Surgical Foundations Lecture Series

Perioperative Pain Management

Oct 30, 2018

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Disclosures

• None
Outline

• Patient Cases
• Why treat pain?
• Pain Assessment
• Methods to Treat Pain
  – Multimodal Analgesia
  – Medications
  – Regional Anesthesia
• Management of Side Effects
• Challenges
• Warning Signs
• Overdose Management
• Acute Pain Service

Case 1

• 85 year old female
  – Laparotomy for bowel resection
  – PMH: CAD, previous MI, renal insufficiency

• What are your options for perioperative pain management?

• Any treatments/Rx to avoid?
Case 2

• 60 year old with Crohn’s disease
  – for laproscopic bowel resection
  – PMH: Chronic leg pain from previous MVA

• How are you going to manage his pain?

• POD#2, the patient has an significant increase in leg pain – what do you do?

Why Treat Perioperative Pain?

• ↓ pain and suffering
• ↓ complications
• ↓ likelihood of chronic pain development
• ↑ patient satisfaction
• ↑ speed of recovery → ↓ length of stay → ↓ cost
• ↑ productivity and quality of life
Adverse Effects of Poor Pain Management

- Cardiovascular
- Respiratory
- Gastrointestinal / Genitourinary
- Neuroendocrine / Metabolic
- Musculoskeletal
- Immunological
- Psychological

Consequences of Poor Pain Control

- Increased suffering, decreased Quality of Life
- Increased development of chronic pain
- Associated with:
  - Pulmonary complications
  - Thromboembolic events
  - Increased length of stay / slower to mobilize
- Delirium
- PTSD

(Abou-Setta AM et al, 2011)
(White J, et al, 2011)
(Chong C, et al, 2010)
Barriers to Effective Pain Management

- Inadequate pain education
- Inadequate assessment
- Underestimation of analgesic requirements
- Failure to recognize patient variability
- Concern that pain may mask injury
- Fear of causing side-effects (S/E)
- Single modality therapy
- Inadequate resources

Pain Assessment

- Recall from Medical School
  - O – Onset
  - P – Provoking / Palliating factors
  - Q – Quality / Quantity
  - R – Radiation
  - S – Severity
  - T – Timing
Pain Assessment

• Origin(s) of Pain
  – Acute Pain
    • ie. Incisional pain, acute appendicitis
  – Chronic Pain
    • ie. Chronic back pain
  – Acute on Chronic Pain
    • Acute and chronic causes may or may not be related to each other

Pain Assessment – Visual Analogue Scale
Pain Assessment

• Current Pain Medications
  – Accuracy and detail very important!
  • Name, dose, frequency, route
  • ie. Oxycontin 10mg TID po
  – Don’t forget to re-order or factor in patient’s pre-existing pain Rx usage when writing orders

• Conflicts with HPI / PMH
  – ie. Renal disease → avoid morphine
  – ie. NPO → avoid oral forms of medication

Pain Assessment

• Allergies / Intolerances
  – Drug allergies
  • Document drug and adverse reaction
  – Intolerances
  • ie. nausea / vomiting, hallucinations, disorientation, etc
Methods to Treat Pain

• Pharmacologic
  – Medications (po, iv, im, sc, pr, transdermal)
    • NSAIDs
    • Acetaminophen
    • Opioids
    • Gabapentin
  – Procedures
    • Regional Anesthesia
    • Local Anesthetic infiltration

• Surgical Intervention

(po = oral, iv = intravenous, im = intramuscular, sc = subcutaneous, pr = rectal)

Methods to Treat Pain

• Non-pharmacologic
  – Cognitive behavioural therapy (CBT)
  – Massage
  – Exercise
  – Acupuncture
  – Thermal
  – Transcutaneous electrical nerve stimulation (TENS)
  – Traction
  – Orthoses
Multimodal Analgesia

• Using more than one drug:
  – Acting at different places or with different mechanism
  – Each with a lower dose than if used alone

• Provides better analgesia with less side effects
  – eg. Acetaminophen + NSAID + Opioid + Regional

• Always consider multimodal analgesia when treating pain

WHO Analgesic Ladder
Acetaminophen

- First line treatment for pain
- Mechanism: thought to inhibit prostaglandin synthesis in CNS → analgesia, antipyretic
- Only available in po form (in North America)
- Typical dose: 650 to 1000 mg q6h po
- Max dose: 4 g / 24 hrs from all sources
- Warning: ↓ dose / avoid in those with liver damage (ie. EtOH)

NSAIDs

- First-line treatment, has ceiling effect
- Mechanism
  - Block cyclooxygenase (COX) enzyme → ↓ prostaglandin synthesis
  - COX-2 → Prostaglandins → pain, inflammation, fever
  - COX-1 → Prostaglandins → gastric protection, hemostasis, renal function
- Ibuprofen 400 mg q6h po
- Celecoxib 200mg BID po
NSAIDs

- Warnings: ↓dose / avoid if patients with
  - GI ulceration
  - Bleeding issues or disorders, platelet problems
  - Renal and hepatic dysfunction
  - Cardiac risk
  - Asthma
  - Bone healing issues
  - Allergy
    - Avoid celecoxib if allergic to Sulpha based Rx

Opioids - Pros

- Rapid Onset
- IV & PO
- Works systemically, treats almost all types of pain
- Easily administered
- Antidote*
Opioids – Cons (side effects)

- Decreased LOC
- Respiratory Depression
- Hypotension and Vasodilation
- Nausea/Vomiting
- Higher intensity monitoring
- Immunosuppression
- Pruritus
- Ileus/Constipation
- Urinary Retention
- Tolerance
- Addiction

Opioids

- Morphine
  - Most commonly prescribed opioid in hospital
  - Metabolism:
    - Conjugation with glucuronic acid in liver and kidney
      - Morphine-3-glucuronide (inactive)
      - Morphine-6-glucuronide (active)
    - Impaired morphine glucuronide elimination in renal failure
      - Prolonged ventilatory depression with small doses
      - Due to metabolite buildup (morphine-6-glucuronide)
Opioids

- **Hydromorphone (Dilaudid)**
  - Better tolerated by elderly, better S/E profile
  - Preferred over morphine for renal disease patients
  - Low cost, IV and PO forms

- **Oxycodone**
  - Good S/E profile, but $$
  - PO form only
  - Percocet (oxycodone + acetaminophen)

Opioids

- **Fentanyl**
  - Potent, short acting opioid
  - IV form must be given in a monitored setting, with resuscitation equipment available
    - ie. OR, PACU, ICU
  - Transdermal (patch) form
    - Patch takes 48-72hrs for effect
    - Allows for constant background level of analgesia
Opioids – poorer choices

- **Codeine**
  - Metabolized into morphine by body
  - ↓ analgesia with ↑ S/E as dose increases
  - Ineffective in 10% of Caucasian patients

- **Meperidine (Demerol)**
  - Neurotoxic metabolite (normeperidine)
  - Avoid in renal disease

Opioids - Formulations

- **Short acting forms**
  - Need to be dosed frequently to maintain consistent analgesia

- **Controlled Release forms**
  - Provides more consistent steady state level
  - Helpful for severe pain or chronic pain situations
  - Never crush / split / chew controlled release pills
Opioids – Patient Controlled Analgesia

- Allows patient to reach their own minimum effective analgesic concentration (MEAC)
- Rapid titration (ie. Morphine 1mg q5 min)
- Better analgesia and less side effects than IM prn
- Locus of Control
### Opioid Equianalgesic Table

<table>
<thead>
<tr>
<th>Drug</th>
<th>Equianalgesic Dose</th>
<th>Initial Adult Dose (&gt;50kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morphine</td>
<td>IV/SC/IM 10 mg</td>
<td>Oral 20-30 mg 2-10 mg q4h</td>
</tr>
<tr>
<td></td>
<td>Hydromorphone 1.5 mg</td>
<td>Oral 4-7.5 mg 0.5-2 mg q4h</td>
</tr>
<tr>
<td>Oxycodone</td>
<td>N/A 10-20 mg</td>
<td>N/A 5-10 mg q4h</td>
</tr>
</tbody>
</table>

**In General:**
- Conversion from IV to oral for morphine/hydromorphone is about x3
- Hydromorphone is about 5x more potent than Morphine on per mg basis
- Oxycodone is about 2x more potent than Morphine on per mg basis

### Gabapentin

- Anti-epileptic drug, also useful in:
  - Neuropathic pain
  - Postherpetic neuralgia
  - Complex Regional Pain Syndrome (CRPS)
- Additive effect with NSAIDs
- Reduces opioid consumption by 16-67%
- Reduces opioid related side effects
- Improved functional recovery
- Drowsiness if dose increased too fast
Ketamine

- Mechanism: NMDA receptor antagonist
- Potent analgesic
- Hallucinations
- Secretions
- Increased sympathetic activity (Inc HR/BP, bronchodilation)
- Increases ICP

Other Adjuncts

- Other adjuncts may be used in specific situations:
  - Pregabalin (similar to gabapentin)
  - Amitriptyline
  - Nabilone
  - Butrans patch (buprenorphine)
Management of Side Effects

• Nausea / Vomitting
  – Ondansetron
  – Dimenhydrinate (Gravol)
  – Metoclopramide
  – Nabilone
  – Low dose Haloperidol (Haldol)

• Pruritus
  – Diphenhydramine (Benadryl)
  – Nalbuphine (Nubain)

Regional Anesthesia

• Involves blockade of nerve impulses using local anesthetics (LA)
• LA bind sodium channels preventing propagation of action potentials along nerves
• Wide variety of LA with different characteristics:
  – ie. Lidocaine – fast onset, short duration of action
  – ie. Bupivicaine (Marcaine) – slow onset, longer duration of action
Regional Anesthesia - Pros

• Intense, specific analgesia
• Decreased sedation
• Minimal side-effects
• Outlasts systemic analgesics
• Potential decreased LOS
• Potential reduced chronic pain/PTSD
• Potential blockade of neuroendocrine stress response

Regional Anesthesia - Cons

• Technical skill
• Procedural Risks
• LAST
• Prolonged block requires catheter
• Consent
Acute Pain to Chronic Pain

- 44% had trauma related chronic pain 3 yrs later
- Have more PTSD, anxiety, depression, disability, absence from work
- 50-80% of traumatic amputees suffer from phantom limb pain
- Evidence of regional catheters decreasing incidence of chronic pain

Hip Fracture Trauma
Hip Fracture Population

- Elderly
  - Limited End-Organ Reserve
  - Potential for Cognitive Impairment
    - Delirium
    - Dementia
    - Poly-Pharmacy
- Potential for Pre-existing Conditions
  - ? Organ Dysfunction
    - Renal, Hepatic, Cardiac, Hematologic, etc
  - ? Chronic Pain
    - Pre-existing Opioid Use

Cognitive Impairment and Pain Management

- Delirium occurs in 13-44% of cognitively intact patients (Bjorkelund et al, 2010)

- Less likely to receive pain medication (Adunsky et al, 2002)
  - Difficulty in assessing pain (86%) (Rantala et al, 2014)
  - Up to 61% unable to respond appropriately (Kang et al, 2013)
  - Advanced dementia patients received 1/3 the amount of opioid analgesia (Morrison, Siu, 2000)
  - Worried about causing side-effects
Cognitive Impairment and Pain Management

• Pain and inadequate analgesia increases risk of delirium (Morrison et al, 2003)

• Opioids and other Rx can potentially increase risk of post-op confusion (Maxwell, White, 2013)

Hip Fracture & Regional Anesthesia

• Sensory Innervation to hip joint & capsule:
  • Lumbar plexus (Femoral nerve & Obturator nerve)
  • Sacral plexus (Sciatic nerve)

• Sensory Innervation to skin:
  • Iliohypogastric nerve
  • Lateral cutaneous nerve of the thigh
  • Superior Cluneal nerves
Fascia Iliaca Compartment Block

- a field block under the fascia iliaca
-Injected local anesthetic spreads in the plane under the fascia iliaca to target nerves
  - Femoral Nerve
  - Lateral Cutaneous Nerve of the Thigh
  - Obturator Nerve

Fascia Iliaca Compartment Block

- Pros
  - Easy
  - Safe (away from major vessels and nerves)
  - Fast (~5 minutes)
  - Minimal equipment
  - Blind or Ultrasound techniques
    - Ultrasound increases effectiveness of block (95% vs 77%)
- Cons
  - Large volume required
  - Not a surgical block
Fascia Iliaca Compartment Block

Injection point

Pubic tubercle

Fascia iliaca compartment block: its efficacy in pain control for patients with proximal femoral fracture

Vaidi Jafari, Nigar Fazilatoomi, Mohsen Nafisi, and Mariam Shirali

![Graph showing pain control effectiveness over time and between groups.](image-url)
"Fascia iliaca blockade had the highest probability of being the most effective against delirium."
Regional Anesthesia

• Neuraxial Techniques
  – Spinal (subarachnoid) anesthesia
  – Epidural anesthesia (lumbar and thoracic)

Regional Anesthesia

• Thoracic epidural for visceral surgery
Regional Anesthesia

• Thoracic epidural for visceral surgery
  – Blocks sympathetic nerve supply to gut:
    • Faster return of bowel function
  – Blocks somatic nerves to abdominal wall
    • Less pain and faster ambulation
  – Improved patient outcome and ↓ length of stay


Regional Anesthesia

• Thoracic epidural for visceral surgery
  – Always followed by APS while epidural insitu
  – NEVER start long-acting or treatment doses of anticoagulation without discussion with APS first
    • ie. warfarin (Coumadin), clopidogrel (Plavix), dabigatran (Pradaxa), etc
Regional Anesthesia

- Truncal Nerve Blocks
  - TAP Block
  - Ilioinguinal Neve Block
  - Rectus Sheath Block

- Serratus Anterior Block
- Erector Spinae Block

- Peripheral Nerve Blocks
  - Upper Limb: brachial plexus
  - Lower Limb: femoral, sciatic nerves

- Use of Ultrasound Imaging has revolutionized peripheral nerve blockade
  - Safety
  - Accuracy / Improved Success
  - Efficiency
Regional Anesthesia

• Ultrasound-guided Supraclavicular Brachial Plexus Block
Common Challenges

• Inadequate analgesia
  – ? Baseline analgesics re-ordered
  – ? Reasonable dose
  – ? Opioid rotation
  – Consider good multimodal regimen

• Difficult to manage nausea
  – ? Antiemetics
  – ? Change opioid
  – ? Standing antiemetic (ie. ondansetron) x 24 hrs
  – Balance between opioid dose and S/E

Common Challenges

• Constipation
  – Opioids only for incisional pain, not cramps
  – Encourage ambulation

• Delirium
  – Opioids only as required
  – Avoid Gravol

• Methadone
  – Generally continue methadone
  – For pain vs addiction
  – Need license
Pitfalls / Warning Signs

• Unexpected increase in:
  – Pain
  – Opioid consumption
  – Side effects
    • ie. Drowsiness

• Epidural Warning signs
  – Back pain
  – Bowel/bladder signs (cauda equina)
  – Unexpected Leg weakness

Opioid Overdose Management

• For unarousable, somnolent patient:
  – Stimulate patient (ie. sternal rub)
  – Circulation (pulse, blood pressure, O₂ saturation)
  – Airway (jaw thrust, chin lift)
  – Breathing (respiratory rate)
  – CODE BLUE (if necessary)
Opioid Overdose Management

• Opioid Reversal – Naloxone
  – Opioid antagonist
  – Reverses effects of opioid overdose (for 30-45min)
    • Hypoventilation
    • Sedation
  – MUST BE diluted before use:
    • 0.4 mg/mL → 1mL Naloxone + 9mL Saline = 0.04 mg/mL
  – Give 0.04 to 0.08 mg (1 to 2 mL) IV q3-5 minutes
  – If no change after 0.2mg, consider other causes

Opioid Overdose Management

• Ddx:
  – Seizure, stroke
  – Other medication effect
  – Hyper/hypoglycemia, hyper/hyponatremia
  – Hypoxia, hypotension
  – MI
  – Sepsis
Case 1

- 85 year old female
  - Laparotomy for bowel resection
  - PMH: CAD, previous MI, renal insufficiency

- What are your options for perioperative pain management?
  - Consider epidural or truncal blocks (ie. TAP block)
  - May not be able to effectively use PCA
  - Consider hydromorphone prn for breakthrough pain
  - Standing acetaminophen

- Any treatments/Rx to avoid?
  - Avoid NSAIDs b/c of renal insufficiency, CAD
  - Avoid dimenhydrinate (Gravol) and benzodiazepines b/c elderly

Case 2

- 60 year old with Crohn’s disease
  - for laparoscopic bowel resection
  - PMH: Chronic leg pain from previous MVA

- How are you going to manage his pain?
  - Continue pre-op pain medications
  - Avoid NSAIDs
  - Multimodal analgesia regimen

- POD#2, the patient has an significant increase in leg pain – what do you do?
  - Rule out reasons of increased pain (ie. DVT, compartment syndrome, etc. instead of just increasing pain Rx dose
Acute Pain Service

• Consult service for complex / specialized pain management
• Anesthesiologists + Advance Practice Nurses
• Call for:
  – Advice
  – Difficult to manage cases
• Many post-op patients will be followed by APS
• If APS involved, APS must write all pain Rx orders

Summary

• Accurate pain assessment
• Use Multimodal pain management
  – NSAIDs, acetaminophen, opioids, etc
  – Regional anesthesia techniques
• Make sure to continue or account for patient’s pre-hospital pain regimen
• Acute Pain Service available 24 hrs/day
Summary

• Superior analgesia, ↓ side effects means:
  – Better rehabilitation
  – Earlier functional return
  – Improved patient satisfaction
  – Earlier discharge from hospital
  – ↓ likelihood of chronic pain