AAHKS®
AMERICAN ASSOCIATION OF
HIP AND KNEE SURGEONS

1ST ANNUAL SPRING MEETING AAHKS

March 31 – April 2, 2016 | Grand Hyatt Washington | Washington, DC

Thank you to the AAHKS Spring Meeting Program Committee

Craig J. Della Valle, MD
Bryan D. Springer, MD

Thank you to the AAHKS Spring Meeting Faculty

Matthew P. Abdel, MD
William P. Barrett, MD
Daniel J. Berry, MD
Michael P. Bolognesi, MD
Kevin J. Bozic, MD, MBA
John J. Callaghan, MD
John C. Clohisy, MD
David F. Dalury, MD
Craig J. Della Valle, MD
Stephen T. Duncan, MD
Thomas K. Fehring, MD
Mark I. Froimson, MD, MBA
William L. Griffin, MD
William A. Jiranek, MD
Jay R. Lieberman, MD
Adolph V. Lombardi Jr, MD, FACS
Steven J. MacDonald, MD
R. Michael Meneghini, MD
Mark W. Pagnano, MD
Brian S. Parsley, MD
Javad Parvizi, MD, FRCS
Gregory G. Polkowski II, MD, MSc
Bryan D. Springer, MD

We Need Your Help!

Would you like to volunteer for the 26th AAHKS Annual Meeting?
We are seeking abstract, poster and surgical technique video reviewers. If you are interested, please contact Sigita Wolfe, AAHKS Director of Education, at **swolfe@aahks.org**.

Course Description

The **First Annual AAHKS Spring Meeting** is intended to equip practicing orthopaedic surgeons with state-of-the art information and cutting-edge strategies aimed at enhancing the care of patients with arthritis and degenerative disease. It combines general and break-out sessions, emphasizing case-based learning in small group setting for most effective results.

Objectives

- Analyze total hip and knee arthroplasty cases
- Investigate the patterns contributing to effective total hip and knee arthroplasty and revision
- Determine the strategies contributing to optimal perioperative and post-operative care, including complication management
- Consider effective practice management tips and related healthcare policy
- Report the highlights of the 2015 Annual Meeting

CME Accreditation and Credit Designation

The American Association of Hip and Knee Surgeons (AAHKS) is accredited by the Accreditation Council for Continuing Medical Education (ACCME) to provide continuing medical education for physicians.

The American Association of Hip and Knee Surgeons (AAHKS) designates this live activity for a maximum of 15.5 *AMA PRA Category 1 Credits™*. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

Spring Meeting Program Schedule

Times and topics are subject to change.

Thursday, March 31, 2016

Time	Session	Room	Faculty
7:00–9:00 p.m.	**Registration**	Declaration Level	
7:00–9:00 p.m.	**Opening Reception**	Cabinet Meeting Room	

Friday, April 1, 2016

Time	Session	Room	Faculty
7:00–7:50 a.m.	**Breakfast and Case Discussions with Faculty**	Constitution Foyer and Constitution A/B	
7:50–8:00 a.m.	**Welcome and Introduction**	Constitution A/B	*Jay R. Lieberman, MD*
8:00–8:30 a.m.	**Highlights of the 25th AAHKS Annual Meeting**	Constitution A/B	*Moderator: Gregory G. Polkowski II, MD, MSc* *Panelists: Brian S. Parsley, MD, William L. Griffin, MD, Stephen Duncan, MD, William P. Barrett, MD*
8:30–9:50 a.m.	**Breakout 1: Primary Total Hip Arthroplasty (THA), Simple to Complex**	Constitution C/D/E, John Cabin/Arlington or Wilson/Roosevelt	
9:50–10:00 a.m.	**Break**		
10:00–11:00 a.m.	**Symposium I–Perioperative Optimization**	Constitution A/B	*Moderator: William A. Jiranek, MD* *Panelists: Michael P. Bolognesi, MD, Steven J. MacDonald, MD, R. Michael Meneghini, MD*
11:00 a.m.–12:20 p.m.	**Breakout 2: Primary Total Knee Arthroplasty (TKA), Simple to Complex**	Constitution C/D/E, John Cabin/Arlington or Wilson/Roosevelt	
12:20–1:00 p.m.	**Lunch and Advocacy Update**	Constitution Foyer and Constitution A/B	*Speaker: Lynn Shapiro Snyder, JD*
1:00–2:00 p.m.	**Symposium II–Periprosthetic Joint Infection**	Constitution A/B	*Moderator: Bryan D. Springer, MD* *Panelists: Matthew P. Abdel, MD, Javad Parvizi, MD, FRCS, Gregory G. Polkowski II, MD, MSc*
2:00–2:20 p.m.	**Break**		
2:20–3:40 p.m.	**Breakout 3: Non-arthroplasty Hip or UKA**	Constitution C/D/E, John Cabin/Arlington (Knee) or Wilson/Roosevelt (Hip)	
3:50–4:50 p.m.	**Symposium III–Preparing for the Transition to Value Based Healthcare**	Constitution A/B	*Moderator: Kevin J. Bozic, MD, MBA* *Panelist: Mark I. Froimson, MD, MBA*
4:50–5:00 p.m.	**Closing Remarks**	Constitution A/B	*Brian D. Springer, MD*
5:00–6:30 p.m.	**Reception**	Constitution Foyer	

Saturday, April 2, 2016

Time	Session	Room	Faculty
7:00–7:50 a.m.	**Breakfast and Case Discussions with Faculty**	Constitution Foyer and Constitution A/B	
7:50–8:00 a.m.	**Welcome and Introduction**	Constitution A/B	*Jay R. Lieberman, MD*
8:00–8:30 a.m.	**Highlights of the AAOS, The Hip Society and The Knee Society Closed Meetings**	Constitution A/B	*Moderator: Mark W. Pagnano, MD* *Panelists: Thomas K. Fehring, MD, Daniel J. Berry, MD, Adolph V. Lombardi Jr., MD, FACS, John C. Clohisy, MD*
8:30–9:50 a.m.	**Breakout 4: Revision Total Hip Arthroplasty (THA), Simple to Complex**	Constitution C/D/E, John Cabin/Arlington or Wilson/Roosevelt	
9:50–10:00 a.m.	**Break**		
10:00–11:00 a.m.	**Symposium IV–The Business of Orthopaedics**	Constitution A/B	*Moderator: Mark I. Froimson, MD, MBA* *Panelists: Kevin J. Bozic, MD, MBA, William A. Jiranek, MD, Jay R. Lieberman, MD*
11:00 a.m.–12:20 p.m.	**Breakout 5: Revision Total Knee Arthroplasty (TKA), Simple to Complex**	Constitution C/D/E, John Cabin/Arlington or Wilson/Roosevelt	
12:20–1:00 p.m.	**Lunch**	Constitution Foyer	
1:00–2:00 p.m.	**Symposium V–Perioperative Care**	Constitution A/B	*Moderator: Jay R. Lieberman, MD* *Panelists: David F. Dalury, MD, Mark W. Pagnano, MD*
2:00–2:20 p.m.	**Break**		
2:20–3:40 p.m.	**Breakout 6: Managing Complications in Hip and Knee Arthroplasty**	Constitution C/D/E, John Cabin/Arlington or Wilson/Roosevelt	
3:50–4:50 p.m.	**Symposium VI–Step by Step: Key Choices and Techniques in the Tough Revision Total Hip Arthroplasty (THA) and Revision Total Knee Arthroplasty (TKA)**	Constitution A/B	*Moderator: Daniel J. Berry, MD* *Panelists: John J. Callaghan, MD, Craig J. Della Valle, MD*
4:50–5:00 p.m.	**Closing Remarks**	Constitution A/B	*Craig J. Della Valle, MD*

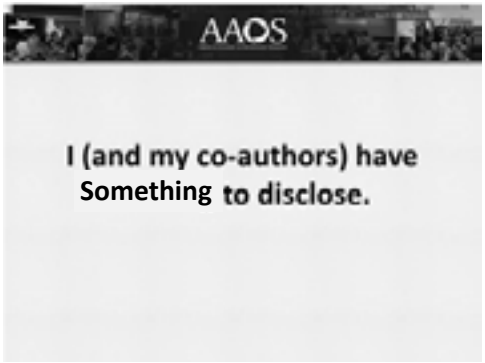
You can visit our sponsors in the exhibit area: DePuy Synthes, DJO Global, Medtronic, Pacira Pharmaceuticals, Inc., Smith & Nephew, Stryker and Zimmer Biomet

Session Materials

"Best of the AAHKS 2015 Annual Meeting"

AAHKS 2016 Spring Meeting

Gregory G Polkowski, MD, MSc
Assistant Professor of Orthopaedic Surgery
Vanderbilt Orthopaedic Institute
2015 AAHKS Annual Meeting Program Chair



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"Best of Symposium"

Gregory G Polkowski, MD, MSc
Moderator

Brian Parsley, MD
William Griffin, MD
William Barret, MD
Stephen Duncan, MD

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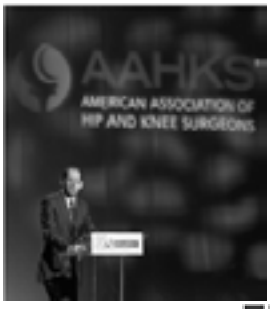
Highlights of the 25th AAHKS Annual Meeting

2015 AAHKS Annual Meeting

- Year for the record books
- 25th Anniversary
- Most abstracts submitted
  - ~1300
  - 59 papers (4.5% acceptance rate)
  - 200 posters (15%)
- Record attendance
  - ~2400 total
    - 1600 clinical
    - 400 more than 2014



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Pre-Meeting Courses

- 7th Annual Residents Course
  - Keith Berend and Matt Austin
- 5th Annual Team Member Course
  - David Dalury and Chris Peters
- 1st Annual "The Business of Total Joint Replacement, Surviving and Thriving"
  - Lawry Barnes and Mark Froimson
- Industry Symposia
  - 15 Total

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Recognition

- Guest Nations
  - Chilean Hip Society
  - Japanese Society for Replacement Arthroplasty
- AAHKS Humanitarian Award Recipient
  - Dr. Adolph Lombardi
- AAHKS Presidential Award
  - Dr. Frank Voss

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2015 Fall Meeting Symposia

- Clinical Practice Difficult Cases
- Outcome Measures
- Metal Reactions
- Risk Stratification
- Outpatient Arthroplasty
- Bundled Payments
- FAI

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James A. Rand Award Paper

A Randomized Controlled Trial of Oral and IV Tranexamic Acid: The Same Efficacy at Lower Cost?

Yale A. Fillingham, MD
Rush University

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A Randomized Controlled Trial of Oral and IV Tranexamic Acid: The Same Efficacy at Lower Cost?

Yale A Fillingham MD, Erdan Kayupov, MS, Darren Plummer, MD, Mario Moric, MS, Tad Gerlinger, MD, Craig J. Dalla Valle, MD

Double-blind, placebo-controlled, powered, RCT

1.95 g oral TXA vs 1g iv bolus TXA in TKA

Primary outcome: reduction in hemoglobin

Results

Equivalent Hb reduction: 3.45 g/dL vs 3.31 g/dL ($p<0.001$)
Equivalent blood loss: 1267 mL vs 1229 mL ($p<0.007$)
Cost: $14 vs $47—108

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A Randomized Controlled Trial of
Oral and IV Tranexamic Acid:
The Same Efficacy at Lower Cost?

Yale A Fillingham MD, Erdan Kayupov, MS, Darren Plummer, MD, Mario Moric, MS,
Tad Gerlinger, MD, Craig J. Dalla Valle, MD

Impact

$23 million to $67 million annual savings

(700,000 TKA/year)

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Lawrence D. Dorr Award

Conversion Total Hip Arthroplasty:
Is it a Primary or
Revision Hip Arthroplasty?

Ran Schwarzkopf, MD, MSc
NYU Langone

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Conversion Total Hip Arthroplasty:
Is it a Primary or
Revision Hip Arthroplasty?

Ran Schwarzkopf, MD and Mahta Baghoolizadeh, BS

ACS-NSQIP database dataset (75,000 procedures)

Conversion THA vs Revision THA vs Primary THA

Compared 53 pre- intra- and post-operative variables

Results

17 variables different Conversion vs Primary (p<0.0003)

1 variables different Revision vs Primary (p<0.0003)

3 variables different Conversion vs Revision (p<0.0003)

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Conversion Total Hip Arthroplasty:
Is it a Primary or
Revision Hip Arthroplasty?

Ran Schwarzkopf, MD and Mahta Baghoolizadeh, BS

Impact

Conversion = Revision Conversion ≠ Primary

Wrong DRG

Ongoing Discussion with CMS, CJR Implications

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AAHKS Clinical Award

Liposomal Bupivacaine and Peri-articular Injection are Not Superior to Single Shot Intra-articular Injection for Pain Control In Total Knee Arthroplasty

Rajesh K. Jain, MD, MPH
Reconstructive Orthopaedics
Marlton, NJ

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Liposomal Bupivacaine and Peri-articular Injection are Not Superior to Single Shot Intra-articular Injection for Pain Control In Total Knee Arthroplasty

Rajesh K. Jain, MD, MPH, Scott D. Schoifet, MD, FACS, Manny D. Porat, MD, Gregory G. Klingenstein, MD, Jeremy J. Reid, MD, Robert E. Post, MD

Single-blind, prospective, powered, RCT, 207 TKA

Intra-articular bupivacaine/morphine
vs
Peri-articular bupivacaine/morphine
Vs
Liposomal bupivacaine (PA)

Primary outcome: VAS Pain & narcotic need (MME)

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Liposomal Bupivacaine and Peri-articular Injection are Not Superior to Single Shot Intra-articular Injection for Pain Control In Total Knee Arthroplasty

Rajesh K. Jain, MD, MPH, Scott D. Schoifet, MD, FACS, Manny D. Porat, MD, Gregory G. Klingenstein, MD, Jeremy J. Reid, MD, Robert E. Post, MD

Single-blind, prospective, powered, RCT, 207 TKA

Primary outcome: VAS Pain & narcotic need (MME)

Results

	IA	PAI	Lipo
Mean VAS :	3.95	vs 3.97	vs 3.86 (p=0.94)
MME/day :	100.7	vs 100.1	vs 98.9 (p=0.97)

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Liposomal Bupivacaine and Peri-articular Injection are Not Superior to Single Shot Intra-articular Injection for Pain Control In Total Knee Arthroplasty

Rajesh K. Jain, MD, MPH, Scott D. Schoifet, MD, FACS, Manny D. Porat, MD, Gregory G. Klingenstein, MD, Jeremy J. Reid, MD, Robert E. Post, MD

Impact

Cost savings: $4.92 vs $315

Also Paper #36, DBRCT Lipo vs PAI

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Scientific Sessions (9)

13 RCTs

22% Level 1 Studies

Focus: Clinically Relevant, Practice Changing

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Scientific Session Highlights
Knee

#9: Fixed vs Mobile TKA 10 yr RCT
No difference

#13: Kinematic vs Mechanical Alignment in TKA RCT
No difference

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Scientific Session Highlights
Hip

#21: RCT Formal PT vs Independent Ex after THA
No Difference

#22: Michigan Arthroplasty Registry
DA vs Post THA Same Dislocation Rates (0.4%)

#24/25: 13 year f/u XLPE, 28 vs 36 heads
No difference in Wear Rates or Osteolysis

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Scientific Session Highlights
Infection

#27: RCT Oral Abx after 2-stage PJI
Reduces Reinfection Risk (5% vs 20%)

#31/32 Injections Prior to TJA Increase Infection Risk
Risk increases with shorter gap

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Breakout 1, Primary THA: Simple to Complex

Daniel J. Berry, M.D.
Mayo Clinic
Rochester, Minnesota

Challenging Primary THA: Introduction and General Principles

Understand the anatomy and specific technical issues related to the specific anatomic problems posed by the problem you face. Know what you are up against.

Perform careful, detailed preop planning: Template and have a plan A, plan B, and plan C.

Consider which operative approach will give you all the options you need to solve the problem.

When appropriate, (previous infection, retained hardware) screen for infection.

Prepare for extra blood loss, consider cell saver.

Make sure you have all the special instruments (for example broken screw removal set) and special implants you need.

WHEN FEMORAL FRACTURE FIXATION FAILS: SALVAGE OPTIONS

The Failed Femoral Neck Fracture:

Young patient:

Attempt to preserve patient's own femoral head. Clinical results reasonably good even if there are patches of avascular necrosis. Preferred methods of salvage: valgus-producing intertrochanteric femoral osteotomy: puts the nonunion under compression. Other treatment option: Meyer's vascularized pedicle graft.

Older patient:

Most reliable treatment is prosthetic replacement. Decision to use hemiarthroplasty (such as bipolar) or THA based on quality of articular cartilage, perceived risk of instability problem. In most patients THA provides higher likelihood of excellent pain relief. Specific technical issues: (1) hardware removal: usually remove after hip has first been dislocated (to reduce risk of femur fracture); (2) Hip stability: consider anterolateral approach in older patients at risk. (3) Acetabular bone quality: poor because it is not sclerotic from previous arthritis; caution when impacting a pressfit cup; low threshold to augment fixation with screws; don't overdo reaming; just expose the bleeding subchondral bone.

The Failed Intertrochanteric Hip Fracture:

Young patient:

Attempt to salvage hip joint with nonunion takedown, autogenous bone grafting and internal fixation. Blade plate usually the favored internal fixation device.

Older patient:

Decision to preserve patient's own hip with internal fixation versus salvage with hip arthroplasty should be individualized based on patient circumstances, fracture pattern, bone quality. THA is an effective salvage procedure for this problem in older patients. If prosthetic replacement is chosen special considerations include:

1. THA vs. hemiarthroplasty: bipolar better stability; THA more reliable pain relief.

2. Removal of hardware: be prepared to remove broken screws in intramedullary canal.

3. Management of bone loss: bone loss to level of lesser trochanter common. Often requires a calcar replacement implant. Proximal calcar build up size dictated by bone loss.

4. Length of stem: desirable to bypass screw holes from previous fixation if possible.

5. Stem fixation: cemented or uncemented fixation depending on surgeon preference, bone quality. If uncemented, consider extensively coated (damaged proximal bone).

6. Greater trochanter: often a separate piece, be prepared to fix with wires or cable grip. Residual trochanteric healing, hardware problems not rare after THA.

7. Bone deformity/heterotopic bone: manage in individual basis.

References

1. Haidukewych GJ, Berry DJ: Hip Arthroplasty for Salvage of Failed Treatment of Intertrochanteric Hip Fractures. J Bone Joint Surg 85A(5):899-904, May 2003
2. Haidukewych GJ, Berry DJ: Salvage of Failed Treatment of Hip Fractures. J Am Acad Ortho Surg 13(2):101-9, Mar-Apr 2005.
3. Tabsh I. Waddell JP, Morton J: Total Hip Arthroplasty for Complications of Proximal Femoral Fractures. J Orthop Trauma 11:166-169, 1997.

SALVAGE OF FAILED ACETABULAR FRACTURES WITH THA

I. Introduction

A. THA after acetabular fracture presents unique technical challenges.

B. These challenges include bone deformity, bone deficiency, sclerotic or dysvascular bone, non-united bony fragments, pelvic discontinuity, retained hardware, heterotopic ossification, previous incisions, and concerns regarding the sciatic nerve.

C. Despite these challenges, with current treatment methods, a high degree of success can be achieved with modern technology.

II. Technical Issues

A. Preoperative evaluation for infection
   1. In previously operated acetabular fractures, infection is always a concern. Screening C-reactive protein and sedimentation rate may be performed. If a concern regarding infection is present, the hip may be aspirated.

B. Incisions
   1. In most cases, a previous incision may be utilized. If necessary, an incision may be extended or a new limb can be created. The hip is less sensitive to multiple incisions than the knee; nevertheless, attention still should be paid to maintaining optimal skin bridges.

III. Hardware Removal

A. In cases with a high degree of concern about infection, a staged procedure may be considered. However, in most cases, hardware removal can be done selectively at the time of THA surgery. Hardware that does not compromise placement of the THA may be left in place. Sometimes hardware can be cut off within the acetabulum to minimize exposure needs.

B. Reconstructive Goals
   1. The reconstructive goal is to place the hip center as close as possible to normal hip center but also to gain good support of the socket on host bone. In most cases, both goals can be met. When necessary, some compromise in hip center of rotation may be considered to optimize implant stability on host bone.

C. Bone Deficiencies
   1. Most bone deficiencies may be managed with methods similar to revision hip surgery. However, in the acetabular fracture patient, usually the host femoral head is available and this can be used as bone graft, either in particulate or bulk form.

   2. Most cavitary deficiencies can be dealt with particulate bone graft. Some superolateral bone deficiencies from posterior wall fractures may be considered for bone grafting or augmentation techniques.

D. Cup Fixation
   1. The principles of revision surgery are followed using uncemented acetabular components fixed with augmentation screws.

E. Nonunited Fracture
   1. Nonunited fractures are not uncommon in these circumstances. Small wall nonunions may be managed as noted above for bone deficiency. If pelvic discontinuity is present, it is usually best treated by following the rules established for treatment of pelvic discontinuity with pelvic plating. Pelvic plating provides a reasonable likelihood of bone healing in these circumstances when combined with bone grafting techniques.

F. Heterotopic Ossification
   1. Heterotopic ossification is common in previously operated acetabular fractures. Removal of heterotopic bone at the time of surgery to gain hip motion is routine. Postoperative measures to reduce the likelihood of bone formation (that is either shielded radiation or use of a nonsteroid anti-inflammatory agent) may be strongly considered.

G. Nerve Issues
   1. The sciatic nerve is at risk during these procedures. In many cases, avoiding the nerve and the region of the nerve is a reasonable approach. When a lot of work must be done on the posterior column, the surgeon needs to know exactly where the nerve is and in such cases the nerve may be exposed distally beneath the gluteus maximus tendon and followed proximally with careful and judicious dissection.

H. Results
   1. Results of total hip arthroplasty after acetabular fracture have varied in the past. More recent series have shown a high rate of acetabular fixation associated with uncemented hemispherical implants. Acetabular fracture patients are disproportionately young and active with unilateral hip disease and, therefore, bearing surfaces should be chosen accordingly.

References

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2. Coventry MB: The treatment of fracture-dislocation of the hip by total hip arthroplasty. *J Bone Joint Surg Am.* 1974; 56:1128-1134.
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15. Row CR, Lowell JD: Prognosis of fractures of the acetabulum. *J Bone Joint Surg Am.* 1961; 43:30-59.
16. Mears DC, Shirahama M: Stabilization of an acetabular fracture with cables for acute total hip arthroplasty. *J Arthroplasty.* 1998; 13:104-107.

Primary THA: Simple to Complex **Berry/Page 6**

THA FOR DEVELOPMENTAL HIP DYSPLASIA

I. Introduction

A. Developmental dysplasia of the hip is among the most common hip diagnoses leading to hip pain, arthritis and hip surgery in young patients.

B. Advances in treatment have led to more technically straight forward reconstructions, and better functional results and durability.

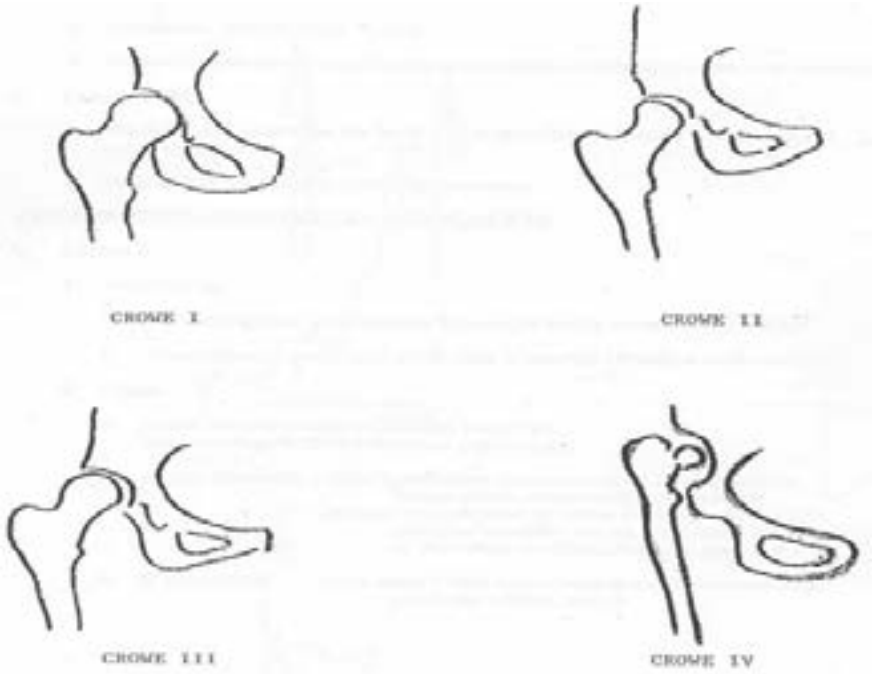
II. Indications for arthroplasty

A. Advanced degenerative disease

B. Anatomy/personality unfavorable for osteotomy

C. Older patient

III. Classification: Crowe



Primary THA: Simple to Complex **Berry/Page 7**

IV. Treatment Principles

A. Acetabulum
1. Acetabular reconstruction at anatomic position with uncemented implant when possible. Use screws for extra fixation in most cases.
2. Anterolateral acetabular auto-grafting if needed—fix with screws
3. Accept mild medialization, elevations of hip center to get cup coverage on host bone
4. Reserve high hip center for Crowe II/III patient in whom anatomic hip center would require socket to mostly be placed on graft

B. Femur
1. Cemented versus uncemented based on patient age, bone quality, anatomy. In most younger patients uncemented is preferred.
2. Problems: anteversion, length
3. Modular uncemented stems simplify management of excessive anatomic anteversion in some cases
4. Shortening/derotation subtrochanteric osteotomies in selected cases (see below)

C. Lengthening
1. No definite guidelines for how much is safe but beware if lengthening more than 2 cm
2. Role of intra-operative nerve monitoring

V. Treatment Based on Classification

A. Crowe I
1. Acetabulum
   a. Reconstruction at anatomic hip center using uncemented socket
   b. Anterolateral structural graft only if needed (fixation with screws)
2. Femur
   a. Uncemented versus cemented bases on anatomy/age/activity/surgeon philosophy
   b. If uncemented:
      -avoid excessive anteversion of stem (because femur often anteverted)
      -in some diaphyseal fixation (extensively coated stem) or modular stems are useful because of distorted proximal femoral geometry modular stem that allows anteversion correction and use of uncemented proximally coated fixation is method of choice for many of these patients
   c. If cemented:
      -may need CDH stem (valgus medial femur may preclude routine stem)

B. Crowe II
   1. Acetabulum
      a. Reconstruction at anatomic hip center or slightly above anatomic center attempting to optimize coverage of uncemented socket with native bone
      b. Graft if needed (usually do)
   2. Femur
      a. Same as Crowe I

C. Crowe III
   1. Acetabulum
      a. Presents the most difficult acetabular problem of DDH cases: severe lateral bone deficiency
      b. Options: -high hip center with small uncemented cup fixed with screws
         -anatomic hip center reconstruction beneath large bone graft
   2. Femur
      a. Same as Crowe I
      b. May require femoral shortening if anatomic hip center is chosen (See below for Crowe IV)

D. Crowe IV
   1. Acetabulum
      a. Reconstruction at anatomic hip center with extra small uncemented socket
      b. Graft usually not needed
      c. Technical tip: prepare socket with reverse reaming (expands socket and impacts bone making it denser)
   2. Femur
      a. Subtrochanteric osteotomy, femoral shortening
         i. advantages: -elegant
            -maintains anatomy of femur
            -allows uncemented implant use
            -avoids trochanteric problems of earlier methods
         ii. technical tips: -osteotomy: transverse
            -length: preop plan/intraop soft tissue tension
            -keep resected segment vascular, split, use as struts
            -implant: best to get proximal and distal fixation: fully coated or an implant with diaphyseal fixation (such as flutes) distally

References

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Primary THA: Simple to Complex **Berry/Page 10**

THA IN PATIENTS WITH PROXIMAL FEMORAL DEFORMITY

Introduction:

Goals of THA in patients with proximal femoral deformity are:

-Avoid letting deformity force suboptimal implant position

-Gain good implant position

-Gain acceptable hip biomechanics

Classification and treatment algorithm: Based on deformity level

-Very proximal (lesser trochanter level or above):

-Subtrochanteric

-Distal: distal to tip of standard THA stem

Management based on Deformity Level:

Distal deformities: Ignore

Proximal deformities: Rx options:

-Remove the deformity and substitute with the implant

-Choose an implant that allows satisfactory position and fixation despite the deformity

Subtrochanteric deformities: The toughest problems to solve (too proximal to ignore; too distal to bypass). Rx options:

-Resurfacing Hip Arthroplasty: now out of favor due to metal-metal bearings in most cases

-Short stem THA

-Corrective osteotomy with THA: principles: maintain femur vascularity, gain fixation proximal and distal to osteotomy with optimal implant choice.

Conclusions:

-Majority of proximal femoral deformities in hips requiring THA can be managed in one procedure.
-Main options: Use implant that compensates for deformity; excise the deformity; corrective osteotomy.

References:

Berry, DJ: Total Hip Arthroplasty in Patients with Proximal Femoral Deformity. Clin Orthop Rel Res 369:262-272, Dec 1999

Breakout 2, Primary Total Knee Arthroplasty (TKA): Simple to Complex

Outline

Pre-operative evaluation

- Indications
- Physical Exam
- Radiographs/Imaging
- Conservative Treatment to Date
- The Role of Pre-hab?
- Evaluation of Risk Factors/Patient Optimization

Anesthetic Technique/Pain Management

- Peri-capsular injections
- Regional blocks

Positioning/Operative Room set up

Surgical Approach/Exposure

Operative Technique Considerations

- Alignment- (neutral, anatomic, kinematic, etc.)
  - Standard Instrumentation
  - CAS
  - Custom guides
  - Other
- Gap Balancing vs Measured Resection
  - Flexion Gap and Extension Gap mismatches
- CR vs PS
- PS (Post vs UC/AS), Mobile bearing
- Patellar resurfacing

- Fixation
  - Cement
  - Cementless
- Ligament Releases
  - Medial releases
  - Lateral releases
- Deformity considerations
  - Flexion contracture
  - Varus deformity/Valgus deformity
  - Extra-articular vs Intra-articular
  - Bone loss and management
- Other considerations
  - Retained hardware
  - Soft tissue defects and previous incisions
  - Previous surgery (HTO, tubercle osteotomy, DFO, patellectomy, etc.)
- The Role of Intra-articular Drains
- Blood Management Strategies
- Wound closure and dressing selection

Post-operative management

- Complications
- Multi-modal pain management
- Physical Therapy
- Discharge Disposition
- Outpatient follow up routine/schedule

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Some Top Testing Facts

1. Care should be taken to avoid placing the tibial component in internal rotation to avoid undesired increases in the Q angle.

2. The patellar component should be placed in a medial and superior position.

3. PCL failure should be considered in a well-functioning PCL-retaining TKA that starts to demonstrate instability, hyperextension, and recurrent effusion.

4. Correction of a gap-balancing mismatch requires equalization of the flexion and extension gap.

5. Successful cementless fixation requires adjunctive peripheral

fixation (eg, pegs and screws).

6. Excellent survival outcomes exist for cruciate-retaining and cruciate-substituting TKA designs.

7. The femoral component should be lateralized, parallel to the neutral rotational axis, and externally rotated 3° to 5° to the posterior condylar axis.

8. If a peroneal nerve palsy is suspected following TKA, the patient's leg should be immediately flexed and all compressive dressings should be removed.

Periprosthetic Joint Infection

AAHKS Spring Meeting
Symposium

Bryan D. Springer, MD
OrthoCarolina Hip and Knee Center
Charlotte, NC

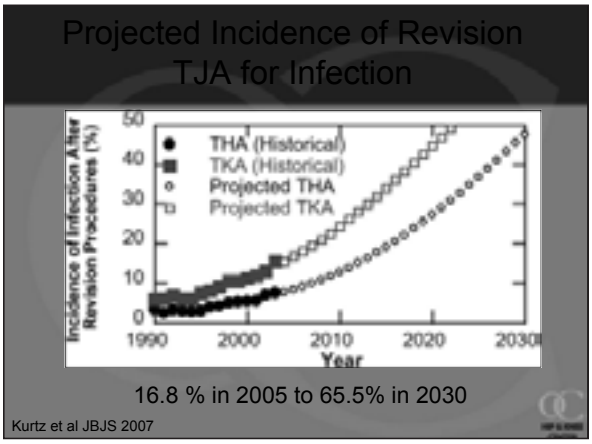
OrthoCarolina
HIP & KNEE CENTER

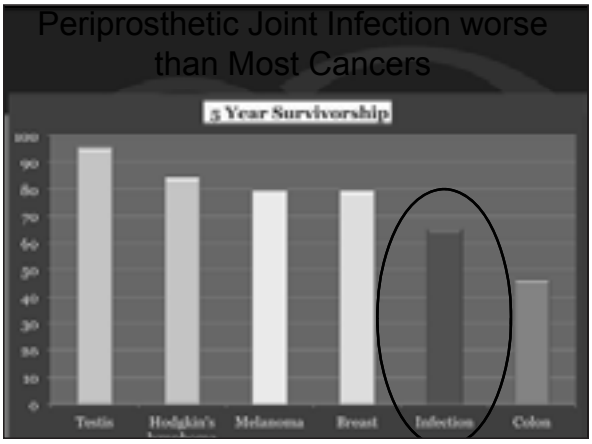
Disclosure

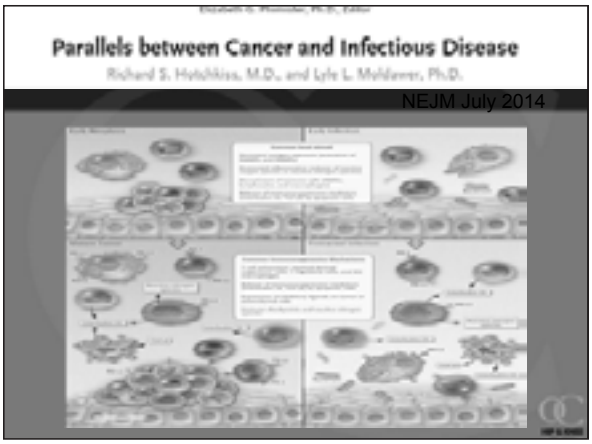
Consultant:	Stryker Orthopedics ConvaTec
Speakers Bureau:	Ceramtec
Research Support:	Depuy/Wright Medical/Zimmer/Pacira
Editorial Board:	JoA, Arthroplasty Today
Board of Directors:	AJRR
Medical Advisor:	Joint Purification Systems

The Epidemiology of Revision Total Knee Arthroplasty in the United States

- Periprosthetic Joint infection (PJI) is one of the most challenging and frequent complications after TJA
- Range from 0.5% to 7% ….and increasing
- #1 reason for failure of TKA
- #3 reason for failure of THA


Projected Incidence of Revision TJA for Infection
Incidence of Infection After Revision Procedures (%)
50
40
30
20
10
0
1990
2000
2010
2020
2030
Year
THA (Historical)
TKA (Historical)
Projected THA
Projected TKA
16.8 % in 2005 to 65.5% in 2030
Kurtz et al JBJS 2007


Periprosthetic Joint Infection worse than Most Cancers
5 Year Survivorship
Testis
Hodgkin's
Melanoma
Breast
Infection
Colon


Parallels between Cancer and Infectious Disease
NEJM July 2014

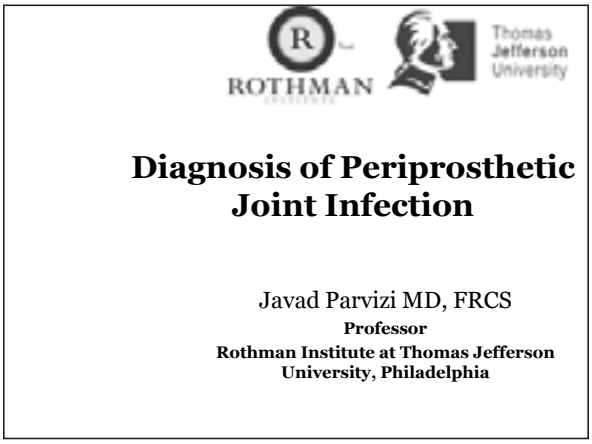
Periprosthetic Joint Infection

Still remains a tremendous amount of variation:

- How to Evaluate and Diagnose a suspected PJI
- What is the appropriate Surgical Management

Periprosthetic Joint Infection AGENDA

- The Diagnosis of PJI: Current and Future
  - Dr. Javad Parvizi
- The Role of Irrigation and Debridement
  - Dr. Matt Abdel
- Removal of Implants: One Stage or Two ?
  - Dr. Greg Polkowski
- Interactive Discussion


ROTHMAN
Thomas Jefferson University
Diagnosis of Periprosthetic Joint Infection
Javad Parvizi MD, FRCS
Professor
Rothman Institute at Thomas Jefferson University, Philadelphia


Disclosures
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NIH
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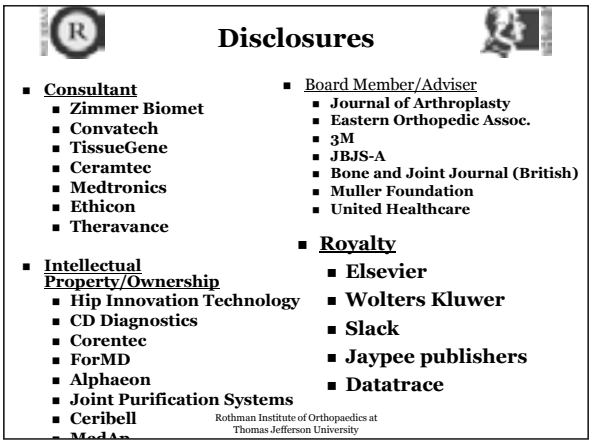
Cempra
CeramTec
DePuy
Integra
Myoscience
NDRI
Novartis
Pfizer
Rothman Institute of Orthopaedics at
Rotation Medical
Simplify Medical
Smith and Nephew
Stelkast
Stryker Orthopedics
Synthes
TissueGene
Tornier
Orthospace
Zimmer Biomet


Disclosures
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CD Diagnostics
Corentec
ForMD
Alphaeon
Joint Purification Systems
Ceribell
Board Member/Adviser
Journal of Arthroplasty
Eastern Orthopedic Assoc.
3M
JBJS-A
Bone and Joint Journal (British)
Muller Foundation
United Healthcare
Royalty
Elsevier
Wolters Kluwer
Slack
Jaypee publishers
Datatrace
Rothman Institute of Orthopaedics at
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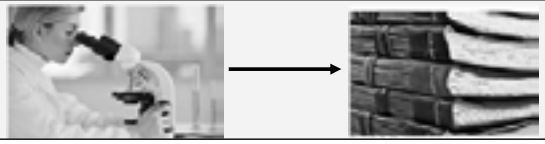
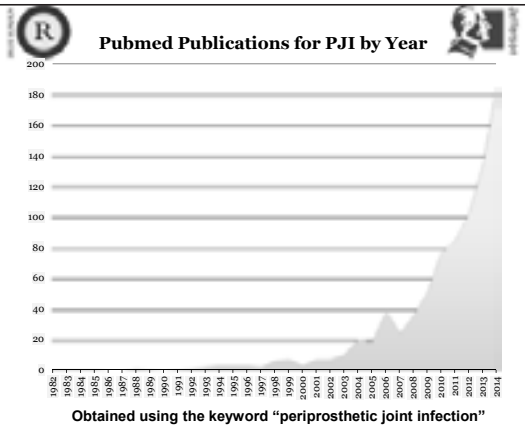
Facts

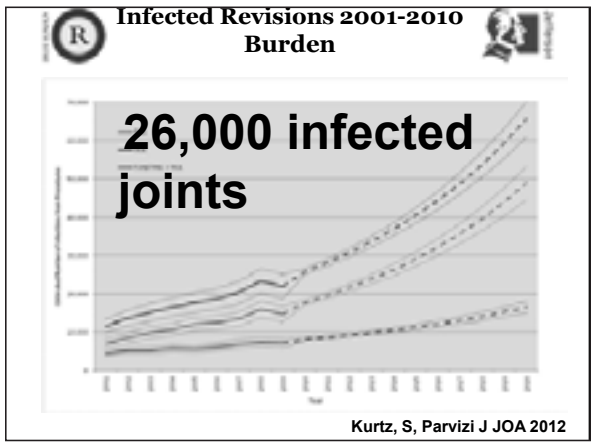
The diagnosis of periprosthetic infection has been the subject of considerable research

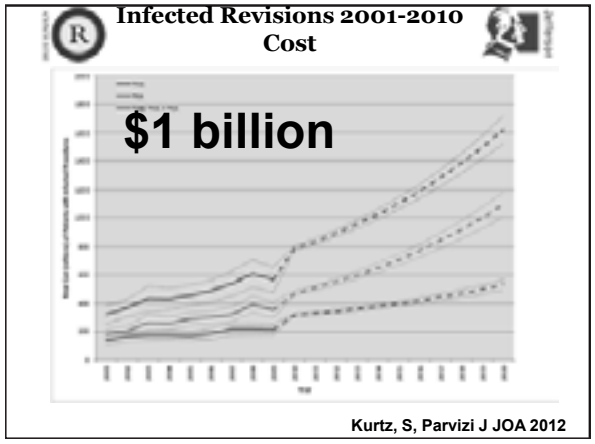
Background

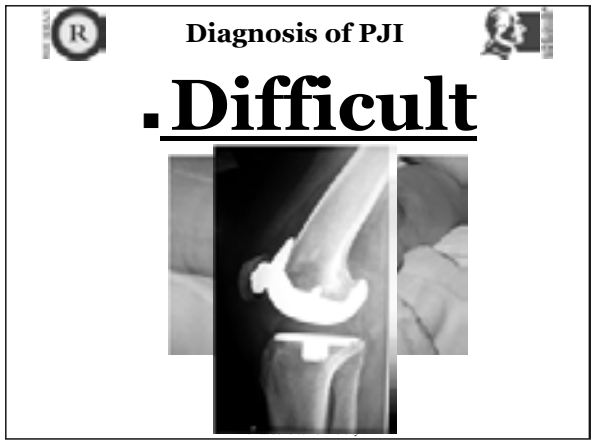
This research has produced a large number of peer-reviewed manuscripts

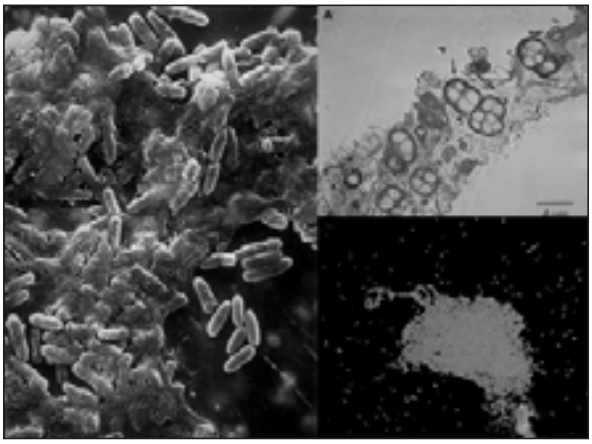




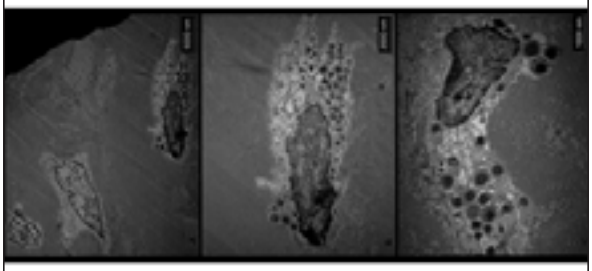

Infected Revisions 2001-2010
Burden
26,000 infected joints
Kurtz, S, Parvizi J JOA 2012


Infected Revisions 2001-2010
Cost
$1 billion
Kurtz, S, Parvizi J JOA 2012


Diagnosis of PJI
Difficult



Intracellular *S. aureus* in Periprosthetic Tissue



Parham S et al, Clin Infect Dis 2006

The Problem

- No test with absolute accuracy exists
  - i.e. no gold standard

Problem Diagnosing PJI

Blood

10 mg/L

Sensitivity 87%
Specificity 77%

- Different labs use different units - mg/L vs. mg/dL
- The lab's normal range has nothing to do with PJI

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Problem Diagnosing PJI

Synovial Fluid

3000 cells/ul

Sensitivity 89%
Specificity 92%

- Problems with automated cell counters?
- The cutoff is about 3000 cells/ul, not 50,000 cells/ul

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Thomas Jefferson University

Problems Diagnosing PJI

Synovial Fluid

Sensitivity 52%
Specificity 95%

Poor Results

Year	Author	Journal	Sensitivity	Specificity
2006	Bare et al.	CORR	53%	94%
2008	Gallo et al.	New Microbiol	44%	94%
1999	Spangehl et al.	JBJS	73%*	94%
2012	Gomez et al.	J Clin Micro	64%	97%
2014	Shanmugasundaram et al.	HSS Journal	45%	

Background

Increasing knowledge
has led to many
official diagnostic recommendations

IDSA MSIS AAOS ICM

AAOS

AMERICAN ACADEMY OF ORTHOPAEDIC SURGEONS

THE DIAGNOSIS OF PERIPROSTHETIC JOINT INFECTIONS OF THE HIP AND KNEE

GUIDELINE AND EVIDENCE REPORT

Adopted by the American Academy of Orthopaedic Surgeons
Board of Directors
June 18, 2010

AAOS Guidelines
www.aaos.org/guidelines

- 15 recommendations
- Majority strong
- Review of literature

Parvizi et al. JAAOS 2010

Della Valle et al. JAAOS 2010

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Main Principles

- Every painful prosthetic joint is potentially infected

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Truly Aseptic?

- Infection should always be ruled out
- 12% of so called "aseptic" were infected

Parvizi J , et al CORR 2011

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AAOS Guidelines
www.aaos.org/guidelines

ESR and CRP for all patients undergoing revision arthroplasty

Aspiration of joint before any further imaging

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AAOS Guidelines
www.aaos.org/guidelines

Patients be off antibiotics before aspiration (2 weeks)

No Antibiotics until diagnosis reached or refuted

No role for intraoperative gram stain

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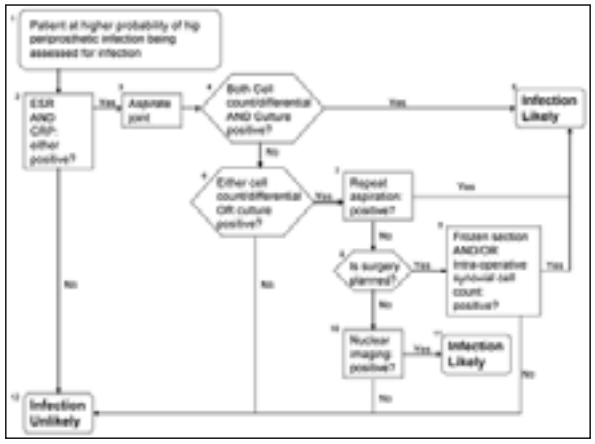
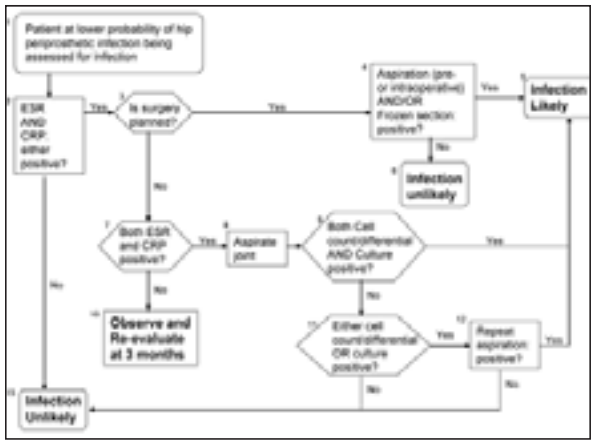
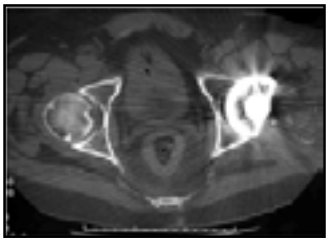




AAOS Guidelines
Rec 10: Inconclusive

- CT or MRI



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AAOS Guidelines
Rec 9: Weak

Bone scan (leukocyte labeled) and PET scan is an option for patients not scheduled for reoperation or diagnosis not reached

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ARTICLE IN PRESS

The Journal of Arthroplasty

Diagnosis of Periprosthetic Joint Infection: The Role of Nuclear Medicine May Be Overestimated

Claudio Diaz-Ledezma, MD, Courtney Lamberton, BS, Paul Lichtorin, MD, Javad Parvizi, MD, FRCS

ARTICLE INFO

ABSTRACT

Rothman Institute of Orthopaedics at
Thomas Jefferson University

International Consensus Meeting
Philadelphia, August 2013

New Algorithm

International Consensus

- Cell count
- Neutrophil differential
- Culture
- ? Biomarkers

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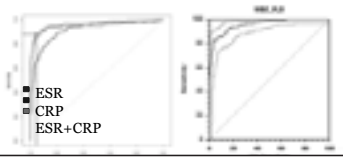
Thresholds (Consensus)
Acute PJI

- ESR- No threshold
- CRP > 100 mg/L (hip and knee)
- Synovial WCC = 10,000 cells/ul
- Synovial PMN >90%

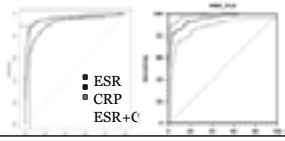


Definition of PJI

CDC (National Healthcare Safety Network) adopts the MSIS definition of PJI

Thresholds (Consensus)
Chronic PJI

- ESR > 30 mm/hr
- CRP > 10 mg/L (hip and knee)
- Synovial WCC > 3,000 cells/ul
- Synovial PMN >80%



Premature Treatment

- Interferes with isolation of infecting organism
- Affects cell count
- Affects serological markers

Shahi A et al Clin Orthop 2015

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Opportunities in Management of PJI

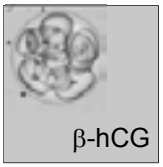
Era of Biomarkers is here

The Journal of Arthroplasty Vol. 26 No. 6 Suppl. 1 2011

Molecular Markers for Diagnosis of Periprosthetic Joint Infection

Christina L. Jacovides, BS, Javad Parvizi, MD, FRCS, Bahar Adeli, BA, and Kwang Am Jung, MD

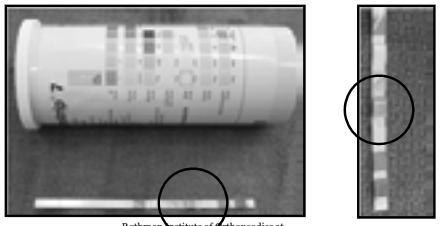
Biomarkers in Medicine



cs at

Diagnosis of PJI Simple Test

- UA strips for leukocyte esterase



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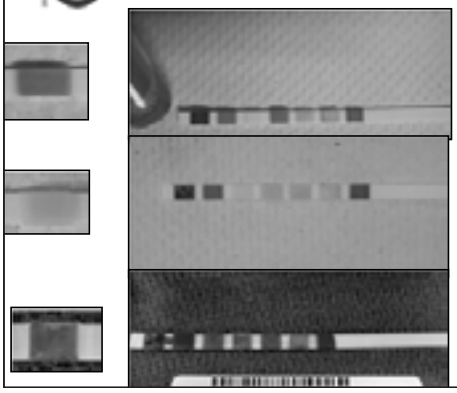
LE Strips



Results

- **Prospective study**
- **Rothman Institute**
- **31 infected / 83 uninfected**

*** sensitivity = 81%**
*** specificity = 100%**
*** positive predictive value = 100 %**
*** negative predictive value = 93.3 %**

Parvizi et al. JBJS 2011

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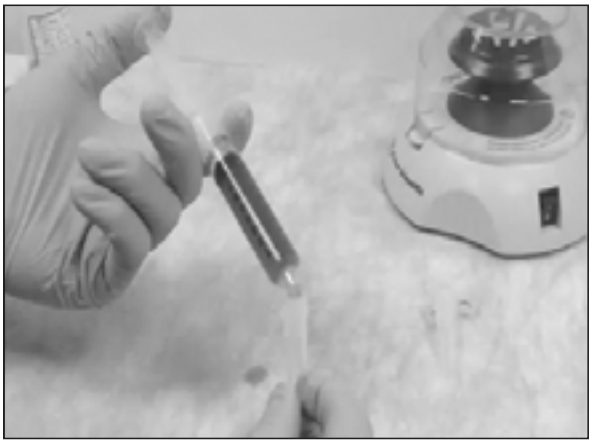


Molecular Markers Protein Analysis

Category	Proteins
Cytokines	IL-1α, IL-1β, IL1ra, IL-2, IL-3, IL-4, IL-5, IL-6, IL-7, IL-8, IL-10, IL-12 subunit p40, IL-12 subunit p70, IL-15, IL-17, IL-23, IFN-γ, TNF-α, TNF-β, TNF receptor-like 2
Adhesion Molecules	ICAM-1, Vascular Cell Adhesion
Growth Factors	VEG-F, BDNF
Acute-phase reactants	CRP
Complement cascade	Complement C3, α-2 macroglobulin, Beta-2-Microglobulin, von Willebrand Factor, Fibrinogen, Factor VII
Chemotactic proteins	Monocyte Chemotactic Protein 1, Eotaxin-1
Metalloproteinase compounds	MMP-2, MMP-3, MMP-9, TIMP-1
Lysis/Destruction	Alpha-1-Antitrypsin, Granulocyte-Macrophage Colony-Stimulating Factor, Macrophage Inflammatory Protein-1 alpha Macrophage Inflammatory Protein-1 beta
Other	Ferritin, Haptoglobin, Stem Cell Factor, T-Cell-Specific Protein, RANTES, Molecule-1, Vitamin D-Binding Protein

Biomarker Screen

Biomarkers Failing Prescreen

- PCT
- TGFa
- LL-37, Human, ELISA kit
- LBP
- CGRP
- Orsomucoid
- Nibrin
- TSG6
- Plekstrin
- SOD2
- Urokinase
- MIF
- PAI-1 (total)
- sFas
- sFasL
- sICAM-1
- sVCAM-1
- Granzyme B
- HSP70
- IL-1α
- IL-10
- IL-17
- MIP-1α
- MIP-1β
- MMP-8

45 Markers Screened

Biomarkers Passing Prescreen

- IL-1b
- IL-6
- IL-8
- TNFa
- G-CSF
- IL-1a
- VEGF
- IP-10
- BFGF (aka FGF2)
- CRP
- a2M
- SKALP
- HNE Enzyme assay
- LE Strip
- Lactoferrin
- Lipocalin-2/NGAL
- Neutrophil Elastase-2 (ELA2)
- Resistin
- Thrombospondin-1 (TSP-1)
- HNP1-3, Human, ELISA kit
- BPI

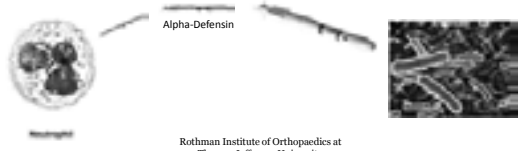
Genomic Experiments

Rothman Institute of Orthopaedics at Thomas Jefferson University

Thomas Jefferson University

Alpha-Defensin

Antimicrobial Peptide Secreted by Neutrophils to fight Infection



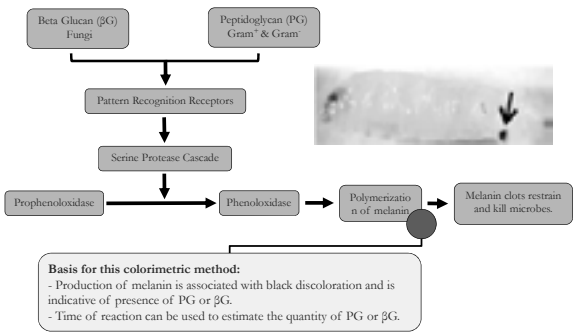
Rothman Institute of Orthopaedics at Thomas Jefferson University

Overall study data

Study	N	Gold Standard	Sensitivity	Specificity
Rothman Institute	149	MSIS Criteria	**97%** (95% CI: 86-100%)	**96%** (95% CI: 90-99%)
Mayo Arizona	61	MSIS Criteria	**100%** (95% CI: 79-100%)	**95%** (95% CI: 83-99%)
Cleveland Clinic	111	MSIS Criteria	**96%** (95% CI: 82-99%)	**99%** (95% CI: 93-100%)
Combined	320	MSIS Criteria	**98%** (95%CI: 92-100%)	**97%** (95% CI: 93-99%)

Rothman Institute of Orthopaedics at Thomas Jefferson University

Prophenoloxidase Pathway



Rothman Institute of Orthopaedics at Thomas Jefferson University

Preliminary Results

- Samples from 8 patients with PJI and 5 patients undergoing primary arthroplasty (control group) have been tested.
- In PJI group, the pathogens were S. aureus (4 cases), coagulase negative Staphylococcus (2 cases), Strep. Intermedius and Candida tropicalis.
- The test was positive in all PJI cases and negative in all control cases.
- The test has been done on two blood (both S. aureus) and two periprosthetic solid tissue samples (S. aureus and Candida tropicalis) at the time of reimplantation and all were positive.

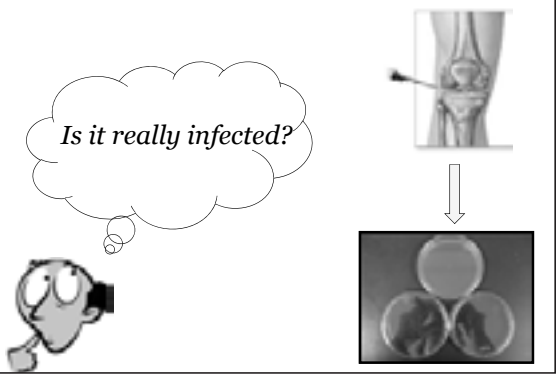
Advantages as diagnostic method

- Directly targets the pathogenic bacteria
  - Most of the pathogens in PJI can be detected.
- Simple
- Inexpensive: (approximate cost will depend on optimization of the method but can be less than 20 $ for each experiment)
- Rapid
  - Time of reaction varies between 30-90 minutes and depends on the quantity of PG/βG.
- Potentially quantitative
- Doable on synovial fluid, solid tissue samples and blood
- Easy to perform
  - In-hospital & out-patient

Issues

- Pathogen
  - Parvizi et al JBJS 2013

Pathogen



Novel Molecular System

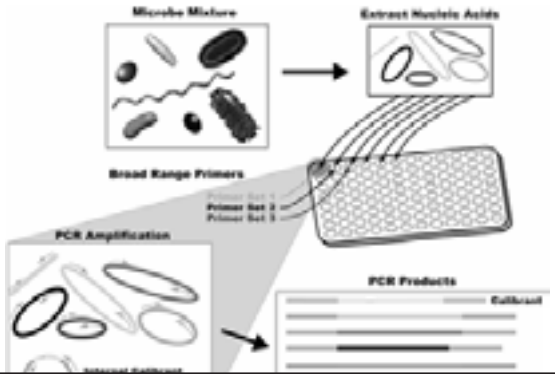
PLEX-ID

1) Amplification
   - ❑ Broad identifiction (3100 species)
2) Targeted identification (spectrosray)

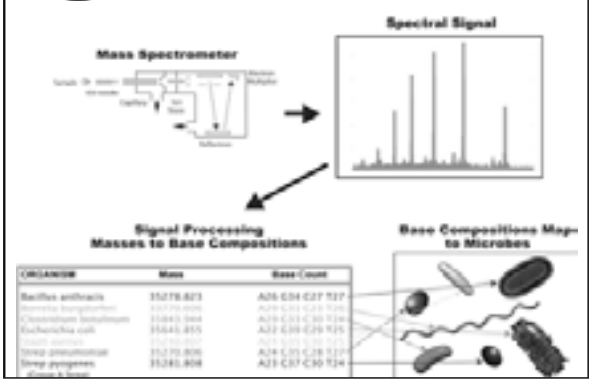
1) Characterization (high resolution subtyping and drug resistance)
   - ❑Pathogen status
   - ❑Genomes/Well
   - ❑Confidence
   - ❑ *mecA gene*

Rothman Institute of Orthopaedics at Thomas Jefferson University

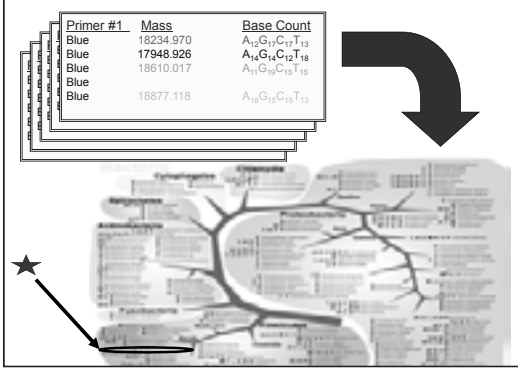
IBIS 5000: Step 1
Sample Prep and Broad Range PCR



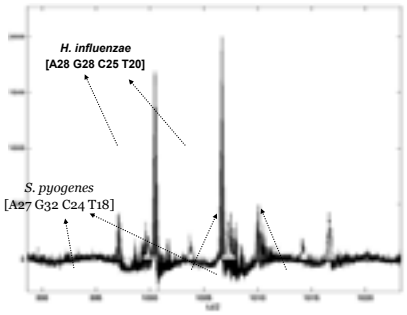
IBIS 5000: Step 2
MS Analysis and Signal Processing



IBIS 5000: Step 3
Triangulation Using Multiple Primers



Organisms Profile



Thank you

ROTHMAN

Thomas Jefferson University

The Role of I&D: When, How, and What the Literature Tells Us

Matthew P. Abdel, M.D.
Associate Professor of Orthopedic Surgery
Mayo Clinic, Rochester, MN

Disclosures

- **Individual Disclosures**
  - ***BJJ* Editorial Board**
  - ***JOR* Editorial Board**
  - ***JOT* Editorial Board**
  - ***EJOST* Editorial Board**
  - **Minnesota Orthopedic Society Board of Directors**
- **Institutional Research Support**
  - **DePuy-Synthes, Stryker, and Zimmer-Biomet**

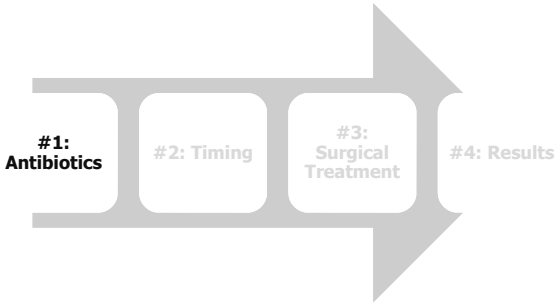
Introduction

- **Type I: + intraop cx after presumed aseptic revision**
- **Type II: Acute postoperative infection (< 4 weeks)**
- **Type III: Late acute hematogenous (< 4 weeks)**
- **Type IV: Chronic infections (> 4 weeks)**

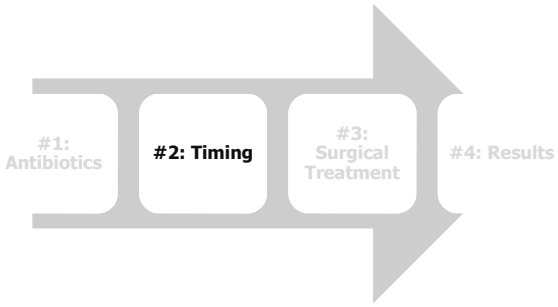
Introduction

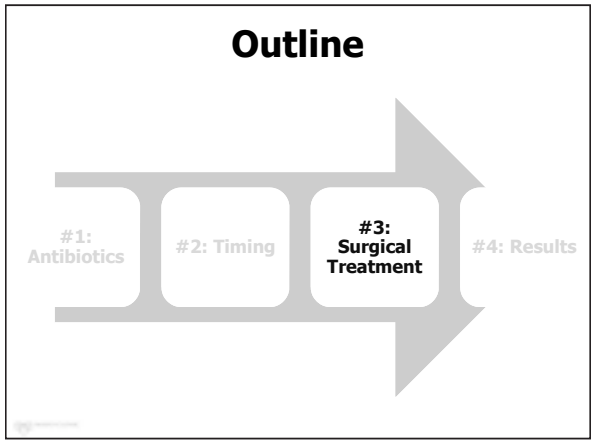
- **Type I: + intraop cx after presumed aseptic revision**
- **Type II: Acute postoperative infection (< 4 weeks)**
- **Type III: Late acute hematogenous (< 4 weeks)**
- **Type IV: Chronic infections (> 4 weeks)**

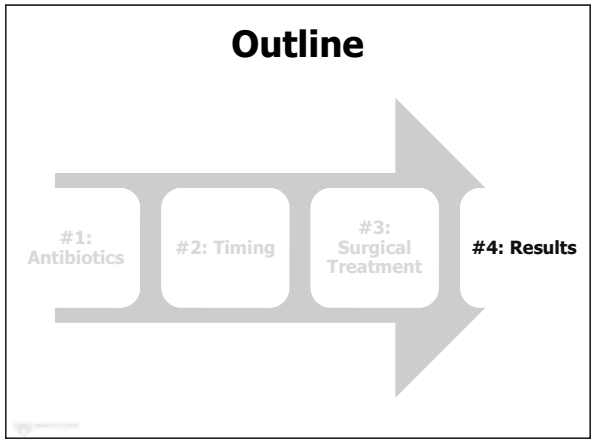
Outline



Outline




Outline
#1: Antibiotics
#2: Timing
#3: Surgical Treatment
#4: Results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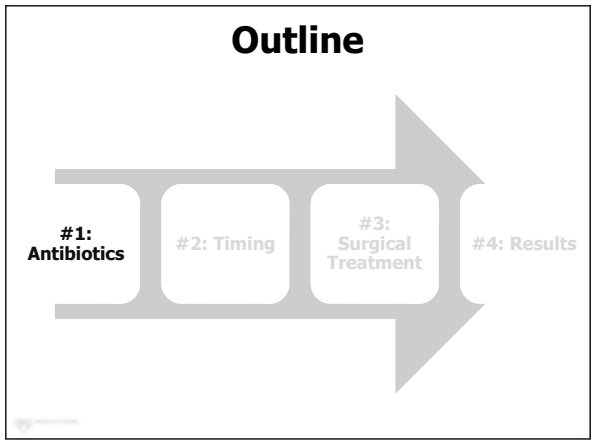
Outline
#1: Antibiotics
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#4: Results

Case 1
61 YOF, 2 Wks s/p R THR, c/o Fevers

Case 1
61 YOF, 2 Wks s/p R THR, c/o Fevers

Cx: ß hemolytic strep

✓ **I&D, Bead Placement, Head/Liner Exchange**

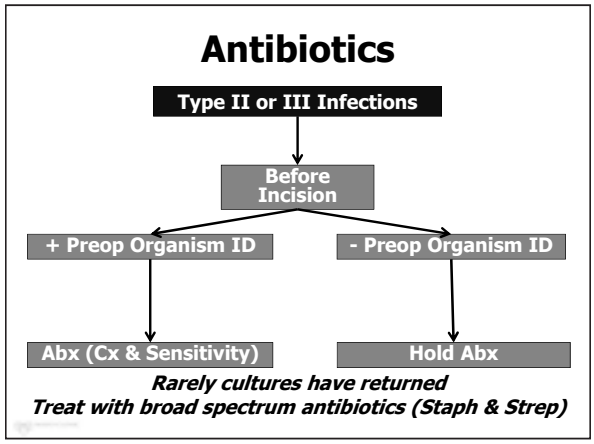
✓ **IV Abx Choice?**
✓ **PO Suppression?**

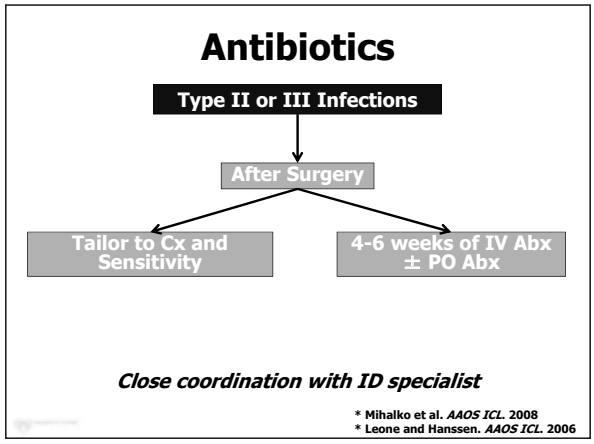
Antibiotics

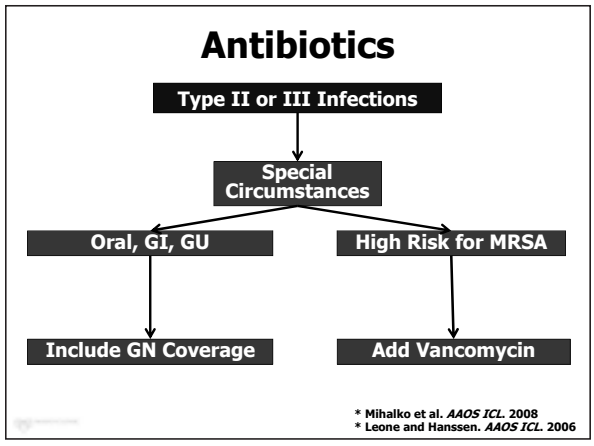
Type II or III Infections

- **Before Incision**
- **After Surgery**
- **Special Circumstances**

* Mihalko et al. *AAOS ICL.* 2008
* Leone and Hanssen. *AAOS ICL.* 2006


Antibiotics
Type II or III Infections
Before Incision
+ Preop Organism ID
- Preop Organism ID
Abx (Cx & Sensitivity)
Hold Abx
Rarely cultures have returned
Treat with broad spectrum antibiotics (Staph & Strep)


Antibiotics
Type II or III Infections
After Surgery
Tailor to Cx and Sensitivity
4-6 weeks of IV Abx ± PO Abx
Close coordination with ID specialist
* Mihalko et al. AAOS ICL. 2008
* Leone and Hanssen. AAOS ICL. 2006


Antibiotics
Type II or III Infections
Special Circumstances
Oral, GI, GU
High Risk for MRSA
Include GN Coverage
Add Vancomycin
* Mihalko et al. AAOS ICL. 2008
* Leone and Hanssen. AAOS ICL. 2006

Case 1
61 YOF, 2 Wks s/p R THR, c/o Fevers

Case 1
61 YOF, 2 Wks s/p R THR, c/o Fevers

PMH: Contralateral THA
BMI = 62 kg/m²
Cx: ß hemolytic strep

✓ **I&D, Bead Placement, Head/Liner Exchange**
✓ **IV Ceftriaxone**
✓ **PO Duricef**

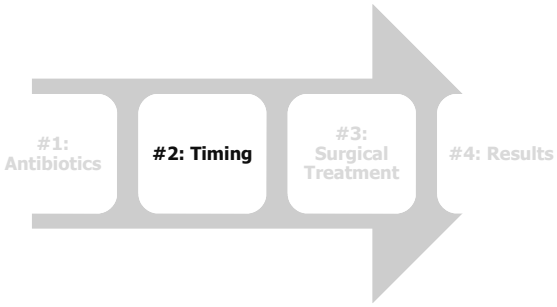
Case 1
61 YOF, 2 Wks s/p R THR, c/o Fevers

PMH: Contralateral THA
BMI = 62 kg/m²
Cx: ß hemolytic strep

✓ **I&D, Bead Placement, Head/Liner Exchange**
✓ **IV Ceftriaxone**
✓ **PO Duricef**

ESR 3
CRP < 3

Outline



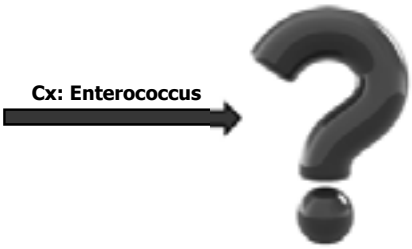
Case 2

52 YOF, 2 Yrs s/p L TKR
Acute Pain, Recent Colonoscopy

Case 2

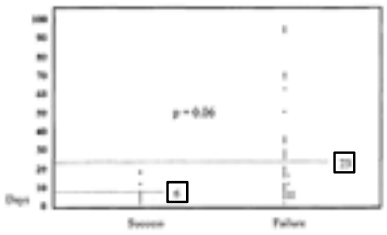
52 YOF, 2 Days of Pain, Colonoscopy

Cx: Enterococcus



Timing
Total Hip Replacement

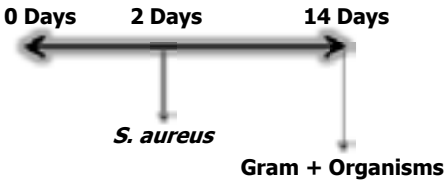
- ***Crockarell et al, JBJS Am, 1988***
  - **Successful with head/liner exchanges completed < 2 weeks from onset of symptoms**



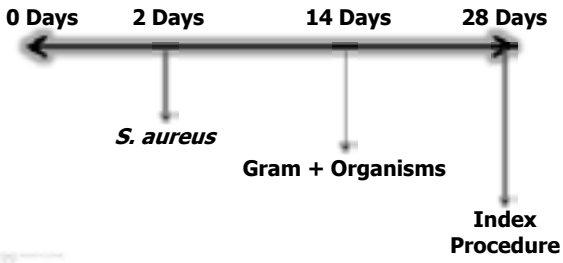
Timing
Total Knee Replacement

- **Schoifet and Morrey, JBJS Am, 1990**
  - **77% failure with I&D and poly exchange**
  - **All failures in those with > 28 days of symptoms**
- **Brandt et al, Clinical ID, 1997**
  - **> 2 days increased failures rates with *S. aureus***
- **Marculescu et al, Clinical ID, 2006**
  - **> 8 days increased failure rates**

Timing
Acute Hematogenous Infections



Timing
Acute Postoperative Infections



Case 2
52 YOF, 2 Yrs s/p L TKR
Acute Pain, Recent Colonoscopy

Case 2
52 YOF, 2 Days of Pain, Colonoscopy

PMH: Contralateral TKR
BMI = 59 kg/m²
Cx: Enterococcus

✓ I&D with Poly Exchange
✓ IV Vancomycin
✓ PO Amoxicillin

Outline

#1: Antibiotics → #2: Timing → **#3: Surgical Treatment** → #4: Results

Case 3

78 YOM, 3.5 Weeks s/p L THR, c/o Pain

Case 3

78 YOM, 3.5 Weeks s/p L THR, c/o Pain

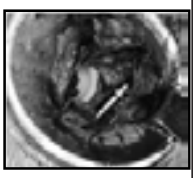
PMH: DM, RA, smoker
Cx: ß hemolytic strep

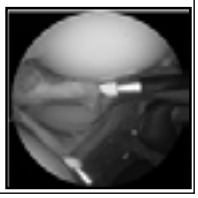
Surgical Management

- Antibiotic Suppression (<20%, infirm)
- I&D with Modular Exchange
  - Open
  - Arthroscopic
- Acute One-Stage Exchange
- Two-Stage Exchange
- Resection Arthroplasty

Surgical Management

- Antibiotic Suppression
- I&D with Modular Exchange
  - Open
  - Arthroscopic (limited role; TKA)
- Acute One-Stage Exchange
- Two-Stage Exchange
- Resection Arthroplasty





Surgical Management

- Antibiotic Suppression
- I&D with Modular Exchange
  - Open
  - Arthroscopic
- Acute One-Stage Exchange (hip)
- Two-Stage Exchange
- Resection Arthroplasty

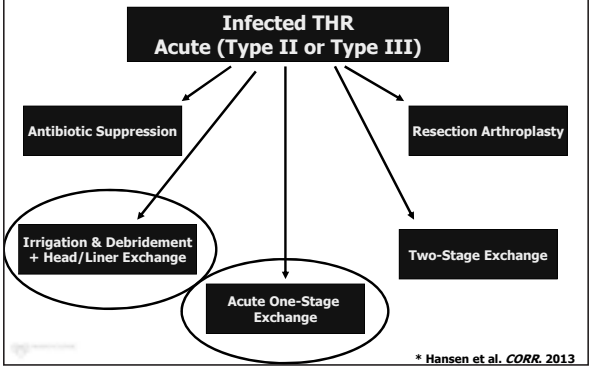
Surgical Management

- Antibiotic Suppression
- I&D with Modular Exchange
  - Open
  - Arthroscopic
- Acute One-Stage Exchange
- Two-Stage Exchange
- Resection Arthroplasty

Surgical Management

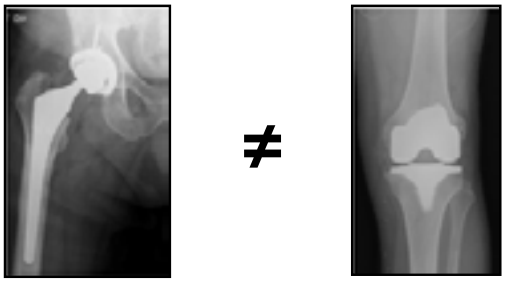
- Antibiotic Suppression
- I&D with Modular Exchange
  - Open
  - Arthroscopic
- Acute One-Stage Exchange
- Two-Stage Exchange
- Resection Arthroplasty

Surgical Management
Total Hip Replacement



* Hansen et al. *CORR.* 2013

Important Difference

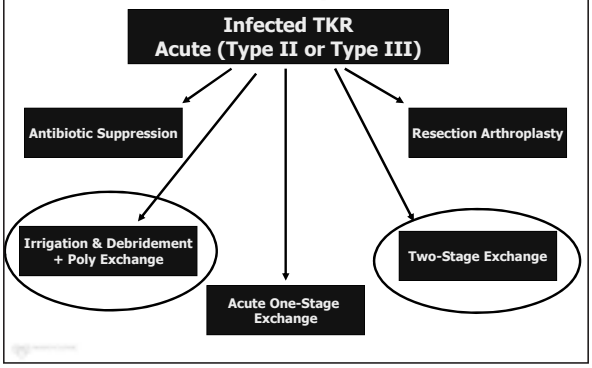


Mode of Fixation

- TKAs: Mostly cemented

- THAs: Mostly uncemented

Surgical Management
Total Knee Replacement



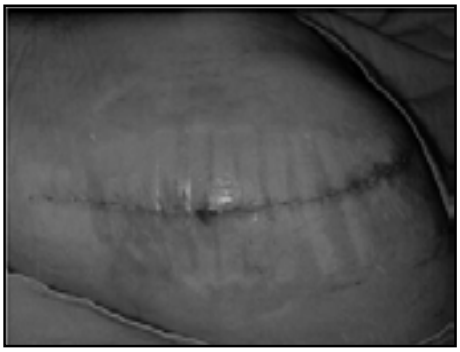
Mayo Protocol

- Favor open I&D with component retention in patients
  - Short-lived symptoms
  - Intact soft tissue envelope
  - Previously well-functioning joint is a must
- Open debridement allows for the exchange of modular components and improved joint access for synovectomy
- The results may improve with the addition of Rifampin in certain biofilm-producing infections (Staph)*

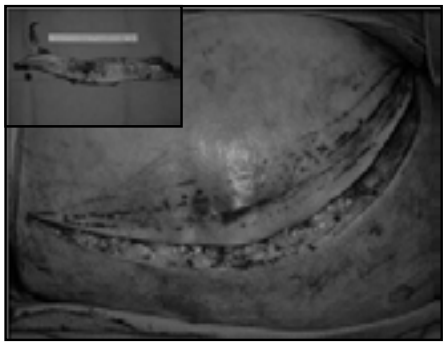
* Zimmerli W et al. *JAMA* 1998

SURGICAL TECHNIQUE

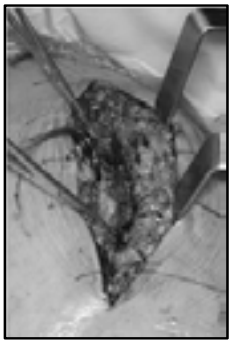
1. Ellipse Previous Incision



1. Ellipse Previous Incision



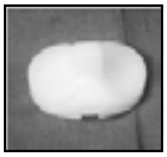
2. Full Thickness Flaps



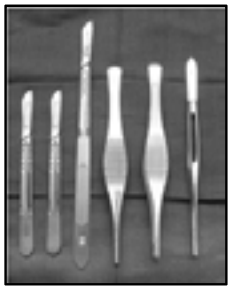
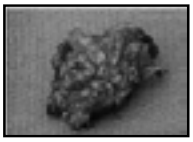
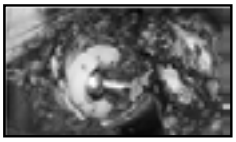
3. Modular Junction Exchange

HIP

KNEE



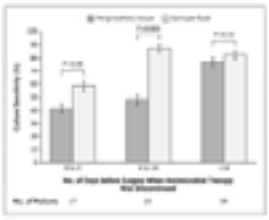
4. Five Cultures
Synovium and Peri-Implant Tissue

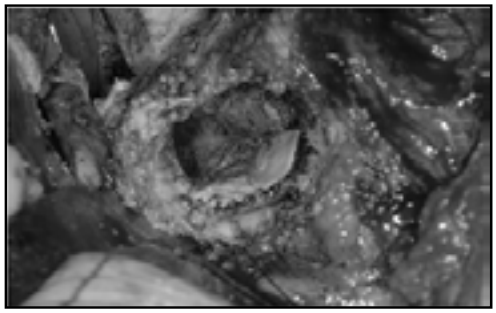
Sonication of Removed Hip and Knee Prostheses for Diagnosis of Infection

Andrej Trampuz, M.D., Kerryl E. Piper, M.S., Melissa J. Jacobson, A.S., Arlen D. Hanssen, M.D., Krishnan K. Unni, M.D., Douglas R. Osmon, M.D., Jayawant N. Mandrekar, Ph.D., Franklin R. Cockerill, M.D., James M. Steckelberg, M.D., James F. Greenleaf, Pxh.D., and Robin Patel, M.D.

N Engl J Med
Volume 357(7):654-663
August 16, 2007

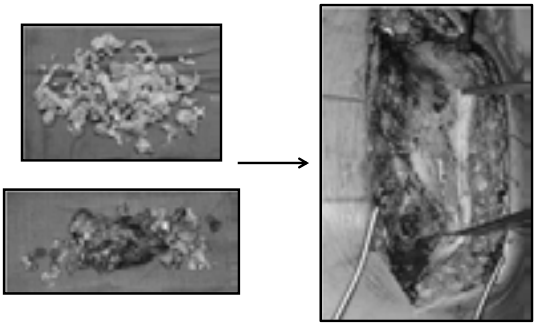


5. Frozen Section
>5 WBC/hpf*



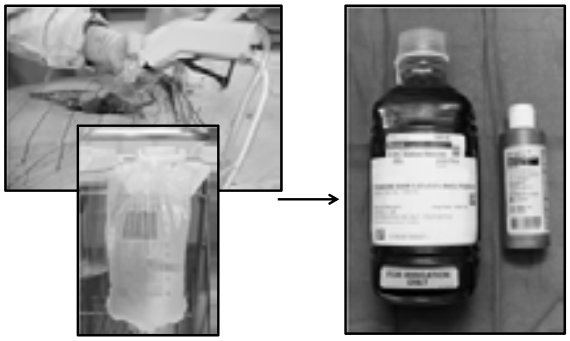
*** Feldman et al. *JBJS.* 1995**
*** Musso et al. Post Grad Med. 2003**

6. Complete Debridement



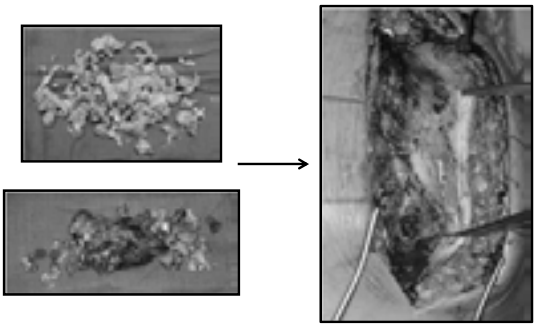
7. Inspect Interfaces

8. Irrigation

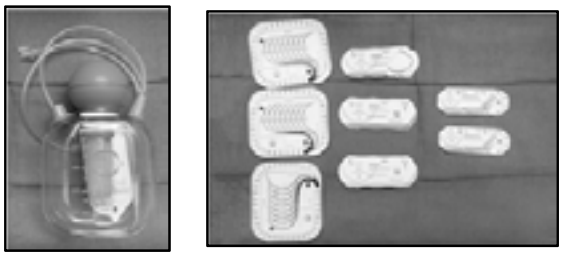


* Brown et al. *JOA.* 2012

9. Repeat Debridement



10. New Instruments, Drain, and Closure



Infected THAs: Are We Doing Better with Modern Treatment

Andrew J. Bryan, M.D.
Matthew P. Abdel, M.D.
Steven J. Fitzgerald, M.D.
Arlen D. Hanssen, M.D.
Daniel J. Berry, M.D.

Infected THA
Questions

- **What are modern results of I&D?**
- **Are we doing any better than in the past?**

Infected THA

Infected THA
Methods

- **All I&D with *implant retention* for deep infection after primary hip replacement at Mayo**
- **2000-2008**
- **90 hips**

Infected THA
Demographics

- **Early postop infection: 73%**
- **Acute hematogenous: 27%**
- **Treatment : I&D ± PE liner/head exchange**

Infected THA
Demographics

- **Postop abx suppression after I&D = 84% hips**
- **Mean followup = 6 years**

Infected THA
Results

- **Overall failure rate for recurrent infection =**

10% (9/90)*

***Lower than most previous series**

Infected THA
Results

Recurrent Infections (stratified):

- **Acute postop infection: 13% vs.**
- **Acute hematogenous: 9%**

No Significant Difference

Infected THA
Discussion

Why might results be better than previous series?

- **Possible reasons:**
  - **Rigorous criteria for I&D alone (MSIS)**
  - **Most patients on suppressive antibiotics**
  - **Improved antibiotics (rifampin, etc)**
  - **Mid-term follow-up**

Contemporary Results
I&D with Component Retention

Acute Hematogenous Infection Following Total Hip and Knee Arthroplasty[a]

Beau S. Konigsberg, MD[a], Craig J. Della Valle, MD[b], Nicholas T. Ting, MD[a], Fang Qiu, PhD[c], Scott M. Sporer, MD[a]

The Journal of Arthroplasty 29 (2014) 808–812

- **42 patients**
- **76% success at 2 years**
- **96% for non-staphylococcal infections**

Aggressive Early Débridement for Treatment of Acutely Infected Cemented Total Hip Arthroplasty

Mohamed Sakeh MRCS(Ed), Shrisin Patel MRCS, Farez Sami Haddad FRCS(Tr&Or)

Clin Orthop Relat Res (2012) 470:3164–3170

- **26 patients**
- **77% success at 5 years**

Case 3
78 YOM, 3.5 Weeks s/p L THR, c/o Pain

Case 3
78 YOM, 3.5 Weeks s/p L THR, c/o Pain

PMH: DM, RA, smoker
Cx: ß hemolytic strep

- ✓ **Acute 1-Stage Exchange**
  - ✓ **IV Ceftriaxone**
  - ✓ **PO Duricef**

Outline

#1: Antibiotics → #2: Timing → #3: Surgical Treatment → **#4: Results**

Results

Author	Journal	Year	# of Pts	FU	Success
Koyonos	CORR	2011	136	54 mos	35%
Choi	CORR	2011	32	36 mos	31%
Odum	JOA	2011	150		31%
Zmistowski	JOA	2011	104		GN = 70% MSSA = 33%
Azzam	JOA	2010	19	5.7 yrs	44%
Bradbury	JOA	2009	20	Min 2 yrs	16%
Salgado	CORR	2007	20		33%
Marculescu	Clin ID	2006	99	2 yrs	60%
Deirmengian	CORR	2003	31	4 yrs	35%
Silva	CORR	2002	530		33%
Segawa	JBJS	1999	10	3.7 yrs	50%
Wasielewski	JOA	1996	10	32 months	75%
Kramhoft	JOA	1994	27		19%
Teeny	JOA	1990	21	4 yrs	29%
Schoifet	JBJS	1990	31	3 yrs	23%

Results

Author	Journal	Year	# of Pts	FU	Success
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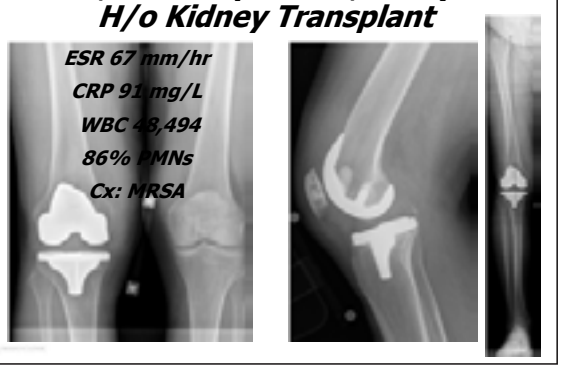
Teeny	JOA	1990	21	4 yrs	29%
Schoifet	JBJS	1990	31	3 yrs	23%

Results

Success is ~ 60% in selected patients
Range of 19% - 83%

Case 4

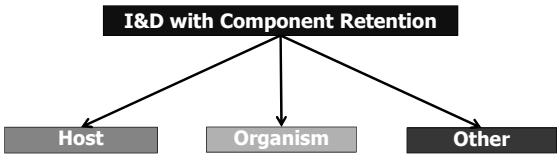
56 YOM, 4 Yrs s/p R TKR, 7 Days Pain
H/o Kidney Transplant



Case 4
52 YOM, 7 Days of Pain, Transplant, MRSA

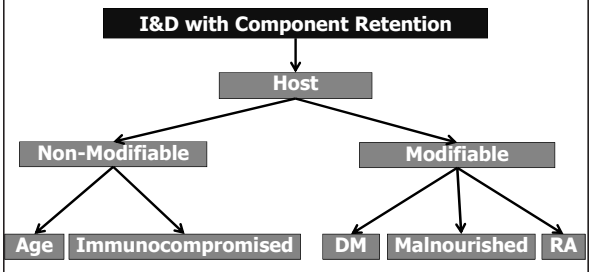
PMH: Kidney Transplant
Immunosuppressed
Cx: MRSA

Risk Factors for Failure



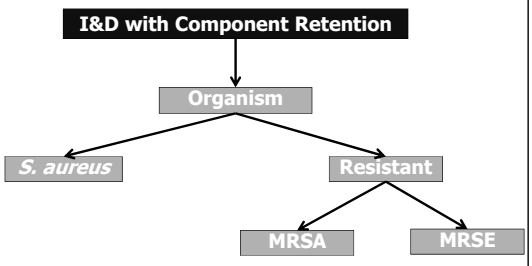
* Vilchez et al. *Clin Microbiol Infect.* 2011
* Theis et al. *ANZ J Surg.* 2007
* Berbari et al. *Clin ID.* 2006

Risk Factors for Failure



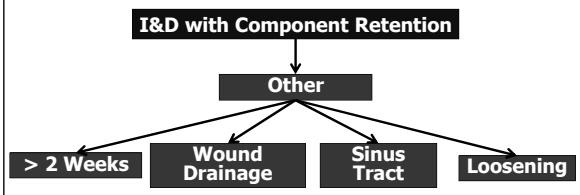
* Vilchez et al. *Clin Microbiol Infect.* 2011
* Theis et al. *ANZ J Surg.* 2007
* Berbari et al. *Clin ID.* 2006

Risk Factors for Failure



* Vilchez et al. *Clin Microbiol Infect.* 2011
* Theis et al. *ANZ J Surg.* 2007
* Berbari et al. *Clin ID.* 2006
* Parvizi et al. *CORR.* 2009

Risk Factors for Failure



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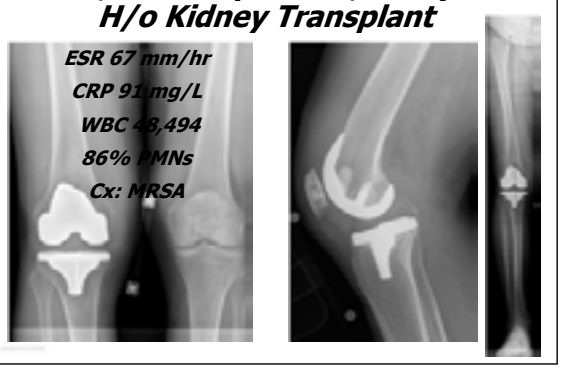
Case 4

56 YOM, 4 Yrs s/p R TKR, 7 Days Pain
H/o Kidney Transplant



Case 4
52 YOM, 7 Days of Pain, Transplant, MRSA

PMH: Kidney Transplant
Immunosuppressed
Cx: MRSA

- ✓ **Two-Stage Exchange with Articulating Spacer**
- ✓ **IV Vancomycin**

Summary

- **Indications**
  - **Acute postoperative infection (<4 weeks)**
  - **Late acute hematogenous infection (<2 weeks)**
- **Timing**
  - **Most organisms < 2 weeks**
  - ***S. aureus* 48 hours**
- **Aggressive I&D with IV abx (6 wks) ± PO abx**
- **Success in ~60% if without risk factors**

Thank You

Periprosthetic Joint Infection Symposium
Removal of Implants: One Stage or Two?
Gregory G. Polkowski, MD, MSc
Vanderbilt Orthopaedic Institute

With the increasing burden of periprosthetic joint infections (PJI) expected to increase in the coming decades, it is imperative for the orthopaedist to be well-versed in the surgical management of PJI. While indications for debridement with component retention have been recognized, in many cases removal of implants is essential for infection eradication. For most surgeons in the United States, the gold standard for treatment of chronic and antibiotic-resistant cases of PJI is with a two-stage exchange. However, orthopaedists on the global stage have employed one-stage procedures for the management of chronic PJI under certain circumstances and have found similar outcome compared with two-stage procedures in many case series. In this symposium we will address some of the indications and contraindications between one-stage and two stage treatment for PJI.

In July, 2013, under the organizational assistance of the Musculoskeletal Infection Society, an international cohort of orthopedic surgeons, infectious disease medical specialists, radiologists, and basic scientists with an interest in PJI gathered for the "International Consensus Meeting on Periprosthetic Joint Infection" in Philadelphia, PA, USA. The Proceedings from the International Consensus Meeting were published[1] and are available on the website of the MSIS (http://www.msis-na.org/international-consensus/). The methodology has been published elThe following criteria and considerations for when one-stage and two-stage treatment for PJI are appropriate are largely taken from the opinions of the workgroup as described in that meeting.

Definitions:
One stage exchange: A one stage exchange is defined as the surgical treatment PJI in which the surgeon performs complete removal of infected components, cement, and associated hardware from the infected joint, followed by an extensive surgical debridement of the synovium and any infected tissue. This is followed by irrigation, partial wound closure, re-prepping the extremity, new drapes and clean instruments, and performance of definitive revision procedure in the same setting.

Two-stage exchange: A two-stage exchange is defined as the surgical treatment PJI in which the surgeon performs complete removal of infected components, cement, and associated hardware from the infected joint, followed by an extensive surgical debridement of the synovium and any infected tissue. This is followed by irrigation and wound closure, usually after placement of a temporary antibiotic impregnated spacer device for maintenance of the joint space and local delivery of antibiotics. A prolonged course of intravenous antibiotics ensues, which is followed by an antibiotic “holiday” in which the patient is monitored for serologic and clinical signs of infection recurrence. Once infection eradication is declared, the patient is brought back to the operating room for the second stage procedure: removal of the temporary spacer, and definitive revision joint replacement surgery with re-implantation of components.

Situations/Conditions in which **one-stage** treatment for PJI may be considered:
1. PJI with known bacterial species (i.e., positive culture and antibiotic sensitivities available).
2. Antibiotic available for systemic treatment.
3. If possible, antibiotic available for cementation of components to deliver local antibiotics.

4. Evolving indication: There is growing support for the use of one-stage exchange procedures for early post-op cementless THA PJI[2].

Contra-indications to considering one-stage treatment of PJI:

1. Patient with systemic sepsis.
2. Unknown organism, or infectious agent unknown (culture negative infection).
3. Presence of sinus tract.
4. Severe soft tissue damage that may require flap coverage.

Situations/Conditions in which **two-stage** treatment for PJI may be considered:

1. Any of the criteria present for treatment of stage one (any patient who is a candidate for a one-stage treatment is also a candidate for two-stage treatment).
2. Patients with systemic sepsis.
3. Infection with unknown organism, or culture-negative infection.
4. Preoperative cultures positive for high- virulence or drug-resistant organisms.
5. Severe soft tissue compromise, either in the form of a chronic sinus tract or poor coverage that may require additional flap procedure.

Other considerations:

1. The touted success of the one-stage process in the international community frequently involved re-implantation with cemented components, in which high doses of antibiotics directed at the infecting organism were included in the final reconstruction construct.
2. Most advocates for one-stage treatment of PJI support performance of fairly aggressive surgical debridement, and cite much of their success on this stage of the procedure.
3. Currently the operative implant choices and surgical techniques in the US differ enough from international community such that the two-stage treatment is still the most common technique employed in the US.

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Breakout 3, Unicondylar Knee Replacement

David F. Dalury M.D.

Unicondylar knee replacements, the replacement of an isolated part of the knee joint, have a long history in knee surgery. The basic concept is to replace what is worn and retain the more normal native tissue. There are many theoretical advantages of this approach when compared to a TKR: less bone resection, a quicker and easier recovery, better knee kinematics, an easier revision if needed as well as a more cost effective way to manage isolated knee arthritis.

Traditionally, the typical Uni candidate was considered to be an elderly, sedentary, female with good range of motion and an intact ACL. However, over time there have been many advances in implant and instrument design, improvements in surgical technique and now, into our 4th decade of Uni use, longer follow up that has given more confidence to cautiously expand the utilization of Unis. Use restrictions such as age, weight, activity level and status of the remaining compartments have all been challenged.

Long term results of Unis now rival those of TKRs in many publications and patients who have both a Uni and a TKR routinely prefer their Unis. Typically, Unis were utilized in the medial femoral-tibial articulation but there has been a successful expansion of Unis into the lateral compartment as well as the patello-femoral joint. Not all designs have equal outcomes and joint registries have been helpful in detailing that certain devices have superior outcomes compared with others.

Several controversies still exist such as, how much pre-op deformity is acceptable; how much disease in other compartments can be tolerated and can Unis be used if the ACL is deficient?

New advances in Uni surgery including concepts such as computer and haptic use, cementless fixation and improvements in technique and implant design raise the potential for improved outcomes. The availability of more long term data supporting Uni's use along with an increasingly internet savvy patient population raises the probability of an increase in popularity of Unis.

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Breakout 3, Non-Arthroplasty Hip

John C. Clohisy, M.D.
Daniel C. and Betty B. Viehmann Distinguished Professor of Orthopaedic Surgery
Director, Adolescent and Young Adult Hip Service
Chief Adult Reconstructive Surgery
Washington University School of Medicine
St. Louis, MO

Objectives:

1) Review concepts of patient evaluation and selection for joint preservation surgery
2) Present current surgical options in joint preservation hip surgery

Introduction:

Do we really need it? YES.
Should we try to avoid it? YES, if better alternative.
How about alternatives? YES. Early diagnosis and hip joint preservation surgery.

Total hip arthroplasty (THA) is an effective surgical treatment for endstage OA of the hip, yet these procedures can have limitations in highly active, young patients. In these patients, high-level performance and long-term survivorship of the implant is the desired result. Nevertheless, bearing surface wear, osteolysis, aseptic loosening, thigh pain, dislocation, squeaking, mechanical failure, metallosis and activity limitation are some of the potential drawbacks of prosthetic joint reconstruction. As a result, the concepts of early diagnosis and hip joint preservation surgery have gained attention. The potential benefits of joint preservation procedures include symptom relief, enhanced activity, and prolonged survivorship of the natural hip joint. **To obtain these goals the surgeon must be familiar with the etiologies of hip dysfunction, patient selection criteria, surgical options and anticipated clinical outcomes.** These topics will be discussed.

1) Etiology of premature hip joint failure?

Recent analysis of structural abnormalities associated with endstage hip disease at young age (<50 years) demonstrated the following underlying etiologies:

Osteoarthritis- 56%
Osteonecrosis- 30%
other- 14%

The OA subgroup etiology make-up included:

45% DDH
45% FAI (including Perthes and SCFE)
10% other or not able to classify

Therefore, mechanical hip disease (DDH, FAI, Perthes, SCFE) should be targeted by early diagnosis and preventive treatment initiatives.

2) Concepts of patient evaluation and selection for joint preservation surgery

Patient selection is a critical component of joint preservation hip surgery. Evaluation of the patient should focus on the following questions.

a) What is the specific etiology of hip dysfunction (structural anatomy, associated soft tissue disease, associated muscle dysfunction)?
b) Is the hip disorder surgically correctable?
c) Is the hip joint adequately healthy to respond to joint preservation surgery?
d) Are there significant patient-specific factors (age, BMI, activity level, etc) that will impact treatment decision-making?

e) What is the risk-benefit profile for the patient (compared to THA/SRA)?
f) What are the expected outcomes?

3) Current surgical options in joint preservation hip surgery

DDH

a. Acetabular reorientation (PAO)
b. Proximal femoral osteotomy (PFO)
c. Combined PAO/PFO

FAI

a. Anteversion PAO
b. surgical hip dislocation
c. hip scope/limited open
d. hip arthroscopy

Key Points:

1) Premature hip joint osteoarthritis is commonly (90%) associated with underlying structural hip disease.
2) Careful patient selection is an important component of hip joint preservation surgery.
3) A variety of surgical techniques are required to provide comprehensive hip preservation surgical care.
4) Clinical outcomes of joint preservation surgery are good to excellent in 80% of patients and should improve with continued refinement of patient selection criteria and surgical technique.

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Symposium III, Preparing for the Transition to Value Based Healthcare

Kevin J. Bozic, MD, MBA Professor and Inaugural Chair Department of Surgery and Perioperative Care
Dell Medical School at the University of Texas at Austin

Mark I. Froimson, MD, MBA
President, Euclid Hospital Cleveland Clinic

Challenges Facing the US Healthcare System

1) Emphasis on healthcare, not health
2) Fragmented delivery, payment systems
3) Medical error/defensive medicine
4) "Medical arms race" 5) Moral hazard

Lack of Competition Based on Value

1) Patient choice and competition for patients are powerful forces to encourage continuous improvement in value and restructuring of care
2) Today's competition in health care is not aligned with value since the financial success of system participants is not tied to patient success

Value-Based Healthcare

Primary Goal: Improve Value
1) Value can be defined as patient centered health outcomes per health dollar expended
2) Outcome = Quality (e.g. clinical outcome, safety) + Service (e.g. satisfaction, convenience, communication)

Keys to Success
1) Empower stakeholders with better information
    a) Tools for efficient, real time data collection
    b) Transparency of cost, quality (actionable, easy to understand/use, risk adjusted)
2) Reorganize delivery, payment system around patient-centered value (not volume)
    a) Align stakeholder incentives around value
    b) Increased accountability for providers, patients
3) *Leadership* from the medical profession

Empowering Patients to Be Better Consumers

1) When rating factors that influenced their selection of provider for elective total joint arthroplasty, patients chose Physician Manner and Physician Quality as the two most important factors [1]
2) Patients also on average strongly agreed with statements that their choice of surgeon would impact their outcome and that there are big differences in the quality of care among different surgeons [1]

Quality Measures

1) Need to measure outcomes in order to track improvement
2) Define quality measures for your practice, focusing on outcomes that matter to patients
3) Develop infrastructure to measure outcomes (e.g. clinical data registries)

4) Use outcomes data for continuous quality improvement, public reporting, value-based payment
    a) Increase transparency of cost, outcomes
    b) "If I am through learning, I am through." – John Wooden

Reorganizing the delivery system around value

1) Existing model: care is organized by specialty and discrete service
2) Model organized around value:
    a. Staffed by dedicated multidisciplinary team
    b. Joint accountability for outcomes and costs
    c. Shared information platform
    d. Single administrative & scheduling structure
    e. Services co-located to the extent possible
3) Train, engage surgeons in Population Health Management
    a. Define appropriateness of diagnostic, therapeutic interventions
    b. "Downstreaming" care
    c. Patient Engagement
    d. Patient Activation
        i. A measurement of an individual's propensity to engage in positive health behavior [2]
        ii. Patients with higher preoperative activation had better patient-reported outcomes after TJA [3]
    e. Shared decision making
4) Develop patient-centric, disease-based Integrated Practice Units

Role of the Payment System in Improving Value

1) In order to implement value driven healthcare, must identify and eliminate or reduce non-value added care.
    a. Unnecessary care
    b. Inappropriate variation in care
    c. Avoidable complications/readmissions/reoperations
    d. Excess cost due to variation in price

Principles for Successful Implementation of Value-Based Payment

1) Assess culture, operational readiness
    a. Risk tolerance
    b. Data systems, sharing
    c. Trust, alignment
    d. Leadership
2) Identify clinical, administrative champions
3) Define the episode for which you accept risk
4) Define performance metrics, gainsharing models
5) Understand care from the patient's perspective
6) Measure the actual costs of care delivery (e.g. using time-drive activity-based costing)
7) Use data to identify opportunities for improvement
8) Redesign care to improve quality, reduce cost
9) Price/market episode of care program 10) Evaluate results, iterate

Preparing for Payment System Transformation

1) More granular cost, outcomes measurement
2) Greater integration/alignment across providers
3) Experiment with new payment methodologies

What Do We Have To Lose?

1) Current fee-for-service (RVU, DRG) system:
    a. Set up such that as you become a better clinician (fewer complications, etc), your reimbursement decreases
    b. NO consideration of outcomes or value

2) Value based approaches require an up-front investment but can lead to improved provider financial performance over time

Breakout 4, Revision Total Hip Arthroplasty (THA): Simple to Complex

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Surgical Exposures

Introduction

There are multiple approaches to the hip in primary total hip arthroplasty (anterior, antero-lateral, transgluteal, transtrochanteric, posterolateral, multiple mini-incision approaches), however in revision total hip arthroplasty there are only 3 that are employed routinely (transgluteal, transtrochanteric, posterolateral). The advantages and disadvantages of the approaches will be discussed in this lecture as will the extensile approaches (femoral osteotomies, controlled perforation, scaphoid window, retroperitoneal approach) performed in revision procedures.

Revision Approaches: Advantages/Disadvantages

Approach	Advantages	Disadvantages	Notes
Direct Lateral	↓ Dislocation Rate Can be extensile	Extensile exposure → Superior gluteal nerve injury Longer period of postoperative limp Poor posterior column access	
Transtrochanteric	Extensile Allows trochanteric advancement	↑ Risk of trochanteric nonunion	
Posterolateral	Extensile Posterior column access Preservation of abductors	↑ Risk of dislocation	

Specialized Approaches

1) Extended Trochanteric Osteotomy
   - can be performed with either a posterolateral[1] or transgluteal[2] approach
   - indications
     - R/O cement, broken implant, ingrown stem
     - proximal femoral varus remodeling has occurred preventing straight shot at femoral canal
     - previous trochanteric malunion
     - significant trochanteric osteolysis precluding trochanteric osteotomy

3

2) Controlled Perforation[3]
   - indications – cement removal
   - technique
     - 7 mm anterior femoral perforation is created with a high-speed burr
     - additional perforations, depending on length of cement mantle, performed 5 cm apart
     - revision femoral component must bypass most distal perforation by at least 2 component diameters

3) Scaphoid Window[4]
   - indications – cement removal
   - advantages – allows greater access to femoral canal
   - disadvantages – devascularized fragment may be created

4) Retroperitoneal Approach[5]
   - indications - intrapelvic migration of components/cement
     - minimize risk of injury to neurovascular structures

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4

Acetabular Osteolysis: When to Graft/Exchange Polyethylene and When to Operate

I. Introduction

- Modular acetabular components in THA have been the component of choice for more than three decades in North America
- While achieving solid bone ingrowth of these components has proved reproducible with excellent long-term clinical track records, the polyethylene has been the weak link in the system
- Polyethylene wear and osteolysis are seen frequently with long-term follow-up
- The current generation of highly cross-linked polyethylenes will hopefully reduce the incidence of these complications, but millions of modular components with non highly cross-linked polyethylenes were performed, and the issues related to their failure modes, and indications for revision will be important clinical issues for decades to come
- While there are occasional exceptions, in general once osteolysis begins to develop it will be progressive and can lead to massive bone loss and acetabular component loosening
- Strategies to minimize the complications of massive osteolysis include routine radiographic review of THA patients (q1-2 years), more frequent reviews once the presence of osteolysis is established, and earlier rather than later surgical intervention once progression is seen

II. Assessment of Osteolysis

- In general, plain radiographs tend to underestimate the amount of true bone loss that is present
- Routine imaging may include:
  i) AP Pelvis and AP and lateral hip views
  ii) Judet views
  iii) CT scan

III. Fundamental Questions to Answer

I) *When should I operate?*
  i) symptomatic patient (however <50% of patients with osteolysis will have symptoms)
  ii) asymptomatic patient with large lesion potentially compromising component fixation
  iii) asymptomatic patient with documented progression of osteolysis on serial radiographs

II) *Why has the component failed?*
i) specific polyethylene issues
ii) cup design issues
iii) technical issues
iv) related to time in vivo
v) r/o infection (especially if see early osteolysis)

III) *Is the acetabular component solid or loose?*
i) often difficult to assess preoperatively
- if 50% of shell circumference has osteolysis on AP or lateral xray, have a suspicion for possible fixation compromise
ii) may be an intraoperative decision – judiciously check acetabular component fixation intraoperatively

IV) *If the acetabular component is solid, can I retain it and either do a liner exchange or cement in a new polyethylene?*
A) Conditions necessary for a liner exchange:
i) Satisfactory component position
ii) Intact locking mechanism
iii) Undamaged acetabular component
iv) Liner of adequate thickness
v) Acceptable track records of components
vi) Ability to achieve intraoperative hip stability
vii) Availability of polyethylene of appropriate shelf life and sterilization technique
B) Conditions necessary for cementing a liner
i) Satisfactory component position
ii) Adequate acetabular component internal diameter for cement mantle and polyethylene thickness
iii) match age/demands of patient

IV. Technical Considerations

A) Liner Exchange
- Remove liner
- Assess component stability
- Assess locking mechanism
- Graft osteolytic lesions either directly, or via a trapdoor technique in the ilium (note – contraindicated if this compromises the lateral buttress of the pelvis)
- Always be prepared for a full revision with extraction devices and revision acetabular components and inserts and bone graft

B) Cementing a liner
- The acetabular component needs to be textured by design or by technique
- The polyethylene component needs to be textured by design or by technique
- The cement mantle should be 2-4 mm thick
- Avoid over-sized and uncontained polyethylene
- Performed correctly, cemented liners are equal to modular liners for pushout strength

C) Bone grafting
- No data to suggest what technique or material is superior
- Cancellous chips probably most frequently used
- BMPs have been tried by this author as they are osteoinductive, but there is a significant cost associated with them

V. Results and Complications

- at this point there are only short-term reports in the literature
- the largest series is from the Norwegian Arthroplasty Register which demonstrated that isolated liner revisions (318 cases) had a higher re-revision rate than those cases that underwent revision of their ingrown sockets (398 cases)
- most frequent complication has been postoperative dislocation
- instability complication may be less with direct lateral approach

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7

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8

THE HIP IS NOT STABLE

Introduction

Hip instability continues to be a significant complication following total hip arthroplasty that is devastating for the patient and frustrating for the arthroplasty surgeon. Current quoted incidence in the literature remains at approximately 1%. While dislocations cannot be eliminated, an algorithmic approach to assessing and managing intraoperative instability will assist the surgeon in addressing the issues intraoperatively and minimize the probability of postoperative instability.

Preoperative Assessment

Minimizing the risk of intraoperative and postoperative instability actually begins with the preoperative assessment and identifying the patient at risk and proactively discussing this with the patient and creating a plan to minimize this event.

Obviously not all patient factors are modifiable, but some are. Patients at an increased risk include:

1) Morbidly obese

2) Elderly

3) Non compliant (alcohol, substance abuse)

4) Neuromuscular disease

5) DDH

Intraoperative Assessment

With trials in place the surgeon begins the assessment with first confirming the leg lengths and offset, assesses component orientation and then takes the hip through a range of motion assessing for the presence of impingement.;

A) Leg length and offset

It is most helpful to have a reproducible methodology to determine preoperative and intraop leg length and offset. A fixed device in the pelvis, with another marker of some description on the femur, is a reliable technique. This is very valuable information in maximizing the ability to achieve a stable total hip, without the added issue of lengthening the limb

B) Assess component orientation

Similarly the arthroplasty surgeon should develop an intraoperative technique to assessing the orientation of both the acetabular and femoral components. There is a great range of variability in acetabular component placement and malposition increases the probability of postop dislocation. While correct acetabular component orientation is critical, minor adjustments can also be made via the use of lipped or face-changing liners. The role of these liner options is greater in revision, rather than primary, total hip arthroplasty.

C) Impingement

Impingement can be bone-bone, component-component or bone-component. Removal of osteophytes and correct component orientation are the keys to minimizing impingement. Impingement must be carefully assessed for and corrected with trials, or components in place.

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11

Evaluation of the Symptomatic & Asymptomatic Metal on Metal THA

The Metal on Metal Hip

II. Introduction

- Metal on metal bearings, in both a total hip and resurfacing application, saw an increase in global utilization over the past several years
- This peaked in 2008 in the US, with approximately 35% of bearings being hard on hard (metal on metal, or ceramic on ceramic)
- Beginning in 2008, reports in the orthopaedic literature began to surface re local soft tissue reactions and hypersensitivity to metal on metal bearings
- A major implant manufacturer recalled a resurfacing device in 2010 after national joint registries demonstrated higher than expected revision rates
- Patients with painful metal on metal bearings presenting to the orthopaedic surgeon are a difficult diagnostic challenge
- The surgeon must go back to basic principles, perform a complete history and physical exam, obtain serial radiographs and basic bloodwork (ESR,CRP) to rule out common causes of pain and determine if the pain is related to the bearing, or not

II The Asymptomatic MoM Arthroplasty

- Patients will present for either routine followup, or because of concerns re their bearing
- It is important to emphasize that at this point the vast majority of patients with a MoM bearing are indeed asymptomatic and their bearings are performing well
- The surgeon must take into account:
  a) which specific implant are they dealing with and what is its track record
  b) what is the cup position
  c) when do perform metal ion testing
  d) when to perform further soft tissue imaging (MARS MRI, Ultrasound)
  e) when to discuss possible surgery
- A simple algorithm for both painless and painful MoM Arthroplasties has been developed and is presented below

III. Painful MoM THA causes not related to the bearing couple

A) Extrinsic to the hip
- -spine (radiculopathy, stenosis)
- -vascular
- -metabolic
- -malignancy

B) Intrinsic to the hip
- i) Extracapsular
  - -iliopsoas tendonitis
  - -trochanteric bursitis
- ii) Intracapsular
  - -sepsis
  - -loosening
  - -thigh pain
  - -prosthetic failure

IV. Painful MoM THA causes related to the bearing couple

There are now described a number of possible clinical scenarios and causes of pain that relate to the metal on metal bearing couple itself:

A) Local hypersensitivity reaction without a significant soft tissue reaction
B) Local hypersensitivity reaction with a significant soft tissue reaction
C) Impingement and soft tissue pain 2^0 to large head effect

V. Factors related to a hypersensitivity reaction

Some patients, and prosthesis, seem to be at a higher risk of developing issues following a metal on metal bearing, although our understanding of the interplay of these factors is still in evolution:

A) Patient
- - female gender
- - smaller component sizes

B) Implant
- -some implants have higher wear rates and perhaps are more prone to corrosion
- -large heads and monoblock shells

C) Technique
- -high cup inclination angles > 50^0

VI. Special tests

There is ongoing confusion related to the relative value of the various special tests that patients with a painful MoM undergo.

A) Metal Ions

- obtaining serum, or whole blood, cobalt and chromium levels is recommended as a baseline test. However there is no established cutoff level to determine with certainty if a patient is having a hypersensitivity reaction. A 7 parts per billion cutoff has been suggested. This gives high specificity, but poor sensitivity. Metal ions therefore can be used as a clue, and one more test in the workup, but cannot be relied upon in isolation to make a diagnosis.

B) MARS (Metal Artifact Reduction Sequence) MRI

- a useful tool for demonstrating soft tissue involvement, but there are many painless, well functioning MoM implants that have soft tissue reactions, that don't require a revision. In the painful MoM hip an MRI, or ultrasound, is recommended to look for soft tissue destruction or a fluid-filled periprosthetic lesion (pseudotumour). Significant soft tissue involvement is concerning and is commonly an indication for revision in the painful MoM hip

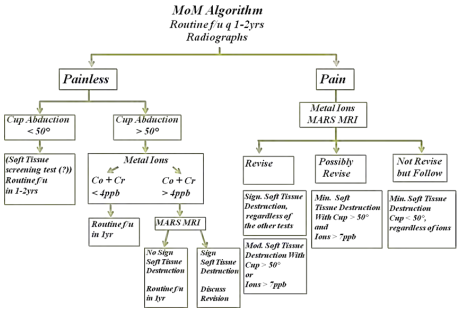
C) CT imaging

- can be utilized to help determine cup position and combined anteversion, however plain radiographs can give a rough estimate of this as well, so routine CT scan evaluations are not currently recommended

VII. Treatment

Management of the painful MoM hip is directly related to the etiology of the pain. Unique to MoM bearing is the issue of pain secondary to a local hypersensitivity reaction. All above test should be utilized to help determine the best course of action in any individual patient.

The painful MoM bearing, that is demonstrating significant soft tissue involvement is a concerning scenario. Earlier revision, to prevent massive abductor damage, would seem prudent for these patients. The painful MoM bearing with no significant soft tissue changes can probably be followed and reviewed at regular intervals. If the pain persists and is felt to be secondary to a hypersensitivity reaction, then revision is really the only option, although the patient must be cautioned regarding the unpredictable nature of the pain relief.



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2012 Australian National Joint registry at www.aoa.org.au/docs

Management of the Infected THA

Defining the Problem

In total hip replacement surgery, the incidence of infection has ranged from 1.6-2.6 % after the advent of pre-operative antibiotics, to as low as 0.39% in high volume centres using special ORs and all precautions. Infection in the prosthesis is a significant problem and has been shown to decrease the outcome and benefit for the patient. The serious complication of infection leads to significant morbidity for the patient, opens the doors to further complications as a result of further surgery, as well as adding substantial costs to the care of the patient.

An approach to the prevention, diagnosis and treatment of infection is therefore critical to the arthroplasty reconstructive surgeon.

A) Prevention

I - Patient Factors

The general pre-operative health of the patient is an important factor to consider. Patients with multiple comorbidities (ASA class III or more) are at higher risk for infection. While clearly some factors can't be modified (ie, previous surgery), many others can be optimized.

i) Diabetes
- Patients with poor sugar control and higher HbA1C concentrations are at higher risk for infection. Glucose control should be optimized prior to surgery. Post-operatively tighter glucose control has also been shown to decrease the rate of infection and other complications, although the data is primarily from post-cardiac surgery.

ii) Obesity
-Controversy exists re the relative risk of obesity and deep infection post TKA, however clearly there is a higher risk of prolonged drainage in these hips, which increases the risk of surgical site infection. For the morbidly obese, weight loss counseling and gastroplasty consultation is recommended.

iii) Rheumatoid Arthritis
-Often patients coming for joint arthroplasty are on a cocktail of drugs:
a) NSAIDs - weak anti-platelet effect and should be stopped if possible pre-operatively, especially aspirin with its non-reversible effect on platelets (10 days)
b) Steroids - powerful effect on the inflammatory cascade, and depression of the immune system. If possible, steroid use should be tapered pre-operatively to minimum levels, and if the patient remains on supra-physiologic doses of over 5 mg daily, intravenous steroids should be administered peri-operatively to avoid adrenal insufficiency crisis. Recent literature indicates that the relatively high doses of intravenous hydrocortisone (100 mg every 8 hours) are not necessary, and for total joints 25 mg every 12 hours for three doses is adequate, with no need for prolonged therapy beyond this.
c) Methotrexate – variable historical recommendations, however 2 recent publications have shown no increased complications maintaining, rather than stopping it
d) Leflunomide - one of the new DMARDs has shown a significant increase in infection rate post-operatively when not stopped
e) TNF blockers (infliximab, adalimumab, etanercept) - have not been definitively demonstrated to be harmful in the peri-operative context from multiple studies

iv) Immunocompromised
-HIV, hemophilia, previous organ transplantation, skin disorders (psoriasis)

v) Previous hip surgery

II - Intraoperative Factors

i) Antibiotic Prophylaxis
-administered <60 minutes prior to surgical incision (critical point)
-Cefazolin routinely, or Vancomycin/Clindamycin in allergic patient
-no evidence for extended use >24 hrs in routine primary THA

ii) OR suite
-high airflow turnover room (doesn't have to be laminar flow necessarily)
-vertical laminar flow improves air quality
-ultra-violet light also effective
-no convincing evidence for body exhaust suits

iii) Sterile technique
-breaks in sterile technique are more common than considered
-change to new gloves prior to handling implants

iv) Length of Operating Time
- increased OR time is associated with increased infection rates and this has been confirmed in several papers and registry data

v) Antibiotic cement
- national joint registries clearly demonstrate reduced infection rates with its routine use
- approved for routine use in many countries (not the US – only for 2nd stage revision procedures)

III – Postoperative Factors

i) Drain use
- no evidence that a drain either increases or decreases the infection rates

ii) VTE prophylaxis
- no evidence that the routine postop use of low mw heparin increases the infection rates
- evidence that preop use does increase infection rates

iii) Prolonged wound drainage
- should have a low threshold for returning to the OR in a patient who has had wound drainage for longer than 7-10 days, particularly in a patient with further risk factors such as obesity, diabetes, previous surgical scars in the area, poor vascularity, ongoing need for anti-coagulation, or evidence of wound edge necrosis

iv) Antibiotic prophylaxis for dental work
- beyond 2 years postop - joint statement from the AAOS and American Dental Association advocated its' use only in at risk patients
- if patients tolerate the antibiotics, we discuss option of prophylaxis indefinitely

B) Diagnosis

i) History
- key – have a high index of suspicion in all failed and painful THAs
- look for – wound healing problems with index procedure
    - "always painful/ never right"
    - recent systemic illness (ask about recent/current Ab use,dental procedures,etc)
    - rest pain and nocturnal pain

ii) Physical exam
- often normal
- local skin changes

iii) Imaging
a) plain radiographs – most commonly normal, although may see periosteal
b) nuclear imaging – role is ill-defined, useful to evaluate the painful hip with all tests being negative to look for incomplete boney ingrowth

iv) Blood tests
- ESR and CRP should be obtained on every patient assessed for a painful THA
    - if both are normal, probability of infection is very low
    - if one or both are elevated, further investigate with an aspiration

v) Aspiration
- confirm patient has been off all antibiotics for at least 2 weeks
- performed in all cases with abnormal bloodwork, and send for:
a) Cell count
- indicative of infection if > 3000 WBC/mm (if both ESR and CRP elevated)
- indicative of infection if > 9000 WBC/mm (if only one of ESR or CRP elevated)
b) Cell count differential
- be suspicious of infection if > 80% WBC count
- very indicative of infection if > 90% WBC count
c) Culture
- send for aerobic, anaerobic and fungal and TB infections in some cases (previous cultures negative when clinical suspicion is high)

vi) Intraoperative Evaluation
a) Frozen section
- results are pathologist specific
-average of 5-10 PMNs per high powered field is normally the cut-off, although again this varies between pathologists
- we have found the best approach is to speak directly with our pathologist and have them determine – is this consistent with chronic or acute inflammation
b) Gram stain
- can see both false positives and false negatives
- can be used as a guide to determine which postoperative antibiotic to use, but can't be used as the only method to diagnose an infection
- in many institutions no longer available as a stat test
- always take at least 3, if not more, independent culture swabs to help guide postop Rx

There is not one widely accepted gold standard test for diagnosing the infected THA. It is a clinical judgment based on many factors, particularly in the face of negative cultures.

C) Treatment

Historically infected THAs have been classified into 4 broad categories based on the timing of presentation: an unexpected positive intraoperative culture, acute infection, chronic infection and acute hematogenous infection. It must be emphasized that it is often not entirely clear which category a given patient falls into, so treatment recommendations based on the categories should be viewed as general guidelines only.

i) Positive intraoperative culture
- in this scenario one or more of the intraoperative cultures taken at the time of a revision THA come back as positive
- there is no strong evidence based medicine to guide the surgeon in this case
- our routine is to involve Infectious Disease in the process and our strong leaning is to treat all of these cases with 6 weeks of IV antibiotics (although some authors would argue that if only one positive culture and no others signs of infection, those patients do not require prolonged antibiotic coverage)
- we would not take the patient back to the operating room and perform a first stage revision

ii) Acute postoperative infection
- historically this has been defined as an infection occurring within the first 6 weeks following THA
- however more recently authors are beginning to discuss this in terms of within the 3-4 weeks of the index procedure
- while it seems intuitive that the longer the infection has been present the lower the success rate will be with an I&D and polyethylene exchange, there is actually very little published to guide the surgeon as to when to make the transition and perform component removal and antibiotic spacer insertion
- in general, we use the cut-off of 4 weeks, but this has to be individualized to patient and in particular the organism cultured
- staph infections are much harder to eradicate and will have a higher failure rate for I&D's, strept infections on the other hand are more amenable to that intervention
- Rx – in summary, patients presenting with acute infections should undergo:
1) an operative intervention with a formal I&D with removal of the polyethylene insert so that that interface can be accessed
2) multiple intraoperative cultures should be obtained
3) a postop ID consult
4) 6 weeks of IV Abs
5) some authors are actually recommending chronic oral suppression for these cases, however again there is no evidence based medicine to give clear guidelines

iii) Chronic postoperative infection
- divergent literature re one-stage versus two-stage procedure
- majority of North American centres perform two-stage
- I&D's are not successful and simply delay ultimate treatment
- a two-stage revision has an approx 90% success rate and includes:

i) **1st stage**: a) thorough meticulous debridement of involved soft tissue
b) removal of all components and cement if present
c) pulsatile lavage irrigation with 9L (at minimum)
d) use of an antibiotic spacer

Spacers

- there are two types of antibiotic spacers, static and articulating. Spacers allow for the local delivery of antibiotics. Current recommendations are for the use of 3 doses of Vancomycin and 3 doses of Tobramycin per bag of cement (if the patient has any underlying urine clearance or kidney issues we reduce the dosage). This amount of antibiotic will create a very thick doughy cement that is hard to mix so we routinely add another ½ vial of the monomer. It must be emphasized that this amount of Ab in the cement will reduce the mechanical properties of the cement so is only recommended for spacers knowing that they will be converted to THA's at the time of the second stage revision
- there is no literature to suggest that the success rate for static vs articulating spacers is any different, however articulating spacers do offer some advantages: prevent the limb shortening allowing an easier exposure at the 2nd stage, perhaps improved functionality. One disadvantage is the risk of dislocation. In cases of severe bone loss they are difficult to use and there is the possibility for increased bone loss with movement between the articulating spacer and host bone.

ii) **Interval between stages**

- patient receives 6 weeks of IV antibiotics, guided by intra-operative cultures (in consultation with Infectious disease)
- some authors recommend very frequent ESR and CRP checks. Our routine is to do this bloodwork at 6 weeks when they are seen in clinic and their antibiotics are stopped and then again 3 weeks later when they are seen in the preadmission clinic and have a repeat aspiration that same day.
- approx 10% of patient will fail the first attempt at infection eradication and will need to have a repeat 1st stage and spacer insertion

iii) **2nd stage:**

a) repeat the debridement and obtain multiple samples for cultures and frozen section. Controversial re what constitutes ongoing infection – at our site our pathologists will tell us if samples are consistent with acute or chronic inflammation
b) if evidence of ongoing infection – proceed to spacer insertion
c) if no evidence of ongoing infection – proceed to definitive implants
d) keep patient on IV Abs until cultures back

iv) Acute hematogenous infection

- by history, this is a well functioning THA that acutely changes
- this source of infection is often never determined
- look for recent dental procedures, any infections (ie, UTIs), skin ulcers in diabetics, etc
- patient presents with very short direction of ++pain, perhaps decreased ROM, difficulty ambulating, occasionally a fever
- Rx is identical to that for acute postoperative infection:

1) an operative intervention with a formal I&D with removal of the polyethylene insert so that that interface can be accessed
2) multiple intraoperative cultures should be obtained
3) a postop ID consult
4) 6 weeks of IV Abs

5) some authors are actually recommending chronic oral suppression for these cases, however again there is no evidence based medicine to give clear guidelines

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Symposium IV, The Business of Healthcare

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Trinity Health

Healthcare in general, and joint replacement in particular, has come under fire for being of uneven quality and cost, without a direct correlation between the two. As a result, payers and regulators are attempting to correct this perceived deficiency by incentivizing providers, that is physicians and health systems, to focus on the value of the care provided. While there is general agreement that both quality improvement and cost reduction are tandem paths to value creation, there is less agreement on the best models for achieving one or both of these. Waste and unnecessary interventions are commonly cited reasons for excess cost and lack of quality. Duplication of services occurs when there is lack of communication and coordination and when practitioners attempt to ply their craft in traditional silos. The move to alternative payment models has begun to shed light on the importance of care coordination and transitions of care, in eliminating redundancy and ensuring compliance with prescribed treatments. Such seamless care requires that providers know one another, that there are common and accepted pathways across the continuum, that communication is fostered, that follow up is assured and that complications and deviations from the expected course are managed by those with the most knowledge of the patient. Although such care can occur in a virtual network of providers who are well known to each other, there is increasing evidence that the most reliable way to ensure such quality and efficiency is through the creation of integrated delivery systems. Such systems can take the form of a unified entity with a single business model, but can also exist in the form of a clinically integrated network that is linked by shared agreements between independent entities. It is the degree of integration that matters more than the financial ties of the parties delivering the care. One additional conclusion is clear, in order for the healthcare system to be redesigned and optimized for better care deliver and better health, physicians will need to play a more central role in the leadership of such efforts. Whether in private practice, group practice, in academic medicine or as employees, physicians, and surgeons in particular, will need to understand the legislative and regulatory landscape, and, importantly, how they can either impact it or adapt to it. Change is rapid on all fronts, but what is immutable is the value that patients see in the doctor

patient relationship. It is imperative that surgeons get educated on the non clinical drivers of the system, both financial and regulatory. Only by empowering themselves with knowledge will they be able to influence teams, build systems, eliminate waste and lay claim to the value that these activities create.

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Breakout 6, Complications after THA and TKA: Current Strategies for Diagnosis and Treatment

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Diagnosis and Treatment of Infection in the Early Post-Operative Period

Diagnosis can be *extremely* difficult in the early post-operative period secondary to normal post-operative pain, edema and peri-incisional erythema that make the appearance of the wound and normal cues to diagnosis unreliable.

While the ESR, CRP, synovial fluid WBC count and differential have been found to be useful in the diagnosis of *chronic infection*, one would expect that they would be elevated in the early post-operative period and potentially unreliable.

We performed a retrospective review of 6,033 consecutive primary total hip arthroplasties performed by (3) surgeons to determine the utility of the ESR, CRP and synovial fluid WBC count with differential in the early post-operative period; 73 patients (1.2%) underwent early re-operation within the first 6 weeks.

	Mean Infected (N=36)	*Mean Not Infected (N=37)*	*P-Value*
ESR (mm/hr)	69 (6-140)	46 (8-80)	0.016
CRP (mg/L)	192 (5-395)	30 (5-68.7)	<0.001
Synovial Fluid WBC Count	84,954 (1,400-455,322)	2,291 (260-12,680)	< 0.001
Differential (% PMN)	91% (64%-99%)	63% (19%-96%)	<0.0001

We determined the following optimal cut-off values
- C-Reactive Protein: 93mg/L (normal < 8 mg/L)
- Synovial Fluid WBC count : 12,800 WBC/uL
- Differential: 89%

These numbers are similar to our experience with the diagnosis of infection in the early postoperative period following TKA (see Bedair et. Al CORR 2011)
How do we use this in oury own practices?
- If there is ANY question regarding the wound appearance, we get a CRP.

- If the CRP is near or > 100mg/L, we aspirate the hip (or knee)
- If the synovial fluid WBC is > 10,000 and differential is > 90%, the hip is very likely infected.
- If you are still unsure, you can wait for the culture results

Treatment of Infection in the Early Post-Operative Period

Although the most common treatment for an acute post-operative infection is irrigation and debridement (I+D) with exchange of the modular bearing surface, the validity of this approach has recently been questioned given a high rate of failure.

- Particularly bad results with any type of a staphyloccal infection
- Or with a resistant organism

Alternative options include a *1-stage exchange or a 2-stage exchange*. We performed a decision analysis to compare quality of life outcomes among irrigation and debridement, one and two-stage exchange (*Bedair et. al, CORR 2011*).

- Based on this analysis, if the rate of eradication of infection with a 1-stage exchange exceeds 69%, it is the preferred treatment option;
- I+D with a bearing surface change is only preferred if the success rate is > 60%.
- Advantages of a one-stage exchange include
    - Relative ease of cementless component removal in the early post-operative period
    - Greater exposure and access for debridement of the bony surfaces
    - Removal of colonized implants, which may harbor bacterial biofilm.

Early experience with 1-Stage Exchange in the early postoperative period following THA

- Multi-center study (Rush, Jefferson, University College Hospital in London)
- 28 Hips; all had cementless components at index arthroplasty and all exchanged to cementless implants
- 71% implant retention at mean 41 months
- *Hansen et. al, CORR 2013*

Based on the published results of an isolated I+D, the decision analysis and the early clinical results of a 1-stage exchange, *it seems reasonable to consider a 1-stage exchange for the treatment of the acute infected THA*.

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Management of the Unstable THA

Recurrent dislocation following total hip arthroplasty (THA) is a complex, multifactorial problem that has been shown to be the most common indication for revision THA. At our center, we have tried to approach the unstable hip by identifying the primary cause of instability and correcting that at the time of revision surgery.

Type	Reason for Instability	Treatment
1	Malposition Acetabulum	Revision acetabular component; upsize femoral head
2	Malposition Femoral Component	Revision femoral component; upsize femoral head
3	Abductor Deficiency	Constrained liner or dual mobility bearing; optimize component position
4	Soft Tissue/Bony Impingement	Remove sources of impingement; upsize femoral component and optimize component position
5	Late Polyethylene Wear	Exchange of acetabular liner; upsize femoral head and optimize component position
6	Unable to identify cause	Constrained liner or dual mobility bearing

The most common etiologies of instability in our experience include cup malposition (Type 1) and abductor deficiency (Type 3)

We reviewed 75 hips revised for instability and at a mean 35.3 months 11 re-dislocations occurred (14.6%). Acetabular revisions were protective against re-dislocation ($p<0.015$). The number of previous operations ($p=0.0379$) and previously failed constrained liners ($p<0.02$) were risk factors for failure. The highest risk of failure was in patients with abductor insufficiency with revisions for other etiologies having a success rate of 90%.

Although instability can be multifactorial, by identifying the primary cause of instability, a rational approach to treatment can be formulated. In general the poorest results were seen in patients with abductor deficiency. Given the high rate of failure of constrained liners (9 of the 11 failures were constrained), we currently are exploring alternatives such as dual mobility articulations.

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Leg Length Inequality

Total hip arthroplasty provides an effective operative solution in managing patients with joint failure. Leg length inequality is a cause of patient morbidity with serious medico-legal implications. Management relies on an accurate understanding of the cause of LLI and is usually conservative. Revision surgery for managing LLI is occasionally required and often very successful.

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Periprosthetic Fractures: Early

With the popularity of cementless stems in primary total hip arthroplasty (THA) we have seen a concomitant rise in the prevalence of intra-operative and early postoperative fractures of the femur. While initial press-fit fixation is a requirement for osseointegration to occur, there is a fine balance between optimizing initial stability and overloading the strength of the proximal femur. Hence, the risk of intra-operative fractures is intimately related to the design of the femoral component utilized (metaphyseal engaging, wedge shaped designs having the highest risk) and the strength of the bone that it is inserted into (elderly females being at highest risk).

If a fracture is identified, typically during or immediately after implant insertion, the stem should be removed and the fracture examined to determine its extent; most are non-displaced after removal of the implant. At this time, the surgeon can either place a cerclage wire or cable and re-insert the stem or switch to a femoral component that gains fixation primarily in the diaphysis. Recognition intra-operatively is preferable as

unrecognized fractures can lead to early femoral component subsidence and/or displaced fractures that in our experience are challenging to manage.

These fractures typically are associated with a loose femoral component and require revision to a stem that gains primary fixation distally. We have found a high risk of complications and problems when treating these fractures in the early postoperative period with a high risk of infection, heterotopic ossification and the requirement for subsequent surgery.

Periprosthetic Fractures: Late

The Vancouver Classification is based on the location of the fracture, the fixation of the implant and the quality of the surrounding host bone. The most common pitfall in treatment is mistaking a B2 fracture (stem loose) for a B1 (stem stable); treatment of a loose implant with ORIF alone will necessarily fail.

Type	Fracture Location	Implant	Treatment
A	Per-Trochanteric	Stable	ORIF of the trochanter; concomitant bearing surface exchange if associated with osteolysis
B	Around the stem		
B1		Stable	ORIF; typically long locked plate of whole femur
B2		Loose	Femoral component revision to distally fixed stem
B3		Loose	As for B2 but surrounding bone stock poor; typically little isthmus for distal fixation; may require proximal femoral replacement
C	Well distal to stem	Stable	ORIF; typically long locked plate of whole femur

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Symposium VI, Step by Step: Key Choices and Techniques in the Tough Revision Total Hip Arthroplasty (THA) and Revision Total Knee Arthroplasty (TKA)

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I. Revision THA

A. Exposure
   1. When do you perform an ETO?

B. Acetabular bone loss/reconstruction
   1. What is role of cancellous graft?
   2. What is role of structural graft?
   3. When do you use metal augments?
   4. When do you need something more than a hemispheric shell?
   5. Do you always use a highly porous/high friction cup surface?
   6. Indications for cup-cage; triflange cup?

C. Femoral bone loss
   1. What percent of cases are uncemented?
   2. What category of uncemented stem do you usually use?
      a. Fluted/tapered
      b. Fully coated
   3. Is there still a role for impaction grafting?
   4. Is there still a role for proximal femoral allografts?

D. Instability
   1. What head size do you use in most revisions?
   2. What is the role of dual mobility implants?
   3. What is the role of dual mobility constrained cups?

II. Revision TKA

A. Exposure
   1. In a revision TKA, how often do you use a quadriceps snip?
   2. In a revision TKA, how often do you use a tibial tubercle osteotomy?

B. Implant removal
   1. What is your favorite way to take out a well-fixed femur?
   2. What is your favorite way to take out a well-fixed tibia?
   3. Any tricks to take out well-fixed stems?

C. Bone loss
   1. Tibia
      a. What is the role of cancellous bone graft?
      b. What is the role of structural bone graft?
      c. What is the role of sleeves?
      d. What is the role of highly porous cones?

   2. Femur
      a. What is the role of cancellous bone graft?
      b. What is the role of structural bone graft?
      c. What is the role of sleeves?
      d. What is the role of highly porous cones?

   3. Stems
      a. What percent of your stems are cemented?
      b. What percent of your stems are uncemented?
      c. How do you decide how long to go with the stems?

D. Constraint
   1. What percentage of your revision TKA's are posterior stabilized?
   2. What percentage of your revision TKA's are constrained condylar?
   3. What percentage of your revision TKA's are hinged?
   4. What are your indications for hinged implant in 2016?

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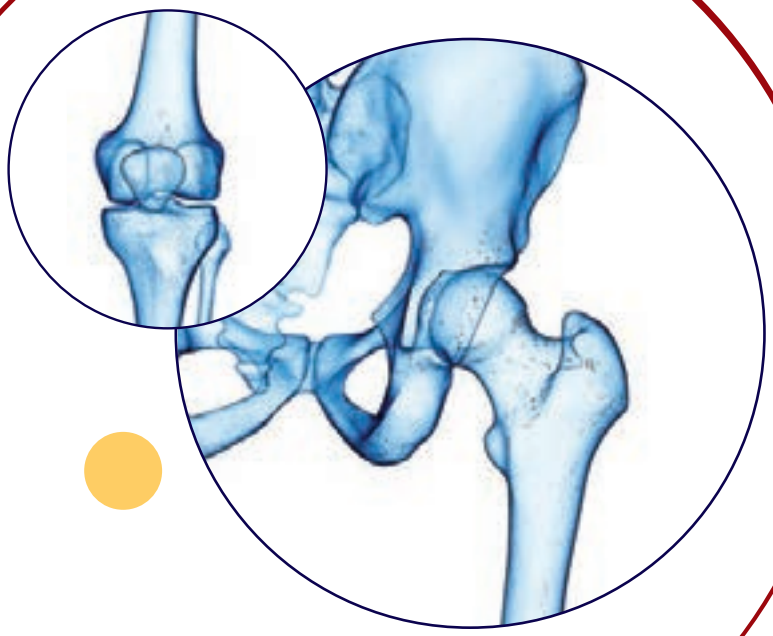

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