Opioid-Sparing Anesthesia Techniques: The Multimodal Wave
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Postoperative Pain Considerations

- Acute pain affects people of all ages\(^1\)
- >80% of patients report pain after surgery\(^2\)
  - 75% of these patients report moderate, severe, or extreme pain
- Postoperative pain is the primary concern of most patients prior to surgery\(^2\)
- Pain is a major component of the recovery process\(^3\)

References:
Potential Consequences of Unrelieved Acute Pain

Acute pain

- Sympathetic Activity
  - Tachycardia, Hypertension
    - $O_2$ Consumption
      - Myocardial Ischemia

- Fear, Anxiety
  - Sleeplessness, Helplessness
    - Regional Blood Flow
      - Infection, Ischemia

- Splinting, Shallow Breathing
  - Atelectasis, Hypercarbia, Hypoxia
    - Impaired Rehabilitation
      - Pneumonia

Pain Management Remains Suboptimal in the Acute Care Setting

Patients (%)

<table>
<thead>
<tr>
<th></th>
<th>Warfield 1995 (N=500)</th>
<th>Apfelbaum 2003 (N=250)</th>
<th>Gan 2014 (N=300)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any Pain</td>
<td>77</td>
<td>82</td>
<td>86</td>
</tr>
<tr>
<td>Slight</td>
<td>19</td>
<td>13</td>
<td>13</td>
</tr>
<tr>
<td>Moderate</td>
<td>49</td>
<td>47</td>
<td>45</td>
</tr>
<tr>
<td>Severe</td>
<td>23</td>
<td>21</td>
<td>23</td>
</tr>
<tr>
<td>Extreme</td>
<td>8</td>
<td>18</td>
<td>8</td>
</tr>
</tbody>
</table>

Patient is the Focus of Accountable Care¹,²

- How will hospitals successfully navigate the shift from Volume-Based to Value-Based care?

Payment of claims based on volume of care

A payment reform under which hospitals are provided financial incentives based on their performance against quality measures

Current Surgical Challenges

Preoperative  Intraoperative  Postoperative

STANDARDIZED CARE

Variability reduction is critical

Importance of Balancing Pain Management with Risk of Adverse Events

• Most post-surgical patients in one study chose less pain relief than increased/more severe side effects (N=50)

* Mental cloudiness/dizziness
Pain Management Remains Suboptimal in the Acute Care Setting

Opioids have Historically been the Foundation for Acute Pain Management

- In a 2012 research database of 1,665,418 patients, 72% of inpatients treated with IV analgesia received IV opioid monotherapy

Data from the hospital research database maintained by the Premier healthcare alliance. July 17, 2013.
Current versus ERAS

**Business as Usual**
- Avoidable readmissions
- Avoidable complications
- Unsubstantiated variation
- Current costs continue
- Current patient experience
- Current return to work

**ERAS**
- Minimized readmissions
- Minimized complications
- Evidence-based care
- Costs decreased
- ↑ satisfaction / ↓ suffering
- Increased productivity

or
Cost Per Hospital Day


Note: Costs converted to US dollars.
Pain Scores and Opioid Consumption in the United States versus Europe

- European patients reported significantly less pain on the first day after orthopedic surgery than American patients.
- A larger proportion of American patients received opioids on the first postoperative day compared to Europeans.

Multimodal Analgesia in the Era of Enhanced Recovery After Surgery

"The immediate challenge to improving the quality of surgical care is not discovering new knowledge, but rather how to integrate what we already know into practice."  

The Preoperative Piece: Prehabilitation and Education

- **Timeframe**
  - Scheduling of surgery to arrival in pre-op holding
- **Information management/Healthcare literacy/Expectation management**
- **Nutritional optimization and carbohydrate loading**
- **Exercise/ “prehabilitation”**
- **Mental health assessment**
- **As applicable, smoking cessation**
Healthcare Literacy and Patient Factors

- A third of all patients function at or below a basic level of literacy\(^1\)
- This complicates matters when these tasks are difficult\(^1\):
  - Complete intake forms
  - Follow written pre-op instructions
  - Follow written prescriptions instructions or calculate a dose
- Only 63\% of patients receive education on pain management prior to surgery\(^2\)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Any Education</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before surgery</td>
<td></td>
</tr>
<tr>
<td>Total (n=250)</td>
<td>63%</td>
</tr>
<tr>
<td>Inpatient (n=129)</td>
<td>63%</td>
</tr>
<tr>
<td>Outpatient (n=121)</td>
<td>63%</td>
</tr>
<tr>
<td>After surgery</td>
<td></td>
</tr>
<tr>
<td>Total (n=250)</td>
<td>66%</td>
</tr>
<tr>
<td>Inpatient (n=129)</td>
<td>70%</td>
</tr>
<tr>
<td>Outpatient (n=121)</td>
<td>61%</td>
</tr>
</tbody>
</table>
The Pre-op Piece: Enhanced Recovery

- Avoid N/G tubes
- Selective bowel prep
- Goal directed therapy
- Appropriate use of medications
- Use short acting anesthetics
- Avoid PONV
- Maximize use of MMA
The Intraoperative Piece: SCIP + Anesthetic Standardization

- **Timeframe**
  - Arrival in preop holding until discharge to ward

- **Surgical Care Improvement Project (SCIP) Measures**
  - Antibiotics, glucose, bladder, temperature, beta-blocker, venous thromboembolism (VTE)
Intra-op (Con’t)

Avoidance of nasogastric tubes
Selective bowel preparation
Goal-directed fluid therapy
Appropriate use of premedication
Use of short-acting anesthetics
Avoidance of post-operative vomiting
Maximize use of multimodal analgesia
The PostOperative Piece: Enhanced Recovery

- Timeframe
  - Arrival on ward until return to baseline function
- Maximize use of multimodal analgesia
- Stimulation of gut motility
- Early enteral feeding
- Early mobilization
- Early removal of drains/catheters
- Information management
  - Healthcare literacy
  - Expectation management
Opioid Monotherapy and the Shift to Multimodal Analgesia for Pain Management
Pain Scores and Opioid Consumption in the United States versus Europe

- European patients reported significantly less pain on the first day after orthopedic surgery than American patients.
- A larger proportion of American patients received opioids on the first postoperative day compared to Europeans.

Multimodal Techniques for Perioperative Pain Management

- Multimodal analgesia combines two or more analgesic agents or techniques that act by different mechanisms to provide analgesia

- American Society of Anesthesiologists (ASA) Task Force recommendations
  - Unless contraindicated, all patients should receive an around-the-clock regimen of a non-opioid agent
    - Non-steroidal anti-inflammatory drugs (NSAIDs)
    - Cyclooxygenase-2 specific drugs (COXIBs)
    - Acetaminophen
  - Consider supplemental regional anesthesia techniques

Multimodal Analgesia Sites of Action

- Multimodal analgesia combines two or more analgesic agents or techniques that act by different mechanisms to provide analgesia to optimize efficacy while minimizing risk of adverse events.

Opioids

α2-agonists

Acetaminophen

NMDA antagonists

Local anesthetics

Opioids

α2-agonists

NSAIDs

COXIBs

NMDA=N-methyl-D-aspartate.

Opioid Monotherapy vs. Multimodal Approach to Acute Pain Management

1. Aubrun et al., 2003

+++
Opioids

+++ Opioids

Severe Pain

Steps 1 & 2 and Local Anesthetic Peripheral Neural Blockade and Sustained Release Opioids

Step 3

Multi-modal Analgesia

++
Opioids

Moderate Pain

Step 2

Step 1 and Low Doses of Opioids

Step 2

Low Doses of Opioids

Step 1

Mild Pain

1. Aubrun et al., 2003

Acetaminophen, NSAIDs, or COX-2 Selective Inhibitors and Local/regional anesthesia

2. Crews 2002

3. WHO pain relief ladder

4. Ventafridda et al., 1987

5. ASA Task Force 2004

NSAIDs = non-steroidal anti-inflammatory drugs; COX-2 = cyclooxygenase-2


Multiple Organizations Recommend a Non-Opioid Foundation to Multimodal Analgesia

• **Society Recommendations**
  - American Society of Anesthesiologists (ASA)¹
  - American Society of Pain Management Nursing (ASPMN)²
  - American Society of PeriAnesthesia Nurses (ASPN)³
  - American Geriatrics Society (AGS)⁴
  - Society for Critical Care Medicine (SCCM)⁵
  - Surgical Societies (e.g., American Academy of Orthopaedic Surgeons)⁶
  - Enhanced Recovery After Surgery (ERAS) Society⁷

• **Accrediting and Quality Organizations**
  - The Joint Commission (TJC)³
  - Agency for Healthcare Research and Quality (AHRQ)³

Treatment Considerations for Implementing Multimodal Analgesia

• Base multimodal analgesia decision on:
  – Optimizing efficacy for procedure being performed\(^1,2\)
  – Side effects of individual medications\(^2\)
  – Patient factors\(^3\)
  – Type of surgery
  – Expected severity of post-op pain
  – Underlying medical conditions
  – Risk-benefit ratio for the available MMA techniques
  – Patient preferences or previous experience with pain
  – Ease of use (around-the-clock vs as-needed)\(^3\)
  – Acquisition Cost vs Global Value\(^4\)

### Types of Non-Opioids Used in Multimodal Pain Treatment Plans

<table>
<thead>
<tr>
<th>Acetaminophen</th>
<th>Alpha-2 agonists</th>
<th>Gabapentinoids</th>
</tr>
</thead>
<tbody>
<tr>
<td>acetaminophen</td>
<td>clonidine</td>
<td>gabapentinin</td>
</tr>
<tr>
<td></td>
<td>dexmedetomidine</td>
<td>pregabalin</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Local anesthetics</th>
<th>NMDA receptor antagonists</th>
<th>NSAIDs</th>
</tr>
</thead>
<tbody>
<tr>
<td>bupivacaine</td>
<td>ketamine</td>
<td>celecoxib</td>
</tr>
<tr>
<td>lidocaine</td>
<td></td>
<td>ibuprofen</td>
</tr>
<tr>
<td>liposomal bupivacaine</td>
<td></td>
<td>ketorolac</td>
</tr>
<tr>
<td></td>
<td></td>
<td>diclofenac</td>
</tr>
</tbody>
</table>

Note: The agents listed above are commonly employed in the perioperative management of acute pain. This list is not meant to be a comprehensive directory of all available analgesic agents.

NMDA = N-methyl-D-aspartate; NSAIDs = non-steroidal anti-inflammatory drugs
## Sample Protocol

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Details</th>
<th>Phase of care</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nutrition</td>
<td>Nutritional assessment, and protein containing supplement 3x/day x 5 days pre-op</td>
<td>Pre-op</td>
</tr>
<tr>
<td>CHO Loading</td>
<td>Gatorade/juice on morning of surgery</td>
<td>Pre-op</td>
</tr>
<tr>
<td>Strength</td>
<td>Incentive spirometry for 1 week prior to surgery, increase exercise daily x 2 weeks</td>
<td>Pre-op</td>
</tr>
<tr>
<td>Bowel Prep</td>
<td>Standardized for all surgeons doing similar procedure (mechanical/antibiotic)</td>
<td>Pre-op</td>
</tr>
<tr>
<td>Premeds</td>
<td>Avoid sedatives in patients &gt;70 or with dementia/confusion</td>
<td>Pre-op</td>
</tr>
</tbody>
</table>
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<tr>
<th>Intervention</th>
<th>Details</th>
<th>Phase of care</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Goal Directed Fluid Therapy</strong></td>
<td>• IV Fluids on pump throughout case</td>
<td>Intra-Op</td>
</tr>
<tr>
<td></td>
<td>• Consider SVV/PPV monitoring for specific high-risk patients</td>
<td></td>
</tr>
<tr>
<td><strong>Anesthetic Optimization</strong></td>
<td>• Use short-acting anesthetics (avoid volatile agents)</td>
<td>Intra-Op</td>
</tr>
<tr>
<td></td>
<td>• Ketamine infusion (0.5 mg/kg for induction, followed by 0.10-0.15 me/kg/hr)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• IV lidocaine infusion (1.0-1.5mg/kg with induction followed by 1-2mg/kg/hr until emergence)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Propofol infusion (dose as needed for induction, the 50-150 mic/kg/min)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Use N₂O as needed</td>
<td></td>
</tr>
</tbody>
</table>
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<thead>
<tr>
<th>Intervention</th>
<th>Details</th>
<th>Phase of Care</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multimodal Analgesia</td>
<td>· Thoracic epidurals for all scheduled open procedures</td>
<td>Pre/Intra/Post-Op</td>
</tr>
<tr>
<td></td>
<td>· Infiltrate all wounds</td>
<td></td>
</tr>
<tr>
<td></td>
<td>· Gabapentin 600mg preop, then 300mg TID for 3d (not PRN)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>· Ketamine 0.5mg/kg IV with induction of anesthesia</td>
<td></td>
</tr>
<tr>
<td></td>
<td>· Ketorolac 30mg IV in OR, then 15mg q6hr for 3d (not PRN)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>· Acetaminophen 1000mg IV in OR, then IV or po q6hr for 3d (not PRN)</td>
<td></td>
</tr>
<tr>
<td>Glycemic Control</td>
<td>· Check HgbA1C on all patients 3d prior to surgery. Cancel if level is &gt;9%.</td>
<td>Pre/Intra/Post-Op</td>
</tr>
<tr>
<td></td>
<td>· If elevated in non-diabetics: Check glucose on morning of surgery, Treat as you would a Type-2 patient</td>
<td></td>
</tr>
<tr>
<td></td>
<td>· Continue glycemic control throughout perioperative period</td>
<td></td>
</tr>
<tr>
<td>Education &amp; Expectation Management</td>
<td>· All patients taught by ARNP with friend/family</td>
<td>Pre/Intra/Post-Op</td>
</tr>
<tr>
<td></td>
<td>· Appropriately written patient education brochure provided</td>
<td></td>
</tr>
</tbody>
</table>
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<thead>
<tr>
<th>Intervention</th>
<th>Details</th>
<th>Phase of Care</th>
</tr>
</thead>
</table>
| Nausea and Vomiting Control           | • 1 risk factor: ondansetron 4mg prior to induction. 2 risk factors: Dexamethasone 4mg with induction. 3 risk factors: Scopolamine patch prior to surgery OR diphenhydramine 25mg OR droperidol 0.625mg OR metoclopramide 10mg. 4 risk factors: Add from the list above.  
• Postoperative prophylaxis with ondansetron 4mg q6hr x 24hr (*not* PRN)  
• Patients encouraged to chew gum for nausea treatment ad lib | Intra/Post-Op  |
| Early Removal of Tubes and Catheters  | • Nasogastric tubes avoided unless patients have active bowel obstruction  
• Bladder catheters to be removed as soon as possible  
• Avoid use of invasive drains for most procedures | Intra/Post-Op  |
<table>
<thead>
<tr>
<th>Intervention</th>
<th>Details</th>
<th>Phase of Care</th>
</tr>
</thead>
</table>
| Early Feeding and Bowel Stimulation | • Clear liquids on evening of surgery  
• Gum chewing encouraged after their surgery  
• Regular/full diet day after their surgery | Post-Op       |
| Early Mobilization and Conditioning | • Patients with weakness or instability or patients over 70 receive PT consult  
• Out of bed to chair on evening of surgery  
• Walk 20min 4x/d starting on POD 1  
• Sit in chair 6-8 hours a day  
• limb and breathing exercises per hour while awake | Post-Op       |
Implementation Strategies

**IDENTIFY**
- surgeon, anesthesia, nursing, and admin champion

**GATHER**
- local data on length of stay, re-admits/revisits, SSI, Satisfaction and variability

**TARGET**
- long length of stay/high complication procedures
  - Colorectal surgery, esophagectomy, cystectomy, pancreatectomy, hepatic resection, spine

**GENERATE**
- protocol

**COLLECT**
- analyze/re-analyze data/massage protocol

**PLAN**
- before face-to-face kickoff meeting (the most time intensive)

**MONITOR**
- and measure daily for first few months

**FOLLOW-UP**
- weekly

TEAM WORK is key