LETTERS TO THE EDITOR

Prevalence of Nasal Carriage of *Staphylococcus aureus* and Susceptibility of Isolates to Methicillin and Mupirocin Among Healthcare Workers in an Iranian Hospital

TO THE EDITOR—*Staphylococcus aureus* has long been recognized as an important pathogen that causes human disease. Despite the use of antibiotic therapy, staphylococcal infection occurs regularly in hospitalized patients and has severe consequences. Therefore, the increased resistance of *S. aureus* to antimicrobials is a cause for concern. *S. aureus* infection often is difficult to treat, because many methicillin-resistant *S. aureus* (MRSA) strains are also resistant to multiple other drugs.[1]

The ecological niche of *S. aureus* strains is the anterior nares. Studies have shown that the nares is the area from which this organism can be isolated most consistently. Healthcare workers (HCWs) constitute an important reservoir of *S. aureus*. Several studies have reported that the rate of nasal carriage of *S. aureus* among HCWs ranges from 16.8% to 56.1%.[2]

The control of MRSA transmission relies on rapid and sensitive detection of carriers.[3-5] Mupirocin is used for the treatment of staphylococcal nasal colonization in HCWs. The detection of resistance to mupirocin among MRSA isolates recovered from HCWs who are nasal carriers is very important.[3] The aim of the present study was to determine the prevalence of nasal carriage among HCWs at Milad Hospital (Tehran, Iran) and to determine the susceptibility of the isolates recovered to various antibiotics, including methicillin and mupirocin.

Milad Hospital is the largest hospital in Iran, with 1,000 beds. In a study conducted from July 2002 through November 2002, we asked 1,000 HCWs in the hospital to undergo screening for nasal carriage of *S aureus;* 774 HCWs (77.4%) agreed to participate. Nasal specimens were obtained by inserting moistened cotton swabs into both anterior nares and rotating them 5 times. Swabs were plated onto mannitol salt agar and were incubated at 35°C for 48 hours. Organisms with yellow colonies (indicating mannitol fermenters) were suspected of being *S. aureus*. Subcultures were done on sheep's blood agar for pure isolation and for the study of hemolysis. *S. aureus* isolates were identified by use of Gram stain and other conventional methods, such as catalase, rapid slide, and tube coagulase tests.[3]

Antimicrobial susceptibility testing was performed according to NCCLS guidelines by use of the diffusion method.[4] The zone-diameter break points for susceptibility and resistance to mupirocin (Mast Diagnostic) were 14 mm or more and 13 mm or less, respectively.

Of 1,000 HCWs, 774 (77.4%) participated in our study. The mean age of participants was 25 years; 239 participants (30.8%) were men, and 535 participants (69%) were women. Of the 774 HCWs, 241 (31.1%) were nasal carriers of *S. aureus* (Table). Of the 241 nasal carriers, 149 (61.8%) were women, and 92 (38.2%) were men. There was a significant difference between the sexes with regard to rates of carriage.

The frequency of *S. aureus* carriage also varied between different departments. For example, 45% of HCWs in the clinics of the hospital were carriers of *S. aureus,* whereas only 5% of HCWs in the pediatric department were carriers. An important finding of this study was the differing rate of detection of nasal carriers in the intensive care units and the operating rooms. Of 104 HCWs in intensive care units, 29 (27.8%) were carriers of *S. aureus,* whereas, of 182 HCWs in operating rooms, 65 (35.7%) were nasal carriers of *S. aureus.* The frequency of nasal carriage in other department was different as well.

Susceptibility testing for all isolates was performed according to methods recommended by the NCCLS.4 Ninety-seven percent of all isolates were resistant to penicillin. The rate of resistance to erythromycin was 9.5%, that to gentamycin-clindamycin was 9%, that to trimethoprim-sulfamethoxazole was 40.5%, that to cholramphenicol was 7.51%, and that to ciprofloxacin was 5.4%. The rate of resistance to methicillin was low (ie, 35% of isolates). All MRSA and methicillin-susceptible *S. aureus* isolates were also susceptible to mupirocin and bacitracin.

The ecological niche of *S. aureus* is the anterior nares. Screening for carriage of MRSA is fundamental to nosocomial

TABLE. Prevalence of Nasal Carriage of *Staphylococcus aureus* Among Healthcare Workers in Milad Hospital (Tehran, Iran), by Ward

Ward	No. of *S. aureus* isolates / total no. of isolates (%)
Intensive care unit	29/104 (27.8)
Operating room	65/182 (35.7)
Emergency department	12/42 (28.57)
Gynecology	22/70 (31.42)
Delivery room	9/23 (39.1)
Central sterilization room	7/20 (35)
Internal medicine	9/27 (33.33)
Endoscopy, bronchoscopy, and colonoscopy	4/20 (20)
Day care	7/20 (35)
Surgery	11/38 (28.94)
Critical care unit	22/66 (33.33)
Pediatric	1/17 (5.88)
Clinics	14/31 (45.16)
Orthopedic	12/41 (29.26)
Urology	7/26 (26.9)
Miscellaneous	10/47 (21.27)
Total	241/774 (31.1)

https://doi.org/10.1086/501153 Published online by Cambridge University Press

infection control practices, including epidemiological surveys and day-to-day decisions.[2] In the present study, nearly 31% of HCWs were carriers of *S. aureus*. The prevalence and incidence of *S. aureus* carriage has varied in different Iranian studies. In a study by Hashemi et al.[5] conducted at Sina Hospital (Hamadan, Iran), 31.7% of HCWs were carriers of *S. aureus*. In 2 other studies,[5] conducted at 2 different hospitals in Tabriz, Iran, 36% and 42% of HCWs were carriers of *S. aureus*. Our other study,[6] which was conducted at Imam Khomeini Hospital (Urmia, western Azatbaijan, Iran), revealed that 40% of HCWs were nasal carriers of *S. aureus*. The prevalence of nasal carriage of *S. aureus* in other countries is also different. For example, in a study conducted in India by Verghese et al.,[7] 724 nasal swab specimens were obtained from HCWs in a cardiovascular tertiary-care center, and 18.23% of the HCWs were found to be nasal carriers of *S. aureus*. In other study conducted in Saudi Arabia by Alghaithy et al.,[8] 25.45% of 279 HCWs were carriers of *S. aureus*. In that study, there was no significant difference in the prevalence of nasal carriage of *S. aureus* among HCWs and individuals from the community. Differences in the prevalence of nasal carriage of *S. aureus* may be due, in part, to differences in the quality and size of samples and the culture methods used to detect *S. aureus*.

The rate of MRSA carriage in the present study was 35%; however, other studies conducted in Iran have revealed a higher rate of MRSA carriage. In our hospital, nearly 40% of *S. aureus* isolates recovered from HCWs in the intensive care unit and in the neonatal intensive care unit were resistant to methicillin. The majority of MRSA isolates found in our hospital were recovered from tracheal tubes and wounds. A reason for the difference in the prevalence of MRSA could be the different techniques used for the detection of MRSA. Unfortunately, many laboratories do not use standard methods for susceptibility testing,[9] and oxacillin antibiotic disks used for the detection of MRSA are of poor quality.

To our knowledge, the present study is the first Iranian study to evaluate the susceptibility of *S. aureus* to mupirocin. All the *S. aureus* isolates that we recovered from nasal carriers, including MRSA and methicillin-susceptible *S. aureus*, were susceptible to mupirocin. We also isolated many *S. aureus* strains from other clinical specimens (eg, urine, wounds, tracheal aspirates, and blood), and all the isolates that we recovered were susceptible to mupirocin. We do not have any published data on the resistance of *S. aureus* to mupirocin in Iran, possibly because the use of mupirocin in Iran is limited. Many laboratories also do not have access to mupirocin disks. In our hospital, we use mupirocin only for the eradication of *S. aureus* in nasal carriers. There are a limited number of agents available for the eradication of mucosal colonization with *S. aureus*. Topical calcium mupirocin, an agent with bactericidal activity, has been used successfully to eradicate nasal and hand staphylococcal colonization in patients and HCWs. Eradication of colonization reduces the subsequent infection rate in patients undergoing hemodialysis or cardiothoracic surgery and in individuals with recurrent skin infections. In vitro resistance to mupirocin among MRSA strains has long been associated with the use of nasal mupirocin ointment.[10,11] Alternate therapies include the use of bacitracin, either in combination with trimethoprim-sulfamethoxazole and rifampin or as a single agent.[12] In our study, all isolates were susceptible to bacitracin.

In conclusion, we found that all isolates of *S. aureus* recovered from the nares of HCWs were susceptible to mupirocin and bacitracin. Mupirocin has often used for eradication of nasal carriage of *S. aureus* among HCWs.

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Infect Control Hosp Epidemiol 2006; 27:323-325

 0899-823X/2006/2703-0021$15.00.

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The Growth of Infection Control, Impact of *ICHE,* and Challenges Ahead

TO THE EDITOR—In preparing for the president's address at the 2005 Society for Health Care Epidemiology (SHEA) Annual Meeting, I sought to measure the growth of infection control as a field of endeavor, determine the impact of *Infection Control and Hospital Epidemiology (ICHE),* and record our past leaders' opinions about the success of SHEA and its future challenges. Using Science Citation Index Expanded (SCIE), I performed a literature search in March 2005 for published articles written in any language, using "infection control" as the subject search term. A comparison of hits during 5-year increments from 1990 through 2004 revealed a nearly a 3-fold incremental increase in the number of infection control–related articles that were published (Figure 1). It takes a few years before key articles become widely known and cited in the literature. SCIE was searched using "Infect Control Hosp Epidemiol" as the cited-work search term starting in 1985 to determine how often articles published in *ICHE* appeared in bibliographies of articles in print. A comparison of hits during 5-year increments revealed that, between 1985 and 1999, there was greater than a 2-fold incremental increase in the citation of articles published in *ICHE* (Figure 2). Together, these data suggest that infection control as a field of scientific endeavor is growing steadily and that, in addition to the known impact factor of *ICHE,* publications in our society's journal are read and quoted with increasing frequency.

I queried the 24 past SHEA presidents and used a modified Delphi process to analyze their insight into the accomplishments of and future challenge for our society. When the past SHEA presidents were asked to report SHEA's most important contribution during the last 25 years, the consensus opinion was (1) the identification of infection control and healthcare epidemiology as a discipline, (2) the inauguration of the SHEA Annual Meeting, and (3) the creation of *ICHE.* When they were asked to report the greatest future challenge for SHEA, the consensus was to further enhance a rigorous evidence-based approach to this discipline.

Infection control and healthcare epidemiology is undeniably an established and growing field of endeavor that is in step with the steadily increasing impact of our society's journal. To continue the momentum, we must share our enthusiasm with medical, nursing, and public health students, as well as nurses and house staff; nurture SHEA fellows; and remain true to ourselves.

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Infect Control Hosp Epidemiol 2006; 27:325

 0899-823X/2006/2703-0022$15.00.

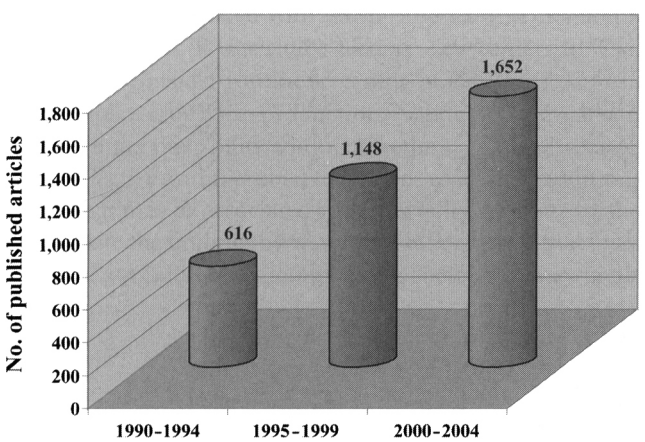

FIGURE 1. The number of published articles revealed during a search of Science Citation Index Expanded with "infection control" as the search term.

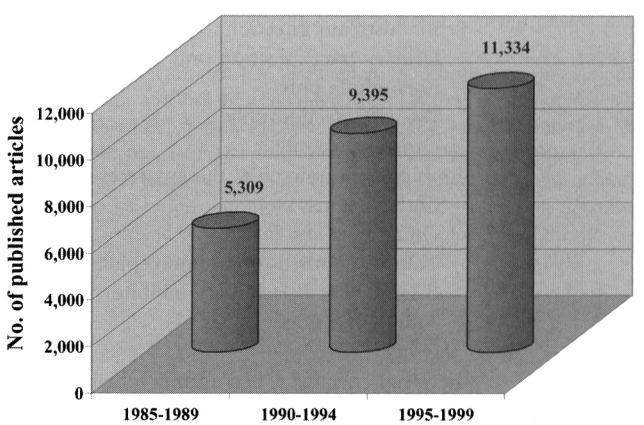

FIGURE 2. The number of published articles revealed during a search of Science Citation Index Expanded with "Infect Control Hosp Epidemiol" as the search term.