Medical Optimization Prior to Elective Total Joint Arthroplasty

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Take Home Points:
HARD STOPS

BMI greater than 40
HbA1C greater than 8.0
Glucose greater than 170
Concurrent infections (UTI & Dental)
Hypoalbuminemia
Immune Deficiency
Quality and Low Cost

We must provide high quality service at the most prudent cost points

- minimize complications by
  - excellent surgery in appropriate patients
  - refine the surgical procedure thru standardization
  - only operate on patients who are likely to enjoy a good result
  - patients must “qualify”
Why is this necessary?

We cannot afford a lot of complications

- Median Household income 2000- $56,000
- Median Household income 2013- $51,000
- By 2020, national health spending is expected to reach $4.6 trillion and comprise 19.8 percent of GDP
Why is this Important for Total Joints?
Complications COST $$ !

• 21% of the U.S. population aged 18 or older have arthritis

• The percentage grows higher with age

• 67 million, or 25 percent of the adult population, will have arthritis in 2030.
Why is this Important for Total Joints?

• Knee replacement postoperative infection rates ranging from 0.68% to 1.60%
• Hip replacement infection rates from 0.67% to 2.4%.
• Estimated between 6,000 and 20,000 SSIs occur annually in hip and knee replacements
• The annual cost of infected revisions to US hospitals increased from $320 million to $566 million during the study period and was projected to exceed $1.62 billion by 2020.

Why is this Important for Total Joints?
Diagnosis

Healthy Knee

Arthritic knee
Diagnosis

Normal hip

Arthritic hip
What leads to Complications?

OBESITY
SMOKING
PREOPERATIVE ANEMIA
PREOPERATIVE HYPOPROTINEMIA
IMMUNE DEFICIENCY
EXISTING SUBCLINICAL INFECTIONS
What Labs are necessary

- CBC
- Erythrocyte Sedimentation Rate
- C-reactive Protein
- Urinalysis and Culture
- HgbA1C
- BMI
- Chest X-ray

- EKG
- MRSA Nasal Culture
- Type and Screen?
- PT?
- PTT?
- albumin
So let's break it all down

- Hgb > 12g/dl
- HgbA1C < 8
- Albumin > 3.5mg/dl
- Total Lymphocyte count between 1200-1500cells/mm³
- BMI < 40

- NO SMOKING
- HIV must be on at least 2 anti-retroviral meds
So let's break it all down

• Grady Memorial in Atlanta 900 bed teaching hospital

• Nine patients in the pre-protocol group developed an infection for a rate of 12.9%. Two patients in the post-protocol group developed an infection for a rate of 1.9%. *P*-value of 0.007

• Decreased infection rates following total joint arthroplasty in a large county run teaching hospital: A single surgeon's experience and possible solution. Gottschalk, Michael B. et al. The Journal of Arthroplasty, Volume 29, Issue 8, 1610 – 1616
The Charlson Comorbidity Index consists of seventeen items:

- myocardial infarction, congestive heart failure, peripheral vascular disease, dementia, cerebrovascular accident, pulmonary disease, connective tissue disorder, peptic ulcer, mild to moderate liver disease, and diabetes (each item has a score of 1 point);
- hemiplegia, diabetes with complications, renal disease, and cancer (each item has a score of 2 points);
- severe liver disease and metastatic cancer (each item has a score of 3 points);
- acquired immunodeficiency syndrome (AIDS), which scores 6 points.

Studies have shown that patients who have increased levels of hemoglobin A1c and glucose levels greater than 170 mg/dl in the immediate preoperative & postoperative period are associated with an increased risk for surgical site infections.

The highest rate of surgical site infection at 4.23% was in patients with a preoperative hemoglobin level of ≤10 g/dL. Patients with a preoperative hemoglobin level of 12 to 13 g/dL had the lowest rate of surgical site infection at 0.84%.
### Complications and Nutrition

<table>
<thead>
<tr>
<th></th>
<th>Malnourished (Low Albumin or Transferrin (n = 184))</th>
<th>Normal Transferrin and Albumin (n = 1977)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiovascular complications</td>
<td>1/184 (0.5%)</td>
<td>0/1977 (0%)</td>
<td>0.001</td>
</tr>
<tr>
<td>Neurovascular complication</td>
<td>5/184 (2.7%)</td>
<td>0/1977 (0%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Pulmonary complication</td>
<td>2/184 (1.1%)</td>
<td>6/1977 (0.3%)</td>
<td>0.094</td>
</tr>
<tr>
<td>Renal complication</td>
<td>10/184 (5.4%)</td>
<td>16/1977 (0.8%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Required I&amp;D</td>
<td>5/184 (2.7%)</td>
<td>12/1977 (0.6%)</td>
<td>0.002</td>
</tr>
<tr>
<td>Hematoma</td>
<td>7/184 (3.8%)</td>
<td>13/1977 (0.7%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>DVT</td>
<td>3/184 (1.6%)</td>
<td>21/1977 (1.1%)</td>
<td>0.482</td>
</tr>
<tr>
<td>PE</td>
<td>2/184 (1.1%)</td>
<td>15/1977 (0.8%)</td>
<td>0.63</td>
</tr>
<tr>
<td>Acute Infection within 3 months</td>
<td>5/184 (2.7%)</td>
<td>8/1977 (0.4%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Any complication</td>
<td>22/184 (12.0%)</td>
<td>58/1977 (2.9%)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

The Effect of Malnutrition on Patients Undergoing Elective Joint Arthroplasty

Huang, Ronald et al.
The Journal of Arthroplasty, Volume 28, Issue 8, 21 - 24
April 2010-May 2011 Rothman Institute
BMI- our registry data

- Normal and overweight (BMI 15-30) patients: SSI rate at baseline (0.25%)
- Obese patients: 2X Rate of SSI (0.5%)
- Morbid obesity (BMI 40-50) 10X Rate of SSI (2.5%)
- Super obese (BMI greater than 50) 20X Rate of SSI (5%)

- SOS Joint Registry (2008-2016)
HIV

10 fold increase in infection with CD4 <200

Why UA

Classic urinary tract infection symptoms of dysuria and urgency and increased frequency of urination are often absent in elderly patients

4% of total joint arthroplasty patients have asymptomatic urinary tract infections prior to surgery

Staph Treatment We all are exposed

- **Basic principles of therapy:**
  - *Staph aureus* is a very common organism. Colonization of the nose, and subsequently on the skin, is frequent
  - 60% of people are intermittently colonized
  - 20% always colonized
  - 20% never colonized
  - Colonization with a certain strain of bacteria can persist for years.
  - Spread between people is by skin contact (shaking hands, etc.) and sometimes on equipment (e.g., Hospital bedrail, gym workout equipment, home utensils, cups, TV remote, computer keyboards, stethoscopes).

Decolonization procedure MRSA:

1. **All active skin infection sites must be resolved before decolonization becomes feasible.** Boils must be drained. Antibiotics may be needed. Soaks or warm compresses are appropriate.

2. **Ideally, no chronic intravenous device is present** (e.g. Hickman, PICC line, etc.), and urinary catheters should be avoided.

3. **Colonization eradication should be attempted at home,** not in the hospital.

4. **Chlorhexidine or hexachlorophene antiseptic soap:**
   - Wash whole body (from scalp to toes) once daily. A big lather is not necessary! Skin moisturizer may be applied for dry skin after bathing.
   - Remove all artificial nails and all fingernail polish.
   - Scrub fingernails for one minute with nail brush twice daily.
   - **Duration:** 7 days

5. **Mupirocin 2% ointment**
   - Apply inside each nostril twice daily for 7 days, using a cotton tipped swab. No need to put deep into the nose. One Rx enough for all.
   - **Duration:** 7 days

6. **Oral antibiotics:**
   - Are not required for decolonization
   - May be used to decrease gastrointestinal colonization, and may include clindamycin, doxycycline, or TMP-SMZ, occasionally with rifampin

7. **Encourage treatment of all household members (and regular sexual contacts) with chlorhexidine/hexachlorophene and mupirocin during the same time period.**

8. Post-treatment nasal culture for surveillance is optional and not encouraged.
Smoking Cessation

• Smoking causes vascular constriction

• Since a history of smoking is associated with a statistically significant increased risk of periprosthetic joint infection, many centers use formal smoking cessation programs to assist patients in giving up, preferably Mandatory before surgery.

• 6 WEEKS BEFORE AND AFTER

• Nicotine test

Dentition

• Approximately 2% of total joint arthroplasty infections involve organisms found in the oropharynx, and most affected patients have preexisting cavities or oral abscesses

• Antibiotic prophylaxis before substantial dental procedures in patients who have undergone total joint arthroplasty is controversial; authors of 74% of the prior literature on the topic take no clear position

• The American Academy of Orthopaedic Surgeons (AAOS) suggests prophylaxis in patients at high risk of hematogenous or prosthetic infection

• Bacteremia from dental procedures can cause seeding and sepsis of the prosthetic joint

• Treatable dental issues should be screened for and treated before total joint arthroplasty

• Preoperative Risk Stratification and Risk Reduction for Total Joint Reconstruction Vincent Y. Ng, David Lustenberger, Kimberly Hoang, Ryan Urchek, Matthew Beal, Jason H. Calhoun, Andrew H. Glassman The Journal of Bone & Joint SurgeryFeb 2013,95(4)
Who Needs Cardiac Evaluation

left bundle branch block and left ventricular hypertrophy with a “strain pattern,” stress cardiac imaging should be strongly considered.

Functional capacity should be assessed with use of a metabolic equivalent (MET) scale.

Unless contraindicated, beta-blockers are indicated for patients with at least one of the clinical risk factors or poor cardiovascular functional capacity.

If poor functional capacity is present, patients with at least one of the clinical risk factors should be evaluated by a specialist

EKG, ECHO, STRESS TEST - EXERCISE OR THALLIUM

ASK YOUR FRIENDLY LOCAL CARDIOLOGIST!!
Obstructive sleep apnea is present in 5% to 11% of total joint arthroplasty patients.

The current gold standard for diagnosing obstructive sleep apnea is an overnight sleep study involving polysomnography, but the STOP-BANG questionnaire can screen for high-risk.

The maximum possible score is 8. A score of ≥3 is considered to indicate a high risk of obstructive sleep apnea.

S: Do you snore loudly, loud enough to be heard through a closed door?
T: Do you feel tired or fatigued during the daytime almost every day?
O: Has anyone observed that you stop breathing during sleep?
P: Do you have a history of high blood pressure with or without treatment?
B: BMI >35
A: Age >50 yr
N: Neck circumference >40 cm
G: Male gender
Renal

- Renal impairment is associated with a longer hospital stay, cardiac complications, early and late infections, and greater in-hospital and one-year mortality
- Patients with renal insufficiency (serum creatinine > 1.5 mg/dL\textsuperscript{182} or creatinine clearance < 100 mL/min\textsuperscript{181}) should be evaluated for potential treatment and preventative preoperative measures
- Dialysis
  - 66% rate of medical complications, a 21% rate of orthopaedic complications, and a 40% mortality at three years
  - Prevalence of periprosthetic infection ranges from 0% to 19%

- Preoperative Risk Stratification and Risk Reduction for Total Joint Reconstruction Vincent Y. Ng, David Lustenberger, Kimberly Hoang, Ryan Urchek, Matthew Beal, Jason H. Calhoun, Andrew H. Glassman The Journal of Bone & Joint Surgery Feb 2013, 95(4)
Meds To Consider

Stress-dose steroids (SDS) for patients on steroids
- If <7.5 mg/day or any dose for <3 wks, only use typical daily dose perioperatively
- If 7.5 to 20 mg/day, individualize SDS on basis of infection risk and chronicity of steroid use
- If >20 mg/day for >3 wks, secondary adrenal insufficiency is likely; treat with SDS

Methotrexate
- Considered safe to continue in the perioperative period

Reasonable to hold for 2-4 weeks preoperatively if patient does not have debilitating disease and can tolerate withdrawal of methotrexate therapy

Other disease-modifying antirheumatic drugs
- Hydroxychloroquine considered safe to continue in perioperative period
- Leflunomide, sulfasalazine, and azathioprine generally held until normal bowel/renal function postoperatively

Tumor necrosis factor inhibitors (Enbrel, Remicade, Humira)
- Caution advised. Hold agents for at least one dosage cycle prior to surgery and until staple/suture removal postoperatively

Rituximab
- Prolonged B-cell depletion can occur; may consider postponing surgery until B-cell counts normalize
# Medication Plan for Preoperative Management of Antirheumatic Medication in Patients with Rheumatic Diseases Undergoing Elective Total Joint Arthroplasty (2017 American College of Rheumatology & AAHKS)

<table>
<thead>
<tr>
<th>Disease Modifying Antirheumatic Drugs</th>
<th>Dosing Interval</th>
<th>Continue/Withhold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methotrexate</td>
<td>Weekly</td>
<td>Continue</td>
</tr>
<tr>
<td>Sulfasalazine</td>
<td>Once or twice daily</td>
<td>Continue</td>
</tr>
<tr>
<td>Hydroxychloroquine</td>
<td>Once or twice weekly</td>
<td>Continue</td>
</tr>
<tr>
<td>Leflunomide (Arava)</td>
<td>Daily</td>
<td>Continue</td>
</tr>
<tr>
<td>Doxycycline</td>
<td>Daily</td>
<td>Continue</td>
</tr>
</tbody>
</table>

**BIOLOGIC AGENTS:** STOP these medications prior to surgery and schedule surgery at the end of the dosing cycle. RESUME medications at minimum 14 days after surgery in the absence of wound healing problems, surgical site infection, or systemic infection.

<table>
<thead>
<tr>
<th>Biologic Agent</th>
<th>Dosing Interval</th>
<th>Schedule Surgery (relative to last biologic agent dose administered)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date of last dose</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Adalimumab (Humira)</th>
<th>Weekly or every 2 weeks</th>
<th>Week 2 or 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Etanercept (Enbrel)</td>
<td>Weekly or twice weekly</td>
<td>Week 2</td>
</tr>
<tr>
<td>Golimumab (Simponi)</td>
<td>Every 4 weeks (SQ) or every 8 weeks (IV)</td>
<td>Week 5 or Week 9</td>
</tr>
<tr>
<td>Infliximab (Remicsc)</td>
<td>Every 4, 6, or 8 weeks</td>
<td>Week 5, 7, or 9</td>
</tr>
<tr>
<td>Abatacept (Orencia)</td>
<td>Monthly (IV) or weekly (SQ)</td>
<td>Week 5</td>
</tr>
<tr>
<td>Certolizumab (Cimzia)</td>
<td>Every 2 or 4 weeks</td>
<td>Week 2 or 5</td>
</tr>
<tr>
<td>Rituximab (Rituxan)</td>
<td>2 doses 2 weeks apart every 4-6 months</td>
<td>Month 7</td>
</tr>
<tr>
<td>Tocilizumab (Actemra)</td>
<td>Every week (SQ) or every 4 weeks (IV)</td>
<td>Week 2 or 5</td>
</tr>
<tr>
<td>Anakinra (Kineret)</td>
<td>Daily</td>
<td>Day 2</td>
</tr>
<tr>
<td>Secukinumab (Cosentyx)</td>
<td>Every 4 weeks</td>
<td>Week 5</td>
</tr>
<tr>
<td>Ustekinumab (Stelara)</td>
<td>Every 12 weeks</td>
<td>Week 13</td>
</tr>
<tr>
<td>Belimumab (Benlylta)</td>
<td>Every 4 weeks</td>
<td>Week 5</td>
</tr>
<tr>
<td>Tofacitinib (Xeljanz): STOP these medications 7 days prior to surgery</td>
<td>Daily or twice daily</td>
<td>7 days after last dose</td>
</tr>
</tbody>
</table>

**SEVERE SLE-SPECIFIC MEDICATIONS:** CONTINUE these medications in the perioperative period.

<table>
<thead>
<tr>
<th>Medication</th>
<th>Dosing Interval</th>
<th>Continue/Withhold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methylprednisolone</td>
<td>Twice daily</td>
<td>Continue</td>
</tr>
<tr>
<td>Azathioprine</td>
<td>Daily or twice daily</td>
<td>Continue</td>
</tr>
<tr>
<td>Cyclosporine</td>
<td>Twice daily</td>
<td>Continue</td>
</tr>
<tr>
<td>Tacrolimus</td>
<td>Twice daily (IV and PO)</td>
<td>Continue</td>
</tr>
</tbody>
</table>

**NOT SEVERE SLE:** DISCONTINUE these medications 1 week prior to surgery.

<table>
<thead>
<tr>
<th>Medication</th>
<th>Dosing Interval</th>
<th>Continue/Withhold</th>
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<td>Withhold</td>
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</tbody>
</table>

*Circle Intended Plan for Patient, Retain in Allscripts, and Send to Hospital with Preoperative Paperwork*
What to do with Coumadin

**Low risk** (<4% annual risk of thromboembolism without anticoagulation)

- Nonvalvular atrial fibrillation
- Cardiomyopathy without atrial fibrillation
- Deep venous thrombosis >3 mo ago without high-risk features

**Recommendations:**

- Stop warfarin 6 days preoperatively
- Resume warfarin on day of surgery

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Intermediate risk (4%-7%)

- Mechanical aortic valves in sinus rhythm
- Atrial fibrillation and (1) age >65 yr without high-risk features, (2) age <65 yr with diabetes mellitus, coronary
- Deep venous thrombosis <3 mo ago without high-risk features
- Mitral stenosis, coronary artery disease, left ventricle aneurysm, or congestive heart failure with left ventricle dilation

**Recommendations:**

- Stop warfarin 6 days preoperatively
- Bridge with Lovenox: preoperatively and postoperatively (discontinue 12-24 hr before surgery and resume 12-24 hr postoperatively)
- Resume warfarin on day of surgery
**HIGH RISK (7%)**

Mechanical mitral valves

Aortic mechanical heart valve with prior thromboembolism, atrial fibrillation, or congestive heart failure

Deep venous thrombosis >3 mo ago with high-risk features (recurrent venous thromboembolism, malignancy, hypercoagulable state, extremity paresis)

Atrial fibrillation with history of stroke or transient ischemic attack, congestive heart failure, left ventricle dysfunction, mitral stenosis, prosthetic heart valves, thyroid disease, or age >75 yr with diabetes mellitus or hypertension

Hypercoagulable state (Factor V Leiden, prothrombin gene mutation, antiphospholipid antibody, anticardiolipin antibody, protein-C and S deficiency, antithrombin-III deficiency)

**Recommendations:**

Stop warfarin 6 days preoperatively

Bridge with Lovenox (LMWH or UFH) preoperatively and postoperatively (discontinue 12-24 hr before surgery and resume 12-24 hr postoperatively)

Resume warfarin on day of surgery
# Anticoagulation/Discharge Worksheet

**Name:**

**Date of Birth:**

## Anticoagulation Present

- **Prep:**
  - Yes (reason: ____________)
  - No

## Cardiac Stent Present

- **Yes**
  - **Prep per Cardiologist:**
    - Yes
    - No

- **No**

## Medication

**Trends:**

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASA</td>
<td>75 mg, daily</td>
</tr>
<tr>
<td>Plavix</td>
<td>75 mg, daily</td>
</tr>
<tr>
<td>Clopidogrel</td>
<td>75 mg, daily</td>
</tr>
<tr>
<td>Xarelto</td>
<td>10 mg, daily</td>
</tr>
<tr>
<td>Xarelto</td>
<td>15 mg, daily</td>
</tr>
<tr>
<td>Xarelto</td>
<td>20 mg, daily</td>
</tr>
<tr>
<td>Proxal</td>
<td>150 mg, bid</td>
</tr>
<tr>
<td>Proxal</td>
<td>75 mg, bid</td>
</tr>
<tr>
<td>Brilinta</td>
<td>90 mg, daily</td>
</tr>
<tr>
<td>Effient</td>
<td>10 mg, daily</td>
</tr>
<tr>
<td>Effient</td>
<td>3 mg, daily</td>
</tr>
<tr>
<td>Aggrenex</td>
<td>1 capsule, bid</td>
</tr>
<tr>
<td>Pletal</td>
<td>100 mg, bid</td>
</tr>
<tr>
<td>Ticlid</td>
<td>250 mg, bid</td>
</tr>
</tbody>
</table>

## VTE Risk Factors

- **Yes**
  - Prior DVT
  - Prior PE
  - Family history DVT/PE
  - Marjor Obstructive Disease
  - Current Smoker
  - Immobilization therapy
- **No**

## Inherited Traits

- **Yes**
  - Factor IV Leiden
  - Protein C Deficiency
  - Protein S Deficiency
  - Thrombophilia syndrome
  - Polycystic Kidney
- **No**

## Hormone Replacement Therapy & BCP

- **Yes**
  - Discontinue two weeks prior to surgery and may start
  - Oral contraceptives—discontinue two weeks prior to surgery
- **No**

## Postoperative anticoagulation recommendation

- **ASA 81 mg, bid**
  - As an adjust to other anticoagulation plan
- **ASA 81 mg, bid**
  - Only in an adjust to other anticoagulation plan
- **Proxal 150 mg, daily**
  - Proxal 75 mg, daily
  - Xarelto 10 mg, daily
  - Xarelto 15 mg, daily
  - Xarelto 20 mg, daily
  - Brilinta 90 mg, daily
  - Effient 10 mg, daily
  - Effient 3 mg, daily
  - Aggrenex 1 capsule, bid
- **Pletal 100 mg, bid**
- **Ticlid 250 mg, bid**

## Other Postoperative recommendations:

- Restart hormone-replacement & BCP after __________ weeks
- Hip precautions: direct anterior & anterior lateral
- Pedal lateral & direct superior
- Heterotopic Ossification Prophylaxis
- Indomethacin 50 mg TID with Prilosec 20 mg daily or another proton pump inhibitor

**MD/PA/RP Signature:** ____________

**Date/Time:** ____________
Total Joint Replacement Council

Steve Bogosian
Michael Clark
Brett Greenky
Seth Greenky
Tim Izant
Kevin Kopko

John Parker, Glen Axelrod, Dan Wnorowski, Todd Battaglia

We meet monthly to review the literature and update our protocols and to review specific higher risk patient particulars
THANK YOU