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Original Article

Clinical findings of bacteremic septic arthritis according to the site of acquisition: The overlap between health care-related and community- and nosocomial-acquired cases

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ABSTRACT

Background: The site of acquisition of infection may have a major impact on outcome. The health care-related (HCR) environment has recently come under scrutiny. In a group of patients with bacteremic septic arthritis (SA), we compared their characteristics, type of SA, microbiology and prognosis according to the site of acquisition: community-acquired (CA), nosocomial-acquired (NA), and HCR.

Methods: We studied all patients with bacteremic SA seen at our institution between 1985 and 2013. Data were obtained from a protocol of prospectively recorded bacteremia cases.

Results: There were 273 cases of bacteremic SA (CA: 51%; NA: 31%; and HCR: 18%). NA and HCR sites were more frequent in older and fragile patients. SA of peripheral joints was the most common presentation; infections of the axial skeleton predominated in CA and HCR (24%), and prosthetic joint infection in NA (44%). MRSA and *Pseudomonas aeruginosa* were mainly found in NA (21% and 6% respectively) and HCR (14% and 8% respectively), whereas *Streptococcus* spp. was more frequent in CA (30%) and HCR (28%). The 30-day mortality rates were: CA 7%, HCR 18%, and NA 26%.

Conclusion: The characteristics of HCR-SA overlapped with those of the CA or NA-SA cases. The HCR and NA cases presented more advanced age, greater fragility, and the predominance of difficult-to-treat microorganisms, while the HCR and CA cases presented an involvement of the axial skeleton, streptococcal etiology, and a lower number of prosthetic joint infections. Our data show that the site of acquisition should be considered when planning diagnostic and therapeutic management for SA.

1. Introduction

Septic arthritis (SA) remains a significant health concern and presents high rates of morbidity and mortality. Its treatment requires emergency medical and surgical care, including antibiotic therapy and debridement to avoid joint destruction and loss of functionality. The presence of bacteremia is common and may be either the cause or the consequence of SA [1–3].

Several medical conditions have been identified as the risk factors for SA, such as the presence of rheumatoid arthritis, diabetes mellitus, corticosteroid therapy, intravenous drug abuse or joint prosthesis [3,4]. In addition, recent changes in patients' characteristics and social habits and the use of more aggressive therapies have increased the numbers of elderly individuals with more chronic debilitating conditions. This may predispose them to a greater number of joint infections, either native or prosthetic (PJI) [5–8]. Indeed, although native SA and PJI present notable differences, several epidemiological studies have stressed the value of addressing both entities together [5–8].

The site of acquisition of infection may have a strong influence on microbiology or on patients' characteristics. While the distinction between community and nosocomial acquisition has been well established, health care-related infections have only recently been described as a specific entity [9–11]. To our knowledge, differences in the current pattern of SA in relation to the site of acquisition have not been previously reported. Moreover, mortality due to SA may also be influenced by the site of acquisition, but this has not been specifically evaluated to date.

In the present study we analyzed a large cohort of patients suffering from bacteremic SA (native or prosthetic) over the last three decades. Our main objective was to compare patients' characteristics, microbiology and prognosis according to the site of acquisition.

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2. Patients and methods

2.1. Setting and study design

This study was performed at the Hospital Bellvitge, a 700-bed tertiary care teaching institution in Barcelona, Spain. The hospital does not have pediatric, obstetric or burn wards.

Over the past three decades, information on all patients with bloodstream infection has been collected in a prospective database which contains data on patients' baseline characteristics, clinical presentation and source of bacteremia, microbiologic data, and outcome.

3. Patients' characteristics, microbiological studies and definitions

All patients with SA and bacteremia who were attended at our institution from 1985 to 2013 were analyzed. The study included both patients with an SA focus as the source of bacteremia (defined as "primary" bacteremic SA) and patients with bacteremia from a distant focus, in whom the SA was the result of a septic metastasis (defined as "secondary" bacteremic SA). Specifically, the location of SA, the number of joints involved, and the presence of joint prosthesis were recorded. In view of the recent epidemiology of bacteremic osteoarticular infection [5] and in order to analyze a representative sample of SA cases according to the site of acquisition, we decided to exclude intravenous drug users from the study because this young population presents its own particular pattern of osteoarticular infections which are almost exclusively community-acquired [12–14].

Blood samples were cultured following the standard recommendations by the automated Bactec method with both aerobic and anaerobic media (current Bactec FX system, Becton-Dickinson Microbiology Systems, USA). Microorganisms were identified and their antibiotic susceptibility was assessed using standard biochemical reactions, disk-diffusion, and the MicroScan system (Dade Behring, West Sacramento, CA, USA). Antimicrobial susceptibility was defined according to CLSI criteria [15]. We applied the definitions for multidrug-resistant and extensively drug-resistant microorganisms described by Magiorakos et al [16].

SA cases were defined according to the modified criteria used by Newman [3]. All cases included met at least one of these two criteria: i) isolation of a pathogenic microorganism from an affected joint; or ii) isolation of a pathogenic organism from another source (blood) in the context of compatible clinical picture of SA (inflammatory local signs). In addition, PJI was defined by the isolation of a pathogenic microorganism from two or more surgical, joint-aspirated or blood cultures, or by one such positive culture plus the presence of typical signs and clinical symptoms (inflammatory signs, the presence of a sinus tract or purulence around the prosthesis during surgery) [1,3]. According to our protocol, arthrocentesis is routinely performed to obtain synovial fluid samples and a pair of blood cultures is obtained for microbiological analyses; in cases in which the process affects joints with difficult access (i.e., the axial skeleton) only blood cultures are initially taken.

Joint involvement was divided into "peripheral" (joints of the appendicular skeleton) and "axial". Specifically, axial SA cases were those that involved joints forming part of the axis of the skeleton: acromioclavicular, sternoclavicular, sternocostal, pubic symphysis and sacroiliac (obviously, cases of spondylodiscitis were not considered).

Cases of bacteremia by *Neisseria* sp. (*Neisseria meningitidis* and *Neisseria gonorrhoeae*) were not considered, so as to avoid the inclusion of patients with reactive arthritis. Cases of interapophyseal arthritis were excluded because their diagnosis is mainly confirmed by the use of magnetic resonance imaging, which was only available for part of the study period [17]. Microbiology was always identified by blood samples, and in most cases by additional local samples obtained from the affected joint. In accordance with the Lancefield and Sherman classifications, the *Streptococcus* species were divided into two groups: *Pyogenic* (*Streptococcus pyogenes*, *Streptococcus agalactiae*, and *Streptococcus pneumoniae*) and *Other* streptococci (*Streptococcus viridans*, *Streptococcus bovis* and *Streptococcus milleri*, along with the remaining species) [18]. Cases were considered to be nosocomial-acquired (NA), health care-related (HCR) or community-acquired (CA) in accordance with the definitions provided by Friedman et al. [9]; thus, the SA cases recorded prior to that publication were classified retrospectively. Briefly, health care-related SA was defined by a diagnosis obtained from a patient at the time of admission or within 48 h of admission if he/she: i) had received intravenous therapy or specialized nursing care at home in the 30 days before the infection; ii) had attended a hospital or hemodialysis clinic or received intravenous chemotherapy in the 30 days before the infection; iii) had been hospitalized in an acute care hospital for 2 or more days in the 90 days before the infection; or iv) resided in a nursing home or a long-term care facility. Nosocomial-acquired SA was defined by a diagnosis obtained from patients who had been hospitalized for 48 h or longer, and community-acquired SA by a diagnosis obtained at the time of hospital admission or within 48 h of hospital admission in patients who did not meet the criteria for a health care-related SA.

Mortality associated with bacteremic SA (30-day mortality) was considered when the patient died within 30 days of diagnosis of bacteremia with concomitant SA.

4. Statistical analysis

Data were analyzed with SPSS (version 20.0). Continuous variables are expressed as mean ± SD or median and range, according to normality tests; categorical variables are expressed as counts and valid percentages. Comparative analyses were performed with X^2 or Fisher's test for categorical variables, and the Mann–Whitney *U*-test for continuous variables. All tests were two-tailed, and a P value < 0.05 was considered as statistically significant.

5. Results

A total of 35,250 episodes of clinically significant bacteremia were recorded during the period of study. Among these, 273 cases (0.8%) had a concomitant SA; the source of bacteremia was considered "primary" in 200 cases (73%), and "secondary" in the remaining 73 cases (27%). Among the latter, the most frequent initial origins of bacteremia were vascular-catheter infection ($n = 27$, 10%), infectious endocarditis ($n = 20$, 7%), and soft tissue infections ($n = 13$, 5%).

The site of acquisition of SA was classified as: community-acquired ($n = 139$, 51%), nosocomial-acquired ($n = 84$, 31%), and health-care related ($n = 50$, 18%). Differences in the source of bacteremia regarding the site of acquisition were observed between primary and vascular-catheter foci (which represented 81% and 0% of community-acquired cases, 69% and 21% of nosocomial-acquired cases, and 62% and 18% of health care-related cases respectively; $P < 0.001$ and $P = 0.05$).

SA occurred more frequently in male patients (56%), and the median age was 67 years (IQR 55–77). The most frequent baseline conditions are presented in Table 1. Older and more fragile patients with SA were more likely to have nosocomial or health care-related sites of acquisition. Nosocomial-acquired and health care-related cases were more likely than community-acquired cases to present relevant risk factors for SA such as immunosuppressive therapy, chronic renal insufficiency or prosthesis infection.

The location of SA also differed depending on the site of acquisition: while in community-acquired and health care-related cases the location was similar (peripheral joints in 76% and the axial skeleton in 24%), in nosocomial-acquired cases it was mainly the peripheral joints (92% vs 8% for the axial skeleton; $P = 0.003$ and $P = 0.01$, respectively) (Table 1). The higher number of PJIs acquired in the hospital environment was responsible for the differences in the overall percentage of peripheral joint SA between nosocomial-acquired and community-acquired or health care-related cases ($P < 0.001$ and $P = 0.005$