

# CHRONIC OSTEOMYELITIS RESULTING FROM MISSILE INJURIES

by Haider Abdul-Lateef MOUSA<sup>o</sup>  
Iraq

## R é s u m é

### OSTÉOMYÉLITE CHRONIQUE CONSÉCUTIVE AUX BLESSURES PAR PROJECTILE

Soixante-six patients ont été étudiés prospectivement au sujet des infections osseuses aérobiques, consécutives aux blessures par projectile. Le tibia, le fémur et les os du pied en sont les localisations les plus fréquentes. Au total, 139 cultures ont été effectuées (109 germes aérobiques et 30 anaérobiques). Le *Pseudomonas aeruginosa* fut l'agent causal le plus courant. Cet organisme pourrait être amené par infection croisée dans l'hôpital durant les premiers soins aux blessés.

Il y eut 20 patients (30,3%) infectés par les bactéries aérobiques. L'un d'eux fut infecté par le *leptostreptocoque anaérobique* seul. Ces résultats montrent le rôle significatif des anaérobiques dans la production de l'ostéomyélite chronique qui ne cède pas aux mesures courantes de traitement.

Une technique aseptique rigoureuse dans les premiers soins aux patients présentant des fractures compliquées est recommandée. Des cultures anaérobiques de routine doivent aussi être exécutées dans les cas où existe une infection osseuse chronique.

## R e s u m e n

### OSTEOMIELITIS CRÓNICA POR HERIDAS DE METRALLA.

Se estudiaron sesenta y seis pacientes con infecciones óseas por aerobios y anaerobios que aparecieron tras sufrir heridas de metralla. Los huesos que se vieron afectados con mayor frecuencia fueron la tibia, el fémur y los huesos del pie. Se realizaron un total de 139 cultivos, 109 aerobios y 30 anaerobios. El agente causal más frecuente fue la *Pseudomonas aeruginosa* que pudiera adquirirse por una infección cruzada intrahospitalaria en los primeros momentos del tratamiento.

De los 20 pacientes (30,3%) infectados por anaerobios sólo uno lo fue únicamente por *Peptostreptococcus anaerobius*. Este resultado muestra el papel significativo de los anaerobios en la etiología de la osteomielitis crónica que no responde al tratamiento habitual.

Se recomienda una asepsia rigurosa en las primeras curas de las fracturas complicadas. En las infecciones óseas crónicas deben realizarse cultivos para anaerobios de rutina.

**Keywords :** Osteomyelitis, missile injuries, anaerobic infection, Iraq.

## INTRODUCTION

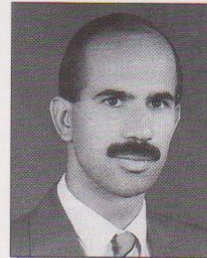
The route of bone infection is of three types : haematogenous, direct inoculation, or postoperative. Osteomyelitis due to direct inoculation of organisms usually follows a compound fracture that exposed a bone to external environment.

In studies of osteomyelitis, *Staphylococcus aureus* has continued to be the most common pathogen isolated from patients with different types of infected bone<sup>(1-4)</sup>.

The aim of this study was to investigate the causative agents of osteomyelitis resulting from missile injuries with special emphasis on anaerobic infection.

## PATIENTS AND METHODS

A prospective study was conducted of 66 patients admitted to the orthopaedics units between December 1992 and June 1996. Only patients with clinical, radiological and bacteriological evidence of osteomyelitis were included in this study. The mean age was 27 years (range 3-72 years); 64 were males and 2 were females. Duration of illness at time of specimen collection ranged from one week to eight years. Draining sinuses present in 49 patients before surgical treatment. The causes of injuries were as follow : mine injury (31 cases), bullet injury (22 cases) and shell injury (13 cases). All patients had previous compound fractures. There were 16 patients at



Abdul-Lateef MOUSA

Haider Abdul-Lateef MOUSA, born in Basrah, Iraq, on 2 October 1961.

Qualifications :

M. B. Ch. B., July, 1987,

College of

Medicine, University of Basrah, Iraq.

M. Sc. degree in Medical Microbiology, January, 1994, College of Medicine, University of Basrah, Iraq.

Post held since graduation :

Resident doctor from August 1987 to December 1988, Babylon, Iraq.

Demonstrator in medical microbiology from February 1989 to September 1991, College of Medicine, University of Basrah.

Assistant lecturer from March 1994 to August 1997.

Lecturer from September 1997 till now.

Teaching of undergraduate medical students and postgraduate students of medical microbiology from February 1989 till now, College of Medicine, University of Basrah.

age of 3-12 years, of whom 13 were injured by mines. Most of these injuries happened at time of Iraqi-Iranian conflict and Gulf conflict.

The specimens were obtained directly from the infected bone or accumulated material in the soft tissues during operations. Contamination from sinus-track was prevented. The specimens for anaerobic cultures were inoculated on to the pre-reduced culture media immediately in the operating room and incubated, also by the bedside, in anaerobic condi-

o Dr. Haider Abdul-Lateef Mousa  
P.O. Box 601  
Post Code 42001  
Ashar, Basrah, Iraq.

tions in a GasPak anaerobic jar (BBL). Cultivation in aerobic condition and in 5-10% CO<sub>2</sub> was also performed. Aerobic and anaerobic cultures were made for all cases. Aerobes and anaerobes were identified using conventional methods<sup>(5)</sup>.

## RESULTS

The site which is the most commonly affected by osteomyelitis was tibia (43.3%), followed by femur (31.3%) and bones of foot (14.9%) (Table 1).

Organisms were isolated from all 66 patients. A total of 139 isolates were recovered (109 aerobes and 30 anaerobes). The infection was monomicrobial in 35 patients (53%), while the remaining cases yielded polymicrobial infection. *Pseudomonas aeruginosa* was the most frequent isolate<sup>(27)</sup>, followed by *Klebsiella* sp.<sup>(25)</sup>, *Proteus* sp.<sup>(16)</sup>, *Staphylococcus aureus*<sup>(12)</sup> and *Staphylococcus epidermidis*<sup>(12)</sup>. *Ps. aeruginosa* was recovered as a single infecting organism (monomicrobial infection) in 12 patients (18.2%).

Twenty patients were infected with anaerobic bacteria (30.3%). All patients with anaerobic infection were also infected with aerobic organisms except for one patient who was infected with *Peptostreptococcus anaerobius* alone. The most common anaerobic organism isolated was *Bacteroides* sp. (12 isolates).

## DISCUSSION

This study revealed that tibia, femur and bones of foot were the most frequent site involved by osteomyelitis. This could be related to that these sites are more vulnerable to missile injuries specially by mines.

The most common microorganism isolated from patients with bone infection in this study was *Ps. aeruginosa*. This is not in agreement with that found by other investigators who had found that *S. aureus* was the commonest causative agent of post-traumatic osteomyelitis<sup>(1,6)</sup>. This high

Table 1 : Site of osteomyelitis.

Site	Number	%
Tibia	29	43.3
Femur	21	31.3
Bones of foot	10	14.9
Humerus	2	3
Pelvic bones	2	3
Fibula	1	1.5
Vertebra	1	1.5
Mandible	1	1.5
Total	*67	100

\*One patient had two infected bones.

Table 2 : Organisms isolated on culture.

Organism	Number isolated	%
Aerobic bacteria		
<i>Pseudomonas aeruginosa</i>	27	19.4
<i>Klebsiella</i> sp.	25	18
<i>Proteus</i> sp.	16	11.5
<i>Staphylococcus aureus</i>	12	8.6
<i>Staphylococcus epidermidis</i>	12	8.6
<i>Escherichia coli</i>	6	4.3
Enterobacteriaceae	5	3.6
<i>Streptococcus faecalis</i>	2	1.4
<i>Morganella morganii</i>	1	0.72
<i>Enterobacter cloacae</i>	1	0.72
<i>Serratia</i> sp.	1	0.72
<i>Moraxella catarrhalis</i>	1	0.72
Anaerobic bacteria		
<i>Bacteroides fragilis</i>	6	4.3
Pigmented <i>Bacteroides</i>	6	4.3
<i>Fusobacterium</i> sp.	5	3.6
<i>Peptostreptococcus anaerobius</i>	4	2.9
<i>Propionibacterium acnes</i>	4	2.9
<i>Fusobacterium nucleatum</i>	3	2.1
<i>Eubacterium</i> sp.	2	1.4
Total	139	100

incidence of *Ps. aeruginosa* in present study may be caused by faulty dressing technique in the early management of wounds with compound fractures. Also during mass management of injured patients at war time no much care might be taken for aseptic manipulation. So, this organism could be acquired by cross-infection (nosocomial infection). However, this organism is highly resistant to antibiotics and antiseptics, and it was found to be the most frequent isolate in cases of nosocomial infection<sup>(7)</sup>.

In the present study, anaerobes were isolated from 30.3% of patients. This high rate of recovery of anaerobes was related to the care taken during the collection and cultivation of the specimens, that the specimens were collected by syringes rather than cotton swabs and were inoculated and cultivated by the bedside, and this concurs with previous reports<sup>(8,9)</sup>. In missile injuries, there could be metallic foreign bodies, massive soft tissue destruction, devitalized tissue and diminished blood supply; all these factors encourage the growth of anaerobes. This high prevalence of anaerobes in the present cases and their isolation as a single infecting organism in one patient indicates an important role of anaerobes in producing a resistant chronic osteomyelitis that may not respond to the normal treatment measures.

In view of the findings of the present study, it is recommended to follow a strict aseptic technique in the early management of injured patients. In addition, routine anaerobic culture should be done for all cases with chronic osteomyelitis resulting from missile injuries.

#### SUMMARY

Sixty-six patients were studied prospectively for aerobic and anaerobic bone infections that follow missile injuries. Tibia, femur and foot bones were the most frequent sites involved. A total of 139 isolates were recovered (109 aerobes and 30 anaerobes). *Pseudomonas aeruginosa* was the most common causative agent. This organism might be acquired by cross-infection in hospital during early management of wounded patients.

There were 20 patients (30.3%) infected with anaerobic bacteria, of whom one was infected with *Peptostreptococcus anaerobius* alone. These results indicate a significant role of anaerobes in producing chronic osteomyelitis that may not yield to normal treatment measures.

Strict aseptic technique in the early management of patients with compound fracture is recommended. Routine anaerobic culture should

also be performed for all cases with chronic bone infection.

#### References

1. Hierholzer G, Rehn J, Knothe H, Masterson J. Antibiotic therapy of chronic post-traumatic osteomyelitis. *J Bone Joint Surg (Br)* 1974; 56-B : 721-729.
2. Sapico FL, Montgomerie JZ. Pyogenic vertebral osteomyelitis : report of nine cases and review of the literature *Rev Infect Dis* 1979; 1 : 754-775.
3. Pichichero ME, Friesen HA. Polymicrobial osteomyelitis : report of three cases and review of the literature *Rev Infect Dis* 1982; 4 : 86-96.
4. Lauschke FHM, Frey CT. Hematogenous osteomyelitis in infants and children in Northwestern Region of Namibia : management and two-year results. *J Bone Joint Surg (Am)* 1994; 76-A : 502-510.
5. Finegold SM, Baron EJ (Eds). In : «Baily and Scott's Diagnostic Microbiology», 8th edition, St Louis : Mosby, 1990.
6. Gerszten E, Allison MJ, Dalton HP. An epidemiologic study of 100 consecutive cases of osteomyelitis. *South Med J* 1970; 63 : 365-367.
7. Elbasher AM. Five years of prospective surveillance of nosocomial infection in a Saudi Arabian General Hospital. *Saudi Medical Journal* 1997; 18 : 414-417.
8. Mousa Hal, Bakr SS, Hamdan TA. Anaerobic osteomyelitis. *Eastern Mediterranean Health Journal*, WHO, 1996; 2 : 494-500.
9. Mousa Hal. Evaluation of sinus-track cultures in chronic bone infection. *J Bone Joint Surg (Br)* 1997; 79-B : 567-569.



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Switzerland

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Fax : ++41-1-729-70-81

E-mail : acutron@ dial.eunet.ch