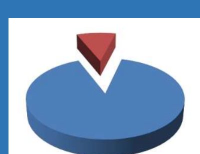
Results Overview:
Peri-prosthetic Infection
Salvage – One Stage – Two Stage

Edward Silverman MD
Hip and Knee Arthroplasty
9/20/2018
Arthroplasty Disaster International Conference

Results Overview

- Review results of surgical treatment only
- Omitting: Diagnosis / Workup / Antibiotics

- Implant Salvage / DAIR (debridement and implant retention)
- Single Stage Exchange
- Two Stage Exchange



Treatment of Periprosthetic Infections

- Surgical Options
  - Debridement and implant retention DAIR (exchange of poly, head & liner)
  - Single stage exchange arthroplasty
  - Two stage exchange arthroplasty
- No one size fits all strategy
- Must consider
  - Current implants (fixation, stability, bone stock, reconstructive options)
  - Host (medical co-morbidities, compliance, social factors, support)
  - Organism / Culture results
  - Timing of infection

Implant Salvage

- Incision and debridement of infection +/- exchange of interchangeable parts (head/liner, polyethylene tibia insert)
- Candidate for DAIR
  - Well positioned, well fixed implants
  - Implants with good track record
  - No bone lesions requiring debridement
  - Acute postop or acute hematogenous infection

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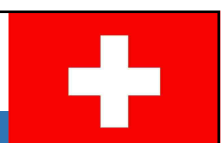
Debridement and implant retention in the management of hip periprosthetic joint infection

OUTCOMES FOLLOWING GUIDED AND RAPID TREATMENT AT A SINGLE CENTRE



- 2017 - Switzerland, Sendi et al.
- Retrospective - 34 hips DAIR for confirmed PJI, 2 year f/u
- Exogenous (3 days), Hematogenous (3 weeks)
- 90% success after 2 yrs
- 2 failures – both hematogenous, both S. aureus
- Key – rapid debridement upon diagnosis of infection.

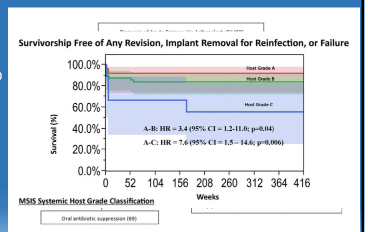
Irrigation and Debridement with Component Retention for Acute Infection After Hip Arthroplasty

Improved Results with Contemporary Management

Andrew J. Bryan, MD, Matthew P. Abdel, MD, Thomas L. Sanders, MD, Steven F. Fitzgerald, MD, Arlen D. Hanssen, MD, and Daniel J. Berry, MD

Investigation performed at the Mayo Clinic, Rochester, Minnesota

- JBJS - 2017 – Mayo
- 90 hips retrospective (2000 – 2012)
- Acute PJI (Hemi or THA)
  - Early postoperative (<28 days)
  - Acute hematogenous (<21 days)
- 70% Head and liner exchange, 30% I&D only
- Chronic Suppressive Abx (77%)
- Treatment failure (persistent infection) 15% early postop, 21% acute hematogenous
  - 6 year f/u avg
- Failure by host type
  - A – 8%, B – 16%, C – 44%



Complications - Infection

Poor Outcomes of Irrigation and Debridement in Acute Periprosthetic Joint Infection With Antibiotic-Impregnated Calcium Sulfate Beads

Michael A. Flierl, MD [a], Brian M. Culp, MD [a], Kamil T. Okroj, BA [a], Bryan D. Springer, MD [b], Brett R. Levine, MD [a], Craig J. Della Valle, MD [a, *]

[a] Department of Orthopaedics, Midwest Orthopaedics at Rush, Chicago, Illinois
[b] Department of Orthopaedics, OrthoCarolina Hip and Knee Center, Charlotte, North Carolina

- 2017 JOA – Rush / OrthoCarolina
- 33 hips – retrospective (2012 – 2016)
- Acute hematogenous or acute postoperative PJI (6 weeks)
- Irrigation and debridement with implant retention
- Antibiotic impregnated calcium sulfate beads (Vancomycin / Tobramycin)
- Avg 1 year f/u, 48% failure (no difference hematogenous vs postop)
- 7 → 2 stage exchange, 9 → antibiotic suppression

Fig. 1. Antibiotic-impregnated beads in place in the deep portion of the wound.

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Outcomes following debridement, antibiotics and implant retention in the management of periprosthetic infections of the hip

A REVIEW OF COHORT STUDIES

- Gaston et.al. UK - JBJS 2017
- 39 papers, 1296 patients
- Success of DAIR
  - Absence of recurrent PJI, no long term suppression, no revision, no mortality due to PJI, retention of components at final f/u
- Overall success 64%
- Before 2004 – 43%, After 2004 67%*
- Symptoms <7 days 72%, >7 days 51%*
- Exchange of modular components 74%, No exchange 60%*
- Time from procedure >/< 4 weeks – no sig diff.

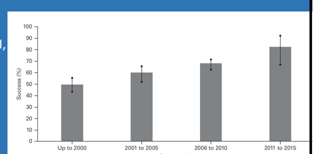
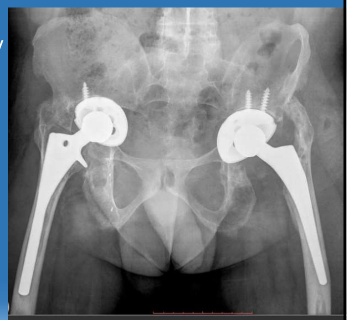


Fig. 2

Single and Two Stage Exchange Arthroplasty



- Removal of all components with debridement and reconstruction
  - Placement of spacer versus final implants
- Current implants not salvageable
  - Chronic Infections
  - Loose / unstable implants
  - Poorly positioned implants

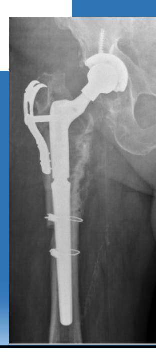
Outcome of One-stage Cementless Exchange for Acute Postoperative Periprosthetic Hip Infection

Erik Hansen MD, Matthew Tetreault BS, Benjamin Zmistowski BS, Craig J. Della Valle MD, Javad Parvizi MD, Fares S. Haddad MD, William J. Hozack MD

- 2013 – CORR – Rothman / Rush / UK
- Single stage cementless for acute postop infection
- Retrospective 27 pts – 2 yr f/u
- 70% (19/27) retained implants (4 required another debridement)
- 56% success with no further intervention
- 30% went on to 2-stage exchange

Preliminary Results After Changing From Two-Stage to One-Stage Revision Arthroplasty Protocol Using Cementless Arthroplasty for Chronic Infected Hip Replacements

Guillem Bori, MD, PhD [a, b, c, *], Guillem Navarro, MD [a, b], Laura Morata, MD [b, d], Jenaro A. Fernández-Valencia, MD, PhD [a, c], Alex Soriano, MD, PhD [b, c, d], Xavier Gallart, MD, PhD [a, c]



- 2018 – Spain – JOA
- Prospective – single stage exchange for chronic infections (cementless)
  - No exclusion criteria
- 19 patients – 18 successfully cured infection
  - 1 repeat debridement
  - 1 aseptic revision
  - 1 periprosthetic fracture
  - 1 repeat single stage for persistent infection
- Cost Savings $390,000 US dollars (for the cohort)

Comparison of One-Stage Revision With Antibiotic Cement Versus Two-Stage Revision Results for Infected Total Hip Arthroplasty

Ho-Rim Choi, MD [a], Young-Min Kwon, MD, PhD [a], Andrew A. Freiberg, MD [b], Henrik Malchau, MD, PhD [a]

[a] Harris Orthopedic Laboratory, Department of Orthopedic Surgery, Massachusetts General Hospital, Boston, Massachusetts
[b] Adult Reconstructive Service, Department of Orthopedic Surgery, Massachusetts General Hospital, Boston, Massachusetts

- MGH 2013 – Retrospective Review (1999-2009)
- 83 patients
  - 17 Single stage exchange – 82% success
  - 44 Two stage exchange - 75% success
    - Mean time btw stages 8 months
  - 22 Two stage non-reimplanted – 68% success
    - Reasons for no 2nd stage
      - uncontrolled infx, poor host, satisfied with function
- Success = no additional surgeries / no recurrent infection
- Selection Bias
  - Less severe cases – single stage

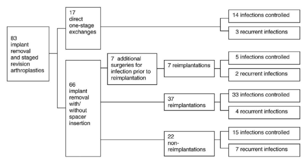


Fig. 1. Treatment methods and results for 83 infected total hip arthroplasties.

Complications - Infection

Characterization of Outcomes of 2-Stage Exchange Arthroplasty in the Treatment of Prosthetic Joint Infections

Check for updates

Amy N. Ford, MD, Adam M. Holzmeister, MD, Harold W. Rees, MD [*], Paul D. Belich, MD

Department of Orthopaedic Surgery and Rehabilitation, Loyola University Chicago, Maguire Center, Maywood, IL

- 2018 – JOA – Loyola University – Chicago
- 80 pts – retrospective – 2 stage exchange (hips/knees)
- 17% never had second stage
  - Spacer retention, resection arthroplasty, amputation, fusion
- 30% major complication
- 66 pts completed 2 stage
  - 48 pts successful control of infx (72%)
  - 60% success if all attempted 2 stage pts included

Complications - Infection

Predictors of Treatment Failure After 2-Stage Reimplantation for Infected Total Knee Arthroplasty: A 2- to 10-Year Follow-Up

Check for updates

Chen-Yang Ma, MD [a], Yu-Der Lu, MD [a], Kerri L. Bell, BA [b], Jun-Wen Wang, MD [a], Jih-Yang Ko, MD [a], Ching-Jen Wang, MD [a], Feng-Chih Kuo, MD [a,*]

- 2018 – JOA – Rothman / Taiwan
- Retrospective 106 pts – 2 stage exchange for chronic PJI
  - >4 weeks of symptoms
- 84% success at 10 years
- Failure Predictors
  - BMI >30
  - OR Time > 4 hrs
  - Gout
  - Enterococcus

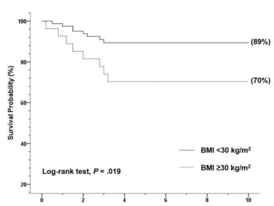


Fig. 2. Kaplan-Meier curve of time to treatment failure in 2-stage reimplantation in obese and non-obese patients.

Mortality of Elderly Patients After Two-Stage Reimplantation for Total Joint Infection: A Case–Control Study

Jonathan E. Webb, MD [a], Cathy D. Schleck, BS [b], Dirk R. Larson, MS [b], David G. Lewallen, MD [a], Robert T. Trousdale, MD [a]
[a] Department of Orthopedic Surgery, Mayo Clinic, Rochester, Minnesota
[b] Department of Biostatistics, Mayo Clinic, Rochester, Minnesota

- Mayo – 2014 – JOA
- Retrospectively compared 90 day, 1 year and 5 year mortality
- Two stage exchange vs aseptic revision
- 134 pts >80 y/o
- No difference in most complications or mortality at any time point
  - 5 year mortality - 39.9 % (2-stage), 34.1% (aseptic)
- Increased risk of infection in 2-stage group
  - 19% vs. 3.6% *

J.E. Webb et al. / The Journal of Arthroplasty 29 (2014) 2206–2210

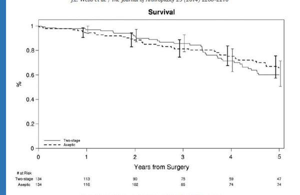


Fig. 1. Overall survival of patients within the study period.

HIP

Repeat two-stage exchange arthroplasty for prosthetic hip re-infection

- Brown, Fehring, Hanssen Abdel – Mayo - 2018
- Retrospective – pts undergoing second 2 stage exchange
- Survival free revision – 74% 2 yrs, 45% 5 yrs
- Reinfection rate 42%

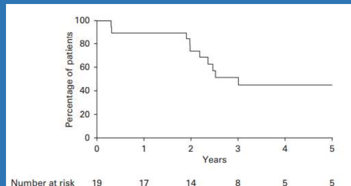


Fig. 1

Kaplan-Meier curve for survivorship free from any revision surgery.

Defining Treatment Success After 2-Stage Exchange Arthroplasty for Periprosthetic Joint Infection

Timothy L. Tan, MD [a], Karan Goswami, MD [a], Yale A. Fillingham, MD [a], Noam Shohat, MD [a,b], Alexander J. Rondon, MD, MBA [a], Javad Parvizi, MD, FRCS [a,*]
[a] The Rothman Institute at Thomas Jefferson University, Philadelphia, Pennsylvania
[b] Sackler Faculty

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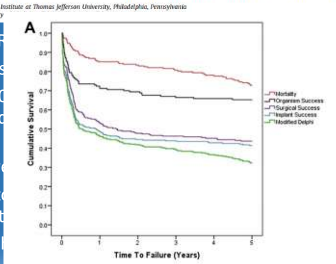


Fig. 1. (A and B) Five-year survivorship based on conventional ar

Table 1
Definitions for Treatment Success.

Criteria	Treatment Outcome Definitions	
1	International multidisciplinary Delphi consensus success	Lack of the following: (a) The presence of a sinus tract, an unhealed wound drainage, pain, or infection recurrence caused by the same organism strain. (b) Subsequent surgical intervention for infection after reimplantation surgery. (c) Occurrence of PJI-related mortality.
2	Modified Delphi consensus criteria success	Lack of the following: (a) The presence of a sinus tract, an unhealed wound or drainage, or infection recurrence caused by any organism strain. (b) Any unplanned surgical intervention (reimplantation not counted). (c) Occurrence of mortality of any cause. (d) Reimplantation surgery.
3	Organism success	Considered no recurrence of any organism regardless of whether it was present at the time of the first stage.
4	Implant success	Considered patients who were reimplanted.
5	Surgical success	Defined by no additional surgeries except planned surgeries (ie, other than reimplantation). Unplanned spacer exchanges or interim surgeries such as irrigation and debridement were considered a failure.

Single Stage

- No downtime waiting for second stage
- Single anesthetic
- Decreased cost
- Faster return to WBAT

Two Stage

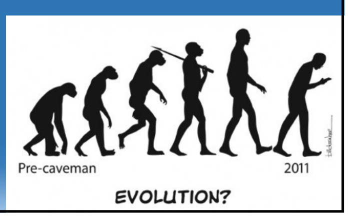
- 2 months minimum downtime
  - Static spacer / articulating spacer
- 2 anesthetics
- 15-25% of patients never make it to second stage
- Increased Cost
- Better infection eradication (debated)

Notice…

- Small series
- Most retrospective
- ?Definition of treatment success?
- Lack of randomized controlled studies
- Difficult to determine clear superiority
- Must weight risks/benefits for each patient

My Strategy

- Implant Salvage
  - Acute post-op infection <4 weeks
  - Acute hematogenous infection <7 days symptoms
  - Chronic Infx - too sick to undergo major revision
  - Well functioning implants
- Single Stage Exchange
  - Chronic infection
  - Unwilling or unable to undergo two surgeries
- Two Stage Exchange
  - Most chronic infections
  - Likely being over-utilized



Thank You!

Edward Silverman MD