AFRICAN JOURNAL OF MEDICINE
and medical sciences

VOLUME 31, NUMBER 2 JUNE 2002

EDITOR:
B. O. OSOTIMEHIN

ASSISTANT EDITOR:
A. O. UWAIFO

ISSN 1116 — 4077

Afr J Med med Sci (2002) 31, 167-169

Microbial isolates in chronic osteomyelitis – a guide to management

TO Alonge[1], SO Ogunlade[1] and AN Fashina[2]

[1]Department of Surgery, College of Medicine, University of Ibadan and [2]Department of Medical Microbiology, University College Hospital, Ibadan, Nigeria

Summary

Between August 1995 and December 1999, sixty patients with chronic osteomyelitis had the effluent from the discharging sinuses and bone biopsies cultured aerobically and anaerobically. 47 positive isolates were obtained and the organism commonly isolated both in the single- and two-organism isolates was *Staphylococcus aureus*. The sensitivity patterns of these isolates were carried out with the available antibiotic discs. 30 per cent of the organisms isolated were sensitive to ceftriaxone (Rocephine) and gentamycin.

Keywords: *Chronic osteomyelitis, Microbial isolates, Belfast operation, Sickle cell anaemia*

Résumé

Entre août 1995 et décembre 1999, soixante malades ayant l'ostémyélite chronique avaient l'effluve écoulant des sinus et la biopsie des Os en culture aérobie et anaérobie. 47 isolés positifs ont été prélevées et l'organisme le plus souvent isolé dans le cas d'un ou deux organismes d'isolés était le *staphylococcus aureus* Les constantes de sensibilité de ces isolées avaient été faites avec les disques antibiotiques disponibles. 30 pourcent des organismes isolés avaient une sensibilité à ceftriaxone (Rocephine) et gentamycine.

Introduction

Chronic osteomyelitis is a distressing bone disease often characterized by subsidence of systemic symptoms but with one or more foci of pus, infected granulation tissue or sequestra still lodged in the bone [1]. Chronic osteomyelitis can be primary, when it arises from failed treatment of acute haematogenous osteomyelitis [1] or secondary, when it is caused by trauma to the bone, open fractures or from post-operative infection [1,2]. While the volume of the affected bone is much larger in primary chronic osteomyelitis, the severity of bone involvement per unit volume of tissue is greater in secondary chronic osteomyelitis [1]. One of the hallmarks of chronic osteomyelitis is the presence of chronic discharging sinus(es). In most cases of chronic osteomyelitis, bacteria can be cultured from the infected bone segment or from the discharging sinus tracts [1,3].

Although the bone cultures tend to give a slightly higher percentage yield of positive cultures, a carefully obtained wound culture can be as accurate as a bone culture [3]. *Staphylococcus aureus* is the singular micro-organism isolated in about 60 per cent of cases [1,2] but the isolate is often a mixed flora particularly in secondary chronic osteomyelitis [1,3,4,5]. Since the aetiology of chronic osteomyelitis (by way of causative micro-organism) is no longer almost certain to be *Staphylococcus aureus*, identification of the infecting organism(s) has become necessary for the appropriate choice and mode of antibiotic treatment [2]. This prospective study was to ascertain the pattern of bacterial isolates from chronic discharging sinuses and bone biopsies in chronic osteomyelitis in our environment with a view to formulating a management modality based on the antibiotic sensitivity pattern.

Correspondence: Mr. T.O. Alonge, Department of Surgery, University College Hospital, Ibadan, Nigeria. E-mail alonge@skannet.com.

Patients and methods

The study was conducted at the University College Hospital, Ibadan, Nigeria. The subjects of this prospective study is composed of 110 patients with chronic osteomyelitis who presented at the Orthopaedic Surgical Outpatient Department of the University College Hospital, Ibadan, Nigeria between August 1995 and December 1999. Of this number, only sixty patients could afford the cost of the basic microbiological test (microscopy, culture and sensitivities of either wound swabs obtained from the discharging sinuses or bones specimens).

Specimen collection

The area around the discharging sinuses were cleaned with normal saline or water for injection and with sterile swab sticks, the specimens were obtained (from the actively discharging sinuses) and sent to the microbiology laboratory within one hour of collection. The bone samples obtained at surgery from the operating theatre or extruding bone specimens obtained in the outpatient clinics were stored in sterile universal containers and again sent to the microbiology laboratory within an hour of collection.

Culture technique.

The swab sticks or bone specimens were inoculated aseptically (using the multiple touch technique) unto blood agar, chocolate agar and MacConkey agar plates and were incubated at 37°C for 24 hours for aerobic culture whilst anaerobic culture were performed on blood agar and thioglycolate broth. Specimens that yielded no anaerobe after 48 hours had their broths subcultured on blood agar and incubated anaerobically for a further 48 hours. All the isolates obtained from these cultures were identified by standard biochemical methods and subjected to antibiotic sensitivity tests using the disc diffusion technique of Stokes [6]. However, all antibiotic discs were not always available during the study period due to non-availability of these discs therefore, not all isolates were tested against the same panel of antibiotics discs.

Results

There were 110 subjects in all and only 60 could afford the bacteriological test i.e. microscopy, culture and sensitivity. There were forty-five males (75%) and fifteen (25%) females with a male to female ratio of 3:1. Primary chronic osteomyelitis occurred in forty-two patients (70%). Table 1 shows that eight patients with secondary chronic osteomyelitis (44%) had previous open fracture of the affected bone while six patients (33%) had previous bone surgery. Three patients gave a history of blunt trauma to the affected bone but without a concomitant fracture. One of the patients in the secondary chronic osteomyelitis group had a previous close fracture of the affected bone that was managed conservatively.

Table 1: Pathogenesis of secondary chronic osteomyelitis

Aetiopathogenesis	Number	%
Previous open fracture	8	44.0
Previous bone surgery (ORIF = 5, K-nail=1)	6	33.0
Previous blunt trauma to limb (no fracture)	3	16.6
Previous close fracture managed non-operatively	1	5.5

Thirteen patients presented within 6 months of the onset of symptoms, six patients within 7 – 12 months, eight patients within 13 – 24 months and thirty-three patients presented after 24 months of the onset of symptoms. The duration of symptoms had no bearing on the type and number of micro-organisms isolated.

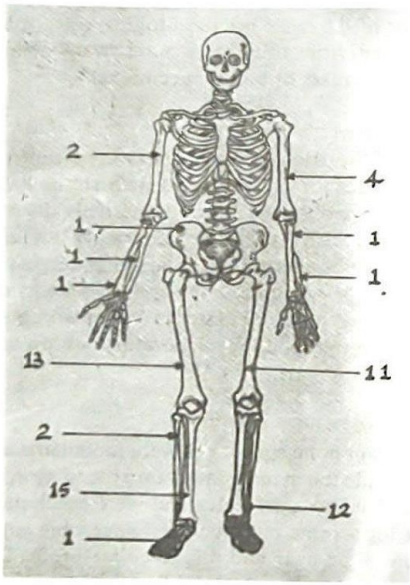

Fig. 1: *A skeleton depicting the bones affected with chronic osteomyelitis*

The bones affected are as shown in Figure 1 with the tibia (41%) and the femur (37%) being the bones commonly affected. Infection of the femur and the tibia in the same limb was observed in four patients while both tibiae were affected in one patient.

Table 2: Pattern of microbial isolates.

Organism	Number	% of single org. isolates	% of two-org. isolates	Overall %
Staph. aureus	33	71.0	62.5	60.0
Pseudomonas spp.	8	10.2	50.0	14.5
Klebsiella spp.	6	7.7	37.5	11.0
Proteus spp.	3	5.0	12.5	5.4
Staph. epidermidis	3	2.6	25.0	5.4
Strep. pyogenes	1	2.6	-	1.8
Escherichia coli	1	-	12.5	1.8
Total	55			

Table 2 shows that positive bacterial isolates were found in 47 (78%) patients and of this, single microbial isolates occurred in 39 cases while 8 patients had two–organism isolates. Twenty-eight (71.8%) of the single-organism isolates grew *Staphylococcus aureus* and of the eight two-organism isolates, *Staphylococcus aureus* along with another organism was found in five cases.

Seven of the patients (11.6%) suffered from sickle cell anaemia. *Staphylococcus aureus* and *Klebsiella species* were isolated in three cultures (each) of these seven patients and *Staphylococcus epidermidis* (probably a contaminant) was isolated in one case. Three cultures grew no organism.

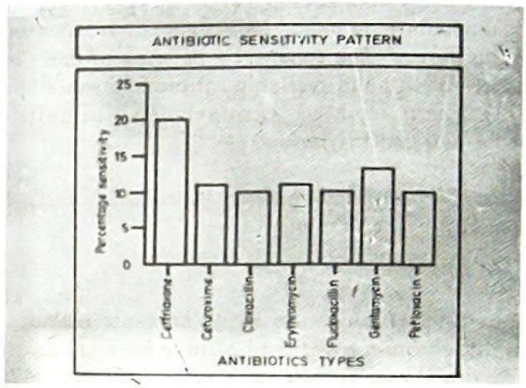

Fig. 2: *A bar chart showing the antibiotic sensitivity pattern for the organisms isolated.*

The bar chart in figure 2 shows that the highest percentage antibiotic sensitivity (to all the isolates) of 20% was to ceftriaxone while 13% of the organisms were sensitive to gentamycin. 11% of the isolates were sensitive to cefuroxime and erythromycin and 10% were sensitive to flucloxacillin, cloxacillin and perfloxacin, respectively. However, 36% of the isolates on the other hand were resistant to ampicillin while 17% were resistant to penicillin. There was no superiority of microbial yield in the bone specimens compared to those from the discharging sinuses.

Discussion

Chronic osteomyelitis is more a problem of chronic ischemia than one of chronic sepsis [7] and although *Staphylococcus aureus* is the singular organism commonly isolated [1,5], it is not uncommon to find a mixed flora [1-5] or even negative cultures in this disease. Waldvogel *et al* [3], Carnesale [1] and Mader *et al* [5] have shown that the singular organism commonly isolated in chronic osteomyelitis in various parts of the United States of America was *Staphylococcus aureus*. Long-term oral and sometimes parenteral antibiotics are often still prescribed for the treatment of chronic osteomyelitis in many orthopaedic units despite the attendant complications of drug toxicities [5,8]. However, it is now universally accepted that the mainstay of treatment of chronic osteomyelitis is surgical as this will ensure the complete debridement of all the devitalized bone and soft tissues [9] which is beyond the reach of oral antibiotics.

From this study, the sensitivity pattern of the antibiotics were very low, the highest being 20 per cent for ceftriaxone and just over 30 per cent of all the organisms isolated in both primary and secondary chronic osteomyelitis were sensitive to a combination of ceftriaxone and gentamycin. This would imply that no single antibiotic is effective against the microbial

isolates in chronic osteomyelitis and therefore a combination therapy appears to be the way forward.

At the University College Hospital, Ibadan, the commonly prescribed oral antibiotics for the treatment of chronic osteomyelitis prior to this recent study included cloxacillin, flucloxacillin and erythromycin. These oral antibiotics were prescribed often singly but seldomly in combination and this may be partly responsible for the apparent high recurrence rates of chronic osteomyelitis seen in our center. However, this study further shows that at the present time, these oral antibiotics have relatively lower sensitivities to the organisms isolated compared to ceftriaxone and gentamycin.

This study also shows that a combination of ceftriaxone and gentamycin beads using the Belfast operation [10], perhaps with oral cefuroxime or erythromycin as follow-on antibiotics will be effective in eradicating the offending organisms in over 50 per cent of the cases. The effective elution of ceftriaxone from the ceftriaxone-PMMA beads and the far cheaper cost [11] of procuring these beads makes this combination a viable cost-effective option in our locality. We strongly believe that the isolation of the offending organism in chronic osteomyelitis should be sought as much as possible as this may influence the choice of antibiotic to be used as well as the surgical approach(es) that needs to be taken in the management of this debilitating disease.

The main difficulty encountered in this study was the rather small number of patients with chronic osteomyelitis who could afford the basic bacteriological tests of the wound and bone swabs. This may be responsible for the inability to validate or evaluate which of the specimens - sinus swab or bone gives, a better result for accurate microbial isolation.

Conclusion

The exact incidence of chronic osteomyelitis is not known in our environment However, from the data bank of the new referrals to the orthopaedic outpatient clinic, it accounts for almost 10 per cent of the referrals to the clinic. This disease is therefore not a rarity and the primary type still dominates while open fractures appear to be the main predisposing factor to the development of secondary chronic osteomyelitis. The tibia and the femur are the bones most commonly affected and *Staphylococcus aureus* is still the commonest microorganism isolated. Since 30 per cent of the isolated microorganisms are sensitive to ceftriaxone and gentamycin both of which have no oral preparations, the two-stage Belfast operation has been advocated for the treatment of chronic osteomyelitis in our environment as it allows the implantation of ceftriaxone and gentamycin antibiotic beads at the site of infection following adequate debridement.

References

1. Carnesale PG: Osteomyelitis. In Campbell's operative orthopaedics Vol 1, 657-670. Crenshaw AH (Ed). The CV Mosby Company St Louis. 1987.
2. Waldvogel FA, Medoff G and Swartz MN: Osteomyelitis: A review of clinical features, therapeutics considerations and unusual aspects. N Eng J Med. 1970; 282(6) : 316-322.
3. Waldvogel FA, Medoff G and Swartz MN: Osteomyelitis: A review of clinical features, therapeutics considerations and unusual aspects. N Eng J Med. 1970; 282(5) : 260-266.
4. Badoe EA, Archampong EQ and Jaja MOA: Principles and practice of surgery including pathology in the tropics. Ghana Publishing Corproration. 1986.
5. Mader JT, Cantrell JS and Calhou J: Oral ciprofloxacin compared with standard parenteral antibiotic therapy for chronic osteomyelitis in adults. J Bone J Surg. 1990; 72-A(1): 104-110.
6. Stokes EJ and Watersmoth TM. Antibiotic sensitivity testing by disc diffusion method. Ass of Clin Pathologist Broadsheet 55. Reviewed Dec. 1972.
7. Dombrowski ET and Dunn AW: Treatment of osteomyelitis by debridement and closed wound irrigation-suction. Clin Orthop. 1965; 43 : 215-240.
8. Steinfeld SM, Graziani AL, MacGregor RR and Eaterhai JL: Toxicities of antimicrobial agents used to treat osteomyelitis. Ortho Clin N Ame. 1991; 22(3) 439-465.
9. Eckardt JJ, Wirganowicz PZ and Mar T: An aggressive surgical approach to the management of chronic osteomyelitis. Clin Orthop. 1994; 298 : 229-239.
10. McNally MA, Small JO, Tofighi HG and Mollan RAB: Two-stage management of chronic osteomyelitis of long bones. The Belfast technique. J Bone J Surg. 1993; 75-B (3) : 375-380.
11. Alonge TO and Fashina AN: Ceftriaxone-polymethylmethacrylate antibiotic beads – A slow release preparation? Int J Clin Prac. 2000; 54(6) : 353-355.