Postoperative Pain Control For Orthopaedic and Spinal Procedures Performed in the Ambulatory Setting

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Disclosure Information

• Consultant
  – Medtronic
  – Mylan
  – Pacira
  – Stryker Spine

• Research/Institutional Support
  – Vertiflex
  – SI-BONE
  – Spinal Kinetics

• Advisory Positions
  – Cerapedics
  – DiFusion
  – Histogenics
  – Paradigm Spine
  – Relievant

• Speakers Bureau
  – Medtronic
  – Pacira
  – Stryker Spine
Future of Health Care

Population Health

Experience of Care

Per Capita Cost

Better Health

Better Care

Lower Cost
Shift toward Ambulatory Setting

- A broader number of more complex surgeries moving from inpatient to outpatient setting
  - Facilitated by improvements in surgical/anesthesia techniques
  - Increase patient satisfaction
  - Reduce overall costs
Minimally Invasive Techniques

• Potential advantages
  – Avoids morbidity of open procedures
  – Decreased postoperative pain
  – Shorter hospital LOS/reduced utilization of services
  – Improved functional/clinical outcomes
The New Standard of Care?

By JONATHAN TOPAZ | 5/27/14 12:33 PM EDT

George W. Bush underwent knee replacement surgery in Chicago this weekend, a spokesman for the former president has confirmed.

“He underwent a successful partial knee replacement on Saturday in Chicago,” Bush communications director Freddy Ford told POLITICO in an email. “It was an outpatient procedure and he was able to walk up and down a flight of stairs just a couple hours after the surgery. He came back to Dallas yesterday where he is recovering quickly at home.”

NBC Chicago first reported that the former president had outpatient surgery at Rush University Medical Center in Chicago on Saturday.
NEW YORK(CBS New York) – Imagine having a knee replacement and being able to walk on the same day with almost no pain and no narcotic pain medication.

Not only is it possible, but as CBS 2’s Dr. Max Gomez reported it’s actually safer and less expensive.
Ambulatory Spine Surgery

- 2015 Shift of Spine to ASCs – 45%
- Driven by Technology, Anesthesia, Physician Mindset and Insurance Acceptance
- Society Ambulatory Spine Surgery – NASS launch 2011 – Goal 50% to ASC
- Insight from Spine Investments – MSP

**Estimated Migration of Spine Surgery from Inpatient to Outpatient**

<table>
<thead>
<tr>
<th>Spine Surgery</th>
<th>2005</th>
<th>2010</th>
<th>2015</th>
<th>CAGR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inpatient</td>
<td>523,629</td>
<td>417,770</td>
<td>348,150</td>
<td>-4.0%</td>
</tr>
<tr>
<td>Outpatient</td>
<td>27,559</td>
<td>179,044</td>
<td>284,850</td>
<td>26.3%</td>
</tr>
<tr>
<td>Total</td>
<td>551,188</td>
<td>596,814</td>
<td>633,000</td>
<td>1.4%</td>
</tr>
</tbody>
</table>

\% Outpatient:
- 2005: 5.0%
- 2010: 30.0%
- 2015: 45.0%

Source: NeuroSource Inc. 2005
Thoracic and lumbar spinal surgery under local anesthesia for patients with multiple comorbidities: A consecutive case series

Muhammad Babar Khan, Rajesh Kumar, Syed Ather Enam
• Retrospective review of large multicenter clinical registry evaluating readmissions after lumbar spine operations

• 4.4% incidence of 30-day unplanned admissions (695/15,568 patients)
Most frequent reasons for readmission

- Wound complications – 38.6%
- Inadequate pain relief – 22.4%
- Thromboembolic events – 9.4%
- Systemic infections – 8.0%
Factors affecting hospital length of stay following anterior cervical discectomy and fusion

Authors: Paul M Arnold¹, Lisa R Rice², Karen K Anderson¹, Joan K McMahon², Lynne M Connelly³, Daniel C Norvell⁴

• Retrospective review of consecutive series of ACDF procedures intended to identify factors contributing to increased hospital LOS
• Most common complication – uncontrolled postoperative pain (13%)
Postsurgical Pain
Treating Postsurgical Pain in ASC

- Prerequisites for successful management of postoperative pain
  - Provide adequate analgesia
  - Easy to implement
  - Minimal side effects
  - Facilitate mobility
  - Cost-effective
Ongoing Challenges

• Suboptimal efficacy
  – Analgesia
  – Duration
• Not staff- or patient-friendly
• Potential for complications
• Hinders rehabilitation
• Expensive
Consequences of Postoperative Pain

- Prolonged patient suffering – physical and psychological
- Longer postsurgical recovery time
- Delayed ambulation and daily functioning
- Higher incidence of surgery-related complications
- Increased length of stay (LOS) in the hospital
- Hospital readmission
- Unrelieved acute postsurgical pain is a predictor for chronic pain

Pain and Patient Satisfaction

• **Pain management is the only clinical marker assessed:** The HCAHPS survey contains 27 questions on 8 topics ranging from communication and cleanliness to staff responsiveness and pain management¹
  – *How often was your pain well controlled?* (question 13)
  – *How often did the hospital staff do everything they could to help you with your pain?* (question 14)

• **HCAHPS scores have a direct impact on reimbursement:** 30% of a hospital’s value-based incentive payment from CMS is determined by HCAHPS scores²

• **Hospital HCAHPS performance is publically available:** Results are reported online quarterly at²: [http://www.medicare.gov/hospitalcompare](http://www.medicare.gov/hospitalcompare)

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Opioid Use is Ubiquitous

~95% of Patients Received Opioid-Based Pain Management

As demonstrated in a national retrospective study utilizing patients from >450 hospitals in a large GPO database

1. Oderda G, Gan TJ. Poster presented at 46th ASHP Midyear Clinical Meeting & Exhibition; December 4-8, 2011; New Orleans, LA.
Hidden Costs of Opioids

- Effective
- Low cost

- Falls
- Adverse events over 10%
- Increased length of stay
- PCAs
  - Dose errors
  - Monitoring
  - Risk of respiratory depression
- Societal burdens
# Opioid-Related Adverse Events

<table>
<thead>
<tr>
<th>Common ORAEs</th>
<th>Incidence</th>
<th>Opioid-Related Risk Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constipation</td>
<td>40%-95%²</td>
<td>• Can occur with a single dose of morphine²</td>
</tr>
<tr>
<td>Nausea &amp; vomiting</td>
<td>≥50%³⁴</td>
<td>• Patients receiving injectable opioids have ~5 times higher risk of requiring medications to treat nausea and vomiting³</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Increases with cumulative opioid dose⁵</td>
</tr>
<tr>
<td>Urinary retention</td>
<td>18%-35%²⁶</td>
<td>• Occurs most frequently with intrathecal morphine²⁵</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Risk increases in patients with benign prostatic hyperplasia⁷</td>
</tr>
<tr>
<td>Pruritus</td>
<td>30%-&gt;50%⁵⁸</td>
<td>• Highest incidence associated with epidural administration⁸</td>
</tr>
<tr>
<td>Respiratory</td>
<td>1.1%⁹</td>
<td>• Different opioid regimens are associated with variations in incidences⁹</td>
</tr>
<tr>
<td>depression</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Random sample of 402 surgical patients undergoing orthopedic procedures

Number of ORAE’s

- 54.2% experienced ≥ 1 adverse effects
- 25.6% experienced ≥ 2 adverse effects
- 7.2% experienced ≥ 3 adverse effects

Adverse events with significant increase in LOS (days)

- 36.1% – nausea and vomiting (+ 0.7)
- 6.5% – constipation (+1.4)
- 3.7% – confusion (+1.1)
# Opioid-Related Adverse Events

Patient Populations at a Greater Risk of Experiencing ORAEs

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td><strong>Elderly</strong></td>
<td>Risk increases with age in patients 61+</td>
</tr>
<tr>
<td><strong>Obese patients</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Patients with respiratory disease</strong></td>
<td>Including sleep apnea and COPD</td>
</tr>
<tr>
<td><strong>Males</strong></td>
<td>Patients with benign prostatic hyperplasia and urinary retention</td>
</tr>
<tr>
<td><strong>Chronic opioid users</strong></td>
<td>Patients who are opioid tolerant</td>
</tr>
</tbody>
</table>

- Factors affecting incidence of ORAEs
  - Route of administration
  - Dose
  - Tolerance
  - Physical condition

Opioid-Related Adverse Events

Higher Associated Hospitalization Costs

<table>
<thead>
<tr>
<th></th>
<th>ORAE</th>
<th>No ORAE</th>
<th>Cost Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>$0</td>
<td>$22,077</td>
<td>$17,370</td>
<td>$4,707</td>
</tr>
</tbody>
</table>

Longer Length of Hospital Stay

<table>
<thead>
<tr>
<th></th>
<th>ORAE</th>
<th>No ORAE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Days</td>
<td>7.6</td>
<td>4.2</td>
</tr>
</tbody>
</table>

$\textit{P<0.0001}$ for cost and LOS increases.
Why Do We Need to Do Better?

- **Improved Patient Care Experience**
  - Decrease opioids and opioid-related adverse events

- **Improved Outcomes (Better Health)**
  - Improve quality measures, faster recovery

- **Lower Costs**
  - Increase efficiencies, decrease PACU time, improve nursing acuity, decrease length of stay, reduce use of PCA and pain pumps

- **HCAHP Surveys**
  - (Pain represents 2 of 6 clinical questions on survey)
  - Improve pain scores

- **HAC**
  - Reduce falls, infections, DVTs
A shot in the arm
Like many of America’s new generation of users, Ms Scudo never intended to take up the drug. Her addiction began in 2000 when, after a hip injury, a doctor prescribed her “anything and everything” to relieve the pain. This included a high dose of OxyContin, a popular brand of opioid pill. Her prescription was later reduced, but she was already hooked. On the black market OxyContin pills cost $80 each, more than she could afford to cover her six-a-day habit; so she began selling her pills and using the proceeds to buy cheaper heroin. As if from nowhere, Ms Scudo had become a heroin addict.

By THOMAS CATAN and EVAN PEREZ
Updated Dec. 17, 2012 11:36 a.m. ET

It has been his life’s work. Now, Russell Portenoy appeals

Two decades ago, the prominent New York pain-care sp people with chronic pain. He campaigned to rehabilitit from the opium poppy that were long shunned by physi addictiveness.

The face of heroin use in America has changed utterly. Forty or fifty years ago heroin addicts were overwhelmingly male, disproportionately black, and very young (the average age of first use was 16). Most came from poor inner-city neighbourhoods. These days, the average user looks more like Ms Scudo. More than half are women, and 90% are white. The drug has crept into the suburbs and the middle classes. And although users are still mainly young, the age of initiation has risen: most first-timers are in their mid-20s, according to a study led by Theodore Cicero of Washington University in St Louis.
Preemptive Analgesia

- Blockade of noxious stimuli during/immediately after surgery reduces postoperative pain
- Prevents sensitization of CNS
- Administration of antinociceptive agents
  - Local anesthetics
  - Opioids/analgesics
  - Antineuropathic agents
Novel Strategies for Postsurgical Pain

• Medications
  – Route of administration – po, iv, epidural
  – Timing – preop, intraop, postop
  – Mechanism of action – NSAIDs, analgesics, gabapentinoids

• Injectable local anesthetics
  – Continuous infusion devices
  – Liposomal bupivicaine
- Opioids
- Alpha-2 agonists
- Acetaminophen
- Anti-inflammatory agents
- Ketamine

- Local anesthetics (epidural)
- Opioids
- Alpha-2 agonists
- NMDA antagonists

- Local anesthetics (peripheral nerve block)
- Local anesthetics (field block)
- NSAIDs
- COX-2 inhibitors
- Opioids

Pain

Descending modulation

Tissue Injury
NSAIDs

- Perioperative administration of parecoxib with PCA morphine resulted in significantly improved postoperative analgesic management compared with PCA morphine alone after lumbar spine surgery.
- Parecoxib 40 mg reduced the total amount of morphine required over 48 hours by 39% compared with placebo. Pain at rest was reduced by 30%. Ninety
NSAIDs


Nonsteroidal antiinflammatory drugs for postoperative pain management after lumbar spine surgery: a meta-analysis of randomized controlled trials

Kitti Jirarattanaphochai, M.D., Ph.D., and Surachai Jung, M.D.

Conclusions. This meta-analysis provides evidence that the addition of NSAIDs to opioid analgesics in lumbar spine surgery provided better pain control than opioid analgesics alone. (DOI: 10.3171/Spine%2F2008%2F9%2F7%2F022)
Gabapentinoids

- Attenuate the nociceptive response by facilitating central desensitization
  - Bind to presynaptic calcium channels in nerve fibers
  - Inhibit release of excitatory neurotransmitters
Gabapentinoids

Patients who received gabapentin 300 mg had significantly lower VAS score at all time points. They consumed less fentanyl (patients who received placebo processed 1217.5 ± 182.0 versus 987.5 ± 129.6 μg; \( P < 0.05 \)). Patients who received gabapentin 600, 900, and 1200 mg had lower VAS scores at all time points than patients who received gabapentin 300 mg (\( P < 0.05 \)). Increasing the dose of gabapentin from 600 to 1200 mg did not decrease the VAS score, nor did the increasing dose of gabapentin significantly decrease fentanyl consumption (702.5, 635, and 626.5 μg). Thus, gabapentin 600 mg is the optimal dose for postoperative pain relief following lumbar disectomy.
Conclusions: Perioperative PG administration reduces early postsurgical pain at rest and particularly during movement after major spine surgery with less opioid consumption, and it seems to influence the improvement of overall QoL 3 months after surgery.
Gabapentinoids

Key Points

- Perioperative administration of gabapentinoids reduces early static and dynamic pain. Findings of the study suggest that in postoperative pain management, gabapentin, and pregabalin are the preferred alternatives in multimodal analgesia.

- Gabapentinoids effectively reduce the opioid consumption and opioid-related adverse effects after surgery.
Epidural Local Anesthetics

The results of our study provide evidence that a single epidural injection of 0.1% ropivacaine (10 mL) before one-level posterior lumbar interbody arthrodesis is effective and suitable for reducing early postoperative pain and opioid use without procedure-related complications. This appears to be a good component of multimodal pain management in lumbar spine surgery.
Epidural Steroids

Conclusions

In conclusion, there is evidence that epidural steroids decrease short-term pain in adults undergoing lumbar spine surgery for degenerative spinal disease. This evidence is supported by trials of moderate methodological quality subject to outcome reporting bias and lacking validated outcomes. More research is required before establishing perioperative epidural steroids as an effective and safe adjunct to surgery for long-term pain reduction.
Epidural Steroids

Conclusions
The considerable variation between the trials makes it difficult to make undisputed conclusions. Nevertheless, based on the assessment of 16 intraoperative epidural steroids trials it appears that there is relatively strong evidence that they are effective in reducing pain in the early stage and reducing the consumption of postoperative analgesia without an increased risk of complications. There is also relatively
In summary, we conclude that the perioperative use of bupivacaine and corticosteroids during lumbar discectomy maintains effective postoperative analgesia and decreases postoperative opioid usage without complications.
Epidural Steroids/Local Anesthetic

Peridural Methylprednisolone and Wound Infiltration

Key Points

- Administration of methylprednisolone and bupivacaine was effective in reduction of morphine consumption and postoperative pain intensity after posterior lumbosacral spine surgery for discectomy, decompression, and/or spinal fusion.
Conclusion

Intraoperative bolus epidural fentanyl is a quick and simple technique that is effective at alleviating early postoperative pain after lumbar canal decompression without significant systemic side effects. This method of analgesia may be a useful adjunct in patients undergoing lumbar spine surgery.
Continuous Local Infusion Devices

- Elastomeric pump with flow restrictor connected to catheter
- Allows for consistent delivery of medication into soft tissues
- Inserted following wound closure
- Patient may be discharged with device in place
Continuous Local Infusion Devices
Continuous Local Infusion Devices

Key Points

- After lumbar spine fusion procedures, continuous infusion of local anesthetic into the subfascial aspects of the wound resulted in lower postoperative pain scores and narcotic usage.
- Decreased use of narcotics and NSAIDs in the postoperative period may lessen the morbidities associated with their side effect profiles.
- Placement of a local anesthetic infusion pump represents a simple and safe technique for postoperative analgesia.
Continuous Local Infusion Devices

A Prospective, Randomized, Double-Blind Study Evaluating the Efficacy of Postoperative Continuous Local Anesthetic Infusion at the Iliac Crest Bone Graft Site After Spinal Arthrodesis

Kern Singh, MD,* Dino Samartzis Dip, EBHC,† James Strom, RN,‡ David Manning, MD,‡ Marion Campbell-Hupp, RN,§ F. Todd Wetzel, MD,§ Pernendu Gupta, MD,‡ and Frank M. Phillips, MD*

A Prospective, Randomized, Double-Blind Study of the Efficacy of Postoperative Continuous Local Anesthetic Infusion at the Iliac Crest Bone Graft Site After Posterior Spinal Arthrodesis

A Minimum of 4-Year Follow-up

Kern Singh, MD,* Frank M. Phillips, MD,* Eugene Kuo, MD,† and Marion Campbell, MSN*
Injectable Liposomal Bupivacaine

- Indicated for single-dose administration into the surgical site for postoperative analgesia
- Requires no catheter, pump, or additional device
- Shown to decrease pain and opioid consumption during the perioperative period
Injectable Liposomal Bupivacaine

- **Mechanism of action**
  - DepoFoam – microvesicular liposomal carrier composed of natural membrane components that are biocompatible and biodegradable
  - Encapsulates drugs without altering their molecular structure
  - Allows for controlled release of bupivacaine over time

Injectable Liposomal Bupivacaine

- Other formulations of bupivacaine should not be administered within 96 hours following administration of EXPAREL®.
- Systemic plasma levels of bupivacaine following administration of EXPAREL® are not correlated with local efficacy.
- The rate of systemic absorption of bupivacaine is dependent upon the total dose of drug administered, the route of administration, and the vascularity of the administration.
- This curve represents the pharmacokinetic profile from a TKA. The shape of curves consistently (across several surgical models and various doses) exhibited bimodal kinetics, with the first peak in the first hour or so and the second peak over hours 12-48.

Injectable Liposomal Bupivacaine

- Technique of administration
  - 20 mL single-use vial which may be expanded with sterile normal saline
  - May be stored for up to 4 hours at room temperature prior to injection
  - Infiltration into soft tissues of surgical site
Injectable Liposomal Bupivacaine

- Technique of administration
  - Less diffusion throughout tissues
  - Requires additional injections to cover the same area
Injectable Liposomal Bupivacaine

- Technique of administration – total knee replacement
Injectable Liposomal Bupivivcaine

• Technique of administration – total hip replacement
Injectable Liposomal Bupivacaine

- Potential economic benefits
  - Reductions in opioid/PCA use
  - Decreased risk of ORAEs/hospital-acquired conditions
  - More rapid rehabilitation
  - Improved system efficiency
  - Shorter hospital LOS
  - Better patient satisfaction scores
Multimodal Regimens

The perioperative use of corticosteroids and bupivacaine in the management of lumbar disc disease

Ryan S. Glasser, M.D., Robert S. Knego, M.D., Johnny B. Delashaw, M.D., and Richard G. Fessler, M.D., Ph.D.

In summary, this study indicates that the perioperative use of bupivacaine and corticosteroids during lumbar microdiscectomy results in a reduction in postoperative pain, decreased narcotic analgesic use, and a shorter postoperative hospital stay, without complications. We suggest that the use of this combination can be a highly beneficial adjunct to lumbar microdiscectomy.
Multimodal Regimens

Preemptive analgesia for postoperative pain relief in lumbosacral spine surgeries: a randomized controlled trial
C. Sekar, MD, S. Rajasekaran, PhD, FRCS, M Ch Ortho, MS Ortho, DNB Ortho, D Ortho*, Rajesh Kannan, Diploma Anesthesiology, Shashidhar Reddy, DNB Ortho, D Ortho, T. Ajoy Prasad Shetty, MS Ortho, DNB Ortho, Yogesh K. Pithwa, MS Ortho, DNB Ortho, D Ortho

Conclusions

Preemptive analgesia with a single caudal epidural injection of bupivacaine and tramadol is a safe, simple and effective technique giving postoperative pain relief for a period
Comparison of Perioperative Oral Multimodal Analgesia Versus IV PCA for Spine Surgery

Sharad Raijpal, MD,* Debra B. Gordon, RN, MS, FAAN,† Teresa A. Pellino, RN, PhD,‡ Andrea L. Strayer, RN, NP,§ Denise Brost, RN, NP,§ Gregory R. Trost, MD,§ Thomas A. Zdeblick, MD,¶ and Daniel K. Resnick, MD§

Use of a perioperative oral multimodal analgesia protocol in spine surgery, including scheduled long-acting oral oxycodone, gabapentin, and acetaminophen with PRN dosing of short-acting oxycodone, seems to provide safe and effective pain control. Use of the oral protocol was well tolerated and associated with an opioid sparing effect, less nausea, and decreased sleep interference compared with patients who received conventional IV PCA.
Multimodal Regimens

A Prospective Randomized Study of Preemptive Analgesia for Postoperative Pain in the Patients Undergoing Posterior Lumbar Interbody Fusion

Continuous Subcutaneous Morphine, Continuous Epidural Morphine, and Diclofenac Sodium

Yasutsugu Yukawa, MD, Fumihiko Kato, MD, Keigo Ito, MD, Teruo Terashima, MD, and Yumiko Horie, MD

Key Points

- Diclofenac sodium was pretty effective immediately after surgery, but its effects did not continue so long. Diclofenac sodium group needed more supplemental analgesic drugs, and the time to first request of them was shortest.
- Continuous epidural morphine did not seem to be suitable for preemptive analgesia because of technical difficulty and high rates of adverse effects.
- Continuous subcutaneous morphine was recommended for preemptive analgesia because of its technical ease, moderate effects, and few complications.
Multimodal Analgesia

Opioid Monotherapy

1. Weak opioids
2. Potent opioids
3. Give more opioids

MILD TO MODERATE PAIN  MODERATE TO SEVERE PAIN  BREAKTHROUGH PAIN

Multimodal Analgesia

1. Step 1:
   - Acetaminophen, NSAIDs, or coxibs
   - Local analgesic infiltration

2. Step 2:
   - Step 1 strategy +
   - Intermittent opioid analgesics

3. Step 3:
   - Step 1 & 2 strategies +
   - Peripheral neural blockade
   - Additional opioids

Conclusion

• Increasing number of orthopaedic and spinal surgeries will be performed in ASC
• Success of these procedures contingent upon obtaining adequate postoperative pain control
• Multimodal analgesia may be safer, more effective, and give rise to greater cost savings that conventional regimens
Thank You!