

## BURDEN OF CHRONIC OSTEOMYELITIS: REVIEW OF ASSOCIATED FACTORS

\*Emmanuel Ifeanyi Obeagu<sup>1</sup> <https://orcid.org/0000-0002-4538-0161>

<sup>1</sup>Department of Medical Laboratory Science, Kampala International University, Western Campus, Ishaka, Uganda, <https://orcid.org/0000-0002-4538-0161>

[emmanuelobeagu@yhaoo.com](mailto:emmanuelobeagu@yhaoo.com)

### ABSTRACT

Osteomyelitis can happen if a bacterial or fungal infection enters the bone tissue from the bloodstream, due to injury or surgery. Chronic osteomyelitis is a debilitating dirty disease endemic in peasantry communities associated with major source of morbidity and mortality, increasing poverty. There is some evidence that the overall burden of surgical sepsis has increased with the increasing prevalence of HIV. Other factors are associated with chronic osteomyelitis such as sickle cell anaemia, upper respiratory tract infection, trauma, HIV/AIDS, poor hygiene, diabetes mellitus.

**Keywords: burden, osteomyelitis, HIV, sickle cell anaemia**

### Introduction

Osteomyelitis can happen if a bacterial or fungal infection enters the bone tissue from the bloodstream, due to injury or surgery (Schmitt, 2017). Staphylococcus is the organism responsible for 90% of cases of acute and chronic osteomyelitis (Kalinka *et al.*, 2014). Other organisms include, Haemophilus influenzae and salmonella infection with the latter may occur as a complication of sickle cell anemia.

Haematogenous osteomyelitis begins with entry of bacteria through a break in the skin or mucosa from otitis, pharyngitis, respiratory tract infections, or urinary tract infections, the physiological status of the host is a determinant factor (Marais *et al.*, 2014). Most often the bacteria are staphylococcus, but in sickle-cell children, both salmonella and staphylococcus are implicated. The bacteria are haematogenously disseminated and deposited in the trabecular bone or marrow, usually in the metaphysis of the proximal tibia or distal femur. Sluggish blood flow in the metaphysis provides an ideal milieu for bacterial replication. The pus under pressure escapes outward through Volkmann and Haversian canals and then spreads subperiosteally, stripping the cortex of its periosteal blood supply (Cohen *et al.*, 2016)

Without either endosteal or periosteal blood supply, the cortex becomes nonviable bone called sequestrum. As the devascularised cortex is being absorbed, the inner surface of the periosteum produces new bone, called involucrum (Ferguson and Sandu, 2012).

Chronic osteomyelitis is a debilitating dirty disease endemic in peasantry communities associated with major source of morbidity and mortality, increasing poverty. Direct medical charges per episode of staphylococcus osteomyelitis, including average hospital facility charges, professional fees, and post discharge costs, was estimated to 35,000 dollars in 1995 in a New York hospital; no specification of IV or oral (PO) therapy, 135-263 dollars/day for outpatient intravenous antimicrobial therapy versus cost of oral doses of antibiotics (Gomes *et al.*, 2013)

### Risk factors associated with chronic osteomyelitis

#### HIV/AIDS

There is some evidence that the overall burden of surgical sepsis has increased with the increasing prevalence of HIV, but there are no published data to confirm that haematogenous osteomyelitis is more common in HIV-positive children studies have recently shown that HIV disease may not be a contraindication to the fixation of open fractures. The implications of HIV disease with regard to treatment and prognosis, however, are unknown. The potential benefits of treatment with antiretroviral agents with regard to chronic haematogenous osteomyelitis are also unknown.

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Chronic haematogenous osteomyelitis continues to affect many children throughout the world and it is a cause of severe morbidity and disability. Despite this, it is the subject of little current research.

### **Diabetes mellitus**

Amongst patients who underwent standardized assessments where they monitored for all foot complications, defined infections by criteria consistent with International Working Group guidelines, and defined osteomyelitis as a positive culture from a bone specimen. Results showed that: “1666 persons were enrolled, 50% male, mean age 69 years. Over a mean of 27.2 months of follow-up, 151 patients developed foot infections, 30(19.9%) of which involved bone. Independent risk factors for osteomyelitis were: wounds that extended to bone or joint (relative risk [RR] =23.1), previous history of a wound prior to enrollment (RR=2.2), and recurrent or multiple wounds during the study period (RR =1.9). results suggest that suggest that independent risk factors for developing osteomyelitis are deep , recurrent and multiple wounds (Lavery *et al.*, 2009).

Osteomyelitis of the foot in patients with diabetes was polymicrobial in 83 percent of patients with an average of 2.25 pathogens per patient. Infections in patients with diabetes are frequently polymicrobial and the microbiology of diabetic osteomyelitis in the lower extremity follows this trend. *Staphylococcus aureus*, *Staphylococcus epidermidis*, *Enterococcus* and *Streptococcus* species were most commonly isolated from bone culture. (Lalani, 2016)

*Salmonella* osteomyelitis in patients without hemoglobinopathy is quite uncommon. Osteal involvement is seen in only 0.8% of all *Salmonella* infection cases. The case of a 67-year-old diabetic woman who developed *Salmonella* osteomyelitis and subsequently underwent a surgical excision of a tibial lesion followed by two months of intravenous (IV) antibiotic therapy, the patient responded very well to the treatment (Pak and Pham, 2017)

### **Poor hygiene**

*Fusobacterium*'s exceptional ability to adhere to both gram-negative and gram-positive plaque microorganisms in biofilms (specifically in soft tissue) makes it a highly invasive microbe. Primarily given attention for its periodontal implications, strains of *Fusobacterium* have been identified as pathogen in many parts of the body as one of the causes vertebral osteomyelitis caused by *Fusobacterium* species with bacteremia and sepsis syndrome that has been as a result of poor oral hygiene (Khatoon and Hunter, 2015). Mandibular chronic osteomyelitis usually arises as a result of a long-standing odontogenic infection. In this study, however, the major predisposing factor was advanced periodontal disease which is common in the population studied. It was surprising that in spite of the large number of extractions performed for advanced periodontal disease, there were very few cases that were attributable to post-extraction infection.

### **Upper respiratory Infections**

As all other forms of Cranial Osteomyelitis, Pott's puffy tumor is reported as rare in the antibiotic therapy era, although, despite the use of broad-spectrum antibiotics, the number of cases reported has increased since 2000 (Akhaddar, 2016) . In 2012, 141 cases of Pott's puffy tumor were reported in the world literature .This form of cranial osteomyelitis is more common in male and almost always confined to the second decade of life, more rarely in adults and newborns. The prevalence in young males is attributed to their larger diploic veins, which makes it easier for infections to spread. Besides the frontal sinus, the other paranasal sinuses should be taken into considerations: ethmoidal sinuses, maxillary sinuses .if not all paranasal sinuses (pansinusitis). Osteomyelitis of the calvaria can also spread from orbital, oral or dental infections. One of our patients developed an occipital osteomyelitis 3 weeks following a dental procedure.

### **Sickle cell disease**

A total of 187 sickle cell patients were reviewed. Mean age of the study population was 6.95 (plus or minus) 4.23. There were more males (105) than females (82) giving a male female ratio of 1.3:1. Out of the 187

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subjects with sickle cell anemia 15 had osteomyelitis which accounted for a prevalence of 0.08%. Acute osteomyelitis accounted for 100% of cases. Salmonella infections was commonest organism isolated from blood culture 5(33.3%). Fever, leg swelling and bone pains were the commonest mode of presentation. The Tibia bone was commonly involved 8(53.3%). The etiological organisms were sensitive to ceftazidime and gentamycin in 55% of the positive blood culture (George *et al.*, 2011; Obeagu *et al.*, 2015; Obeagu *et al.*, 2020; Obeagu *et al.*, 2022; Swem *et al.*, 2018; Obeagu, 2018).

Twenty-seven patients with known sickle cell disease were included in this study complaining of acute painful vaso-occlusive crisis. All the patients complaining of bony pain in different body region (Khedr *et al.*, 2012)

### **Socio-economic burden of chronic osteomyelitis**

According to (Malizos and Poultsides, 2007) states that the number of reports examining the cost of Musculoskeletal disorders is small in comparison with the unanimous recognition that bone and joint infections induce major financial cost, and more severely, great human suffering. Raising awareness of the patient, the physician and the society in general is of paramount importance. Recognition of the burden of the musculoskeletal infections will result in greater awareness of the pervasive effect they have on the individual and of their cost to society. So estimating the burden will facilitate the process of setting appropriate priorities and adopting relevant strategies towards its reduction.

Direct medical and non-medical costs, for which actual payments are made, have an impact on both the patient and health services. They include treatment costs, hospital and medication costs, which can be divided into fixed and variable ones. Control of variable costs such as implants and supplies plays a predominant role in cost-containment programs. Personal payments such as the cost of transport to the health provider and specialist aids, as well as the building's opportunity cost consist the direct non-medical costs. (Stanley *et al.*, 2010)

As for the costs due to loss of productivity no direct payment is actually made. They include morbidity costs, which consist of lost resources due to the patient's or a relative's absence from work, less production during the work shift, and early retirement due to illness. The mortality costs also reflect lost production due to premature death caused by a lethal infection.

The third category refers to psychosocial or intangible costs, which represent deterioration in the quality of the patient's life, as well as their families' and friends'. People with musculoskeletal infections suffer from disability, pain, reduced self-esteem, and feelings of non-well-being, those being factors extremely difficult to quantify.

### **Management modalities and complications**

The diagnosis and management is generally poor because the quality of published work to guide clinicians. Diagnosis should be based primarily on clinical signs supported by results of pathologic and radiologic investigations. Although the gold standard comes from the histological and microbiological examination of bone available evidence suggests that in many cases (excepting those in whom immediate surgery is required to save life or limb) a nonsurgical approach to management of osteomyelitis may be effective for many, if not most although experts have traditionally recommended surgical removal of infected bone (Game *et al.*, 2013.)

The treatment of choice of this severe infective condition is represented by an aggressive radical debridement, bone fenestration, reaming, bone troughing, the Masquelet-technique, segmental resection with callus distraction with the aim to drainage pus and to remove infective and non-vital tissue. In case of concomitant severe peripheral vascular disease any revascularization procedures, surgical or endoluminal, have to be performed once the local and systemic infection has been controlled. Surgical debridement has to be performed as soon as possible since any delay corresponds to an increase of the risk of major

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amputation and deaths (Hogan *et al.*, 2013)

Plain radiograph still provide the best screening for acute and chronic osteomyelitis. There is a particular emphasis on magnetic resonance imaging (MRI), which is the best available imaging modality owing to its high sensitivity for detecting early osteomyelitis, excellent anatomical detail and superior soft tissue resolution (Lee *et al.*, 2016). The decision to use oral or parenteral antibiotics should be based on results regarding microorganism sensitivity, patient compliance, infectious disease consultation, and the surgeon's experience which helps in quick management to avoid permanent deformity or loss of the limbs (Schmitt, 2017)

Choice of antibiotic therapy haematogenous osteomyelitis should be determined by culture and susceptibility results if possible, in the absence of such information, broad-spectrum, empiric antibiotics should be administered for example clindamycin 600mg intravenous every 6 hours with alternative regimen of cefotetan 2 grams intravenous every 12 hours for anaerobic bacteria (Baker and Macnicol, 2008).

According to (Lima *et al.*, 2014) stated the fifteen patients who had sickle-cell disease and osteomyelitis (affecting thirty bones) were treated with operative decompression and parenteral administration of antimicrobial treatment between 1973 and 1988. Organisms were isolated on culture of specimens of bone from all fifteen patients. Parenteral antibiotic therapy was continued for a minimum of six weeks after operative decompression. The osteomyelitis resolved in twenty-nine (97 per cent) of the thirty affected bones after follow-up ranging from two to fifteen years. With their compromised immune status and poor circulation of blood in bone, patients who have sickle-cell disease and osteomyelitis are prone to have complications.

Treatment of osteomyelitis is challenging particularly when complex multiresistant bacterial biofilm has already been established. Bacteria in biofilm persist in a low metabolic phase, causing persistent infection due to increased resistance to antibiotics. *Staphylococcus aureus* and *Staphylococcus epidermidis* are the most common causative organism responsible for more than 50% of osteomyelitis cases. Osteomyelitis treatment implies the administration of high doses of antibiotics (AB) by means of endovenous and oral routes and should take a period of at least 6 weeks. Local drug delivery systems, using non-biodegradable or biodegradable and osteoactive materials such as calcium orthophosphates bone cements, have been shown to be promising alternatives for the treatment of osteomyelitis (Gomes *et al.*, 2013)

### **Conclusion**

Chronic osteomyelitis is a debilitating dirty disease endemic in peasantry communities associated with major source of morbidity and mortality, increasing poverty. Factors are associated with chronic osteomyelitis such as sickle cell anaemia, upper respiratory tract infection, trauma, HIV/AIDS, poor hygiene, diabetes mellitus.

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