Community-Acquired Methicillin-Resistant *Staphylococcus aureus* in the Suburban Hand Surgery Patient Population

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Abstract Methicillin-resistant *Staphylococcus aureus* (MRSA) is a frequent cause for patients to present to a physician's office or emergency department. We observed increasing numbers of community-acquired MRSA infections in patients admitted to the hand surgery service at our suburban academic center. It is an important issue as unsuspected community-acquired MRSA hand infections can be admitted to the hospital, inadequately treated, and allowed for nosocomial spread. This study was performed to examine the trend in the incidence of community-acquired MRSA infections in patients admitted to the hand surgery service in order to sensitize practitioners to have a high index of suspicion for this entity and promote early recognition and treatment of this organism. A multihospital retrospective chart review was undertaken to compare the total number of community-acquired MRSA infections in our hospital as well as the number in patients admitted to the hand surgery service with community-acquired MRSA from 2000 through 2008. Statistical analysis was provided by linear regression. Two community-acquired hand MRSA infections were treated in 2000, as compared to three in 2001 and 2002, four in 2003, five in 2004, six in 2005, 14 in 2006, 13 in 2007, and ten in 2008. This increase was

statistically significant ($p=0.038$). This retrospective review documents a rapidly rising number of community-acquired MRSA hand infections in the suburban environment. The hand surgeon must be aware of the increased prevalence of this entity to adequately combat this organism and prevent prolonged hospital stays, expanded morbidity, and inflated treatment costs.

Keywords Methicillin-resistant *Staphylococcus aureus* (MRSA) · Postoperative infection · Community-acquired MRSA hand infections · Plastic surgery hand patients

Introduction

Methicillin-resistant *Staphylococcus aureus* (MRSA) is a frequent cause for patients to present to a physician's office or emergency department. The incidence of MRSA infections has increased exponentially from 2.4% in 1975 to 29% in 1991 in the USA [7]. More recently, it has been suggested that approximately 0.8% (2.3 million people) of the US population is colonized with MRSA [6]. To date, little has appeared in the surgical literature regarding the incidence of MRSA in the hand surgery patient. The focus of this paper was to examine trends in community-acquired MRSA treated by the hand surgery service at a suburban academic community hospital and identify systems adopted by the network to facilitate early recognition and treatment of this organism.

Materials and Methods

Approval was obtained from our Institutional Review Board to perform a chart review on unidentified data. A

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multihospital retrospective chart review was undertaken to define the incidence of community-acquired MRSA infections in patients admitted to the hand surgery service. The hospital database queried for this study yielded 9 years worth of data pertaining to MRSA infections at three suburban hospital sites within the same system. The database afforded the researcher the ability to quickly review the MRSA infections and determine whether they were community-acquired or nosocomial in nature. Individual chart review was necessary to determine which infections were localized in the hand versus those found in other anatomic locations and to document patient demographics. Only community-acquired infections of the hand were selected. Appropriate charts were reviewed from 2000 through 2008. Statistical analysis was provided by linear regression modeling with significance set at $p < 0.05$.

Results

From the charts reviewed from 2000, community-acquired MRSA hand infections were evident in just two patients. However, a review of patient records in subsequent years revealed three cases for both 2001 and 2002, four cases in 2003, five cases in 2004, six cases in 2005, 14 in 2006, 13 in 2007, and ten in 2008 (Table 1). Linear regression analysis determined that the trend of increasing incidence of MRSA hand infections was significant over time ($p = 0.038$; Fig. 1). Evaluation of patient demographics documented associated conditions to be diabetes, puncture wounds, kitchen-related burns, insect bites, altercations, and IV drug use but did not identify any single common factor associated with later presentation for an MRSA infection of the hand. There were no work-related injuries associated with MRSA hand infections.

Table 1 Hospital admissions for community-acquired MRSA infections.

Year	No. of hand infections	Total no. of MRSA-cultured infections	Percent of admissions for hand infections
2000	2	69	2.9
2001	3	69	4.3
2002	3	154	1.9
2003	4	105	3.8
2004	5	165	3.0
2005	6	170	3.5
2006	14	163	8.6
2007	13	159	8.2
2008	10	175	5.7

Figure 1 Linear regression defining the best-fitting trend line for incidence of MRSA hand infections. The slope of this line is positive and significantly different from zero ($p = 0.038$).

Discussion

The increasing prevalence of MRSA is becoming a public health challenge in the USA. Based on data from 1999 to 2000, Kuehnert et al. [5] surmised that *S. aureus* infection occurred in 9.13 of every 1,000 hospital discharges with the overall rate of MRSA of 42.3%. By 2003, Klevens et al. [4] noted that in the National Nosocomial Infections Surveillance System, the proportion of MRSA in intensive care units had increased from 35.9% to 64.4% over the course of a decade. Recently, Kiran et al. [3] have attested to an increase in MRSA in the urban hand surgical patient.

The incidence of MRSA among hospitals varies greatly from one geographic location to another. In Denmark, only 0.1% of *S. aureus* strains are resistant to methicillin, and Switzerland exhibits resistance of just 1.8%, whereas in other areas, such as France, *S. aureus*-resistant strains account for greater than 30% of this bacteria [7]. Recent estimates in the USA suggest that 0.8% of the US population is colonized with MRSA [6].

It is common for MRSA to spread quickly in the hospital among patients with various susceptibilities, such as immune systems compromised by illness or chemotherapeutics, breaks in epithelial barriers, and cross-infection from both patient to patient as well as physician to patient [8]. MRSA has a unique mechanism of resistance. Many Gram-positive organisms quickly developed enzymes, so-called B-lactamases, to destroy the B-lactam rings of penicillins and acquire resistance. However, methicillin becomes inactivated by the organism's ability to alter its cell membrane penicillin-binding proteins, thus, preventing binding of the drug to the organism [9].

Once unsuspected MRSA infections are admitted into a hospital environment, it becomes very difficult to eliminate the organism from the facility. In fact, it has been well

documented that once MRSA has been introduced into a facility, the incidence of MRSA infections in a hospital increases dramatically [7]. A documented hospital outbreak of MRSA was reported in which 27 isolates of the resistant organism were discovered and 17 of those were from the plastic surgery ward. Their results concluded that the MRSA outbreak initiated in the plastic surgery ward before spreading throughout other wards [1]. Another such case of a hospital outbreak of MRSA was presented whereby the authors were able to attribute it to contaminated hydrotherapy equipment used in a plastic surgery or burn unit [2].

Our study clearly delineates the rising incidence of community-acquired MRSA infections in the suburban hand surgery patient, supporting the findings of Kiran et al. [3] in the urban environment. The importance of this study's findings must not be overlooked in our daily practices. In Pennsylvania, a recent legislation (The Health Care-Associated Infection Prevention and Control Act, Act 52) mandates that all nursing-home patients and other high-risk patients admitted to acute care facilities be cultured and screened for MRSA to establish colonization or infection. At our institution, we also categorize patients admitted to critical care units as high risk and, therefore, require the same MRSA screening. Furthermore, in the routine review of our records, it became apparent that the diagnosis of MRSA was not always made with the benefit of a documented wound culture. As stated previously, patients admitted to the hospital with unrecognized MRSA can result in delay of therapy and serve as a reservoir for potential nosocomial transmission. If proper contact precautions are not instituted, the healthcare facility increases its risk for nosocomial spread of MRSA and potential outbreaks of infection. The societal impact of this is significant as the unsuspected MRSA-infected patient contributes to the community and institutional spread of MRSA leading to the need for much more extensive use of highly selective antibiotic regimens directed at this virulent pathogen. The value of active surveillance for MRSA, therefore, in terms of quality of care and cost control, cannot be overstated.

In the absence of universal MRSA screening for all patients admitted to a healthcare facility, clinicians must retain a high level of suspicion that soft tissue wounds may be infected with a resistant organism, specifically MRSA. Our practitioners are sensitized to culture any wound, particularly when there has been little healing or progress using first-generation antibiotic therapy. Standard precautions, including strict hand hygiene along with glove and gown use when coming in contact with wounds, are strictly enforced and monitored by the Infection Control and Prevention Department. Patients with identified MRSA infections are isolated in a private room.

Our Infection Control and Prevention Department also conducts surveillance for all cases of antibiotic-related infections, i.e., *Clostridium difficile*, vancomycin-resistant enterococci, and certain multidrug resistant Gram-negative bacilli in addition to MRSA. Surveillance efforts include daily review of microbiology reports utilizing an electronic data mining system as well as daily rounds on patient care floors to review charts and discuss potential cases with clinical personnel and infectious disease physicians. Surveillance data are analyzed utilizing statistical process control charts (SPCC). When SPCC demonstrates a significant variance or when a cluster of infections is identified in a unit, an immediate investigation is conducted by the infection control and prevention practitioners. Outbreak investigations involve an exhaustive review of patient risk factors, infection control measures, and environmental practices. An action plan is created to address deviations from accepted practices or opportunities for improvement that were identified in the review process.

It is, therefore, incumbent upon the practicing hand surgeon to be aware of this increased presence of MRSA in the hand patient population. It is our responsibility to have a high index of suspicion, obtain necessary cultures, take appropriate contact isolation precautions, and involve our infectious disease colleagues early in the treatment process to adequately combat the organism early and prevent prolonged hospital stays, expanded morbidity, and inflated cost of therapy.

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