Surgical Foundations Lecture Series

Perioperative Pain Management

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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

Verbal Pain Intensity Scale

No Pain | Mild Pain | Moderate Pain | Severe Pain | Very Severe Pain | Worst Possible Pain

Visual Analogue Scale

No Pain | Worst Possible Pain

0-10 Numeric Pain Intensity Scale

0 1 2 3 4 5 6 7 8 9 10

No Pain | Moderate Pain | Worst Possible Pain

“FACES” Scale*

0 2 4 6 8 10
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

1. Pain
   - Paracetamol, aspirin, or NSAID

2. Pain persisting or increasing
   - ± Non-opioid
   - ± Adjuvant
   - Opioid for mild to moderate pain

3. Pain persisting or increasing
   - ± Non-opioid
   - ± Adjuvant
   - Opioid for moderate to severe pain
   - ± Non-opioid
   - ± Adjunct

Morphine, Fentanyl, etc

Codine, Tramadol, etc
Acetaminophen

- First line treatment for pain
- Mechanism: thought to inhibit prostaglandin synthesis in CNS → analgesia, antipyretic
- Only available in PO/PR 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

- Initial loading dose of drug
- Repeated self-administered doses

Time (minutes):

15  30  60  120
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></td>
<td>IV/SC/IM</td>
<td>Oral</td>
</tr>
<tr>
<td>Morphine</td>
<td>10 mg</td>
<td>20-30 mg</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2-10 mg q4h</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5-20 mg q4h</td>
</tr>
<tr>
<td>Hydromorphone</td>
<td>1.5 mg</td>
<td>4-7.5 mg</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.5-2 mg q4h</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1-4 mg q4h</td>
</tr>
<tr>
<td>Oxycodone</td>
<td>N/A</td>
<td>10-20 mg</td>
</tr>
<tr>
<td></td>
<td></td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>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
- 50-80% of traumatic amputees suffer from phantom limb pain
- Have more PTSD, anxiety, depression, disability, absence from work
- Evidence of regional catheters decreasing incidence of chronic pain

(Gadsden J, 2012)
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
**Fascia Iliaca Compartment Block**


**ORIGIINAL ARTICLE**

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

Yuki Fujihara · Shigeo Fukunishi · Shoji Nishio · Jyuichi Miura · Sahoko Koyanagi · Shinichi Yoshiya

<table>
<thead>
<tr>
<th>Time</th>
<th>Group 1</th>
<th>Group 2</th>
<th><em>P &lt; 0.05 (Welch's t test)</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-block</td>
<td>91</td>
<td>92</td>
<td></td>
</tr>
<tr>
<td>after 10min</td>
<td>31</td>
<td>36</td>
<td></td>
</tr>
<tr>
<td>after 12hr</td>
<td>81</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Fascia Iliaca Compartment Block

ULTRASOUND-GUIDED FASCIA ILIACA COMPARTMENT BLOCK FOR HIP FRACTURES IN THE EMERGENCY DEPARTMENT

Lawrence Haines, MD, MPH, RDMS,* Eitan Dickman, MD, RDMS, FACEP,* Sergey Ayvazyan, MD,* Michelle Pearl, DO, MA, RDMS,* Stanley Wu, MD, MBA, RDMS,† David Rosenblum, MD,‡ and Antonios Likourezos, MA, MPH*

![Graph showing Fascia Iliaca Compartment Block Pain Scores]
Fascia Iliaca Compartment Block

“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 in-situ
  - 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

http://pie.med.utoronto.ca/OBAnesthesia/OBAnesthesia_content/OBA_blocks_module.html
Regional Anesthesia

- 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
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 (i.e. sternal rub)
  – Circulation (pulse, blood pressure, $O_2$ 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 laproscopic 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