Infection of Arthroplasties

E E G LAUTENBACH
Department of Orthopaedics
Witwatersrand Medical School

LAUTENBACH & WEBER
1970 - 2001

516 Infected Total Hips
261 Infected Total knees

ORTHOPAEDIC SURVEY OF TOTAL JOINT REPLACEMENTS IN SOUTH AFRICA

2.5 Hips to 1 Knee

OUR EXPERIENCE OF INFECTION

2 Hips to 1 Knee

Incidence 1% 1.25%

EARLY INFECTION AROUND TOTAL KNEE REPLACEMENT
(Less than 6 weeks)

Differentiate
Acute Inflammation
Wound Split
Skin necrosis
Haematoma
Reflex sympathetic dystrophy

CLINICAL

Pyrexia
Swelling
Inflammation
Pain on Movement
Seepage - Bloody
Serous
Purulent
Adenopathy
Pyrexia could arise from infection elsewhere – e.g. Urinary tract, Chest
Trauma of surgery
Swelling due to haematoma
Traumatic oedema
Deep vein thrombosis

Full Blood Count
- Haemoglobin
- Red cell count
- Haematocrit
- MCV
- MCH
- MCHC
- RDW

White Cell Count
- Neutrophils %
- Neutrophils absolute
- Platelets count
- Rouleaux formation
- Toxic granulation
- Shift to left

Activity Markers
- C Reactive Protein
- Sedimentation Rate
- Plasma Viscosity

Iron Profile
- Serum Iron
- Saturation
- Transferrin
- Ferritin

MANAGEMENT
- Immobilise the knee
- Establish exact diagnosis
- Narrow spectrum antibiotic
- Every exposure invites infection
- Closed cast prevents contamination
Vigorous movement promotes wound split and spread of infection

Narrow spectrum antibiotic for gram positive cocci
These are commonest by far

Diagnosis of infection
Not easy - many causes of
Inflammation, swelling and fever

Laboratory and radiological investigations not always clear

INVESTIGATIONS ON SYNOVIAL FLUID

Bacterial culture
Antibiotic sensitivity
Number and type of white cells
Synovial sugar

EARLY INFECTION AROUND TOTAL HIP REPLACEMENT

Inflammation and swelling
Haematoma and seroma
Less visible necrosis
Wound split unusual
Sonar to distinguish fluid from oedema

1/3 of Haematoma become infected

Imaging generally unhelpful in first six weeks

Synovial Fluid

- Appearance
- Viscosity
- Mucin Clot
- White cell count
- Polymorphs
- Monocytes
- Red blood cells
- Bacteria
- Culture
- Synovial sugar
- Blood sugar

With the passage of time after op laboratory tests and imaging become more relevant.

2004-10-04

2004-12-17
Technetium relevant after one year
Gallium somewhat earlier
Distribution of white cells very evident
in traumatic inflammation and healing.

MANAGEMENT
Evacuate haematoma
Debride sick tissue
Strangulating sutures
Antibiotic irrigation

INITIATION OF INFECTION
Race between
Bacteria Eliminate Host Defences
Stick to prosthesis Eliminate or dead tissue Host Defences
Cover with Ineffective “Too late” glycosyllex

EARLY SYNOVECTOMY
If no penetration between bone and cement
Antibiotic instillation
Suction drainage

EARLY SYNOVECTOMY
\[
\begin{array}{c|c|c|c|c}
\text{Type} & \text{Good} & \text{Fair} & \text{Poor} \\
\hline
\text{TKR} & 19 & 9 & Infected \\
22 & 2 & 5 & 2 & 22\% \\
\text{THR} & 11 & 11 & Infected \\
27 & 3 & 5 & 3 & 27\% \\
\end{array}
\]
**GAMBLE**

- Microscopic gap
- Glycocalyx

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**CONSERVATIVE MANAGEMENT**

- High surgical risk
- Very ill patient
- Advanced age
- Tolerable pain
- Acceptable disability
- Low functional demand

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**CONSERVATIVE MANAGEMENT**

- Good bone stock
- Depleted bone stock
- Unwilling patient
- Unrealistic hopes
- Very well patient
- Uncertain diagnosis

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**PAIN ASSOCIATED WITH JOINT REPLACEMENT**

**(A) SOFT TISSUE ABSCESS**

- **Cause**
  - Fluid under tension in soft tissues
- **Provocation**
  - Direct pressure
- **Pain**
  - Constant
- **Relief**
  - Drainage

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**PAIN ASSOCIATED WITH JOINT REPLACEMENT**

**(B) INTERFACE INFECTION**

- **Cause**
  - Fluid under pressure inside a bone
- **Provocation**
  - Nothing special
  - Perhaps wt bearing
- **Pain**
  - Constant & persistent
- **Relief**
  - When fluid escapes

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**No op for**

- 1/3 Infected TKR
- 1/4 Infected THR
- If pain acceptable
PAIN ASSOCIATED WITH JOINT REPLACEMENT

(C) LOOSENING

<table>
<thead>
<tr>
<th>Cause</th>
<th>Provocation</th>
</tr>
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<tbody>
<tr>
<td>Fluctuating hydraulic</td>
<td>On weight bearing</td>
</tr>
<tr>
<td>pressure in bone</td>
<td>or movement</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Relief</th>
<th>Pain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dissipation of pressure</td>
<td>On initiating activity</td>
</tr>
<tr>
<td>on resting or steady</td>
<td></td>
</tr>
<tr>
<td>activity</td>
<td></td>
</tr>
</tbody>
</table>

PAIN ASSOCIATED WITH JOINT REPLACEMENT

(D) IN RESPONSE TO HEAVY ACTIVITY

<table>
<thead>
<tr>
<th>Cause</th>
<th>Provocation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inflammatory oedema</td>
<td>Excessive activity</td>
</tr>
<tr>
<td>Mechanical irritation</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pain</th>
<th>Relief</th>
</tr>
</thead>
<tbody>
<tr>
<td>Only on provocation</td>
<td>Rest and passage of time</td>
</tr>
</tbody>
</table>

Note extensive infection in proximal tibia but good bonding distally- therefore no pain.

EACH SUCCESSIVE REVISION

- depletes bone stock
- damages soft tissues
- shortens joint survival
- increases infection risk

EXCHANGE ARTHROPLASTY

In Literature good results in:

2 out of 3 Knee revisions
3 out of 4 Hip revisions
Without infection as a factor
REVISION WITH SEPSIS

• More demanding
• Must be meticulous
• Long operation
• Heavy Blood loss
• High risk to major nerves and vessels

INDICATION FOR EXCHANGE

• Significant pain or instability
• Sufficient bone stock
• Reasonable feasibility
• Healthy patient

ONE STAGE EXCHANGE

For milder less extensive uncertain infection

Loosening polythene granuloma and infection may be in combinations and difficult to distinguish

In doubt treat all as septic until proven otherwise then abort irrigation – valuable prophylaxis

EXCHANGE ARTHROPLASTY

1 Stage in 17 Knees 9 Confirmed infected
2 Stage in 50 Knees 50 Confirmed
1 Stage in 65 Hips 43 Infected
2 Stage in 198 Hips 198 Confirmed

ADVANTAGES OF ONE STAGE EXCHANGE

Half the
• cost
• hospitalisation
• wound complication
• venous thrombosis
• rehabilitation time

ADVANTAGE OF TWO STAGE EXCHANGE

Better chance of eradicating infection
Same pain and function eventually
Further options if infection persists
ADVANTAGES OF TWO STAGE EXCHANGE

OPTIONS
a) Repeat debridement before THR (8)
b) Leave as excision arthroplasty of hip or arthrodesis of knee with better prognosis for infection control

FIRST STAGE HIP DEBRIDEMENT

• Lateral position
• Approach via previous cut
• Excise soft tissue fibrosis and granulation
• Synovium capsule labrum

FEMORAL STEM

• Essential remove all cement
• Midas-rex and lazer OK for revision
• Not for sepsis
• All cement must be removed

Very Meticulous

• Chipping, Flushing, Sucking.
• Drilling, Reaming

• Try to avoid cortical windows and Wagner osteotomy

REAM SHAFT

• Anterograde
• Retrograde
• Flush
• Pulsed lavage

CUP POLY

• 6mm Drill hole
• AO cement corkscrew
• Combine rocking with curved cement chisels and peripheral hammering
DO NOT LEVER

• Against the bone as a fulcrum

Outer metal backing

• Curved cement chisels
• Explant around periphery
• Screw introducer into cup
• Rocking combined with peripheral and external chiseling

There is NO single sure fire technique

IRRIGATION

• After thorough debridement lay two tubes
• one up, one down femur
• Third between muscle and fascia lata
• Close muscle, fascia, fat, skin
• Denham pin

IRRIGATION

• until cavity closed
• and bacteria eliminated
• Average 3 to 4 weeks
• 7-10 Days mobilisation
• Then 2nd stage

HIP SPACER

• For mild infection with good bone
• Template acetabulum and proximal femur pre-op
• Problem - Frequent mismatch between stem and cup
• After femur debrided cavity larger than planned
HOBSONS CHOICE
• Subsided or protruding stem
• Compromise good femoral fit with small femoral head
• Disagree with 3-6 month delay
• Often bone attrition
• Unnecessary with irrigation

KNEE TECHNIQUE
• Use existing approach
• Total and thorough synovectomy
• Leaving periosteum below, quadriceps muscle and tendon outside
• Protect patellar tendon insertion (K wire)
• Quadriceps snip
• Open distal capsule from medial to lateral

PATELLAR BUTTON
• Steinberg flat chisels between button and cement
• Remove cement intrusions
• Drill and small spoon
• Clear periphery of patella of synovium and scar

Remove femoral prosthesis
• Thin Steinberg blades or Gigli saw
• Tap out femoral component
• Remove tibial poly
• Remove tibial tray (free up with Steinberg

REMOVE FEMORAL CMENT
• Thoroughly remove pannus
• Remove cement intrusions
• Remove inert femoral plugs
• Synovium off back of femur, condyles and metaphysis
• Lift femur high

SYNOVECTOMY
• Lift femur high
• Remove posterior synovium and capsule
• to expose gastrocnemius muscle
• Begin in medial gutter
• End in lateral gutter
• For safety cut vertically down
• towards posterior edge of tibia
**TIBIAL COMPONENT**
- Remove cement on tibial surface
- Remove pannus and cement intrusion
- Lastly remove cement down tibia
- Breach medulla only
- When all cement out
- and joint well washed
- and only if evidence of pathology at op
- or radiological

**KNEE SPACERS**
- Pull knee out to length
- Fashion spacer to embrace periphery
- of femur and tibia
- Half cylindrical open in front
- When set place double lumen tubes up into
- femur, down into tibia

**KNEE SPACERS**
- Approximate anterior soft tissue edges with temporary sutures
- Shape patty to fill space between femur below and quads and patella in front
- While wound comfortably apposed
- Remove patty and allow to set
- Insert irrigation tubes, reinsert patty and close in layers
- Apply above knee plaster splint
POSTOP IRRIGATION

- Continue till cavity closed and bacteria free
- Average 2 to 3 weeks
- One week to allow tube holes to dry up
SECOND STAGE

- On average ready at 4 weeks
- Most regain 90° of flexion
- No need to delay to 3-6-9 months
- Leads to severe bone attrition

PERCENTAGE PERSISTENT INFECTION

<table>
<thead>
<tr>
<th></th>
<th>Good</th>
<th>Fair</th>
<th>Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Stage Knee</td>
<td>9</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>2 Stage Knee</td>
<td>50</td>
<td>37</td>
<td>2</td>
</tr>
<tr>
<td>1 Stage Hip</td>
<td>43</td>
<td>16</td>
<td>9</td>
</tr>
<tr>
<td>2 Stage Hip</td>
<td>198</td>
<td>128</td>
<td>42</td>
</tr>
</tbody>
</table>

Please note-
Only the most favourable qualify for one stage programme

SALVAGE PROCEDURES

Best option for pain and infection control
for most severe infections and soft tissue loss

77 (47.2%) of our infected Total knees had
arthrodesis using long intramedullary nail
or external fixation
Many had soft tissue defects
1 Patient fused after removal and gaiter

ARTHRODESIS AFTER TOTAL KNEE REPLACEMENT

- 1. External Fixator suitable and feasible if
  a) Good bone quality (not porotic)
  b) Good bone apposition
  c) Compliant patient

OPTIONS

- Monotube
- Double Orthofix
- Hybrid Orthofix (very expensive)
- Ilizarov (very elaborate)
RESULTS OF 77 KNEE ARTHRODESES

<table>
<thead>
<tr>
<th></th>
<th>Good</th>
<th>Fair</th>
<th>Poor</th>
<th>Failed</th>
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<tbody>
<tr>
<td>1-Stage external fixator</td>
<td>9</td>
<td>6</td>
<td>0</td>
<td>3 (33.3)</td>
</tr>
<tr>
<td>2-Stage closed nail</td>
<td>10</td>
<td>2</td>
<td>0</td>
<td>8 (80)</td>
</tr>
<tr>
<td>2-Stage open nail</td>
<td>55</td>
<td>34</td>
<td>1</td>
<td>20 (36.4)</td>
</tr>
<tr>
<td>2-Stage external fixation (THR on same side)</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>1 (33.3)</td>
</tr>
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</table>

RESULTS OF 108 EXCISION ARTHROPLASTIES

81 (75%) cured at first procedure
98 (93.5%) cured after further attempt
10 (6.5%) infected but comfortable

DRASTIC CURES

4 TKR had AK amputation
2 THR had hip disarticulations
1 Had hindquarter amputation
Persistent infection (irradiated)

SERIOUS COMPLICATIONS

<table>
<thead>
<tr>
<th></th>
<th>Deaths</th>
<th>Severe Vascular Injury</th>
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<tbody>
<tr>
<td>1 Stage TKR</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>2 Stage TKR</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>2 Stage THR</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Girdlestone</td>
<td>1</td>
<td>1</td>
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Summary of Overall Management

<table>
<thead>
<tr>
<th></th>
<th>Knees</th>
<th>%</th>
<th>Hips</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>No op</td>
<td>94</td>
<td>(36.0)</td>
<td>131</td>
<td>(28.4)</td>
</tr>
<tr>
<td>Synovectomy</td>
<td>19</td>
<td>(7.3)</td>
<td>11</td>
<td>(2.1)</td>
</tr>
<tr>
<td>1 Stg exchange</td>
<td>17</td>
<td>(6.5)</td>
<td>65</td>
<td>(12.6)</td>
</tr>
<tr>
<td>2 Stg exchange</td>
<td>50</td>
<td>(19.1)</td>
<td>198</td>
<td>(38.4)</td>
</tr>
<tr>
<td>Excis. arthroplasty</td>
<td>78</td>
<td>(29.9)</td>
<td>108</td>
<td>(20.9)</td>
</tr>
<tr>
<td>Arthrodesis</td>
<td>3</td>
<td>(1.1)</td>
<td>3</td>
<td>(0.6)</td>
</tr>
<tr>
<td>Amputation</td>
<td>261</td>
<td></td>
<td>516</td>
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Surgical Result

<table>
<thead>
<tr>
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<th>166 Total Knees</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Good</td>
</tr>
<tr>
<td>Synovectomy</td>
<td>19 (9)</td>
</tr>
<tr>
<td>1 Stg exchange</td>
<td>17 (9)</td>
</tr>
<tr>
<td>2 Stg exchange</td>
<td>50</td>
</tr>
<tr>
<td>Arthrodesis: 1 Stg XFX</td>
<td>9</td>
</tr>
<tr>
<td>2 Stg XFX</td>
<td>3</td>
</tr>
<tr>
<td>2 Stg Closed nail</td>
<td>10</td>
</tr>
<tr>
<td>2 Stg Open nail</td>
<td>55</td>
</tr>
<tr>
<td>Gaiter</td>
<td>1</td>
</tr>
<tr>
<td>Amputation</td>
<td>3</td>
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## Surgical Result

### 385 Total Hips

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Good</th>
<th>Fair</th>
<th>Poor</th>
<th>%</th>
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<tbody>
<tr>
<td>Synovectomy</td>
<td>11</td>
<td>3</td>
<td>5</td>
<td>3 (27.3)</td>
</tr>
<tr>
<td>1 Stg exchange</td>
<td>65 (43)</td>
<td>16</td>
<td>9</td>
<td>18 (41.9)</td>
</tr>
<tr>
<td>2 Stg exchange</td>
<td>198</td>
<td>128</td>
<td>42</td>
<td>28 (14.1)</td>
</tr>
<tr>
<td>Excision - first go</td>
<td>108</td>
<td>47</td>
<td>34</td>
<td>27 (25.0)</td>
</tr>
<tr>
<td>repeat</td>
<td>24</td>
<td>10</td>
<td>8</td>
<td>8 (7.4)</td>
</tr>
<tr>
<td>Disarticulation</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hindquarter amputation</td>
<td>1</td>
<td>1 (100)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Serious vascular injury</td>
<td>2</td>
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<tr>
<td>Deaths</td>
<td>4</td>
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<tr>
<td>Total</td>
<td>385</td>
<td>254</td>
<td>156</td>
<td>11</td>
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