Nasal carriage rate of methicillin resistant *Staphylococcus aureus* among at National Medical College Teaching Hospital, Birgunj, Nepal

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ABSTRACT

Present study was conducted to assess the nasal carriage rate of methicilin resistant *Staphylococcus aureus* (MRSA) among patients, visitors/patient attendants and healthcare personnel at National Medical College Teaching Hospital, Birgunj, Nepal. A total of 112 nasal swabs (patients: 31, visitors/patient attendants: 61, and healthcare personnel: 20) were subjected to bacteriological investigation following standard protocol. *S. aureus* isolates were identified by mannitol fermentation and coagulase positivity. Antimicrobial susceptibility test was performed by Kirby-Bauer's disc diffusion method on Muller-Hinton agar medium. *S. aureus* was isolated in 14 (12.5%) of participants (M: 11.3%, F: 13.6%). Highest nasal colonization rate was found among health-care personnel (25.0%) followed by the visitors/patient attendants (13.1%) and the patients (3.2%) (P>0.05). Highest positive rate was observed in the age group d"14 years (33.3%), followed by 15 to 50 years (13.2%) and >50 years (5.6%) (P>0.05). Out of 14 *S. aureus* isolates, 57.1% were methicillin resistant, prevalence rate of MRSA among total subjects being 7.1%. MRSA prevalence rate were 5.6% and 8.5% in total male and female participants, respectively (P>0.05). Highest MRSA prevalence rate was among health-care personnel (10.0%), followed by visitors/patient attendants (8.2%) and the patients (3.2%) (P>0.05). All MRSA isolates were resistant to Ampicillin, followed by Cephalexin (37.5%), Ciprofloxacin (37.5%), Tetracycline (37.5%), Gentamycin (25.0%), Erythromycin (0.0%) and Vancomycin (0.0%). High rate of nasal MRSA carriage rate found in this study indicates the need for standard infection control to prevent MRSA transmission.

Keywords: *Staphylococcus aureus*, MRSA, hospital, Nepal

INTRODUCTION

Staphylococcus aureus is one of the commonest human pathogens capable of causing a wide range of infections. A great deal of 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 carriers of the organism.[1]

The incidence of community-acquired and hospital-acquired *S. aureus* infections has been rising with increasing emergence of drug-resistant strains called methicillin resistant *S. aureus* (MRSA).[2-6] MRSA now represents a global problem. Ever since its isolation, MRSA has emerged as one of the commonest cause of hospital acquired infection and continues to remain as an important factor contributing to failure of management.[7] Transmission of isolates of epidemic MRSA has traditionally been associated with hospital facilities.[8] In recent years, dissemination of MRSA has been increasingly recognized in other healthcare settings, including primary health care.[9] Similarly, healthcare providers are also exposed to patients with MRSA infection and/or colonization in the course of their work.[10]

Most of invasive *S. aureus* infections are assumed to arise from nasal carriage.[12] Nasal carriage rates of MRSA has been reported to be 0.8 to 3.0% among adults in the community elsewhere in the world.[13-15] Among healthcare workers in hospital setting, it ranges from 6.0 to 17.8%.[10, 16-18] Earlier, the MRSA among the patients, staff and hospital environment of a tertiary medical care center (Teaching Hospital) in Kathmandu, Nepal has been reported to be 29.1%.[11] Recently, Pant and Rai from Nepal reported nasal carriage rate of 43.8% among healthcare personnel of a Medical College Teaching Hospital in Kathmandu.[19] The significance of MRSA colonization in healthcare workers in transmission of MRSA to patients and the community is not entirely clear and further research is needed.[10] In this study, we report the nasal carriage rate of *S. aureus* among patients, visitors/patient attendants and health care personnel at National Medical College and Teaching Hospital (NMCTH), Birgunj, Nepal and the antibiotic susceptibility pattern of the isolates.

MATERIALS AND METHODS

Sample collection: Nasal swabs from 112 participants (aged 7 to 74 years) were collected during the period of January to May 2008. Of the total 112 participants, 31 were patients, 61 were visitors/attendants and 20 were healthcare personnel of NMCTH, Birgunj, Nepal. The

Table-1: Gender-wise prevalence of *S. aureus* isolates and the MRSA isolates

Gender	Total sample	*S. aureus* positive (%)*	MRSA positive (%)#
Male	53	6 (11.3%)	3 (5.6%)
Female	59	8 (13.6%)	5 (8.5%)
Total	112	14 (12.5%)	8 (7.1%)

*P>0.05 # P>0.05

specimens were collected using commercial sterile cotton swabs (Hi media) from both anterior nares of each of the participants. After proper sampling, the specimens were transported to the microbiology laboratory of NMCTH and processed immediately.

Sample processing and bacterial identification: Specimens were inoculated onto mannitol salt agar (MSA), a selective medium for the isolation of *S. aureus* and incubated at 37^{0}C for 48 hours. Mannitol fermenting colonies (i.e. those that were yellow or gold) were selected from the MSA and sub-cultured on nutrient agar (NA) and colonies on NA were subjected to Gram's staining, catalase test and coagulase test. The Gram positive, catalase positive and coagulase positive isolates were considered as *S. aureus.*

Antibiotic susceptibility testing: All the identified isolates of *S. aureus* were undertaken in-vitro antibiotic susceptibility test by using Kirby-Bauer's disc diffusion method.[20] The antibiotics used were Ampicillin (10mcg/disc), Methicillin (30mcg/disc), Ciprofloxacin (5mcg/disc), Cephalexin (30mcg/disc), Tetracycline (30mcg/disc), Gentamycin (10mcg/disc), Erythromycin (10mcg/disc), and Vancomycin (30mcg/disc).

Statistical analysis: The findings were statistically analyzed using Chi-square test.

RESULTS

Of the 112 nasal samples studied, *S. aureus* was isolated from 14 samples (12.5%). The nasal carriage rate of *S. aureus* among male and female were 11.3% and 13.6%, respectively (P>0.05) (Table-1). The highest nasal colonization rate was among healthcare personnel (25.0%) followed by the visitors/attendants of the patients (13.1%), and the patients (3.2%) (P>0.05) (Table-2). Likewise, the nasal carriage rate of the organism was highest among the subjects of age group ≤14 years (33.3%), followed by 15 to 50 years (13.2%) and >50 years (5.6%) (P>0.05).

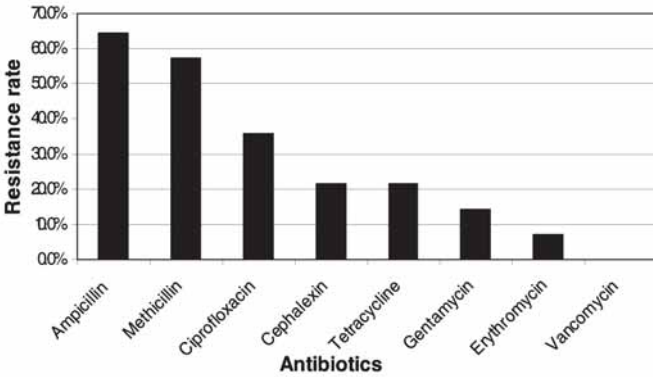

Fig. 2. Antibiotic resistance pattern of S. aureus isolates

Out of 14 *S. aureus* isolates, 8 (57.1%) were methicillin resistant. The prevalence rate of MRSA among total study subjects was 7.1%. Among them, 3 (37.5%) were from male and 5 (62.5%) were from female, MRSA prevalence rate being 5.6% and 8.5% among total male and female, respectively (P>0.05) (Table-1). Similarly, 2 (25.0%) were from healthcare personnel, 5 (62.5%) were from visitors/attendants of the patients, and 1 (12.5%) was from patient, being highest MRSA prevalence rate among health-care personnel (10.0%), followed by visitors/attendants of the patients (8.2%) and the patients (3.2%), respectively (P>0.05) (Table-2). All of the MRSA were isolated from the subjects of age group 15 to 50 years (100%).

The *S. aureus* isolation rate from male surgical wards, female surgical wards, and post-operative wards were 28.6%, 35.7%, and 35.7%, respectively. The MRSA isolation rate from male surgical wards, female surgical wards, and postoperative wards were 37.5%, 37.5%, and 25.0%, respectively (Fig 1).

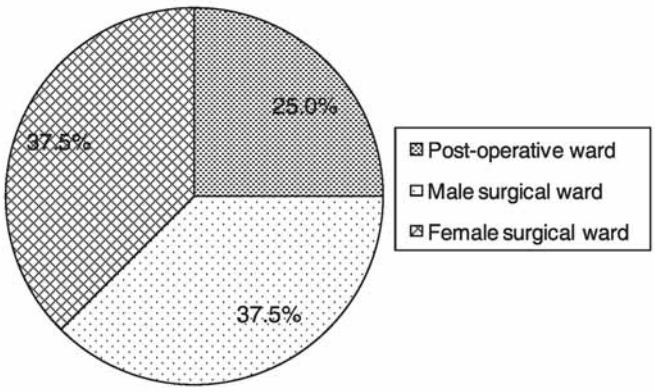

Fig. 1. Percentage of MRSA isolates among study subjects in different wards

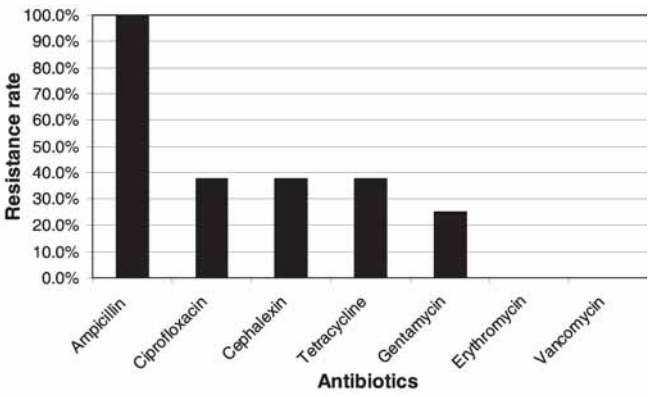

Fig. 3. Antibiotic resistance pattern of MRSA

Table-2: Study subject-wise prevalence of *S. aureus* isolates and the MRSA isolates

Study subjects	Total sample	*S. aureus* positive (%)*	MRSA positive(%)#
Health-care personnel	20	5 (35.7%)	2 (25.0%)
Visitors/patient attendants	61	8 (57.1%)	5 (62.5%)
Patient admitted	31	1 (7.1%)	1 (12.5%)
Total	112	14 (12.5%)	8 (57.1%)

*P>0.05 # P>0.05

Among 14 *S. aureus* isolates, 64.3% showed resistance towards Ampicillin followed by Methicillin (57.1%), Ciprofloxacin (35.7%), Cephalexin (21.4%), Tetracycline (21.4%), Gentamycin (14.3%), Erythromycin (7.1%), and Vancomycin (0.0%) (Fig 2). Out of 8 MRSA isolates, all (100.0%) were resistant to Ampicillin, while none (0.0%) were resistant to Erythromycin and Vancomycin. The resistance pattern for other antibiotics was Cephalexin (37.5%), Ciprofloxacin (37.5%), Tetracycline (37.5%), and Gentamycin (25.0%) (Fig. 3).

DISCUSSION

The nasal carriage rate of *S. aureus* (12.5%) in the present study was lower than the rate reported among children in Nepal[21] and elsewhere.[22,23] Likewise, relatively higher prevalence has been reported among healthy volunteers in some other studies elsewhere.[24-26] This may be attributed to smaller sample size in the study. On the other hand, the higher MRSA carriage rate among total study subjects as compared to the studies among US population (0.8%)[26] and that among community adults in the other countries (0.8 to 3.0%)[13-15] might be due to the inclusion of participants present in the hospital environment; thus it indicates the possibility of hospital acquired MRSA colonization among them. Further, the higher prevalence of MRSA (29.1%) reported among patients, staff and hospital environment in a tertiary medical care center in Kathmandu also signifies the role of hospital ambience in increasing dispersion of MRSA in the hospitals.[11]

One quarter of the healthcare personnel under study were the carriers of *S. aureus* which was quite lower than that reported by Panta and Rai (43.8%)[19] and Tejero *et al* (34.9%)[27] among teaching hospital staffs, and Onyemelukwe *et al* (34.4%)[28] among general hospital staffs. However, Na'was and Fakhoury have reported lower prevalence among general hospital staffs in North Jordan (19.8%).[29] One tenth of these healthcare personnel in the study were carriers of MRSA. This was in agreement with the internationally reported range of MRSA carriage (5.8 to 17.8%) among healthcare workers in the hospital setting[10,16-18,29] which indicated the dispersion of MRSA among healthcare personnel in NMCTH as per global trend.

Though not significant, higher nasal carriage of *S. aureus* and MRSA among female as compared to their counter parts was in agreement with the previous findings of Onyemelukwe *et al*[28] and Arch *et al*[26], respectively. The relatively lower colonization rate among old subjects in the study was in agreement with Arch *et al*.[26] It has been reported that the older adults are less likely to be colonized with *S. aureus* than their younger ones but, when colonized, are more likely to have MRSA strains. So, older adults with suspected staphylococcal infections may need antibiotic coverage against resistant strains. Because of the higher rates of carriage of resistant organisms in this medically vulnerable population, clinicians may want to initiate Vancomycin therapy earlier in the course of a suspected *S. aureus* infection in patients older than 65 years.[26] However, in our study, all MRSA were isolated from subjects of age group 15-50 years. This might be attributed to relatively less number of elderly participants in the study.

The nasal carriage of MRSA among healthcare personnel and visitors/patient attendants has indicated the chances of transmission of the organism to the patients during patient-care. As all of the isolates in the study belonged to the subjects at post operative and surgical wards, the vulnerability of the surgical wound infection with MRSA among the patients, following transmission from the healthcare providers and the visitors/patient attendants, further complicating the treatment and recovery, cannot be ignored. The increasing emergence of community acquired MRSA[2-6] further increases the chances of infection of the patients with community acquired MRSA, following transmission from visitors/patient attendants. Moreover, the patients are also susceptible to the staphylococcal infection of wounds and other sites from endogenous source during hospital stay due to own nasal carriage.

The high colonization rate among visitors/patient attendants necessitates the need of control in the frequency of their exposure with the vulnerable patients. Similarly, the healthcare personnel require awareness regarding the nosocomial infection and should know their status of nasal carriage of MRSA and accordingly, take necessary measures to prevent possible transmission. Further, while making therapeutic decisions, clinicians should monitor bacterial carriage rates and resistance patterns for their own hospital and city, as well as, take into account the risk patterns found. Clinicians and hospital infection control personnel should remain vigilant in using appropriate protocols for minimizing microbial transmission.[26]

Besides the limitation of small sample size, this study is deficit in analysis of risk factors associated with the nasal

carriage among study participants. Because many clinical infections arise from spread from a healthy carrier, an understanding of the risk factors for carriage of *S. aureus* is crucial for understanding the potential for invasive infections and transmission of MRSA. Nasal carriage of *S. aureus* has been reported to have positive association with asthma, whereas negative association with exposure to cigarette smoke and recent use of antibiotics.[26] In addition to *S. aureus*, coagualse negative staphylococci (CONS) isolated from medical personnel, equipments and hospital environment have also been reported to be methicillin resistant.[30] This necessitates the immediate surveillance of methicillin resistant CONS in the hospitals, followed by execution of effective measures for their control and curtailing the transmission.

Thus, the study emphasizes the need for a regular surveillance of microbial flora among hospital staffs and environment to prevent MRSA transmission among healthcare personnel, visitors/patient attendants and patients.

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