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

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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

#1: Antibiotics

#2: Timing

#3: Surgical Treatment

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

#1: Antibiotics

#2: Timing

#3: Surgical Treatment

#4: Results
Case 1
61 YOF, 2 Wks s/p R THR, c/o Fevers

ESR 54 mm/hr
CRP 121 mg/L
WBC 23,795
89% PMNs
Cx: β hemolytic strep
Case 1

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

- I&D, Bead Placement, Head/Liner Exchange
- IV Abx Choice?
- PO Suppression?

Cx: β hemolytic strep

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

Preop

Postop
Antibiotics

Type II or III Infections

Before Incision

After Surgery

Special Circumstances

* Leone and Hanssen. *AAOS ICL*. 2006
Antibiotics

Type II or III Infections

Before Incision

+ Preop Organism ID
Abx (Cx & Sensitivity)

- Preop Organism ID
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

Include GN Coverage

High Risk for MRSA

Add Vancomycin

* Leone and Hanssen. *AAOS ICL*. 2006
Case 1
61 YOF, 2 Wks s/p R THR, c/o Fevers

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Cx: β hemolytic strep
Case 1
61 YOF, 2 Wks s/p R THR, c/o Fevers

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

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

2 Years
ESR 3
CRP < 3
#1: Antibiotics

#2: Timing

#3: Surgical Treatment

#4: Results
Case 2

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

ESR 72 mm/hr
CRP 333 mg/L
WBC 27,598
70% PMNs
Case 2
52 YOF, 2 Days of Pain, Colonoscopy

Preop

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

0 Days  2 Days  14 Days

S. aureus  Gram + Organisms
Timing
Acute Postoperative Infections

0 Days  2 Days  14 Days  28 Days

S. aureus  Gram + Organisms  Index Procedure
Case 2

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

ESR 72 mm/hr
CRP 333 mg/L
WBC 27,598
70% PMNs
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

ESR 47 mm/hr
CRP 186 mg/L
Case 3

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

PMH: DM, RA, smoker
Cx: β 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
Infected THR
Acute (Type II or Type III)

Antibiotic Suppression

Resection Arthroplasty

Irrigation & Debridement + Head/Liner Exchange

Two-Stage Exchange

Acute One-Stage Exchange

* Hansen et al. CORR. 2013
Important Difference

≠

MAYO CLINIC
Mode of Fixation

• TKAs: Mostly cemented

• THAs: Mostly uncemented
Surgical Management
Total Knee Replacement

Infected TKR
Acute (Type II or Type III)

- Antibiotic Suppression
- Resection Arthroplasty
- Irrigation & Debridement + Poly Exchange
- Two-Stage Exchange

Acute One-Stage Exchange
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

MAYO CLINIC
Sonication of Removed Hip and Knee Prostheses for Diagnosis of Infection


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

>5 WBC/hpf*

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

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
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

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

The Journal of Arthroplasty 29 (2014) 469-472

- 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 Sukeik MRCSEd, Shelain Patel MRCS, Fares Sami Haddad FRCS(Tr&O)


- 26 patients
- 77% success at 5 years
Case 3

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

ESR 47 mm/hr
CRP 186 mg/L
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

Preop

1 Year
Outline

#1: Antibiotics

#2: Timing

#3: Surgical Treatment

#4: Results
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<th>Author</th>
<th>Journal</th>
<th>Year</th>
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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

ESR 67 mm/hr
CRP 91 mg/L
WBC 48,494
86% PMNs
Cx: MRSA
Case 4
52 YOM, 7 Days of Pain, Transplant, MRSA

PMH: Kidney Transplant
Immunosuppressed
Cx: MRSA

Preop
Risk Factors for Failure

I&D with Component Retention

Host
Organism
Other

* Vilchez et al. *Clin Microbiol Infect.* 2011
* Berbari et al. *Clin ID.* 2006
Risk Factors for Failure

I&D with Component Retention

Host

Non-Modifiable

Age
Immunocompromised

Modifiable

DM
Malnourished
RA

* Vilchez et al. Clin Microbiol Infect. 2011
* Theis et al. ANZ J Surg. 2007
Risk Factors for Failure

I&D with Component Retention

Organism

S. aureus

Resistant

MRSA

MRSE

* Vilchez et al. Clin Microbiol Infect. 2011
* Theis et al. ANZ J Surg. 2007
* Parvizi et al. CORR. 2009
Risk Factors for Failure

I&D with Component Retention

Other

> 2 Weeks

Wound Drainage

Sinus Tract

Loosening

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