

Original Research Article

Nasal Screening of Health care workers (Nursing staff) to study the Prevalence of ~~Methicillin~~-Methicillin-Resistant Staphylococcus aureus (MRSA) carriage and its antibiotic sensitivity profile in a Rural tertiary health care centre

Abstract:

The present study is carried out to determine nasal carriage of MRSA among nursing staff posted in Medicine and allied wards of a rural tertiary health care center in North India and the antibiotic sensitivity profile of the isolated MRSA strains. Many of the carriers of MRSA harbour pathogens in areas like nares, hand surfaces, and axilla and are generally asymptomatic. Colonisation in healthcare workers has increased the incidence of serious nosocomial infection wherein healthcare workers act as vectors for transmission of infection in already immunocompromised patients. The study undertaken was a cross-sectional type where nursing staff was analysed for nasal carriage of MRSA and antibiotic sensitivity profile of MRSA. A total of 60 nursing staff members posted in medicine and allied wards were recruited in this study. A total of 34 (56.6%) were females and 26 (43.3%) were males. Our study showed considerable MRSA carriage among the nurses and also reported a decreased sensitivity to commonly used drugs. Also, no resistance was detected against higher antibiotics like Vancomycin, Teicoplanin, and Linezolid which points to their use in the eradication of infection caused by MRSA. There is a need to strictly implement and follow the hospital infection control guidelines to reduce the spread of MRSA to susceptible persons.

Keywords: MRSA, HCW, VRSA

1. INTRODUCTION

Staphylococcus aureus is a gram-positive coccus colonising external skin surfaces and the upper respiratory tract commonly nares. (1) It can invade through any breach in the skin and mucosal lining to cause infections ranging from minor skin infections like impetigo to fatal sepsis and toxic shock syndrome. At the time of the introduction of penicillin in 1944 about 94% of strains of *S. aureus* were susceptible to it. (4) Until the 1950s *S. aureus* was sensitive to treatment with penicillin but later developed resistance due to the production of the β -lactamase enzyme. This problem was overcome in 1959 with the introduction of methicillin. (1) However, methicillin resistance was identified shortly after the introduction of methicillin in clinical practice. (2,3) First case of ~~methicillin~~-methicillin-

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resistant *S.aureus*(MRSA) was identified in Europe from the nares of an infant admitted ~~in~~to the medicine ward.(3)
The use of various antibiotics has led to the development of ~~multi drug~~-resistant strains of MRSA.(1,4)
Since then, MRSA has spread worldwide, becoming an notorious bug responsible for difficult-to-treat infections both atthe community and hospital levels. In context to the Indian scenario, MRSA prevalence grew from 12% in 1992 to 80.33% in 1999(5). Many of the carriers of MRSA harbour pathogens in areas like nares, hand surfaces, axilla and are generally asymptomatic. Colonisation in healthcare workers has increased the incidence of serious nosocomial infection wherein healthcare workers act as vectors for transmission of infection in already immunocompromised patients. (6,7) Furthermore, no stringent following of hospital infection control norms and overlooking ~~of~~ antimicrobial stewardship adds to the current disaster of ~~pan-pan~~-drug resistance in microbes including MRSA, thereby making the study of this organism significant.

Since nursing staff is often the first to come in contact with patients and also responsible for regularly looking after ~~of~~ patients in wards, screening them for carriage of MRSA will not only detect carriers but also help the hospital infection control committee to take appropriate steps in limiting its spread. Also, little work has been done in peripheral healthcare settings regarding MRSA - in contrast to most of the Indian population residing in rural settings - this study will thus help increase awareness among currently practicing healthcare workers and various other epidemiological studies being carried out. Keeping in mind all this the present study is carried out to determine nasal carriage of MRSA among nursing staff posted in Medicine and allied wards of a rural tertiary healthcare center in North India and the antibiotic sensitivity profile of the isolated MRSA strains.

MATERIAL AND METHOD

The study was carried out under the Department of Microbiology for a duration of 2 months (July-December) after obtaining ethical clearance (Ref no.MAMC/IEC/2022/10) from the Institute. The study undertaken was a ~~cross~~cross-sectional type where in nursing staff was analysed for nasal carriage of MRSA and antibiotic sensitivity profile of MRSA. The study was done on the nursing staff posted in medicine and allied wards of a rural tertiary healthcare center of North India.

Inclusion criteria-Complete nursing staff posted in medicine and allied wards were studied.

Exclusion criteria-Staff members suffering from an active upper respiratory tract infection or skin infection were excluded. Nursing students were not included in this study.

Staff members who did not give consent for being enrolled in the study were also excluded.

Method

Two sterile nasal swabs were taken from both the anterior nares of the participants. Swab was inserted about 2 cm into the anterior nares and rolled clockwise thrice and collected in an airtight container ~~was~~ labelled and sent to the microbiology laboratory immediately. One swab was used for gram staining & another for culture on blood agar. Inoculated plates were incubated ~~for~~ overnight at 37°C. *S.aureus* was identified by colony morphology, microscopic appearance on ~~gram-gram~~-stained smears, catalase test, slide and tube coagulase test. (36) Isolated strains of *S.aureus* were screened for methicillin susceptibility by modified Kirby-Bauer method using cefoxitin (30ug) discs on Muller Hinton Agar (MHA) by using an inoculum density which was equivalent to MacFarland's 0.5 standard (1.5×10^8 CFU/ml) and then incubated at 35°C overnight. (37) Isolates which showed inhibition zone size of diameter <21mm were considered as MRSA stains. (38) The isolated MRSA strains were further studied for antimicrobial sensitivity profile by automated identification and antimicrobial susceptibility system using Vitek-2 compact system (Biomérieux, India). (39) In the case of Vancomycin, the strains showing MIC of >4ug/ml by Vitek-2 compact system were considered as ~~vancomycin~~ vancomycin-resistant *S.aureus* (VISA)

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The data was ~~compiled~~ compiled, tabulated, and subjected to SPSS version 17.0 software statistical package for analysis. A p-value of < 0.05 was considered ~~as~~ significant.

Results

A total of ~~A total of~~ 60 nursing staff members posted in medicine and allied wards were recruited in this study. A total of 34 (56.6%) were females and 26 (43.3%) were males. Their age ranged from 21-60 years of which maximum belonged to the 21-30 years age group - 29 (48.3%). Maximum nursing staff 32 (53.3%) have working experience of >5 years [Table-1].

Table 1: Characteristics of study participants

PARAMETERS	FREQUENCY (%) N=60
Age (in years)	
21-30	29 (48.3)
31-40	19 (31.6)
41-50	10 (16.6)
51-60	2 (3.3)
Sex	
Female	34 (56.6)
Male	26 (43.3)
No of years working in a hospital (years)	
<1	2 (3.3)
1-5	26 (43.3)
>5	32 (53.3)

The nasal carriage rate of *S.aureus* was 20%(12/60) ,out of which MRSA was 13.3%(8/60) whereas Methicillin sensitive *S.aureus*(MSSA) was 6.7%(4/60). [Table-2].

Table-2 MRSA carriage status

No.of healthcare workers screened	No. positive for S.aureus	No. positive for MRSA
60	12(20%)	8(13.3%)

Our study showed maximum carriage of MRSA in the 31-40 age group 50% (4/8), followed by 41-50 years 25% (2/8). Females reported a higher carriage of 62.5% (5/8) compared to males 37.5% (3/8). Nursing staff members who have a longer work duration in the hospital (>5 years) reported a higher nasal carriage of MRSA 75% (6/8) compared to those with lesser years of work in the hospital (1-5 years) and 25% (2/8). [Table-3]

[Table-3 Characteristics of MRSA carriers]

PARAMETERS	MRSA FREQUENCY (%) N=8
Age (years)	
21-30	1 (12.5)
31-40	4 (50)
41-50	2 (25)
51-60	1 (12.5)
Sex	
Female	5 (62.5)
Male	3 (37.5)
No. of years of working in the hospital (years)	
<1	0 (0)
1-5	2 (25)
>5	6 (75)

MRSA isolated was further analysed for antibiotic sensitivity profile. All isolates showed resistance of 100% to Ampicillin, Erythromycin, and Amoxycylav where as sensitivity of 12.5% to Ciprofloxacin; 37.5% to Clindamycin and Amikacin; 87.5% to Co-trimoxazole. All MRSA isolates were 100% sensitive to Linezolid, Vancomycin, Teicoplanin, and Rifampin [Table-4]

[Table-4 Antibiotic sensitivity profile of MRSA isolates]

ANTIBIOTIC	SENSITIVITY(%) N=8
Amikacin	3 (37.5)
Amoxiclav	0 (0)
Ampicillin	0 (0)
Ciprofloxacin	1 (12.5)
Clindamycin	3 (37.5)
Cotrimoxazole	7 (87.5)
Erythromycin	0 (0)
Linezolid	8 (100)
Rifampin	8 (100)
Teicoplanin	8 (100)
Vancomycin	8 (100)

DISCUSSION

S.aureus can colonise multiple sites in the body like the anterior nares, axilla, perineum, pharynx, and gastrointestinal tract, however, the most common site is anterior nares [1][22]. Nasal colonization with *S.aureus* has been reported to range from 6.3% to 17.8% in the general population while in healthcare workers from 18.2% to 28.2% [23][24]. In our study, the carriage of *S.aureus* in the anterior nares of nursing staff is 20% of which MRSA is

Comment [SZ3]: The author have only 14 references, from where he have 22-34???? need to be re-written in normal orders.

13.3% and MSSA is 6.7. The prevalence of MRSA varies among different institutions and geographical areas. The differences in the study design such as sample size and the methodology which has been employed for MRSA detection, may account for the disparity in the carriage.

The prevalence of MRSA carriage worldwide among healthcare workers is reported to be around 10-40% [25]. Various studies in healthcare settings report different rates of MRSA carriage among healthcare workers. Studies in Indian healthcare settings report MRSA carriage of 1.8% in Pondicherry, 6.6% in Delhi and 2% in Madurai [26][27][28][29][30]. In our study, MRSA carriage among nursing staff is 13.3% (Table-3) which is in accordance with the findings of studies from Assam (11.4%) [40] and Bangalore (10%) [41]. A study by Kalyani K et al reports a carriage of 7.5% among nursing staff [33]. Another study in Saudi Arabia showed a carriage of 23% in nursing staff [32]. These differences in the prevalence of MRSA might be due to the variability in geographical distribution, hospital settings, hospital specialities, and areas within the hospital where the study was conducted.

In our study, nasal carriage was found to be higher in female staff (62.5%) as compared to males (37.5%) (Table-4). A study conducted at Bhubaneswar also reports a higher carriage of MRSA among females [31]. This might be due to the fact that more females constituted the study population. The highest rate of MRSA carriage (75%) is among the nursing staff who have worked for >5 years in the hospital (Table-4). In a study by Al Humaiden et al in Saudi Arabia the highest rate of MRSA carriage was among the healthcare workers who have worked for 4-6 years (26%) [32]. This can be due to the time required for developing resistance and colonising the host.

All the MRSA isolates were 100% sensitive to Linezolid, Vancomycin, and Teicoplanin (Table-5). A study conducted by Radhakrishnan et al reported 100% sensitivity to Vancomycin, Linezolid, and sensitivity of 80% to Teicoplanin [34]. However, sensitivity to vancomycin was 84.3% in a study done by El Aila et al [35]. In our study, the sensitivity of MRSA isolate to Amikacin was 37.5%, Ciprofloxacin 12.5%, Clindamycin 37.5%, and Cotrimoxazole 87.5%. All the MRSA isolates showed 100% resistance to Ampicillin, Amoxiclav, and Erythromycin. In a study conducted by Radhakrishna et al, the sensitivity of Erythromycin is 40%, Gentamicin is 80% and Ciprofloxacin is 20%. [34].

Comment [SZ4]: Although it is wrong, but if used many references follow each other can be written 26-30 only not 26.27.28.29.30

Comment [SZ5]: Al-Humaidan OS, El-Kersh TA, Al-Akeel RA. Risk factors of nasal carriage of Staphylococcus aureus and methicillin-resistant Staphylococcus aureus among health care staff in a teaching hospital in central Saudi Arabia. *Saudi Med J.* 2015;36(9):1084-1090. The missed reference

Comment [SZ6]: EL Aila et al not written in references below??
El Aila NA, Al Laham NA, Ayesh BM. Nasal carriage of methicillin resistant Staphylococcus aureus among health care workers at Al Shifa hospital in Gaza Strip. *BMC Infect Dis.* 2017;17(1):28.

Comment [SZ7]: Radhakrishna et al, is not written in references below
M, Radhakrishna et al. "Prevalence of Methicillin Resistant Staphylococcus aureus Carriage amongst Health Care Workers of Critical Care Units in Kasturba Medical College Hospital, Mangalore, India." *Journal of clinical and diagnostic research : JCDR* vol. 7,12 (2013): 2697-700.

Thus, our study showed considerable MRSA carriage among the nurses and also reported a decreased sensitivity to commonly used drugs. Also, no resistance was detected against higher antibiotics like Vancomycin, Teicoplanin, and Linezolid which points to their use in eradication of infection caused by MRSA. The Hospital Infection Committee was informed regarding the detected resistance in nursing staff so that appropriate measures can be taken and regular ~~cus~~ screening can be done to curb the spread of resistant nosocomial infections.

CONCLUSION

In this study, nasal carriage of MRSA among the nursing staff posted in the Medicine and allied branches is 13.3%. Considering the fact that nurses are more involved in patient care activities, it is necessary that they should be sensitized regarding this issue. The importance of handwashing should be emphasized for all healthcare workers as it is the single most appropriate method to combat the spread of nosocomial infections including MRSA.

There is hence a need to strictly implement and follow the hospital infection control guidelines ~~so as~~ to reduce the spread of MRSA to susceptible persons.

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