e - ISSN - 2349 - 8005

INTERNATIONAL JOURNAL OF ADVANCES IN CASE REPORTS

Journal homepage: www.mcmed.us/journal/ijacr

SCREENING OF *STAPHYLOCOCCUS AUREUS* AS NASAL CARRIER FROM HOSPITAL PERSONNEL

J Thulunga[1], A Bhattarai[1], S Basnyat[1], SK Singh[2], A Singh[1], KR Rijal[1]*

[1]Central Department of Microbiology, Tribhuvan University, Kirtipur, Kathmandu, Nepal.
[2]Shree Birendra Hospital, Chauni, Kathmandu, Nepal.

Corresponding Author:- **Komal Raj Rijal,** Lecturer**,** Central Department of Microbiology, TU
E-mail: rijalkomal@yahoo.com

Article Info
Received 15/01/2015
Revised 27/02/2015
Accepted 25/03/2015

Key words:
S. aureus, MDR, MRSA, Nasal carrier,

ABSTRACT
Staphylococcus aureus is one of the most common human pathogen and is capable of causing wide range of infections in human. The present study was conducted from June 2007 to December 2007 to screen out *S. aureus* as nasal carrier from hospital personnel of Shree Birendra Hospital Chhauni. A total of 264 nasal swab samples were collected from hospital personnel of different wards and subjected to culture on Mannitol Salt Agar and suspected isolates were identified as *S. aureus by standard microbiological methods and* antibiotic susceptibility test of the isolated *S. aureus* was done by Modified Kirby Bauer disc diffusion method. Among 65 isolates of *S. aureus* from nasal swabs; 27.02% (47/174) isolates were from males and 20% (18/90) were from females. The distribution of *S. aureus* as a nasal carrier between male and female was not statistically significant (P = 0.21). In both male and female, the highest prevalence (31.66%) of nasal carrier of *S. aureus* was found in the age group of 26-30 years. Among hospital personnel, maximum nasal carrier rate was found in nursing assistant 33.87% (21/62) followed by intern doctors 31.82% (7/22) and medical trainee 27.59% (16/58). Regarding the department wise distribution of nasal carrier, highest nasal carrier rate of *S. aureus* was from Medical III 53.84% (7/13) followed by orthopedic 50% (2/4) and surgical officer cabin 42.85% (6/14). The isolates *S. aureus* showed highest resistant to amoxicillin (76.9%) followed by penicillin (38.5%), cotrimoxazole (21.5%), gentamycin (13.8%), erythromycin (9.2%), ciprofloxacin (9.2%), chloramphenicol (4.6%) and least towards tetracycline (3.1%). Out of 65, only 20% (n=13) *S. aureus* isolates were multi-drug resistant (MDR) and highest number of MDR *S. aureus* was isolated from Intensive Care Unit 75% (n=3). No methicillin resistant *S. aureus* (MRSA) was found among the isolates of *S. aureus*.

INTRODUCTION

Carrier harbors a specific infectious agent in the absence of discernible clinical disease and serves as a potential source of infection for others. Carriers are significantly dangerous to community and in hospital. Among different carrier's categories, nasal carriers are those who harbour infectious agents in their nasal cavity. Important pathogens are *Staphylococcus aureus*, *Streptococcus pyogenes*, *Streptococcus pneumoniae*, *Niesseria meningitidis*, *Haemophilus influenzae* (mostly non-capsulate) [1]. *S. aureus* is one of the most common human pathogens and is capable of causing a wide range of infections in human. Although primary staphylococcal infections are not common, a great deal of the virulence from this organism occurs through cross-infection by spread from patient to patient in hospitals and other institutional settings. In contrast, healthy individuals have a small risk of contracting an invasive infection caused by *S. aureus*, but they can be carrier organism. Because its primary habitat is most squamous epithelium of the anterior nares, most invasive *S. aureus* infections are

assumed to arise from nasal carrier [2]. *S. aureus* is the normal flora of the nasal cavity, which is carried in the nose of about 40% of healthy people. *S. aureus* as a nasal carrier has been identified as a risk factor for community acquired and nosocomial infection. Healthy hospital personnel may carry pathogenic strains in their nose and skin, and may spread these pathogens to the community leading to more dreadful condition. The earlier research done in this case has reported that medical personnel were colonized with more antibiotic resistant isolates than non-medical personnel.

Many studies done in Nepal about *S. aureus* and their antibiotic sensitivity pattern suggest the gradual emergence of MRSA in hospitals. The prevalence of MRSA in Nepal ranges from 11.7% to 54.9% [3,4]. Many studies have also shown the emergence of MDR *S. aureus* in hospitals.[5] These studies clearly indicate about the appropriate steps to be taken to reduce MRSA and MDR strains in hospital settings to minimize nosocomial infections. The fact that huge portions of healthy population carry *S. aureus* in their nose and body surfaces is responsible for fast spread of Staphylococcal infections and the situation seems worse in hospitals. So, study of *S. aureus* as nasal carrier is of importance, especially in people concerned with hospitals to explore the clear picture regarding its existence. It not only gives information about the nasal carrier rate but also gives idea about the preventive measures to be initiated against the *S. aureus* infections in hospital. This study focuses on *S. aureus* as nasal carrier in hospital personnel of Shree Birendra Hospital, Chhauni and it has been assumed that this study will help to bring health awareness among the staffs of the hospital especially in nasal health as well as personnel hygiene. Since this study has been performed as a part of surveillance of nosocomial infection, it will help to analyse the current microbial status of the hospital personnel and can aid in control of nosocomial infections.

MATERIALS AND METHODS

This study was carried out from June 2007 to December 2007 in Microbiology section of Pathology Department of Shree Birendra Hospital, Chhauni. A total of 264 Nasal swab samples were taken from doctors, paramedical officers, nurses, nursing assistants, nursing volunteers, laboratory technicians, medical trainees and sweepers.

Sample collection

Sterile cotton swab dipped in physiological saline was used for the collection of sample from anterior nares. The cotton swabs were used to sample both the nostrils. The swab was introduced into first nostril 1-2cm inside, which was rotated 2-3 times with gentle pressure for 3-5 seconds in same manner; nasal swab from the second nostril was collected. Then, the swabs were kept immediately in the sterile test tube and plugged with cotton. All the tubes were labeled with personnel's identification number and other required information. In case of delay, samples were usually stored at 4°C in the refrigerator. A nasal swab samples were collected as described by standard protocols [1](Cheesbrough, 2000).

Sample processing

The collected swab samples were put into the sterile cotton capped test tubes and transported to the laboratory immediately for inoculation into Mannitol Salt Agar (MSA) for the isolation of *Staphylococcus aureus.* The inoculated MSA plates were incubated at 37°C for 24 hours, *S. aureus* colonies were identified on the basis of colony characteristics, Gram staining and biochemical tests. Mannitol fermenting colonies of *S. aureus* surrounded by yellow zones due to acid production were selected for further processing. Mannitols fermenting typical yellow colonies from MSA were subcultured on nutrient agar (NA) at 37°C for 24 hours for further processing. Colony having round, convex, opaque, smooth glistening surface with colony diameter 2-3 mm were indicative of Staphylococci. Most staphylococci produce soft butyrous colony with golden yellow pigment. For further confirmation of *S. aureus*, various tests like Gram staining, catalase test, slide and tube coagulase test, Voges-Proskauer (VP) test, deoxyribonuclease (DNase) test were performed from isolated colonies.

Antibiotic susceptibility test

All *S. aureus* isolated from nasal screening process were subjected to in vitro antibiotic susceptibility test by using modified Kirby-Bauer disc-diffusion method as recommended by CLSI guidelines.[6] The antibiotics used in this study were amoxicillin (10µg), chloramphenicol (30µg), ciprofloxacin (5µg), cotrimoxazole (25µg), erythromycin (15µg), gentamicin (10µg), methicillin (5µg), penicillin (10 units) and tetracycline (30µg).

Quality control for the tests

Quality and accuracy of all test was maintained by following standard procedures of collection, isolation and identification. For identification and standardization of the Kirby-Bauer test, standard culture of *S. aureus* ATCC25923 was used as a reference strain. For quality control, media, antibiotics and reagents were prepared, stored and utilized as recommended by the manufacturing company. Antibiotic discs were stored at refrigerator temperature. For each batch of test, a positive and negative known culture was used for color reaction, biochemical test and antibiotic sensitivity test.

RESULTS

A total of sixty five *S. aureus* was isolated from 264 nasal swab samples. 47 isolates of S. *aureus* were from male and 18 isolates were from female. In male, the prevalence of nasal carrier of *S. aureus* was found to be highest in the age group of 26-30 yrs. (31.66%) followed by 36-40 (30%). In female, the highest prevalence of nasal

carrier of *S. aureus* was found in the age group of 26-30 (31.57%) followed by 31-35 (22.22%) (Table-1).

Hospital personnel related to health care was further classified into doctor, paramedical officer, nurses, nursing assistant, nursing volunteer, laboratory technician, medical trainee and sweeper. The maximum number of samples were collected from nursing assistant (n=62) followed by medical trainee (58) and nurses (n=43). Among the hospital personnel, highest percentage nasal carrier rate was found in nursing assistant 33.87% (n=21) followed by intern doctors 31.82%. Statistically, there is no any significant relationship of nasal *S. aureus* carrier rate among different occupational group (Table- 2).

The nasal samples were collected from different wards. The wards included in the study was pathology, medical I (MI), medical II (MII), medical III(MIII), surgical officer cabin (SOC),surgical I(SI), surgical II(SII), surgical III (SIII) , post operative Ward (POP), intensive care unit (ICU), new family ward (NFW), pediatric ward, haemodialysis unit, gynecology Ward, Very Important Person ward (VIP), intensive trauma care unit (ITCU), ear, nose and throat ward(ENT), orthopedic ward, physiotherapy ward, trauma hall and general outpatient department (GOPD). Highest nasal carriage rate of *S. aureus* was from medical III 53.84% followed by orthopedic 50% respectively (Table-3).

A total of 264 nasal samples, *S. aureus* was isolated from 24.62% (n=65) samples. All the samples were sensitive towards Methicillin and Vancomycin. The bacterial isolates showed highest resistant towards Amoxicillin (76.9%), followed by Penicillin (38.5%), Cotrimoxazole (21.5%) respectively (Table-4).

Out of 65 *S. aureus* isolates, only 20% (n=13) were MDR. Among 65 isolates, male constituted 21.27% (n=10) whereas female constituted 16.66% (n=3) MDR strains of *S.aureus*. The distribution of MDR strains of *S. aureus* among male and female was not found to be statistically significant (Table-5).

Table 1. Age wise distribution of nasal carrier rate of *S. aureus*

Age Group (year)	Male		Female	
	Total	No. and % isolates.	Total	No. and % isolates.
20-25	56	14 (25)	48	9(18.75)
26-30	60	19(31.66)	19	6(31.57)
31-35	30	8(26.66)	9	2(22.22)
36-40	10	3(30)	9	1(11.11)
41-45	14	2(14.28)	2	0
> 45	4	1(25)	3	0
Total	174	47	90	18

Table 2. Occupation-wise distribution of *S.aureus*

S.N.	Occupational group	No. of samples	Carrier of *S. aureus*	Significance (p-value)*
1	Doctors	19	1(5.27%)	
2	Intern doctors	22	7(31.82%)	
3	Paramedical officers	4	0(0%)	
4	Nurses	43	9(20.93%)	
5	Nursing Assistants	62	21(33.87%)	0.334
6	Nursing Volunteers	8	2(25%)	
7	Lab. technicians	30	6(20%)	
8	Medical trainees	58	16(27.59%)	
9	Sweepers	18	3(16.67%)	
	Total	264	65(24.62%)	

Table 3. Ward and department wise distribution of *S. aureus*

S.N.	Wards and Departments	Total No. of samples collected	Total *S. aureus* isolated
1	Pathology	42	10(23.80%)
2	Medical I	13	3(23.07%)
3	Medical II	15	2(13.33%)
4	Medical III	13	7(53.84%)
5	Surgical Officer Cabin	14	6(42.85%)
6	Surgical I	12	3(25%)
7	Surgical II	12	4(33.33%)
8	Surgical III	15	4(26.66%)

9	Post Operative Ward	11	3(27.27%)
10	Intensive Care Unit	18	4(22.22%)
11	New Family Ward	12	2(16.66%)
12	Pediatric	8	0
13	Haemodialysis	7	0
14	Gynecology	9	1(11.11%)
15	Very important person ward	7	2(28.57%)
16	Intensive Trauma Care	10	2(20%)
17	Ear Nose and Throat	8	3(37.5%)
18	Orthopedic	4	2(50%)
19	Physiotherapy	13	3(23.07%)
20	Trauma Hall	7	1(14.28%)
21	General Out Patient Department	14	3(21.42%)
	Total	264	65

Table 4. Antibiotic Susceptibility pattern of *S.aureus* isolated from the nasal swab.

Antibiotic Tested	Total No. of *S. aureus* isolates	Number and Percentage of *S.aureus*	
		Susceptible	Resistant
Amoxicillin	65	15(23.1%)	50(76.9%)
Penicillin		40(61.5%)	25(38.5%)
Ciprofloxacin		59(90.8%)	6(9.2%)
Cotrimoxazole		51(78.8%)	14(21.5%)
Erythromycin		59(90.8%)	6(9.2%)
Tetracycline		63(96.9%)	2(3.1%)
Chloramphenicol		62(95.4%)	3(4.6%)
Gentamycin		56(86.2%)	9(13.8%)
Methicillin		65(100%)	0(0%)

Table 5. Distribution of MDR *S.aureus*

Gender	Total *S. aureus* isolates	No. and percentage of MDR *S. aureus*	Significance (P value)*
Male	47	10(21.27%)	0.721
Female	18	3(16.66%)	
Total	65	13(20%)	

DISCUSSION

The anterior vestibule of the nose is an important reservoir of *S. aureus* and dissemination of this organism by carriers is important in the perpetuation and spread of Staphylococcal disease. Staphylococci are responsible for more than 80% of the suppurative diseases found in medical practice and are a major problem in newborn nurseries and neonatal intensive care units. Additionally, the emergence of methicillin-resistant patterns highlights the importance of finding methods to treat staphylococcal disease, the staphylococcal carrier state and associated nososcomial outbreaks. Bryan *et al*., 1980 has reported that 70% of hospitals continue to obtain cultures from person during staphylococcal disease outbreaks and about 40% prescribe tropical antibiotic ointment for person with staphylococcal positive culture [7]. Approximately 20% of individuals almost always carry one type of strain of *S. aureus* and are called persistent carriers. A large proportion of population (~60%) harbors *S. aureus* intermittently, and the strains change with varying frequency. Such persons are called intermittent carriers. Finally, minorities of people (~20%) almost never carries *S. aureus* and are called non-carriers [8]. Persistent carrier is more common in children than in adults and many people change their pattern of carriage between the ages of 10 to 20 years. The reasons for these differences in colonization patterns are unknown. The ecological niches of *S. aureus* strains are the anterior nares. When the nares are treated topically to eliminate nasal carriers, in most cases the organism also disappears from other areas of the body [9].

In this study, a total of 264 nasal swabs were taken from doctors, intern doctors, paramedical officers, nurses, nursing assistants, nursing volunteers, laboratory technicians, medical trainees and sweepers of different wards in hospital. Out of total 264 nasal samples, 24.62% (n=65) *S. aureus* was isolated. Staffs in the hospitals tend to be colonized with *S. aureus* depending on the length of their stay in hospital and carrier rate of *S. aureus* may increase during their prolonged stay [10]. Cruickshank *et al.*,1975 showed 30-40% nasal carriage rate and the chances of nasal harboring *S. aureus* by hospital personnel

and ward attendants was usually higher 50-60% and could be easily transmitted to the patients due to frequent contact with them [11]. It has been previously established that *S. aureus* carriage among patients and staffs has been found to be directly correlated with the occurrence of nosocomial infection due to the organisms [12]. In this study 20% (n=13) of the isolates were MDR *S. aureus*. In male hospital personnel 21.27% of *S. aureus* were found to be MDR; while in female hospital personnel, 16.66% of them were found to be MDR. The distribution of MDR *S. aureus* among male and female was not found to be statistically significant. Ahmed *et al.*, 1998 reported that medical personnel were colonized with more antibiotic resistant isolates than non-medical personnel [13]. The highest percentage of MDR *S. aureus* was isolated from Intensive Care Unit (ICU) 75% (n=3) followed by SOC 50% (N=2), MI 50% (n=1), SI 50% (n=1), SII 50% (n=2), MIII 20% (n=1) and pathology 10% (n=1).Study done on nasal carriage by Sapkota *et al*., reported 23.5% MDR *S. aureus* in Bir Hospital, but no MRSA was isolated [14]. However, Pant *et al.*, reported 9.5% MRSA from nasal carrier of hospital personnel in Nepal Medical College Teaching Hospital [15]. No MRSA was found in our study, it may be due to absence of MRSA strains in this hospital. MDR strains are the biggest problem for hospital personnels. The presence of high percentage of MDR in nasal cavity of hospital personnel may signify the possible danger of transmitting these strains to patients. Because nasal carriage in hospital nurses and doctors is an important risk factor for infection to patients, eradicating nasal carriage of *S. aureus* is a useful control measures. Screening of *S. aureus* as nasal carrier from hospital personnel is necessary in hospital outbreaks of MDR *S. aureus* infections.

REFERENCES

1. Cheesbrough M. (2000). District Laboratory practice in tropical countries Part II. Cambridge University Press, Low Price edition, India, 196-274.
2. Von Eiff C, Becker K, Machka K, Stammer H and Peters G. (2001). Nasal carriage as a source of *S. aureus* bacteremia Study Group. *N Engl J Med*, 344, 11-6.
3. Pokhrel BM, Rawal S, Joshi HH and Kubo T. (1993). Bacteriological study at Tribhuvan University Teaching Hospital, Kathmandu, Nepal. *J Inst Med*, 15, 217-21.
4. Rajbhandari R, Manandhar SP and Shrestha J. (2003).Comparative study of MRSA and its Antibiotic susceptibility pattern in indoor patients of Bir Hospital. *Nepalese J Microbiol*, 1, 62-65.
5. Anupurba S, Sen MR, Nath G, Sharma BM, Gulati AK and Mohopatra TM. (2003). Prevalence of methicillin resistant *Staphylococcus aureus* in a tertiary referral hospital in eastern Uttar Pradesh. *Indian J Med Microbiol*, 21, 49-51.
6. Clinical and Laboratory Standard Institute. (2008). Performance standards for Antimicrobial Susceptibility Testing Eighteenth informational supplement. M100-S18, 28(1), 46-52.
7. Bryan CS, Wilson RS, Maede P et al. (1980). Topical antibiotic ointment for staphylococcal nasal carriers' survey of current practices and comparison of bacitracin and vancomycin ointments. Infect. Control (Thorofare), 1, 153-156.
8. Williams REO. (1963) Healthy carriage of *Staphylococcus aureus*: its prevalence and importance. Wright-Fleming Institute of Microbiology, St. Mary's Hospital Medical School, London, England, 27, 56-67.
9. Petrez-Fontan M, Garcia-Falon T, Rasales M et al. (1993). Treat of *S. aureus* nasal carriers in continuous ambulatory peritoneal dialysis with mupirocin, long term results. *Am J Kidney Dis*, 22, 708-712.
10. Boyce JM. (1996). Preventing Staphylococcal infections by eradicating nasal carriage of *Staphylococcus aureus*. Infection Control and Hospital Epidemiology, 17(12).
11. Cruickshank R Medical Microbiology. (1975). The practice of Medical Microbiology, 12th edition. Churchill Livingstone, London, UK, Volume 2, 432-6.
12. Chiang FY and Climo M. (2002). *Staphylococcus aureus* carriage and health care-acquired infection, *Curr Infect Disease*, Reports, 4, 498-504.
13. Ahmed AO, Van Belkum A, Fahal AH et al. (1998). Nasal carriage of *Staphylococcus aureus* and epidemiology of surgical-site infections in Sudanese university hospital. *J Clin Microbiol*, 12, 3614-18.
14. Sapkota K, Basnayat SR, Shrestha CD et al. (2007). Prevalence of methicillin resistant *Staphylococcus aureus* (MRSA) in clinical specimens from patients Bir Hospital. *J Nepal Assoc Medi Lab Sci*, 8, 82.
15. Pant J, Rai SK. (2007). Occurrence of *Staphyloccous aureus* in Hospital Environment and Staffs in Teaching Hospital in Katmandu, Nepal. *J Nepal Assoc Medi Lab Sci*, 8, *72*-73.