Hip and Knee Arthroplasty: Every Detail Makes a Difference

Harry A. Demos, MD
Department of Orthopaedics and Rehabilitation

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

Goals and Objectives

At the conclusion of the session participants should be able to:

- Discuss appropriate perioperative care in THA/TKA, including DVT prophylaxis and infection prophylaxis
- Describe implant bearing surfaces and the longevity of total joints
- Review THA/TKA post-op protocols, including pain management and physical therapy

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“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.

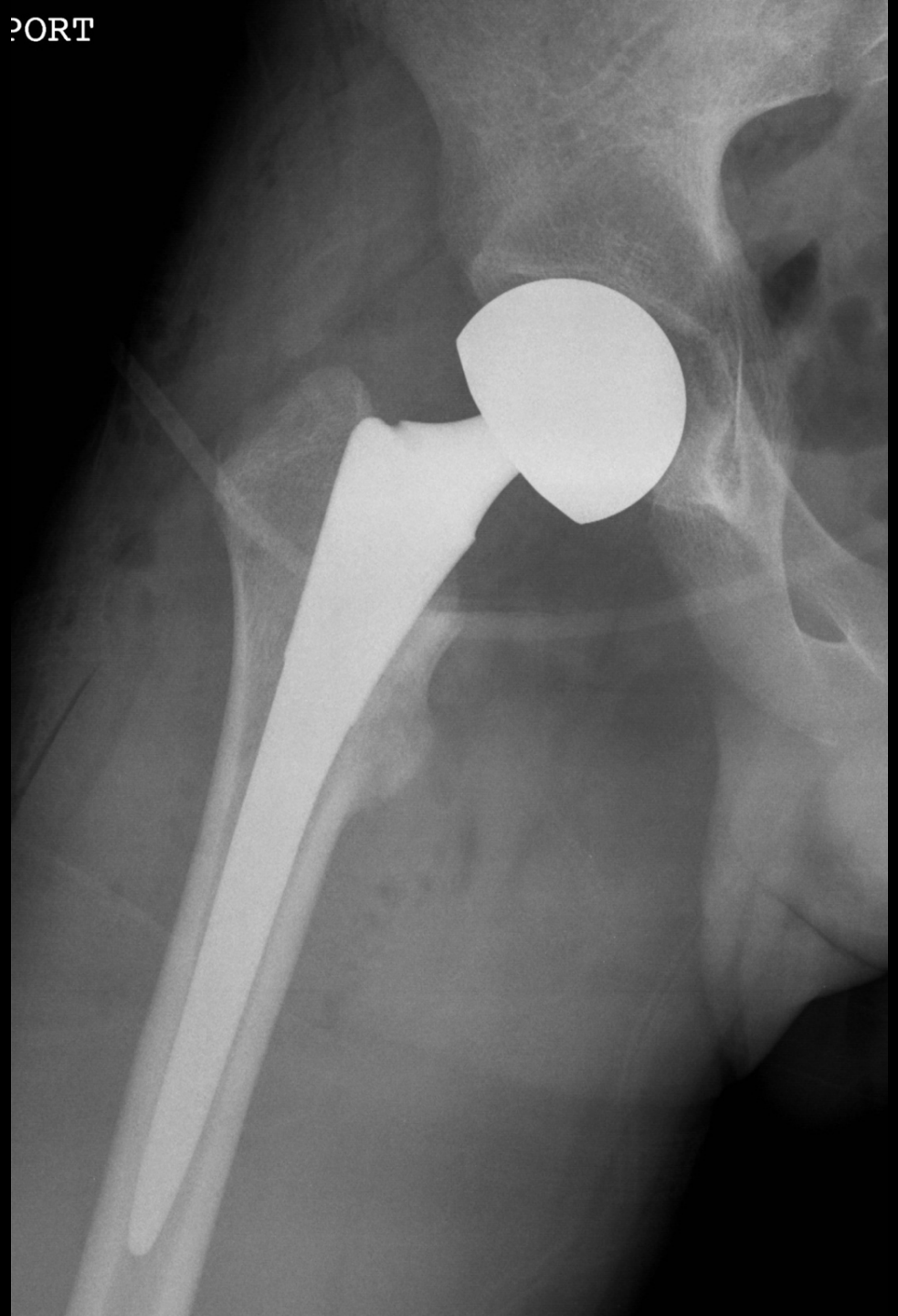
How would you advise him?

- 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

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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

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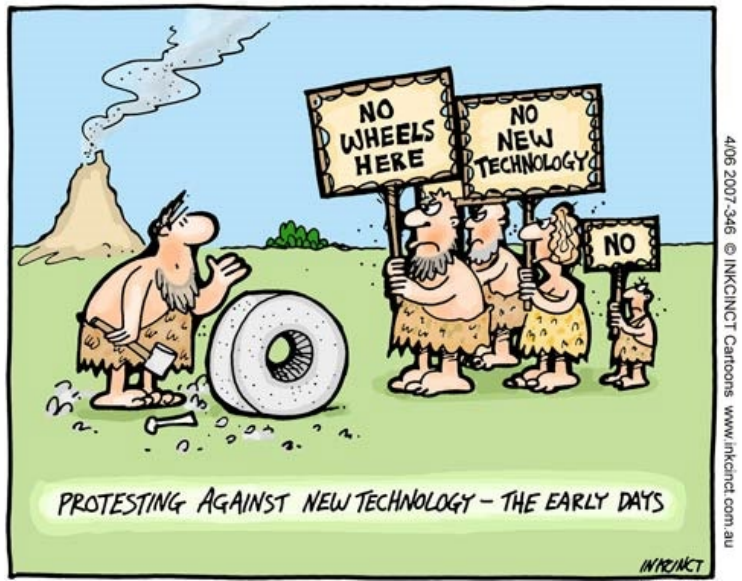
“I want the newest technology for my joint replacement”



Computer Assisted Surgery / Robotics

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Computer Assisted Surgery / Robotics

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Computer Assisted Surgery / Robotics

- Available from most manufacturers
- Image based and imageless systems available
- Allow planning based on mechanical axis (Hip, knee, and ankle center)
- Allows more accurate kinematic balancing
- Avoids canal instrumentation
- Allows sizing, balancing, alignment, and planning prior to making first bone cut
- High degree of accuracy
- Usually adds time
- Not smaller skin incision

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.”

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“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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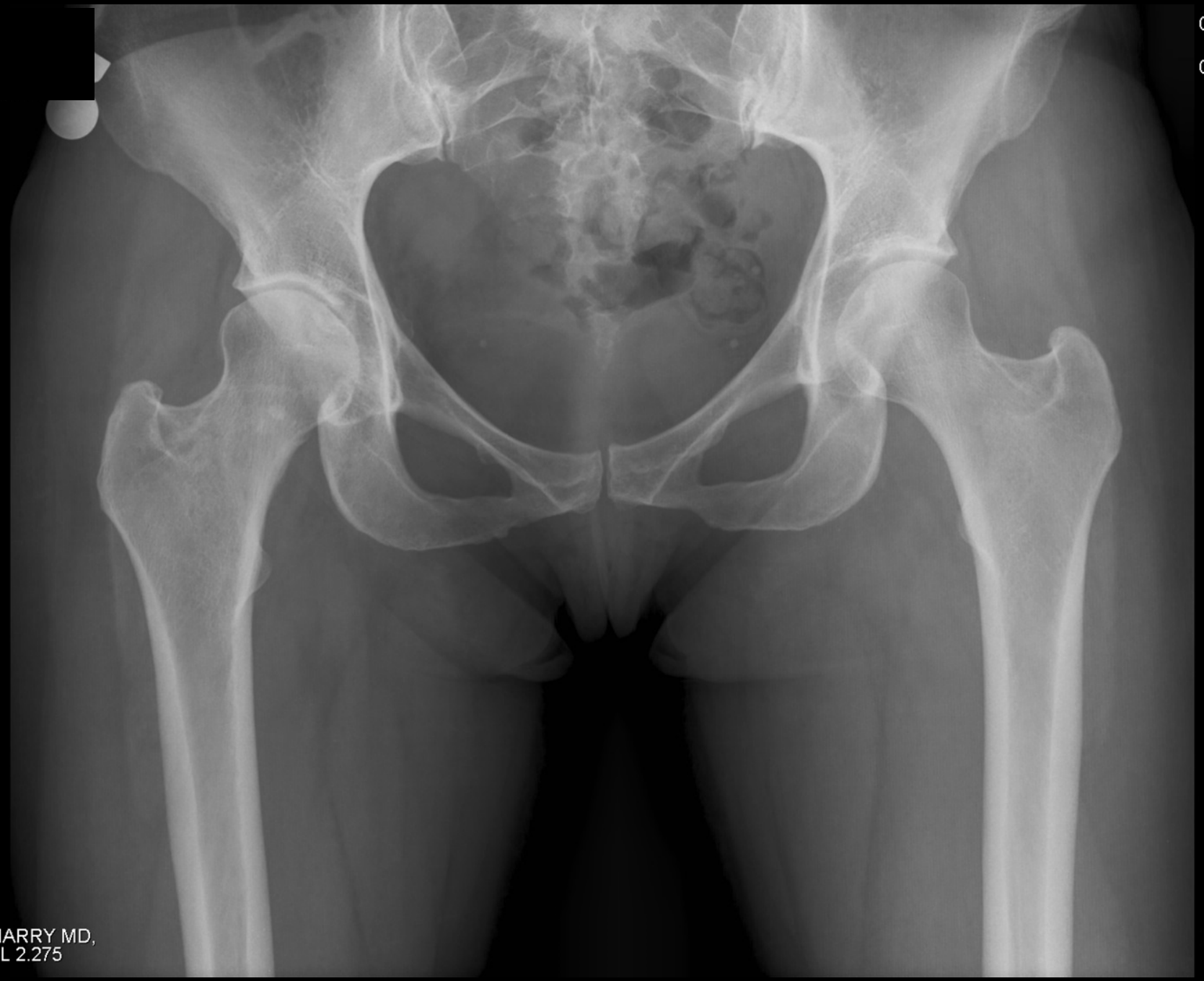
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DEMOS,HARRY MD,
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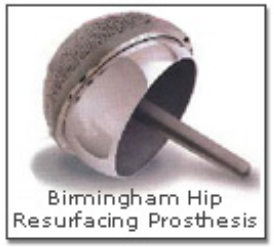
“I want a metal on metal Birmingham Hip Resurfacing procedure and I’ve decided to go to India to have it done.”

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

Birmingham Hip Resurfacing operation in India


Birmingham Hip Resurfacing Prosthesis

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....

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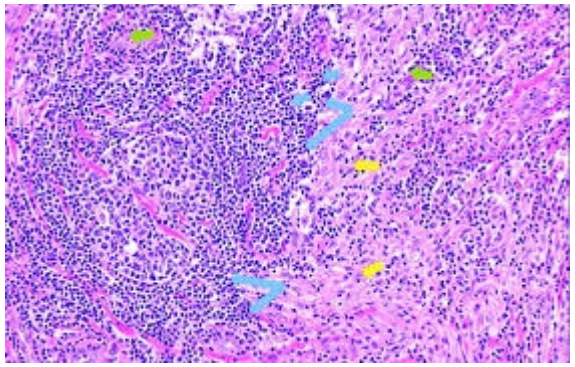
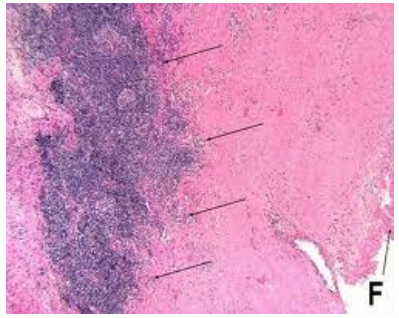
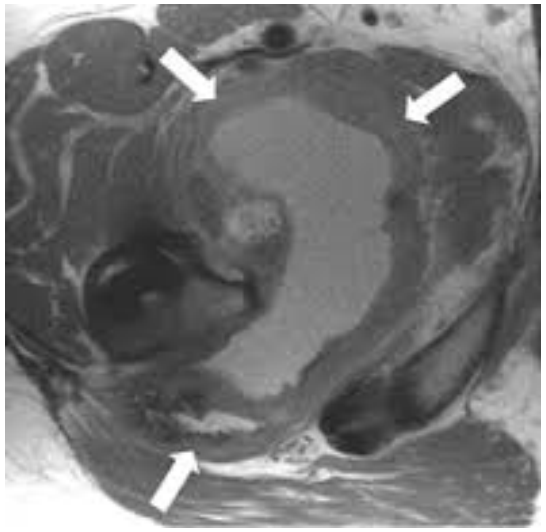
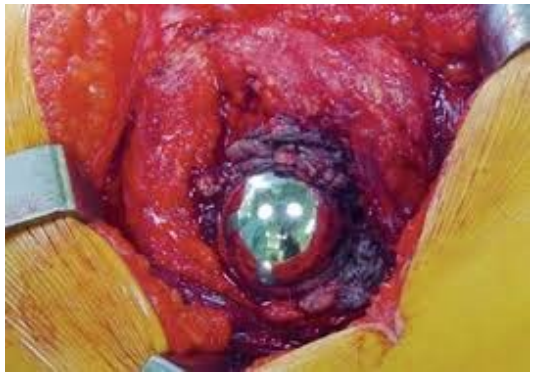
ALTR / ALVAL









The New York Times

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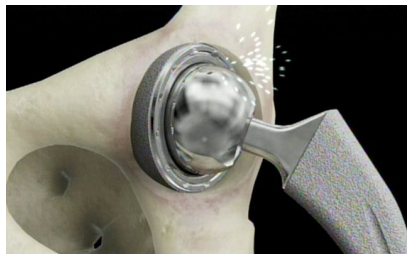
With Warning, a Hip Device Is Withdrawn

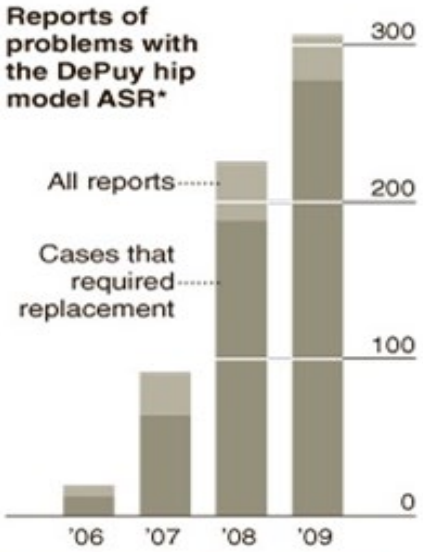
By BARRY MEIER
Published: March 9, 2010

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

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Cobalt intoxication diagnosed with the help of Dr House

Kirsten Dahms, Yulia Sharkova, Peter Heitland, Sabine Pankuweit, Juergen R Schaefer

Lancet 2014; 383: 574

Philipps-University Marburg, University Clinic Marburg, Internal Medicine—Cardiology and Center for Undiagnosed Diseases, Marburg, Germany (K Dahms, Y Sharkova MD, Prof S Pankuweit PhD, Prof J R Schaefer MD); and Medizinisches Labor Bremen, Bremen, Germany (P Heitland PhD)

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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 metal-on-polyethylene prosthesis (head Zimmer CoCrMo Proasul, metal [Zimmer, Winterthur, Switzerland]; inlay Aesculap NH 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 NH 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)[1]—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 metal debris at the left-sided hip. The measurement of cobalt and chromium in the blood showed severe increase of these metals. 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 metal head of the hip replacement was severely damaged (figure). Shortly after the hip replacement, 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 metal 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 steel work-related exposure to cobalt.[2,3] The stability of cobalt in combination with chromium and molybdenum (usually Co 70%, Cr 25%, Mo 5%) made this metal an excellent and stable compound in hip prosthetics. Numerous studies have investigated metal exposure due to metal hip arthroplasties.[4] However, in certain situations—false placement, technical problems in metal-on-metal prosthesis, and strikingly often after an off-label replacement of broken ceramic hips by metal parts—cobalt exposure to the patient from a hip prosthesis occurs. This cobalt intoxication is an increasingly recognised and life-threatening problem.[5]

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

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

References

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Arthroplasty Today 3 (2017) 151–153

Contents lists available at ScienceDirect

Arthroplasty Today

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

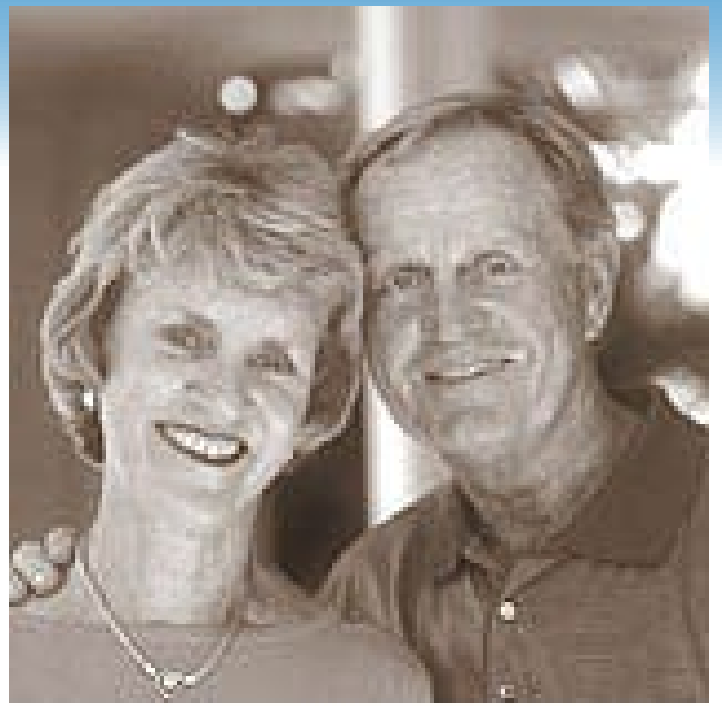
Case report

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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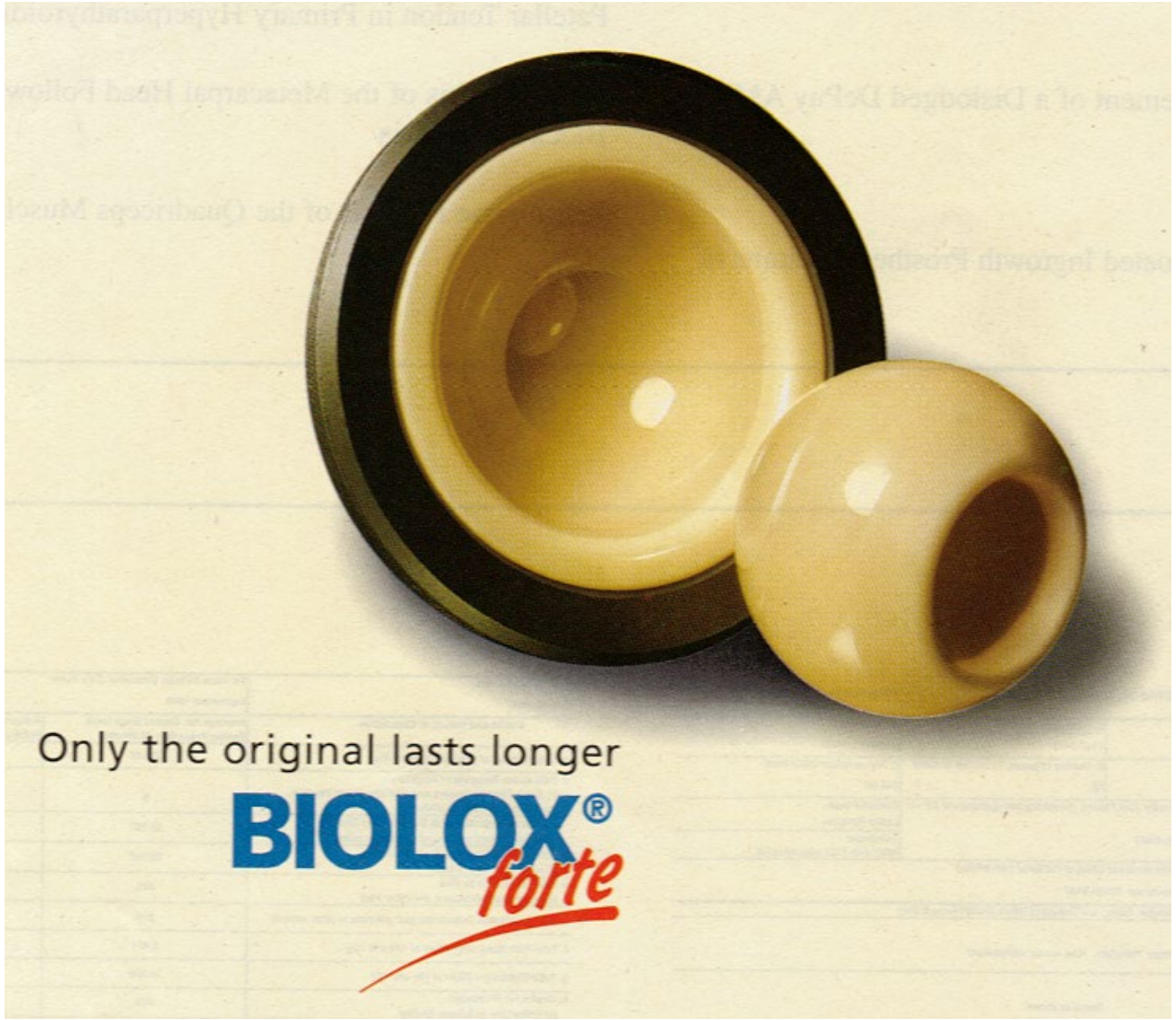
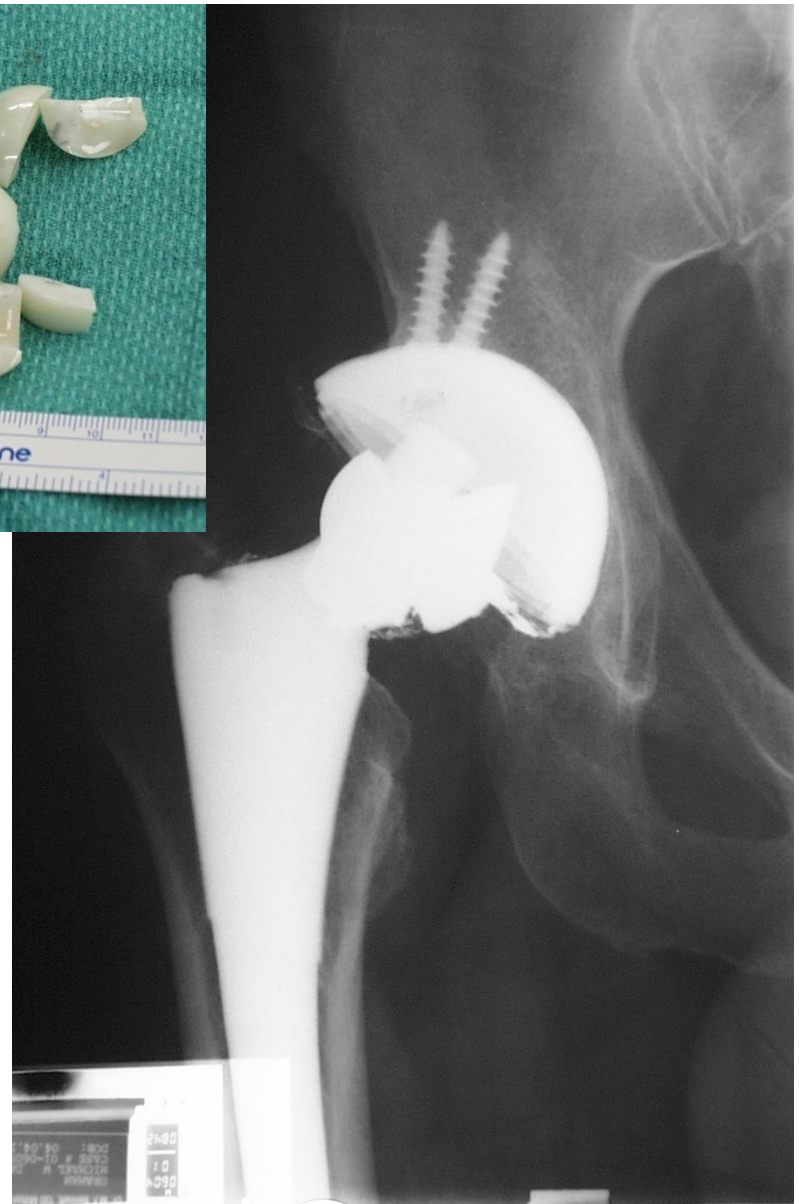
Ceramics



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%)



“Joint replacements wear out after 10 years”

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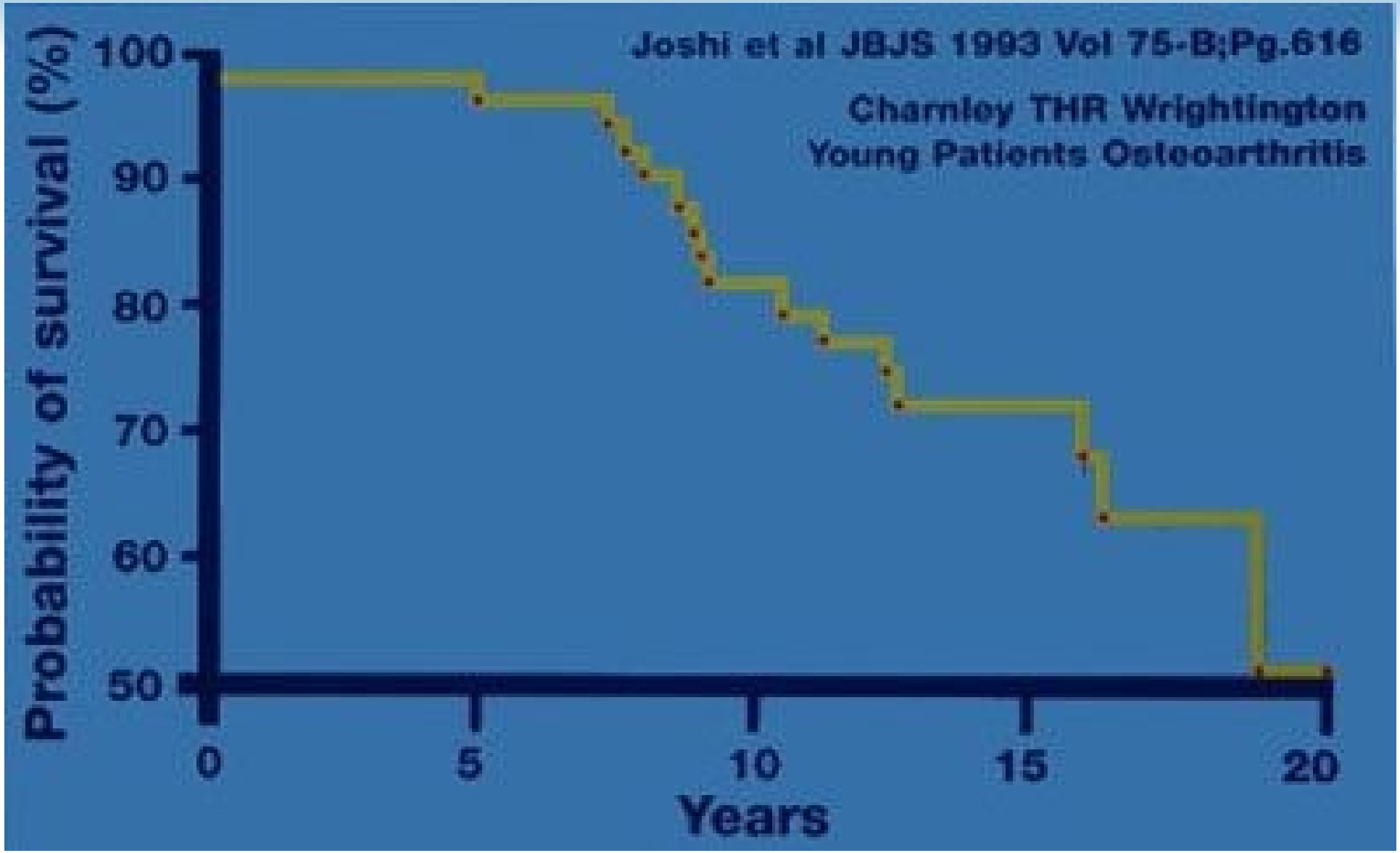

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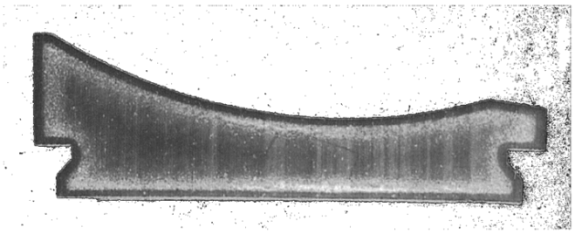

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The Problem with Poly

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

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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

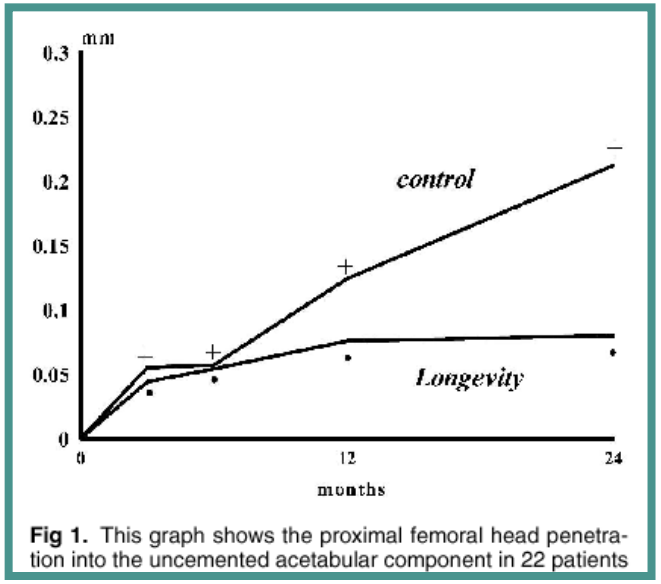

Fig 1. This graph shows the proximal femoral head penetration into the uncemented acetabular component in 22 patients

Durasul

Longevity

1 yr – 0.08 vs 0.08 mm

>1yr- 0.12 vs 0.21 mm

p<0.005

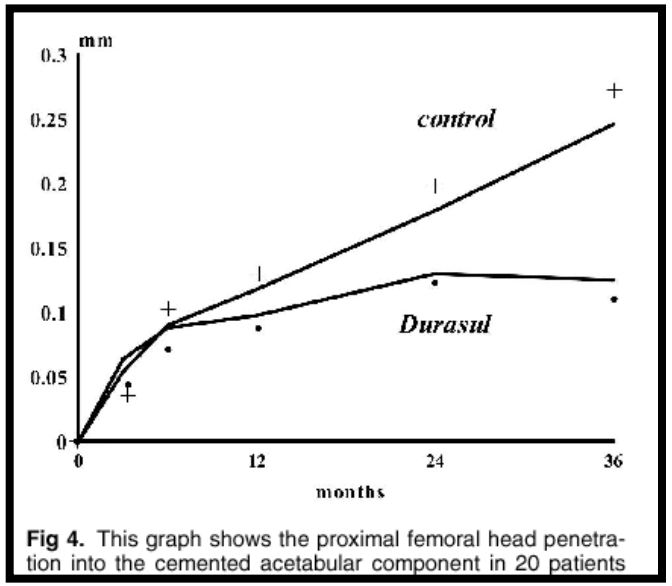

Fig 4. This graph shows the proximal femoral head penetration into the cemented acetabular component in 20 patients

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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

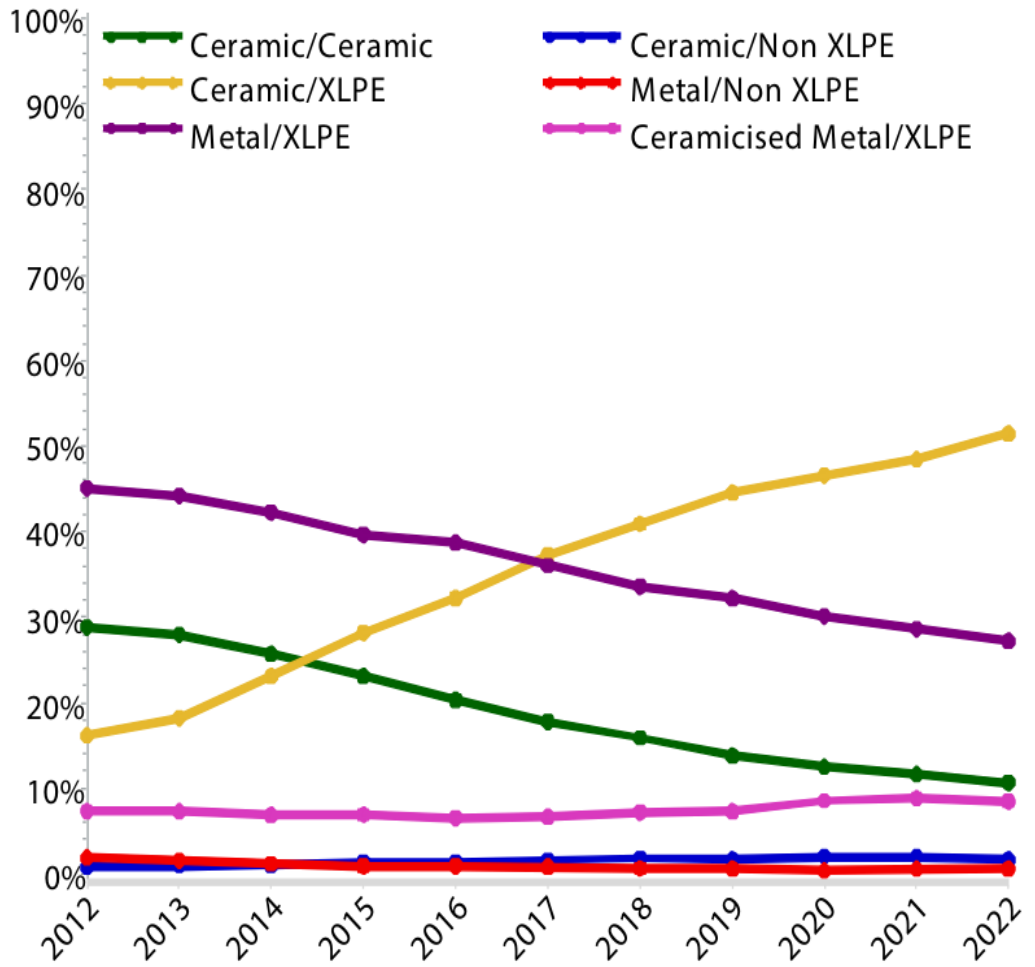
0.031 mm linear wear per year for XLPE versus 0.141 mm for conventional (78% reduction)

No osteolysis in XLPE versus 50% in conventional

No mechanical failure

Australian Registry 2023 Report

Figure HT31 Proportion of Primary Total Conventional Hip Replacement by Bearing Surface (Primary Diagnosis OA)



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How long does a knee replacement last? A systematic review and meta-analysis of case series and national registry reports with more than 15 years of follow-up

Jonathan T Evans, Robert W Walker, Jonathan P Evans, Ashley W Blom, Adrian Sayers, Michael R Whitehouse**

Lancet. 2019 Feb 16; 393(10172): 655–663

- Articles reporting 15 year or greater survival of primary total knee replacement (TKR), unicondylar knee replacement (UKR), and patellofemoral replacements in patients with osteoarthritis were included
  - 33 case series in 30 eligible articles, which reported all-cause survival for 6490 TKRs (26 case series) and 742 UKRs (seven case series)
- Reviewed national joint replacement registry reports and extracted the data to be analysed separately
- Registries contributed 299 291 TKRs (47 series) and 7714 UKRs (five series)
  - The pooled registry 25 year survival of TKRs (14 registries) was 82·3% (95% CI 81·3–83·2) and of UKRs (four registries) was 69·8% (67·6–72·1)
- “Our pooled registry data, which we believe to be more accurate than the case series data, shows that approximately 82% of TKRs last 25 years and 70% of UKRs last 25 years. These findings will be of use to patients and health-care providers; further information is required to predict exactly how long specific knee replacements will last.”

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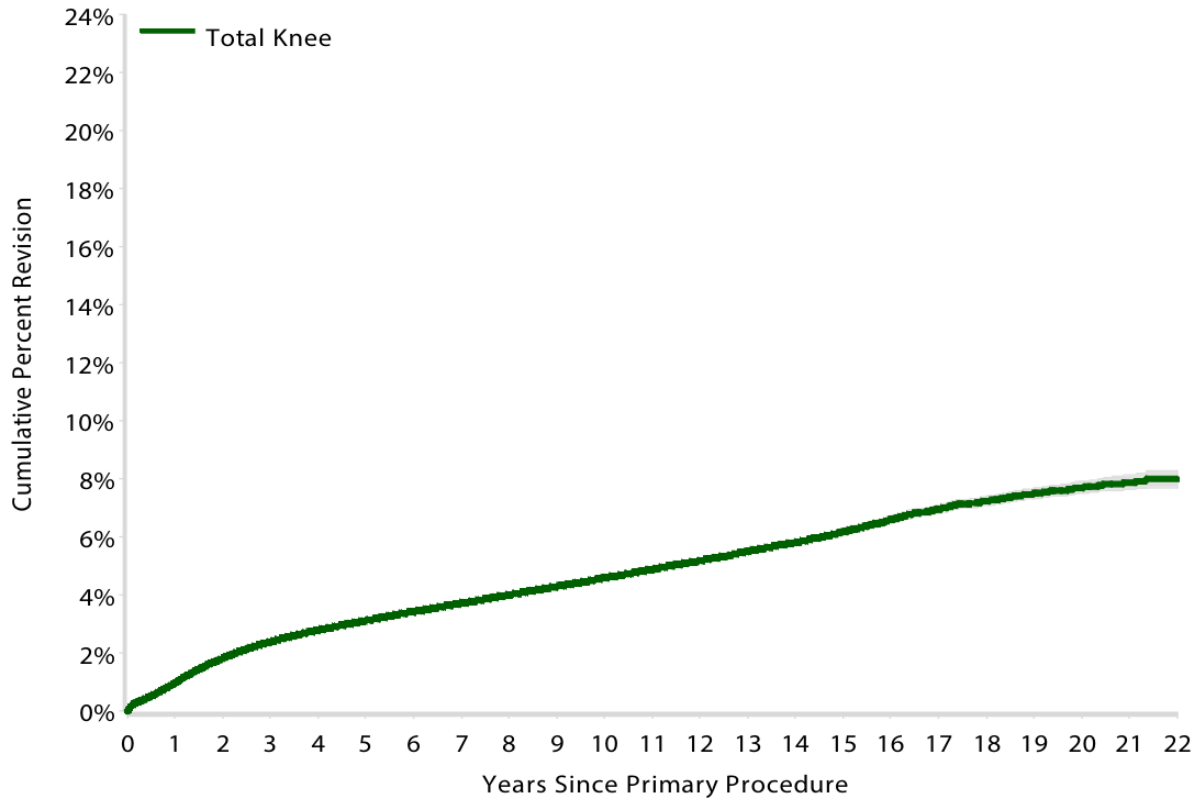
Australian Registry 2023 Report

Figure KT7 Cumulative Percent Revision of Primary Total Knee Replacement (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	15 Yrs	20 Yrs
Total Knee	741847	675256	544838	421804	176167	46509	5258

Note: Restricted to modern prostheses

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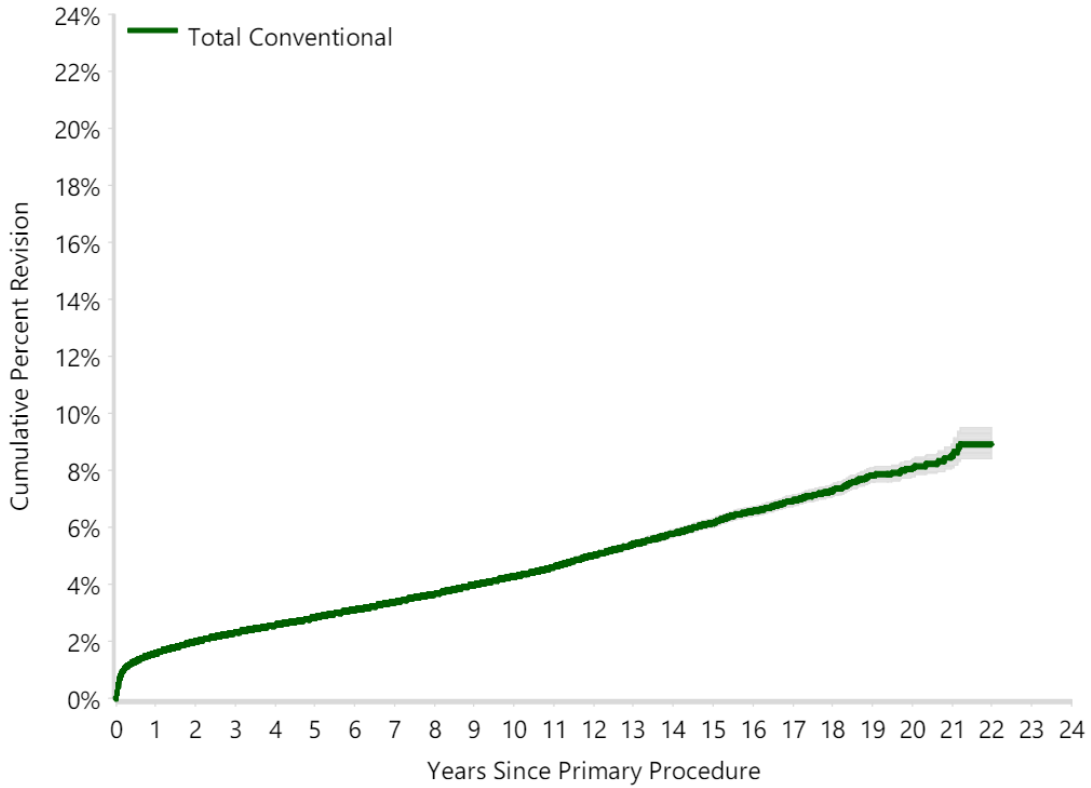
Australian Registry 2023 Report

Figure HT5 Cumulative Percent Revision of Primary Total Conventional Hip Replacement (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	15 Yrs	20 Yrs
Total Conventional	432674	386337	306450	231396	92710	26702	3298

Note: Restricted to modern prostheses
All procedures using metal/metal prostheses have been excluded

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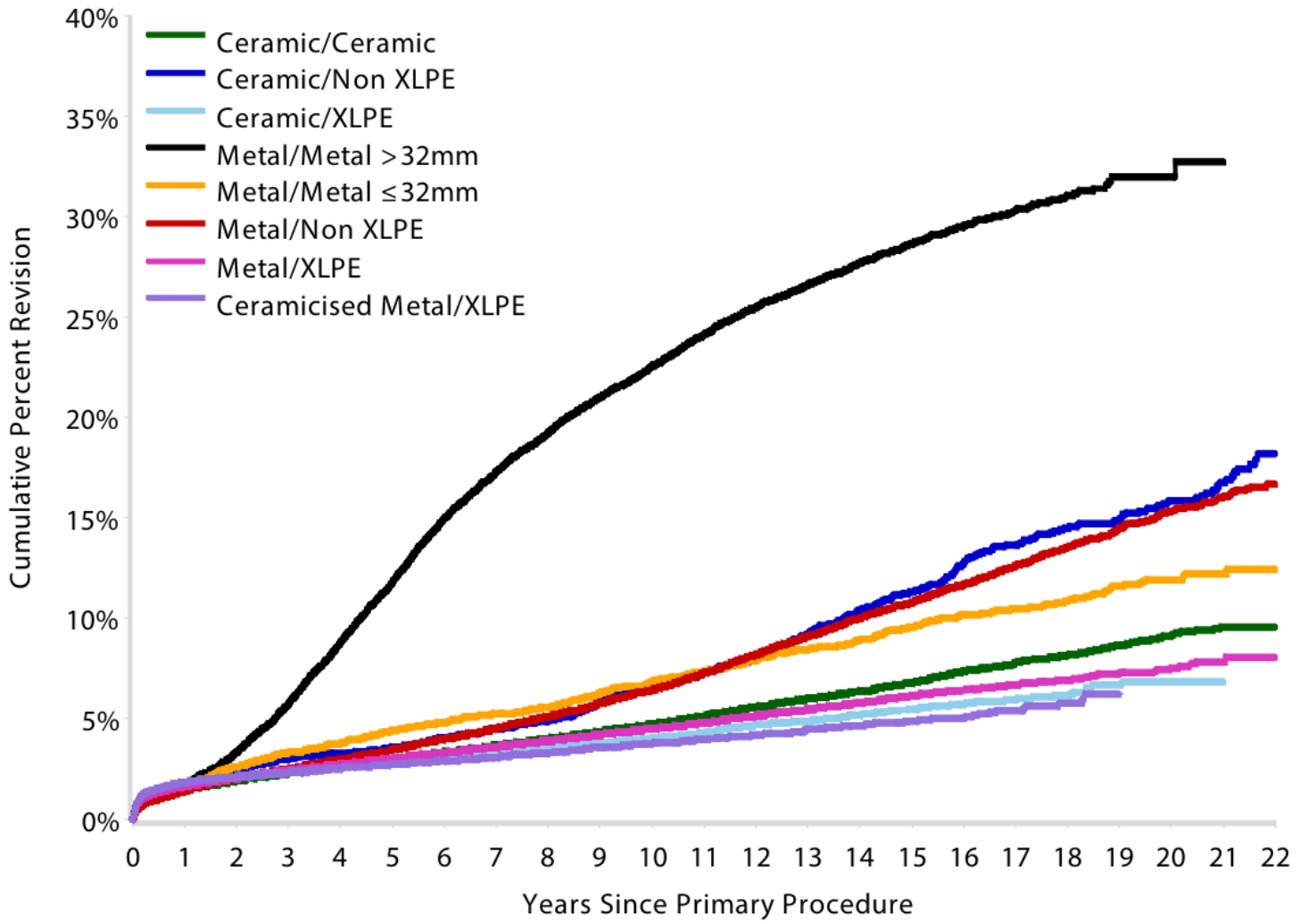
Australian Registry 2023 Report

Figure HT32 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Bearing Surface (Primary Diagnosis OA)



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MUSC Experience

- Over the past 20+ years, >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

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Joint Commission Health Care Organization

Organization ID: 6584-Medical University of South Carolina Medical Center 169 Ashley Avenue Charleston, SC 29425

Certification Activity- 60-day Evidence of Standards Compliance

DSC-Advanced Total Hip and Knee Replacement DSSE.01 EP 1
Likelihood: Low Scope: WideSpread

Standard Text: The program involves patients in making decisions about managing their disease or condition.

EP Text: The program involves patients in decisions about their care, treatment, and services.

Finding(s): 1) Observed in Record Review at MUSC Medical Center - Main University Hospital (169 Ashley Avenue, Charleston, SC) site .
The program did not involve patients in decisions about their care, treatment, and services as seen in chart review in which there was no discussion of the implant rationale and alternatives. The importance of involving the patient in the decision making process was discussed with the program coordinator and they voiced understanding.

Assigning Accountability
The Medical Director Joint Replacement is ultimately responsible for all corrective actions and ongoing compliance associated with this element of performance.

Correcting Non - Compliance
Q. All corrective actions identified below must be completed prior to submission
Documentation of discussion between surgeon and patient that includes type of procedure, cemented vs. non-cemented, and bearing surface will be incorporated into the surgeon's note at the time that surgery is discussed.

Q. All corrctive actions described above were completed by Jun 01, 2023

Ensuring Sustained Compliance
Q. Describe how the organization will identify issues of non-compliance in a timely manner and monitor/audit the effectiveness of the corrective action put in place to ensure it is working and sustained. Example: auditing medical records, conducting observations, coding changes in systems, etc.
Will perform 10 audits per QAPI bi-monthly to determine compliance with documentation of surgeon's note.

Q. Indicate how often the auditing/monitoring will occur (e.g. daily, weekly, monthly).

Note:

- To ensure sustained compliance, monitoring should be ongoing periodically and not stop after a period of time.
- We encourage organizations to be aggressive in setting 100% compliance goals and monitoring to achieve 100% compliance.

Bi-monthly to achieve 100% compliance


724

Pre-op (Holding)

- Nursing check in
  - Review consent, confirm site
  - SCD for non-operative leg
  - Chlorhexidine wipes
  - Clip surgical site
  - Betadine to surgical site
  - IV and initiate Vancomycin, if needed
  - Blood, meds, other orders
  - Empty bladder before going to OR
- Anesthesia team
  - Review consent
  - Discuss anesthesia plan
  - Peripheral nerve blocks
  - Confirm Vanco, if needed
- Surgical team
  - Review consent
  - Mark surgical site
  - Discuss surgery and answer questions
  - Discuss discharge plan
  - Confirm all of above as being done

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.

OR Order of Operations

- No sterile equipment opened prior to patient arrival
- Circulator writes Name, MRN, DOB, Procedure, Antibiotic timing on White Board
- Patient brought to OR by anesthesia team
  - Hair covering, masks for all personnel. Shirts tucked, Boots (?)
  - No outside jackets
- Transfer to OR table
  - Stretcher and all linens out of room
- Administration of anesthetic
  - Surgical team reviews radiographs, templates, history, equipment
- Position bed, establish barrier between anesthesia and surgical site (sheet) before opening any equipment
- Scrub and circulator / facilitator begin opening equipment
- Surgical team (MDs, PAs) prepares patient
  - Positioning, lights, leg suspension, tourniquet, Blue U drape, Pre-prep
- Antibiotics during pre-prep

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OR Order of Operations

- Time out
  - Circulator reviews consent
  - Introductions
  - Surgeon discusses case
    - Surgical plan, time, EBL, needed equipment and blood products, specimens, drains, recovery / discharge plan, anything unusual
  - Anesthesia concerns
  - Scrub tech concerns
- Surgical team scrubs while OR nurses continue opening equipment
- Sterile gloves for prep (no gowns for person applying prep)
- Hoods – fan off until gloves on
- Down and top sheets, stockinette, drape, impervious skin covering, change gloves, mark, suction/cautery/pulse lavage.
- No forced air warmers until all drapes on
- Operate!
- Change gloves every hour and before implants
- No change of personnel unless absolutely necessary
- Chlorhexidine irrigation and saline pulse lavage
- Chlorhexidine prep at final skin closure
- Impervious dressing

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

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Prophylactic Antibiotics - 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[82]

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

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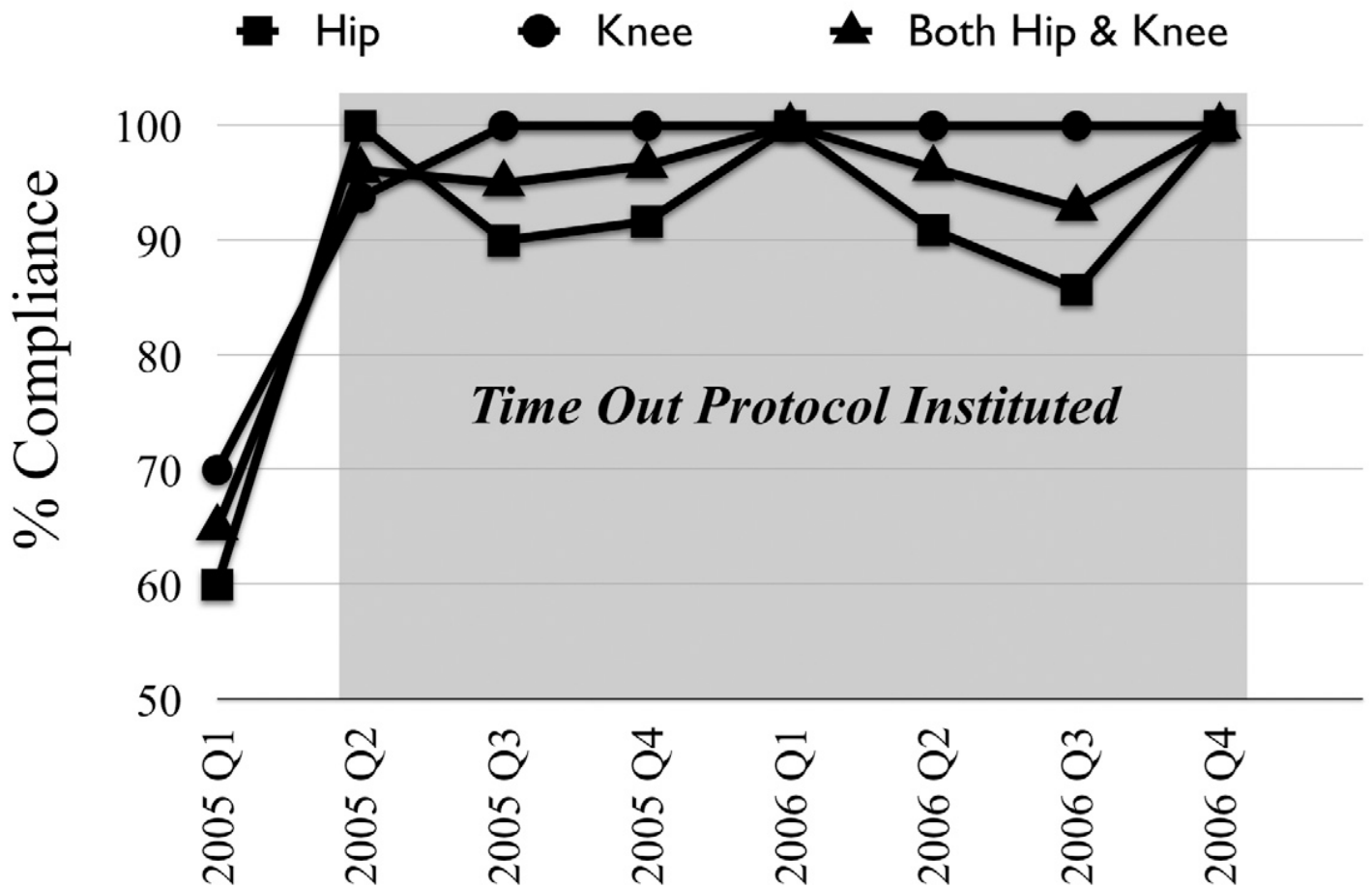
Ensuring Appropriate Timing of Antimicrobial Prophylaxis

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



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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
- 5 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

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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).

The NEW ENGLAND JOURNAL of MEDICINE

Trial of Vancomycin and Cefazolin as Surgical Prophylaxis in Arthroplasty

Trisha N. Peel, M.B., B.S., Ph.D., Sarah Astbury, B.Nurs., Allen C. Cheng, M.B., B.S., M.Biostat., Ph.D., David L. Paterson, M.B., B.S., Ph.D., Kirsty L. Buising, M.B., B.S., M.D., Tim Spelman, M.B., B.S., Ph.D., An Tran-Duy, Ph.D., Sam Adie, M.B., B.S., M.P.H., Ph.D., Glenn Boyce, M.B., B.S., Catherine McDougall, M.B., B.S., Robert Molnar, M.B., B.S., Jonathan Mulford, M.B., B.S., Peter Rehfisch, M.B., B.S., Michael Solomon, M.B., Ch.B., Ross Crawford, M.B., B.S., D.Phil., Tiffany Harris-Brown, R.N., M.P.H., Janine Roney, M.P.H., B.H.Sc., R.N., Jessica Wisniewski, Ph.D., Richard de Steiger, M.B., B.S., Ph.D., for the ASAP Trial Group

N Engl J Med: Volume 389(16):1488-1498 October 19, 2023

- Double-blind, randomized trial, vancomycin was added to cefazolin as surgical prophylaxis for arthroplasty
- Surgical-site infections occurred in 4.5% of vancomycin recipients and 3.5% of placebo recipients

“The addition of vancomycin to cefazolin prophylaxis was not superior to placebo for the prevention of surgical-site infections in arthroplasty among patients without known MRSA colonization.”

Clin Orthop Relat Res (2017) 475:1767–1774
DOI 10.1007/s11999-017-5302-0

Clinical Orthopaedics and Related Research®
A Publication of The Association of Bone and Joint Surgeons®

CrossMark

SYMPOSIUM: 2016 MUSCULOSKELETAL INFECTION SOCIETY PROCEEDINGS

Vancomycin Prophylaxis for Total Joint Arthroplasty: Incorrectly Dosed and Has a Higher Rate of Periprosthetic Infection Than Cefazolin

Michael M. Kheir MD, Timothy L. Tan MD, Ibrahim Azboy MD, Dean D. Tan BS, Javad Parvizi MD, FRCS

"The majority of patients given vancomycin prophylaxis are underdosed according to the weight-based dosage recommendations, and MRSA did not occur in patients who were adequately dosed with vancomycin.

Surgeons should thus ensure that their patients are adequately dosed with vancomycin using the recommendation of 15 mg/kg and that the dose of vancomycin is administered in a timely fashion. Furthermore, and based on the findings of this study, we have moved toward limiting the

utilization of vancomycin prophylaxis for patients undergoing elective arthroplasty at our institution."

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Bains *et al. Arthroplasty* (2024) 6:20
https://doi.org/10.1186/s42836-023-00222-2

Arthroplasty

RESEARCH Open Access

Addition of vancomycin to cefazolin is often unnecessary for preoperative antibiotic prophylaxis during total joint arthroplasties

Sandeep S. Bains[1], Jeremy A. Dubin[1], Daniel Hameed[1], Zhongming Chen[1], Mallory C. Moore[1], Ashesh Shrestha[1], James Nace[1] and Ronald E. Delanois[1*]

2,907 patients (1,437 receiving both cefazolin and vancomycin and 1,470 given cefazolin only)

There was no signifcant diference in the rates of SSI (P=0.089) and PJI (P=0.279) between the groups at one year after operation

VC cohort did have a greater reduction of MRSA in the previously nasal swab-screened subset of patients.

“Adjunctive vancomycin therapy offers increased protection against MRSA in previously screened individuals. However, those negative for MRSA screening do not require vancomycin and have similar protection to infection compared to recipients of cefazolin only in a high-powered single institution analysis in an MRSA endemic area”

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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

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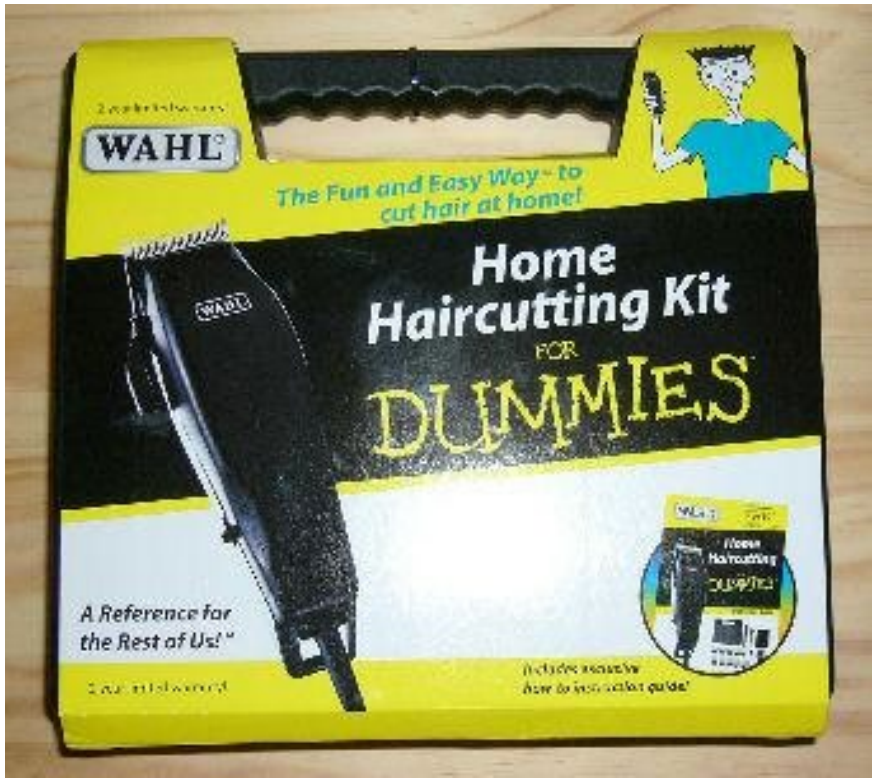
Surgical Issues – Hair Removal

- 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.



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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.

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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.

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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

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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)

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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.”

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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!

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Instrument contamination

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

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

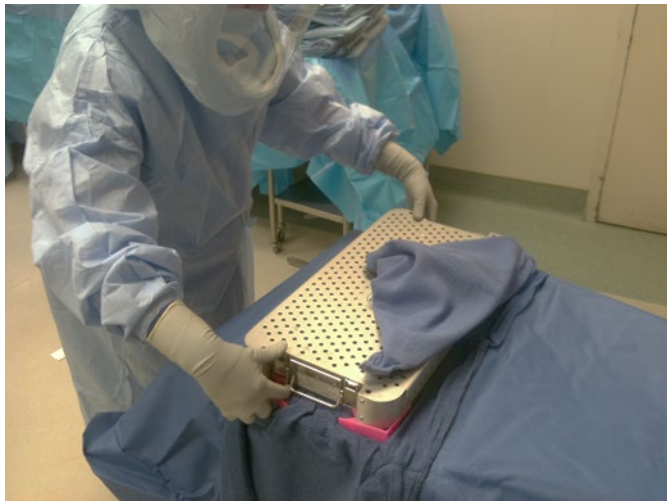
- CNS, Pseudomonas, Neisseria, etc.

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



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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 saline
- Betadine irrigation
- Irrisept (Chlorhexadine)
- Antibiotic cement in high-risk TKA's

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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 (rarely used) removed POD 1
- Drain for some TKA's, removed within 24 hours
- Staples for most knee wounds
- Prineo / Dermabond for THAs
- Impervious Aquacel dressing
- Dressing change POD7

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

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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

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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

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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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journal homepage: www.arthroplastyjournal.org

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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cost saving
quality improvement
surgical blood loss

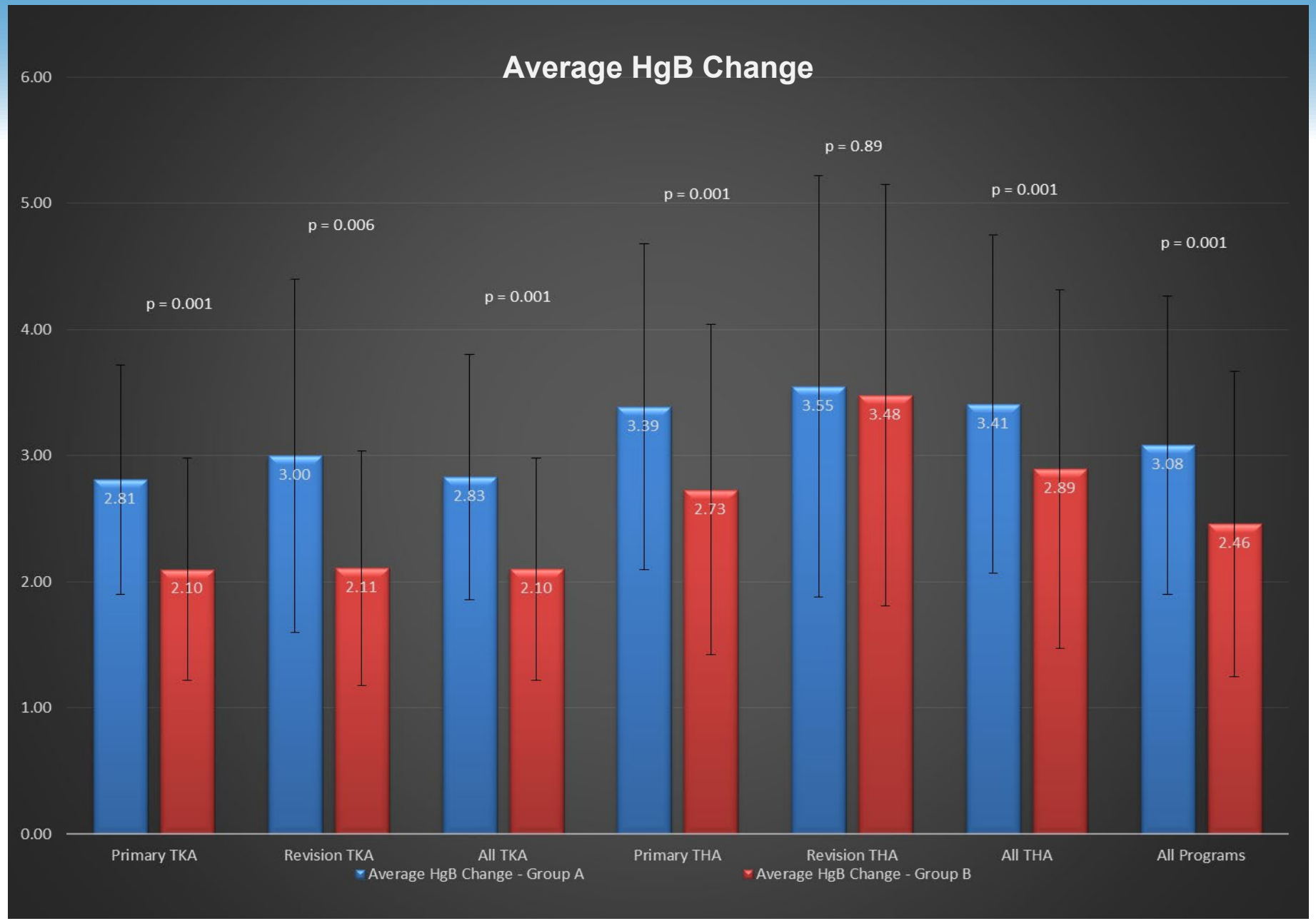
ABSTRACT

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.



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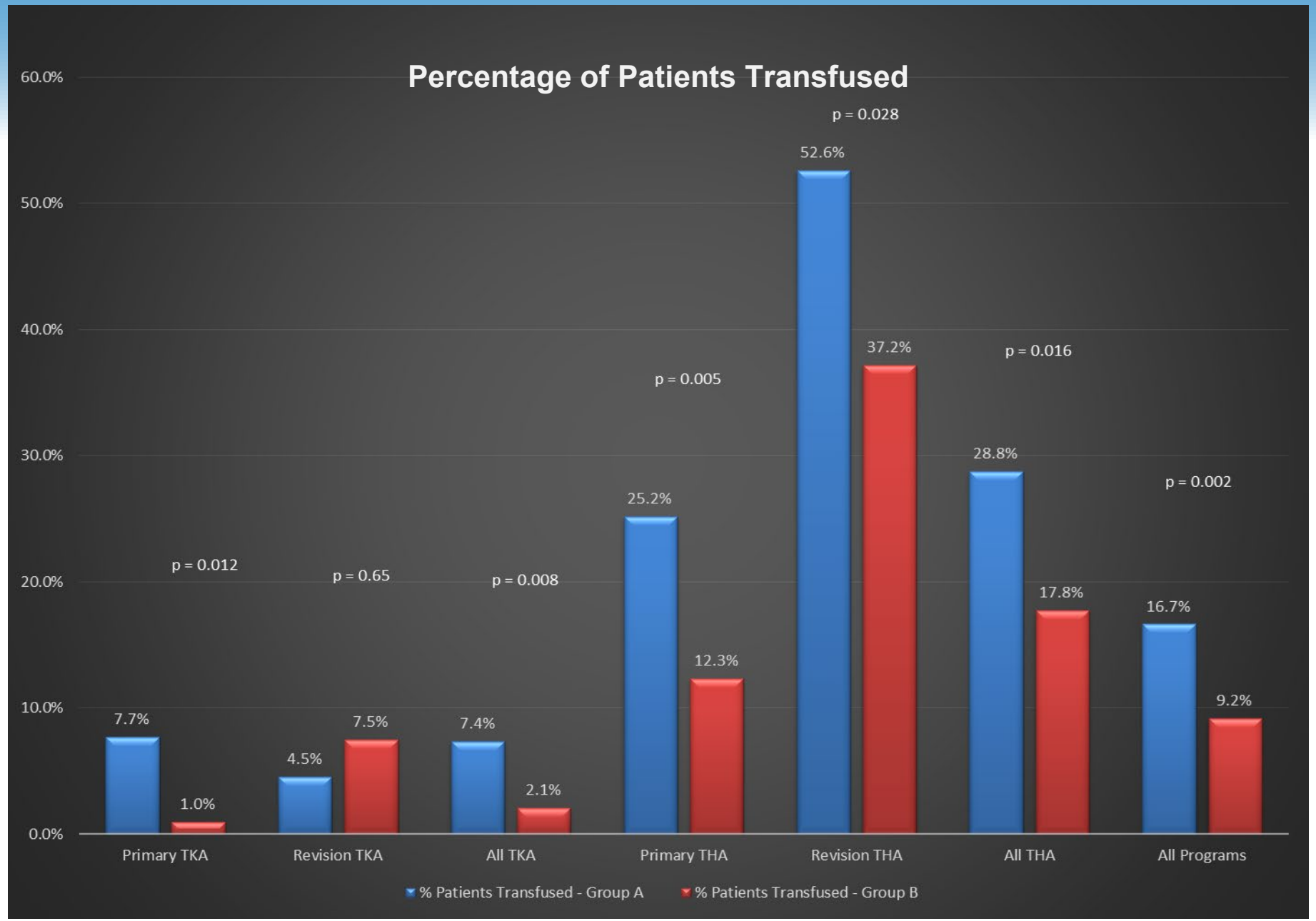

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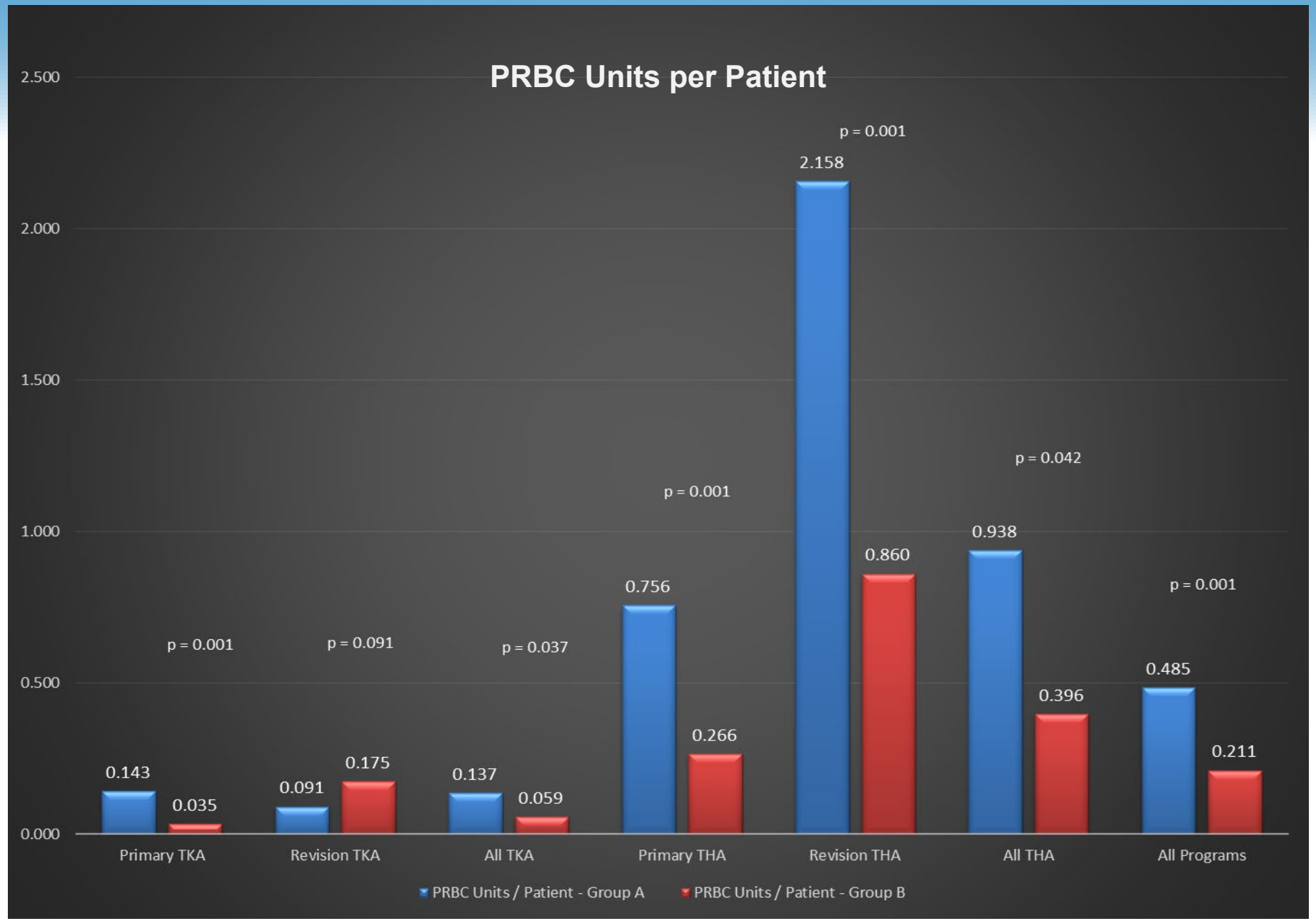

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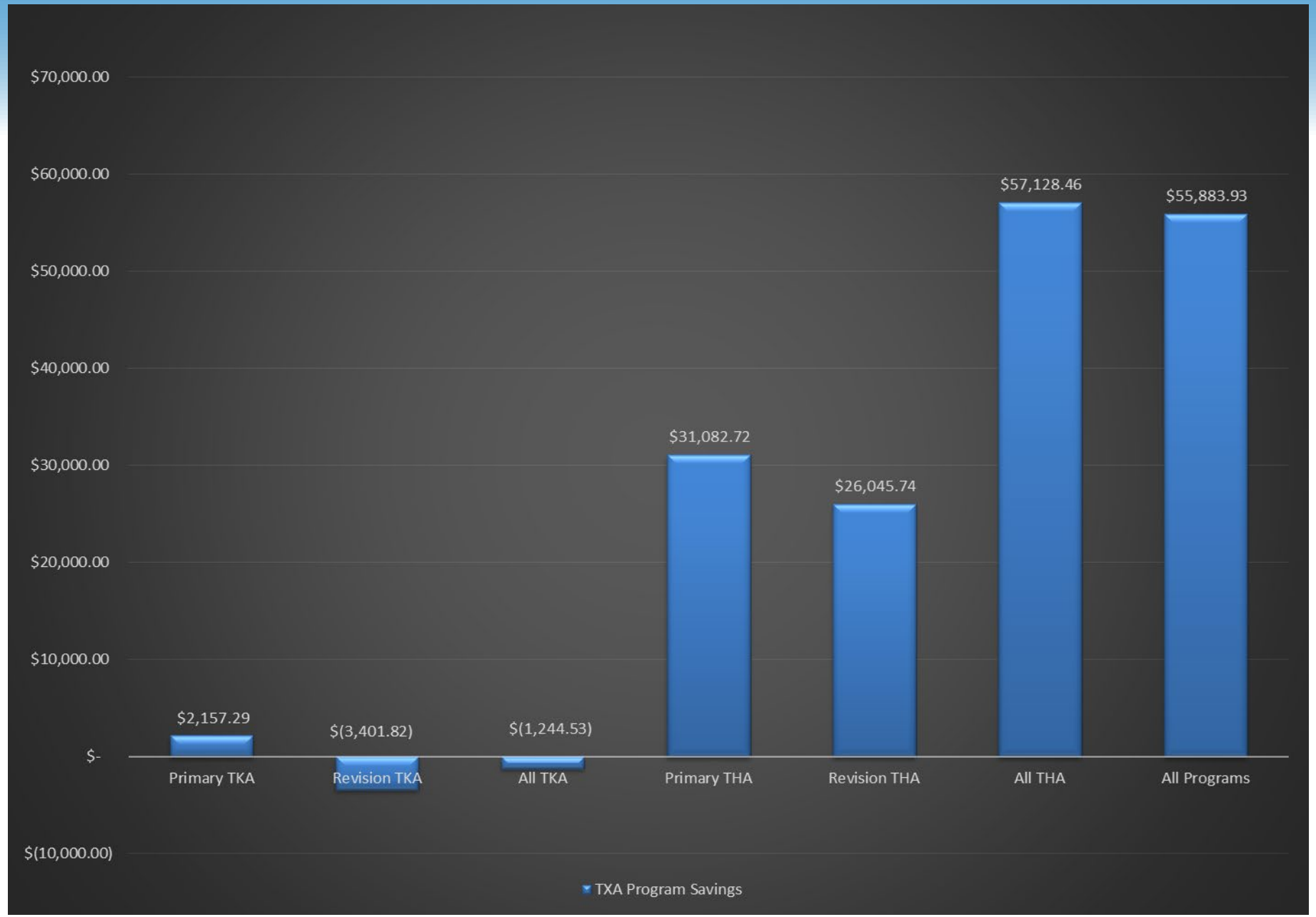

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TXA Protocol Summary

- 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).

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AAOS CPG Hip OA 2023

TRANEXAMIC ACID

High Quality evidence supports that tranexamic acid (TXA) should be considered for patients with symptomatic osteoarthritis of the hip who are undergoing total hip arthroplasty (THA) to reduce blood loss and the need for blood transfusions.

Quality of Evidence: High

Strength of Recommendation: Strong ★★★★

Evidence from two or more "High" quality studies with consistent findings for recommending for or against the intervention. Also requires no reasons to downgrade from the EtD framework.

“I want
minimally invasive
joint surgery”

“My friend had an arthroscopic knee replacement and went home the same day.
He only missed one day from work.”

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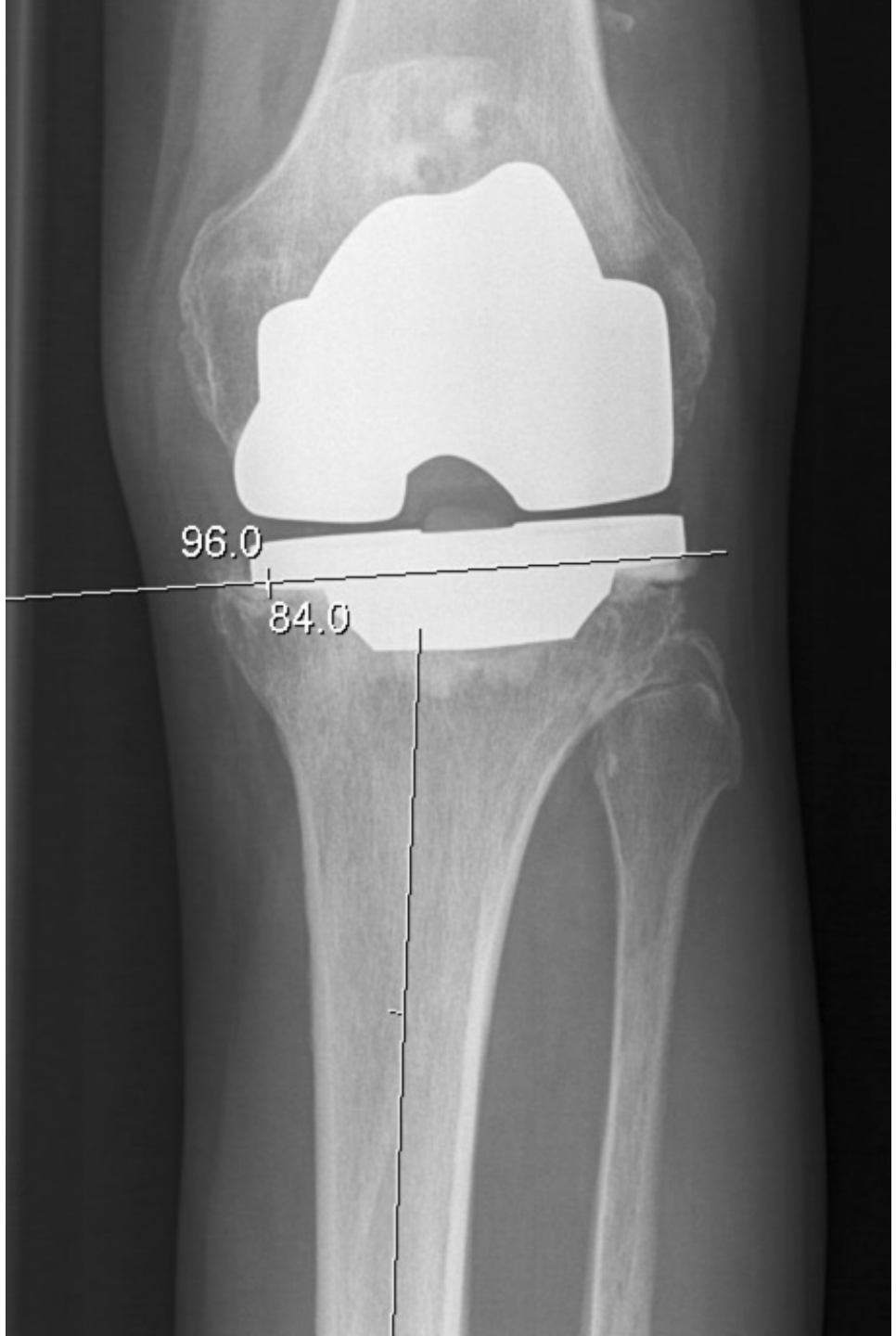
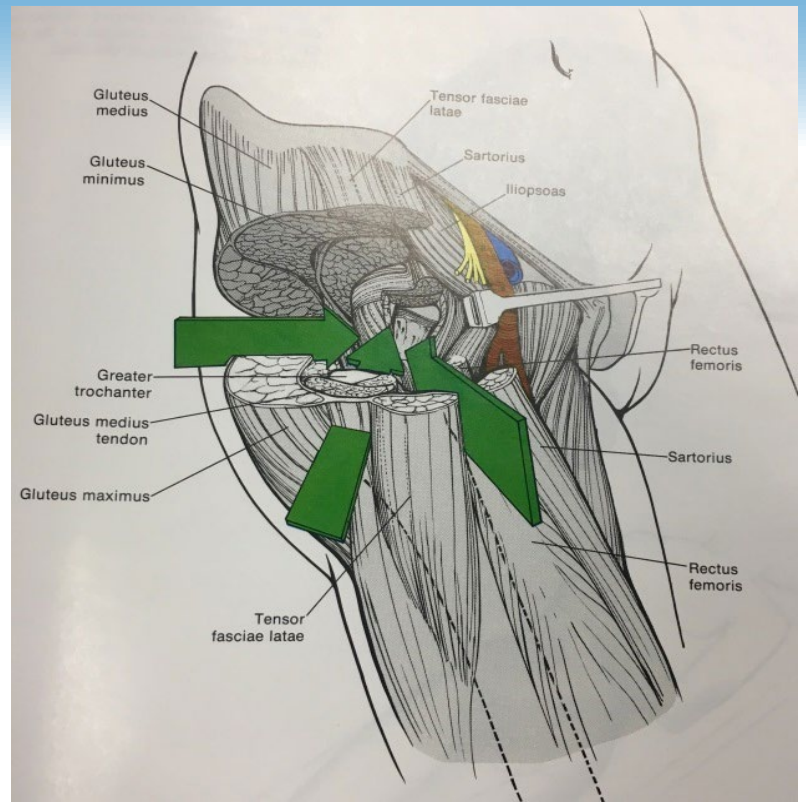
Minimally Invasive Surgery

- 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.

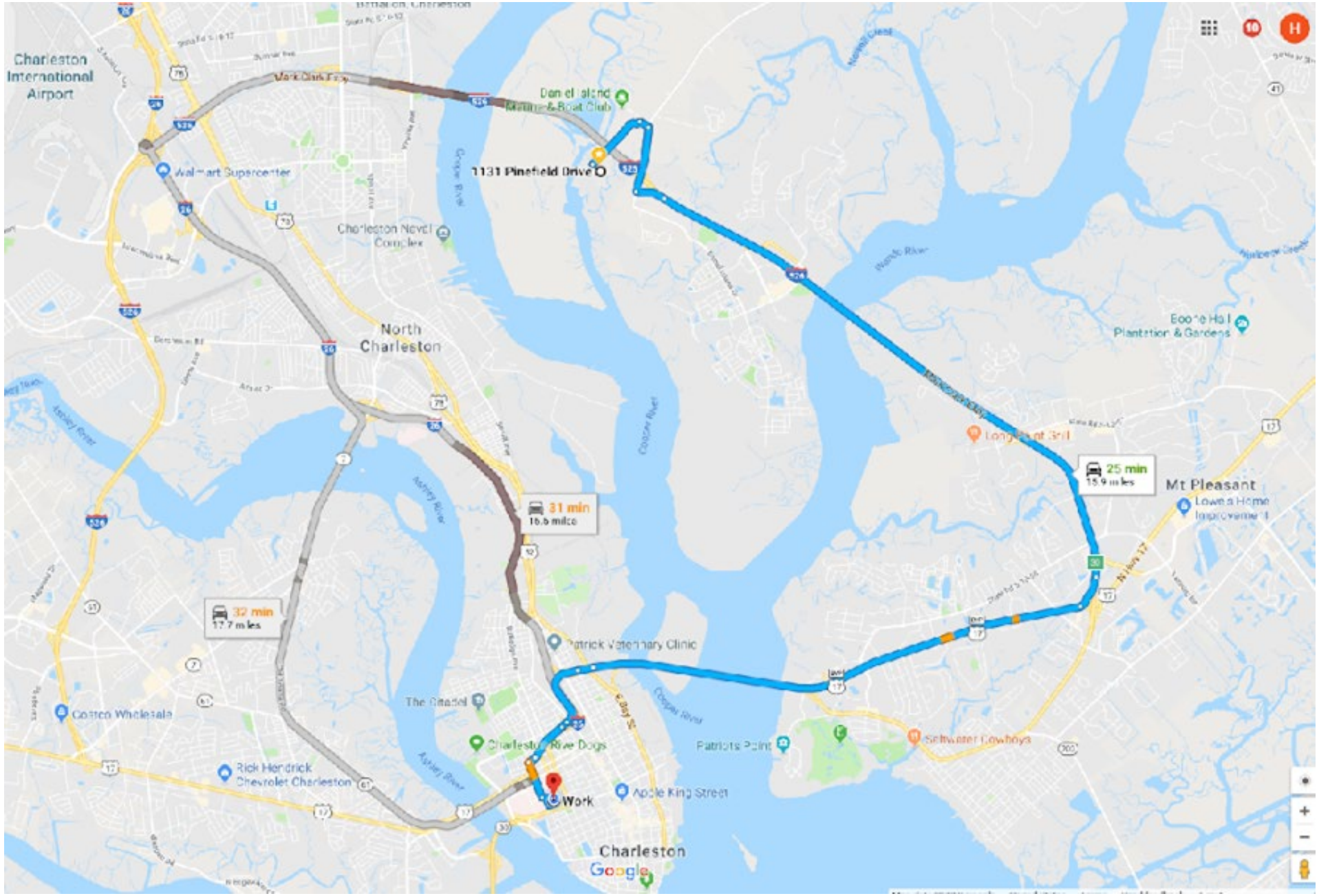

96.0
84.0


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


Charleston International Airport
1131 Pinefield Drive
Wal-Mart Supercenter
Charleston Naval Complex
North Charleston
31 min
16.6 miles
32 min
17.7 miles
25 min
15.9 miles
Mt Pleasant
Patrick Veterinary Clinic
The Citadel
Charleston River Dogs
Patriots Point
Costco Wholesale
Rick Hendrick Chevrolet Charleston
Work
Apple King Street
Charleston
Google

AAOS CPG Hip OA 2023

EXPOSURE APPROACH

High quality evidence supports that there are specific risks and benefits to each surgical approach and that there is not a preferred surgical approach for patients with symptomatic osteoarthritis of the hip undergoing total hip arthroplasty.

Quality of Evidence: High

Strength of Recommendation: Moderate ★★★☆ (Downgraded)

Evidence from two or more "High" quality studies with consistent findings for recommending for or against the intervention. Recommendation was downgraded based on EtD framework.

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Post Operative Management

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

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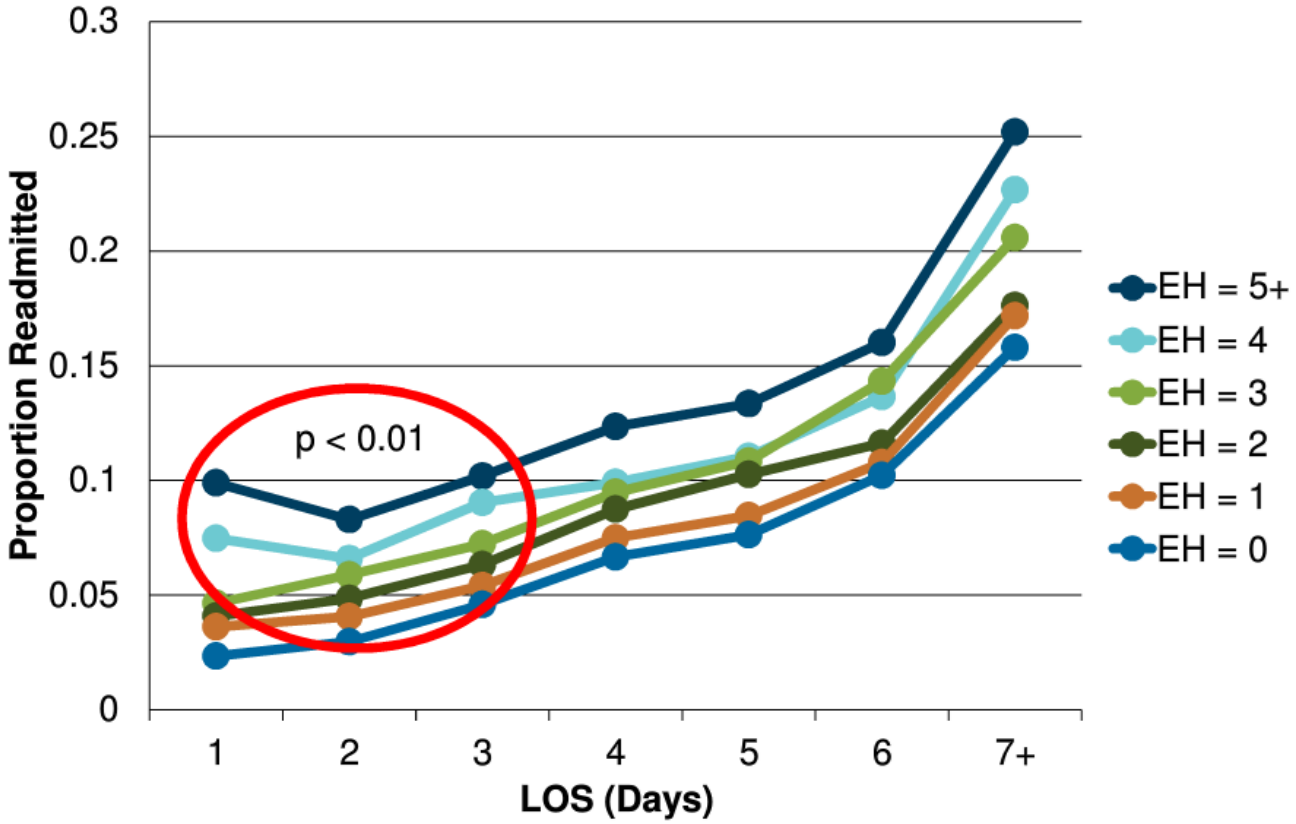
Optimal Length of Stay Following Total Joint Arthroplasty to Reduce Readmission Rates

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



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Same Day Discharge Hip, Knee, Shoulder Arthroplasty Patient Selection
Pre-op Clinic Guidelines

- All Patients must go through Pre-op Clinic and Pre- op Optimization Protocol :
  - Patient meets accepted Pre-op Risk Stratification (may include Outpatient Arthroplasty Risk Assessment/OARA Score)
    - assessed in outpatient clinic by surgeon at time of discussion with patient
    - assessed in pre-op TJR clinic
  - Patient meets pre-op optimization parameters: no smoking, adequate nutrition, etc.
- These patients will be screened to participate in the PePPER Trial, unless otherwise indicated by surgeon (Hip/Knee)
- Patient agrees to discharge to home, per discussion with surgeon
- Verified home support for the first few post-op days
- Patient must ambulate independently without use of an assistive device
- Local patients only: Patient must live within 1-1.5 hour travel time to home at discharge
- Patient must have DME arranged Pre- Admission
- Home Health services will be set up to start morning of POD 1 (day after discharge) as needed
  - Physical Therapy- establish goals, exercises per protocols, wound check, home safety
  - For patients identified as able to start with outpatient PT, this will be arranged as requested

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Same Day Discharge Hip, Knee, Shoulder Arthroplasty Patient Selection
Pre-op Clinic Guidelines

Medical Exclusions

- No age limit if patient medically healthy, motivated, caregiver home support
- ASA 3 classification- if poorly controlled underlying condition
- Bleeding disorders
- Pre-op Hemoglobin less than 12
- Poorly controlled /severe cardiac or pulmonary comorbidities (i.e.: heart failure, history of MI within 1 year, dysrhythmia, CHF, CAD, COPD, hx respiratory failure)
- CKD- consider function
- IF CKD 3a mild to moderate w/ GFR 55-60 may be appropriate for SDD
- Cirrhosis
- Uncontrolled DM Type I or Type II
- OSA w/ history of poor compliance
- BMI >40 should be considered if otherwise healthy
- Chronic opioid use
- Functional neurologic impairments
- Dependent functional status
- Reduced Pre-op cognitive capacity, history of post op delirium
- Urologic medical history/History urinary retention
- History of inadequate pain control

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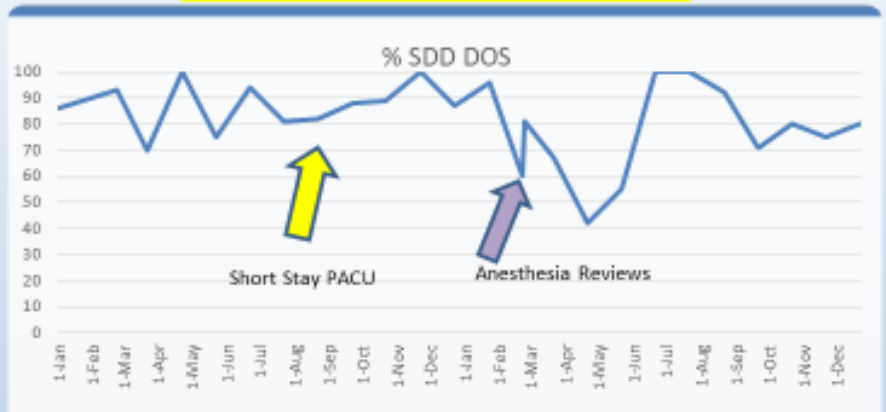
Top Focus For Improvement: Increasing Same Day Discharge (SDD) Joint Replacements

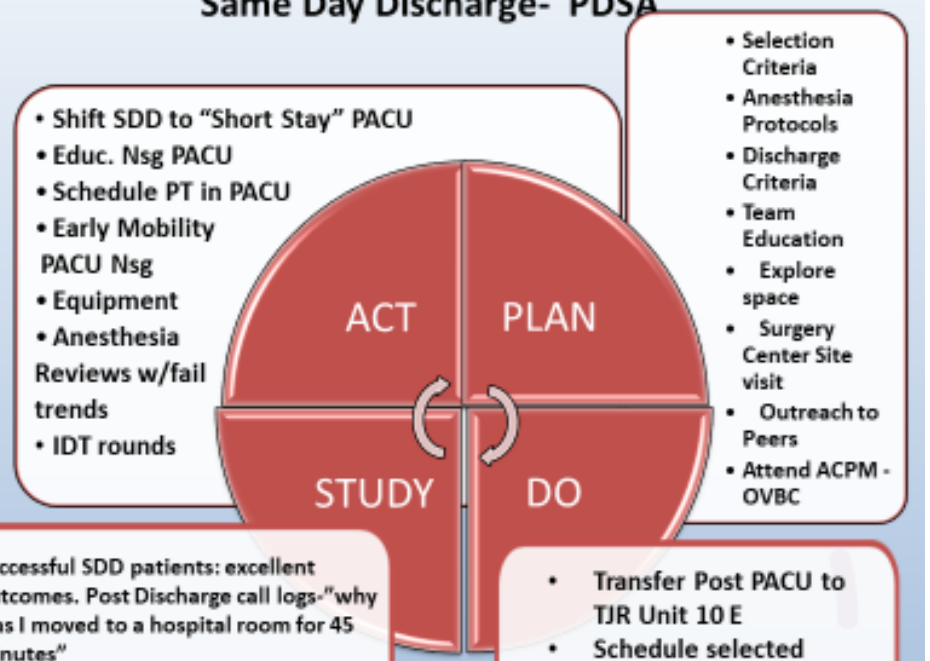
Goal = 90

Jan 2021- Dec 2022 % Sched DOS Successful



Jul 2022 – Mar 2023

Same Day Discharge- PDSA



- Shift SDD to "Short Stay" PACU
- Educ. Nsg PACU
- Schedule PT in PACU
- Early Mobility PACU Nsg
- Equipment
- Anesthesia Reviews w/fail trends
- IDT rounds

- Selection Criteria
- Anesthesia Protocols
- Discharge Criteria
- Team Education
- Explore space
- Surgery Center Site visit
- Outreach to Peers
- Attend ACPM - OVBC

- Successful SDD patients: excellent outcomes. Post Discharge call logs-"why was I moved to a hospital room for 45 minutes"
- TJR Inpatient Unit Negative Impact: throughput, resource planning, reimbursement, observation beds, Leading reasons for SDD failure rates 50-60%: sensorimotor deficit, post-op hypotension, nausea, pain.
- First & Second cases best

- Transfer Post PACU to TJR Unit 10 E
- Schedule selected patients
- Pre-op Pt/Coach Education
- Therapy & Nursing DOS Ambulation
- Expedited Pathways

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

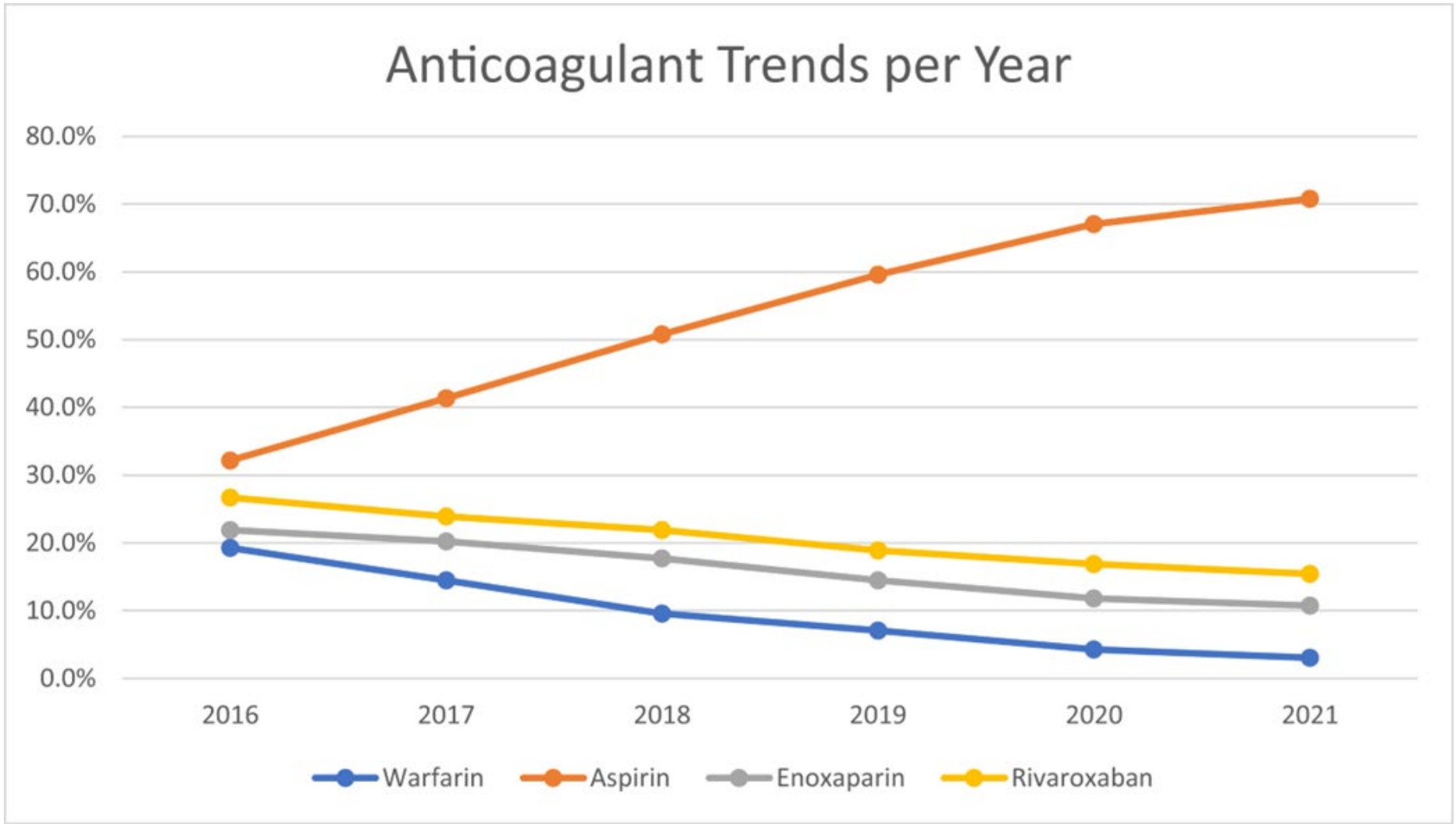
Prophylaxis is Standard of Care

- 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)

Trends in Deep Vein Thrombosis Prophylaxis After Total Knee Arthroplasty: 2016 to 2021

Jeremy A. Dubin, BA, Sandeep S. Bains, MD, DC, MBA, Daniel Hameed, MD, Ethan A. Remily, DO, Mallory C. Moore, BS, Michael A. Mont, MD, James Nace, DO, MPT, Ronald E. Delanois, MD

The Journal of Arthroplasty
DOI: 10.1016/j.arth.2024.01.050



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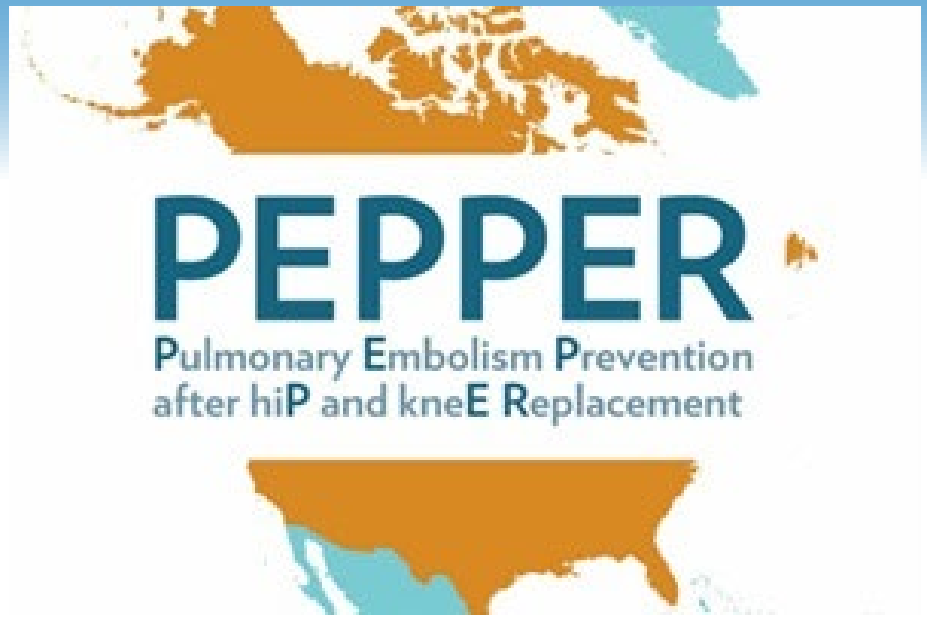


PE Prevention after hiP and kneE Replacement

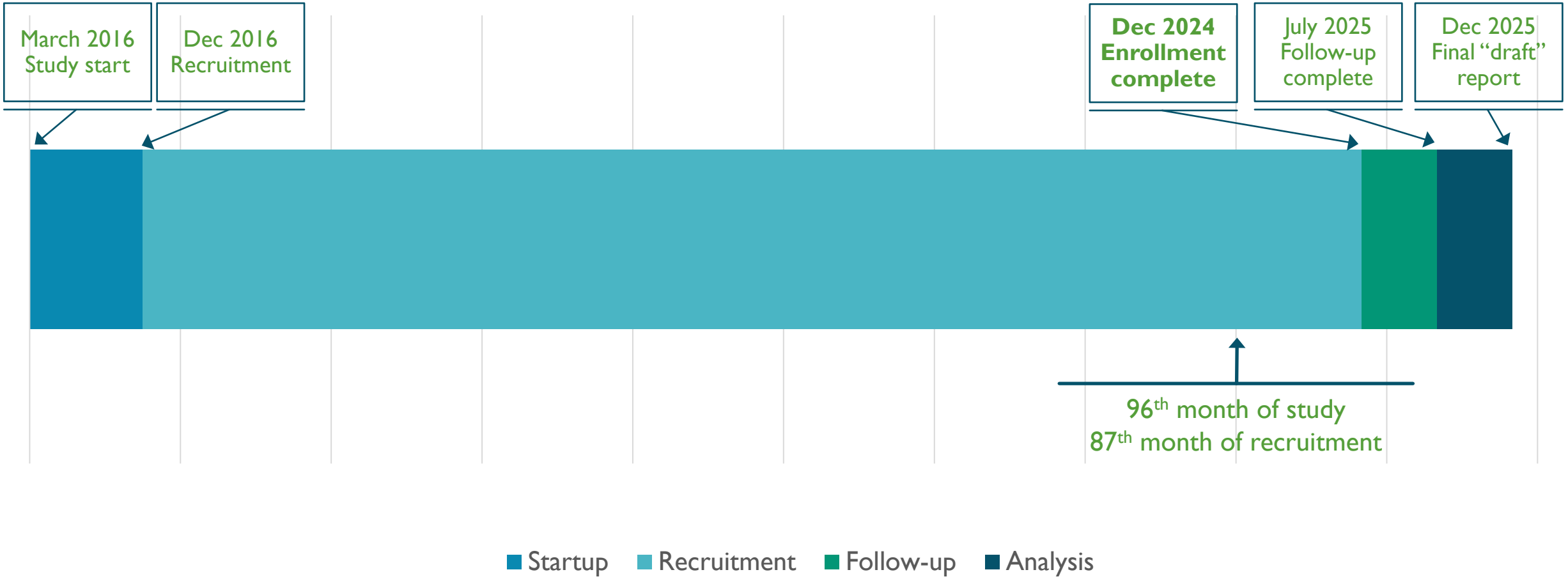
PCORI Multicenter Clinical Trial of 25,000 patients at 25 centers

Aspirin / Warfarin / Rivaroxaban for 28 days

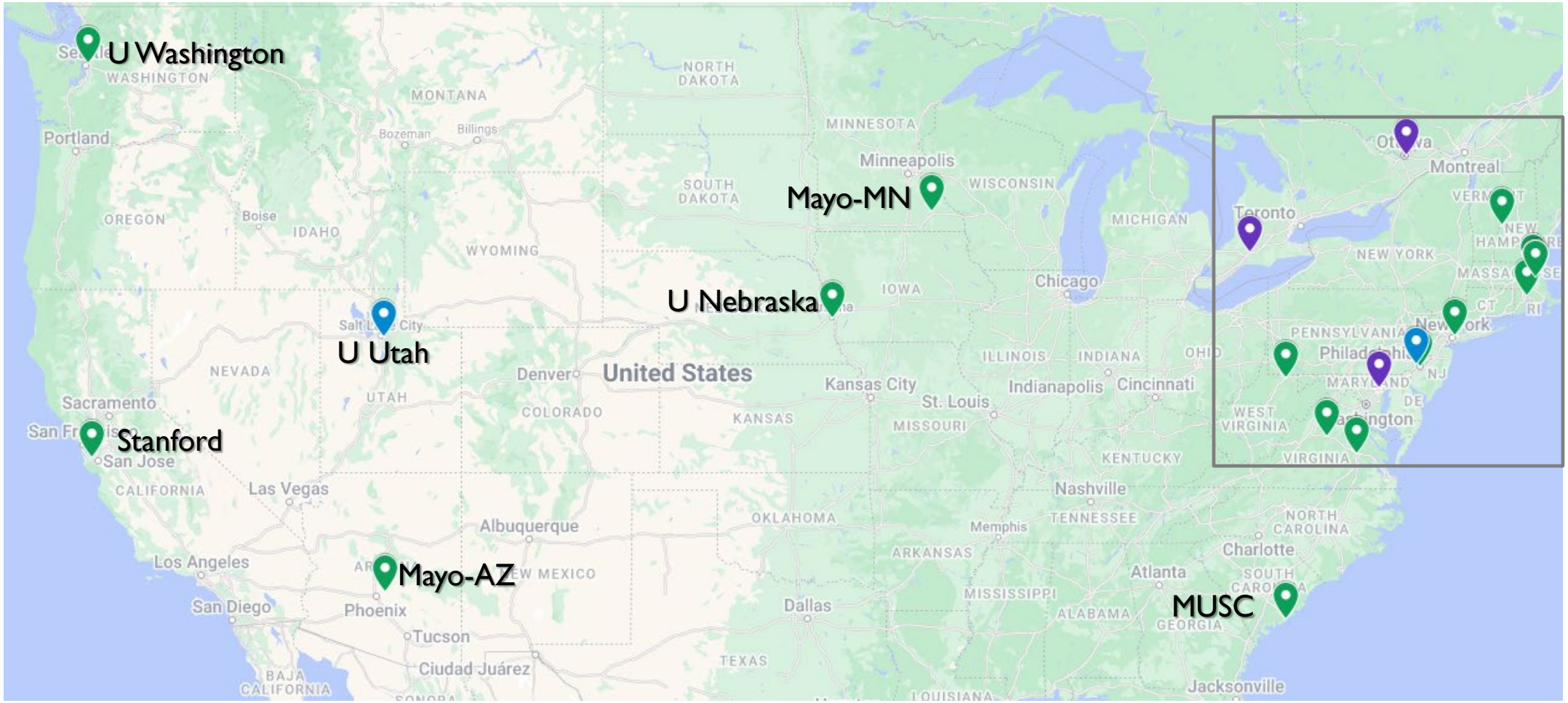
Clinical endpoint: Mortality, VTE, bleeding, reoperation, functional outcomes

No differences so far….

STUDY TIMELINE – WITH FINAL EXTENSION



CLINICAL SITES



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PEPPER Pulmonary Embolism Prevention after hiP and kneE Replacement

STUDY RECRUITMENT

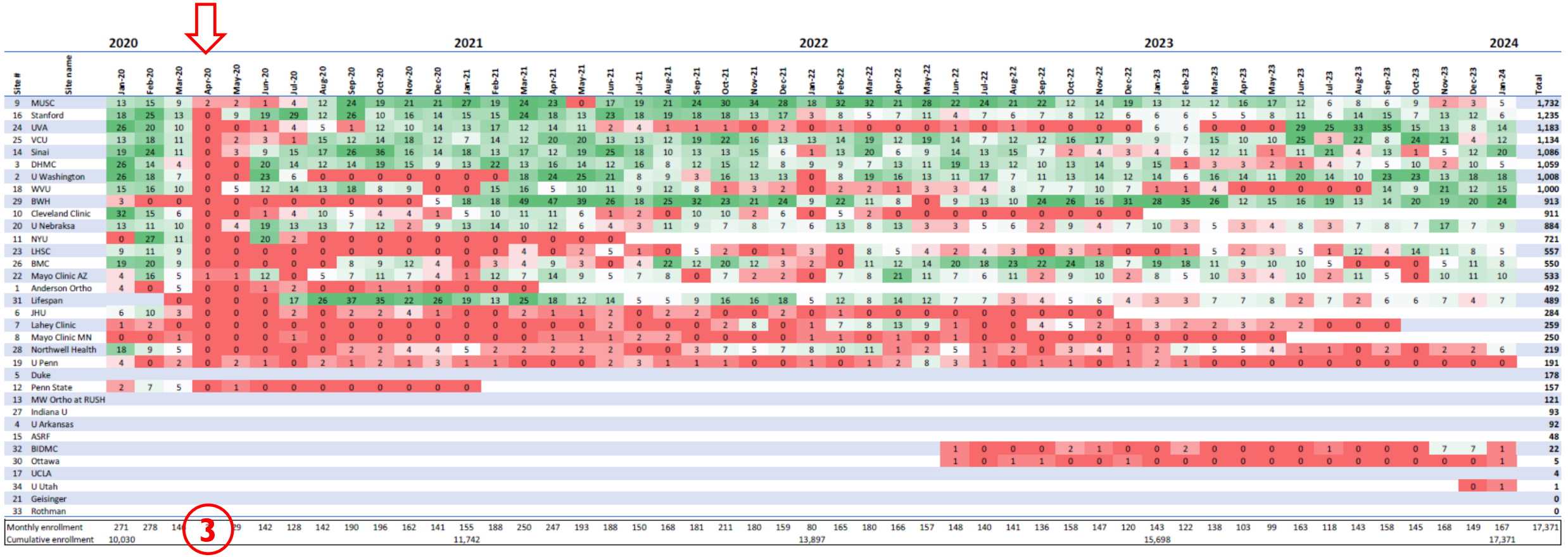
Two-Drug Protocol: New Enrollment Target 18,829

Warfarin 5,495 Aspirin 6,667 Rivaroxaban 6,667

Remaining Enrollment Target: 133 patients/month

Data @01/31/24

STUDY RECRUITMENT: THE COVID STORY



Site #	Site name	2020 Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2021 Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2022 Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2023 Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2024 Jan	Total
9	MUSC	13	15	9	2	2	1	4	12	24	19	21	21	27	19	24	23	0	17	19	21	24	30	34	28	18	32	32	21	28	22	24	21	22	12	14	19	13	12	12	16	17	12	6	8	6	9	2	3	5	1,732
16	Stanford	18	25	13	0	9	19	29	12	26	10	16	14	15	15	24	18	13	23	18	19	18	18	13	17	3	8	5	7	11	4	7	6	7	8	12	6	6	6	5	5	8	11	6	14	15	7	13	12	6	1,235
24	UVA	26	20	10	0	0	1	4	5	1	12	10	14	13	17	12	14	11	2	4	1	1	1	0	2	0	1	0	0	0	1	0	1	0	0	0	0	6	6	0	0	0	29	25	33	35	15	13	8	14	1,183
25	VCU	13	18	11	0	2	3	1	15	12	14	18	12	7	14	12	20	20	13	13	12	19	22	16	13	13	14	19	12	19	14	7	12	12	16	17	9	9	7	15	10	10	25	3	22	8	24	21	4	12	1,134
14	Sinai	19	24	11	0	3	9	15	17	26	36	16	14	18	13	17	12	19	25	18	10	13	13	15	6	1	13	20	6	9	14	13	15	7	2	4	3	4	6	12	11	1	11	21	4	13	1	5	12	20	1,086
3	DHMC	26	14	4	0	0	20	14	12	14	19	15	9	13	22	13	16	14	12	16	8	12	15	12	8	9	9	7	13	11	19	13	12	10	13	14	9	15	1	3	3	2	1	4	7	5	10	2	10	5	1,059
2	U Washington	26	18	7	0	0	23	6	0	0	0	0	0	0	0	18	24	25	21	8	9	3	16	13	13	0	8	19	16	13	11	17	7	11	13	14	12	14	6	16	14	11	20	14	10	23	23	13	18	18	1,008
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20	U Nebraksa	13	11	10	0	4	19	13	13	7	12	2	9	13	14	10	12	6	4	3	11	9	7	8	7	6	13	8	13	3	3	5	6	2	9	4	7	10	3	5	3	4	8	3	7	8	7	17	7	9	884
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23	LHSC	9	11	9	0	0	0	0	0	0	0	0	0	0	0	4	0	2	5	1	0	5	2	0	1	3	0	8	5	4	2	4	3	0	3	1	0	0	1	5	2	3	5	1	12	4	14	11	8	5	557
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22	Mayo Clinic AZ	4	16	5	1	1	12	0	5	7	11	7	4	1	12	7	14	9	5	7	8	0	7	2	2	0	7	8	21	11	7	6	11	2	9	10	2	8	5	10	3	4	10	2	11	5	0	10	11	10	533
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6	JHU	6	10	3	0	0	0	2	0	2	2	4	1	0	0	2	1	1	2	0	2	2	0	0	2	0	1	0	0	0	0	0	0	0	0	0															284
7	Lahey Clinic	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2	8	0	1	7	8	13	9	1	0	0	4	5	2	1	3	2	2	3	2	2	0	0	0					259
8	Mayo Clinic MN	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	1	1	1	2	2	0	0	0	0	1	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0								250
28	Northwell Health	18	9	5	0	0	0	0	0	2	2	4	4	5	2	2	2	2	2	0	0	3	7	5	7	8	10	11	1	2	5	1	2	0	3	4	1	2	7	5	5	4	1	1	0	2	0	2	2	6	219
19	U Penn	4	0	2	0	2	1	0	2	1	2	1	3	1	1	0	0	0	2	3	1	1	1	0	0	1	0	1	2	8	3	1	0	1	1	0	1	2	1	0	0	0	0	0	0	0	0	0	0	0	191
5	Duke																																																		178
12	Penn State	2	7	5	0	1	0	0	0	0	0	0	0	0																																					157
13	MW Ortho at RUSH																																																		121
27	Indiana U																																																		93
4	U Arkansas																																																	92
15	ASRF																																																		48
32	BIDMC																														1	0	0	0	2	1	0	0	2	0	0	0	0	1	0	0	0	7	7	1	22
30	Ottawa																														1	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5
17	UCLA																																																		4
34	U Utah																																																0	1	1
21	Geisinger																																																		0
33	Rothman																																																		0
	Monthly enrollment	271	278	140	3	29	142	128	142	190	196	162	141	155	188	250	247	193	188	150	168	181	211	180	159	80	165	180	166	157	148	140	141	136	158	147	120	143	122	138	103	99	163	118	143	158	145	168	149	167	17,371
	Cumulative enrollment	10,030												11,742												13,897												15,698												17,371	

Pre-COVID
Preceding 7 months
High 335, **Mean 282**

Recovery

Post-COVID
Last 12 months (3-arm)
High 147, **Mean 129**

Two Drugs
8 months
High 168, **Mean 151**

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PEPPER
Pulmonary Embolism Prevention after hiP and kneE Replacement

Extended Oral Antibiotics Prevent Periprosthetic Joint Infection in High-Risk Cases: 3855 Patients With 1-Year Follow-Up

Michael M. Kheir, MD, Julian E. Dilley, MD, Mary Ziemba-Davis, BA, R. Michael Meneghini, MD

JOA - AAHKS AWARD PAPER| VOLUME 36, ISSUE 7, SUPPLEMENT , S18-S25, JULY 2021
Published:January 22, 2021 DOI:https://doi.org/10.1016/j.arth.2021.01.051

- Retrospective review of 3855 consecutive primary THAs and TKAs performed between 2011 and 2019
- 7 Days oral antibiotics for patients at high-risk for PJI starting 1/2015
- High-risk patients with extended antibiotic prophylaxis had a significantly lower rate of PJI than high-risk patients without extended antibiotic prophylaxis (0.89% vs 2.64%, respectively; $P < .001$)
- There was no difference in the infection rate between high-risk patients who received antibiotics and low-risk patients (0.89% vs 1.29%, respectively; $P = .348$) with numbers available
- “Extended postoperative oral antibiotic prophylaxis for 7 days led to a statistically significant and clinically meaningful reduction in 1-year infection rates of patients at high risk for infection. In fact, the PJI rate in high-risk patients who received antibiotics was less than the rate seen in low-risk patients. Thus, extended oral antibiotic prophylaxis may be a simple measure to effectively counteract poor host factors. “

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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”

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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)

Hip Precautions

- Minimal PT required – mostly ambulation
- Dislocation and periprosthetic fractures among highest risks for revision
- Protected WBAT – Walker to cane
- “Universal precautions”
  - Pillow between legs
  - Avoid hip flexion > 90 degrees
  - Avoid extremes of IR / ER
- Cane until limp resolves
- Avoid impact loading 3-6 months

Clin Orthop Relat Res (2019) 477:60-69
DOI 10.1097/CORR.0000000000000561

Clinical Orthopaedics and Related Research®
A Publication of The Association of Bone and Joint Surgeons®

2018 Knee Society Proceedings

2018 John N. Insall Award: Recovery of Knee Flexion With Unsupervised Home Exercise Is Not Inferior to Outpatient Physical Therapy After TKA: A Randomized Trial

Andrew N. Fleischman MD, Meredith P. Crizer BS, Majd Tarabichi MD, Shelby Smith BS, Richard H. Rothman MD, PhD, Jess H. Lonner MD, Antonia F. Chen MD, MBA

290 Primary TKA with pre-op ROM >90 degrees

Randomized to outpatient PT , unsupervised home exercise using a web-based platform (web PT), or unsupervised home exercise using a printed paper manual

Delayed recovery intervention within the home exercise program, in which patients began outpatientt PT if knee flexion was < 70° at 2 weeks or < 90° at 4 weeks

Home programs Non-inferioir to OPPT for ROM, KOOS, back to work, driving, and walking without assistive device

“It is worthwhile to reconsider the current practice of automatically designating patients for outpatient PT after primary TKA, because appropriately selected patients with adequate clinical support can achieve similar results at home”

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Self-Directed Home Exercises vs Outpatient Physical Therapy After Total Knee Arthroplasty: Value and Outcomes Following a Protocol Change

William L. Wang, MD, Alexander J. Rondon, MD, MBA, Timothy L. Tan, MD, John Wilsman, BSc, James J. Purtill, MD

Published:May 15, 2019DOI:https://doi.org/10.1016/j.arth.2019.05.020
JOA Volume 34, Issue 10, p2197-2522

- 520 Consecutive patients with primary TKA
  - 251 in 2016 prescribed OPPT
  - 269 in 2017 given self directed HEP, and OPPT if needed at 2 week visit (<90 deg)
- 65.8% in HEP group did not require OPPT
- No difference in number of patients with <90 deg at 2 weeks
- No difference in rate of MUA
- No identified risk factors for failing HEP
- Savings of $1340 (Medicare) or $1893 (private insurance) per patient avoiding OPPT

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AAOS CPG Hip OA 2023

POSTOPERATIVE PHYSICAL THERAPY

High quality evidence supports either formal physical therapy or unsupervised home exercise after total hip arthroplasty for symptomatic osteoarthritis of the hip.

Quality of Evidence: High

Strength of Recommendation: Moderate★★★☆ (Downgraded)

Evidence from two or more "High" quality studies with consistent findings for recommending for or against the intervention. Recommendation was downgraded based on EtD framework.

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ISCR (ERAS) Core Process Measures

	Facility #(%)	ISCR #(%)
Evidence of Advanced Care Planning	NA	426(46.81%)
Use of Regional Anesthesia	19(100.00%)	552(62.87%)
Transexamic Acid (TXA) Use	19(100.00%)	655(71.98%)
Multi-modal Pain Management	18(94.74%)	702(77.14%)
Medical DVT Prophylaxis Cont'd 28 Days Postop	19(100.00%)	583(58.18%)
First Postop Mobilization	12(63.16%)	599(81.28%)
Foley Removal	19(100.00%)	873(95.93%)
Weight Bearing as Tolerated POD#1	14(73.68%)	786(86.47%)

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Expectation Management

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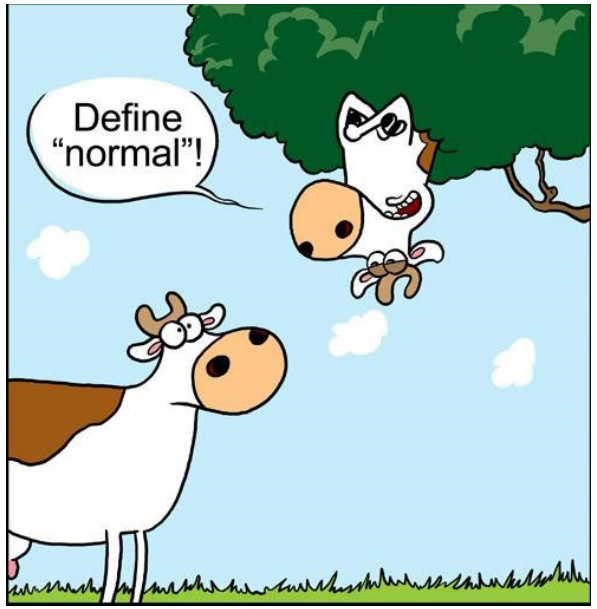
“A knee replacement will make my knee normal again”



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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 o

South Carolina | Designated BlueDistinction® Center Knee and Hip Replacement

OWN THE BONE 2023–2024 STAR PERFORMER

HIGH PERFORMING HOSPITALS U.S.News & WORLD REPORT 2023-2024 KNEE REPLACEMENT

HIGH PERFORMING HOSPITALS U.S.News & WORLD REPORT 2023-2024 HIP REPLACEMENT

MAGNET RECOGNIZED AMERICAN NURSES CREDENTIALING CENTER

healthgrades

THE JOINT COMMISSION NATIONAL QUALITY APPROVAL

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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

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Improvements

- Robotic TKA
- Spinals in holding
- DME to patients at preop
- Preop clinic expansion / optimization
- Pre-op allergy testing
- Standardization of vancomycin administration
- Decrease in utilization of home health PT
- Increases in same day discharge and initiated arthroplasty at West Ashley location
- Electronic PROs in EPIC
- Elimination of Coumadin from PEPPER randomization

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Summary

What matters most

- Patient motivation
- Patient optimization
- Surgeon experience
- Implants and bearings
- Hospital volume
- Joint Team
- Standardized processes
- Pain management
- Appropriate prevention and management of complications
- Rehab / return to function

What matters less

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

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