Strategies for Opioid Reduction in Trauma

Brian Cornelius DNP CRNA NRP

Disclosures

- Trauma hurts but with a solid plan we can reduce the pain.
- Nothing financial to see here

Objectives

- Identify negative consequences associated with current treatment modalities.
- Identify common types of surgical trauma and examine analgesic strategies
- Identify and discuss techniques to reduce opioid usage and improve patient outcomes in a variety of practice settings.

Ahmadi A et al.

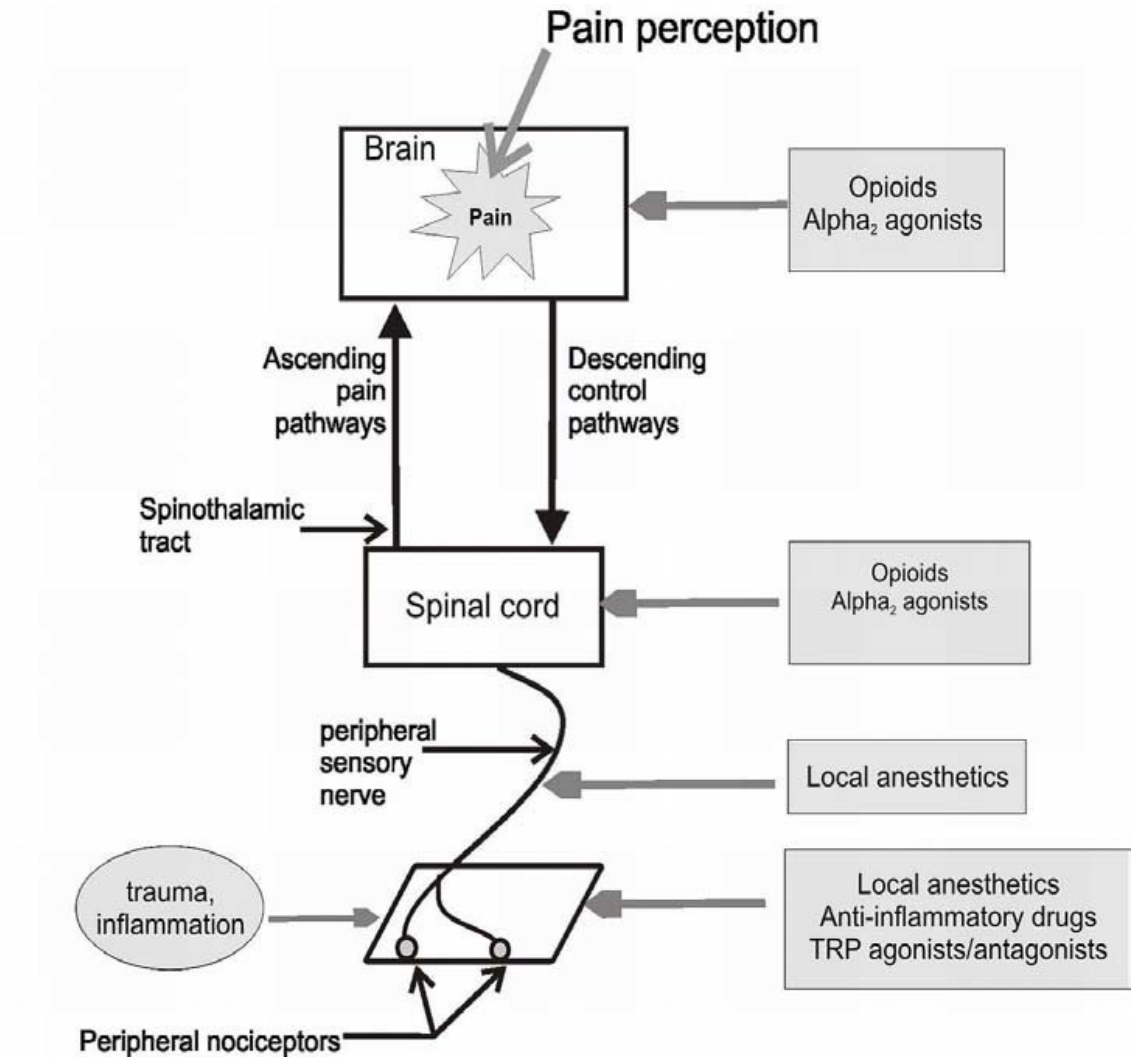
J Inj Violence Res. 2016 Jul; 8(2): 89-98.

doi: 10.5249/ jivr.v8i2.707

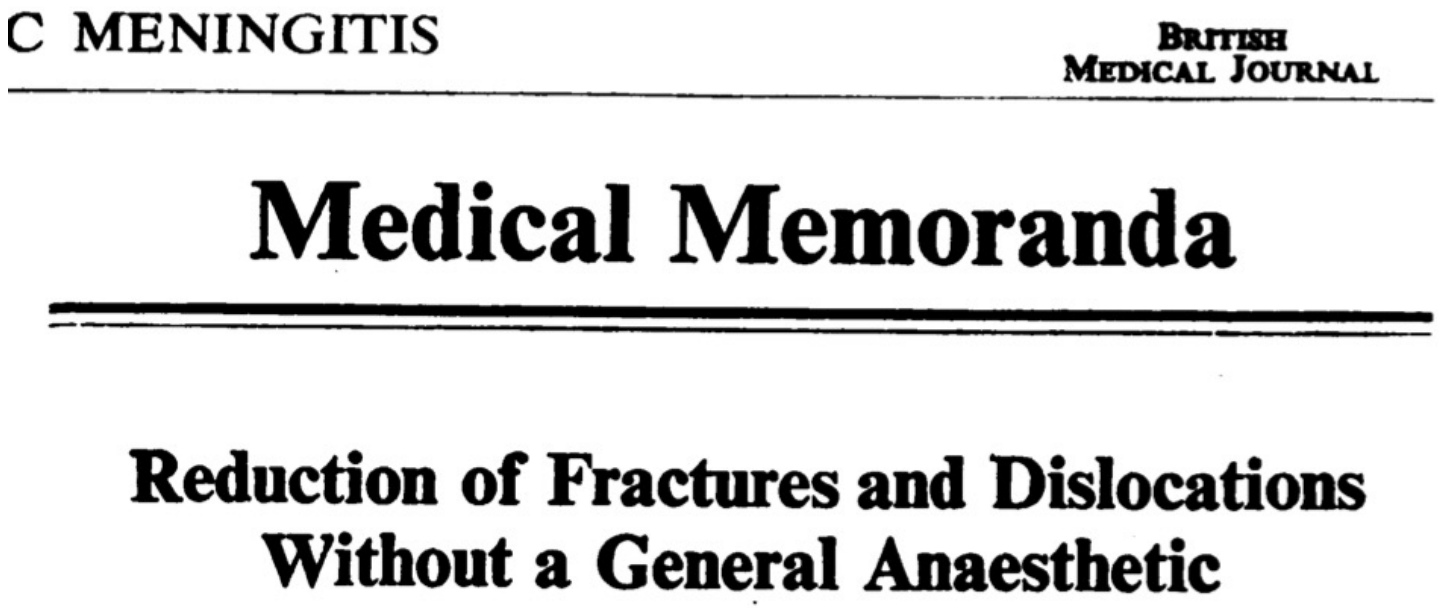
Review Article

Pain management in trauma:

Opportunities for Intervention



Where We've Come From……



C MENINGITIS

BRITISH MEDICAL JOURNAL

Medical Memoranda

Reduction of Fractures and Dislocations Without a General Anaesthetic

Ketorolac, an injectable nonnarcotic analgesic

Litvak KM, McEvoy GK. Ketorolac, an injectable nonnarcotic analgesic. Clin Pharm. 1990 Dec;9(12):921-35. PMID: 2292174.

The Middle Ages….Multimodal Analgesia

Exploring Opioid-Sparing Multimodal Analgesia Options in Trauma: A Nursing Perspective

Denise Sullivan, MSN, ANP, BC, RN-BC ■ Mary Lyons, MSN, APN, RN-BC, ONC ■
Robert Montgomery, DNP, RN-BC, ACNS-BC ■ Ann Quinlan-Colwell, PhD, RNC, AHN-BC

Analgesia Today

- Multimodal Approach
- Incorporate Regional Anesthesia
- Addition of ERAS Guidance
- Standardized Treatments
- Skills matter more than titles
- GOAL=Optimal Post-Operative Pain Management

medicina

Review

Role of Multimodal Analgesia in the Evolving Enhanced Recovery after Surgery Pathways

Acute pain management in trauma: anatomy, ultrasound-guided peripheral nerve blocks and special considerations

Management of Acute Pain in Trauma

- Resuscitation Vs Analgesia-Lets Do Both
- It Takes a Village
- What is Oligoanalgesia?
- Potential Barriers
  - Hemodynamic Instability
  - Respiratory Depression
  - Airway Compromise

Use of Opioids

- Systemic Opioids
- Timing
- Barriers
- Adverse Effects
  - Nausea and vomiting
  - Delirium
  - Vasodilation and hypotension (especially in hypovolemia)
  - Respiratory depression
  - Pruritus
  - Immunosuppression
  - Increased staffing requirements to monitor the patient
  - Increased length of stay in emergency department or recovery room

Are Opioids Superior?

Anaesthesia
Peri-operative medicine, critical care and pain
Association of Anaesthetists

Review Article | Free Access

Analgesic impact of intra-operative opioids vs. opioid-free anaesthesia: a systematic review and meta-analysis

Other Opioid Effects (That we don't talk about)

Introduction to the Opioid Epidemic: The Economic Burden on the Healthcare System and Impact on Quality of Life

RESEARCH ARTICLE

Chronic oxycodone induces axonal degeneration in rat brain

Review Article

Opioid-Induced Constipation and Bowel Dysfunction: A Clinical Guideline

Neuropnarmacology

Single opioid administration modifies gonadal steroids in both the CNS and plasma of male rats

Urgent Vs Emergent Management

- Acuity
- Time
- Planning
- Increased Risk

Injury Based Analgesic Approach

- Orthopedic
- Thoraco-Abdominal
- Soft Tissue

Orthopedic Trauma

- Radius/Humerus
- Femur/Tibia
- Ribs
- Pelvic
- Amputations

Canad. Med. Ass. J.
Aug. 10, 1963, vol. 89

REVIEW ARTICLE

Fractures

MICHAEL C. HALL, Ph.D., F.R.C.S.[C],
Toronto

Anesth Pain Med. 2017 February; 7(1):e40619. doi: 10.5812/aapm.40619.

Published online 2016 November 27. **Research Article**

Hematoma Block Versus General Anesthesia in Distal Radius Fractures in Patients Over 60 Years in Trauma Emergency

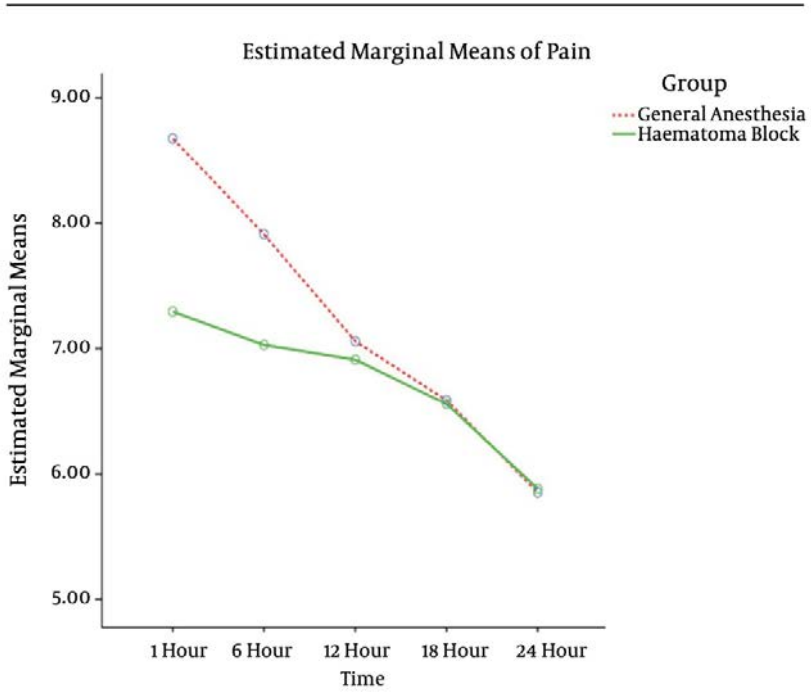


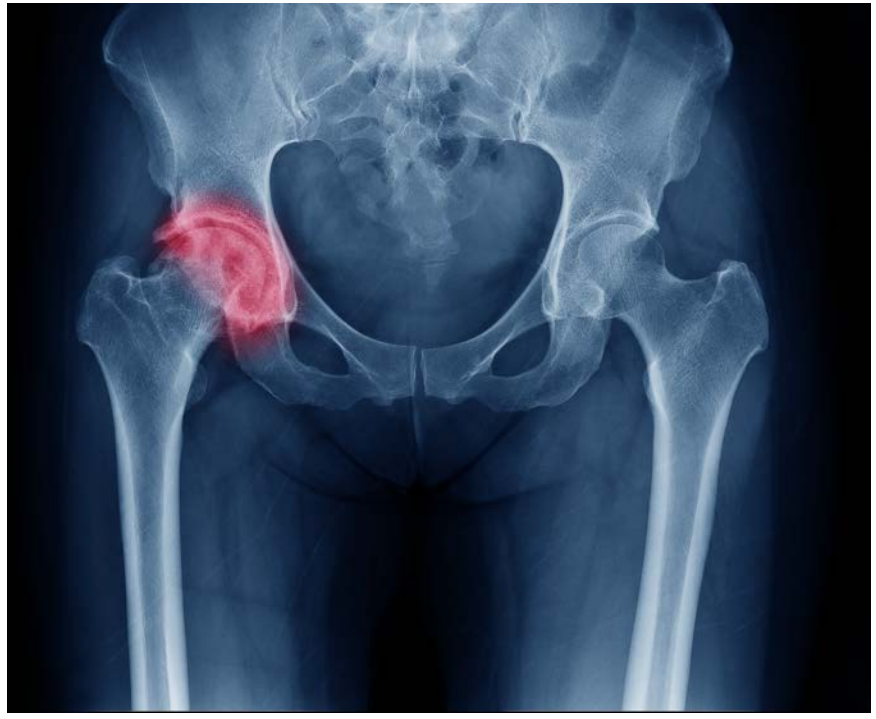
Figure 1. Comparison of Changes of Pain Intensity Scores at Different Time Points Between Two Hematoma Block and General Anesthesia Methods

Anaesthesia
Peri-operative medicine, critical care and pain
Association of Anaesthetists

Guidelines | Open Access

Guideline for the management of hip fractures 2020

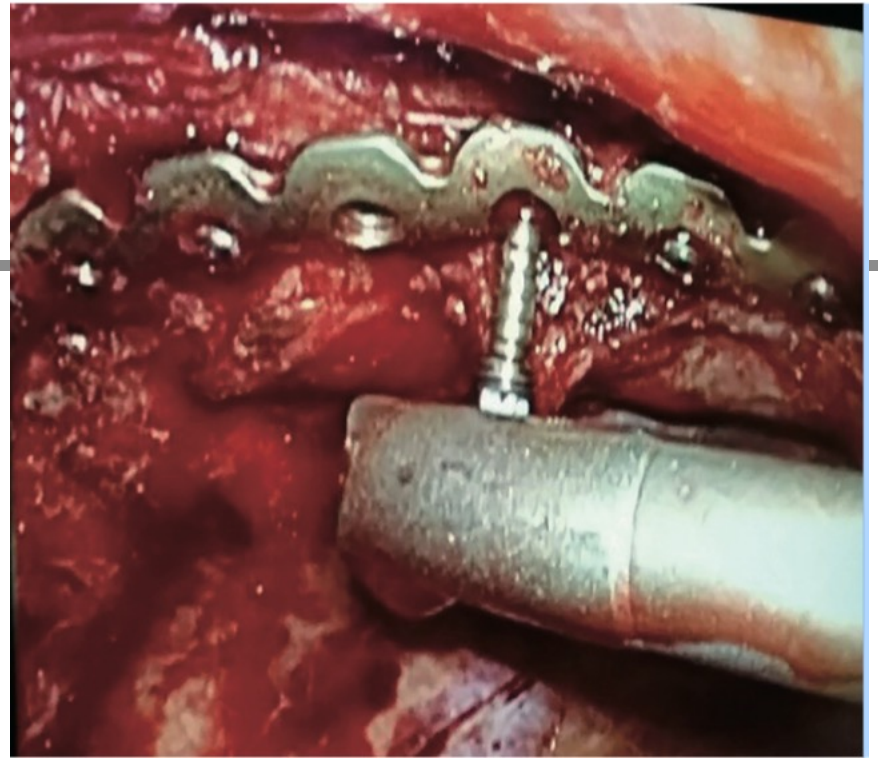
Guideline by the Association of Anaesthetists



Pain control in acute hip fracture

	Dose	Comments
First line: nonopioid analgesia		
Peripheral nerve block (femoral nerve block, fascia iliaca block)	Ropivacaine 0.5%, 15–20 mL in primary block; if catheter placed, infusion may be run with ropivacaine 0.2% at 8–10 mL/hour	Quadriceps weakness can be a limitation
Acetaminophen	1,000 mg intravenously or orally every 6 hours	For patient weighing < 50 kg, orally 650 mg every 6 hours
Celecoxib	200 mg orally twice a day	Use if glomerular filtration rate is > 60 mL/min
Ibuprofen	400 mg by mouth every 6 hours	Use if glomerular filtration rate is > 60 mL/min
Opioids		
Tramadol	50 mg orally every 6 hours as needed for mild to moderate pain	Use 25 mg if creatinine clearance rate is < 60 mL/min
Oxycodone	2.5–5 mg orally every 4–6 hours as needed for severe pain	Start with 2.5 mg if creatinine clearance rate is < 60 mL/min
Hydromorphone	0.25 mg intravenously every 4–6 hours as needed	Preferable to morphine, since morphine's metabolites can accumulate in patients with impaired renal function Respiratory depression, delirium, urinary retention, sedation, nausea and vomiting, and constipation are side effects of all opioids. Elderly patients may be particularly vulnerable to changes in mental status with opioids

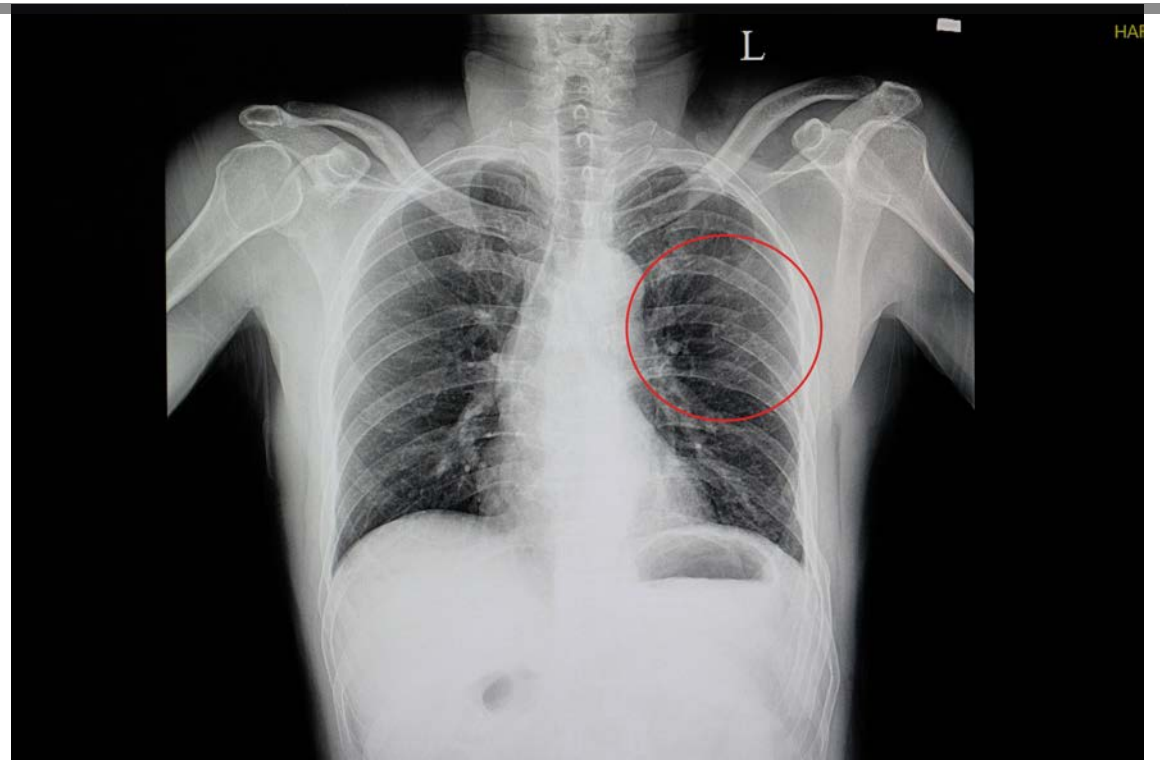
Rib Fractures



Anaesthesia
Peri-operative medicine, critical care and pain
Association of Anaesthetists

Original Article | Free Access

The effect of erector spinae plane block on respiratory and analgesic outcomes in multiple rib fractures: a retrospective cohort study†



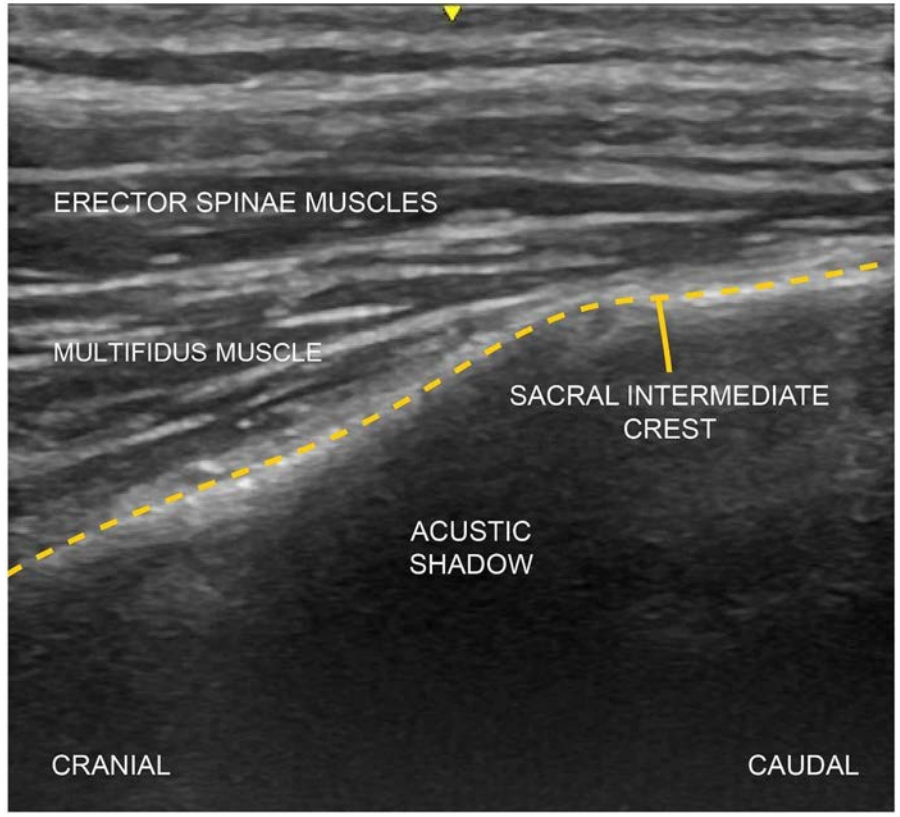
Pelvic Fractures

Sacral multifidus plane block: The correct name for sacral erector spinae plane block.

Piraccini E[1], Taddei S[1]

Author information

Journal of Clinical Anesthesia, 28 Feb 2020, 63:109754
DOI: 10.1016/j.jclinane.2020.109754 PMID: 32120194



Choice of Analgesia in Patients with Critical Skeletal Trauma

Amputations

Table 1

Multimodal analgesia: pharmacological components.

Type		Examples
Principle	Regional anesthesia	Central neuraxial or peripheral nerve block
		Single-shot or continuous catheter
		+/− local infiltration analgesia
	Opioid analgesics	Oxycodone, morphine, fentanyl, hydromorphone
	Systemic nonopioid analgesics	Acetaminophen, nonsteroidal anti-inflammatory drugs (NSAIDs)
Adjuvants	Gabapentinoids	Gabapentin, pregabalin
	N-methyl D-aspartate (NMDA) receptor antagonists	Ketamine, memantidine, dextromethorphan, magnesiun
	Alpha-2 adrenergic agents	Clonidine
	Glucocorticoids	Dexamethasone
	Others	Antidepressant, calcitonin, nicotine, capsaicin, cannabinoid, lidocaine

Open access Original research

BMJ Open

Exploring patients' experiences of analgesia after major lower limb amputation: a qualitative study

Review Article

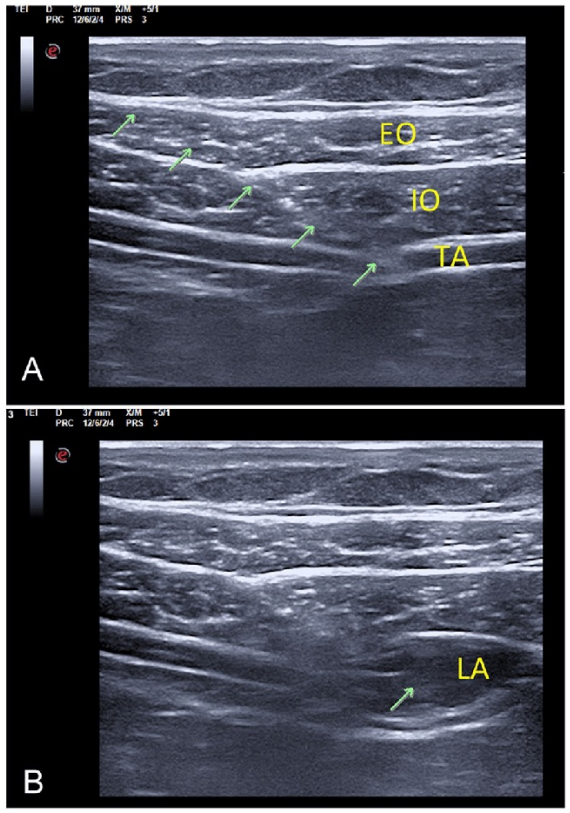
Development of a Multimodal Analgesia Protocol for Perioperative Acute Pain Management for Lower Limb Amputation

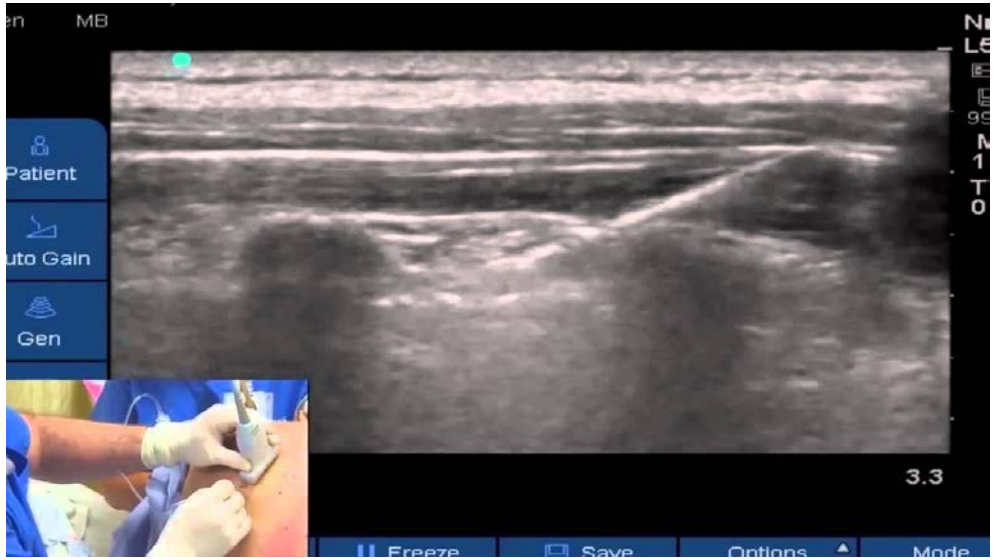
Thoraco-Abdominal Trauma

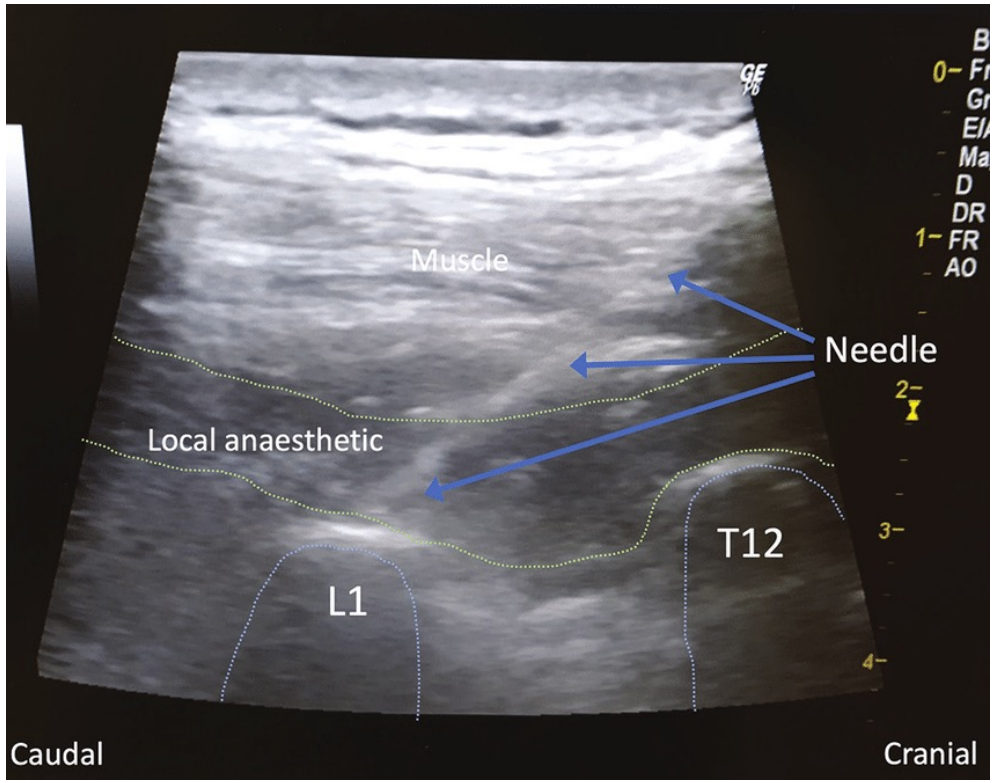
- Thoracic
  - Pulmonary
  - Vascular
- Abdominal

Thoracic

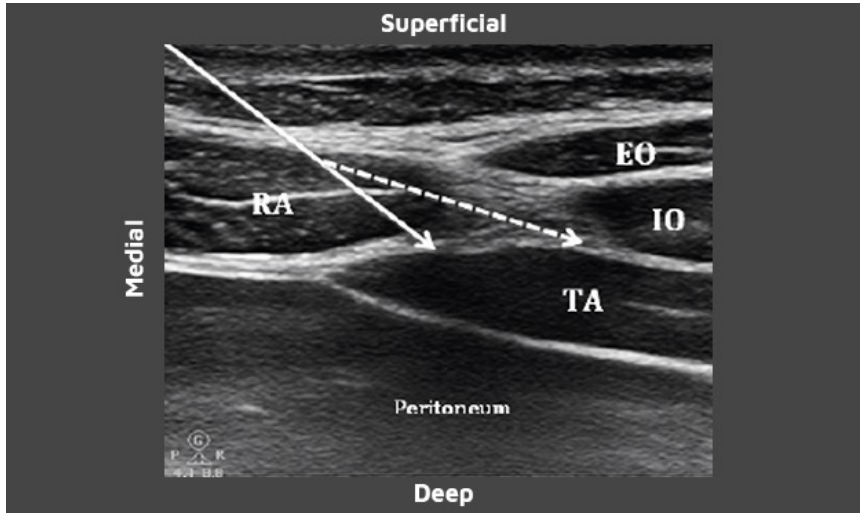
- Epidural
- Regional
  - Erector Spinae
  - Transversus Abdominis Plane



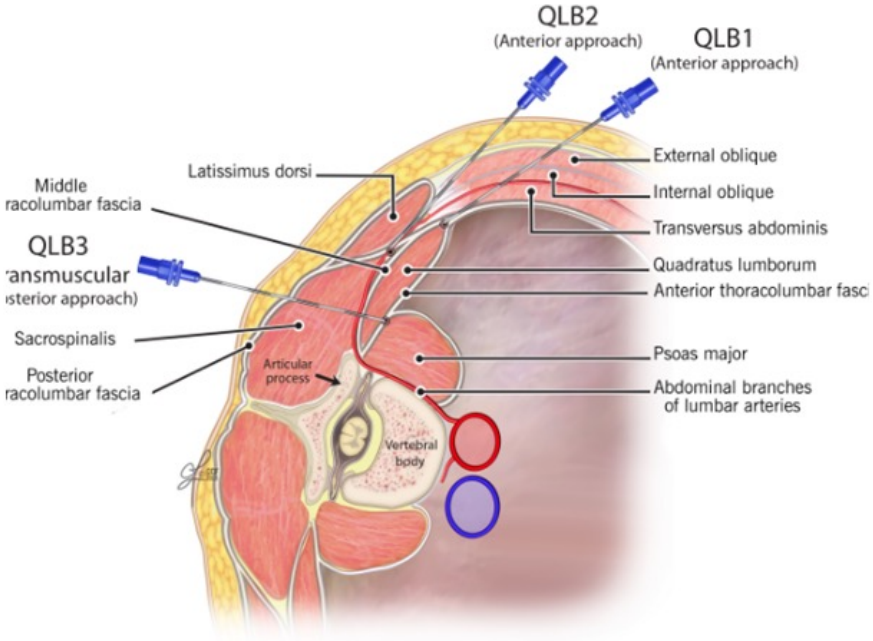


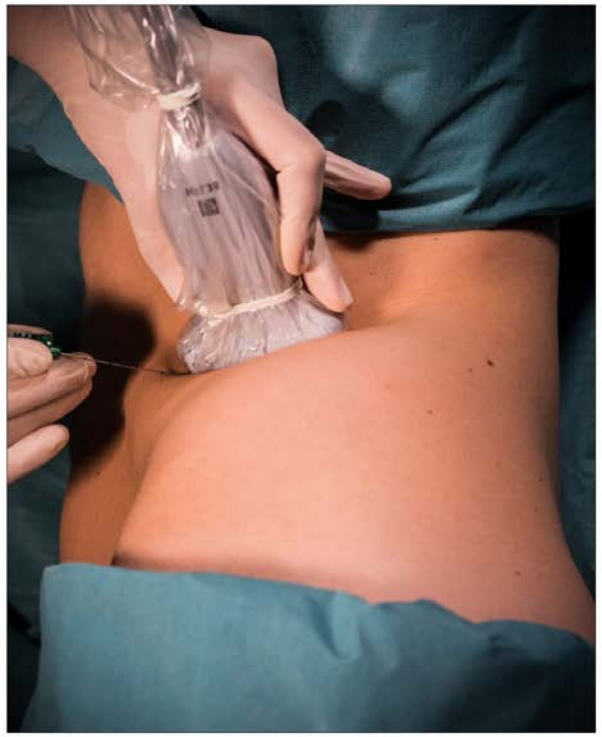


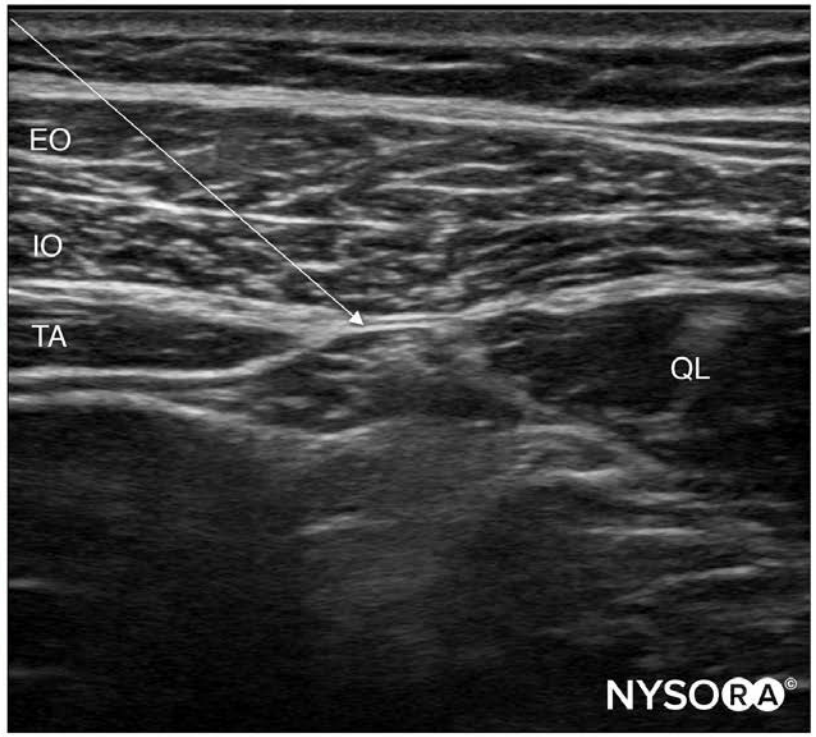
Abdominal



- Epidural
- Regional
  - Transversus Abdominis Plane
  - Quadratus Lumborum







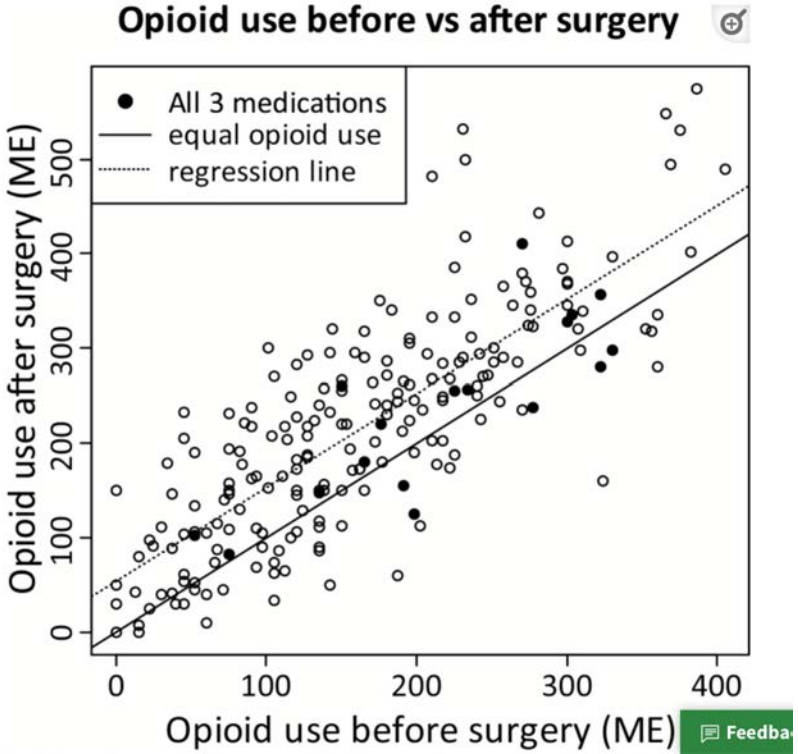
Soft Tissue

- Crush Injuries
- Cold Injuries
- Burns
- Lacerations
- Degloving

Table 4.

Multivariable ANOVA of the effect of different analgesic medications on opioid use while controlling for age, gender, log-transformed BSA burned, log-transformed grafted area, and intraoperative opioid dose

Medication	n	No	Yes	Difference	*P*
Tylenol	63	56.0 (43.5, 68.5)	42.8 (24.2, 61.4)	−13.2 (−34.1, 7.7)	.215
Gabapentin	62	59.2 (46.9, 71.5)	33.9 (15.3, 52.6)	−25.3 (−46.2, −4.4)	.018
Ketamine*	75	55.9 (42.8, 69.1)	45.3 (27.8, 62.9)	−10.6 (−31.5, 10.2)	.316
All three medications	17	55.6 (44.5, 66.7)	9.1 (−25.3, 43.4)	−46.5 (−81.6, −11.4)	.010



ORIGINAL ARTICLE

Perioperative Multimodal Analgesia Reduces Opioid Use Following Skin Grafting in Nonintubated Burn Patients

Oral Medications

- Acetaminophen
- Gabapentin
- Robaxin
- Celebrex
- Tramadol
- Lidocaine (Transdermal)

Acetaminophen

Effect of Preemptive Acetaminophen on Opioid Consumption: A Meta-Analysis

- Acetaminophen 1000 mg PO every 6 hours.
  - Do not exceed 4000 mg every 24 hours.
  - If <50 kg: 75 mg/kg/day max dose, divided in 4 doses.
  - Liver disease patients
    - MELD <15, Child class A or B – standard acetaminophen regimen
    - MELD >15, Child C – Begin normal regimen. Check serum acetaminophen level 3 hours after 3rd Adjust acetaminophen dosage as indicated. Target level <30.
  - Limit IV route x 24 hours unless specific indication exists

Gabapentin

Arch Trauma Res.2012;1(1):38-43. DOI: 10.5812/atr.5304
Archives of TRAUMA Research

Effect of Gabapentin on Morphine Consumption and Pain after Surgical Debridement of Burn Wounds: A Double-Blind Randomized Clinical Trial Study

- Gabapentin 300 mg PO every 8 hours thereafter
  - Consider continuing pregabalin for certain indications:
    - Neuropathic pain responsive to pregabalin
    - Strongly consider in spinal cord injury patients.
  - Titrate gabapentin higher as indicated for uncontrolled pain. Max dose 1200 mg every 8 hours.
  - Gabapentin in setting of renal failure:
    - eGFR <30 mL/min start 200 mg once daily, max dose 700 mg once daily

Methocarbamol

- Methocarbamol 500-750mg per dose
- Consider a maximum dose of 3-6gm daily in divided doses.
- Available IV if PO unavailable

Observational Study > Ann Pharmacother. 2021 Jun;55(6):705-710.
doi: 10.1177/1060028020964796. Epub 2020 Oct 12.

Efficacy of Methocarbamol for Acute Pain Management in Young Adults With Traumatic Rib Fractures

Tramadol

Opiate Analgesia Treatment Reduced Early Inflammatory Response After Severe Chest Injuries

- Tramadol 50 or 100 mg PO every 6 hours (for eGFR <30 mL/min, 50 mg PO every 6 hours)
- Contraindications
  - History of seizures
  - Monoamine oxidase inhibitor (MAOI) use
  - Selective serotonin reuptake inhibitor (SSRI) use (relative contraindication)

Lidocaine (Transdermal)

› Curr Pain Headache Rep. 2019 Nov 14;23(12):89. doi: 10.1007/s11916-019-0830-9.

Transdermal Lidocaine for Perioperative Pain: a Systematic Review of the Literature

- Lidoderm 5% topical Patch, Apply for 12 hours on, then 12 hours off daily
  - Apply up to 3 patches in 24 hours

Intravenous Medications

- Ketamine
- Magnesium
- Dexmedetomidine
- Acetaminophen
- Ketorolac
- Lidocaine
- Dexamethasone

Ketamine

- Sub Disassociative Dose Ketamine
  - 0.2-0.5mg/kg Initial Dosing
  - 0.1-0.2mg/kg/hr
- Head Trauma
- Less Hemodynamic Consequences
- Emergence Delirium

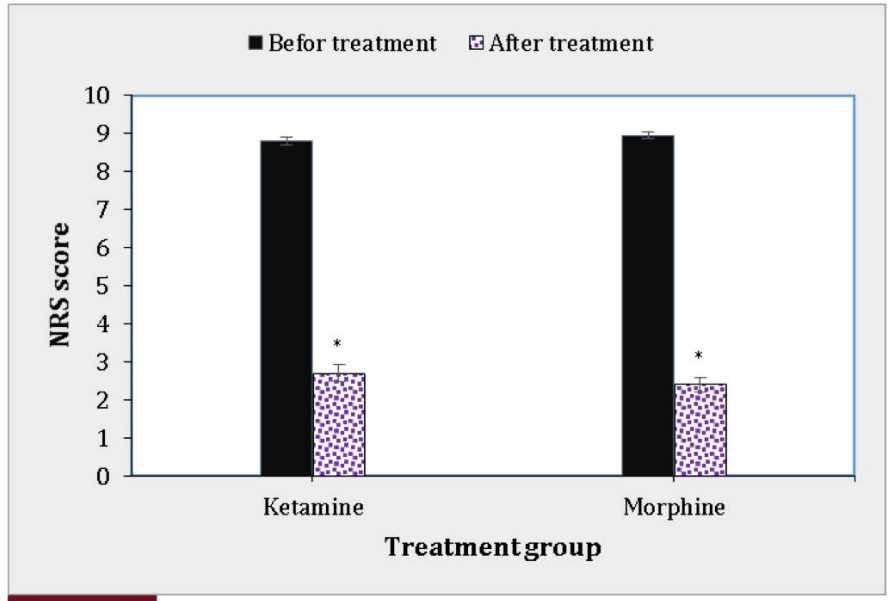


Figure 1: Means (SD) of pain severity in patients receiving ketamine and morphine before and after intervention. * indicates significant difference from the period before intervention at P<0.001. NRS: numeric rating scale. ⇧

ARTICLE IN PRESS

PAIN MANAGEMENT AND SEDATION/ORIGINAL RESEARCH

Intravenous Subdissociative-Dose Ketamine Versus Morphine for Analgesia in the Emergency Department: A Randomized Controlled Trial

ELSEVIER

Contents lists available at SciVerse ScienceDirect

American Journal of Emergency Medicine

journal homepage: www.elsevier.com/locate/ajem

Brief Report

Effective analgesia with low-dose ketamine and reduced dose hydromorphone in ED patients with severe pain☆,☆☆

Magnesium

- 50 mg/kg over 15 minutes
  - Then 15 mg/kg/hr
- Other studies suggest 10mg/kg/hr
- Concern over prolonged relaxation
  - Reversal considerations

Review > Pain Physician. Sep-Oct 2015;18(5):405-18.

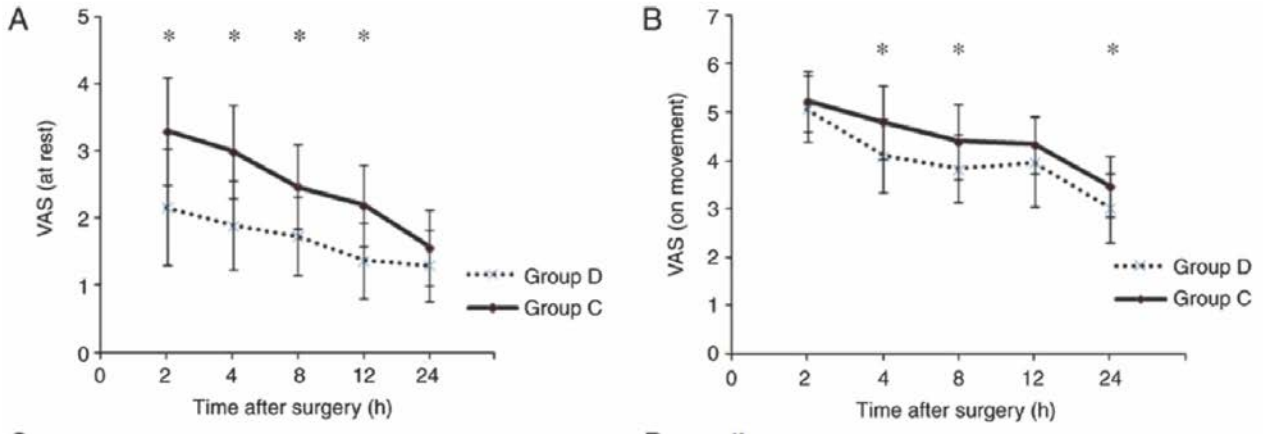
Effects of Systemic Magnesium on Post-operative Analgesia: Is the Current Evidence Strong Enough?

Dexmedetomidine

- Loading Dose 0.5-1mcg/kg
- Infusion 0.2-0.7mcg/kg/hr

EXPERIMENTAL AND THERAPEUTIC MEDICINE 17: 1776-1782, 2019

Efficacy of dexmedetomidine in reducing post-operative pain and improving the quality of recovery in patients with burn wounds undergoing tangential excision skin grafting



Acetaminophen

Intravenous non-opioid analgesia for peri- and postoperative pain management: a scientific review of intravenous acetaminophen and ibuprofen

Table 1. *Pharmacokinetics table of acetaminophen IV vs. PO.*

Plasma	**Acetaminophen 1g IV**	**Acetaminophen 1g PO**
C_{max} (mg/L)	46.1 (21.7-99.7)	18.0 (2.8-30.8)
T_{max} (min)	15 (15-15)	120 (30-360)
AUC (total) (mg min/L)	3924 (2937-7323)	2659 (527-5616)
AUC (first hour) (mg min/L)	1688 (880-2992)	87 (0-907)
AUC (second hour) (mg min/L)	973 (437-1647)	283 (53-1775)

Data are presented as median (range).
Abbreviations: C_{max}, maximum concentration; T_{max}, time to C_{max}; AUC, area under the plasma curve.

Ketorolac

Anesthesiology 2001; 94:599–603

Preemptive Analgesic Effects of Ketorolac in Ankle Fracture Surgery

- Ketorolac 30 mg IV once
- Hold in all patients if eGFR <30 mL/min.
  - *Hold in patients with a traumatic brain injury (TBI) unless cleared by Neurosurgery.*
  - May administer IM if IV route unavailable.

Table 2. Intergroup VAS Pain Scores

Values are mean ± SD. Visual Analog Scale (VAS) pain scores.

* P = significant.

OR = operating room.

Table 2. Intergroup VAS Pain Scores

		Time after Tourniquet Inflation					
	Before OR	2 h	4 h	6 h	8 h	10 h	24 h
PRE group	27 ± 28	26 ± 21	23 ± 26	29 ± 29	33 ± 31	28 ± 26	35 ± 30
POST group	18 ± 15	52 ± 30	38 ± 29	29 ± 26	25 ± 22	33 ± 30	31 ± 27
P value	0.981	0.0203*	0.00549*	0.388			

Values are mean ± SD. Visual Analog Scale (VAS) pain scores.
* *P* = significant.
OR = operating room.

Lidocaine

- Initial bolus dose of lidocaine 1.5 mg/kg body weight followed by an infusion run at 2 mg/minute
- Consider continuing infusion post operatively

Intravenous lidocaine for the treatment of background or procedural burn pain (Review)

Dexamethasone

- Dosing Variation
  - 4-16mg
  - Consider Reduction in brittle diabetics
  - ?Role of wound healing

Original Article

Analgesic effect of intravenous dexamethasone after volar plate surgery for distal radius fracture with brachial plexus block anaesthesia: a prospective, double-blind randomised clinical trial*

Neuraxial

Clinical Study

Epidural Analgesia for Severe Chest Trauma: An Analysis of Current Practice on the Efficacy and Safety

ANNALS OF SURGERY
Vol. 229, No. 5, 684–692

Prospective, Randomized Comparison of Epidural *Versus* Parenteral Opioid Analgesia in Thoracic Trauma

Regional Anesthesia

Injury Pattern	Potential Block
Mandible fracture	Inferior alveolar (needs to be performed immediately preoperatively—not an option in non-operative fractures or if already in MMF)
Clavicle fracture	Superficial cervical plexus
Distal clavicle, scapula, proximal humerus	Interscalene (causes unilateral diaphragm paresis. Axillary nerve and suprascapular nerve blocks an alternative in patients with respiratory insufficiency). Also causes Horner syndrome.
Injury lower than mid-humerus	Supraclavicular (50% diaphragm paralysis rate) Infraclavicular (25% diaphragm paralysis rate) Axillary nerve
Rib fractures	Serratus (lateral rib fractures) Paravertebral blocks Consider thoracic epidural
Sternal fractures	Transverse thoracic
Status postoperative laparotomy	Rectus sheath Quadratus lumborum
Lower extremity long bone fractures	Femoral Fascia iliaca Lateral femoral cutaneous Sciatic (subgluteal, popliteal) Adductor canal Ankle blocks

Where Regional Isn’t an Option

- Practice Restriction
- Financial and Logistical Barriers

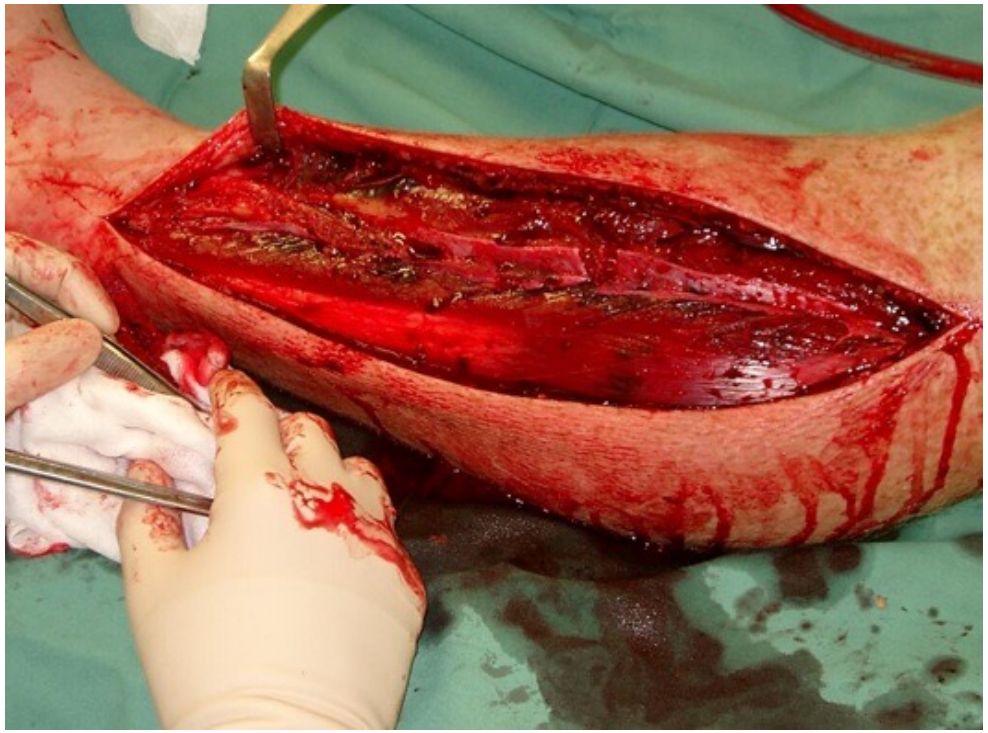
Practice Considerations

- Schedule
- Cost Vs. Benefit
- Availability of Supplies and Equipment
- Overcoming myths, dogma and tradition
- TIME

Identification of Complications

- Compartment Syndrome
- Constipation
- Prolonged Sedation

Compartment Syndrome



Constipation

- **Bowel Regimen**
  - Docusate 100 mg PO every 12 hours
  - Senna 2 mg PO every 12 hours
  - Polyethylene glycol 3350 17 g PO every 12 hours
  - Bisacodyl suppository 10 mg rectally daily PRN for no bowel movement

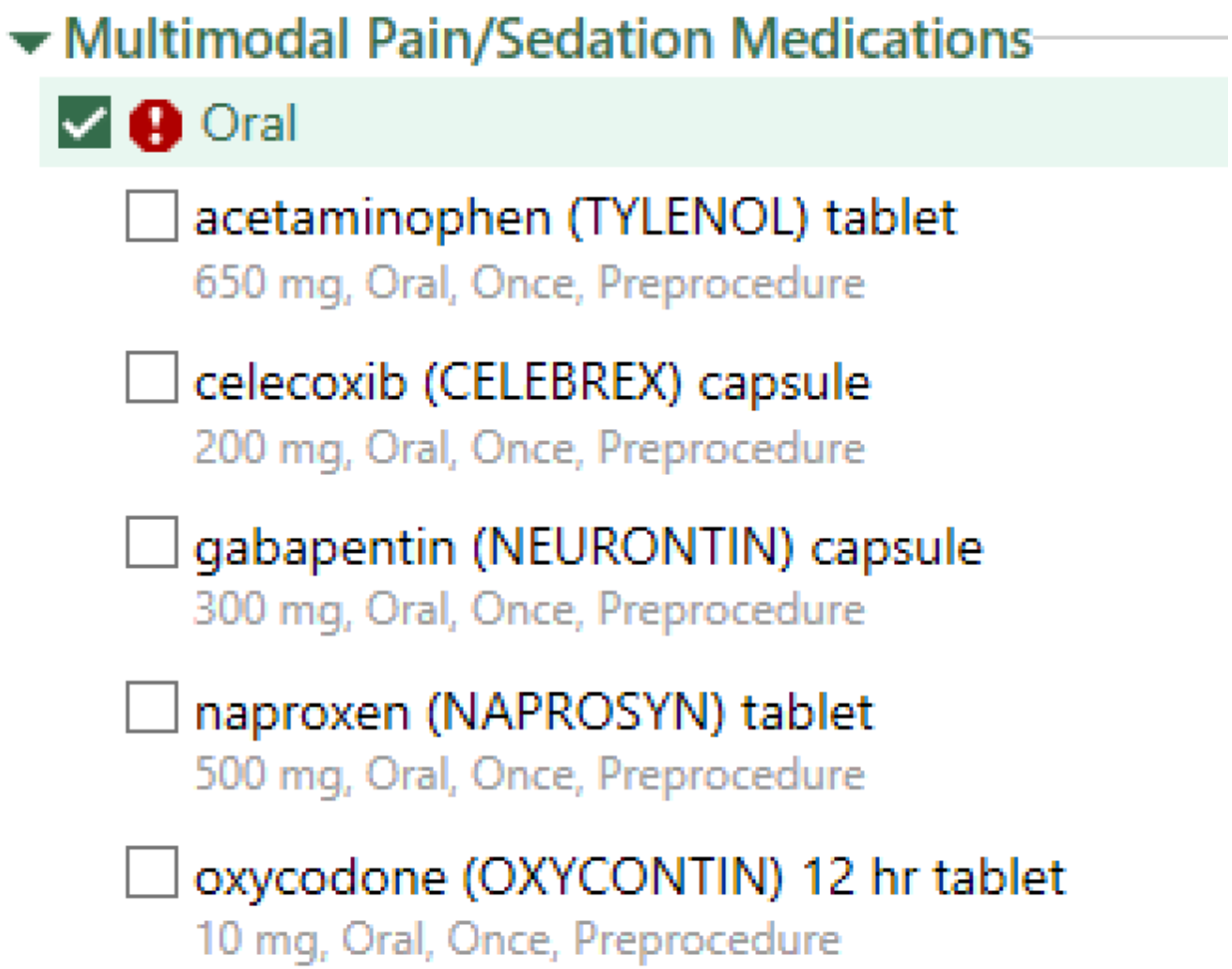
Prolonged Sedation

- Multimodal Analgesia
- Triggering Medications
- Post-Operative Monitoring

Sample Analgesia Orders

- Pre-Operative
- Post-Operative

Pre-Operative Orders



Post-Operative Orders

- **Multimodal Regimen to be Ordered Upon Admission for Background Pain:**
  - Acetaminophen 1000 PO every 6 hours.
    - IV formulation should be used in patients in bowel discontinuity or who are not tolerating PO intake
  - Naproxen 500 mg PO every 12 hours (contraindicated in patients with eGFR <30 mL/min)
  - Gabapentin 300 mg PO every 8 hours (200 mg once daily for eGFR <30 mL/min)
  - Lidoderm 5% topical Patch, Apply for 12 hours on, then 12 hours off daily
- **As Needed Opioids to be Ordered Upon Admission for Breakthrough Pain:**
  - For **Moderate** pain (pain score 4-6):
  - Tramadol 50 mg tab PO q 6 hours PRN pain score 4-6, or
  - Oxycodone (immediate-release) 5 mg tab PO q 4 hours PRN pain score 4-6
  - For **Severe** pain (pain score 7-10):
  - Tramadol 100 mg tab PO q 6 hours PRN pain score 4-6, or
- Oxycodone (immediate-release) 10 mg PO q 4 hours PRN pain score 7-10

- **For Severe pain (pain score 7-10) and NOT responding to oral therapy:**
- Re-assess patient for potential missed injury or impending complication (e.g. compartment syndrome of an extremity)
- Consider:
  - Ketamine IV drip
    - Dose: initial bolus of 0.1 to 0.5 mg/kg, followed by 0.1 to 0.25 mg/kg/hr continuous infusion.
  - Lidocaine IV drip
    - Dose: 20 mcg/kg/min – no titration
    - Cirrhosis is not a contraindication; use with caution.
    - Contraindication: heart failure with EF < 20%.
  - Scheduled opioids:
    - Methadone 5 mg PO q 8 hours
    - Oxycodone Extended Release 10 mg PO q 12 hours
      - *Must be swallowed; cannot be crushed and maintained the sustained release properties.*
    - One-time rescue medications:
      - HYDROmorphone 0.5 mg IV q 4 hours PRN severe pain
      - Fentanyl 50 mcg IV q 1 hour PRN severe pain

Post Operative Management Strategies

- Pumps
- Pain Rounds
- PO Regimen

Questions?

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