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Thirty-day mortality in UK patients with community-onset and hospital-acquired meticillin-susceptible *Staphylococcus aureus* bacteraemia

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SUMMARY

Background: The difference in mortality between patients with community-onset and hospital-acquired *Staphylococcus aureus* infections has rarely been described and where it has, results have been conflicting.

Aim: To determine 30-day mortality in consecutive patients with meticillin-susceptible *Staphylococcus aureus* (MSSA) bacteraemia and the association between community-onset infection and outcome.

Methods: From August 2007 to July 2011, demographic, clinical and microbiological data were prospectively collected on patients with MSSA bacteraemia. Patients were followed until death, hospital discharge or recovery from infection. Multivariate logistic regression was used to determine the association between community-onset infection and 30-day mortality.

Findings: A total of 403 bacteraemic episodes occurred in 392 patients. Overall, there were 44 deaths (11.2%; 95% confidence interval: 7.9–14.0%) at 7 days and 101 deaths (25.8%; 21.5–30.4%) at 30 days. The difference in 30-day mortality between patients with community-onset and hospital-acquired infection was 71/256 (27.7%) versus 31/147 21.1%). Community-onset infection more frequently caused infective endocarditis (13/14, 92.9%), vertebral osteomyelitis (12/13, 92.3%) and skin and soft tissue infection (61/71, 85.9%) whereas intravascular catheter-associated infections were predominantly hospital-acquired (60/82, 73.2%). Age, Pitt score, Charlson comorbidity index (CCI), specific sites of infection (skin and soft tissue, lower respiratory tract and peripheral joints) and delay in appropriate treatment were strongly associated with 30-day mortality. In multivariate analysis, after adjustment for age, CCI and delay in appropriate treatment, community-onset infection was strongly associated with 30-day mortality (odds ratio: 1.59; 95% confidence interval: 0.91–2.80).

Conclusions: Compared with hospital-acquired MSSA bacteraemic infection, community-onset infection was associated with worse 30-day outcomes. Hospital-acquired MSSA bacteraemic infections were rarely metastatic, frequently associated with medical devices and patients had better outcomes.

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Introduction

Staphylococcus aureus is a frequent cause of bacteraemia and associated with significant morbidity and mortality.[1–11] Where meticillin-resistant *S. aureus* (MRSA) and meticillin-susceptible *S. aureus* (MSSA) have been studied together, 30-day mortality ranges from 6.8% in Iceland to 43.6% in Turkey.[1,2] The effect of meticillin resistance on outcomes has been described for both community-onset and hospital-acquired infection with a trend towards worse outcomes with meticillin resistance.[3,4] Other factors associated with poor outcomes include age, underlying comorbidities, presence of shock, site of infection, persistent bacteraemia and glycopeptide use.[2,5–11] The difference in mortality between patients with community-onset and hospital-acquired *S. aureus* infections has rarely been described, and where it has, results have been conflicting.[7,12,13] With the exception of a Swiss cohort study demonstrating an association between community-onset bacteraemia and metastatic infection, the differences in sites of infection that cause community-onset and hospital-acquired bacteraemia have rarely been described.[7]

In view of the Swiss findings, and our own perceptions locally, we hypothesized that community-onset MSSA bacteraemia, compared with hospital-acquired MSSA bacteraemia, was more likely to be associated with severe metastatic infection and worse 30-day outcomes.[7] The principle aim of this study, therefore, was to determine outcomes in consecutive patients with MSSA bacteraemia and to examine the association between 30-day mortality and community-onset infection. We also describe the differences in sites of infection between community-onset and hospital-acquired bacteraemia.

Methods

Study setting

The study was undertaken at Barking, Havering and Redbridge University Hospitals NHS Trust (BHRUT). This is comprised of Queen's Hospital, a 900-bedded major acute hospital, and King George Hospital, a 600-bedded local district hospital. BHRUT serves an elderly and ethnically diverse population of 750,000 patients in Essex, adjacent to East London. In addition to general surgery, medicine, paediatric and maternity services, BHRUT has 30 high-dependency and critical-care beds (including neurosurgical beds), a specialist ward for haematology and oncology patients and a high level neonatal intensive care unit.

Study population

From August 2007 to July 2011, consecutive inpatients with significant MSSA bacteraemia were prospectively studied.

Definitions

Significant bacteraemia was defined as a blood culture isolate, unlikely to be an environmental or skin contaminant, obtained from a patient with a compatible clinical syndrome. This decision was based upon the patient's history, examination findings, response to antimicrobial treatment, blood culture isolate and bacterial cultures from other body sites. Community-onset bacteraemia was defined as a positive blood culture obtained within 48 h of hospital admission and included healthcare-associated infections. A positive blood culture obtained more than 48 h after hospital admission was defined as hospital-acquired. Specialties at time of treatment of bacteraemia were medicine, surgery, critical care, obstetrics and gynaecology, and paediatrics. Resistance profiles for MSSA were classified as fully susceptible, macrolide resistant, or multiply drug resistant.

For hospital-acquired bacteraemia, sites of infection were defined according to the Centers for Disease Control and Prevention surveillance definitions.[14] For community-onset infections, sites were classified as infective endocarditis (native or prosthetic valve), pacemaker endocarditis, osteomyelitis (vertebral or non-vertebral column), peripheral joints (native or prosthetic), skin and soft tissue (SSTI), including surgical site infection, urinary tract infection (catheter- or non-catheter-associated), lower respiratory tract infection (LRTI), central venous catheter (CVC), peripheral venous catheter (PVC), and other. Identification of site of infection was made on clinical grounds, supported by radiological imaging or bacteriological cultures. Duke's criteria were used to classify endocarditis. Bacteraemias in patients with an unknown source were classified as undefined. Subsequent bacteraemic episodes were defined as an infection with the same organism occurring more than 14 days after the first episode. If the same organism was isolated from the same patient within 14 days, then only the last bacteraemic episode was analysed.

Appropriate treatment was defined as any component of an antibiotic regimen, empiric or definitive, used to treat an infection to which the organism was susceptible *in vitro*.[15] The first day was defined as the day a significant blood culture was taken from the patient. Patients were treated empirically according to the local antibiotic policy. Once sites of infection had been determined and susceptibility profiles known, antibiotic treatment regimens were rationalized to narrow-spectrum agents.

Data collection

Physicians were advised to obtain blood cultures from patients presenting with symptoms and signs suggestive of sepsis before administration of empirical antibiotics.[16] Demographic, laboratory and clinical data were collected on all inpatients with significant MSSA bacteraemia following hospital admission. Five consultant microbiologists, covering five different areas and making individual judgements, reviewed case notes within 72 h of laboratory confirmation. In addition to demographic data, specialty at the time of bacteraemia, site of infection, organism, susceptibility profile, delay in appropriate treatment, Pitt bacteraemia score, Charlson comorbidity index (CCI) and outcomes were recorded. The Pitt bacteraemia score is a validated index used to quantify severity of infection, based upon mental status, need for ventilation and vital signs.[17,18] Patients were followed until death, hospital discharge or recovery from infection. All-cause outcomes were recorded as survived or died at 7 and 30 days. It was assumed that patients who were discharged prior to 7 and 30 days survived until 30 days.