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Original Contributions

THE PREVALENCE OF METHICILLIN-RESISTANT *STAPHYLOCOCCUS AUREUS* ON INANIMATE OBJECTS IN AN URBAN EMERGENCY DEPARTMENT

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□ **Abstract—Background: There is a rising prevalence of both hospital-acquired and community-associated strains of methicillin-resistant *Staphylococcus aureus* (MRSA) infections. Both strains are found in patients presenting to emergency departments (EDs). Objective: The purpose of this study was to identify objects in the ED that might contribute to the spread of MRSA. Methods: This was a cross-sectional prevalence study in which culture swabs were taken from 20 different objects in a large urban ED between May and August 2006. The objects were identified a priori, and included common items found in an ED. Items ranging from computers to telephones, desktop surfaces, security door keypads, and ultrasound probes were included in the study. Each item was cultured twice, on separate days, for a total of 40 samples. The samples were screened for the presence of MRSA, and positive samples underwent additional susceptibility analysis. Results: Only one sample of 40, from the ambulance bay security door keypad, was positive for MRSA. Thus, the prevalence of MRSA was 2.5%. The single strain isolated was resistant to clindamycin, erythromycin, oxacillin, and penicillin. Conclusion: MRSA does not seem to thrive on inanimate objects found in the ED. Routine cleaning measures in an urban ED must include all areas of medical personnel use, including areas outside of the department utilized by non-ED workers. © 2009 Elsevier Inc.**

□ **Keywords—MRSA; infection; emergency department; nosocomial**

INTRODUCTION

Controlling the spread of methicillin-resistant *Staphylococcus aureus* (MRSA) remains a major challenge for health care workers across the country (1–3). Historically, infection control research has centered on the nosocomial spread of hospital-acquired MRSA (HA-MRSA) in intensive care settings (4,5). However, over the past decade, emergency departments (EDs) across America have experienced a dramatic rise in the prevalence of community-associated MRSA (CA-MRSA) in skin and soft tissue infections (6–8). As a result, traditional methods for treating these infections are being altered to adapt to the increase in antibiotic resistance. Individuals colonized with MRSA are at risk of spreading this organism to others. Skin-to-skin spread of MRSA among professional athletes, prisoners, exotic dancers, and child daycare attendees has been well documented (9–12). Outbreaks in the community occur in urban settings, as well as remote locations like rural Alaska (13,14).

As ED crowding becomes increasingly more common, additional attention must be placed on curbing the spread of MRSA within the ED patient population. Busy EDs may contribute to the spread of both HA-MRSA and CA-MRSA. Nurses, physicians, and ancillary staff care for multiple patients infected with MRSA during a single shift, increasing the potential risk of spreading MRSA and other organisms from person to person with direct

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hand contact. Therefore, the importance of hand washing, standard precautions, and isolation protocols becomes paramount when working in a busy ED.

In addition, MRSA may spread indirectly by being transferred via fomites. To date, there are no published studies describing the lifespan of MRSA on inanimate objects. However, "hand touch sites" near patients pose a high risk for patient contamination with MRSA (15). Several studies have shown high rates (14–41%) of MRSA colonization of objects in clinical areas (15). Computer keyboards, faucet handles, and ultrasound probes all have been linked to the spread of MRSA in the intensive care unit (16–18). No comprehensive studies have been conducted regarding the potential for nosocomial spread of MRSA in the ED. The purpose of this study was to identify inanimate objects that may contribute to the transfer of MRSA between patients and health care workers in a busy urban ED.

MATERIALS AND METHODS

This was a cross-sectional prevalence study looking for MRSA on inanimate objects and was conducted in an urban, academic ED. This Level-1 trauma center in Northern California treats approximately 60,000 patients annually, and also serves as the county hospital for a population of 2 million. Sterile culture swab samples were taken from 20 different objects in the ED in May 2006, and then repeated again 4 months later in August. These objects were identified a priori and are detailed in Table 1. These objects were chosen because they are commonly located throughout the ED, including triage, the resuscitation rooms, and in both pediatric and adult patient care areas. In addition, these objects are frequently touched, with potential for exposure to medical staff and patients.

Table 1. List of Emergency Department Items Sampled

Computers
Telephones
Desktop surfaces
Chairs
Wipe-board pens
Sinks
Pyxis® medication dispensers
Electrocardiogram machines
Cardiac monitors
Otoscopes/ophthalmocopes
Curtains
Gurneys
Isolation carts
Security door keypads
Blood pressure cuffs
Thermometer probes
Supply carts
Examination tables
Ultrasound probes
Weight scales

Each object in the study was swabbed for MRSA in the same fashion by a single investigator. The collection of samples adhered to written protocols used by the study site's Infectious Control Department for culturing MRSA. A couple of drops of 0.9% normal saline in sterile capped tubes were first placed on each item. Then a sterile BBL™ CultureSwab™ (BD, Franklin Lakes, NJ) was used to spread the saline around the specimen and collect the sample. The swabs were labeled and sent to the laboratory for further analysis. Trained microbiology technicians from the hospital's laboratory screened the swabs for the presence of MRSA using universally accepted performance standards (19–21). In the laboratory, the swabs were rolled back and forth over a 4-mm-deep, 5% sheep blood agar plate, ensuring that all sides of the swab made contact with the plate. A second 4-mm-deep mannitol salt agar plate (1% mannitol, 7.5% NaCl, Phenol red, peptones) was inoculated in the same manner. Both plates were incubated lid down in an ambient air, 35°C incubator overnight, and then observed for 2 days for any bacterial growth. All positive MRSA samples underwent an oxacillin susceptibility screen, and then proceeded to a susceptibility panel analysis.

All 20 items were cultured twice on separate days, once in May 2006 and again in August, leading to a total of 40 samples. The purpose of this method was to control for variation in hygiene practices of the medical staff as well as the effectiveness of housekeeping services. The samples were taken on two different days, months apart, once on a day shift and once on a night shift. During this study, no attempt was made to elicit the exact length of time that transpired between the cleaning of an object, when it was used or touched, and when it was swabbed. Cultures were carried out randomly by convenience sampling. Furthermore, we did not document the different individual hygiene practices of the staff working those days. Again, these dates were chosen at random without knowing in advance who was scheduled to work.

RESULTS

Among the 40 total cultures collected, only one sample was positive for MRSA. This sample was collected from the ambulance bay security door keypad, which is physically located outside the ED. Only one of the two samples collected from this location was positive for MRSA. The MRSA strain isolated was resistant to clindamycin, erythromycin, oxacillin, and penicillin. None of the other items in the ED were contaminated with MRSA. Thus, the prevalence of MRSA was 2.5% among all samples taken.

DISCUSSION

Contrary to the popular belief that MRSA is omnipresent in EDs, it was very difficult to isolate MRSA on frequently touched objects within this particular urban ED. These results are somewhat surprising considering the increasing prevalence of CA-MRSA skin and soft tissue infections treated in EDs nationwide (6–8). No studies have reliably demonstrated the lifespan of MRSA on inanimate objects in the ED. Although this pathogen may thrive in warm, moist environments like nasal passages or intertriginous skin folds, the open ED environment might be too harsh for the pathogen to survive for extended periods of time.

It was only the ambulance bay security keypad that resulted in a positive MRSA culture. Technically, the security keypad is not physically located inside the ED. It is important to note the high frequency with which this keypad is touched, with high-volume ambulance traffic to this urban, Level-1 trauma center. The keypad is used not only by hospital staff, but also by a multitude of Emergency Medical Services personnel and law enforcement agents. The actual number of times that this keypad was touched during the shift was not recorded in this study. However, the keypad serves as the gateway to triage and all treatment areas for every patient arriving by ambulance. It would seem that this item is one of the most frequently touched objects evaluated in this study.

The fact that the security door keypad in the ambulance bay was positive for MRSA raises interesting questions about controlling the spread of this infectious organism. The importance of hand washing as a means of preventing the spread of infectious disease among patients is standard of care; pre-hospital personnel may not be able to wash their hands as easily, as they have no access to running water and may have to rely instead on alcohol gels. Often, this security keypad is touched by gloved hands that have been involved in patient care. Furthermore, this keypad may not be cleaned at regular intervals because it is outside the ED. Focus on standard precautions and professional cleanliness extends beyond the ED and includes pre-hospital personnel. Cleaning protocols for hospital environmental services should include routine disinfection of areas immediately adjacent to hospital wards and the ED utilized by medical personnel on a daily basis.

Limitations

There are limitations to this study. First, swabs were taken at random times and only on two separate days. Variations in the cleaning habits of hospital staff working those particular shifts may have lead to different outcomes. Sample acquisition on different shifts in different months was done to minimize these effects. However, the exact timing between when an object was cleaned, when it was used or contacted, and when it was swabbed was not quantified. These timing details may have had a dramatic effect on the final culture results. The number of times an object was touched also was not recorded. Moreover, a convenience sample of only 20 ED objects does not represent the ED as a whole and there may be items that might have been positive for MRSA but were not sampled. Financial restraints limited the amount of samples taken. Among the items chosen for the study, there was a relatively diverse sampling of ED equipment and patient care areas. Only one individual collected all of the swab samples, which eliminated variability in data collection technique. Adding normal saline to the samples before swabbing followed institutional guidelines for MRSA swabbing technique but may differ from the methodology employed in other studies. The use of normal saline may have had a positive or negative effect on the yield of MRSA cultures. Strict standards were used in the laboratory to process the cultures, which limited the amount of error seen in the results from a processing standpoint.

Additional studies investigating the prevalence of MRSA and other bacterial pathogens found in EDs need to be conducted. Future research should be carried out in multiple centers, including private, community, health maintenance organization, and county EDs. Culturing medical personnel for MRSA and other organisms raises both ethical issues and questions regarding medical confidentiality and job security. Future studies should quantify the number of times an object is handled and the temporal relationship between cleaning, handling, and swabbing of each item. This study is only a first step in identifying and controlling the spread of antibiotic resistant organisms in the ED setting.

CONCLUSION

The prevalence of MRSA on inanimate objects in the ED does not seem to be as widespread as popularly believed. Both pre-hospital and hospital personnel are responsible for practicing sound infection control protocols and standard precautions. It is recommended that hospital environmental services disinfect all areas of patient care, even areas technically outside of the ED, that are utilized by medical personnel. Only by understanding the life span of MRSA, its transmission on inanimate objects, and its transmission from individual to individual will the medical community be able to reduce the spread of this infectious pathogen among patient populations.

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ARTICLE SUMMARY

1. Why is this topic important?

Methicillin-resistant *Staphylococcus aureus* (MRSA) is a serious problem in the emergency department (ED) with regard to skin infections. Staff may be exposed to and contributing to the spread of MRSA.

2. What does this study attempt to show?

This study focuses on the prevalence of MRSA on inanimate objects in the ED.

3. What are the key findings?

MRSA does not seem to thrive on inanimate objects in the ED. The only object that tested positive for MRSA was a keypad used by pre-hospital, law enforcement, and hospital personnel.

4. How is patient care impacted?

Attention to frequent hand washing, and periodic disinfection of frequently touched objects in the ED should be emphasized.