Optimizing Postoperative Pain Management: Role of Local Anesthetics

Presented as a Midday Symposium and Live Webinar at the 48th ASHP Midyear Clinical Meeting and Exhibition

Tuesday, December 10, 2013
Orlando, Florida

Planned and conducted by ASHP Advantage and supported by an educational grant from Pacira Pharmaceuticals, Inc.
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Optimizing Postoperative Pain Management: Role of Local Anesthetics

Agenda

11:30 a.m. – 11:35 a.m.  Welcome and Introductions
Julie Golembiewski, Pharm.D., FASHP

11:35 a.m. – 12:10 p.m.  Analysis and Implementation of Analgesic Delivery Systems for Managing Postoperative Pain
Virginia L. Ghafoor, Pharm.D.

12:10 p.m. – 12:45 p.m.  Incorporating Current Guidelines for Multimodal Pain Management into Postoperative Order Sets
Leslie N. Schechter, Pharm.D.

12:45 p.m. – 1:20 p.m.  Role of Local Anesthetics in Managing Postoperative Pain
Julie Golembiewski, Pharm.D., FASHP

1:20 p.m. – 1:30 p.m.  Faculty Discussion and Audience Questions

Faculty

Julie Golembiewski, Pharm.D., FASHP, Activity Chair
Clinical Pharmacist, Anesthesia and Pain
University of Illinois Hospital and Health Sciences System
Clinical Associate Professor
Colleges of Pharmacy and Medicine
University of Illinois at Chicago
Chicago, Illinois

Virginia L. Ghafoor, Pharm.D.
Pharmacy Specialist, Pain Management
University of Minnesota Medical Center
Minneapolis, Minnesota

Leslie N. Schechter, Pharm.D.
Advanced Practice Pharmacist, Pain Management and Nutritional Support
Thomas Jefferson University Hospital
Clinical Assistant Professor
Philadelphia College of Pharmacy
University of the Sciences
Philadelphia, Pennsylvania
Disclosure Statement

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- Julie Golembiewski, Pharm.D., FASHP, declares that she has served on the pharmacist advisory board for Pacira Pharmaceuticals, Inc.
- Virginia L. Ghafoor, Pharm.D., declares that she has served on the pharmacist advisory board for Pacira Pharmaceuticals, Inc.
- Leslie N. Schechter, Pharm.D., declares that she has served on the pharmacist advisory board for Pacira Pharmaceuticals, Inc.

The following faculty and planners report no relationships pertinent to this activity:

- Susan R. Dombrowski, M.S., B.S.Pharm.
- Carla J. Brink, M.S., B.S.Pharm.

ASHP staff has no relevant financial relationships to disclose.
Activity Overview

Despite an increasing focus on improvement in pain management in the postsurgical setting and publication of guidelines and standards by government and health care agencies, suboptimal management of postoperative pain continues to be a problem. New therapeutic options and delivery systems have been developed to deliver analgesics more effectively for a longer period of time, but these can add a layer of complexity that health care systems must evaluate to ensure safe and effective implementation. This activity will begin with a review of factors to consider when analyzing analgesic delivery systems and developing guidelines for safe use. The multimodal approach for pain management will be discussed, including a review of therapeutic options and roles for pharmacists. The role of local anesthetics as a component of a multimodal approach for managing postoperative pain will also be discussed.

Learning Objectives

At the conclusion of this application-based educational activity, participants should be able to

- Outline a plan for ensuring the safe and effective use of analgesic delivery systems for managing postoperative pain.
- Explain key recommendations in recently released guidelines on the management of postoperative pain.
- Review postoperative order sets to ensure that multimodal therapy has been incorporated in the pain management regimen.
- Discuss the role of local anesthetics for managing postoperative pain.
Continuing Education Accreditation

The American Society of Health-System Pharmacists is accredited by the Accreditation Council for Pharmacy Education as a provider of continuing pharmacy education. This activity provides 2 hours (0.2 CEUs) of continuing pharmacy education credit (ACPE activity # 0204-0000-13-486-L01P).

Attendees may print their official statements of continuing pharmacy education credit online after completion of the online evaluation. All statements are available online at the ASHP eLearning portal (http://elearning.ashp.org). For complete activity information, visit www.ashpadvantage.com/postoppain

Complete instructions for receiving your statement of continuing pharmacy education credit online are available on the next page. Be sure to record the attendance code beginning with “M” announced during the activity.

ACTION REMINDER EMAIL

Have ideas about what YOU want to remember to do as a result of what you are learning in this educational session? Use the Action Reminder tool via your smart device, and you will be sent an email reminder from YOURSELF next month.

If you do not have a smart device, access the Action Reminder for this activity at http://www.ashpadvantagedmedia.com/postoppain/remindme.php
CPE Processing Instructions

1. Write down the Attendance Code for each session you attend. These codes are announced during each session. If you miss the code, check with the Room Monitor at the session.

2. Log in to ASHP’s eLearning Portal using your username and password. [http://elearning.ashp.org](http://elearning.ashp.org)

3. Click on My Learning Activities. Then click on 2013 – Midyear Clinical Meeting & Exhibition (Orlando, FL) under Conferences.

4. At the bottom of the page is a field for redeeming Attendance Codes (formerly called CE codes). Enter the Attendance Code(s) from each session, and click Submit.

   Tip: If your code is not redeeming successfully, verify that you have clicked on the title of your conference in order to access the Attendance Code field, not the Enrollment Code field.

5. Each session will be listed under Your Sessions. Click Claim Credit for a session.

6. Click on the name of a session and complete the requirements for the session.

7. Click Claim Credit for your profession. It is important that you select the correct profession.
   - Pharmacists and Pharmacy Technicians: Fill in your NABP eProfile ID and birth month and date. Check the box at the bottom and click Claim. You will see a message advising you whether or not your credits were claimed successfully. Your CPE credit will be reported directly to CPE Monitor.
   - Other (International, Students, etc.): Use ASHP Statement of Completion. Check the box at the bottom and click Claim.

You may print your statement of credit by clicking on Print Statement of Credit. If you require a reprint of a statement of credit, you can return here at any time to print a duplicate.

Exhibitors: Additional First Steps

1. Login to [www.ashp.org/exhibitorce](http://www.ashp.org/exhibitorce) with your ASHP username and password.

2. Click on the Get Started button.

3. Select the 48th ASHP Midyear Clinical Meeting & Exhibition from the dropdown menu.

4. Select your Exhibiting Company from the list of exhibitors. From here, follow the instructions above.

ASHP is now using the eLearning Portal ([http://elearning.ashp.org](http://elearning.ashp.org)) for CE Processing, which allows ASHP to report pharmacy credits via CPE Monitor. For more information, visit [www.ashp.org/CEtransition](http://www.ashp.org/CEtransition)

Pharmacists and Pharmacy Technicians: To process your CE on the eLearning Portal, you must enter your NABP e-Profile ID and birth month and date. After you have entered this information once it is saved for future CE processing. You may obtain your eProfile ID at [www.nabp.net](http://www.nabp.net).

There may be different directions for workshops and review courses.

<table>
<thead>
<tr>
<th>Date of Activity:</th>
<th>Attendance Code:</th>
<th>CPE Hours:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tuesday December 10, 2013</td>
<td>M _ _ _ _ _</td>
<td>2.0</td>
</tr>
</tbody>
</table>

NEED HELP? Email educserv@ashp.org
Your educational opportunities related to postoperative pain management extend beyond today’s symposium…

- **Available in 2014**
  - A live webinar on February 13, 2014, where faculty will explore issues raised by participant questions in today’s symposium (1 hour CPE)
  - Informational podcasts featuring the faculty in a roundtable discussion
  - e-Newsletters featuring tips for incorporating information from this symposium into practice, as well as updates on emerging information on postoperative pain management
  - Web-based activity based on today’s live symposium (2 hours of CPE, please note that individuals who claim CPE credit for the live symposium or webinar are ineligible to claim credit for the web-based activity)

For more information and to sign up to receive e-mail updates about this educational series, visit

[www.ashpadvantage.com/postoppain](http://www.ashpadvantage.com/postoppain)
Optimizing Postoperative Pain Management: Role of Local Anesthetics

Virginia L. Ghafoor, Pharm.D.
Pharmacy Specialist, Pain Management
University of Minnesota Medical Center
Minneapolis, Minnesota

Virginia L. Ghafoor, Pharm.D., is Pharmacy Specialist in Pain Management at University of Minnesota Medical Center in Minneapolis. For more than 10 years, she has been instrumental in developing pharmacy services for acute and chronic pain management at the University of Minnesota Medical Center and throughout the Fairview health system. She advocates for pain medication safety, promotes pharmacy pain medication stewardship, and leads the health system’s Pain Medication Committee to advance evidence-based practice standards.

Dr. Ghafoor earned her Doctor of Pharmacy degree from the University of Nebraska Medical Center in Omaha. Early in her career she received a two-year fellowship award from the American Society of Health-System Pharmacists (ASHP) Research and Education Foundation for oncology research at University of Wisconsin-Madison, and the fellowship involved working with nationally recognized leaders in cancer and pain management research. Before assuming her current position, Dr. Ghafoor was on the faculty at the University of Rhode Island (URI) College of Pharmacy and conducted research and pharmacy education programs in pain management at Rhode Island Hospital in Providence. During this time she also developed an ASHP-accredited pharmacy practice residency program for the URI College of Pharmacy.

Dr. Ghafoor has authored several articles on pain topics, including intrathecal pumps, palliative sedation, and patient-controlled analgesia. She has also contributed chapters on pain management to the texts, Koda-Kimble and Young’s Applied Therapeutics: The Clinical Use of Drugs, Smart Infusion Pumps published by ASHP, and Core Curriculum for Pain Management Nursing published by American Society of Pain Management Nurses. Dr. Ghafoor is a member of ASHP and Minnesota Society of Health-System Pharmacists. She currently serves on the ASHP Advisory Group for Pain Management and Palliative Care.
Analysis and Implementation of Analgesic Delivery Systems for Managing Postoperative Pain

Virginia L. Ghafoor, Pharm.D.
University of Minnesota Medical Center
Minneapolis, Minnesota

“The purpose of medicine is to prevent significant disease, to decrease pain and to postpone death...Technology has to support these goals, if not, it may even be counterproductive.”
- Dr. Joel J. Nobel
Founder, ECRI Institute
Inventor of the crash cart

Driving Forces for New Pain Management Technology

- Medication safety with “smart” pumps
- Reduction in human operation errors
- Innovation allowing patient control of pain management
- Device mobility with care transitions
- Recalls due to a design problem or operation failure
What is your biggest concern about the safety of pain medication devices?

a. Medication overdose  
b. Programming errors  
c. Lack of staff expertise  
d. Recall due to defect

Safety Recommendations

• Use smart infusion technology with dosage error reduction software (DERS)

• Process for handling elastomeric pain relief pump

Building Safe Practice Around High-Risk Medication Devices

• Expertise and training for high-risk routes
  Example: Intrathecal, epidural, and nerve blocks restricted to anesthesia and certified specialists

• Patient care policies to guide monitoring
  Example: Pain assessment, vital signs, and capnography

• Order sets for high-risk medications
  Example: Opioids and local anesthetics
The Balancing Act

<p>| Example: Device Selection for Local Anesthetics |</p>
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Electronic Pump</th>
<th>Elastomeric Pump</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pro</td>
<td>Con</td>
</tr>
<tr>
<td>Continuous infusion</td>
<td>Drug volume indicator</td>
<td>- One-time cost (reusable)</td>
</tr>
<tr>
<td>Patient-controlled dose</td>
<td>Flexible dose settings</td>
<td>- One-time cost (reusable)</td>
</tr>
</tbody>
</table>

Vetting a Device

“Success is doing ordinary things extraordinarily well.”
- Jim Rohn

American entrepreneur

Key Stakeholders

Biomed Engineer
Finance Member
Supply Chain
Physician Staff
IT Specialist
Nursing Staff
Pharmacy Staff

TEAM

“Teamwork divides the task and multiplies the success.”
- Author Unknown

Assigning Ownership and Responsibility

- Corporate and financial
  - Contract and purchase of the device
  - Budget for costs
    - Staff training
    - Trouble shooting problems
    - Drug library upgrades for smart pumps
    - Risk management and quality improvement processes
- Technology, engineering, and supply chain
  - Software integration and maintenance of computer
  - Device maintenance

Assigning Ownership and Responsibility

- Clinical departments and practitioners
  - Device policy and procedure
  - Order sets, guidelines for dispensing and administration
- Quality assurance and performance improvement
  - Monitor medical device hardware failures and recalls
  - Review manual overrides for the device
  - Evaluate medication errors related to device
“Price is what you pay. Value is what you get.”
- Warren Buffett
  American business magnate

What do you think is the most important attribute when vetting a new device?

a. Safety features
b. Price
c. Health care provider satisfaction
d. Ease of implementation

Value Analysis
Value of a device is determined by estimating how well it performs, divided by the cost
  - Customer focused
  - Process oriented
  - Data-driven (Example: MAUDE data)

MAUDE DATA
(Manufacturer and User Facility Device Experience)

- FDA database for device events
- Example of a real-time search
  - Product class: Pump, infusion, elastomeric
  - Event type: Injury
  - Date: 1/1/2013 through 9/30/2013
  - Results: 159 records (2 deaths)
  - Commonly reported: runaway flow rate where elastomeric pump delivered local anesthetic faster than the rate setting

In vetting a process, adverse event data would disqualify a device unless safety improvements have been made.

Weighted Matrix

Weighted-matrix recognizes medical device attributes that must be present
- Weight of attribute indicates level of desire for a feature
- Attribute score is the performance of the device
- Total weighted score for the device is obtained by multiplying weight of attribute by the attribute score

Medical device with the highest total weighted score indicates it is the best performer


Example: Weighted Decision Matrix

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Weight of attribute (1-10 scale)</th>
<th>Attribute score for Pump #1 (1-4 scale)</th>
<th>Total weighted score for Pump #1</th>
<th>Attribute score for Pump #2 (1-4 scale)</th>
<th>Total weighted score for Pump #2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vendor provides staff education materials</td>
<td>6</td>
<td>4</td>
<td>24 (6 x 4)</td>
<td>2</td>
<td>12 (6 x 2)</td>
</tr>
<tr>
<td>Vendor offers continuing education</td>
<td>1</td>
<td>2</td>
<td>2 (1 x 2)</td>
<td>4</td>
<td>4 (1 x 4)</td>
</tr>
<tr>
<td>TOTAL</td>
<td>7</td>
<td>6</td>
<td>26</td>
<td>6</td>
<td>16</td>
</tr>
</tbody>
</table>

Failure Mode and Effects Analysis (FMEA)

"A systematic method of examining a process prospectively for possible ways in which failure can occur and the redesigning of the process to eliminate the possibility of the failure, stop the failure before it harms an individual, or minimize the consequences of the failure"


Methods

- The hazard score is the product of the severity and probability scores
- Each item was determined to be detectable (Yes/No) based on whether or not the failure mode would be detected before reaching the patient

<table>
<thead>
<tr>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-3</td>
</tr>
<tr>
<td>4-6</td>
</tr>
<tr>
<td>7-9</td>
</tr>
<tr>
<td>10</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Severity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minor</td>
</tr>
<tr>
<td>Moderate</td>
</tr>
<tr>
<td>Major</td>
</tr>
<tr>
<td>Catastrophic</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doubtful</td>
</tr>
<tr>
<td>Possible</td>
</tr>
<tr>
<td>Likely or Probable</td>
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</tr>
<tr>
<td>7-9</td>
<td>Major</td>
<td>Likely or Probable</td>
</tr>
<tr>
<td>10</td>
<td>Catastrophic</td>
<td>Absolute</td>
</tr>
</tbody>
</table>

FMEA Results

Example from the University of Minnesota Medical Center

<table>
<thead>
<tr>
<th>STUDENT</th>
<th>PUMP FAILURE MODE</th>
<th>PREDICTED EFFECT</th>
<th>S</th>
<th>F</th>
<th>D</th>
<th>HS</th>
<th>ACTION PLAN</th>
<th>NEW SF/M</th>
<th>CHANGE</th>
<th>OCCUR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Key not available to unlock pump.</td>
<td>Delay in use of pump and pain control</td>
<td>7</td>
<td>Y</td>
<td>Y</td>
<td>06</td>
<td>Know plan for placement of keys so additional keys can be obtained from known location quickly</td>
<td>2/8/16</td>
<td>-71%</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Medication delivery by proxy</td>
<td>Overdosing and patient harm</td>
<td>6</td>
<td>Y</td>
<td>Y</td>
<td>06</td>
<td>Cards are attached to the button warning against PCEA by proxy</td>
<td>6/4/32</td>
<td>-43%</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Extension tubing cannot deliver ordered volume</td>
<td>Unable to use pump set-up for patient</td>
<td>6</td>
<td>Y</td>
<td>Y</td>
<td>72</td>
<td>2 sizes of tubing purchased</td>
<td>6/4/32</td>
<td>-55%</td>
<td>No</td>
<td></td>
</tr>
</tbody>
</table>

See page 18 for enlarged view
Limitations of FMEA

- Little research on the reliability and validity of the FMEA process and output
- Severity, frequency, and detectability scores are subjective
- Variation in hazard score interpretation
- Follow up required to make sure potential problem is resolved


“Stay committed to your decisions but flexible in your approach.”
- Tom Robbins
American author

Conclusion

- Value analysis is fundamental to the selection of pain management devices
- Safety is an important attribute not to be overlooked when acquiring new technology
- FMEAs are valuable for prospective identification of problems prior to implementation of a device
### FMEA Results
Example from the University of Minnesota Medical Center

<table>
<thead>
<tr>
<th>Epidural Pump Failure Mode</th>
<th>Predicted Effect</th>
<th>S</th>
<th>F</th>
<th>D</th>
<th>HS</th>
<th>Action Plan</th>
<th>New S/F/HS</th>
<th>Change</th>
<th>Occur?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Key not available to unlock pump</td>
<td>Delay in use of pump and pain control</td>
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<td>8</td>
<td>Y</td>
<td>56</td>
<td>Know plan for placement of keys so additional keys can be obtained from known location quickly</td>
<td>2/8/16</td>
<td>-71%</td>
<td>Yes</td>
</tr>
<tr>
<td>Medication delivery by proxy</td>
<td>Oversedation and patient harm</td>
<td>8</td>
<td>7</td>
<td>N</td>
<td>56</td>
<td>Cards are attached to the button warning against PCEA by proxy</td>
<td>8/4/32</td>
<td>-43%</td>
<td>No</td>
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<tr>
<td>Extension tubing cannot deliver ordered volume</td>
<td>Unable to use pump set-up for patient</td>
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<td>2 sizes of tubing purchased</td>
<td>8/4/32</td>
<td>-55%</td>
<td>No</td>
</tr>
</tbody>
</table>

S= Severity  
F= Frequency  
D= Detectability  
HS= Hazard score
Selected References


Leslie N. Schechter, Pharm.D., is Advanced Practice Pharmacist specializing in pain management and nutritional support at Thomas Jefferson University Hospital in Philadelphia, Pennsylvania. She is also Clinical Assistant Professor at Philadelphia College of Pharmacy at the University of the Sciences and Adjunct Assistant Professor at Temple University School of Pharmacy in Philadelphia. She serves as a preceptor for Doctor of Pharmacy students at Jefferson School of Pharmacy.

At Thomas Jefferson University Hospital (TJUH), Dr. Schechter serves as Pharmacy Liaison for the Acute Pain Management Service (APMS) and is involved in APMS clinical trials. She also provides pharmacotherapy recommendations relating to pain management, conducts medication use reviews related to pharmaceutical pain management therapy, and is involved in the drug review process for formulary addition considerations for anesthesia and pain medications. Dr. Schechter is a member of the TJUH Pain Initiative, an interdisciplinary group that developed a booklet of pain management guidelines, which is updated periodically and distributed to all medical, surgical, nursing, and pharmacy staff.

Dr. Schechter earned her Bachelor of Science degree in pharmacy from the Virginia Commonwealth University’s Medical College of Virginia in Richmond and her Doctor of Pharmacy degree from Purdue University College of Pharmacy and Pharmaceutical Sciences in West Lafayette, Indiana. She completed a residency accredited by the American Society of Health-System Pharmacists (ASHP) at the Medical College of Virginia Hospitals.

Dr. Schechter is a member of ASHP and the American Society for Parenteral and Enteral Nutrition. She has contributed chapters to several textbooks on pain management, including The Essence of Analgesia and Analgesics (Cambridge University Press), Handbook of Drug-Nutrient Interactions (Humana Press), Acute Pain Management, 1st ed. (Cambridge University Press), and Textbook of Regional Anesthesia and Acute Pain Management (McGraw-Hill). She has also authored several articles related to pain management. She is frequently invited to speak on topics related to pain management for interdisciplinary health care audiences.
Incorporating Current Guidelines for Multimodal Pain Management into Postoperative Order Sets

Leslie N. Schechter, Pharm.D.
Thomas Jefferson University Hospital
Philadelphia, Pennsylvania

Pain by the Numbers

• Of the 80% of patients undergoing surgery who experience postoperative pain
  – Fewer than 50% report adequate pain relief1
    • Of these, 86% report the pain as moderate, severe, or extreme
  – 10% to 50% of patients with postoperative pain develop chronic pain (surgical procedure dependent)2
    • For 2% to 10% of these patients, the chronic pain is severe


The Joint Commission Standards

• Right of patients to appropriate assessment and management of pain
• Screen patients for pain
  – During their initial assessment
  – When clinically required
  – Ongoing periodic re-assessments
• Educate patients and families about pain management

The Joint Commission. Facts about pain management. URL in ref list.
Hospitals Are Accountable for Adequate Pain Management

- Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) hospital survey
  - Summary measures or composites summarize
    - How well nurses and doctors communicate
    - How responsive hospital staff are to patients' needs
    - How well hospital staff help patients manage pain
    - How well the staff communicates about medicines
    - Whether key information is provided at discharge

Centers for Medicare & Medicaid Services. HCAHPS Fact Sheet (CAHPS® Hospital Survey). August 2013. URL in ref list.

Acute Pain Practice Guidelines

- Institute of Medicine (IOM) report, "Relieving Pain in America: A Blueprint for Transforming Prevention, Care, Education and Research" (2011)
- American Society of Anesthesiologists Task Force report: Practice Guidelines for Postanesthetic Care (Apfelbaum JL et al., 2013)

IOM: Relieving Pain in America

- Full report available online (364 pages)
  - Relieving Pain in America: A Blueprint for Transforming Prevention, Care, Education, and Research
- 2010 Patient Protection and Affordable Care Act
  - Required U.S. Department of Health and Human Services (DHHS) to enlist IOM in examining pain as public health problem
- IOM
  - Assessed the state of the science regarding pain research, care, and education

IOM: Relieving Pain in America

- IOM report
  - Provides recommendations for improving acute and chronic pain management
    - Cultural, educational, and research methods
    - Limited information on appropriate selection of therapeutic modalities
- No report available evaluating progress
- Use other guidelines for specific therapeutic evidence-based options


2012 Practice Guidelines for Acute Pain Management in the Perioperative Setting

- Updated 2004 Practice Guidelines
- October 2012
  - American Society of Anesthesiologists (ASA) Committee on Standards and Practice Parameters
    - Collected new evidence to determine whether existing 2004 guidelines were supported by current evidence


2012 Practice Guidelines for Acute Pain Management in the Perioperative Setting

- Pain management in the perioperative setting
  - Actions before, during, and after a procedure
  - Intended to reduce or eliminate pain before discharge
- New evidence includes
  - Updated evaluations of scientific literature
  - Surveys of experts and randomly selected ASA members
- Recommendations: NOT changed

2012 Practice Guidelines for Acute Pain Management in the Perioperative Setting

- Purpose of the guidelines
  - Facilitate safety and effectiveness of acute pain management
  - Reduce risk of adverse outcomes
  - Maintain patient's functional abilities, physical, and psychologic well being
  - Enhance quality of life


2012 Practice Guidelines for Acute Pain Management in the Perioperative Setting

- Application
  - Intended use
    • Anesthesiologists
    • Individuals under their supervision
  - Resource
    • Health care providers managing postoperative pain
    • Policymakers to promote effective and patient-centered care


Pathophysiologic Responses Associated with Trauma


See page 36 for enlarged view
Adverse Outcomes Associated with the Management of Perioperative Pain

- Respiratory depression
- Sedation
- Circulatory depression
- Nausea and vomiting
- Pruritus
- Urinary retention
- Impairment of bowel function
- Sleep disruption

Preoperative Evaluation of the Patient

- Patient factors to consider
  - Type of surgery
  - Expected severity of postoperative pain
  - Underlying medical conditions
    - Sleep apnea
    - Allergies
    - History of opioid use
  - Risk-benefit ratio for the available techniques and medications
  - Patient preferences or previous experience

Case Scenario

- Cardiothoracic surgeons at your institution provide pain management using a prescriber-specific, reactive approach to postoperative pain management
- Pain management is opioid driven
  - Opioids prescribed as needed (PRN) immediately postoperative, followed by acetaminophen and opioid combination products PRN
- They seek your input about how to improve postoperative pain management
What recommendations could you offer to improve pain management for patients having cardiothoracic surgery?

a. Order PCA morphine, then long-acting opioids around clock
b. Order PCA morphine followed by short-acting opioids PRN
c. Add multimodal non-opioid therapy around clock
d. Continue current approach – has been modestly effective

PCA = patient-controlled analgesia

Perioperative Techniques for Pain Management: Therapeutic Options

- Epidural or intrathecal opioids
- Systemic opioid PCA
- Peripheral regional techniques
  - Intercostal blocks
  - Plexus blocks
  - Local anesthetic infiltration of incisions
  - Catheter placement with continuous infusion
  - Prior to suturing, local anesthetic injection
- Consider risks and benefits for the individual patient
- Avoid intramuscular (IM) injections as needed


Multimodal Analgesia

- Pain involves multiple mechanisms
- Multimodal analgesia
  - Administration of two or more drugs that act by different mechanisms either via the same route or by different routes of administration
- Opioid and non-opioid analgesics
  - Acting at different sites within the central and peripheral nervous systems
  - Goal
    - Additive or synergistic effects
    - Diminish or eliminate adverse effects
    - Fewer analgesic gaps

Multimodal Approach


Multimodal Analgesia

- Consider the following as part of non-opioid multimodal therapy
  - Acetaminophen
  - NSAIDs (selective or nonselective COX inhibitors)
  - Gabapentinoids (pregabalin, gabapentin)
- Unless contraindicated, administer around-the-clock and not as needed
- Individualize choice of medication, dose, route, and duration of therapy

COX = cyclooxygenase
NSAIDs = nonsteroidal anti-inflammatory drugs


Opioids - Pure Mu Agonists

- Considered drugs of choice for moderate to severe pain
- Little difference in ability to relieve pain
- Unrelieved pain usually not a reason to switch agents
  - Pain relief is dose related
- No ceiling effect to analgesia for pure mu-agonists
- Consider minimizing the opioid peak concentration
  - Decrease dose
  - Decrease dosing interval while maintaining the same 24-hour total dose
- Adverse effects
  - Sedation, nausea, constipation, respiratory depression, pruritus, urinary retention

FDA News Release: September 10, 2013

• Class-wide safety labeling changes and new postmarket study requirements for all ER and LA opioid analgesics

• Updated indication for ER and LA opioids
  – Management of pain severe enough to require daily, around the clock, long-term opioid treatment and for which alternative treatment options are ineffective, not tolerated, or inadequate to provide sufficient management of pain
  – NOT indicated for PRN pain relief

ER = extended release   LA = long acting


FDA News Release: September 10, 2013

• FDA requiring drug companies to conduct further studies and clinical trials
  – More information needed to assess the serious risks associated with long-term use of ER and LA opioids
    • Misuse, abuse, hyperalgesia, addiction, overdose, and death

• New boxed warning
  – Chronic maternal use during pregnancy can result in neonatal opioid withdrawal syndrome (NOWS)

• Modification of ER and LA opioid REMS

REMS = Risk Evaluation and Mitigation Strategy


FDA News Releases: October 24 and 25, 2013

• Will submit to DHHS by early December 2013
  – Formal recommendation to reclassify hydrocodone combination products into Schedule II

• Approved hydrocodone bitartrate extended-release capsules
  – Schedule II
  – Single entity (no acetaminophen)

REMS for ER and LA Opioids

- Approved by FDA on July 9, 2012
  - Part of national prescription drug abuse plan announced by Obama Administration in 2011 to combat prescription misuse and abuse
- Focus
  - Educating prescribers about proper pain management
  - Selecting suitable patients
  - Improving patient awareness of risks
- Physician training about opioids not mandatory
  - Some federal agencies working to get Congress to link mandatory physician training to DEA registration number
  - Obama Administration pursuing modification of Controlled Substances Act to require training to obtain and renew DEA registration


Acetaminophen

- Exact mechanism unclear, current evidence points to variety of central and peripheral mechanisms
  - Inhibition of centrally-acting cyclooxygenase with very weak peripheral effects
    - Central effects may explain antipyretic effect
    - Minimal peripheral effects – Lack of gastric irritation and clotting abnormalities
  - Interaction with various neurotransmitters and modulators controlling pain processing and perception (serotonergic and cannabinoid systems)
- Contraindicated in patients with severe hepatic impairment


Acetaminophen

Dosing Considerations

- FDA changes on January 13, 2011
  - Limit strength of acetaminophen in prescription, combination products to 325 mg per tablet
  - Boxed warning on prescription products - potential for severe liver injury
  - Pharmacists: notify prescribers when acetaminophen dosage in combination product can exceed 3000 mg in any 24-hr period
- McNeil Pharmaceuticals on July 28, 2011 voluntarily lowered maximum recommended daily dose from 4000 mg to 3000 mg in Tylenol® products
- Maximum safe dose of acetaminophen remains 4000 mg per day

Intravenous Acetaminophen

- Alternative to intravenous NSAIDs for management of postoperative pain
  - Avoid NSAID adverse effects
- Alternative to oral and rectal acetaminophen
  - Oral administration may not be feasible immediately after surgery
  - Rectal administration produces slow and unpredictable absorption
- Consider single dose, then convert to oral

Nonselective NSAIDs

- Mechanism of action
  - Inhibition of prostaglandin biosynthesis via nonselective inhibition of cyclooxygenase enzymes
- Adverse effects similar for all products
  - Gastrointestinal ulceration
    - Inhibiting prostaglandins involved in protection of GI mucosa
  - Prolonged bleeding
    - Inhibiting platelet thromboxane A2 synthesis resulting in inhibition of platelet aggregation
  - Renal impairment
    - Inhibiting renal prostaglandins

GI = gastrointestinal

NSAIDs

- Intravenous and oral NSAIDs
  - Decrease opioid requirements
  - Decrease incidence of adverse events
- No clinical trials showing comparative efficacy of IV ketorolac and ibuprofen
- Duration of IV ibuprofen currently not restricted
  - Only studied for up to 5 days
  - Use with caution for > 5 days


Anticonvulsants

- Gabapentin and pregabalin
- Mechanism: bind to alpha-2-delta subunit of the N-type voltage gated calcium channel
  - Propensity to dampen neuronal excitability
  - Used primarily for neuropathic pain
- Results in decreased release of substance P, calcitonin gene-related peptide, glutamate


Anticonvulsants: Dosing

- Pregabalin
  - Preoperative dose: 150-300 mg
  - Continued therapy: 75-150 mg twice daily for up to 14 days after surgery
- Gabapentin
  - Preoperative dose: 300-1200 mg
    - 600 mg – optimal in dose-response study
  - Postoperative therapy: 100-600 mg three times daily for 2-10 days


Ketamine

- Renewed interest in enhancing postoperative analgesia
- Antagonist at NMDA receptor
  - At low sub-anesthetic doses, exerts a specific NMDA blockade, modulating central sensitization induced by the incision and tissue damage
  - By blocking NMDA receptors, can reduce development of tolerance
- Opioid-sparing effect with advantages in patients likely to have high postoperative opioid consumption

NMDA = N-methyl-D-aspartate
Ketamine: Dosing

- Perioperative ketamine use in RCT\(^1\)
  - Reduced opioid dose by 30%
  - Reduced chronic post-surgical pain syndromes

- Dose\(^2\)
  - 0.1 - 0.5 mg/kg bolus ± 0.1 - 0.5 mg/kg/hr infusion
  - Adverse effects: < 10% of patients complained of psycho-cognitive effects (were opioid-naïve, rarely seen in opioid-tolerant patients)

- Protocol in adult patients with chronic opioid use (TJUH)
  - Initial bolus with 15 mg; may repeat \(\times 1\)
  - Begin infusion at 1 mg/hr
  - 5-mg bolus doses prior to infusion rate increases
  - Increase infusion up to 15 mg/hr (higher doses require attending physician approval)


2013 American Society of Anesthesiologists
Task Force Report: Practice Guidelines for Postanesthetic Care

- Updated 2002 practice guidelines
- Collected new evidence to determine whether existing 2002 guidelines supported by current evidence
- Purpose: improve postanesthetic care outcomes for patients who just had anesthesia or sedation and analgesia care
- Recommendations: NOT changed


PROSPECT: Evidenced-based, Procedure-specific Postoperative Pain Management

- Existing general guidelines do not consider
  - Procedure-specific differences in analgesic efficacy
  - Applicability of a given analgesic technique
- Website provides information and recommendations for evidence-based procedure-specific postoperative pain management
  - Intensity of pain and consequential effects on organ function may be procedure related
- PROSPECT Working Group
  - Conducts systematic reviews of the literature
  - Includes only randomized, controlled trials of postoperative interventions compared with placebo or other interventions

PROSPECT: evidenced-based, procedure-specific postoperative pain management. URL in ref list.
PROSPECT: Format of Recommendations

- Evidence and recommendations
  - Organized in a tree structure
  - Interventions for pain management
    - Preoperative
    - Intraoperative
    - Postoperative
- For each procedure, overall recommendations summarized in a table or algorithm
  - Abdominal hysterectomy
  - Colon resection
  - Hemorrhoid surgery
  - Herniorrhaphy
  - Laparoscopic cholecystectomy
  - Non-cosmetic breast surgery
  - Radical prostatectomy
  - Total hip and knee arthroplasty

PROSPECT: evidenced-based, procedure-specific postoperative pain management. URL in ref list.

CT surgeons request help modifying their pain regimens. Who should be included in the discussion? Select all that apply.

a. Pharmacists
b. Nurses
c. Cardiothoracic surgeons
d. Pain service staff and anesthesiologists
e. Hospital administration policymakers

Institutional Review of Postoperative Order Sets

- Review preoperative order sets, intraoperative anesthesia orders, and postoperative order sets
  - Based on surgical procedure, are appropriate pain medications ordered before, during, and after surgery?
  - If yes, evaluate HCAHPS scores for the surgical procedure and surgeon
    - If HCAHPS scores are acceptable, continue current regimen
    - If HCAHPS scores need improvement, discuss alternative therapy to improve patient pain management
Institutional Review of Postoperative Order Sets

- If the order sets do not offer multimodal therapy or do not follow clinical guidelines
  - Review HCAHPS scores for the surgical procedure and surgeon
  - Set up meeting with surgeons and anesthesiologists to review HCAHPS data and clinical guidelines
  - Present information for modifying current pain regimens in a constructive, informative manner

Institutional Review of Patient Discharge Instructions for Pain Management

- Review discharge medications and ensure appropriate medications for pain management are prescribed upon discharge
- Review the instructions for use and possible adverse effects with the patient and family
- Work with community pharmacy to ensure prescribed medications are covered under the patient’s health insurance plan

Changes to TJUH CT Surgery Pain Management Protocol

- Pregabalin 150 mg po x 1 dose pre-op and 75 mg po q12hr x 6 doses postop
- Acetaminophen 1000 mg IVPB q6hr x 36 hr postop (convert to oral if tolerated), then 1000 mg PO q6hr x 72 hr (adjust dose for patients < 50 kg)
- Postoperative day 0: hydromorphone PRN or PCA
  - 0.5 mg IV q3hr PRN moderate pain
  - 1 mg IV q3hr PRN severe pain
- Postoperative days 1-5
  - Ketorolac 15 mg IV q6hr x 4 doses (begin 1.5 hours postop), withhold if contraindicated
  - Oxycodeone 5 mg orally q4hr moderate pain
  - Oxycodeone 10 mg orally q4hr severe pain
  - Continue hydromorphone IV if not tolerating oral medications
- Other: Bowel regimen and tramadol

TJUH = Thomas Jefferson University Hospital

See page 37 for enlarged view
TJUH Results with Improved Pain Management for CT Surgery Patients

<table>
<thead>
<tr>
<th></th>
<th>Pre-Implementation</th>
<th>Post-Implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Postoperative opioid consumption (morphine equivalents)</td>
<td>222 mg</td>
<td>174 mg</td>
</tr>
<tr>
<td>How much pain relief did you experience after each pain treatment?</td>
<td>66%</td>
<td>92%</td>
</tr>
</tbody>
</table>

Thoma BN et al. Poster presentation at 2014 SCCM Meeting.

Conclusion

- Inadequately treated postoperative pain remains a concern for patients and health systems
- Current clinical guidelines continue to emphasize the importance of multimodal therapy
- Pre-, intra- and postoperative order sets should be reviewed for appropriateness of current surgical pain management modalities
- Review and provide HCAHPS scores to surgeons to support modification of postoperative pain management regimens
Pathophysiologic Responses Associated with Trauma

Multimodal Approach

Changes to TJUH CT Surgery Pain Management Protocol

- Pregabalin 150 mg po x 1 dose pre-op and 75 mg po q12hr x 6 doses postop
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- Other: Bowel regimen and tramadol

TJUH = Thomas Jefferson University Hospital
Selected References


**Other Useful References**


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Julie Golembiewski, Pharm.D., FASHP, is Clinical Pharmacist in Anesthesia and Pain at the University of Illinois Hospital and Health Sciences System (UI Health) in Chicago. She also has a shared appointment in the Departments of Pharmacy Practice and Anesthesiology and a faculty appointment of Clinical Associate Professor at the University of Illinois at Chicago (UIC) Colleges of Pharmacy and Medicine. She serves as co-coordinator for the UIC Department of Anesthesiology Midwest Anesthesia Residents Conference. Dr. Golembiewski teaches pharmacy students and anesthesiology resident physicians, as well as participates in research and committees at UI Health.

Dr. Golembiewski earned her Bachelor of Science in Pharmacy and Doctor of Pharmacy with honors degrees from the UIC College of Pharmacy. She has over 20 years of active pharmacy experience with the majority concentrated in the areas of operating room pharmacy, anesthesiology, and pain management.

Dr. Golembiewski is on the editorial advisory board of Pharmacy Practice News, writes a regular column for the Journal of PeriAnesthesia Nursing, and is a senior editor for LexiComp’s Anesthesiology & Critical Care Drug Handbook. She also co-authored the chapter on perioperative care in the text, Applied Therapeutics: The Clinical Use of Drugs. In addition to these contributions to the literature, Dr. Golembiewski has presented extensively on the topics of operating room pharmacy practice, anesthesia, and pain management.

Dr. Golembiewski is an active member of numerous professional organizations, including the American Society of Health-System Pharmacists (ASHP), American Society for Pain Management Nursing, International Anesthesia Research Society, and Illinois Council of Health-System Pharmacists. She is a fellow of ASHP and received the University of Illinois Class Act Award.
Role of Local Anesthetics in Managing Postoperative Pain

Julie Golembiewski, Pharm.D., FASHP
University of Illinois Hospital & Health Sciences System
Chicago, Illinois

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Postoperative Pain Mechanisms

**Nociceptive - somatic**
**Nociceptive - visceral**
**Inflammatory**
Peripheral and central sensitization
**Neuropathic**

---

General Principles

- Most nociceptive impulses originate from the surgical wound itself
- The surgical wound itself can reinitiate central sensitization
- Skin, muscle, and viscera respond differently to surgical injury
  - Deep tissue nociceptors sensitize dorsal horn neurons
  - Visceral pain can account for much of the discomfort following certain types of surgery (e.g., laparoscopic)

<table>
<thead>
<tr>
<th>Agent</th>
<th>Duration</th>
<th>Route of Administration</th>
<th>Maximum Dose *</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lidocaine</td>
<td>1 – 3 hr</td>
<td>Local infiltration, epidural, tumescent, topical</td>
<td>300 (500)</td>
</tr>
<tr>
<td>Bupivacaine</td>
<td>2 – 8 hr</td>
<td>Local infiltration, peripheral nerve block, epidural, spinal</td>
<td>175 (225)</td>
</tr>
<tr>
<td>Ropivacaine</td>
<td>2 – 8 hr</td>
<td>Local infiltration, peripheral nerve block, epidural</td>
<td>225 (225)</td>
</tr>
<tr>
<td>Bupivacaine liposome</td>
<td>Up to 72 hr</td>
<td>Local infiltration</td>
<td>266</td>
</tr>
</tbody>
</table>

*In milligrams; epinephrine containing solution in parentheses.


Bupivacaine Liposome

- Initial release of bupivacaine HCl followed by slow release of bupivacaine from liposomes to provide analgesia up to 72 hours
- May be diluted with saline (up to 280 mL) to infiltrate all tissue layers along the length of surgical site

The most appropriate analgesic modality following open abdominal surgery is

a. Continuous wound infiltration (bupivacaine)
b. Epidural infusion (bupivacaine + hydromorphone)
c. IV patient-controlled analgesia (morphine)
Perioperative Routes of Administration of Local Anesthetics

Topical
Subcutaneous, deep tissue
Transversus abdominal plane
Tumescent technique
Intra- or periarticular

Spinal
Epidural
Intravenous (lidocaine only)
Peripheral nerve block

Local Infiltration

Subcutaneous, deep tissue
Transversus abdominal plane
Tumescent technique
Intra- or periarticular (hip or knee surgery)

Local anesthetic is instilled at or near the site of surgery

Finite area of tissue; no specific nerve or nerve plexus is targeted

Single injection or continuous infusion

Continuous Wound Catheters (Liu et al. 2006)

- 44 RCTs (2,141 subjects)
  - Cardiothoracic (14 trials), orthopedics (12 trials), general surgery (11 trials), gyn – urology (7 trials)
  - No orthopedic surgery

- Patients with continuous wound catheters
  - Had significantly decreased pain (at rest and with activity) and opioid use
  - Appeared to have less postoperative nausea/vomiting, shorter length of stay, and increased patient satisfaction

Continuous Wound Catheters
(Gupta et al. 2011)

- 32 RCTs
  - Obstetrical and gynecologic surgery
  - Major abdominal surgery
  - Inguinal herniorrhaphy
  - Cardiothoracic surgery
  - No orthopedic surgery
- Patients with continuous wound catheters
  - No significant reduction in pain at rest or with activity, except OB-gyne surgery
  - No significant reduction in opioid consumption except for first 24 hr in OB-gyne surgery
  - Magnitude of these effects was small


Considerations:
Continuous Wound Catheters

- Position of catheter
  - For open nephrectomy, catheter placed
    - Superficial to muscle fascia was not effective
    - In pre-peritoneal space was effective
    - Between abdominal wall muscle layers and pre-peritoneum was very effective ("optimal analgesia")
    - Transverse abdominal plane (TAP)

- Optimal concentration and dose


Local Infiltration Analgesia:
Orthopedic Surgery (Kerr & Kohan 2008)

- Case series (hip resurfacing arthroplasty, total hip replacement, total knee replacement, N=325)

- MULTIMODAL ANALGESIA
  - Ropivacaine, ketorolac, epinephrine intra-op
    - 150 – 200 mL ("high volume"), "moving needle" injection technique over 1 hr
  - Catheter delivered mixture to all joint and tissue planes
    - "Top up" doses to flood joint if needed
  - Reinjection of surgical field 15 – 20 hr post-op
  - Scheduled ibuprofen x 24 hr then prn; rescue opioid
  - Compression, cooling and splinting of injection site or wound area

Local Infiltration Analgesia: Orthopedic Surgery (Kerr & Kohan 2008)

- Results
  - Satisfactory pain control (pain scores 0 – 3)
  - Most able to walk with assistance 5 – 6 hours after surgery
  - Most able to walk with independent mobility 13 – 22 hours after surgery
  - 71% discharged home after single overnight stay


Local Infiltration Analgesia: Orthopedic Surgery (McCarthy & Iohom 2012)

- 10 studies (N = 893)
  - 8 RCTs, two case series
  - Hip resurfacing arthroplasty, total hip replacement, total knee replacement

- Results
  - 6 studies → LIA was an effective analgesic
  - 2 studies → no benefit when LIA was added to a multimodal analgesic regimen
  - LIA efficacy questioned in total hip replacement


Considerations: LIA, Orthopedic Surgery

- Meticulous infiltration technique and catheter placement
  - Kerr and Kohan switched to a subcutaneous (posterior to knee) and an intra-articular (suprapatellar pouch) catheter following total knee replacement
  - Not all structures and joints (relevant to pain) are accessible for LIA

- Drugs
  - Ropivacaine or bupivacaine
    - Total dose, total volume
    - Large incision with significant exposed tissue, blood vessels and bone raises concern of local anesthetic systemic toxicity
  - Addition of ketorolac, epinephrine and/or morphine

Tumescent Infiltration for Liposuction

Large volumes of very dilute lidocaine and epinephrine infiltrated into subcutaneous tissue. Tissue becomes swollen and firm ("tumescent"), area anesthetized, cannulas placed, liposuction begins.

Risk for Systemic Toxicity

- Systemic absorption after tumescent infiltration equivalent to slow infusion (max dose: 35 mg/kg)
- When total dose and infiltration time are held constant, more dilute solution delays systemic absorption

Lidocaine dilution is as important as maximum dose

<table>
<thead>
<tr>
<th>Maximum Recommended Lidocaine Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.01% - 0.05%</td>
</tr>
<tr>
<td>(0.05% = 0.5 mg/mL = 50 mL 1% lidocaine in 1000 mL saline)</td>
</tr>
</tbody>
</table>


Epidural Analgesia

Local anesthetic (often with an opioid) infused into epidural space for analgesia following thoracic, abdominal, pelvic, or lower extremity surgery.
Epidural Analgesia

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Better analgesia than parenteral opioids</td>
<td>Skilled technique (anesthesiologist)</td>
</tr>
<tr>
<td>Better analgesia than IV patient-controlled analgesia (PCA)</td>
<td>Hemodynamic instability</td>
</tr>
<tr>
<td>Analgesic agent (local anesthetic + opioid, local anesthetic or opioid alone) does not matter</td>
<td>Motor weakness</td>
</tr>
<tr>
<td>Location of catheter does not matter</td>
<td>Urinary retention</td>
</tr>
<tr>
<td>Analgesic agent (local anesthetic + opioid, local anesthetic or opioid alone) does not matter</td>
<td>Spinal hematoma with concurrent anticoagulation</td>
</tr>
</tbody>
</table>

Block BM et al. JAMA. 2003; 290:2455-63.

Peripheral Nerve Block (Perineural)

Local anesthetic injected or infused adjacent to a peripheral nerve for analgesia in area innervated by that nerve or nerve plexus

Continuous Peripheral Nerve Block (Perineural Local Anesthetic Infusion)

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decreased pain (baseline/breakthrough/dynamic)</td>
<td>Skilled technique (anesthesiologist)</td>
</tr>
<tr>
<td>Decreased analgesic requirements</td>
<td>Motor weakness (impaired PT, fall risk)</td>
</tr>
<tr>
<td>Decreased opioid adverse effects</td>
<td>Catheter leak</td>
</tr>
<tr>
<td>Decreased sleep disturbances</td>
<td>Nerve injury (rare)</td>
</tr>
<tr>
<td>Catheter can be removed regardless of thromboprophylaxis</td>
<td>Infection (rare)</td>
</tr>
</tbody>
</table>

Considerations: Continuous Peripheral Nerve Block

- Analgesia appears to be better than intra- or periarticular infusions. Some effect could be due to systemic distribution.
- Total dose (mass) of local anesthetic is more important than volume and concentration. Ropivacaine 0.1% – 0.2%, 5 – 10 mL/hour +/- patient-controlled boluses.
- Doesn’t matter if block is performed pre- or post incision.
- Patient-controlled boluses (vs. continuous infusion) can reduce local anesthetic consumption without affecting analgesia.

Transversus Abdominis Plane (TAP) Block

- Technique:
  - Ultrasound-guided
  - Direct visualization by surgeon
- Provides analgesia for surgery involving lower abdominal wall:
  - Bowel surgery, appendectomy, cesarean delivery, hysterectomy, prostatectomy, laparoscopic cholecystectomy
- Single-injection alternative for patients who are not candidates for epidural analgesia or intrathecal morphine.

References:
Intravenous Administration
(Lidocaine Only)

IV Lidocaine

- 16 RCTs
  - Cholecystectomy, prostatectomy, cystectomy, nephrectomy, colectomy, colorectal, total hip, hysterectomy, herna, appendectomy, breast surgery
- Bolus, then infusion intra-op and in some studies, up to 24 hours post-op vs. saline
- 13/16 (81%) studies demonstrated improved analgesia with lidocaine infusion
- Consider when epidural or peripheral nerve block not indicated


The most appropriate analgesic modality following open abdominal surgery is

a. Continuous wound infiltration (bupivacaine)
b. Epidural infusion (bupivacaine + hydromorphone)
c. IV patient-controlled analgesia (morphine)
Procedure-Specific Pain Management

- Epidural > continuous wound infiltration >> IV PCA¹
- PROSPECT for laparoscopic colorectal surgery²
  - Local infiltration + IV NSAID + IV acetaminophen + IV PCA (weak opioid when oral); add IV lidocaine if necessary
- Enhances Recovery After Surgery (ERAS®) multimodal perioperative pathway for colorectal surgery³
  - Pre-op patient education; fluid management (esophageal Doppler monitoring); early oral nutrition, catheter/drain and mobilization; epidural + acetaminophen + NSAID analgesia, etc.
  - Significantly reduced:⁴
    - Length of stay (6 vs. 8.4 days, P<0.001)
    - Readmissions (8.8% vs. 20.2%, P=0.012)
    - Hospital costs (by 15%)

³Enhances Recovery After Surgery (ERAS) Society. ERAS protocol (EP). URL in ref list;

Adverse Effects and Safety

What is your biggest concern about the safety of local anesthetics?

a. Medication overdose
b. Lack of surgeon expertise
c. Lack of nurse expertise
d. Lack of pharmacist expertise
e. None – these drugs are very safe
Maximum Recommended Dose

- Although not necessarily evidence-based, maximum dose highlights "dose" as a risk factor for systemic toxicity
- Large, deep surgical incisions and dissections with muscle and vascular exposure may increase systemic absorption
- "...because drug concentrations in various regions of heart and brain tissue differ quite markedly, the deterministic notion of a "toxic" or "lethal" blood or tissue concentration of local anesthetic appears invalid even with standardized conditions"


Local Anesthetic Systemic Toxicity (LAST)

- Blood levels influenced by site of injection and dose
- Other factors that can increase likelihood of LAST
  - Advanced age
  - Heart failure, ischemic heart disease, conduction abnormalities
  - Metabolic (e.g., mitochondrial) disease
  - Liver disease or low plasma protein concentration
  - Metabolic or respiratory acidosis
  - Medications that inhibit sodium channels
- Patients with severe cardiac dysfunction, particularly low ejection fraction
  - More sensitive to LAST
  - Prone to 'stacked' injections (due to slowed circulation time) with resulting elevated tissue concentrations


LAST (continued)

- Central nervous system signs (metallic taste, circumoral numbness, altered mental status) may be subtle or absent
- Cardiovascular signs may be only manifestation
- More than one third of reports of toxicity involved patients with underlying cardiac, neurologic, renal, hepatic, pulmonary, or metabolic disease
  - Dose reduction and heightened vigilance may be warranted
- Treatment
  - Airway management
  - Seizure suppression – avoid propofol
  - Advanced cardiac life support
  - Lipid rescue (20% lipids)

Weinberg G. LipidRescue Resuscitation for drug toxicity. URL in ref list.
Safety Considerations

- **Intraoperative documentation and communication**
  - Medications administered by surgeon and/or anesthesia care provider may not flow to medication administration record
  - Administration by two different providers (anesthesiologist, surgeon) without knowledge or discussion
- “Other formulations of bupivacaine should not be administered within 96 hours following administration of Exparel® (bupivacaine liposome injectable suspension)"*
- **Monitoring**
- **Drug interactions (CYP3A4)**
- **Availability of lipid rescue**


Conclusion

- **Different types of surgery have different types of structures relevant for postoperative pain; structures may or may not be accessible for local anesthetic**
  - Direct visualization or ultrasound guided
  - Systematic approach to determine optimal injection technique, drug, and dose
- **Local anesthetics**
  - An important component of multimodal perioperative analgesia
  - Safe when appropriate measures are taken to minimize the risk of systemic toxicity

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Selected References


Self-assessment Questions

1. ABC Hospital is reviewing its policies related to the use of high-risk medication devices in managing postoperative pain. As a way to build safe practice around the use of these devices, use of intrathecal, epidural, and nerve blocks should be restricted to
   a. Anesthesia care providers and certified specialists.
   b. Pharmacists and surgeons.
   c. Pharmacists and anesthesia care providers.
   d. Surgeons and certified specialists.

2. ABC Hospital should use which of the following techniques for prospective identification of problems before implementing an analgesic delivery device?
   a. Value analysis.
   b. Weighted decision matrix.
   c. Failure mode and effects analysis.
   d. Survey of health care provider satisfaction.

3. Which of the following is a peripheral regional technique included in the 2012 practice guidelines of the American Society of Anesthesiologists for acute pain management in the perioperative setting?
   a. Local anesthetic infiltration of incision.
   b. Intramuscular injection.
   c. Epidural opioids.
   d. Systemic opioid patient controlled analgesia (PCA).

4. Cardiothoracic surgeons at XYZ Health System have been providing pain management using a prescriber-specific, opioid-driven approach with opioids prescribed as needed (PRN) immediately postoperative, followed by acetaminophen and opioid combination products PRN. The surgeons seek input about how to improve postoperative pain management. Which of the following best reflects the group that should be included in the discussion?
   a. Team of pharmacists and cardiothoracic surgeons.
   b. Team of pharmacists, nurses, cardiothoracic surgeons, anesthesiologists, and hospital administration policy makers.
   c. Staff of XYZ’s existing pain service and cardiothoracic surgeons.
   d. No team needed, rely on expertise of chief cardiothoracic surgeon.

5. Which of the following recommendations would be most appropriate to improve pain management for patients having cardiothoracic surgery at XYZ Health System?
   a. Order PCA morphine, then long-acting opioids around the clock.
   b. Order PCA morphine followed by short-acting opioids PRN.
   c. Add multimodal non-opioid therapy around the clock.
   d. Continue current opioid-driven approach.

6. Which of the following types of local infiltration of local anesthetic agents is a single-injection alternative for patients who are undergoing major abdominal surgery?
   a. Peripheral nerve block.
   b. Tumescent infiltration.
   c. Continuous wound catheter.
   d. Transversus abdominis plane block.
7. Which of the following patient characteristics can increase the risk of developing local anesthetic systemic toxicity?
   a. Young age.
   b. Male gender.
   c. Severe cardiac dysfunction.
   d. Metabolic alkalosis.

Answers
1. a
2. c
3. a
4. b
5. c
6. d
7. c