Chronic Osteomyelitis

Literature Review

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- Definition
- The problem
- Organisms
- Classification
- Management
- Literature Search
Definition

- a bone infection predicated on preexisting osteonecrosis.

- Chronic ~ post-traumatic ~ exogenous

- Very rarely, acute → chronic

Rodner et al, 2003
Acute vs Chronic

- ? Not duration
- Absence or presence of dead bone

Rodner et al, 2003
The Problem

- More trauma
- More surgeries
- More chronic osteomyelitis

Rodner et al, 2003
Common Organisms

- Polymicrobial, variable (Bohm 1992)

- *S. aureus*: 50-75% (Cierny 1990)

- *S. epidermidis*: 1/3 (Bergman 1982)

- G –ve (*E. coli, Pseudomonas*): 1/3 (Bergman 1982)
  - 95% of foot puncture wounds: *P. aeruginosa* (Jacobs 1989)
Cierny-Mader (UTMB) Classification
Cierny et al, 1985

1. **Anatomic Type**

   I - Medullary
   II - Superficial
   III - Localized
   IV - Diffuse
Cierny-Mader Classification
Cierny et al, 1985

Physiological Class

A Host: Normal, immunocompetent, good local vascularity

B Host: Compromised, local (L) or systemic (S)

C Host: Prohibitive, minimal disability, prohibitive morbidity anticipated, and/or poor prognosis for cure
Cierny-Mader Classification
Cierny et al, 1985

1. **Anatomic Type (II)**

2. **Physiological Class (B)**

Clinical Stage (II B)
Management

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1. **Limb Salvage (Extent of Necrosis)**
   - **Yes**
   - **No** → **Amputation**

2. **Benefit/Risk Ratio**
   - **Patient tolerate operation(s)?**
     - **No** → **Suppressive Therapy**
     - **Yes**

3. **Patient Choice**
   - **?multiple operations, ?years, ?amputation**
     - **Yes** → **Literature Search**

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Rodner et al, 2003
Literature Search
Publication Bias

Dickersin 1997

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Amputation

- **Cho et al, 1997:**
  - 31 patients, long bone chronic osteomyelitis
  - combined debridement, antibiotic bead placement & bone grafting
  - Amputations: 4 pt (13%) at average 4 yr F/u

- **Helfet 1990 & Lange 1989:**
  - Amputation rates for IIIC fractures up to 50%
Amputation

- may give the patient the best chance
  - to be symptom-free and
  - to return to his/her level of functioning ASAP.

- unless obvious criteria for amputation are met, this decision is more of an art than a science.

Dirschi et al 1996
Limb Salvage Principles

1. Thorough debridement of necrotic tissues (paprika sign),
2. Bone stability
3. Intraoperative cultures: tissue, sinus tract, fluid (Patzakis 1994)
4. Dead space management
5. Soft tissue coverage
6. Limb reconstruction, if needed
7. Systemic antibiotics
8. Complimentary therapy, if needed
Debridement

- **Patzakis 1999:**
  - 53 patients 2-staged debridement & muscle flap coverage for chronic osteo of tibia
  - All +ve cultures at initial debridement
  - 2-7 days interval
  - 14/53 (26%): +ve culture at 2nd debridement
Dead Space Management

First stage: Antibiotic Beads

- PMMA or calcium hydroxyapatite
- Impregnated with antibiotic (genta, vanco)
- Unless biodegradable, remove in 4 weeks
- Not only dead space:
  - Nelson 1997: animal study, antibiotic beads 9x better than placebo beads
Second Stage: Cancellous Bone Graft
(Papineau 1979, Panda 1998)

- After 2-4 weeks of beads & growth of granulation tissue, removal
- Autogenous cancellous bone graft
- Bone chips (3-6cm long, 3mm thick, 4mm wide) in concentric layers
- Success rate: 92%, Sachs 1984; 100%, Emmami
Soft Tissue Coverage

1. Split-Thickness Skin Grafting

2. Muscle Flaps (Local or Free)
   - Anthony 1991:
     - 34 pt, LE chronic osteomyelitis, free or local flap after 2 weeks of debridement and antibiotics
     - 96% success rate, minimum 5 yr f/u
   - Maynor 1998:
     - patients who had muscle flaps were more likely to be drainage free than patients who had only debridement
   - Sekiguchi 1998:
     - 4 recurrences of 31 pt, flap couldn’t fill the dead space
Limb Reconstruction Options

- Long-term cast therapy
- ORIF
- IM Nail
- Ilizarov method (distraction osteogenesis)
Ilizarov method

- **Acute Shortening and Relengthening**
  - For segments <4cm
  - Acute excision, gradual lengthening 1mm/6hr
  - Disadvantages: pin site infection, long time (average 9 months)
  - Paley 1989, Dendrinos 1995
Ilizarov method

- **Bone Transport**
  - For segments >4cm
  - 2 stage:
    - 1st excision, beads & ex fix; 2nd bone transport
  - Ueng et al 1999:
    - 15 pt, femur #, 3 initial infection treated by re-debridement
Ilizarov method

- Green 1994:
  - 15 Papineau vs 17 Ilizarov bone transport
  - 1.9 mo in fixation / cm of defect reconstructed
  - Papineau: limited graft availability, donor site morbidity (3), graft fractures (3)
  - Ilizarov: failure of the docking site to unite without a supplementary graft (7), joint contractures (7).
Systemic Antibiotic Therapy

- **Adjuncts**

- **Selection**
  - Started intra-operatively, broad-spectrum covers *S. aureus* & *P. aeruginosa*
  - Postoperatively, culture-specific
  - Supplemental Rifampin: 1\textsuperscript{st} 2 months (Norden 1986)

- **Duration:** no consensus, ~ 3-4 months

- **Route:** IV or Oral,
  - Swiontkowski 1999: 93 IV for 1wk, oral 6wk versus 22 IV for 6 wk. No difference in outcome.
Complimentary Therapy

- Hyperbaric oxygen
  - Mader 1990

- Electrical stimulation (in delayed union)
  - Sharrard 1990: RCT, inductive coupling
    - Union rate: 12/20 vs 1/20
  - Scott 1994: RCT, capacitive coupling
    - Union rate: 6/10 vs 0/11

- Ultrasound stimulation
  - Kristiansen 1997: ↓ time to healing, radius #
Take Home Messages

1. The 8 principles of limb salvage
2. Chronic osteomyelitis is NOT an orthopedic problem.

It is a multidisciplinary problem.
Thank You