“NEW” DEVELOPMENTS IN ACUTE PAIN MANAGEMENT

The Changing Practice of Anesthesia
September 19, 2014

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Department of Anesthesia and Perioperative Care
Director of Acute Pain Services
DISCLOSURES

Honararium from Medtronic
Coverage of Travel Expenditures from Boston Scientific
MEDICINE

Keown, O. Lessons from Eight Countries on Diffusing Innovation in Health Care. Health Affairs, Sep 2014

"NEW"

Rogers Diffusion Of Innovation Bell
ACUTE PAIN SERVICES

Started in academic centers in the late 1980s.
Regional Catheter Service
Medication Management
Multi-Disciplinary Service

SPECIAL ARTICLE

Development of an Anesthesiology-based Postoperative Pain Management Service

L. Brian Reedy, M.D., F.R.C.P.(C),* Rollin Oden, M.D.,† H. S. Chadwick, M.D.,‡ Costantino Benedetti, M.D.,* G. Alec Rooke, M.D.,† Robert Caplan, M.D.,‡ Lorla M. Wild, R.N., M.N.:‡


Occasional Review

Postoperative pain management and Acute Pain Service activity in Canada

D.L. Zimmerman MD, J. Stewart MD FRCPC


Introducing an acute pain service

P. D. Cartwright, R. G. Helfinger, J. J. Howell and K. K. Siepmann

THE FIRST YEAR’S EXPERIENCE OF AN ACUTE PAIN SERVICE

R. G. Wheatley, T. H. Madej, I. J. B. Jackson and D. Hunter

Reedy, Anesthesiology, 1988
Cartwright, Anaesthesia, 1991
Zimmerman, CJA, 1990
Wheatley, BJA, 1991
ACUTE PAIN

- PLANNED
- UNPLANNED
# TOC

## PAIN ASSESSMENT

## PAIN MANAGEMENT

<table>
<thead>
<tr>
<th>MEDICATIONS</th>
<th>INTERVENTIONS</th>
<th>PT</th>
<th>PSYCH</th>
<th>CIM</th>
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<tbody>
<tr>
<td>PRE-OP</td>
<td>INTRA-OP</td>
<td>POST-OP</td>
<td></td>
<td></td>
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<tr>
<td>X</td>
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<td>X</td>
<td>X</td>
<td>X</td>
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</tbody>
</table>

*Note: X indicates the presence of a specific intervention or medication.*
Some of the topics covered today are not particularly new.

Not all new (recently developed) subjects will be covered… Just those deemed relevant by the presenter.

FDA indications, or lack thereof, will be stated.
PAIN ASSESSMENT

T: 37.0
HR: 96
BP: 139/83
RR: 18
Pain: 7

ANALGESIA NOCICEPTION INDEX (ANI)

Not FDA Approved
Ledowski, BJA, 2013
Boselli, BJA, 2014
MDoloris Medical Systems
PAIN MANAGEMENT

PERI-OP

ENHANCED RECOVERY AFTER SURGERY [ERAS]

Evidence

- Adamina, Surgery, 2011
- Fawcett, BJA, 2012
- Joshi, Colorectal Disease, 2012
- Danninger, World J of Surgery, 2014
- Mortensen, Brit J of Surg, 2014
# Pain Management

## Peri-Op

Enhanced Recovery After Surgery @ UCSF

<table>
<thead>
<tr>
<th>Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colorectal</td>
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<tr>
<td>Arthroplasty</td>
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<tr>
<td>Gynecological Oncology</td>
</tr>
<tr>
<td>Spine</td>
</tr>
<tr>
<td>Cystectomy</td>
</tr>
<tr>
<td>Hepatobiliary</td>
</tr>
<tr>
<td>Mastectomy</td>
</tr>
<tr>
<td>Thoracotomy</td>
</tr>
<tr>
<td>Liver Transplant</td>
</tr>
<tr>
<td>Craniotomy</td>
</tr>
</tbody>
</table>
### PRE
- Order Pre-Op Warming and IV fluids 30 ml/hr
- Gabapentin 600mg PO once
- Acetaminophen 1000mg PO once
- Diclofenac (if eGFR>60) 100mg PO once
- Scopolamine (Optional) 1.5mg TTS x 1
- Meclizine (Optional) 25mg PO x 1 (Optional)

### REGIONAL
- 30 minutes before start time, complete anesthesia assessment, go to Block Room, and place Thoracic Epidural placed at T8-10

### INTRA
- Antibiotic: Cefazolin 25mg/kg IV over 10 minutes
- Patient temperature must not drop below 36.0 C.
- Orogastic Tube with LIWS.
- Opioid of Choice: Hydromorphone or Morphine
  - Titrate to RR 10bpm at time of extubation.
  - If Opioid-Tolerant, continue their opioid regimen intra-op.
  - Start ketamine load and infusion. 0.2 mg/kg x 1.
  - Then 2 mcg/kg/min.
- Dexamethasone 4mg IV x 1 after induction.
- Ondansetron 4mg IV x 1
- Thoracic Epidural 0.0625% Ropi + Fentanyl 2 mcg/ml @ 8 ml/hr
- Bilateral TAP Block. 20ml of Ropi 0.2% with dexamethasone 4mg. Done prior to prep & drape.

### POST
- Order opioid of Choice: Hydromorphone or Morphine
- Order Antiemetics
- Thoracic Epidural 0.0625% Ropi + Fentanyl 2 mcg/ml @ 8 ml/hr

### POD1
- Gabapentin 600mg PO qHS
- Acetaminophen 1000mg IV q6H
- Toradol (if eGFR>60) 15mg IV q6H
- If Opioid-Tolerant, continue ketamine infusion 2 mcg/kg/min
- If Opioid-Tolerant, continue their daily opioid requirement.
- Thoracic Epidural 0.0625% Ropi + Fentanyl 2 mcg/ml @ 8 ml/hr

### NURSING
- Please complete Pre-Op RN checklist 45 minutes prior to OR start time
- Boost Breeze and water ok until 2 hours Pre-Op
- Consent, Site Marking, and 24-hr H&P completed 40 minutes before OR start time.
- Consent, Site Marking, and 24-hr H&P completed 40 minutes before OR start time.

### PATIENT
- No food until 8 hours before surgery. Water and Boost Breeze taken up until two hours before surgery
- Risks of surgery and anesthesia will be discussed. You will sign a consent for the procedure, and discuss the possibility of receiving blood products.
- If there is any chance you might be pregnant, please discuss with surgery and anesthesia

### MEDS
- Gabapentin 600mg PO once
- Acetaminophen 1000mg PO once
- Diclofenac (if eGFR>60) 100mg PO once
- Scopolamine (Optional) 1.5mg TTS x 1
- Meclizine (Optional) 25mg PO x 1 (Optional)
- Gabapentin 600, APAP 1000,Celecoxib given once with water (<100ml).
- Anti-Emetics may also be ordered

### REGIONAL
- Hydromorphone or Morphine IV PRN
- Titrate to RR 10bpm
- Thoracic Epidural 0.0625% Ropi + Fentanyl 2 mcg/ml @ 8 ml/hr
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- Thoracic Epidural 0.0625% Ropi + Fentanyl 2 mcg/ml @ 8 ml/hr

### POST
- Vital Signs q 4H, I&O shift, weight daily, surgical incision care abdomen,
- Out of bed ad lib

### POD1
- DVT Proph: Heparin 5kU SQ TID
- Ambulation: OOB ad lib
- Incentive Spirometry x15 q 1H
- Foley Catheter to gravity.
- DVT Proph: Heparin 5kU SQ TID
- Clears. Gum chewing ok.
- Incentive Spirometry x15 q 1H
- Clears. Gum chewing ok.
PAIN MANAGEMENT

PRE-OP

PREHABILITATION: Exercise program prior to surgery to address functional recovery and strength.

Evidence:

• TKA (Swank, 2013)
• Colorectal (Gillis, Anesthesiology, 2014; Carli, B J Surg, 2010)
• Spine (Nielsen, Clin Rehabil, 2010)
PAIN MANAGEMENT

PRE-OP

CATASTROPHIZATION: characterized by the tendency to magnify the threat value of pain stimulus and to feel helpless in the context of pain, by a relative inability to inhibit pain-related thoughts in anticipation of, during or following a painful encounter.

(Quartana, Expert Review Neurotherapeutics, 2009)

Evidence:

- Catastrophization and Pre-Op Anxiety play a role in the development of Persistent Post-Surgical Pain (Theunissen, Clin J of Pain, 2012)
- Pre-Op Catastrophizing and Post-Op Pain in Cardiac Surgery (Khan, Pain Med, 2012)
PAIN MANAGEMENT
PRE-OP INTRA and POST-OP
LIPOSOMAL BUPIVACAINE

No catheter. No pump.
Less worries about antithrombotics…
Does it work?
Is it safe?


FDA Approved. Hemorrhoidectomy & Bunionectomy
PAIN MANAGEMENT

PRE-OP

FOCUSED COLD THERAPY /
COOLED RADIOFREQUENCY ABLATION /
PULSED RADIOFREQUENCY ABLATION
## PAIN MANAGEMENT

### PRE-OP

**FOCUSED COLD THERAPY / COOLED RADIOFREQUENCY ABLATION / PULSED RADIOFREQUENCY ABLATION**

<table>
<thead>
<tr>
<th>Treatment Method</th>
<th>Primary Type of Targeted Nerve</th>
<th>Duration of Clinical Effect</th>
<th>Degree of Nerve Injury</th>
<th>Regeneration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phenol Injection</td>
<td>Sensory and Motor</td>
<td>Months to Years</td>
<td>2nd to 3rd</td>
<td>Normal to Mild Deficit</td>
</tr>
<tr>
<td>Alcohol Injection</td>
<td>Sensory and Motor</td>
<td>Months to Years</td>
<td>2nd to 3rd</td>
<td>Normal to Mild Deficit</td>
</tr>
<tr>
<td>Cryoneuromodulation (-100°C)</td>
<td>Sensory</td>
<td>Months to Years</td>
<td>3rd</td>
<td>Mild Deficit</td>
</tr>
<tr>
<td>Cryoneuromodulation (-60°C)</td>
<td>Sensory; Emerging Use for Motor</td>
<td>Months to Years</td>
<td>2nd</td>
<td>Normal</td>
</tr>
<tr>
<td>Conventional Radiofrequency</td>
<td>Sensory</td>
<td>Months to Years</td>
<td>3rd to 4th</td>
<td>Moderate to severe deficit</td>
</tr>
<tr>
<td>Pulsed Radiofrequency</td>
<td>Sensory</td>
<td>Months to Years</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Transection</td>
<td>Sensory</td>
<td>Permanent</td>
<td>5th</td>
<td>None</td>
</tr>
</tbody>
</table>

Hsu, M. J of Neur Disorders, Jun 2014
PAIN MANAGEMENT

INTRA and POST-OP

PROGRAMMED INTERMITTENT BOLUS

FDA Approved Jan 2014.
PAIN MANAGEMENT

INTRA and POST-OP

LOW-DOSE KETAMINE INFUSION  NMDA
LOW-DOSE LIDOCAINE INFUSION  NA-CHANNEL
LOW-DOSE DEXMEDETOMIDINE INFUSION  ALPHA-2

Evidence:

• TKA (Aveline, Eur J Pain, 2009)
• Spine (Loftus, Anesthesiology, 2010)
• Laparoscopy (Kaba, Anesthesiology, 2007)
• Abdominal Surgery (Marret, Brit J of Surg, 2008)
PAIN MANAGEMENT

POST-OP

INTRANASAL KETOROLAC
PAIN MANAGEMENT

POST-OP

SUFENTANIL NANOTAB (ZALVISO)

Sufentanil NanoTab PK
Single-Dose and Multiple-Dose

Repeat Dose: Patients dosed 1 NanoTab every 20 minutes

Total 40 NanoTabs consumed in 13.3 hours

For reference, single IV dose of 15 mcg results in:

\[ C_{\text{max}} = 445 \text{ pg/ml} \]
\[ T_{\text{max}} = 4 \text{ minutes} \]

Completed Phase III Trials
PAIN MANAGEMENT
POST-OP
HYDROCODONE-CONTAINING COMPOUNDS. #1 Rx in USA.

JAN 14, 2014: ACETAMINOPHEN RESTRICTED TO 325mg or less
OCTOBER 6, 2014: WILL BE MOVED FROM SCHEDULE III to SCHEDULE II
PAIN MANAGEMENT
POST-OP
NALOXONE HOME KIT

Evzio
FDA Approved.
PAIN MANAGEMENT

POST-OP

METHYLNATREXONE (RELISTOR) - 2008
ALVIMOPAN (ENTEREG) - 2008

NALOXEGOL (MOVANTIK) - 2014: Oral peripheral mu-antagonist for opioid-induced constipation.

Chey, NEJM, 2014. Statistically improved constipation (40% vs 29%) with naloxegol vs placebo.
PAIN MANAGEMENT
POST-OP to HOME
HEALTH SENSORS
THE STATE OF ACUTE PAIN MANAGEMENT

No evidence of real progress in treatment of acute pain, 1993–2012: scientometric analysis

Collaborative strategies that:

- Reduce Cost: length of stay (LOS) & readmission rates - ERAS
- Reduce Opioid Consumption.
- Improve HCAHPS scores
- Employ The Perioperative Surgical Home.
- Reduce Persistent Post-Surgical Pain.

Methods to prolong neural blockade

Methods to manage opioid-related complications.

Disconnecting from the IV.

Health sensors that interface with our EMR to track patient progress.

Tracking of outcomes.

A need to more efficiently and safely adopt new ideas and technologies that can reduce severe acute pain and the development of chronic pain.
REFERENCES

Adamina, M.; Gie, O.; Demart... 2013 Contemporary perioperative care strategies  Br J Surg
Aveline, C.; Gautier, J. F.; Va... 2009 Postoperative analgesia and early rehabilitation after total knee replacement: a comparison of continuous low... Eur J Pain
Boselli, E.; Bouvet, L.; Begou... 2014 Prediction of immediate postoperative pain using the analgesia/nociception index: a prospective observational study  Br J Anaesth
Boselli, E.; Daniela-lonescu,... 2013 Prospective observational study of the non-invasive assessment of immediate postoperative pain using the a... Br J Anaesth
Carli, F.; Charlebois, P.; Stei... 2010 Randomized clinical trial of prehabilitation in colorectal surgery  Br J Surg
Chey, W. D.; Webster, L.; So... 2014 Naloxegol for opioid-induced constipation in patients with noncancer pain  N Engl J Med
Danninger, T.; Opperer, M.;... 2014 Perioperative pain control after total knee arthroplasty: An evidence based review of the role of peripheral ner... World J Orthop
Fawcett, W. J.; Mythen, M. G.... 2012 Enhanced recovery: more than just reducing length of stay?  Br J Anaesth
Gillis, C.; Li, C.; Lee, L.; Aswa... 2014 Prehabilitation versus Rehabilitation: A Randomized Control Trial in Patients Undergoing Colorectal Resection... Anesthesiology
Keown, O. P.; Parston, G.; Pa... 2014 Lessons from eight countries on diffusing innovation in health care  Health Aff (Millwood)
Khan, R. S.; Ahmed, K.; Bla... 2011 Catastrophizing: a predictive factor for postoperative pain  Am J Surg
Ledowski, T.; Tiong, W. S.; Le... 2013 Analgesia nociception index: evaluation as a new parameter for acute postoperative pain  Br J Anaesth
Lovely, J. K.; Maxson, P. M.;... 2012 Case-matched series of enhanced versus standard recovery pathway in minimally invasive colorectal surgery  Br J Surg
Marret, E.; Rolin, M.; Beaussi... 2008 Meta-analysis of intravenous lidocaine and postoperative recovery after abdominal surgery  Br J Surg
Nielsen, P. R.; Jorgensen, L.... 2010 Prehabilitation and early rehabilitation after spinal surgery: randomized clinical trial  Clin Rehabil
Remerand, F.; Le Tendre, C.;... 2009 The early and delayed analgesic effects of ketamine after total hip arthroplasty: a prospective, randomized, co... Anesth Analg
Tufanogullari, B.; White, P. F.... 2008 Dexmedetomidine infusion during laparoscopic bariatric surgery: the effect on recovery outcome variables  Anesth Analg
Wijk, L.; Franzen, K.; Ljungqv... 2014 Implementing a structured Enhanced Recovery After Surgery (ERAS) protocol reduces length of stay after ab... Acta Obstet Gynecol Scand