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**ORIGINAL ARTICLE**

# Staphylococcal nasal colonization in Mofid children hospital staff; carrier state and antibiotic susceptibility

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## ABSTRACT

**Background**: Staphylococcus aureus (SA) is frequently found on normal human skin and mucous membranes. Methicilline resistance S. aureus (MRSA) strains have spread in many hospital isolates world wide since 1970s. Hospital personnel tend to have higher colonization rates than the general population. Colonized residents and personnel are sources for dissemination of organism.

**Materials and methods**: For this cross sectional study, Mofid children's hospital staff were evaluated for staphylococcal nasal colonization. Isolated staphylococci tested for methicilline sensitivity by MIC method and their antibiotic susceptibility was investigated for six antibiotics by Disk diffusion technique.

**Results**: Of 284 tested personnel, 56 (19.7%) revealed to have nasal colonization of whom 23 (8.1%) were methicilline resistant (MRSA). Working in the office ($p<0.003$), age ($p<0.008$) and years of employment in hospital ($p<0.039$) were correlated with colonization with MRSA. Totally, 96% of carriers were persistent carrier. Logistic regression showed a significant association between the working place (health care) ($p<0.049$) and years of employment ($p<0.07$) with S.aureus nasal colonization rate.

**Conclusion**: Hospitals should assess the advantages and disadvantages of routinely culturing personnel, however, in outbreak situation hospital personnel especially older persons may be sources of nosocomial infection.

**Keywords**: *Staphylococcus, Colonization, Hospital staff, Carrier state.*

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## INTRODUCTION

Staphylococcus aureus (S.A) is frequently found on normal human skin and mucous membranes. The spread of methicilline resistance S. aureus (MRSA) becomes an alarming problem throughout the world. It has emerged worldwide as an important nosocomial pathogen. Generally once MRSA appears in an institution; it becomes established as persistent cause of nosocomial infection (1). However, MRSA strains have spread in many hospitals isolates worldwide since 1970s (2). The nose is the most common reservoir site for staphylococci (3), and colonization of organism in this part of the body lead to dissemination to other body surfaces. Hospital personnel tend to have higher colonization rates than the general population (4). Colonized residents and personnel are sources for dissemination of organism and they can serve as reservoirs for MRSA and may harbor

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the organism for many months (5). Colonization may be either transient or persistent (3). It is recommended that every hospital or institute plans own institution strategy in controlling S. aureus infection.

Despite of this fact there is still no unique protocol for finding and controlling S. aureus infection in Iran's hospitals. Thus, we designed this study to ascertain the rate of nasal carriage of S. aureus in the hospital personnel.

## PATIENTS and METHODS

A cross sectional study was designed by Pediatric Infectious Research Center in Mofid children's hospital, a referral pediatric hospital in Tehran. It is a 200-bed pediatric hospital with an approximate 850 admissions per month. Hospital personnel work as healthcare worker and official staff.

Having explained our goal and requested them to fill an informed consent, hospital personnel were evaluated for staphylococcal nasal colonization. Initial data including sex, age, and years of employment were gathered by a questionnaire. Past medical history of underlying diseases that might increase the chance of colonization, such as, chronic renal disease, insulin dependent diabetes mellitus, and dialysis were inquired (6).

None of the subjects had received antibiotic for at least 1 week prior to the study. Samples were obtained by rotating a sterile cotton swab in both nares. Then, the specimens were incubated on 5% sheep blood agar with blood agar base (Merck) in 35ºC for 24 hrs. The colonies were tested for catalase, coagulase and DNAase and were cultured on maintol salt agar. Finally, those colonies documented as staphylococci, were tested for Methicilline susceptibility in order to detect MRSA colonies. We determined MIC with oxacilline dilution tube method. We used oxacilline (Sigma. P 1891, lot 76 H9930) for MIC test. Staphylococci considered as methicilline sensitive when MIC was less than 8 µg/ ml and it was reported as MRSA, when MIC was >8µg/ml (7). We tested all staphylococcal colonies for 6 antibiotics susceptibility (Methicillin, Oxacillin, Vancomycin, Chloramphenicol, Cotrimoxazole, and Ciprofloxacin) by disc diffusion method (Mast Diagnostic Company, UK). Resistance or susceptibility was reported based on the last version of NCCLS guideline.

Data were analyzed by SPSS for Windows (version 11.5, USA). Two-tailed *P* values are given, and those of 0.05 were considered to be of statistical significance. Chi square analysis was used for comparison of qualitative variables. T test was used for comparison of quantitative variables between two groups. We also conducted a multivariate analysis with binary logistic regression.

## RESULTS

Totally, 284 subjects (193 females and 91 males) were evaluated for S. aureus colonization among whom 237 (83.5%) were healthcare workers (83.5%), 5 had diabetes mellitus, and 1 had undergone dialysis because of chronic renal failure.

S. aureus was detected in 56 (19.7%) persons including 37 females (19.2%) and 19 males (20.7%) (table1). No association was found between S. aureus colonization and sex, age, working place, and years of employment (NS).

Figure 1 represents S. aureus susceptibility pattern. S. aureus colonies were completely sensitive to ciprofloxacin, while they were partially resistant to oxacillin.

Methicilline resistant strains (MRSA) were found in 23 personnel (8.1%) including 16 (43.2%) females and 7 males. Although colonization with MRSA was not associated with sex, working in office ($p<0.003$), age ($p<0.008$) and years of employment in hospital ($p<0.039$) were shown to be associated with MRSA colonization.

**Table 1**. *Characteristics of Mofid Hospital staff according to the status of colonization with staphylococcous aureus*

| Colonization | No.(%) | Mean age (year) | Sex | | Years of employment | Official worker | Healthcare worker |
|---|---|---|---|---|---|---|---|
| | | | Male | Female | | | |
| **Negative** | 228(80.3) | 35.0 | 72 | 156 | 7.7 | 41 | 187 |
| **Positive** | 56(19.7) | 35.6 | 19 | 37 | 9.3 | 6 | 50 |
| **MRSA** | 23(8.1) | 39.1 | 7 | 16 | 12.1 | 6 | 17(34) |
| **MSSA** | 33(11.6) | 33.1 | 12 | 21 | 7.4 | 0 | 33(66) |

MRSA: Methicillin-resistant S. aureus
MSSA: Methicillin-sensitive S. aureus

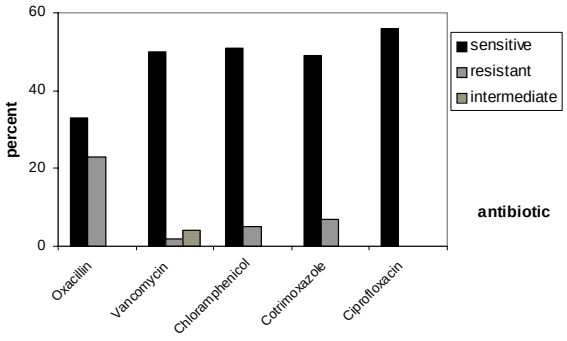


**Figure 1**. *Pattern of Staphylococcous aureus susceptibility*

Fifty-three carriers were reevaluated one month later without any treatment during which S. aureus was isolated from 51 persons (96.2%). All of the official staff (6 cases) who were carrier remained positive. During the second work up, 28 (55%) MSSA and 23 MRSA (45%) were detected. Meanwhile, during this phase type of colonized staphylococci and pattern of susceptibility remained unchanged.

In summary, 19.7% of our hospital personnel were nasal carriers of S. aureus, of whom 8% were colonized with MRSA and 96.2% were persistent carriers.

## DISCUSSION

Carriage of S. aureus in the nose appears to play a key role in the epidemiology and pathogenesis of infection (8). Healthy individuals have a slight risk of invasive infection caused by S aureus during their carrier state but they can be carriers of the organism, because its primary habitat is moist squamous epithelium of the anterior nares (9). S. aureus nasal carrier rate of 20-50% can be found in normal adults (5). In healthy subjects, over time, three patterns of carriage can be distinguished: about 20% of people are persistent carriers, 60% are intermittent carriers, and approximately 20% almost never carry S. aureus. Zimakoff reported that staphylococcal infection occurred significantly more frequently among carriers, and more than half of the patients were infected by the same or possibly the same strain as they carried in the nose or on skin (10).

MRSA persisted in the oral cavities of children for more than five years with the potential to cause nosocomial infections (11). Healthcare providers may become transient or persistent MRSA carriers whilst working in hospitals in which MRSA is endemic (12). They may then become a source of infection for patients as well as their own families. Persistent or transient carriers among the hospital personnel may disseminate S. aureus into the hospital environment. Haley et al. reported an outbreak due to direct dissemination from colonized personnel (13). Studies from Turkey showed different hospital personnel S. aureus carrier rates, ranging 15.3-31.5% (5). Also Verghese et al found 18.2% of health care workers to be nasal carriers, of these, 12.2% were carriers of MRSA (8).

The importance of MRSA colonization in hospital personnel remains controversial. Some studies demonstrated that MRSA is not more virulent than MSSA. MRSA colonization has been found in 2% of the hospital personnel in various studies (5). In our study MRSA colonization was found in 8% of personnel whilst 43% of all staphylococcal species were MRSA. It might be an alarming sign for us. We must pay further attention to nosocomial infection with S aureus species.

This study shows significant association between the working place (health care) and years of employment in hospital with S. aureus nasal colonization rate. Prior investigators believed elderly residents are an increased risk for colonization with MRSA, in addition to having the potential to carry MRSA for long periods of time (6).

We showed a significant association between the working place (office) and age with MRSA nasal colonization rate. However, we didn't find association between MRSA and working as a healthcare worker. This could be in part explained by the differences between age in these two groups (younger medical students, resident who were included in health care group) and long term working in hospital for official personnel.

It is known that routine screening of hospital personnel for S. aureus colonization requires considerable time and expenditure, and if colonized personnel are removed from patient care, routine services of that hospital will be disrupt. Thus, periodic screening for the hospital personnel with a carrier rate about 15% is not recommended. Personnel should be cultured when they are thought to be a possible source for dissemination of S aureus (5).

In conclusion, hospital should assess the advantages and disadvantages of routinely culturing personnel, however, in outbreak situation hospital personnel especially older persons may be source of nosocomial infection.

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