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# Comparison of Methicillin Resistant *Staphylococcus aureus* (MRSA) carriage among Health Care Workers serving in different areas of Cardiac Unit of a Tertiary Care Hospital, India

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**A B S T R A C T**

MRSA has become a leading cause of infections in both the community and in hospitals. Healthcare-associated MRSA (HA-MRSA) are the strains that circulate and are transmitted to individuals within health care facilities. The infected or colonized patients serve as the major reservoirs of MRSA in health care facilities. Transient carriage of MRSA on the hands of health care workers is the predominant mode of transmission from health care workers to patients and further from one patient to other patient. Our aim was to compare the prevalence of MRSA carriage among health care workers serving in different areas (Ward, ICU, Recovery and Emergency) of cardiac unit. This prospective study was conducted in the Department of Microbiology, Dayanand Medical College and Hospital, Ludhiana on 250 health care workers serving in different areas of cardiac unit. Screening was done by collecting swabs from hands and anterior nares. The specimens were processed by standard procedures for the isolation of *S. aureus* and methicillin resistance was determined using cefoxitin, 30µg disks as per Clinical and Laboratory Standards Institute (CLSI) guidelines. Highest percentage of MRSA carriage was seen among the subjects working in recovery area (14%). The prevalence of MRSA among the subjects working in emergency, wards and ICUs was found to be 12%, 8% and 5% respectively. The healthcare personnel require awareness regarding the nosocomial infections as well as bacterial colonization and should know their status of MRSA carriage and accordingly, take necessary measures to prevent possible transmission. Therefore, a continuous surveillance and improvement of hygiene standards in hospitals should be adopted.

## Introduction

Health care-associated infections (HAIs) result in excess length of stay in hospitals, mortality and healthcare costs. In 2002, an estimated 1.7 million health care-associated infections occurred in the United States, resulting in 99,000 deaths (Klevens RM *et al.*, 2007).. *aureus* strains which are resistant to the penicillinase-stable β lactam antibiotics, like methicillin, cloxacillin and flucloxacillinare referred to as MRSA. MRSA strains are

important because they have a remarkable ability to develop resistance to a variety of antimicrobials belonging to other classes like aminoglycosides, quinolones and macrolides. This poses a major threat to public health. Certain strains of MRSA are found to have the propensity to spread very quickly in hospitals (Sachdev *et al.,* 2003).

Various studies have documented the occurrence of multiple drug resistant MRSA in hospitals and its subsequent transmission through the hands of health care workers (Barrett *et al.,* 1968; Craven *et al.,* 1981; Crossley *et al.,* 1979). Methicillin resistance among *S. aureus* isolates was found to be 15-30% according to studies conducted in the 1990s (Edmond *et al.,* 1999; Kesah *et al.,* 2003; Tiemersma *et al.,* 2004). However, recent studies done by Mekviwattanawong S *et al.,* 2006 and Nimmo *et al.,* 2007 have shown methicillin resistance among *S. aureus* isolates to be as high as 41.5%.

MRSA has remained a major nosocomial pathogen in India as well. Percentage of MRSA among the *S. aureus* isolates varied from 20-80% (Verma *et al.,* 2000; Vidhani *et al.,* 2001; Pulimood *et al.,* 1996; Tahnkiwale *et al.,* 2002) in the 1990s. Other studies conducted all over India from 2000-2009 have shown this percentage to vary from 30-55% (Rajaduraipandi *et al.,* 2006; Anuprabha *et al.,* 2003; Mulla *et al.,* 2007; Chaudhury *et al.,* 2007; Arora *et al.,* 2010).

A number of studies have been conducted all over the world to know the prevalence of MRSA carriage in healthcare workers and the carriage rate was found to be 0.2% to 14% (Amorim *et al.,* 2009; Shakya *et al.,* 2010; Goyal *et al.,* 2002; Kaminski *et al.,* 2007; Vos *et al.,* 2009; Askarian *et al.,* 2009; Farzana *et al.,* 2008; Ibarraa *et al.,* 2008; Verwer *et al.,* 2011; Vidhani *et al.,* 2001). Screening for carriage of MRSA is fundamental to modern day nosocomial infection control, both for epidemiologic investigation and day-to-day decisions on barrier isolation (Safdar *et al.,* 2003).

## Materials and Methods

This prospective study was conducted in the Department of Microbiology, Dayanand Medical College and Hospital, Ludhiana on 250 health care workers of cardiac unit serving in different areas like wards, ICUs, recovery and emergency. The following data was collected from the health care workers screened: name, age, sex, designation and area of service. Using pre-moistened sterile cotton swabs, taking aseptic precautions, the specimens were collected from the anterior nares and hands of the health care workers. For collecting specimen from anterior nares, a pre-moistened sterile cotton swab was inserted into the nostril, to a depth of approximately 1cm, and rotated five times. For collecting specimen from hands, a pre-moistened sterile cotton swab was rubbed over the palm and web spaces.Swabs were transported to the laboratory in tubes containing sterile nutrient broth with 7% NaCl (7% salt broth). Tubes containing 7% salt broth with inoculated swab specimens were incubated overnight at 37°C, subcultures were done from salt broth on blood agar plates which were again incubated overnight at 37°C. *S.aureus*was identified by standard techniques based on colony morphology, Gram's stain, catalase, slide and tube coagulase and mannitol fermentation test. Methicillin resistance was determined using cefoxitin, 30µg disks using Modified Kirby-Bauer disk diffusion method on Mueller-Hinton agar. ATCC strain *S. aureus* 25923 was used as quality control. Isolates which showed cefoxitin (30µg) disk inhibition zone sizes of diameter less than or equal to 21mm were considered MRSA strains as per CLSI guidelines. A health care worker showing growth of MRSA from either the hand swab,

nasal swab or both the sites was labelled MRSA carrier. After the identification of isolates and obtaining their methicillin resistance pattern, the percentage of MRSA carriage in the health care workers serving in different areas (Ward, ICU, Recovery and Emergency) of cardiac unit was calculated.

## Results and Discussion

A total of 250 health care workers (127 from wards, 62 from ICUs, 37 from recovery and 24 from emergency) were screened by collecting swabs from hands and anterior nares. 88 staphylococcal isolates were obtained from samples of 250 health care workers screened. Out of 88 staphylococcal isolates, 42 (48%) were identified as *Staphylococcus aureus* and 46 (52%) were coagulase negative staphylococci (CONS). Out of 42 isolates of *S. aureus*, 21 (50%) were MRSA. So, out of 250 health care workers, 21 were found to be MRSA carriers.

The percentage carriage of MRSA among health care workers serving in recovery, emergency, wards and ICUs was found to be 14%, 12%, 8% and 5% respectively (Table 1).

**Table.1** Prevalence of MRSA in different areas

| S. No. | AREA | NUMBER OF SUBJECTS SCREENED | NUMBER OF MRSA CARRIERS (%) |
|---|---|---|---|
| **1.** | Recovery | 37 | 5 (14%) |
| **2.** | Emergency | 24 | 3 (12%) |
| **3.** | Wards | 127 | 10 (8%) |
| **4.** | ICUs | 62 | 3 (5%) |

In our study, highest carriage rate of MRSA was found among the subjects working in the recovery area (14%). This could be attributed to the presence of multiple risk factors among the patients in this area like presence of cutaneous lesions, limited mobility, presence of urinary catheters and antibiotic intake. In a study conducted in Iran, highest nasal carriage of MRSA was found in surgical wards and the emergency department (Askarian *et al.*, 2009).

In 1963, Stewart and Holt described the first major nosocomial epidemic of MRSA (Stewart *et al.*, 1963). Numerous medical centers, first in Europe in the 1960s (Benner *et al.*, 1968) and then in the United States in the 1970s, (Crossley *et al.*, 1979) have reported outbreaks of nosocomial infections caused by MRSA. The first three methicillin-resistant isolates of *S. aureus* were among 5,440 *S. aureus* strains tested for methicillin resistance. All three were from the same hospital. These isolates were also resistant to antibiotics chemically unrelated to methicillin like streptomycin and tetracycline. The circumstances surrounding isolation of these three strains were noteworthy because they typify those associated with outbreaks of methicillin-resistant staphylococci even today. The first isolate was from a patient with eczema who had been treated with penicillin. Two subsequent isolates came from an infected finger of a nurse and from the wound of a post operative patient whom she had attended (Jevons *et al.*, 1961). This occurrence of a multiple drug resistant strain in a carrier recently treated with a β lactam antibiotic and subsequent nosocomial transmission literally through the hands of hospital personnel has become a familiar story (Barrett *et al.*, 1968; Craven *et al.*, 1981; Crossley *et al.*, 1979). Therefore, screening of health care workers for MRSA carriage should be included in hospital infection control policy and necessary

measures should be taken to prevent further transmission of such multidrug resistant pathogens.

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