
MUSC
MEDICAL UNIVERSITY
of SOUTH CAROLINA
Changing What's Possible
Hip and Knee Arthroplasty:
From Pre-op to Post-op
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Department of Orthopaedics and Rehabilitation

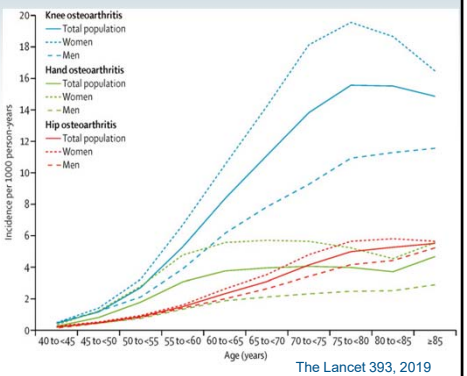
I (and/or my co-authors) have nothing to disclose.

Goals and Objectives

- Discuss the assessment and treatment of hip and knee osteoarthritis
- Identify important considerations for surgical planning, risk assessment, and optimization
- Understand bearing surfaces and their influence on joint implant longevity
- Discuss appropriate perioperative care in THA/TKA, including DVT prophylaxis and infection prophylaxis
- Review THA/TKA post-op protocols, including pain management and physical therapy

Arthritis

- 46.9 Million Americans affected
- 21% of Americans with diagnosis
- 50% in >65 year-old population
- 78.4 Million expected by 2040
- Knee is 85% burden of OA
- Limitations
  - walking 1/4 mile—6 million
  - stooping/bending/kneeling—7.8 million
  - climbing stairs—4.8 million
  - social activities such as church and family gatherings—2.1 million



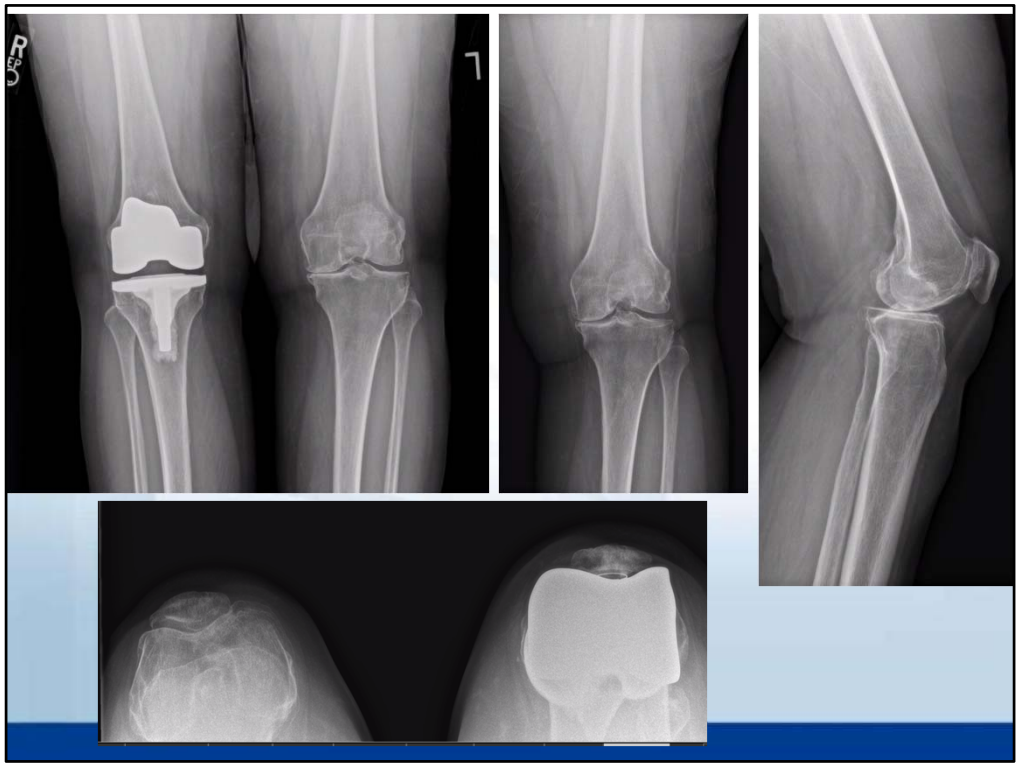
The Lancet 393, 2019

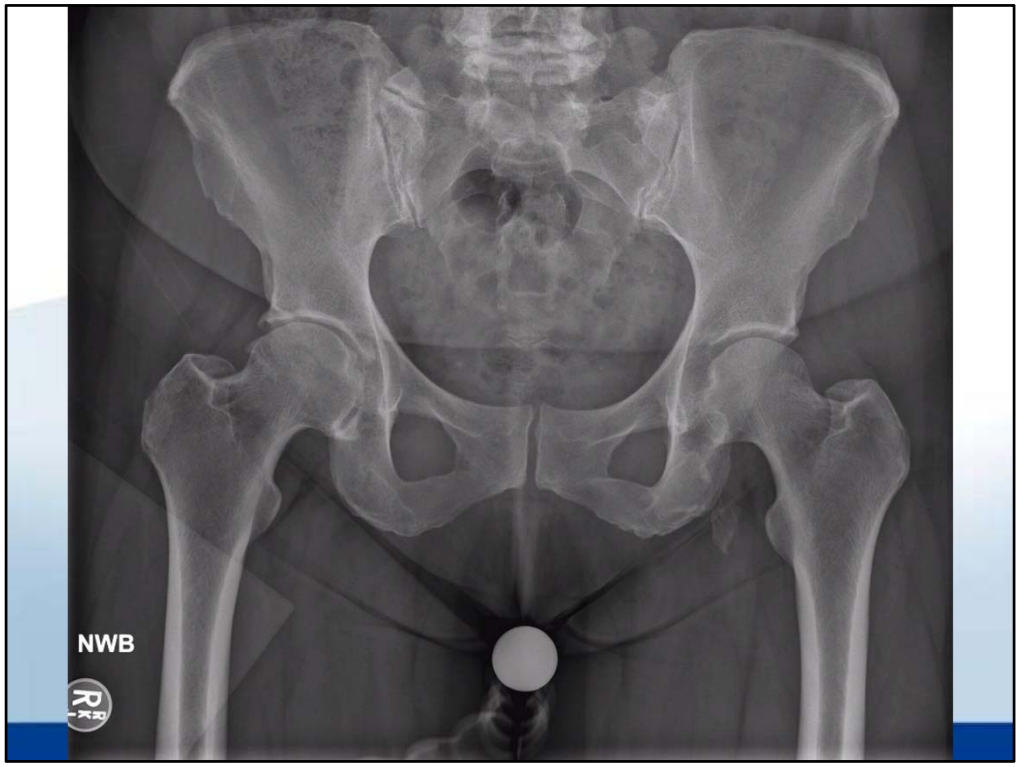
Economic Impact

- Fourth leading cause of disability
- 34% of lost work days
- 30.6% of arthritis patients have work limitations
- $128 Billion in costs in 2003
  - $80.8 Billion in direct medical costs
  - $47 Billion in earnings losses
- Medical cost is 1-2.5% of GDP

Risk Factors

- Age
- Female Sex
- Obesity
- Previous injury
- Knee malalignment
- Quad Weakness
- Acetabular dysplasia
- Cam Deformity
- Heavy work activities or Impact sports
- Genetic predisposition

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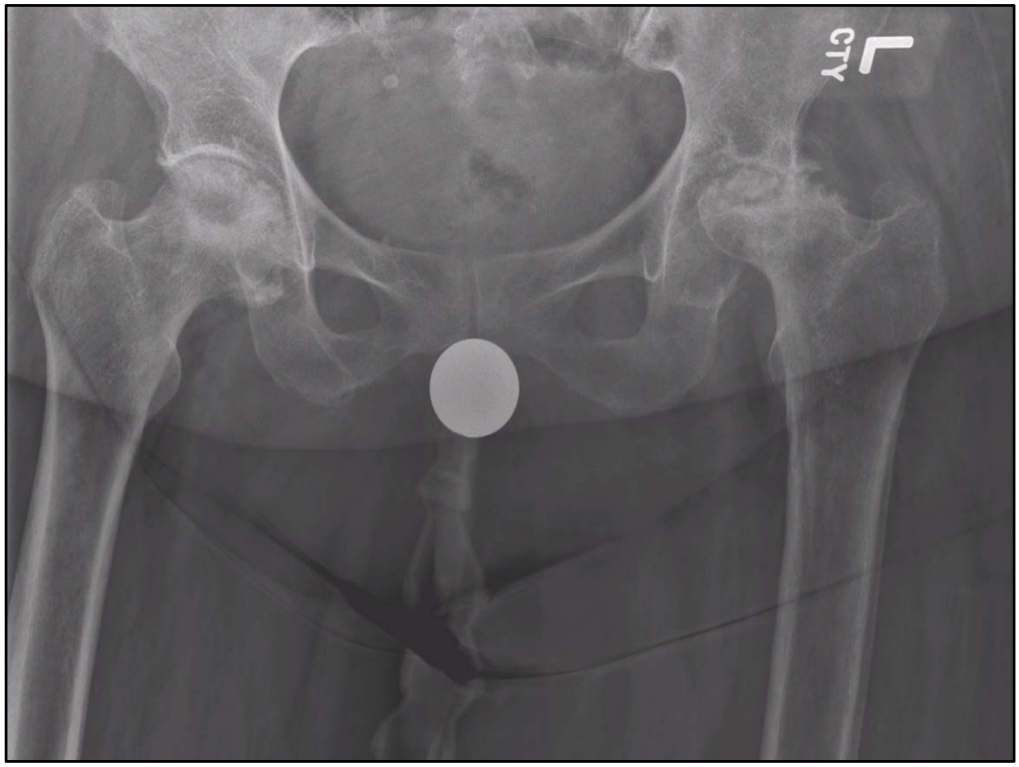
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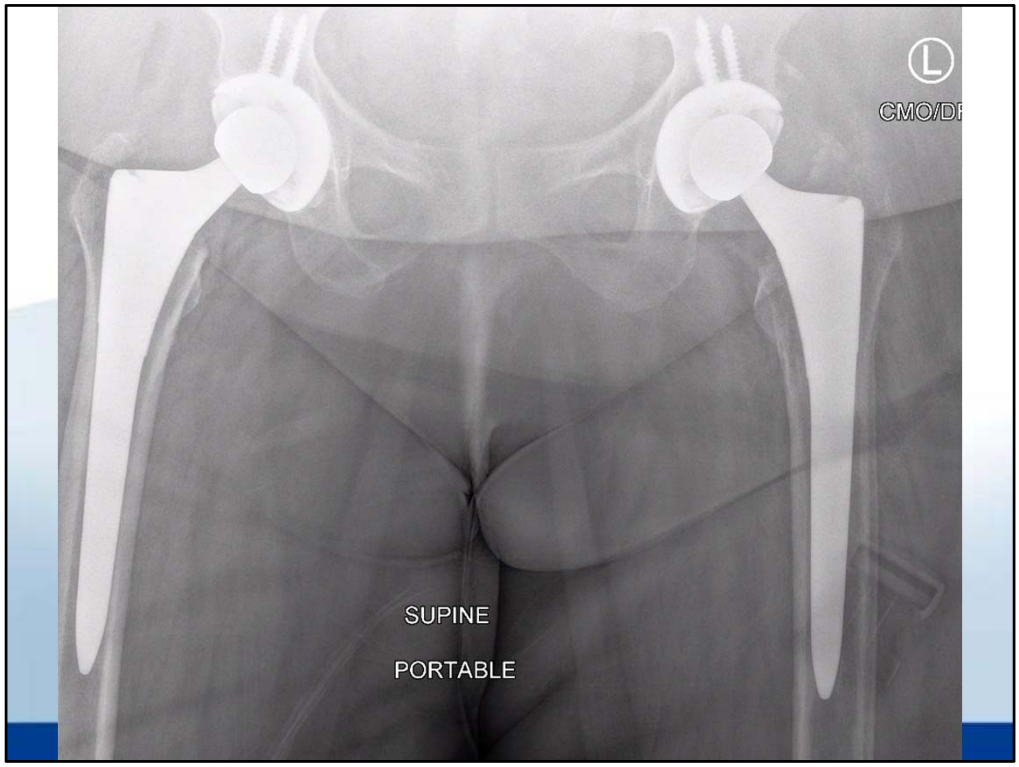
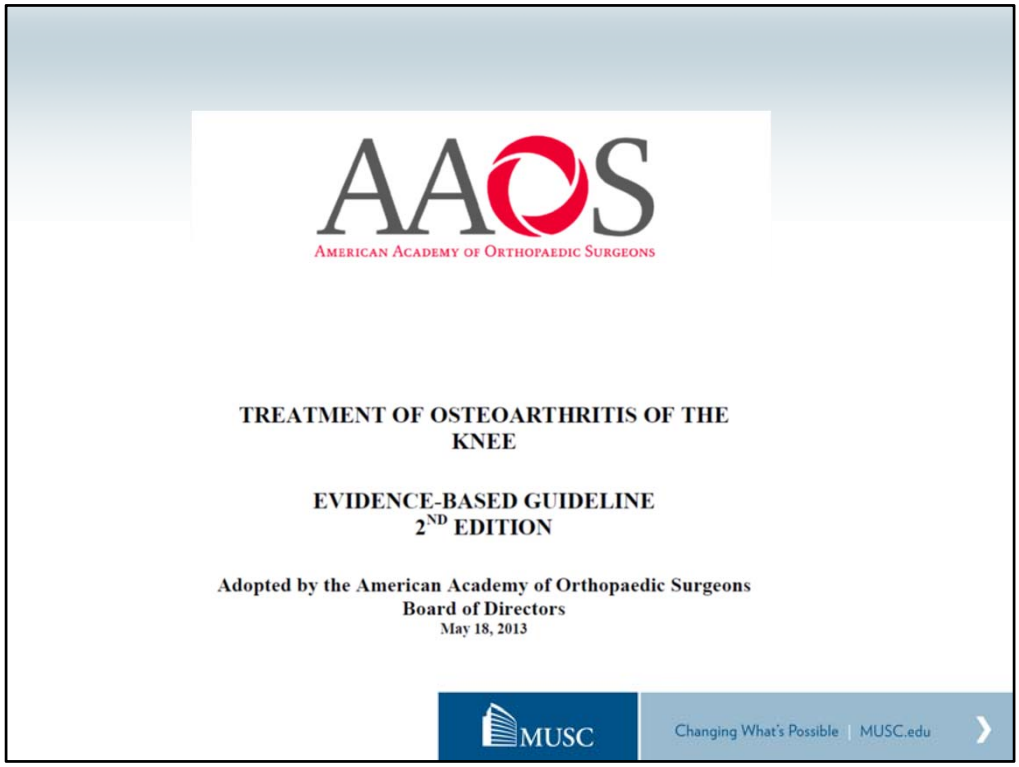

L
CMO/DR
SUPINE
PORTABLE

Conservative Treatment

- Activity modification / assistive devices
- NSAIDS
- Topical ointments and patches
- Bracing / shoe modifications
- Physical therapy / exercise
  - 3x/week decreases disability 47%
- Weight loss
  - 11 lbs reduces risk of knee arthritis in women by 50%
- Injections
  - Corticosteroid
  - Hyaluronic acid
  - Stem cells / PRP


AAOS
American Academy of Orthopaedic Surgeons
TREATMENT OF OSTEOARTHRITIS OF THE KNEE
EVIDENCE-BASED GUIDELINE
2ND EDITION
Adopted by the American Academy of Orthopaedic Surgeons
Board of Directors
May 18, 2013
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Conservative Treatments

RECOMMENDATION 1

We recommend that patients with symptomatic osteoarthritis of the knee participate in self-management programs, strengthening, low-impact aerobic exercises, and neuromuscular education; and engage in physical activity consistent with national guidelines.

Strength of Recommendation: Strong

RECOMMENDATION 2

We suggest weight loss for patients with symptomatic osteoarthritis of the knee and a BMI ≥ 25.

Strength of Recommendation: Moderate

RECOMMENDATION 3A

We cannot recommend using acupuncture in patients with symptomatic osteoarthritis of the knee.

Strength of Recommendation: Strong

RECOMMENDATION 3B

We are unable to recommend for or against the use of physical agents (including electrotherapeutic modalities) in patients with symptomatic osteoarthritis of the knee.

Strength of Recommendation: Inconclusive

Conservative Treatments

RECOMMENDATION 3C

We are unable to recommend for or against manual therapy in patients with symptomatic osteoarthritis of the knee.

Strength of Recommendation: Inconclusive

RECOMMENDATION 4

We are unable to recommend for or against the use of a valgus directing force brace (medial compartment unloader) for patients with symptomatic osteoarthritis of the knee.

Strength of Recommendation: Inconclusive

RECOMMENDATION 5

We cannot suggest that lateral wedge insoles be used for patients with symptomatic medial compartment osteoarthritis of the knee.

Strength of Recommendation: Moderate

RECOMMENDATION 6

We cannot recommend using glucosamine and chondroitin for patients with symptomatic osteoarthritis of the knee.

Strength of Recommendation: Strong

Pharmacologic Treatments

RECOMMENDATION 7A

We recommend nonsteroidal anti-inflammatory drugs (NSAIDs; oral or topical) or Tramadol for patients with symptomatic osteoarthritis of the knee.

Strength of Recommendation: Strong

RECOMMENDATION 7B

We are unable to recommend for or against the use of acetaminophen, opioids, or pain patches for patients with symptomatic osteoarthritis of the knee.

Strength of Recommendation: Inconclusive

Procedural Treatments

RECOMMENDATION 8

We are unable to recommend for or against the use of intraarticular (IA) corticosteroids for patients with symptomatic osteoarthritis of the knee.

Strength of Recommendation: Inconclusive

RECOMMENDATION 9

We cannot recommend using hyaluronic acid for patients with symptomatic osteoarthritis of the knee.

Strength of Recommendation: Strong

RECOMMENDATION 10

We are unable to recommend for or against growth factor injections and/or platelet rich plasma for patients with symptomatic osteoarthritis of the knee.

Strength of Recommendation: Inconclusive

RECOMMENDATION 11

We cannot suggest that the practitioner use needle lavage for patients with symptomatic osteoarthritis of the knee.

Strength of Recommendation: Moderate

Surgical Treatments:

RECOMMENDATION 12

We cannot recommend performing arthroscopy with lavage and/or debridement in patients with a primary diagnosis of symptomatic osteoarthritis of the knee.

Strength of Recommendation: Strong

RECOMMENDATION 13

We are unable to recommend for or against arthroscopic partial meniscectomy in patients with osteoarthritis of the knee with a torn meniscus.

Strength of Recommendation: Inconclusive

RECOMMENDATION 14

The practitioner might perform a valgus producing proximal tibial osteotomy in patients with symptomatic medial compartment osteoarthritis of the knee.

Strength of Recommendation: Limited

RECOMMENDATION 15

In the absence of reliable evidence, it is the opinion of the work group not to use the free-floating (un-fixed) interpositional device in patients with symptomatic medial compartment osteoarthritis of the knee.

Strength of Recommendation: Consensus

Joint Replacement Indications

- Osteoarthritis, inflammatory arthritis, post traumatic arthritis, avascular necrosis, fracture, malignancy
- Pain relief
  - Not responding to conservative treatment
  - Impacting quality of life and ADL's
- Correction of deformity
  - Malalignment
  - Contractures

Total Hip Arthroplasty (THA) Documentation of Medical Necessity

Patient Name: _____

I hereby document that I have treated the above patient, and all reasonable conservative treatments have failed to control their disease, which causes significant pain and influences their function and now requires THA.

Indication:

□ malignancy of the pelvis or proximal femur or soft tissues of the hip, OR

□ avascular necrosis of the femoral head, OR

□ fracture of the femoral neck, OR

□ acetabular fracture, OR

□ nonunion, malunion, or failure of previous hip fracture surgery, OR

□ advanced joint disease demonstrated by:

□ X-Ray OR □ MRI

AND

one or more of the below conservative treatments have been tried and failed for 3months or more:

□ anti-inflammatory medication : _____

□ analgesic: _____

□ home exercise □ physical therapy

□ use of cane or walker □ weight loss

□ cortisone shot(s)

I also certify that the patient does NOT have any of the following **contraindications** to THA:

- active infection of the hip joint, OR
- active systemic bacteremia, OR
- active skin infection or open wound at surgical site, OR
- neuropathic arthritis, OR
- severe, rapidly progressive neurological disease, OR
- severe medical condition that makes risks of the surgery outweigh the potential benefit.

Physician: _____ Physician Signature: _____ Date: _____

Total Knee Arthroplasty (TKA) Documentation of Medical Necessity

Patient Name: _____

I hereby document that I have treated the above patient, and all reasonable conservative treatments have failed to control their disease, which causes significant pain and influences their function and now requires TKA.

Indication:

□ failure of previous osteotomy, OR

□ distal femur fracture, OR

□ malignancy of distal femur, proximal tibia, knee joint, soft tissues, OR

□ failure of previous unicompartmental knee replacement, OR

□ avascular necrosis of knee, OR

□ advanced joint disease demonstrated by:

□ X-Ray OR □ MRI

AND

one or more of the below conservative treatments have been tried and failed for 3months or more:

□ anti-inflammatory medication : _____

□ analgesic: _____

□ home exercise □ physical therapy

□ use of cane or walker □ weight loss

□ brace □ cortisone shot(s)

□ supartz, synvisc, hyalagan, orthovisc, euflexxa

I also certify that the patient does NOT have any of the following **contraindications** to TKA:

- active infection of the knee joint, OR
- active systemic bacteremia, OR
- active skin infection or open wound at surgical site, OR
- neuropathic arthritis, OR
- severe, rapidly progressive neurological disease, OR
- severe medical condition that makes risks of the surgery outweigh the potential benefit.

Physician: _____ Physician Signature: _____ Date: _____

TJ Benefits

- Pain relief
- Improved function
- Return to ADLs
- Improved quality of life
- Return to productive employment
- Discontinuation of assistive devices
- Correction of deformity
- Correction of contractures

TJ Risks

- Pain
- Diminished function
- Temporary loss of independence
- Time away from work
- Need for assistive devices
- Financial burden
- Complications
  - infection, blood clots, pulmonary embolism, perioperative death, cardiovascular problems, medical issues, anesthetic related issues, continued pain, failure of the implants, fractures, loosening, dislocation, leg length differences, damage to nerves, blood vessels, tendons, or other soft tissues, etc.

Informed Consent

- "We discussed the surgical procedure, including the anesthetic, the surgical approach, the implants to be used, the hospitalization, and the post-op rehabilitation. Models of the implants were available in the office to assist with patient education. The benefits of joint replacement surgery and the potential risks were discussed including, but are not limited to, infection, blood clots, pulmonary embolism, perioperative death, cardiovascular problems, medical issues, anesthetic related issues, failure of the implants, fractures, loosening, dislocation, limb length differences, damage to nerves, blood vessels, tendons, or other soft tissues, and numerous other potential complications both medical and surgical that could exist. No guarantees were given or implied. The patient was also given a copy of our Total Joint Handbook as an educational resource and will participate in our pre-operative education class and workup."
- Imponderables

Hip and Knee Complications

Table 1

Complications and Adverse Events Following Total Hip Arthroplasty as Developed by The Hip Society

Complication	Definition of Complication
Bleeding	Postoperative bleeding requiring surgical treatment
Wound complication	Failure of wound healing requiring reoperation or a change in THA protocol
Thromboembolic disease	Symptomatic thromboembolic event requiring more intensive, nonprophylactic anticoagulant or antithrombotic treatment during the first 3 months following index THA
Neural deficit	Postoperative neural deficit (sensory or motor) related to the index THA
Vascular injury	Intraoperative vascular injury requiring surgical repair, bypass grafting, or stenting (compartment syndrome or amputation should be reported)
Dislocation/instability	Dislocation of the femoral head out of the acetabulum or recurrent symptomatic subluxation of the hip joint (direction of instability and type of treatment should be recorded)
Periprosthetic fracture	Periprosthetic fracture of the proximal femur or the acetabulum (intraoperative fracture or postoperative fracture should be recorded, surgical or nonsurgical treatment should be recorded)
Abductor muscle disruption	Symptomatic abductor dysfunction that was not present before the surgery, associated with a positive Trendelenburg sign and use of an ambulatory assist (eg, cane, crutch, walker) for treatment of limp or weakness (nonsurgical management should be recorded)
Deep periprosthetic joint infection	A deep periprosthetic joint infection can be diagnosed when there is a sinus tract communicating with the prosthesis, or a pathogen is isolated by culture from at least two separate tissue or fluid samples obtained from the affected prosthetic joint, or four of the following six criteria exist: elevated ESR and serum CRP concentration; elevated synovial WBC count; elevated synovial PMN; presence of purulence in the affected joint; isolation of a microorganism in one culture of periprosthetic tissue or fluid; or >five neutrophils/high-power field in five high-power fields observed from histologic analysis of periprosthetic tissue at 400× magnification
Heterotopic ossification	Symptomatic heterotopic ossification at 1 year following surgery associated with stiffness, reduced range of motion, and radiographic grade of Brooker III or IV
Bearing surface wear	Wear of the bearing surface that is symptomatic or requires surgery
Osteolysis	Expansile lytic lesion adjacent to one of the implants that is ≥1 cm in any one dimension or increasing in size on serial radiographs/CT
Implant loosening	Implant loosening confirmed intraoperatively or identified radiographically as a change in implant position or a progressive radiolucent line at the bone-cement or bone-implant interface
Cup-liner dissociation	Dissociation of the cup liner from the acetabular cup
Implant fracture	Implant fracture (specific implant should be recorded)
Reoperation	Return to the operating room related to the index THA (reasons for reoperation should be recorded)
Revision	Revision of one or more of the THA implants (acetabular cup, acetabular liner, femoral head, femoral stem)
Readmission	Admission to the hospital for any reason during the first 90 days after THA (reasons for admission and relation to index THA should be recorded)
Death	Death occurring for any reason during the first 90 days following THA (cause of death and relation to index THA should be recorded)

CRP = C-reactive protein, ESR = erythrocyte sedimentation rate, PMN = polymorphonuclear neutrophil, THA = total hip arthroplasty, WBC = white blood cell

Table 2

Complications and Adverse Events Following Total Knee Arthroplasty as Developed by The Knee Society[5,6]

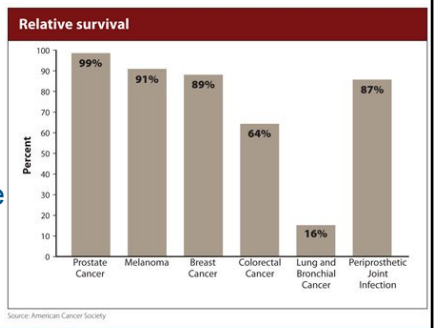
Complication	Definition of Complication
Bleeding	Postoperative bleeding requiring surgical treatment
Wound complication	Failure of wound healing requiring reoperation or a change in TKA protocol
Thromboembolic disease	Symptomatic thromboembolic event requiring more intensive, nonprophylactic anticoagulant or antithrombotic treatment during the first 3 months after index TKA
Neural deficit	Postoperative neural deficit (sensory or motor) related to the index TKA
Vascular injury	Intraoperative vascular injury requiring surgical repair, bypass grafting, or stenting (compartment syndrome or amputation should be reported)
Medial collateral ligament injury	Intraoperative or early postoperative medial collateral ligament injury requiring repair, reconstruction, a change in prosthetic constraint, revision surgery, or TKA protocol
Instability	Symptomatic instability reported by the patient and confirmed by laxity on physical examination as defined by The Knee Society Knee Score
Malalignment	Symptomatic malalignment reported by the patient and confirmed radiographically with angular deformity in the coronal plane >10° from the mechanical axis
Stiffness	Limited ROM as reported by the patient and demonstrated in a physical examination with extension limited to 15° short of full extension or flexion <90° (not applicable if preoperative arc of motion <75°)
Deep periprosthetic joint infection	A deep periprosthetic joint infection can be diagnosed when there is a sinus tract communicating with the prosthesis, or a pathogen is isolated by culture from at least two separate tissue or fluid samples obtained from the affected prosthetic joint, or four of the following six criteria exist: elevated ESR and serum CRP concentration; elevated synovial WBC count; elevated synovial PMN; presence of purulence in the affected joint; isolation of a microorganism in one culture of periprosthetic tissue or fluid; or >five neutrophils/high-power field in five high-power fields observed from histologic analysis of periprosthetic tissue at 400× magnification
Periprosthetic fracture	Periprosthetic fracture of the distal femur, proximal tibia, or patella (surgical or nonsurgical treatment should be recorded)
Extensor mechanism disruption	Disruption of the extensor mechanism (surgical repair and/or extensor lag should be recorded)
Patellofemoral dislocation	Dislocation of the patella from the femoral trochlea (direction of instability should be recorded)
Tibiofemoral dislocation	Dislocation of the tibiofemoral joint (direction of instability should be recorded)
Bearing surface wear	Wear of the bearing surface symptomatic or requiring reoperation
Osteolysis	Expansile lytic lesion adjacent to one of the implants >1 cm in any one dimension or increasing in size on serial radiographs/CT
Implant loosening	Implant loosening confirmed intraoperatively or identified radiographically as a change in implant position or a progressive, radiolucent line at the bone-cement or bone-implant interface
Implant fracture or tibial insert dissociation	Implant fracture or dissociation of the tibial insert from the tibial implant
Reoperation	Return to the operating room related to the index TKA (reasons for reoperation should be recorded)
Revision	Revision of one or more of the TKA implants (femur, tibia, tibial insert, patella)
Readmission	Admission to the hospital for any reason during the first 90 days after TKA (reasons for admission and relation to index TKA should be recorded)
Death	Death occurring for any reason during the first 90 days after TKA (cause of death and relation to index TKA should be recorded)

CRP = C-reactive protein, ESR = erythrocyte sedimentation rate, PMN = polymorphonuclear neutrophil, ROM = range of motion, TKA = total knee arthroplasty, WBC = white blood cell

JAAOS 23:11, 2015

Prosthetic Joint Infections

- 0.25 - 3% of primary TJA (OA); up to 8% RA
- Up to 6x greater risk for revision TJA
- Expected to reach 6.8% by 2030
- Is rapidly replacing aseptic loosening as most frequent cause of revision
- Mortality 2.7-18%
- Cost of revision - $60K per case
- Costs > $600 million in US annually
  - 1M TJA * 1% * $60K = $600M
- $1.62 Billion is current cost estimate

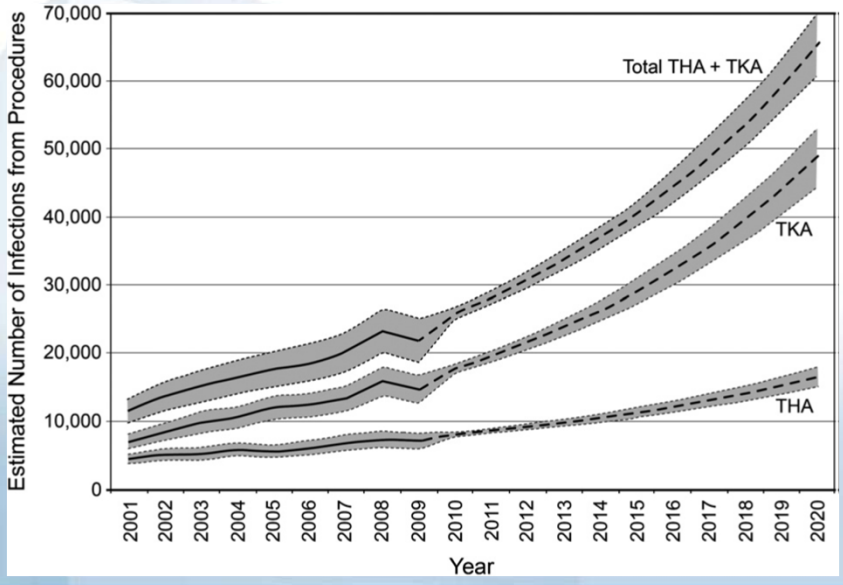


5 year mortality 25%
Cause-related mortality of 13% is higher that prostate cancer, melanoma and lung cancer
$60,000 per case is a conservative estimate of medical costs. Societal costs much higher.

Economic Burden of Periprosthetic Joint Infection in the United States

Steven M. Kurtz, PhD, Edmund Lau, MS, Heather Watson, PhD, Jordana K. Schmier, MA, Javad Parvizi, MD

The Journal of Arthroplasty Vol. 27 No. 8 Suppl. 1 September 2012



Number of infections now >50,000

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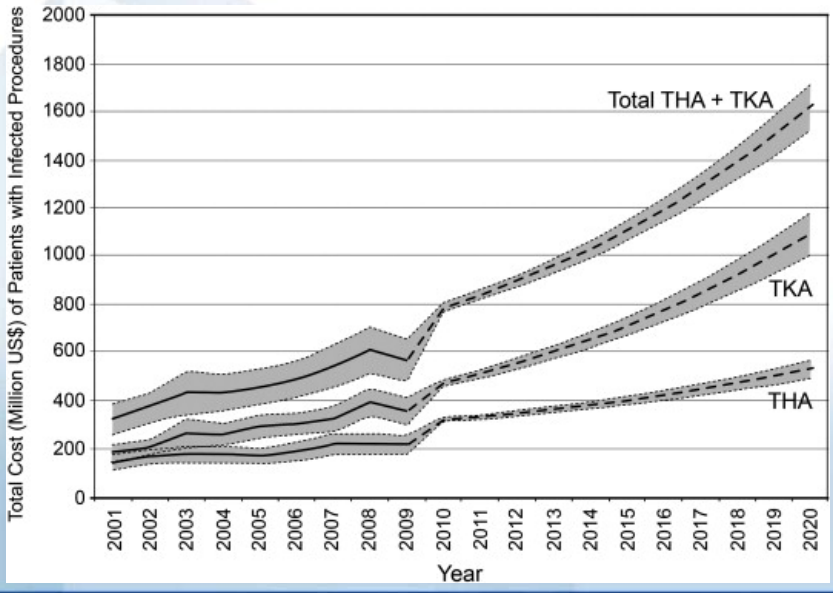
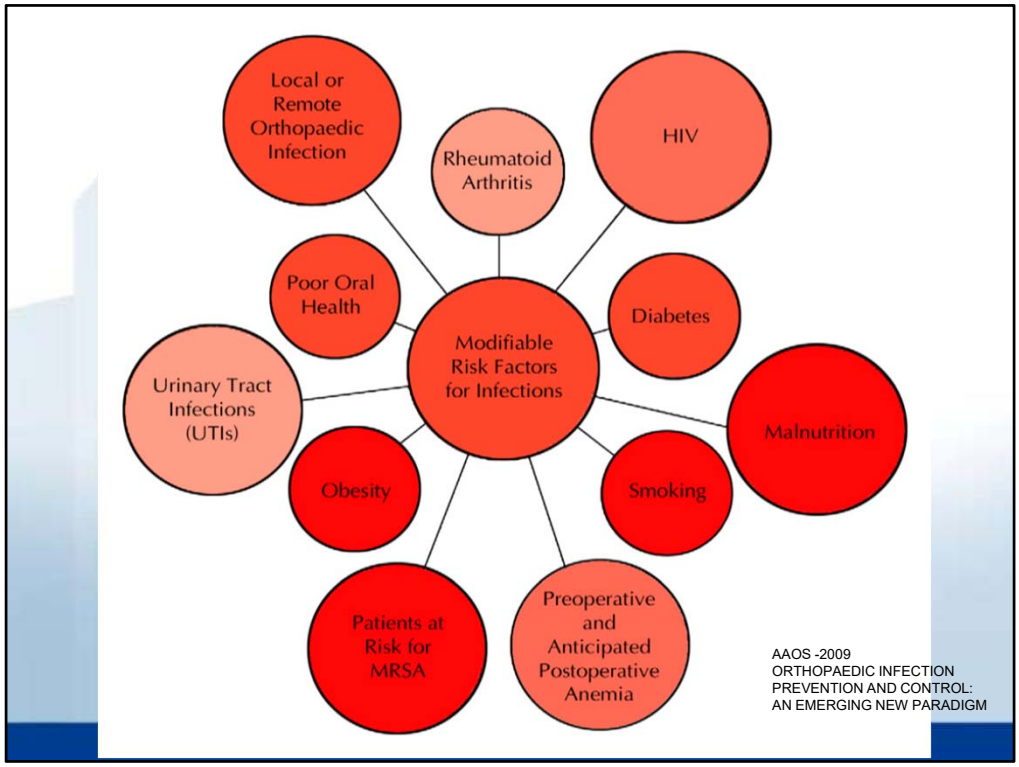


Cost of TJ infections > $1.2 Billion

Risk Factors

- Inflammatory Arthritis (2-8%)
- Diabetes (3.1-13.5%)
- Immunosuppressed
  - HIV
  - Transplant (10-15%)
  - Sickle cell disease
  - Medications
- Malnutrition (3-5x higher)
- ASA >3
- Hemophilia (9-13%)
- Malignant tumors
- Tobacco use
- Renal failure (HD)
- Dental infections / hygiene
- Skin infections
- Chronic UTI's
- Previous surgeries
- Vascular disease
  - Arterial
  - Cardiac
  - Venous stasis
- MRSA Colonization
- Obesity (6.7x higher THA, 42X for THA)
- Anticoagulation
- Atrial fibrillation
- Older patients
- Low income
- Male gender
- Hospital or surgeon with low volume
- Longer operations (>3 hours)


Local or Remote Orthopaedic Infection
Rheumatoid Arthritis
HIV
Poor Oral Health
Diabetes
Modifiable Risk Factors for Infections
Urinary Tract Infections (UTIs)
Malnutrition
Obesity
Smoking
Patients at Risk for MRSA
Preoperative and Anticipated Postoperative Anemia
AAOS -2009
ORTHOPAEDIC INFECTION
PREVENTION AND CONTROL:
AN EMERGING NEW PARADIGM

PJI Risk Assessment

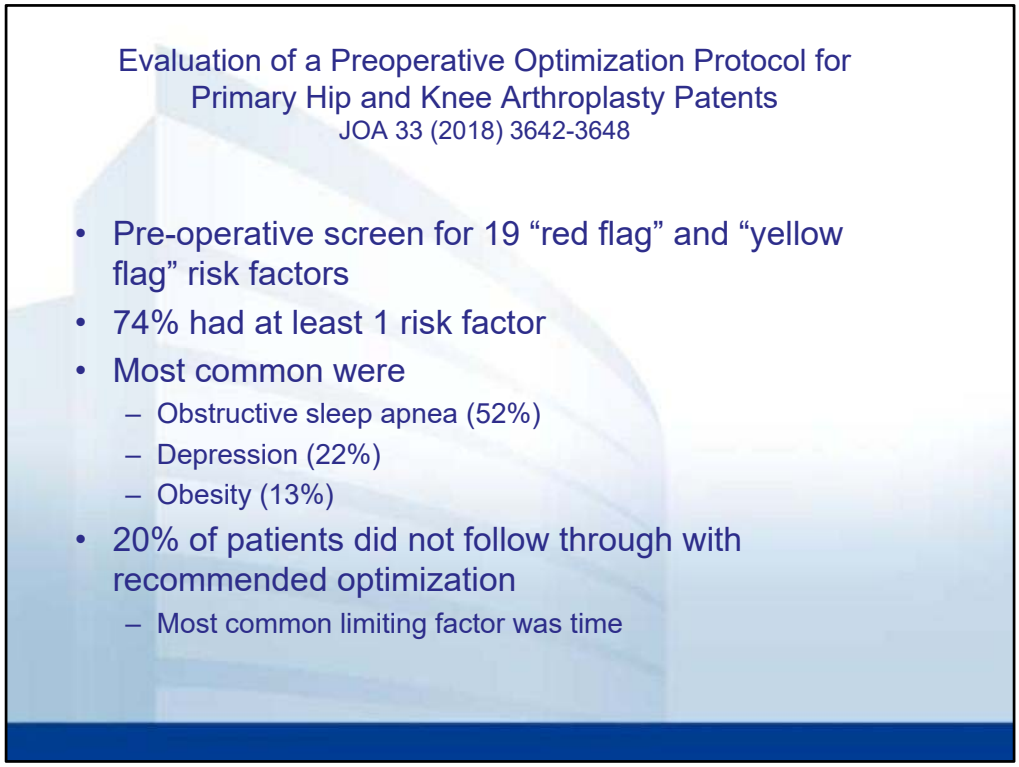
- Identify increased risk
- Preoperative counseling
  - Consideration of non-operative management
  - Shared decision-making
  - Manage expectations
- Address modifiable factors

Prevalence of Modifiable Surgical Site Infection Risk Factors in Hip and Knee Joint Arthroplasty Patients at an Urban Academic Hospital

JOA 29 (2014) 272-276

- 80% of primary TJA and 93% of revisions had a modifiable risk factor
- Most common were
  - Obesity (46%)
  - Anemia (29%)
  - Malnutrition (26%)
  - Diabetes (20%)
  - Smoking (10% overall, 21% with PJI)
- HIV and UTIs more common in patients undergoing surgery for PJI

Mount Sinai School of Medicine, New York



Kevin Bozic’s group - University of Texas at Austin

Diabetes

- Known risk in cardiac, vascular, general, colorectal, spinal, pancreatic, and breast surgery for decades.
- Perioperative hyperglycemia
  - Microvascular effects
  - Inhibition of complement function
  - Increases in cytokines
  - Inhibition of chemotaxis
  - Impaired phagocytosis
  - Impaired O2 delivery

Perioperative Issues – Glucose Control

- JBJS 2009 Marchant, et al
  - Retrospectively compared over 1M TJA patients with controlled DM, uncontrolled DM, and no DM from Nationwide Inpatient Sample database
  - Uncontrolled versus controlled resulted in increase in:
    - CVA – 3.42x
    - Ileus – 2.47x
    - Transfusion – 1.19x
    - Death – 3.23x
    - UTI – 1.97x
    - Hemorrhage – 1.99x
    - Wound infection – 2.28x
    - Length of stay – 1 day

Glucose Control

- Currently only being reported to CMS for cardiac surgery
- Probable future quality indicator for TJA
- Monitored at MUSC for JCAHO Center of Excellence for DM certification
- Monitor percentage of DM patients with BS > 200 and those without HgA1C level

Glucose Control on TJRU

15 patients having elective surgery had post op BS > 200
11/15 had pre-op medicine consult
3 arrived on unit with BS>200
5 had pre-op glucose over 140
1 had > 450 at pre-op w/u, another 310
46% had HgA1C, 2 were > 9
60% had no perioperative insulin coverage ordered

MUSC Protocol

Screening POC HgA1c in clinic when diabetic patients posted.

Letter generated to PCP if >8.0

If BS > 250 at workup, delay surgery

If fasting BS > 250 on AM of sx, cancel

Sliding scale insulin post-op

Hospitalists and DMS consults

Consider antibiotic cement

Total Joint Replacement Diabetes Data Summary
12/01/2016 through 11/30/2017

Procedure	# Diabetic Patients	% Diabetic Patients	% with BG > 200 Morning of Procedure	% On Sliding Scale Insulin Protocol	A1C At Most 30 Days Prior	A1C At Most 90 Days Prior	% with A1C at Most 90 Days Prior
All Programs	166	19.3%	2.6%	88.6%	140	159	95.8%
Total Knee	82	24.4%	3.2%	89.0%	73	80	97.6%
Rev Knee	22	40.0%	7.1%	90.9%	13	19	86.4%
Total Hip	30	11.9%	0.0%	96.7%	29	30	100.0%
Rev Hip	5	10.6%	0.0%	80.0%	4	5	100.0%
Shoulder	24	18.3%	0.0%	79.2%	19	23	95.8%
Other Shoulder	3	7.5%	0.0%	66.7%	2	2	66.7%

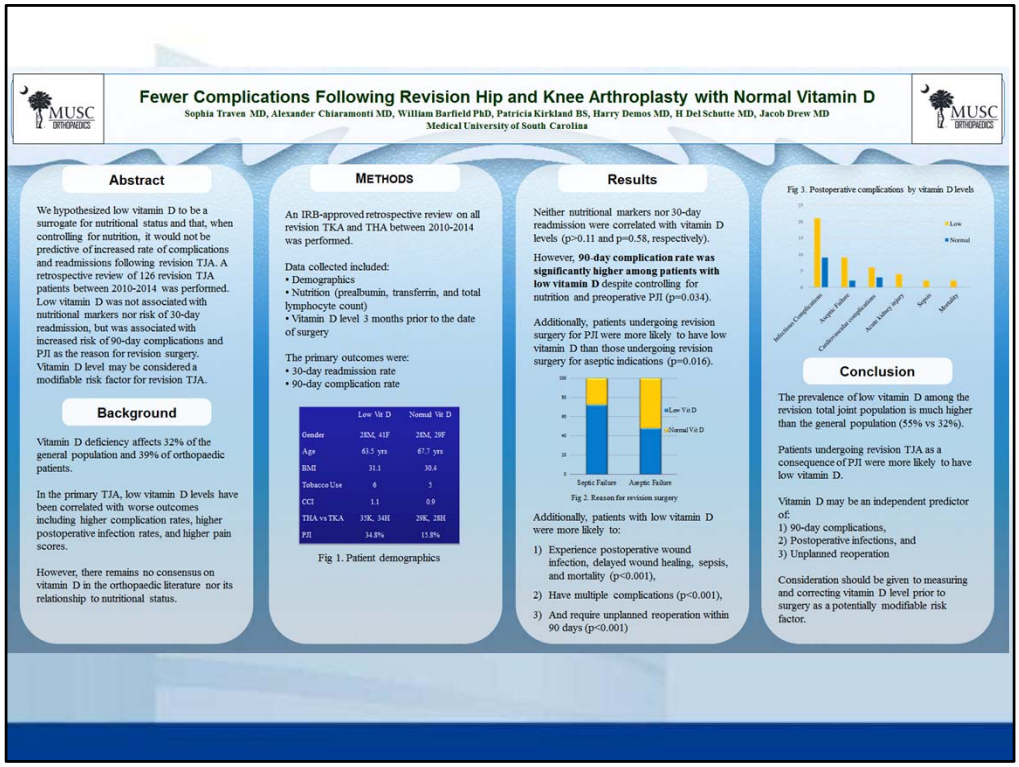
Procedure	A1C At Most 90 Days Prior	Median A1C	Average A1C	# with A1C >8.0	% with A1C >8.0	AIC <=8: % With BG >200 POD 1-3	AIC >8: % With BG >200 POD 1-3
All Programs	159	6.60	6.65	9	5.7%	42.7%	77.8%
Total Knee	80	6.40	6.56	4	5.0%	44.9%	75.0%
Rev Knee	19	6.80	6.62	1	5.3%	33.3%	100.0%
Total Hip	30	6.70	6.62	.	.	53.3%	.
Rev Hip	5	7.00	6.75	.	.	60.0%	.
Shoulder	23	6.90	7.04	4	17.4%	30.0%	75.0%
Other Shoulder	2	6.25	6.25	.	.	0.0%	.

Urinary retention / UTI's

- David and Vrahas - J Am Acad Orthop Surg 2000;8:66-74
- Strong association between post-op UTI and PJI
- Unknown association between pre-op UTI and PJI
- Dysuria, urgency, frequency are frequently absent in elderly
- 10,000 wbc/ml and 1000 bacteria cutoff, if symptomatic
- Can treat asymptomatic (>100K bacteria) patients post-op
- Routine perioperative prophylaxis may be enough
- Obstructive symptoms or irritation should post-pone surgery until treated
- Bladder catheters should be removed within 24 hours post-op
- Urinary retention → 6% risk of PJI

Malnutrition

- Transferrin <200 mg/dl
- Albumin <3.5 g/dl
- Prealbumin
- Total lymphocyte count <1500 cells/mm^3
- 5 – 7x higher risk of major wound complications
- Longer hospital stays / higher costs
- Consider screening high risk and revisions and use nutritional supplements +/- nutritionist.
- Protein, Vitamin A,C,&D, zinc, copper



Presented at AAOS last year
Vitamin D levels did not correlate with nutritional markers.
55% of patients undergoing revision TJA have low vitamin D.
90 day complication rate and reoperation rate higher with low vitamin D.
Low vitamin D more likely in patients undergoing revision for infection.
Low vitamin D associated with wound infection, sepsis, delayed wound healing, and mortality

The Journal of Arthroplasty 32 (2017) S193–S196

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journal homepage: www.arthroplastyjournal.org

Revision Arthroplasty

Fewer Complications Following Revision Hip and Knee Arthroplasty in Patients With Normal Vitamin D Levels

Sophia A. Traven, MD [a,*], Alexander M. Chiaramonti, MD [a], William R. Barfield, PhD [a], Patricia A. Kirkland, BS [a], Harry A. Demos, MD [a], Harold D. Schutte, MD [b], Jacob M. Drew, MD [a]

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ABSTRACT

Background: Surgeons and hospitals increasingly face penalty for complications and readmission following total joint arthroplasty; therefore, optimization of modifiable risk factors is paramount. Literature associates low vitamin D with risk of periprosthetic joint infection, and we hypothesized low vitamin D to be predictive of increased rate of complications and readmissions.
Methods: A retrospective review of 126 revision total joint arthroplasty patients between 2010 and 2014 was performed.
Results: Low vitamin D was not associated with risk of 30-day readmission but was found to be associated with an increased risk of 90-day complications as well as periprosthetic joint infection as the reason for revision surgery.
Conclusion: Preoperative vitamin D level should be considered a modifiable risk factor for complications following revision arthroplasty.

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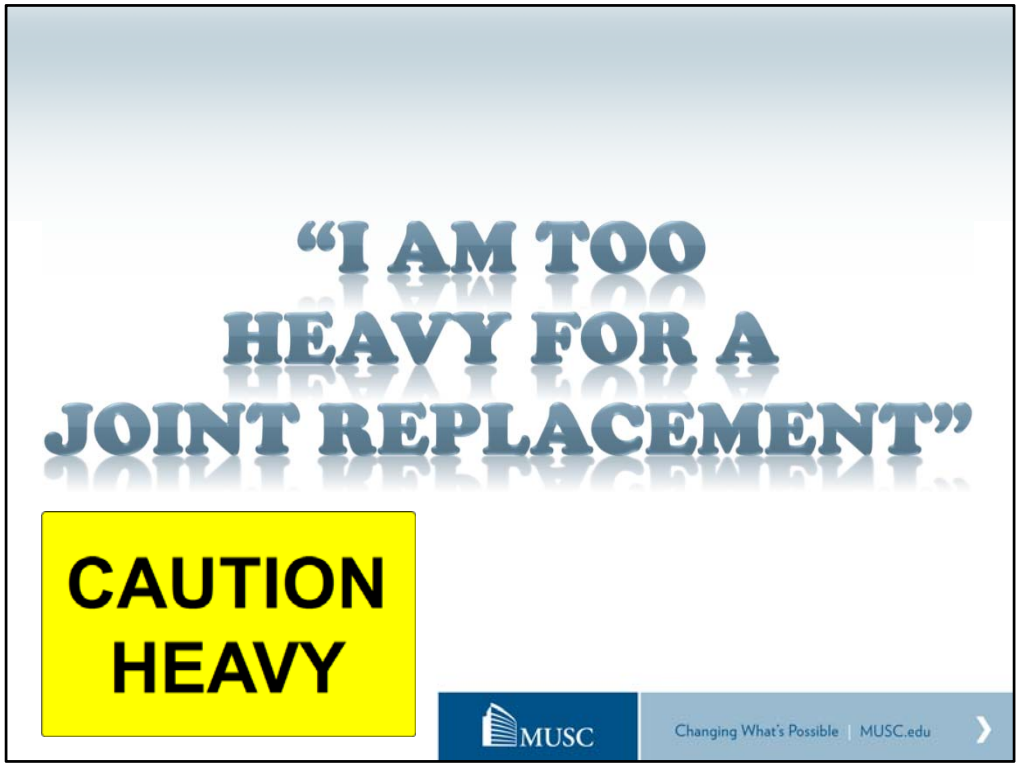

"I AM TOO HEAVY FOR A JOINT REPLACEMENT"
CAUTION HEAVY
MUSC
Changing What's Possible | MUSC.edu

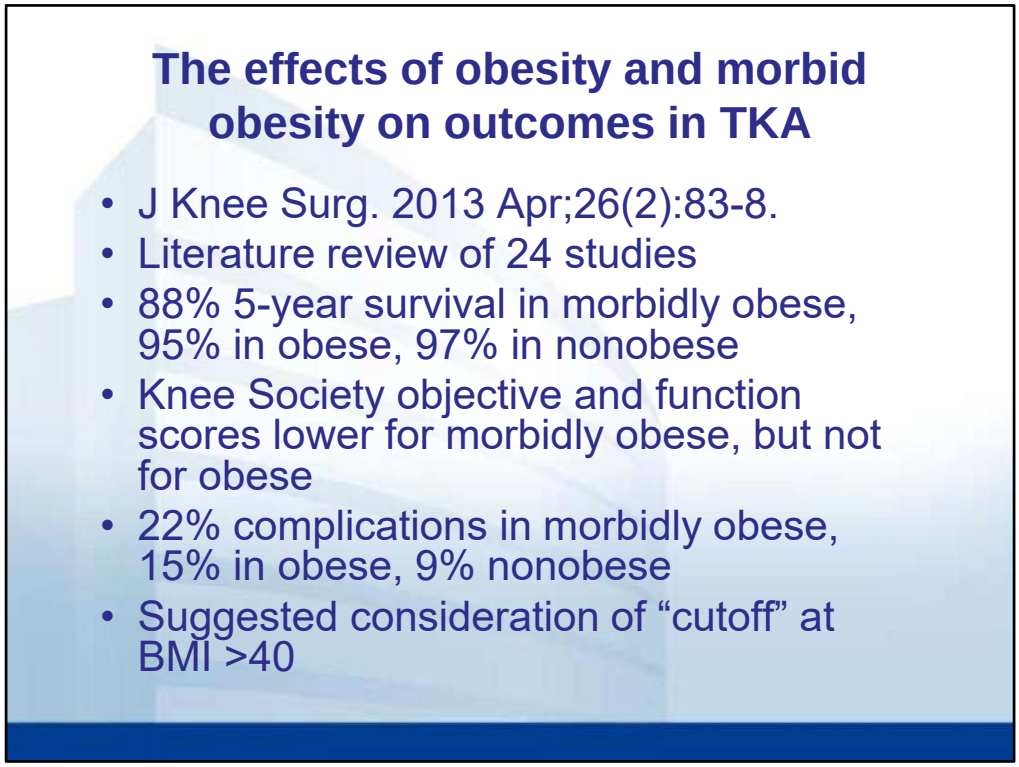
Obesity

- 502M obese worldwide
- ½ TJA patients are obese
- 6.7x higher PJI for TKA, 4.2x for THA
- Consider pre-op weight-loss surgery
- Evaluate for malnutrition
- Evaluate for diabetes
- Optimize antibiotic doses
- Avoid weight loss in immediate pre-op period

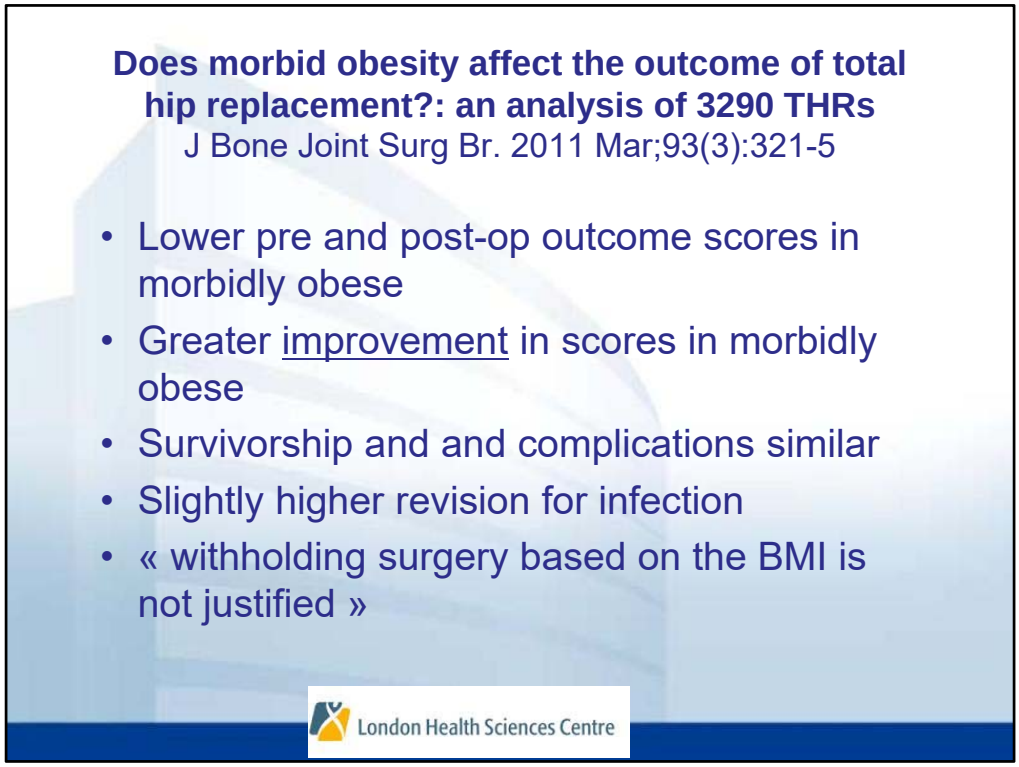
The Influence of Obesity on the Complication Rate and Outcome of Total Knee Arthroplasty

A Meta-Analysis and Systematic Literature Review
JBJS 2012;94:1839-44

- 20 study meta-analysis
- Infection more common in obese patients: OR=1.90
- Deep infection requiring revision: OR=2.38
- Revision for any reason: OR=1.30



Review showing lower 5 year survival of 88%, 22% Complication rate, and lower KS Scores in Morbidly Obese.



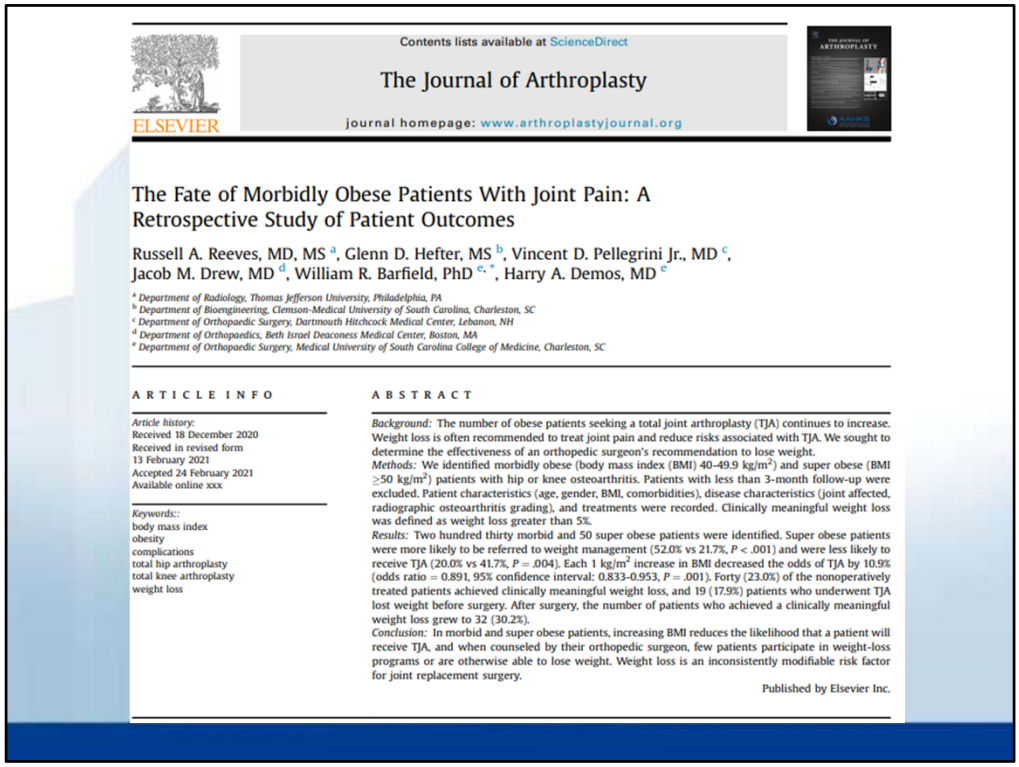
McCalden RW1, Charron KD, MacDonald SJ, Bourne RB, Naudie DD.

Obesity and total joint arthroplasty: a literature based review

JOA 2013 May;28(5):714-21

- Workgroup of the American Association of Hip and Knee Surgeons Evidence Based Committee
- Patients with BMI >35 require TJR 7 years earlier
- Clear association between knee OA and obesity
- Strong association with other comorbidities
- Degree of improvement controversial
- Increased risk of perioperative complications
- Morbid and super obese patients may have complications that outweigh benefits with TJA
- Recommended consideration of delaying TJA
- Acknowledged that surgery may be unavoidable in this population

AAHKS
American Association of Hip and Knee Surgeons



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journal homepage: www.arthroplastyjournal.org

The Fate of Morbidly Obese Patients With Joint Pain: A Retrospective Study of Patient Outcomes

Russell A. Reeves, MD, MS [a], Glenn D. Hefter, MS [b], Vincent D. Pellegrini Jr., MD [c], Jacob M. Drew, MD [d], William R. Barfield, PhD [e, *], Harry A. Demos, MD [e]

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weight loss

ABSTRACT

Background: The number of obese patients seeking a total joint arthroplasty (TJA) continues to increase. Weight loss is often recommended to treat joint pain and reduce risks associated with TJA. We sought to determine the effectiveness of an orthopedic surgeon's recommendation to lose weight.
Methods: We identified morbidly obese (body mass index (BMI) 40-49.9 kg/m^2) and super obese (BMI ≥50 kg/m^2) patients with hip or knee osteoarthritis. Patients with less than 3-month follow-up were excluded. Patient characteristics (age, gender, BMI, comorbidities), disease characteristics (joint affected, radiographic osteoarthritis grading), and treatments were recorded. Clinically meaningful weight loss was defined as weight loss greater than 5%.
Results: Two hundred thirty morbid and 50 super obese patients were identified. Super obese patients were more likely to be referred to weight management (52.0% vs 21.7%, $P < .001$) and were less likely to receive TJA (20.0% vs 41.7%, $P = .004$). Each 1 kg/m^2 increase in BMI decreased the odds of TJA by 10.9% (odds ratio = 0.891, 95% confidence interval: 0.833-0.953, $P = .001$). Forty (23.0%) of the nonoperatively treated patients achieved clinically meaningful weight loss, and 19 (17.9%) patients who underwent TJA lost weight before surgery. After surgery, the number of patients who achieved a clinically meaningful weight loss grew to 32 (30.2%).
Conclusion: In morbid and super obese patients, increasing BMI reduces the likelihood that a patient will receive TJA, and when counseled by their orthopedic surgeon, few patients participate in weight-loss programs or are otherwise able to lose weight. Weight loss is an inconsistently modifiable risk factor for joint replacement surgery.

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Fate of Obese Patients at MUSC

- Is morbid obesity a “modifiable risk factor?”
- 40 (23.0%) of the nonoperatively treated patients achieved clinically meaningful weight loss
- 19 (17.9%) patients who underwent TJA
- lost weight before surgery
- After surgery, the number of patients who achieved a clinically meaningful weight loss grew to 32 (30.2%)
- Less than 30% enrollment in weight-loss or bariatric surgery programs.
- Each 1 kg/m2 increase in BMI decreased the odds of TJA by 10.9%

Tobacco Use

- Most frequently occurring modifiable risk factor
- 3X more wound healing complications
- 3-4X higher non-union in spinal fusion and fractures
- Decreases oxygen delivery to wound (CO)
- Vasoconstriction (nicotine)
- Impaired angiogenesis
- 4-6 weeks interruption

Preoperative Smoking Cessation as a Durable Form of Long-Term Smoking Cessation

Jacob C. Balmer, BS[1]; Ashley B. Anderson, MD[2]; William R. Barfield, PhD[1]; Vincent D. Pellegrini, MD[1]; and Harry A. Demos, MD[1]

Smokers who undergo total joint arthroplasty (TJA) face increased rates of medical and surgical complications that can be reduced by preoperative smoking cessation. We investigated the long-term durability of preoperative smoking cessation among TJA patients. Twenty-seven TJA patients who were identified as having an active history of smoking at the preoperative appointment before TJA consented to telephone survey about their perioperative and current smoking status. Average time from operation to survey was 3.7 years. Of the 27 patients, 21 (77.8%) were identified as having quit smoking prior to surgery. Of these 21 patients, 10 (47.6%) self-reported continued abstinence from smoking at the time of survey. Our cessation rate was significantly lower than reported long-term smoking cessation rates with standard therapies ($p < 0.001$). Our results suggest that preoperative counseling and a requirement for smoking-cessation prior to elective TJA may have long-term durability that exceeds that of popular reported methods. (Journal of Surgical Orthopaedic Advances 29(2):103–105, 2020)

Keywords: smoking cessation, total joint arthroplasty, quality improvement, hip, knee

Tobacco Cessation at MUSC

- Pre-operative counselling
- Nicotine and cotinine levels at workup
- Phone survey at average of 3.7 years (12 months minimum)
- 77.8% quit smoking prior to surgery
- 47.6% continued abstinence since surgery
- Higher cessation rates than other methods in the literature

Rheumatoid Arthritis

- RA 2-3X risk of PJI over OA
- Combination of autoimmune immunosuppression and medications
- NSAIDs, prednisone, MTX, and biologic agents are all associated with wound healing complications and PJI
- Discontinue non-selective NSAIDs – bleeding risk
- Sulfasalazine can be continued, but may increase INR in patients on warfarin
- Hydroxychloroquine (Plaquenil) is safe to continue peri-op and may decrease VTE (Johnson, CORR 1979)

A Systematic Review and Meta-Analysis Comparing Complications Following Total Joint Arthroplasty for Rheumatoid Arthritis Versus for Osteoarthritis

Arth &Rheu 2012;64:3839-49

- 40 studies
- Increased risk of dislocation in RA after THA – OR=2.16
- Increased risk of infection in TKA
- No difference in 90 day mortality or VTE

Corticosteroids

- Immunosuppression
- Decreased inflammatory response
- Poor wound healing
- Increased protein catabolism
- Bone loss
- Withdrawal → disease flares and adrenal insufficiency
- Continue normal dose peri-op
- Consider stress-dose hydrocortisone (50-100mg with 1-2 day taper)

Adrenal insufficiency

- Friedman, et al. (JBJS 1995;77:1801-1806)
- Prospective study of 28 patients with 35 operations
- 1-20mg prednisone for 6 months to 32 years
- No stress-dose steroids
- No evidence of AI
- 18 of 19 tested demonstrated normal stress response

Methotrexate

- Folate analogue with anti-inflammatory properties
- Inhibition of neovascularization
- Decrease in cytokines (IL-1, IL-8, TNF)
- Conflicting data regarding cessation
  - Grennan, et al. (*Ann Rheum Dis* 2001;60:214-217)
    - 388 patients in 3 groups
    - Lowest infection rate in those who continued MTX
    - Also, fewer flares post-op
  - Potential toxicity if patient develops renal injury or prolonged NPO → give folate

Biologic Agents

- TNF-α Antagonists
  - Etanercept (Enbrel), adalimumab (Humira), and infliximab (Remicade)
  - Usual dosing is 2x/week, 1-2 weeks, 4-8 weeks
  - Serious opportunistic infections are known risk, but PJI risk unclear
- IL-1 Antagonist
  - Anakinra (Kineret)
- Limited data regarding cessation
  - 4x risk of PJI

2017 American College of Rheumatology/American Association of Hip and Knee Surgeons Guideline for the Perioperative Management of Antirheumatic Medication in Patients With Rheumatic Diseases Undergoing Elective Total Hip or Total Knee Arthroplasty

Susan M. Goodman,[1] Bryan Springer,[2] Gordon Guyatt,[3] Matthew P. Abdel,[4] Vinod Dasa,[5] Michael George,[6] Ora Gewurz-Singer,[7] Jon T. Giles,[8] Beverly Johnson,[9] Steve Lee,[10] Lisa A. Mandl,[1] Michael A. Mont,[11] Peter Sculco,[1] Scott Sporer,[12] Louis Stryker,[13] Marat Turgunbaev,[14] Barry Brause,[1] Antonia F. Chen,[15] Jeremy Gililland,[16] Mark Goodman,[17] Arlene Hurley-Rosenblatt,[18] Kyriakos Kirou,[1] Elena Losina,[19] Ronald MacKenzie,[1] Kaleb Michaud,[20] Ted Mikuls,[21] Linda Russell,[1] Alexander Sah,[22] Amy S. Miller,[14] Jasvinder A. Singh,[23] and Adolph Yates[17]

2017 ACR / AAHKS Guidelines

DMARDs: CONTINUE these medications through surgery.	Dosing Interval	Continue/Withhold
Methotrexate	Weekly	Continue
Sulfasalazine	Once or twice daily	Continue
Hydroxychloroquine	Once or twice daily	Continue
Leflunomide (Arava)	Daily	Continue
Doxycycline	Daily	Continue

Continue the current daily dose of glucocorticoids in adult patients with RA, SpA including AS and PsA, or SLE who are receiving glucocorticoids for their rheumatic condition and undergoing THA or TKA, rather than administering perioperative supra-physiologic glucocorticoid doses (so-called “stress dosing”).

2017 ACR / AAHKS Guidelines

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.	**Dosing Interval**	**Schedule Surgery (relative to last biologic agent dose administered) during**
Adalimumab (Humira)	Weekly or every 2 weeks	Week 2 or 3
Etanercept (Enbrel)	Weekly or twice weekly	Week 2
Golimumab (Simponi)	Every 4 weeks (SQ) or every 8 weeks (IV)	Week 5 Week 9
Infliximab (Remicade)	Every 4, 6, or 8 weeks	Week 5, 7, or 9
Abatacept (Orencia)	Monthly (IV) or weekly (SQ)	Week 5 Week 2
Certolizumab (Cimzia)	Every 2 or 4 weeks	Week 3 or 5
Rituximab (Rituxan)	2 doses 2 weeks apart every 4-6 months	Month 7
Tocilizumab (Actemra)	Every week (SQ) or every 4 weeks (IV)	Week 2 Week 5
Anakinra (Kineret)	Daily	Day 2
Secukinumab (Cosentyx)	Every 4 weeks	Week 5
Ustekinumab (Stelara)	Every 12 weeks	Week 13
Belimumab (Benlysta)	Every 4 weeks	Week 5
Tofacitinib (Xeljanz): STOP this medication 7 days prior to surgery.	Daily or twice daily	7 days after last dose

2017 ACR / AAHKS Guidelines

SEVERE SLE-SPECIFIC MEDICATIONS: CONTINUE these medications in the perioperative period.	**Dosing Interval**	**Continue/Withhold**
Mycophenolate mofetil	Twice daily	Continue
Azathioprine	Daily or twice daily	Continue
Cyclosporine	Twice daily	Continue
Tacrolimus	Twice daily (IV and PO)	Continue
NOT-SEVERE SLE: DISCONTINUE these medications 1 week prior to surgery	**Dosing Interval**	**Continue/Withhold**
Mycophenolate mofetil	Twice daily	Withhold
Azathioprine	Daily or twice daily	Withhold
Cyclosporine	Twice daily	Withhold
Tacrolimus	Twice daily (IV and PO)	Withhold

Cardiac issues

- Myocardial infarction
- Atrial fibrillation
- Issues mostly related to anticoagulation, hematomas, wound healing problems, and transfusions
- Avoid therapeutic anticoagulation or aggressive bridging therapy

High complication rate after total knee and hip replacement due to perioperative bridging of anticoagulant therapy based on the 2012 ACCP guideline

Arch Orthop Trauma Surg 2014

- Mitral valve, mechanical aortic valve, recent stroke or TIA, A. Fib with CHADS2 5-6, recent VTE or recurrent VTE
- Therapeutic LMWH pre-op and post-op on POD1
- 92% incidence (12/13) of bleeding complications in patients receiving LMWH bridging
- 69% developed an hematoma
- 15% prosthetic joint infection
- Guidelines now modified to reflect bleeding risk

Transplant Patients

- At high risk for AVN from corticosteroids and osteoporosis
- Chronic immunosuppression
- Avoid sirolimus (Rapamycin) due to inhibition of fibroblasts
- JOA Vol. 27 No. 6 2012 – Cardiac Transplants
  - No infections in 9 patients with 18 TJRs
- JOA 29 (2014) 11–15 – Lung Transplants
  - 1 late infection in 14 patients with 20 primary TJA

Complications of hip and knee joint replacement in solid-organ transplant patients.

J Surg Orthop Adv. 2013 Fall;22(3):204-12.

Angermeier EW, Demos HA, Schutte HD, Barfield WR, Leddy LR.

- 68 patients with 94 TJA from 1995-2008
- 6.5% deep infection in transplant patients vs. 1.9% overall
- All were in diabetic patients
- Superficial infections in 5.1%
- Overall revision rate 13%
- DVT 3.4% / PE 1.7%

Chronic Kidney Disease

- No difference in infection risk between stages 1&2 and Stage 3 CKD – 3.5%
- Stage 4&5
  - 74% hemorrhage
  - 13-33% infections
  - 35% loosening
  - Up to 29% surgery-related mortality

Inpatient Mortality and Morbidity for Dialysis-Dependent Patients Undergoing Primary Total Hip or Knee Arthroplasty

JBJS 2015;97:1326-32

- National Inpatient Sample
- 2934 dialysis-dependent patients (2000-2009) compared with 6.19M non-dialysis patients
- THA – Independent risk factor for mortality and complications:
  - 1.88% mortality vs. 0.13%
  - 9.98 % complications vs. 4.97%
- TKA - Independent risk factor for mortality and complications:
  - 0.92% mortality vs. 0.10%
  - 12.48% complications vs. 5.00%
- Longer LOS, higher transfusion rates, hematomas, cardiac, urinary, and pulmonary complications
- “Arthroplasty should be approached with caution and preferably should be delayed until after renal transplantation.”

HIV

- 1.5 million people in US
- Increasing numbers of TJA – frequently due to AVN
- CD4 < 200 / µL or viral load >10K / mL at higher risk of wound healing issues / infection
- JOA 29 (2014) 277–282
  - 9.1% PJI in HIV vs. 2.2% in non-HIV
  - No association with low CD4
- JOA 28 (2013) 1254–1258
  - 4.4% PJI in HIV vs. 0.72% in controls
  - 6.22x odds ratio (not significant)
  - No correlation with CD4

HIV Infection and Hip and Knee Arthroplasty

JBJS REVIEWS 2017;5(9)

- Systematic review of 6,516,186 joints in 21 studies
- 7.6% complications (RR=2.28)
- Could not analyze infection rate
- No change in survivorship
- “Safe procedures with acceptable outcomes”

Hemophilia

- High association with HIV
  - No change in outcome
- 13-15% infection at 5 years
- Frequent *Staph epi* - ? IV factor infusions
- No association with hematoma formation in some studies

MRSA Colonization

- 27% of PJI in 1999 → 62% in 2006
- 30% S. Aureus carriers in nares
  - 2-9x more likely to develop S. aureus SSI
  - Isolates match 80-85% of time
- Screen at pre-op visit
- Decolonize
  - Mupirocin to nares
  - Chlorhexidine shower
- Adjust antibiotics
  - Add Vancomycin 15mg/kg started in holding and completed prior to beginning of procedure
  - Continue Cefazolin 2 or 3 grams at time of “time-out” – After positioning, immediately before handwashing
- Contact isolation

Sickle-cell disease

- Screen for skin ulcerations and osteomyelitis
- Multidisciplinary approach
- Avoid crisis
  - Avoid acidosis
  - Fluid resuscitation
  - Oxygenation
  - Transfusions
- Pain management
- 3%-25% infection in THA
- Culture and continue antibiotics until negative

Pre-operative Narcotic Use

- 98% of world narcotic Rx are in North America
- 2.1 million people in US with prescription narcotic substance abuse
- "Opioid use prior to total hip arthroplasty leads to worse clinical outcomes" - Int Orthop. 2014 Jun; 38(6): 1159–1165.
  - Narcotic group had:
    - Higher daily opioid doses
    - Longer LOS
    - Higher proportion on opioids at 6 weeks and final f/u
    - Lower final Harris Hip Scores
- "Chronic opioid use prior to total knee arthroplasty" - J Bone Joint Surg Am. 2011 Nov 2;93(21)
  - Narcotic Group had:
    - Knee Society Score 79 vs. 92
    - 5 Arthroscopic evaluations and 8 revisions for stiffness versus none
    - 10 patients referred for pain management versus one.

Preoperative Opioid Misuse is Associated With Increased Morbidity and Mortality After Elective Orthopaedic Surgery

CORR (2015) 473:2402-2412

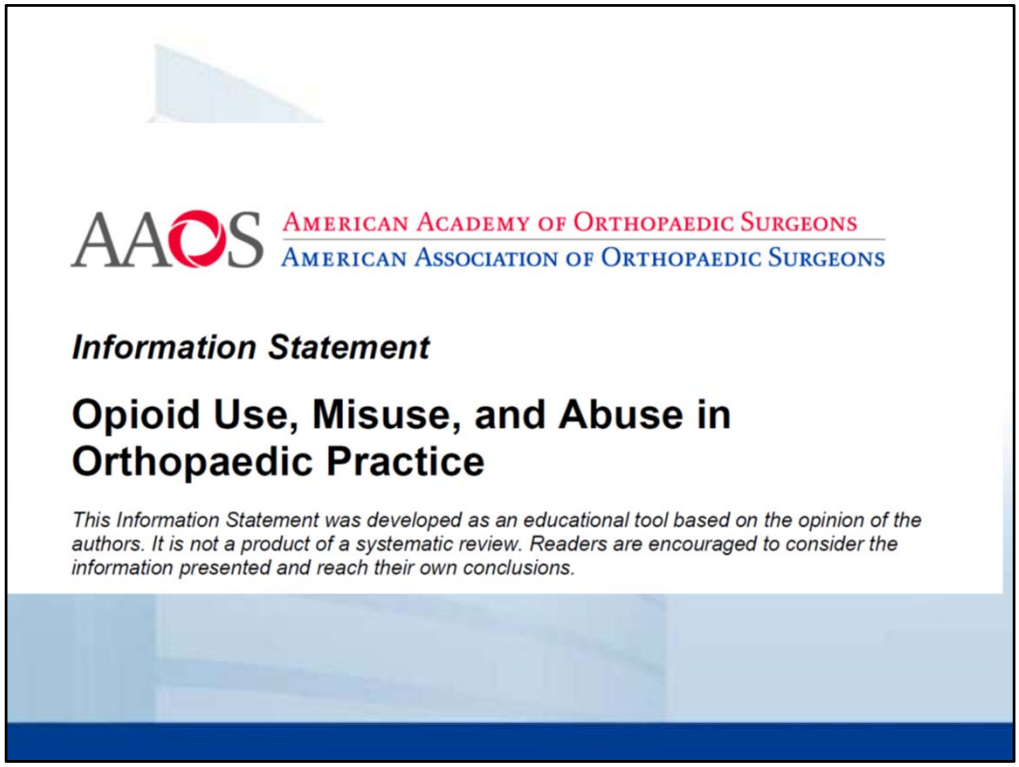
- Nationwide Inpatient Sample
- Increased inpatient mortality OR, 3.7
- Aggregate morbidity OR, 2.3
- Mental disorder OR, 5.9
- Respiratory failure OR, 3.1
- Surgical site infection OR, 2.5
- Mechanical ventilation OR, 2.3
- Pneumonia OR 2.1
- Myocardial infarction OR 1.9
- Postoperative ileus or other gastrointestinal events OR, 1.4
- Increased risk for prolonged hospital length of stay OR, 2.5
- Nonroutine discharge OR, 2.2
- High-risk opioid users were more likely to be younger males

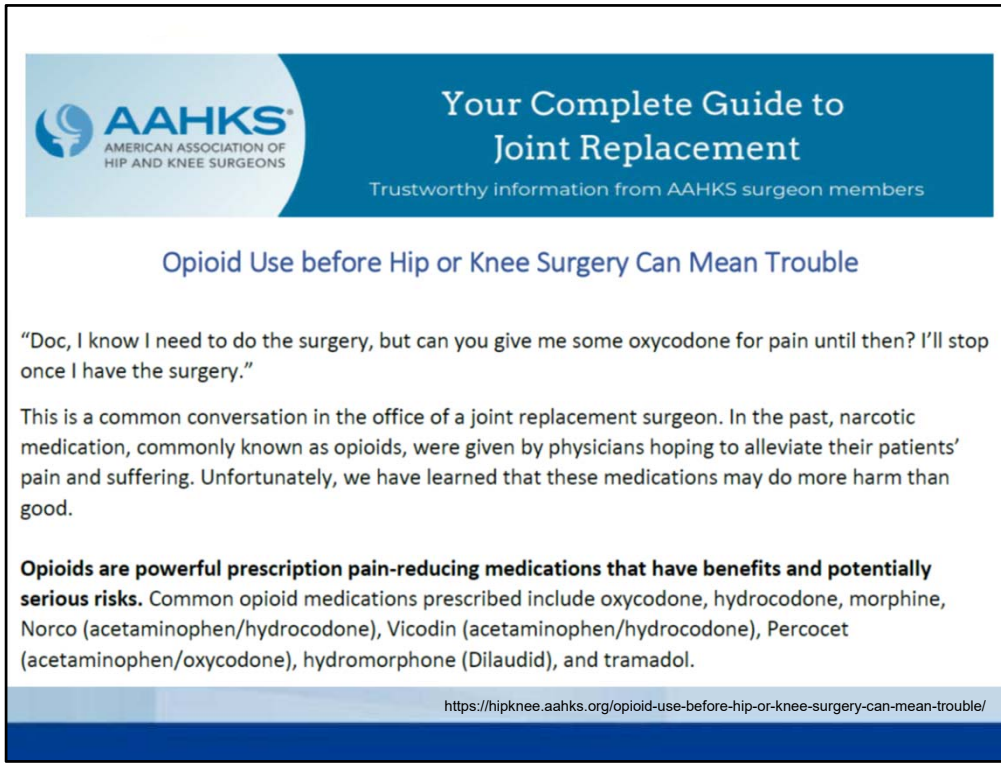
Preoperative Reduction of Opioid Use Before Total Joint Arthroplasty

Nguyen LC, Sing DC, Bozic KJ

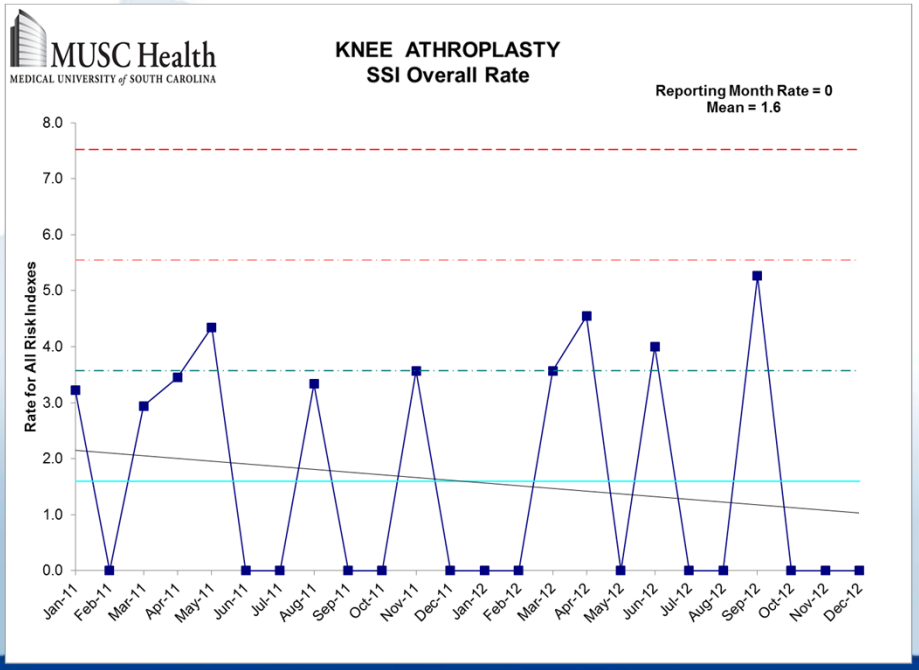
J Arthroplasty. 2016 Sep;31(9 Suppl):282-7

- 41 Patients decreased narcotics >50% compared to no decrease
- Weaned patients had outcomes comparable to non-opioid patients: improved versus non-weaned
  - WOMAC 43.7 vs. 17.8
  - SF12 PCS 10.5 vs. 1.85
  - UCLA Activity Score 1.49 vs. 0

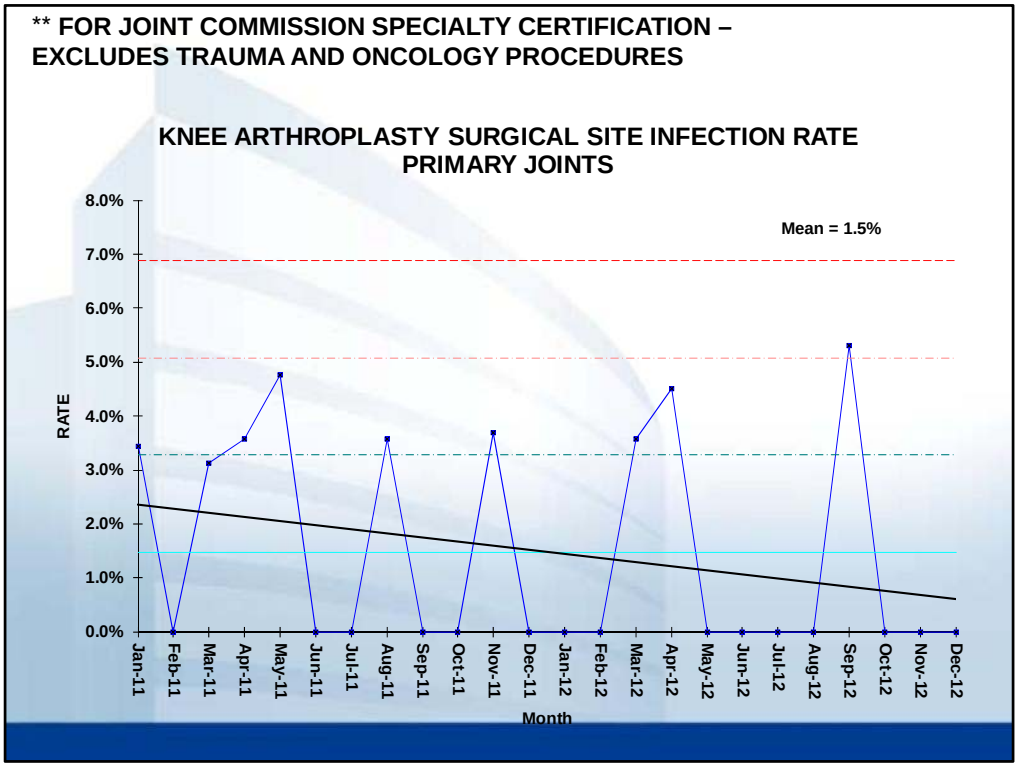

AAOS
American Academy of Orthopaedic Surgeons
American Association of Orthopaedic Surgeons
Information Statement
Opioid Use, Misuse, and Abuse in Orthopaedic Practice
This Information Statement was developed as an educational tool based on the opinion of the authors. It is not a product of a systematic review. Readers are encouraged to consider the information presented and reach their own conclusions.


AAHKS
AMERICAN ASSOCIATION OF HIP AND KNEE SURGEONS
Your Complete Guide to Joint Replacement
Trustworthy information from AAHKS surgeon members
Opioid Use before Hip or Knee Surgery Can Mean Trouble
"Doc, I know I need to do the surgery, but can you give me some oxycodone for pain until then? I'll stop once I have the surgery."
This is a common conversation in the office of a joint replacement surgeon. In the past, narcotic medication, commonly known as opioids, were given by physicians hoping to alleviate their patients' pain and suffering. Unfortunately, we have learned that these medications may do more harm than good.
Opioids are powerful prescription pain-reducing medications that have benefits and potentially serious risks. Common opioid medications prescribed include oxycodone, hydrocodone, morphine, Norco (acetaminophen/hydrocodone), Vicodin (acetaminophen/hydrocodone), Percocet (acetaminophen/oxycodone), hydromorphone (Dilaudid), and tramadol.
https://hipknee.aahks.org/opioid-use-before-hip-or-knee-surgery-can-mean-trouble/

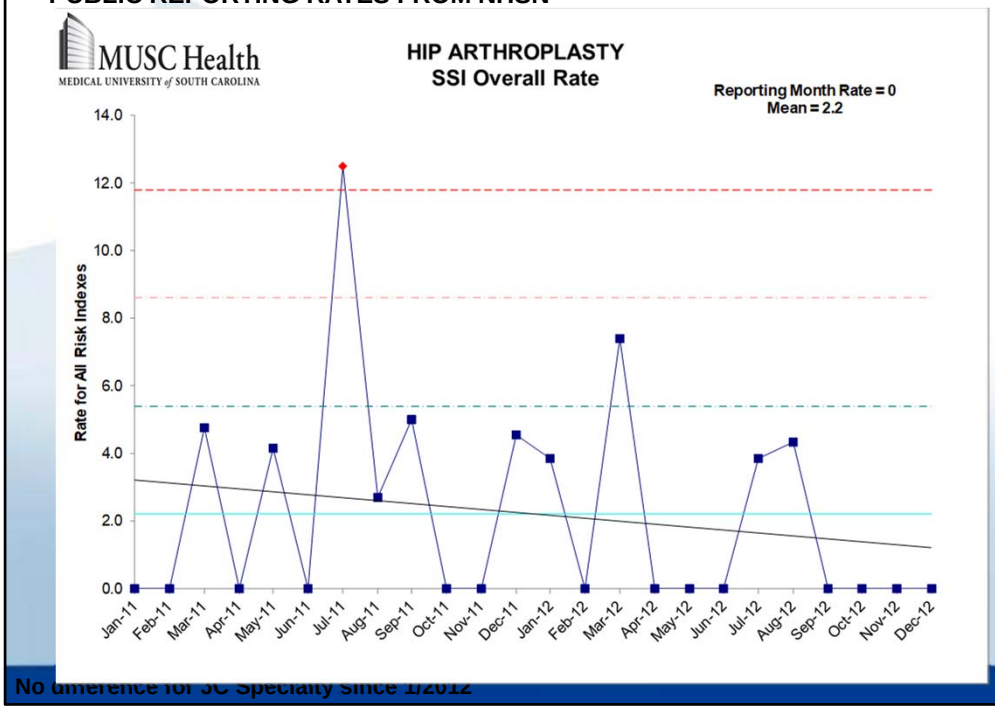
PUBLIC REPORTING RATES FROM NHSN



** FOR JOINT COMMISSION SPECIALTY CERTIFICATION – EXCLUDES TRAUMA AND ONCOLOGY PROCEDURES

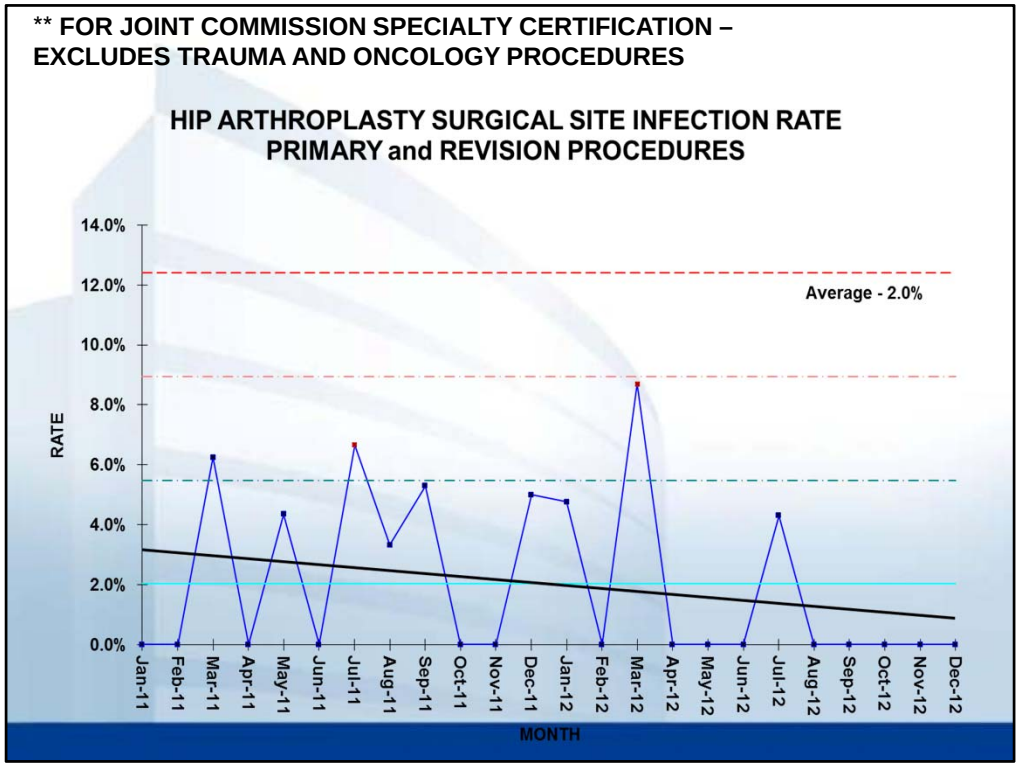


PUBLIC REPORTING RATES FROM NHSN

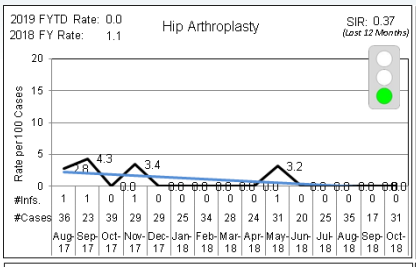


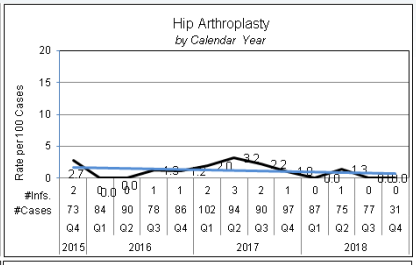
No difference for JC Specialty since 1/2012

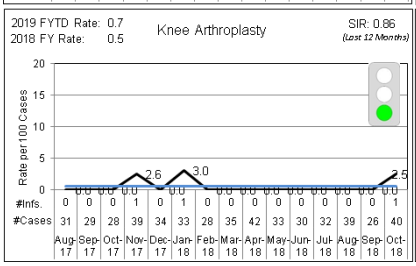
** FOR JOINT COMMISSION SPECIALTY CERTIFICATION – EXCLUDES TRAUMA AND ONCOLOGY PROCEDURES

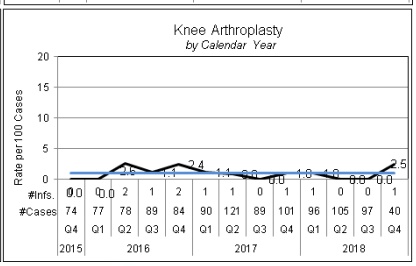


MUSC Internal
(NHSN's "All SSI" Model)









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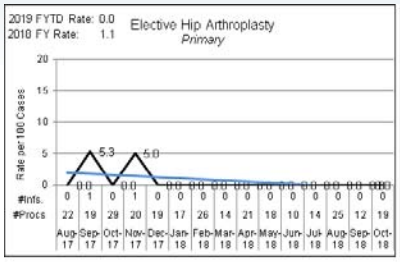
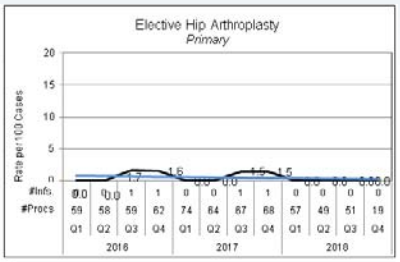
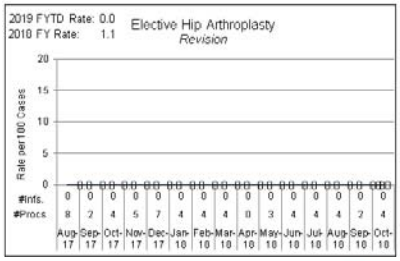
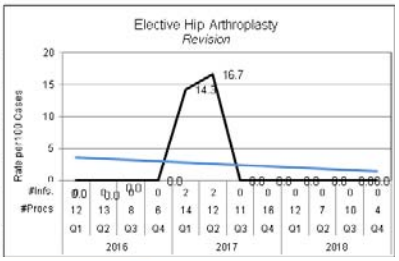
Disease Specific Rates

Hips



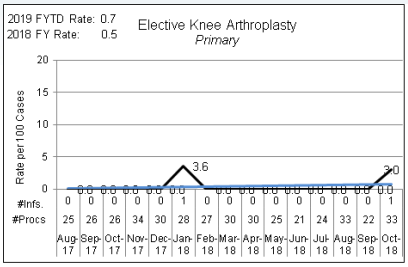


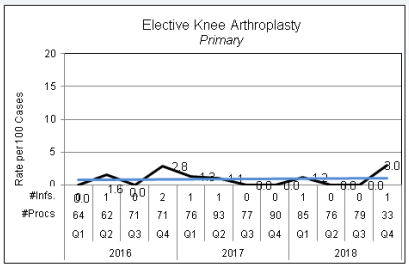


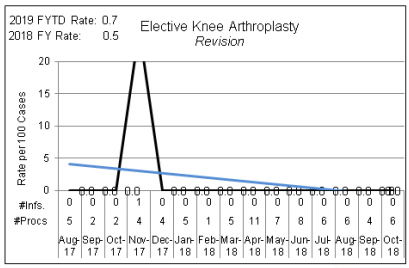


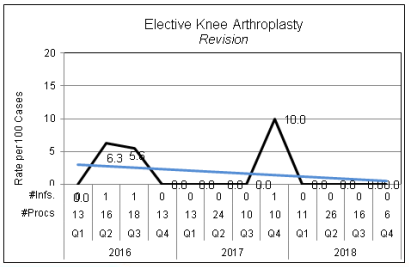
Disease Specific Rates (cont'd)

Knees









“I am to young (or old) for a joint replacement”

J. A. - History

- 14 year old WM with hip pain
- Mild injury playing basketball 1 year prior. Played JV. Athletic.
- Now cannot walk without crutches
- Sedentary, embarrassed.
- Previously seen by 5 other orthopedists (pediatric and adult).
- PMH –
- Family history + for coagulopathy in grandmother

J. A. - Exam

- Pleasant, thin, healthy-appearing 14-year-old with a severe right antalgic limp.
- 1-1/2 cm leg length inequality with the right side being shorter.
- Flex up to about 90 degrees but has no internal rotation and gets exacerbation of his groin pain with external rotation past 45 degrees.
- Abduct 20 degrees.
- Pain in his hip with axial loading of his hip even without motion.

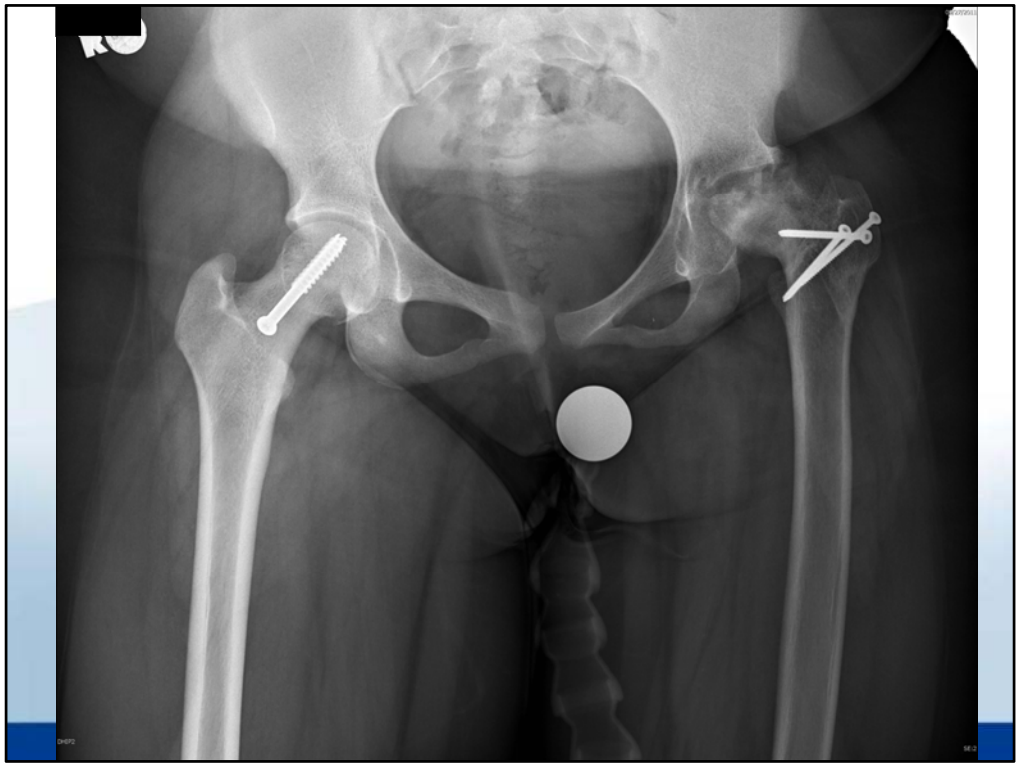
How would you advise him?

- Live with it
- Arthrodesis (Fusion)
- THA
  - Conventional Metal on Polyethylene
  - Ceramic on Polyethylene
  - Ceramic on Ceramic
  - Metal or Ceramic on Crosslinked Poly
  - Metal on Metal
- Something else?

Pre-op Discussion

- We discussed the risks and benefits associated with hip arthroplasty and he does understand that this is a very controversial topic and very risky in somebody his age and that he most likely will require revision surgery in the future.
- He had already decided prior to coming here that he is ready to have this done, as did his family. They have researched this and would like to proceed with plans for a hip arthroplasty.
- We discussed the risks and benefits associated with total hip replacement versus hemiarthroplasty. Since he does have a normal acetabulum, I think a hemiarthroplasty may provide him a good durable long- lasting joint replacement without imposing a significant limitation of his activities.
- It would also leave future options for alternative bearings open as better options become available.
- I did explain to him that a hemiarthroplasty does have an increased incidence of groin pain and he is willing to accept this.


PORT



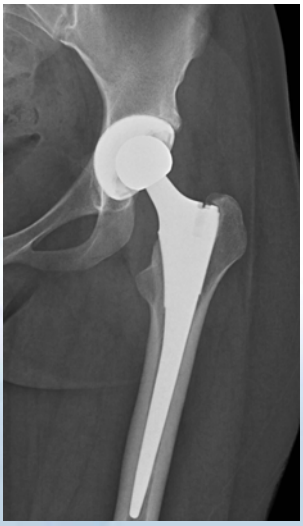

LA-RIGHT

Age 8 – Septic Arthritis

Age 11 Age 13 Age 16

Age 17

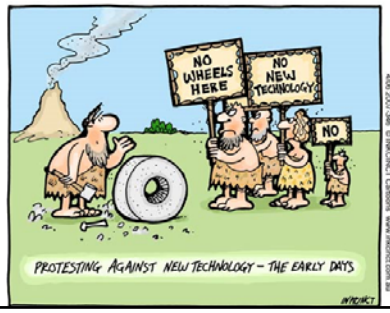
Age 19



Life Expectancy

- People living and working longer
- Average life expectancy over 77
- By 2050, 86 (male) and 92 (female) expected
- 50 year old women expected to live to 82
- 65 year olds have nearly a 20 year average life expectancy

"I want the newest technology for my joint replacement"



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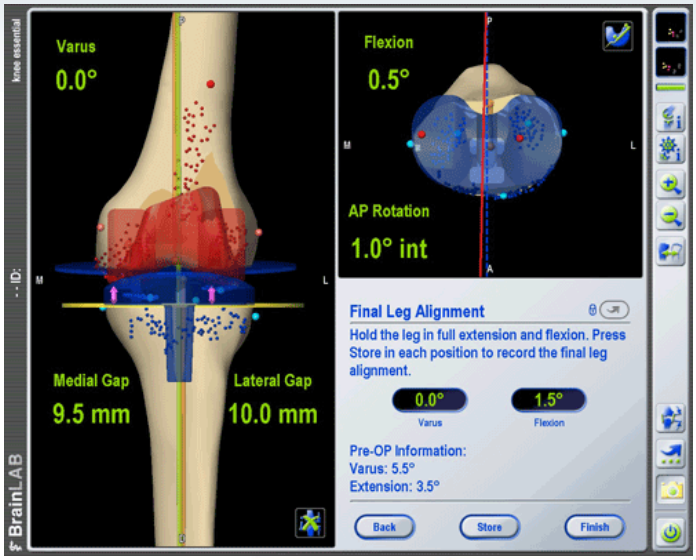
Computer Assisted Surgery / Robotics



Clin Orthop Relat Res (2020) 478:266-275 DOI 10.1097/CORR.0000000000000916

Does Robotic-assisted TKA Result in Better Outcome Scores or Long-Term Survivorship Than Conventional TKA? A Randomized, Controlled Trial

Young-Hoo Kim MD, Sung-Hwan Yoon MD, Jang-Won Park MD

- Randomized trial compared robotic-assisted TKA to manual-alignment techniques
- 700 patients (750 knees) received robotic-assisted TKA and 706 patients (766 knees) received conventional TKA
- At >10 year f/u:
  - No difference in clinical or radiographic parameters
  - No difference in aseptic loosening
  - No difference in frequency of complications
- "Considering the additional time and expense associated with robotic-assisted TKA, we cannot recommend its widespread use."

"Ask your doctor for the new type of knee that rotates as well as bends."

"Ask for the GetAroundKnee™"

"Ask for the 30-year knee replacement"

Television commercials

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"I want the same knee joint replacement as Mary Lou Retton."

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"I want a metal on metal Birmingham Hip Resurfacing procedure and I've decided to go to India to have it done."

Home » Surgery abroad » India » Patient stories » Hip resurfacing

Birmingham Hip Resurfacing operation in India

Mr. Henry Stevens is a professional polo umpire, horse trainer and polo manager who lives south of London. He had been suffering from severe pain and lack of mobility in his right hip, making it at times, impossible for him to "swing a leg" over a horse -- an obvious requirement for his profession.

Through a series of x-rays, it was shown that his hip joint had deteriorated, yet the hip bone was "excellent" making him an ideal candidate for the "Birmingham Hip Resurfacing" operation. The NHS told him he would have to wait 12 to 18 months for the hip operation; private treatment costs were estimated at £10,000, whereas in India he had to pay just £4,000 with no waiting time.

Mr.Stevens contacted Wockhardt Hospitals in Mumbai, for his treatment in India. Wockhardt Hospitals operates a chain of super speciality hospitals, with international accreditation by Joint Commission International.

Mr Stevens said:
"The main objective of our visit here was to get the best possible medical attention which means the best possible surgeon and the best possible nursing, physio-rehab and overall hospital care. The second requirement was to find the best medical services at a cost we could afford. Thirdly, we needed to schedule the procedure for a very specific time -- the time between the two polo seasons: October. All of the medical attention received has exceeded our expectations. Dr. Malhan is not only the skilled surgeon we knew he would be, but he instils in us total confidence and also has a personality (and a sense of humour) to delight. We are blessed with him."

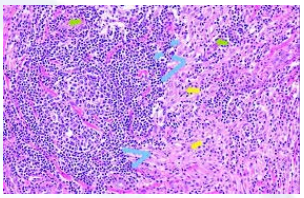
ed by EasySite - EIBS Ltd

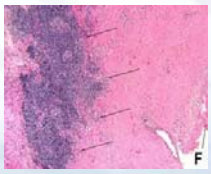
Patient story supplied by Wockhardt Hospitals, Mumbai, India.

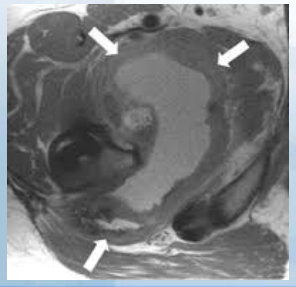
Get a quote

We provide an enquiry service for information or quotations from up to three hospitals overseas for people interested in surgery or medical treatment abroad.
Complete the Treatment Abroad Enquiry Form....

ALTR / ALVAL







The New York Times

Business

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Rolling over to Fidelity is e

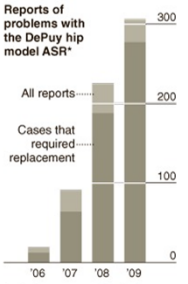
With Warning, a Hip Device Is Withdrawn

By BARRY MEIER
Published: March 9, 2010

A unit of Johnson & Johnson, just months after saying it was phasing out an artificial hip implant because of slowing sales, has warned doctors that the device appears to have a high early failure rate in some patients.

Reported Problems

Between 2006 and 2009, reports of problems with the DePuy model ASR hip replacement device rose sharply. Of the problems reported in 2009, over 90 percent required replacement.



*Includes reports to F.D.A. of some cases outside the U.S.

Source: F.D.A.

The New York Times

Case Report

Cobalt intoxication diagnosed with the help of Dr House

Kirsten Dohrn, Yulia Shaikova, Peter Hebland, Sabine Pankuweit, Juergen R Schaefer

Lancet 2014; 383: 574

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Correspondence to: Prof Dr Juergen R Schaefer, Philipps-University Marburg, University Clinic Giessen and Marburg, Dr Pehl Stiftungs Professur, Internal Medicine—Cardiology and Center for Undiagnosed Diseases, Baldingerstrasse 1, D 35033, Marburg, Germany
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In May, 2012, a 55-year-old man was referred to our clinic for severe heart failure (New York Heart Association class IV). He had raised brain natriuretic peptide of 1053 ng/L (normal <55 ng/L) and his estimated ejection fraction by echocardiography was 25%. His medical history was mostly uneventful, apart from the fact that he had had both hips replaced by prostheses. Coronary artery disease had been excluded by heart catheterisation; cardiomyopathy was therefore regarded as the cause of heart failure. Additionally he was almost deaf and almost blind; furthermore he had fever of unknown origin, hypothyroidism, and reflux oesophagitis. His mediastinal lymph nodes as well as the lymph nodes at his left hip were enlarged. At this side he had had hip replacement surgery in November, 2010, when a mosaic-on-polyethylene prosthesis (head Zimmer CoCrMo Prosanit, mosaic [Zimmer, Winterthur, Switzerland]; Inlay Aesculap N11 413 Chirulen PE [Aesculap, Tuttlingen, Germany]) was implanted to replace a broken ceramic-on-ceramic hip prosthesis (implanted December, 2001: head Aesculap NK 561 Biolox forte, Inlay Aesculap N11 103 Plasmacup). All symptoms appeared within the past year before his admission to our centre. Searching for the cause combining these symptoms—and remembering an episode of the TV series "House" which we used for teaching medical students (series seven/episode 11)—we suspected cobalt intoxication as the most likely reason. We did radiography of the hip and measured cobalt and chromium. The radiograph showed a myositis ossificans-like picture attributable to mosaic debris as the left-sided hip. The measurements of cobalt and chromium in the blood showed severe increase of these mosaics. In a heparin-blood sample the cobalt concentration was 15000 nmol/L (normal <15·3 nmol/L) and chromium was 942 nmol/L (normal <9·6 nmol/L). The cobalt concentration in 24 h urine was 6140 nmol/L (normal <17 nmol/L) and chromium urine concentration was 52300 nmol/L (normal <11·5 nmol/L). We initiated 2,3-dimercaptopropane-1-sulfonate treatment and referred the patient to his former orthopaedic clinic, where he received a new left ceramic hip prosthesis, and subsequently—because of the severe heart failure—an implanted cardioverter-defibrillator. Most likely because of remaining ceramic particles, the mosaic head of the hip replacement was severely damaged (figure). Shortly after the hip replacements, the patient's plasma cobalt and chromium concentrations decreased, and the patient stabilised and recovered slightly. In July, 2013 (14 months after removal of the mosaic hip), heparin-blood concentration of cobalt was 1460 nmol/L and chromium was 365 nmol/L. Cardiac function improved to 40% and there were no new episodes of fever or signs of oesophagitis. However, the patient's hearing and vision recovered only slightly.

Cobalt intoxication has been a well known cause of cardiomyopathy for over 50 years; however, it has mostly been known in the context of so-called Quebec beer drinkers' cardiomyopathy and hard mosaic work-related exposure to cobalt.[1,2] The stability of cobalt in combination with chromium and molybdenum (usually Co 70%, Cr 25%, Mo 5%) made this mosaic an excellent and stable compound in hip prosthetics. Numerous studies have investigated mosaic exposure due to mosaic hip arthroplasties.[3] However, in certain situations—false placements, technical problems in mosaic-on-mosaic prostheses, and strikingly often after an off-label replacements of broken ceramic hips by mosaic pairs—cobalt exposure to the patients from a hip prosthesis occurs. This cobalt intoxication is an increasingly recognised and life-threatening problem.[4]

Figure: Mosaic hip prosthesis causing cobalt intoxication
Removed mosaic head with hole due to severe mosaic loss.

Contributors

KD, YS, and JRS looked after the patients and wrote the report. SP and PH managed and measured the blood samples. All authors reviewed the text. Written consent by the patients to publish this report was obtained. JRS was supported by the Dr R Pohl Foundation.

References

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5 Gilbert CJ, Cheung A, Bourne J, et al. Hip pain and heart failure: the removing link. *Can J Cardiol* 2013; 29: 639.e1–2.

Arthroplasty Today 3 (2017) 151–153

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journal homepage: http://www.arthroplastytoday.org/

Case report

Cardiac transplant due to metal toxicity associated with hip arthroplasty

Sheldon Moniz, MBBS (UWA) *, Sean Hodgkinson, MBBS (UWA), Piers Yates, MBBS (Hons), BSc (Hons), MRCS (Eng), FRCS (Tr & Orth), FRACS (Ortho), FAOrthA

Department of Orthopaedics, Fiona Stanley Hospital, Murdoch, Perth, WA, Australia

"I want the same type of joint replacement as Jack Nicklaus."

"I had my hip replaced to get back my life, not just for golf"

Jack Nicklaus

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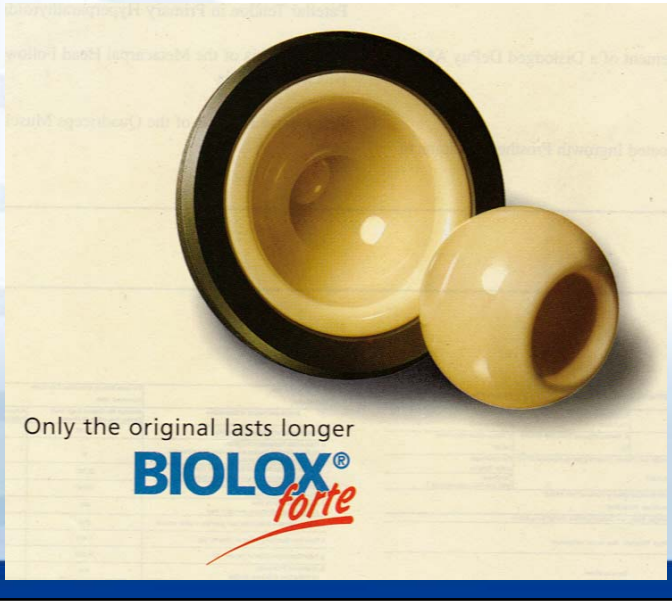
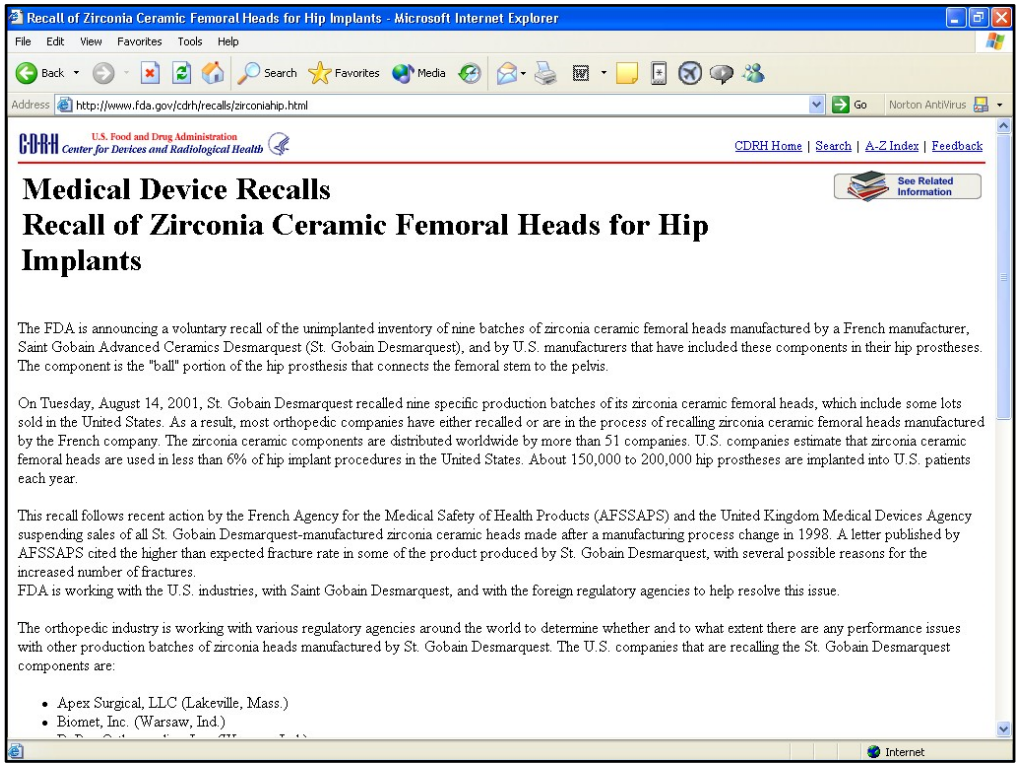
Ceramics




Recall of Zirconia Ceramic Femoral Heads for Hip Implants - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites Media
Address http://www.fda.gov/cdrh/recalls/zirconiahip.html
Go
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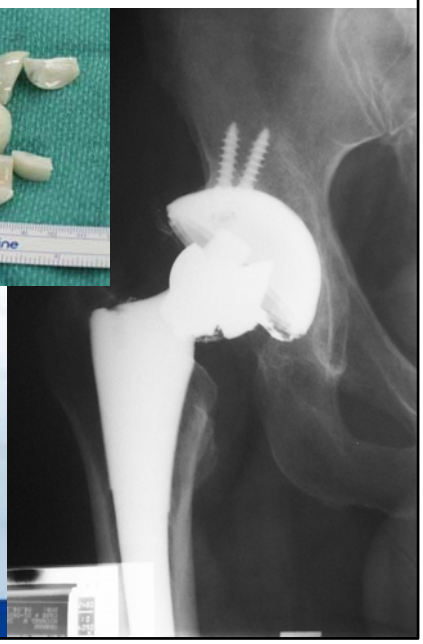
Medical Device Recalls
Recall of Zirconia Ceramic Femoral Heads for Hip Implants
The FDA is announcing a voluntary recall of the unimplanted inventory of nine batches of zirconia ceramic femoral heads manufactured by a French manufacturer, Saint Gobain Advanced Ceramics Desmarquest (St. Gobain Desmarquest), and by U.S. manufacturers that have included these components in their hip prostheses. The component is the "ball" portion of the hip prosthesis that connects the femoral stem to the pelvis.
On Tuesday, August 14, 2001, St. Gobain Desmarquest recalled nine specific production batches of its zirconia ceramic femoral heads, which include some lots sold in the United States. As a result, most orthopedic companies have either recalled or are in the process of recalling zirconia ceramic femoral heads manufactured by the French company. The zirconia ceramic components are distributed worldwide by more than 51 companies. U.S. companies estimate that zirconia ceramic femoral heads are used in less than 6% of hip implant procedures in the United States. About 150,000 to 200,000 hip prostheses are implanted into U.S. patients each year.
This recall follows recent action by the French Agency for the Medical Safety of Health Products (AFSSAPS) and the United Kingdom Medical Devices Agency suspending sales of all St. Gobain Desmarquest-manufactured zirconia ceramic heads made after a manufacturing process change in 1998. A letter published by AFSSAPS cited the higher than expected fracture rate in some of the product produced by St. Gobain Desmarquest, with several possible reasons for the increased number of fractures.
FDA is working with the U.S. industries, with Saint Gobain Desmarquest, and with the foreign regulatory agencies to help resolve this issue.
The orthopedic industry is working with various regulatory agencies around the world to determine whether and to what extent there are any performance issues with other production batches of zirconia heads manufactured by St. Gobain Desmarquest. The U.S. companies that are recalling the St. Gobain Desmarquest components are:
Apex Surgical, LLC (Lakeville, Mass.)
Biomet, Inc. (Warsaw, Ind.)
Internet

Ceramics – Disadvantages

- Fractures
  - Risk with modern components <0.05%
- Difficulty in designing taper locks
- Rigid
  - Direct transmission of energy to bone
- Expensive
- Noise – Squeaking hips (10-20%)



Squeaking Ceramics

“Joint replacements wear out after 10 years”

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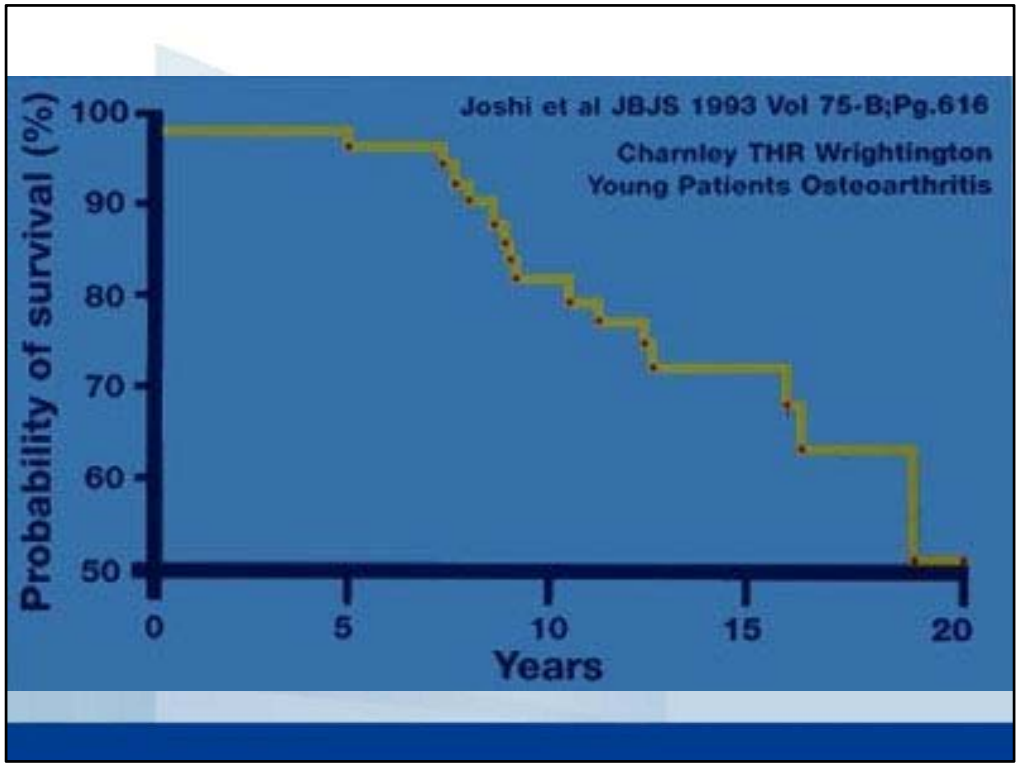
Joshi et al JBJS 1993 Vol 75-B;Pg.616
Charnley THR Wrightington
Young Patients Osteoarthritis
Probability of survival (%)
100
90
80
70
60
50
0
5
10
15
20
Years


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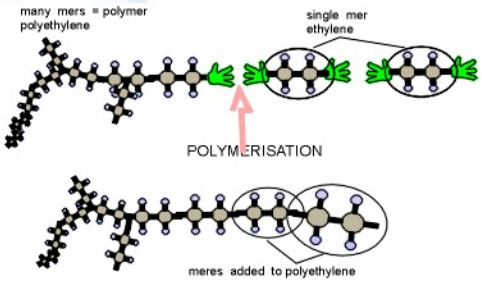
Bearing History

- 1880's – soft tissue interposition
- 1894 – ivory
- 1920's – mold arthroplasty
- 1930's – metal –metal
- 1950's – Teflon
- 1962 – high density polyethylene
  the standard for the next 50+ years

Sir John Charnley

Polyethylene – What is it?

- Polymer of ethylene molecules C_2H_4
- Fine powder consolidated at elevated temp or pressure
  - Ram extrusion
  - Molding followed by machining
  - Direct molding into final shape



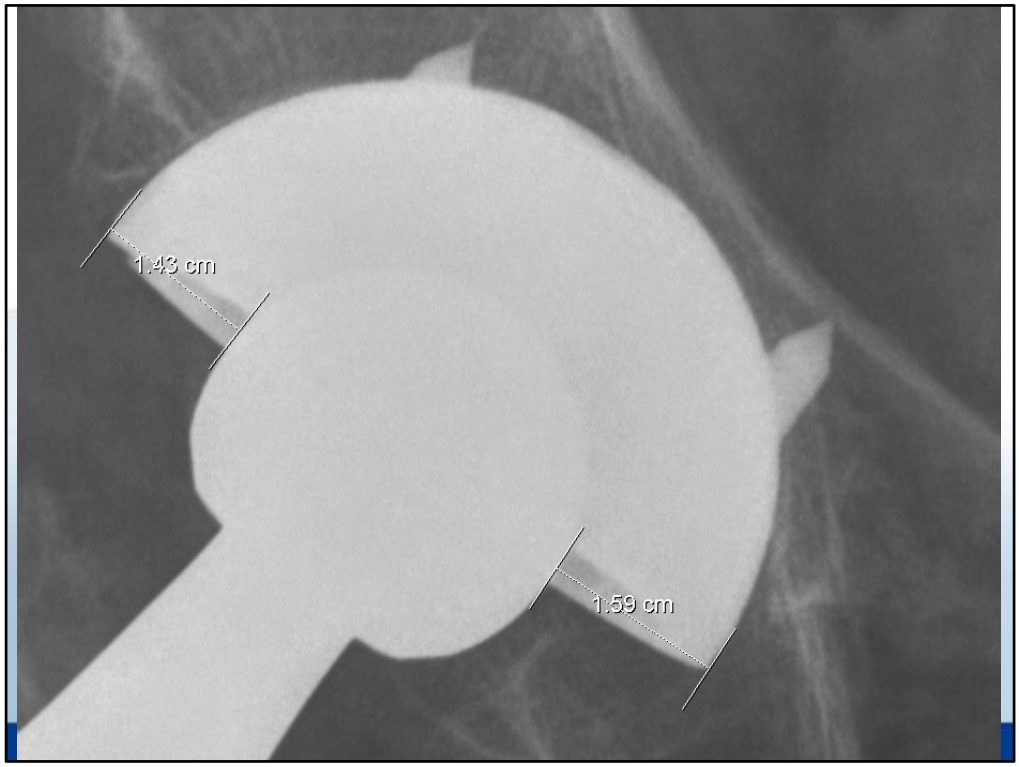
UHMWPE: 160 000 to 210 000 meres

Advantages of Poly

- Abrasion resistance
- Impact strength
- Shock absorption
- Low coefficient of friction
- Chemical inertness
- Resistance to stress cracking
- Inexpensive

The Problem with Poly

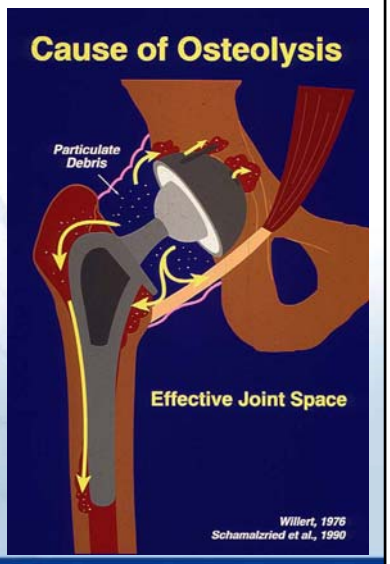
- Wear debris
  - Abrasive and adhesive wear
  - 75 to 250 microns linear wear / year
  - 500 billion particles / year
  - 500,000 particles / step
  - Submicron particles
    - 85% < 1 micron
    - 4% > 2 microns

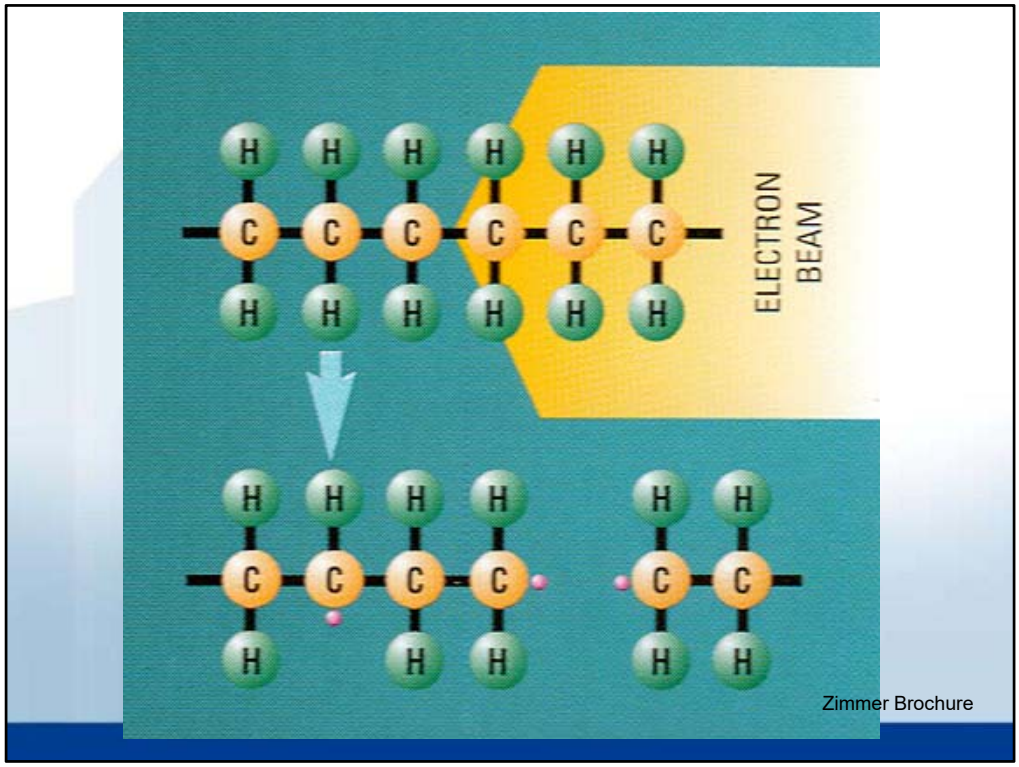

1.43 cm
1.59 cm

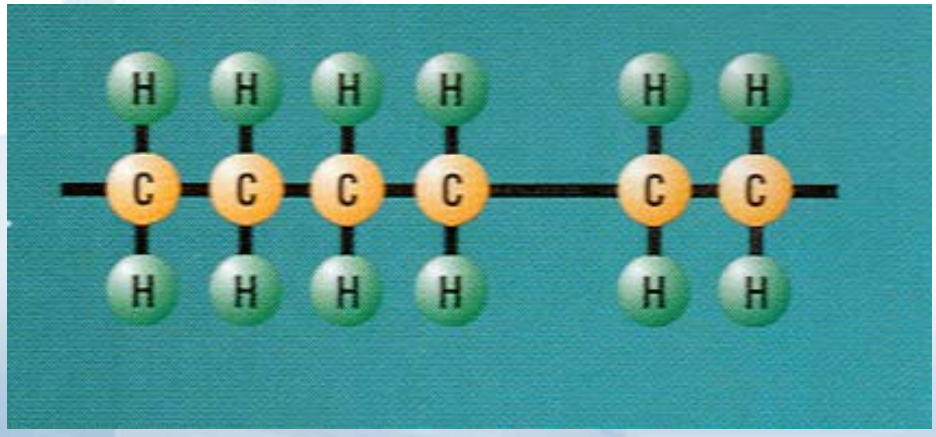
The biggest long term problem in THA is polyethylene wear and the resultant osteolysis.

Attempts to Correct This

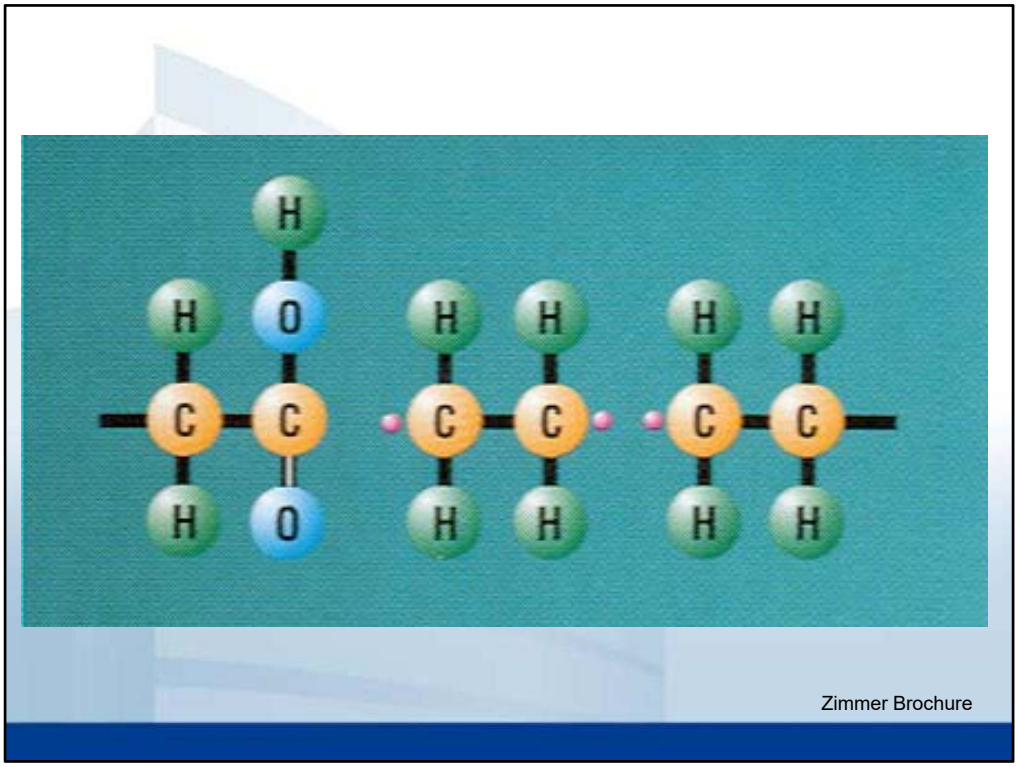
- Avoid thin poly
- Avoid modularity or make connections stable
- Polished backside surfaces
- Avoid screw holes
- Avoid impingement
- Decrease effective joint space
- Avoid poly



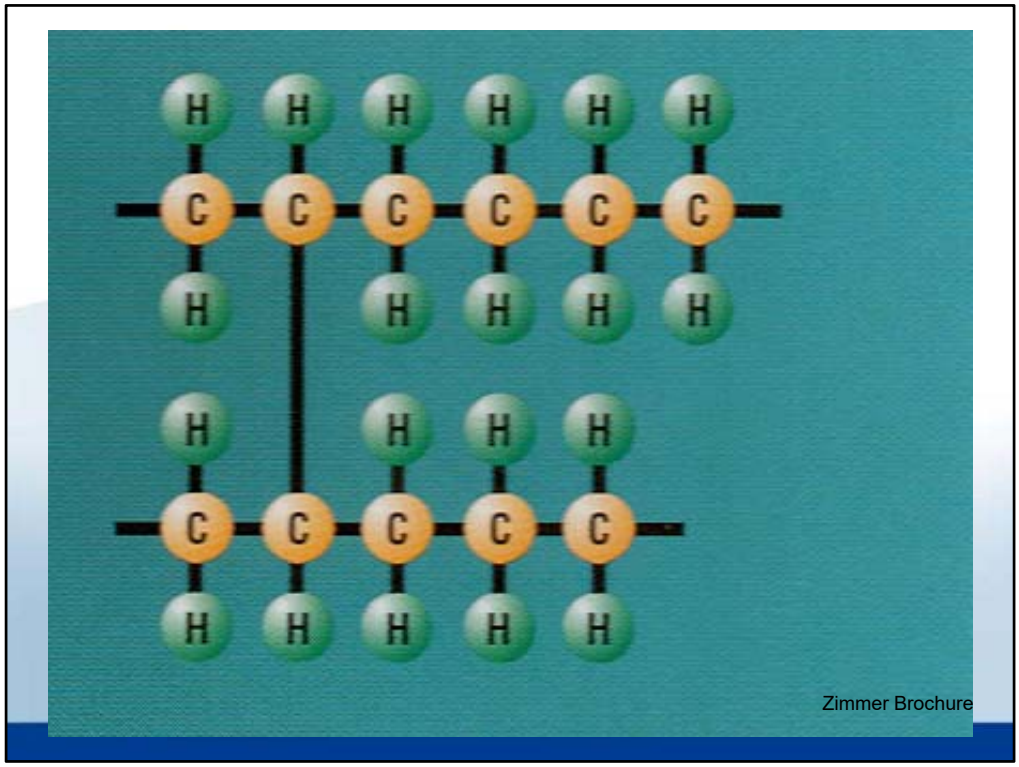

ELECTRON
BEAM
Zimmer Brochure



Zimmer Brochure



Zimmer Brochure


Zimmer Brochure

Crosslinked Polyethylene

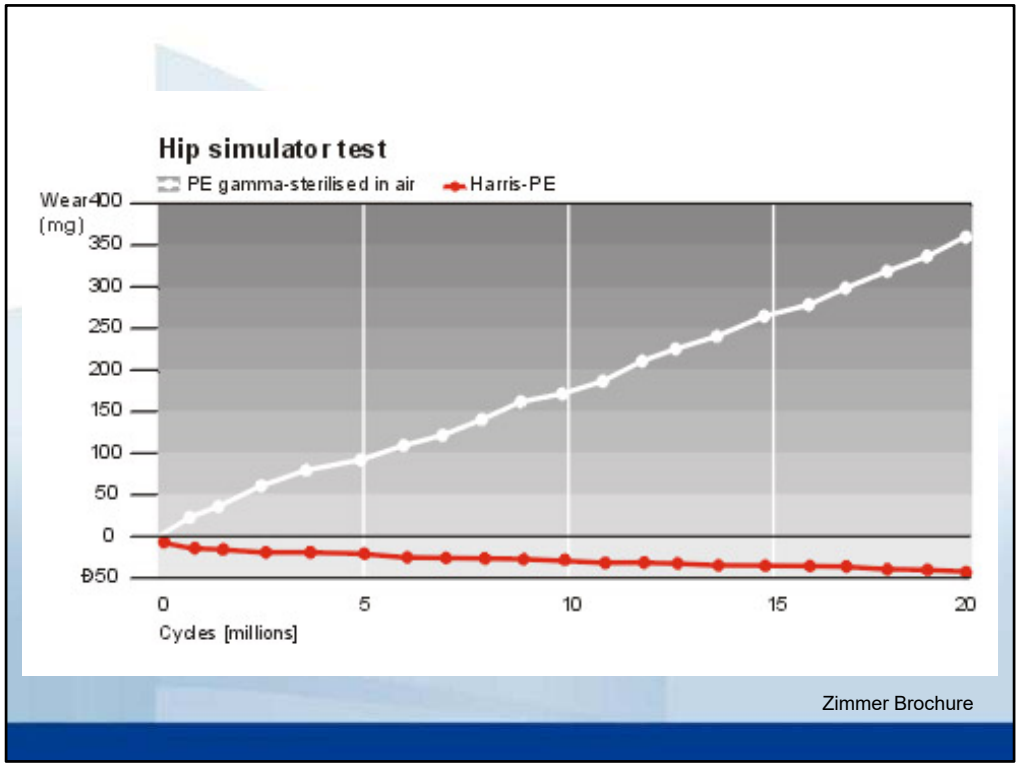
- Radiation causes free radicals
  - May combine with oxygen - Oxidation
    - Polymer chains break
    - Crystalline structure disturbed
    - Mechanical properties deteriorate
  - May combine with each other - Cross linking
- Heating (annealing) helps to reduce oxidation
  - 150 degrees C for 16 hours
  - Outer layer of oxidized material removed

Crosslinked Polyethylene

- Prevents surface deformation
- Increases wear resistance
- Reduces sensitivity to abrasion

Crosslinked Poly - Advantages

- Minimal wear in lab simulations
- No significant change in material properties
- Allows for use of larger heads
  - Reduced dislocation rates
  - Reduced need for skirts
  - Improved ROM



Zimmer Brochure

THE OTTO AUFRANC AWARD

Highly Cross-linked Polyethylene in Total Hip Arthroplasty

Randomized Evaluation of Penetration Rate in Cemented and Uncemented Sockets Using Radiostereometric Analysis

Georgios Digas, MD, PhD; Johan Kärrholm, MD, PhD; Jonas Thanner, MD, PhD; Henrik Malchau, MD, PhD; and Peter Herberts, MD, PhD

- Prospective, randomized
- Bilateral hips –
  - N = 32 (Longevity & Conventional)
- Unilateral hips
  - N= 62 (all poly cups- Durasul or conventional)

Radiostereotmetry: Tantalum markers implanted into acetabulum and liner at time of surgery

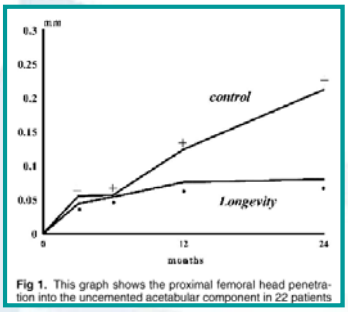


Fig 1. This graph shows the proximal femoral head penetration into the uncemented acetabular component in 22 patients

Longevity

1 yr – 0.08 vs 0.08 mm

>1yr- 0.12 vs 0.21 mm

p<0.005

Durasul

1 yr – 0.09 vs 0.13 mm

>1yr- 0.13 vs 0.25 mm

p<0.002

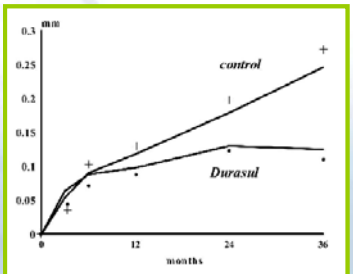


Fig 4. This graph shows the proximal femoral head penetration into the cemented acetabular component in 20 patients

Continued Improved Wear with an Annealed Highly Cross-linked Polyethylene

William N. Capello MD, James A. D'Antonio MD,
Rama Ramakrishnan MS, Marybeth Naughton BS

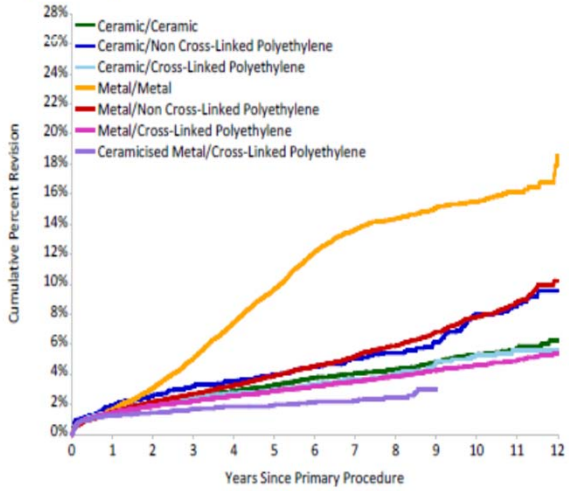
- Clin Orthop Relat Res (2011) 469:825–830
- 42 hips at 8.6 years
- 0.031 mm linear wear per year for XLPE versus 0.141 mm for conventional (78% reduction)
- No osteolysis in XLPE versus 50% in conventional
- No mechanical failure

MUSC Experience

- Over the past decade, >99% of our THA's have been either ceramic or metal on XPLE.
- >90% of primaries are cementless, proximally porous coated stems with porous cups.
- No revisions for any bearing surface related issue (wear, osteolysis, bearing failure)
- Minimal wear on follow-up x-rays
- Our implant of choice for all hip replacement patients

Australian Registry 2013 Report

Figure HT25: Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Bearing Surface (Primary Diagnosis OA)



Operative Considerations

Prophylactic antibiotics
Infection prevention
Blood management
Surgical approaches

OR Prevention of Infection - Disclaimer

There is little Level 1 evidence to support many of the things we do in the operating room to prevent infections.

There is too little time to begin to cover all of the literature on this topic.

A consistent, logical, thoughtful approach seems to have the highest impact on establishing culture and improving outcomes.

Pathogenesis of O.R. Infections

Skin

Airborne Sources / instruments / gloves

Hematogenous

Most common organisms

- Staph Aureus and Staph Epidermidis
- Enterococcus, Streptococcus, GNR's

Glycocalyx biofilms on orthopaedic implants allow non-pathologic organisms to lead to infection

Development of infection depends on virulence of organism, load of contamination, host factors, and local environment.

Host or systemic factors

Systemic antibiotics
MRSA / MSSA isolation and decolonization
Glucose control
Nutritional support
Body temperature
Oxygenation
Shaving / Clipping
Prepping / Draping / Skin isolation

Prophylactic Antibiotics - History

- History
  - Conflicting data prior to mid 1970's
  - "Prophylactic" antibiotics typically given hours or days after surgery
  - 1961 – Burke reported that adequate tissue levels at time of inoculation prevented infection in Guinea pigs
  - Bowers, JBJS 1973
    - Canine model showed high cephaloridine levels in hematoma if given 30 minutes prior to surgery with no infection
    - Starting administration 6 hours post-op could not achieve bacterial sterility
    - Starting after 24 hours were universally infected
  - Pavel, JBJS 1974
    - Prospective, placebo-controlled study of 1591 clean operations using pre and intra-op cephaloridine
    - Decreased infection risk from 5% to 2.8%
  - Charnley – 7% in 1960 to 0.5% in 1970 without antibiotics

Prophylactic Antibiotics
JBJS CCR 2009 – Meehan, et al

- Given to prevent surgical infection when infection is not believed to be present, but risk is present.
- Goal is to achieve serum and tissue levels that exceed the MIC for organisms likely to be encountered during the operation.
- Augments hosts immune system by increasing the amount of contamination required to cause infection

Prophylactic Antibiotics - Timing

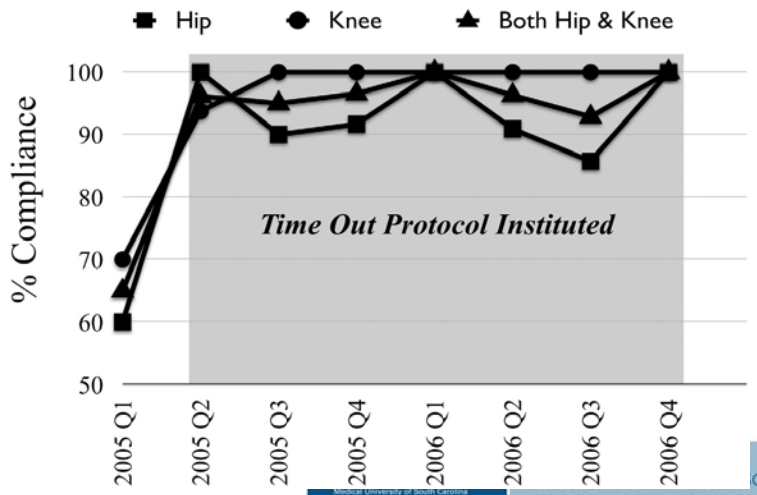
- Within 60 minutes prior to incision
- Peak levels reached within 20 minutes of administration
- Vancomycin can start up 2 hours prior
- Additional dose if procedure exceeds half-life of antibiotic or substantial blood loss.
- AAOS Recommendations

TABLE I Recommendations by the American Academy of Orthopaedic Surgeons for Repeat Doses of Antibiotics[92]

Antibiotic	Frequency of Administration
Cefazolin	Every 2-5 hours
Cefuroxime	Every 3-4 hours
Clindamycin	Every 3-6 hours
Vancomycin	Every 6-12 hours

Ensuring Appropriate Timing of Antimicrobial Prophylaxis

By Andrew D. Rosenberg, MD, Daniel Wambold, MD, Linede Kraemer, RN, MA, CNOR, Maureen Begley-Keyes, BS, RN, CPHRM, CPHQ, Scott L. Zuckerman, Neeraj Singh, BA, Max M. Cohen, MD, and Michele V. Bennett, RN, MA, ONC



Prophylactic Antibiotics - Choice

- Choice should cover must common organisms
  - PCN, Cephalosporins, vancomycin, animoglycosides are bactericidal
  - Clindamycin is bacteriostatic
  - Cefalozin of cefuroxime for sensitive staph.
  - Vancomycin or clindamycin for allergic patients.
    - Cross reactivity between PCN and cephalosporins historically 10%.
    - Current anaphylaxis to cephalosporins estimated between 0.0001% and 0.1%

Prophylactic Antibiotics - Choice

Cefazolin

- Has been antibiotic of choice for 3 decades
- Excellent distribution profiles in bone, muscle, synovium, and hematoma
- Rapid MIC levels in tissue
- Rare anaphylactic reactions
- 2 grams for adults < 120 Kg;
  3 grams if > 120 Kg

Prophylactic Antibiotics – Choice

- Vancomycin
  - Reaches high concentrations in tissue within minutes
  - 5-13% Red man syndrome with rapid infusion
  - 15 mg/Kg for normal renal function
  - Useful for
    - Known colonization with resistant organism
    - Facilities with recent outbreaks of MRSA
    - Anaphylaxis to Penicillin or Cephalosporins
    - May be warranted in high risk patients
  - Risks
    - Development of VRE colonization
    - <1% ototoxicity or nephrotoxicity
    - Hypersensitivity, neutropenia, drug fever - rare

Prophylactic Antibiotics – AAOS Position – June 2004

- Antibiotic selection
  - Cefazolin or cefuroxime
  - Reserve clindamycin or vancomycin for confirmed beta-lactam allergies, MRSA colonization, or outbreaks
- Timing and dosage
  - Within 1 hour of start time, 2 hours for vanc.
  - Completely infused before tourniquet inflation
  - 2 grams cefazolin for patients > 80 Kg
  - Redose during surgery as needed
- Duration
  - Discontinue within 24 hours of the end of surgery
  - Antibiotics not proven to be beneficial for retained catheters or drains

Pre-operative Screening for MRSA

- Allows modification of choice of antibiotics for MRSA colonized patients
- Role of nasal mupirocin remains unclear
- Successful in Netherlands
  - 0.78% Staph isolates are MRSA
- Unreported MUSC data suggests decreased MRSA infection rates in pre-screened patients

Real life at MUSC

MRSA screening and decolonization

Cefazolin 2 or 3 grams at time of “time-out” – After positioning, immediately before handwashing.

Re-dose at 3-4 hours.

Vancomycin 15mg/kg started in holding and completed prior to beginning of procedure for MRSA+ or severe allergy.

Antibiotics stopped within 24 hours (except revisions with pending cultures)

Order example:

- Cefazolin 2 Gram IV x 3 doses – begin on (DOS) at (time) – 6 hours after last dose in OR (time). Must complete before (time, date) – 24 hours after end of surgery (time).

Hypothermia

Rationale:

- Core temperatures outside the normal range pose a risk in all patients undergoing surgery.
- According to the Clinical Guidelines for the Prevention of Unplanned Perioperative Hypothermia by the American Society of PeriAnesthesia Nurses (ASPAN, 2001), published research has correlated impaired wound healing, adverse cardiac events, altered drug metabolism, and coagulopathies with unplanned perioperative hypothermia.
- Kurtz, et al (1996), found that incidence of culture-positive surgical site infections among those with mild perioperative hypothermia was three times higher than the normothermic perioperative patients. In this study, mild perioperative hypothermia was associated with delayed wound closure and prolonged hospitalization.
- Mahoney and Odom (1999), demonstrated that hypothermia is associated with a significant increase in adverse outcomes, including an increased incidence of infections. The authors also concluded that hypothermia is associated with an increased chance of blood products administration, myocardial infarction, and mechanical ventilation. These adverse outcomes resulted in prolonged hospital stays and increased healthcare expenditures.

RLO at MUSC

Forced air warmers
Temp monitors
Pre-warm OR
Warm blankets / cover patients
Ongoing battle between Anesthesia and scrubbed personnel

Surgical Issues – Hair Removal

- Increased risk if infection if shaving done night before surgery
- Clippers reduce post-operative infection rates over shaving
- No difference in hair removal versus no hair removal.
- Tanner J, Woodings D, Moncaster K. Preoperative hair removal to reduce surgical site infection. Cochrane Database Syst Rev. 2006;2:CD004122.

Surgical Issues – Skin Prep.

Chlorhexidine gluconate and iodophors both disrupt bacterial cell membranes, but chlorhexidine is more long-lasting.

Iodophors can be inactivated by blood or serum proteins.

Alcohol germicidal, but no residual activity.

No difference in efficacy in some studies, conflicting in others

"The current literature strongly suggests that chlorhexidine gluconate is superior to povidone-iodine for preoperative antisepsis for patients." Fletcher, 2007

"Skin preparation solution is an important factor in the prevention of surgical-site infections. Iodophor-based compounds may be superior to chlorhexidine for this purpose in general surgery patients." Swenson, 2009

Surgical Issues – Occlusive Drapes

No conclusive evidence of benefit

Geelhoed GW, Sharpe K, Simon GL. A comparative study of surgical skin preparation methods. Surg Gynecol Obstet. 1983;157:265-8.

Ritter MA, Campbell ED. Retrospective evaluation of an iodophor incorporated antimicrobial plastic adhesive wound drape. Clin Orthop Relat Res. 1988;228:307-8.

Jacobson C, Osmon DR, Hanssen A, Trousdale RT, Pagnano MW, Pyrek J, Berbari E, Naessens J. Prevention of wound contamination using DuraPrep solution plus Ioban 2 drapes. Clin Orthop Relat Res. 2005;439:32-7.

RLO at MUSC

Chlorhexidine shower at home

Pre-prep done in holding (Betadine)

If needed, clippers used in OR

Chlorhexidine/Alcohol pre-prep at time of “time-out”

Chlorhexidine/Alcohol entire extremity by scrubbed, gloved, ungowned surgeon

Start at surgical site and work outward

“No touch” skin technique

Iodine impregnated occlusive drape to seal skin and cloth drape together.

Airborne bacteria

- Room traffic / doors
- Blocks in Holding
- Open equipment
- Shedding
  - Outside scrubs
  - Body exhaust
  - Boots
  - Beards and hair
- Airflow
- UV lights
- OR time
- Scheduling / Turnover cleaning

Intraoperative bacterial contamination in operations for joint replacement

N. Davis, A. Curry, A. K. Gambhir, H. Panigrahi, C. R. C. Walker, E. G. L. Wilkins, M. A. Worsley, P. R. Kay

From the Bone Infection Group, University of Manchester, North Manchester General Hospital, Manchester, England

- Samples from 100 primary THA and TKA
- 63% overall contamination rate
  - 11.4% suction tips
  - 14.5% light handles
  - 9.4% skin blades
  - 3.2% inside blades
  - 28.7% prep gloves – “Over-gloves should be used during the preparation and changed before application of an adhesive plastic drape.”
  - 17% surgical gowns
  - 10% fascia suture needles – “implying that these cases are deeply contaminated”
- 76% Coag negative staph.
- Only 1 deep infection – not with contaminating organism

Surgical Issues – OR Environment

Decreased circulating CFUs and incidence of infection with:

- Laminar Flow – 90% reduction
- UV light
- High-volume air exchange
- Eliminating open doors / traffic
- Synthetic gowns
- Eliminating open implants > 2 hours
- Reducing OR time

Ears and beards shed most bacteria

Men shed more than women

Surgical Issues – Room Traffic

Positive correlations with

- Number of residents present
- Proximity of door to OR equipment
- Number of times door opened
- Laterality of TKA's (proximity to door)

Body Exhaust Suits

Mostly personal protection

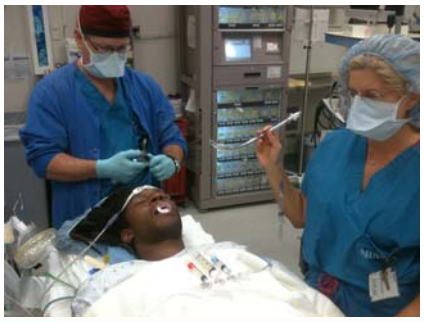
Variable data

Not sterile

- CORR 469:11, 2011
- 22% + culture at time 0
- 47% + at end of procedure
- 43% CNS, S. Aureus, and MRSA
- “change gloves if the PPS is touched or adjusted during the procedure.”

RLO at MUSC

- Blocks done in holding
- Vertical laminar flow rooms with high exchange and HEPA filters
- No UV lights
- No forced air warmers until after fully draped
- Body exhaust suits, tucked in tops, boot covers, synthetic gowns, covered hair and beards
- All traffic from sterile corridor (minimize)
- Instruments not opened before patient arrival
- Keep traffic away from sterile areas!



Instrument contamination

Wrapping / containerization
Flash sterilization
Skin knife
Wash basin
Light handles
Double and re-gloving

Surgical Issues – Flash Sterilization

Should be used only for dropped instruments or emergency situations

Avoidance requires accurate posting, timely delivery of loaner sets, adequate on hand supplies, and minimal set contamination (wrap holes, filter issues, bioburden)

Splash Basins

J of Infection 52:231-232, 2006

21 TJA cases, laminar flow, 24h abx.

Cultured 100ml fluid from basin at end of case.

5 (23.8%) positive cultures

- CNS, Pseudomonas, Neisseria, etc.

No clinical infections

"This study emphasizes that the orthopaedic community should stop using the splash basin since it increases the risk of wound contamination. We suggest that the surgical instruments should be left on the main instrument trolley until the end of surgery. It also underlines the importance of adhering to rigorous protocol in theatre management and the need for continued vigilance in the prevention of implant related infection."

RLO at MUSC

Struggled with SPD issues for years

- Worse with off-site processing
- High incidence of contaminated trays (noticed before use)
- Education, improved wrapping, containerization, padded corners

No wash basins

Skin knife

Double glove and change after draping, before implants, and hourly

Host contamination

Pulse lavage
Antibiotic cement
Antibiotic suture
Systemic antibiotics

Pulse lavage

Hargrove, et al. J Hosp Infection, 2006

356 Hemiarthroplasties with 2L NS washout

Jug / syringe – 15.6% infection (5.2% deep)

Pulse lavage – 5.6% infection (1.8% deep)

"The use of pulse lavage has never been shown to reduce infection rates in total joint replacement. The quoted infection rate for total hip replacements is 0.5–1.5%. If the use of pulse lavage reduced a quoted 1% infection rate to 0.5%, a prospective study of over 30,000 hips would be necessary to prove its success."

Antibiotic Cement

Negligible reduction in fatigue strength
Costs about $300 more per batch than plain
Numerous studies support use in high-risk population and revisions
Chiu JBJS 2009
- Vancomycin cement for 183 revision TKA without “clean-air”
- 7% in plain cement versus 0% in ALBC (P=0.013)

FDA-approved for revision after infection
Questionable benefit in routine primaries
Gandhi, et al JOA 2009
- 1625 patients with primary TKA
  - 2.2% ABLC vs. 3.1% Plain (not sig)

Jiranek WA, et al JBJS 2006.
- Would require reduction in rate of infection from 1.5% to 0.3% to be cost effective.
- An increase in usage in the US to 50% would cost $117 Million

RLO at MUSC

- Pulse lavage with bacitracin and polymyxin saline (not for all MD's)
- Betadine irrigation
- Irrisept (Chlorhexadine)
- Antibiotic cement in high-risk TKA's

Surgical Issues - Drains

Higher incidence of retrograde bacterial contamination with conduit drains versus suction drains.

High incidence of contamination beyond 24 hours

No difference in infection rates

More bruising & wound drainage w/o drains, but more transfusions with

No clear advantage in using drains in TJA

Perioperative Issues – Urinary Catheters

UTI's are most frequent nosocomial infections

0.5 – 20% risk of UTI with single catheterization

8 – 30% transient bacteremia with catheterization

Urinary retention common in TJA patients

Up to 48 hours is equivalent to intermittent catheterization

26% of patients develop UTI after 48 hours of catheterization

JBJS 1976 Donovan, et al

- 359 retrospective and 100 prospective patients on cephalosporin
- 8X more likely to develop UTI if catheter present
- Most caused by Pseudomonas or Enterobacter
- 1 had acute hematogenous infection of TJA from UTI

RLO at MUSC

Foley (if used) removed POD 1
Drain for some TKA's, removed within 24 hours
Staples for most wounds
Impervious Aquacel dressing
Dressing change POD7

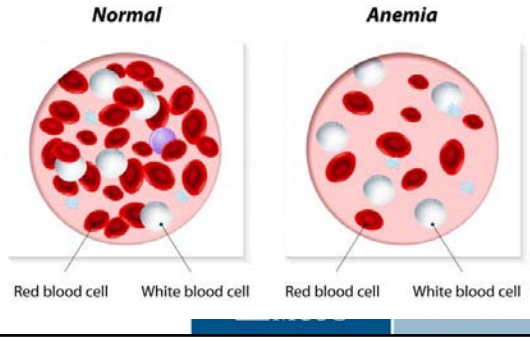
I don't want a transfusion.
I want my relative to give blood for me.
I want to predonate my own blood.

ABLA

stands for

Acute Blood Loss Anemia

Abbreviations.com



Possible | MUSC.edu

Risks of Blood Transfusions
JAAOS 2002 Keating and Meding

Viral infection
- HIV 1:1,000,000
- HBV 1:100,000
- HCV 1:500 to 1:5,000
- HTLV I and II 1:200,000
- CMV and bacterial contamination Varies; 1:2,500

Transfusion reaction
- Fatal hemolytic reaction <1:600,000
- Nonfatal hemolytic reaction 1:6,000
- Fever or urticaria 1:100
- Allergic reaction 1:100
- Graft-versus-host disease Rare

Alloimmunization Common

Immunosuppression
- Infection Increased after surgery
- Cancer Inconclusive

Blood Transfusions and Postoperative Infections in Patients Undergoing Elective Surgery

Surgical Infections 2006;7:S33-35

- Transfusion was single most powerful risk factor for infection in 2809 colorectal resections (OR=5.3 to 6.2)
- Primary THA and TKA have 12x risk of infection if allogeneic transfusion
- Explored evidence behind WBC mediated immunosuppression, free serum iron, storage time, metalloproteinase-1.

Intraoperative Hemostasis

Acute Normovolemic Hemodilution
Tourniquet
Hypotensive Anesthesia
Regional anesthesia
Avoidance of hypothermia
Blood salvage / Cell Saver
Good hemostatic technique
Bipolar Sealer (Aquamantys)
Topical hemostatic agents
Intravenous antifibrinolytics

Tranexamic and Aminocarpoic Acid

- Lysine analogues
- Inhibit binding of lysine residues on fibrin to plasmin or plasminogen
- Prevent fibrinolysis (more significant with tourniquet)
- Inhibit clot breakdown
- Do not affect coagulation

INDICATIONS AND USAGE

- CYKLOKAPRON Injection is indicated in patients with hemophilia for short-term use (two to eight days) to reduce or prevent hemorrhage and reduce the need for replacement therapy during and following tooth extraction.

CONTRAINDICATIONS CYKLOKAPRON

- Injection is contraindicated:
  - 1. In patients with acquired defective color vision, since this prohibits measuring one endpoint that should be followed as a measure of toxicity (see WARNINGS).
  - 2. In patients with subarachnoid hemorrhage. Anecdotal experience indicates that cerebral edema and cerebral infarction may be caused by CYKLOKAPRON in such patients.
  - 3. In patients with active intravascular clotting.
  - 4. In patients with hypersensitivity to tranexamic acid or any of the ingredients.

MUSC Tranexamic Acid Protocol

- All Primary and Revision THA, TKA, TSA
- 20mg/Kg IV TXA with maximum of 2g
- All patients except thromboembolic disease within 6 months
- THA and TSA – Administer before scrubbing
- TKA administer when inserting implants, or before tourniquet deflation

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Primary Arthroplasty

Process Improvement Project Using Tranexamic Acid Is Cost-Effective in Reducing Blood Loss and Transfusions After Total Hip and Total Knee Arthroplasty

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arthroplasty of knee
cost saving
quality improvement
surgical blood loss

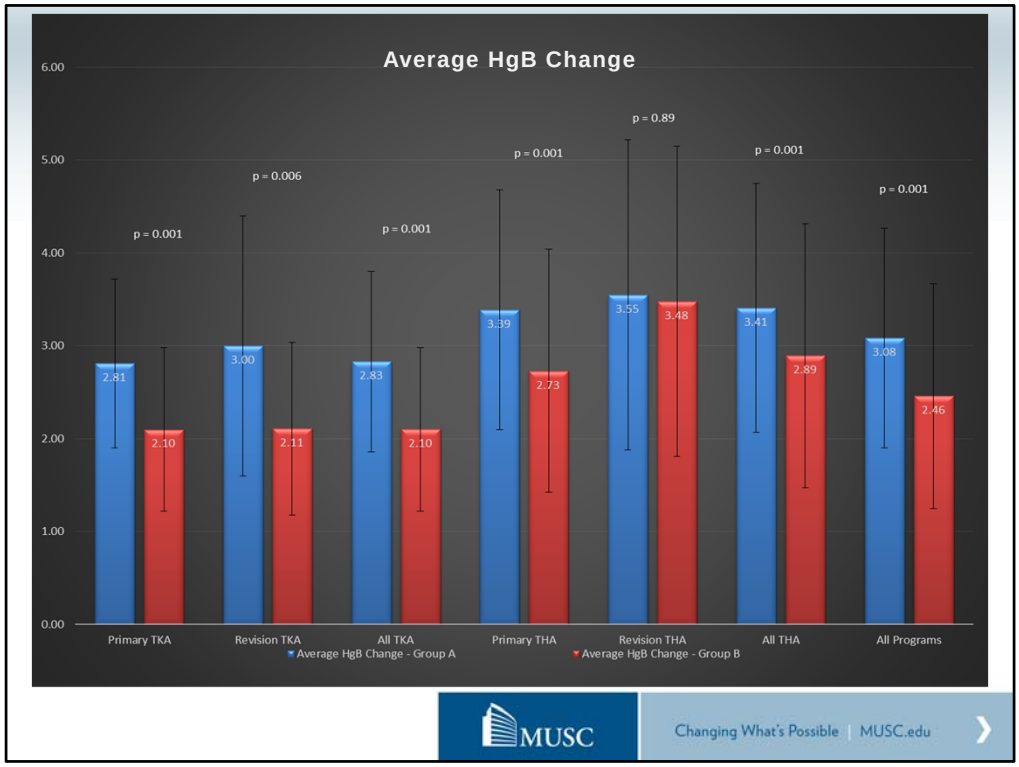
ABSTRACT

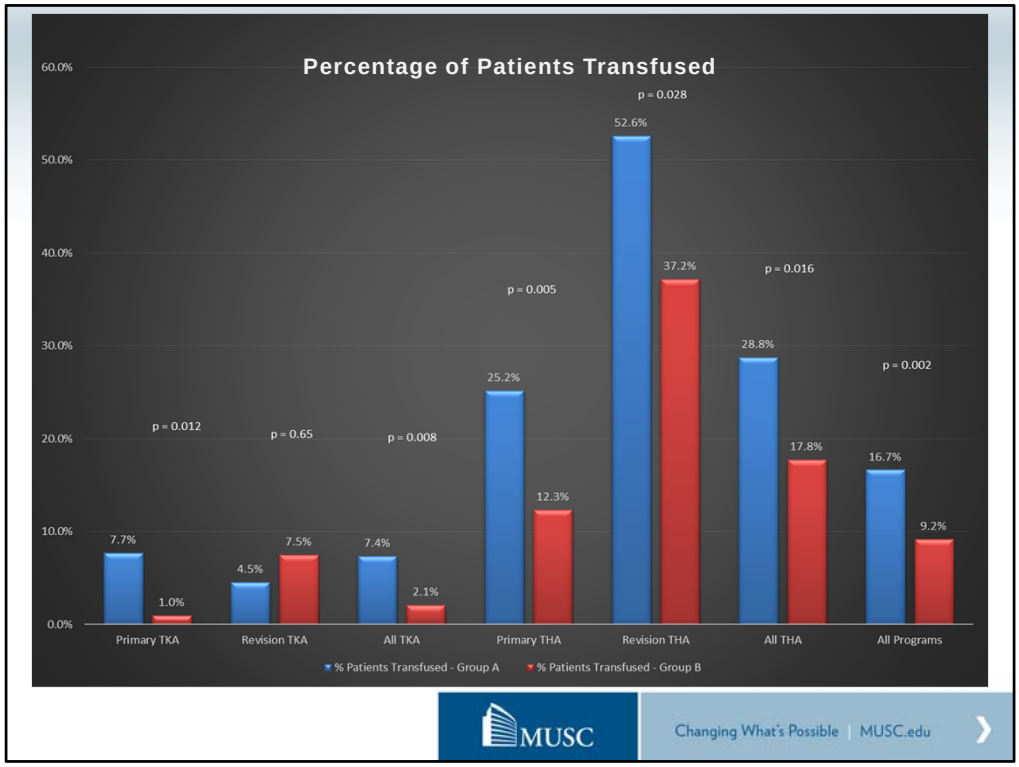
Background: Tranexamic acid (TXA) has been associated with decreased blood loss and transfusion after total hip arthroplasty (THA) and total knee arthroplasty (TKA). The purpose of this study was to examine both transfusion utilization and the economic impact of a Process Improvement Project implementing TXA for THA and TKA.

Methods: After standardization of TXA administration in THA and TKA patients, retrospective data were compared from 12 consecutive months before (group A, n = 336 procedures) and after (group B, n = 436 procedures) project initiation.

Results: TXA administration increased with project implementation (group A = 3.57%, group B = 86.01%) and was associated with reductions in perioperative hemoglobin decrement (20.2%), patients transfused (45%), and number of units transfused per patient (61.9%). Cost savings were notable per patient ($128) and annually program wide ($55,884) with the primary THA subgroup contributing the most to the savings. No increase in adverse effects was observed.

Conclusion: Standardized administration of TXA is an effective and economically favorable blood-reduction strategy for patients undergoing elective THA or TKA. Although reduction in transfusions with TXA may be greater after TKA, the economic and clinical impact of transfusion reduction is more substantial in THA patients.


Average HgB Change
6.00
5.00
4.00
3.00
2.00
1.00
0.00
p = 0.001
p = 0.006
p = 0.001
p = 0.001
p = 0.89
p = 0.001
p = 0.001
2.81
2.10
3.00
2.11
2.83
2.10
3.39
2.73
3.55
3.48
3.41
2.89
3.08
2.46
Primary TKA
Revision TKA
All TKA
Primary THA
Revision THA
All THA
All Programs
Average HgB Change - Group A
Average HgB Change - Group B
MUSC
Changing What's Possible | MUSC.edu


Percentage of Patients Transfused
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
p = 0.012
p = 0.65
p = 0.008
p = 0.005
p = 0.028
p = 0.016
p = 0.002
7.7%
1.0%
4.5%
7.5%
7.4%
2.1%
25.2%
12.3%
52.6%
37.2%
28.8%
17.8%
16.7%
9.2%
Primary TKA
Revision TKA
All TKA
Primary THA
Revision THA
All THA
All Programs
% Patients Transfused - Group A
% Patients Transfused - Group B
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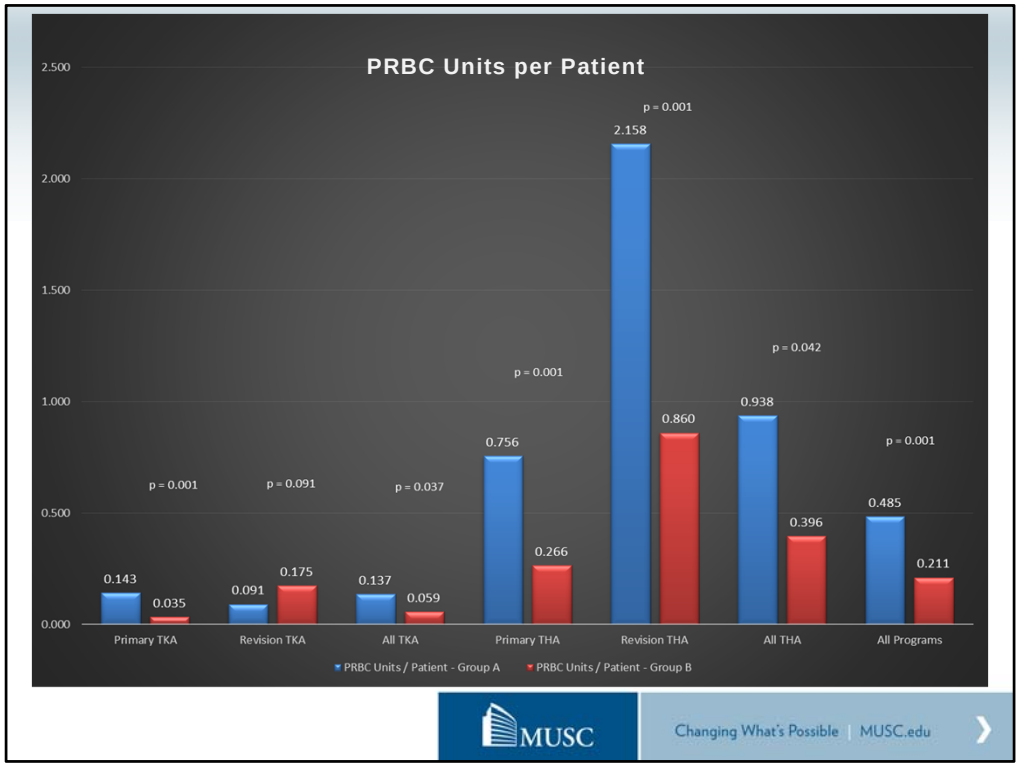
PRBC Units per Patient
2.500
2.000
1.500
1.000
0.500
0.000
p = 0.001
p = 0.091
p = 0.037
p = 0.001
p = 0.001
p = 0.042
p = 0.001
0.143
0.035
0.091
0.175
0.137
0.059
0.756
0.266
2.158
0.860
0.938
0.396
0.485
0.211
Primary TKA
Revision TKA
All TKA
Primary THA
Revision THA
All THA
All Programs
PRBC Units / Patient - Group A
PRBC Units / Patient - Group B
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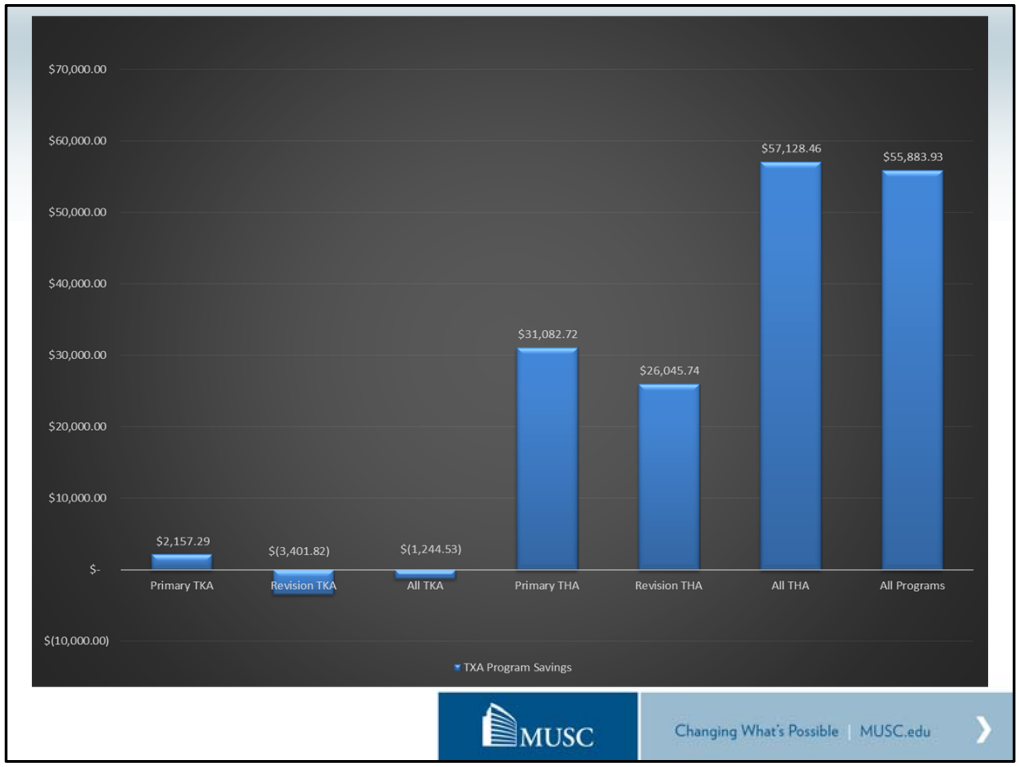
$70,000.00
$60,000.00
$50,000.00
$40,000.00
$30,000.00
$20,000.00
$10,000.00
$-
$(10,000.00)
$2,157.29
$(3,401.82)
$(1,244.53)
$31,082.72
$26,045.74
$57,128.46
$55,883.93
Primary TKA
Revision TKA
All TKA
Primary THA
Revision THA
All THA
All Programs
TXA Program Savings
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TXA Protocol Summary

- A multidisciplinary Process Improvement Project with a standardized approach to using tranexamic acid resulted in greatly increased the use of this blood management strategy.
- This resulted in significantly decreased blood loss and need for transfusion in total joint patients.
- 72% reduction of transfusions in TKA patients
- Largest cost savings in THA patients
- There were no resultant significant increases in complications or readmissions.
- Patients receiving TXA prior to the protocol had a higher complication rate than those receiving TXA after the protocol (16.67% vs. 3.2%; p=0.014).
- Value was created by both increasing Quality and decreasing Costs with a program cost savings of $55,884.
- Creates further opportunities for cost savings (decreased pre-op crossmatching, decreased blood draws, etc).


I want
minimally invasive
joint surgery
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“My friend had an arthroscopic knee replacement and went home the same day.
He only missed one day from work.”

Knee Replacement Surgery

Minimally Invasive Total Knee Replacement Surgery Patients Go Home Same Day

Updated: 1/26/2006 10:04:43 AM

Orthopedic surgeons at Rush University Medical Center found that 96 percent of patients who had minimally invasive total knee replacement surgery were able to go home the same day, without complications-many walking out unassisted or with a cane. These results were published in the October issue of the Journal of Arthroplasty.

Lead author surgeon Dr. Richard A. Berger says it's not just the surgeon's skills and techniques that help patients avoid a hospital stay.

"It's a comprehensive management approach that helps the patient avoid an overnight stay. It's optimal sequencing and timing of interventions by the nursing, physical therapy, anesthesia surgical team; it's a team approach of equally weighted preoperative, intraoperative, and postoperative care."

The MIS Quad-Sparing total knee procedure is performed through one small three- to four-inch incision instead of a large, eight- to 12-inch incision. This approach has the potential for dramatically reducing pain by sparing muscles and tendons that historically have been cut during standard TKA surgery. "Using new tools and minimally invasive surgical techniques, we avoid cutting through the quadriceps tendon and muscles and replace the damaged knee through a three- to four-inch incision, rather than the standard eight- to 12-inch incision down the front of the knee," says Berger.

First, the patients meet with the surgeon to evaluate whether the patient would be appropriate for the minimally invasive knee replacement. Next, patients who will receive a minimally invasive knee replacement meet with the physical therapist and nurse prior to surgery. "They attend a class led by with a nurse where potential surgical complications and postoperative care are discussed. Patients spend an hour learning about the surgery, asking questions about pain, recovery and surgery. We reassure patients that their pain will be controlled, that they will be carefully monitored for the occurrence of complications or delayed recovery due to early discharge, and explain how will be able to move around independently after surgery."

After class with the nurse, patients have a physical therapy session for instruction in gait training with crutches and a cane. An internist also evaluates the patients. Lastly, the hospital discharge planner calls the patient at home before surgery to make sure arrangements have been made to have someone take the patient home after surgery."

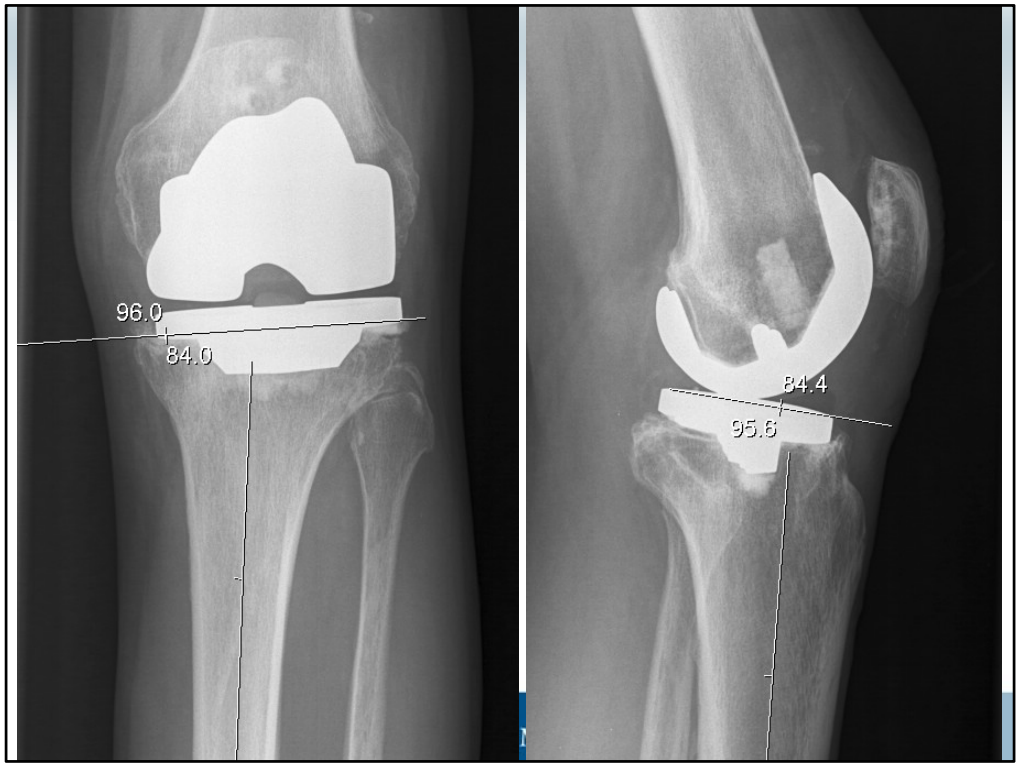
The 50 study patients (20 female, 30 males) in the study had surgery between August 2003 and August 2004. The average age was 68 years old, average weight of 203 lbs. with a body mass index of 29.2. Forty-eight of the patients had osteoarthritis. Each patient was the first surgical case of the day.

Additional Articles

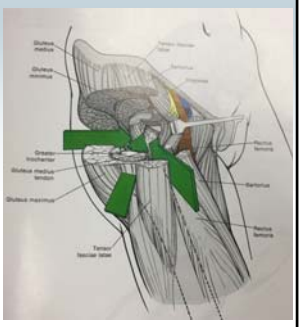
"outpatient total knee replacement through arthroscopy was safe with no short-term readmission or complications related to early discharge. New clinical guidelines, including improvements in anesthetic techniques, postoperative pain management, and rehabilitation protocols, will make performing outpatient total knee arthroscopy a realistic goal."

Minimally Invasive Surgery

- A smaller skin incision does not mean the surgery is less invasive.
- Benefits mostly cosmetic.
- Possibly a slightly decreased recovery time.
- Higher risk of complications for some techniques.
- Do the operation, using proven techniques, through the smallest possible incision that allows proper placement of the implants and the best long term outcome.


96.0
84.0
84.4
95.6

Hip Approaches



- Posterolateral
  - Common, well-known, good femoral exposure
  - Highest dislocation rate (posterior)
- Direct lateral (transgluteal)
  - Lowest dislocation rate, good acetabular exposure
  - Highest rate of abductor dysfunction
- Direct anterior
  - Internervous plane (Sartorius and Tensor), marketable, Good acetabular exposure.
  - Difficult femoral exposure, long learning curve, specialized table / flouro, complications

Post Operative Management

Optimal Length of Stay
Pain Management
DVT Prevention
Physical Therapy
Expectation Management

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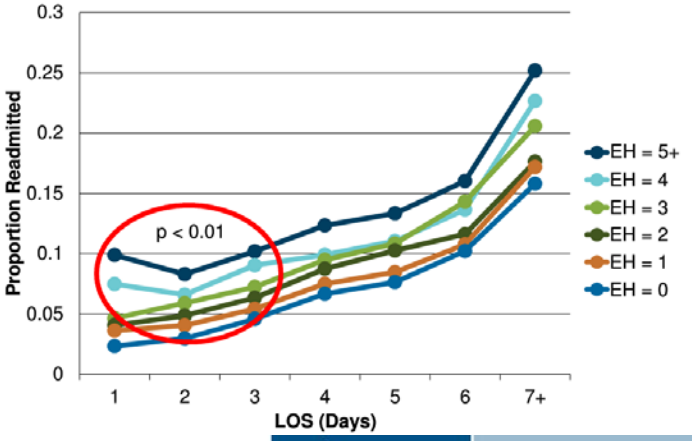
Medical University of South Carolina

Optimal Length of Stay Following Total Joint Arthroplasty to Reduce Readmission Rates

Patricia A. Kirkland[1], William R. Barfield[1], Harry A. Demos[1], Vincent D. Pellegrini, Jr.[1], Jacob M. Drew[2]
[1]Department of Orthopaedics, Medical University of South Carolina
[2]Department of Orthopedic Surgery, Beth Israel Deaconess Medical Center, Harvard Medical School

Figure 2. Chance of Readmission for Specific EH and LOS



Home, Not “Rehab”

Subacute rehab associated with

- Higher costs
- Lower patient satisfaction
- Decreased mobilization
- Slower recovery
- Higher readmission and complication rates
- Worse Patient Reported Outcomes

Reserved for patients with no support system who do not meet PT goals for functional independence

Make sure they understand that it is a “nursing home”.

Pain Management

Spinal Anesthesia
Regional Nerve Blocks
- Adductor canal for TKA
- Lumbar plexus for THA

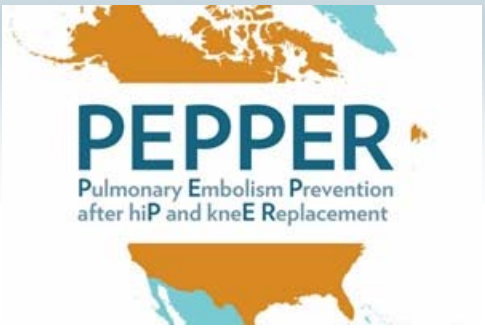
Cryotherapy
Multi-modal pain management
- NSAIDS (Celecoxib) 400mg in holding, 200mg BID (except CRI)
- Acetaminophen 650mg QID (except liver disease)
- Gabapentin 300mg TID (start in holding) if < 80 years old
- Oxycodone / Hydrocodone / Tramadol PRN
- Rarely use IV Opioids

Local blocks
- Bupivacane, Epinephrine, Clonidine, Morphine, Ketorolac, Cortocosteroids

Opioid reduction (Rx #30-40) Most are finished or on Tramadol by 2 weeks

DVT Prevention

Historical DVT rate 40-50% with 3-6% Fatal PE
Symptomatic DVT: 0.5% of THA, 1% TKA
Symptomatic PE: 0.14% of THA, 0.27% of TKA
Mostly after discharge
Prophylaxis is Standard of Care
- Mechanical (SCD, Foot Pumps)
  - Compliance dependent
- Warfarin – Anti Vitamin K (Factors II, VII, IX, X)
- Aspirin – Anti-platelet, anti-inflammatory
- Heparinoids (LMWH) – Anti-III Binding
- Anti Xa (Rivaroxaban), Anti IIa (Dabigatran)



PE Prevention after hiP and kneE Replacement

PCORI Multicenter Clinical Trial of 25,000 patients at 25 centers

Aspirin / Warfarin / Rivaroxaban for 28 days

Clinical endpoint: Mortality, VTE, bleeding, reoperation, functional outcomes

No differences so far….

Mortality 16/7000 (0.23%)

PT Protocols

Same day ambulation
Bed exercises
Independent OOB and ambulation, stairs prior to D/C
WBAT with walker → cane by 2 weeks
Limited home PT
Transition to outpatient PT ASAP (TKA)
Limited hip precautions (THA)
- Pillow between legs
- No extremes of rotation
- No abduction against gravity

Expectation Management

“My left joint replacement will be exactly like my right joint replacement (or vise versa)”

ORYGINAL | LEFT SYMMETRY | RIGHT SYMMETRY

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"A knee replacement will make my knee normal again"

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Residual Pain after TKA

- 75-80% of patients are satisfied or very satisfied with their TKA
- Very few report that their knee is “normal”
  - Unlike THA patients
- Residual pain, stiffness, swelling are most common complaints
- Some report “stiffness”, despite excellent ROM
- Expectation management is critical

“It doesn’t matter where I have my surgery”

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Joint Replacement Program

Restoring the Motion of Life

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Total Joint Program

Dedicated team – Surgeons, Anesthesiologists, PA / NPs, Nurses, Therapists, Case workers, Hospitalists, Managers, Administrators, etc.

Joint class / workup process

Standardization of orders and processes

Pain management - multimodal


"I will never be able
to do the things
I like if I have a
joint replacement"
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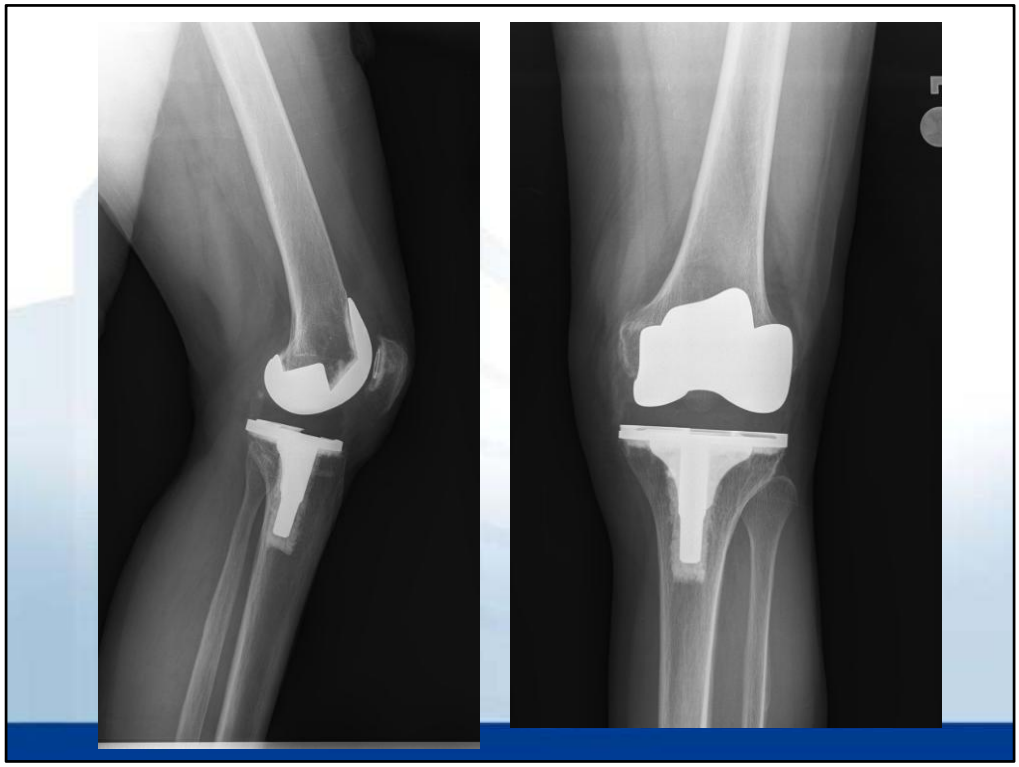

Summary

What matters most

- Patient motivation
- Surgeon experience
- Implants and bearings
- Hospital volume
- Pain management
- Appropriate prevention and management of complications

What matters less

- Patient age
- Consumer advertising
- Computer navigation and robotics
- Smaller incisions
- Rapid discharge (?)