Managing infection in shoulder arthroplasty

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Shoulder replacement

- 7000 TSR/year in the USA from 1996-2002 (Bohsali)
- 17000 SR (Norris)
- 75% are performed by surgeons who do less than 2/yr on average
SR complication rate

- Complication rate: 10-16%
  - $414/2810 = 14.7\%$ (Literature review)
  - $204/1459 = 14\%$ (Wirth)
  - $53/431 = 12\%$ (Chin)
  - $123 / 1183 = 10\%$ TSR (Cofield)
Complications

- Component loosening
- Prosthetic instability
- Cuff rupture
- Stiffness
- Peri-prosthetic Fx
- Infection
- Implant breakage
- Deltoid weakness
- Neural lesions

1997

- Component loosening
- Instability
- Periprosthetic Fx
- Rotator cuff tears
- Neural injury
- Infection (0.7% lit)
- Deltoid muscle dysfonction

2006
<table>
<thead>
<tr>
<th>Causes for revision of shoulder arthroplasty</th>
<th>Dines, 2006</th>
<th>Bayley, 2005</th>
<th>Swedish R</th>
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</thead>
<tbody>
<tr>
<td>Glenoid revision</td>
<td>22</td>
<td>25</td>
<td>6</td>
</tr>
<tr>
<td>Conversion hemi to total</td>
<td>16</td>
<td>19</td>
<td>65</td>
</tr>
<tr>
<td>Humeral stem revision</td>
<td>8</td>
<td>3</td>
<td>12</td>
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<tr>
<td>Periprosthetic Fx</td>
<td>4</td>
<td>3</td>
<td>5</td>
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<tr>
<td>Rotator cuff repair</td>
<td>10</td>
<td>24</td>
<td></td>
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<tr>
<td>Tuberosity reconstruction</td>
<td>4</td>
<td></td>
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<tr>
<td>Cuff tear</td>
<td>4</td>
<td></td>
<td>11</td>
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<tr>
<td>Instability</td>
<td>5</td>
<td></td>
<td>59</td>
</tr>
<tr>
<td>Infection</td>
<td>4</td>
<td>1</td>
<td>19</td>
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</tbody>
</table>
Frequency of SR infection

• 0.3 to 0.8% in literature review for primary replacement (Rockwood, Post, Schwyzer, Cofield, Kelly, SOFCOT, …)

• 0 to 15.4% for revision
**Frequency of SR infection**

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<tbody>
<tr>
<td>n</td>
<td>1641</td>
<td>2734</td>
<td>2396</td>
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<tr>
<td>Primary</td>
<td>1.2%</td>
<td>0.075%</td>
<td>1.8%</td>
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<tr>
<td>Revision</td>
<td>4.46%</td>
<td>0.03%</td>
<td>4%</td>
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- 3-5% after fracture, ≈ 10% for reverse
General considerations

• ≈ 60% of patients present with predisposing factors (diabetes, corticoids, immunosuppression, Lupus or RA,...)

• **Germs:**
  
  
  • *Staphyloccocus epidermidis* (40%), *P. acnes* (20%), *aureus* (15%) *(Boileau, 2004)*
Difficult diagnosis

• Clinical changes: decrease ROM & pain +++

• Redness, oedema, inflammation or sinus tracts are late signs
Difficult diagnosis

- **Blood analysis:**
  - ↑ Serum leucocyte count,
  - ↑ Erythrocyte sedimentation rate,
  - ↑ CRP

- Non specific, can be normal in up to 30% of cases
Difficult diagnosis

- Radiology: late signs
  - “Early changes, endosteal, humeral and glenoid sites, bony resorption”

- Scintigraphy:
  - 7/11 positive (Codd)
  - 58% positivity (Matsen)
  - Gallium or leucocytes cannot be made before 10 months postop (sensibility 80%)
Articular ponction

• To date the best method
• Stop any antibiotics (therapeutic window)
• Efficiency depends on the quality of the ponction and the care of the sample
  • 2 +/-7 (Codd), 16% + (Boileau), 38% positivity (Matsen), 40% + (Jerosch)
  • 100% positivity (Ince)
Classification of infection

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<tbody>
<tr>
<td><strong>Acute</strong></td>
<td>&lt; 1 m</td>
<td>2</td>
</tr>
<tr>
<td><strong>Subacute</strong></td>
<td>2-3 m to 1 yr</td>
<td>6</td>
</tr>
<tr>
<td><strong>Chronic</strong></td>
<td>&gt; 1 yr</td>
<td>14</td>
</tr>
<tr>
<td>(late)</td>
<td></td>
<td>29</td>
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Treatment depends of:

- Stage of infection
- The germ (Found/not found; gram+/gram-)
- General status of the patient
- Bone quality, quality of the cuff, type of implant
Acute infection

• Implants can be left in place
• A large synovectomy is required (open or arthroscopic)
• Drainage
• Adapted antibiotherapy (i/v then p.o.) with the help of a bacteriologist
Acute infection - Results

- Up to 80% of patients present with an acceptable to good result
- 1/3 required a secondary procedure!
- End-results depends on:
  - Delay
  - Quality of resection of all infected-tissues (Rotator cuff!)
Subacute - Late infection

- No consensus
  - One-stage replacement
  - Two-stage replacement w/wo cement spacer
  - Articular resection
Take home message

• Whatever the series, functional results of the treatment of chronically infected shoulder arthroplasties give fair to poor results

• Constant’s score average 30-40 pts!

• At FU: 30/42 are cured from infection (71%) while 29% are still infected or possibly infected (Boileau 2004)
Articular resection

• 1/3 of his series, 30% persistent infection (Boileau 2004)

• 21 resections (out of 32 cases), 6 still infected, the worst results (Sperling 2001)

• 5/18 resections, worse functional results (Codd 1996)
Articular resection

- 7 resection out of 20 infected TSR
- All patients satisfied, poor results even with Neer’s limited goal criteria
- Almost no motion, no or little pain
- No persistent infection

Braman JSE 2006
Articular resection

• Remove all infected tissues (cuff +++)
• Remove the implant(s) AND the cement
• High risk of humeral fracture
  • Cement removal techniques (Oscar)
• Drainage and Antibiotherapy
One-stage replacement

- 8/18 pts (Codd 1996),
- Same functional results

- 16 pts (Ince, 2004),
- Constant’s score 33.6 pt
- 3 re-operations, none for persisting infection

In this series, the germs were known in all cases
Two-stages replacement

- Remove all infected tissues +++
- Cultures +++
- Use of a spacer (?)
  - Oversized
  - Fix tuberosities to spacer in case of Fx
- Rehabilitation with the spacer
Two-stages replacement

- Second operation between 4w-6m
- TSR or Humeral prosthesis with capsular coverage of the glenoid (Burkhead, Seitz)
- Normalization of biologic factors
- Intra-operative tissues sampling
Two-stages replacement

- Constant 48 pts, all 10 pts cured (Jerosch 2003)
- 3/3 cured, best results (Sperling 2001)
- 10 cases, 40% still infected (Boileau 2004)
Other techniques

- Salvage procedures
Antibiotics?

- Adapted to the germs +++
- High doses
  - Gram +: Rifampicin + Fluoroquinolon
  - Gram -: Fluoroquinolon + C3G
Best treatment = prevention

• **Pre-operative**
  • Stop tobacco, Control diabetes
  • Mouth and bladder infection control
• Cutaneous preparation, ATBprophylaxy, laminar flood,..
Best treatment = prevention

• Per-operative
  • ATB prophylaxis, laminar flood,..
• Cement with ATB
• Duration of surgery (< 2hrs NNIS)
• No drainage (Gartsmann)
• No urinary catheter
• Early removal of dressing
Preventive antibiotic therapy?

- Dental care? NO
- Colonoscopy? NO
- Cutaneous infections?
  - Probably useful

Except if confirmed infection

Deacon et al. JBJS am 1996; 78A: 1755-1771