



My Two Cents: Clinical Conundrums

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Skåvsjöholm

Lawrence C. Tsen, MD
Associate Professor in Anaesthesia, Harvard Medical School
Director of Anesthesia, Center for Reproductive Medicine,
Brigham and Women's Hospital

My Two Cents: Heads and Tails



My Two Cents: Heads and Tails

Table 1. Pioneers of Continuous Epidural Techniques

Timeline	Pioneer(s)	Novel Development
1901	Jean Sicard; Fernand Cathelin	Independently introduced single-shot caudal blocks
1910	Arthur Lawen; Walter Stoeckel	Advocated caudal blocks for pelvic and obstetric surgeries
1921	Fidel Pagés Miravé	Introduced single-shot thoracolumbar approach to epidural analgesia
1923	Gaston Labat; Barnet Bonar; William Meeker	Advocated caudal approach for epidural anesthesia
1930	Alberto Gutiérrez	Described the “hanging drop” method for identification of the epidural space
1931	Achille Deglietti	Described loss-of-resistance technique to identify the epidural space
1931	Eugene Aburel	Introduced a continuous catheter technique to block the lumbo-aortic plexus during early stage of labor
1930	Charles Odom; John Harger; John Abajian	Early practitioners of epidural anesthesia in North America
1938	Peter Graffagnino; Louis Seyler	Applied single-shot epidural anesthesia in obstetrics
1940	William Lemmon	Introduced a continuous spinal technique <i>via</i> a malleable needle
1941	Samuel Manalan	Used catheter technique for labor analgesia
1942	Robert Hingson; Waldo Edwards; James Southworth	Modified the malleable Lemmon needle; pioneered an approach to continuous caudal analgesia in obstetrics
1942	Charles Adams; John Lundy; Thomas Seldon	Advocated continuous caudal technique for peripartum analgesia
1944	Edward Tuohy	Introduced the ureteral catheter for continuous spinal anesthesia; modified the Huber needle for epidural use
1944	James Southworth; Robert Hingson	Attempted a modified continuous lumbar epidural technique
1947	Manuel Martinez Curbelo	Introduced continuous lumbar epidural anesthesia with ureteral catheters

My Two Cents: Clinical Conundrums

Disclosures:
No Conflicts of Interest
My glasses/perspectives!



1. **Low Platelet Count** Prior to Neuraxial Technique



1. **Low Platelet Count** Prior to Neuraxial Technique

I would consider a neuraxial technique:

1. >100K
2. 75-100K
3. < 75K

4. Call Colleague



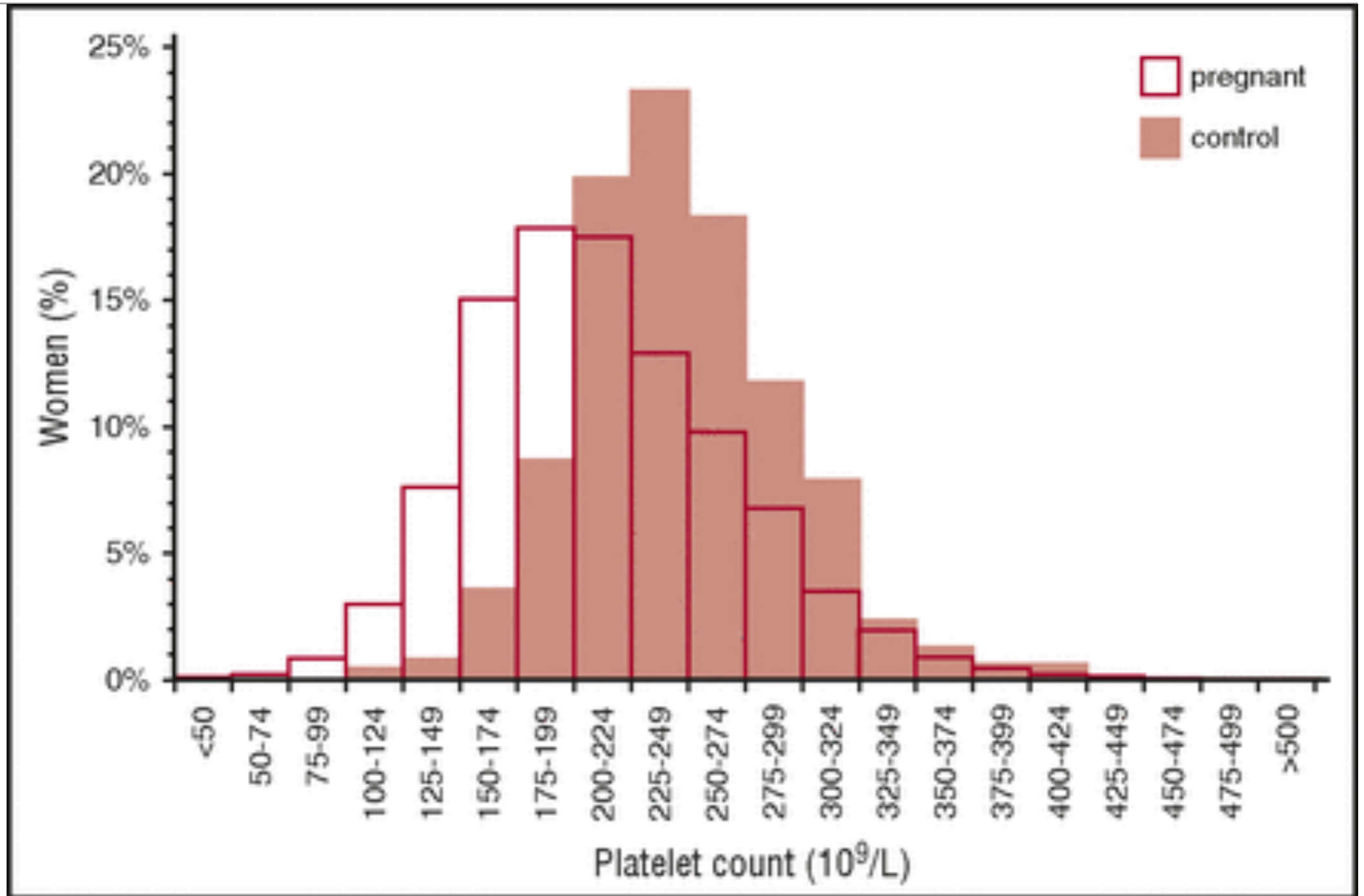
Thrombocytopenia

Etiology	Causes	Issues
Production Low, Decreased Megakaryocytes	Aplastic anemia Leukemia	
Production Low, Despite Megakaryocytes	Deficient B12/folate HIV, Etoh,	
Sequestration	Cirrhosis, Gaucher, Sarcoidosis	
Destruction , Immune	ITP, AntiPLS, Drug, HIV, s/p Transfusion	Steroids, Ivlg
Destruction, NonImmune	Infection, DIC, Sepsis, TTP, Uremia, Gest, PIH	Functional Deficit
Dilution	Gest , Fluids RBC Transfusion	

Thrombocytopenia

<150K/L

5-10%
pregnant
women



Thrombocytopenia

Other: Infection, DIC, type IIb vWD, drug reaction, paroxysmal nocturnal hemoglobinuria, bone marrow failure

ITP: Idiopathic

HT: Hereditary

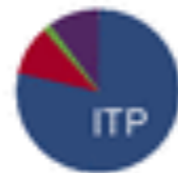
TTP: Thrombotic thrombocytopenic purpura

HUS: Hemolytic uremic syndrome

PEC: Preeclampsia

GT: Gestation

Trimester 1
Platelet Count



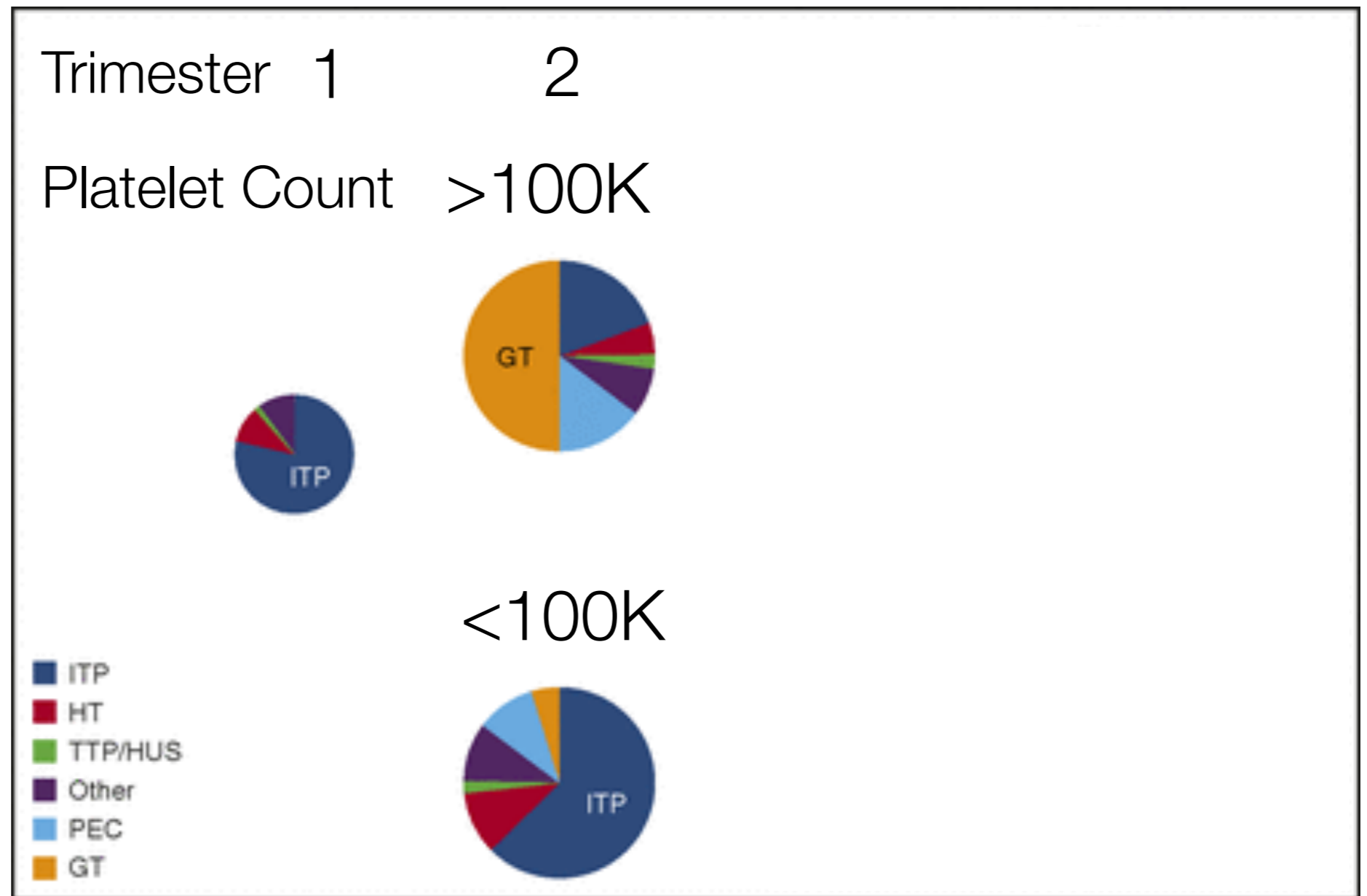
Fogerty AE. Transfusion Med Rev 2018; 32, 225-9

Cines DB, Levine LD. Thrombocytopenia in Pregnancy. ASH 2017;1:144-51

Thrombocytopenia

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Fogerty AE. Transfusion Med Rev 2018; 32, 225-9

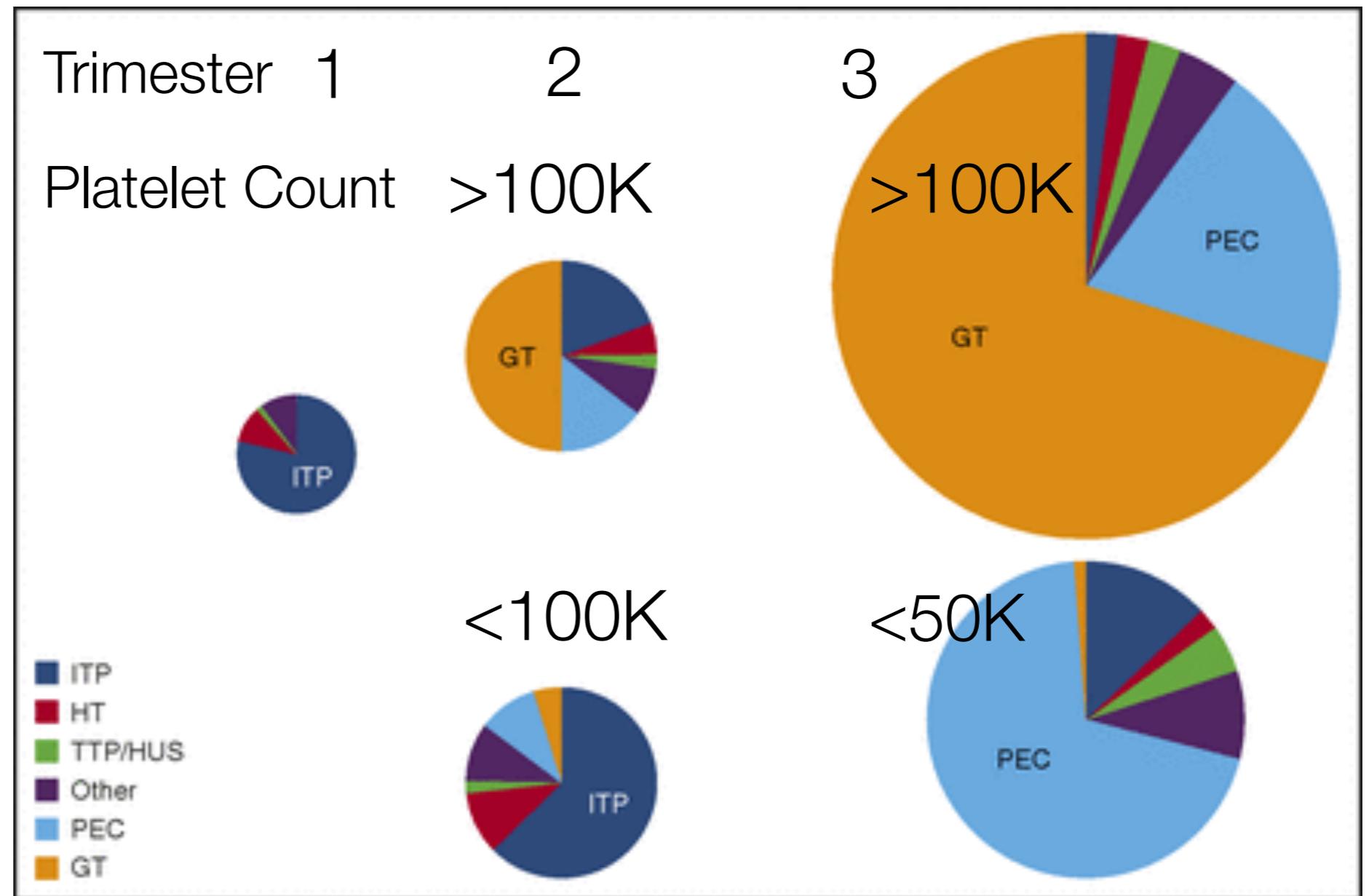
Cines DB, Levine LD. Thrombocytopenia in Pregnancy. ASH 2017;1:144-51

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1. Low Platelet Count prior to Neuraxial Technique

Thrombocytopenia: Number, **Rate of Change**, **Etiology**

Quantitative + Qualitative Deficit: **Destruction**, **NonImmune Infection**, **DIC**, **Sepsis**, **TTP**, **Uremia**, **Gest**, **PIH**

Consider **Functional Assays** (TEG, Platelet Function Assays)

Risks/Benefits

Hematoma 0.6%

(<1:1500) vs GA

Complications 6.5%

Platelet	Recommendation	Hematoma 95% CI
70 to 99 K	Reasonable to proceed	0 to 0.19%
50 to 69 K	Risk/benefit analysis	0 to 2.6%
0 to 49 K	Reasonable to avoid	0 to 9%

Consider Platelet Transfusions/Alternatives

Bauer ME, et al. SOAP Interdisciplinary Consensus Statement Neuraxial Techniques in Obstetric Patients with Thrombocytopenia, 2021 (ASRA, ACOG, SMFM)

2. Inadvertent Dural Puncture: Now What?



2. Inadvertent Dural Puncture: Now What?



When colleagues/trainees do this, I:

1. Pull back needle, thread catheter
2. Repeat at another interspace
3. Thread a spinal catheter
4. Use my invisibility cape

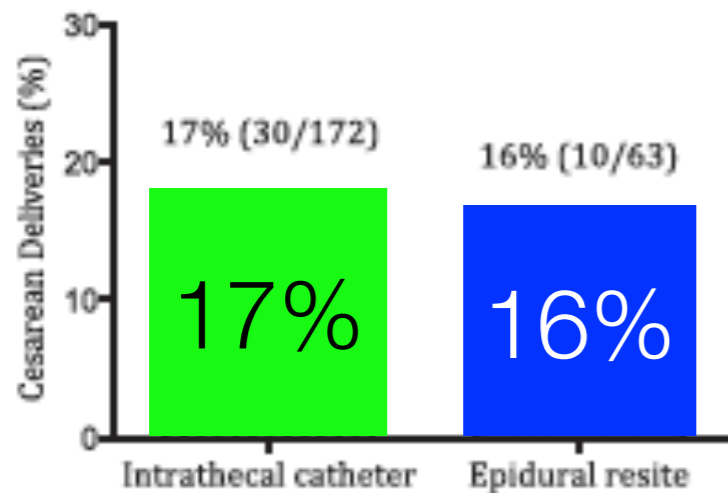
2. Inadvertent Dural Puncture: Now What?

173 (73%)
Spinal
Catheter

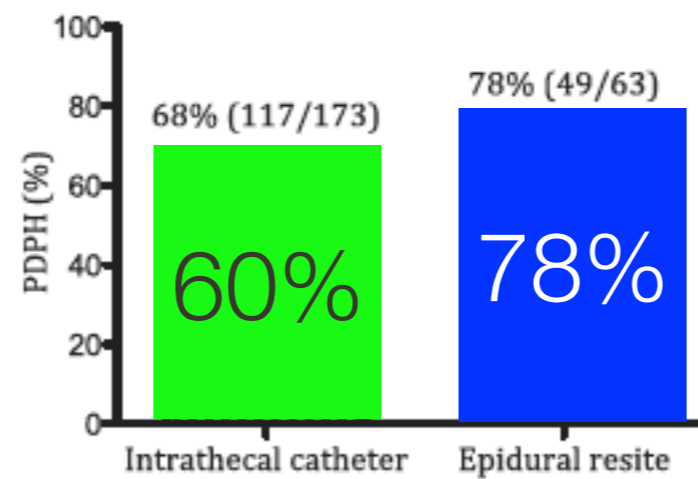
235 patients
retrospective
6 years

17G Weiss

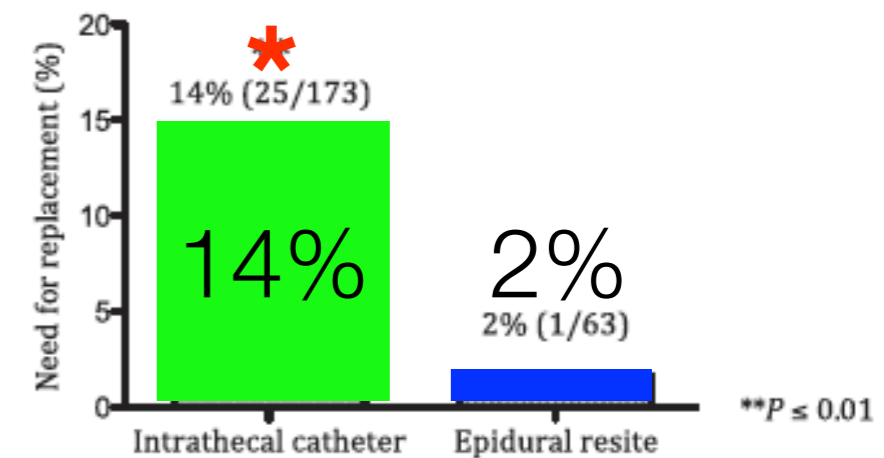
63 (27%)
Epidural
Catheter



CS

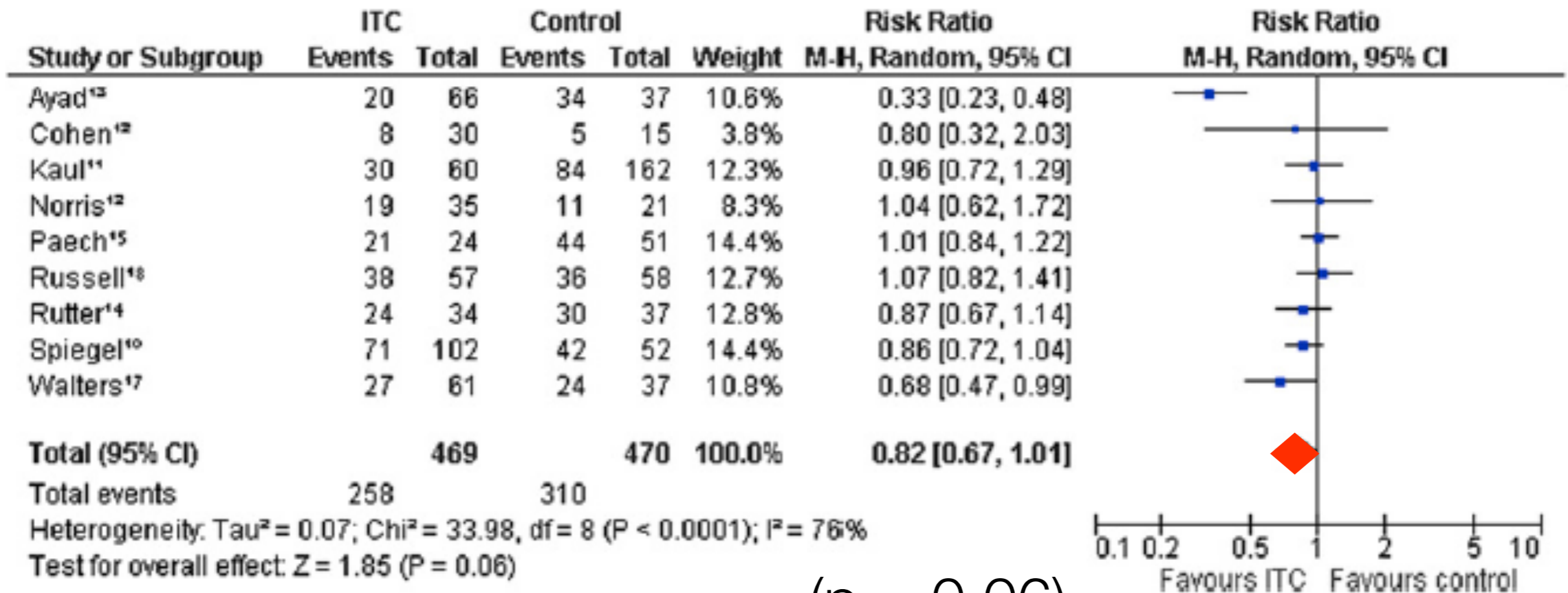


PDPH



Replaced p = 0.01

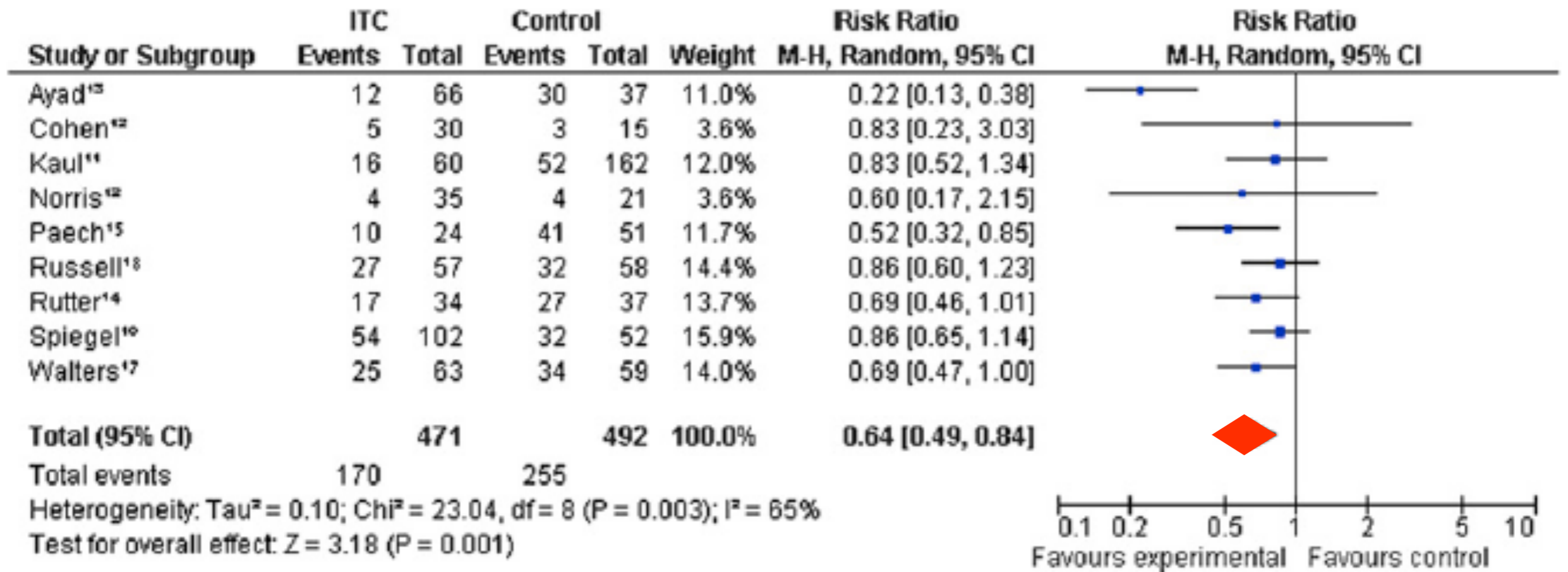
2. Inadvertent Dural Puncture: Now What?



($p = 0.06$)

Spinal Catheter **Reduces** Incidence of **PDPH**

2. Inadvertent Dural Puncture: Now What?



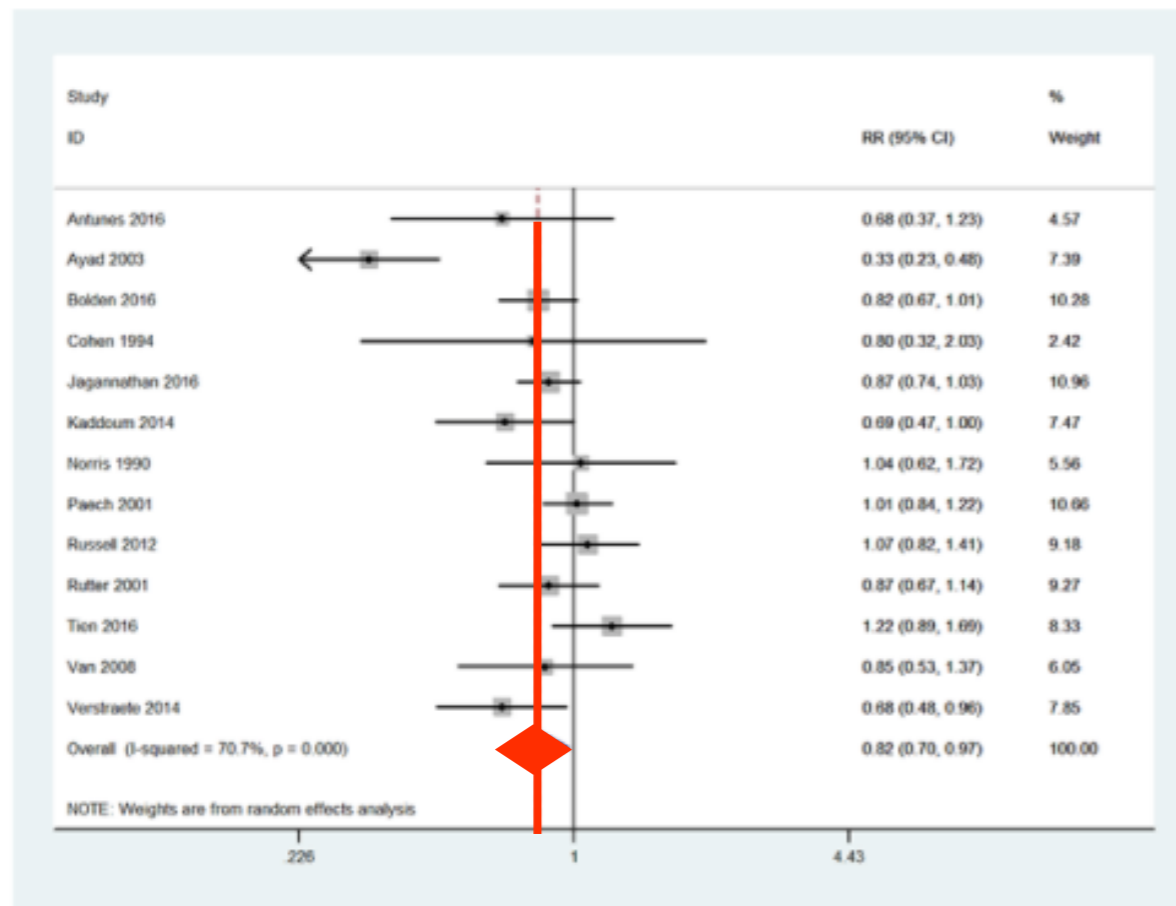
(p = 0.001)

Spinal Catheter **Reduces** Incidence of **Blood Patch**

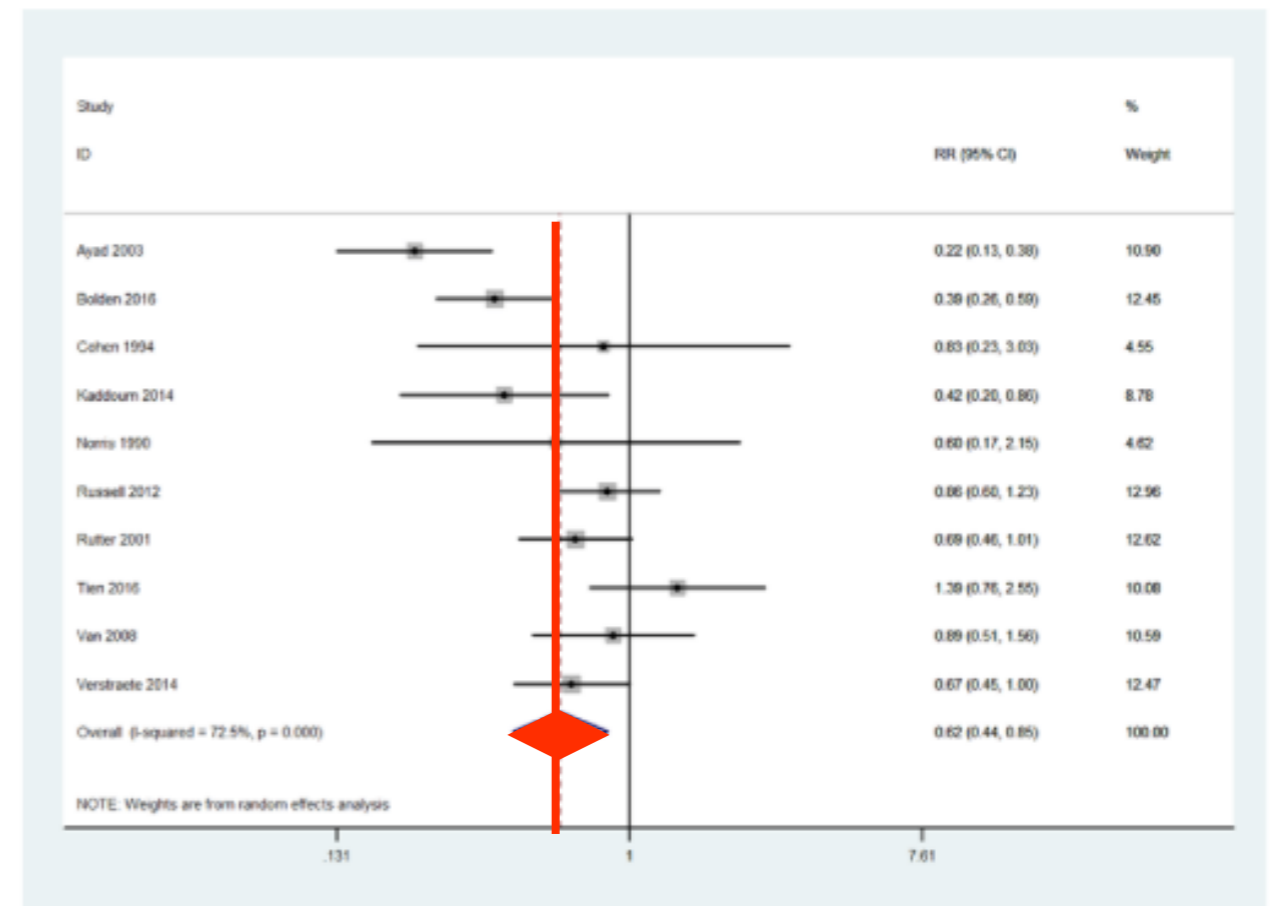
2. Inadvertent Dural Puncture: Now What?

	ITC group (n = 47)	Relocated group (n = 39)	P value
PDPH	20(42.6%)	24(61.5%)	0.08
TEBP	13(27.7%)	20(51.3%)	0.025

Spinal Catheter **reduces PDPH** and need for **Blood Patch**



RR 0.814, 95% CI 0.698-0.950, **P = 0.009**



RR 0.608, 95% CI 0.451-0.819, **P = 0.001**

2. Inadvertent Dural Puncture: Now What?

0.5-2.5% incidence IDP

Spinal Catheter

- Damage already done
- Repeat Wet Tap occur

Replace	Repeat Wet Tap
S-3 (8%) E-0 (0%)	S-0 (0%) E-3 (14%)

Patient Comfort First
“Special Catheter”
Mark Catheter, Pump
Mark Room
Instruct Nurse & MD’s

Pump
No PCEA
Initial Dose: 1-2 mL
(B 0.0625% + F 2 mcg/mL)
Infusion 1-2 mL/hr

3. What is the best way to treat **sacral sparing**?



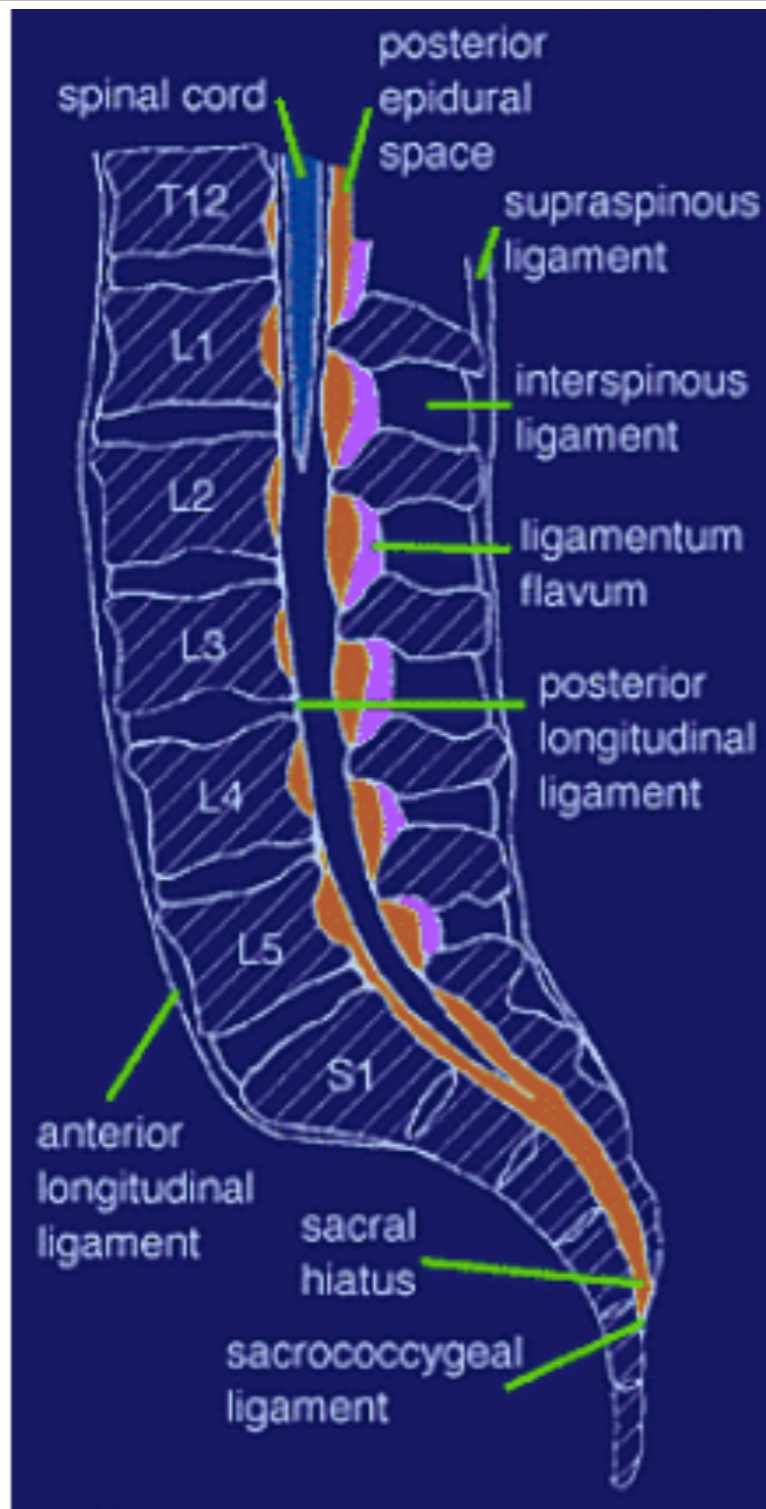
3. What is the best way to treat **sacral sparing**?



My typical response is:

1. Local Anesthetic
2. Fentanyl/opioid
3. Replacement
4. Tasteful selection of wooden/plastic bite sticks, voodoo pain pin dolls, lavender candles, rhythmic chants, positive affirmations

Sacral Sparing: Why an issue?



Sacral Fibers Harder to Block

Nerve Roots

Larger Diameter
Thicker Dura Mata

Spread

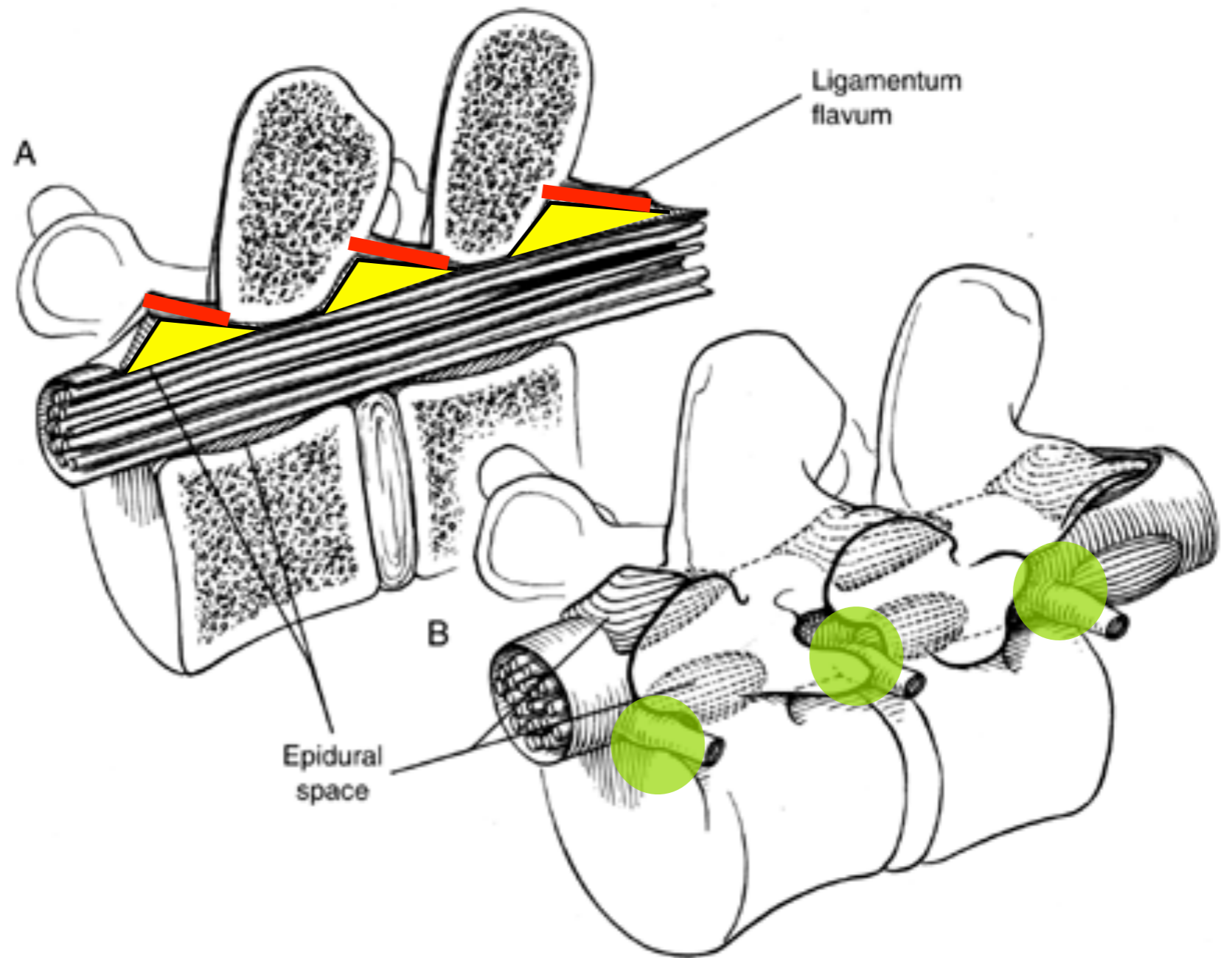
Farther from Catheter
Sacral Resistance

Sacral Sparing: Why an issue?

Discontinuous,
Heterogenous,
Potential Space
with **Escape** Routes

Harrison, BJA 1985;
Blomberg, A&A 1986;
Savolaine, Anesth
1988; Hogan, Anesth
1991, 1999; Collier
Atlas Epiduralgrams

Patchy, One Sided:
5-8%



Sacral Sparing: Why an issue?

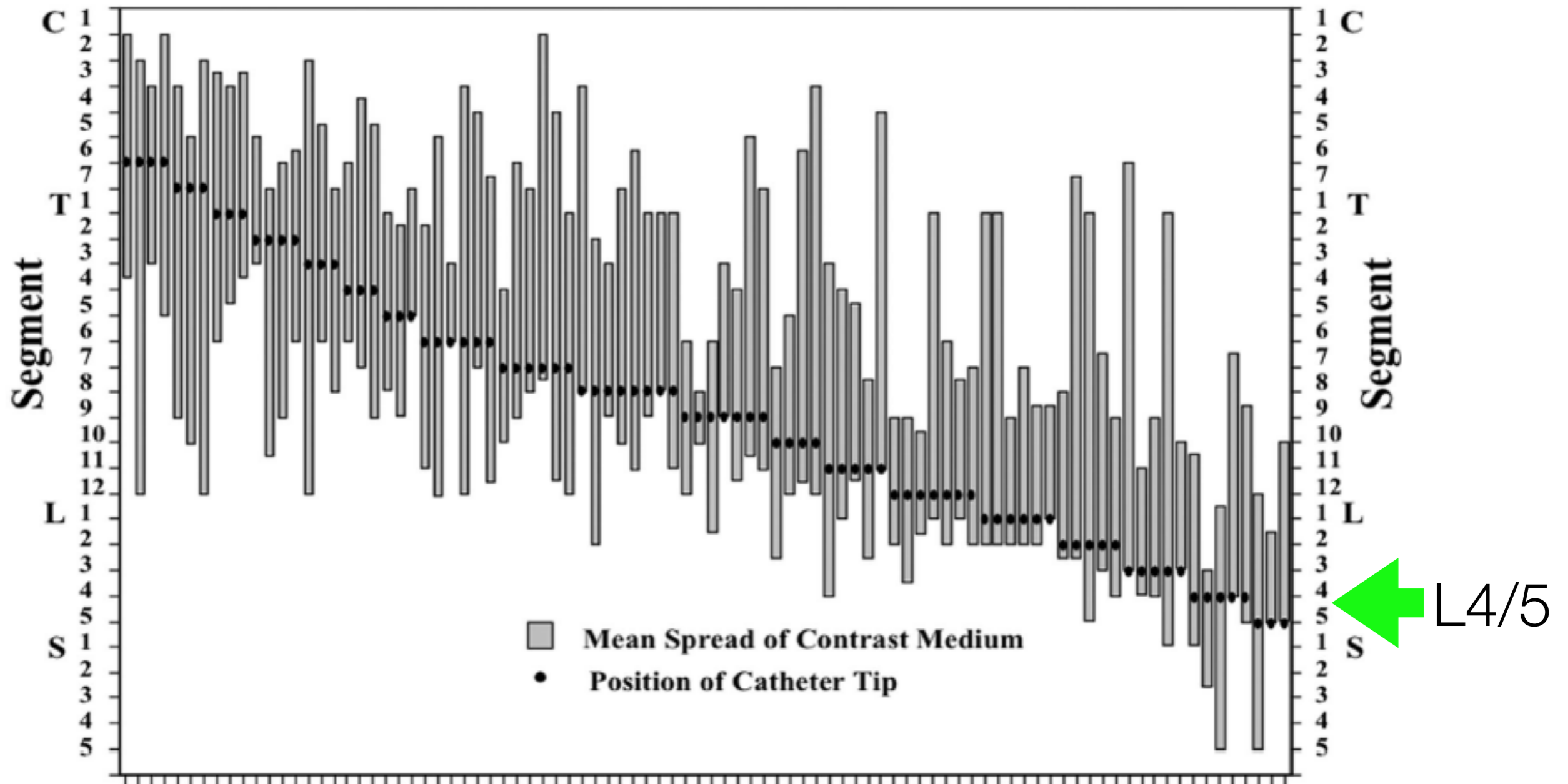


Fig. 2. Mean radiographic spread after injection of 5 ml iotrolan, 240 mg I/ml, in 90 patients. C = cervical segment; L = lumbar segment; S = sacral segment; T = thoracic segment.

Sacral Sparing Treatment: Epidural Fentanyl

Limited Duration Analgesia

Dilution of existing local anesthetic

Fentanyl 100 mcg
to 5 or 10 mL
sterile saline

Side Effects

- Maternal (e.g., pruritus, nausea)
- Neonate: Lower neuropsych x 24 hrs, breastfeeding

Assists visceral but not somatic discomfort

Epinephrine 2 mcg/mL can decrease infusion absorption x 2 hrs

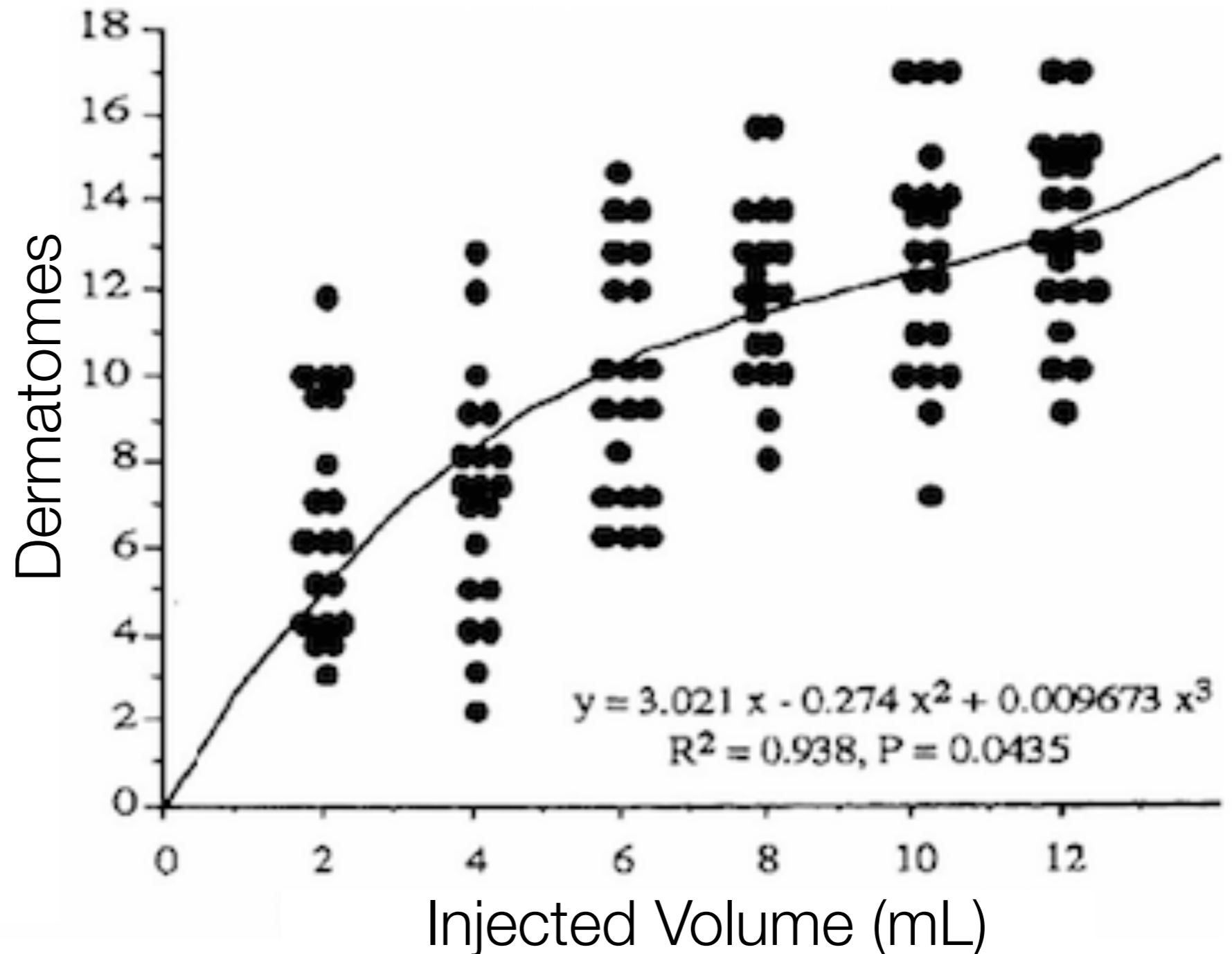
Sacral Sparing Treatment: Local Anesthetic

Bupivacaine
0.25% 10 mL

More Dense
Analgesia

Greater Spread

Consider
replacement
with **DPE/CSE**



Sacral Sparing Treatment: Replace with DPE/CSE

	DPE/EPL			CSE/EPL		
	RR	95%CI	P	RR	95%CI	P
BS2 @ 10 min	2.13	1.39-3.28	<0.001	2.54	1.69-3.80	<0.001
BS2 @ 20 min	1.60	1.26-2.03	<0.001	1.60	1.26-2.03	<0.001
BS2 @ 30 min	1.18	1.01-1.30	0.034	1.18	1.01-1.30	0.034

4. How much Oxytocin do you give for Cesarean?



4. How much Oxytocin do you give for Cesarean?

My typical response is:

1. <5 Units

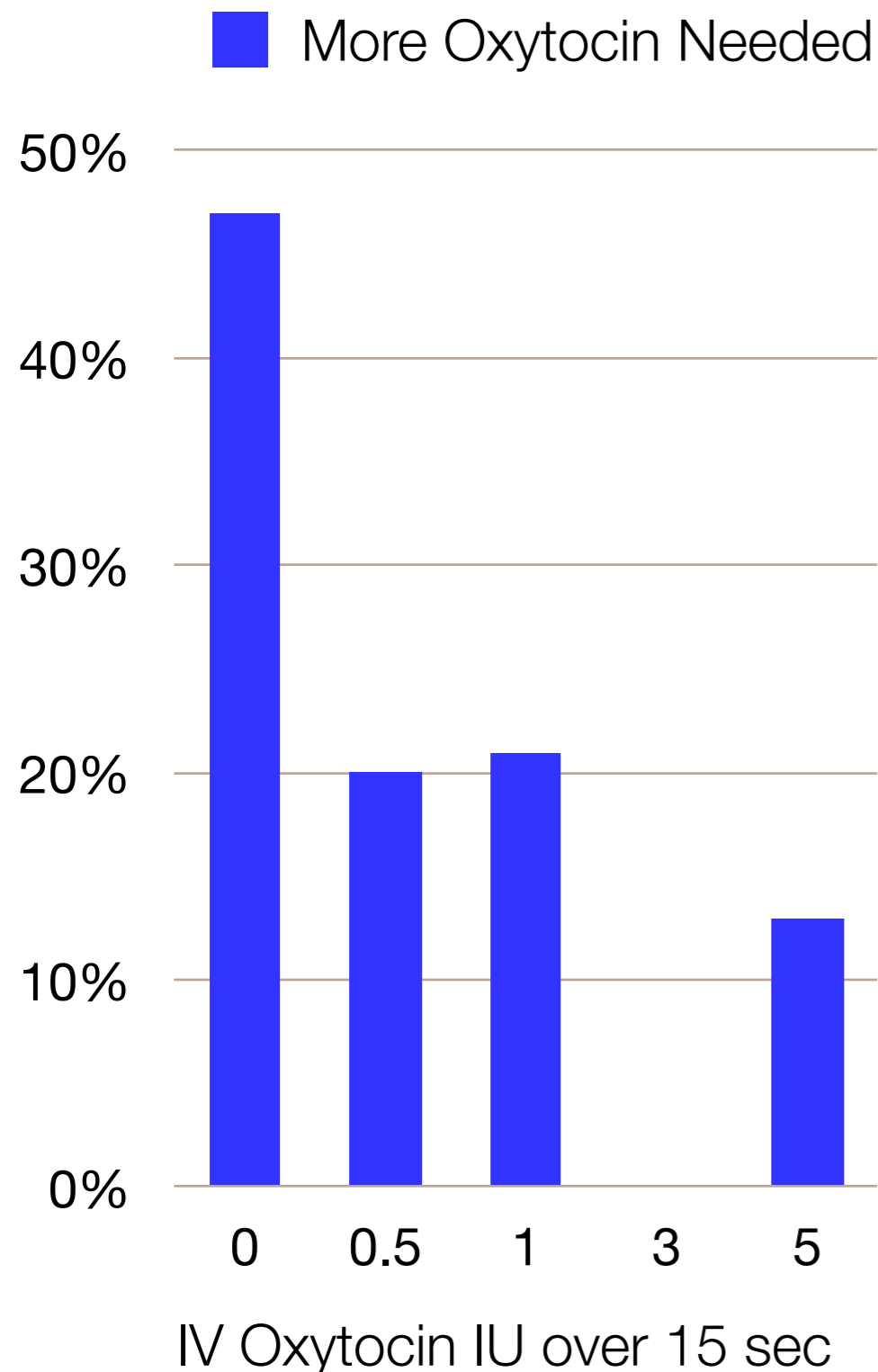
2. 6-40 Units

3. 41-60 Units

4. Oxytocin,
Oxytocin 'til the
Cows Come Home!



How much Oxytocin is Needed?



Uterine Tone/Blood Loss Ceiling Effect

- 5 IU = 10, 15, 20 IU
- Dosed 1U/min

ED₉₀ Labor Arrest Cesarean

- Oxytocin 9.8 ± 6.3 hrs (10.3 ± 8.2 mIU/min)
- 0.5 IU/mL initial; up/down increments
- Dosed over 30 secs
- **2.99 IU**

ED₉₀ Elective Cesarean

- **0.35 IU**
 - Dosed over 30 secs

Sarna MC, et al. Anesth Analg 1997;84:753-6

Carvalho JCA, et al. AJOG 2004;104:1005-1010

Balki M, et al. Ob Gyn 2006;107:45-50

Butwick AJ, et al. BJA 2010; 104:3338-43

How much Oxytocin is Needed?

Oxytocin (3IU) + Saline (wide open)

oxytocin 3 IU in 3 mL

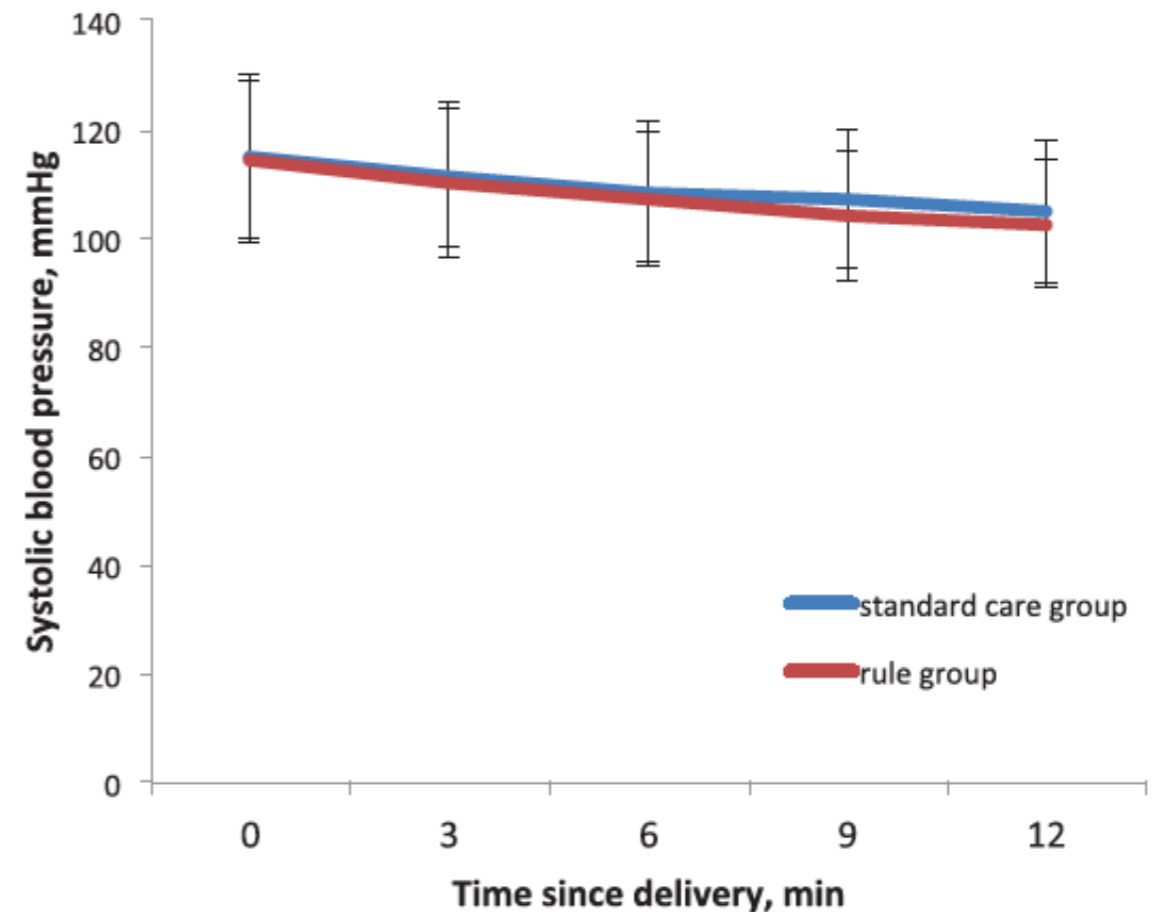
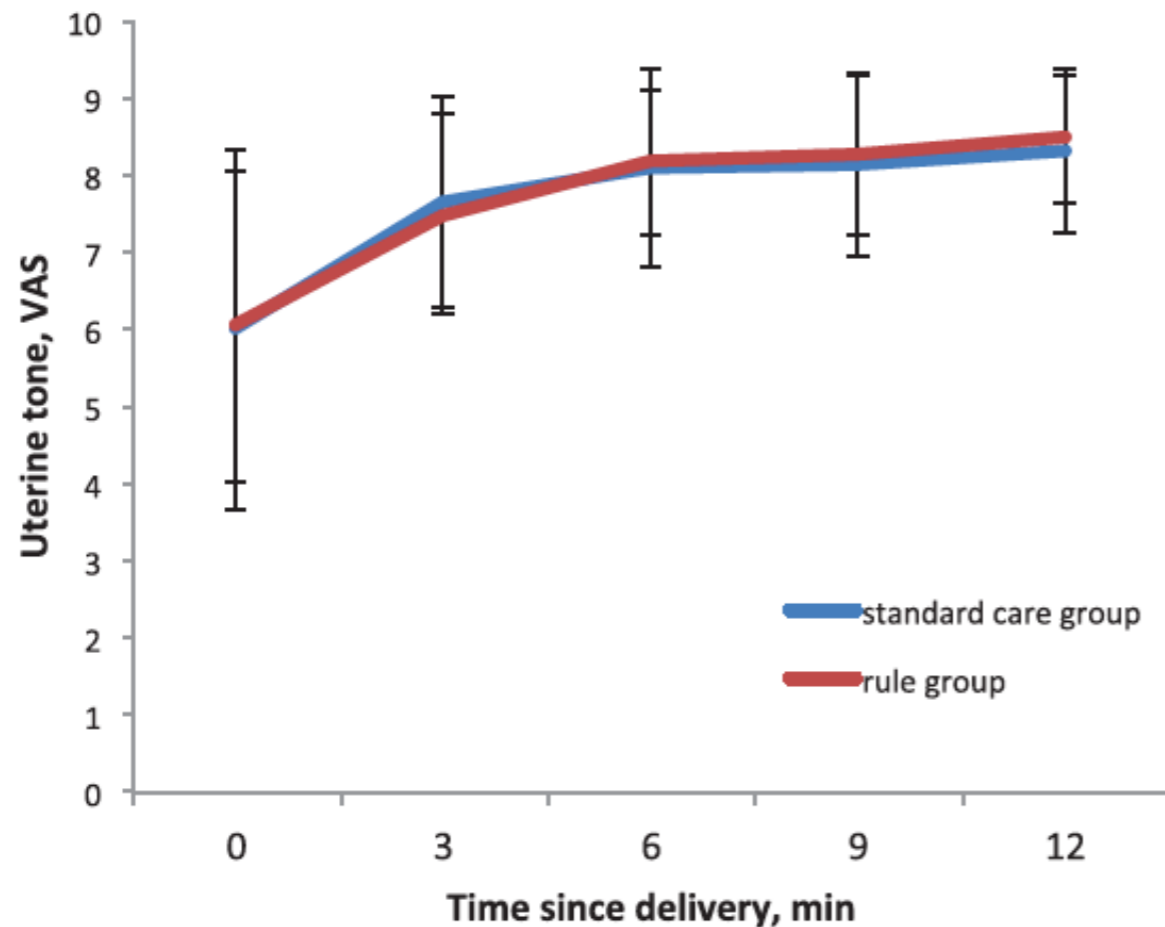
mean, 4.0 IU

Saline (3 mL) + Oxytocin (wide open)

oxytocin 30 IU in 500 mL

mean, 8.4 IU

Uterine Tone at 3, 6, 9, & 12 min



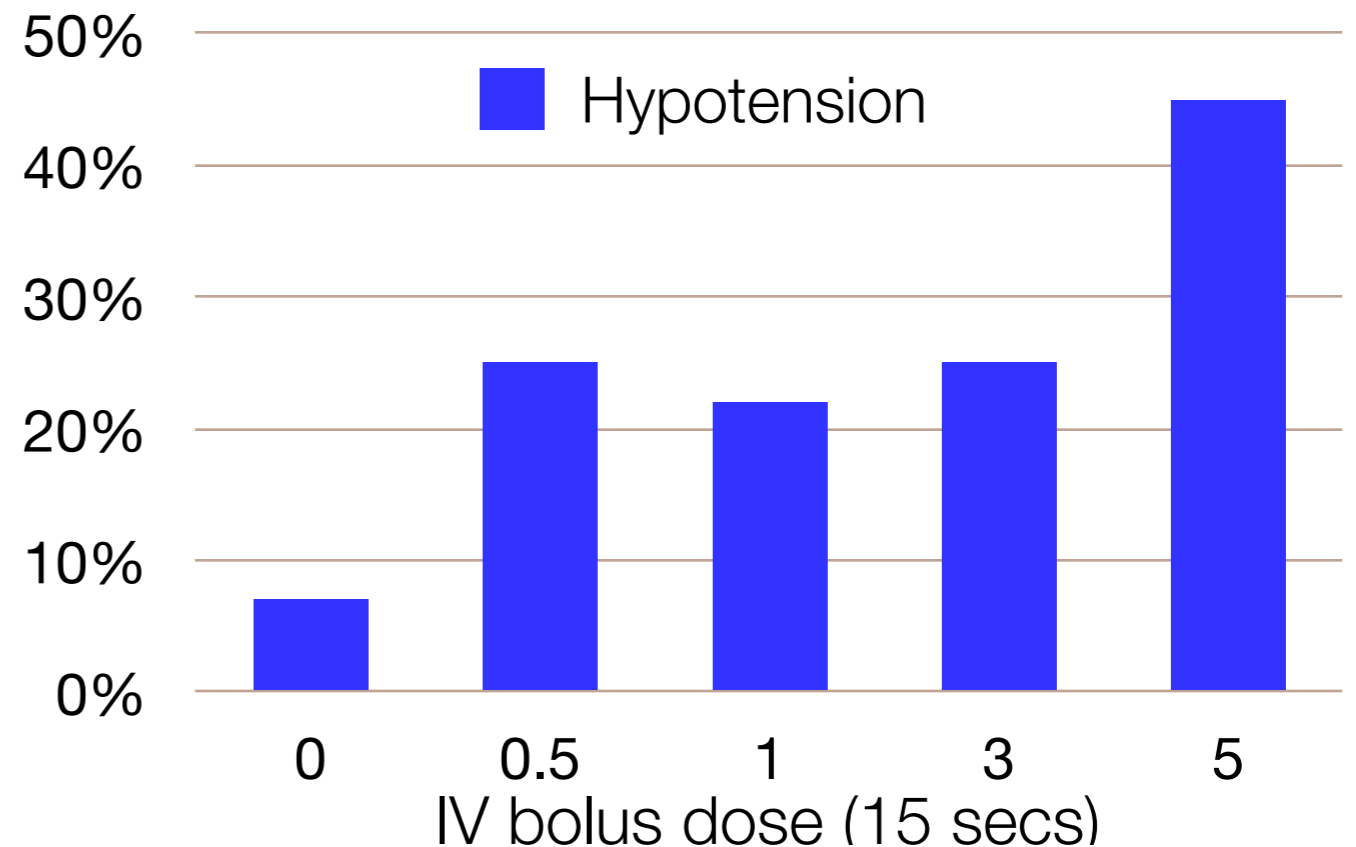
Too much Oxytocin?

Hypotension Effect	Inotropy (-)	Chronotropy (-)	Vasodilation
Direct: Oxytocin	X	X	
Indirect: Natriuretic/NO	X	X	X
Side: Chlorbutanol	X		X

Cardiovascular Collapse

- 10 IU Bolus IV

Butwick AJ, et al. BJA 2010; 104:3338-43
 Jankowski M, et al. PNAS 2000;97:6207-11
 Jankowski M, et al. PNAS 1998;95:14558-63
 Gutkowska J, et al. PNAS 1997;94:11704-9
 Rosaeg OP, et al. Anesth Analg 1998;86:40-4
 Thomas TA, Cooper GM. RCOG Press, 2001



Too much Oxytocin?

Hypotension

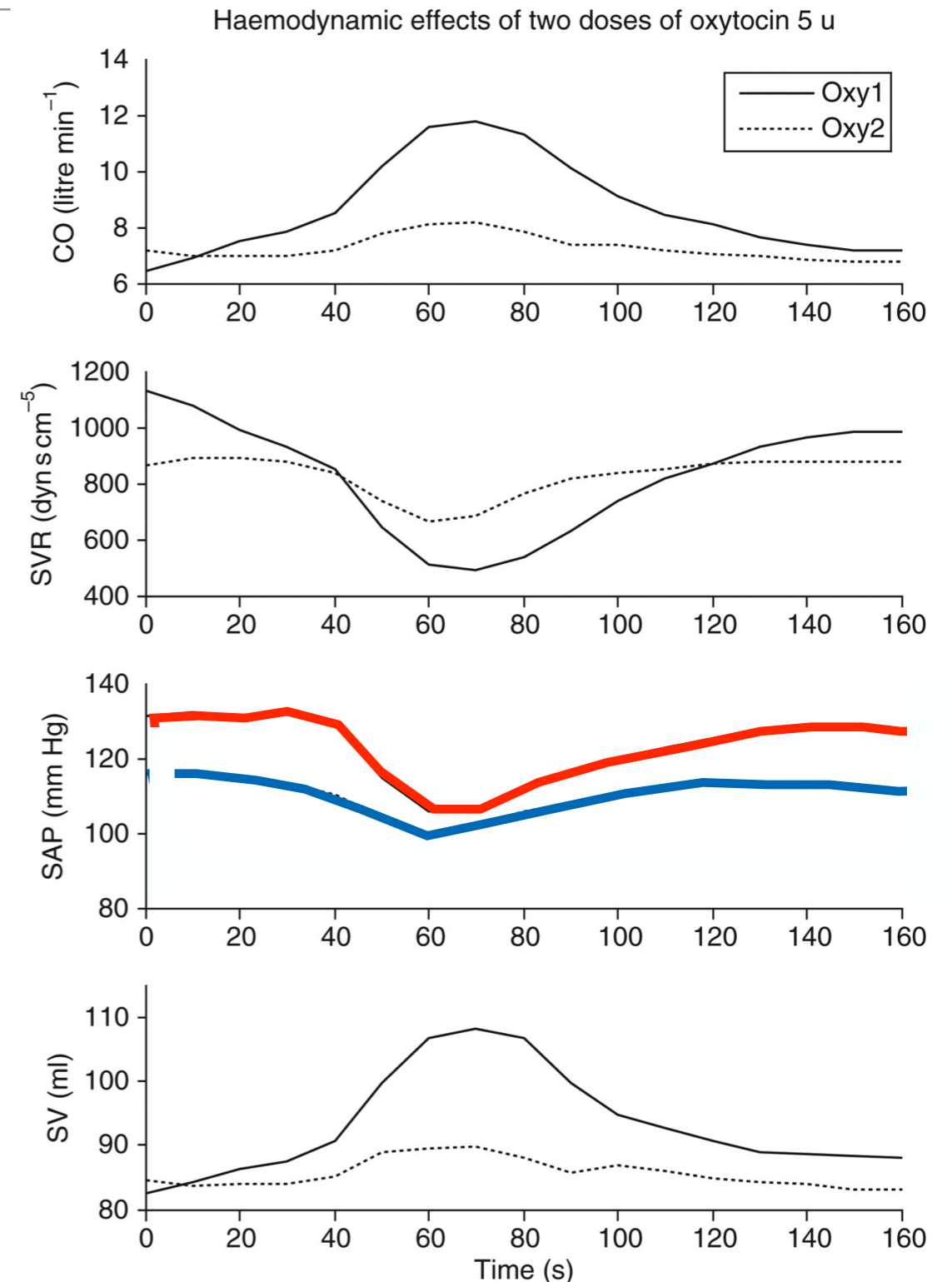
80 women for cesarean

- LidCOPlus (Lithium)
CO, SV, SVR
- Arterial Line
- Oxytocin 5 IU “injected rapidly”
- SBP decrease **31%** (27-35%)

20 women

- Repeat Oxytocin 5 IU
- Ave 6 min after 1st dose
- SBP decrease **23%** (20-27%)

Langesaeter E, et al. BJA 2009; 103:260-2



Too much Oxytocin?

Decreased Free H₂O Clearance: 0.02 IU/min

- Pulmonary Edema

Myocardial Ischemia

- Tachycardia

Complaints

- Flushing: 63%
- Nausea: 38%
- Vomiting: 13%

Uterine Rupture

CEMACH (1997-1999) 2001

Butwick A, et al. Br J Anaesth 2010; 104:338-43

Pinder AJ, et al. IJOA 2002;11:156-9

Sartain JB, et al. Br J Anaesth 2008;101:822-6

Thomas JS, et al. Br J Anaesth 2007;98:116-9

Archer TL, et al. IJOA 2008;17:247-54

Dyer RA et al. Anesthesiology 2008;108;802-11

Too much Oxytocin?



High Postpartum Doses

- Acutely desensitize receptor
- Myometrium less responsive to oxytocin (but not other uterotonics)
- Greater incidence PPH?

High Intrapartum Doses

- Myometrium less responsive to oxytocin (but not other uterotonics)
- Greater incidence PPH

	PPH	Control	P Value
Oxytocin mU	10,054± 11,340	3,762 ± 7,093	< 0.001
Blood Loss (mL)	1199 ± 785	517± 236	< 0.001
% Hct Change	14.9 ± 4.8	5.8±3.9	< 0.001

Munn MB, et al. Obstet Gynecol 2001;98:386-90

Balki M, et al. Reprod Sci 2010; 17:269-77

Dyer R, et al. IJOA 2010;19:313-9

Tsen LC, Balki M. IJOA 2010;19:243-5

Grotegut CA, et al. AJOG 2011;204:56.e1-6

Balki M, Tsen LC. Int Anesth Clinics 2014

News Flash: An Algorithm for Oxytocin Use

“RULE OF THREES”

- 3 IU Oxytocin Load/30 secs
- 3 minute intervals
- 3 total doses (Load + 2 Rescue)
 - 3 IU/hr maintenance (30 IU/L at 100 mL/hr)
- 3 pharmacologic options

LOADING

- Non-Laboring < 1 IU (ED90 = 0.35 IU)
- Laboring 3 IU (ED90 = 2.99 IU)

MAINTENANCE 2.4 IU/hr

- 0.04 IU/min (20 IU/L at 120 mL/hr) x 8 hrs
- 0.08 IU/min (40 IU/L at 125 mL/hr)



Tsen LC, Balki M. Int J Obstet Anesth. 2010 Jul;19(3):243-5.

Kovacheva VP, Soens MA, Tsen LC. Anesthesiology 2015;123:92-100

News Flash: An Algorithm for Uterotonic Use

OXYTOCIN “RULE OF THREES”

- 3 IU Oxytocin Load/
30 secs
- 3 minute intervals
- 3 total doses
(Load + 2 Rescue)
- 3 IU/hr maintenance
(30 IU/L at 100 mL/hr)
- 3 pharmacologic
options

1. METHERGINE

- Methylergonovine Maleate **0.2 mg** IM
- Ergot Derivative
- Avoid if Hypertension/Eclampsia
- **15 min, then q4 hrs repeat to 1 mg**

2. HEMABATE

- Carboprost Tromethamine **0.25 mg** IM
- Prostaglandin F2alpha
- Avoid if Asthma?
- 1.5-3.5 hr intervals; total 12 mg, 2 days
- **15 min interval; repeat to 2 mg**

3. Cytotec

- Misoprostol **800 -1000 mcg** Rectal
or **600 mcg** Buccal
- Prostaglandin E1 Analog
- FDA for NSAID Gastric Ulcer Reduction
- Terminal Half-life 20-40 min

Balki M, et al. Reprod Sci 2010; 17:269-77

Tsen LC, Balki M. IJOA 2010;19:243-5

Balki M, Tsen LC. Int Anesth Clinics 2014

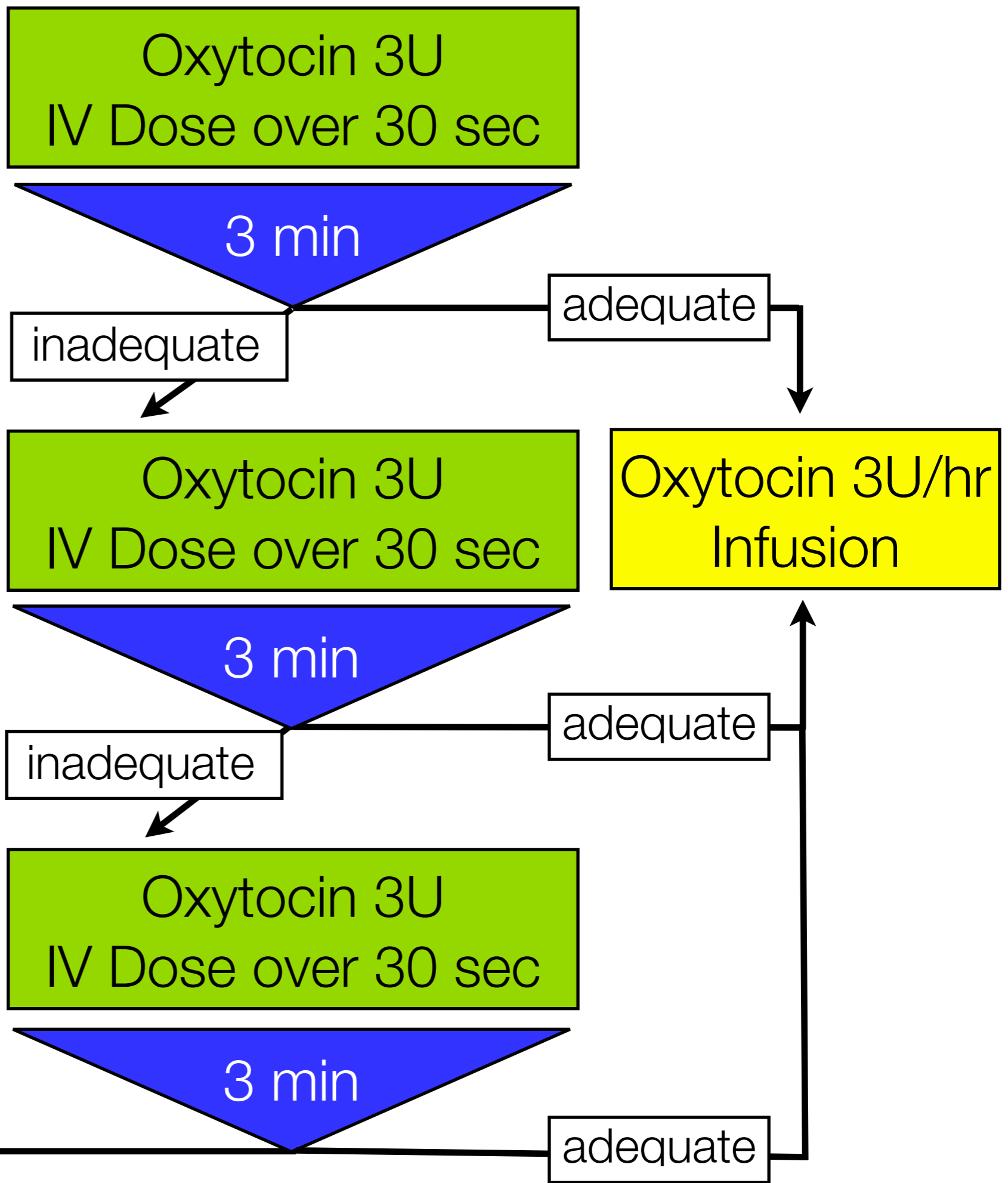
WHO 2000, S-28, Table S-8

An Algorithm for Uterotonic Agents

Methergine
0.2 mg IM

Hemebate
0.25 mg IM

Cytotec
600 mg B



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2. **Inadvertent Dural Puncture:** Now What?

3. What is the best way to **treat Sacral Sparing**?

4. How much **Oxytocin** for **Cesarean**?



My Two Cents: Clinical Connundrums

Thanks for the
adventure
now go have a new one!

Love,

Lawrence

Questions?

