Preoperative Risk Stratification and Reduction for Elective Total Hip and Knee Arthroplasty

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Current projections anticipate the demand for primary total hip arthroplasty (THA) and total knee arthroplasty (TKA) to grow nearly three- and eight-fold respectively over the next twenty years
Kurtz S; Ong K; Lau E; et al

Projections of Primary and Revision Hip and Knee Arthroplasty in the United States from 2005 to 2030

By 2030

- Primary THR: ↑ 174% to 572,000
- Primary TKR: ↑ 673% to 3.48 million
Revisions

- Hips: Projected to double by the year 2026
- Knees: Projected to double by 2015

- Inappropriate patient selection?
- Use of novel (unproven) techniques?
- Poor surgery?

Primary Procedures
Revisions

Concomitantly….

- Rising healthcare costs
- Diminishing financial resources
- New government initiatives

Impetus to minimize postoperative complications.
Many payors, especially the U.S. Center for Medicare and Medicaid Services (CMS), have targeted TJA for cost control.
CMS

- 2008: Replaced DRG system with the Medical Severity DRG (MS-DRG) system

- Identified “Never Events”
  - hospital-acquired
  - reasonably preventable
  - not reimbursed by Medicare

Additional Proposed CMS Measures for THA and TKA

Risk-Standardized Complications Rates at 7 days:

- Acute MI
- Pneumonia
- Sepsis/ Septicemia
<table>
<thead>
<tr>
<th>Additional Proposed CMS Measures for THA and TKA</th>
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<tbody>
<tr>
<td>Risk-Standardized Complications Rates at 30 days:</td>
</tr>
<tr>
<td>➢ Wound infection</td>
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<tr>
<td>➢ Surgical site bleeding</td>
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<tr>
<td>➢ PE</td>
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<tr>
<td>➢ Death</td>
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<thead>
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<tr>
<td>Risk-Standardized Complications Rates at 90 days:</td>
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<tr>
<td>➢ Periprosthetic infection</td>
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<tr>
<td>➢ Mechanical complications</td>
</tr>
<tr>
<td>➢ Dislocation</td>
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<tr>
<td>➢ Loosening</td>
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<tr>
<td>➢ Periprosthetic fracture</td>
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Additional Proposed CMS Measures for THA and TKA

Risk-Standardized Readmission Rate:

All unplanned causes for first 30 days
### University and other Referral Centers

<table>
<thead>
<tr>
<th>Condition</th>
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<tbody>
<tr>
<td>Immune Compromise</td>
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<tr>
<td>Transplant</td>
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<tr>
<td>HIV-AIDS</td>
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<tr>
<td>Dialysis</td>
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<tr>
<td>Obesity</td>
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<tr>
<td>Smoking</td>
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<tr>
<td>Diabetes</td>
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<td>Substance abuse</td>
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<td>Dental caries</td>
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<td>Malnutrition</td>
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<tr>
<td>Coagulopathy</td>
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<tr>
<td>Hemophilia</td>
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<tr>
<td>Sickle Cell</td>
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<tr>
<td>Challenge</td>
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<td>-----------</td>
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<tr>
<td>➢ Provide necessary treatment</td>
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<tr>
<td>➢ Minimize morbidity and mortality</td>
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<tr>
<td>➢ Remain financially viable</td>
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Materials and Methods

- An expansive search of the PubMed electronic database
- Major categories:
  - cardiology
  - pulmonology
  - hematology
  - rheumatology
  - nephrology
  - hepatology
  - PAD
  - transplant
  - immunosuppression
  - endocrinology
  - hypersensitivity
  - drugs/alcohol
  - tobacco
  - dentistry
  - infection
  - obesity
  - age
  - malnutrition
  - neuromuscular

Materials and Methods

- Emphasis placed on studies of total hip or knee arthroplasty
- Published within the past ten years
- Higher levels of evidence
- Dealt specifically with preoperative assessment or preoperative risk factors
- When studies specific to TJA were unavailable, general orthopaedic, general medical and general surgical literature was used
### A Total of 382 Articles Identified (now over 425)

- Comprehensive review
- A systematic and rational algorithmic approach to preoperative assessment was developed

### Findings
Cardiovascular Risks

Cardiovascular-related complications represent 42% to 75% of major systemic adverse events and death following TJA


Cardiac Screening

Unstable Coronary Syndromes
- Unstable or Severe Angina.
- Recent MI (within 4-6 weeks).

Decompensated Heart Failure
- Unable to carry out any physical activity without discomfort.
- Symptoms of cardiac insufficiency at rest such as fatigue, palpitation, or dyspnea.
- Discomfort is increased with physical activity.
- Worsening or new-onset heart failure.
# Cardiac Screening

## Significant Arrhythmias
- High-grade, Mobitz II or 3° AV block.
- Symptomatic ventricular arrhythmias.
- Supraventricular arrhythmias (including atrial fibrillation) with heart-rate >100 bpm at rest.
- Symptomatic bradycardia.
- Newly recognized ventricular tachycardia.

## Severe Valvular Disease
- Severe or symptomatic aortic stenosis.
- Symptomatic mitral stenosis (progressive dyspnea on exertion, exertional presyncope, heart failure)

## Cardiac Screening-Guidelines for:

- Stress testing, echo
- Delay after angioplasty, stents
- Anti-platelet therapy after bare or drug eluting stents
- Beta blockade
At least half of TKA and one-third of THA patients are obese (body mass index, BMI >30)

Batsis JA et al. *J Arthroplasty* 25, 2010
Namba R et al. *J Arthroplasty* 20, 2005
## Obesity

- **Obese/ morbidly obese (BMI >40)**
  - Four- to nearly ten-fold increase in infection


## Obesity

- **Longer skin incisions**
- **Lengthier tourniquet times**
- **Increased fat necrosis**
- **Higher potential for wound complications**

  - Booth RJ. *J Arthroplasty.* 17, 2002
  - Christensen CP *J Arthroplasty.* 29, 2009
“Superobese” e.g. BMI >50
Polga et al AAOS 2009

5 Deaths!

- 43 total hips, 41 patients
- 39.5% surgical complications:
  - Sciatic neuropathy, 3 recurrent dislocations,
  - two chronic infections, stem fracture, acetabular fracture,
  - femoral fracture

5 Deaths!
(1/8 patients died!)
Obesity Guidelines

- BMI >40: encouraged to lose weight prior to surgery
- BMI>45: elective TJA NOT OFFERED
- BMI between 40 and 45: eliminate or optimize ALL other co-morbidities

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

Scoring:
A score of 3 or more out of a total possible score of 8 is considered high risk for OSA.
Diabetes

- Affects approximately 8-10% of patients undergoing TJA
- Preadmission hyperglycemia independent risk factor for in-hospital symptomatic pulmonary embolism
- Uncontrolled DM compared to controlled DM had higher odds of stroke, UTI, ileus, postoperative hemorrhage, wound infections and death

Diabetes

American Diabetes Association and American Association of Clinical Endocrinologists

- Target Hgb A1C of <7.0%
- Hospitalized, non-critically ill pre-meal BG of <140 mg/dL
- Random BG of <180 mg/dL
## Diabetes

- No patient with a Hgb A1C greater than 7.0 will have an elective TJA

- Fasting glucose drawn on the morning of surgery:
  - >140 mg %
  - Surgery cancelled

## Smoking
Smoking

- Significantly increases risk of:
  - Infection
  - Hematoma
  - Wound complications

- Significant risk reduction requires smoking cessation at least 6-8 weeks prior to TJA
  
  Thomsen T et al. *Br J Surg* 96, 2009

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Smoking

- Intense intervention effective:
  - Nicotine replacement therapy (NRT)
  - Individualized counseling by professional counselors

- Ineffective strategies:
  - Short-term counseling (only 2-3 weeks before surgery)
  - Informal counseling sessions
  - Written instructions
  - Counseling alone
  - Pharmacotherapy alone

  Thomsen T et al. *Br J Surg* 96, 2009
Intravenous Drug Abuse (IVDA)

Significant risk factor for recurrent bacteremia and infection after TJA


- 25% of IVDA patients developed joint sepsis from hematogenous spread

- Positive history of IVDA
  - referred to a methadone clinic
  - clean for at least 2 years before TJA
  - confirmed by physical exams and drug screenings

## Dental Caries

- Present in 15%-23% of patients undergoing TJA
- Typically affects multiple teeth
- Associated with infected gums requiring treatment

Barrington J et al *Annual AAOS Meeting.* San Diego; 2011

Screen for and eliminate any treatable dental issues before TJA

Require dental evaluation within previous 6 months and letter of clearance from dentist

1. BMI >45
2. Skin compromised
3. Poor dentition
4. Joint or other active infection
5. Awaiting transplant
6. HIV/AIDS
ALL PATIENTS

1. BMI >45
2. Skin compromised
3. Poor dentition
4. Joint or other active infection
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6. HIV/AIDS

If yes...

FULL STOP!

If no, go to next step
1. BMI 40-50
2. Significant cardiac ds
3. DM (A1C>7), BS>130
4. Malnutrition
5. Smoker

If yes, modifiable risks

1. Weight loss program
2. Cardiology consult
3. Diabetes management
4. Nutrition/ dietary consult
5. Smoking cessation
1. BMI 40-50
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3. DM (A1C>7), BS>130
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*If yes, modifiable risks*

- 1. Weight loss program
- 2. Cardiology consult
- 3. Diabetes management
- 4. Nutrition/dietary consult
- 5. Smoking cessation

*If no…*

Schedule Medical Pre-Op Evaluation

Medical Pre-Op Evaluation
Prior Bariatric Surgery?

- Nutritional eval
- Glucose control
- Lab work

Medical Pre-Op Evaluation

OSA Risk?

- STOP BANG
- Sleep Study
Medical Pre-Op Evaluation

- Prior Bariatric Surgery?
  - Nutritional eval
  - Glucose control
  - Lab work

- OSA Risk?
  - STOP BANG
  - Sleep Study

- DVT/PE Coagulopathy? A-fib
  - Vascular med
  - Heme
  - Bridge Therapy
  - IVC filter

MRSA MSSA screening
MRSA
MSSA
screening

Empiric mupirocin
CHG baths

Culture negative

Empiric mupirocin
CHG baths

Stop mupirocin
Cefazolin, Clindamycin
MRSA MSSA screening

Culture negative
- Empiric mupirocin
- CHG baths

Culture positive
- Stop mupirocin
- Cefazolin, Clindamycin

- Continue mupirocin
- Vancomycin
- Rescreen later

Summary
Historically

- New implants (short stems, modular necks, surface replacements)
- New approaches (anterior supine, MIS etc)
- Newer techniques (navigation, robotics, patient specific instruments)

The Paradigm is Changing!

- Who gets a total joint replacement
- What complications they suffer

A new wave of economic credentialing?
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