Original Article

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Chronic osteomyelitis in Sarajevo, Bosnia-Herzegovina: Long-term health consequences of warfare

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Abstract

Introduction: Chronic osteomyelitis (COM) is a severely debilitating disease, causing both physical and psychological repercussions for patients. It is particularly common in austere environments and areas of armed conflict. 1,2,3 The most common cause across all age groups is neglected penetrating wounds.4 Often overlooked, COM is one of the many lasting health effects of warfare. Deep infections of the bone following penetrating and blast injuries are common in regions plagued byconflict, and cause major physical and social disability.

Materials & Methods: Patient records at the University of Sarajevo Clinical Center Department of Orthopedics & Traumatology were analyzed retrospectively between 2003 and 2013 of patients hospitalized with diagnosed COM.

Results: 155 patients were hospitalized at UCCS for treatment of chronic osteomyelitis between 2003-2013. Mean age of patients at time of hospitalization was 56 years. The most common medical comorbidity of patients was diabetes mellitus type 2. Unemployment among patients was 46.1%. The most common cause of COM in this cohort was intentional injury associated with the war between the years of 1992-1995 (46.2%). These were caused by sniper or gunshot wounds (25.4%), landmines or unexploded ordnances (37.7%), and mortar shell explosions (28.8%).The mean hospital stay among patients with COM at UCCS was 31.10 days, although this varied widely depending upon the severity of symptoms and the type of treatment required.

Conclusions: The health burden of chronic osteomyelitis persists for many years beyond the original. Chronic pain and disability contribute to a lifetime of repeated treatments, hospital stays, and high rates of unemployment. This study describe the current burden of COM upon the population of Sarajevo, as well as serving as a foreboding prediction of what can be expected in war zones many years in the future.

Keywords: Bosnia-Herzegovina, Sarajevo, chronic osteomyelitis, war injuries, orthopedics, infectious disease, social medicine

Introduction

Chronic osteomyelitis (COM) is a severely debilitating disease, causing both physical and psychological repercussions for patients. It is particularly common in austere environments and areas of armed conflict[1,2,3]. The most common cause across all age groups is neglected penetrating wounds[4]. Often overlooked, COM is one of the many lasting health effects of warfare. Deep infections of the bone following penetrating and blast injuries are common in regions plagued by conflict, and cause major physical and social disability. Despite appropriate intervention, the disease is characterized by high recurrence rates and often results in loss of limb. The recurrence rate of osteomyelitis in affluent countries is accepted to be around 30%; in more austere environments, the rate of recurrence is relatively unknown[5]. Furthermore, it has been shown that limb salvage rates in combat-related injuries are lower than non-combat cohorts[6]. While the Bosnian War ended in 1995, the long-term complications of war-related injury persist. It is estimated that there were over 200,000 high-energy missile injuries in Bosnia and Herzegovina during the war. A cohort at the University of Sarajevo Clinical Center showed that up to 7% of these injuries developed osteomyelitis – thus, it is possible that there are as many as 10-15,000 cases of chronic osteomyelitis as a result of the war [7]. Despite the best surgery that could be offered, optimal resources and care were not commonly available during the siege. As a result, permanent disability is commonly the result of COM in settings with limited resources.4 The long-term consequences of war-related injury have been poorly described in these populations. The majority of published literature surrounding outcomes of injury, disability, and limb loss caused by landmines, explosive devices, and firearms is derived from modern U.S. military studies of soldiers involved in combat [6, 8]. To date, there has been no formal analysis of the current incidence of COM or the long-term outcomes of patients in Bosnia-Herzegovina. This retrospective study seeks to evaluate the prevalence and causes of COM at the University of Sarajevo Clinical Center over a period of ten years. We hypothesize that chronic osteomyelitis caused by intentional injuries continues to place a burden upon the local population in Sarajevo.

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Methods

In this retrospective study, patient records between 2003 and 2013 of patients hospitalized with diagnosed COM were analyzed for length of hospital stay and treatment received. Demographics, mechanisms of

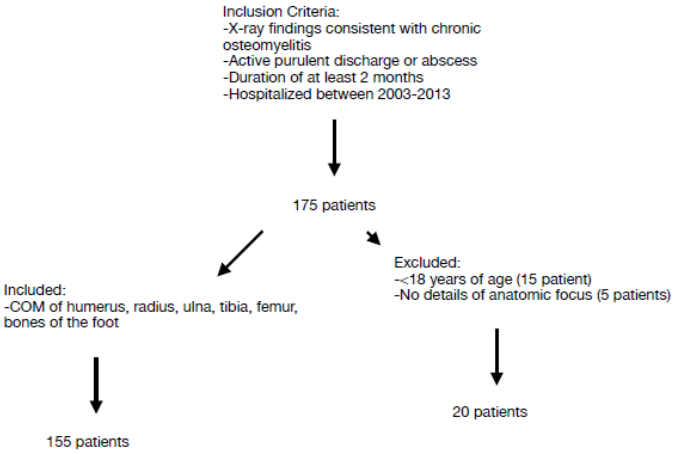

Figure 1: Retrospective study design

injury, site of injury were also evaluated. Patient files were identified with the help of the orthopedic staff at the University of Sarajevo Clinical Center Department of Orthopedics & Traumatology. Inclusion criteria included symptoms lasting over 3 months, active purulent discharge or abscess, and X-ray changes compatible with chronic osteomyelitis. Exclusion criteria included subacute or acute osteomyelitis, and infection of spine, mastoid, mandible, or spine. Only subjects over the age of 18 were included in this study. The University of Iowa Institutional Review Board as well as the Ethics Committee at the University of Sarajevo Clinical Center (UCCS) granted prior approval for the project. Data were collected using paper forms and then entered and managed using REDCap electronic data capture tools hosted at the University of Iowa. REDCap (Research Electronic Data Capture) is a secure, web-based application designed to support data capture for research studies, providing 1) an intuitive interface for validated data entry; 2) audit trails for tracking data manipulation and export procedures; 3) automated export procedures for seamless data downloads to common statistical packages; and 4) procedures for importing data from external sources[9].

Results

Demographics: A total of 155 patients hospitalized at UCCS for treatment of chronic osteomyelitis between 2003-2013 were included in the study. Several patients who were diagnosed with COM were excluded from the study based upon location of the disease process or their age (see Figure 1). 76.1% patients were male (118/155) while 23.9% were female (37/155). The mean age of patients upon hospitalization was 56.41 years (+/- 17.01) though with 30.3% of patients over the age of 65. The most common medical comorbidity of patients was diabetes mellitus type 2. Only 6 patients of the 155 patients had documented depression, anxiety, or post-traumatic stress disorder (PTSD) in their medical record. Unemployment among patients was 46.1% (71/155) (See Table 1). Injury Details: The majority of patients were affected by COM of either the tibia (39.4%) or the femur (30.3%). Of individuals diagnosed with COM of bones of the foot, x% were due to landmines or unexploded ordinances and x% were related to complications of diabetes mellitus. In some cases, diabetes and war-related injuries coincided. The most common cause of COM in this cohort was intentional injury associated with the war between the years of 1992-1995 (46.2%). These were caused by sniper or gunshot wounds (25.4%), landmines or unexploded ordnances (37.7%), and mortar shell explosions (28.8%). Less common causes due to injury were falls (10.1%) and motor vehicle accidents (8.1%). Hospitalization, Disease, and Treatment: The mean hospital stay among patients with COM at UCCS was 31.10 days (+/- 31.15), although this varied widely depending upon the severity of symptoms and the type of treatment required (Table 3). The longest patient stay was 264 days. The most common source of infection was Staphylococcus aureus (53.3%, 80/150) with 12.5% of these cases identified as methicillin resistant strains (10/80). Pseudomonas was the causative pathogen in 14.7% of cases (22/150). Outcome: An overwhelming 89% (137/154) of patients had documented disability as a result of their condition. These types of disability included contractures (52.9%, 72/136), amputations (17.6%, 24/136), and restriction of motion (73.5%, 100/136).

Table 1: Demographics of chronic osteomyelitis patients

Age Range	18-24	25-34	35-44	45-54	55-64	65+
	1.3%	5.2%	12.3%	21.3%	29.7%	30.3%
Gender	Male	Female				
	76.1%	23.9%				
Employment	Employed	Unemployed				
	53.9%	46.1%				

Table 2: Details of injury

Location	Tibia	Femur	Foot	Hip	Humerus	Radius/ulna
	39.4%	30.3%	32.9%	2.6%	1.3%	3.2%
External cause of injury	Intentional injury	Fall	Motor vehicle collieson	Other	Nontraumatic	
	45.9%	10.1%	8.1%	31.8%	4.1%	
	War-related injury	Non warrelated injury				
	46.2%	53.8%				

Discussion

While the war in Bosnia-Herzegovina officially ended with the Dayton Accords in 1995, the long-term sequelae from injuries inflicted upon civilians within the besieged city of Sarajevo remain. Despite the era of antibiotics, this debilitating disease remains difficult to treat with high rates of relapse after treatment, globally. Due to the heterogeneous character of the disease, with many different bacterial causes, both research and treatment have historically been non-standardized. Few randomized trials of therapy for osteomyelitis in adults exist. The length of hospital stay (mean of 31.1 days) required for patients treated with parenteral antibiotics places an enormous burden upon both the patient and the healthcare system. In a systematic review of antibiotic use in COM, oral antibiotics appear to be effective treatments for specific infections, as they are capable of achieving levels that exceed MICs of targeted organisms[10]. Specifically, fluoroquinolones, linezolid, and trimethoprim are capable of achieving bone concentrations at approximately 50% of serum levels. Doxycycline and clindamycin are orally available agents for MRSA that can reliably achieve bone levels exceeding the MICs of susceptible MRSA isolates. Rifampin and fusidic acid are also reasonable adjunctive agents for combination therapy. Oral antibiotic therapy has demonstrated better curative rates than repeated surgical debridement [10]. Further, a composite analysis of 5 trials demonstrate an increased risk of moderate or severe adverse events with parenteral vs. oral antibiotics [11]. All of this taken into consideration, it is reasonable to attempt to stabilize patients with acute flares of chronic osteomyelitis, reduce hospital stays, and utilize oral antibiotic therapy as appropriate. One

study conducted with Iraqi civilians in Jordan with suspected osteomyelitis revealed high numbers of multidrug resistant strains of bacteria causing COM [12]. Importantly, several patients at UCCS were also infected with cefepime-resistant Enterobacteriaceae or methicillin-resistant Staphylococcus aureus, demonstrating that the global issue of bacterial resistance is also a problem in Sarajevo. It is clear from the data obtained from this study that the health burden of chronic osteomyelitis persists for many years beyond the original insult and long after the cessation of warfare. Chronic pain and disability contribute to a lifetime of repeated treatments, hospital stays, and high rates of unemployment. Not only does this study describe the current burden of COM upon the population of Sarajevo, it serves as a foreboding prediction of what can be expected in war zones many years in the future.

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