

## TWO-STAGE REVISION FOR PERIPROSTHETIC INFECTION

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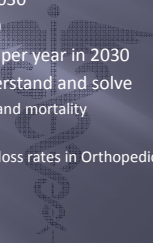
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## Epidemiology of PJI

- ▣ 572,000 THA in the US in 2030
- ▣ 3.5M TKA in the US in 2030
- ▣ 1-2% infection = 80,000 PJI per year in 2030
- ▣ Important problem to understand and solve
  - Individual patient morbidity and mortality
  - Population health care cost
  - Gastric ulcer rates and sleep loss rates in Orthopedic Surgeons



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## Definition of PJI

- ▣ Variable definitions when infection not obvious
  - Contaminated aspirates may confuse diagnosis
  - PCR and genomic testing may clear up definition
  - Role of ESR/CRP
  - Intra op gram stain...reliable?
- ▣ However...majority of infections are clear to the clinician
  - Draining
  - Positive cultures
  - Pain, swelling, erythema
  - Very elevated ESR/CRP



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### Treatment Options

- Irrigation and Debridement
    - "washout" with poly exchange
- Single Stage Exchange
    - Extensive debridement of tissues
    - Removal of all implants, cement and cement restrictors
    - Re-implantation of revision components
    - Post-operative abx (IV +/- orals)
- Two Stage Revision
    - Removal of all components, cement and cement restrictors
    - Extensive debridement of tissues
    - Placement of antibiotic/cement spacer
    - Period of Abx therapy
    - Repeat surgery to remove spacer, repeat the I/D and place revision components

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### Head to Head Prospective Data

- Level I: Non existent (cue crickets chirping)
- However, several literature reviews have been done
    - Data is very heterogenous
    - Definition of infection is variable
    - Definition of cure
    - Recurrent infection or Function as endpoint
    - Inclusion/exclusion requirements quite variable between studies

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### One and Two Stage Data

- One stage
    - Heterogeneous data
    - Many reports have very strict protocol for single stage
      - Resistant organisms only
      - No soft tissue compromise
      - Host not immunocompromised
    - Data more recent than 2 stage
      - Better antibiotics?
      - Better techniques?
    - Mostly level III/IV data subject to selection bias
- Two Stage
    - Heterogeneous data
      - Early data did not include abx in the spacer
    - Generally include all infections without respect to organism, soft tissue coverage or status of host
    - Data dates back to the 80s.

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### Single Stage Hip Data

- ▣ 5% reinfection (Zeller, 2014)
  - Only done for specific indication
    - Healthy patient
    - Duration of symptoms > 2 weeks
    - Prosthesis implanted > 4 weeks
    - No bone loss
    - Organism isolated preoperatively
      - Not "difficult to treat"
- ▣ 12% reinfection (Wolf, 2011)
  - Review of 8 Single Stage Hip Publications
  - Lower death rate than Two Stage

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### Two Stage Hip Data

- ▣ Hsieh, 2004
  - Compared implant-like antibiotic spacer to beads
  - Reinfection rate 5% for both groups
  - Hip spacer resulted in less complications and better outcomes
- ▣ Shih, 2002
  - 5% reinfection
- ▣ Hsieh, 2005
  - 24 patients with infection and massive bone loss
  - 0% reinfection rates after two stage exchange and the use of bulk allograft at revision.

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### Single Stage Knee Data

- ▣ 0-11% reinfection (Masters 2013)
  - Only 4 studies met inclusion criteria
  - Compared to 58 two stage publications
- ▣ 0% (Haddad 2015)
  - 102 patients
  - Strict Protocol
    - NO bone loss
    - Sensitive organism (No MRSA or MRSE in 1-stage group)
    - Healthy soft tissues
    - Host not immunocompromised

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### Two Stage Knee Data

- ▣ 0-41% reinfection (Masters, 2013)
  - 58 studies available
  - 7-17% reinfection for larger studies over 100 patients
- ▣ 9% reinfection (Haleem, 2004)
  - Static spacers
  - 93% infection free survival at 5 years
  - 85% infection free survival at 10 years
- ▣ 7% reinfection (Haddad, 2015)
  - Articulating spacers
  - Cohort of patients with more difficult to treat infections

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### Functional Considerations

- ▣ Post-revision function/ROM expected to be better after single stage procedure
  - Does the more extensive debridement described in the single stage protocols compromise final function?
- ▣ Static spacers thought to result in large amount of scar formation and poor function after revision
- ▣ Poor function of patient during waiting period of two stage procedure

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### Articulating Spacers

- ▣ Knee
  - Fehring, 2000
    - ▣ Better final ROM in articulating group
    - ▣ No difference in infection control (7% vs 12%)
    - ▣ Articulating spacers facilitated reimplantation
  - Hart, 2006
    - ▣ 12% reinfection
    - ▣ Final ROM compared favorably to other published results
- ▣ Hip
  - Cui, 2007
    - ▣ Better final function
    - ▣ Improved patient satisfaction
    - ▣ "facilitated" reimplantation
    - ▣ No difference in infection control

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### Bone Loss

- ▣ Less in one stage
- ▣ More in two stage
- ▣ What is the protocol for failed one stage?
  - Often followed by two stage procedure
  - Does single stage exposes patient to 3x bone loss or more?

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### Single stage success

- ▣ Specific protocols shown success
- ▣ Single procedure exposes patient to less potential complications
- ▣ Protocols generally include
  - Organism identified pre operatively
  - Organism is susceptible to standard antibiotics
  - Soft tissue not compromised
  - Host not immunocompromised

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### What Are Your Colleagues Doing?

- ▣ Leite, 2016, JBJ Infect.
- ▣ Survey of 143 members of the EBJIS
- ▣ 60%: Primarily two stage
- ▣ 34%: Two stage or one stage depending
- ▣ 5.1%: Primarily one stage

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### Conclusion

<ul style="list-style-type: none"><li>▣ Single Stage</li><li>▣ Limited data</li><li>▣ May have utility in very specific circumstances</li><li>▣ Be wary of the way this data gets quoted</li></ul>	<ul style="list-style-type: none"><li>▣ Two Stage</li><li>▣ Most studied</li><li>▣ Equally or more reliable</li><li>▣ Applicable to all patients</li><li>▣ Function no longer compromised with mobile spacers</li><li>▣ Remains the gold standard.</li></ul>
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### Why is Two Stage Preferred

1. Two stage exchange for any organism, hosts, or soft tissue status is equivalent to single stage exchange in very narrow circumstances
2. Failed single stage exchange is generally followed by a two stage exchange, therefore up to 20% of patients treated with single stage exchange will be subjected to excessively more bone loss, more surgical risk and and likely poorer function.
  - ▣ One study also showed poorer infection eradication rates utilizing two stage exchange after an irrigation and debridement versus going straight to a two stage revision. Does this also hold for failed single stage treatment.

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### Why is Two Stage Preferred

3. Single stage protocols often require identification of a resistant organism prior to surgery. However, some studies have shown different or multiple organisms identified after revision surgery. Therefore one might not be totally confident in the aspiration result.
4. Its what your colleagues are doing...

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