



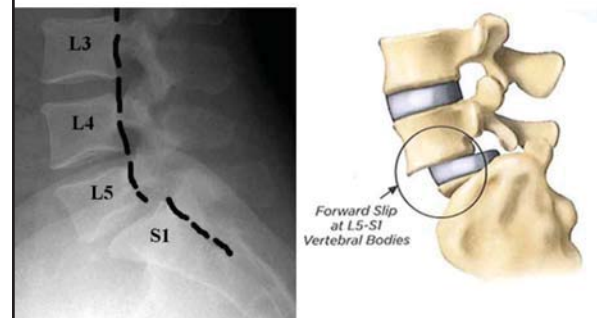
Objectives

1. Describe the needed anesthesia for a major spine case and Neuromonitoring.
2. Describe the management of a patient with chronic pain and spine surgery.
3. Describe the mechanisms and risk factors for post-operative visual loss.

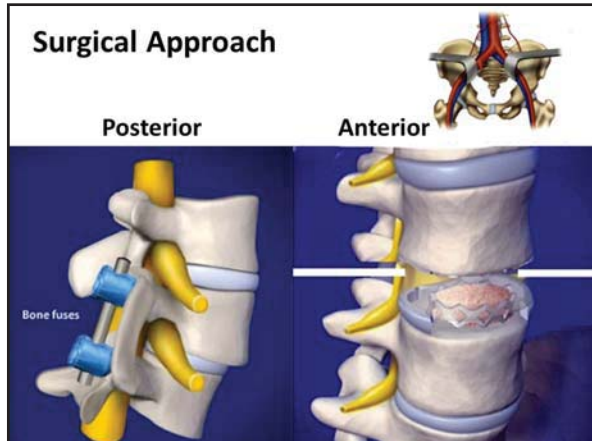
A Spine Case

- Case: 45 yr. old women with L5-S1 spondylolisthesis and severe, chronic pain presents for anterior & posterior spinal fusion.
 - Neuromonitoring is scheduled. Do I have to do a TIVA?
 - What do you mean my patient may go blind

Spondylolisthesis



Surgical Approach



Neurological Monitoring

- Vazelle “wake-up” test
- Clonus test on awakening **Which one/s should we use?**
- Electromyography (EMG)
- SomatoSensory Evoked Potentials (SSEP)
- Transcranial Motor Evoked Potentials (MEP)
- “Neurogenic” Motor Evoked Potentials
- H reflex testing

Wake-up Test

- Patient awakened during surgery. Cooperation confirmed by movement of hands on command. Spinal cord function tested by voluntary movement of legs.
- One time test at critical time. Not able to test multiple surgical maneuvers.
- Largely abandoned if MEP can be conducted.

Anesthesia implications: Muscle relaxants need to be avoided if possible. Other anesthetic effects are negligible except amplification of NMBA effects by halogenated agents if present.

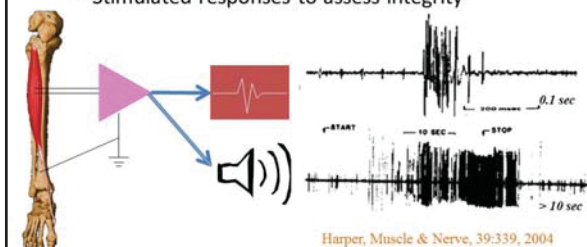
Clonus Test

- Foot flexed during awakening to see the repetitive ankle motion associated with intact spinal function.
- Window of testing during awakening when light anesthesia disconnects the cortical and brainstem influence which inhibits clonus when more awake.
- One time glimpse on awakening.

Anesthesia implications: Can be conducted with most anesthetics on awakening.

Electromyography (EMG)

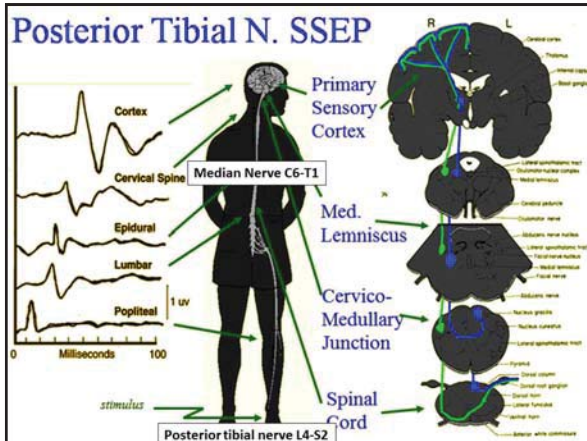
- Simple recording technology to assess nerve roots and reflex pathways
- Spontaneous activity to assess nerve stretch, etc.
- Stimulated responses to assess integrity



Electromyography

Cervical	C2, C3, C4	Trapezius, Sternocleidomastoid Spinal portion of the spinal accessory n.	L2 L3 L4 L5 S1 S2 S3 S4	
	C5, C6	Ilacus	Lumbar Plexus	
	C6, C7	Vastus lateralis/medialis	Femoral	
	C8, T1	Tibialis Anterior	Peroneal	
Thoracic	T5, T6	Gastrocnemius Lateral	Tibial	
	T7, T8	Gastrocnemius Medial	Tibial	
	T9, T10, T11	Abductor Halluces	Tibial	
	T12	External Anal Sphincter	Pudendal	
Lumbosacral	L2, L3, L4	Vastus Medialis		
	L4, L5, S1	Tibialis Anterior		
	L5, S1, S2	Gastrocnemius		
Sacral	S1, S2	Abductor hallucis		
	S2, S3, S4	External anal sphincter		

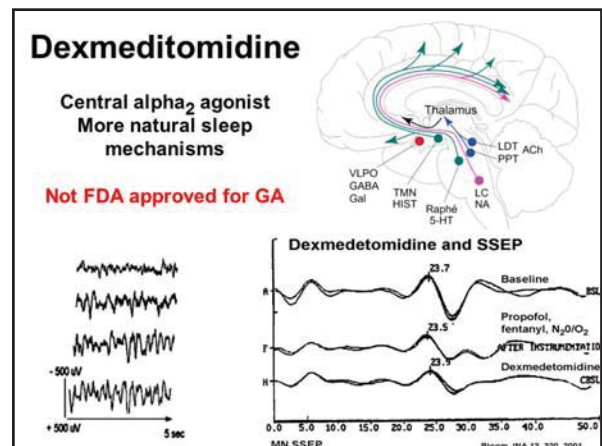
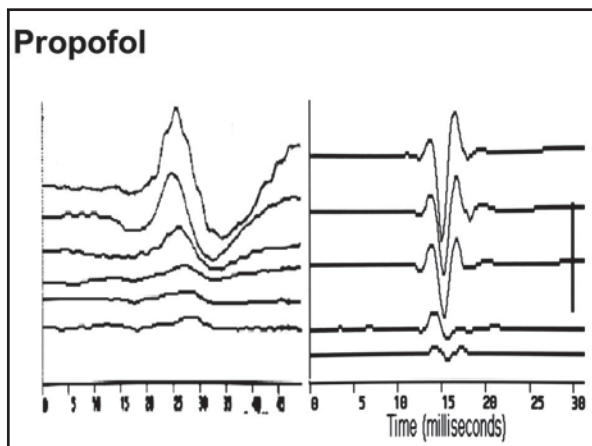
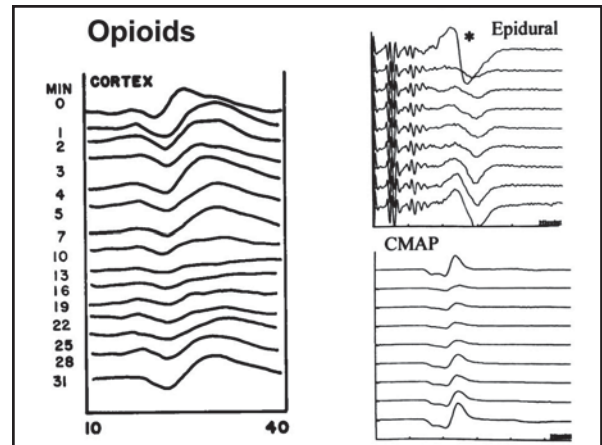
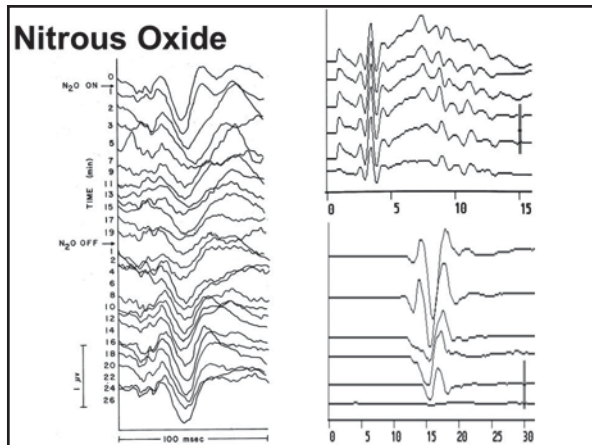
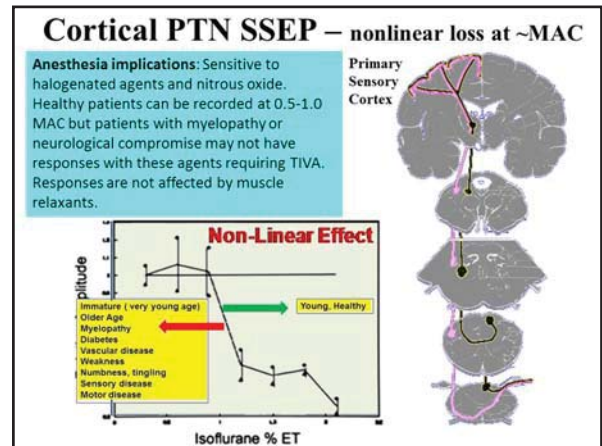
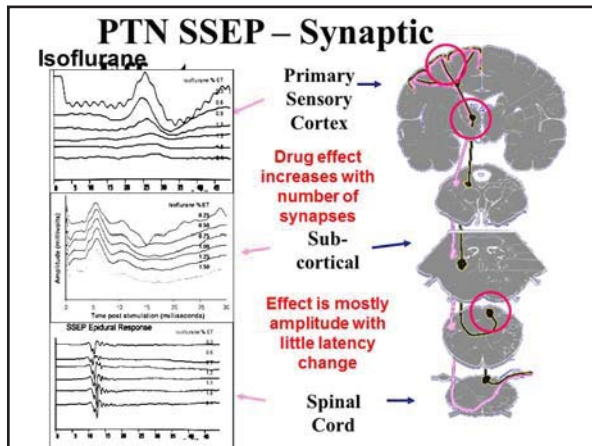
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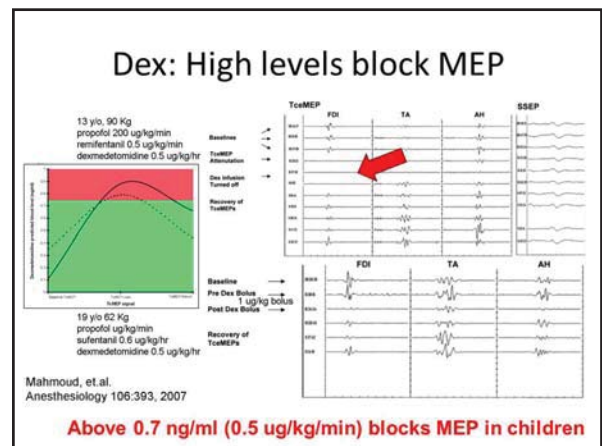
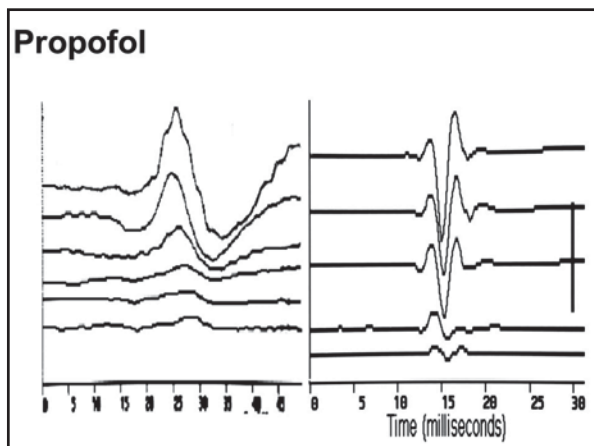
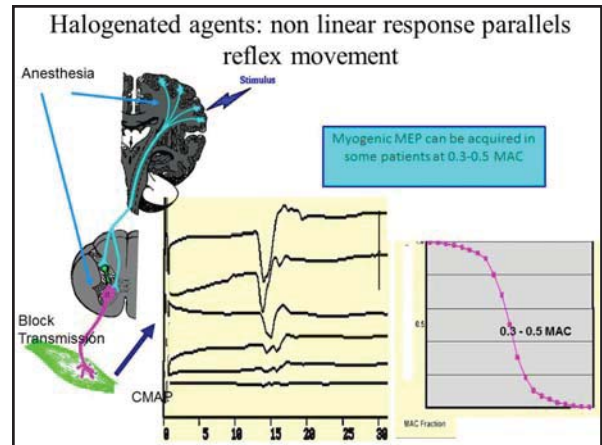
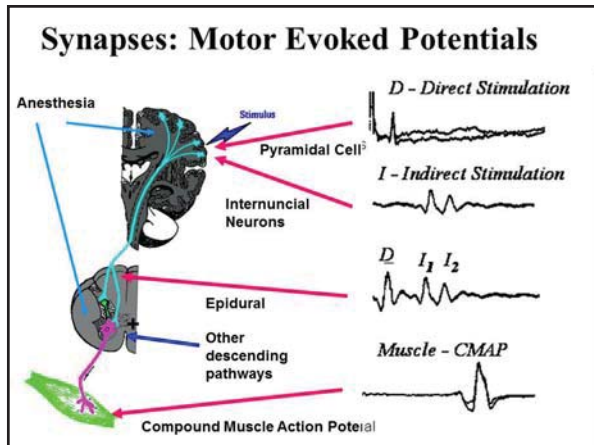
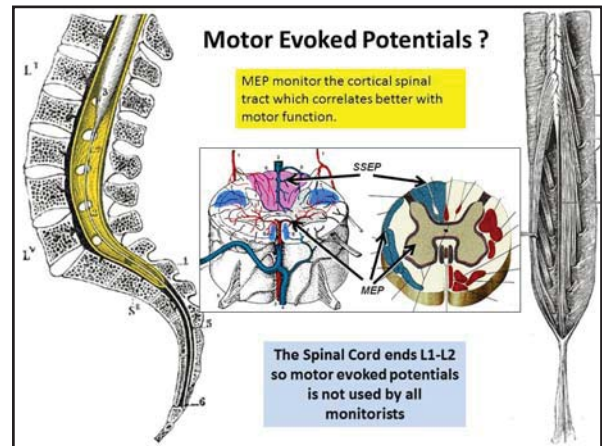
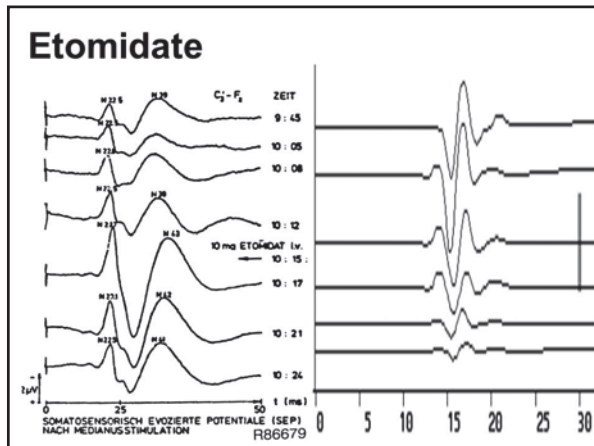


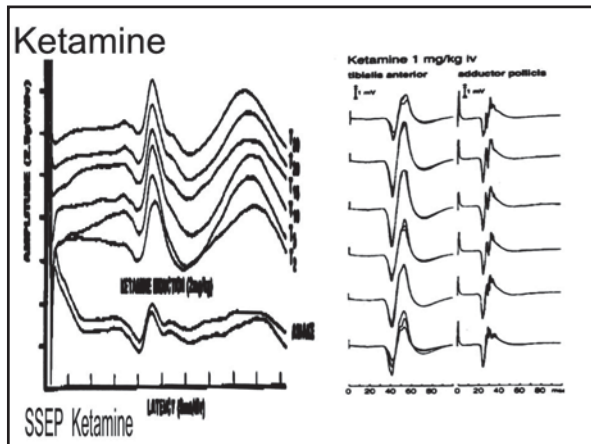
SSEP Monitoring

- Assesses posterior column spinal cord function of pathways stimulated.
 - Median Nerve C6-T1
 - Ulnar nerve C8-T1
 - Posterior tibial nerve L4-S2
 - Common peroneal nerve L4-S1
- May miss injury in component roots.
- Can be done continuously every 3-5 minutes







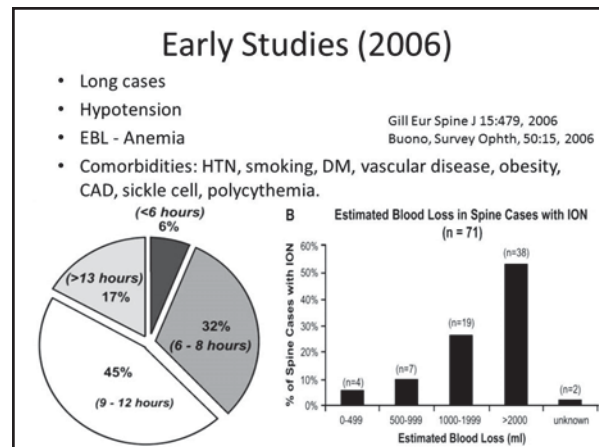
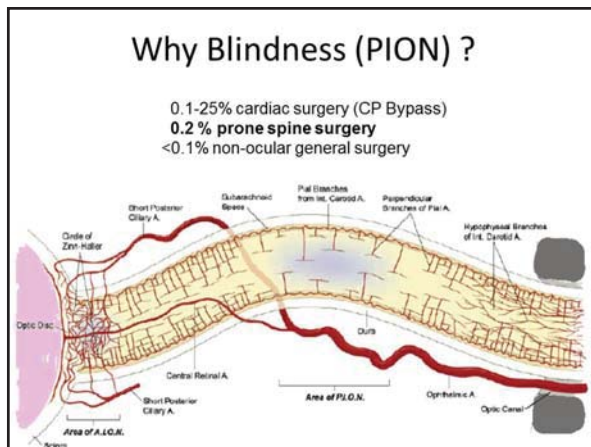


Which Anesthesia? TIVA?

If TIVA is necessary:

- What Agents?
 - Usually propofol & opioid infusions
- In light of chronic pain – What agents might be helpful?
 - [Halogenated agent]
 - [Dexmedetomidine]
 - Ketamine?
 - Lidocaine?
 - Magnesium?

What is the role of acute opioid induced hypersensitivity?



Postoperative Ischemic Optic Neuropathy

Loni A. Lee, MD,* Nancy J. Newman, MD,† Ted A. Wagner, MD,‡ Joseph R. Dettori, MPH, PhD,§ and Nathan J. Dettori, MD,§

2010: Consider Consent, Consider Head up, ? Trigger Hb 10 Consider colloids

Potential Risk Factors (See Refs. 3, 12, 16, 17, 21, 26, 27)	Suggested Preventative Measures (See Refs. 3, 12, 16, 17, 21, 26-28)
Age 45-64 yr	Avoid excessive deliberate hypotension
Anemia	Avoid large crystalloid infusions
Blood transfusion	Avoid perioperative anemia
Diabetes	Avoid perioperative hypotension
Hypotension	Colloids should be used along with crystalloid to maintain intravascular volume in patients with substantial blood loss
Prolonged surgery in the prone position	Consider reverse Trendelenburg during prone surgery
PVD	Consider staging long surgeries (>6 h)
Significant intraoperative overhydration	Raise transfusion trigger to keep HCT >30 in high-risk patients
	Maintain MAP closer to patient's baseline blood pressure
	Minimize blood loss
	Position high-risk patients with head at the level or higher than the head with the head in a neutral forward position

- Consider informing patients of risk of perioperative visual loss.
- Use direct continuous blood pressure monitoring.
- Use colloids along with crystalloids to maintain euvolemia.
- Position the head at the level of heart or higher, and in a neutral position.
- Consider staging very prolonged procedures.
- Frequent eye checks in the prone position may help prevent central retinal artery occlusion and other direct eye injuries from globe compression.

Risk Factors Associated with Ischemic Optic Neuropathy after Spinal Fusion Surgery

The Postoperative Visual Loss Study Group* Anesthesiology, V 116 • No 1 15 January 2012

Univariate Analysis of Coexisting Conditions and Perioperative Factors

Stage*	OR (95% CI)	P Value
Stage 1: Preexisting Conditions		
Male	2.58 (1.55-4.41)	<0.001
Obesity	2.16 (1.32-3.57)	0.002
Diabetes	2.20 (1.04-4.47)	0.03
Stage 2: Predetermined Procedural Factors		
Wilson Frame	4.42 (3.25-8.45)	<0.001
Stage 3: Potentially Modifiable Intraoperative Procedural Factors		
Anesthesia duration (h), OR per 1 h	1.37 (1.25-1.51)	<0.001
Estimated blood loss (l), OR per 1 l	1.43 (1.27-1.65)	<0.001
Stage 4: Potentially Modifiable Intraoperative Management Factors		
BP >40% below baseline 30 min	1.93 (1.09-3.38)	0.02
Lowest intraoperative HCT (%), OR per 5%	0.72 (0.54-0.95)	0.02
Total volume replacement (l), OR per 1 l	1.30 (1.22-1.40)	<0.001
Total nonblood replacement (l), OR per 1 l	1.49 (1.36-1.65)	<0.001
Colloid as % of nonblood replacement, OR per 5%	0.78 (0.65-0.92)	0.005

**Practice Advisory for Perioperative Visual Loss
Associated with Spine Surgery**

*An Updated Report by the American Society of
Anesthesiologists Task Force on Perioperative Visual Loss*

Anesthesiology, 116(2):274-285, February 2012

Consider:

- Position: no direct pressure on eye
- Avoid head below heart (avoid Wilson frame)
- Avoid hypotension
- Avoid anemia
- Consider colloids
- Stage long procedures