Post-operative prosthetic joint infections

Enrico de Visser
Perioperative Strategies for Decreasing Infection

A Comprehensive Evidence-Based Approach

By Joseph A. Bosco III, MD, James D. Slover, MD, MS, and Janet P. Haas, RN, PhD

An Instructional Course Lecture, American Academy of Orthopaedic Surgeons
Best way to deal with infection is: prevention!

1. Infected implant = disaster
2. Large foreign body
3. Antibiotics often not sufficient
4. Multiple interventions
5. Implant removal
History of Prophylaxis

1867 Lister: 
“aseptic surgery”
(skin, scrub, drape, mask, gloves, sterile instruments)

1888-1961: 
movement restriction & tissue handling

1969 Charnley
Charnley J, Eftekhar N. Postoperative infection in total prosthetic replacement arthroplasty of the hip-joint. With special reference to the bacterial content of the air of the operating room. Br J Surg. 1969
98% of bacteria are airborne

Infection Yes / No?

Inoculum, type of bacteria, host
Reduce airborne bacteria

1. Reduce CFU/m$^3$ < 1
2. Effective ventilationsystem
3. Clothing preventing shed
4. Theatre discipline
Ultra Clean Air

Laminar flow

= uniform velocity along parallel lines
  with positive pressure, turnover

Filter system

4-8 fold < of contamination

Charnley: 9.5% >> 1.5%
Systemic antibiotics

One preoperative dose vs 24 hrs (Cefazoline)

Tang et al. J Arthropl 2003
Wymenga et al. Thesis 1991

Norwegian Arthroplasty Register:
22170 cemented THAs, non-randomised, 0-14 years

- 0.5 % revision for deep infection
- best with 4 times in 24 h + AB loaded cement


Antibiotic prophylaxis: risk reduction infection
81% compared to no prophylaxis (p<0.001); pooled analysis, n=3.065)

AlBuhairan et al. JBJS-Br 2008
Timing of systemic prophylaxis?

30-60 min. before skin incision

Hanssen and Osmon CORR 1999
Gyssens et al Drugs 1999
Polk and Christmas Am Surg 2000
Antibiotic loaded cement

Reduction of deep infection, but without i.v. prophylaxis more wound infection

Hanssen and Osmon CORR 1999

Synergy with Systemic Antibiotics
FAQ - preoperative

Preoperative shaving leads to increased risk of infection with time before surgery


The use of alcohol versus repeated scrubbing

- Rehork et al. Investigations into the efficiency of different procedures for surgical hand disinfection between consecutive operations J.Hosp.Inf. 1991
FAQ - preoperative

No increased risk for infections under MTX / TNFa

- den Broeder, AA et al. Risk Factors for Surgical Site Infections and Other Complications in Elective Surgery in Patients with Rheumatoid Arthritis with Special Attention for Anti-Tumor Necrosis Factor. Rheumatol. 2006 Nov 15

Controversy on the use of Mupirocine (Bactroban)

- Biomedica. 2003 Jun;23(2):173-9
FAQ - Clothing

Closure of extremity sleeves
Relatively high particle release from cotton
All hair should be covered
  • Whyte W. The role of clothing and drapes in the operating room. J Hosp Infect 1988;11

Body exhaust suits; no influence on bacterial count in 62 THA
  • Pasquarella et al. J Hosp Infect 2003

Surgical mask versus wound infections
Double gloves?

Gloove perforation: 4 - 67%

Reduction of cutaneous exposure: 90%

Wright et al. JBJS 1993
Contamination during THA?

100 cases

<table>
<thead>
<tr>
<th>Item</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suction tips</td>
<td>11.4%</td>
</tr>
<tr>
<td>Light handles</td>
<td>14.5%</td>
</tr>
<tr>
<td>Skin knife</td>
<td>9.4%</td>
</tr>
<tr>
<td>Inner knife</td>
<td>3.2%</td>
</tr>
<tr>
<td>Gloves</td>
<td>28.7%</td>
</tr>
<tr>
<td>Needles</td>
<td>10%</td>
</tr>
<tr>
<td>OR suite</td>
<td>17%</td>
</tr>
</tbody>
</table>

Davis et al. JBJS-Br 1999
FAQ - Miscellaneous

In hospital stay versus wound infections
*de Boer AS et al. Risk assessment for surgical site infections following total hip and total knee prostheses. Chemother. 2001 Nov;13 Spec No 1(1):42*

Infections and drains.
More transfusions and less wound dressings with drains; Meta analysis of 3689 wounds Hip and Knee +/- drain (18 studies).
*Parker et al. JBJS (Am) 2005*


Door movements on OR
*Van Tiel et al. J Hosp Infect. 2006*
What about dental procedures?

- bacteraemia > 30 min
- 0.05% chance
- patients with systemic disease at risk

Laporte et al. JBJS-Br 1999

- AAOS guideline: no routine AB
Intra-articular steroid injection prior to THA?

Caution when used within 2 months of THA

Mc Intosh et al. CORR 2006

5 deep infections in 40 hips (none in control)

Kaspar and de Beer JBJS-Br 2005
Conclusion

Fundament of prophylaxis:
1. Clean air / theatre discipline
2. Systemic antibiotics
3. AB loaded cement
4. Time out??

Deep infection < 1 %

Zimmerli et al. NEJM 2004
Infections in arthroplasty

- Netherlands (PREZIES study)
  - Overall: deep 1.1% / superficial 2.9%
  - THA: deep 1.0% / superficial 1.1%

- Micro-organism
  - 85% deep SSIs with Gram positive bacteria, mainly staphylococcal species
  - Anaerobes, Gram negative or fungal infections
  - Polymicrobial cultures

Primary Arthroplasties

Kurz et al. CORR 2009

Hip

Knee

Kurz et al. CORR 2009
Revision Arthroplasties
Septic and Aseptic

Kurz et al. CORR 2009

Hip

Knee

Kurz et al. CORR 2009
# Common Microorganisms

<table>
<thead>
<tr>
<th>Microorganism</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coagulase – Staphylococcus</td>
<td>30-43 %</td>
</tr>
<tr>
<td>Staphylococcus Aureus</td>
<td>12-23 %</td>
</tr>
<tr>
<td>Mixed Flora</td>
<td>10-11 %</td>
</tr>
<tr>
<td>Streptococci</td>
<td>9-10 %</td>
</tr>
<tr>
<td>Gram – Bacilli</td>
<td>3-6 %</td>
</tr>
<tr>
<td>Enterococci</td>
<td>3-7 %</td>
</tr>
<tr>
<td>Anaerobes</td>
<td>2-4 %</td>
</tr>
<tr>
<td>False Negative</td>
<td>11 %</td>
</tr>
</tbody>
</table>

*Zimmerli et al. NEJM 2004*
Diagnosis of PJI is DIFFICULT

- Because Organisms reside in a biofilm

- Because Organisms reside inside cells
The run for the surface....... 

Prosthesis is immediately coated with a conditioning film. Thereafter, this films is colonized by either host cells or bacteria.
Glycocalyx

- Exopolysaccharide layer produced by bacteria
- Sequestered micro-environment in which the bacteria can grow and provide additional adhesion for new bacteria
Clinical Presentation

• **Early**< 3 mnths 29 percent
  - Acute onset
  - *Virulent microorganisms*
  - *S. Aureus and gram – bacilli*

• **Delayed** 3 – 24 mnths 41 percent
  - Subtle signs
  - Early implant loosening
  - Less virulent microorganisms
  - Coagulase - *Staphylococci*
  - Low grade infection

• **Late** > 24 mnths 30 percent
  - Hematogenous seeding
Total burden of septic arthroplasty revisions is increasing

- In case of revision: Is it truly aseptic?
- Infection should always be ruled out.
- 12% of so called aseptic revisions could indeed have a PJI. Parvizi J, et al CORR 2011
Diagnostic Workup PJI
IC Recommendations / AAOS Guidelines
Treatment

The NEW ENGLAND JOURNAL of MEDICINE

REVIEW ARTICLE

CURRENT CONCEPTS

Prosthetic-Joint Infections

Werner Zimmerli, M.D., Andrej Trampuz, M.D., and Peter E. Ochsner, M.D.

N Engl J Med 2004; 351: 1645-54
Thank You.