

## **Screening health care personnel for detection of Methicillin resistant of Staphylococcus aureus carrier state at a tertiary care hospital in Mysore.**

Annu Theagrajan<sup>1</sup>, Sumana Mahadevaiah N<sup>2</sup>, Umamaheshwari S<sup>3</sup>,

<sup>1</sup>JSS Medical College, Mysore,

<sup>2</sup>Professor of Microbiology, Dept of Microbiology, JSS Medical College, Mysore.

<sup>3</sup>Dept of Microbiology, JSS Medical College, Mysore.

---

**ABSTRACT:** Background: *Staphylococcus aureus* is an important cause of nosocomial infections. To know the prevalence rate of Staphylococcal carriage among health care workers (HCWs) at intensive care units of JSS hospital, this study was taken up. Methods: Nasal swabs from 200 health care workers (One swab from nose and other from hands, Total- 400 swabs) were collected and cultured on Blood agar and Mannitol salt agar. Methicillin resistance was detected by Oxacillin disc diffusion and growth on oxacillin resistance testing agar.

**RESULTS:** Out of 400 samples tested, 223 samples yielded growth of Staphylococci. Among 200 HCWs screened, 159 of them carried Staphylococci (Carriage rate- 79%). Nasal carriage of MRSA (Methicillin resistant *Staphylococcus aureus*) was found in 19 (9.5%), while Skin carriage was found only in 7 (3.5%).

**Conclusion:** Regular screening for Staphylococcal carriage in HCWs and treating them appropriately can reduce the rate of nosocomial infections and outbreaks of MRSA infections.

**KEY WORDS:** Health care workers, MRSA, Nasal carriage of *Staphylococcus*, Nosocomial infection, Staphylococcal carriage rate.

---

### **I. INTRODUCTION**

*Staphylococcus aureus* is one of the most common causes of nosocomial infections. In many countries emergence of Methicillin resistant strains has led to major outbreaks in hospitals. Staphylococci multiply in the nose, on the skin, in lesions and they can survive for sometime outside the body. It is observed that people who work at hospitals also contribute to the rapid spread of this infection. The increasing prevalence of MRSA among nosocomial isolates of *S.aureus* in the US (from 2% in 1974 to as high as 64% in recent surveys) is of great concern. In a comparative study of Pneumonia due to MRSA and that due to Methicillin susceptible *S.aureus* (MSSA) in patients in ICU, MRSA pneumonia resulted in a significantly greater frequency of bacteremia (36.4% versus 10.5%; RR 3.4) and septic shock (27.3% versus 7.9% RR 3.4) a significantly higher infection associated mortality rate (54.5% versus 2.6%; RR 20.7)[1]. Kluytmans J et al have reported three patterns of carriage, persistent carriers about 20% of people, intermittent carriers- approximately -60% and non carriers who never carried *S.aureus*-20%[2]. HCW's in ICU can cause outbreaks of MRSA infection if they are carriers. This study was initiated to know the rate of Staphylococcal carriage among health care workers (HCWs) at intensive care units of a tertiary care hospital.

### **II. MATERIALS AND METHODS**

The study was carried out at a tertiary care hospital, Mysore. Health care personnel working in NICU, ICU, ICCU and post-operative wards formed the source of material for this study. A total of 200 health care personnel (Nurses working in ICUs) were screened. This includes all the nurses posted to ICUs round the clock to carry out the cross sectional study. Nasal swab, swab from the skin (from web spaces and nails of hands) - two swabs from each subject were collected as per the standard protocol. The swabs were collected in the Microbiology lab and without any delay inoculated on Blood-agar medium and Mannitol salt agar medium - a selective medium for *Staphylococcus aureus*. After overnight incubation, suspected colonies were confirmed to be Staphylococci by standard procedures such as Gram Staining and Catalase test. Tube coagulase test was done to confirm the *Staphylococcus aureus* species. About 0.1ml of young broth culture or agar culture suspension of the isolate was added to 0.5ml of human plasma (EDTA as anticoagulant) in a narrow test tube. Simultaneously positive and negative controls were put up. The tubes were incubated at 37°C for 3-6 hours. If positive, the plasma clots and does not flow when the tube is tilted. All the Coagulase negative and Mannitol non fermenting strains were grouped under Coagulase negative Staphylococci (CONS). These Staphylococcal isolates were subjected to antibiotic susceptibility testing, for the following antibiotics - Penicillin, Ciprofloxacin, Erythromycin, Clindamycin, and Linezolid by Bauer- Kirby disc diffusion method.

Methicillin resistance was tested using oxacillin disc diffusion method and oxacillin resistance testing Agar as per the standard protocol. [4, 5]

Interpretive Criteria (in mm) for Oxacillin Disk Diffusion Tests

	Susceptible	Intermediate	Resistant
Staphylococcus aureus	≥ 13 mm	11-12 mm	≤ 10 mm
Coagulase Negative Staphylococci	≥ 18 mm	N/A	≤ 17mm

N/A = not applicable

This study was conducted after obtaining clearance from the institutional ethical committee.

### III. RESULTS

A total of 200 Health Care Personnel( nurses only) were screened for nasal carriage & skin carriage of Staphylococci (400samples). Out of these, 223 samples yielded the growth of Staphylococci. Of these, 39 isolates were coagulase positive while 184 isolates were coagulase negative. All coagulase positive isolates were mannitol fermenters.

Among 200 Health Care personnel screened, 159 of them carried Staphylococci either on the skin or in the nose (Carriage rate- 79.5%). Of this 94 Health Care workers ( 47% ) harbored Staphylococci only in the nose, 1 Health Care worker ( 0.5% ) harbored Staphylococci only on the skin, and 64 Health Care worker (32% ) harbored Staphylococci both in the nose and skin. To the above data Chi square test was applied. Chi square is the test applied to know the significance among different groups of frequencies. The Staphylococcal carriage rate is highly significant among the HCW's screened (79.5%). Nasal carriage rate is significantly high(79%) compared to skin carriage(32.5%) as per the study.

Out of the 158 Staphylococcal isolates from nose, 61 isolates were methicillin resistant(38.6%)

Out of the 65 Staphylococcal isolates from skin, 23 isolates were methicillin resistant(35.3%).

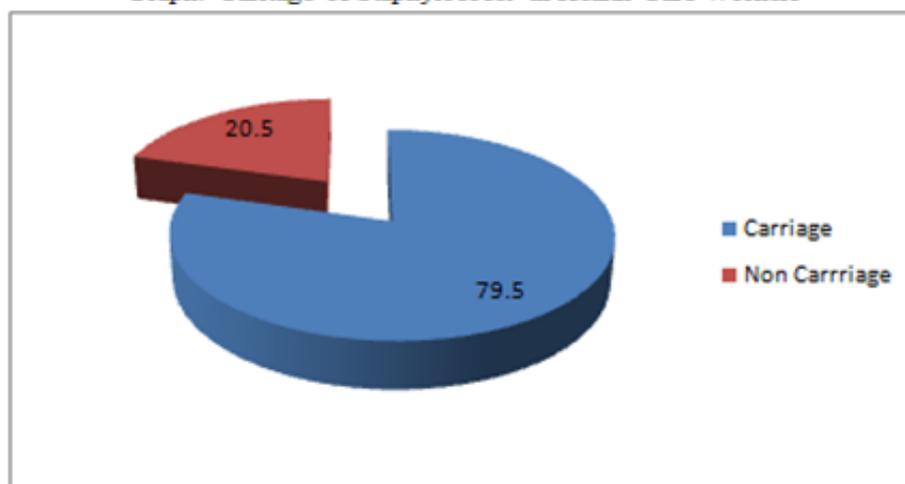
Nasal Carriage of Methicillin resistant Staphylococcus aureus was found in 19 HCWs(9.5%) out of the 200 screened.

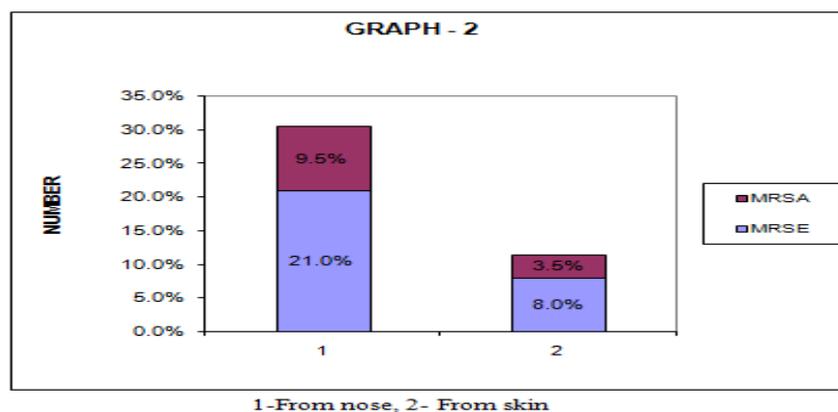
Skin carriage of Methicillin resistant Staphylococcus aureus was found in 7 HCWs(3.5%) out of the 200 screened.

Table: Carriage of Staphylococci in Health Care Workers

	Number	Percentage
Carriage	159	79.5
Non Carriage	41	20.5
Total	200	100

Graph: Carriage of Staphylococci in Health Care Workers





**Methicillin susceptibility by Disc diffusion**

	Coagulase positive	Coagulase negative	Total
Methicillin resistant Staphylococci	8(3.6%)	57(25.6%)	65(29.12%)
Methicillin Sensitive Staphylococci	31(13.9%)	127(56.9%)	158(70.88%)
Total	39(17.5%)	184(82.5%)	223(100%)

**Methicillin Susceptibility by Resistance screening agar.**

	Coagulase positive	Coagulase negative	Total
Methicillin resistant Staphylococci	9(4%)	59(26.5%)	68(30.5%)
Methicillin sensitive Staphylococci	30(13.5%)	125(56%)	155(69.5%)
Total	39(17.5%)	184(82.5%)	223

Limitations of the study: Vancomycin susceptibility to the isolates was not put up because as per CLSI guidelines, Vancomycin susceptibility has to be done by broth dilution method. As the objective of the study was to just find out the rate of Staphylococcal carriage and MRSA carriage, Vancomycin susceptibility was not done.

**IV. DISCUSSION**

In this study out of the 200 Health Care Workers screened 79% (158) of the Health Care Workers were carriers of Staphylococci. Of these, 19.5% (39) of them carried Staphylococcus aureus. Out of the Staphylococcus aureus carriers, 15% (30) were nasal carriers and 3.5% (9) were skin carriers. While the Sudanese University Hospital study conducted in 1998 showed 52.6% Staphylococcus aureus carriage (which is much higher compared to our study), and 13.2% nasal carriage was reported by Abdulla. O.A. et.al from Sudan which almost matches our study.[6] Among the 200 Health Care Workers screened, 13% (26) were carriers of MRSA, of which 9.5% were nasal MRSA and 3.5% were skin MRSA carriers. Kawashima T from Niigata University of Medicine, Japan has reported a nasal carriage of MRSA of 9.2% among nurses and 5.6% among doctors which almost matches our study results that was done 20 years back. [7]

Saxena S from Delhi has reported 29.6% nasal carriage of S. aureus among the healthy individuals in the community, while it was 44.4% among the healthcare workers which is similar to our study (47%). Among the isolates from health care workers, 25% were MRSA [8] which is much higher compared to our study (9.5%).

Javid A Dar et al have reported that in nasal swabs of hospital workers and patients (n = 225) the frequency of MRSA isolates was 28.9% which again is higher compared to our study. [9]

In the studies conducted on the patients admitted in the ICU, Oztoparak et al have reported a nasal carriage of 23.7% and MRSA carriage rate of 8.4%. [10] Krishna.B.V et al from Karnataka Institute of Medical Sciences, Hubli, India have reported that 18.1% of the patients carried MRSA. [11]

All these are studies of Health Care Workers at various hospitals. There are very few references for similar study among Health Care Workers across the globe. However many studies have been conducted on the carriage rate of Staphylococcus in patients in the community. Sonal Saxena et al from a hospital in eastern Delhi have reported a Staphylococcal carriage rate of 29.4%, which almost matches our study results, but the isolates of their study were from the community. They reported Nasal Staphylococcal carriage rate of 18.1% from the community. [12] Arch.G. Mainous et al from USA have reported that 32.4% of the people in the community carry Staphylococcus aureus in the nose, out of which 8.28% are MRSA [13]. Cekovoska et al from Cyprus and Methodist University in their study reported 21% MRSA nasal carriage in the community [14].

## V. CONCLUSION

Although the Staphylococcal carriage rate among Health Care Workers at J S S Hospital, Mysore, is quite high (79%) only 19.5%, of them carry Staphylococcus aureus, 13% carry MRSA. Only 9.5% carry MRSA in the nose. Compared to various other studies, Staphylococcus aureus carriage and MRSA carriage in our study is quite low. This study has helped us to treat the carriers of Staphylococcus aureus in the critical care unit to prevent nosocomial infections in patients, which proves to be of great value in reducing patient morbidity and hospital stay of these patients.

## REFERENCES

- [1]. Thomas J. Marrie, G.Douglas Campbell, David H. Walker, Donald E.Low, Pneumonia, Harrison's principles of Internal Medicine, 16th edition, Vol II, McGraw-Hill publication, 2005;1539.
- [2]. Kluytmans J, Van Velkum A, Verbrugh H, from Ignatius hospital, Breda, Netherlands, Nasal carriage of Staphylococcus aureus : Epidemiology, underlying mechanisms, and associated risks. Clin Microbiol Rev 1997; 10(3): 505-20.
- [3]. Ananthanarayan and Paniker's Text book of Microbiology, 7th edi, Orient Longman publication, 2005.
- [4]. Elmen W .Koneman, Stephen D allen, William M Janda, Paul C Shreckenberger, Washington C Winn, J B Color atlas and textbook of Diagnostic Microbiology, 4th edition, Lippincott company publication 1992;642-3.
- [5]. CLSI. 2007. Performance standards for antimicrobial susceptibility testing. CLSI approved standard M100-S17. Clinical and Laboratory Standards Institute, Wayne, PA.
- [6]. Abdalla OA, Alex van Belkum, Ahmed HF, AbuElnor AE, Elsir AM, Abougroun I, Marjolein FQ, Vandenberg, Zijlstra E, and Henri AV. Nasal carriage of Staphylococcus aureus and Epidemiology of Surgical site infection in a Sudanese University hospital; Journal of Clinical Microbiology 1998;36(12): 3614-18.
- [7]. Kawashima T, Dept of Medicine, Niigata university school of Medicine. Study of Nasal carriage of MRSA Kansenshogaku Zasshi. The Journal of Japanese association for Infectious diseases 1992; 66(6): 686-95.
- [8]. Saxena S ,Department of Microbiology, UCMS and GTB Hospital, Delhi, India, Prevalence of Methicillin-resistant Staphylococcus aureus Colonization among Healthcare Workers, and Healthy Community Residents . J Health Popul Nutr 2002; 20(3):279-280.
- [9]. Javid A Dar, Manzoor A Thoker, Jamal A Khan, Asif Ali, Mohammed A Khan, Mohammed Rizwan et al. Molecular epidemiology of clinical and carrier strains of methicillin resistant Staphylococcus aureus (MRSA) in the hospital settings of north India. Ann Clin Microbiol Antimicrob 2006; 5:22.
- [10]. Oztopark N, Cevik MA, Akinci E, Korkmaz EA, Eren SS, Balaban N, Bodhur H,- Dept of Infectious diseases and Clinical Microbiology. Risk factors for ICU acquired MRSA infections. American Journal of Infection control 2006; 34(1): 1-5.
- [11]. Krishna BV, Patil AB, Chandrashekar MR. Community acquired MRSA infection in South Indian city. Southeast Asian Journal of Tropical Med Public Health 2004; 35(2): 371-4.
- [12]. Saxena sonal, Singh Kavitha, Thalwar Vibha. Methicillin Resistant Staphylococcus aureus prevalence Community in the East Delhi area. J. infect.dis 2003; 56: 54-56.
- [13]. Arch GM, William JH, Charles JE, Vanessa AD. Nasal carriage of Staphylococcus aureus and Methicillin resistant S.aureus in the United States, 2001-02; Annals of Family Medicine 2006; 4:132-7.
- [14]. Cekovska Z, Panovski N, Petrovska M, Kristof K, Rozgonvi F . Incidence of Staphylococcus isolated from patients treated at the Centre of Skopje, Macedonia, with social reference to MRSA. Acta Microbiologica et Immunologica Hungarica 2005; 52(3-4): 373-84

Table 1: Staphylococcal Carriage among health care workers screened

	Frequency	Percent
Number of carrier's	158	79.0
Non carrier's	42	21.0
Total	200	100.0

Table 2: Nasal and skin carriage rate.

	Frequency	Valid Percent	Cumulative percent
Nasal Staphylococcus carriers	30	76.9	76.9
Skin Staphylococcus carriers	9	23.1	100.0
Total	39	100.0	