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Original Research Article

Methicillin-resistant Staphylococcus aureus screening in healthcare workers: should a new protocol be introduced?

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ABSTRACT

Background: In recent times, emerging resistance to majority of antibiotic classes seen in *Methicillin-resistant Staphylococcus aureus* (MRSA) isolates is of concern in hospital-acquired infection. MRSA carriage by healthcare workers (HCWs) has been documented to be as high as 50% in some studies. Higher carrier rate increases the risk of developing active infection as well as transmission of infection to the patients. The study aims to establish a relationship between MRSA carrier rate and healthcare workers of a tertiary care hospital in Pune and understand the need for screening regimens, based on the outcome.
Methods: A cross-sectional study including health care workers from a tertiary care hospital working in different clinical departments was carried out. Data was collected by taking samples of nasal swabs of 115 HCWs and inoculated immediately on blood agar. Culture plates were incubated at 37°C for 24 hours and colonies were tested by routine diagnostic techniques. Antibiotic sensitivity was tested using cefoxitin discs on Mueller Hinton medium.
Results: Prevalence of Staphylococcus aureus carriage was reported in 19 out of 115 (16.52%) healthcare workers, of which 63.2% were MRSA and 36.8% were MSSA. Prevalence of MRSA among Orthopaedic surgeons and General surgeons showed a carrier rate of 25% and 18.2% respectively. Nurses had a prevalence rate of 0.39 %. Overall prevalence of MRSA carriage in healthcare workers was reported to be 10.4%
Conclusions: MRSA carriage among HCWs at the hospital is considerably high. The high prevalence of MRSA carriage emphasizes the need for stringent hospital infection control and regular screening regimen of HCWs.

Keywords: Antibiotic resistance, Infectious disease transmission, *Methicillin resistant Staphylococcus aureus*, Nosocomial infections, Screening

INTRODUCTION

Methicillin-resistant Staphylococcus aureus (MRSA) attributes to be an important causative agent of hospital-acquired infections. In addition, their resistance to antibiotics is posing difficulty in combating these infections.[1] MRSA usually colonizes the nasal cavity and also the other parts of the body which further has potential to cause clinical infection. Colonized HCWs act as a reservoir for transmission of infection to the vulnerable population.[2] Both transiently and persistently colonized HCWs are responsible for disease causation. Risk factors include chronic skin diseases, poor hygiene practices, and having worked in countries with endemic MRSA.[3] Since 1990s, MRSA strains which were primarily associated with hospital, are being reported from community as well.[4] As per the data from the National Nosocomial Infections Surveillance System, MRSA prevalence among *Staph. aureus* isolates causing nosocomial infection in intensive care units (ICUs) has increased from 33-50% in 1995-1999 (6) to 57 % in 2003.[6] Reports of Vancomycin resistant *Staph. aureus*

(VRSA) are alarming. There may be an era where no bactericidal antibiotic effective against this organism is left to treat the infections caused by VRSA.[7,8] Cell envelope, nucleic acids and ribosomes are the important targets of antibiotic action. The ClpP protease and FtsZ from the cell division machinery have emerged as new targets due to recent drug discovery programmes.[9] Resistance mechanisms include enzymatic inactivation of the antibiotic, alteration of the target and efflux pumps acquired by *S. aureus* through horizontal gene transfer, spontaneous mutations and positive selection.[9,10] The most common MRSA infections include pneumonia, soft tissue infections and central venous catheter infection.[11] Nasal MRSA carrier state among health care workers poses a risk of subsequent infection. Thus emphasizes the need of elimination of carrier state with application of suitable topical antimicrobials.[12-14] This has also led some to recommend screening of patients at admission to the hospital and of healthcare workers during their practice.[15-18] Present study is carried out to find the MRSA carrier rate among health care workers and to determine the need for screening regimens, based on the outcome.

METHODS

A prospective cross-sectional study was carried out at Bharati Hospital and research centre, Pune during the period of June 2019 to September 2019. The Institutional Ethics Committee approval was obtained. Healthcare workers including doctors and nurses working in surgical departments and intensive care units of hospital were screened. An information sheet containing details of the study was presented to the subjects and consent was obtained for inclusion in the study. A total of 115 healthcare workers who gave consent to participate in the study were included. Healthcare workers not working in surgical departments and intensive care units and not willing to participate were excluded. Master chart was obtained in Microsoft excel. The data was then analysed using Statistical package for social sciences (SPSS) version 25.0 software. Results were presented in tabular format.

Demographic data such as age, sex, department and designation of the healthcare workers was collected before sample collection. History of infectious diseases, antibiotic therapy and other comorbidities were noted.

Nasal swabs were collected from both nostrils using moist cotton swabs and inoculated on blood agar within 2 hours. Inoculated plates were incubated at 37°C for 24 hours. Colonies were identified using standard bacteriological procedures.[19] Coagulase positive Staph aureus were then tested for cefoxitin (30 µ) disc for MRSA detection by Kirby Bauer method and interpreted as per CLSI guidelines.[20,22]

All individuals diagnosed with the carrier status were informed about the same and were referred to ID specialist for decolonization regimen guidance. All of them were screened again after post decolonization treatment for MRSA carrier state.

RESULTS

A total of 115 HCWs were tested consisting of 39 doctors (33.9%) and 76 nurses (66.1%) MRSA carriage rate was 23% and 0.39% among doctor nurses respectively. (Table 1).

Table 1: Distribution of subjects.

Designation	Frequency	MRSA carriage rate
Doctors	39 (33.9%)	9 (23.0%)
Nurses	76 (66.1%)	3(0.39%)

Table 2: Distribution of Staphylococcal isolates.

Susceptibility	Frequency
CoNS	81 (83.5%)
MRSA	12 (10.4%)
MSSA	07 (06.1%)
Total	115

Table 3: Distribution of MRSA and MSSA carriage status with respect to departments.

Departments	Total samples	MRSA isolates	MSSA isolates
Orthopedics	12	3 (25.0%)	0
Surgery	22	4 (18.2%)	1 (4.5%)
ObGy	28	2 (7.1%)	2 (7.1%)
ICU	53	3 (5.7%)	4 (7.5%)
Total	115	12 (10.4%)	7 (6.1%)

HCWs ages ranged from 21 to 54 years. Various bacterial species isolated from the swabs include MRSA, *Methicillin sensitive Staphylococcus aureus* (MSSA) and *Coagulase Negative Staphylococcus* (CoNS). Isolates predominantly consisted of CoNS (83.5%) followed by MRSA (10.4%) and MSSA (6.1%). Of the total 115 HCWs that were screened, 19 samples were positive for Staphylococcus aureus carriage. Out of these 19 isolates, 12 (63.2%) were resistant and 7 (36.8%) were sensitive to methicillin (Table 2). Overall, 10.4% of the HCWs screened were positive for MRSA colonization. Of all doctors 9 (23.0%) were colonized and of all nurses, 3 (0.39%) were colonized with MRSA. Of the total MRSA isolates, 5 (41.7%) were males and 7 (58.3%) were females. MRSA and MSSA carriage was highest among the health care workers of orthopedics department (25.0%) followed by surgery department (18.2%) Table 3.

DISCUSSION

Several reports suggest high prevalence of MRSA in various countries of the world.[21] As per the reports

carriers may be persistent (20%), intermittent (60%) and while some (20%) may never carry *Staph. aureus.*[22] MRSA has been reported to acquire resistance against several classes of antibiotics including gentamicin and related aminoglycosides which has further burdened the efforts of elimination of MRSA.[23] In our study, we reported a carrier rate of 10.4% although several studies carried out in India have reported lower carriage rate of 2.5% from Mangalore 2% from Madurai, 1.8% from Pondicherry, 6.6% from Delhi.[24-27] Higher carrier rate of 10% and 11.5% was reported by Malini et al from Bangalore and Rongpharpi et al from Assam respectively which is concurrent to our finding.[28,29] In a similar study conducted in the same hospital in 2013, 150 HCWs were screened. Of those, only 3 (2.00%) were colonized by MRSA, 14 (9.3%) by MSSA and 113 (75.3%) by CoNS while 20 (13.4%) showed no growth.[30] Our study shows prevalence of MRSA in 10.4% of HCWs which is higher than previous reports. This calls for more stringent hospital infection control policies and implementation of frequent screening regimens. All 12 MRSA carrier healthcare workers were rescreened after completing decolonisation protocol. None of them were reported to be MRSA carrier.

Higher MRSA carriage rate of 23% was reported among doctors, similar findings are reported by Radhakrishna.[24] This may be correlated to the better hand hygiene compliance among nursing staff than. Since the niche for the colonization of *Staphylococci* is the anterior nares, most of the nasal invasive infections are assumed to originate from nasal mucosa. Therefore, it is imperative that nasal colonization due to *Staph aureus* should be prevented to curb the rate of infection and in preventing the transmission of resistant strains of the organism. Further Health professional's compliance with sanitary and antibacterial guidelines is essential to prevent nosocomial infection. They may be advised upon the usage of topical mupirocin and chlorhexidine washes for nasal carriage. Successful decolonization is possible with topical treatments for 7 to 10 days. Yet, such large-scale decolonization programme may complicate the current situation of drug resistance and eagle eye surveillance must be ensured.

Awareness among health professionals regarding nosocomial infections should be increased so as to reduce the carrier state among them. Various means of health education may be used. Preventive measures recommended by the infection control department of the hospital including hand washing before and after patient examination, use of masks and gloves, use of sterile aprons and awareness while examining immunocompromised patients should be followed by the HCWs strictly to reduce the transmission rate. Hospital infection control committee should monitor and carry out stringent surveillance of nosocomial infections to further reduce the transmission.[30] National health programme for eradication of MRSA carriage remains a possibility. MRSA is considered as a major health issue with high economic demand and should be tackled efficiently. Implementation of screening regimens will not only decrease the nosocomial and community transmission of infection but also decrease the financial burden for treatment of the same.[31]

Limitation of the study was that susceptibility pattern of the isolates for other antibiotics were not done. Further studies can be proposed to understand resistance pattern to other antimicrobial classes.

CONCLUSION

MRSA carriage among HCWs at the hospital was 10.4% which is considerably high. Higher carrier rate was reported among doctors (23.0%) than nurses (0.39%). The high prevalence of MRSA carriage emphasizes the need for stringent hospital infection control practices and regular screening regimen of HCWs.

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