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
J Bone Joint Surg 89A, 2007

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

By 2030

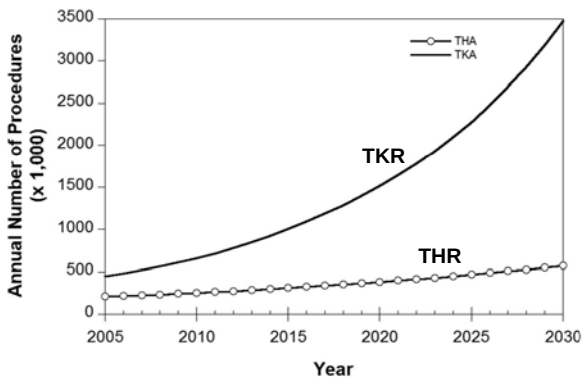
- **Primary THR: ⇧ 174% to 572,000**
- **Primary TKR: ⇧ 673% to 3.48 million**

Revisions

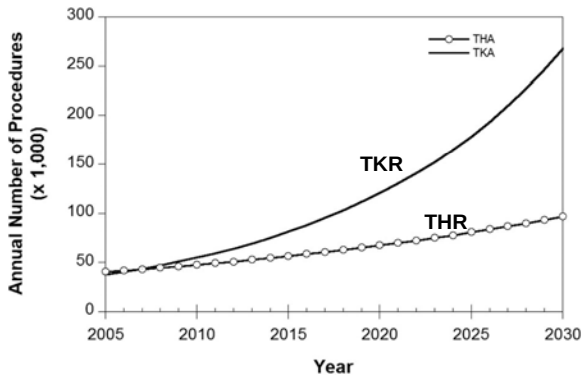
- **Hips : Projected to double by the year 2026**
- **Knees: Projected to double by 2015**

- ***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

Additional Proposed CMS Measures for THA and TKA

Risk-Standardized Complications Rates at 30 days:

- Wound infection
- **S**urgical site bleeding
- PE
- Death

Additional Proposed CMS Measures for THA and TKA

Risk-Standardized Complications Rates at 90 days:

- **P**eriprosthetic infection
- **M**echanical complications
- **D**islocation
- **L**oosening
- **P**eriprosthetic fracture

Additional Proposed CMS Measures for THA and TKA

Risk-Standardized Readmission Rate:

All unplanned causes for first 30 days

University and other Referral Centers

- Immune Compromise
- Transplant
- HIV-AIDS
- Dialysis
- Obesity
- Smoking
- Diabetes
- Substance abuse
- Dental caries
- Malnutrition
- Coagulopathy
- Hemophilia
- Sickle Cell

Challenge

- **Provide necessary treatment**
- **Minimize morbidity and mortality**
- **Remain financially viable**

Initiative

- **Develop and implement a system for risk stratification**
- **Apply to all candidates for elective TJA preoperatively**
- **Educate patients and referral sources**
- **Validate**

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

Aynardi M et al *Clin Orthop Relat Res.* 2009;467:213-218.
Memtsoudis S et al *Anesth Analg.* 2010;111:1110-1116.
Mortazavi SMJ et al *Annual AAOS Meeting*. San Diego; 2011.
Pulido L, et al *J Arthroplasty.* 2008;23:139-145.

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

Obesity

Obesity

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

Giurea A, et al. *J Bone Joint Surg 92-B.* 2010
Lubbeke A, et al. *Arthr Rheum.* 57, 2007
Malinzak R, et al. *J Arthroplasty. 24,* 2009
Namba R, et al. *J Arthroplasty.* 20:2005

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

"Superobese" eg BMI >50

Polga et al AAOS 2009

- 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 loose 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**

Lindstrom D et al.. *Ann Surg 248,* 2008
Moller A, et al. *Lancet 359,* 2002
Thomsen T et al. *Br J Surg 96,* 2009

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**

Lindstrom D et al.. *Ann Surg 248,* 2008
Moller A, et al. *Lancet 359,* 2002
Thomsen T et al. *Br J Surg 96,* 2009

Intravenous Drug Abuse (IVDA)

Significant risk factor for recurrent bacteremia and infection after TJA

Craven D et al, *Am J Med.* 1986

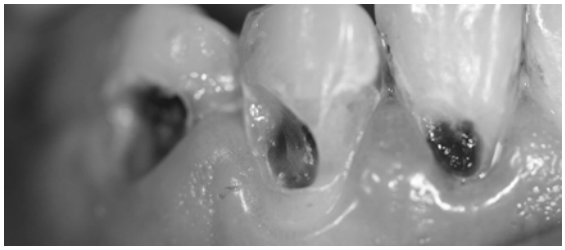
Webb B, *Orthopedics.* 2008

Intravenous Drug Abuse (IVDA)

- 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

Lehman C et al, *J Arthroplasty.* 2001

Dental Caries



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

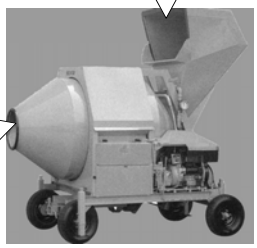
Moholkar K et al, *Eur J Orthop Surg Traumatol. 14 ,* 2004

Dental Pathology

- **Screen for and eliminate any treatable dental issues before TJA**
- **Require dental evaluation within previous 6 months and letter of clearance from dentist**

Hart W, et al. *J Bone Joint Surg 87-B.* 2005
Moholkar K, Corrigan J *Eur J Orthop Surg Traumatol.* 2004
Uckay I, et al *J Bone Joint Surg* 90-B, 2008

Data Input
372 Articles

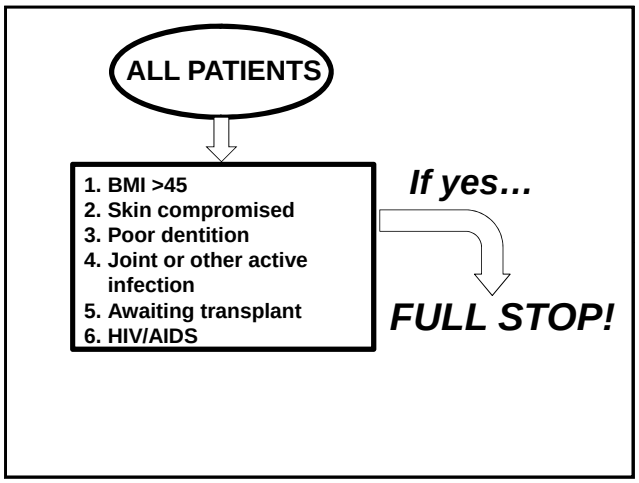


Screening Algorithm

ALL PATIENTS

ALL PATIENTS

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


ALL PATIENTS
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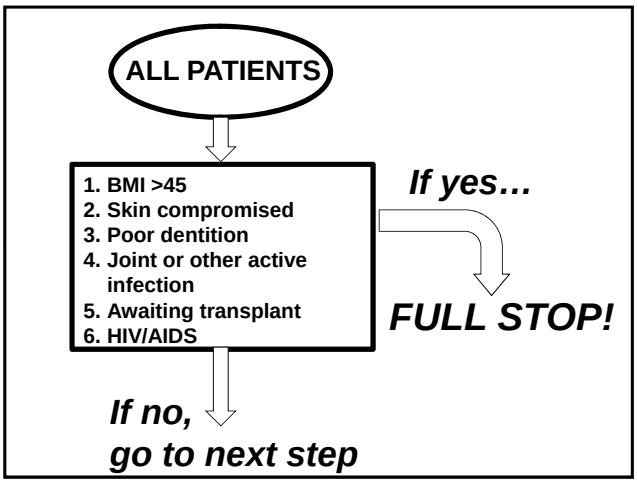
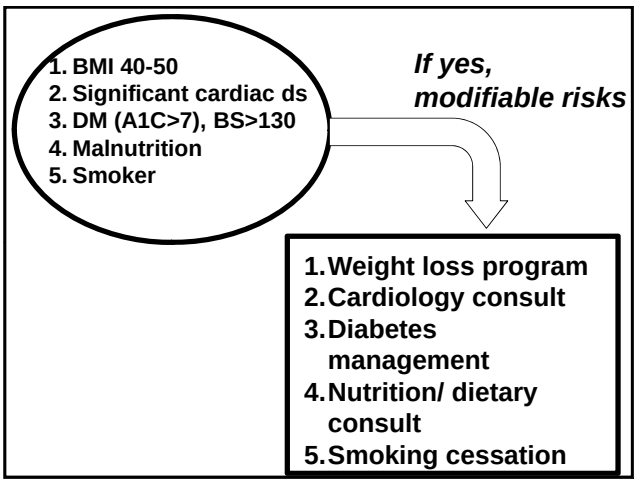
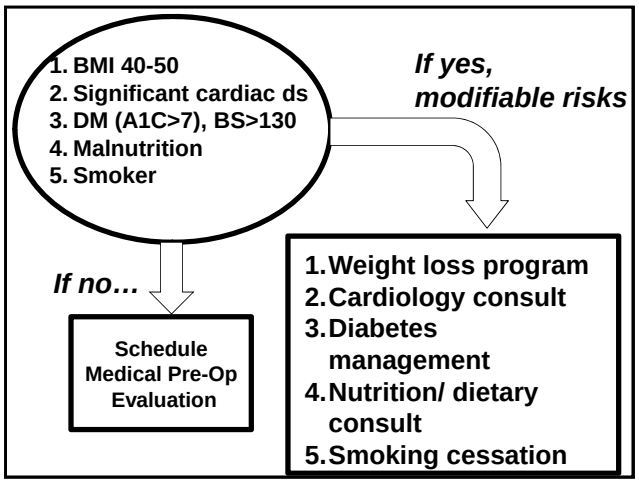
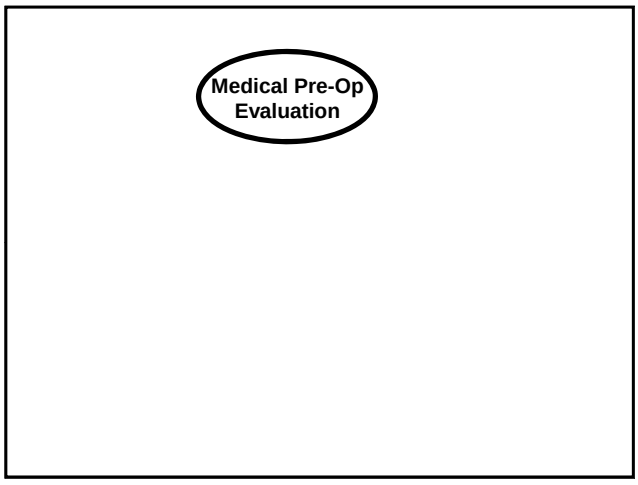
6. HIV/AIDS
If yes…
FULL STOP!

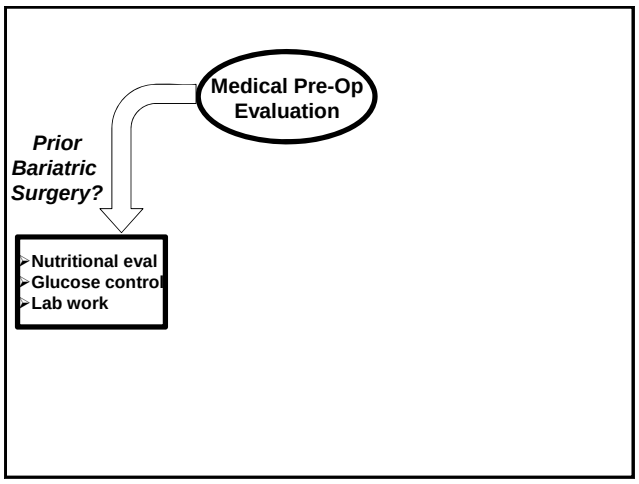

ALL PATIENTS
1. BMI >45
2. Skin compromised
3. Poor dentition
4. Joint or other active infection
5. Awaiting transplant
6. HIV/AIDS
If yes…
FULL STOP!
If no,
go to next step

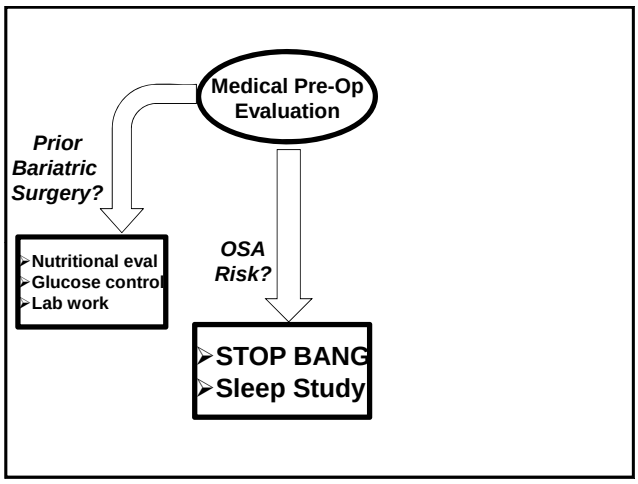

1. BMI 40-50
2. Significant cardiac ds
3. DM (A1C>7), BS>130
4. Malnutrition
5. Smoker

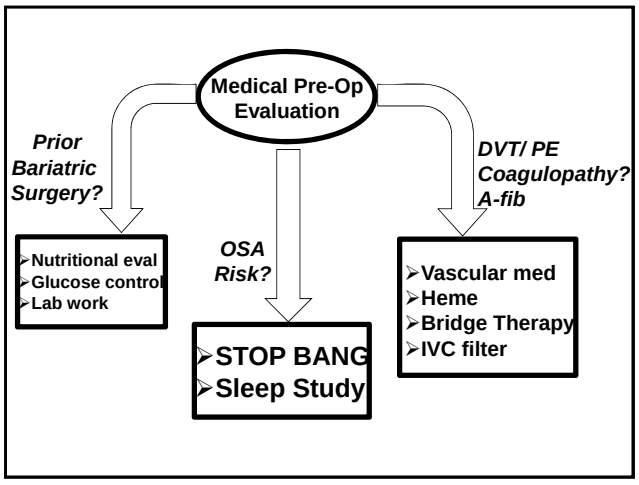

1. BMI 40-50
2. Significant cardiac ds
3. DM (A1C>7), BS>130
4. Malnutrition
5. Smoker
If yes,
modifiable risks
1. Weight loss program
2. Cardiology consult
3. Diabetes management
4. Nutrition/ dietary consult
5. Smoking cessation


1. BMI 40-50
2. Significant cardiac ds
3. DM (A1C>7), BS>130
4. Malnutrition
5. Smoker
If yes, modifiable risks
If no…
Schedule Medical Pre-Op Evaluation
1. Weight loss program
2. Cardiology consult
3. Diabetes management
4. Nutrition/ dietary consult
5. Smoking cessation

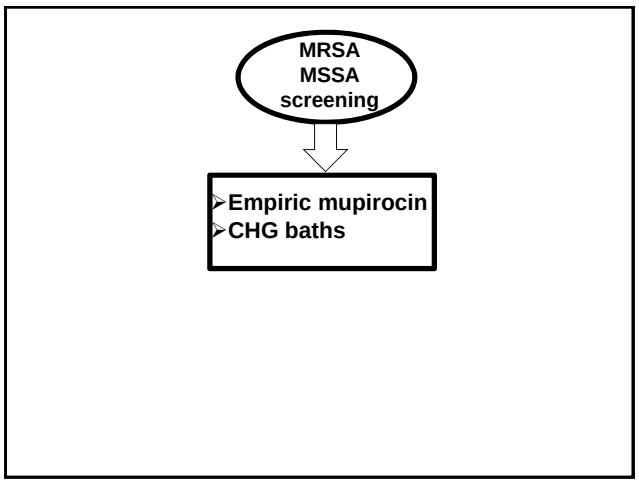

Medical Pre-Op Evaluation

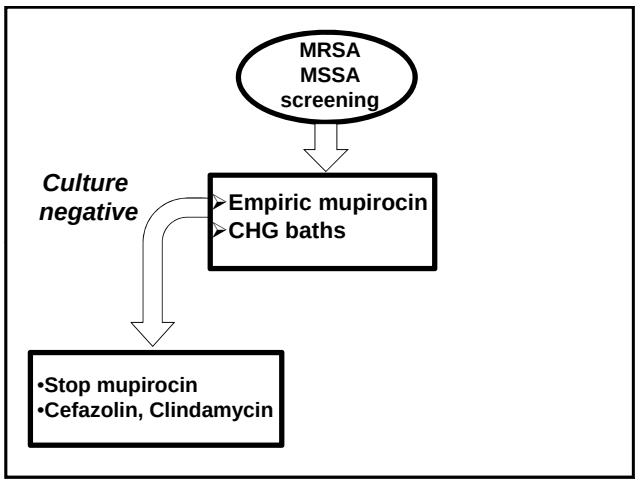

Medical Pre-Op Evaluation
Prior Bariatric Surgery?
Nutritional eval
Glucose control
Lab work

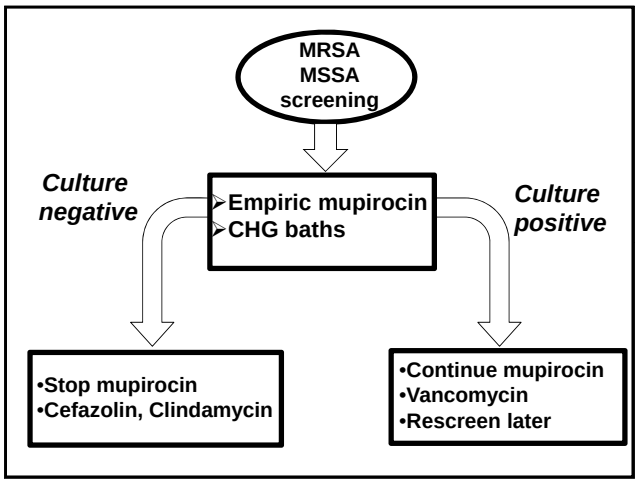

Medical Pre-Op Evaluation
Prior Bariatric Surgery?
Nutritional eval
Glucose control
Lab work
OSA Risk?
STOP BANG
Sleep Study


Medical Pre-Op Evaluation
Prior Bariatric Surgery?
DVT/ PE Coagulopathy? A-fib
OSA Risk?
Nutritional eval
Glucose control
Lab work
STOP BANG
Sleep Study
Vascular med
Heme
Bridge Therapy
IVC filter


MRSA
MSSA
screening


MRSA
MSSA
screening
Empiric mupirocin
CHG baths


MRSA
MSSA
screening
Culture negative
Empiric mupirocin
CHG baths
•Stop mupirocin
•Cefazolin, Clindamycin



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?

Initiative

- **Develop and implement a system for risk stratification**
- **Apply to all candidates for elective TJA preoperatively**
- **Educate patients and referral sources**
- **Validate**