Optimizing Anesthesia for Spine Surgery:

*Can We Help Reduce Postoperative Pain?*

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**Objectives**

- Can perioperative anesthetic choices reduce acute post-operative pain?
- Can we reduce the incidence or severity of chronic post-surgical pain?

**Ketamine, Gabapentin**

**Anesthesiologist’s “Window”**

**Surgical Intervention**

- Goal: make your back feel better

Surgery is gentle
Reality

• What surgeons actually do:

Acute Pain Pathways

• Surgery activates pain receptors –
  Firing of small nerves in the periphery:
  Activity in sensory neurons or nerve roots:

  • Induces peripheral and central effects

“Wind Up”

Repeated stimulation of peripheral nerve fibers causing sensitization of the posterior horn neurons
**“Preemptive Analgesia”**

- Block or reduce afferent pain stimuli from sensitizing the spinal cord or brain:
  - Local
  - Regional anesthesia
    - Peripheral nerve blocks
    - Neuraxial blocks

**Mediators**

- Neurotransmitters / Receptors:
  - Glutamate, NMDA, NO, NK

- Inflammatory agents:
  - Interleukins
  - Cytokines

**Systemic “Preemption”**

- Certain anesthetics will interfere with the signals coming from the periphery that may “wind up” the spinal cord

- Inhaled anesthetics & propofol = poor
- Opiates = great!

**Why Not Use Lots of Opiates?**

- They are useful for balanced anesthesia
- Opiates facilitate evoked potentials

- High degree of side-effects:
  - Respiratory depression
  - Nausea, itching, ileus, delerium
Opiate Tolerance

- Opiates induce opiate tolerance !!!
  - Rapidly
  - Worse with faster onset, shorter acting agents
    - Fentanyl, Sufentanil, Remifentanil
  - Patients with existing pain – already tolerant

- Block development of tolerance
  - Limit the use of perioperative opiates

“Multimodal” Approach

- Blunt pain; limit opiates
- Many studies:
  - 1980’s: NSAIDs -- Toradol
  - 2000’s: COX-2 -- Vioxx
  - 2010’s: IV Acetaminophen ??

- Major Setback: 2009
  - Reuben (21 retractions)

Ketamine Hydrochloride

- Dissociative anesthetic
- μ-receptor agonist
- NMDA antagonist
  + Analgesia
  + Reduces tolerance
  - Hallucinations
  - Hemodynamic effects

Ketamine

Ketamine as an Adjunct to Postoperative Pain Management in Opioid Tolerant Patients After Spinal Fusions: A Prospective Randomized Trial

Urban et al. HSSJ 2008
Ketamine

Intraoperative Ketamine Reduces Perioperative Opiate Consumption in Opiate-dependent Patients with Chronic Back Pain Undergoing Back Surgery

<table>
<thead>
<tr>
<th></th>
<th>Placebo: 0.5</th>
<th>Ketamine: 0.4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preoperative*</td>
<td>0.5</td>
<td>0.4</td>
</tr>
<tr>
<td>24 Hrs Postop**</td>
<td>202</td>
<td>142</td>
</tr>
</tbody>
</table>

units: Morphine Equivalents
* mg/hr ** mg/24 hrs

Loftus, Anesthesiology 2010

Ketamine and Acute Pain

Intraoperative ketamine clearly reduces postoperative pain for a variety of procedures

Dahl, Cochrane 2006; Himmelseher, Anesthesiology 2004

GABA Analogs

- Gabapentin
- Pregabalin

- Anticonvulsants
- Neuropathic pain

Gabapentin

50 patients having laminectomy or fusion:
- SINGLE DOSE: 1200 mg oral Gabapentin
- 1 hour before surgery

Turan, Anesthesiology 2004
Gabapentin

Table 3. Morphine Consumptions (mg) in Gabapentin and Placebo Groups

<table>
<thead>
<tr>
<th>Hours</th>
<th>Gabapentin (n = 25)</th>
<th>Placebo (n = 25)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4.3 ± 1.8*</td>
<td>6.7 ± 2.1</td>
</tr>
<tr>
<td>2</td>
<td>2.7 ± 1.8*</td>
<td>5 ± 2.4</td>
</tr>
<tr>
<td>4</td>
<td>2.4 ± 1.8*</td>
<td>6.4 ± 4.3</td>
</tr>
<tr>
<td>6</td>
<td>2.4 ± 2.4*</td>
<td>6.2 ± 3.9</td>
</tr>
<tr>
<td>12</td>
<td>2.9 ± 2.3*</td>
<td>8 ± 5.1</td>
</tr>
<tr>
<td>Total morphine consumption</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Turan, Anesthesiology 2004

Gabapentin – best dose?

67 pts – Lumbar fusion
Median dose - 22 mg/kg
Effective dose: 30% reduction in morphine

100 pts – lumbar disk
0, 300, 600, 900, 1200 mg
Maximal benefit with 600 mg dose
Effective dose: 40% reduction fentanyl


Gabapentinoids

• Meta-Analysis for use in Spine Surgery:
  – 4 studies
  – ALL showed reduced narcotic need, lower pain scores, & fewer side-effects

• Other surgery:
  – Multiple reviews show benefit
  – Both gabapentin & pregabalin effective


Post-Surgical Chronic Pain

• Definition:
  – Pain lasting > 3-6 months; Different from preop

• Incidence: ~ 10% overall

• Risk Factors / Predictors:
  – “catastrophizing”
  – Fear of surgery, anxiety, depression
  – Less correlation with: surgical trauma or degree of preop pain

Gabapentin / Pregabalin

• Gabapentin decreases anxiety and “catastrophizing” when given preoperatively

Clarke Anesth. & Anal. 2013; Clarke CJA 2013

Ketamine and Chronic Pain

• Rectal Cancer
  – Placebo
  – IV ketamine
  – All with thoracic epidural

De Kock et al. Pain 2001

Ketamine for Spine

• Opiate tolerant patients
  – Equivalent preop narcotic needs
  – Intraop: Ketamine infusion vs. placebo

• 6 weeks post-op: Ketamine: 0.8 mg/hr* Control: 2.8 mg/hr*

Loftus, Anesthesiology 2010

* Morphine equivalents

UCSF Anesthetic Cocktail

• Low-dose inhaled agent (<0.3 MAC) or TIVA
• Propofol: 50 -150 mcg / kg / min
• Fentanyl: 0 - 3 mcg / kg / hr
• Lidocaine: 1.5 - 2.0 mg / kg / hr
• Ketamine: 3 - 10 mcg / kg / min
• IV Acetaminophen 1000 mg

* Consider periop gabapentin (or pregabalin)
Implementation Barriers

• Lack of Awareness

• Lack of Concern
  – Anesthesiologist: focus on OR only
  – Surgeon: chronic pain is someone else’s problem

• Lack of Collaboration
  – Preop clinic
  – Acute Pain Service

Summary

• Intraoperative Ketamine reduces postoperative pain
• Peri-operative Gabapentin / Pregabalin reduces postoperative pain
• These agents facilitate achieving other anesthetic goals with little downside
• Their use is NOT universal
• Further studies on pain and outcomes are needed