



ISSN: 0975-833X

RESEARCH ARTICLE

NASAL CARRIAGE OF METHICILLIN RESISTANT *STAPHYLOCOCCUS AUREUS* IN HEALTHCARE WORKERS AT A SUPERSPECIALTY TERTIARY CARE CENTER

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ARTICLE INFO

Article History:

Received 23rd February, 2016

Received in revised form

10th March, 2016

Accepted 26th April, 2016

Published online 20th May, 2016

Key words:

MRSA,
Healthcare workers,
Nasal carriage.

ABSTRACT

Introduction: Methicillin resistant *staphylococcus aureus* (MRSA) is a common causative agent of nosocomial infections. Healthcare workers (HCW) have been shown to be the carriers and hence help in spread of the organism. Carriage by HCWs provides a very convenient niche for this organism to spread in the society, especially to susceptible patient population.

Aim: This study was done to screen all the healthcare workers (doctors, nurses, technicians, group D workers) in our hospital in order to establish a baseline data for MRSA carrier rates and prevent outbreaks by initiating decolonization protocol.

Material and method: A total of 226 HCWs were screened for nasal carriage of MRSA. Isolates were classified as coagulase negative staphylococci (CoNS) and *Staphylococcus aureus* based on cultural characteristics and biochemical reactions. Methicillin resistance was further tested based on antibiotic susceptibility testing and methicillin resistant organisms were denoted as methicillin resistant coagulase negative staphylococci (MRCoNS) or methicillin resistant *Staphylococcus aureus* (MRSA). Resistance was correlated with results from Biomérieux PBP-2a latex agglutination reaction.

Results: MRSA nasal carriage rate in our hospital was 3.5%. Further, we found that 9% isolates were methicillin sensitive *Staphylococcus aureus* (MSSA) and 61% were MRCoNS, remaining being CoNS.

Conclusion: This study helped in identifying the carriers amongst the HCWs and take preventive actions. A comparatively lower prevalence of MRSA carrier rates as against certain other studies reflects the proper hand hygiene practices and incentivizes the staff to adhere to personal safety precautions.

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Citation: Dr. Kalyani Borde, Dr. Jyoti S. Kabbin, Dr. Nagrathamma, T., Dr. Sandhya, K. and Dr. Aarthi, S. 2016. "Nasal carriage of Methicillin resistant *Staphylococcus aureus* in healthcare workers at a Superspecialty tertiary care center", *International Journal of Current Research*, 8, (05), 31242-31245.

INTRODUCTION

Methicillin resistant *Staphylococcus aureus* was first reported in 1960 (Jevons, 1961). Even after more than half a century, it remains a challenge for the hospitals to control and monitor MRSA outbreaks. Alterations in Penicillin Binding Protein 2a (PBP 2a) are implied in methicillin resistance of staphylococci (Li and Strynadka, 2002). There are reports of emerging mupirocin resistance which is the mainstay of decolonization

procedure in MRSA carriers. Various studies have shown that mortality and morbidity is higher in cases of MRSA infection as compared to MSSA (Whitby et al., 2003). This infection is mostly hospital acquired and has emerged as a major public health problem in India. Prevalence of MRSA carriage among healthcare workers is high and they have been shown to spread the infection both in hospitals as well as their households (Kniehl and Becker, 2005). MRSA control also serves as a marker of control of other nosocomial infections. Hence, there is a need to identify the healthcare workers carrying MRSA and initiating decolonization in order to prevent transmission of hospital acquired infections.

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MATERIALS AND METHODS

It was a prospective study of nasal isolates collected from HCWs working in a super specialty tertiary care center in Bangalore. Samples were collected after taking informed consent from HCWs. Sterile cotton swabs moistened with normal saline were rotated in both the anterior nares and inoculated immediately onto the special medium - mannitol salt agar (MSA)- for selective identification of Staphylococcal colonies. Mannitol fermenting (yellow colored) colonies after 24 hours of incubation at 37°C were confirmed as *Staphylococcus aureus* colonies by biochemical reactions (slide coagulase test, tube coagulase test, DNase) (Baird, 2014). Confirmed Staphylococcal isolates were tested for antibiotic susceptibility according to CLSI 2014 guidelines (Clinical and Laboratory Standards Institute (CLSI) 2014). Kirby-Bauer's disc diffusion testing method was used. Methicillin resistance was determined using cefoxitin disc (surrogate marker of *mecA* gene). Mupirocin resistance was determined in methicillin resistant isolates using mupirocin disc of 5µg (for low level resistance) and mupirocin disc of 200 µg (for high level resistance) (de Oliveira *et al.*, 2007). In our study all the isolated were sensitive to both the concentrations of mupirocin. Antibiogram of MRSA was performed using Mueller-Hinton agar and following discs: Penicillin, Erythromycin, Clindamycin, Linezolid, Cotrimoxazole, Tetracycline, Azithromycin, Doxycycline, Cefoxitin according to CLSI 2014 guidelines (Clinical and Laboratory Standards Institute (CLSI) 2014).



Figure 1. Mannitol salt agar showing mannitol fermenting colonies of *S.aureus*

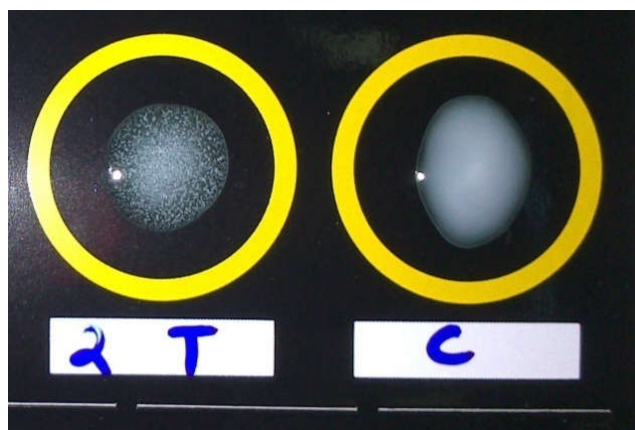


Figure 2. Latex agglutination test for presence of PBP-A2

Biomérieux PBP-A2 latex agglutination test was used to confirm the presence of penicillin binding protein- A2 (a mutation in penicillin binding protein that renders the organism methicillin resistance). All the MRSA isolates gave positive agglutination reaction (Griethuysen *et al.*, 2001). Decolonization was initiated for carriers with mupirocin ointment (2%) as a local application, twice daily, for seven days. Follow-up swabs were collected within 48 hours of finishing the decolonization regimen (Al Que and Moreillon, 2010). All carriers came negative for MRSA growth in follow-up.

RESULTS

A total of 226 HCWs were screened. In this study, carrier rates were higher in females (3.9%) than males (2.7%). A total of 36 doctors, 20 technicians, 8 attenders and 162 nurses participated. Average age of the HCWs was 31.2 years while average age of carriers was 29.8 years, which does not denote an appreciable age difference. Out of 226 HCWs screened, 8 nasal carriers for MRSA were detected, 20 HCWs were carrying methicillin sensitive *Staphylococcus aureus* (MSSA). Amongst the various professions, nurses accounted for 75% of the carriers. 61% of the HCWs were carrying MRCoNS. This data is represented in the Figure 3:

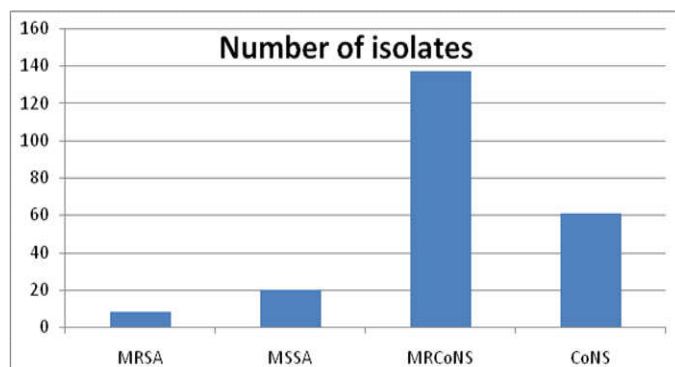


Figure 3. Organisms isolated from the healthcare workers

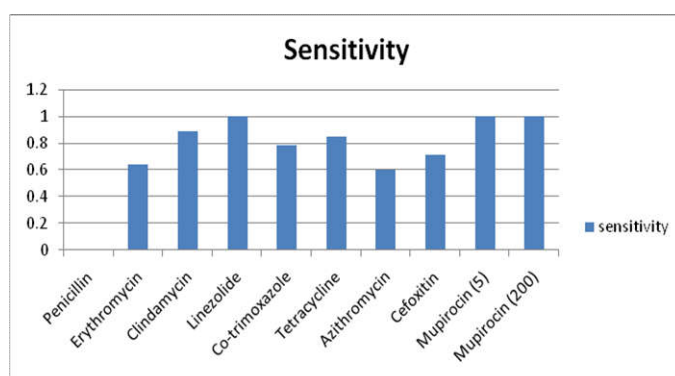


Figure 4. Antimicrobial sensitivity pattern of the MRSA isolates

Antibiogram of Staphylococcal isolates showed that 100% strains were susceptible to Linezolid, Mupirocin (5µg) and Mupirocin (200µg). None of the isolates were susceptible to Penicillin. This data is represented in Figure 4.

Table 1. MRSA isolation rates from Healthcare workers as reported by various studies

Studies	Hcws screened	Mrsa	Mssa	Carriage among nursing staff	Carriage among doctors
Eveillard <i>et al.</i> (2004)	965	6.2%	27.2%	9.6%	6.3%
Vijaya <i>et al.</i> (2011)	600	8%	31.5%	4.8%	5.6%
Ellie-Turenne <i>et al.</i> (2010)	256	6.6%	43%	10.5%	3.8%
Present study	226	3.5%	9%	75%	12.5%
Kumar (2011)	84	21.4%	26%	16%	83.3%
Mathanraj (2009)	57	1.7%	0	1.7%	0

DISCUSSION

MRSA has emerged as an important causative organism of nosocomial infections. In a study of 191 investigations, 11 outbreaks of MRSA had a strong epidemiological evidence that the source were healthcare workers (Vonberg *et al.*, 2006). This argues for the screening of HCWs and decolonizing the carriers. In our screening, carriage rate for MRSA was established at 3.5%. This compares fairly with other studies. In a compilation of 127 studies, average prevalence of MRSA carriage amongst HCWs was found to be 4.6% (Albrich and Harbarth, 2008). We encountered highest prevalence amongst nurses (75%). This compared with American studies of HCWs, which recognized around 6% MRSA nasal carriage rate and highest prevalence amongst nurses (Elie-Turenne *et al.*, 2010; Eveillard *et al.*, 2004). However, in an Indian study done on 600 HCWs, MRSA nasal carriage was found in 8% hospital personnel with maximum prevalence in attenders (Vijaya *et al.*, 2011). In another study of 84 HCWs, highest prevalence was found to be amongst doctors and total nasal carriage rate in HCWs was established at 27.2% (Kumar *et al.*, 2011).

All the MRSA isolates were found to be mupirocin sensitive in our study, which is in concordance with a study done on 150 MRSA isolates at a trauma center in India (Nonika *et al.*, 2014). All the carriers were decolonized successfully with a 7-day regimen of topical mupirocin ointment. Stringent hand washing protocol and enthusiastic hospital infection control committee is necessary to maintain low carrier rates. Also, HCWs identified as carriers should be properly counseled without causing any stigma or guilt (Al Que *et al.*, 2010). In conclusion, we would like to remark that low carrier rates of MRSA amongst HCWs is a positive indicator of hygiene practices followed at the institute and could be taken up as a regular exercise as an indirect measure of infection control practices. Also, though reported in various articles around the world, mupirocin resistance has not been established in our institute amongst MRSA carriers. A regular screening exercise serves to motivate hospital personnel to adhere to the infection control protocols and would go a long way in preventing outbreaks of hospital acquired infections. A plethora of opinions exist upon whether HCWs are victims, culprits or bystanders in the matter of nosocomial MRSA infections, but as it is wisely said, prevention is always better than cure!

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