# 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

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- Component loosening
- Instability
- Periprosthetic Fx
- Rotator cuff tears
- Neural injury
- Infection (0,7% lit)
- Deltoid muscle dysfonction

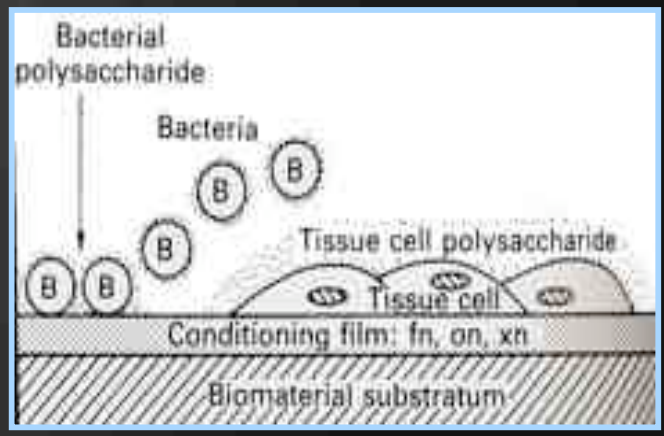
2006

# Causes for revision of shoulder arthroplasty

| | Dines, 2006 | Bayley, 2005 | Swedish R |
|---|---|---|---|
| Glenoid revision | 22 | 25 | 6 |
| Conversion hemi to total | 16 | 19 | 65 |
| Humeral stem revision | 8 | 3 | 12 |
| Periprosthetic Fx | 4 | 3 | 5 |
| Rotator cuff repair | 10 | 24 | |
| Tuberosity reconstruction | 4 | | |
| Cuff tear | 4 | | 11 |
| Instability | 5 | | 59 |
| Infection | 4 | 1 | 19 |

# 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

| | Kozak (1997) | Sperling (2001) | Boileau (2004) |
|---|---|---|---|
| n | 1641 | 2734 | 2396 |
| Primary | 1,2% | 0,075% | 1,8% |
| Revision | 4,46% | 0,03% | 4% |

3-5% after fracture, ≈ 10% for reverse

# General considerations

- ≈ 60% of patients present with predisposing factors (diabetes, corticoids, immunosuppression, Lupus or RA,...)
- Germs:
  - Staphylococcus Aureus (12), epidermidis (9), Pseudomonas (4), Propioni-bacterium acnes (6) (Kozak, 1997)
  - Staphyloccocus epidermidis (40%), P. acnes (20%), aureus (15%) (Boileau, 2004)

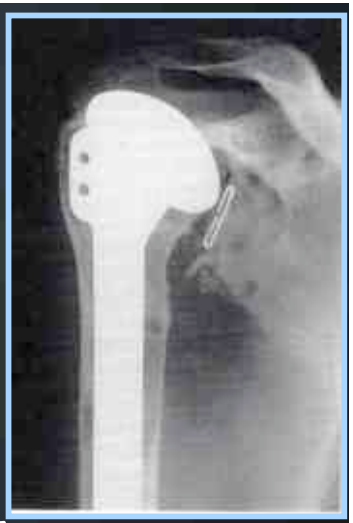
# Difficult diagnosis

- Clinical changes:
  decrease ROM & pain +++
- Redness, oedema,
  inflammation or sinus
  tracts are late signs

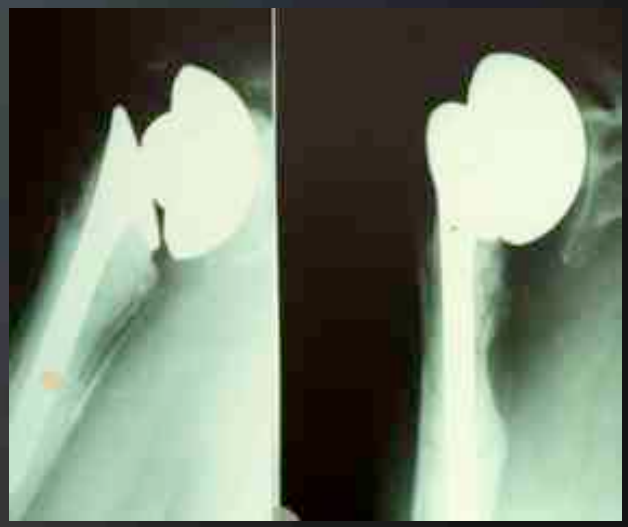
# Difficult diagnosis

- 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)

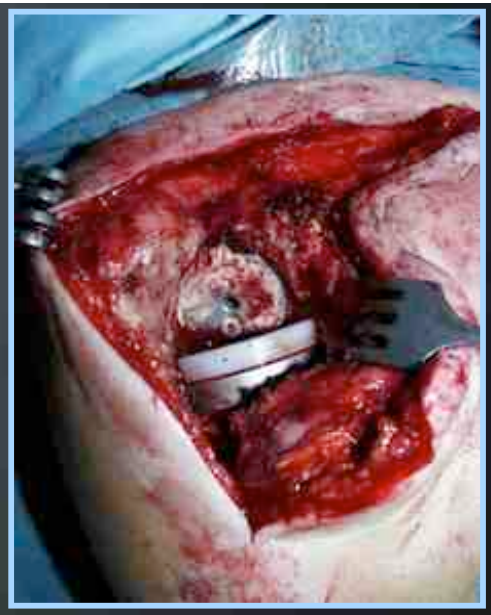
# Classification of infection

| | | Ince (2004) | Boileau (2004) |
|---|---|---|---|
| Acute | < 1 m | 2 | 14 |
| Subacute | 2-3 m to 1 yr | | 6 |
| Chronic (late) | > 1 yr | 14 | 29 |

# 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 a acceptable to good result
- 1/3 required a secondary procedure !
- End-results depends of:
  - Delay
  - Quality of resection of all infected-tissues (Rotator cuff !)

# Subacute - Late infection

- No consensus
  - ✳ One-stage replacement
  - ✳ Two-stage replacement w/wo ciment 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
  - ATBprophylaxy, laminar flood,..
  - Cement with ATB
  - Duration of surgery (< 2hrs NNIS)
  - No drainage (Gartsmann)
  - No urinary catheter
  - Early removal of dressing

# Preventive antibiotherapy ?

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

Except if confirmed infection

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