Management of chronic haematogenous osteomyelitis

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Introduction

Definitions

- Infection in bone
- Originally derived from bacteraemia
- Present for > 3 months


- Persistent draining sinuses (due to underlying sequestra)

Thomas DK. Chronic haematogenous osteomyelitis in children. SAOJ Spring 2007;6:8-12
Bacteriology

• **Staph aureus**
• Beta-Haemolytic streptococcus
• Gram negative organisms (Enterobacter, Proteus Pseudomonas and E. Coli)
• Polymicrobial
• No growth
Burden of disease

- Pain
- Chronic sinuses
- Exposed bone
- Loss of structural integrity
- Deformity
- Leg length discrepancy
- Joint stiffness
Burden of treatment

- Long hospital stay
- Multiple procedures (average 2/patient)
- Repeat admissions (30%)
- Pain
- Immobilisation
- External fixation
  - Pin track infection
  - Joint stiffness
- Donor site morbidity
- Surgical complications
Aims of treatment

1. Host system support
2. Eradication of infection
3. Soft-tissue cover
4. Skeletal structural integrity
5. Deformity correction
6. Functional rehabilitation
Surgery for Chronic osteomyelitis

1. Eradicate/control infection
   • sequestrectomy/debridement
   • stabilise skeleton
   • reconstruct soft tissue

2. Reconstruct
   • bone defects
   • deformity
   • leg length discrepancy

Principles of debridement

- Preserve periosteum at all costs
- Remove all dead bone
- Remove all dead soft tissue
  - infected granulation tissue
  - avascular fibrous tissue

Margins
- Marginal - colonised bone and soft tissue remains behind
Unsolved problems

- Timing of surgery
- Physeal damage
- Role of antibiotics
- Surgical reconstruction technique
- How does HIV affect chronic osteomyelitis

Timing of surgery

• Delayed sequestrectomy
• Avoid complex reconstruction of defects
• Sequestrum may be absorbed
• Increased morbidity
Timing of surgery

• Early sequestrectomy to eradicate infection
• provide a better environment for periosteum to form involucrum


• Minimise damage to surrounding soft tissues
Timing of surgery

• Structurally inadequate involucrum should be apparent by 6 months after diagnosis


• If involucrum has not formed by 3 months after the appearance of sequestrum (Mean 1.9 months) it will not appear (23% of structurally deficient cases in this series)

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Physeal damage

Non-modifiable factors

• Patient age
• Bacteriology
• Location

Modifiable factors

• Timing of surgery
• Type of surgery
• Antibiotics
• Extent of disease (earlier detection)
Role of antibiotics

- **Antibiotics are adjuvant therapy**
- Preoperative
  - Infection suppression
  - Sclerotic involucrum
- Postoperative
  - Unknown whether it improves outcomes after simple infection control procedures
  - Satisfactory results have been obtained where antibiotics were unavailable or used selectively

Role of antibiotics

May be OK without

- Highly vascular involucrum
- Good soft tissue
- Competent immune system

Likely will benefit

- Immune compromise
- Sclerotic involucrum with microsequestra
- Segmental defect after bone graft

Antibiotic regimes

- Oral **flucloxacillin** 50mg/kg/24 hrs routinely
- in sclerotic sequestrum (B3 and C)
- 6/52 following sequestrectomy (B2 and B4)


- **Clindamycin** for 6/52 following surgery (culture directed, 19/23 cases)


- Antibiotics continued until union of bone graft
- **Flucloxacillin** 100mg/kg/24hrs
- **Ciprofloxacin** 10mg/kg/day in 2 divided doses

Thomas DK. Chronic haematogenous osteomyelitis in children. SAOJ Spring 2007;6:8-12
Antibiotic regimes

**Trimetroprim/sulphametoxazole**
- Concentration dependent killing
- Higher dosage required

**Rifampicin**
- Good bone penetration
- Improves cure rates when combined
- Not as monotherapy

Bone defects

• Contained defects
• Conical defects with structural involucrum
• Conical defects with non-structural involucrum
• Segmental defects defects
Masquelet technique: Induced membrane

- Staged debridement and reconstruction
- Antibiotic and PMMA spacer
- Well vascularised induced membrane formed
- Biological chamber
- Prevents graft resorption
- Promotes vascularisation and bone formation

Reconstruction options

• **Conventional**
  • Cancellous bone graft
  • Corticocancellous grafts
  • Non-Vascularised fibula graft interposition
  • Fibula transfer

• **Complex**
  • Vascularised fibula graft
  • Bone transport
The treatment of tibial defects following chronic pyogenic haematogenous osteomyelitis in children

MN Rasool FCS(Orth)
Department of Orthopaedics, Nelson R Mandela School of Medicine, KwaZulu-Natal

- Staged debridement and reconstruction
- Early sequestrectomy
- Systemic antibiotics
- Local antibiotics and dead space management

- <2cm - Onlay corticocancellous bonegraft
- 2-8cm - Segmented bicortical iliac crest graft
- >8cm - Fibula transfer
The treatment of tibial defects following chronic pyogenic haematogenous osteomyelitis in children

MN Rasool FCS(Orth)
Department of Orthopaedics, Nelson R Mandela School of Medicine, KwaZulu-Natal

- Good results with segmented bicortical iliac crest graft for defects 2-8cm
  - good vascular bed
  - partially intact periosteal sleeve
- Fibula transfer
- Salvage procedure
  - long defects
  - fibrotic avascular bed
  - poor overlying skin
• Early sequestrectomy (4-6 months recommended)
• Systemic antibiotics (Genta beads in two cases)
• Skeletal stabilisation if required
• Skeletal reconstruction
  • Cancellous graft up to 10 cm
  • Fibula transfer as salvage if anteromedial scarring
  • Posterolateral (Harmon) bone grafting if required
  • Fibula graft for upper limb
Results

- **Excellent** 20/35 (57%)
  - No infection, deformity or LLD

- **Good** 15/35 (43%)
  - LLD<2cm, angular deformity<10°

- **Poor** none
  - Residual infection, LLD>2cm, angular deformity>10°
Non-vascularized Fibula graft

Advantages
• Simple, structural and available

Disadvantages
• Reactivation of infection
• Non-union
• Slow incorporation with fracture
• Donor site morbidity

Non-vascularised fibular transfer in the management of defects of long bones after sequestrectomy in children

C. W. B. Steinlechner,
N. C. Mkandawire

• 8 patients (3 tibias)
• Mean age 6yr2mo (2-14)
• length of graft 7cm (4-12cm)
• Ipsilateral staged transfer in tibia

Results
• 19.3 weeks to union (6-75 weeks)
• 29% (2/7) infection rate
• Distal septic non-union requiring redebridement in one patient
Fibula transfer
(Hahn’s operation/Huntington technique/Stone modification)

- Anterolateral or Posterolateral
- One or two-stage
  - Proximal
  - Proximal and distal
  - Synostosis without transposition
- Relative simplicity
- Salvage procedure

Rasool MN. The treatment of tibial defects following chronic pyogenic osteomyelitis in children. SAOJ Summer 2008, p.34-42

Fibula transfer
(Hahn’s operation/Huntington technique/Stone modification)

High complication rate

- Non-union
- Reactivation of infection
- Fracture
- Deformity

Vascularized fibula graft

Advantages
- Blood supply
- Does not need to incorporate by creeping substitution

Disadvantages
- Extremely complex
- High rate of vessel thrombosis
- Reactivation of infection
- Donor site morbidity
Ilizarov technique: Distraction Osteogenesis

- Tensioned fine wire circular fixator
- Osteotomy
  - Low energy
- Distraction histiogenesis
  - Rate 0.75-1.0 mm day
  - Rhythm 6-8 hourly adjustment
- Bone transport
- Docking
Ilizarov technique: Advantages

- Allows radical debridement
- Increases the blood supply to the limb 3-10x
- Early functional weight bearing and joint range of motion
- Simultaneous correction
  - Angular deformity
  - Leg-length discrepancy
  - Apply compression
Ilizarov technique: Disadvantages

- Pin site problems
- Neurological injury
- Vascular injury
- Joint subluxation or stiffness
- Delayed consolidation
- Non-union at docking site
Management of Childhood Chronic Tibial Osteomyelitis With the Ilizarov Method

Metin Kucukkaya, M.D., Yavuz Kabukcuoglu, M.D., Mehmet Tezer, M.D., and Unal Kuzgun, M.D.

- 7 children
- Mean age 7.2 years (6-8)
- Mean defect 7.4 cm (3.5-12)
- Systemic antibiotic therapy
- Early sequestrectomy
  - at the initial procedure in 5
  - delayed 4 weeks in 2
- No bone graft procedure at docking
Results

- Mean follow up 4.6 years (2.7-5.8)
- Mean fixator time 7.2 months (4.6-11.8)
- Low grade pin track problems in all
- One patient required pin removal
- One patient required 14 day break in distraction due to ankle hyperesthesia
- No joint subluxation or contracture
- No infection, refracture, LLD
Comparison of conventional technique to Ilizarov

Results comparable in adults

- Complication rate, ALOS, operative time and morbidity higher in conventional group

- Significantly less LLD in Ilizarov group


- Significantly less LLD in Ilizarov group

Treatment of Chronic Osteomyelitis in Children Resistant to Previous Therapy

S. Austin Yeargan III, MD, Cass K. Nakasone, MD, Mark D. Shaieb, MD, William P. Montgomery, MD, and Kent A. Reinker, MD

- Comparison of Ilizarov to conventional methods
- Complications in both groups
  - Non-union requiring repeat bone grafting
  - Deformity
  - Leg-length discrepancy
- Conclusion
  - Both are effective methods with good results
  - Ilizarov method preferred
Bone transport through an induced membrane in the management of tibial bone defects resulting from chronic osteomyelitis

Leonard Charles Marais¹ · Nando Ferreira¹
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“There is some evidence that the overall burden of surgical sepsis has increased with the increasing prevalence of HIV”

- Unknown effect on haematogenous osteomyelitis
- Unknown effect of antiretroviral agents on chronic haematogenous osteomyelitis

Take home

• Prevention is better than cure
• Adequate debridement essential
• Structural defects are complex to reconstruct
• Expect complications
Future research

- Standardise classification and outcome measures
- Long term follow-up for recurrence in adulthood required