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Nasal And Hand Carriage of Methicillin-Resistant Staphylococcus Aureus Among Health Care Workers of A Tertiary Care Hospital in North-East India.

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Abstract : *Health care workers (HCWs) have been known to be an important source for nosocomial transmission of Methicillin Resistant Staphylococcus aureus (MRSA) to hospitalised patients. Screening for MRSA among the HCWs is therefore an essential element of hospital infection control policy. With this aim, the following study was undertaken. A total of 100 health care workers (HCW's) were included in the study.The HCW's comprised of Doctors, Nurses, Nursing students, Ward boy/girl/Cleaner and Laboratory Technicians from various Intensive care units and clinical wards of GMCH.100 nasal and hand swabs each were collected from the 100 HCWs. Following the identification of S.aureus, methcillin resistance was detected by cefoxitin disc diffusion method as per current CLSI Guidelines. Nasal carriage and hand carriage rate of S.aureus was 36% and 18% respectively. MRSA carriage rate in nasal and hand swab were 25% and 13% respectively. Nasal carriage of MRSA was highest among the nurses whereas hand carriage was highest among the nursing students. The highest numbers of nasal carriers and hand carriers were isolated from the Male surgical ward. Strict adherence to infection control policies is the need of the hour to prevent colonization of HCWs.*

Keywords : *Nasal carriage, Hand carriage, Health care workers, MRSA*

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I. Introduction

Staphylococcus aureus, an important pathogen in human disease is frequently associated with multiple human infections. An increase in infections caused by MRSA strains, which are most often multi resistant has been seen in the last two decades. The rising trend of resistance to a wide range of antibiotics by S. aureus represents a significant threat to future treatment efficacy. [1]

Nasal carriage of S. aureus appears to play a key role in the epidemiology and pathogenesis of infection. The ecological niches of S. aureus strains are the anterior nares. [2] S. aureus is predominantly localized to the anterior nares where it attaches to a specific region of moist epithelium devoid of hair and cilia. . Other sites such as the axilla and perineum may become colonized, but S. aureus appears to be a temporary resident here since elimination of nasal carriage by topical antibiotics generally leads to loss of carriage in other sites. [1]

Nasal carriage of MRSA is a recognized risk factor for subsequent endogenous infections as well as of human to human transmission. Studies have reported that the elimination of nasal carriage causes a reduction in the incidence of S. aureus infection. [3,4] The dissemination of this organism to patients is most likely to occur during routine patient care. Low hand-washing compliance, lack of trained health care force, overcrowding and understaffing among health care workers, are some of the postulated reasons for enhanced transmission rates of S.aureus within the hospital set up. [5, 6]

Three patterns of carriage are known. A large proportion of the population (60%) harbours S. aureus intermittently, and the strains change with varying frequencies. Such persons are called intermittent carriers. Approximately 20% of the individuals almost always carry one type of strain and they are called persistent carriers. Finally, a minority of the people (20%) almost never carries S. aureus and they are called non-carriers. [7]

Microorganisms on the hands of HCWs may be resident (persistent over time and not readily removed by hand washing) or transient (recently acquired from another source). Hands of HCWs are an important vehicle for transmission of infection. [8] HCWs who have direct contact with persistently colonized patients, or contaminated objects in the immediate environment around them can contaminate their hands and subsequently transmit the organism to other patients. [9] Transmission of S. aureus by hand to hand transmission is amenable to intervention, particularly in settings where hand washing is infrequent.Several studies have reported the rate of nasal carriage among health care workers ranging from 16.8 to 56.1%. [10, 11, 12, 13] An active surveillance

program needs to be undertaken to identify and eliminate the carriage in healthcare workers and reduce the hospital acquired infection rates in health care establishments. [14]

The goal of this research study was to analyze the prevalence of colonization of S. aureus as well as detect the MRSA carrier state among the HCWs of Gauhati Medical College and Hospital.

II. Materials And Methods

This cross sectional study was conducted in a tertiary care hospital in Assam, Gauhati Medical College and Hospital (GMCH). A total of 100 health care workers (HCW's) were included in the study after taking informed consent. The HCW's comprised of Doctors, Nurses, Nursing students, Ward boy/girl/Cleaner and Laboratory Technicians. These HCW's were from various Intensive care units and clinical wards of GMCH.A questionnaire was used to record the demographic profile (age, sex), hand-washing practices and previous hospitalization history of the participants.

2.1 Exclusion criteria: Any person suffering from skin infections, upper respiratory tract infection, rhinitis, on nasal medication or with history of use of antibiotics in the past 1month were excluded from the study

2.2 Methodology: One nasal swab from the anterior nares and one hand swab each was collected from the 100 HCW's. A sterile cotton swab soaked in sterile saline was inserted into each nostril in turn to a depth of 1cm and rotated four to five times. Hand swabs were collected similarly from the dorsal and palmar aspect of the hands including the web spaces. The swabs were immediately plated in blood agar plates. The plated were incubated at 37˚C for 24hrs. After incubation, growth of S. aureus was identified by colony morphology, gram stain, catalase and coagulase test (slide and tube) and mannitol fermentation. Methcillin resistance among the S.aureus isolates was detected by cefoxitin disc diffusion method (30µg cefoxitin disc) as per current CLSI Guidelines.[15] Isolates with cefoxitin zone ≤21mm were considered methicillin resistant. S.aureus ATCC 25923 and methicillin resistant S.aureus ATCC 43300 were used as controls.Those HCWs who were found to be colonized with MRSA were given Mupirocin ointment for eradication.

III. Results And Observations

A total of 200 swabs collected from 100 HCW's were screened for the presence of S.aureus. Out of these 100 HCWs, 66 were females and 34 were males. The age of the participants ranged from 19-49 years .Out of the 100 nasal swabs screened, S.aureus was isolated from 36 swabs, and therefore the rate of nasal carriage of S.aureus was found to be 36% (36/100). Out of the 36 S.aureus isolated from the nasal swabs, 25 were methicillin resistant i.e. 25% (25/100) and 11 % (11/100) were methicillin sensitive. Out of the 100 hand swabs collected, 18 showed growth of S.aureus, therefore the rate of hand carriage of S.aureus was 18%(18/100). Out of the 18 S.aureus isolated 13% were MRSA (13/100) and 5% (5/100) were methicillin sensitive. 11HCWs (11%) were found to have Staphylococcus aureus colonization in both nasal and hand swabs. Out of these 11 HCWs, 7 had MRSA colonization, 3 had Methicillin Sensitive Staphylococcus aureus (MSSA) and 1 had MSSA in hand swab and MRSA in nasal swab.

TABLE 1 shows the distribution of S.aureus among different professions. The highest carriage rate was seen among the Nurses (73.9%) followed by the laboratory technicians (70%) and nursing students (59%). Nasal carriage of MRSA was highest among the nurses whereas hand carriage was highest among the nursing students. No significant difference in the carriage rate was seen among the males and females as per TABLE2. According to TABLE 3, the highest numbers of nasal carriers were isolated from the Male Surgical Ward (MSW) followed by PaediatricICU and Nephrology ward. Similarly, hand carriage rate was highest among the MSW followed by Paediatric ward and Central Clinical Laboratory.

IV. Figures And Tables

Table 1: Distribution of S.aureus among the different Professions:

Profession	Total sample collected	MSSA		MRSA		TOTAL
		Nasal	Hand	Nasal	Hand	
Nurse	23	4(17%)	2(9%)	9(39%)	2(9%)	**17(73.9%)**
Doctor	30	4(13%)	1(3%)	5(17%)	4(13%)	**14(46.6%)**
Nursing student	22	1(4%)	1(4%)	6(27%)	5(23%)	**13(59%)**
Laboratory technician	10	1(10%)	1(10%)	3(30%)	2(20%)	**7(70%)**
Ward boy/ward girl/cleaner	15	1(7%)	0	2(13%)	0	**3(20%)**
TOTAL	**100**	**11**	**5**	**25**	**13**	**54**

Table 2: Showing the sex distribution of the HCWs

SEX	NO: OF HCWs	Total number of S. aureus isolated from nasal swab	Total number of S.aureus isolated from hand swab

MALE	34	12(35%)	7(20%)
FEMALE	66	24((36%)	11(17%)

Table 3: Distribution of S.aureus among different wards/Intensive units of GMCH

Ward/Intensive unit	Total samples collected	MSSA	MRSA	TOTAL
EICU	10 Nasal	0	1	1(10%)
	10 Hand	0	0	0
ITU	7Nasal	1	1	2(28%)
	7Hand	0	0	0
GICU	7Nasal	0	0	0
	7Hand	0	0	0
PICU	7Nasal	0	4	4(57%)
	7Hand	0	0	0
NICU	8Nasal	0	0	0
	8Hand	0	0	0
0bs and Gynae ward	8Nasal	0	0	0
	8Hand	0	0	0
Nephrology Ward	9Nasal	0	5	5(55%)
	9Hand	0	2	2(22%)
Paediatric ward	9Nasal	2	2	4(44%)
	9Hand	2	2	4(44%)
Orthopaedics ward	9Nasal	2	2	4(44%)
	9Hand	0	2	2(22%)
Male surgery ward (MSW)	11Nasal	4	7	11(100%)
	11Hand	2	4	6(54.5%)
Central clinical laboratory (CCL)	9Nasal	1	2	3(33%)
	9Hand	1	2	3(33%)
Sample collection centre(SCC)	6Nasal	1	1	2(33%)
	6Hands	0	1	1(16%)

EICU: Emergency ICU, ITU: Intensive Therapy Unit, GICU: General ICU, PICU: Paediatric ICU, NICU: Neonatal ICU.

Table 4: Showing the list of other organisms isolated:

ORGANISMS ISOLATED	ANTERIOR NARES SWAB	HAND SWAB
CONS	53	46
Klebsiella pneumonia	2	5
Streptococcus viridians	6	4
Bacillus subtilis	1	9
Escherichia coli	0	1
Micrococcus	0	4
Sterile(No growth)	0	16
TOTAL	**62**	**85**

Cons: Coagulase negative staphylococci

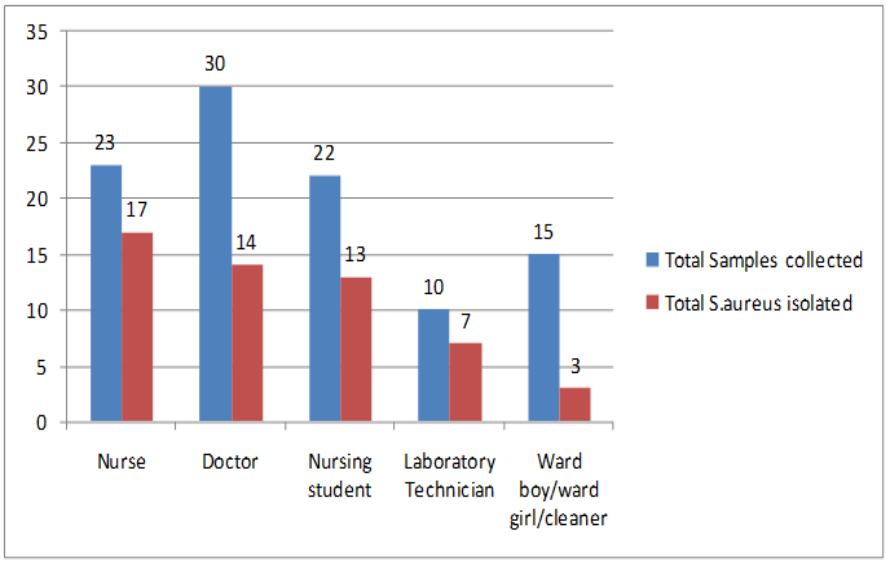

Figure 1: Showing the distribution S.aureus among different profession.

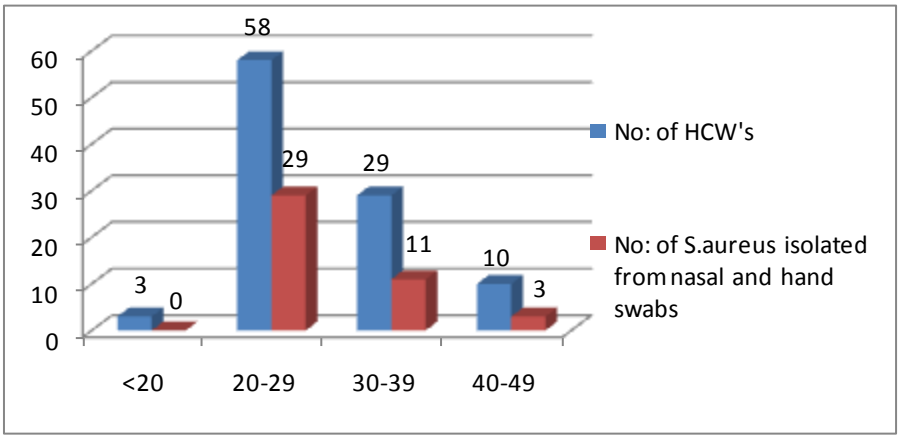

Figure 2: Showing the age distribution of the HCW's and the corresponding number of S.aureus isolated in each age group

V. Discussion

Surveillance of HCWs for MRSA carriage is essential specifically in critical care areas as they pose a threat to infection control practices. Nasal colonisation with S aureus especially among healthcare personnel plays a significant role in the increasing prevalence of resistant community acquired S aureus infection. In the present study, nasal carriage rate of S.aureus was found to be 36% (36/100).Our findings are similar to a study done by H.Mondal et al [16] where the nasal carriage of S. aureus was 34.8% .Similar findings were also reported by Troung et al [17] (35.8%), Yazgi et al[18] (27.5%) and El Aila et al [19] 31%). However the carriage rate was low in studies done by L. Agarwal et al (14%) [20] and P.S.Satpathi et al (21.7%) [21]. Interestingly, in a study by S.R Rongharpi et al [22] in the year 2001 in the same institute, GMCH , the nasal carriage rate of S.aureus among the HCWs was 22.2%. It is clearly evident from these findings that there has been an increase in the colonization rate of S.aureus among the HCWs in our institute.

In our study, 25% (25/100) isolates from the nasal swabs were MRSA. Similar findings were reported byEl Aila et al (25.5%) [19], P.S Satpathi et al (30%) [21] and H.Mondal et al (18.39%) [16]. Lower MRSA carriage was seen in studies by Kausalya et al (1.33%) [23] and S.R Rongharpi et al (11.43%) [22]. A higher MRSA colonisation rate of 34.61% was reported by Shinde RV et al [14].

There is no significant association seen in this study between nasal carriage rate and sex of the HCWs (Females, 36% vs Males, 35%) similar to findings by Rutvi et al [24] (Females 5.4% vs Males 6.8%). In age-wise distribution, it was observed that the highest nasal carriage rate (50%) was seen in young adults of 20-29 yrs age group followed by 30-39 year age group (38%) and 40-49 year age group (30%). The prevalence of higher carriage in young individuals was also reported by Ahmad et al. [25] (33.4%) as compared to the aged group.

In our study, the hand carriage of S aureus was 18%(18/100), out of which 13% were MRSA and 5% were Methicillin sensitive S. Aureus (MSSA)i.e hand carriage of S. aureus was found to be less than the nasal carriage. These findings are similar to study by P.Ganguly et al [26] where the nasal carriage was 37% and the hand carriage was 18.9%. But is in contrast to study by A.D Krishna Thantry et al [27] in Malaysia where the isolation of S. aureus from hand swabs was more than nasal swabs (52.4% vs. 16.8%).

In this study, the highest carriage rate (both nasal and hand) was seen among the nurses (73.9%) followed by technicians (70%) and nursing students (59%). Study by Shinde R.V et al [14] similarly revealed that 52% of nursing staff were carriers of S. aureus. P.S Satpathi et al [21] also reported the nurses to be the highest nasal carriers (43.59%) followed by the doctors (25.64%) and laboratory technicians (25.64%).Studies by L Agarwal et al [20], El Aila et al [19] and Zermina Rashid et al [28] also showed a higher carriage rate among the nursing staff. Overall the groups comprising of the Nurses who remain in constant touch with the patients in a hospital setting constitute the largest group of transmitters of infection in our study. This is in contrast to the study by Kumar P et al [29], P.Ganguly et al [26] and C.A Bancompianet al.[30] where the doctors were found to be the major carriers.

Our study revealed a higher prevalence of nasal carriers in the Male surgical ward (100%) followed by Paediatric ICU (57%) and Nephrology ward (55%). Similarly, hand carriage rate was highest among the MSU (54.5%) followed by Paediatric ward (44%) and CCL (33%). Hand carriage of S.aureus in the intensive care units was 0%.This may be because of good compliance to hand washing practices in the intensive care units. However, among the ICU's, PICU had a high nasal carriage rate of 57% followed by ITU (28%). El Aila et al [19] also reported highest prevalence of MRSA in the surgical ward. P.S. Satpathi et al [21] observed that G&O and Medicine ward contributed maximum (25% each) in comparison to others (Orthopaedics 16.6%, Surgery

16.6% and Pediatrics 16.6%). S.P Kogekar et al.[31] reported highest carriage rate in chest department followed by pediatrics department.

Other organisms isolated from nasal and hand swabs were Coagulase negative Staphylococcus sp, Klebsiella pneumonia, Streptococcus viridans, Bacillus subtilis, E.coli and micrococcus. Study by P.Ganguly et al. [26] also revealed the presence of gram negative bacilli in the swabs. E. coli was the most predominant organism. In the study by Kausalya et al [23] the organisms isolated were Coagulase negative Staphylococcus (57.67%), followed by Micrococci (26.33%).

VI. Conclusion

Strict adherence to infection control practices is essential to limit the spread of MRSA infection by HCWs to susceptible individuals. The present study also emphasizes the need for active surveillance of HCWs to detect MRSA colonization early and take appropriate control measures. Also, regular training of HCWs on infection control practices is essential to enhance their knowledge. Hand washing being the simplest and most effective measure for infection control should be strictly followed.

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