

# What Is the Role of 1 vs 2 Stage in Periprosthetic Infection?

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# I (and/or my co-authors) have something to disclose.

Detailed disclosure information is available via:

“My Academy” app;



# PERIPROSTHETIC INFECTION

## Scope Of The Problem

2020

- 49,000 PJI Projected
- Projected Costs - \$1.6 Billion

Kurtz, JBJS 2007



# PREVENTION STRATEGIES- CRITICAL

- Perioperative Antibiotics
- Pre Op Decolonization Protocols
- Chlorhexidine Wipes
- OR Traffic Reduction
- Laminar Flow
- Occlusive Post Op Dressings

**PATIENT OPTIMIZATION**

# PATIENT OPTIMIZATION- CRITICAL

## Modifiable Risk Factors

- HgB A1C < 8
- BMI <40
- Albumin >3.5
- Smoking Cessation



# MSIS INFECTION CRITERIA

- Sinus tract communicating with the prosthesis or Positive Culture on 2 separate tissues or fluid samples or
- Three of the following 5 criteria exist
  - Sedrate > 30 + CRP>10
  - Synovial WBC > 2000
  - Synovial PMN's >75%
  - One positive culture
  - > 5 Neutrophils in 5 high power histologic fields

# SYNOVIAL BIOMARKERS

- Alpha Defensin
  - Leukocyte Esterase
  - Synovial CRP
  - IL-6
  - Next Generation Sequencing
- Helpful in culture negative infections

# TREATMENT OPTIONS

- I & D & Poly Exchange
- 2 Stage Re-implantation
- 1 Stage Re-implantation





# Periprosthetic Knee Sepsis

## The Role of Irrigation and Debridement

MARK B. HARTMAN, M.D., THOMAS K. FEHRING, M.D.,  
LINDA JORDAN, M.S., AND H. JAMES NORTON, PH.D.

61 % Reinfection Rate

Clin Orthop Relat Res, December, 1991

### Failure of Irrigation and Débridement for Early Postoperative Periprosthetic Infection

Thomas K. Fehring MD, Susan M. Odum MEd, Keith R. Berend MD,  
William A. Jiranek MD, Javad Parvizi MD, Kevin J. Bozic MD,  
Craig J. Della Valle MD, Terence J. Gloc MD

64 % Reinfection rate

Clin Orthop Rel Res 471, 2013

# Irrigation and Debridement for Periprosthetic Infections

Does the Organism Matter?

Susan M. Odum, MEd,\* Thomas K. Fehring, MD, †† Adolph V. Lombardi, MD, §  
Ben M. Zmistowski, BS, || Nicholas M. Brown, BS, ¶|| Jeffrey T. Luna, MD, #  
Keith A. Fehring, MD, \*\*<sup>1</sup> and Erik N. Hansen, MD ††<sup>1</sup>  
and The Periprosthetic Infection Consortium<sup>1</sup>

Strep 71% failure all other organisms 67%

J Arthroplasty, Sept 2011

## The Fate of Acute Methicillin-Resistant *Staphylococcus aureus* Periprosthetic Knee Infections Treated by Open Debridement and Retention of Components

Thomas Bradbury, MD,\* Thomas K. Fehring, MD, † Michael Taunton, MD, ‡  
Arlen Hanssen, MD, ‡ Khalid Azzam, MD, ‡ Javad Parvizi, MD, §  
and Susan M. Odum, MEd||

J Arthroplasty, Sept 2009

84 % Reinfection Rate

# SERIAL DEBRIDEMENT LITERATURE

Estes, et al., CORR 2010

- 2 stage debridement with beads between stages
- 2 perioperative
- 18 acute hematogenous
- 18/20 successful

Mont, et al., J Arthroplasty, 1997

- 10 acute perioperative infections  
7/10 - 2 or 3 debridements
- All successful

# THE PROBLEM → BIOFILM

- Dooms I & D Poly Exchange Results
- Bacterial colonies attach to the implant
- Secrete a protective matrix that protects the bacteria from external threats such as antibiotics or the immune system
- Once mature they shed free planktonic bacteria which start new colonies on the implant
- Antibiotics can only kill the free planktonic bacteria

# 2 STAGE RE-IMPLANTATION

## The Chitranjan Ranawat Award

Fate of Two-stage Reimplantation After Failed Irrigation and Débridement for Periprosthetic Knee Infection

J. Christopher Sherrell MD, Thomas K. Fehring MD, Susan Odum MEd,  
Erik Hansen MD, Benjamin Zmistowski BS, Anne Denny BS,  
Niraj Kalore MD, the Periprosthetic Infection Consortium

Clin Orthop Relat Res January 2011

30% Reinfection rate

## Two-Stage Reimplantation for Periprosthetic Knee Infection Involving Resistant Organisms

By Yogesh Mittal, MD, Thomas K. Fehring, MD, Arlen Hanssen, MD,  
Camelia Marculescu, MD, Susan M. Odum, MEd, and Douglas Osmon, MD

J Bone Joint Surg 89-A, June, 2007

86% Success rate

# 1 STAGE RE-IMPLANTATION

- One Stage vs. Two Stage- Controversial  
Implant extraction only removes  
Implant related Biofilm
- Soft tissue Biofilm must also be removed through meticulous  
debridement

? Can local Biofilm attach to a newly implanted prosthesis?

# EUROPEAN ONE STAGE STUDIES

Clin Orthop Relat Res (2016) 474:81–87  
DOI 10.1007/s11999-015-4408-5

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



SYMPOSIUM: 2015 KNEE SOCIETY PROCEEDINGS

## Can Good Infection Control Be Obtained in One-stage Exchange of the Infected TKA to a Rotating Hinge Design? 10-year Results

Akos Zahar MD, Daniel O. Kendoff MD, PhD, Till O. Klatte MD,  
Thorsten A. Gehrke MD

Clin Ortho Relat Res 474; 2016

- 70 patients minimum 9 year f/u
  - Radical resection of bone
  - Hinged implants used exclusively - 93% infection free
  - 16% lost to f/u
  - 16% loose implants
- 32%
-

# EUROPEAN ONE STAGE STUDIES

## Single-Stage Hip and Knee Exchange for Periprosthetic Joint Infection



David A. George, MBChB, BMedSc, MRCS (Eng)<sup>a</sup>, Sujith Konan, MBBS, MD (Res), FRCS (Orth)<sup>a</sup>,  
Fares S. Haddad, MD (Res), FRCS (Orth), FFSEM<sup>a,b,c</sup>

<sup>a</sup> Department of Trauma and Orthopaedic Surgery, University College London Hospitals, London, UK

<sup>b</sup> The Princess Grace Hospital, London, UK

<sup>c</sup> Institute of Sport, Exercise and Health, University College London, London, UK

- 100% Success rate
- 11 Periprosthetic Hip Infections
- 28 Periprosthetic Knee infections
- 5 year f/u
- Exclusion criteria
  - Significant comorbidities
  - Resistant organisms
  - Presence of sinus tract
  - Peripheral Vascular disease

J Arthroplasty. 2015



# ONE STAGE VS. 2 STAGE WHICH IS BEST?

- One Stage data encouraging but difficult to interpret due to limited numbers, organism exclusion & comorbid patient exclusion
- Two Stage is the gold standard in U.S. but the reinfection rate is closer to 80% than the 90% often quoted
- **Patient convenience & Economic ramifications of 2 Stage Demand reevaluation**

## **Economic Burden of Periprosthetic Joint Infection in the United States**

Steven M. Kurtz, PhD,\*† Edmund Lau, MS,‡ Heather Watson, PhD,‡  
Jordana K. Schmier, MA,§ and Javad Parvizi, MD

J Arthroplasty. 2012

- Nationwide inpatient sample study
- Annual cost in 2009 - 566 million
- Projected to exceed 1.62 Billion by 2020
- Gold standard in U.S- 2 Stage

Do health economics mandate an investigation concerning 1 Stage ?

# OREF SPONSORED STUDY

T.FEHRING P.I.

- Prospective randomized multicenter study One stage vs. Two stage treatment for Periprosthetic hip & knee infections

## Initial Sites

- OrthoCarolina
- Rush
- Rothman
- Cleveland Clinic
- HSS

## Additional Sites

- USC
- UCSF
- Emory
- Ochsner Clinic
- UT Chattanooga
- Univ. of Michigan
- Univ. of Iowa

# ONE STAGE vs. 2 STAGE STUDY

## Inclusion Criteria

- Primary surgery
- Infection/MSIS criteria
- Known organism
- Resistant organisms
- Previous I & D

- Reprep/Re-drape Protocol
- All host classified/ MSIS criteria
- 350 patients

## Exclusion Criteria

- Fungal Infection
- Immunosuppressed patients
- Extensive soft tissue defect
- Revision surgery

# ONE STAGE VS. TWO STAGE

Go with the status quo or an unknown quantity with significant risk  
but a possible upside



It's time to settle this controversy

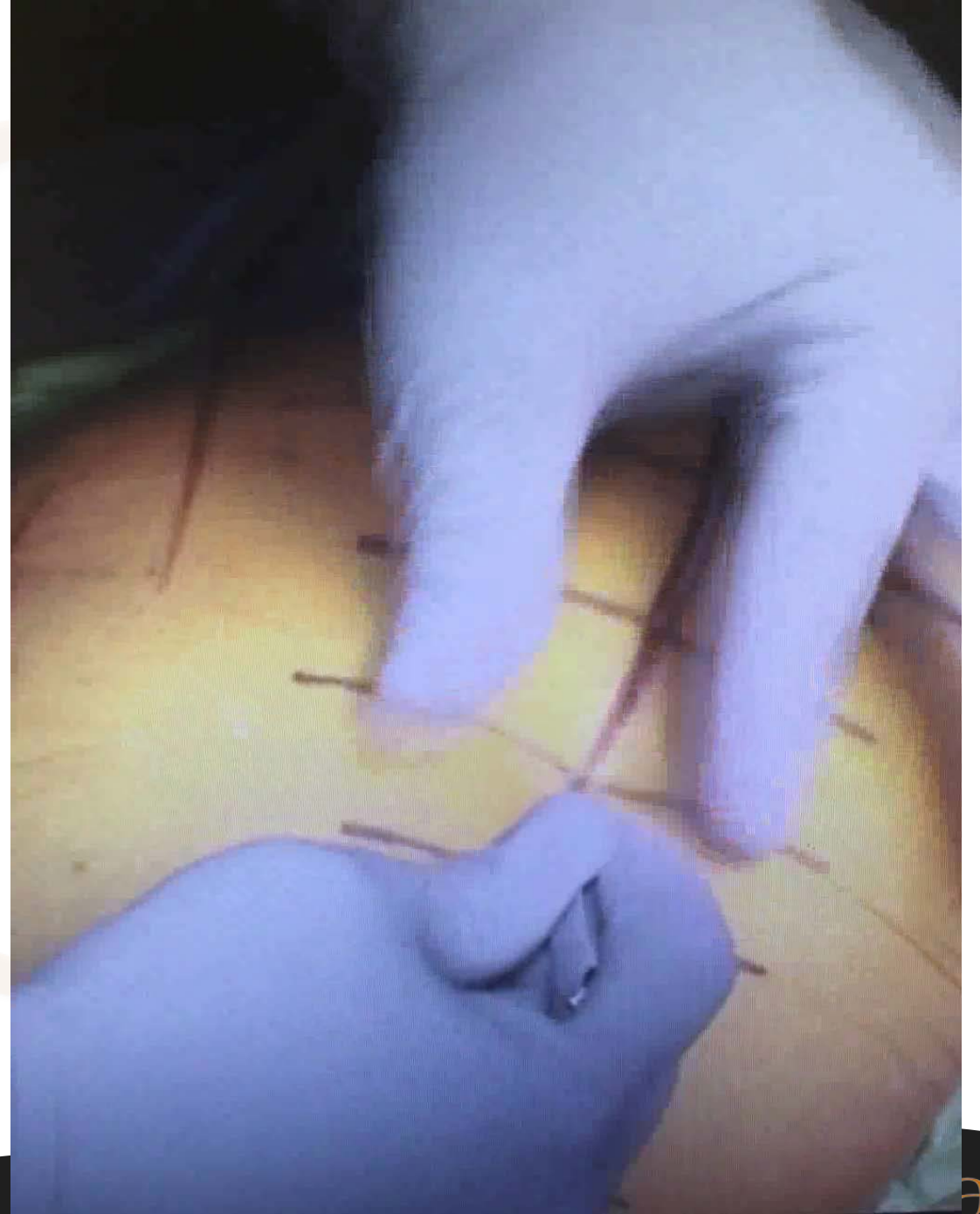
# WHAT DO WE NEED?

A prospective randomized multicenter study excluding only fungal organisms and immunosuppressed patients



# ONE STAGE VS. TWO STAGE

**WE'LL LET YOU KNOW**



# AUDIENCE RESPONSE QUESTION

I would consider doing a One Stage Preimplantation for a Periprosthetic Hip or Knee Infection.

1. If the organism was a sensitive staph or strep in a healthy patient.
2. In an elderly infirmed patient with multiple medical problems regardless of organism
3. In any patient even one with a resistant organism if not immunosuppressed
4. #1 & #2 only
5. Never I would prefer a 2 Stage Approach





OrthoCarolina

**HIP & KNEE CENTER**

Thank You