Nasal Screening of Healthcare Workers for Nasal Carriage of Methicillin Resistance Staphylococcus Aureus, Vancomycin Resistance Staphylococcus Aureus and Prevalence of Nasal Colonization with *Staphylococcus Aureus* in Burdwan Medical College and Hospital

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ABSTRACT

Introduction: Nasal colonization by *Staphylococcus aureus* is a major risk factor for the *spread* of *infection in the hospital settings.* It can cause various types of infections ranging from furuncle to osteomyelitis,meningitis and wide varieties of systemic infections. Study aimed to find out the carrier rate of Staphylococcus aures among different health care professionals of present institution and the susceptibility pattern of S.aureus to find out the best possible antibiotic against it.

Material and methods: Nasal swabs were collected from the healthcare workers of various clinical departments of the hospital over a period of 4 months. The isolation of *Staphylococcus aureus* and their antimicrobial susceptibility patterns were carried out by standard bacteriological procedures. We processed 250 nasal swabs from different healthcare professionals (100 doctors,100 nurses,50 lab technicians).

Results: Among the nasal swabs processed, 87 were found to be positive with growth of Staphylococcus aureus i.e 41.37% doctors, 45.97% nursing staffs and 12.64% lab technicians showed Staphylococcus aureus colonization in anterior nares. Colonization with MRSA is significantly higher among nursing professionals (25%) when compared to Doctors (18.8%). Among nursing staffs single strain of *Staphylococcus aureus* was found to be both MRSA as well as VRSA.

Conclusion: To prevent the spread of this type of nosocomal infection, proper hand washing plays the key role. Other the sanitary protocols and the antibacterial guidelines of the health professionals remains important factor in preventing nosocomial infections . Mupirocin nasal ointment is the drug of choice.

Keywords: MRSA,VRSA, Nasal Carriage, Health Care Worker, Antibiogram

INTRODUCTION

Staphylococcus aureus is a Gram positive bacteria (GPB) which is the leading etiology of diseases in humans and animals. It is also found as a normal flora of humans especially, in the skin and nasal vestibule. Other body areas where this Gram positive organism colonizes are axilla, umbilicus, perineal region and mammary folds. *Staphylococcus aureus* can cause opportunistic infections when acquired from different sources like patients, hospital staff mainly through their hands and also from their normal flora. The common types of diseases caused by *Staphylococcus aureus* are skin infections including furuncle, Staphylococcal scalded skin syndrome (SSSS), Osteomyelitis, Meningitis, Pneumonia, Septicemia, Gastroenteritis etc**.** Nasal carriage of Staphylococcus aureus is one of the commonest health problem of the globe. Colonization of Staphylococcus aureus which is capable of causing a wide range of infections, carries a subsequent risk for antibiotic resistant infection. Staphylococcus causes infection by spread from patient to patient in hospitals and in other institutional settings. Though healthy individuals have a lesser risk of contracting invasive infections caused by Staphylococcus aureus, they can be carriers of the organism.[1] Most important sites for Staphylococcus colonization are nose and open skin areas eg. Wounds and devices entry or exit site. Nasal carriage without any documented invasive infection can lead to emergence of Methicillin resistant Staphylococcus aureus infection (MRSA) which is subsequently associated with increased mortality and morbidity i.e prolonged hospital stay, higher cost of treatment. MRSA have been documented as endemic in the world in past two decades even in primary health care settings.Immuno-compromised individuals and patients in ICU care face a higher rate of morbidity and mortality when acquire multidrug resistant strain of S.aureus.[2-5] Healthcare givers are always exposed to patients with MRSA infection. Also they can be colonized in the course of their work.[6] The MRSA carrier rate ranges from 5-50% in different countries. In Asian countries the range is between 5% and 40% . It has been reported that, among health care worker, nasal carriage rate of MRSA is between 6.0% and 17.8%.Some part of the world showed even higher rate of colonization.[7,8] Mass screening of health care worker for Staphylococcus sp. colonization is whether ethical in terms of advantages and disadvantages is still under debate. It is proven that the transmission of nosocomial infection with MRSA occur through health care givers who are always at direct contact with the patients thus community.Poor hand hygiene appears to be the most common mode of transmission.[9,10] Many infection control policies are made and implemented towards the control of spread and infection caused by this organism .Present study

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How to cite this article: Himadri Mondal, Indrajit Gupta, Poulami Nandi, Purbasha Ghosh, Saswati Chattopadhyay, G.D. Mitra. Nasal screening of healthcare workers for nasal carriage of methicillin resistance staphylococcus aureus, vancomycin resistance staphylococcus aureus and prevalence of nasal colonization with *staphylococcus aureus* in burdwan medical college and hospital. International Journal of Contemporary Medical Research 2016;3(11):3342-3346.

was carried out with the aim at establishing the carriage rate of MRSA among healthcare workers in our hospital and also their antibiotic sensitivity pattern thus to make an effective antibiotic policy and infection control programme. At present we have very few antibiotics available to treat this organisms. Among them vancomycin, teicoplanin,linezolid are used as almost last resorts.There are many reports from all over the world which showed resistance to these antibiotics are emerging.

Study aimed to find out the carrier rate of Staphylococcus aures among different health care professionals of present institution and the susceptibility pattern of S.aureus to find out the best possible antibiotic against it.

MATERIAL AND METHODS

We screened Health care provider from ICU,General ward and laboratory worker in our hospital between January and April 2016. A total number of 250 participants were included in our study, among them 100 were doctors, 100 were nursing staffs and rest 50 were technicians from laboratory. Nasal swabs from anterior nares were taken from the participants not having any clinical signs and symptoms of infections like tonsillitis, otitis media, pharyngitis and upper respiratory illness .No participants were on antibiotics during sample collection. Approval was obtained by the ethical committee of our institution for carrying out the study. Informed consents were obtained as per the format.

Collection of nasal swab: After taking the consent from each participants, swabs moistened with sterile normal saline were carefully inserted into each nostrils. Tip of the swab was entirely at the nasal osteum level. It was gently rolled for 5-6 times. Swabs were transported to laboratory with immediate effect. Specimens were processed within 4hrs of collection.

Processing of specimen for bacterial identification: The swabs were inoculated onto different media [Blood agar (with 5 - 7% defibrinized blood), Nutrient agar, mannitol salt agar] and incubated for 18 to 24 hours at 37º C in an incubator aerobically. The incubation was extended to at least 48 - 72 hours for distinguishable colony development.Biochemical tests were also used for the specific identification of the isolates. Using standard procedures, any growth was confirmed as *Staphylococcus aureus* by studying colony morphology and microscopic appearance on gram stained smears.Further catalase test, tube coagulase test and deoxyribonuclease test, oxidase test and novobiocin disc susceptibility test (5 µg) were performed to reach species level identification.[11] Mueller-Hinton agar was used for the testing of the susceptibility of the isolates by Modified Kirby-Bauer method for commonly used antibiotics as per CLSI guideline. Following are the antibiotics used from from Himedia ltd, Mumbai: amoxicillin-clavulanic acid (30 µg, 20/10 mcg), ciprofloxacin (5 mcg), ceftriaxone (30 mcg), linezolid (15 mcg), co-trimoxazole (25 mcg), erythromycin (15 µg), cefixime (5 mcg µg), Gentamicin (10 µg), teicoplanin (30 µg), cefoxitin (30 µg) and vancomycin (30 µg) mupirocin (200 µg), Rifampicin (5 µg). Interpretation of inhibitory zone size of specific antibiotic disc was done following the tables for interpretative zone diameters of Clinical and Laboratory Standards Institute (CLSI).[12] Each isolates were tested for its sensitivity to methicillin./oxacillin. 0.5 McFarland turbidity standard's (1.5 × 108 CFU/ml) suspension of each isolated Staphylococcus aureus strain was made. Modified Kirby-Bauer method was used to inoculate Mueller-Hinton agar (MHA) by using above mentioned inoculum density . For Phenotypic detection of MRSA,Cefoxitin (30 µg) discs and oxacillin MIC testing using Ezy MIC Strips (Himedia ltd, Mumbai) were placed on Mueller-Hinton agar plates and incubated for 24 hours at 37°C in the aerobic medium. Inhibition zone sizes (cefoxitin) of diameter ≤21 mm and MIC for Oxacillin ≥4 were labelled methicillin resistant Staphylococcus aureus. Zone size ≥ 22mm for cefoxitin and MIC for Oxacillin ≤2 as Methicillin sensitive.[13-15]

Screening for vancomycin susceptibility was done by using vancomycin discs (30 µg) on MHA.Inhibition zone sizes of diameter ≤15 mm were considered as resistant which was further confirmed by detection of MIC by broth dilution method. Vancomycin Resistant *Staphylococcus aureus* (VRSA) strains were confirmed when showed an MIC of more than 4 µg /ml.[16] *S. aureus* ATCC 25923, MRSA ATCC 29213 and MSSA ATCC 33591 are used as control strain during antibiotic susceptibility testing.

STATISTICAL ANALYSIS

Statistical analysis and calculations were done using the Microsoft Excel 2010 and SPSS 15.0 Software. P value were calculated based on chi square test.

Among nursing staffs single strain of Staphylococcus aureus was found to be both MRSA as well as VRSA.

Rifampicin, Mupirocin, Linezolid showed 100% sensitivity to both MRSA and MSSA.Resistance to Amoxycillin-clavulanic acid, cefixime, ceftriaxone are more than 80% among MSSA strains. Co-trimoxazole and ciprofloxacin resistance were more among MRSA isolates. Only one isolate of MRSA showed teicoplanin resistance.(Figure 1)

DISCUSSION

In the present study, it was seen that 34.80% health care worker carried Staphylococcus aureus in their anterior nares (Table 1), and that of 18.39% were MRSA(Table 4). We have also found that 41.37% doctors,45.97% doctors and 12.64% technicians carry S.aureus in their nose (Table 2).

There are many similar and contrasting studies from different institution and epidemiological area. Vinodhkumaradithyaa A showed 13% carrier rate among health care worker in Madurai.[17] In Assam, 22.22% health care worker were colonized with S.aureus (Sharon Rainy Rongpharpi et al).[18] None of the Health care worker were colonized with S.aureus as per Shoba KL et al.[19] In Mangalore, a study by Radhakrishna M et al[20]

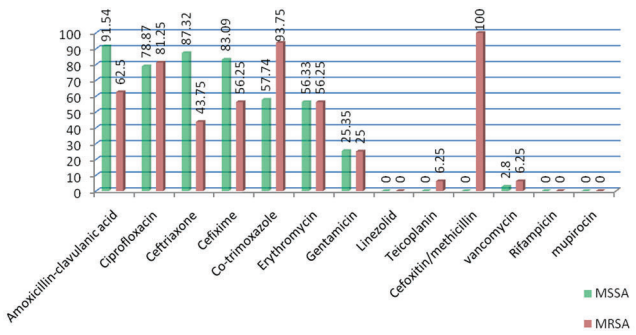

Figure-1: Antibiotic Resistance Pattern

Department	Doctor	Nursing Staff	Lab technician	Total
ICU	15	22	0	37
General ward	60	78	0	138
Laboratory	25	0	50	75
Total	100	100	50	250

Table-1: Distribution of participant in different department

Designation	Total no. of samples collected n=250	S. aureus isolated N=87 (34.8%)	CONS N=90	No growth or other n=73
Doctor	100	36 (41.37%)	30	34
Nurse	100	40(45.97%)	40	20
Technicians	50	11(12.64%)	20	19

Table-2: Profession related distribution of different Organisms

Department	Doctor n=36	Nurse n=40	Technicians n=11
ICU	9 (60%)	15(68.18%)	0
General Ward	25(41.66%)	25(32.05%)	0
Laboratory	2 (8%)	0	11 (22%)

Table-3: Departmental distribution of Staphylococcus aureus

Profession	MSSA	MRSA(18.39%)	VRSA
Doctor (n-36)	31(86.11%)	5 (18.8%)	1
Nurse (n-40)	30(75%)	10(25%)	2
Technicians (n=11)	10 (90.90%)	1 (9.09%)	0
Among nursing staffs single strain of Staphylococcus aureus was found to be both MRSA as well as VRSA.			

Table-4: Nature of Staphylococcus aureus isolated in different professionals

Departments	MSSA	MRSA	VRSA
ICU (n=24)	20 (83.33%)	4(16.67%)	2
General Ward (n=50)	40(80%)	10(20%)	1
Laboratory (n=13)	11(84.62%)	2(15.38%)	0

Table-5 Nature of Staphylococcus aureus isolated from different departments

showed 17.5% colonization rate of S.aureus among Health care professional. Sample Size, Method of isolation, epidemiological area may have an effect on difference in carriage rate. MRSA carriage rate was 18.39% in our study which is similar to the finding by Sharon Rainy Rongpharpi et al (11.43%), Vinodh kumaradithyaa A et al (15.4%)[17,18], Mathanraj S et al (1.8%)[21], Goyal R et al (6.6%)[22], Malini J (10%).[23] A study from Nigeria by Fadeyi A et al[24] reported 38.9% carriage rate . Shakya B et al[25] from Nepal reported only 2% carrier rate among health care worker. MRSA colonisation among health care givers are a potential source of infection among patients thus increasing morbidity and mortality. There should be proper implementation of Hospital infection control measures and periodic screening, health education and related measures should be followed strictly. MRSA carriers can transmit infection to their family members too thus a constrain to economy in a long run. Our study finding also correlates with studies in China among health care workers 15.4% (Jimei Du et al) and 38.6% as reported by Taj Y et al.[26,27] In the present study, 60% doctors and 68.18% of nursing staffs involved in Critical care units showed S.aureus colonisation which is higher when compared to staffs of general wards i.e 41.66% and 32.05% respectively (Table 3). MRSA was found among 18.8% of doctors and 25% nursing staffs (Table 4). So, MRSA carriage rate is relatively high among Nurses. These are the staffs who come to direct contact of the patients and threat the society in terms of this superbug transmission. MRSA colonisation was 16.67% and 20% respectively in ICU and general ward in our study (Table 5). According to Radhakrishna M. et al[20] showed none of the doctors were MRSA carrier. This scenario may be due to their good infection control practice implementation.

Among nursing staffs only 2 S.aureus showed Vancomycin resistance, among them one was resistant to both vancomycin and Methicillin. Only 1 strain of Staphylococcus aureus among doctors showed vancomycin resistance (Table 4). Diana Panesso reported Staphylococcus aureus strain from blood culture which was sensitive to methicillin but resistant to Vancomycin.[28] Hiramatsu et al showed emergence of vancomycin resistant subclones of *S. aureus* strains may be induced in the presence of vancomycin with dependency to concentration of Vancomycin.[29] Ali .M.Al-Dahbi[3] showed resistance to Ciprofloxacin is 29.2%, Trimethoprim/sulfamethoxazole 50%, Gentamicin 29.3%, Clindamycin 9.4%, Clarithromycin 14.2%, Erythromycin 37.7% and Vancomycin 3.8%. The highest frequency of sensitivity was observed with Rifampin 96.2% followed by Clarithromycin 78.3%. But in the present study (Figure 1) we found linezolid, rifampicin and mupirocin had the highest sensitivity to Staphylooccus aureus. Yukti Sharma et al[30] did not find a single isolate which were resistant to Vancomycin and linezolid. The results observed by Chatterjee et al.showed 1% resistance towards rifampicin.[31] Ciprofloxacin resistance by MRSA being 82.25% in our study raises alarm to control indiscriminate use of antibiotics.

CONCLUSION

Highlighted feature of this study is that health care giver might have acquired Staphylococcus aureus and other drug resistant Staphylococcus aureus (MRSA,VRSA) during their patient care. They are also responsible for cross contamination. It is necessary to follow the proper hand washing protocols and other measures to protect both the health care giver and patients. They should use the mupirocin ointment to protect patients. This is a district referral hospital which is overloaded with patients from all types of background. Alarming rise of the drug resistant strain showed the importance of proper infection control

protocol making and strict implementation of this. Though this is a single institutional study involving a smaller population, we hope to point out the threating conditions to some extent.

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Source of Support: Nil; **Conflict of Interest:** None

Submitted: 25-10-2016; **Published online**: 07-12-2016