The Importance of Optimal Anesthesia

State of Pain
Effective Analgesia in the midst of the Opioid Crisis

The Problem: Opioid Crisis

Death toll:
National Opioid Overdose Epidemic

- Drug overdose is the leading cause of accidental death in the US, with 52,404 lethal drug overdoses in 2015.
- Opioid addiction is driving this epidemic
  - 20,101 overdose deaths related to prescription pain relievers
  - 12,990 overdose deaths related to heroin in 2015.
Making of the Crisis
- 1999-2008: Overdose death rates, sales and substance use disorder treatment admissions related to prescription pain relievers increased in parallel.
- Overdose death rate in 2008 was nearly 4x 1999
- Sales of prescription pain relievers in 2010 were 4x those in 1999
- In 2012, 250 million opioid prescriptions written
  - Enough to give every American adult their own bottle of pills.

Origins...
- 1990’s- Pain as “5th Vital Sign”
  - Joint Commission, AMA
    - Recent retractions
  - Patient satisfaction surveys
    - Press Ganey/HCAHPS
  - Patient expectations

The Problem: Perioperative
- Post op Respiratory Depression
  - ASA Closed Claims 1990-2009
    - Of 357 Acute Pain Claims, 92 result of opioid related RD
    - Vast majority within 24hr of surgery, 97% percent judged preventable
  - Inadequate Analgesia/hyperalgesia
  - Stress response
  - Postop ileus, infection, patient experience, cost
Toss the opioids?

Stress Response to Surgery
- Pain
- Catabolism
- Immuno-dysfunction
- Ileus
- Increased Cardiac Demand
- Fatigue/Sleep disturbance
- Altered Fluid Homeostasis

Stress Response to Surgery
- Preventive Measures
  - Minimally Invasive Surgery
  - Afferent Nerve Blockade
  - Fluid/Carbohydrate Optimization
  - Multimodal Analgesia
  - Glucocorticoids, Beta Blockade
  - Normothermia
Enhanced Recovery After Surgery: Acceleration of Positive Outcomes

Our Impact
- Engage and educate colleagues
  - Acute Pain Council, BREATHE, ERAS
- Discuss plan and manage expectations
  - New patient education
- Minimize intraoperative opioid and stress response
  - ERAS, multimodal, regional
- Reduce need for postoperative opioid

Enhanced Recovery after Surgery (ERAS)
- Preoperative preparation
  - Prehab, Education, Diet
- Day of Surgery Preop/Holding
  - Water/Gatorade up to 2hrs preop
  - PO Medications
- Intraoperative
  - Regional/Neuraxial Anesth/analgesia
  - IV Induction/analgesics
  - Anti-emetic
  - Goal-Directed Fluid Therapy
- Postoperative
  - Early Clear liquids and ambulation
  - Minimal Opioid

"C'mon, c'mon—it's either one or the other."
Multimodal Analgesia

- GETA vs Neuraxial
- Regional Analgesia
  - TAP Block, Adductor Canal, Brachial Plexus Blocks
- PO Analgesics
  - Celecoxib: selective COX II
  - Gabapentinoinds: Neurontin, Lyrica
  - Acetaminophen
- IV Analgesic
  - Opioids: traditional, methadone
  - NMDA Antagonist: ketamine
  - Lidocaine
  - Alpha-2 Agonists: Dexmedetomidine, Clonidine

Anesthetic Selection

- General Anesthetic
- Neuraxial Anesthetic
  - Spinal Anesthetic
  - Epidural
- Regional/Spinal with Sedation
Regional Analgesia

- **TAP Block**
  - Gynecologic
  - Colorectal
  - Abdominal

Regional Analgesia

- **Adductor Canal**
  - Equianalgesic
  - Quad-Sparing

Regional Analgesia

- **Brachial Plexus**
  - Inter-scalene
  - Supraclavicular
  - Infra-Clavicular
PO Analgesics

- Celebrex
  - Selective COX-II inhibition
  - Ortho and Gyn
- Gabapentinoids
  - Lyrica
  - Gabapentin
- Acetaminophen/Combo

IV Analgesics

- Opioids:
  - Traditional
  - Methadone: mixed receptor
- NMDA Antagonist: Dissociation, analgesic, anti-hyperalgesic
  - Ketamine: Bolus/infusion
- Lidocaine: Analgesic, anti-hyperalgesic, anti-inflammatory
  - Bolus 1.5-3 mg/kg, Infusion 1.5mg/kg/hr
- Alpha 2 Agonists:
  - Dexmedetomidine
  - Clonidine

Taming the Tiger

- History of ketamine
- 50th anniversary in 2014
- Phencyclidine Derivative
  - 1960's: UMich
- Floating in outer space, "disconnected"
  - Dissociative Anesthetic
- Vietnam: safe but abused
Ketamine Basics

- NMDA receptor Antagonist
  - Alpha t1/2 7 min, Beta t1/2 2-4hr
- Dissociative Anesthetic, Antinoiceptive
- Potent Analgesic
  - NMDA/Opioid receptors, descending inhibition
- 1987: prevents wind-up response/hyperalgesia
  - Very effective in chronic pain syndromes
    - neuralgias/neuropathy, migraine, burns, fibromyalgia, CRPS, palliative care
    - Reduced opioids, chronic pain at 6 months
- Anti-inflammatory
- Antidepressant
  - Rapid effect, reduces suicidal ideation

A Tame Tiger?

- Problems
  - Mimics schizophrenia
- Emergence Delirium
- Adjuncts
  - GABA Agonists
- Turn it down!!
  - ASRA 2016 - spine surgery, high risk
  - Postop ketamine infusion (max 0.25mg/kg/hr)
  - 16% incidence CNS excitation, 35/37 resolved after ketamine stopped.

Ketamine Protocol

- All patients will be monitored according to opioid monitoring guidelines- q4hr: RR, BP, pain and sedation levels.
- Initial bolus dosing is 10–15 mg IVP, MR
- Initiate infusion at 5 mg/h. Max dose is 0.4 mg/kg per hour. Dose titration by APMS physicians or nurses.
Coming soon to BSW...

- The RN may administer Low Dose Ketamine as mono or adjunctive analgesic therapy by continuous IV infusion, with a starting rate of 0.1 mg/kg/hour (ideal body weight).
- Dose may be escalated every 60 min by 0.1 mg/kg/hour to a max dose of 0.4 mg/kg/hour.
- In critical care settings (emergency department, intensive care unit, post-anesthesia care unit), the RN may administer an off-pump IV loading dose of 0.1-0.2 mg/kg over 5-10 minutes prior to the initiation of the IV infusion.

Perioperative Lidocaine Infusion

Amide Local Anesthetic
Benefits
- Reduced pain, nausea, ileus duration, opioid requirement and LOS
Mechanism
- Reduced opioids
- Effect exceeded infusion by 8.5hr (5.5x half life)

Lidocaine Mechanism

- Na channel blockade?
  - only block small proportion of neuronal channels
- PMN do not express Na channel
  - Surgery: pro/anti-inflammatory effects
  - Lido blocks priming of PMN (G Protein)
  - Priming results in increased cytokines, ROS → endothelial damage, organ injury
- Blocks excitatory response in spinal cord
Lidocaine in Lap Colectomy
- 1.5mg/kg bolus, 2mg/kg intraop, 1.33mg/kg 24hr postop,
- Benefit observed despite NSAID/Acet
- Pain scores improved more during activity
- Reduced Sevo requirements
- Plasma concentration similar to Epidural Infusion - well below toxic after 24 hr
- Toxicity (rare): tinnitus, perioral numbness, dysrhythmias

Consensus on PONV
- General incidence of Vomiting 30%
- Incidence of Nausea 50%
- PONV up to 80% among high risk

Risk Factors: The Evidence

<table>
<thead>
<tr>
<th>Evidence</th>
<th>Risk factors</th>
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<tbody>
<tr>
<td>Positive overall</td>
<td>Female sex (B1), History of PONV or motion sickness (B1), Non-smoking (B1), Younger age (B1), General versus regional anesthesia (A1), Use of volatile anesthetics and nitrous oxide (A3), Postoperative opioids (A1), Duration of anesthesia (B1), Type of surgery (cholecystectomy, laparoscopic, gynecological) (B1), ASA physical status (B1), Menstrual cycle (B1), Level of anesthesiologist's experience (B1), Muscle relaxant antagonists (A2), BMI (B1), Anxiety (B1), Nausea on rise (A1), Supplemental oxygen (A1), Perioperative fasting (A2), Magnesium (B1)</td>
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<tr>
<td>Conflicting</td>
<td>ASA physical status (B1), Menstrual cycle (B1), Level of anesthesiologist's experience (B1), Muscle relaxant antagonists (A2), BMI (B1), Anxiety (B1), Nausea on rise (A1), Supplemental oxygen (A1), Perioperative fasting (A2), Magnesium (B1)</td>
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</tbody>
</table>
| Disproved or of limited clinical relevance | PONV = postoperative nausea and vomiting, BMI = body mass index, MG = medication guidelines. Note: An evidence level from A to C
Enhanced Recovery After Surgery: Acceleration of Positive Outcomes

Risk Score

Risk factors:
- Female gender
- Non-smoker
- History of PDW
- Postoperative opioids

Risk Score Points:
- Female gender: 1
- Non-smoker: 1
- History of PDW: 1
- Postoperative opioids: 1

Risk Score Formula:
Risk Score = Sum of Points

Reduce Baseline Risk

1. Avoidance of general anesthesia by the use of regional anesthesia (A1)
2. Use of propofol for induction and maintenance of anesthesia (A1)
3. Avoidance of nitrous oxide (A1)
4. Avoidance of volatile anesthetics (A2)
5. Minimization of intraoperative and postoperative opioids (A2)
6. Adequate hydration (A1)

GA = general anesthesia.

Table 3: Strategies to Reduce Baseline Risk
Enhanced Recovery After Surgery: Acceleration of Positive Outcomes

Pain and Patient Satisfaction
- Laparoscopic vs Open Colorectal Surgery
- Higher with pain scores open-
  - Increase ambulation, spinal duration
  - 78% reduction in opioid use
  - Higher Press Ganey
    - Pt satisfaction increased from 43rd to 98th percentile despite higher pain scores
- Critical role of nursing

LOS for Colorectal Patients vs Entire Hospital

Financial Impact
- Mean direct cost decreased by $7,129 per patient
- Compared to Mayo Clinic ERAS $1,039/pt
- Length of Stay decreased
- Hospital throughput: 261 patient-days in course of 6 month study
  - 47 additional admits
Enhanced Recovery After Surgery: Acceleration of Positive Outcomes

**CDC Opioid Guidelines**
- Long-term opioid use often begins with treatment of acute pain.
- Lowest effective dose and quantity needed
  - Three days or less will often be sufficient; more than seven days will rarely be needed.
- Evaluate benefits and harms with patients within 1 to 4 weeks of starting opioid therapy for chronic pain or of dose escalation, then every at least every 3 months.
- Taper or discontinue if harms outweigh benefits

**CDC Opioid Guidelines**
- When starting opioid therapy for chronic pain:
  - Prescribe immediate-release opioids instead of extended-release/long-acting (ER/LA) opioids.
  - Always prescribe lowest effective dose
  - Cliffs:
    - Risk increases at ≥50 morphine milligram equivalents (MME)/day
    - Avoid increasing dosage to ≥90 MME/day or carefully justify a decision to titrate dosage to ≥90 MME/day.

**Our Impact**
- Discuss plan and manage expectation
- Minimize intraoperative opioid and stress response
  - ERAS, multimodal, regional
- Reduce need for postoperative opioid
- Continue educating patients and colleagues
References