

Screening for Methicillin - Resistant *Staphylococcus aureus* (MRSA) carriage among the health care workers in a tertiary care center

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Abstract

Introduction: It was observed that Health care workers (HCW) play an important role in the transmission of MRSA between the patients in the hospital environment. The aim of present study was to find out the carriage rate of MRSA among the HCWs in the critical care units in our setting.

Material and Method: All healthy HCWs involved in the management of critically ill patients were recruited into the study. By using sterile cotton swabs, specimens were collected from the anterior nares, finger web spaces and finger print directly taken on Brain-Heart infusion agar plate. *Staphylococcus aureus* was identified by the standard procedure. Antibiotic susceptibility testing was performed according to the Kirby-Bauer disc diffusion method. MRSA was identified by using a cefoxitin disc.

Result: Among the 112 HCWs who were screened for MRSA, 54(48.21%) were Nurses and Brothers, 26(23.22%) were nursing students and 32(28.57%) were doctors. Twenty one (18.75%) *Staphylococcus aureus* strains were isolated. Among them 14 (12.5%) were MRSA. The proportion of nasal carriage of MRSA was higher 9(8.04%) than that on hand 5(4.46%). The highest carriage rate was noted in nurses and brothers (7.14%). Antimicrobial pattern of MRSA had revealed 100% sensitivity to Vancomycin and Linezolid while highest resistance to penicillin, Erythromycin and ciprofloxacin in the present study.

Conclusion: MRSA carriage among HCW can be reduce by their regular Screening and decolonization. Strict standard infection control practices should be employed to minimize either the carriage or the transmission rate of MRSA.

Keywords: Nasal carriage, Health care workers, MRSA

Introduction

Methicillin - Resistant *Staphylococcus aureus* (MRSA) is a well-known cause of nosocomial infection worldwide. Infections caused by MRSA strains are associated with longer hospital stay as well as prolonged antibiotic administration resulting into higher costs of treatment.⁽¹⁾ Major concern about MRSA is that these isolates are frequently resistant to many different classes of antibiotics. Thus limiting the treatment options to fewer and expensive antibiotics like vancomycin, linezolid and tigecycline.⁽²⁾ Methicillin and other betalactam antibiotic resistance in *Staphylococcus aureus* is based on the production of an additional penicillin binding protein, PBP2 or PBP2a, which is mediated by the *mecA* gene, which is situated on a mobile genetic element, the *Staphylococcal Cassette Chromosome mec* (SCCmec).⁽³⁾

Health care workers (HCW) and asymptotically colonized patients are the major sources of MRSA in the hospital environment. Among them HCW play a major role in the transmission of MRSA between the patients by acquiring the organism from direct patient contact or by handling contaminated material. Principal mode of transmission from patient to patient is via the transiently colonized hands of healthcare workers (HCWs).⁽⁴⁾ As HCWs are at the interface between the hospital and the community they serve as the main agents of the cross transmission of the hospital acquired MRSA and the community acquired MRSA.⁽⁵⁾

Various literature regarding Outbreaks and prevalence of Methicillin resistant *Staphylococcus aureus* (MRSA) Nosocomial Infection (NI) among different populations particularly those from developed countries were well documented. But there is a lack of knowledge on carriage of MRSA in developing nations, including the carriage by HCW who are major transmitters. Identification of healthcare workers and asymptotically colonized patients with MRSA, along with hand hygiene care and other standard infection control precautions have been helpful in reducing transmission and controlling spread of MRSA.

Prevalence of MRSA carriage in health care worker is unknown in our setting. Knowledge regarding prevalence of MRSA in hospital and its current antimicrobial profile is important for the selection of the appropriate antimicrobial empirical treatment for these infections. Also, the screening and eradication of MRSA from the colonized HCWs have been recognized and recommended as an important part of a comprehensive infection control policy for this organism.⁽⁶⁾ Clinical isolates from invasive infections can only focus on the severity of the disease but does not give an estimate or prevalence of carriers among the healthy population. This formed the basis for our study, to find out the carriage rate of MRSA among the HCWs in the critical care units as they could pose a potential risk factor for nosocomial transmission when exposed to the hospital setting during their clinical postings.

Materials and Method

Present study was conducted in department of Microbiology at tertiary care center. After taking informed consent all healthy HCWs involved in the management of critically ill patients [in the adult intensive care unit, all surgical specialties, Neonatal ICU, Pediatric ICU] were included into the study. This study has been approved by the ethical committee of the institution.

All relevant information about participant such as age, sex, work category, time of employment, duration of working in the critical care unit, prior hospitalization, current skin infection/ other illness will be taken in a proforma designed for this purpose. By using sterile cotton swabs, specimens will be collected from the anterior nares, finger web spaces and finger print directly taken after at least 30 min of the last hand wash on Brain-Heart infusion agar plate of the HCWs. Swabs were inoculated into Brain-Heart infusion broth and transported to laboratory. Subcultures were done on Blood agar and Mannitol salt agar. *S. aureus* was identified by Gram's stain, catalase, mannitol fermentation and coagulase test (Slide and Tube) as per the standard procedures.⁽⁷⁾ Routine antibiotic susceptibility testing was performed by Kirby Bauer disc diffusion method for the following antibiotic: Penicillin (10U), Amoxiclav(20/10ug), Gentamicin (30µg), Erythromycin(15µg), Cotrimoxazole(1.25/23.70µg), Ciprofloxacin (5µg), Vancomycin (30µg), Linezolid (30µg).⁽⁸⁾ The results were interpreted according to the CLSI guideline. All the *Staphylococcus aureus* isolates were tested for methicillin resistance by Cefoxitin (30µg) disc diffusion test.⁽⁸⁾

The HCW with MRSA carriage were identified and advised to apply 2% Mupirocin ointment in anterior nares or on hands 2-3times/day for 5 days. They were asked to use barrier precautions like gloves, mask while handling patients. Also avoid working in operation theatre and dressing of patients wound till treatment over. Once duration of treatment was completed, HCW was asked to submit another nasal and hand swabs to make sure that he or she was no longer a carrier.

Exclusion criteria: HCW suffering from any known disease or infection.

Result

Out of the 112 HCWs who were screened for MRSA, 54(48.21%) were Nurses and Brothers 26(23.22%) were nursing students and 32(28.57%) were doctors. Among them 69(61.60%) were males and 43 (38.40%) were females. Twenty one (18.75%) *Staphylococcus aureus* strains were isolated in all, of which 14 (12.5%) were MRSA. The proportion of HCWs with the nasal carriage of MRSA was higher 9(8.04%) than that on the hand 5(4.46%).The highest carriage rate was seen in nurses and brothers (7.14%), followed by doctors and nursing students. (2.68% and 2.68% respectively)

The anti-biograms of MRSA revealed the highest resistance to penicillin (92.85%), Erythromycin (85.71%) and ciprofloxacin (78.57%) while Vancomycin and Linezolid had shown 100% sensitivity in the present study. Single MRSA isolate was found to be sensitive to all the drugs. No strain was found to be absolutely resistant to all drugs.

Repeat swabs collected from the HCW following treatment also yielded no growth, thus eliminating the carrier rate.

Table 1: Distribution of MRSA carriage in HCW of different work category

Work Category	Total number of sample taken (%)	Number of sample positive for MRSA (%)
Doctors	32 (28.57%)	3 (2.68%)
Nurses and Brothers	54 (48.21%)	8 (7.14%)
Nursing Students	26 (23.22%)	3 (2.68%)
Total	112 (100%)	14(12.5%)

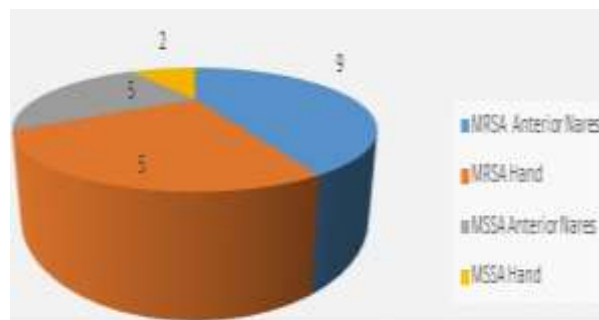


Fig. 1: Site Wise Distribution of Staphylococcus aureus isolated from HCW

MRSA- Methicillin Resistant *Staphylococcus aureus*
MSSA- Methicillin Sensitive *Staphylococcus aureus*

Table 2: Antibiotic susceptibility pattern of MRSA isolated from HCW. (n=14)

Drugs	Sensitivity (%)	Resistance (%)
Penicillin	1 (7.15)	13(92.85)
Erythromycin	2 (14.29)	12(85.71)
Amoxiclav	3(21.43)	11(78.57)
Gentamicin	5(35.72)	9(64.28)
Ciprofloxacin	3(21.43)	11(78.57)
Cotrimoxazole	8(57.15)	6(42.85)
Vancomycin	14(100)	0(0)
Linezolid	14(100)	0(0)

Discussion

Healthcare workers (HCWs) colonized with MRSA act as a main reservoir for transmission of these resistant organisms to patients and other HCWs. Spread of these resistant organism to the community leads to more alarming condition.⁽⁹⁾ Among health care workers almost 25% are stable nasal carriers, and 30% to 50% of them also possess the bacteria on their hands. Occasionally, health care workers who carry *S. aureus* in their nares are

at high risk of infection and can be a potential source of nosocomial pathogens.⁽¹⁰⁾ In our study, the rate of colonisation of *S. aureus* among HCW was 18.75% (21/112) which was in consistent with result of other report in the literature by Moghadam SO et al.⁽¹¹⁾ While other studies by Kakhandki LS et al (23.60%)⁽¹²⁾ and Singh R et al (29.16%)⁽¹³⁾ had noted higher colonisation rate of *S.aureus* compare to our study.

Different studies carried out internationally had reported MRSA carriage rate among the HCWs range from 5.8% to 17.8% in the hospital setting.⁽¹⁴⁾ In present study overall MRSA carriage rate was 12.5% which is in agreement with other international studies. Differences in the study design such as the sample size and the method of MRSA detection may be responsible for variation in the prevalence of MRSA between different institutions and geographic area. In our study higher prevalence of MRSA carriage was seen in males compared to females. Similar finding were noted by Mathanraj S et al⁽¹⁵⁾ in his study.

In present study, nurses and brothers (7.14%) had revealed highest MRSA carriage rate, followed by doctors and nursing students (2.68% and 2.68%) [Table 1] which was in consistent with result recorded by Synder GM et al⁽¹⁶⁾ study. In contrast to present study Malini J et al⁽⁶⁾ had noted higher MRSA carriage rate among doctors followed by nurses and nursing orderlies. Mathanraj S et al⁽¹⁵⁾ and Malini J et al.⁽⁶⁾ had reported higher nasal carrier rate of MRSA as compared to hand carriage rate. Our study had also showed similar finding with higher nasal carrier rate of 8.04% compared to hand carrier rate of 4.46% [Fig. 1].

Antibiotic susceptibility pattern of the MRSA isolates (Table 2) had showed 78.57% resistance to ciprofloxacin while 100% sensitivity to Vancomycin and Linezolid. Our results are consistent with a finding reported other studies by Goyal R et al⁽¹⁷⁾ and Sharma Y et al⁽¹⁸⁾ but in contrast to the findings by Chatterjee et al⁽¹⁹⁾ who reported 12.5% resistance to ciprofloxacin. Ciprofloxacin is use as an alternative treatment for MRSA in our setup. It is important to note that high level of resistance was seen among MRSA to ciprofloxacin in our study which may be the result of selection pressure owing to uncontrolled drug usage in the community. Multidrug resistant isolates were not seen in the present study in contrast to this study by Goyal et al⁽¹⁷⁾ had reported 30% (3/10) resistance to all the antibiotics tested.

MRSA carriage among health care workers (HCW) is a great challenge to deal with as HCWs are the main link in transmission of infection to the patients and those who mostly transmit such infection in hospital and community. This emphasize the need of educational activities for HWC regarding common hospital acquired infections such as MRSA and the importance of preventive strategies in controlling them. Implementation of effective hospital infection control policies for eradicating the MRSA carriage in the

hospital staff and in the institution will be beneficial by preventing MRSA transmission to the patients, family members of HCW and others in the community.

Conclusion

It is important that health care worker should be aware regarding MRSA carriage among them as they are the potential source of these multidrug resistant nosocomial infection to their patients. To prevent outbreaks of MRSA infection following steps are essential such as formulation and strict implementation of hospital infection control policy, regular screening programs for MRSA carriage among high risk group like HCW, education regarding awareness of MRSA carriage and hand sanitization practices.

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