World Journal of Clinical Pharmacology, Microbiology and Toxicology
World J. Clin. Pharmacol. Microbiol.Toxicol.
Vol. 1 [2] July 2015; 21-25

URL: http//wjcpmt.com
Online ISSN 2454-1729

REVIEW ARTICLE

High level of MRSA colonization in health care worker: alarm to implement health care policy

S.P.Kogekar[1], Khyati Jain[2], Priyanka Kumari[3], Nilesh Chavan[4], Prashant Peshattiwar[5], Madhurendra S Rajput[6]
1.Professor & Head, Department of Microbiology, Index Medical College, Hospital & Research Center, Indore (Madhya Pradesh), India.
* 2,4,5,6 Asst. Professor, Department of Microbiology, Index Medical College, Hospital &Research Center, Indore (Madhya Pradesh), India.
3. Tutor, Department of Microbiology, Index Medical College, Hospital &Research Center, Indore (Madhya Pradesh), India.
Corresponding author Email address: dr.khyati_jain@yahoo.com

ABSTRACT
The aim of the study was to investigate probable carrier rate of the healthcare workers and screened for carriers of MRSA as they could pose a potential risk factor for nosocomial transmission when the same carrier are exposed to the hospital setting during their clinical postings. A total of 100 nasal swabs were collected from the nursing staff and doctors. Sterile cotton swabs moistened with glucose broth were used for sample collection. Swabs were cultured on to nutrient agar, blood agar, and mannitol salt agar, incubated at 35 ˚C for 48 hrs. Staphylococcus aureus was identified by standard methods according to CLSI guidelines. Methicillin resistance was detected by using cefoxitin disc 30µgm on Mueller Hinton agar with 4% NaCl. Of the 100 samples screened 30(30%) strains of Staphylococcus aureus were isolated, out of which 16 (53.33%) were Methicillin resistant Staphylococcus aureus (MRSA) and 14 (46.66%) were methicillin sensitive Staphylococcus aureus (MSSA). The overall carriage rate of methicillin resistant Staphylococcus aureus in our study was 16% with the highest rate being seen among the nursing staff (19.35%) and clinical staff carriage rate was lesser (10.52%) as compared to the nursing staff. Chest department samples showed higher carriage rate (33.33%) followed by pediatrics department (28.57%). The present study revealed that HCWs who have contact with patients are at risk of acquisition and colonization with antimicrobial resistant bacteria especially MRSA. Transient hand colonization is the primary mean of cross transmission. Simply education of HCWs on hygienic measures especially proper hand wash is the key to overcome MRSA infection in ICUs.
Keywords: *Health care workers (HCWs), Nasal Carrier, Staphylococcus aureus, Methicillin resistant Staphylococcus aureus (MRSA).*

INTRODUCTION

Asymptomatic carriage of *Staphylococcus aureus* in healthy individuals has been shown to have a high prevalence, especially in healthcare workers [1, 2, 3]. Evidences are there to suggest there is increase in carriage of MRSA among hospital personnel as exposure to the hospital environment increases their potential risk of being colonized by different pathogens including *Staphylococcus aureus*.[4]. The main ecological niche for *S.aureus* is anterior nares[5]. Colonization is an established risk factor for subsequent infections to themselves and to others. Methicillin-resistant *Staphylococcus aureus* (MRSA) has been recognized as an important nosocomial pathogen worldwide[6]. Approximately 20% of healthy adults are persistent nasal carriers of this potential pathogen and 60% harbor the organism intermittently and appear to play a key role in the epidemiology and pathogenesis of infection[7, 8]. MRSA infections cause significant morbidity and mortality in both the community and hospital settings. Treatment of infection caused by MRSA has become more problematic since MRSA strains are resistant to all β-lactam antibiotics and the treatment options are limited significantly. Patient-to-patient transmission of MRSA within healthcare settings primarily occurs via carriage on the hands of healthcare workers[9]. Screening for MRSA carriers among this population is necessary for nosocomial infection control[10]. Identification of healthcare workers colonized with MRSA, combined with other precautions and taking care of hand hygiene has been helpful in reducing transmission and controlling spread [11]. This formed the basis for our study and its importance of screening for healthy carriers of MRSA. In this study, we investigated the probable carrier rate of the healthcare workers and screened for carriers of MRSA as they could pose a

potential risk factor for nosocomial transmission when the same carrier are exposed to the hospital setting during their clinical postings.

MATERIAL AND METHOD

Study area: The study was conducted in a Tertiary Care Hospital of Indore, India. A total of 100 nasal swabs from health care workers have been collected as per standard policy protocols. **Ethical consideration: Before** samples were collected; information regarding the study was explained to the Ethical Committee of the Institute and health care workers, after getting approval oral consent for participation in the study was obtained.

Questionnaire: Relevant and detailed history was collected and only those personnel were included in the study who had not taken any antibiotic 7 days before sample collection. **Specimen collection**: Nasal swab: Sterile cotton tipped swab was moistened in a culture tube containing 2 ml of glucose broth. Swab was wrung out within the tube, swirled inside the anterior nares for five clockwise and five counter clockwise rotations re-introduced into the culture tube and wrung out [12].

Processing and identification: Nasal specimens collected from a tertiary care hospital were processed at the medical microbiology laboratory IMCH as per (CLSI, 2008)[13]. Specimens have been inoculated on blood agar to look for β-hemolysis of *S.aureus*, nutrient agar was used for the direct colony identification, and mannitol salt agar (MSA) have been used as selective media for the isolation of *S.aureus* and incubated at 35˚C for 48 hrs. All isolates were identified routinely by Grams stain, Catalase test, Coagulase test and Mannitol Salt agar (MSA) test. The identification of organisms was based on cellular, cultural and biochemical characteristics. **Detection of MRSA:** Resistance to methicillin was detected with the cefoxitin (30 µg) Disk Diffusion Test (Bauer et al., 1966)[14] and interpreted according to (CLSI, 2009). A diameter of ≥22 mm was considered as susceptible and ≤21 mm as resistant as per (CLSI, 2010)[15]**.**

Results:

A total of 100 nasal swabs were collected of which 62 were from the nursing staff and 38 were from the clinical doctors (Table-1).Out of 100 samples, 30 (30%) showed growth of *S.aureus*. Overall 16 (16%) showed carriage of MRSA and among *S.aureus* 53.33% were MRSA (Table-2).Of the 38 swabs (clinical doctors) 14(20%) strains of *Staphylococcus aureus* were isolated. Out of which 4(11.7%) were methicillin resistant *Staphylococcus aureus* and 10 (8.3%) were methicillin sensitive *Staphylococcus aureus* (MSSA) (Table-3). Of the 62 swabs (nursing staff), 16(23.6%) strains of Staphylococcus aureus were isolated. Out of which 12(12.2%) strains were methicillin resistant *Staphylococcus aureus* and 04(11.4%) strains were methicillin sensitive *Staphylococcus aureus* (MSSA) (Table-4).Out of total MRSA isolated (16%), 12 were from nursing staff and 4 were from clinical doctors (Table-3&4). Among various department samples, MRSA positive samples were found in chest ward of (33.33%), pediatrics (28.57%), dental surgery (25%), gynecology (25%), medicine ICU (14.28) and Orthopedics (12.5%).

Table1: Distribution of samples

Total	Clinical doctors	Nursing staff
100	38	62

Table2: Isolation rate of *Staphylococcus aureus* and MRSA

Total samples	Total *Staphylococcus aureus* isolated			
	S.aureus		MRSA	MSSA
100	30 (30%)		16(16%)	14(14%)
	MRSA	MSSA		
	16(53.33%)	14(46.66%)		

Table-3: Clinical doctors

Total specimen	*S.aureus* isolated	MRSA	MSSA
38	14(36.84%)	04(10.52%)	10(26.31%)

Table-4: *Nursing staff*

Total specimen	*S.aureus* isolated	MRSA	MSSA
62	16(25.80%)	12(19.35%)	04(6.45%)

Table5: Department wise MRSA isolated

Department	No. of samples processed	*Staphylococcus aureus*	MRSA	MSSA
Medicine ICU	14	02(14.28%)	02(14.28%)	
Pediatrics NICU	14	06(42.85%)	04(28.57%)	02(14.28%)
Orthopedics ward	16	02(12.5%)	02(12.5%)	
Gynecology ward	08	02(25%)	02(25%)	
Laboratory HCW	18	06(33.33%)		06(33.33%)
Surgery	08	00(00%)		
Tuberculosis ward	06	02(33.33%)	02(33.33%)	
Dental surgery	16	10(62.5%)	04(25%)	06(37.5%)

DISCUSSION

Medical personnel have been traced as source of infection in many outbreaks of MRSA in hospitals[16]. The reservoir for *Staphylococcus aureus* is anterior nares[5].Colonization provides a reservoir from which bacteria can be introduced when host defenses are breached, whether by surgery, aspiration, insertion of an indwelling catheter, or simply by shaving. In a study of bacteremia, blood isolates were identical to nasal isolates in 82% of patients[17]. Accurate and rapid detection of *MRSA* is important not only for choosing appropriate antibiotic therapy for the individual patient; but also for control of the endemicity of *MRSA*[18]. We have assessed the prevalence of colonization of MRSA among health care workers and thus the possibility of its spread in hospital. Results of bacteriological study of nasal swabs from participating HCWs were revealed that *S.aureus* strains were isolated from 30% HCWS. Among *S. aureus* isolates 53.33% were *MRSA* strain; the overall *MRSA* carriage rate was 16%. This proves that *S. aureus* remains one of the most frequently encountered nosocomial pathogen. Human carriers are predominantly colonized by *S. aureus* in the nares and may contaminate their hands[19]. *MRSA* has become predominant form of clinically significant *S. aureus* within Hospitals[20]. The results of this study regarding the carriage rate of *MRSA* are nearly similar to those reported by Opal et al.(1990), who found high rates (56%) of *S. aureus* colonization among nurses, 65% of which were *MRSA*[21]. Also Badawi et al.(2001), and Kamp et al.(2003), in their studies reported similar rates of nasal carriage of *S. aureus* but much lower rates of *MRSA* carriage (26% and 5%; 33.8% and 0.7% respectively[22,23]). Higher nasal carriage rate (33% and 48%) for *S. aureus* of HCWs has been reported in two Pakistani studies[24, 25]. Prevalence of nasal carriage of *S. aureus* in other countries is also different (16.8-56.1%) [8]. This difference may be due, in part, to differences in geographical distribution, differences in the quality and size of samples and the culture methods used to detect *S. aureus*. Varying rates for MRSA carriage by HCWs are reported in Pakistan (14%) and India (39.7%) [25, 26]. The high carriage rate of *MRSA* in our study can be attributed to several factors e.g. high prevalence of *MRSA* among patient which increases the exposure potential among the participating HCWs[23]. One study done Jain K et al. (2014) on Bacteriological profile of post-surgical wound infection along with special reference to MRSA in central India, Indore states higher prevalence of MRSA among patients and thus health care workers having direct patient contact have higher carriage rate[27].Suboptimal infection control practices have a strong influence on the possibility of transmission between patients and HCWs[28]. These include; failure to perform active surveillance cultures to identify colonized patients, HCWs compliance with hand hygiene and incomplete use of protective barrier equipments. In our study, nursing staff showed higher carriage rate than doctors. This can be explained by the fact that HCWs having direct patient contact have higher carriage rate than those who have lesser contact[29]. Study done by Lakshmi S. Kakhandki et al.(2012) states higher carriage rate in nursing staff than clinical doctors which is in accordance to our study[30]. Among various department samples, highest rate was found in chest department followed by pediatrics department. This is in accordance with the study done by Cesur and Cokca(2004) , who found that the highest rate of *MRSA* carriage was in chest department[31]. Also study done by Sayed Mustaq Ahmed et al.(2013) reported highest prevalence rate of MRSA in NICU followed by SICU[32].

CONCLUSION

Our study revealed that health care workers were the potential colonizers of methicillin resistant *Staphylococcus aureus*. These carriers may serve as reservoir and disseminator of MRSA, and should be treated with mupirocin 3 times daily for 5 days. So regular screening of carriers is required for the prevention of nosocomial infection. Initial educational programs need to be followed by reinforcement and infection control staff should evaluate intrahospital compliance and identify lapses for further measures and education.

REFERENCES

1. Lin YC, Lauderdale TL, Lin HM, Chen PC, Cheng MF, Hsieh K.S., 2007. An outbreak of methicillin-resistant Staphylococcus aureus infection in patients of a pediatric intensive care unit and high carriage rate among health care workers. J Microbiol Immunol Infect. 40:325–34.
2. Uhlemann AC, Knox J, Miller M, Hafer C, Vasquez G, Ryan M., 2011. The environment as an unrecognized reservoir for community-associated methicillin resistant Staphylococcus aureusUSA300: a case-control study. PLoS One.6:e22407 .
3. Busato C, Carneiro Leão M, Gabardo J.,1998. Staphylococcus aureus nasopharyngeal carriage rates and antimicrobial susceptibility patterns among health care workers and their household contacts. Braz J Infect Dis. 2:78–84.
4. Al-Anazi A., 2009. Prevalence of methicillin-resistant Staphylococcus aureus in a teaching hospital in Riyadh, Saudi Arabia. Biomed Res 20:7.
5. Namita Srivastava, Ankur Goyal, Sapna Goyal, Ritesh Kumar, Bhavna, Rashmi Gupta., *2015.* Comparative Study On Prevalence Of Nasal Carriage Of MRSA And MSSA In Medical Students With Clinical Posting And Without Clinical Posting: Is Introduction Of Hospital Infection Control Policy In Medical Curiculum Need Of Hour. *IOSR Journal of Dental and Medical Sciences. 14(4) 77-79.*
6. Shenoy MS, Bhat GK, Kishore A, Hassan MK., (2010). Significance of MRSA strains in community associated skin and soft tissue infections. 28(2) 152-154.
7. Boyce JM., 1997. Epidemiology and prevention of nosocomial infections. In: Crossley KB, Archer GL, editors. The staphylococci in human disease. New York: *Churchill Livingstone;*.p. 309-29.
8. Kluytmans J, Von Belkum A, Verburgh H., 1997. Nasal carriage of *Staphylococcus aureus:* epidemiology, underlying mechanisms, and associated risks. *Clin Microbiol Rev*; 10:505-20.
9. David K Henderson., 2006. Managing methicillin-resistant staphylococci: A paradigm for preventing nosocomial transmission of resistant organisms AJIC: *American Journal of Infection Control* 34(5) S46-S54.
10. Mathanraj S, Sujatha S, Sivasangeetha K, Parija SC., 2009. Screening for methicillin-resistant Staphylococcus aureus carriers among patients and health care workers of a tertiary care hospital in south India. *Indian journal of medical microbiology* 27(1) 62-64.
11. Haas, J.P. and E.L. Larson, *Academic Emergency Medicine,* 2008. 15(4): p. 393-396.
12. Dar JA, Thokar MA, Khan JA, Ali A, Khan MA, Rizwan M, Bhat KH, Dar MJ, Ahmed N and Ahmad S., 2006. Molecular epidemiology of clinical and carrier strains of mrsa in the hospital settings in India. Annals of Clinical Microbiology and Antimicrobials, 5: 1-15.
13. Clinical Laboratory Standards Institute, 2008. Performance Standards for Antimicrobial Susceptibility Testing Approved Standard. Clinical and Laboratory Standard Institute: Wayne PA-USA.
14. Bauer AW, Kirby WMM, Sherris JC, Turck M. 1966. Antibiotic susceptibility testing by a standardized single disk method. American Journal of Clinical Pathology, 45: 493.
15. Clinical and Laboratory Standards Institute, 2010. Performance Standards for Antimicrobial Susceptibility Testing: 20th Informational Supplement (June 2010 Update). Wayne, Pa.
16. Locksley RM, Cohen ML, Quinn TC., 1982. Multiple Antibiotic resistant Staphylococus aureus: introduction, transmission and evolution of noscocomial infection. Ann Int Med. 97:317-324
17. Von Eiff C, Becker K, Machka K, Stammer H, Peters G., 2001. Nasal carriage as a source of Staphylococcus aureus bacteremia. N Engl J Med; 344:11–6.
18. Skov R., Smyth R. and Kahlmeter G.,2003: Evaluation of a cefoxitin 30µg disc on ISO – Sensitest agar for detection of MRSA. J. Antimicrob chemother; 52:204-7.
19. Blok H. E., Troelstra A., and Hopmans T. E., 2003: Role of HCWs in outbreaks of MRSA: a 10 years evaluation from a Dutch university hospital. Infect control hospital epidemiology 24: 679-85.
20. Warren D. K., Nitin A., andKollef M. H., 2004: occurrence of Co-colonization with VRE and MRSA in a medical ICU. Infect Control Hosp. Epidemiol; 25: 99- 104.
21. Opal S. M., Mayer K. H., and Musser J. M., 1990: Frequent acquisition of strains of methicillin resistant *Staph. aureus* by health care workers in an endemic hospital environment. Infect. Control Hosp. Epidemiol; 11: 479-85.
22. Badawi H., Omar M., and Helmi H., 2001: Evaluation of screening method for detection and typing of MRSA strains involved in noscomial spread. Egypt J. Med. Microbiol; 10(4): 679-89.
23. Kampf G., Adena S., and Weist K., 2003: inducibility and potential role of *mec* A gene positive oxacillin susceptible *Staphylococcus aureus* from coloniged health care warkers as a source for no socomial infections. J. Hosp. Infect; 54: 124-9.
24. Naheed A, Saima S, Mobina D, Hayat A., 2002. Nasal carriage of *Staphylococcus aureus* in health care workers in Rawalpindi General Hospital. *J Rawal Med Coll.* 6:74-6.
25. Kalsoom F, Zermina R, Akhtar N, Abdul Sattar, Khan JA, Bushra N., 2008. Nasal carriage of staphylococci in healthcare workers: antimicrobial susceptibility profile. *Pak J Pharm Sci*; 21:290-4.
26. Rajaduraipandi K, Mani KR, Panneerselvam K, Mani M, Bhaskar M, Manikandan P., 2006. Prevalence and antimicrobial susceptibility pattern of methicillin resistant *Staphylococcus aureus*: a multicentre study. *Indian J Med Microbiol* . 24:34-8. Comment in: *Indian J Med Microbiol* 2006; 24(4):304.
27. Jain K, Chavan N.S. , Jain S.M., *2014.*Bacteriological profile of post-surgical wound infectionalongwith special reference to MRSA in central india, indore. *Int J IntgMed Sci. Vol 1(1):9-13.*
28. Boyce J. M., Havill N. L., and Ligi C. E., 2004. Do infection control measures work for MRSA? Infect control Hosp Epidemiology 25: 395-401.

29. John JF Jr, Grieshop TJ, Atkins LM, Platt CG., 1993. Widespread colonization of personnel at a Veterans Affairs Medical Center by methicillin-resistant coagulase-negative Staphylococcus. *Clin Infect Dis* . 17:380-8.
30. Lakshmi S. Kakhandki , B.V. Peerapur.,2012. Study of nasal carriage of MRSA among the clinical staff and health care workers of a teaching hospital of Karnataka, India. Al Ameen J Med Sci . 5 (4): 367-370.
31. Cesur S., and Cokca F., 2004. Nasal carriage of MRSA among hospital staff and outpatients. Infect Control Hosp. Epidemiol; 25: 169-171.
32. Syed Mustaq Ahmed, Shakir VPA, Arya1 and Fuhad Pullani, 2013. Nasal screening for MRSA among the health care workers of a tertiary care hospital of North Kerala. Archives of Applied Science Research. 5 (1):167-171.

CONFLICT OF INTEREST : Nil
Received : 20.06.2015
Accepted : 08.07.2015

CITATION OF THIS ARTICLE

S.P.Kogekar, Khyati Jain, Priyanka Kumari, Nilesh Chavan, Prashant Peshattiwar, Madhurendra S Rajput High level of MRSA colonization in health care worker: alarm to implement health care policy. World J. Clin. Pharmacol. Microbiol.Toxicol. Vol 1 [2] July 2015. 21-25