What Happens When the Blocks Wear Off?  
Strategies for Rebound Pain after Single-Shot Blocks

Faraj Abdallah, MD  University of Toronto

Outline

- Has regional anesthesia optimized post-surgical pain control?
- What are the proposed rebound pain mechanisms?
- Is there evidence of rebound pain in contemporary literature?
- What approaches are available for rebound pain?

Has RA optimized post-surgical pain control?

Original Articles

Rebound Pain Scores as a Function of Femoral Nerve Block Duration After Anterior Cruciate Ligament Reconstruction: Retrospective Analysis of a Prospective, Randomized Clinical Trial

Brian A. Willkens, M.D., M.B.A., Matthew T. Bottegol, B.S., Michael L. Kralov, M.D., James J. Jorgins, Ph.D., P.T., A.T.C., and John P. Willkens, M.D.

Reye Amrose Pain Med 2017;32:266-272

- Groups:
  - Fem cath bolus + saline infusion
  - Fem cath bolus + L.A. infusion
- Mean rebound pain scores increased by 2.0 VAS units (95% confidence interval, 1.6-2.4)

Disclaimer

- The views and opinions presented here represent those of the speaker and should not be considered advice or guidance on behalf of the organizers of this event.
- No conflicts of interest.

Where applicable:

- DexA: Dexamethasone
- DexM: Dexmedetomidine
- GA: General Anesthesia
- ISB: interscalene block
- LIA: Local infiltration analgesia
- RA: Regional Anesthesia
- s-PNB: Peripheral Nerve Block
- RCT: Randomized Controlled Trial
Rebound pain

- Concept: when s-PNB wears off, patients with such blocks have higher VAS scores than:
  - those who get a continuous block (intuitive)
  - those who do not get any blocks at all (new!)

Four years later...

- Rebound pain is a phenomenon that is independent of surgical stimuli
  - Rats received sciatic block vs. control
  - Rear paw subjected to mechanical and thermal stimuli
  - Rats with block had exaggerated pain response (hyperalgesia)

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Rebound pain theories

1. It’s lack of compliance!
   - Post-surgical pain
   - Active block
   - P.O. pain meds not taken
   - Pain ramped-up

2. It’s the memories!
   - “Barrage of stimuli” theory:
     - Sensory nerve block causes failure of pain signal transduction
     - Memories of the signals that are not transmitted are retained
     - Cross-synaptic “facilitation”
     - Amplification of signals when block wears off

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Rebound pain theories

3. It’s the block!  
Intrinsic effect of local anesthetics:  
- Oedema  
- Altered permeability  
- Aberrant conduction


Rebound pain theories

4. It’s an inflammation!  


Rebound pain theories

Opposing argument

Brief Technical Report

Thermal Hyperalgesia After Sciatic Nerve Block in Rat Is Transient and Clinically insignificant

- Thermal stimulation of rat’s hind paw after sciatic nerve block

- Exaggerated response is transient and not clinically significant

Rebound pain theories

5. Effect of local anesthetics

<table>
<thead>
<tr>
<th>Effect of local anesthetics</th>
<th>Centrally (spinal cord, dorsal horn)</th>
<th>Peripherally</th>
</tr>
</thead>
<tbody>
<tr>
<td>Centrally suppressed</td>
<td>Inhibited</td>
<td>Inhibited</td>
</tr>
<tr>
<td>Peripherally enhanced</td>
<td>Improved</td>
<td>Autoimmune</td>
</tr>
<tr>
<td>Effect</td>
<td>Anti-inflammatory</td>
<td>Increased inflammation</td>
</tr>
<tr>
<td></td>
<td>Anti-hyperalgesic</td>
<td>Increased pain sensitivity</td>
</tr>
</tbody>
</table>


Opposing argument

- Thermal stimulation of rat’s hind paw after sciatic nerve block

- Exaggerated response is transient and not clinically significant

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Accumulating evidence of rebound pain

- Rebound pain following RA is well documented in numerous RCTs:
  - Popliteal block for ankle surgery  J Orthop Trauma 2012; 26: 557-61
  - Interscalene block for shoulder surgery  Arthroscopy 2011; 27: 405-10
  - Femoral block for knee arthroplasty  Orthopedics 2012; 35: 660-4
  - Spinal block for knee arthroplasty  Br J Anaesth 2013;111: 391–9

Rebound pain following knee arthroplasty

- Spinal: No intrathecal opioids, propofol sedation + LIA
- GA: Propofol, remifentanil, Rocuronium, ET tube, IV oxycodone + LIA

Post-op: PCA morphine, slow-release oxycodone, fast-release oxycodone

Rest pain  Dynamic pain

- Superior analgesia with spinal anesthesia for 2 hrs
- Rebound pain with spinal anesthesia up to 48 hrs

Rebound pain following shoulder surgery

- Meta-analysis of 23 RCTs (1090 patients) of single-shot interscalene block (ISB)
  - Included surgical and analgesic blocks
  - Excluded:
    - Continuous ISB
    - Adjuvants were used to analgesic duration
    - Concurrent analgesic interventions (LIA, intra-articular injection)
    - Surgeries involved proximal humerus or axilla
    - Closed reduction
  - Primary outcome: rest pain severity score at 24 hours

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What Happens When the Blocks Wear Off?

• Results remained robust when potential sources of bias were explored:
  1. low-volume (< 15 mL) vs. high-volume ISB
  2. intermediate-acting vs. long-acting local anesthetics
  3. surgical vs. analgesic ISB
  4. nerve stimulator vs. US-guided
  5. multi-modal vs. uni-modal postoperative analgesia
  6. open vs. arthroscopic shoulder surgery

“Block” is consistently worse than “no block” at 24 hrs!

Variations in analgesic efficacy over time

<table>
<thead>
<tr>
<th>Time (hrs)</th>
<th>0-4 hrs</th>
<th>8-16 hrs</th>
<th>16-24 hrs</th>
<th>24-48 hrs</th>
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<tbody>
<tr>
<td>Pain level</td>
<td>Low</td>
<td>No</td>
<td>Worse</td>
<td>No</td>
</tr>
<tr>
<td>Pain score</td>
<td>No difference</td>
<td>No difference</td>
<td>Worse</td>
<td>No difference</td>
</tr>
</tbody>
</table>

Pain scores results corroborated by opioid consumption

- 0-12 hours: ISB reduces opioid consumption
- 12-24 hours: ISB has no effect

Implications

• Evidence of rebound pain:
  - In vitro trials (rats)
  - Level IA evidence
  - Retrospective data
  - Sporadic RCTs

Controverts earlier convictions

• “ISB provided effective pain control up to 24 hrs”


Conclusions

• Rebound pain is a reality; it usually occurs during the 16-24 hours postoperative interval
  - Usually at night
  - Augmenting the severity of baseline postoperative pain
  - Transition from active block to (postoperative + rebound) pain may interrupt sleep
  - May prompt an ED visit or readmission
  - May contribute to failure of ambulatory surgery
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Strategies

1. Inform your patient:
   ➢ incorporate into the block risk-benefit discussion
   ➢ Explain what to expect as part of informed consent
   ➢ emphasize the potential of rebound pain
   ➢ may occur at night
   ➢ Give your patient the choice:
     ➢ Accept block: encourage compliance with multi-modal analgesia
     ➢ Decline block: offer effective alternative strategies that are not block-dependent

Strategies

2. Consider modifying your practice:
   ➢ Procedures associated with mild-moderate pain may best be performed without blocks
   ➢ Fortify your multimodal analgesic regimen to account for absence of block
   ➢ Procedures done with s-PNB
     ➢ Use multi-modal analgesia (not block-dependent uni-modal strategies)
     ➢ Consider incorporating a limited number of tablets of long-acting opioids to cover the transition:
     
     Numbness (active block) ➤ postoperative pain + rebound pain

Strategies

3. Prolong the duration of your blocks beyond 24 hrs:

   Scenario 1: Rebound pain is a retained memory of a barrage of stimuli that has a constant magnitude regardless of time; thus prolonging block duration allows a reduction of the postoperative pain component.

   Aim: (postoperative + rebound) pain within the comfort zone

   Scenario 2: Rebound pain is an inflammatory process that resolves quickly; thus prolonging block duration serves to uncouple it from the worst postoperative pain

   Aim: (postoperative + rebound) pain within the comfort zone
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Scenario 2: rebound pain decreases with time

Strategies

3. Prolong the duration of your blocks:
   - Consider ambulatory catheters for ambulatory procedures with prolonged duration of pain with high intensity:
     - Invasive open shoulder surgeries
     - Major foot and ankle surgeries
     - Major arthroscopic shoulder surgeries
     - Knee cruciate ligament repair
   - Evidence from RCTs of continuous blocks vs. control do not report any rebound pain

Strategies

3. Consider adjuvants to prolong the analgesia of s-PNB
   - Adjuvants can prolong the duration of analgesia by at least 40-50%
   - Adjuvants possess anti-inflammatory properties; may mitigate the effect of perineural application of local anesthetic, one of the proposed mechanisms of rebound pain.
       Brummett et al. Anesthesiology 2006;100:552–61
     - DexA: An et al. Plos One DOI:10.1371/journal.pone.0123459

Thank you!