Caring for Surgical Patients – Getting it Just Right for Patients, Colleagues and Systems

Presenters:
Ryan Bode, MD
Anjna Melwani, MD
Kelly Kelleher, MD
Sonaly McClymont, MD
David Rappaport, MD
Rebecca Rosenberg, MD, MPH
Blair Simpson, MD
Sarah Denniston, MD

Disclosure

We have no relevant financial relationships with the manufacturers(s) of any commercial products(s) and/or provider of commercial services discussed in this CME activity.

We do not intend to discuss an unapproved/investigative use of a commercial product/device in our presentation.
Objectives

- Define hospitalist co-management and describe various co-management models
- Discuss the utilization of clinical pathways with surgical co-management
- Interactive review of evidence-based case scenarios in the clinical management of surgical patients

Agenda

<table>
<thead>
<tr>
<th>Introduction to co-management and clinical pathways</th>
<th>10 min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interactive evidence-based case scenarios with examples of clinical pathways</td>
<td>55 min</td>
</tr>
<tr>
<td>Summary and questions</td>
<td>10 min</td>
</tr>
</tbody>
</table>
What is Co-management?

- “Shared responsibility, authority, and accountability for the care of a hospitalized patient across clinical specialties.”
- In the case of co-management of surgical patients:
  - Surgeon manages the surgery-related treatments
  - Hospitalist manages the medical conditions
  - Shared decision-making over some aspects


Models of Shared Care

<table>
<thead>
<tr>
<th>Primary Service</th>
<th>Consulting Service</th>
<th>Automatic Consultation</th>
<th>Who Writes Orders?</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surgery</td>
<td>Pediatrics</td>
<td>No</td>
<td>Surgery</td>
<td>Similar to “traditional” consultation</td>
</tr>
<tr>
<td>Surgery</td>
<td>Pediatrics</td>
<td>Yes</td>
<td>Usually Surgery</td>
<td>Pre-arranged consultation, consultant may sign off</td>
</tr>
<tr>
<td>Pediatrics</td>
<td>Surgery</td>
<td>Yes</td>
<td>Usually Pediatrics</td>
<td>Pre-arranged consultation, consultant may sign off</td>
</tr>
<tr>
<td>Combined <strong>One must be primary</strong></td>
<td>N/A</td>
<td>N/A</td>
<td>Each service writes their own</td>
<td>Comanagement, no sign-off from either service permitted</td>
</tr>
</tbody>
</table>

Clinical Pathway - Definition

- Multidisciplinary plan of best clinical practice for specified groups of patients with a particular diagnosis that aids in the coordination and delivery of high-quality care
  - Decrease variation in care
  - Identify and clarify clinical processes
  - Institution-specific
  - Driven by order sets and decision support

Predictors of Pathway Success

- Picking the right condition
- Local adaptation and buy-in (+ local champion!)
  - Multi-disciplinary involvement from the start
- Ongoing evaluation of the pathway
  - Real-time tracking of outcomes
  - Sharing data in real time with end users
Costs of Hospitalization and Length of Stay
Before and After Implementation of Pathways


Appendicitis Pathway
Creating a Clinical Pathway

<table>
<thead>
<tr>
<th>Task</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identify a guideline/pathway that is needed</td>
</tr>
<tr>
<td>Gather content experts</td>
</tr>
<tr>
<td>Provide background research</td>
</tr>
<tr>
<td>Develop the guideline</td>
</tr>
<tr>
<td>Build an order set</td>
</tr>
<tr>
<td>Establish quality metrics</td>
</tr>
<tr>
<td>Implement guideline</td>
</tr>
</tbody>
</table>

Interactive Evidence Review

- Interactive Evidence Review
- Case scenarios related to perioperative management of surgical patients
  - Clinical question with evidence support
  - Clinical pathway associated with clinical topic
- Vegas Rule: “What happens in a PHM Nashville Co-management Workshop, stays in PHM Nashville Co-management Workshop”
Polling Instructions

• Search for the session title in the mobile app using the search bar or the agenda layout

• Select the session to open the session page and select “Live Polls”

• Answer the question under “Live Polls” by selecting your answer selection and then selecting “Finish” to submit your answer

Venous Thromboembolism (VTE)
Clinical Question

Malik is a 14 yr old boy who presents with fever and a limp. He is diagnosed with osteomyelitis with bacteremia. He undergoes aspiration of the bone. What is the appropriate VTE prevention strategy for Malik?

a. Early mobilization
b. Early mobilization + compression stockings
c. Early mobilization + compression stockings + aspirin
d. Early mobilization + subcutaneous enoxaparin
e. Early mobilization + compression stockings + subcutaneous enoxaparin
Clinical Question

Meredith is a 16 yr old with a history of ulcerative colitis undergoing spinal fusion surgery for idiopathic scoliosis. She uses Depo-Provera for contraception. She is otherwise in good health. Which is her preferred approach to VTE prophylaxis?

a. Early mobilization
b. Early mobilization + compression stockings
c. Early mobilization + compression stockings + aspirin
d. Early mobilization + subcutaneous enoxaparin
e. Early mobilization + compression stockings + subcutaneous enoxaparin
VTE represents 19% of harm across Nation

Risk factors for in-hospital venous thromboembolism in children: a case-control study employing diagnostic validation

Brian R. Branchford,²,³ Peter Mourani,² Lalit Bajaj,³ Marilyn Manco-Johnson,²,³ Michael Wang,²,³ and Neil A. Goldenberg¹,²,³

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>Unadjusted OR</th>
<th>95% CI</th>
<th>Adjusted OR</th>
<th>95% CI</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical ventilation</td>
<td>6.36</td>
<td>3.4-11.8</td>
<td>3.29</td>
<td>1.53-7.06</td>
<td>0.002</td>
</tr>
<tr>
<td>Central venous catheter</td>
<td>3.81</td>
<td>2.16-6.75</td>
<td>1.44</td>
<td>0.70-2.97</td>
<td>0.33</td>
</tr>
<tr>
<td>Systemic infection</td>
<td>3.88</td>
<td>2.19-6.89</td>
<td>3.05</td>
<td>1.57-5.94</td>
<td>0.001</td>
</tr>
<tr>
<td>Surgery</td>
<td>1.49</td>
<td>0.81-2.76</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Malignancy</td>
<td>1.65</td>
<td>0.59-4.62</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Dehydration</td>
<td>2.11</td>
<td>0.51-8.66</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Inflammatory disease</td>
<td>NE</td>
<td>NE</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Obesity</td>
<td>0.82</td>
<td>0.16-4.30</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Hospitalization &gt;/=5 d*</td>
<td>1.04</td>
<td>1.03-1.06</td>
<td>1.03</td>
<td>1.01-1.04</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Prior hospitalization within 30d</td>
<td>1.73</td>
<td>0.81-3.68</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

34 → 58 cases per 10,000 admissions (P < 0.001).
- 70% increase
- 7 year period

**Solutions for Patient Safety**

**VTE Prevention Intervention Based on VTE Risk Assessment**

<table>
<thead>
<tr>
<th></th>
<th>Low Risk</th>
<th>At Risk</th>
<th>High Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobility Status</td>
<td>Baseline</td>
<td>Baseline</td>
<td>Altered</td>
</tr>
<tr>
<td>Number of VTE Risk Factors</td>
<td>0</td>
<td>1 or more</td>
<td>0-1</td>
</tr>
<tr>
<td>Interventions: with no contraindications present</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>o Encourage highest degree of mobility</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>o SCD</td>
<td>-</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>o Anticoagulation</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
Challenges

• Low volume, high risk
• Lots of stakeholders (and opinions)
• Paucity of evidence
• Ineffective for younger children and catheter-associated thrombosis??

Post-operative Pain Control
Clinical Question

Juliana is a 15 yr female with adolescent idiopathic scoliosis, now POD2 s/p T4-L2 posterior spinal fusion. She had no complications, currently on a morphine bolus PCA and scheduled acetaminophen. Currently, she complains of 8/10 lower back pain. Which type of pain is this patient currently experiencing?

a. Nociceptive and Inflammatory
b. Neuropathic
c. Noninflammatory / Nonneuropathic
d. Nociceptive and Functional
e. None of the above
Back to the Case...

Juliana complains of 8/10 lower back pain. She is tearful and fearful of PT. The patient admits to stopping her anxiolytic medication 3 months prior because her symptoms were resolved. Which of the following approaches to pain control is considered the best example of multimodal therapy for Juliana?

a. Ketorolac, oxycodone, acetaminophen
b. Acetaminophen, PO midazolam, distraction techniques, deep breathing
c. IV acetaminophen, fentanyl PCA
d. Regional anesthetic, IV morphine
e. Ketorolac, IV hydromorphone, ropivacaine epidural
Pain Processing & Multimodal Therapy

- Several different agents, each acting along different sites of the pain pathway
- May be able to use lower doses of individual drugs, minimizing unwanted side effects
- Pharmacological + non-pharmacological modalities

Manworren, Renee. Multimodal Pain Management and the Future of a Personalized Medicine Approach to Pain
Modified WHO Analgesic Ladder

- **Interventional Pain Management**
  - (Nerve block, Epidural, PCA pump, Neurolytic block, Spinal stimulator)

- **Strong Opioids**
  - (Morphine, Fentanyl, Hydromorphone, Methadone)

- **Mild Opioids**
  - (Hydrocodone, Oxycodone)

- **Non-opioid Analgesics & Adjuvants**
  - (NSAIDs, Acetaminophen & Antidepressants, Antianxietytics, Topical anesthetics, Stimulants)

- **Non-Pharmacologic Management**
  - (Behavioral therapies / Mindfulness / Integrative therapies)

---

**Post-op Management Begins Pre-op**

- Previous post-op pain control
- Patient/Caregiver education
  - Establish post-op expectations
  - Individualized components of standardized process
- Patients at high risk for poor pain management
  - PMH of chronic pain
  - PMH of psychiatric diagnosis
  - Pain difficult to assess
Non-controversy: Ketorolac/NSAID in Bone Surgery

- Effective for management of mild to moderate pain or in combo with opioids for more severe pain
- Use of Ketorolac decreases opioid use by 25-45% in the first 12 hours after surgery
- Children have lower incidence of renal and GI side effects than adults
- Ceiling effect


Variation in Management is Common

# Pain Pathway Example - AIS PSF

<table>
<thead>
<tr>
<th>POD#0</th>
<th>Non-Pharm</th>
<th>Non-Opioid</th>
<th>Opioid</th>
<th>Anti-Inflammatory</th>
<th>Anti-Spasmodic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ice packs</td>
<td>Scheduled acetaminophen (IV or PO)</td>
<td>Basal + PRN PCA</td>
<td>Scheduled Ketorolac</td>
<td>Scheduled Robaxin + PRN Valium or Baclofen</td>
</tr>
</tbody>
</table>

| POD#1  | Ice packs | Increase mobility | Behavioral coaching | Scheduled acetaminophen | Start scheduled oxycodone | Continue bolus PCA | Discontinue Basal | Scheduled Ketorolac | Same |

| POD#2  | Ice packs | Increase mobility | Behavioral coaching | Transition to PRN? | Discontinue bolus PCA | Continue scheduled oxycodone | PRN IV opioid | Discontinue after 8 doses | Same |

## Post-operative Fever
Clinical Question

Joe is a medically complex pt. with a hx of NM scoliosis now POD#2 s/p PSF. Tmax o/n was 38.9, and he has been spiking fevers for the past 36hrs. Other VS are normal, he is well appearing, pain is well controlled on scheduled acetaminophen and oxycodone. What is the best approach?

a. Watchful waiting because inflammation is a common cause of fever on POD#1-2.

b. Start chest PT because atelectasis is a common cause of fever in on POD#1-2 and we should be cautious to prevent PNA.

c. Order a UA/UCx due to persistent high fever on POD#2, UTI risk with Foley still in place, and UTI sx in a medically complex patient can be difficult to discern despite lack of sx.

d. Order CBC/Bld Cx due to high fever and new hardware - at risk for hardware infection/bacteremia and fever is spiking despite Tylenol ATC which is concerning.

e. Both C & D are appropriate.
The Traditional 5 Ws

<table>
<thead>
<tr>
<th>5 Ws</th>
<th>Clinical Correlate</th>
<th>Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind</td>
<td>Atelectasis/Pneumonia</td>
<td>POD 1-2</td>
</tr>
<tr>
<td>Water</td>
<td>Urinary Tract Infection</td>
<td>POD 3-5</td>
</tr>
<tr>
<td>Wound</td>
<td>Surgical Site Infection</td>
<td>POD 5-7</td>
</tr>
<tr>
<td>Walking</td>
<td>Venous Thromboembolism</td>
<td>POD 5+</td>
</tr>
<tr>
<td>Wonder Drugs</td>
<td>Drug Fever</td>
<td>Anytime</td>
</tr>
</tbody>
</table>

Outdated? Old Dogma?

Postoperative Atelectasis

Retrospective, n=196 patients

Lit review, 8 eligible studies reviewed

Submitted November 17, 2010; Accepted February 20, 2011.

Submitter January 17, 2011; Accepted April 3, 2011.

Association Between Postoperative Fever and Atelectasis in Pediatric Patients

Jason M. Kane, MD, MS1, Matthew Friedman, MD2, J. Bryan Mitchell, MD3, Dui Wang, MD, PhD3, Zhenling Huang, MS4, and Carl L. Backer, MD1

Edict of Postoperative Fever and Atelectasis

To the Editor:

CHES / 141 / 1 / JANUARY 2012

CHEST 2011; 140(2):418-424

Mavros and colleagues conclude that there is a need for additional large studies to precisely evaluate whether there is an association that the prior studies have not detected. We respectfully disagree, given the findings of our most recent study. From our perspective, based on our large cohort of patients and the outcome of our study, rather than performing additional studies, it would seem more prudent and appropriate to simply throw out the dogma.

Jason M. Kane, MD
Carl L. Backer, MD
Chicago, IL
Early Postoperative Fever

- Fever is common. Infection is uncommon.
  - Post-op fever rates vary 10-90%
  - Peds > Adults
  - Post-op infection rates significantly lower
- Postoperative Inflammation/Temperature Regulation
  - Greater tissue damage = Greater response
  - Neurosurgical procedures that involve hypothalamus

- Natural course of benign post-op fever
  - Peaks on POD 0-1
  - Typically subsides within 72 hrs
  - Commonly occurs despite antipyretics
  - Height/degree not informative POD 0-2
  - Patient is well appearing

Fever Work-Up: Co-Management considerations

- Avoid labs/studies for early post-op fever
  - Painful, invasive, interrupt sleep/recovery, consumes time of staff, cost, consequences of false positives
  - Rarely positive in well appearing patient, regardless of medical complexity

- Rely on History and Physical Exam (*Lesperance et al.)

- When to check labs/consider abx:
  - Focal findings, ill appearing
  - Immunocompromised
  - Central line
  - Fever persists/newly spikes after POD#2-3 (unnatural course)
  - Surgery specific considerations
Reconsidering the 5 Ws → 6Ws

<table>
<thead>
<tr>
<th>6Ws</th>
<th>Clinical Correlate</th>
<th>Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Watchful Waiting</td>
<td>• Postoperative inflammation <em>(in otherwise asymptomatic, well appearing patient)</em></td>
<td>POD 0-2</td>
</tr>
<tr>
<td>Wind</td>
<td>• Pulmonary Causes: Ventilator-associated pneumonia, Aspiration</td>
<td>POD 1-2</td>
</tr>
<tr>
<td>Water</td>
<td>• Urinary tract infection</td>
<td>POD 3-5</td>
</tr>
<tr>
<td>Wound</td>
<td>• Surgical site infection (superficial or deep/abscess)</td>
<td>POD 3-5+</td>
</tr>
<tr>
<td></td>
<td>• Surgery specific considerations</td>
<td></td>
</tr>
<tr>
<td>Walking</td>
<td>• Venous thromboembolism</td>
<td>POD 5+</td>
</tr>
<tr>
<td>What did we do?</td>
<td>• Iatrogenic causes: Drug fever, Blood product reaction, IV site or central line infection, etc.</td>
<td>Anytime</td>
</tr>
</tbody>
</table>


Clinical Pathway Considerations

- Minimize/deter infectious work-up of early post-op fever
- Standardization of post-op antibiotic administration
- Hospital Acquired Conditions
  - Foley removal
  - Early extubation
  - Central Line
  - Surgical site care
Post-operative Lung Recruitment

Immediate Post-Surgical Periods:
1. Admit to floor
2. Ambulation: Bed → Chair
3. HOB at 30 degrees
4. Positioning: roll q.2 hours, never prone
5. Cefazolin × 24 hours
6. Post-op fever expected, defer infectious evaluation if well appearing.
7. Pain Control: PCA, IV/PO diazepam, IV/PO narcotics
8. Bowel care regimen
9. Scheduled Zofran
10. Foley catheter
11. Neuro checks q.1 hours x 4 and then per floor routine.

POD #1
1. Out of bed and then ambulation as tolerated
2. Pain Control:
   - Discontinue IV narcotics if able
   - Place on tegaderm
   - IV/PO diazepam
3. Scheduled Zofran
4. Neuro checks q 4 hours
5. D/C Foley Catheter

• Post-op antibiotics
• Foley
• Minimize infectious evaluation in first 24 hours
Clinical Question

MJ is a 17 yr old female, BMI 34, with moderate persistent asthma presenting for preoperative evaluation 1 week prior to scheduled T&A. Her asthma is poorly controlled with frequent nighttime coughing and rescue inhaler use 2-5 times per week. She is compliant with her inhaled corticosteroid BID. Which of the following would you recommend for this patient prior to surgery?

a. Continue current management with no changes
b. Use of albuterol 4-6 times daily for 1 week leading up to surgery
c. Start a course of oral corticosteroids in addition to her current asthma regimen for 3-5 days prior to surgery
d. Cancel her upcoming surgery
e. Increase dose of her daily inhaled corticosteroid
Lung Recruitment Preoperatively

- Increasing prevalence of asthma and obesity
- ↑ risk of adverse respiratory events (bronchospasm)
- Preoperative intervention can significantly reduce risk for adverse outcomes

Suggested Stepwise Approach

**Controlled asthma**
(no current or recent symptoms, no daily maintenance inhaled medication)

- No pre-operative additional therapy
- Consider SABA 1-2 hours before surgery

**Controlled asthma**
(no current or recent symptoms, daily maintenance inhaled medication)

- Continue maintenance therapy
- Consider SABA for 1 week preoperatively if no LABA

**Poorly controlled asthma**
(recent symptoms, use of rescue SABA, maintenance inhaled medication)

- Consider SABA for 1 week preoperatively if no LABA
- Oral corticosteroids for 3-5 days preoperatively

---

High Risk, Low Evidence

- Post-operative pulmonary complications
  - Atelectasis in up to 90% of anesthetized patients
- AARC Clinical Practice Guideline
  - Evidence limited for airway clearance medications (bronchodilators, mucoactive medications)
- Cochrane Review of incentive spirometry
  - Low quality evidence showing lack of effectiveness
- Post-operative pain control

Atelectasis
Pneumonia
Pneumothorax
Pleural effusion
Pulmonary emboli
ARDS, empyema
Respiratory failure

Preoperative Assessment

- Asthma History
  - Recent flare requiring corticosteroids
  - Increased use of inhaled B2 agonist
  - Recent exacerbation of asthma
  - Recent ED visit or hospitalization
- Atopy History
  - > 2 family members having asthma, atopy or smoking
  - History of eczema
  - Allergies (e.g., latex)
- Risk or complicating factors
  - Recent infections in the upper/lower respiratory tract
  - History of perioperative bronchospasm
  - Pulmonary complications during anesthesia
- Obesity
- Pulmonary Function Tests
  - FEV1 < 80%
  - Frequency of respiratory infections
  - Physical exam
Tonsillectomy and Adenoidectomy Preop Plan*

*Acquired from Seattle Children’s Hospital/Bellevue Clinic, 2016

Successful Co-management Models

<table>
<thead>
<tr>
<th>Structure</th>
<th>People</th>
<th>Ongoing Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ Provider engagement with appropriate scope of practice</td>
<td>▪ Strong leadership</td>
<td>▪ Clinical outcomes</td>
</tr>
<tr>
<td>▪ Multi-directional service agreements</td>
<td>▪ Champions of co-management from each service</td>
<td>▪ Adaptable teams</td>
</tr>
<tr>
<td></td>
<td>▪ Division and Administration involvement</td>
<td>▪ Focus on patient and provider satisfaction</td>
</tr>
<tr>
<td></td>
<td>▪ Solid conflict resolution plans</td>
<td>▪ Financial and legal implications</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Structure</th>
<th>People</th>
<th>Ongoing Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Clinical outcomes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Adaptable teams</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Focus on patient</td>
</tr>
<tr>
<td></td>
<td></td>
<td>and provider</td>
</tr>
<tr>
<td></td>
<td></td>
<td>satisfaction</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Financial and legal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>implications</td>
</tr>
</tbody>
</table>
Metrics for Successful Co-Management Program

- Quality metrics
- Engagement metrics
- Financial metrics

Successful Clinical Pathway Development

- Decrease variation in care
- Identify and clarify clinical processes
- Institution-specific
- Driven by order sets and decision support
- Goal: Share our models, clinical experience and pathway development
Questions?

• Please contact us if you would be interested in:
  • Obtaining evidence or examples of pathways presented in the workshop
  • Presenting current co-management practices at your institution
  • Becoming a member of the AAP Section on Hospital Medicine Surgical Care Subcommittee

Presenters:
• Ryan Bode, MD  Ryan.Bode@nationwidechildrens.org
• Anjna Melwani, MD  amelwani@childrensnational.org
• Kelly Kelleher, MD  kkelleher@phoenixchildrens.com
• Sonaly McClymont, MD  smcclymo@childrensnational.org
• David Rappaport, MD  David.Rappaport@nemours.org
• Rebecca Rosenberg, MD, MPH  Rebecca.Rosenberg@nyumc.org
• Blair Simpson, MD  Blair.Simpson@cchmc.org
• Sarah Denniston, MD  Sarah.Denniston@bcm.edu

Thank You!

• Please join us for Happy Hour
  • BarLines at the Omni Hotel
  • July 21 from 4:30 pm to 6:00 pm
References

- Kane JM, Backer CL. Edict of Postoperative Fever and Atelectasis, To the Editor. CHEST. 2012; 141(1): 274-275.