Non-Narcotic Pain Management Strategies in Post-Operative Patients

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Conflicts of Interest

The speaker has no potential or actual conflicts of interest.
Objectives

• Review current state of post-operative pain control.

• Discuss non-pharmacologic, topical, and local anesthetic pain management strategies.

• Summarize evidence for non-narcotic pain management strategies.
Patient Case

TL is a 35 y/o female who presents today for a planned abdominoplasty. Her PMH is only significant for GERD. She is very anxious about any post-operative pain that she may experience. You are preparing to discuss potential pain management strategies with TL. Which of the following strategies may help to decrease TL’s post-operative pain?

a. Acetaminophen scheduled every 6 hours for the first 24 hours post-operatively.
b. Music therapy and guided positive imagery.
c. Neuraxial anesthesia administered as an epidural.
d. All of the above.
Definition

“An unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage.”

## Types of Pain

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nociceptive</td>
<td>Signal of tissue irritation or injury that should resolve once the damaged tissues are healed.</td>
</tr>
<tr>
<td>Neuropathic</td>
<td>Nervous system injury (central or peripheral) that causes pain beyond the apparent healing of damaged tissues.</td>
</tr>
<tr>
<td>Psychogenic</td>
<td>Exaggeration of pain secondary to psychological factors.</td>
</tr>
</tbody>
</table>

Timing of Pain

**Acute Pain**
- Occurs immediately after noxious stimuli and tissue injury
- May persist for days-to-weeks
- Commonly nociceptive
- Sometimes neuropathic

**Chronic Pain**
- Pain that lasts >3 months after initial insult/injury
- May persist for months-to-years
- Commonly neuropathic
- Sometimes nociceptive

Physiology of Pain

Pain signal is transmitted into the thalamus and other parts of the brain.

The central nervous system is activated at the spinal cord.

Pain is transmitted through the peripheral nerves.

Painful stimuli activates the peripheral nervous system.

Ascending pathway

Input

Modulation

Descending pathway

Pain

Prevalence of Post-Op Pain

• ~100 million surgical procedures are performed in the U.S. each year- ~60% are conducted in ambulatory settings.

• It is reported that 80% of patients suffer from post-operative pain and over 50% have inadequate pain relief.

• In a 300 patient survey, the highest concern of respondents was pain after surgery (80%), followed by whether surgery would improve condition (62%), and full recovery after surgery (50%).

Level of Pain Intensity

Proportion (%) of Patients Reporting Pain

- Any Pain
- Slight
- Moderate
- Severe
- Extreme

After Surgery vs. After Discharge

Consequences of Uncontrolled Pain

Chronic Pain:

• Persistent post-surgical pain (PPP) definition:
  1. Develops after surgery
  2. Lasts for >2 months
  3. Other causes ruled out

• Incidence varies depending on type of procedure:
  • Knee replacement < Hernia repair < mastectomy < thoracotomy

Strategies to Prevent PPP

- NSAIDS and acetaminophen
- Peripheral nerve blocks and neuraxial anesthesia
- Gabapentinoids
- Non-pharmacologic and topical products

Multimodal approach to analgesia

Current Pain Control Practices

• In a retrospective review of 300,000 surgical patients from 380 U.S. hospitals, about 95% of patients were treated with opioids post-operatively.

• This may not align with patient preference. In a survey of 300 patients, 92% specified concerns about pain medications causing adverse effects and because of this:
  • 57% of patients preferred non-narcotic pain medications.
  • 36% of patients preferred narcotic pain medications.

Current Recommendations

Some considerations:

1. Use a validated pain assessment tool.
2. Offer a multimodal approach—variety of medications combined with non-pharmacologic interventions.
3. Oral preferred over intravenous administration.
4. Acetaminophen and/or NSAIDs should be included in the absence of contraindications.
5. Consider pre-operative celecoxib in the absence of contraindications.

Current Recommendations

More considerations:

6. Consider use of gabapentin or pregabalin as part of the multimodal approach.
7. Consider site-specific local anesthetic infiltration.
8. Peripheral and regional anesthetic techniques to be considered.
9. Neuraxial therapies should be offered to patients undergoing major thoracic/abdominal procedures.
10. Clinicians should provide education to all patients/caregivers regarding their pain treatment plan and how to taper analgesics.

The Problem with Opioids

- Constipation, nausea, bladder dysfunction
- Sedation, respiratory depression, sleep disturbances
- Hyperalgesia, tolerance, and physical dependence

Two patients receive abdominoplasties, performed by the same surgeon on the same day. Both patients are females, in their mid-to-late 50’s. Patient number 1 reports her post-operative pain to be mild at 3/10. Patient number 2 reports her pain to be the worst pain she has ever felt in her life, 10/10.

This must mean that patient number 2 is exaggerating her pain. Right?
Pain Assessment: Visual Analog Scale (VAS)

Verbal Descriptor Scale:
- No Pain: 0
- Mild Pain: 1-3
- Moderate Pain: 4-6
- Severe Pain: 7-10

Generally, opioids are reserved for moderate-to-severe pain.

Pain Management Checklist

✓ Assess the patient’s level of pain.
How to Effectively Manage Pain, with Non-Narcotic Treatment Modalities
Cognitive-Behavioral Strategies

- Non-pharmacologic modalities for pain relief
- Pain and anxiety are correlated—theory that less anxiety= less post-operative pain
- Use in combination with pharmacologic therapy
- Examples:
  - Guided imagery
  - Relaxation methods
  - Hypnosis
  - Intraoperative suggestions
  - Music therapy

Non-Pharmacologic Pain Relief

Listening to encouraging messages (intraoperative suggestions), meditating (guided imagery), and listening to calming music all have been shown to reduce patients’ post-operative discomfort.

Pain Management Checklist

✓ Assess the patient’s level of pain.
✓ Offer the patient non-pharmacologic therapy to calm anxiety and reduce pain.
Techniques of Local Anesthesia

Skin

Main nerve trunk = nerve blocks

Terminal nerve endings = infiltration

Free nerve endings = topical

Topical Anesthetic Creams

• Potential Benefits:
  • Useful in minor procedures
  • Avoid painful injection of local anesthetics
  • Minimize edema associated with injections

• Consider for:
  • Routine biopsies
  • Laser removal of hair/veins/tattoos
  • Botulinum toxin type A and filler placement
  • Minor operations

• Safety:
  • Large surface area or mucosal application increase risk of systemic absorption

# Topical Anesthetic Products

<table>
<thead>
<tr>
<th>Product</th>
<th>Composition</th>
<th>Time to Onset</th>
</tr>
</thead>
<tbody>
<tr>
<td>TAC</td>
<td>0.5% tetracaine, 1:2000 epinephrine, 11.8% cocaine</td>
<td>30 min</td>
</tr>
<tr>
<td>LET</td>
<td>0.5% tetracaine, 1:2000 epinephrine, 4% lidocaine</td>
<td>15-30 min</td>
</tr>
<tr>
<td>Topicaine</td>
<td>4% lidocaine</td>
<td>30 min</td>
</tr>
<tr>
<td>EMLA</td>
<td>2.5% lidocaine, 2.5% prilocaine</td>
<td>30 min- 2 hours</td>
</tr>
<tr>
<td>LMX 4/5</td>
<td>4% or 5% liposomal lidocaine</td>
<td>15-40 min</td>
</tr>
<tr>
<td>BLT</td>
<td>20% benzocaine, 6% lidocaine, 4% tetracaine</td>
<td>15-30 min</td>
</tr>
</tbody>
</table>

*Systemic absorption of topical anesthetics may lead to seizures, cardiac arrest, or methemoglobinemia*

Addition of Thrombin

- Using topical thrombin in addition to local anesthetics at the end of elective hand surgeries increases pain control.

Local Infiltration of Anesthesia

• **Locations:**
  • Subcutaneous, submucosal, intraarticular, wound infiltration

• **Anesthetics used:**
  • Bupivacaine, ropivacaine, lidocaine

• **Adverse effects:**
  • Transient burning, swelling, skin discoloration
  • If inadvertent systemic absorption occurs:
    • Cardiovascular: bradycardia, hypotension, arrhythmias
    • CNS: stimulation (seizures) followed by depression (coma and respiratory arrest)

Lidocaine-Infused Pain Pump

N= 690 augmentation mammoplasty and 215 abdominoplasty

Average Pain Scores at 24 hours

Breast: 2.27, 3.68
Abdomen: 2.81, 4.32

Average Hydrocodone (mg) Self-Administered at 72 hours

Breast: 26.5, 29.5
Abdomen: 49, 56.5

Liposomal Bupivacaine in Cosmetic Surgery

N= 611 (405 receiving liposomal bupivacaine) in 8 trials of patients undergoing abdominoplasty, abdominal wall reconstruction, augmentation mammaplasty, and breast reconstruction.

**Intervention:** both infiltrative and nerve block methods were studied

**Results:**
- Liposomal bupivacaine did not show any significant adverse effects.
- Generally decreased pain scores and opioid consumption.
- Two trials demonstrated decreased length of stay when compared to a standard care group.

Regional Anesthesia

**Includes:**
- Neuraxial—spinal or epidural blocks
- Peripheral nerve blocks
- Intravenous regional blocks

**Short-acting:** lidocaine, mepivacaine
**Intermediate-acting:** prilocaine
**Long-acting:** bupivacaine, ropivacaine

Most commonly used in orthopedic procedures, but may also be used in abdominal or breast surgeries.

Regional Anesthesia

Potential Complications:

- **Peripheral Nerve Blockade**
  - Nerve injury, paresthesias, systemic toxicity (altered mental status, cardiac/respiratory disturbances).
  - Bleeding or infection

- **Neuraxial Anesthesia**
  - Postdural headache, sciatic/back pain
  - Hypotension/bradycardia
  - Bleeding (spinal/epidural hematoma) or infection (spinal/epidural abscess)

Continuous Nerve Blocks: Meta Analysis

N= 603 patients from 19 trials

• Included trials comparing regional anesthesia to opioids for post-operative pain control.
• Overall, there was increased efficacy in terms of pain control and decreased adverse effects associated with the use of nerve blocks versus opioids.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Nerve Block</th>
<th>Opioids</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean VAS at 24 hours post-op</td>
<td>1.4-2.0</td>
<td>3.4-4.0</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Mean VAS at 48 hours post-op</td>
<td>0.9-1.3</td>
<td>2.2-2.6</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Mean VAS at 72 hours post-op</td>
<td>1.3-1.7</td>
<td>2.5-3.3</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Nausea/vomiting</td>
<td>20.9 %</td>
<td>48.7 %</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Sedation</td>
<td>26.7%</td>
<td>52.3%</td>
<td>&lt;0.012</td>
</tr>
<tr>
<td>Pruritus</td>
<td>9.7%</td>
<td>26.6%</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Pain Management Checklist

- Assess the patient’s level of pain.
- Offer the patient non-pharmacologic therapy to calm anxiety and reduce pain.
- Utilize local anesthesia to manage patient’s pain when feasible.
Non-Steroidal Anti-Inflammatory Drugs (NSAIDs)

Physiological Stimuli
- COX-1
  - Stomach, Kidney, Platelets, Endothelium
  - PGE2
  - TxA2
  - Physiologic functions

NSAIDs Inhibit
- Arachidonic Acid
- COX-2
  - Inflammatory sites (MPs, synoviocytes, etc)
  - Prostaglandins
  - Proteases
  - O2 Free Radicals
  - Inflammation

Inflammatory/Painful Stimuli

## NSAIDs

<table>
<thead>
<tr>
<th>Product</th>
<th>Dosing</th>
<th>Time to Onset</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ibuprofen</td>
<td>200-800 mg TID-QID (maximum 3200 mg/day)</td>
<td>30 to 60 minutes</td>
</tr>
<tr>
<td>Naproxen</td>
<td>500 mg q12 hours</td>
<td>30 to 60 minutes</td>
</tr>
<tr>
<td>Ketorolac</td>
<td>30 mg IV q6 hours (maximum 120 mg/day x5 days). Reduce dose by 50% in elderly patients.</td>
<td>30 minutes</td>
</tr>
<tr>
<td>Aspirin</td>
<td>325-650 mg every 4 hours (maximum 4 grams/day)</td>
<td>60 minutes</td>
</tr>
<tr>
<td>Diclofenac</td>
<td>50 mg q8 hours</td>
<td>15 minutes</td>
</tr>
<tr>
<td>Celecoxib</td>
<td>100-200 mg twice daily</td>
<td>3 hours</td>
</tr>
<tr>
<td>Indomethacin</td>
<td>20-40 mg q8 hours</td>
<td>30 minutes</td>
</tr>
</tbody>
</table>

NSAID Selectivity

Celecoxib, Diclofenac
- Increased risk for CV events
- Decreased risk for GI effects

Ibuprofen, Naproxen, Indomethacin
- Some risk of CV or GI effects

Ketorolac, Aspirin
- Decreased risk for CV events
- Increased risk for GI effects

COX-2 Selective
Semi-selective
COX-1 Selective

### Perioperative vs. Postoperative Celecoxib

<table>
<thead>
<tr>
<th>Group 1:</th>
<th>Group 2:</th>
<th>Group 3:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Placebo before and after surgery for 3 days</td>
<td>Placebo before surgery and celecoxib 400 mg after surgery followed by 200 mg BID x3 days</td>
<td>Celecoxib 400 mg before surgery and placebo immediately after surgery followed by celecoxib 200 mg BID x3 days</td>
</tr>
</tbody>
</table>

RCT of 128 patients undergoing major plastic surgery: breast augmentation, abdominoplasty procedures

Perioperative vs. Postoperative Celecoxib

Mg of Morphine Equivalents Used Postoperatively

Ketorolac Use in Plastic Surgery: Is it Safe?

N= 6 trials including 981 patients

**Procedures**: facial aesthetic surgery, breast augmentation, reduction, and reconstruction, miscellaneous other procedures

**Primary Endpoint**: rate of hematoma formation similar in ketorolac group compared to the control group (P=0.59).

<table>
<thead>
<tr>
<th></th>
<th>With Ketorolac:</th>
<th>Without Ketorolac</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2.5% (12 out of 483 patients)</td>
<td>2.4% (12 out of 498 patients)</td>
</tr>
</tbody>
</table>

Ibuprofen in Plastic Surgery: Meta-Analysis

N= 4 randomized controlled trials of 443 patients

**Intervention:** ibuprofen 400 mg PO every 4 hours versus control group (acetaminophen, acetaminophen/codeine, or ketorolac)

**Results:**
- No statistically significant difference in post-operative bleeding, need for rescue pain medications, or overall patient satisfaction
- Patients in the ibuprofen group had a lower pain scores on POD 0 using the VAS when compared to patients in the control group (mean difference: -6.82, p< 0.01).

Acetaminophen (APAP)

**Oral APAP**: 650 mg q4-6 hours (or 500-1000 mg q6 hours of extra strength)

**IV APAP**: 1000 mg q6 hours

**Onset**:  
Oral= 30 minutes  
IV= 5-10 minutes

**Adverse effects**: minimal

**Elimination**: cleared through the hepatic system. Overdose will cause liver toxicity!

Meta-Analysis of Paracetamol (Acetaminophen)

• 36 trials including 3896 patients being managed for acute postoperative pain

• Opioid-sparing effect??

Patients receiving propacetamol or paracetamol required 30% less opioid over 4 h and 16% less opioid over 6 h than those receiving placebo

Meta-Analysis of Paracetamol (Acetaminophen)

Pain Outcomes using Paracetamol versus Placebo

- 50% pain reduction at 4 hours: 32% (Paracetamol), 16% (Placebo)
- % of satisfied patients: 66% (Paracetamol), 54% (Placebo)
- % requiring rescue medications: 59% (Paracetamol), 77% (Placebo)

Pain Management Checklist

✓ Assess the patient’s level of pain.
✓ Offer the patient non-pharmacologic therapy to calm anxiety and reduce pain.
✓ Utilize local anesthesia to manage patient’s pain when feasible.
✓ Consider treating patient with pre- and postoperative celecoxib.
✓ Treat patient with NSAIDs and/or acetaminophen, especially those with mild-to-moderate pain.
Gabapentin/Pregabalin

**Gabapentin**: 300-1200 mg given pre-operatively or immediately following surgery

**Pregabalin (Lyrica)**: 50-150 mg given pre-operatively or immediately following surgery

**Adverse effects**: dizziness, drowsiness, ataxia, headache, peripheral edema

**Elimination**: both medications are renally cleared

- Gabapentin
  - Crosses blood-brain barrier
  - Binds nociceptive presynaptic neuron
  - Inhibits neurotransmitter release from neuron
  - Decreased neuronal hyperexcitability
  - Analgesic effect

Gabapentin and Post-op Pain

N= 1151 patients from 16 randomized controlled trials
- Most trials gave a single pre-op gabapentin 1200 mg dose, and some trials continued gabapentin for 24 hours after surgery.

Patients receiving gabapentin had increased rates of post-operative sedation.

Gabapentin group had lower pain scores (VAS) at 6 and 24 hours post-op, decreased opioid consumption at 24 hours, and less vomiting and pruritis.

Pregabalin Following Cosmetic Surgery

N= 110 women who underwent same-day cosmetic surgery were randomized to either pregabalin 75 mg every 12 hours x5 days beginning the night before surgery or placebo.

No statistically significant difference in outcomes:

- No difference in mean or median pain scores at 2, 24, 48, 72, or 96 hours post-operatively.
- No difference in amount (mg) of morphine equivalents requested or number of NSAIDs requested.
- No difference in opioid related side effects:
  - Nausea, vomiting, or somnolence

Pain Management Checklist

- Assess the patient’s level of pain.
- Offer the patient non-pharmacologic therapy to calm anxiety and reduce pain.
- Utilize local anesthesia to manage patient’s pain when feasible.
- Consider treating patient with pre- and postoperative celecoxib.
- Treat patient with NSAIDs and/or acetaminophen, especially those with mild-to-moderate pain.
- Consider using pre-operative gabapentin (and possibly post-operative).
Patient Case

TL is initiated on ibuprofen 600 mg PO every 6 hours as needed for pain. The patient reports that this adequately relieves her pain, but also reports symptoms of nausea about 1 hour after taking each dose. Which strategy is BEST for managing this problem?

a. Switch ibuprofen to acetaminophen 500 mg PO q6 hours prn pain.
b. Switch ibuprofen to hydrocodone/acetaminophen 5/325 mg PO q4 hours prn pain.
c. Switch ibuprofen to ketorolac 30 mg IVP q6 hours prn pain.
d. Any of the above are good options for TL.
Questions?