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Doctor's Pen: Fomite for a Super Bug Methicillin Resistant *Staphylococcus aureus*

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Methicillin Resistant *Staphylococcus aureus* (MRSA) is one of the major pathogen responsible for nosocomial and community acquired infection. High level of MRSA is present on everyday items in hospitals and can be transmitted by the hands of healthcare personnel, materials and articles used in hospitals. The present investigation aimed to determine the contamination of writing pen of doctors with MRSA in hospital environment and to assess the survival of MRSA on three kinds of new pens. Total 100 writing pens used by doctors during patient interaction were swabbed and inoculated on Blood agar. *Staphylococcus aureus* were identified by standard methods. After confirmation by coagulase test, S. *aureus* strains were tested for their methicillin resistance by agar screen method using Muller-Hinton agar containing 6 μg oxacillin/mL and 4% NaCl. To determine the survival of MRSA on pen, three kind of new pens like metal, plastic and pen with rubber grip were smeared with 0.5 McFarland culture of MRSA, incubated and survival was determined at every 3hrs interval. Out of 100 pens analyzed, 60 were found to be contaminated with different bacteria. Gram positive bacteria were isolated from 40 pens. Staphylococci were isolated from 29 pens of which 25 were coagulase positive and 4 were coagulase negative. Out of 25 coagulase positive staphylococci, 7 were resistant to oxacillin (MRSA). MRSA survived up to 48 h on pen with rubber grip, about 30 h on plastic pen and minimum survival i.e. 21 h on pen with metal surfaces. Thus pens can carry bacteria and are fomites.

Key words: MRSA, nosocomial infections, fomites, doctor's pen.

Hospitals are crowded with sick people in close proximity to one another, even though years of work in infection control have shown us that patients pass their microorganisms to those nearby [1,2]. Healthcare-associated infections persist as a major problem in many hospitals. Methicillin Resistant *Staphylococcus aureus* (MRSA) is one of the major pathogen responsible for nosocomial and community acquired infection. *Staphylococcus aureus* is an organism that colonizes the skin, particularly the nose, skin folds, hairline, perineum and navel. Also it is commonly found on many sites of body including the face, hand, axilla and groin. It commonly survives in these areas without causing infection, a state known as colonization. A patient becomes clinically infected if the organism invades the skin or deeper tissues and multiplies[3].

MRSA, first discovered in 1961, is now immune to methicillin, amoxicillin, penicillin, oxacillin, and many other antibiotics[4]. This multiple drug resistant bacteria usually cause nosocomial infections that are associated with much morbidity, mortality and excess health care cost[5]. Hence MRSA is considered as an important nosocomial pathogen worldwide.

Such multidrug resistant nosocomial pathogen can be transmitted by the hands of healthcare personnel, materials and articles used in hospitals[5]. Articles such as charts, bins, pens, medical notes, phones and computer keyboards, staff aprons and other nonmedical devices may acts as a fomite.

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Research has shown that high level of MRSA is present on everyday items in hospitals [6-11]. The most common route is between patient via doctor or nurse. They can spread MRSA by using such contaminated items during patient interaction. Person to person transmission of microorganisms is well recognized, but the role of fomites in nosocomial infection is not as well understood. Incomplete cleaning of equipment and patient rooms, and medical devices used with multiple patients are well-described means of transmission[12], but little attention has been paid to nonmedical devices as fomites[13]. One of the most important nonmedical fomite is writing implement used by doctors[14, 15, 16]. In ICUs doctors are required to wash their hands and put on new gloves before examining each patient they visit. But very few or no doctors disinfect their writing implements between patients. Although unlike a stethoscope, a pen usually does not directly contact the patient and clinician may not touch the pen until the patient interaction is completed but still a pen can be a fomite. Although procedures and protocols have been developed to reduce the transmission of microorganism responsible for nosocomial infections, eliminating the sources and transmission of those organisms remains a challenge. Thus the present investigation was aimed at the determination of contamination of writing implements of doctors with MRSA in hospital environment and to assess the survival of MRSA on three kinds of new pens.

MATERIALS AND METHOD

Total 100 writing pens used by doctors during patient interaction were studied for Staphylococcal contamination. Samples collected from male and female doctors from different wards and OPDs are depicted in figure 1. The swabs were taken aseptically by using sterile cotton swab moistened with saline. The collected samples were inoculated on blood agar and Mac Conkey agar plates. After incubation plates were examined for bacterial growth. The bacteria were identified by using standard methods[17]. Staphylococcal isolates were subjected to coagulase test to differentiate *Staphylococcus aureus* from other Staphylococcal species. After confirmation *Staphylococcus aureus* strains were tested for their methicillin resistance by agar screen method using Muller-Hinton agar containing 6 µg oxacillin/mL and 4% NaCl[17].

To determine the survival of MRSA on pen, three kind of new pens like metal, plastic and pen with rubber grip were employed. Saline suspension of MRSA adjusted to McFarland 0.5 standard was prepared and 0.01 mL of this suspension was smeared on pen (6 pen of each type). Inoculated pens were kept at 37^0C and examined for surviving bacteria. All pens were swabbed from different surface with sterile cotton swab by moistened with saline after equal interval of 3 hours. Swabs are inoculated on blood agar plates and kept for incubation at 37^0C for 24 h and observed for the presence of bacterial growth.

RESULTS

Out of 100 pens analyzed, 60 were found to be contaminated with different bacteria. Gram positive bacteria were isolated from 40 pens. Staphylococci were isolated from 29 pens of which 25 were coagulase positive and 4 were coagulase negative. Out of 25 coagulase positive staphylococci, 7 were resistant to oxacillin (MRSA). Total 58 samples of pens were collected from male doctors. Out of these 27 (46.55%) were colonized with Gram positive organisms, of which 20 (34.48%)

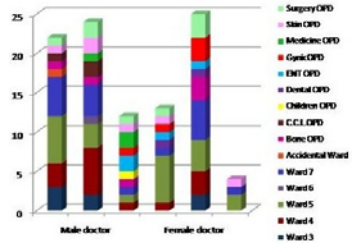

Fig. 1. Samples collected from different OPDs and wards of hospitals and from male and female doctors

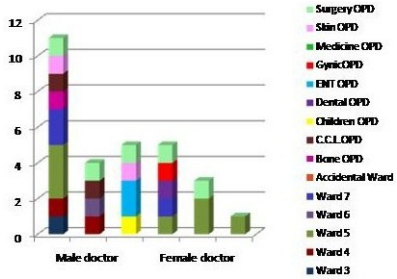

Fig. 2. Contamination of pens with *S. aureus* collected from male and female doctors from various wards and OPDs

were contaminated with *S.aureus* and 5 (8.62%) were MRSA. Total 42 samples of pens were collected from female doctor, of which 13 (30.95%) were colonized with gram positive organisms, 9 (21.42%) were contaminated with *S.aureus* and 2 (4.76%) were contaminated with MRSA.

New pens were deliberately contaminated with MRSA to determine extent of survival. MRSA survived up to 48 h on pen with rubber grip, about 30 h on plastic pen and minimum survival i.e. 21 h on pen with metal surfaces.

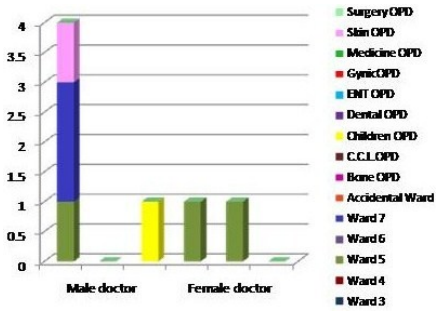

Fig. 3. Contamination of pens with MRSA collected from male and female doctors from various wards and OPDs

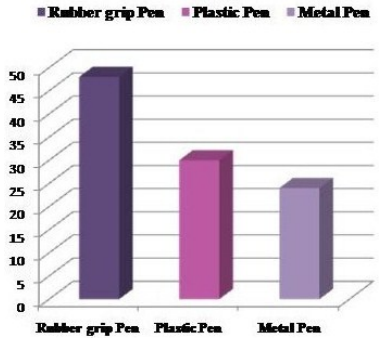

Fig. 4. Survival of MRSA on three kinds of pen

DISCUSSION

The study indicates that the pens used in hospitals can be contaminated with pathogenic bacteria like MRSA. And it can survive on pen for about 24 h depending on surface. Several factors such as duration of usage, type of pen, number of person using the pen may influence the rate of contamination of pens. This study also showed that the *S. aureus* survives longer on rubber grips of the pens and minimum survival on pens having metal surfaces. This is in agreement with the findings of previous study[18].

In present study the method used for the collection of microbes was swabbing the surface of pen used. It may not have collected all cultivable bacteria. However, considering the differences in pen shape and sizes, it was thought that this sampling technique was the most effective and standard method to sample the entire pen surface area.

The above study indicates that 60% of the pens used by doctors can be contaminated with pathogenic bacteria. Out of which 7 % are MRSA. Total 75 writing pens were studied by Bhat et al, (2009), collected from doctors and nurses from intensive care unit. Out of 75 pen studied, 26 (34.6%) were contaminated with bacteria. They isolated *S. aureus* from six pens, of which two were methicillin resistant.

The doctors working in hospital were not aware they were going to be asked for their pens, and it was observed that they transfer the pen from one person to another during checking the patient in same ward. The pen is presumably colonized, and clinician could be colonized later by touching the pen without gloves, and thus could become a vector for transmission of pathogens and it contaminate objects with his or her hands. This could correspond to more time handling the pen outside the hospitals. This shows how MRSA become community acquired pathogen. The present study most commonly identified microbes were coagulase positive *S. aureus* which is in controversy with previous studies[13].However *S .aureus* is a normal skin flora, though harmless on skin and mucous membranes of healthy individuals, may be pathogen in immunocompromised patients and patients with indwelling medical devices. This is responsible for hospital acquired infection in persons, who even visit the hospital for very short duration.

Out of total 100 samples, 58 were collected from male and 42 from female doctors. Percent contamination was found out to be more in male doctors (46.55) than in female (30.95) doctors. Around 8.62% pens of male doctors were found to be contaminated with MRSA where as 4.76% pens of female doctors were contaminated. This shows that males were more likely to be MRSA carriers than females. Previous study also has found a marginally higher prevalence of MRSA carriage in males. The reason for this male preponderance

needs to be further studied including the possible role of hormones[19].

MRSA has been reported earlier form hospital in various parts of world. There is a need to screen individuals in hospitals for risk exposures and infections, to avoid outbreak and cross infection. Also, studies with large number of medical as well as nonmedical devices, their sizes would help to identify sources of nosocomial infection. In order to reduce the spread of MRSA in health care staff should ensure that they wash their hands thoroughly between patients. Pens can carry bacteria and are fomites. This could be due to the fact that pens, unlike stethoscopes, uniforms and scissors usually do not touch the patient and may not be used until after the clinician-patient interaction. But pens are used both in and outside of the patient room and should therefore be treated as potential fomites and covered in the standard disinfection and contact precaution protocols. One possible infection control procedure is to have a separate writing implement assigned to each patient room.

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