

# The Dural Puncture Epidural (DPE)

## Technique:

Has Optimal Labor Analgesia Arrived?

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SFOAI Varmote 2023  
Skåvsjöholm

**Lawrence C. Tsen, MD**

**Director**, Center for Reproductive Medicine, Department of Anesthesiology, Perioperative & Pain Medicine, Brigham & Women's Hospital  
**Associate Professor** in Anaesthesia  
Harvard Medical School



# No Disclosures

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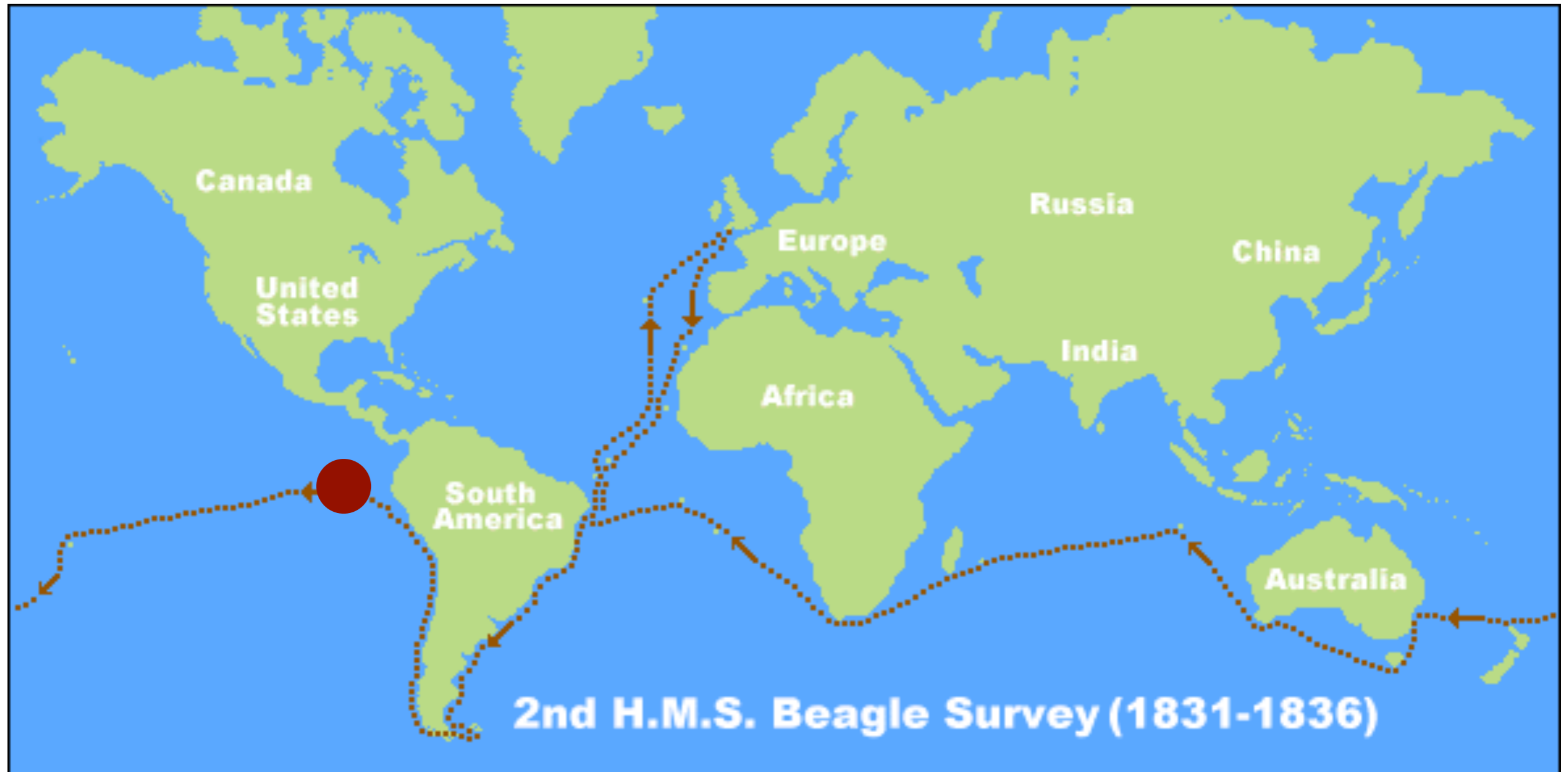
“...from so simple a beginning, endless forms **most beautiful and most wonderful** have been and are being evolved”

Origin of the Species  
Darwin



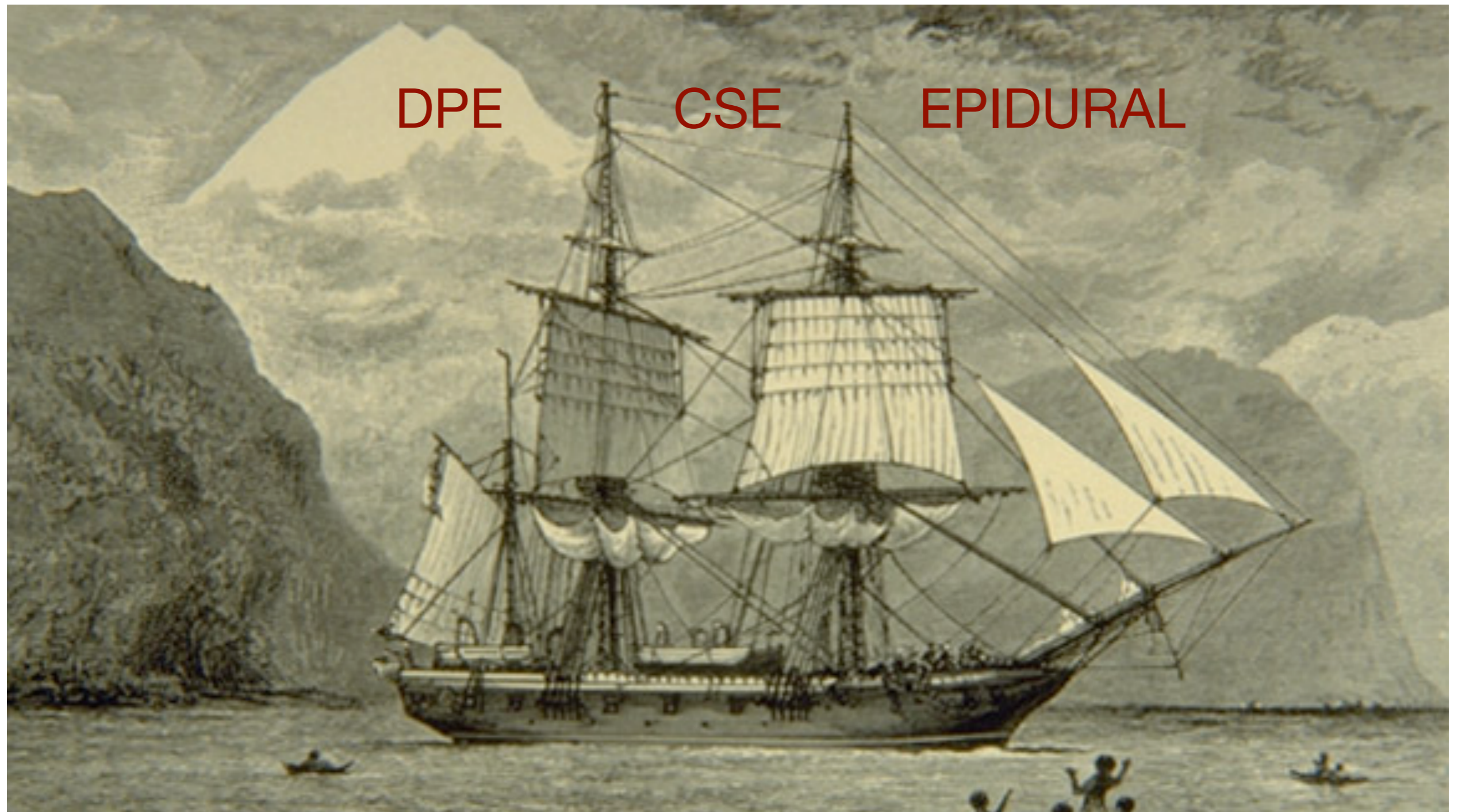
# A Darwinian Adventure

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# A Darwinian Adventure

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TECHNIQUES

# Neuraxial Techniques

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## “Ideal Technique”

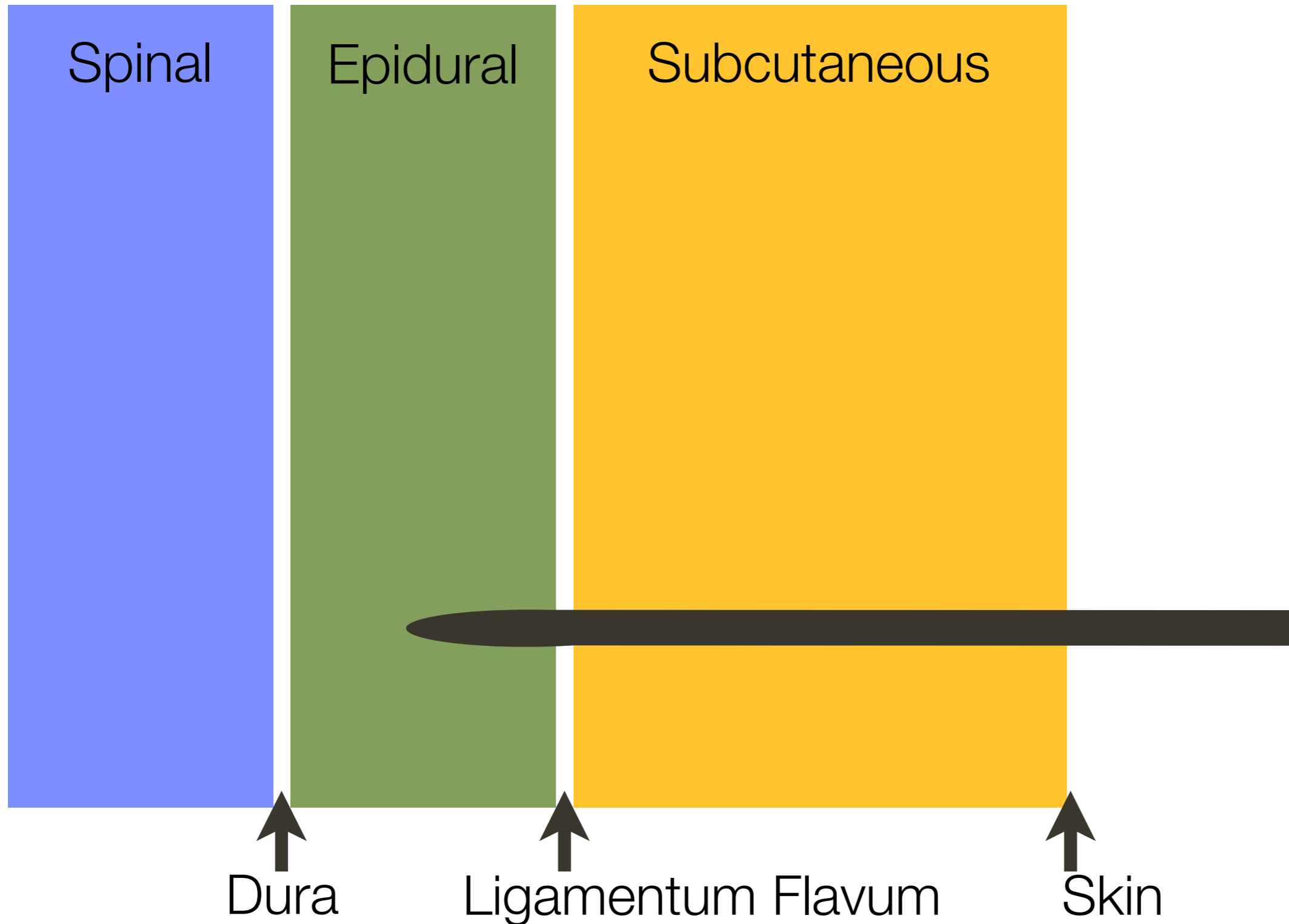
Quick **Onset**,  
Predictable **Spread** &  
**Quality**, Adjustable  
**Depth** & **Duration**,  
Minimal **Motor Block**,  
Minimal Maternal and  
Fetal **Side Effects**

Origin of the Species  
Darwin

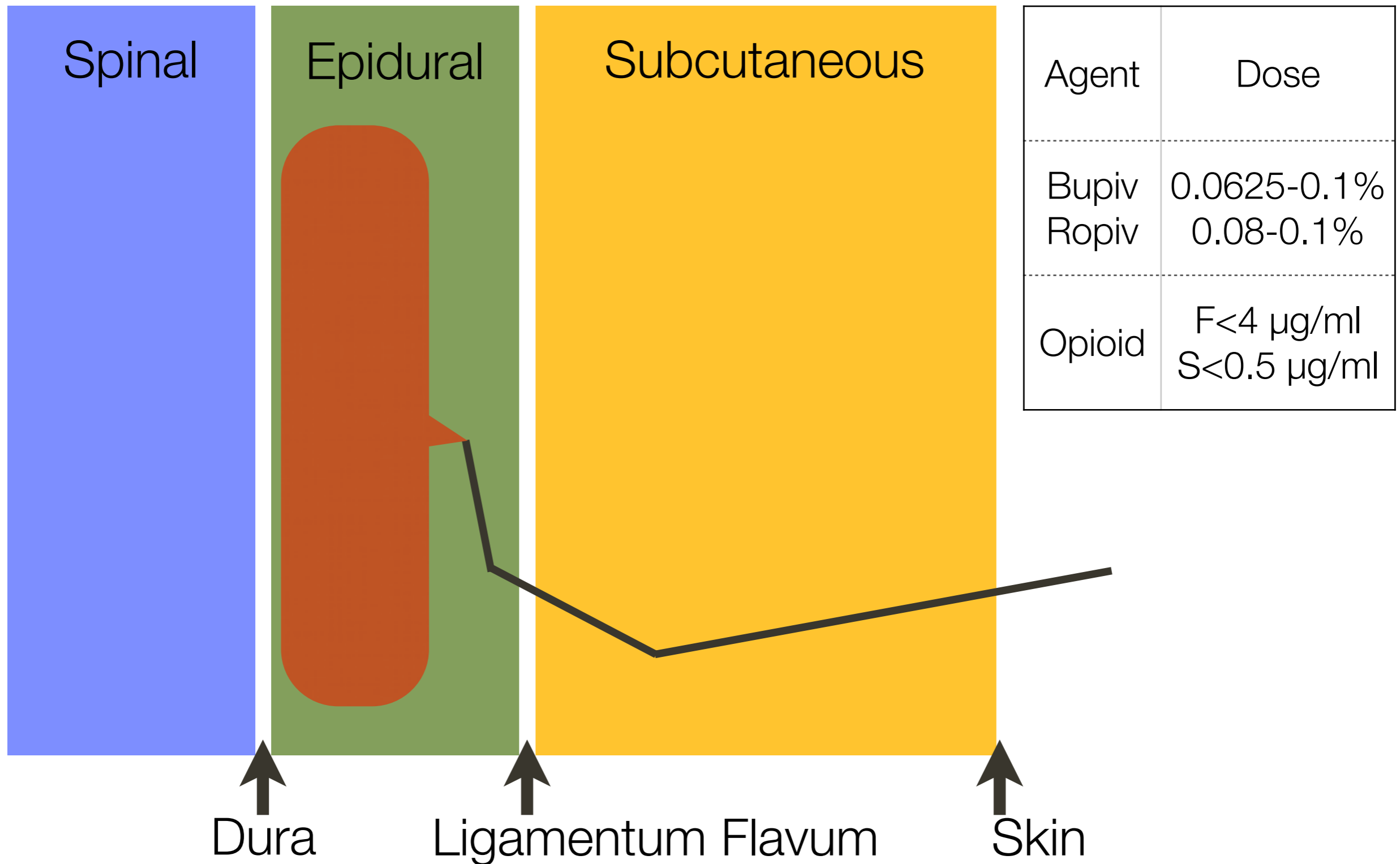


# Epidural Technique

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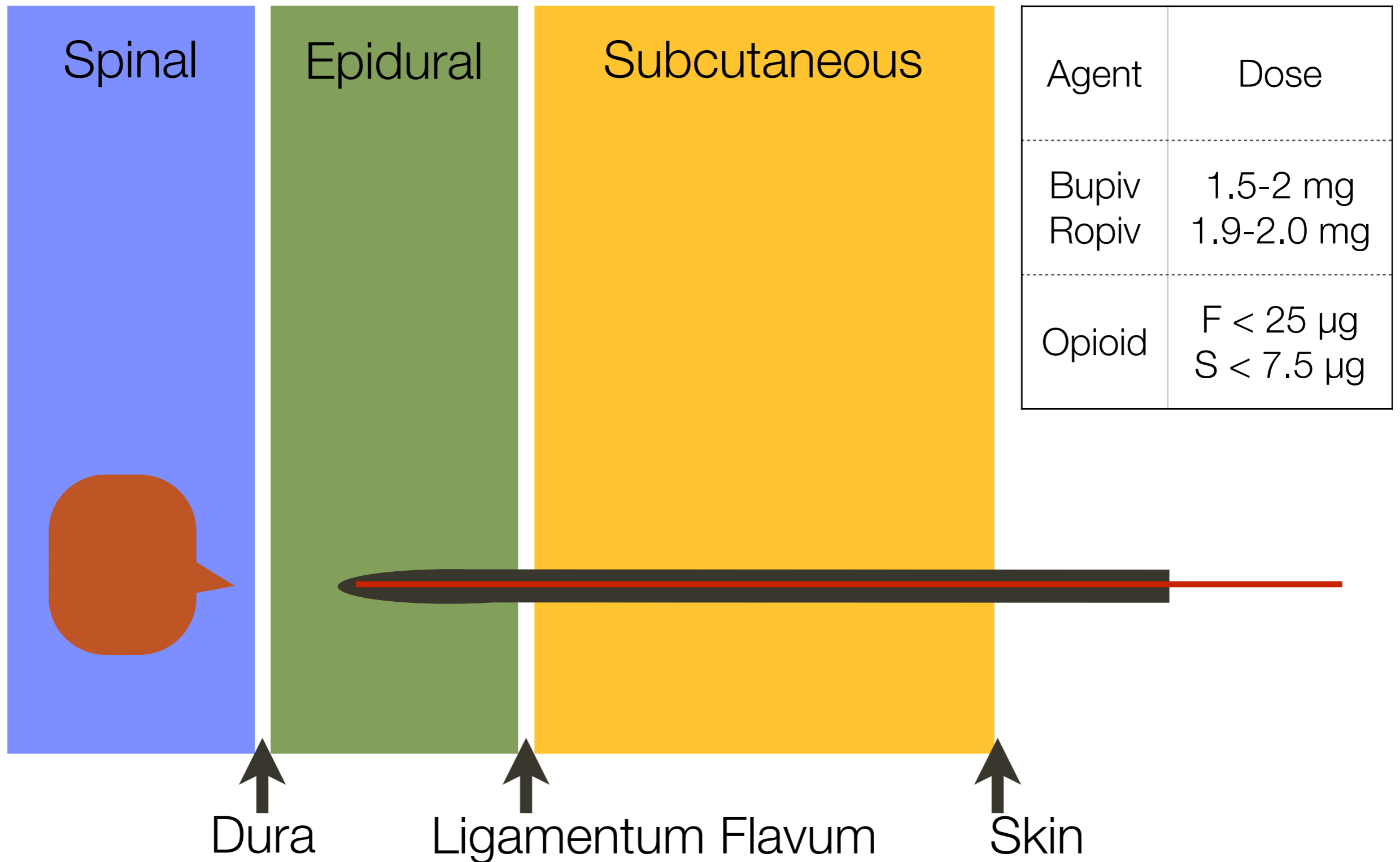


# Epidural Technique

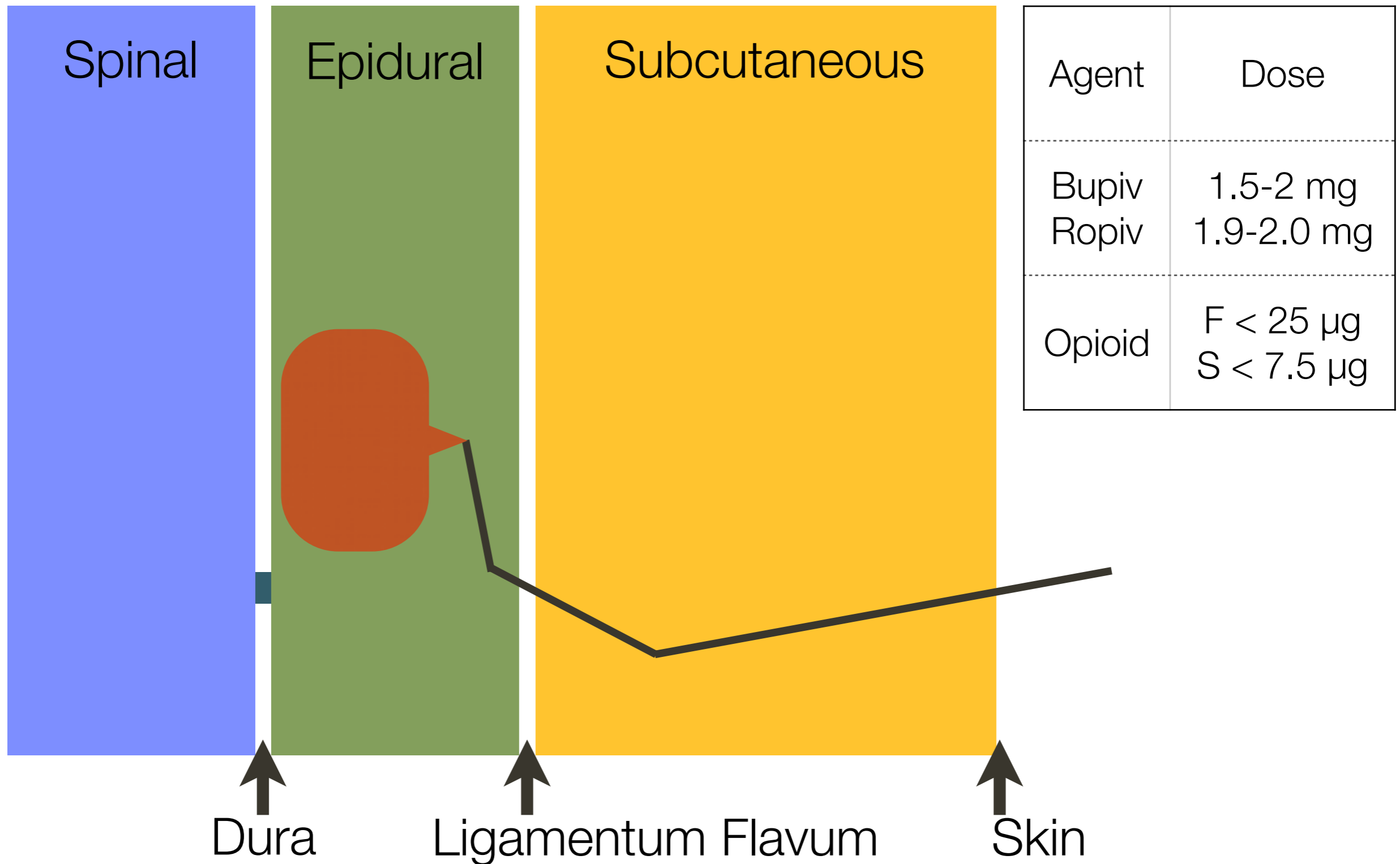




# CSE Technique

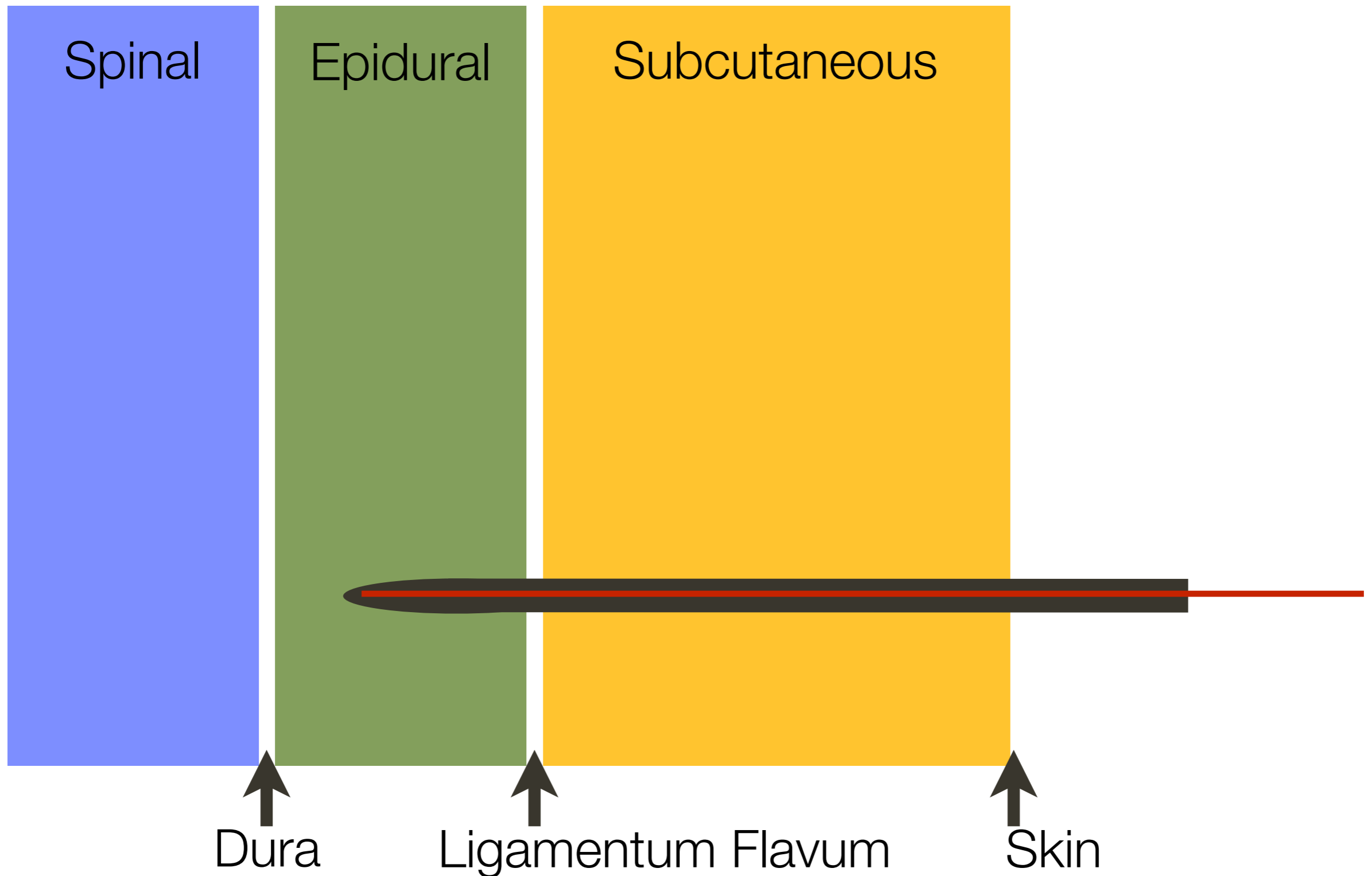


# CSE Technique



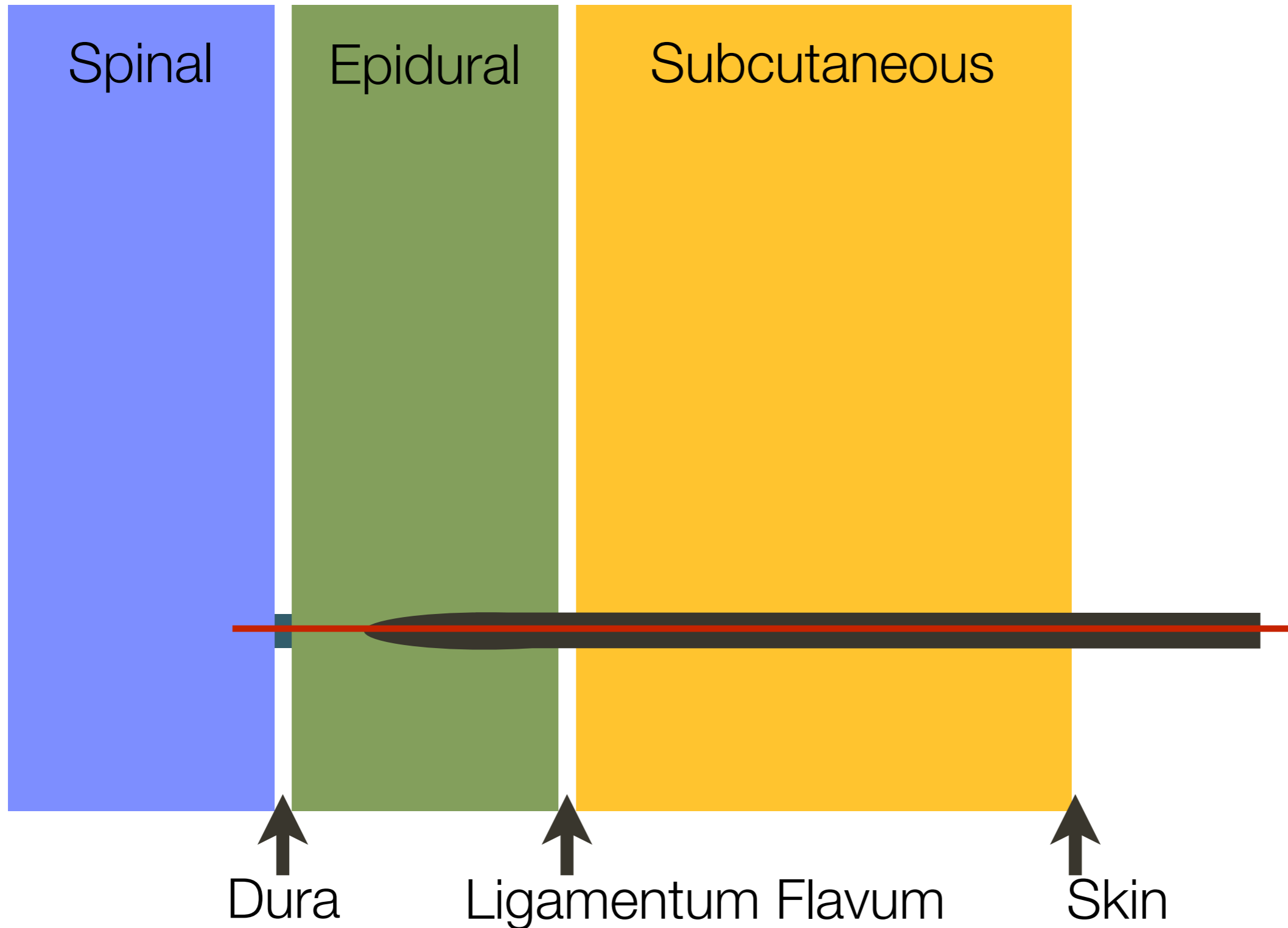
# DPE Technique

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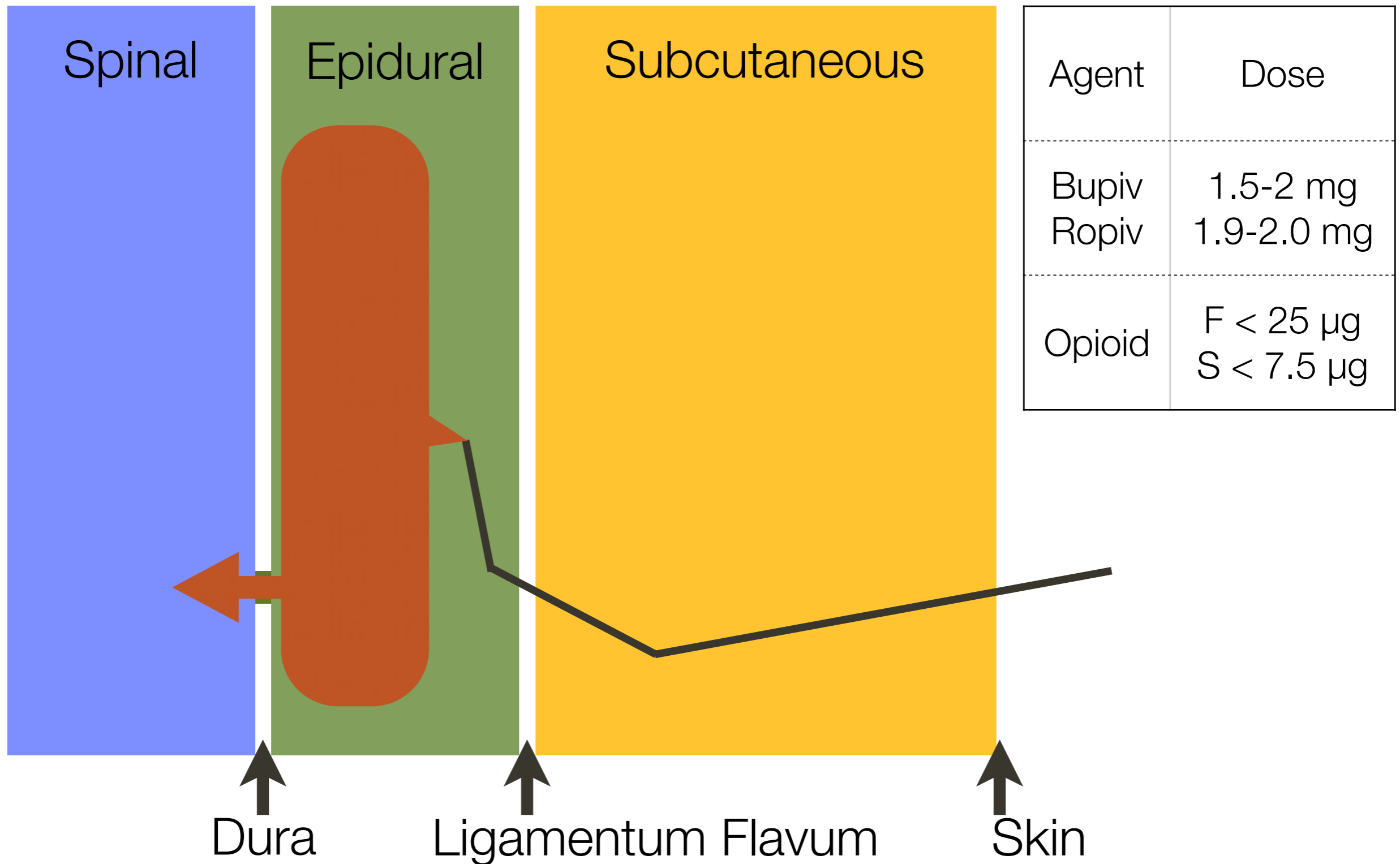


# DPE Technique

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# DPE Technique



# DPE Technique

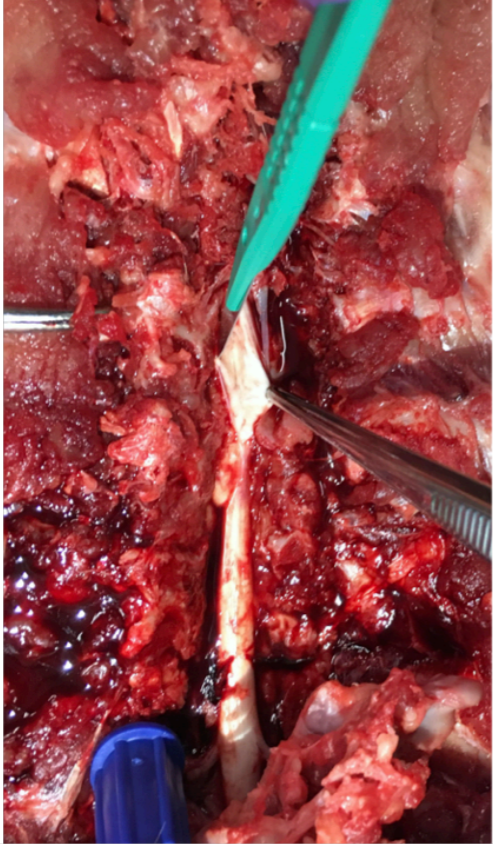
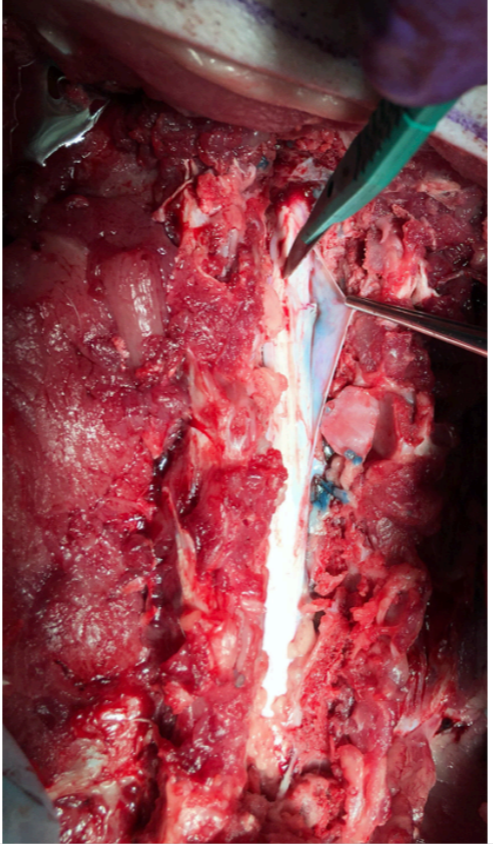
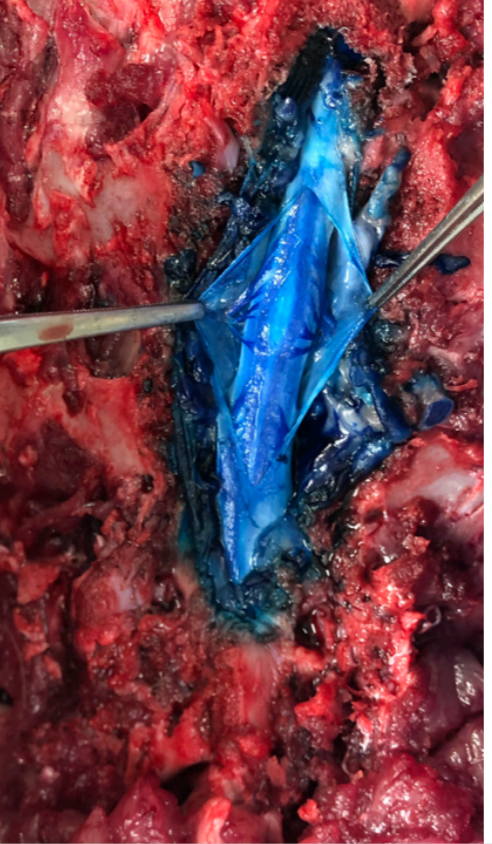
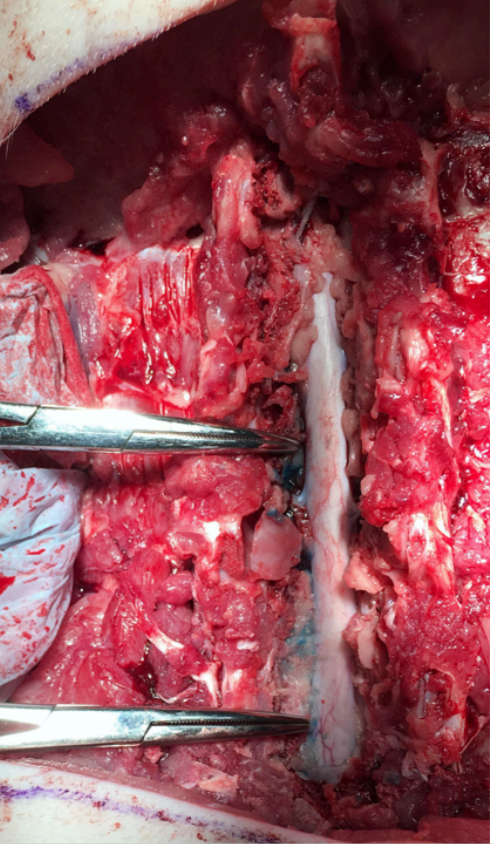
Study	Needle	Anesthetic	Effect
Thomas	27G	2% Lido 10 mL	No
Suzuki	26G	2% Mepiv 18 mL	Yes
Wilson	26G	0.125% Bup 12 mL	Yes
Cappiello, Tsen	25G	0.25% Bup 12 mL	Yes
Chau, Tsen	25G	0.125% Bup 20 mL	Yes
Chau, Tsen	25G	0.1% Bup 16 mL	Yes
Song	25G	0.1% Ropiv 10 mL	Yes

Faster, Greater Sacral Spread, Bilateral

No Difference Hypotxn, High Sensory, PDPH; **PIEB > CEI**

Thomas J, Anesth 2005; Suzuki N, et al. A&A 1996; Cappiello E, Tsen LC. A&A 2008  
Chau A, Tsen LC. A&A 2017; Wilson SH, A&A 2018  
Weale, Tsen LC, Chau A, SOAP; 2018 Song Y, A&A 2020

# DPE Technique

	EPIDURAL	DPE	CSE	WET-TAP
				
Epidural Dye	+	+	+	+
Spinal Dye	-	+	+++	++



ADVANTAGES



# Technique Advantages

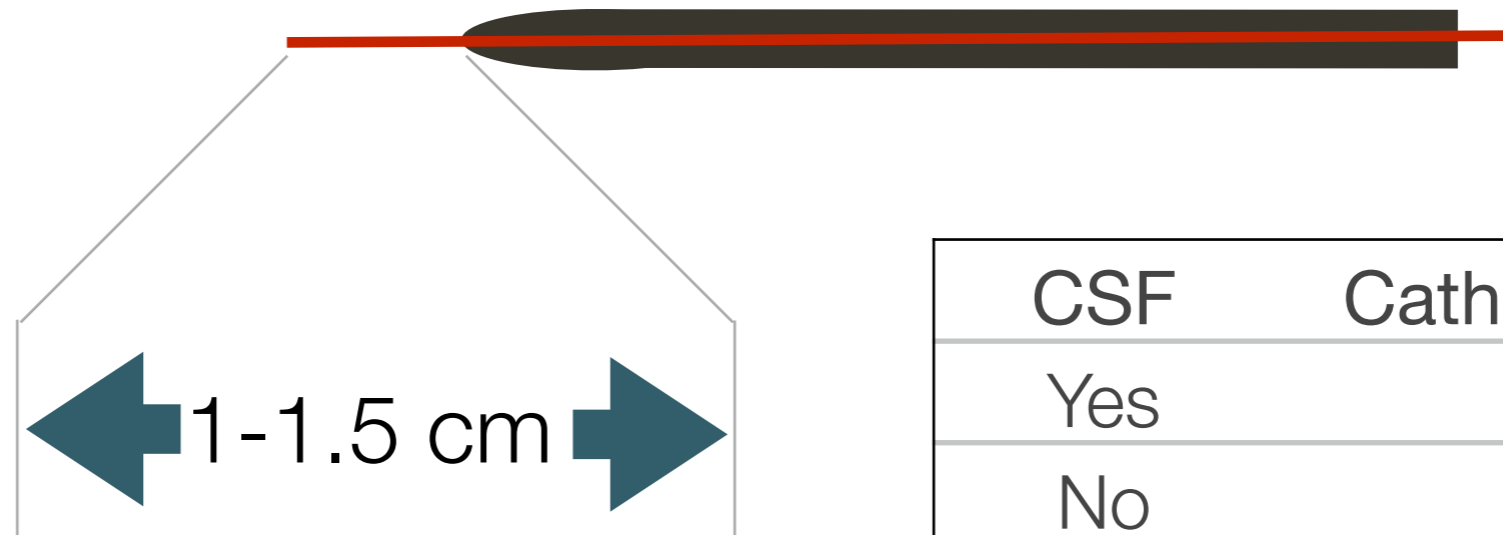
Characteristic	CSE	DPE	Epidural
Location Confirmation	X	X	

Cappiello E, O'Rourke N, Segal S, Tsen LC. Anes Analg 2008;107:1646-51

Chau A, Bibbo C, Huang CC, Elterman KG, Cappiello E, Tsen LC. Anesth Analg 2017

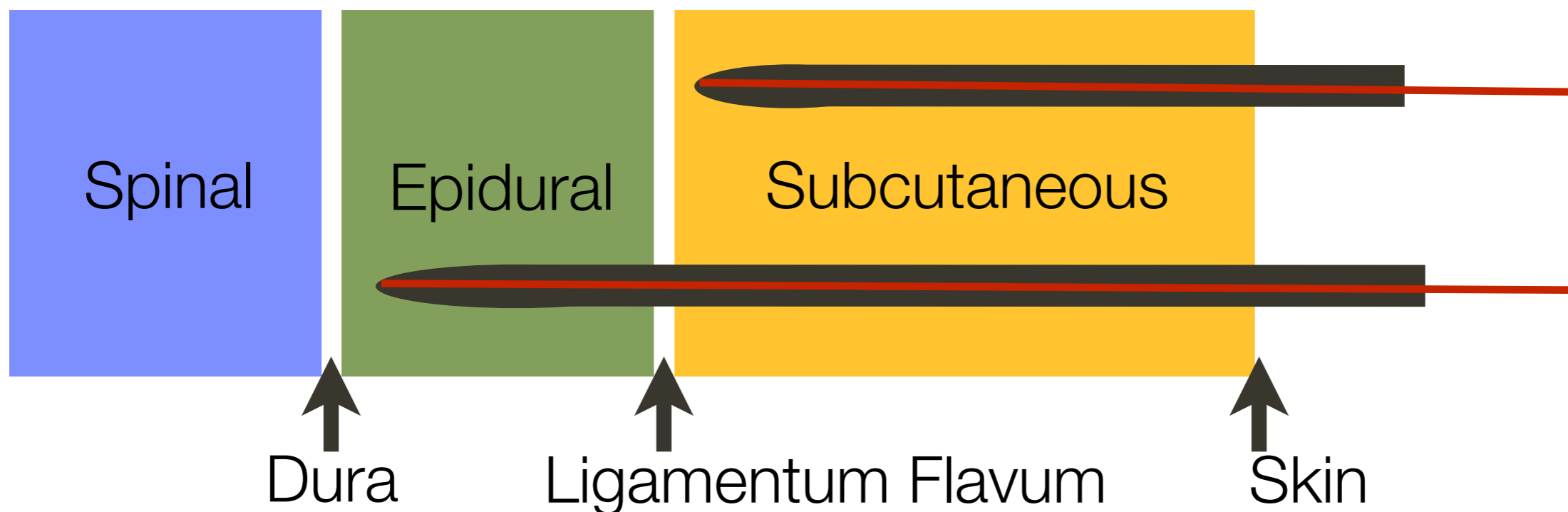
# Location Confirmation

CSE + DPE Techniques (25G + 26G Spinal)



CSF	Catheter Failure
Yes	9.3%
No	22.2%

Thomas, 2005



# Technique Advantages

Characteristic	CSE	DPE	Epidural
Location Confirmation	X	X	
Onset	X	X	

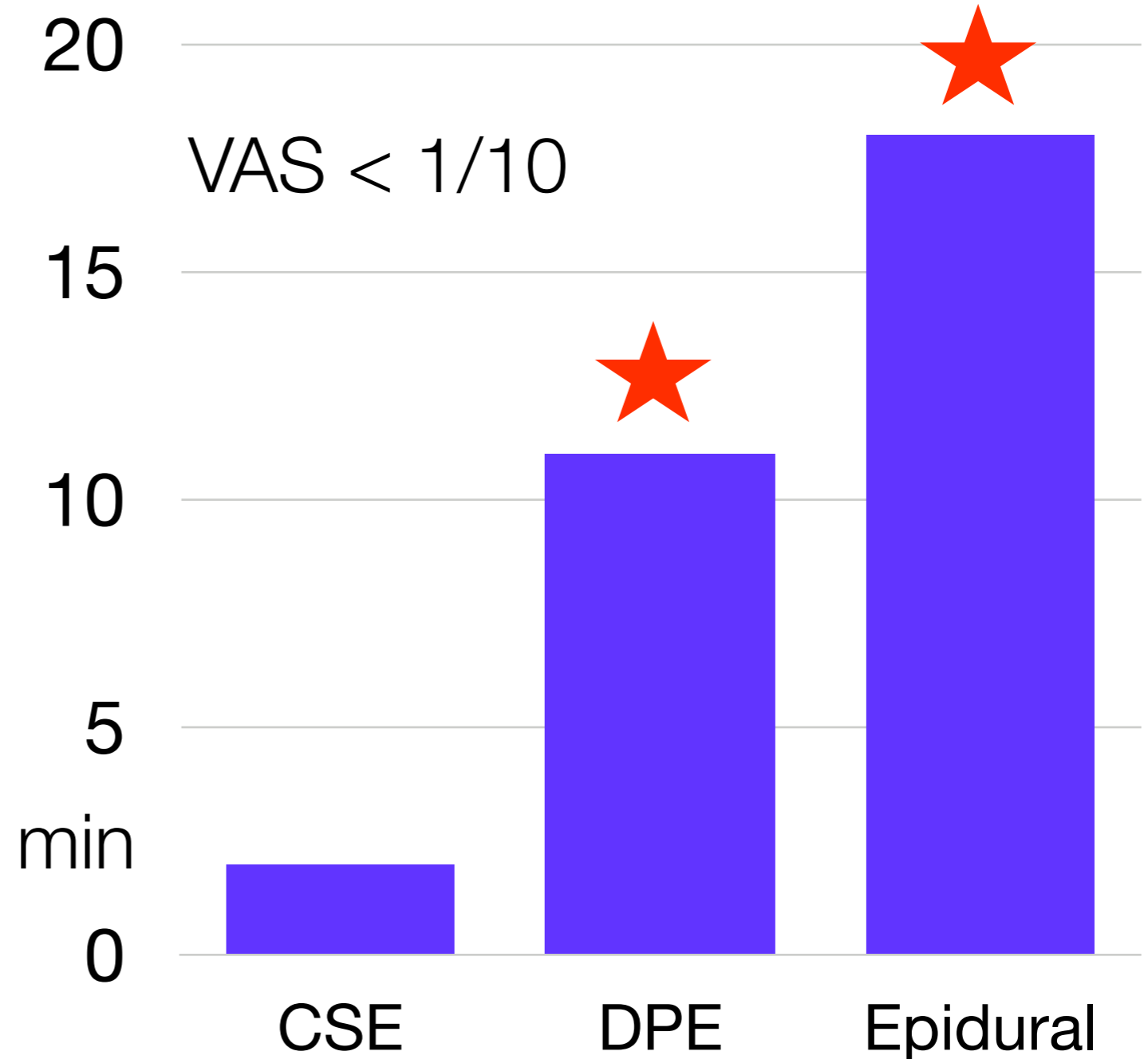
Cappiello E, O'Rourke N, Segal S, Tsen LC. Anes Analg 2008;107:1646-51

Chau A, Bibbo C, Huang CC, Elterman KG, Cappiello E, Tsen LC. Anesth Analg 2017

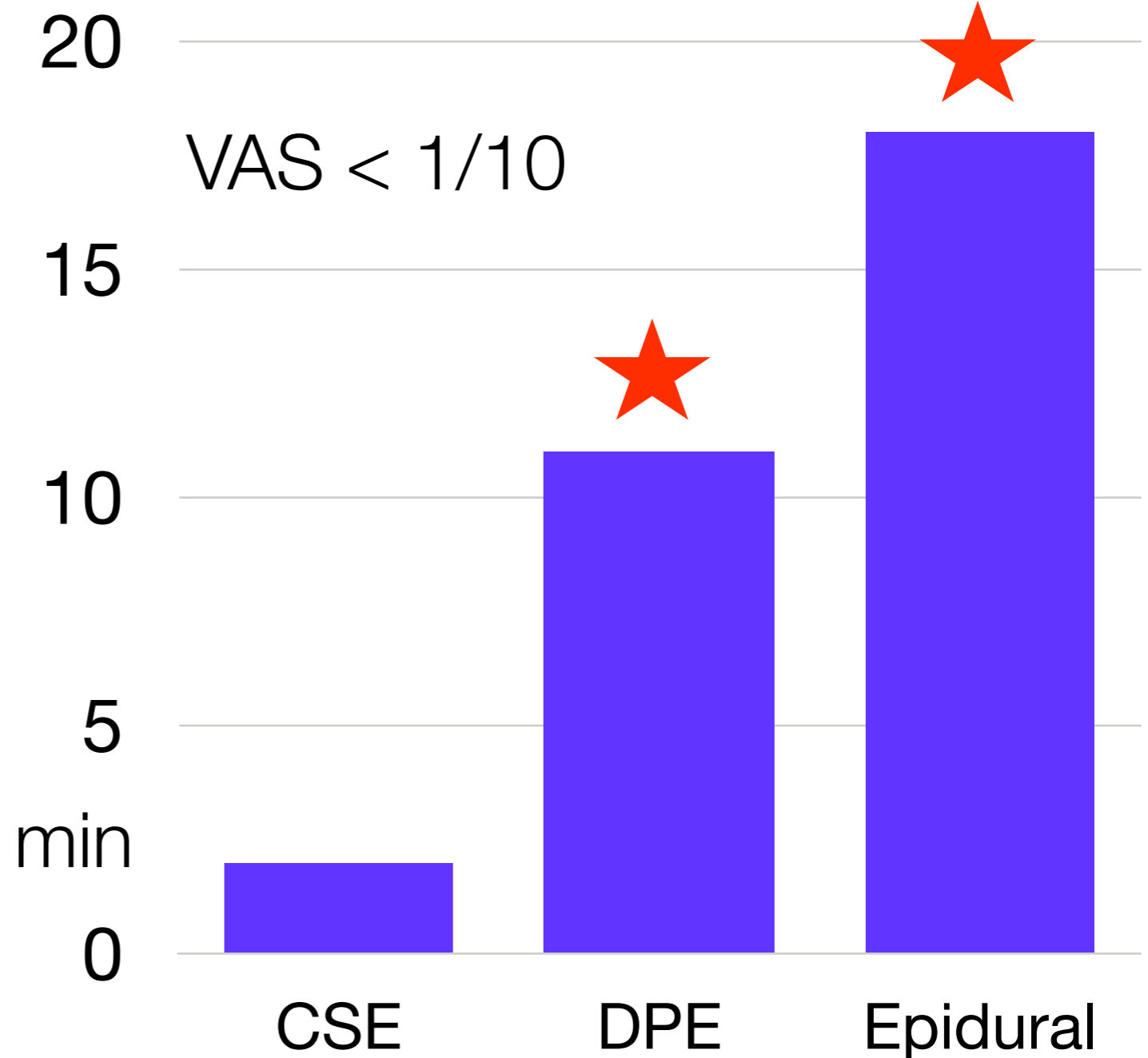
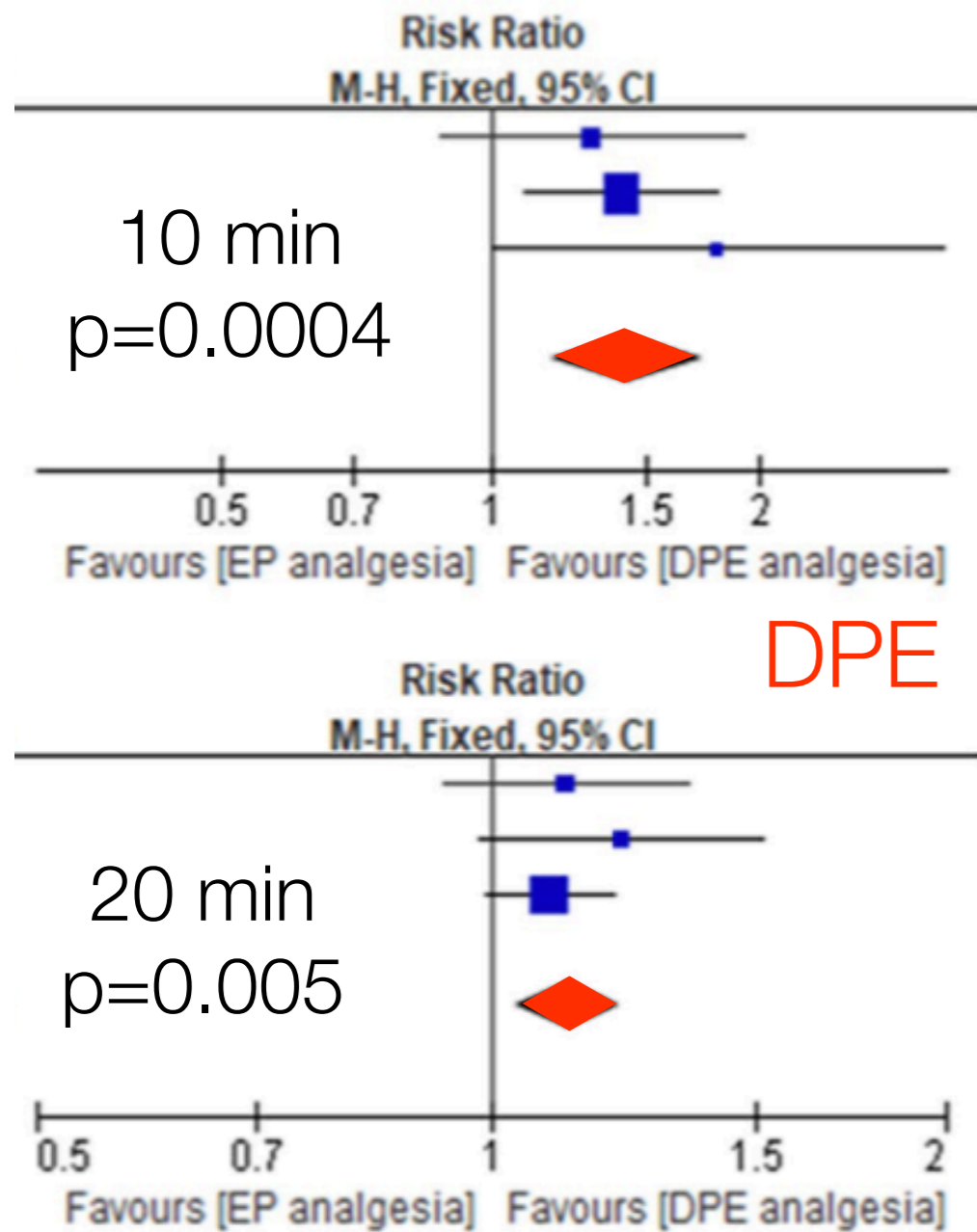
# Median Onset

Median Onset  
CSE: 3-5 min  
Epidural: 10-20 min

Thomas, Anesthesiology 2005  
Norris, IJOA 2000;9:3-6  
Eappen, IJOA 1998;7:220-5  
Nageotte NEJM  
1997;337:1715-9



# Median Onset



Yin H, Huang H. J Anesth 2022

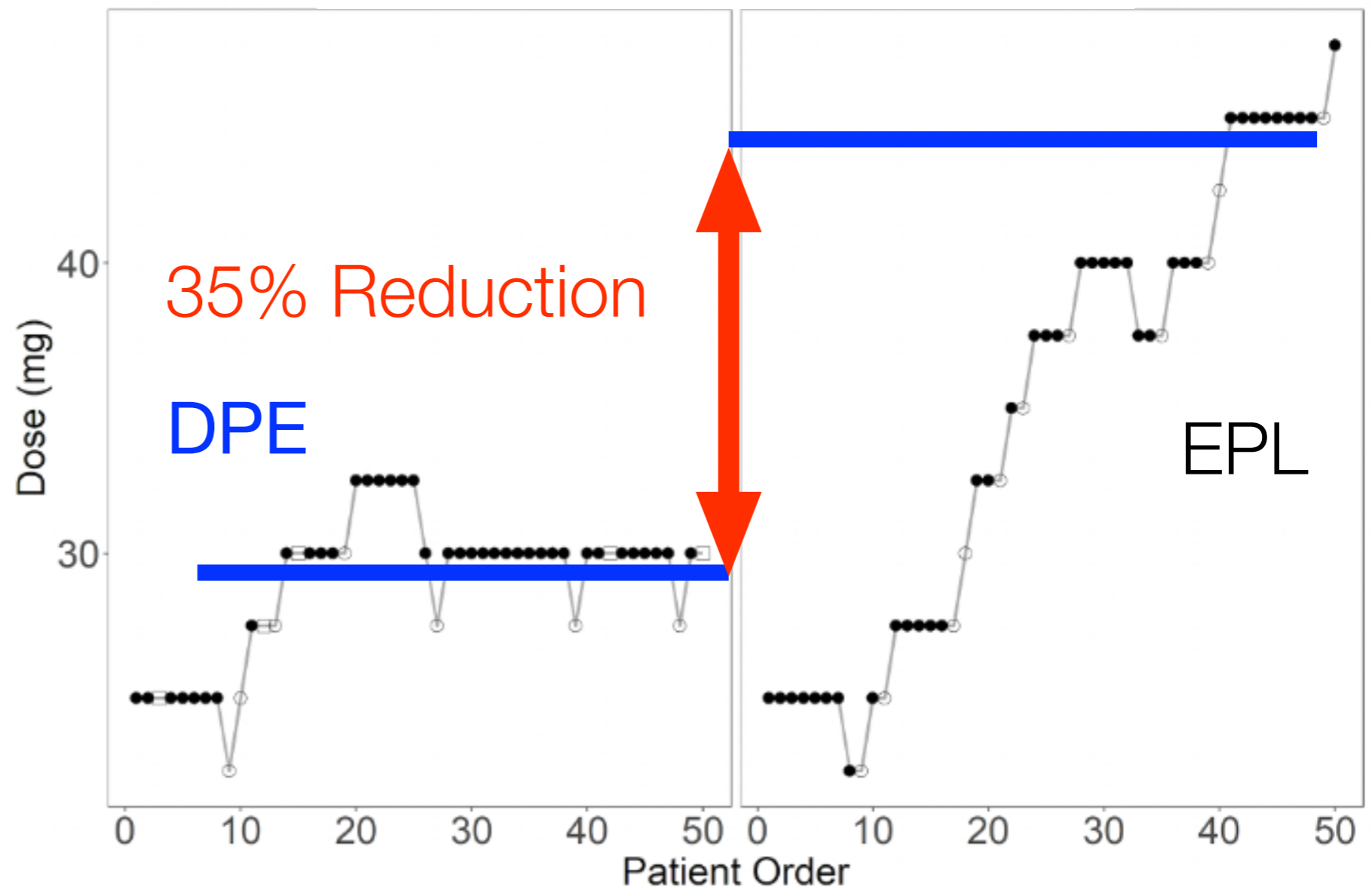
Chau A, Bibbo C, Huang CC, Elterman KG, Cappiello E, Tsen LC. Anesth Analg 2017

# Median Dose to Comfort

Bupivacaine  
Up/Down, ED90  
Sequential  
Allocation

Initial Analgesia  
DPE: 29.56 mg

EPL: 45.25 mg



# Technique Advantages

Characteristic	CSE	DPE	Epidural
Location Confirmation	X	X	
Onset	X	X	
Sacral Spread	X	X	

Cappiello E, O'Rourke N, Segal S, Tsen LC. Anes Analg 2008;107:1646-51

Chau A, Bibbo C, Huang CC, Elterman KG, Cappiello E, Tsen LC. Anesth Analg 2017

# Sacral Spread

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

## Sacral Fibers Harder to Block

Nerve Roots-Larger in Diameter, Thicker Dura Mater;  
 Spread-Farther from Epidural Catheter, Sacral Resistance



# Sacral Spread

	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

## Sacral Fibers Harder to Block

Nerve Roots-Larger in Diameter, Thicker Dura Mater;  
 Spread-Farther from Epidural Catheter, Sacral Resistance

# Technique Advantages

Characteristic	CSE	DPE	Epidural
Location Confirmation	X	X	
Onset	X	X	
Sacral Spread	X	X	
Bilateral Spread	X	X	

Cappiello E, O'Rourke N, Segal S, Tsen LC. Anes Analg 2008;107:1646-51

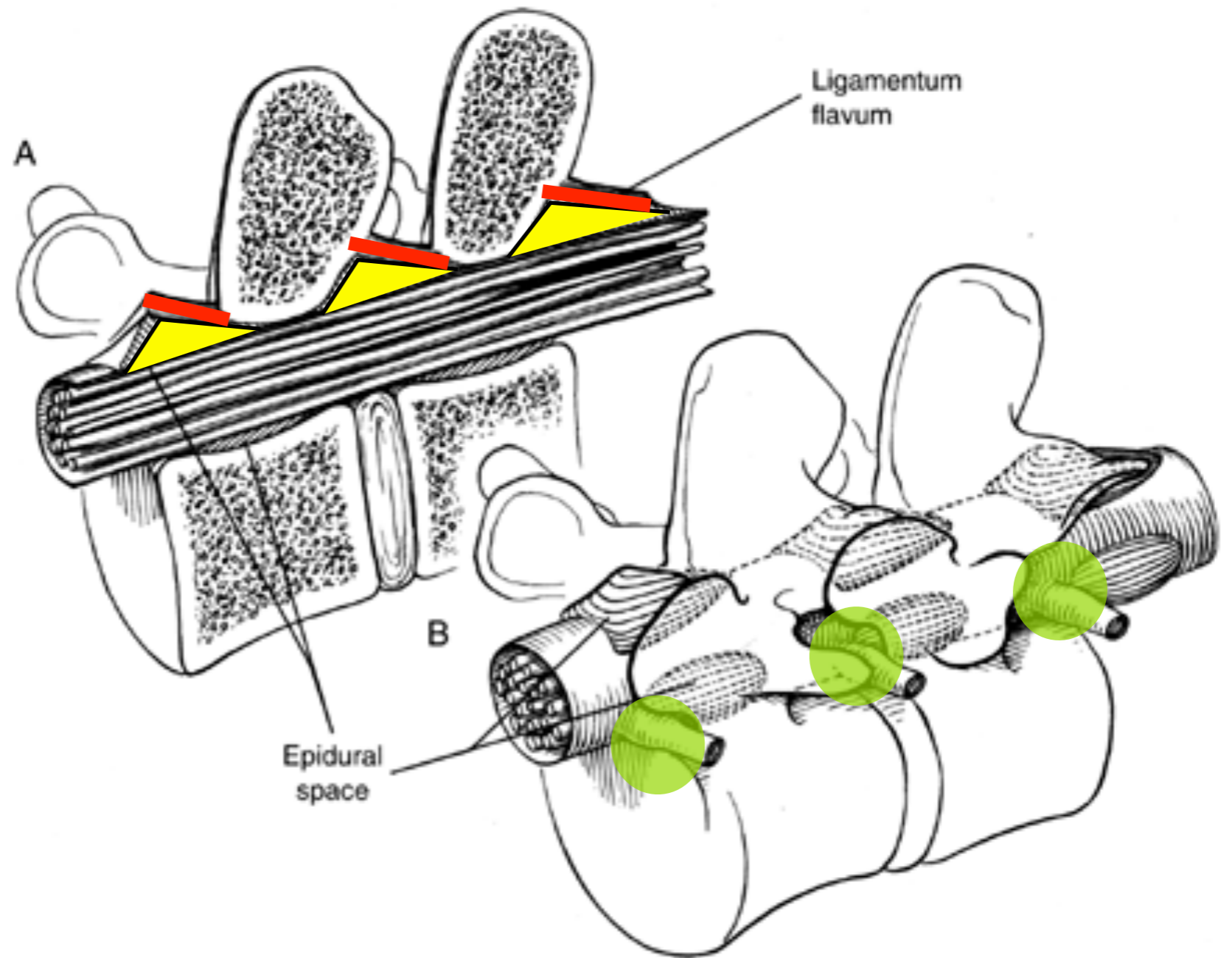
Chau A, Bibbo C, Huang CC, Elterman KG, Cappiello E, Tsen LC. Anesth Analg 2017

# Bilateral Spread

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

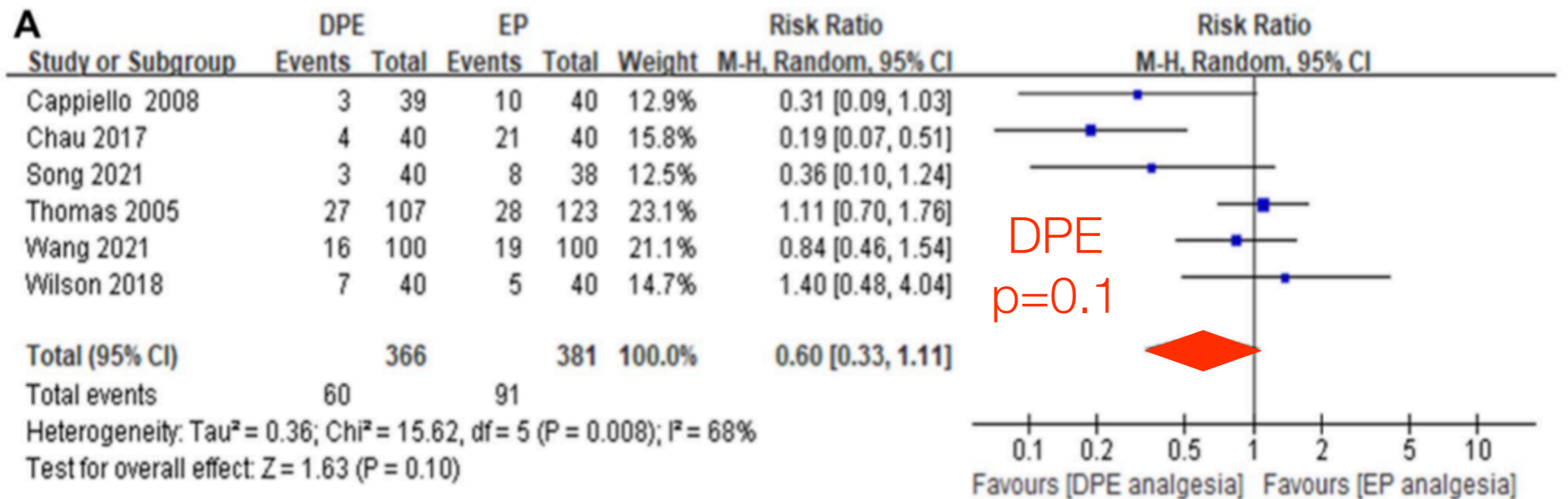
Harrison, BJA 1985;  
Blomberg, A&A 1986;  
Savolaine, Anesth  
1988; Hogan, Anesth  
1991, 1999; Collier  
Atlas Epiduralgrams

Patchy, One Sided:  
5-8%



# Bilateral Spread

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



Chau A, Bibbo C, Huang CC, Elterman KG, Cappiello E, Tsen LC. Anesth Analg 2017  
 Yin H, Tong XM, Huang H. J Anesth 2022

# Technique Advantages

Characteristic	CSE	DPE	Epidural
Location Confirmation	X	X	
Onset	X	X	
Sacral Spread	X	X	
Bilateral Spread	X	X	
Tested Catheter		X	X

Cappiello E, O'Rourke N, Segal S, Tsen LC. Anes Analg 2008;107:1646-51

Chau A, Bibbo C, Huang CC, Elterman KG, Cappiello E, Tsen LC. Anesth Analg 2017

# Tested Catheter

Failed Blocks	Epidural	CSE	DPE	Needle
Eappen n = 4240	13.1%	7.2%		25G
Norris n = 1660	1.3%	0.2%		25G
Van de Velde n = 661/2075	3.18%	1.49%		27, 29G
Thomas n = 248	9.3%	8%		27G
Booth n = 955/1440	11.6%	6.6%		27G
Berger n = 1548		9.7%	6.4%	25G

Eappen IJOA 1998; Norris IJOA 2000; Van de Velde Anaesth Intens Care 2001  
 Thomas Anesth 2005; Bauer, Tsen IJOA 2012; Booth Anesth 2016; Berger, IJOA 2022



DISADVANTAGES

# Agents

“What a **trifling difference** must often determine which should survive...and which perish”

Darwin





# Technique Disadvantages

Characteristic	CSE	DPE	Epidural
Fetal Bradycardia	X		

Cappiello E, O'Rourke N, Segal S, Tsen LC. Anes Analg 2008;107:1646-51

Chau A, Bibbo C, Huang CC, Elterman KG, Cappiello E, Tsen LC. Anesth Analg 2017

# Fetal Bradycardia

	CSE	EPIDURAL	RR	NNH
FHR abnl	7.7%	6.7%	1.17	75
FHR brady	7.3%	4.8%	1.81	28
CS FHR	6%	7.8%	0.86	-87
CS Any	17%	16.6%	1.03	208
Apgar < 7	1%	0.9%	1.17	623

Mardirosoff: Meta-analysis: 24 Trials (n=3513) Intrathecal Opioids, BJOG 2002

## Minimize Effect: Fentanyl (<50 mcg), Sufentanil (<7.5 mcg)

Van de Velde RAPM 2001, Fun Minerva Anesthesiol 2008

	CSE	DPE	EPIDURAL
FHR decelerations	52.5%	45%	42.5%
NICHD I to II	32.5%	12.5%	12.5%

National Institute of Child Health and Human Development (NICHD) Classifications  
 Chau A, Bibbo C, Huang CC, Elterman KG, Cappiello E, Tsen LC. Anesth Analg 2017

# Technique Disadvantages

Characteristic	CSE	DPE	Epidural
Fetal Bradycardia	X		
Uterine Hypertonus	X		

Cappiello E, O'Rourke N, Segal S, Tsen LC. Anes Analg 2008;107:1646-51

Chau A, Bibbo C, Huang CC, Elterman KG, Cappiello E, Tsen LC. Anesth Analg 2017

# Uterine Hypertonus

	CSE	DPE	EPIDURAL
PRE UT/HT	5 (15%)	8 (20%)	8 (20%)
POST UT/HT	18 (45%)	4 (10%)	5 (12.5%)
Tocolysis	2 (5%)	0 (0%)	1 (2.5%)

1 Hour UT/UH: Uterine Tachysystole; Uterine Hypertonus

National Institute of Child Health and Human Development (NICHD) Classifications  
Chau A, Bibbo C, Huang CC, Elterman KG, Cappiello E, Tsen LC. Anesth Analg 2017

# Technique Disadvantages

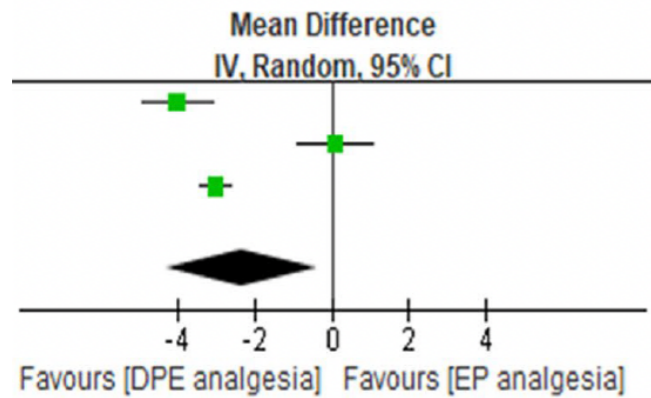
<b>Characteristic</b>	<b>CSE</b>	<b>DPE</b>	<b>Epidural</b>
Fetal Bradycardia	X		
Uterine Hypertonus	X		
Workload	X		X

Cappiello E, O'Rourke N, Segal S, Tsen LC. Anes Analg 2008;107:1646-51

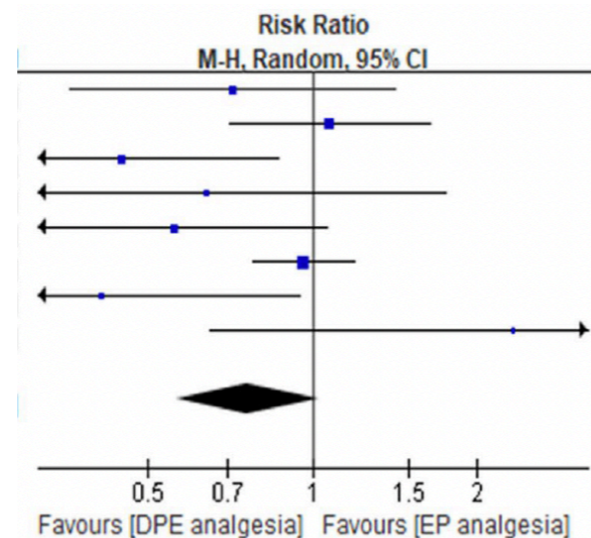
Chau A, Bibbo C, Huang CC, Elterman KG, Cappiello E, Tsen LC. Anesth Analg 2017

# Workload

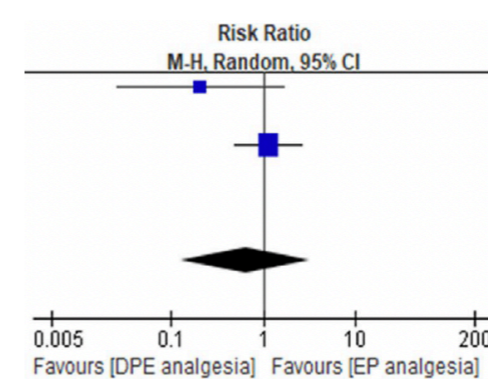
	CSE	DPE	EPIDURAL
NONE	20 (50%)	31 (77.5%)	20 (50%)
ONE or MORE	20 (50%)	9 (22.5%)	20 (50%)
TIME TO TOP-UP	132 ± 85	250 ± 163	207 ± 133



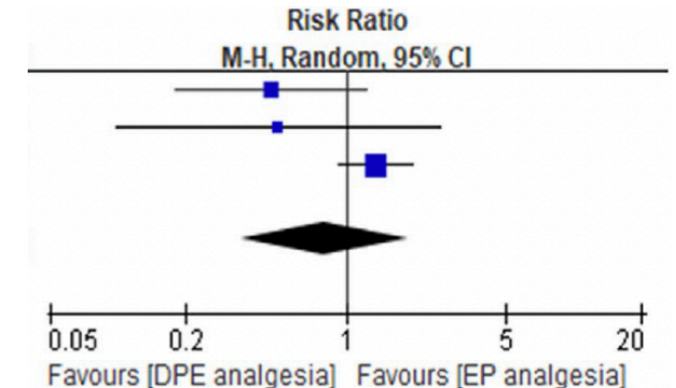
PCEA Bolus  
p = 0.02



Hand Bolus  
p = 0.07



Cath Adjust  
p = 0.61



Cath Replace  
p = 0.59

# Technique Disadvantages

Characteristic	CSE	DPE	Epidural
Fetal Bradycardia	X		
Uterine Hypertonus	X		
Workload	X		X
Adverse Events	X		
High Spinal/ Motor Block			X
PDPH			

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Chau A, Bibbo C, Huang CC, Elterman KG, Cappiello E, Tsen LC. Anesth Analg 2017

# Adverse Events

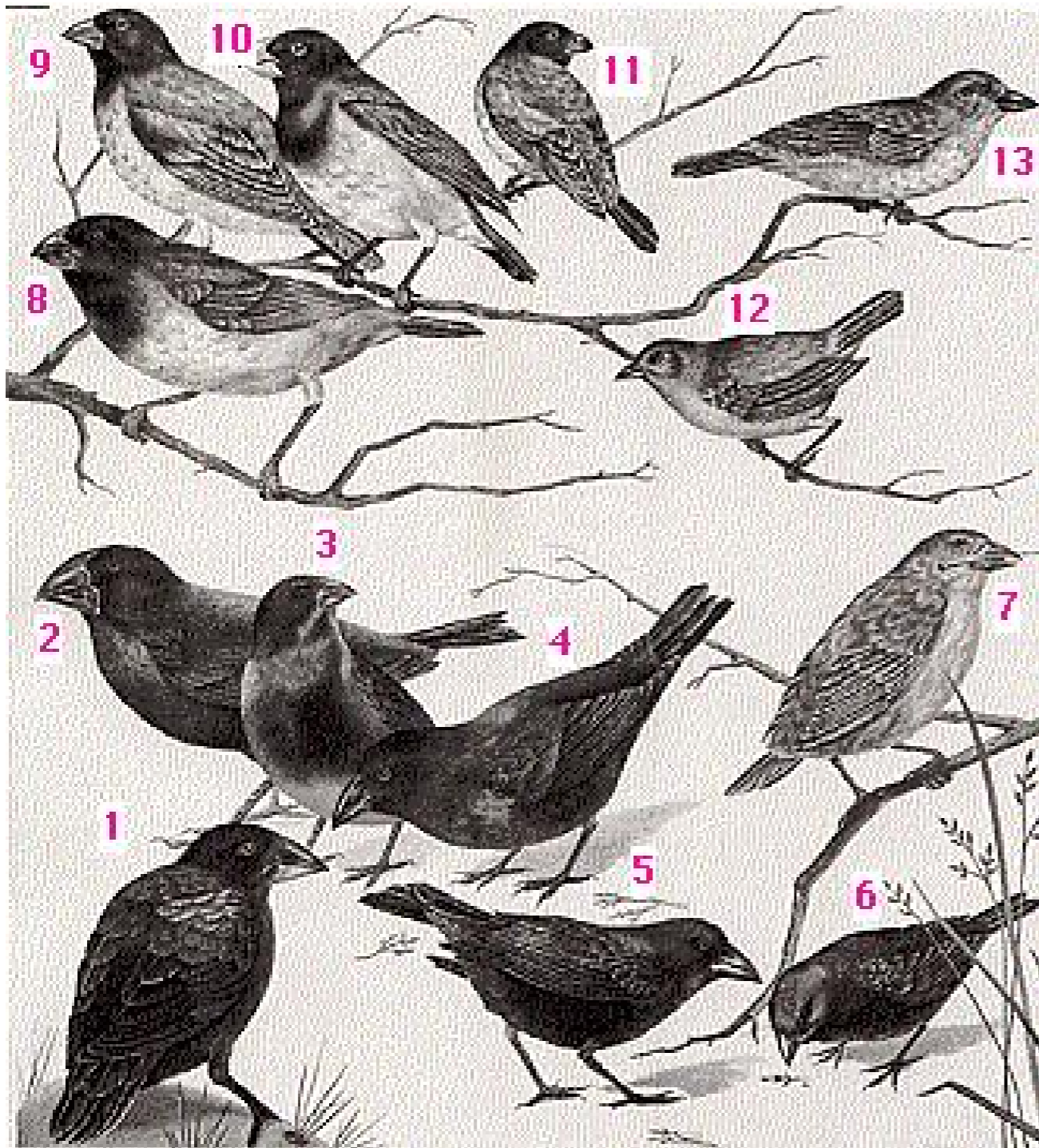
	CSE	DPE	EPIDURAL
NAUSEA	1 (2.5%)	1 (2.5%)	4 (10%)
PRURITUS	27 (67.5%)	4 (10%)	4 (10%)
HYPOTENSION	13 (32.5%)	5 (12.5%)	5 (12.5%)
HIGHEST LEVEL	T4 [T2-T6]	T4 [T2-T8]	T4 [T2-T8]
MOTOR BLOCK	3 (7.5%)	6 (15%)	15 (37.5%)
PDPH	0 (0%)	0 (0%)	0 (0%)





CONCLUSIONS

# Optimal Neuraxial Technique?

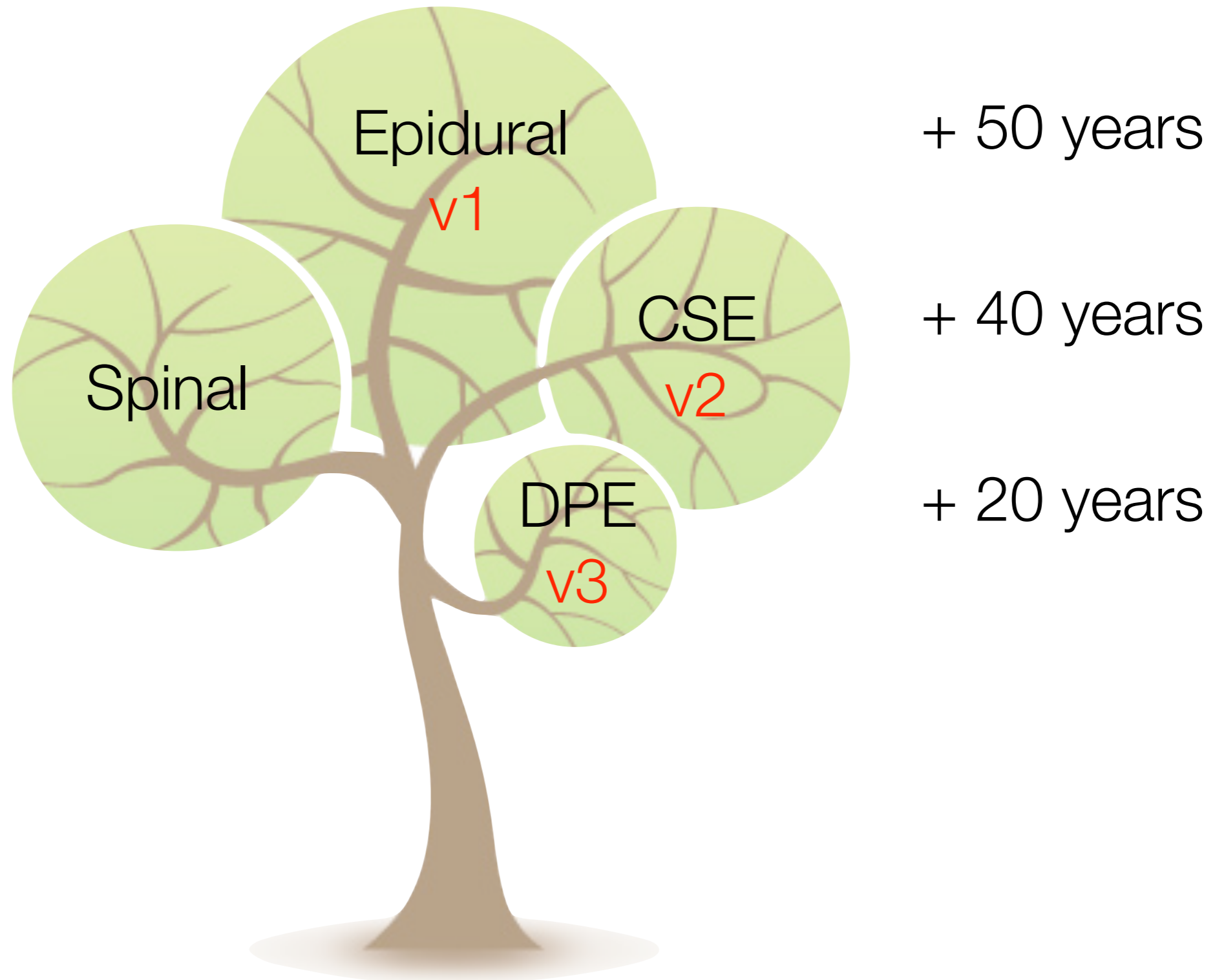


“Natural selection is daily and hourly **scrutinizing**, **rejecting** those that are bad, **preserving** all that are good”

“We see nothing of these slow **changes in progress**, until the hand of time has marked the lapse of ages” Darwin

# Neuraxial Techniques

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# Technique Disadvantages

Characteristic	CSE	DPE	Epidural
Fetal Bradycardia	X		
Uterine Hypertonus	X		
Workload	X		X
Adverse Events	X		
High Spinal Motor Blockade			X
PDPH			

Cappiello E, O'Rourke N, Segal S, Tsen LC. Anes Analg 2008;107:1646-51

Chau A, Bibbo C, Huang CC, Elterman KG, Cappiello E, Tsen LC. Anesth Analg 2017

# Technique Advantages

Characteristic	CSE	DPE	Epidural
Location Confirmation	X	X	
Onset	X	X	
Sacral Spread	X	X	
Bilateral Spread	X	X	
Tested Catheter		X	X

Cappiello E, O'Rourke N, Segal S, Tsen LC. Anes Analg 2008;107:1646-51  
 Chau A, Bibbo C, Huang CC, Elterman KG, Cappiello E, Tsen LC. Anesth Analg 2017

# The Dural Puncture Epidural (DPE)

## Technique:

Has Optimal Labor Analgesia Arrived?

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SFOAI Varmote 2023  
Skåvsjöholm

**Lawrence C. Tsen, MD**

**Director**, Center for Reproductive  
Medicine, Department of  
Anesthesiology, Perioperative & Pain  
Medicine, Brigham & Women's Hospital  
**Associate Professor** in Anaesthesia  
Harvard Medical School



Questions?

