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Original Article

A modified staging system for chronic osteomyelitis

Leonard Charles Marais [a,*], Nando Ferreira [a], Colleen Aldous [b], Benn Sartorius [c], Theo Le Roux [d]

[a] Tumour, Sepsis and Reconstruction Unit, Department of Orthopaedics, School of Clinical Medicine, University of KwaZulu-Natal, Grey's Hospital, Pietermaritzburg, 3201, South Africa
[b] School of Clinical Medicine, College of Health Sciences, University of KwaZulu-Natal, Durban, 4013, South Africa
[c] Public Health Medicine, School of Nursing and Public Health, College of Health Sciences, University of KwaZulu-Natal, Howard College Campus, Durban, 4041, South Africa
[d] Department of Orthopaedics, University of Pretoria, I Military Hospital, Pretoria, 0187, South Africa

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ABSTRACT

Aims: To investigate the short-term outcome of treatment of chronic osteomyelitis where management was based on a refined host stratification system.
Methods: A retrospective review of 109 adult patients with chronic osteomyelitis.
Results: At a minimum follow-up of 12 months (range 12–36) we observed an overall success rate of 89.9% (95% CI: 82.7–94.9%). There was no statistically significant difference in success rates by host status (p-value = 0.201).
Conclusion: By integrating the redefined host status and treatment strategy, we were able to achieve comparable short-term outcomes in both low and high-risk cases while maintaining a low rate of amputation.

1. Introduction

There are currently no evidence-based guidelines in terms of the treatment of chronic osteomyelitis.[1] Achieving remission is notoriously difficult, with some studies reporting failure rates of 20–60%.[2,3] In essence the aim is to improve quality of life through either a curative or a palliative treatment strategy. Curative management strategies, aimed at limb salvage, usually comprise of a combination of complex surgical procedures and tailored adjuvant antibiotic therapy.[4] On the other hand, palliative treatment strategies are less invasive and typically involve to the use of chronic suppressive antibiotic therapy.[5] The decision to embark on either a curative or palliative treatment strategy requires consideration of several factors, principle amongst which is the host's physiological status. Furthermore, in cases where a curative treatment strategy is employed the host status also influences the

* *Corresponding author*. Department of Orthopaedic Surgery, Greys Hospital, Private bag X9001, Pietermaritzburg, 3201, KwaZulu-Natal, South Africa. Tel.: +27 33 897 3424; fax: +27 33 897 3409.
E-mail address: maraisl@ukzn.ac.za (L.C. Marais).
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clearance margin that is required during surgical debridement.[6]

Recognizing the importance of considering the host's physiological status during formulation of a treatment plan, Cierny and Mader revolutionized our approach to chronic osteomyelitis through the publication of their clinical staging system in 1985 (Table 1).[7] According to this classification system A- and B-hosts could be considered for a curative treatment protocol. To justify the considerable demands and risks associated with limb salvage, the expected outcome should, however, offer distinct advantages over an amputation or palliation. In cases where treatment aimed at remission is contraindicated or deemed excessive, as a result of the risks it entails, a patient should be classified as a C-host and offered palliation.[8,9] Amputation should be considered in cases where limb salvage or palliation is deemed to be neither safe nor feasible.[10]

The choice between curative or palliative treatment strategies may however be particularly problematic. This results from the absence of precisely defined criteria according to which a C-host should be defined. Unfortunately no discreet objective criteria exist to guide the decision-making process. Originally, Cierny and Mader defined a C-host as any patient in whom treatment or the result of treatment will be more compromising to the patient than the disability caused by the disease itself.[7] The main shortcoming of this definition is that it is subjective in nature and susceptible to widely varying interpretation depending on the experience of the surgeon.

In this study we set out to determine the short term outcome of treatment in a cohort of adult patients with chronic osteomyelitis where management strategy selection was based on a modified classification system.

2. Patients and methods

A retrospective review was performed of patients with chronic osteomyelitis treated at our tertiary referral center from 2011 to 2013. Patient notes, blood tests and radiographs were reviewed pre- or post-treatment. For the purposes of this study chronic osteomyelitis was defined as a bone infection characterized by the presence of necrotic bone (sequestrum) or host reparative reaction (involucrum) and/or duration of at least 6 weeks.[1] All patients, 18 years or older, treated for chronic osteomyelitis with a minimum follow-up of twelve months were included in the study. Cases involving atypical organisms, acute postoperative infection where the fracture was expected to unite, periprosthetic joint infection with retained implants and hand sepsis were excluded from the study.

Following clinical, radiological and biochemical evaluation, patients were classified according to a modified version of the Cierny and Mader classification system (Table 2).[7] The characterization of the host's physiological status was modified in order to provide a more pragmatic definition of a C-host. A patient was classified as a C-host if one major risk factor or three (or more) minor risk factors were present (Table 3). Risk factors were selected following systematic review of existing data and consideration of previously published classification systems.[11–25] One of the aims of the modified classification system was to emphasize host optimization prior to surgical intervention. Resultantly the majority of major risk factors are modifiable which places appropriate emphasis on risk factor modification prior to surgery.

Palliative treatment was instituted in all C-hosts without skeletal instability. A- or B-hosts with minimal impairment, no sequestrum and no skeletal instability, were also managed palliatively (Fig. 1). All remaining A- and B-hosts were treated curatively. C-hosts with skeletal instability were managed through the implementation of alternative treatment strategies that involved either amputation (if union was unlikely to occur) or chronic suppressive antibiotic therapy in combination with external fixation, with or without debridement.

Curative treatment involved debridement, dead space management, provision of bony stability, soft tissue reconstruction and/or skeletal reconstruction, in conjunction with pathogen directed adjuvant antibiotics for a period of six weeks. The extent of the debridement was determined by the host status and the anatomic nature of the infection. Resection margins were defined according to the guidelines previously published by Simpson et al.[6] In B-hosts we strived to obtain a wide clearance margin, as long is it did not compromise skeletal stability. In type I, II and III lesions this was achieved by direct debridement (tangential excision with high speed burr) and/or indirect debridement (medullary reaming). In cases with pre-operative skeletal instability (type IV lesions)

Table 1 – Cierny and Mader clinical staging system for adult chronic osteomyelitis.[7]

Anatomic type	
I	Medullary osteomyelitis
II	Superficial osteomyelitis
III	Localized osteomyelitis
IV	Diffuse osteomyelitis
Physiological Class	
A	Good immune system and delivery
B	Compromised locally (B^L) or systemically (B^S)
C	Requires suppressive or no treatment; minimal disability; treatment worse than disease; not a surgical candidate
Clinical Stage	
	Type + Class = Clinical stage

Table 2 – Modified classification system.

Physiology	
Type A host	No risk factors
Type B host	Less than three minor risk factors
Type C host	One major and/or three or more minor risk factors
Pathoanatomy	
I - Medullary (stable)	No cortical sequestration
II - Cortical (stable)	Direct contiguous involvement of cortex only
III - Combined (stable)	Both cortex and medullary regions involved
IV - Combined (unstable)	As for III plus unstable prior to debridement