Perioperative Surgical Home

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Disclosures

Prior Medical Director of the Bozeman Health Research Group
What is a Perioperative Surgical Home?

- Patient-centered
- Coordinated care
- Standardization
- Empowered patients
- Reduced length of stay
- Reduced readmissions
- Reduced complications
- Reduced costs

“A patient-centered and physician-led multidisciplinary team-based system of coordinated care that guides the patient throughout the entire surgical experience.” - Marc Warner, MD Mayo Clinic College of Medicine
What is a Perioperative Surgical Home?

- Hospitalists / Anesthesiologists
- Orthopedic surgeons
- Pharmacy
- Educators
- Discharge planning
- Physical Therapy
- Nutritionists
- Respiratory Therapy

“A patient-centered and physician-led multidisciplinary team-based system of coordinated care that guides the patient throughout the entire surgical experience.” - Marc Warner, MD Mayo Clinic College of Medicine
Preoperative standardization

- Labs/ diagnostics
- Cardiac risk stratification
- OSA screening
- Frailty assessment
- SNF risk identification
- Patient education
- Medications
- Identify opiate track
### Risk assessment & prediction tool

**RAPT score**

- Predicts discharge disposition after total joint replacement 90% <6 & >9

<table>
<thead>
<tr>
<th>Question</th>
<th>Value</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. What is your age group?</td>
<td>50-65 years</td>
<td>=2</td>
</tr>
<tr>
<td></td>
<td>66-75 years</td>
<td>=1</td>
</tr>
<tr>
<td></td>
<td>&gt;75 years</td>
<td>=0</td>
</tr>
<tr>
<td>2. Gender?</td>
<td>Male</td>
<td>=2</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>=1</td>
</tr>
<tr>
<td>3. How far on average can you walk?</td>
<td>Two blocks or more (+/-rest)</td>
<td>=2</td>
</tr>
<tr>
<td></td>
<td>1-2 blocks (+/-rest)</td>
<td>=1</td>
</tr>
<tr>
<td></td>
<td>Housebound (most of time)</td>
<td>=0</td>
</tr>
<tr>
<td>4. Which gait aid do you use?</td>
<td>None</td>
<td>=2</td>
</tr>
<tr>
<td></td>
<td>Single-point stick</td>
<td>=1</td>
</tr>
<tr>
<td></td>
<td>Crutches/frame</td>
<td>=0</td>
</tr>
<tr>
<td>5. Do you use community supports? (home help, meals on wheels, district nursing)</td>
<td>None or one per week</td>
<td>=1</td>
</tr>
<tr>
<td></td>
<td>Two or more per week</td>
<td>=0</td>
</tr>
<tr>
<td>6. Will you live with someone who can care for you after your operation?</td>
<td>Yes</td>
<td>=3</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>=0</td>
</tr>
</tbody>
</table>

**Your score (out of 12)**

*Key: Destination at discharge from acute care predicted by score.*

- Scores <6 — extended inpatient rehabilitation
- Score 6-9 — additional intervention to discharge directly home (e.g. Rehabilitation in the Home)
- Score >9 — directly home.
Intraoperative standardization

- Normothermia
- Goal-directed IVF
- Total joints: Neuraxial
- GA: 80% FIO2
- Total joints: TXA
- Total joints: Avoid foley
- Multimodal analgesia
- Intensive BG control
Multimodal Pain for Total Knee

- Pre: Tylenol, Celebrex, Gabapentin, oxycodone
- Bupivacaine spinal
- Versed
- Propofol
- Fentanyl
- Ketamine
- Adductor canal catheter
Postoperative standardization

- PONV treatment
- Bowel regimen
- Opiate track
- Total knee: Adductor block
- DVT prophylaxis
- Early ambulation
- Avoid post-operative IVF
- Colorectal: eat regular diet POD #0
Post-Discharge standardization

- Discharge plan already identified preoperatively
- Patient has realistic expectations for pain
- Patient has realistic expectations for recovery time
- Patient access for post-operative issues
- Communication with PCP, ER
Q&A #1

- 75-yo male
- NSTE MI 3 months ago 1 DES RCA. Preserved EF
- Discharged on aspirin, clopidogrel, atorvastatin, and metoprolol.
- No recurrent angina sx

- Referred to you prior to a total knee arthroplasty for severe OA
- Which of the following preoperative recommendations would you make to this patient?
Q&A #1

1. Defer surgery for 1 year post-PCI
2. Stop aspirin 7 days prior to surgery
3. Stop clopidogrel 7 days prior to surgery
4. Stop both aspirin and clopidogrel 7 days prior to surgery
Q&A #1

1. Defer surgery for 1 year post-PCI
2. Stop aspirin 7 days prior to surgery
3. Stop clopidogrel 7 days prior to surgery
4. Stop both aspirin and clopidogrel 7 days prior to surgery
• This is elective surgery! Defer for 1 year. For patients who cannot wait one year, defer for minimum of 6 months for DES

• Cessation of DAPT prematurely is the strongest predictor of stent thrombosis

• PCI to surgery had increased MACE if within 1 year (OR 2.59, 95% CI 1.36-4.94). Case control N=24313 NCS with 1120 stented

Cardiac disease

- Screen for active angina.
- N= 1568 NSQIP 2005-2011 Previous MI & NCS.
- Primary outcome MI/cardiac arrest (5.8%): Angina is an independent predictor for postop MI. OR 2.49 [CI 1.20-5.58].

Cardiac disease

- Risk stratify using RCRI or NSQIP; Gupta
- If high risk (>1%), only perform cardiac stress testing for elective surgery if cardiac symptoms or METS<4

2014 ACC/AHA Guidelines
Cardiac disease

“If 30-day post-op mortality was a disease, it would be the 3rd leading cause of death.” – Daniel Sessler, Cleveland Clinic

Threshold for injury is intraoperative MAP < 65 mmHg. Injury worse with the longer and deeper hypotension.

• 60-yo female
• h/o atrial fibrillation and embolic stroke with no residual deficits
• She takes apixaban bid and metoprolol daily.
• Orthopedics recommends right hip replacement for her severe OA
• Anesthesiology plans on performing neuraxial anesthesia for the surgery.
• She is referred to you from his orthopedic surgeon for preoperative assessment prior to elective right hip arthroplasty.
• Which of the following preoperative recommendations would you make to this patient?
Q&A #2

1. Stop apixaban 3 days prior to surgery and continue metoprolol. Restart apixaban 48-72 post-op if hemostasis is achieved.

2. Stop apixaban 3 days prior to surgery and continue metoprolol. Restart apixaban the day of surgery if hemostasis is achieved.

3. Stop apixaban 3 days prior to surgery and continue metoprolol. Start enoxaparin bridge before and after surgery. Restart apixaban the day of surgery if hemostasis is achieved.

4. Stop apixaban 3 days prior to surgery and continue metoprolol. Start enoxaparin bridge before and after surgery. Restart apixaban 48-72 post-op if hemostasis is achieved.
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3. Stop apixaban 3 days prior to surgery and continue metoprolol. Start enoaxparin bridge before and after surgery. Restart apixaban the day of surgery if hemostasis is achieved.

4. Stop apixaban 3 days prior to surgery and continue metoprolol. Start enoaxparin bridge before and after surgery. Restart apixaban 48-72 post-op if hemostasis is achieved.
Q&A #2

- Avoid bridging except for HIGH thrombotic risk which outweighs bleeding risk. This patient’s CHA2DS2-VASc = 3. (High thrombotic risk is ≥7)

- When to stop NOAC: AHA and SHM recommend discontinuation based on CrCl. For apixaban, ≥48 hr if intermed/high bleed risk, but ASRA has stricter guidelines (3 days). When in doubt, call the anesthesiologist.

- When to restart NOAC: 48-72 h after major surgery if hemostasis achieved. When in doubt, check with surgery. ASRA allows resuming within 6 hr.

Johnson SA, Labrin J. Periprocedural Bridging Anticoagulation. JHM; Published online January 24, 2018.
### TABLE 1. Study Characteristics and Outcomes Associated with Periprocedural Bridging Anticoagulation

<table>
<thead>
<tr>
<th>Author, Study Year</th>
<th>Study Design</th>
<th>Indication for OAC</th>
<th>No Bridging</th>
<th></th>
<th>Bridging</th>
<th></th>
<th>Thromboembolic Events, P Value</th>
<th>Major Bleeding Events, P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Patients, n</td>
<td>Thromboembolic Events, n (%)</td>
<td>Major Bleeding Events, n (%)</td>
<td>Patients, n</td>
<td>Thromboembolic Events, n (%)</td>
<td>Major Bleeding Events, n (%)</td>
</tr>
<tr>
<td>Douketis et al., 2015 [14]</td>
<td>Prospective randomized, double-blind</td>
<td>AF</td>
<td>918</td>
<td>4 (0.4)</td>
<td>12 (1.3)</td>
<td>895</td>
<td>3 (0.3)</td>
<td>29 (3.2)</td>
</tr>
<tr>
<td>Steinberg et al., 2015 [2]</td>
<td>Prospective observational registry</td>
<td>AF</td>
<td>1766</td>
<td>9 (0.5)</td>
<td>31 (1.8)</td>
<td>514</td>
<td>4 (0.8)</td>
<td>19 (3.7)</td>
</tr>
<tr>
<td>Clark et al., 2015 [17]</td>
<td>Retrospective cohort</td>
<td>VTE</td>
<td>1257</td>
<td>3 (0.2)</td>
<td>2 (0.2)</td>
<td>555</td>
<td>0 (0.0)</td>
<td>15 (2.7)</td>
</tr>
<tr>
<td>Daniels et al., 2009 [16]</td>
<td>Retrospective cohort</td>
<td>MHV</td>
<td>213</td>
<td>1 (0.5)</td>
<td>5 (2.4)</td>
<td>342</td>
<td>4 (1.2)</td>
<td>15 (4.4)</td>
</tr>
<tr>
<td>Siegal et al., 2012 [13]</td>
<td>Systematic review and meta-analysis</td>
<td>AF, MHV, VTE</td>
<td>5160</td>
<td>32 (0.6)</td>
<td>18 (0.9)*</td>
<td>7118</td>
<td>73 (0.9)</td>
<td>211 (4.2)*</td>
</tr>
</tbody>
</table>

*Patients at risk major bleeding events n = 2104.

*Patients at risk major bleeding events n = 6404.

NOTE: Abbreviations: AF, atrial fibrillation; MHV, mechanical heart valve; NR, not reported; OAC, oral anticoagulation; VTE, venous thromboembolism.
<table>
<thead>
<tr>
<th>Risk Level</th>
<th>MHV</th>
<th>Atrial Fibrillation</th>
<th>VTE</th>
<th>Patient-Specific</th>
<th>Procedure-Specific</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>Mechanical mitral valve</td>
<td>CHADS2 score ≥5 or CHA2DS2-VaSc score ≥7</td>
<td>Severe thrombophilia (e.g., protein C/S deficiency, antiphospholipid syndrome)</td>
<td>Prior bleeding event within 3 months</td>
<td>Cardiothoracic surgery</td>
</tr>
<tr>
<td></td>
<td>Multiple mechanical valves</td>
<td>Stroke, TIA, or systemic embolism within 3 months</td>
<td>Recent VTE (e.g., within 3 months)</td>
<td>Bleeding history with similar procedure or prior bridging</td>
<td>Neurosurgery</td>
</tr>
<tr>
<td></td>
<td>Mechanical aortic valve with additional risk factors (e.g., prior thromboembolism, AF, LVEF &lt;40%)</td>
<td>Prior thromboembolism with short-term interruption of anticoagulation</td>
<td>Prior thromboembolism with short-term interruption of anticoagulation</td>
<td>Thrombocytopenia</td>
<td>Retinal surgery</td>
</tr>
<tr>
<td>Low/Moderate</td>
<td>Bileaflet mechanical aortic valve without additional risk factors (e.g., prior thromboembolism, AF, LVEF &lt;40%)</td>
<td>CHADS2 score ≤4 or CHA2DS2-VaSc score ≤6</td>
<td>Absence of severe thrombophilia</td>
<td>None of above risk factors</td>
<td>Vascular surgery</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Prior TIA/stroke ≥3 months previously</td>
<td>No VTE within previous 3 months</td>
<td>HAS-BLED score ≤2</td>
<td>Urologic surgery (excluding laser lithotripsy)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Gastrointestinal endoscopy ± biopsy</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Pacemaker implantation</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Orthopedic surgery</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Abdominal surgery</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Mohs surgery</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Cataract surgery</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Dental extraction(s)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Angiography</td>
</tr>
</tbody>
</table>
Obstructive Sleep Apnea

- OSA & sedation / anesthesia associated with higher complications (respiratory complications, postoperative cardiac events and transfer to the ICU)

- 17% fewer major complications if neuraxial anesthesia used instead of general anesthesia in OSA pts for total joint replacement

Nagappa et al. PloS 2015
<table>
<thead>
<tr>
<th>Question</th>
<th>No</th>
<th>Yes</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you snore loudly?</td>
<td>No</td>
<td>Yes</td>
<td>0</td>
</tr>
<tr>
<td>Do you feel tired, fatigued, or sleepy during the day?</td>
<td>No</td>
<td>Yes</td>
<td>1</td>
</tr>
<tr>
<td>Has anyone observed you stop breathing during sleep?</td>
<td>No</td>
<td>Yes</td>
<td>1</td>
</tr>
<tr>
<td>Do you have (or are you being treated for) high blood pressure?</td>
<td>No</td>
<td>Yes</td>
<td>1</td>
</tr>
<tr>
<td>BMI</td>
<td>&lt; 35 kg/m²</td>
<td>&gt; 35 kg/m²</td>
<td>0</td>
</tr>
<tr>
<td>Age</td>
<td>&lt; 50 years</td>
<td>&gt; 50 years</td>
<td>1</td>
</tr>
<tr>
<td>Neck circumference</td>
<td>&lt; 40 cm (16 in)</td>
<td>&gt; 40 cm (16 in)</td>
<td>0</td>
</tr>
<tr>
<td>Gender</td>
<td>Female</td>
<td>Male</td>
<td>0</td>
</tr>
</tbody>
</table>

High Risk OSA: 5-8
Intermediate Risk OSA: 3-4
Low Risk OSA: 0-2
Which of the following body phenotypes have the highest 1-year mortality rate following elective surgery?

1. High muscle / High fat
2. Low muscle / Low fat
3. Low muscle / High fat
4. High muscle / Low fat
1. High Muscle / High Fat
2. Low Muscle / Low Fat
3. Low Muscle / High Fat
4. High Muscle / Low Fat
1. High Muscle / High Fat
2. Low Muscle / Low Fat
3. Low Muscle / High Fat
4. High Muscle / Low Fat

~14% 1-year post-op mortality
Frailty

- N=202,911 (6289; 3.1% were frail) Retrospective cohort for elective NCS

- Increased risk for death in frail patients existed between different surgery types, but was strongest after total joint arthroplasty. (HR, 3.79; 95% CI, 3.21-4.47 for hip replacement; HR, 2.68; 95% CI, 2.10-3.42 for knee replacement)

Frailty

- Measuring frailty
- Medication management
- Opiate naïve track
- Delirium risk
- Nutrition
- Discharge planning
- Prehabilitation?
Frailty

- Timed Up and Go test (TUG)
- Easy and quantifiable
- Cutoff of 10 would identify 93% frail, but specificity only 62%

Prehabilitation

- Enhancement of the preoperative condition of the patient
- Aims to improve the functional capacity of the patient before surgery with the intent to minimize morbidity and improve surgical recovery.
Q&A #4

- 43-yo female
- Rheumatoid arthritis
- Infliximab IV Q4 weeks for a year.
- She is a marathon runner and has no other medical problems.
- No active infections or RA flares.
- She was offered elective right total knee replacement for severe right knee pain.

Which of the following preoperative recommendations would you make to this patient?
Q&A #4

1. Continue infliximab and schedule surgery after monthly dose
2. Continue infliximab and schedule surgery the week prior to monthly dose
3. Stop infliximab and schedule surgery on week 5 relative to last dose
4. Stop infliximab and schedule surgery on week 9 relative to last dose
Q&A #4

1. Continue infliximab and schedule surgery after monthly dose

2. Continue infliximab and schedule surgery the week prior to monthly dose

3. Stop infliximab and schedule surgery on week 5 relative to last dose

4. Stop infliximab and schedule surgery on week 9 relative to last dose
Q&A #4

- New guidelines 2017 developed by American College of Rheumatology and the American Association of Hip & Knee Surgeons for rheumatic disease patients undergoing total knee or hip surgeries.
- In general, continue DMARDs, hold biologics
- Different recommendations on immunosuppressants depending on the severity of systemic lupus erythematosus
- Avoid stress dose steroids, taper <20 mg/day when possible
- Different from gastroenterologist recommendations regarding inflammatory bowel disease patients and infliximab for colorectal surgeries.

Surgical Site Infection Prevention

- Total knee replacement CMS: $31K
- I&D for SSI: $93K non-reimbursable
- 2-stage exchange SSI: $187K non-reimbursable
Surgical Site Infection Prevention

- Shower within 24 hours & no shaving
- Chlorhexidine scrub prior (mupirocin X 5 days in addition if +MRSA)
- Appropriate antibiotics
- Blood glucose control
- Avoid hypothermia intraop
- Goal directed fluids
- Smoking cessation
- Limit steroid /biologic use*

Surgical Site Infection Prevention

- HbA1C >7% increased SSI 35.3% compared to 0.0% for thoracic and lumbar spinal instrumentation surgery.

- Peri-operative hyperglycemia (>200 mg/dL) even without a diagnosis of diabetes is an independent risk factor for SSI at 30 days (OR 3.2, 95% CI:1.3-7.8).

- Post-operative morning hyperglycemia associated with a 3-fold increased risk of peri-prosthetic infection in lower total joints

Enhanced Recovery After Surgery
ERAS Pathway for colorectal

- No fasting
- Avoid drains & NG tubes
- Opiate-sparing pre-op
- Goal directed IVF
- Minimally invasive surgery
- Early removal drains
- Early mobilization
- PO POD#0

Ljungqvist O, Scott M, Fearon KC. ERAS. JAMA Surgery 2017;152(3):292-8
ERAS Surgical Site Prevention

ERAS Pathway for colorectal

- Chlorhexidine shower
- Mechanical bowel prep with oral antibiotics and IV antibiotics 1 hour prior
- Dedicated wound closure tray
- Blood glucose control
- Avoid hypothermia intraop
- Goal directed fluids
- Smoking cessation

Ljungqvist O, Scott M, Fearon KC. ERAS. JAMA Surgery 2017;152(3):292-8
ERAS Pulm Complication Prevention

ERAS Pathway for colorectal

- Ariscat pulmonary risk stratification tool (N=5099. C-stat 0.8)

- Inspiratory muscle training preoperatively associated with a reduction of postop atelectasis and pneumonia compared to usual care

Katsura M et al Cochrane Review 2015