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Challenges in managing paediatric osteomyelitis in the developing world: Analysis of cases presenting to a tertiary referral centre in Tanzania

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ABSTRACT

Background: The literature on paediatric osteomyelitis in the developing world is scarce, and there have been calls for further characterisation of its epidemiology and the identification of factors that limit effective management in order to guide local service delivery. Our centre is a hospital serving a population of 11 million people in Tanzania. **Materials and Methods:** We identified patients <18 years admitted between 1st January 2008 and 31st December 2010 with a diagnosis of osteomyelitis through a search of admission logbooks. Patient notes were reviewed for information regarding the nature of the presentation, treatment given and outcome, with the primary outcome measure being recurrence of infection at follow-up. **Results:** A total of 63 patients were identified, notes available for 55: 40 males and 15 females, mean age of 11 years. The most common sites were the tibia and femur with other sites including the skull, humerus and foot. At presentation, 8 cases were categorised as acute, 5 as acute with X-ray changes, 40 as chronic localised and 2 as chronic systemic.A total of 11 patients were treated with antibiotics only, 11 with incision and drainage and 30 with surgical debridement. Bacterial cultures were available in 11 cases. all *Staphylococcus aureus* tested were gentamicin-sensitive, but at least one patient had *S. aureus* resistant to cloxacillin, erythromycin, co-trimoxazole, tetracycline or a combination of these. Of 29 patients attending follow-up, 20 made a full recovery and 9 developed recurrence of infection. Eight out of nine with recurrence had time from symptom onset to presentation of >3 months. Twelve out of 13 with a time from symptom onset to presentation of <2 months did not develop recurrence. **Conclusions:** This is, to the best of our knowledge, the second largest study of paediatric osteomyelitis in the developing world. Major challenges facing this centre include a lack of availability of bacterial cultures and failure to attend follow-up. Delayed presentation of osteomyelitis to our centre is associated with recurrence of infection.

Key words: Osteomyelitis, paediatric, Tanzania

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INTRODUCTION

Paediatric bone and joint infection represents a significant burden of disease in the developing world: It is estimated that of the 400 million children under the age of 18 living in the least-developed countries, 12 million suffer from musculoskeletal impairment due to infection.[1,2] In a review of surgical procedures in Uganda, 3.5% were performed for osteomyelitis,[3] and of children under the age of 15 admitted to a government referral hospital in the Gambia, osteomyelitis accounted for 15.4% of inpatient days, more than for any other diagnosis except burns.[4]

Delay in the presentation and treatment of acute osteomyelitis due to a lack of availability of primary and secondary healthcare services often results in progression to chronic disease with associated morbidity.[5,6] The literature on paediatric osteomyelitis in the developing world is scarce, and there have been calls for further characterisation of its epidemiology and the identification of local factors that limit effective management in order to guide local service delivery.[1]

Kilimanjaro Christian Medical Centre (KCMC) is a tertiary referral centre for a population of 11 million people in Northern Tanzania and contains a specialist orthopaedic department. Our aims were to characterise

the paediatric population presenting to this hospital with osteomyelitis, the treatment provided and outcomes at follow-up, thus giving an insight into the challenges faced in managing this condition in the developing world.

MATERIALS AND METHODS

Permission to conduct the following research was granted by the KCMC Executive Directorate (reference KCMC P 1/11). We identified all children aged 18 and under who were admitted to KCMC between 1st January 2008 and 31st December 2010 with a recorded diagnosis at discharge of osteomyelitis (International Classification of Diseases-10 classification system) through a manual search of admission logbooks. The notes for these patients were collected, and the following information obtained: Age, sex, nature of admission (direct or referred from a district hospital), site of osteomyelitis, stage of osteomyelitis (defined as either acute, acute with X-ray changes, chronic localised or chronic systemic),[7] time from symptom onset to presentation at KCMC, history of trauma, duration of stay at KCMC, treatment given, follow-up time and outcome, organisms isolated and antibiotic sensitivities [Table 1].

RESULTS

During the study period, 63 patients were identified of whom notes were available for 55 (40 males, 15 females, mean age of 11 years; range 6 months to 18 years). Of the 55 patients, 24 patients (44%) were direct admissions to KCMC and 31 patients (56%) had previously been admitted to a district general hospital with osteomyelitis and referred to KCMC for further management. Six patients had a history of trauma coinciding with symptom onset (1 open fracture and 5 closed fractures).

The most common bones affected were the tibia (22 patients, 40%) and femur (13 patients, 24%), with other sites including the skull, foot, humerus, hand, ulna and vertebrae [Figure 1]. At the time of presentation to KCMC, 8 cases (15%) were categorised as acute, 5 cases (9%) as acute with X-ray changes, 40 cases (73%) as chronic localised and 2 cases (4%) as chronic systemic [Figure 2]. The median time from symptom onset to presentation for all patients was 7 months (range: 0-72 months), for patients admitted directly to KCMC was 11 months, and for patients referred from a district hospital was 6 months.

The median duration of stay at KCMC was 6 days (range: 0-48 days). A total of 11 patients (20%) were treated with antibiotics only, 11 patients (20%) with incision and drainage and 30 patients (55%) with surgical debridement (sequestrectomy or saucerisation). One patient required a below knee amputation, one was transferred to another hospital and one was admitted for removal of a tibial pin [Figure 3]. Seven patients had previously been admitted to KCMC for the treatment of osteomyelitis prior to the study period, 5 for incision and drainage and 2 for sequestrectomy.

Table 1: classification system for osteomyelitis, taken from Meier *et al*.[7]

Classification	Characteristics
Acute	Local and systemic signs. No bone changes on X-ray (<2 weeks history)
Acute with X-ray changes	Undrained acute osteomyelitis (2-8 weeks history). Local and maybe systemic signs with bone destruction on X-ray and no clear sequestrum
Chronic localised	Long history of osteomyelitis, usually with persistent spontaneous drainage. No systemic symptoms
Chronic systemic	Chronic osteomyelitis with systemic manifestations

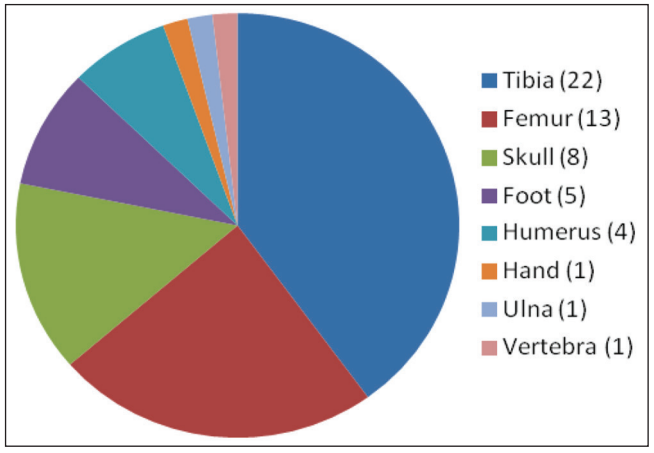


Figure 1: Site of osteomyelitis at time of presentation to Kilimanjaro Christian medical centre

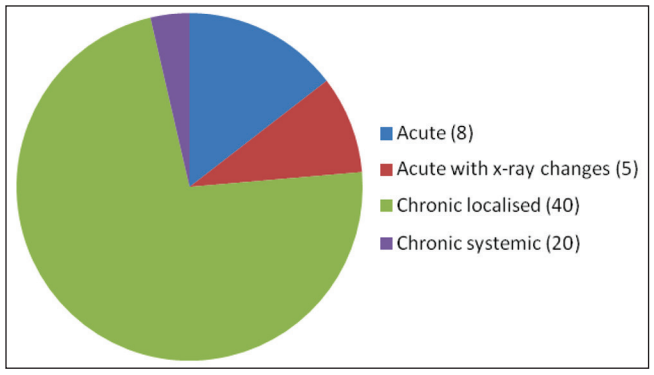


Figure 2: Stage of osteomyelitis at time of presentation to Kilimanjaro Christian medical centre

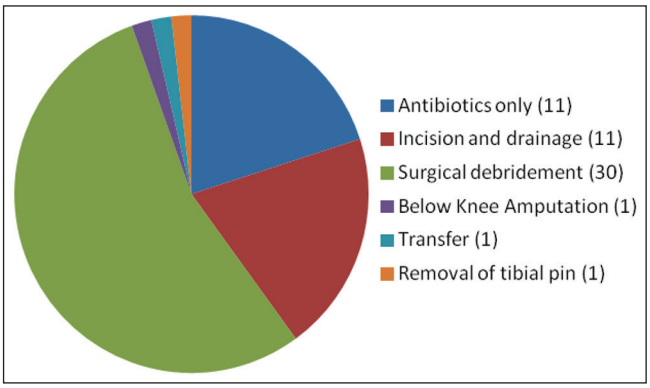


Figure 3: Treatment given at Kilimanjaro Christian medical centre

The antibiotic therapy (intravenous) used included cloxacillin alone (8 patients, 15%), cloxacillin and gentamicin (30 patients, 55%), another single or combination of antibiotics (16 patients, 29%) and in a single case no antibiotics were used. Bacterial cultures (taken from pus ± bone fragments at the time of operation) were available in 11 cases: *Staphylococcus aureus* 7, coliforms 1, proteus 1 and no growth 2. All *S. aureus* tested were gentamicin-sensitive, but at least one patient had *S. aureus* resistant to cloxacillin, erythromycin, co-trimoxazole, tetracycline or a combination of these. 29 (53%) out of 55 patients attended for follow-up at KCMC. Of the 29 patients, 20 patients made a full clinical recovery and 9 patients developed recurrence of infection. Three patients died while in hospital (two from meningitis and one from severe hydrocephalus). The median duration of follow-up for those attending was 5 months, and no patients subsequently required reconstructive surgery. Eight out of nine patients presenting with recurrence of infection had a duration from symptom onset to presentation at KCMC of >3 months. Twelve out of 13 patients with duration from symptom onset to presentation of <2 months did not present again with recurrence of infection.

DISCUSSION

This study was a retrospective analysis of cases of paediatric osteomyelitis over a 3-year period in a tertiary referral centre in Tanzania. It is, to our knowledge, the second largest epidemiological study of paediatric osteomyelitis in the developing world.[1]

The patient group affected were predominantly males (73%) with a mean age of 11 years, and the most commonly affected sites were the tibia and femur, in keeping with comparable studies elsewhere in Africa.[8-10] In the majority of cases (89%), there was no relevant history of trauma and infection was presumed to be haematogenous in origin. Of the remaining cases (11%), only one had a history of an open fracture.

The number of patients arriving directly at KCMC was similar to the number referred from a district hospital (44% vs. 56%): In cases of referral it was unclear whether antibiotic therapy had been started prior to presentation at KCMC, but in no case was there documentation of prior surgical treatment. As can be seen from Figure 2, the majority of patients (73%) presented with chronic localised disease, that is, had been symptomatic for >8 weeks at the time of presentation but did not have systemic manifestations of disease: this group was amenable to surgical treatment.

Eight out of nine patients presenting with recurrence of infection had a duration from symptom onset to presentation at KCMC of >3 months. Twelve out of 13 patients with duration from symptom onset to presentation of <2 months did not present again with recurrence of infection. Of note, the median time from symptom onset to presentation at KCMC was greater for direct admissions than from admissions from district hospitals (11 months vs. 6 months), and thus delay in referral from district hospitals to KCMC does not appear to be a significant factor accounting for the total duration of time between symptom onset and presentation to KCMC. The small number of patients in this group and lack of clarity about the onset and duration of antibiotic therapy make it difficult to infer a reason for the association of delayed presentation with recurrence of infection. Possible reasons include delay in commencing antibiotic therapy and more advanced osteomyelitis in those patients with delayed presentation that make it difficult to ensure removal of all infected tissue.

A total of 47% of patients failed to attend follow-up. 20 (69%) of the 29 patients attending follow-up did not develop recurrence of infection. Four out of this group of 20 patients had previously been admitted to KCMC for the treatment of osteomyelitis. Thus, 16 (55%) of the 29 patients attending follow-up were successfully treated at a single visit. In a study by Beckles *et al.* from Malawi, which is the largest reported series on paediatric osteomyelitis in the developing world, 72.5% of patients were successfully treated at a single visit as defined by the lack of need for future hospital admission,[8] although comparison with this study is limited as it does not give information on the stage of osteomyelitis at presentation. The lack of availability of detailed information from medical records (particularly

with regards to treatment given at district hospitals and functional outcome of patients) and poor attendance at follow-up are limitations of this study, and may be difficulties also encountered by other centres.

The pattern of antibiotic resistance demonstrated in cases where cultures were available (20%) highlights the importance of obtaining bacterial cultures, with at least one patient having *S. aureus* resistant to cloxacillin, erythromycin, co-trimoxazole, tetracycline or a combination of these.

CONCLUSIONS

The majority of patients presenting to KCMC with osteomyelitis over the study period had chronic localised disease amenable to surgical debridement. Delayed presentation to our centre is associated with recurrence of infection: This may be due to delay in commencing antibiotic therapy or more advanced disease in those with delayed presentation. Key challenges faced by this centre include poor attendance at follow-up and limited capacity for obtaining bacterial cultures to guide antibiotic therapy. The data presented here, and indeed the difficulties described in obtaining relevant data, may be of use to other centres in Africa seeking to characterise the burden of disease attributable to paediatric osteomyelitis and develop mechanisms for improving service delivery.

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