Reducing General Anesthesia for Cesarean Delivery:
10 Practical Tested Tips!

SFOAI Varmote 2023
Skåvsjöholm

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

A Fable

A Fable

The Grasshopper's summer was squandered with singing,
Now without a morsel, found winter most stinging.
Off he went to the house of the Ant, his neighbor,
To ask for a meager share of the fruits of her labor.
Alas, he discovered, after an arduous journey
through blinding ice and heavy snow,
A sign, tacked firmly to her door:

"Wintering in Skåvsjöholm…
with all of my dough"

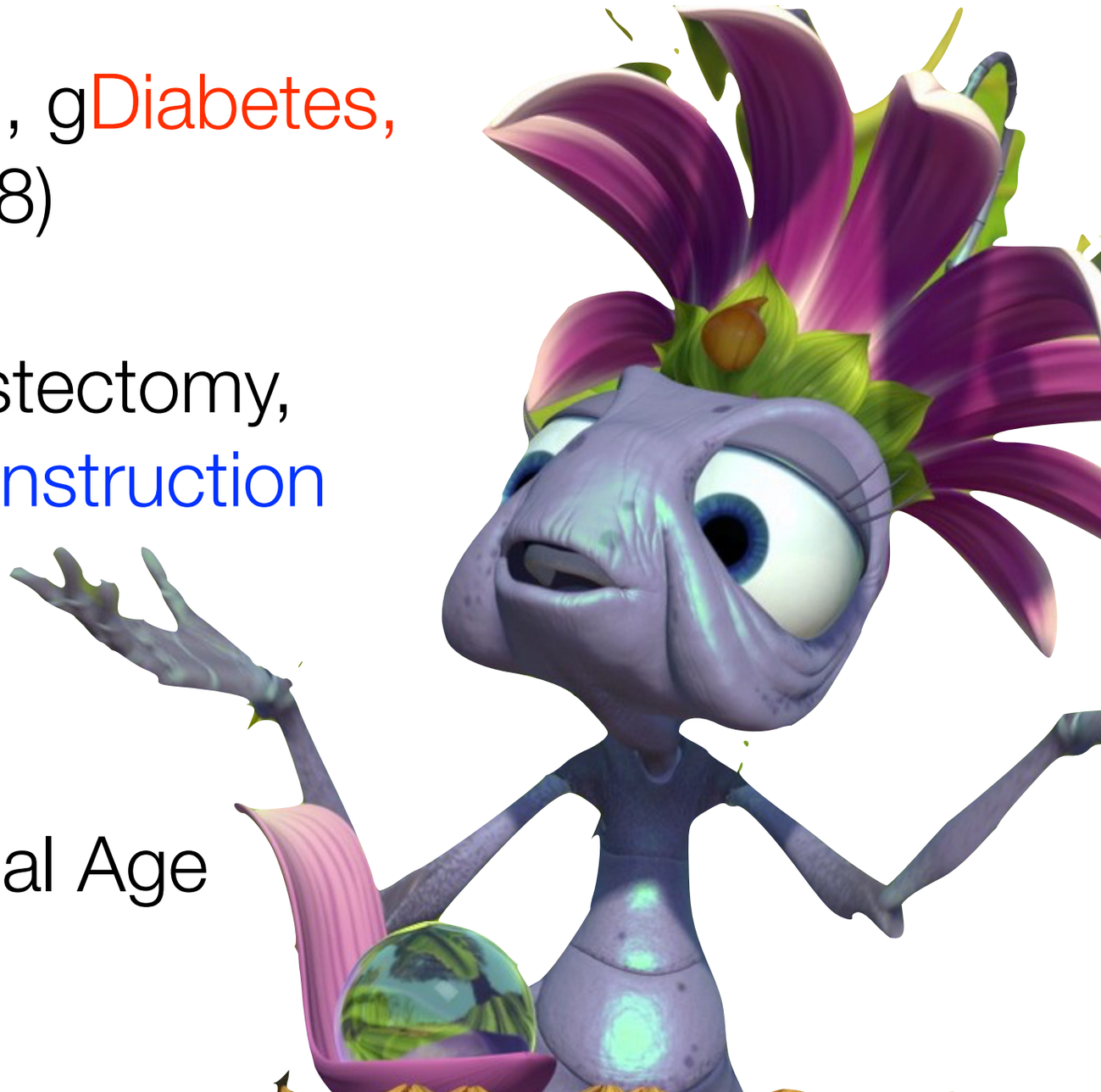
Reducing GA for Cesarean: Learning Objectives

Reducing GA for Cesarean: Appropriate?

Reducing GA for Cesarean: Appropriate?

38 yo, G3P0 at 36 wks, 5’4”, 280#, (BMI 48.1), MP IV

- Preeclampsia (BP 168/88), gDiabetes, gThrombocytopenia (Plt 98)
- Surgical History: Cholecystectomy, Appendectomy, Jaw Reconstruction
- Anterior Placenta Previa
- Fetus: Large for Gestational Age



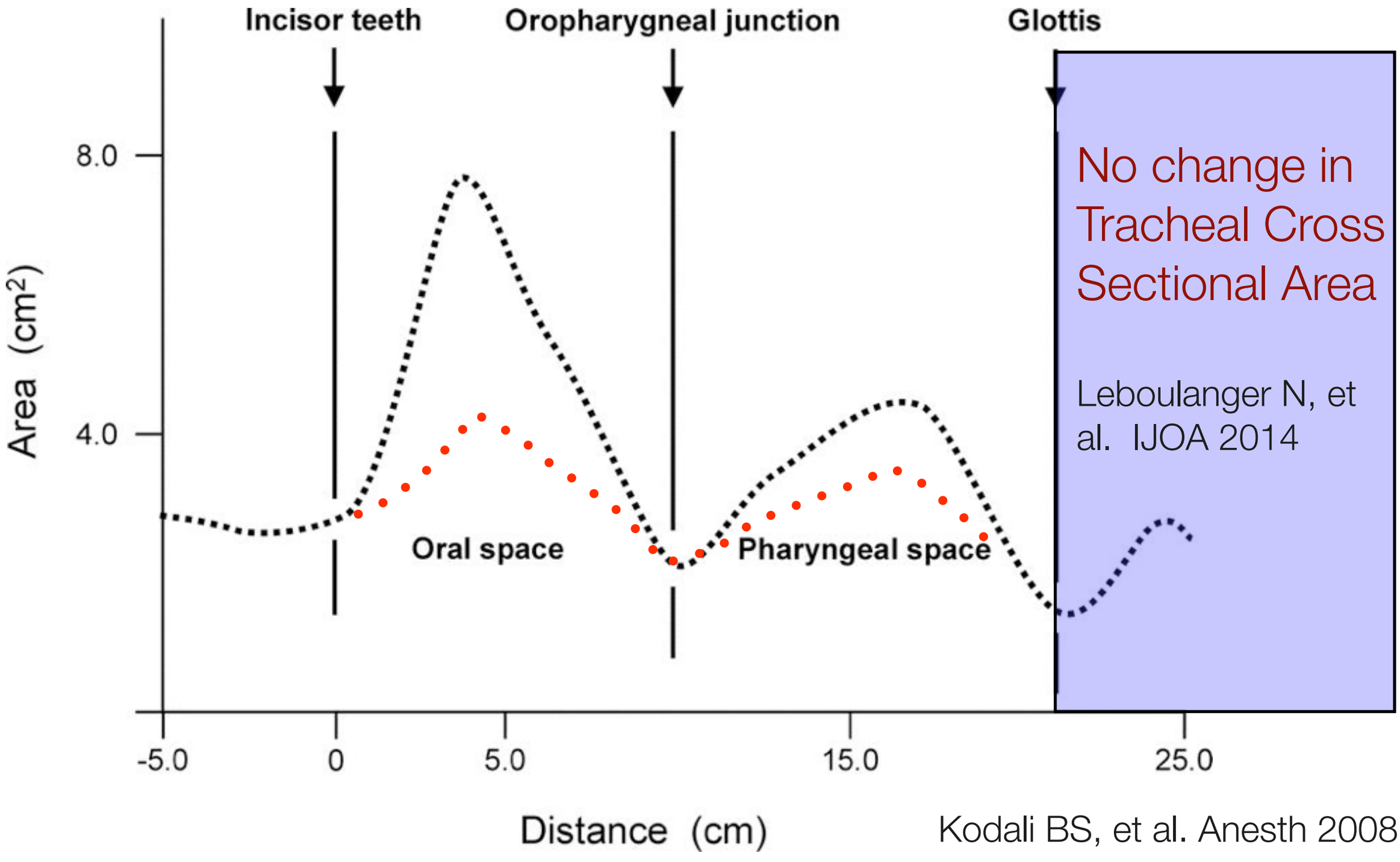
Maternal Airway Changes

Capillary Engorgement

- Increased Class IV, Facial Edema & Swollen Tongue
- Further Engorgement with Labor and Active Pushing

Pinkington et al., BJA 1995; Rocke et al., Anesth 1992; Kodali et al., Anesth 2008

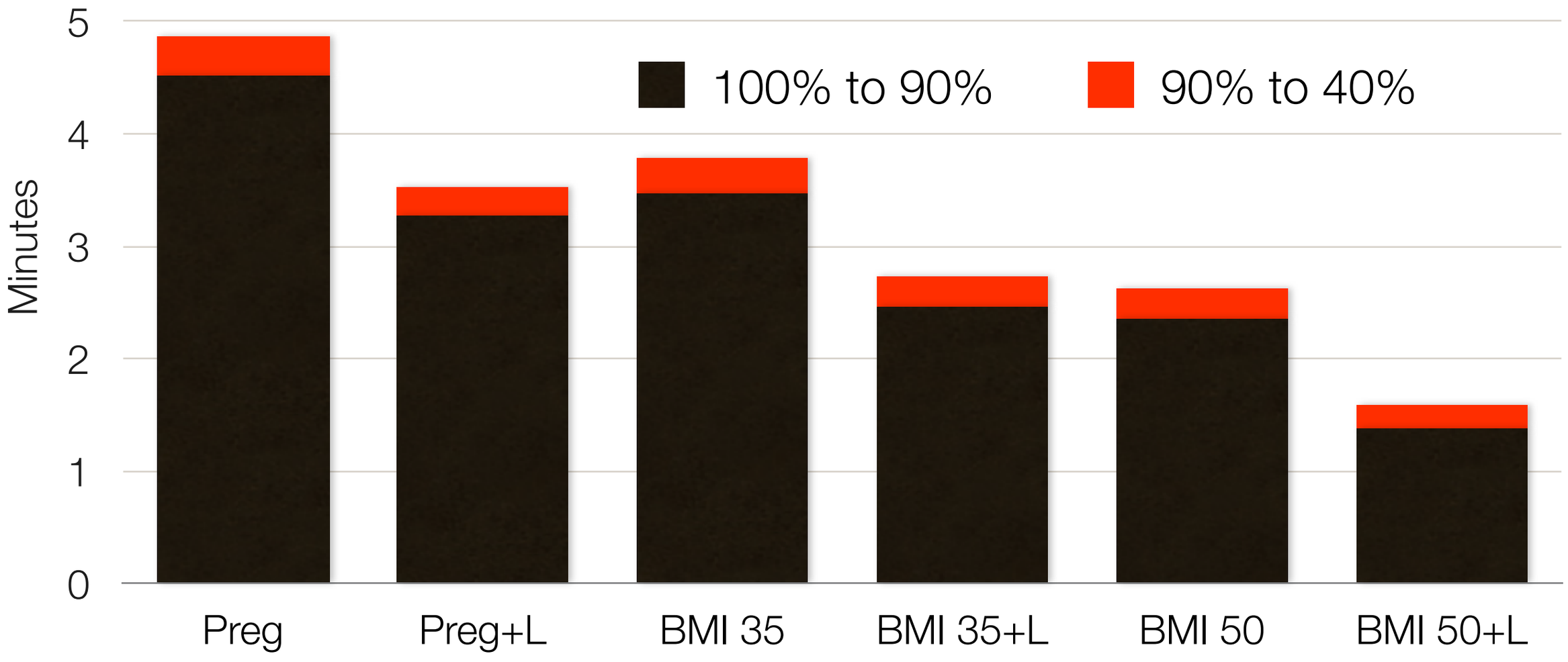
Maternal Airway Changes



Kodali BS, et al. Anesth 2008

Maternal Thoracic & Respiratory Changes

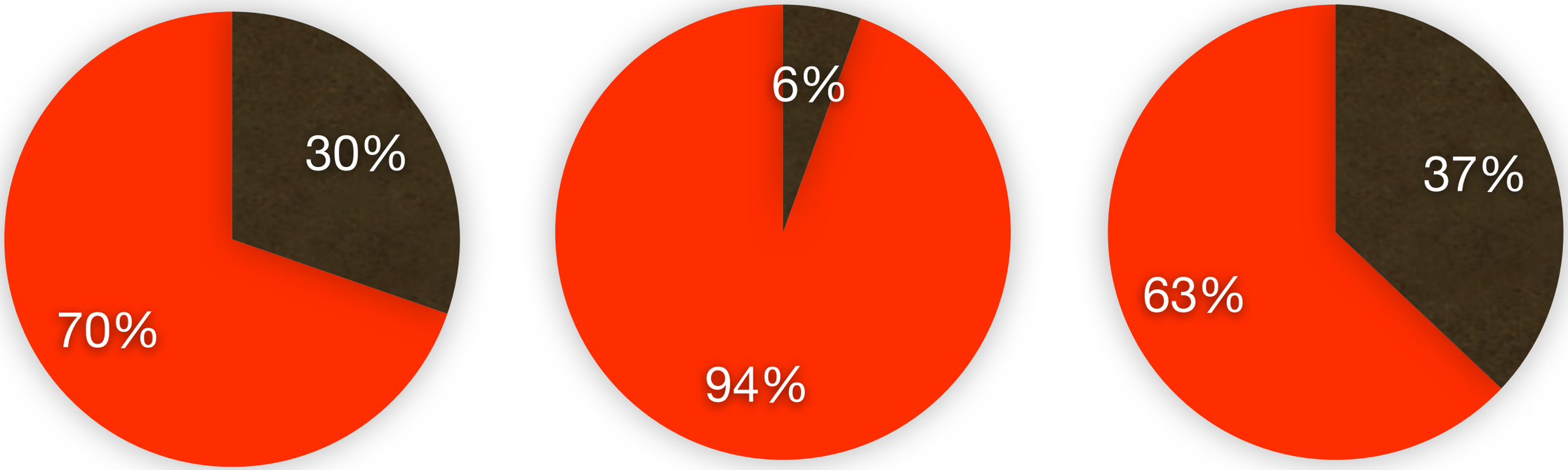
- Increased Thoracic Chest Diameter/Breast Mass
- Faster Desaturation (FRC -30%, O2 Demand +60%)



McClelland SH et al. Anaesthesia 2009

Maternal Mortality Higher with GA

Case fatality ratio 2.3:1 to 16.7:1 to 1.7:1



1979-1984 1985-1990 1991-2002

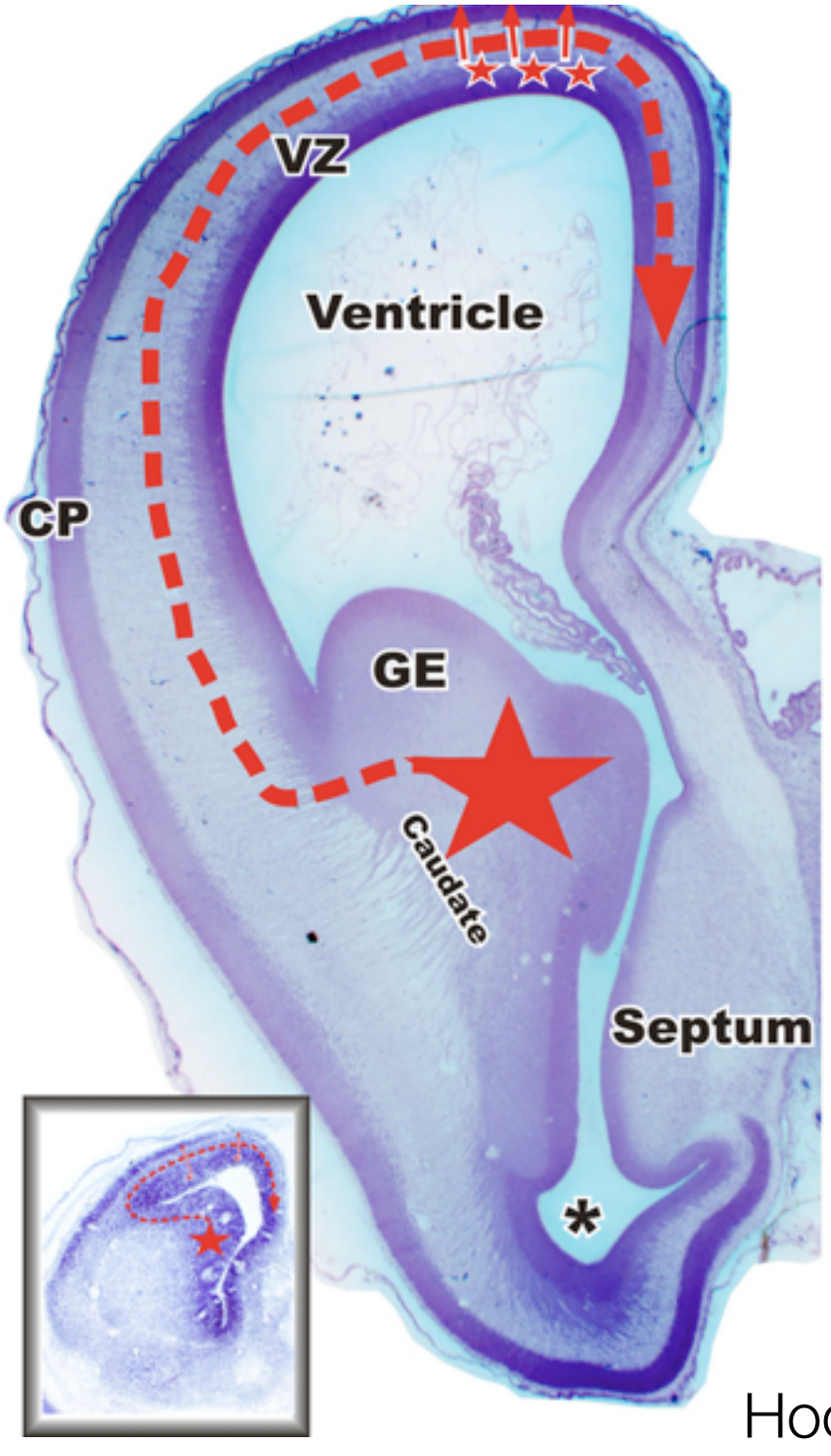
Regional
General

Hawkins, et al. Anesthesiology 1997;Obstet Gyn 2011

Fetal Morbidity Worse with GA

Emergent	Design	UA pH	Agpar <8	Intubation
Gale ‘82	R			GA worse
Marx ‘84	P		GA worse	
Ong ‘89	R		GA worse	GA worse
Elective	**Design**	**UA pH <7.20**	**Apgar**	**Ventilation**
Evans ‘89	R	RA worse	GA worse	
Dick ‘92	P	GA worse	RA worse	GA worse
Ratcliffe ‘93	R		GA worse	
Roberts ‘95	R	RA worse	GA worse	GA worse
Mueller ‘97	R	RA worse	RA worse	GA worse
Sendag ‘99	R	RA worse	RA worse	
Kolatat ‘99	P	GA worse	GA worse	

Fetal Morbidity Worse with GA



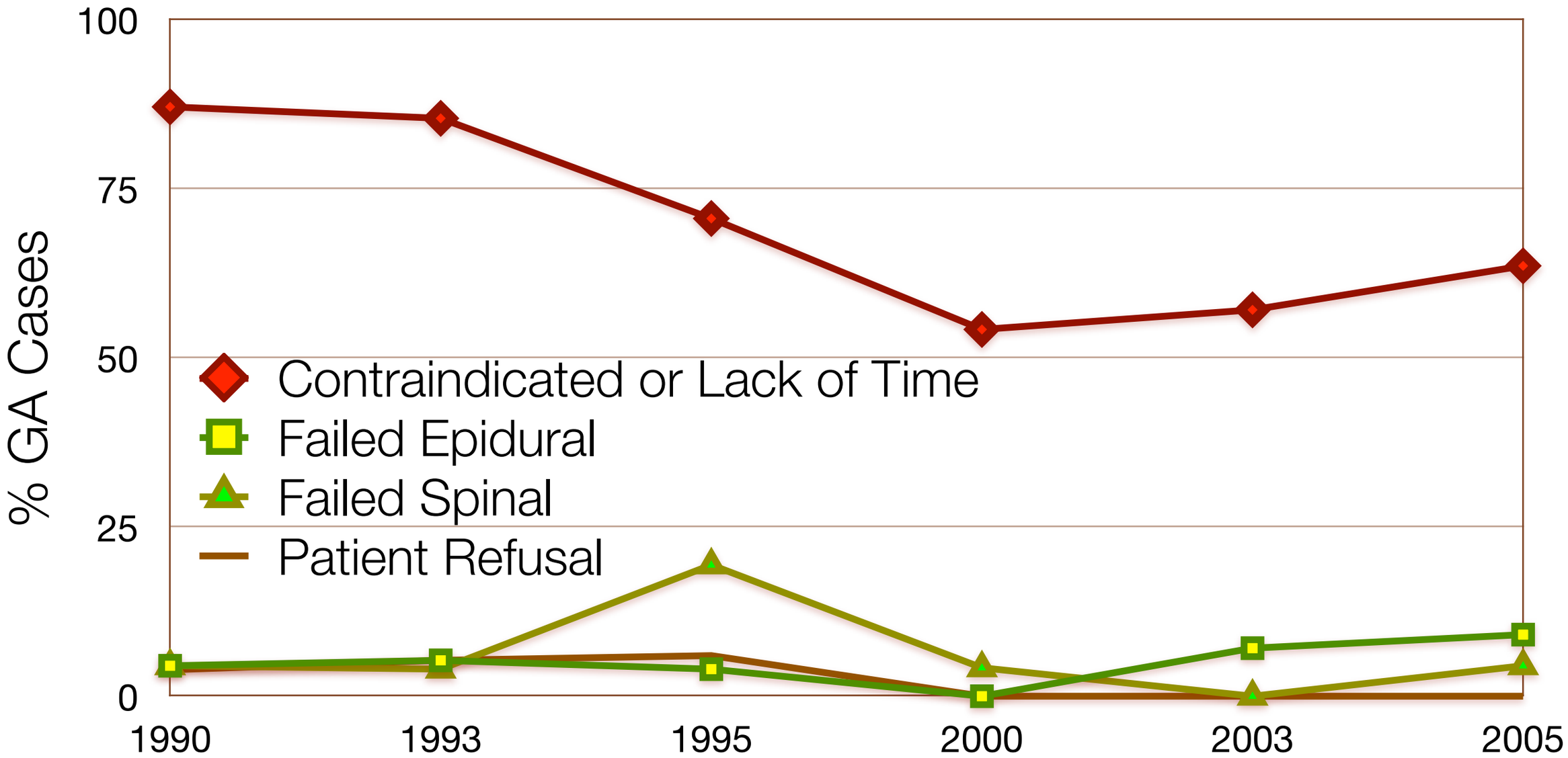
- Neural Stem/Progenitor Cells (NPCs)
- Neuron Creation, Migration, Differentiation, Synapsis Formation, Reorganization
- GABA agonism
  NMDA antagonism

Jevtovic-Todorovic V, J Neurosci 2003
Soriano S, Anesth 2005; BMJ 2019; A&A 2020
Palanisamy A, et al. Anesth 2011; Behav Brain2017
Hooijamans CR, SR + Meta. Nature Scientific Reports 2023

Reducing GA for Cesarean: Not Possible?

Reducing GA for Cesarean: Not Possible?

Lack of Time/Contraindications/Refusal?



Tsen et al. IJOA 1998; Palanisamy, Tsen et al. IJOA 2011

Time: Decision to Incision

Time: Decision to Incision

30 minutes: ACOG, RCOG, ACP, ISOG, CNCC

ACOG Standards for Obstetric Services, 6th edition 1988
ACOG + AAP Guidelines for Perinatal Care, 2nd edition 1988

Time: Decision to Incision

30 minutes: ACOG, RCOG, ACP, ISOG, CNCC

20 minutes: GSGO

ACOG Standards for Obstetric Services, 6th edition 1988
ACOG + AAP Guidelines for Perinatal Care, 2nd edition 1988

Time: Decision to Incision

30 minutes: ACOG, RCOG, ACP, ISOG, CNCC

20 minutes: GSGO

15 minutes: ACOG

High Risk

ACOG Standards for Obstetric Services, 6th edition 1988
ACOG + AAP Guidelines for Perinatal Care, 2nd edition 1988

Time: Decision to Incision

15 minutes?

Obstetric Decision

Time: Decision to Incision

15 minutes?

Obstetric Decision

Anesthesia Contact

Time: Decision to Incision

15 minutes?

Obstetric Decision

Anesthesia Contact

Anesthesia Provision

Time: Decision to Incision

15 minutes?

Obstetric Decision

Anesthesia Contact

Anesthesia Provision

Incision

Time: Decision to Incision

5 minutes:

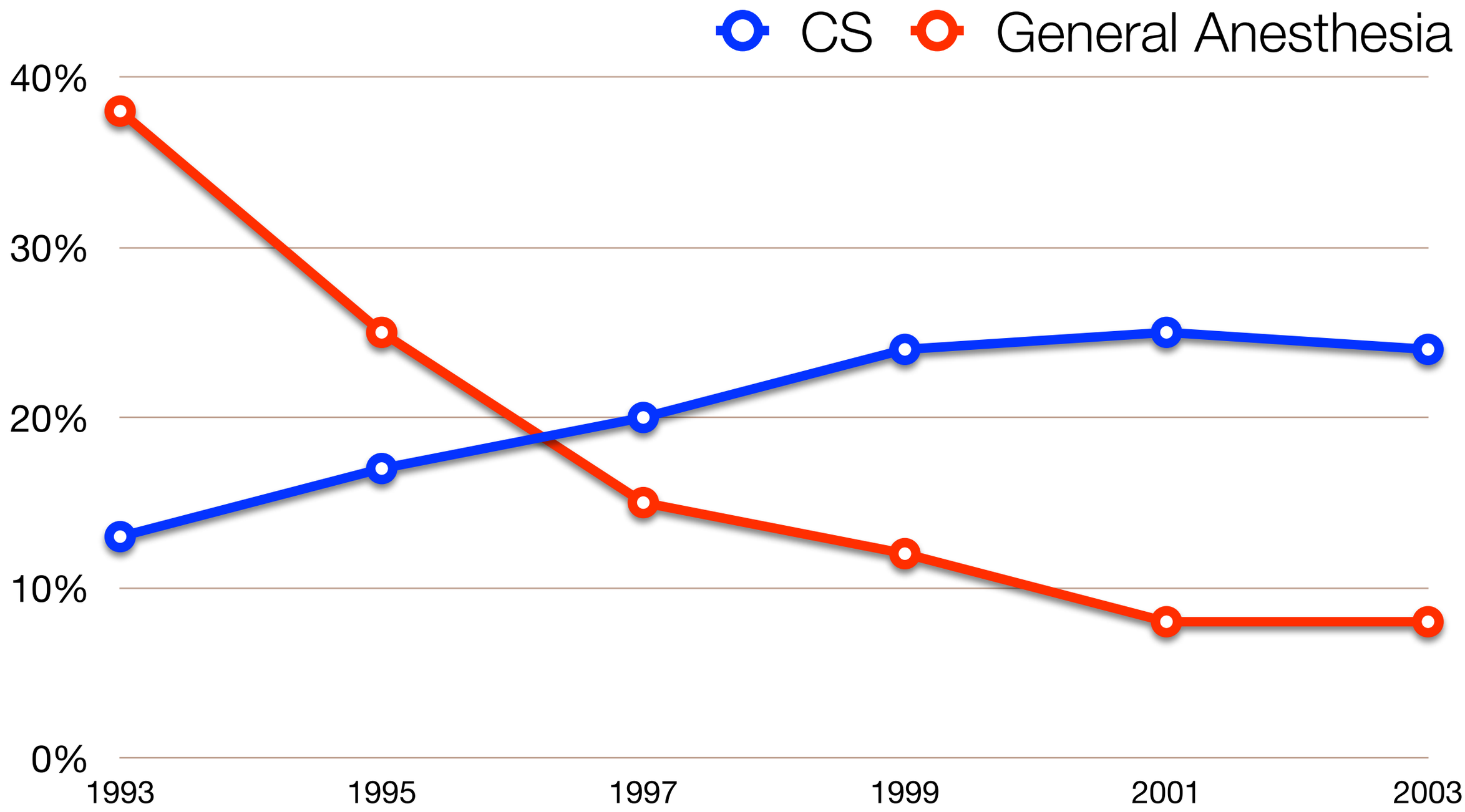
Complete Fetal Anoxia

- Maternal Cardiac Arrest
- Total Placental Abruption
- Complete Cord Prolapse
- Uterine Rupture

Lipman S, Tsen L, et al. SOAP Consensus Statement on Cardiac Arrest. A&A 2014

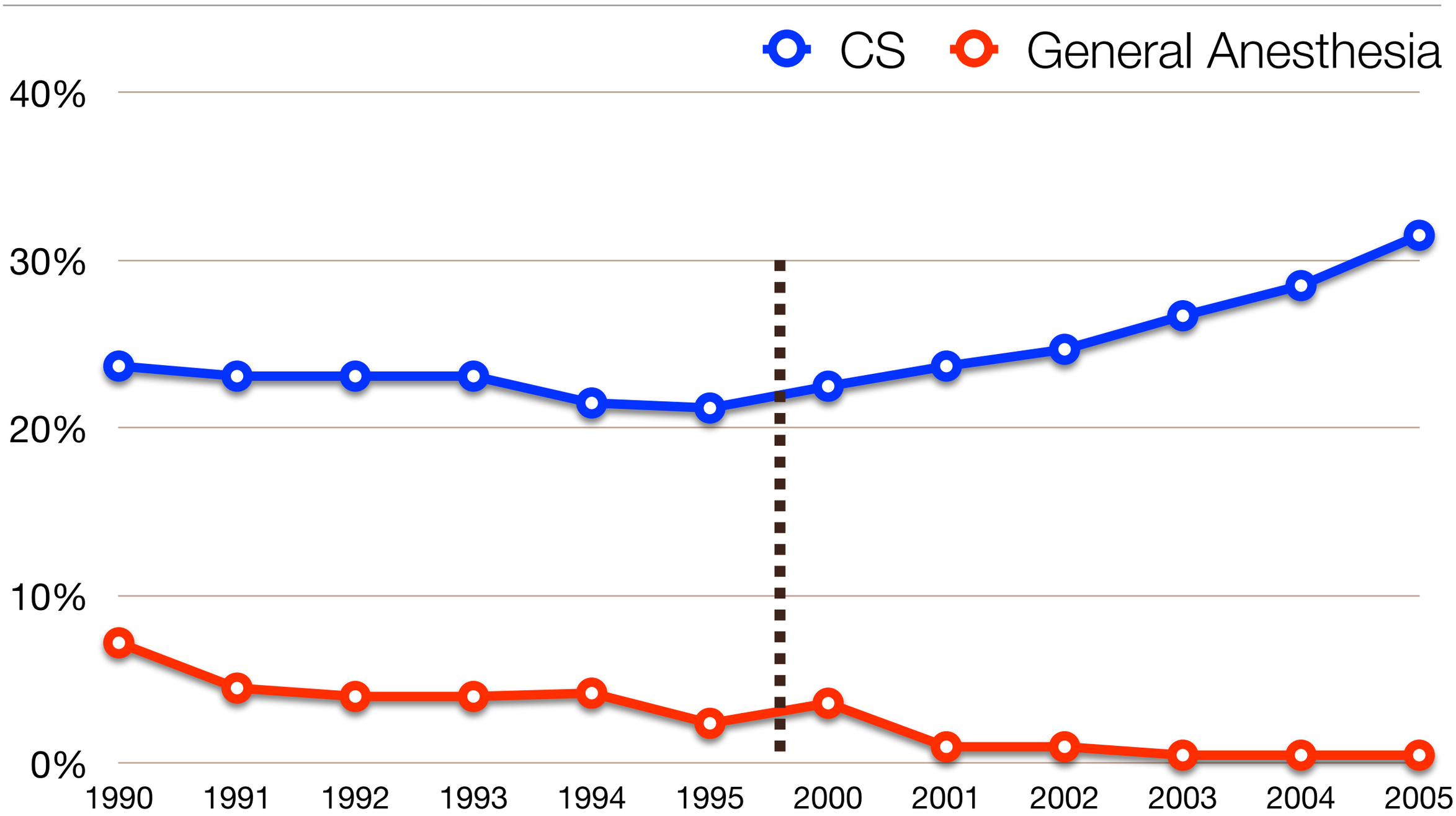
Reducing GA for Cesarean: Tips

Incidence of Cesarean and Obstetric GA



Rahman et al., Anaesthesia 2005

Incidence of Cesarean and Obstetric GA



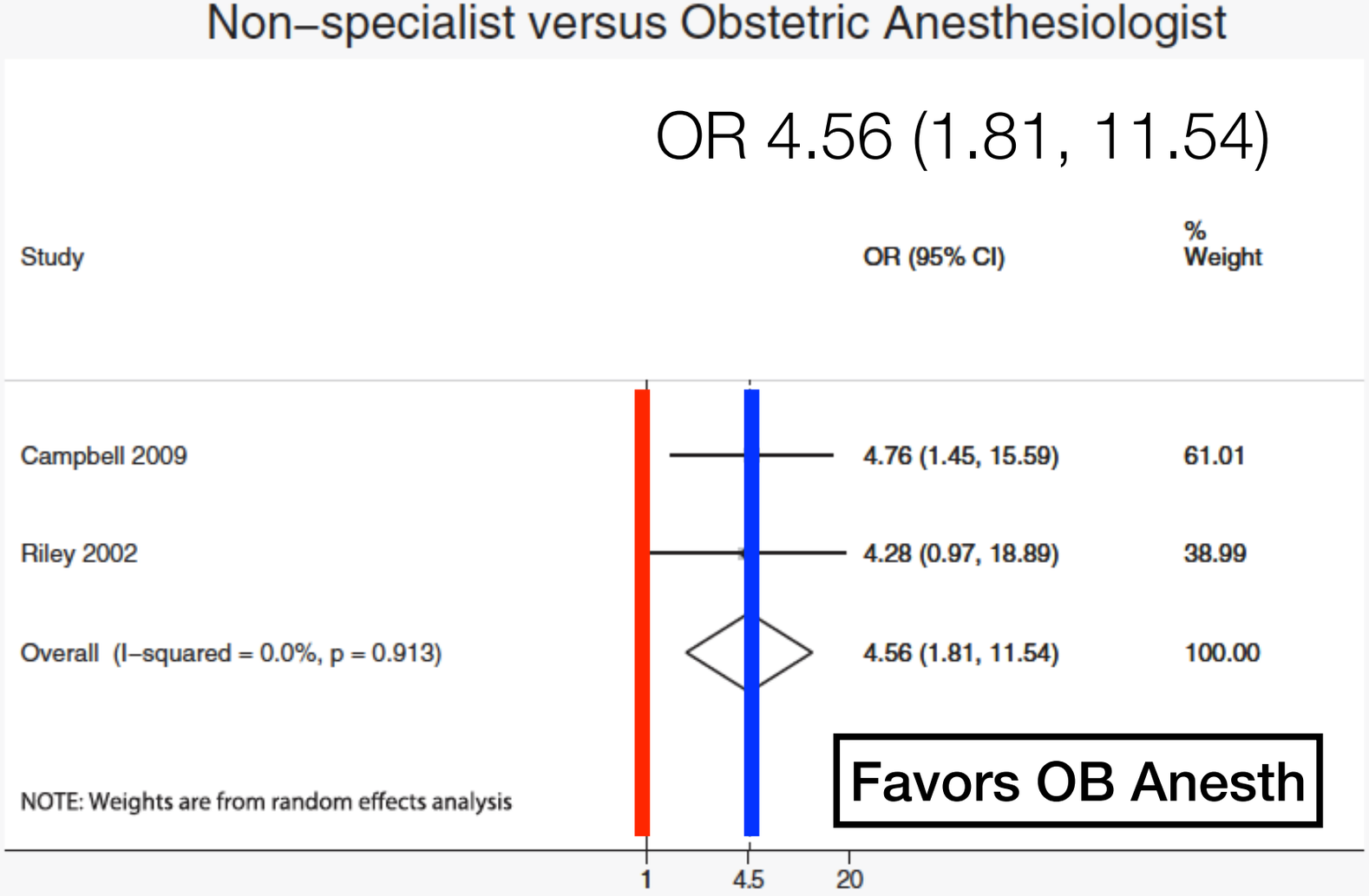
Tsen L et al. IJOA 1998; Palanisamy A, Tsen LC Anesth Analg 2011

Tip #1: Develop a "Core Team" with QA/QI

Uncommon, Unlikely, but a Possible Goal?

Shared Mental Models, Expectations

Similar Methods, Management Styles



Bauer ME, Tsen LC, Mhyre JM, et al. IJOA 2012; 21:294-309
Chau A, Tsen LC. Anesth Analg 2017

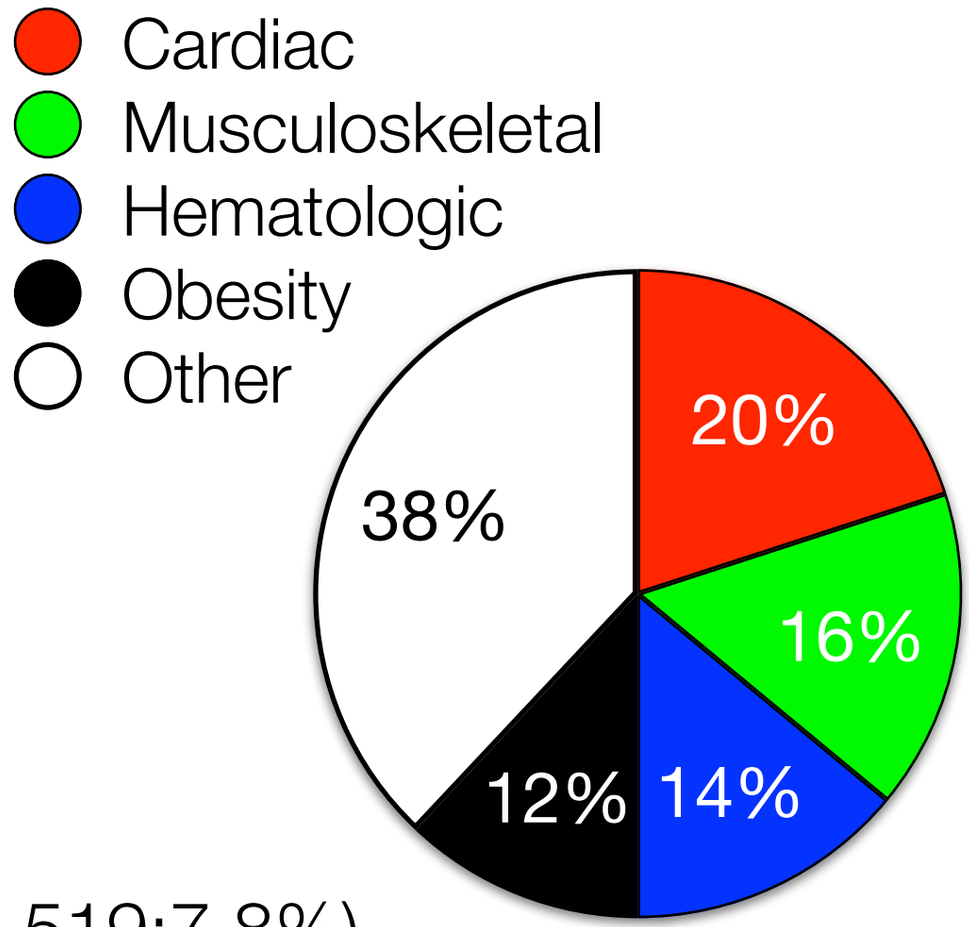
Tip #2: Institute "High Risk" Consult System-Need

Optimizes significant disease

Creates a multi-specialty plan (30% change)

Establishes expectations

Minimizes anxiety



Generates referrals & revenue (n = 519;7.8%)

Reduces maternal mortality (CMACE-counsel/referral)

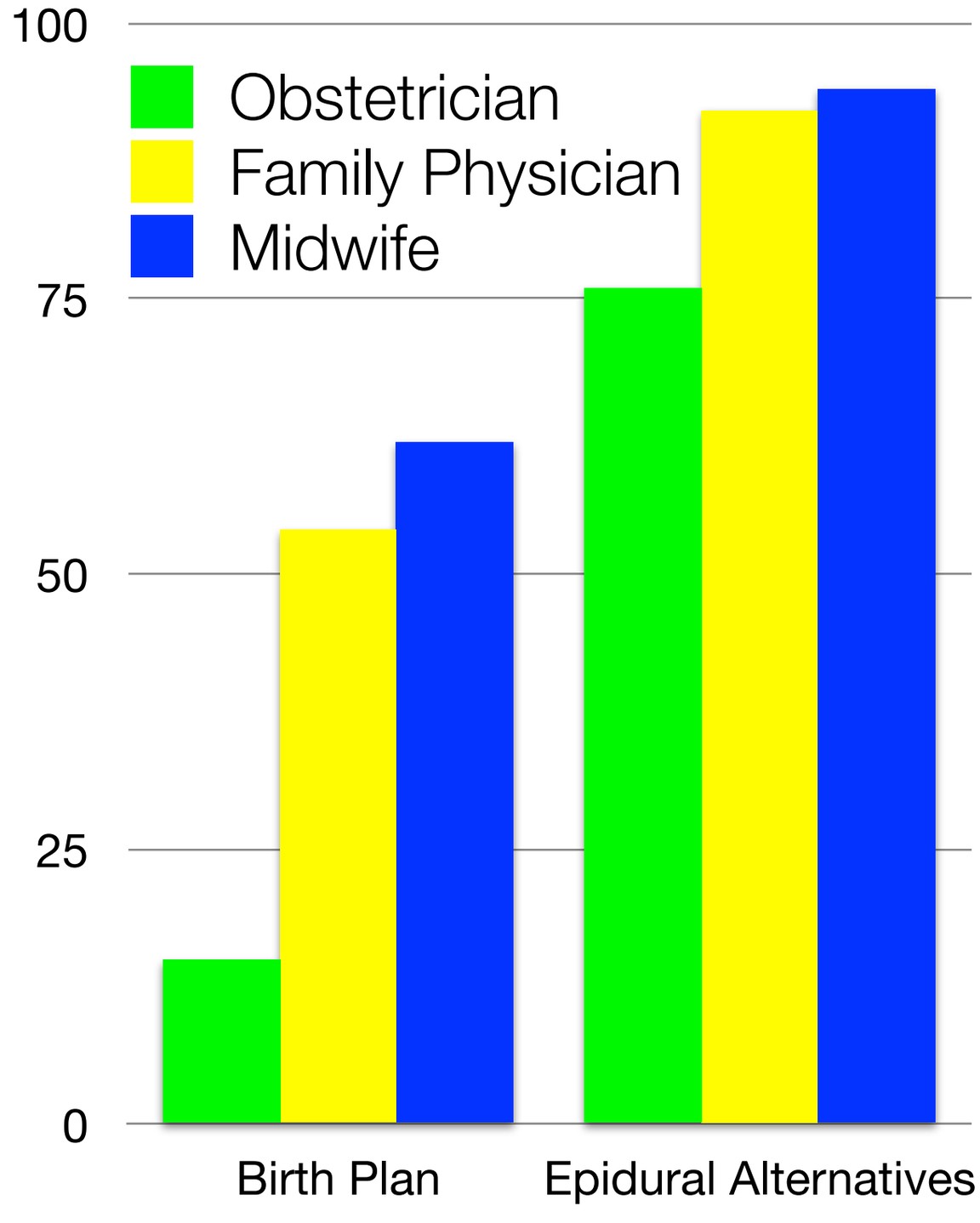
Bharwani F, MacArthur A. CJA 2013; Butwick AJ, Carvalho B, IJOA 2007
Cooper GM et al. BJA 2005; Tsen LC, et al. Anesth Analg 2002

Tip #3: Mandate Ability to see all Parturients

The "Natural" Child Birth:
Intervention-Free
(No IV, Epidural or CS)

Evaluate Difficult Airway/
Difficult Back

Evaluate Cardiac,
Hematologic, BMI Issues



Reime B et al. BJOG 2004;111:1388-93
Malacrida C, et al. Health 2014;18:41-59

Tip #4: Deputize an "Early Warning System"

Admin Assist, OB's, Nurses

Early/Prophylactic Epidural

Joint Board Rounds

Goal: Information/Safety

Benefit: Names, Hierarchy, Norms (& Outliers), Rationale & Respect, Teamwork KSA's

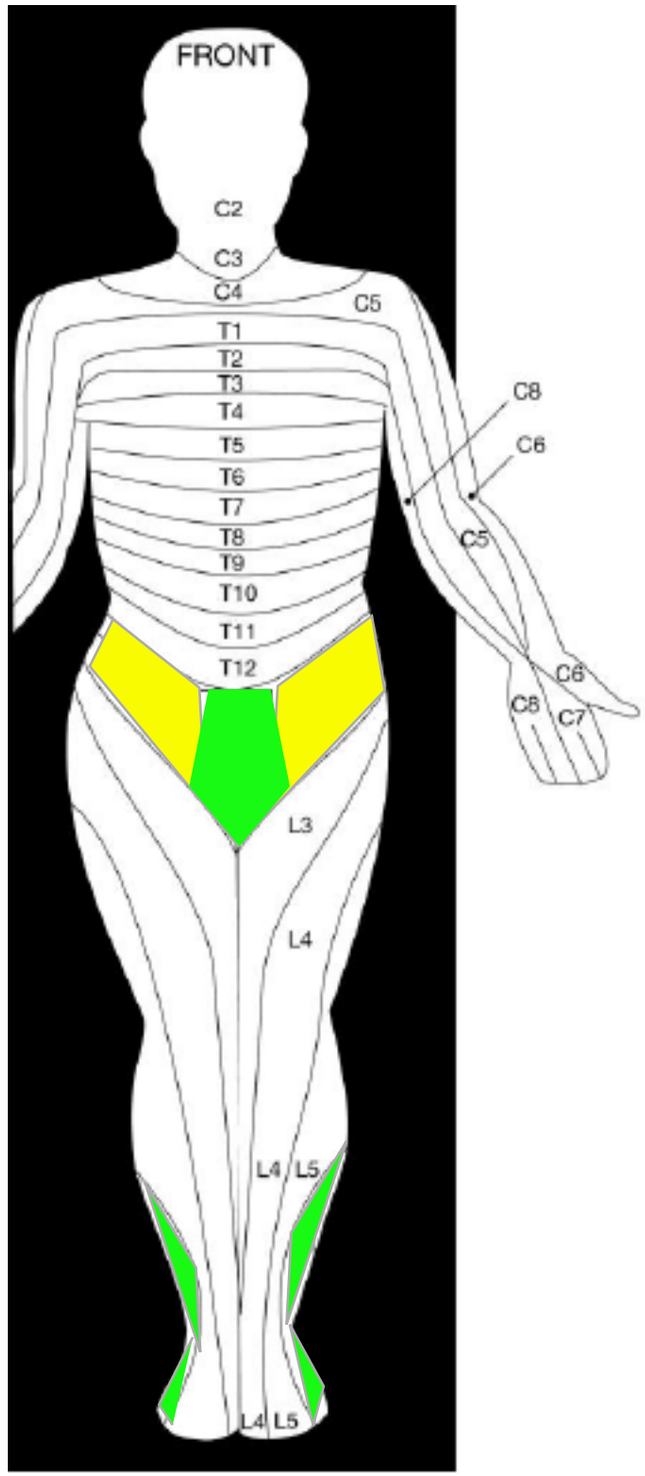
Teamwork Knowledge, Skills, and Attributes

Shared Mental Models
Team Leadership
Team Orientation
Mutual Performance
Backup Behavior
Mutual Trust
Adaptability
Closed Communication

Chau A, Vijjeswarapu MA, Hickey M, Acker D, Tsen LC:Anesth Analg 2017

Tip #5: Insert "Early Epidural" Catheters

- Before Requested or Required
- Consider Dural Puncture Epidural (DPE) Technique
- Dose Epidural Catheter (5-6 mL)
- Test Sensory Band



Obstetric Anesthesia Guidelines Update Task Force, **2016**

Stratify Risk for GA "OB-CMI Score"

Development

Bateman BT, et al. Obstet Gynecol, 2013;122:957-65

Validation

Metcalfe A, et al. BJOG 2015;122:1748-55

Prediction Morbidity

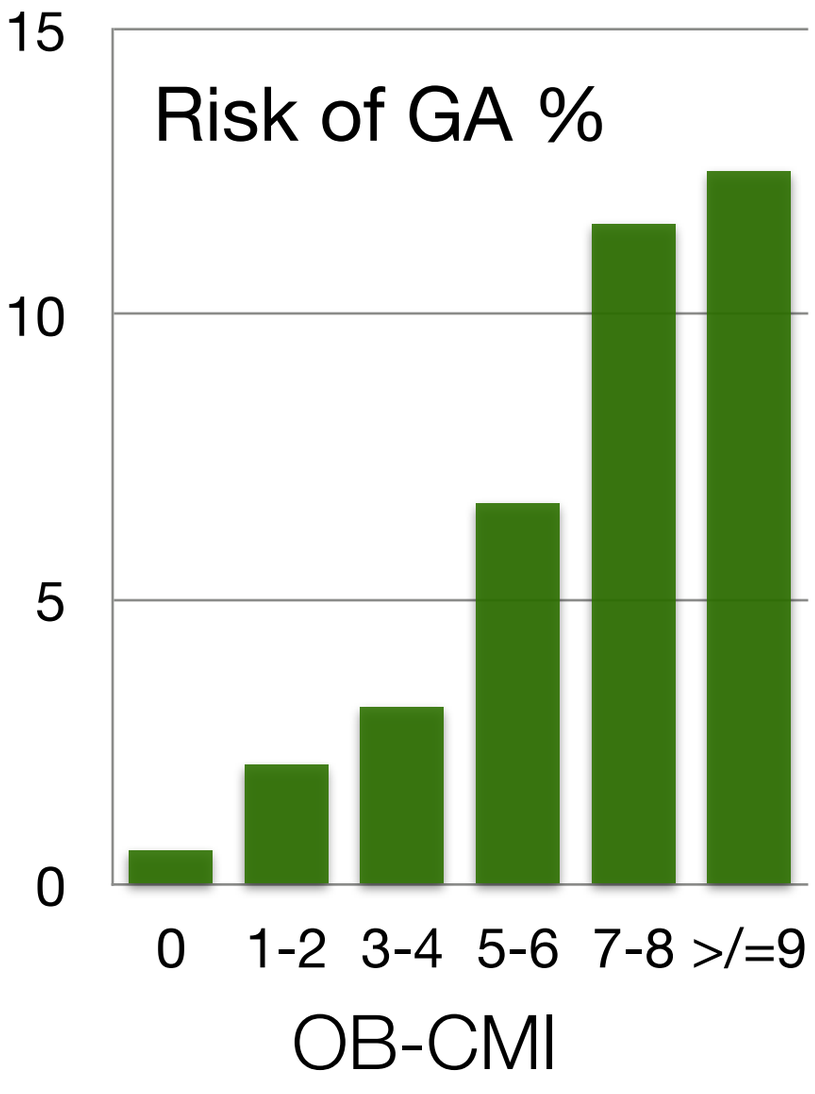
Easter SR, et al. AJOG 2019:

Prediction Odds of GA

Singh/Tsen LC, IJOA 2022
1point=32% increase GA

Maternal condition	Points
Preeclampsia with severe features or eclampsia	5
Preeclampsia/Gestational/Chronic Hypertension	2
Congestive Heart Failure	5
Pulmonary Hypertension	4
Ischemic Heart Disease/Cardiac Arrhythmia	3
Congenital Heart Disease and/or valvular disease	4
Multiple Gestation	2
Intrauterine Fetal Demise	2
Placenta previa/Suspected accreta/abruption	4
Previous cesarean delivery/ myomectomy	1
Autoimmune disease/Lupus	2
HIV/AIDS	2
Sickle cell disease/ Bleeding disorder/Coagulopathy/	3
Epilepsy/Cerebrovascular accident/Neuromuscular	2
Chronic Renal disease	1
Asthma	1
Diabetes on Insulin	1
Maternal Age >44	3
Maternal Age 40-44	2
Maternal Age 35-39	1
Substance use disorder	1
Alcohol Abuse	1
BMI>50	3
BMI>40	2

Stratify Risk for GA "OB-CMI Score"



Prediction Odds of GA

Singh/Tsen LC, IJOA 2022

1point=32% increase GA

Maternal condition	Points
Preeclampsia with severe features or eclampsia	5
Preeclampsia/Gestational/Chronic Hypertension	2
Congestive Heart Failure	5
Pulmonary Hypertension	4
Ischemic Heart Disease/Cardiac Arrhythmia	3
Congenital Heart Disease and/or valvular disease	4
Multiple Gestation	2
Intrauterine Fetal Demise	2
Placenta previa/Suspected accreta/abruption	4
Previous cesarean delivery/ myomectomy	1
Autoimmune disease/Lupus	2
HIV/AIDS	2
Sickle cell disease/ Bleeding disorder/Coagulopathy/	3
Epilepsy/Cerebrovascular accident/Neuromuscular	2
Chronic Renal disease	1
Asthma	1
Diabetes on Insulin	1
Maternal Age >44	3
Maternal Age 40-44	2
Maternal Age 35-39	1
Substance use disorder	1
Alcohol Abuse	1
BMI>50	3
BMI>40	2

Tip #6: Confirm "Functional" Epidural Catheter

Initial Technique?

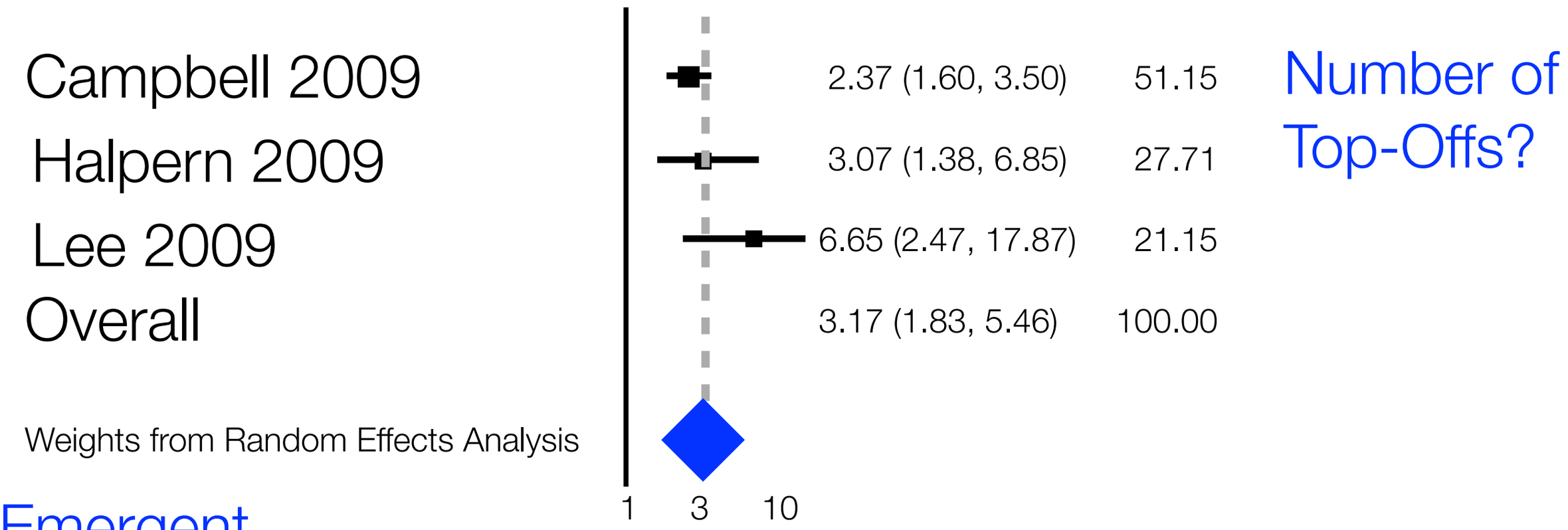
Failed Blocks	Epid	CSE	DPE	Needle
Eappen; n=4240	13.1%	7.2%		25G
Norris; n=1660	1.3%	0.2%		25G
vandeVelde; n=2075	3.1%	1.5%		27G, 29G
Berger; n=1548		9.7%	6.4%	25G

Bauer, Tsen, Mhyre. IJOA 2012; Berger. IJOA 2022
Van de Velde, Anaesth Intens Care 2001; Norris, IJOA 2000; Eappen, IJOA 1998

Tip #6: Confirm "Functional" Epidural Catheter

Initial Technique?

Failed Blocks	Epid	CSE	DPE	Needle
Eappen; n=4240	13.1%	7.2%		25G
Norris; n=1660	1.3%	0.2%		25G
vandeVelde; n=2075	3.1%	1.5%		27G, 29G
Berger; n=1548		9.7%	6.4%	25G



Emergent

Bauer, Tsen, Mhyre. IJOA 2012; Berger. IJOA 2022

Van de Velde, Anaesth Intens Care 2001; Norris, IJOA 2000; Eappen, IJOA 1998

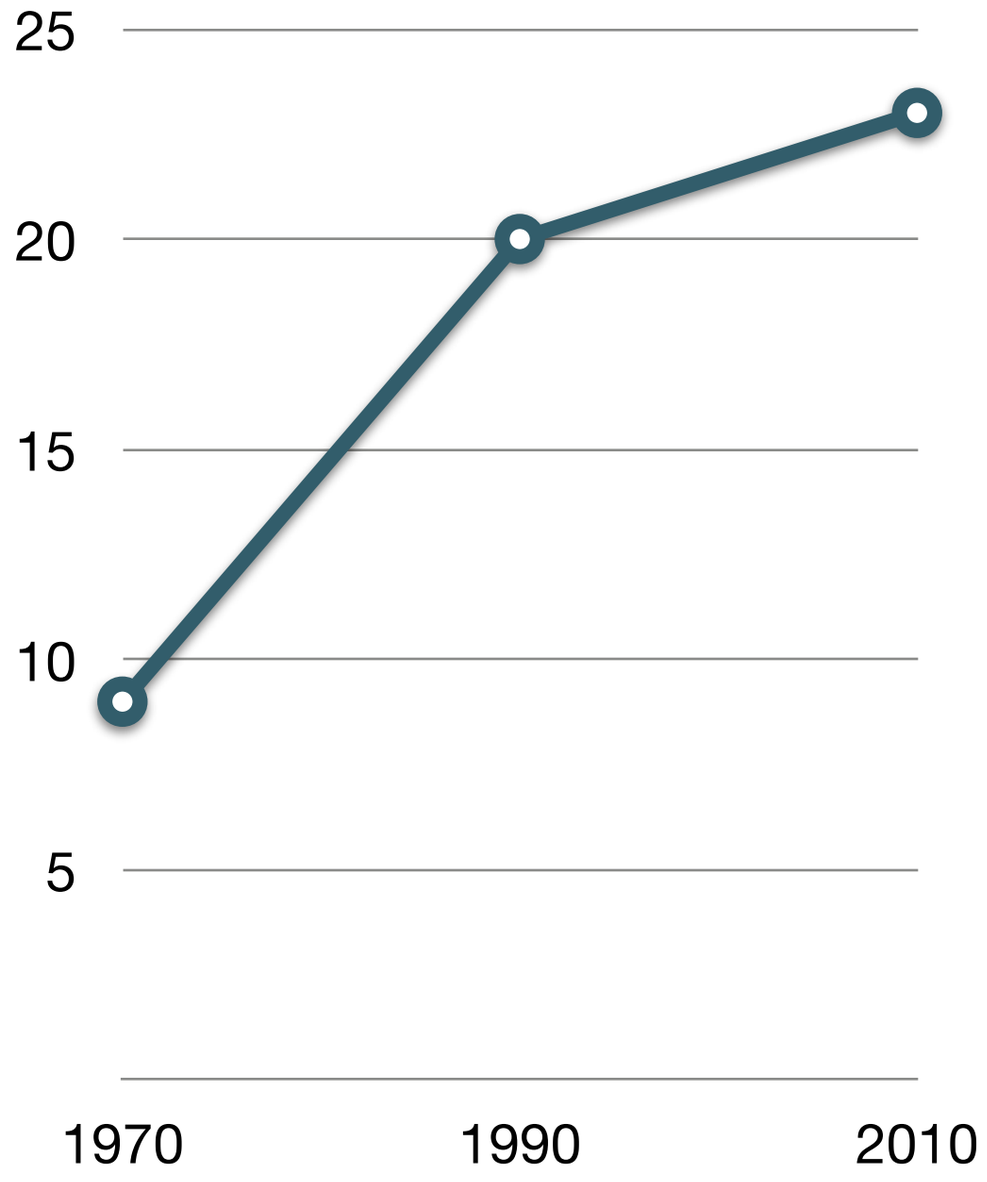
Tip #7: Reaffirm No "Emergent" Cesarean

Emergent Cesarean = 23%

Acidosis with Decelerations

- Initially Normal to Late:
  115 Minutes

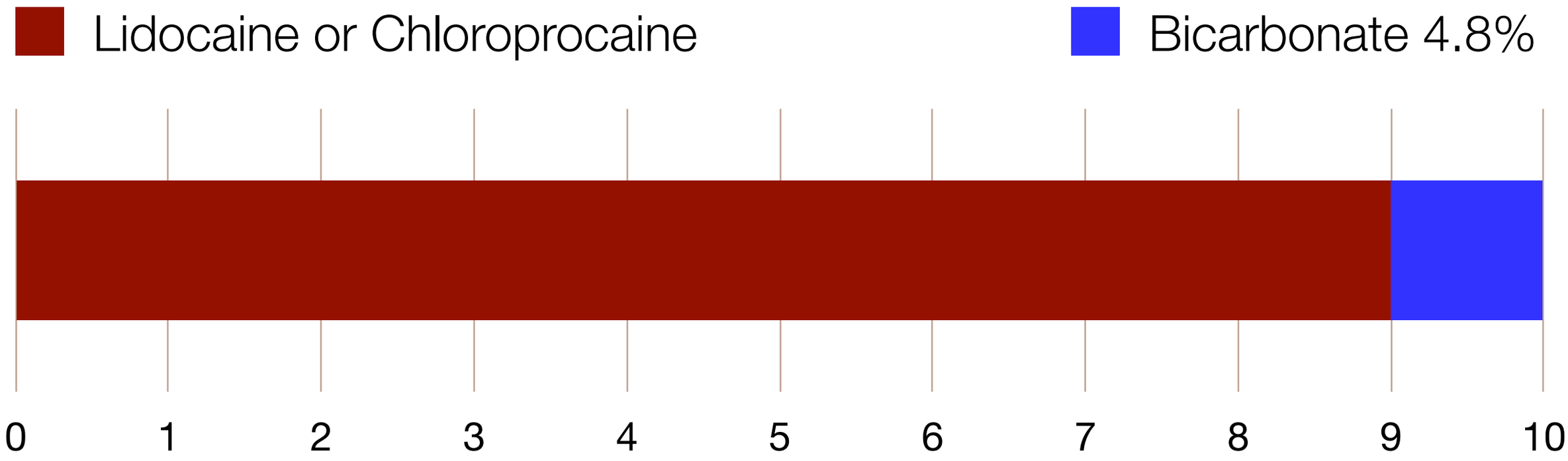
- Initially Normal to Variable:
  145 Minutes



CDC, National Center for Vital Statistics; Fleisher AJOG 1982

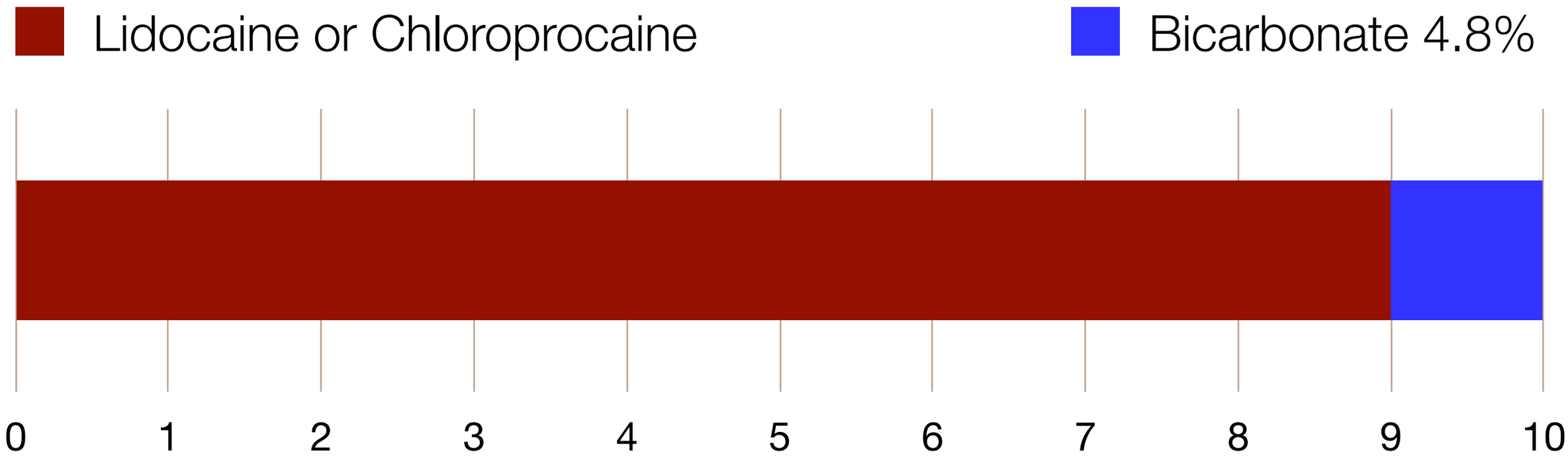
Tip #8: Implement "Fastest" Anesthesia Combo

Study	Agent	Time	Comment
Lam, Anaes 2001;56:790-4	Lido 2% + Epi+Bicarb	5.2 min	Extension T6
	Lido 2% + Epi	9.7 min	Extension T6



Tip #8: Implement "Fastest" Anesthesia Combo

Study	Agent	Time	Comment
Gaiser, IJOA 1998;7:27-31	Chloro 3% + Bicarb	3.1 min	Extension T4
	Lido 1.5% + Bicarb	4.4 min	Extension T4
Lam, Anaes 2001;56:790-4	Lido 2% + Epi+Bicarb	5.2 min	Extension T6
	Lido 2% + Epi	9.7 min	Extension T6

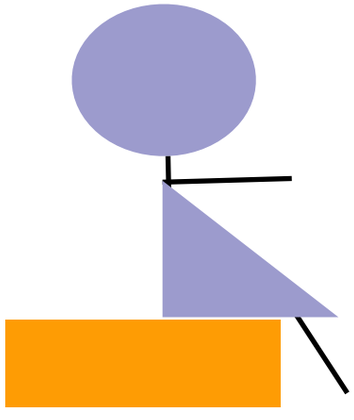


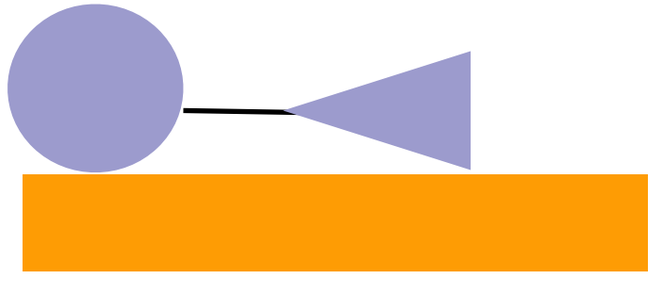
Tip #9: Affirm "Neuraxial Technique" Commitment

Early/Prophylactic Catheters + Fast Epidural Analgesia

Study	Agent	Time	Comment
Gaiser, IJOA 1998;7:27-31	Chloro 3% + Bicarb	3.1 min	Extension T4
	Lido 1.5% + Bicarb	4.4 min	Extension T4
Lam, Anaes 2001;56:790-4	Lido 2% + Epi+Bicarb	5.2 min	Extension T6
	Lido 2% + Epi	9.7 min	Extension T6

Comfortable with quick lateral placements?





Tsen LC. Int J Obstet Anesth 2008

Sprung J, et al. Anesth Analg 1999; Chien I, et al. T JMS 2003

Tip #10: Trouble-Shoot Neuraxial Technique

Scenario #1: Urgent Cesarean, Spinal Failed

- Repeat Spinal (Reduced Dose?)
  - Initial: Bupiv 12-15 mg, Fent 10-20 µg (T8)
  - Repeat: Bupiv 10 mg, Fent 10-20 µg (T3)
- Continuous Spinal Catheter?

Scenario #2: Urgent Cesarean, Intraop Pain

- Consider Epidural Options
- Somatic: Chloroprocaine or Lidocaine (+ Bicarb)
- Viceral: Sufentanil/Fentanyl 20-50% to 5-10%
- Consider Analgesia/Anesthesia

Dadarkar/Vadhera et al. Anesthesiology 2002; Stocks, GM; Wilson MJ. IJOA 2005
Dahlgren et al. Anesth Analg 1997; Ginosar et al. Anesth Analg 2003

Reducing GA for Cesarean: Summary

Reducing GA for Cesarean: Summary

1. Develop a Core Team
2. Institute a "High Risk" Consult System
3. Mandate Ability to See All Parturients
4. Deputize an "Early Warning System"
5. Insert Early Epidural Catheters
6. Confirm Functional Epidural Catheters
7. Minimize Emergent Cesareans
8. Implement Fastest Local Anesthetic Combinations
9. Affirm Commitment to Neuraxial Anesthesia
10. Trouble Shoot Neuraxial Technique

Reducing GA for Cesarean: Summary


Questions?