

THE PREVALENCE OF NASAL CARRIAGE METHICILLIN-RESISTANT *STAPHYLOCOCCUS* *AUREUS* IN HOSPITALIZED PATIENTS

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ABSTRACT

Objective: To determine the nasal colonization of methicillin-resistant *Staphylococcus aureus* in hospitalized patients.

Methodology: This descriptive study was carried out on 100 hospitalized patients at Shahid Beheshti Hospital in Kashan in 2007. The nasal samples were collected by sterile swabs, and transferred to Brain Heart infusion (BHI) culture medium and immediately referred to the microbiology lab in Kashan University of Medical Sciences. Samples were inoculated on blood agar and manitol salt agar media. Identification of the isolates was done by standard biochemical tests. Oxacillin susceptibilities of *S. aureus* isolates were determined using Mueller-Hinton oxacillin agar screen plate. The results were analyzed statistically by chi Square and Fischer's exact tests.

Results: The prevalence of nasal carriage of *Staphylococcus aureus* and MRSA were 38% (38 out of 100), and 52.6% (20 out of 38), respectively. The results showed that by urinary tract catheterization ($P=0.005$), administration of any antibiotic ($p=0.008$), history of diabetes mellitus ($p=0.0303$), and hospitalization time more than one week ($p=0.0009$) were the main predisposing factors for nasal colonization of MRSA. The ICU ward was the principle ward of nasal colonization by both *Staphylococcus aureus* (75%) and MRSA (100%), followed by infectious diseases ward with rates of 64.7% and 75%, respectively.

Conclusion: The overall colonization rate of MRSA in the hospitalized patients in this study was high. A systematic selective screening of patients with high risk of carriage should be fruitful to implement barrier precautions and reduce cross-transmission.

KEYWORDS: Hospitalized patients, *Staphylococcus aureus*, Methicillin resistance, Nasal carriage.

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INTRODUCTION

Methicillin-resistant *Staphylococcus aureus* (MRSA) is one of the major nosocomial pathogens responsible for a wide spectrum of infections, including skin and soft tissue infections, pneumonia, bacteraemia, surgical site infections (SSI), and catheter related infections.¹ MRSA isolation from an inpatient is associated with increased risk of nosocomial infection and an excess of morbidity and hospitalization costs.² MRSA prevalence varies markedly

between different countries and between different regions and hospitals within countries.³ Within hospitals, the ICU characteristically has higher rates of infections and increased transmission rates, high antibiotic use and large numbers of vulnerable patients. Numerous studies have shown that clinical infections by MRSA represent a small fraction of the vast population of asymptomatic colonized patients, most of whom are unrecognized which constitutes the institutional reservoir for spread of these organisms on the hands, apparel, or equipments of health care workers to susceptible patients.⁴ Detection of MRSA carriage is essential for the prompt implementation of barrier isolation of colonized patients.⁵⁻⁷ The main mode of MRSA transmission is from MRSA-colonized or MRSA-infected patients to another one through indirect contact via the transiently colonized hands of healthcare workers. Therefore, the identification of MRSA carriers is essential for implementation of targeted infection control measures to prevent dissemination. The aim of the present study was to evaluate the prevalence of MRSA nasal carriage in hospitalized patients, and its relative risk factors.

METHODOLOGY

This is a prospective study conducted in a 400-bed teaching hospital Shahid Beheshti Hospital, Kashan, Iran over a 3-month period. Patients enrolled in this study were hospitalized in ICU, cardiology, neurology, endocrinology, gastroenterology, dermatology, pediatrics, infectious diseases and thoracic surgery wards. All study participants underwent swabbing of the anterior 1.5 cm of the nasal vestibule of both nares with sterile dry swabs. Samples from nares were collected from hospitalized patients within 48 hours of admis-

Table-I: Demographic data of nasal carriage MRSA in hospitalized patients

Characteristics	
Male/female	61/39
Age(SD)(years)	50.24±25.77
Length of hospitalization(days)	
Mean (SD)	7.47±7.94
Median	5
Range	2-45
Use of antibiotic	73

sion, and immediately inoculated into Stuart transport medium. The specimens were sent to the microbiology laboratory within one hour. Swabs were cultured on sheep blood agar and mannitol-salt agar incubated at 35°C for up to 48 hours. Organisms with a yellow color (mannitol fermenters) were identified as *S. aureus* by standard methods including gram stain, and tube coagulase test. Oxacillin susceptibilities of *S. aureus* isolates were determined using a Mueller-Hinton oxacillin agar screen plate (containing oxacillin 6µg/ml) according to Committee for Clinical Laboratory Standards Institute (CLSI). The study protocol was approved by the ethical committee of the Kashan University of Medical Sciences.

RESULTS

Out of one hundred individuals included in the present study, 38 (38.0%) were positive for *S. aureus* nasal carriage (including 18 Methicillin-sensitive *Staphylococcus aureus* (MSSA) and 20 MRSA). The patient's demographic characteristics are shown in Table-I.

The highest staphylococci isolation (75%) was obtained in ICU followed by infectious diseases (66.7%), CCU (55.6%), thoracic surgery (50%), pediatrics (40%) and cardiology wards (22.6%). The highest MRSA isolation (100%)

Table-II: Risk factors for MRSA colonization during study period

Risk factor	MRSA 20	MSSA 18	OR (95% CI)	P value
Recent antibiotics usage	18	2	7.2 (1.274 40.678)	0.027
Urine catheter usage	10	10	8 (1.445 44.297)	0.01
≥1week hospitalization	12	8	12 (2.147 67.067)	0.002

was obtained in CCU. The MRSA carriage rate was significantly higher among patients hospitalized for one week or more (85.7%, 12/14) than patients less than one week (33.3%, 8/24) ($P < 0.002$, OR: 12, 95% CI: 2.147– 67.067). History of diabetes mellitus ($p < 0.0303$), administration of urinary catheter (OR: 8, 95% CI: 1.445–44.297), and recent antibiotics usage ($p=0.027$) (OR: 7.2, 95% CI: 1.274–40.678) were significantly associated with higher rate of MRSA carriage. There were no significant association with MRSA carriage ($P > 0.05$) according to sex, and history of cardiopulmonary diseases, and recent corticosteroids administration. The risk factors for MRSA colonization during surveillance period are shown in Table-II. MRSA colonization according to sex and mean of age of hospitalized patients are shown in Table-III.

DISCUSSION

Although MRSA largely remains as a nosocomial acquired pathogen, many patients with MRSA may have unrecognized colonization or infection with the organism at the time of admission to a hospital. Such patients often serve as a reservoir for subsequent transmission of the nosocomial infection. Patients who have recently been discharged or transferred from another hospital are at increased risk of carrying MRSA. Identification of the organism's reservoir by screening of the high-risk patients is the main strategy to control the transmission of MRSA in hospitals. Colonization and infection by *S. aureus* are known to be significantly associated with infection among hospitalized patients.⁸ Several risk factors for acquisition of MRSA have been identified. A prolonged hospital stay and prior exposure to broad-spectrum antimicrobial therapy also appear to predispose patients to MRSA. In the area with high prevalence of MRSA, a relatively high percentage (11–19%) of MRSA nasal carriage among hospital patients on admission will increase the likelihood of MRSA infection during the same episode of hospitalization.^{9,10} The results from several studies on MRSA in intensive care units have also revealed that MRSA

Table-III: The MRSA colonization in relation to sex and mean age of hospitalized patients.

MRSA	Female		Male	
	Mean (SD)	No.	Mean (SD)	No.
Positive	47 (24.94)	5	64.73 (22.36)	15
Negative	62.2(11.75)	5	42.84 (27.51)	13

colonization predisposed to MRSA infection during the same hospitalization period.¹¹ The present study yields a high proportion (52.6%) of hospitalized patients with MRSA carriage.¹²⁻¹⁵ But the *S. aureus* colonization rate in hospitalized patients was relatively lower than results in another study from Turkey (38%; vs. 56.7%, respectively),¹⁶ and was compatible to the study from Saudi Arabia with an overall nasal carriage of 38.0%, and various carriage rates in different age groups.¹⁷ The carriage rate for the American-Indian population was higher than this study (27.3%).¹⁸

Results in this study showed that the history of diabetic mellitus, any antibiotic usage, duration of hospitalization >1 week and use of urine catheter were significant risk factors for colonization of MRSA in nasal cavity of hospitalized patients. Various studies have demonstrated that the risk factors for MRSA include the use of broad-spectrum antibiotics.¹⁹ The hospitalized patients particularly the elderly, the acutely ill in ICU, those with surgical wounds or an intravenous catheter, and those in physical proximity to a patient with MRSA are at the greatest risk.^{1,6} Measures taken to control the spread of MRSA infections including laboratory-based surveillance, isolation of the colonized and infected patients, use of barrier precautions, hand washing, and hand antisepsis. Sampling and culture of specimen from hospitalized patients who are at high risk of acquiring MRSA can facilitate screening and isolation of colonized patients.

Eradicating MRSA nasal colonization among affected patients and healthcare personnel has also been an effective control measure, with variable success.²⁰ As MRSA is transmitted primarily through the hands of healthcare workers (HCWs), greater emphasis should be

given to improving hand hygiene practices among healthcare personnel.²⁰

CONCLUSION

In conclusion, the nasal carriage of MRSA among hospitalized patients is significant not only in terms of predisposing to subsequent infections, but also plays an important role in transmission among staffs and their family members. Monitoring and eradication of MRSA from patients and HCWs should be considered to prevent continuous spread between healthcare facilities and the community.

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