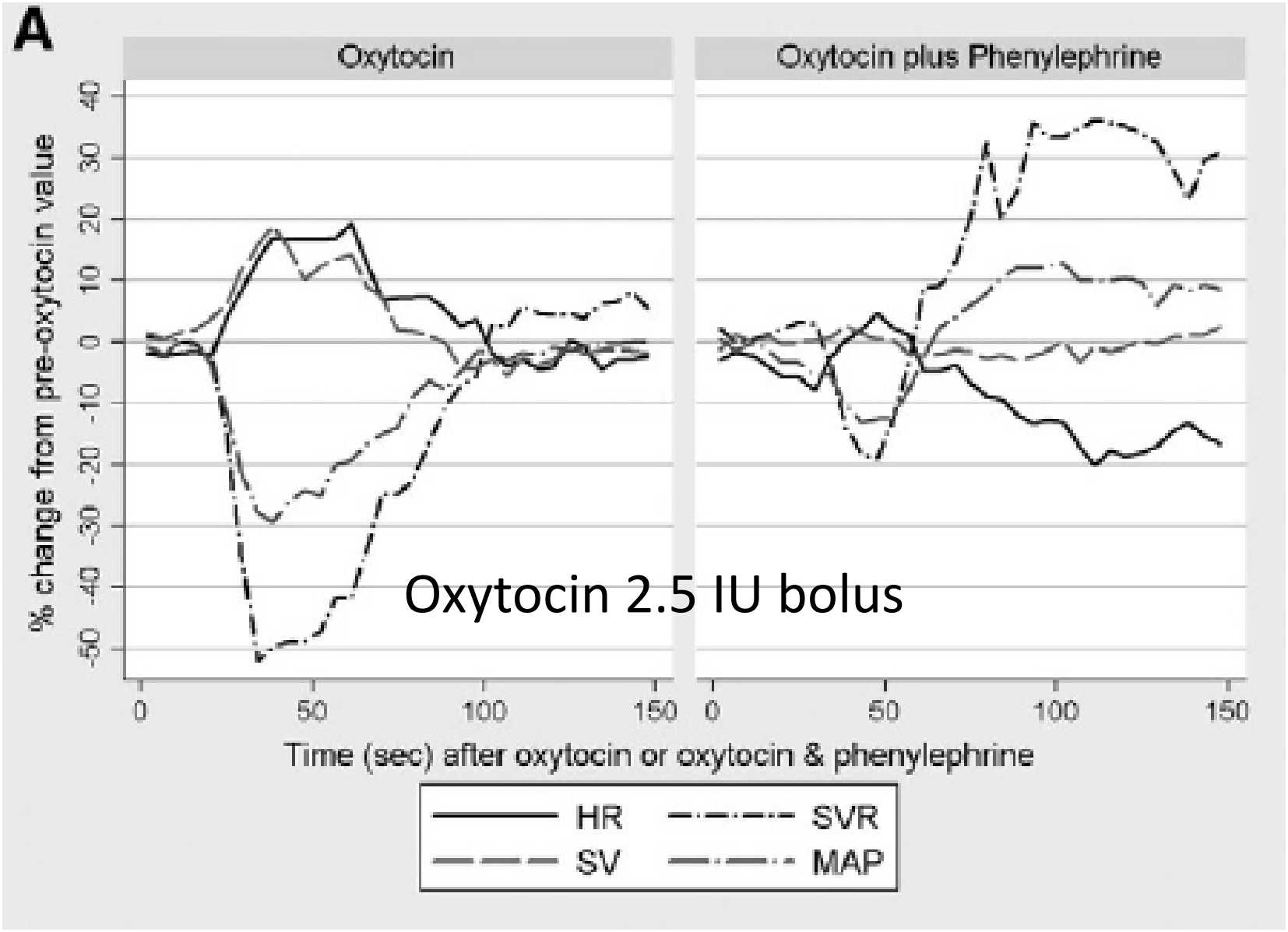
Question (raise your hands):

Who routinely adds oxytocin 20 IU to a one-liter bag of fluid and runs it in wide open after delivery?



Oxytocin 2.5 IU bolus

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Dyer RA. Anesthesiology 2009;111:753

British Journal of Anaesthesia **100** (5): 683–9 (2008)
doi:10.1093/bja/aen071 Advance Access publication April 2, 2008

BJA

OBSTETRICS

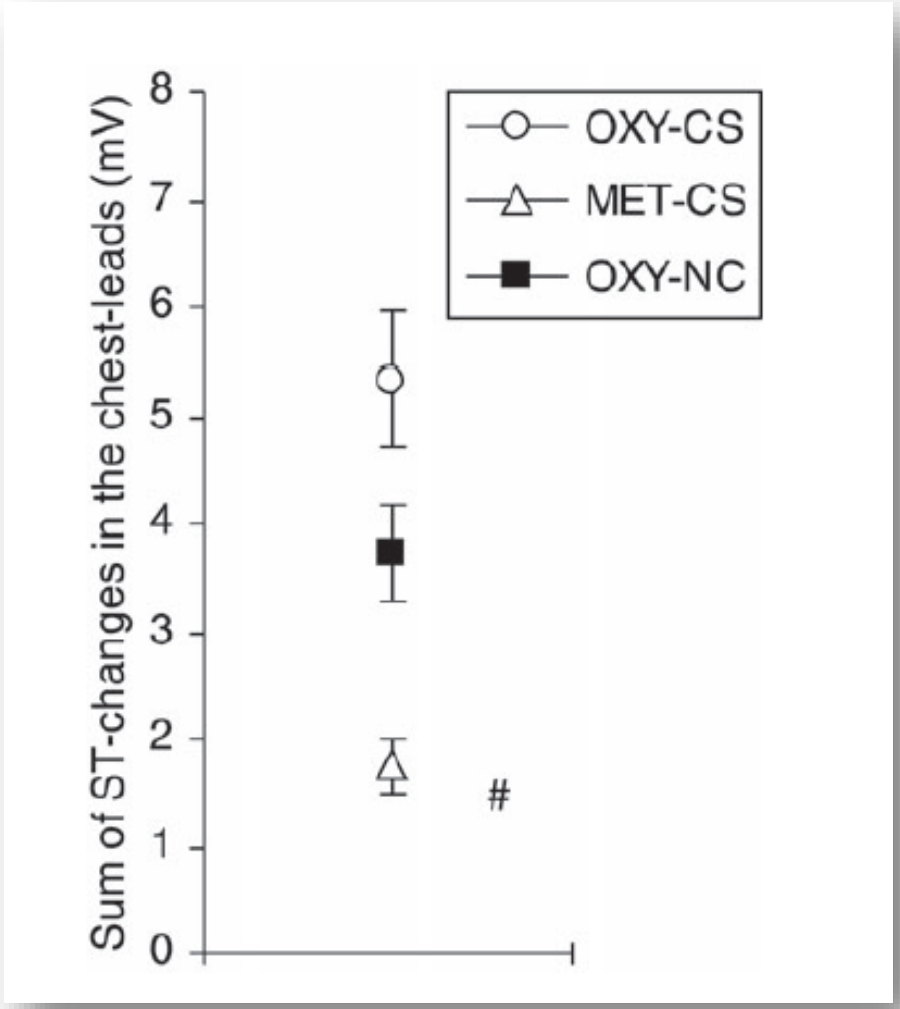
Signs of myocardial ischaemia after injection of oxytocin: a randomized double-blind comparison of oxytocin and methylergometrine during Caesarean section

M. C. Svanström[1], B. Biber[3], M. Hanes[3], G. Johansson[3], U. Näslund[2] and E. M. Bålfors[4]*

[1]Department of Thoracic Anaesthesiology, [2]Department of Cardiology, Heart Centre and [3]Department of Anaesthesiology and Intensive Care Medicine, Umeå University Hospital, SE-901 85 Umeå, Sweden. [4]Department of Anaesthesia and Intensive Care, Karolinska Institutet, Stockholm Söder Hospital, SE-118 83 Stockholm, Sweden

- Blinded RCT
- N = 40 / 10 non-pregnant
- Oxytocin 10 IU vs. methylergometrine 0.2 mg IV bolus
- Primary outcome: ST segment changes

Oxytocin: ST Segment Depression



Br J Anaesth 208;100:683-9

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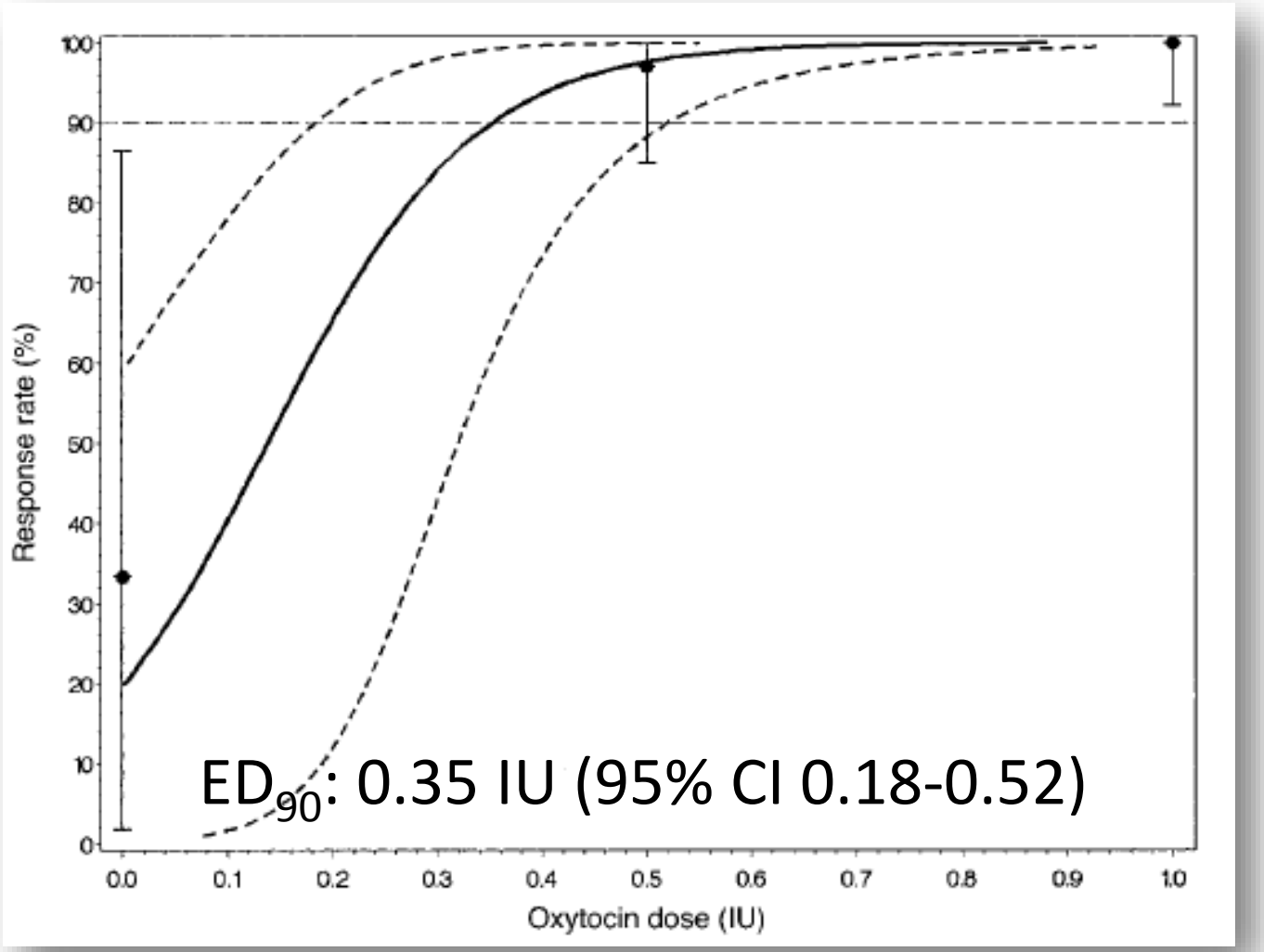
Oxytocin ED_{90} (Elective)



Carvalho JA. Obstet Gynecol 2004;104:1005

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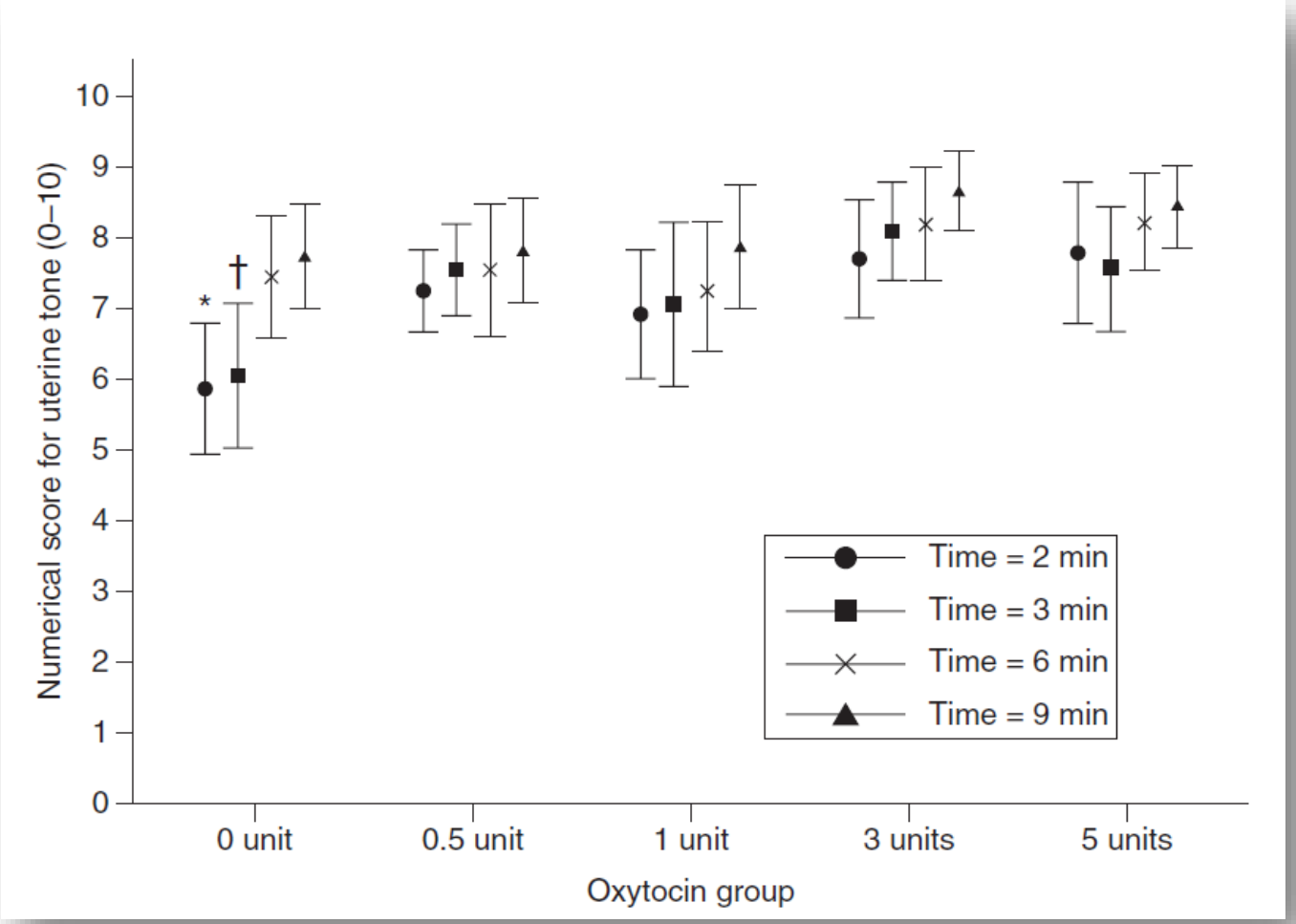
Oxytocin Bolus: Dose Response



Butwick AJ. Br J Anaesth 2010;104:338

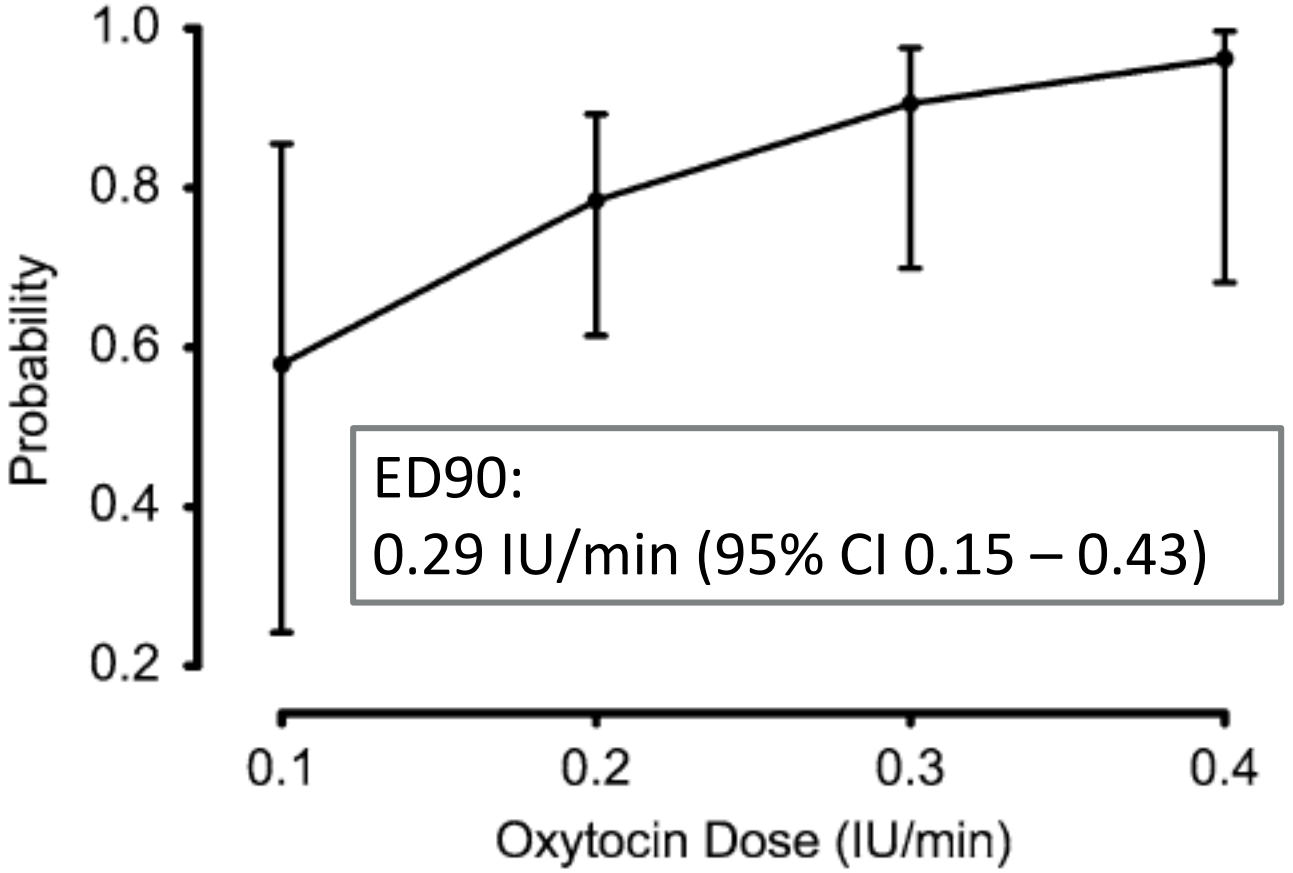
Can J Anesth/J Can Anesth (2010) 57:578–582
DOI 10.1007/s12630-010-9297-1

Up-down determination of the ED_{90} of oxytocin infusions for the prevention of postpartum uterine atony in parturients undergoing Cesarean delivery

Ronald B. George, MD · Dolores McKeen, MD · Anna C. Chaplin, BSc · Lynne McLeod, MD

- Prospective, biased-coin up-down sequential allocation dose-finding study
- Elective cesarean delivery
- Outcome: ED_{90} of oxytocin infusion for "satisfactory uterine tone"

Oxytocin Infusion: ED_{90}



George RB. Can J Anesth 2010;57:578

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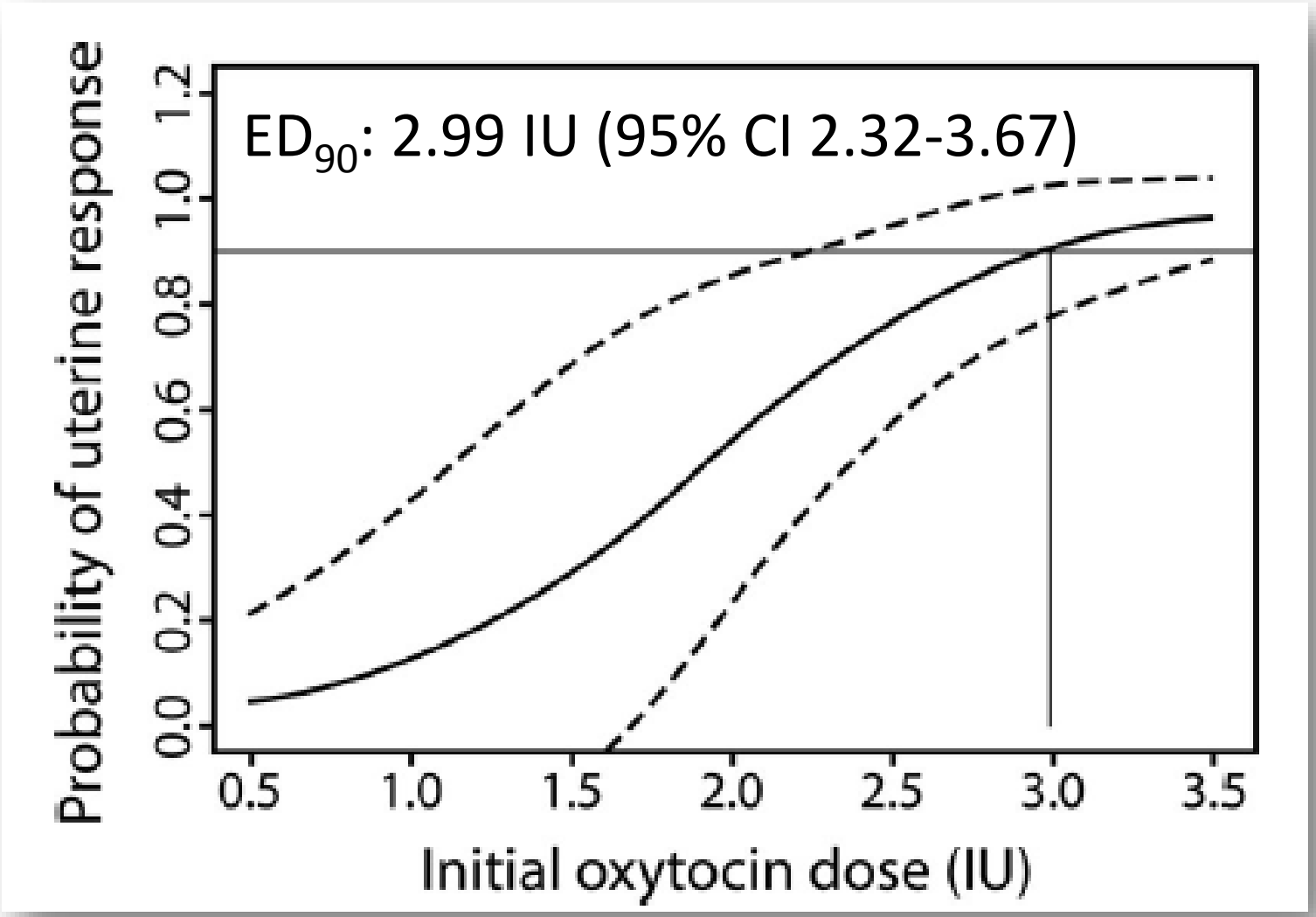
Oxytocin ED_{90} (following labor)



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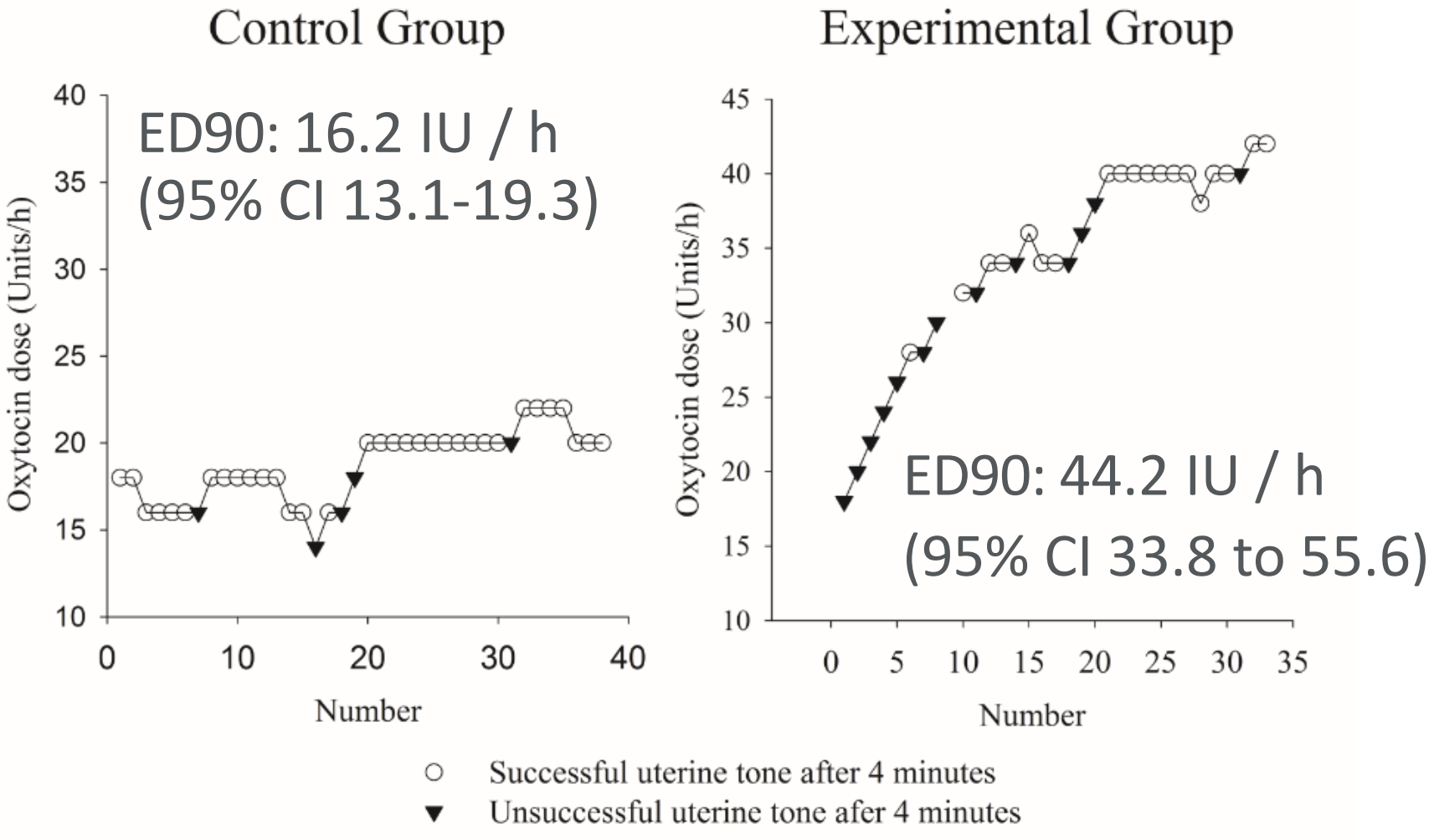
Balki M. Obstet Gynecol 2006;107:45

Oxytocin infusion: ED_{90} (following labor)



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Lavoie A 2013. Unpublished

Five Unit Bolus Oxytocin at Cesarean Delivery in Women at Risk of Atony: A Randomized, Double-Blind, Controlled Trial

Kylie J. King, MBBS, FANZCA,* M. Joanne Douglas, MD, FRCPC,† Waldemar Unger, MD, FRCSC,‡ Areta Wong, BSc,† and Robert A. R. King, PhD§

Anesth Analg 2010;111:1460-6

- RCT: N = 143
- Cesarean delivery: 1 risk factor for uterine atony
- Oxytocin 5 IU vs. NS over 30 s
- All had oxytocin 40 IU for 30 min, then 20 IU for 8 h
- Primary outcome: need for additional uterotonics

Table 3. Outcome Measures

Outcome measure	Oxytocin (n = 70)	Saline (n = 73)	P value
Additional uterotonics			
1st h, n (%)	12 (17)	15 (21)	0.38[a]
24 h, n (%)	20 (29)	29 (40)	0.11[a]
Additional oxytocin, mean dose[b]			
1st h (IU)	16.5 (12.5)	20.6 (21.2)	0.28[c]
24 h (IU)	44.0 (42.0)	45.1 (37.5)	0.47[c]
Uterotonics other than oxytocin			
15-Methyl PG $F_{2\alpha}$	2	2	0.67[d]
Ergonovine	1	1	0.74[d]
Misoprostol	1	3	0.93[d]
Estimated blood loss (mL)	812 (761–862)	902 (825–980)	0.92[c]
No. needing blood transfusion	1 (1.4)	3 (4.1)	0.33[d]

King KJ. Anesth Analg 2010;111:1460-6

BMJ

BMJ 2011;343:d4661 doi: 10.1136/bmj.d4661

Oxytocin bolus versus oxytocin bolus and infusion for control of blood loss at elective caesarean section: double blind, placebo controlled, randomised trial

Sharon R Sheehan *research fellow in obstetrics*[1], Alan A Montgomery *reader in health services*

- RCT, elective cesarean delivery, N = 2069
- Oxytocin 5 IU over 1 min, 40 IU for 4 h vs. oxytocin 5 IU over 1 min, NS for 4 h
- Primary outcome: EBL > 1000 mL, additional uterotonics

Table 2| **Primary outcomes**

	Bolus and infusion No (%)	Bolus only No (%)	Adjusted odds ratio* (95% CI)	P value	Number needed to treat (95% CI)
Major obstetric haemorrhage (blood loss >1000 mL)†	158/1007 (15.7)	159/994 (16.0)	0.98 (0.77 to 1.25)	0.86	–
Additional uterotonic agent‡	126/1033 (12.2)	189/1025 (18.4)	0.61 (0.48 to 0.78)	<0.001	16 (11 to 32)

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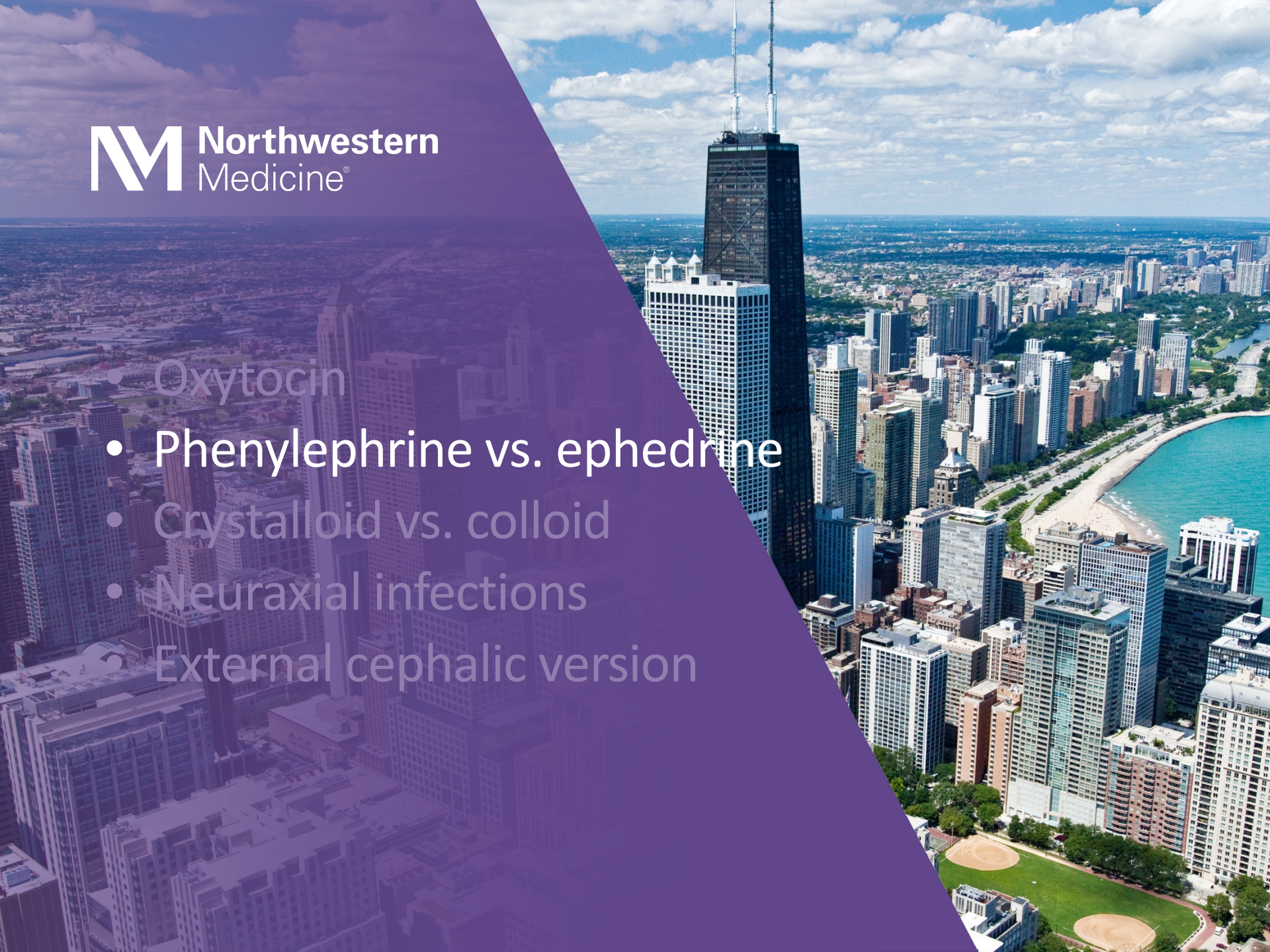
Sheehan SR. BMJ 2011;343:d4661

Oxytocin: Conclusions

- Low bolus dose (≤ 3 IU) or infusion (0.3 – 0.4 IU/h)
- Laboring > elective
- Infusion > bolus without infusion
- Adding bolus before infusion does not improve outcome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• Oxytocin
• Phenylephrine vs. ephedrine
• Crystalloid vs. colloid
• Neuraxial infections
• External cephalic version

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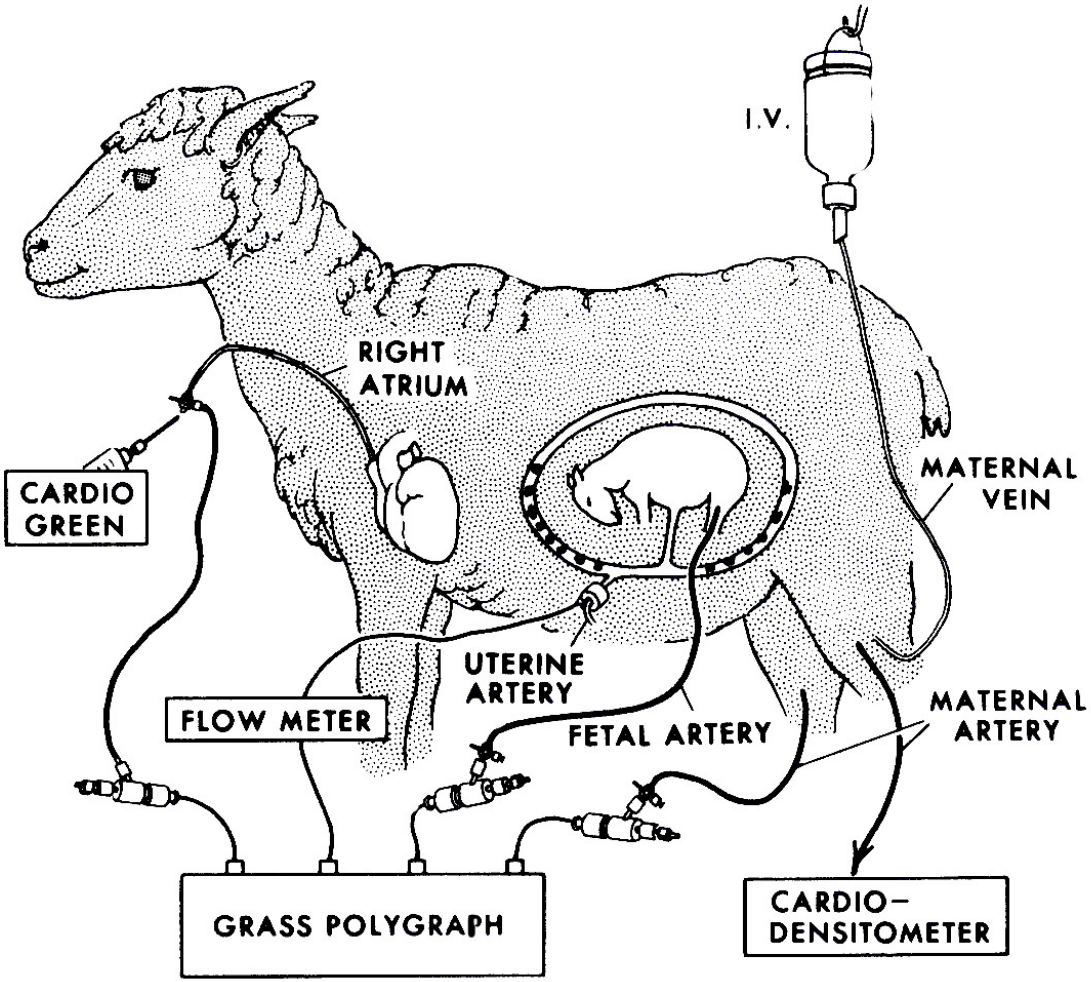
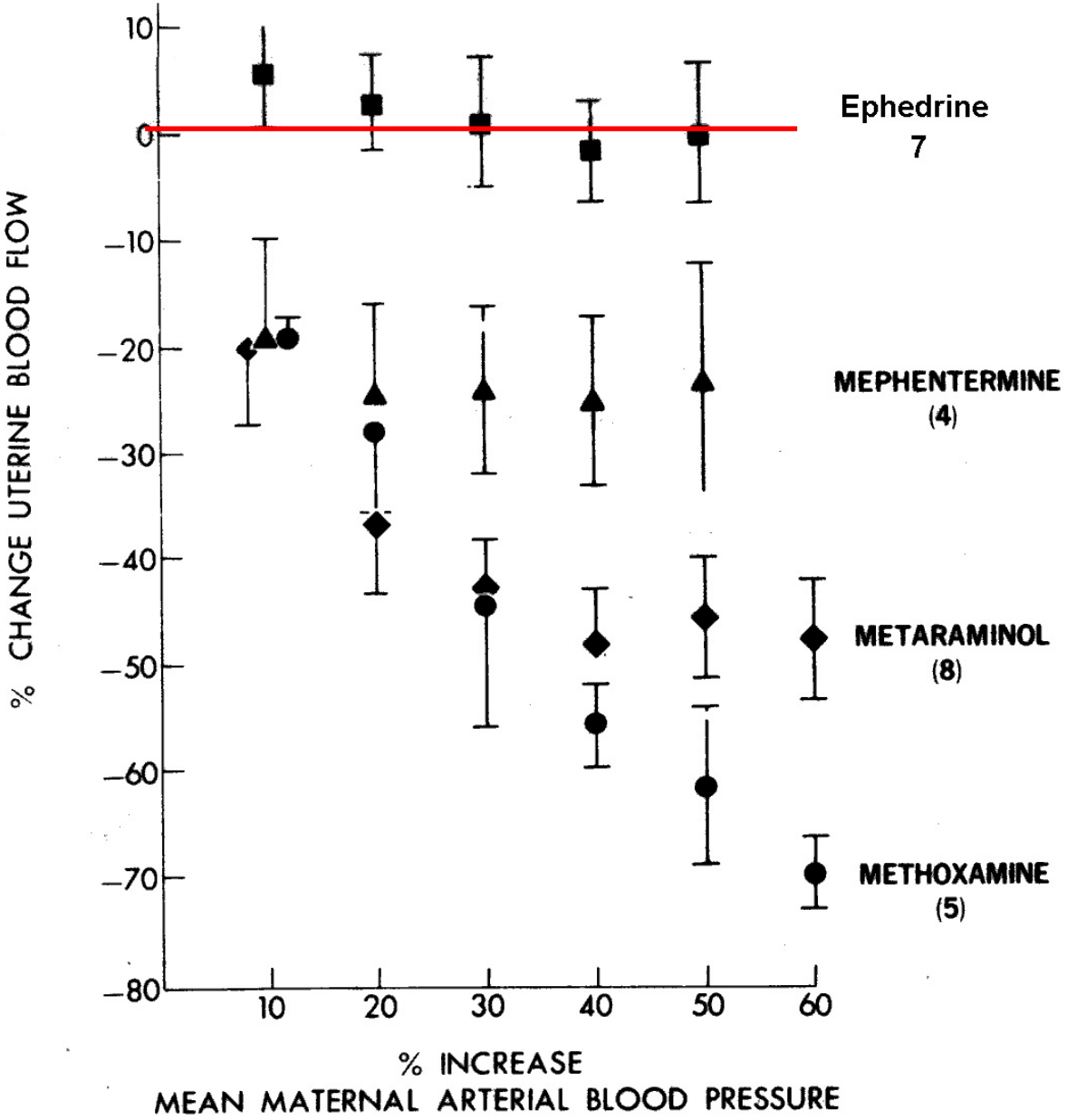
Question (raise your hands):

Who routinely uses EPHEDRINE for preventing/treating hypotension associated with spinal anesthesia in CS patients?

Who routinely uses PHENYLEPHRINE for preventing/treating hypotension associated with spinal anesthesia in CS patients?



Ralston DH. Anesthesiology 1974



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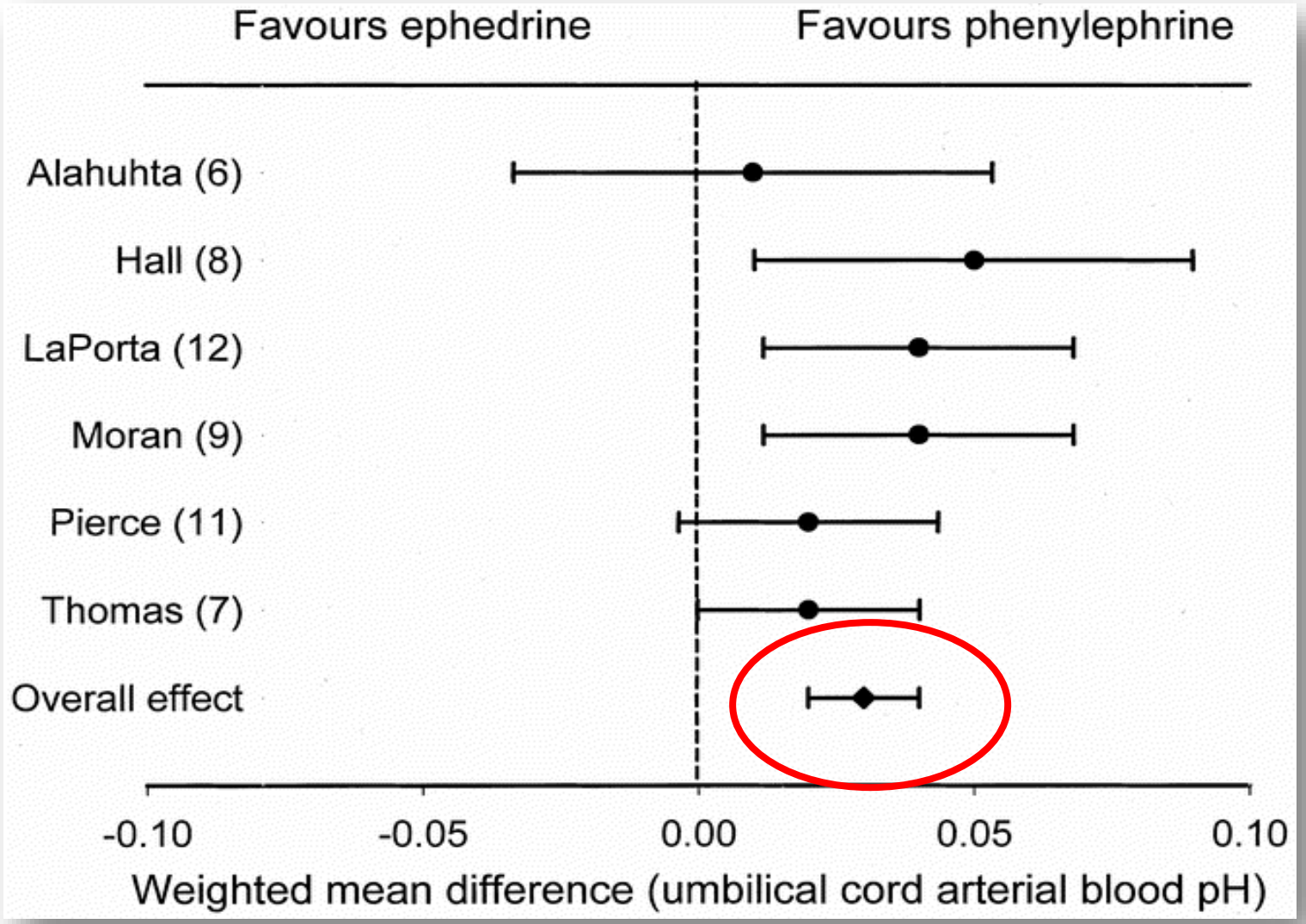
Ralston DH. Anesthesiology 1974

Ephedrine vs. Phenylephrine



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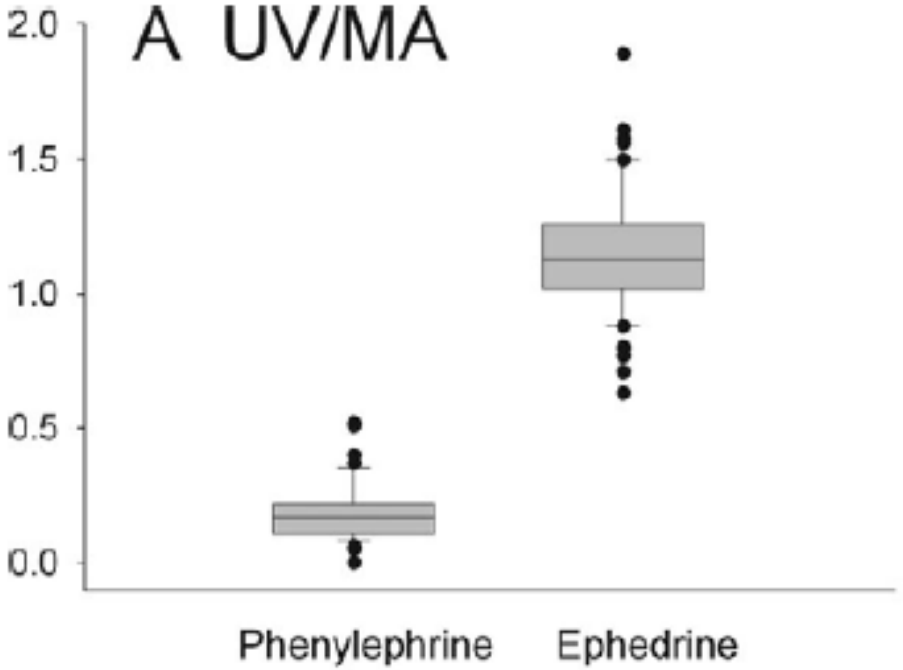
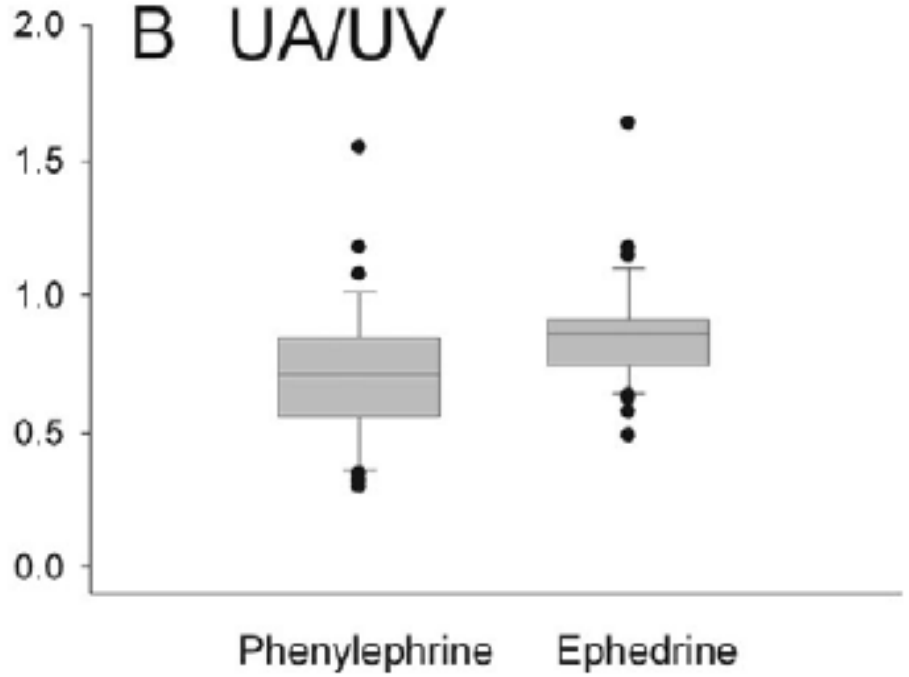
Lee A. Anesth Analg 2002

Phenylephrine vs. Ephedrine

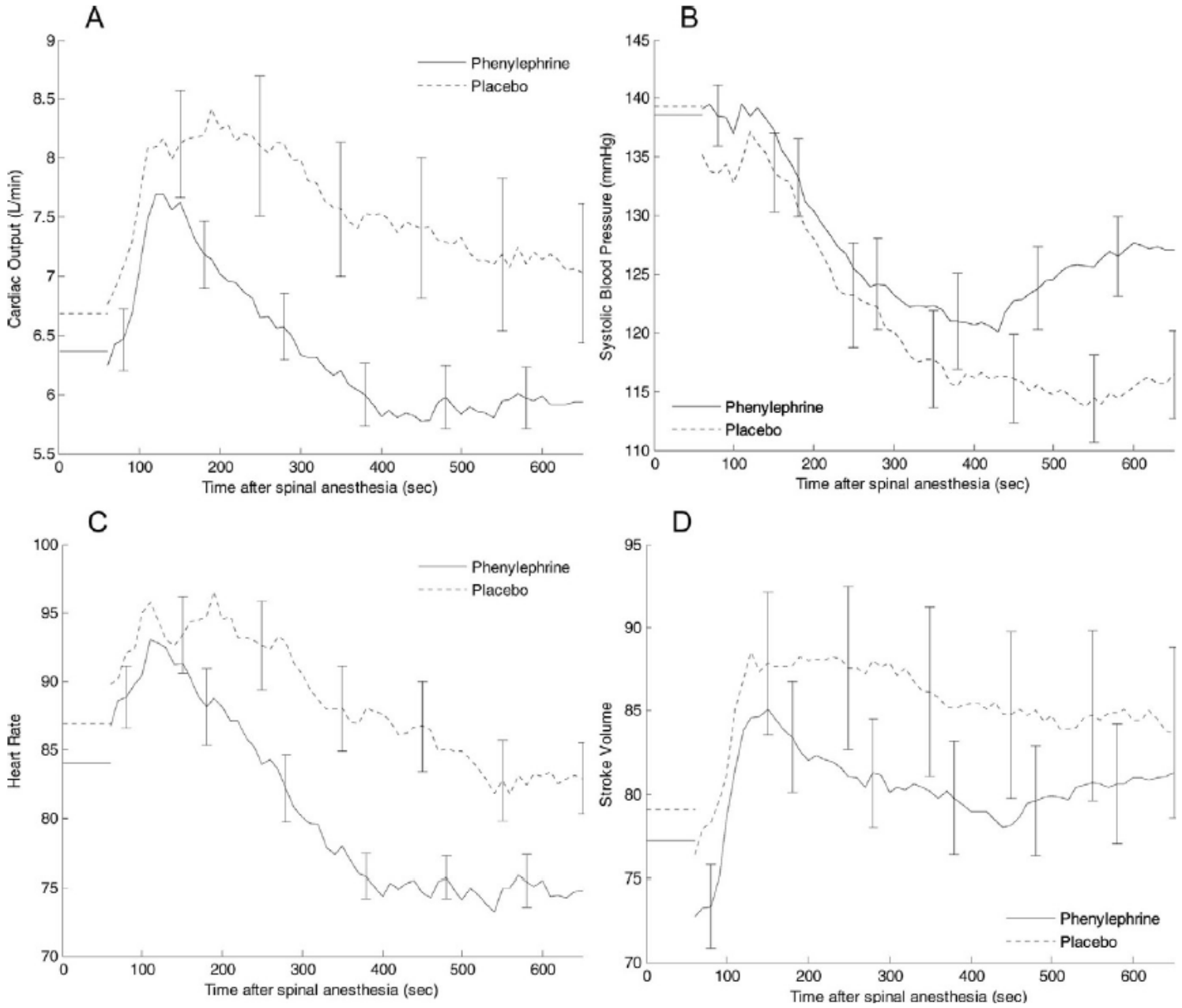


Placental transfer



Fetal metabolism

Ngan Kee W. Anesthesiology 2009;111:506



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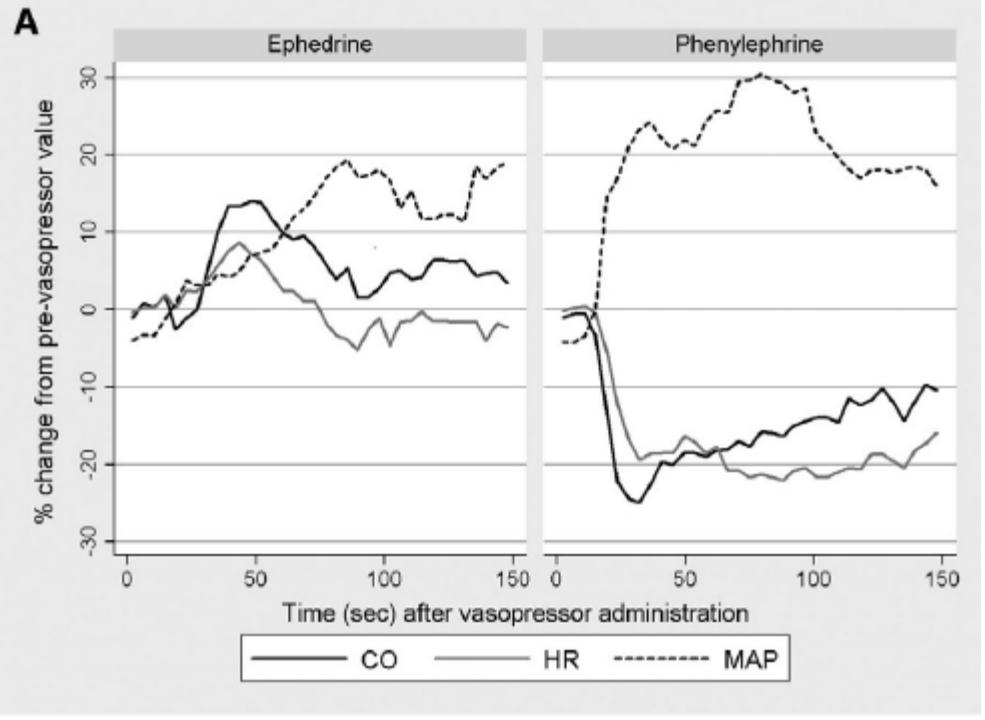
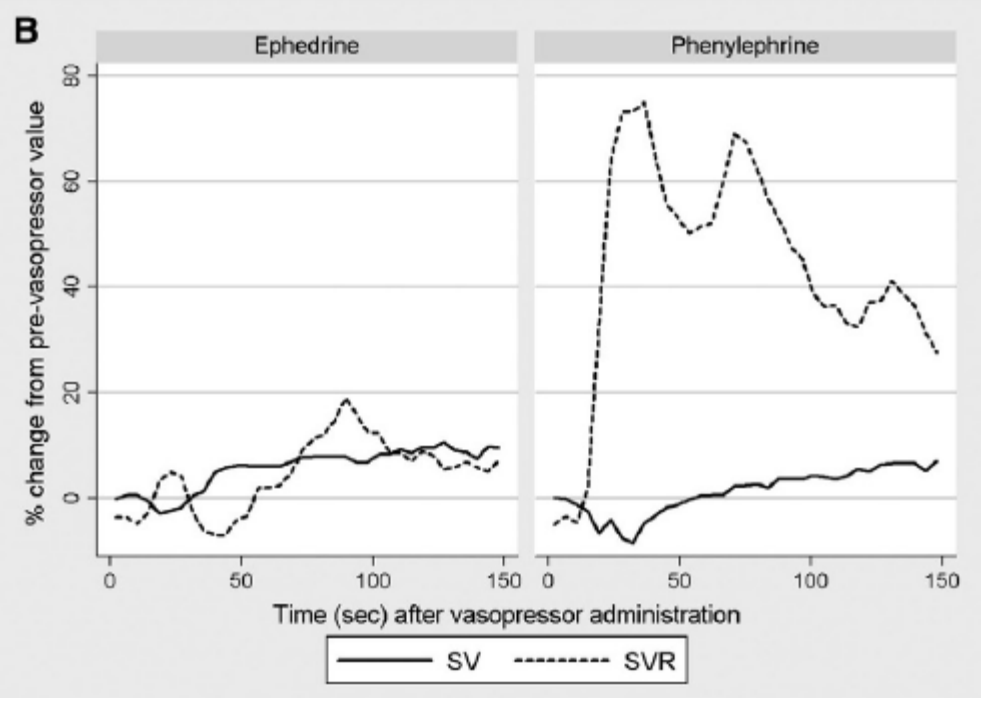
Langesæster E. Anesthesiology 2008;109:856

Phenylephrine vs. Ephedrine



Cardiac Output



Stroke Volume / SVR

Dyer R. Anesthesiology 2009;111:753

How much phenylephrine?

	80% **N = 24**	**90%** **N = 25**	**100%** **N = 25**	***P***
UA pH	7.30 (0.03)	7.30 (0.03)	7.32 (0.04)	0.036
Nausea (n)	10	4	1	0.006

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Ngan Kee WD. Br J Anaesth 2004

Phenylephrine Infusion Rate

Table 2. Hemodynamic Variables

	PE 0 (n = 20)	PE 25 (n = 20)	PE 50 (n = 20)	PE 75 (n = 19)	PE 100 (n = 22)
No. of interventions	2 (1–3.5)	0.5 (0–4.5)	1.5 (0–3.5)	4 (1–6)	5 (4–6)*
Infusion permanently stopped	1 (5%)	5 (25%)	3 (15%)	9 (47%)	15 (68%)†
Predelivery hypotension	16 (80%)‡	6 (30%)	3 (15%)	2 (11%)	0 (0%)
Predelivery hypertension	2 (10%)§	5 (25%)	8 (40%)	14 (74%)	18 (82%)‖
Postdelivery hypotension	9 (45%)	5 (25%)	1 (5%)	4 (21%)	2 (22%)
Postdelivery hypertension	0 (0%)	0 (0%)	5 (25%)	2 (11%)	8 (36%)
No. of hypotensive episodes	2 (1–3)¶	0 (0–2)	0 (0–0)	0 (0–1)	0 (0–0)
No. of hypertensive episodes	0 (0–0)#	0 (0–0)**	0.5 (0–2)††	2 (0–5)	3 (2–6)
Maximum percent change in SBP	8.3 (4.7–15.5)‡‡	12.7 (5.0–19.8)§§	22 (14.4–27.1)	29.3 (19.9–37.2)	33.2 (23.9–46.5)
Minimum percent change in SBP	−26.9 (−30.5, −19.1)‖‖	−19.2 (−22.5, −13.1)	−9.8 (−15.1, −5.5)	−8.3 (−19.7, −0.4)	−11.8 (−17.6, −6.2)
Bradycardia	1 (5%)	3 (15%)	0 (0%)	6 (32%)	7 (32%)

*$P < 0.05$ vs. PE 25 and PE 50

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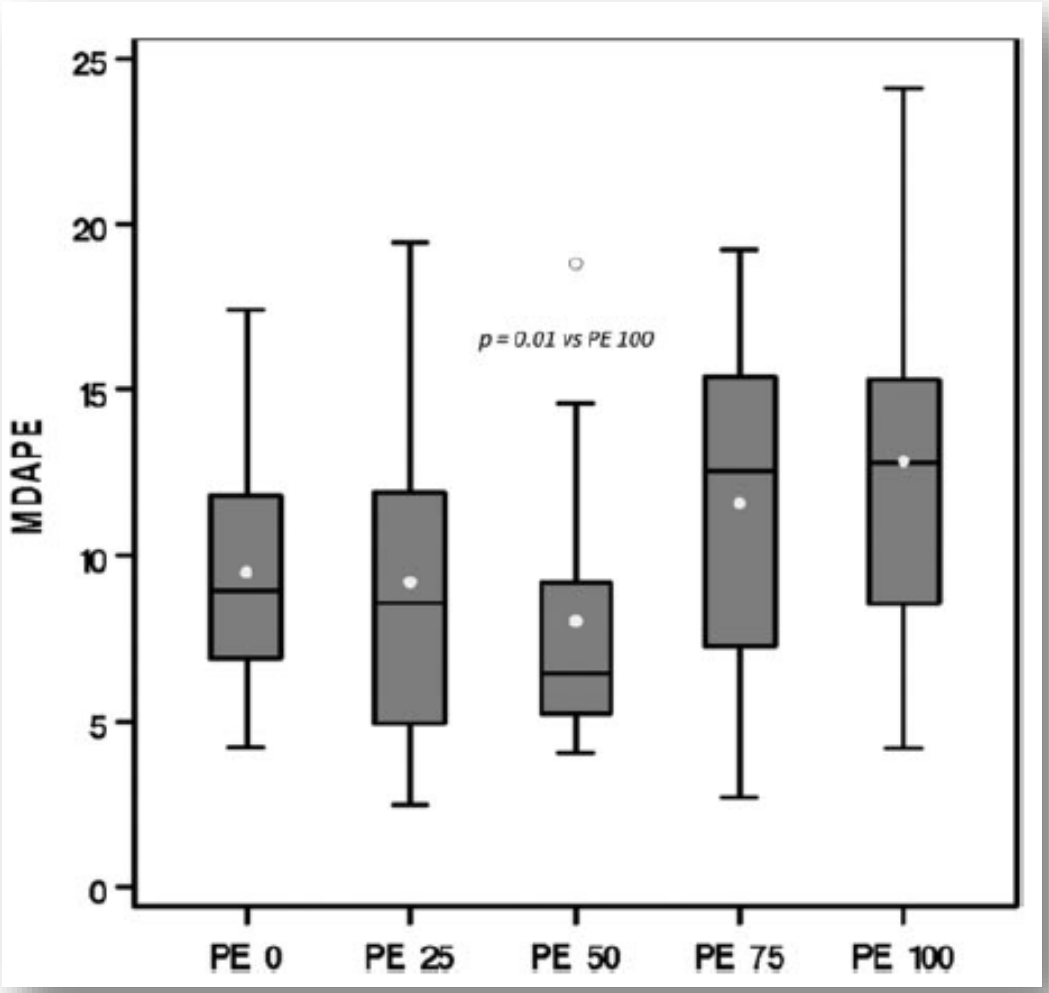
Allen TK. Anesth Analg 2010:111;1221

Phenylephrine Infusion Rate: Median Absolute Performance Error



Allen TK. Anesth Analg 2010:111;1221

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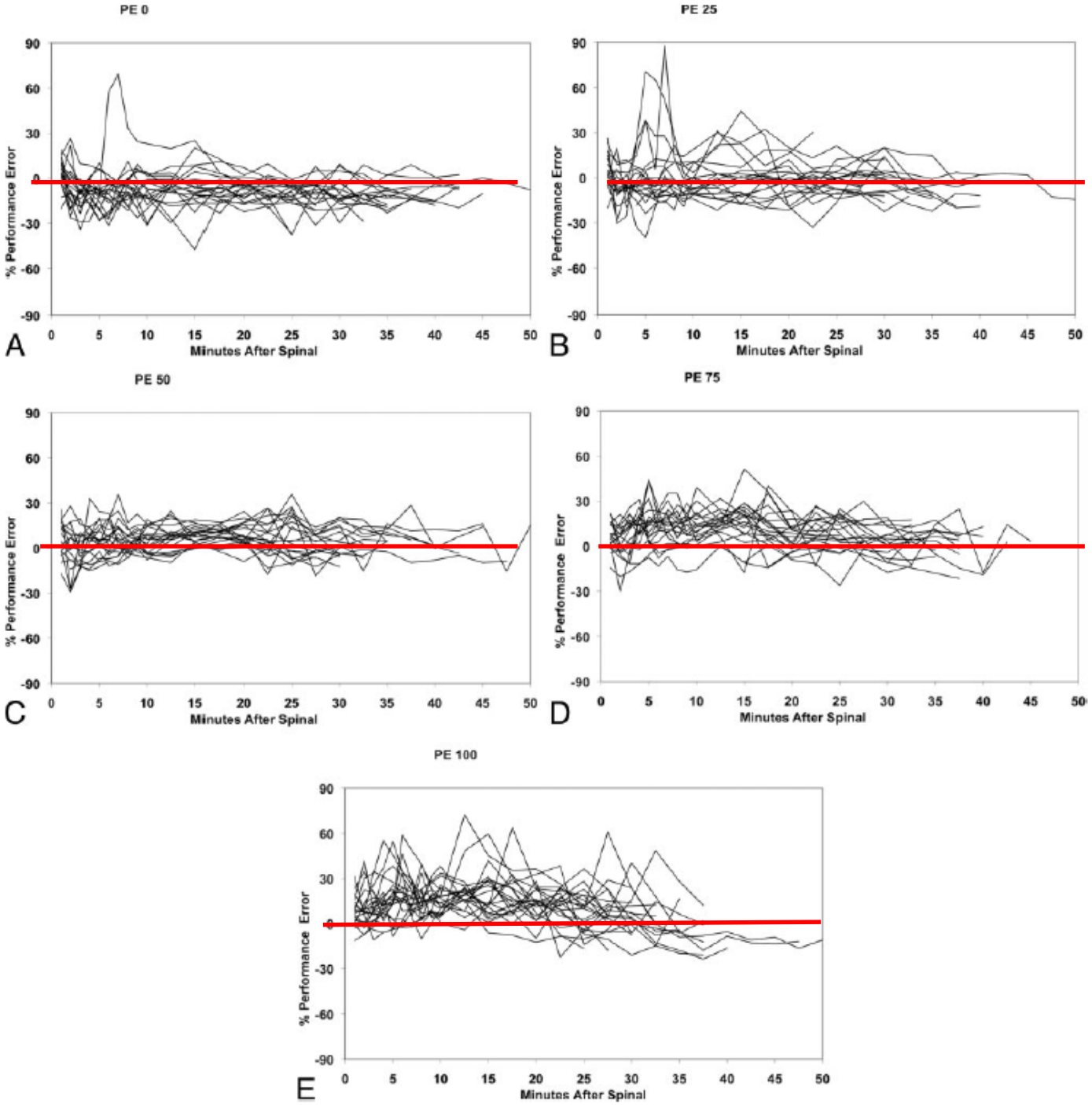
Percent Performance Error



Phenylephrine vs. ephedrine: Conclusions

Phenylephrine

- Higher umbilical cord pH
- Less nausea and vomiting
- CO and HR move in the same direction
  - Low dose phenylephrine to move HR back to baseline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• Phenylephrine vs. ephedrine
• Crystalloid vs. colloid
• Neuraxial infections
• External cephalic version

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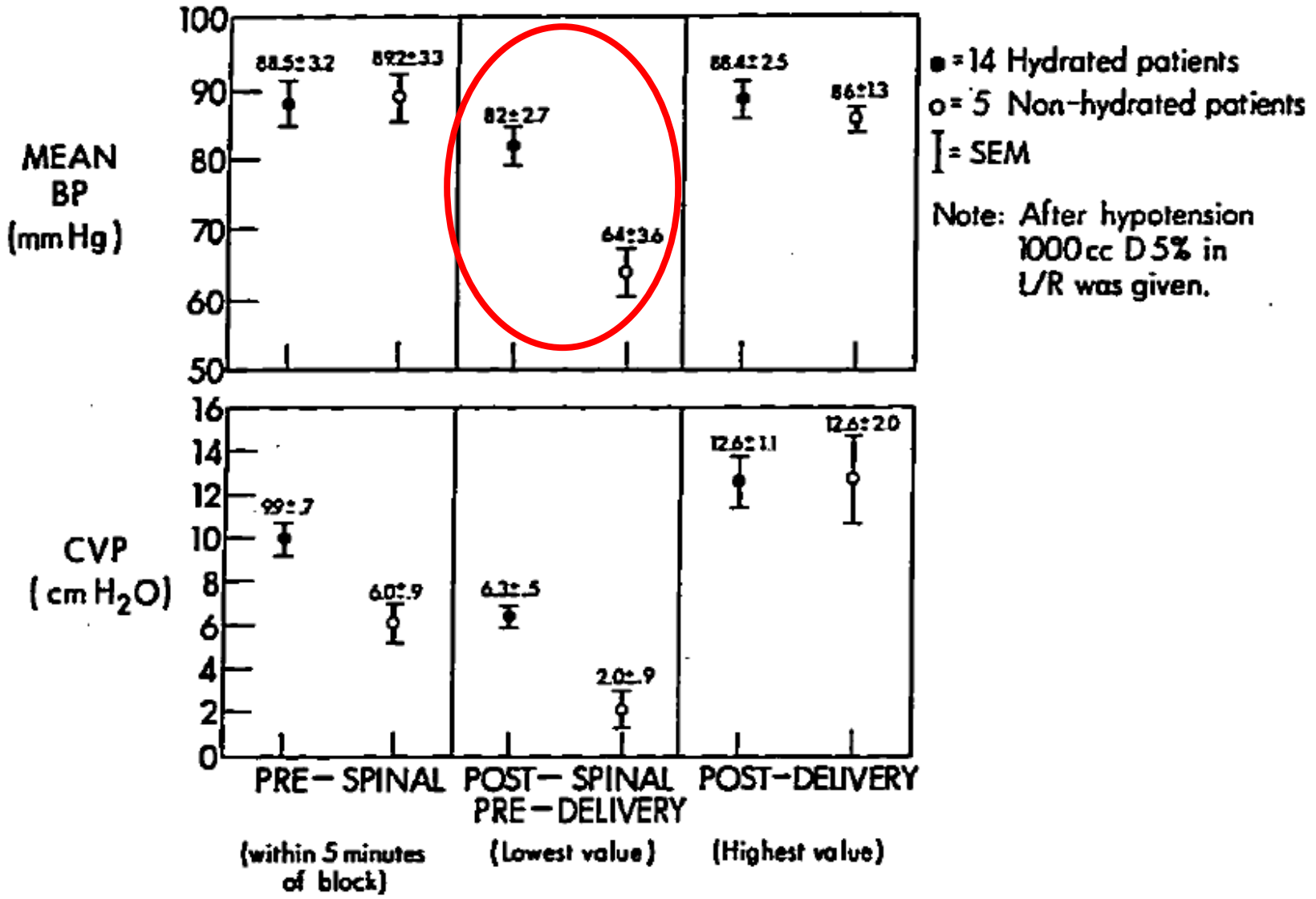
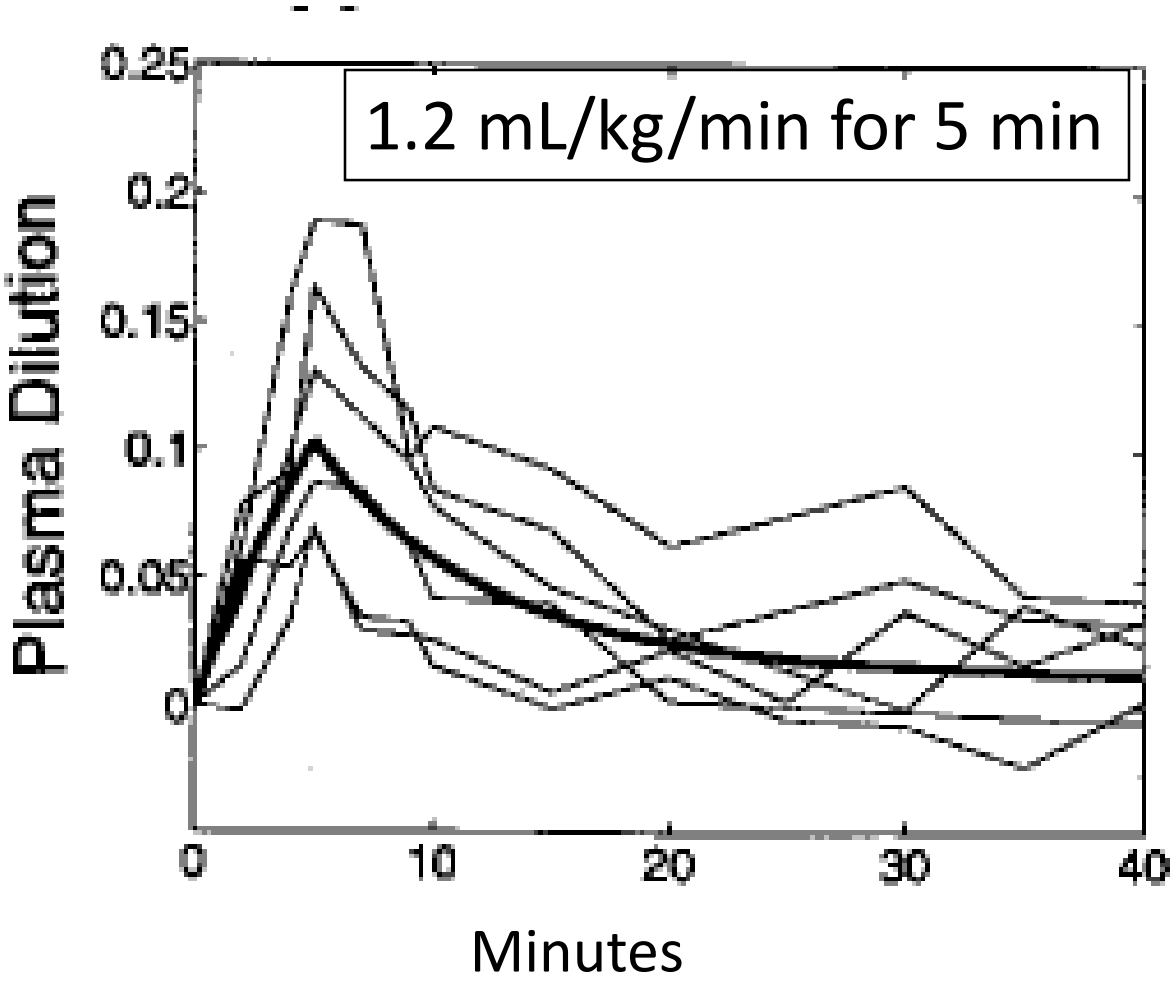
Question (raise your hands):

Who administers a crystalloid bolus BEFORE initiation of spinal anesthesia?



Wollman SB. Anesthesiology 1968;29:374

Crystalloid Kinetics



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Brauer LP. Anesth Analg 2002;95:1547

Fluid Management

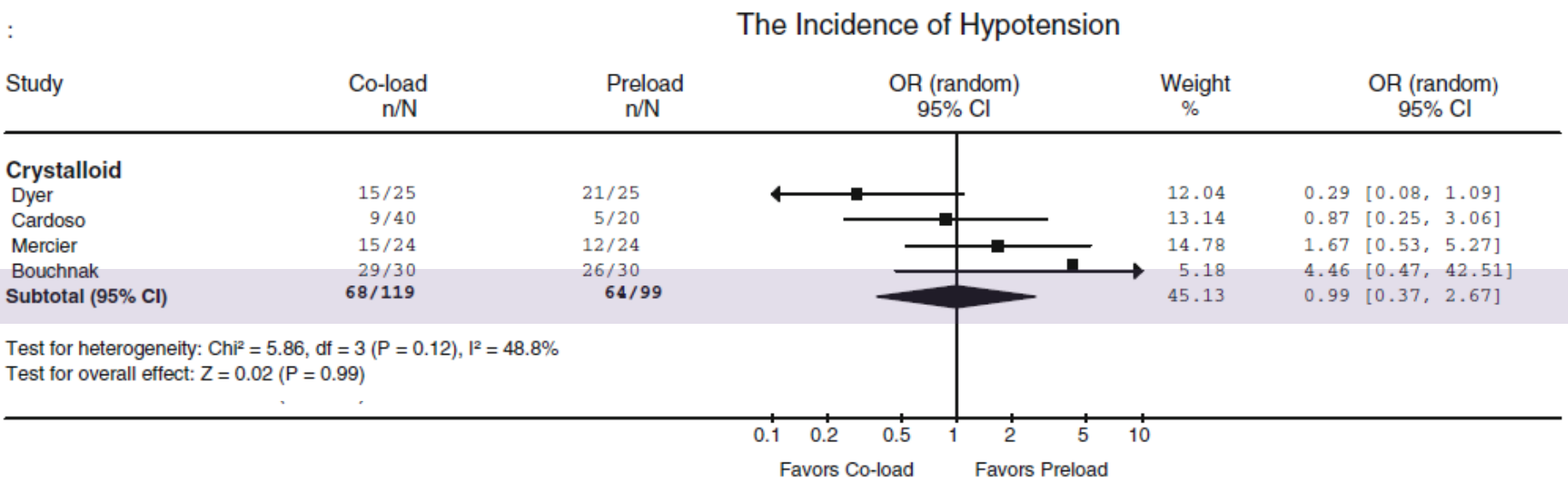
- Crystalloid preload vs. coload
- Colloid vs. crystalloid preload
- Colloid preload vs. coload
- Crystalloid vs. colloid coload

Crystalloid Preload vs. Coload: 20 mL/kg

	Coload N = 25	Preload N = 25	*P*-value
Volume (mL)	1386 ± 177	1474 ± 206	0.13
Duration infusion (min)	9.8 ± 4	20 ± 0	0.01
Ephedrine unit doses (n)	0 (0-5)	2 (0-13)	0.04
Ephedrine (mg)	0 (0-10)	10 (0-20)	0.03

Dyer RA. Anaesth Intensive Care 2004

Crystalloid Pre-load vs. Co-load



Banjeree A. Can J Anaesth 2010;57:24-31

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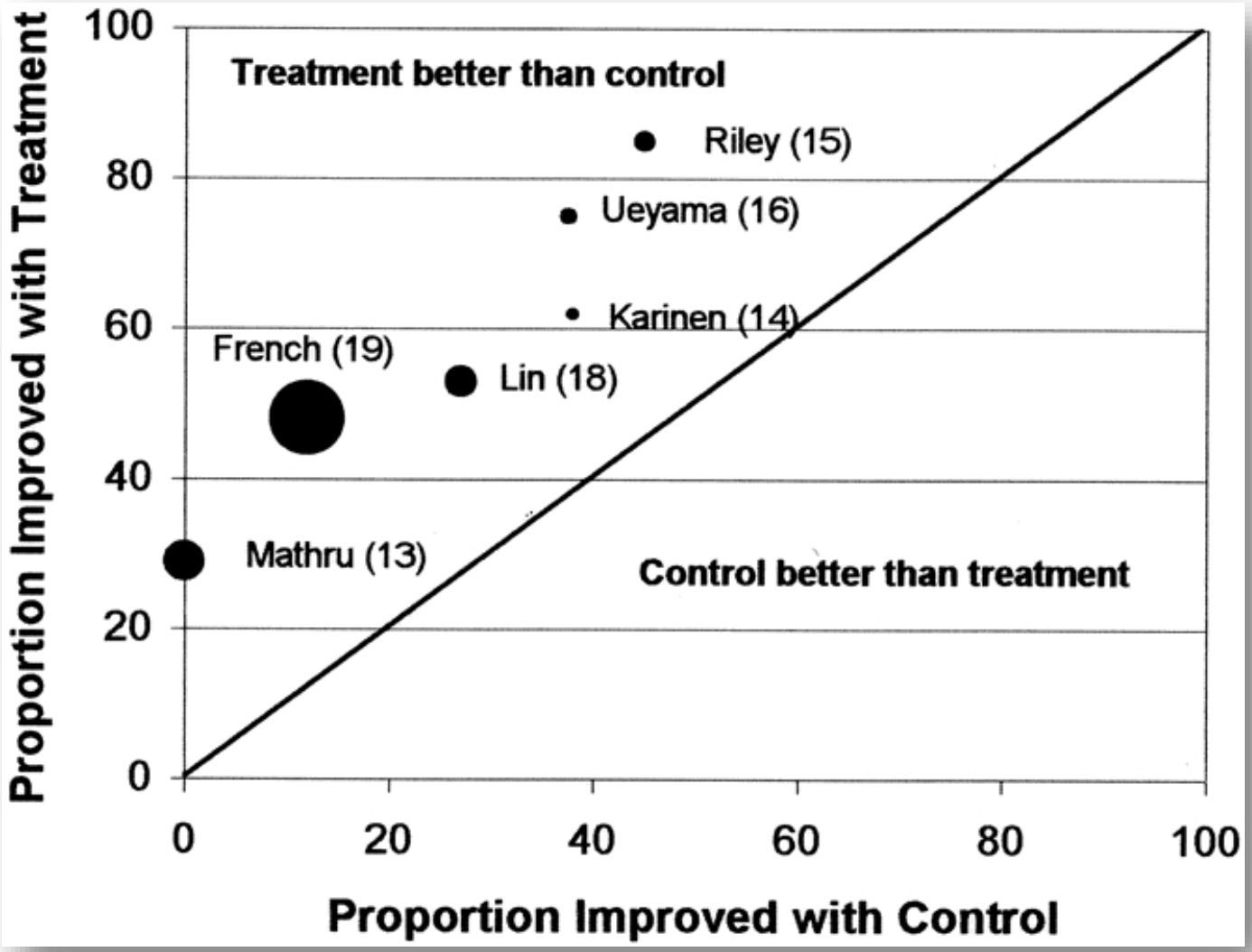
Fluid Management

- Crystalloid preload vs. coload
- Colloid vs. crystalloid preload
- Colloid preload vs. coload
- Crystalloid vs. colloid coload

Crystalloid vs. Colloid Preload

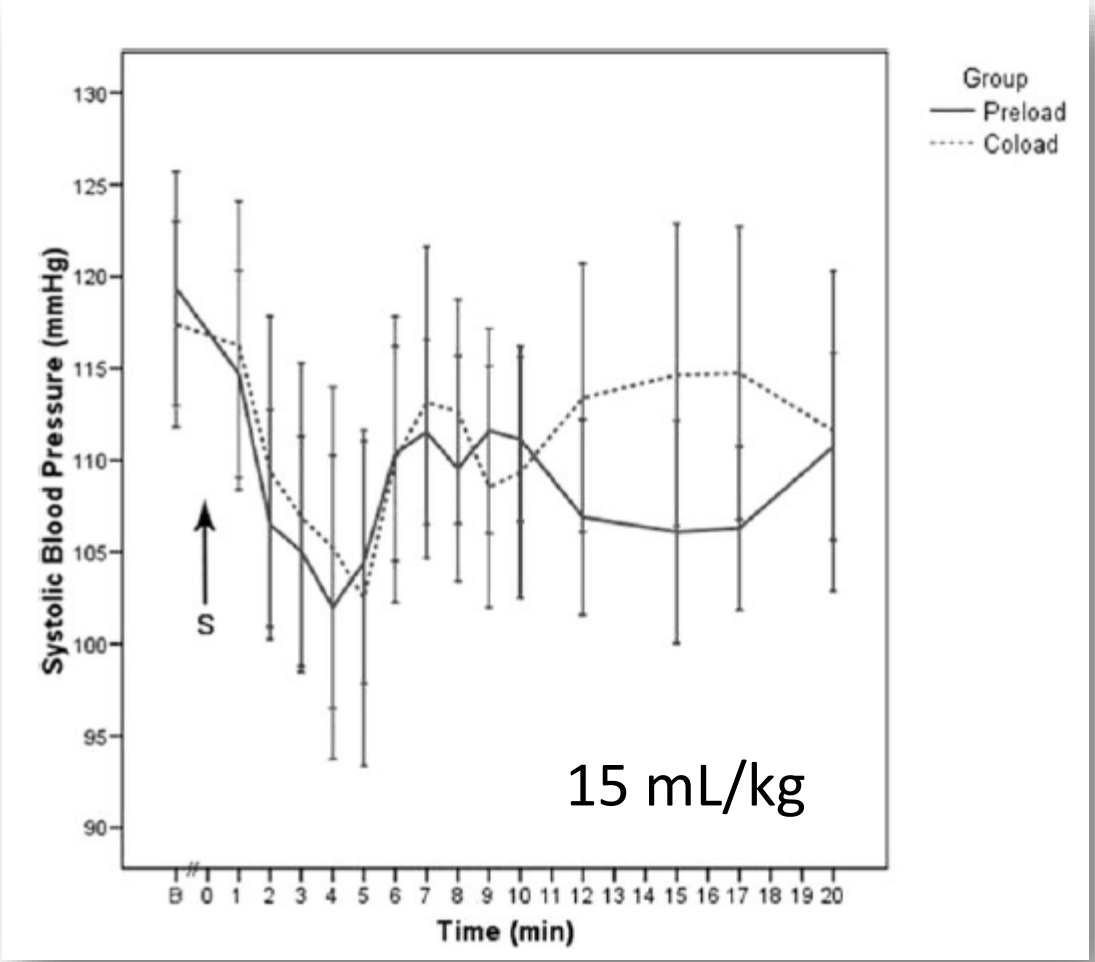


Morgan PJ. Anesth Analg 2001

Fluid Management

- Crystalloid preload vs. coload
- Colloid vs. crystalloid pre-load
- Colloid preload vs. coload
- Crystalloid vs. colloid coload

Colloid Preload vs. Coload



Teoh WH. Anesth Analg 2009;108:1592

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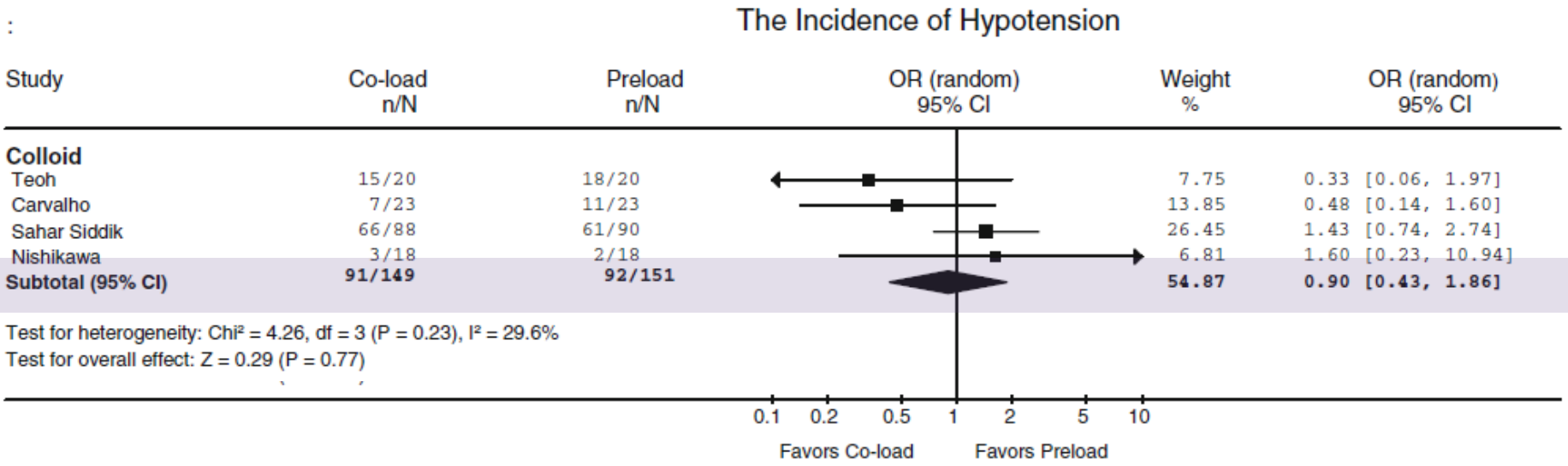
Colloid Preload vs. Coload



Banjeree A. Can J Anaesth 2010;57:24-31

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Fluid Management

- Crystalloid preload vs. coload
- Colloid vs. crystalloid preload
- Colloid preload vs. coload
- Crystalloid vs. colloid coload

Anesth Analg 2011;113:803

Society for Obstetric Anesthesia and Perinatology

Section Editor: Cynthia A. Wong

Maternal Cardiac Output Changes After Crystalloid or Colloid Coload Following Spinal Anesthesia for Elective Cesarean Delivery: A Randomized Controlled Trial

Sarah McDonald, FRCA,* Roshan Fernando, FRCA,* Keri Ashpole, FRCA,* and Malachy Columb, FRCA†

- RCT, elective cesarean delivery, N = 60
- Colloid 1-L vs. crystalloid 1-L coload
- Primary outcome: cardiac outcome
- Secondary outcomes: phenylephrine dose

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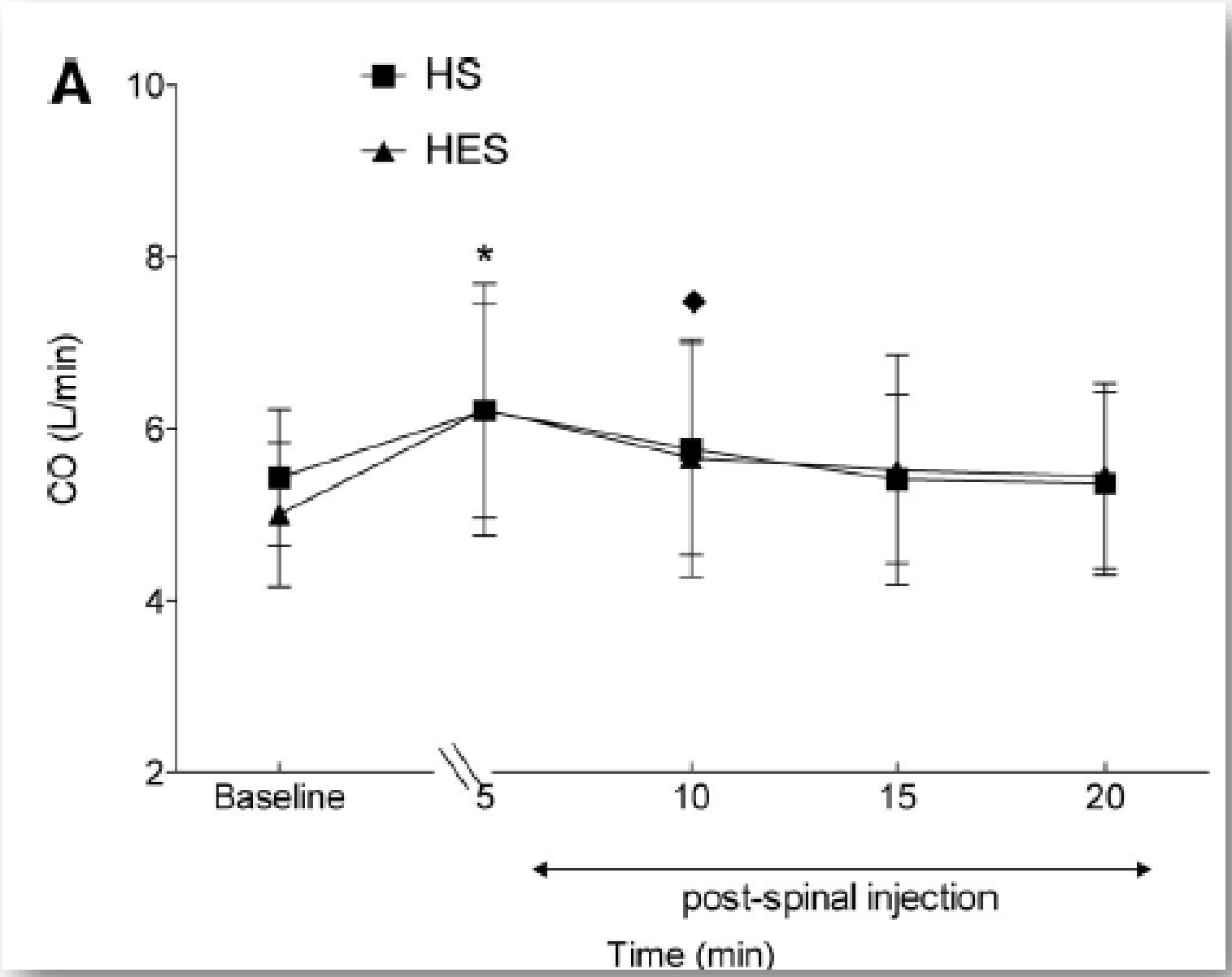

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McDonald S. Anesth Analg 2011;113:803

Table 3. Hemodynamic Data and Phenylephrine Requirements from Spinal Injection to Delivery

	HS group (n = 30)	HES group (n = 30)	P value
Total phenylephrine dose: spinal injection to delivery (mg)	2.59 (1.05)	2.21 (0.90)	0.14
≥1 boluses of phenylephrine, n (%)	8 (27%)	3 (10%)	0.18
Hypotension,[a] n (%)	18 (60%)	12 (40%)	0.20

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McDonald S. Anesth Analg 2011;113:803

Crystalloid vs. Colloid: Conclusions

- Crystalloid preload has no advantage over coload
- Colloid preload > crystalloid preload
- No difference between colloid preload and coload
- No difference between colloid and crystalloid coload
- Fluid loading does not reliably prevent hypotension

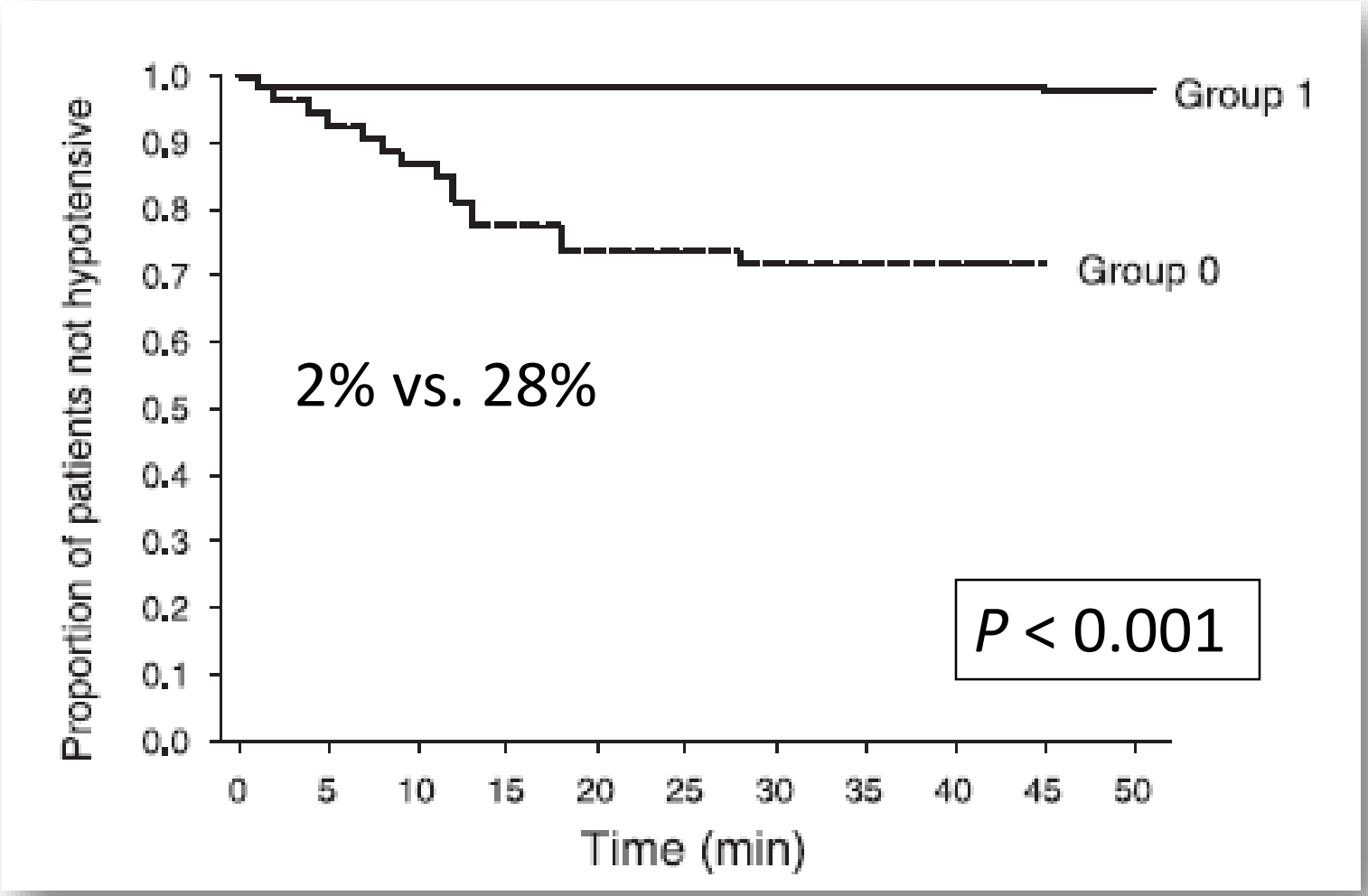
Anesthesiology 2005; 103:744–50

Prevention of Hypotension during Spinal Anesthesia for Cesarean Delivery

An Effective Technique Using Combination Phenylephrine Infusion and Crystalloid Cohydration

Warwick D. Ngan Kee, M.B.Ch.B., M.D., F.A.N.Z.C.A., F.H.K.A.M., Kim S. Khaw, M.B.B.S., F.R.C.A., F.H.K.A.M.,† Floria F. Ng, R.N., B.A.Sc.‡*

- RCT, N = 112
- Crystalloid coload (~ 2 L) vs. none
- Phenylephrine infusion starting 100 µg/min
- Primary outcome: incidence of hypotension (80% baseline)



Ngan Kee WD. Anesthesiology 2005;103:744

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• Oxytocin
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• External cephalic version

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Question (raise your hands):

Who uses POVIDONE IODINE for skin prep before an epidural or spinal procedure?

ASA Closed Claims Database

Table 5. Injuries to the Neuraxis in Regional Anesthesia Claims, 1980–1999 (n = 84)

	Obstetric (n = 26), No. (% Cases)		Nonobstetric (n = 58), No. (% Cases)
Hematoma	3 (12)	*	33 (57)
Unknown	4 (15)		9 (16)
Anterior spinal artery syndrome	2 (8)		3 (5)
Meningitis	6 (23)	†	2 (3)§
Spinal cord infarct	2 (8)		3 (5)
Abscess	6 (23)	†	2 (3)
Herniated disc	2 (8)		3 (5)
Other causes‖	1 (4)		4 (7)

Lee LA. Anesthesiology 2004;101:143

Estimated incidence: 1:302,757

Reynolds F. Anesthesiol Clin 2008;26:23

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Sources of Infection

- Spinal-epidural abscess: skin flora
  - *Staph aureus*

The NEW ENGLAND JOURNAL of MEDICINE

Chlorhexidine–Alcohol versus Povidone–Iodine for Surgical-Site Antisepsis

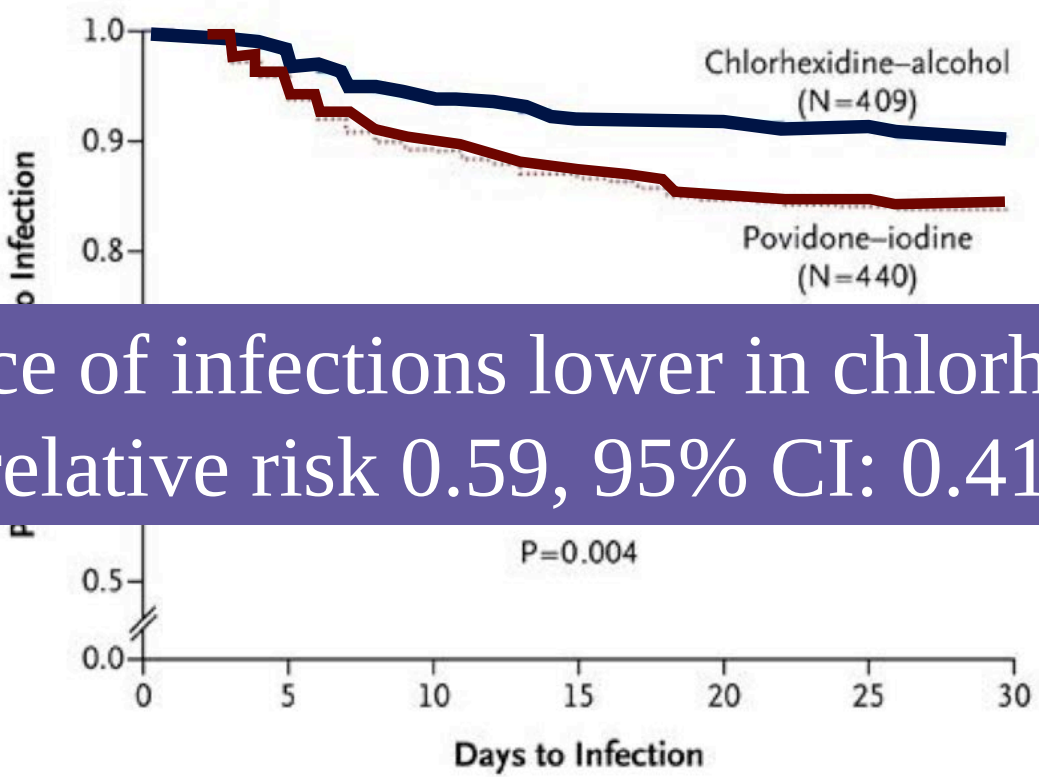
Rabih O. Darouiche, M.D., Matthew J. Wall, Jr., M.D., Kamal M.F. Itani, M.D., Mary F. Otterson, M.D., Alexandra L. Webb, M.D., Matthew M. Carrick, M.D., Harold J. Miller, M.D., Samir S. Awad, M.D., Cynthia T. Crosby, B.S., Michael C. Mosier, Ph.D., Atef AlSharif, M.D., and David H. Berger, M.D.

- RCT, surgical wound prep
  - chlorhexidine-alcohol scrub (n=409) vs. povidone-iodine (n=440)
- Primary outcome: incidence of infections

The NEW ENGLAND JOURNAL of MEDICINE

Chlorhexidine–Alcohol versus Povidone–Iodine for Surgical-Site Antisepsis

Rabih O. Darouiche, M.D., Matthew J. Wall, Jr., M.D., Kamal M.F. Itani, M.D., Mary F. Otterson, M.D., Alexandra L. Webb, M.D., Matthew M. Carrick, M.D., Harold J. Miller, M.D., Samir S. Awad, M.D., Cynthia T. Crosby, B.S., Michael C. Mosier, Ph.D., Atef AlSharif, M.D., and David H. Berger, M.D.



Incidence of infections lower in chlorhexidine group (relative risk 0.59, 95% CI: 0.41-0.85)

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Anesthesiology 2010; 112:000–000

Practice Advisory for the Prevention, Diagnosis, and Management of Infectious Complications Associated with Neuraxial Techniques

A Report by the American Society of Anesthesiologists Task Force on Infectious Complication

- Aseptic techniques should always be used during the preparation of equipment (*e.g.*, ultrasound) and the placement of neuraxial needles and catheters, including the following:
  - Removal of jewelry (*e.g.*, rings and watches), hand washing, and wearing of caps, masks (covering both mouth and nose and consider changing before each new case), and sterile gloves.
  - Use of individual packets of antiseptics for skin preparation.
  - Use of chlorhexidine (preferably with alcohol) for skin preparation, allowing for adequate drying time.§§
  - Sterile draping of the patient.
  - Use of sterile occlusive dressings at the catheter insertion site.

AAGBI

Maximal barrier precautions involve full hand washing, the wearing of sterile gloves and gown, a cap, mask and the use of a large sterile drape [42]. The skin entry site should be cleaned with an alcoholic chlorhexidine gluconate solution or alcoholic povidone-iodine solution [43]. The antiseptic should be allowed to dry before proceeding.

Certain invasive anaesthetic procedures require this optimum aseptic technique:

- Insertion of central venous catheters.
- Spinal, epidural and caudal procedures.

Anaesthesia 2008;63:1027

Sources of Infection

- Spinal-epidural abscess: skin flora
  - *Staph aureus*
- Meningitis
  - *Strep viridans*

Centers for Disease Control and Prevention
MMWR
Morbidity and Mortality Weekly Report
Weekly / Vol. 59 / No. 3
January 29, 2010

Bacterial Meningitis After Intrapartum Spinal Anesthesia — New York and Ohio, 2008–2009

- 2 anesthesiologists / 2 hospitals
- 5 cases of meningitis (3 CSE, 2 SAB)
- Onset of symptoms 13 – 21 h
- One death (26 h)
- *Strep salivarius 4/5*
- One anesthesiologist did not wear a mask

Meningitis Case Clusters

- 4 cases of viridans streptococci meningitis after spinal anesthesia in 15 months
- One anesthesiologist
  - Recurrent pharyngitis
  - No handwashing
  - Did not remove jewelry
  - Did not wear a face mask
  - Wore sterile gloves

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Schneeberger PM. Infection 1996;24:29

Anesthesiology 2010; 112:000–000

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2007 Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings

Jane D. Siegel, MD; Emily Rhinehart, RN MPH CIC; Marguerite Jackson, PhD; Linda Chiarello, RN MS; the Healthcare Infection Control Practices Advisory Committee

Acknowledgement: The authors and HICPAC gratefully acknowledge Dr. Larry Strausbaugh for his many contributions and valued guidance in the preparation of this guideline.

Suggested citation: Siegel JD, Rhinehart E, Jackson M, Chiarello L, and the Healthcare Infection Control Practices Advisory Committee, 2007 Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings
http://www.cdc.gov/ncidod/dhqp/pdf/isolation2007.pdf

venous catheters [919]. In October 2005, the Healthcare Infection Control Practices Advisory Committee (HICPAC) reviewed the evidence and concluded that there is sufficient experience to warrant the additional protection of a face mask for the individual placing a catheter or injecting material into the spinal or epidural space.

Neuraxial Infection: Conclusions

- Skin prep solution: Chlorhexidine with alcohol
- Anesthesiologist: should wear masks


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• Oxytocin
• Phenylephrine vs. ephedrine
• Crystalloid vs. colloid
• Neuraxial infections
• External cephalic version

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Question (raise your hands):

Who works in an institution that offers ECV for breech presentation?

Who offers NEURAXIAL ANALGESIA/ANESTHESIA for attempted ECV in their institution?

Can J Anesth/J Can Anesth (2010) 57:408–414
DOI 10.1007/s12630-010-9278-4

REPORTS OF ORIGINAL INVESTIGATIONS

Anesthetic dose neuraxial blockade increases the success rate of external fetal version: a meta-analysis

À dose anesthésique, les blocs périmédullaires accroissent le taux de succès des versions fœtales: une méta-analyse

Anne Lavoie, MD · Joanne Guay, MD

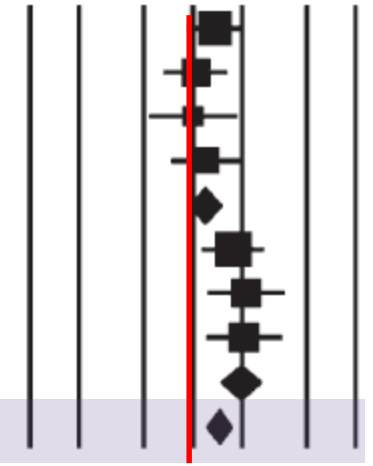
- 7 studies, N = 681
- Neuraxial analgesia/anesthesia vs. no neuraxial
- Primary outcome: success ECV

Neuraxial Analgesia: Success

Lavoie A. Can J Anaesth 2010;57;408-14

Effects of central neuraxial blocks on the success rate of fetal versions

Group by Dose	Study name	Statistics for each study				Success / Total		Risk ratio and 95% CI
		Risk ratio	Lower limit	Upper limit	p-Value	CNB	Control	
Analgesic	Delisle	1.363	0.936	1.984	0.106	41 / 99	31 / 102	
Analgesic	Dugoff	1.040	0.666	1.624	0.863	22 / 50	22 / 52	
Analgesic	Hollard	1.006	0.542	1.867	0.985	9 / 17	10 / 19	
Analgesic	Sullivan	1.197	0.744	1.926	0.459	22 / 48	18 / 47	
Analgesic	*Subtotal*	1.182	0.940	1.485	0.152			
Anesthetic	Mancuso	1.778	1.148	2.753	0.010	32 / 54	18 / 54	
Anesthetic	Schorr	2.119	1.241	3.620	0.006	24 / 35	11 / 34	
Anesthetic	Weiniger	2.061	1.203	3.529	0.008	24 / 36	11 / 34	
Anesthetic	*Subtotal*	1.950	1.464	2.597	0.000			
Overall		1.436	1.201	1.716	0.000			



Mixed effects models

RR 1.44; 95% CI 1.16 – 1.79; *P* = 0.001

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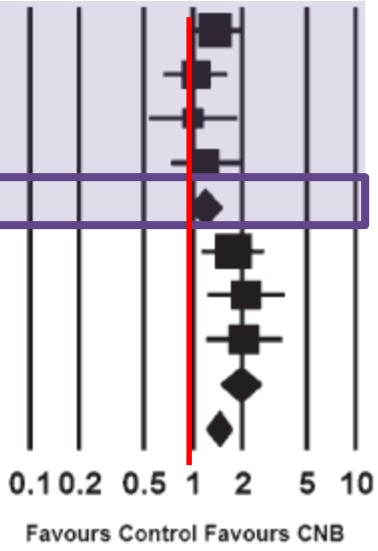

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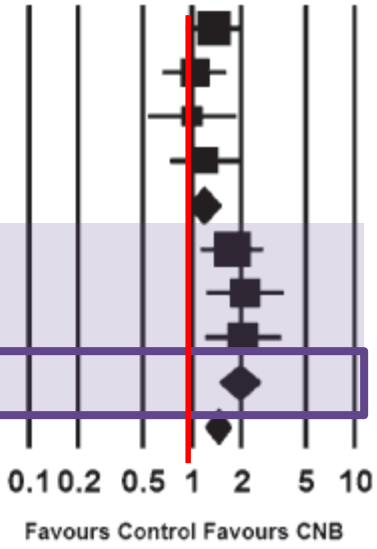
Risk ratio and 95% CI



Mixed effects models

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RR 1.95; 95% CI 1.46 – 2.60; $P < 0.001$

Society for Obstetric Anesthesia and Perinatology

Section Editor: Cynthia A. Wong

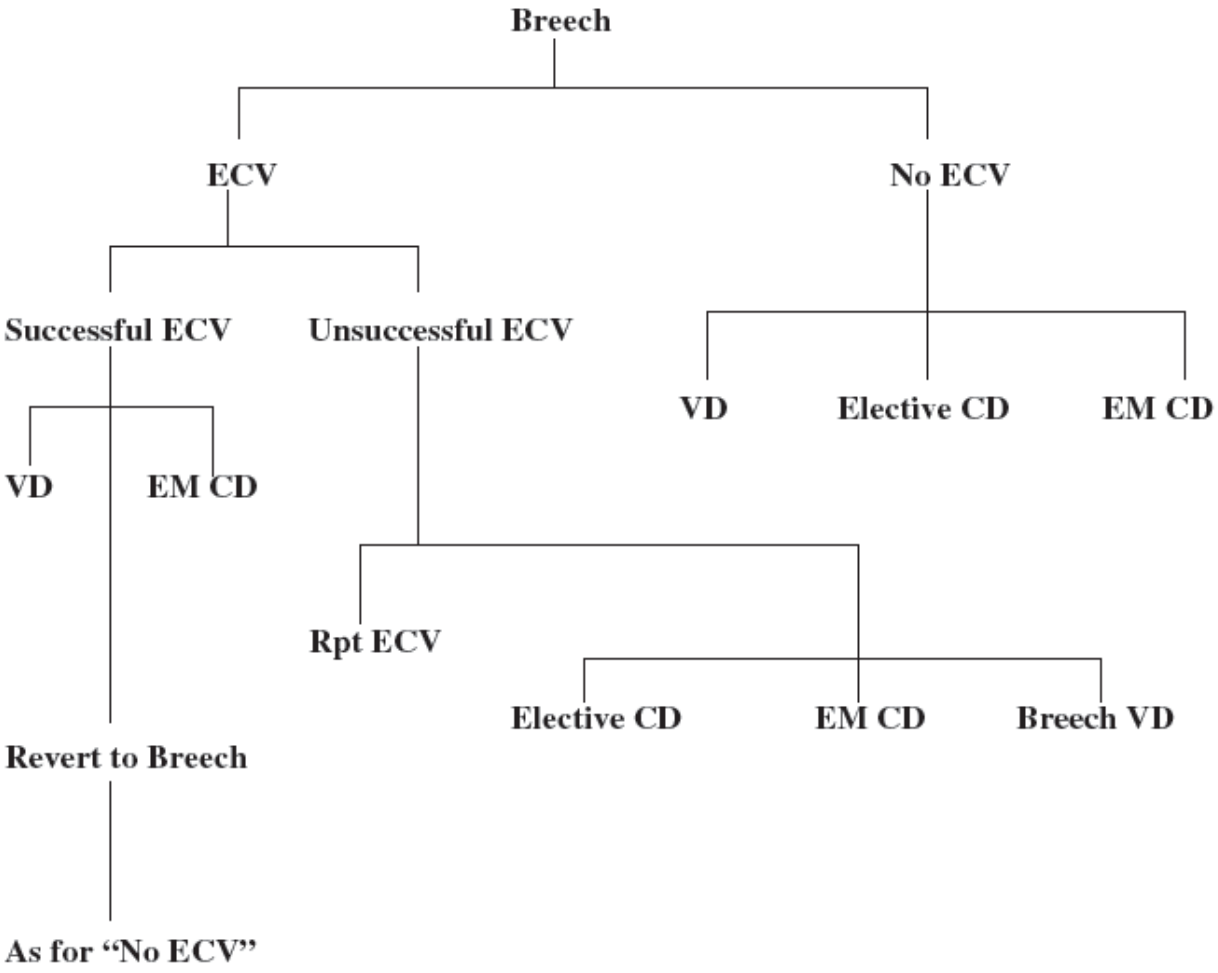
Anesth Analg 2013;117:155-9

BRIEF REPORT

A Cost Analysis of Neuraxial Anesthesia to Facilitate External Cephalic Version for Breech Fetal Presentation

Brendan Carvalho, MBBCh, FRCA,* Jonathan M. Tan, MD, MPH,† Alex Macario, MD, MBA,* Yasser Y. El-Sayed, MD,* and Pervez Sultan, MBChB, FRCA‡

Neuraxial Analgesia: Cost



Carvalho B. Anesth Analg 2013;117:155-9

Neuraxial Analgesia: Cost

Carvalho B. Anesth Analg 2013;117:155-9

- 6 studies, N = 508
- Mean ECV success rate
  - with analgesia 60% (range 44% - 87%)
  - without analgesia 38% (range 31% - 58%)
- Mean delivery cost $8931/$9207
- Difference $-276 (2.5th-97.5th CI $-720 to $112)

- Oxytocin
- Phenylephrine vs. ephedrine
- Crystalloid vs. colloid
- Neuraxial infections
- External cephalic version

Update in Obstetric Anesthesia

Conclusions

- Oxytocin: Low-dose infusion/± small bolus
- Phenylephrine > ephedrine
  - Infusion 25 – 50 µg/min
- Crystalloid coload
- Chlorhexidine with alcohol skin prep
- Neuraxial anesthesia/analgesia for ECV