ORTHOPAEDICS

FOR PRIMARY HEALTH CARE

LION

LEARNING INNOVATION VIA ORTHOPAEDIC NETWORKS

EDITOR: **MICHAEL HELD**

UNIVERSITY OF CAPE TOWN'S **ORTHOPAEDIC DEPARTMENT**

Chronic bone infections in adults

by Thomas Hilton, Mohammed Daoub, Len Marais, Nando Ferreira & Luan Nieuwoudt

Learning objectives

1. Define acute osteomyelitis.
2. Recognise a patient presenting with acute bone infection.
3. Know the management of acute bone infections.
4. Exclude immunocompromise and assess nutritional status.

Introduction

Infection of the bone or osteitis/osteomyelitis (OM) can be divided into the subtypes - acute, sub-acute and chronic. According to the temporal classification, acute OM has a duration of under two weeks, sub-acute OM one to three months and chronic for more than three months. Clinically, acute osteomyelitis is characterised by the absence of sequestrum, sub-acute osteomyelitis by Brodie's bone abscess and chronic osteomyelitis by sequestra and involucrum or foreign material (such as orthopaedic implants).

Microbiology

- Chronic osteomyelitis is typically characterised by bacterial biofilms on sequestra (dead bone) or foreign bodies (such as orthopaedic implants).

- A biofilm is a complex aggregation of microorganisms in which cells adhere to each other in a fluid matrix on a solid substrate. The biofilm consists of microorganisms in various states of activity, an extracellular polymeric substance produced by organisms which contain extracellular DNA, proteins, polysaccharides. The structure of the biofilm helps bacteria to evade the host's immune defence mechanisms and antibiotics.

- Apart from the microorganisms embedded in a biofilm, bacteria also show an adaptive stress response and formation of dormant persister cells that provide a survival advantage during an antimicrobial challenge.

- The bacteria may also hide in the bone microstructure and, in some instances, they (Staphylococcus aureus, for example) may internalise themselves in osteoblasts, thus becoming intracellular organisms.

- These mechanisms enable the causative organisms to persist in an asymptomatic host, and the infection can reactivate and become clinically evident years after the primary infection.
(See the table in the chapter Bone and Joint Infections - Basics for Specific

Organisms.)

Risk factors for poor prognosis

Despite surgical debridement and long-term antibiotics, the recurrence rate of chronic OM in adults can still be as high as 30%. Certain risk factors lead to poor prognosis (see table).

Risk factors poor prognosis
Previous surgery or trauma
Smoking
Corticosteroid use
Diabetes Mellitus
Immunocompromise
IV drug abuse
Poor vascular supply
Peripheral neuropathy
Malnutrition
Chronic renal failure/Dialysis

Classification

Cierny and Mader (1984) classified chronic OM according to the infection's anatomic distribution and the host's physiological status. The **anatomic** areas are:

1. Medullary (bone marrow only)
2. Superficial (cortex)
3. Localised (medulla and cortex, stable)
4. Diffuse (medulla and cortex, unstable)

The **host** is divided into:

A - Healthy (No comorbidities)

B_L: - Local compromise

B_s - Systemic compromise

C - Poor host status (surgical treatment carries higher morbidity than the disease itself)

Diagnosis

History

The duration and severity of symptoms such as pain, pus drainage or functional impairment that is the inability to walk and so on, must be established. Find out about previous
treatment or surgery and comorbidities

Examination

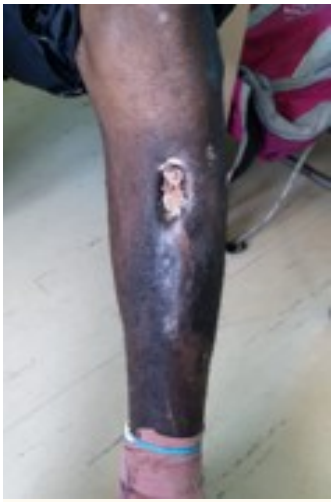
Evaluate vital signs (fever, tachycardia, tachypnoea and hypotension suggest sepsis) and signs of systemic disease.

Local

Erythema, tenderness and oedema are commonly seen. Discharge or a draining sinus is common in chronic OM. The soft tissue condition including scarring or Lipodermatosclerosis, abscess formation or cellulitis must be noted.

The vascular status of the limb must be assessed.

Any skeletal instability, pathological fracture or fracture non-union must be noted. The range of motion, limping or being unable to bear weight because of pain are signs of instability.



Sinus formation in chronic OM

Radiographs:

AP and lateral views of the affected limb often show bone resorption with a sclerotic rim around the infected bone, disuse osteopenia, periosteal reaction, lucency (lysis around hardware/ implants) and sequestrum and involucrum formation.

CT scan and MRI:

Valuable in diagnosis and surgical planning by identifying necrotic bone.

Laboratory analysis:

WCC, ESR, CRP may not always be raised in chronic osteomyelitis.

Staging of the host:

- FBC to screen for anaemia
- Tests for renal function, liver function, serum albumin, HIV serology and CD4 count as indicated

Identification of causative organisms:

- Blood culture is often negative but may be used to guide antibiotic therapy in acute haematogenous osteomyelitis.
- Sinus tract culture is not recommended. Culture of bone and soft tissues obtained surgically from the infection site remains the gold standard for guiding antibiotic therapy.

Management

The management of chronic osteomyelitis is complex, and cases should ideally be referred to orthopaedic units specialising in treating chronic bone infections.

Optimisation of the patient:

This should entail the cessation of smoking and alcohol abuse, nutritional support (high protein diet for patients with low albumin level), blood sugar control and anti-retroviral therapy for HIV+ve patients.

In patients with acute flare-ups (cellulitis or abscess formation), systemic antibiotics are required to control the infection. Definitive surgery is typically delayed until the soft tissue condition improves.

Local treatment:

Colostomy bags over the sinus protect the skin from excoriation. Acute abscess formation requires urgent incision and drainage with

tissue sampling for MCS, followed by directed intravenous antibiotics.

Surgical

During surgery, a tissue biopsy for culture and microscopy is taken, all necrotic and devitalised tissue is debrided, and implants are removed. Skeletal stability is typically achieved by external fixation. Soft tissue reconstruction is then performed, which may involve plastic surgery.

Following surgery, empiric intravenous antibiotics are given until the culture results become available, after which directed oral antibiotics are given for six weeks. The antibiotic regime should include agents that exhibit appropriate activity against biofilm-based organisms.

In severe cases, surgical reconstruction may not be possible, and amputation may need to be considered

Non-surgical

Chronic suppression with antibiotics may be useful for patients where surgery is not feasible. This requires an opinion from a bone infection unit.

References

Cierny G, Mader JT, Penninck JJ. A clinical staging system for adult osteomyelitis. Contemporary Orthopaedics 1985;10:17-37.

Cierny G, Mader JT. Adult chronic osteomyelitis.Orthopedics 1984;7:1557–64.

Lalani T, Schmitt SK. Osteomyelitis in adults: Clinical manifestations and diagnosis.

Marais LC, Ferreira N, Aldous C, Le Roux TL. The classification of chronic osteomyelitis. SA Orthopaedic Journal. 2014 Mar;13(1):22–8.

Miller MD, Thompson SR. Miller's review of Orthopaedics, 7th edition

Mthethwa PG, Marais LC. The microbiology of chronic osteomyelitis in the developing world. S Afr J Orthop 2017; 16(2): 39–45.

Osmon, DR, Tande, AJ. Osteomyelitis in adults: Treatment. https://www.uptodate.com/contents/osteomyelitis-in-adults-treatment (accessed 5.2.21)

Solomon L, Warwick D, Nayagam S. Apley's System of Orthopaedics and Fractures (9th edition). CRCpress, 2010

Spritzer, CE: Approach to imaging modalities in the setting of suspected nonvertebral osteomyelitis. https://www.uptodate.com/contents/approach-to-imaging-modalities-in-the-setting-of-suspected-nonvertebral-osteomyelitis (accessed 5.2.21)

Editor: Michael Held
Conceptualisation: Maritz Laubscher & Robert Dunn
Cover design: Carlene Venter (Creative Waves Brand Design)
Developmental editing and design: Vela Njisane and Phinda Njisane

ABOUT THE BOOK

Informed by experts: Most patients with orthopaedic pathology in low to middle-income countries are treated by non-specialists. This book was based on a modified Delphi consensus study* with experts from Africa, Europe, and North America to provide guidance to these health care workers. Knowledge topics, skills, and cases concerning orthopaedic trauma and infection were prioritised. Acute primary care for fractures and dislocations ranked high.

Furthermore, the diagnosis and the treatment of conditions not requiring specialist referral were prioritised.

* Held et al. Topics, Skills, and Cases for an Undergraduate Musculoskeletal Curriculum in Southern Africa: A Consensus from Local and International Experts. JBJS. 2020 Feb 5;102(3):e10.

THE LION

The Learning Innovation via Orthopaedic Network (LION) aims to improve learning and teaching in orthopaedics in Southern Africa and around the world. These authors have contributed the individual chapters and are mostly orthopaedic surgeons and trainees in Southern Africa who have experience with local orthopaedic pathology and treatment modalities but also in medical education of undergraduate students and primary care physicians. To centre this book around our students, iterative rounds of revising and updating the individual chapters are ongoing, to eliminate expert blind spots and create transformation of knowledge.

DISCLAIMERS

Although the authors, editor and publisher of this book have made every effort to ensure that the information provided was correct at press time, they do not assume and hereby disclaim any liability to any party for any loss, damage, or disruption caused by errors or omissions, whether such errors or omissions result from negligence, accident, or any other cause.

This textbook is not intended as a substitute for the medical advice of physicians. The reader should regularly consult a physician in matters relating to his/her health and particularly with respect to any symptoms that may require diagnosis or medical attention.

The information in this book is meant to supplement, not replace, Orthopaedic primary care training. The authors, editor and publisher advise readers to take full responsibility for their safety and know their limits. Before practicing the skills described in this book, be sure that your equipment is well maintained, and do not take risks beyond your level of experience, aptitude, training, and comfort level.

The individual authors of each chapter are responsible for consent and rights to use and publish images in this book.

ACKNOWLEDGEMENTS

This work was carried out with the aid of a grant from the International Development Research Centre, Ottawa, Canada. Thanks to Johan Fagan, Michelle Willmers and Glenda Cox for their mentorship and support.