

Original Research Article

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## Carriage of Methicillin Resistant *Staphylococcus aureus* (MRSA) among Health Care Workers in Cardiac Unit of a Tertiary Care Hospital

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### ABSTRACT

Health care-associated infections (HAIs) with methicillin resistant *Staphylococcus aureus* (MRSA) are a major cause of illness and death, and impose serious economic costs on patients and hospitals. The major reservoirs of MRSA in health care facilities are infected or colonized patients. The anterior nares and skin are common sites of MRSA carriage. 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 determine the prevalence of MRSA carriage among health care workers. This prospective study was conducted in the Department of Microbiology, Dayanand Medical College and Hospital, Ludhiana on 250 health care workers 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. The carriage rate of MRSA among health care workers was found to be 8.4% out of which 5.6% were nasal carriers and 2.8% were carrying MRSA on hands. Screening of health care workers for MRSA carriage may help in reduction of MRSA prevalence in patients, decreased risk of spread to close contacts, reduction of glycopeptides use and long term cost savings.

#### Keywords

MRSA, Health care-associated infections, Cefoxitin, Antimicrobial susceptibility testing, Health care worker

#### Article Info

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### Introduction

MRSA has recently emerged worldwide as a major cause of HAIs that cause significant morbidity and mortality. Various studies done worldwide have shown a rise in the prevalence of HAIs caused by MRSA from 2.4% in 1975 to as high as 77% in 2001 (Emori *et al.*, 1993; Hsueh *et al.*, 2004; Johnson *et al.*, 2005). Incidence of MRSA in India ranges from 30 to 70% (Verma *et al.*, 2000; Rajadurai pandi *et al.*, 2006). Concern about MRSA is related to

its potential for nosocomial transmission and the limited number of antibiotics available for its treatment (Sachdev *et al.*, 2009).

Common factors raising the risk of MRSA carriage or infection include poor chronic health status, limited mobility, chronic skin lesions, presence of urinary catheters, history of hospitalization within the last 3 months and recent history of antibiotic use (Lucet *et al.*, 2005; Oztoprak *et al.*, 2006; Denis *et al.*, 2009). At the institution level, the factors

include lack of MRSA surveillance, lack of antibiotic therapeutic formulary and the combination of less-developed infection control activities and a high ratio of physicians to residents (Denis *et al.*, 2009).

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).

Therefore, 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 who were in close contact with the admitted patients.

**Data Collection** - The following data was collected from the health care workers screened: name, age, sex, designation, area of service, brief history about risk factors for MRSA carriage like any history of cutaneous lesion or condition, sinusitis or rhinitis, chronic otitis externa, recent urinary tract infection, recent antibiotic intake and any history of contact with MRSA infected patients.

**Specimen Collection and Transport** - 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).

**Specimen Processing** - 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.

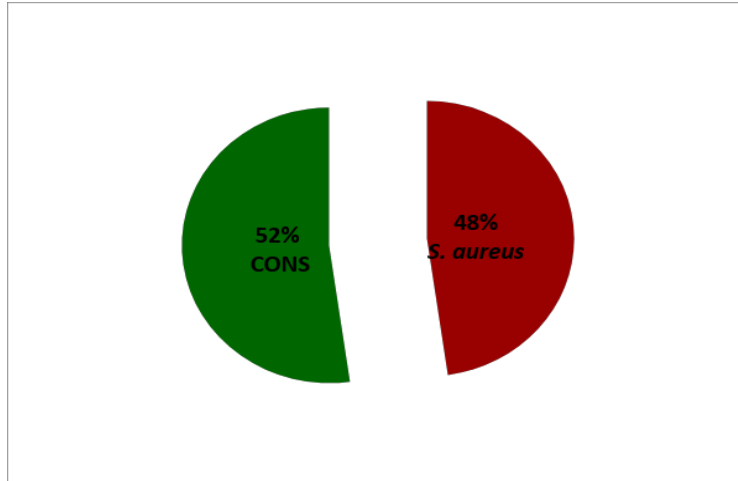
**Identification of Isolate and Methicillin Resistance Testing** - *S. aureus* was identified by standard techniques based on colony morphology, Gram's stain, catalase, slide and tube coagulase and mannitol fermentation test. Methicillin resistance was determined using cefoxitin, 30µg disks using Modified 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.

After the identification of isolates & obtaining their methicillin resistance pattern, the percentage of MRSA carriage in the health care workers was calculated.

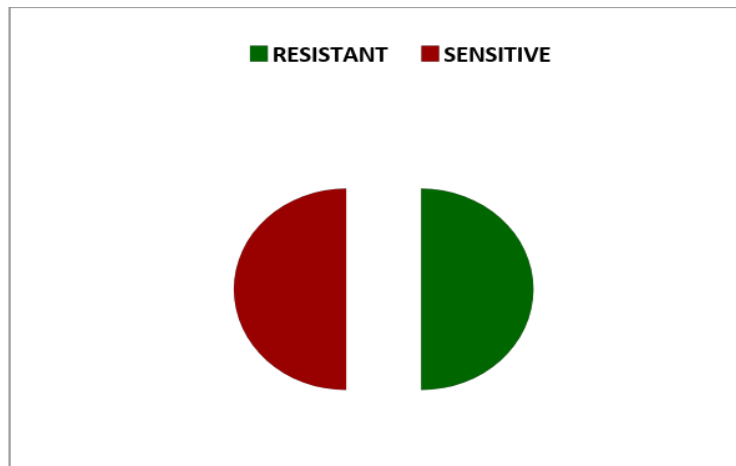
## **Results and Discussion**

A total of 250 health care workers were screened by collecting swabs from hands and anterior nares. Eighty eight 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 (Fig. 1 and 2).

**Fig.1** Distribution of Staphylococcal isolates (n=88)



**Fig.2** MRSA among *S. aureus* isolates (n=42)



**Fig.3** Prevalence of MRSA carriage among health care workers (n=250)

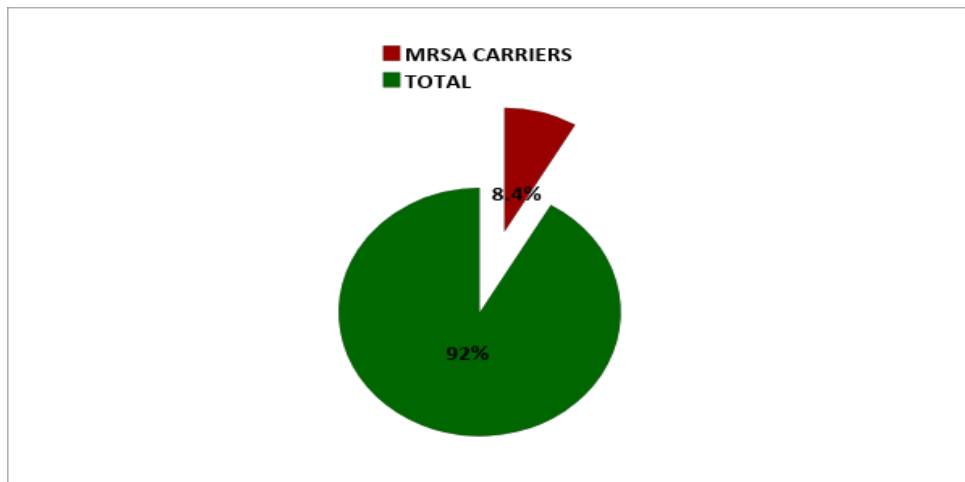
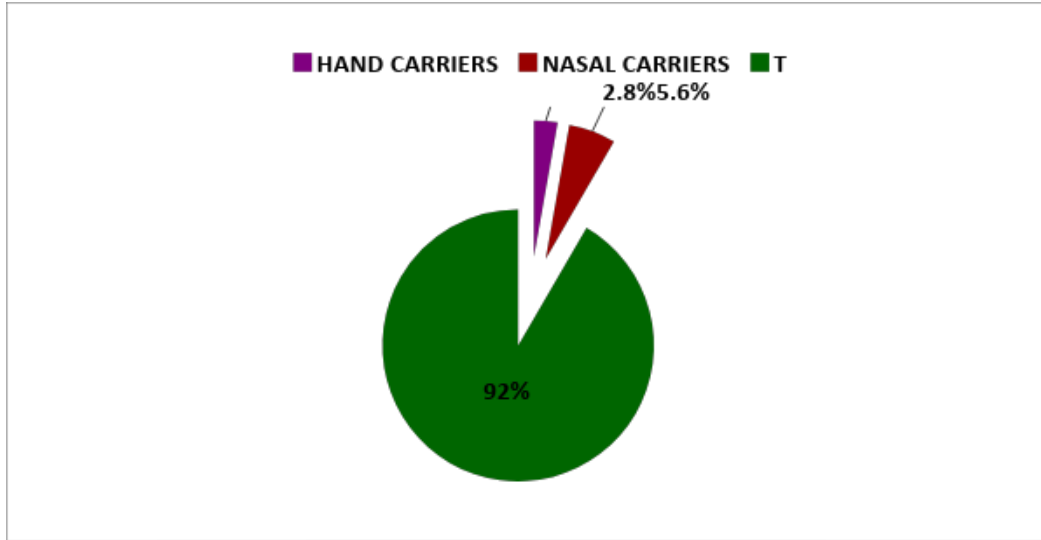


Fig.4 Site-wise carriage of MRSA among health care workers (n=250)



The percentage carriage of MRSA among health care workers was 8.4% (21/250), out of which 5.6% (14/250) were nasal carriers while 2.8% (7/250) were carrying MRSA on hands. No health care worker showed carriage of staphylococci in both the sites.

MRSA has remained a major cause of nosocomial disease worldwide (Emori *et al.*, 1993; Vidhani *et al.*, 2001), including India (Verma *et al.*, 2000; Vidhani *et al.*, 2001; Anuprabha *et al.*, 2003; Rajadurai pandi *et al.*, 2006).

The major reservoirs of MRSA in health care facilities are infected or colonized patients. The anterior nares and skin are common sites of MRSA carriage. Transient carriage of MRSA on the hands of health care workers is the predominant mode of patient to patient transmission. Presence of MRSA on environmental surfaces also serves as a major reservoir (Sachdev *et al.*, 2009).

The present study was conducted on 250 health care workers of cardiac unit who were in close contact with the admitted patients, with the aim of determining the prevalence of MRSA carriage among health care workers.

In our study, the carriage rate of MRSA among health care workers was 8.4% (21/250). A similar study conducted in Delhi, by Goyal *et al.*, (2002) has shown MRSA carriage among health care workers to be 6.6%. Other studies, however, have shown higher carriage rates of MRSA (ranging from 10 to 14%) as compared to our study (Shakya *et al.*, 2010; Farzana *et al.*, 2008; Ibarra *et al.*, 2008). Lower carriage rate of MRSA among health care workers in our study could probably be accounted to promoting hygienic practices like careful hand washing and strict adherence to isolation and barrier precautions like gowning and gloving by the staff in our hospital. Some other studies have done worldwide have shown lower prevalence of MRSA carriage as compared to our study, which ranged from 3.4 to 5.3% (Kaminski *et al.*, 2007; Askarian *et al.*, 2009; Verwer *et al.*, 2011). Whereas, Vos MC *et al.*, (2011) in Netherlands, determined that 31 (0.2%) of 13,195 health care workers were MRSA carriers (Fig. 3).

The carriage rate of MRSA in anterior nares was double (5.6%) as compared to carriage on hands (2.8%). Similarly, Goyal *et al.*, (2002) have also reported higher carriage rate of MRSA in anterior nares as compared to hands.

The present study indicated a carriage rate of 8.4% for MRSA among healthcare workers (Fig. 4). The healthcare personnel require awareness regarding the nosocomial infections as well as bacterial colonization and should know their status of carriage of MRSA and accordingly, take necessary measures to prevent possible transmission (Shakya *et al.*, 2010). Therefore, a continuous surveillance and improvement of hygiene standards in hospitals should be adopted. Thus, the study emphasizes the need for a regular surveillance of microbial flora among hospital staff to prevent MRSA transmission in hospital setting. Vancomycin has been used as the drug of choice for treating multidrug resistant MRSA infections. However, regular monitoring of vancomycin sensitivity and routine testing of other newer glycopeptides like teicoplanin should be carried out. Further, the regular surveillance of hospital associated infections including monitoring antibiotic sensitivity pattern of MRSA and formulation of definite antibiotic policy may be helpful for reducing the incidence of MRSA infection (Anuprabha *et al.*, 2003).

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