Perioperative Medical Management of the Orthopaedic Patient

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Department of Internal Medicine
### Complex Orthopaedic patients’ profile

**Table 2: Frequency of morbidities (overall and by arthroplasty)**

<table>
<thead>
<tr>
<th>Frequency of morbidities</th>
<th>Total cohort (N = 419)</th>
<th>THA (N = 110)</th>
<th>TKA (N = 309)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Frequency</strong></td>
<td><strong>Prevalence (%) (95% CI)</strong></td>
<td><strong>Frequency</strong></td>
<td><strong>Prevalence (%) (95% CI)</strong></td>
</tr>
<tr>
<td>Osteoporosis</td>
<td>65/419</td>
<td>15.5</td>
<td>(12.4–19.3)</td>
</tr>
<tr>
<td>History of myocardial infarct</td>
<td>10/271</td>
<td>3.7</td>
<td>(2.0–6.7)</td>
</tr>
<tr>
<td>History of heart failure</td>
<td>8/271</td>
<td>3.0</td>
<td>(1.5–5.7)</td>
</tr>
<tr>
<td>History of deep vein thrombosis or PE</td>
<td>4/274</td>
<td>1.5</td>
<td>(0.6–3.7)</td>
</tr>
<tr>
<td>History of liver failure</td>
<td>4/274</td>
<td>1.5</td>
<td>(0.6–3.7)</td>
</tr>
<tr>
<td>History of Stroke or TIA</td>
<td>15/271</td>
<td>5.5</td>
<td>(3.4–8.9)</td>
</tr>
<tr>
<td>Dementia</td>
<td>0/419</td>
<td>0.0</td>
<td>(0.0–0.0)</td>
</tr>
<tr>
<td>Asthma</td>
<td>20/419</td>
<td>4.8</td>
<td>(3.1–7.3)</td>
</tr>
<tr>
<td>COPD</td>
<td>8/271</td>
<td>3.0</td>
<td>(1.5–5.7)</td>
</tr>
<tr>
<td>Diabetes</td>
<td>24/419</td>
<td>5.7</td>
<td>(3.9–8.4)</td>
</tr>
<tr>
<td>History of kidney failure</td>
<td>7/271</td>
<td>2.6</td>
<td>(1.3–5.3)</td>
</tr>
<tr>
<td>History of cancer (any)</td>
<td>22/271</td>
<td>8.1</td>
<td>(5.1–12.6)</td>
</tr>
<tr>
<td>Psoriasis</td>
<td>11/419</td>
<td>2.6</td>
<td>(1.4–4.7)</td>
</tr>
<tr>
<td>History of Crohn’s diseases or ulcerative colitis</td>
<td>1/110</td>
<td>0.9</td>
<td>(0.2–5.0)</td>
</tr>
<tr>
<td>Rheumatoid arthritis</td>
<td>1/110</td>
<td>0.9</td>
<td>(0.2–5.0)</td>
</tr>
<tr>
<td>Polymyalgia rheumatica</td>
<td>0/419</td>
<td>0.0</td>
<td>(0.0–0.0)</td>
</tr>
<tr>
<td>Gout</td>
<td>1/419</td>
<td>0.2</td>
<td>(0.0–1.1)</td>
</tr>
<tr>
<td>Psoriatic arthritis</td>
<td>1/419</td>
<td>0.2</td>
<td>(0.0–1.1)</td>
</tr>
<tr>
<td>Depression (CES-D thresholds)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No depression</td>
<td>368/419</td>
<td>87.8</td>
<td>(84.4–90.6)</td>
</tr>
<tr>
<td>Mild-to-moderate depression</td>
<td>35/419</td>
<td>8.4</td>
<td>(6.1–11.4)</td>
</tr>
<tr>
<td>Possible major depression</td>
<td>15/419</td>
<td>3.6</td>
<td>(2.2–5.8)</td>
</tr>
<tr>
<td>Mean CES-D score (SD)</td>
<td>6.94 (6.68)</td>
<td>N/E</td>
<td>7.64 (8.01)</td>
</tr>
<tr>
<td>Mean Charlson comorbidity index (SD)</td>
<td>0.57 (0.97)</td>
<td>N/E</td>
<td>0.56 (0.93)</td>
</tr>
</tbody>
</table>

**Prevalence**

- Osteoporosis: 15.5%
- History of myocardial infarct: 3.7%
- History of heart failure: 3%
- Stroke/TIA: 5.5%
- Asthma: 4.8%
- COPD: 3%
- Diabetes: 5.7%
- Kidney failure: 2.6%
- Cancer: 8.1%
- Gout: 2.8%
- Depression: 10%

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**Importance of perioperative medical management!**
Introduction

• **Goal of the pre-operative evaluation**
  • Identify undiagnosed co-morbidities and/or risk factors to minimize the complications of surgery
  • Assess the level of risk for the patient given the co-morbidities
  • Work-up, manage, and optimize the co-morbidities prior to surgery
  • Make recommendations for intra-operative/post-operative care

• **Goal of the post-operative period**
  • Minimize complications of known medical co-morbidities
  • Minimize the onset of acute medical complications

• **Outcomes associated with Co-Management with Internal Medicine**
  • Decrease in length of stay
  • Decrease in costs/Improved resource allocation
  • Decrease in complication rates
  • Improved patient outcomes
  • Staff and patient satisfaction
Pre-operative Evaluation

- HPI +ROS (assess for any active medical conditions; if present, post-pone surgery until work-up is complete)
- PMHx
- Medications (reconciliation) and Allergies
- Surgical/Anesthetic History
- Social and Family History (specifically tobacco, ETOH, drug use)
- Functional Capacity
  - Can take care of self, such as eat, dress, or use the toilet (1 MET)
  - Can walk up a flight of steps or a hill or walk on level ground at 3 to 4 mph (4 METs)
  - Can do heavy work around the house such as scrubbing floors or lifting or moving heavy furniture or climb two flights of stairs (between 4 and 10 METs).
  - Can participate in strenuous sports such as swimming, singles tennis, football, basketball, and skiing (>10 METs)
- Physical Exam (evaluate for baseline exam as well as undiagnosed murmur, new edema, wheezing etc.)
- Laboratory Testing (pending the above history/exam)
- EKG (lack of evidence in many patient populations)
- CXR (seldomly required, only if symptomatic)
Pre-operative Cardiac Risk Assessment for Non-Cardiac Surgery

Assess the need for further stress testing

1. If emergent surgery $\rightarrow$ proceed with surgery

2. If non-emergent surgery AND
   - Low risk surgery OR
   - Good functional capacity (>4METs) without symptoms OR
   - No clinical risk factors
   Then no contraindication to surgery $\rightarrow$ proceed with surgery

3. If none of the above are true, assess
   - Active cardiac condition $\rightarrow$ stress test/cath
   - >3 clinical risk factors (RCRI) AND high risk surgery $\rightarrow$ stress test/cath
Pre-operative Cardiac Risk Assessment for Non-Cardiac Surgery

Revised Goldman cardiac risk index (RCRI)

<table>
<thead>
<tr>
<th>Six independent predictors of major cardiac complications[^1]</th>
</tr>
</thead>
<tbody>
<tr>
<td>High-risk type of surgery (examples include vascular surgery and any open intraperitoneal or intrathoracic procedures)</td>
</tr>
<tr>
<td>History of ischemic heart disease (history of MI or a positive exercise test, current complaint of chest pain considered to be secondary to myocardial ischemia, use of nitrate therapy, or ECG with pathological Q waves; do not count prior coronary revascularization procedure unless one of the other criteria for ischemic heart disease is present)</td>
</tr>
<tr>
<td>History of HF</td>
</tr>
<tr>
<td>History of cerebrovascular disease</td>
</tr>
<tr>
<td>Diabetes mellitus requiring treatment with insulin</td>
</tr>
<tr>
<td>Preoperative serum creatinine &gt;2.0 mg/dL (177 μmol/L)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Rate of cardiac death, nonfatal myocardial infarction, and nonfatal cardiac arrest according to the number of predictors[^2]</th>
</tr>
</thead>
<tbody>
<tr>
<td>No risk factors - 0.4 percent (95% CI: 0.1-0.8)</td>
</tr>
<tr>
<td>One risk factor - 1.0 percent (95% CI: 0.5-1.4)</td>
</tr>
<tr>
<td>Two risk factors - 2.4 percent (95% CI: 1.3-3.5)</td>
</tr>
<tr>
<td>Three or more risk factors - 5.4 percent (95% CI: 2.8-7.9)</td>
</tr>
</tbody>
</table>

[^1]: MI: myocardial infarction; ECG: electrocardiogram; HF: heart failure.

[^2]: References:
Risk factors and prevalence for myocardial ischemia after hip and knee arthroplasty

Myocardial ischaemia after hip and knee arthroplasty: incidence and risk factors

Anne Ruth Bass¹ · Tomás Rodriguez² · Gina Hyun² · Francisco Gerardo Santiago³ · Jacqueline Iiji Kim⁴ · Scott Christopher Woller⁵ · Brian Foster Gage²

DOI 10.1007/s00264-015-2853-0

Table 2 Risk factors for myocardial ischemia after multivariate analysis with inverse probability treatment of weighting propensity score (IPTW) for statin use

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>OR (95% CI)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Statin</td>
<td>0.74 (0.40–1.35)</td>
<td>0.326</td>
</tr>
<tr>
<td>Age per decade</td>
<td>3.52 (2.00–6.19)</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Diabetes</td>
<td>2.23 (1.04–4.77)</td>
<td>0.038</td>
</tr>
<tr>
<td>Hypertension</td>
<td>1.78 (0.83–3.83)</td>
<td>0.140</td>
</tr>
<tr>
<td>CAD</td>
<td>2.15 (0.84–5.46)</td>
<td>0.109</td>
</tr>
<tr>
<td>Smoker</td>
<td>2.27 (0.51–10.07)</td>
<td>0.280</td>
</tr>
<tr>
<td>Bilateral TKA</td>
<td>1.52 (0.55–4.21)</td>
<td>0.420</td>
</tr>
<tr>
<td>Male sex</td>
<td>1.19 (0.62–2.28)</td>
<td>0.604</td>
</tr>
<tr>
<td>Race³</td>
<td>1.32 (0.38–4.56)</td>
<td>0.663</td>
</tr>
</tbody>
</table>

CAD coronary artery disease, TKA total knee arthroplasty
Anemia and risk of cardiac events after TKA

Definition

- Normal Hb: > 130 g/L males, > 120 g/L females
- Mild anaemia: 110 < Hb < 129
- Moderate anaemia: 80 < Hb < 109 g/L
- Severe anaemia: Hb < 80 g/L

Preoperative anemia has no association with cardiac outcome after TKA
Pre-operative Medication Management

- **Anti-platelet agents:** ASA, NSAIDs, thienopyridine, and non-thienopyridine (plavix, prasugrel)
  - Primary prevention: generally reasonable to discontinue ASA/NSAIDs etc. 7-10 days prior to elective surgery
  - Secondary prevention: case by case basis/complex, touch base with consultants (i.e. outpatient Cardiologist, Neurologist etc. for anti-plt therapy recommendations)
- **Cardiovascular medications:** in general, should be continued in the perioperative period (however would hold ACE/ARBS, diuretics, and anti-hypertensives immediately pre and post-op to minimize complications, except BBs)
- **Pulmonary medications:** continue usual outpatient regimen
- **Diabetic medications:** oral medications should be held prior to surgery. If on insulin, take about half of outpatient regimen prior to surgery in the setting of NPO status
- **Corticosteroids:** if chronic use, worry about HPA axis suppression, resulting in adrenal insufficiency/crisis.
  - If taking the equivalent of 5mg of prednisone or less in the last 12 months, stress dose steroids are not indicated
  - If taking the equivalent of 20mg of prednisone or more x5 days, give stress dose steroids (50mg IV hydrocortisone for intermediate risk surgery with subsequent taper back to home dose)
  - If taking between 5-20mg, ACTH stim test or simply give stress dose steroids
- **Psychiatric medications:** generally continued
- **Anti-coagulation:** for hx of heart valve, DVT, afib etc., an assessment will need to be made on whether bridging will be required pre and post-op (discussion with surgeon as well)
Post-operative Management

Risk for cardiac complications: Acute onset chest pain

• Work-up
  − STAT troponin, CK, and EKG (cycle over time)
    • If elevated, consult Cardiology
  − STAT CXR
    • Evaluate for volume overload, PNA, dissection, PTX etc.
  − Expand history
    • DDX to also include GI (GERD), MSK (costochondritis), Psych (anxiety/panic attacks)
    • Consider PE on DDX if hypoxic and/or tachycardic
Post-operative Management

Risk for cardiac complications: Atrial Fibrillation (with RVR)

- Patients with pre-existing afib should be continued on outpatient medications
- **Identify precipitating cause and attempt to reverse the underlying trigger** (hypovolemia/anemia, hypervolemia, infection, electrolyte abnormalities, PE, uncontrolled pain etc.)
- If BP stable → consider giving IV metop (x3) or IV diltiazem. If refractory, consider bolusing amiodarone with subsequent gtt or digoxin (Call for help!)
- If BP unstable → will need to cardiovert (consult cardiology)
- Statins may be cardio-protective
- Anti-coagulation → risk for stroke versus complications from post-op bleeding must be evaluated and ultimately discussed amongst all teams
Post-operative Management

Risk for pulmonary complications

- Risk factors: underlying COPD/OSA, age >60, CHF, pulmonary HTN, AMS, ETOH use, albumin <3.6, obesity, prolonged surgery
- Minimize complications by…
  - Wean O2 as soon as possible to assess O2 sats ASAP
  - Aggressive IS use, 10x/hr while awake
  - Avoid oversedation/aspiration precautions
  - Continue home CPAP/BiPAP machine
  - Consider starting duonebs q4 x24 hours ppx if hx of COPD/asthma
  - Avoid volume overload
  - VTE ppx usually directed by ortho team/early mobility
Post-operative Management

Risk for renal complications (ARF)

• Risk factors: age, emergent surgery, liver disease, CHF, HTN, CKD, high BMI, high risk surgery, PVD

• Minimize complications by…
  – Ensure adequate hydration post-op without volume overload
  – Avoid hypotension/hypoperfusion
  – Monitor electrolytes and Cr (also ensure appropriate diet if CKD)
  – Goal UOP 0.5cc/kg/hr
  – AVOID nephrotoxic agents
  – Renally dose medications as necessary
Post-operative Management

Risk for hyperglycemia or hypoglycemia

• If on outpatient oral medications (DM2), hold and place on an ISS immediately post-op
  – If BG levels are persistently >180, consider starting weight based levemir BID (titrating for no hypoglycemia)
• If on outpatient insulin (DM2), resume at half of outpatient dose immediately post-op in addition to an ISS
  – Up-titrated basal insulin according to sliding scale needs and oral intake
• If the patient is a Type I diabetic, caution is advised. Insulin should NEVER be discontinued as the patient will be at high risk for developing DKA (if hypoglycemic, start D5 and decrease insulin with frequent monitoring of BG levels as ongoing insulin titration will be required)
Delirium

- Delirium is an acute confusional state that causes morbidity and mortality in hospitalized patients
- Orthopaedic patients are at Increased Risk for Delirium Postoperatively

- The incidence of delirium has been reported to be as high as 73.5% after surgery
  - Hip fracture: 21.7%
  - Elective hip or knee surgery: 12.1%

- Consequences: poor patient outcomes/readmission, prolonged functional decline, increased LOS, and increased costs

- As health care providers, we will need to minimize the incidence of delirium by identifying at-risk populations and initiate interventions early on that can impact modifiable risk factors
Delirium: What is it?

• **Delirium** is characterized by
  – Acute onset/fluctuating course
  – Inattention
  – Disorganized thinking or change in cognition
  – Altered level of consciousness
    • The Confusion Assessment Method (CAM): first two findings and at least one of the last two findings is 94% sensitive and 89% specific for delirium

• **Hyperactive delirium**: increased vigilance and autonomic over activity manifested as...
  – Agitation
  – Restlessness
  – Hallucinations
  – Tremulousness

• **Hypoactive delirium**: decreased arousal
  – Somnolence
  – Decreased awareness
Prevention

• The development of delirium is often multi-factorial, therefore primary prevention of delirium using a non-pharmacologic, multi-modal approach has been shown to be the most effective strategy.

• Identify risk factors early on for early intervention.

• Risk is categorized as modifiable and non-modifiable.
Prevention

Non-modifiable risk factors

• Male
• Age
  – Age 50-59, 22%
  – Age 60-69%, 42%
  – Age 70-79%, 72%
  – Age 80-89, 92%
• Cognition impaired at baseline (dementia, MMSE <24/30), history of delirium, and depression
• Poor functional status, history of falls, malnutrition, ETOH abuse
• Co-morbidities
  – Having multiple co-morbidities
  – Infection
  – Renal disease or liver disease
  – Hx of CVA or other neurologic disorder
  – Trauma (fractures)
Risk factors for delirium

**Reduced risk**
- Olanzapine

**Increased risk**
- ASA = 3
- Age ≥ 74
- Intra-operative morphine
- Mean arterial pressure < 90 mmHg
Prevention

Modifiable risk factors

- **Cognitive:** disturbance of day/night and sleep wake cycle
- **Sensory impairment:** visual, hearing, tethers-lines/draains/restraints
- **Toxic metabolic:** dehydration, electrolytes abnormalities, hypoxemia, polypharmacy, anti-cholinergics and psychotropic drugs
- **Perioperative:** intraoperative hypotension, anemia/transfusion, depth of anesthesia, uncontrolled pain, constipation, urinary retention
Acute delirium

Work-up is required to rule out any acute medical issue with treatment of the underlying abnormality

- CBC
- BMP with calcium, magnesium, phos
- Blood cultures (possibly)
- UA + culture, bladder scan
- CXR
- EKG (trop)
- Head CT

In addition, minimize/stop all possible high risk medications
High Risk Medications

- **Anti-depressants**: amitriptyline, doxepin, paroxetine, NT
- **Anti-histamines**: diphenhydramine, hydroxyzine, promethazine
- **Anti-cholinergics**: atropine, scopalamine
- **Anti-psychotics**
- **Benzodiazepines**
- **Urinary incontinence**: oxybutinin
- **OPIOIDS**: especially meperidine
Non-pharmacologic Therapy

- **Orientation protocols:** having clocks, calendars, windows with outside views/sunlight, and staff to verbally re-orient the patient as disorientation occurs in unfamiliar environments.

- **Cognitive stimulation:** crucial for patients with cognitive impairment. Encourage family and friends to be at bedside regularly, but minimize at night. Nursing staff may also contribute.

- **Facilitation of physiologic sleep:** nursing and medical procedures (i.e., medication administration, vitals) should be minimized during sleeping hours whenever possible. Reduce night time noise.
Non-pharmacologic Therapy

- Early mobilization (PT/OT)

- Minimize use of physical restraints, as well as discontinue all unnecessary lines, oxygen supplementation, catheters etc. ASAP

- Ensure that visual and hearing aids are available for patients with these impairments

- Medications
Pharmacologic Therapy

- Start melatonin 3-6mg qhs to be given at 8PM
- Ensure proper bowel regimen (DSS, senna, miralax, dulcolax prn, enema prn)-often already prescribed
- Ensure pain is well-controlled while avoiding oversedation
- Low dose haldol (0.5mg-1mg PO/IV/IM, qhs to prn BID) pending QTC is not prolonged (<500). **DO NOT USE** if hx of Parkinson’s disease or recent acute TBI.
- Seroquel: may start 12.5mg-25mg prn then uptitrate as required (qhs and scheduled based on severity) pending QTC is not prolonged (<500)
- **DO NOT GIVE BENZODIAZEPAMS!!!**
Role of pre-assessment clinic

• Preoperative anesthetic assessment clinic
  – Multidisciplinary team: anesthetist, orthopaedic junior resident, nurse practitioner
  – Need for HD or ICU bed assessed and booked
  – Identify and optimized medical conditions
Role of pre-assessment clinic

The role of a multidisciplinary pre-assessment clinic in reducing mortality after complex orthopaedic surgery

T Kamal, RM Conway, I Littlejohn, D Ricketts

<table>
<thead>
<tr>
<th>TABLE 1</th>
<th>Without pre-assessment clinic</th>
<th>With pre-assessment clinic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>April 2005 – March 2006; n=298</td>
<td>May 2006 – April 2009; n=1,147</td>
</tr>
<tr>
<td>HDU</td>
<td>Admissions 14/298 (4.7%)</td>
<td>85/1,147 (7.4%)</td>
</tr>
<tr>
<td></td>
<td>Unplanned admissions 4/298 (1.34%)</td>
<td>20/1,147 (1.7%)</td>
</tr>
<tr>
<td></td>
<td>Length of stay 2.1 days</td>
<td>1.6 days</td>
</tr>
<tr>
<td>ICU</td>
<td>Admissions 4/298 (1.3%)</td>
<td>18/1,147 (1.5%)</td>
</tr>
<tr>
<td></td>
<td>Unplanned admissions 4/298 (1.3%)</td>
<td>4/1,147 (0.4%)</td>
</tr>
<tr>
<td></td>
<td>Length of stay 2.3 days</td>
<td>1.9 days</td>
</tr>
<tr>
<td>PACU</td>
<td>Admissions 65/298 (22%)</td>
<td>111/1,147 (10%)</td>
</tr>
<tr>
<td></td>
<td>(all unplanned)</td>
<td></td>
</tr>
<tr>
<td>Mortality</td>
<td>HDU, ICU and PACU 18/298 (6.1%)</td>
<td>14/1,147 (1.2%)</td>
</tr>
</tbody>
</table>
Role of pre-assessment clinic

Anesthesia Preoperative Clinic Referral for Elevated Hba1c Reduces Complication Rate in Diabetic Patients Undergoing Total Joint Arthroplasty

Peter J. Kallio 1,2; Jenea Nolan 2; Amy C. Olsen 2; Susan Breakwell 3; Richard Topp 3; Paul S. Pagel 1

Background: Diabetes mellitus (DM) is a risk factor for complications after orthopedic surgery.

Objectives: We tested the hypothesis that anesthesia preoperative clinic (APC) referral for elevated glycosylated hemoglobin (Hba1c) reduces complication rate after total joint arthroplasty (TJA).

Patients and Methods: Patients (n = 203) with and without DM were chosen from 1,237 patients undergoing TJA during 2006-12. Patients were evaluated in the APC had surgery in 2006-8 regardless of Hba1c (uncontrolled). Those evaluated between in subsequent two-year intervals were referred to primary care for Hba1c ≥10% and ≥8%, respectively, to improve DM control before surgery. Complications and mortality were quantified postoperatively and at three, six, and twelve months. Length of stay (LOS) and patients requiring a prolonged LOS (> 5 days) were recorded.

Results: Patients (197 men, 6 women) underwent 71, 131, and 1 total hip, knee, and shoulder replacements, respectively. Patients undergoing TJA with uncontrolled Hba1c and those with Hba1c <10%, but not those with Hba1c < 8%, had a higher incidence of coronary disease and hypercholesterolemia than patients without DM. An increase in complication rate was observed in DM patients with uncontrolled Hba1c versus patients without DM (P < 0.001); the complication rate progressively decreased with tighter Hba1c control. More DM patients with preoperative Hba1c that was uncontrolled or ≥10% required prolonged LOS versus those without DM (P < 0.001 and P = 0.0404, respectively).

Conclusions: APC referral for elevated Hba1c reduces complication rate and the incidence of prolonged hospitalization during the first year after surgery in diabetics undergoing TJA.

Keywords: Diabetes Mellitus; Glycosylated Hemoglobin; Orthopedic Surgery; Arthroplasty
Table 3. Incidence Proportion of Postoperative Complications in Patients With and Without Diabetes Based on A1c Control Before elective Total Joint Surgery

<table>
<thead>
<tr>
<th>Variables</th>
<th>-DM</th>
<th>+DM No Referral</th>
<th>+DM Referral for A1c &lt; 10%</th>
<th>+DM Referral for A1c &lt; 8%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>100</td>
<td>55</td>
<td>32</td>
<td>16</td>
</tr>
<tr>
<td>Cardiac</td>
<td>0.06</td>
<td>0.11</td>
<td>0.13</td>
<td>0.06</td>
</tr>
<tr>
<td>Pulmonary</td>
<td>0.02</td>
<td>0.07</td>
<td>0.16</td>
<td>0.13</td>
</tr>
<tr>
<td>Neurologic</td>
<td>0.01</td>
<td>0.07</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Urinary Tract Infection</td>
<td>0.02</td>
<td>0.07</td>
<td>0.06</td>
<td>0</td>
</tr>
<tr>
<td>Transfusion</td>
<td>0.11</td>
<td>0.27</td>
<td>0.19</td>
<td>0.06</td>
</tr>
<tr>
<td>Pain</td>
<td>0.04</td>
<td>0.27</td>
<td>0.19</td>
<td>0.06</td>
</tr>
<tr>
<td>Surgical Site Infection</td>
<td>0.05</td>
<td>0.15</td>
<td>0.19</td>
<td>0.06</td>
</tr>
<tr>
<td>Delayed Wound Healing</td>
<td>0.04</td>
<td>0.18</td>
<td>0</td>
<td>0.19</td>
</tr>
<tr>
<td>Mortality</td>
<td>0.01</td>
<td>0.07</td>
<td>0.03</td>
<td>0</td>
</tr>
</tbody>
</table>

Note: 0.15 and 0.18 are encircled to highlight the significant differences.

Abbreviations: + and – DM, with and without diabetes mellitus, respectively; A1c, glycosylated hemoglobin concentration.
Stanford Hospital -
Identification of higher risk patients for arthroplasty

<table>
<thead>
<tr>
<th>Present</th>
<th>Clinical Risk Factor</th>
<th>ICD9 Code</th>
<th>Descriptor</th>
</tr>
</thead>
<tbody>
<tr>
<td>N/A</td>
<td>Morbid obesity BMI &gt;40</td>
<td>278.01</td>
<td>Morbid Obesity</td>
</tr>
<tr>
<td>N/A</td>
<td>Smoking</td>
<td>305.1</td>
<td>Tobacco use disorder</td>
</tr>
<tr>
<td>N/A</td>
<td>Chronic anticoagulant use</td>
<td>V58.61</td>
<td>Long-term (current) use of anticoagulants</td>
</tr>
<tr>
<td>N/A</td>
<td>Chronic narcotic use</td>
<td>305.51</td>
<td>Opioid abuse, continuous</td>
</tr>
<tr>
<td>N/A</td>
<td>Workmen’s compensation case</td>
<td>V62.1</td>
<td>Adverse effects of work environment</td>
</tr>
<tr>
<td>N/A</td>
<td>Previous intra-articular infection</td>
<td>139.8</td>
<td>Late effect of other and unspecified infectious and parasitic diseases</td>
</tr>
<tr>
<td>N/A</td>
<td>Congenital hip deformity</td>
<td>755.63</td>
<td>Other congenital deformity of hip</td>
</tr>
<tr>
<td>N/A</td>
<td>Angular knee deformity &gt;15 degrees</td>
<td>736.6</td>
<td>Other acquired deformity of knee</td>
</tr>
<tr>
<td>N/A</td>
<td>Previous ORIF hip</td>
<td>716.15</td>
<td>Traumatic arthropathy, pelvic region and thigh</td>
</tr>
<tr>
<td>N/A</td>
<td>Previous ORIF knee</td>
<td>716.16</td>
<td>Traumatic arthropathy, lower leg</td>
</tr>
<tr>
<td>N/A</td>
<td>Depression/psychiatric disease</td>
<td>300.9</td>
<td>Unspecified nonpsychotic mental disorder</td>
</tr>
</tbody>
</table>
Summary

• Orthopaedic patients have become increasingly medically complex

• The pre-operative risk assessment is key in directing a patient’s care

• A risk assessment for each patient should be ongoing, as this can often guide immediate medical management during a hospitalization

• Co-management has been shown to minimize perioperative complications with improved patient outcomes
Resources


- UpToDate: Overview of the principles of medical consultation and perioperative medicine

- UpToDate: Evaluation of cardiac risk prior to nocardiac surgery

- UpToDate Management of cardiac risk for noncardiac surgery


- Lee et al., Circulation, 1999; 100: 1043-1049

- Wesorick and Eagle, American Journal of Medicine, 2005; 118: #12, 1413


- UpToDate: Delirium and acute confusional states: Prevention, treatment, and prognosis
