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The Frequency of *Staphylococcus aureus* Nasal Carriers and its Antibiotic Resistance among the Personnel of the Clinical Wards at Imam Hussein Hospital Of Tehran

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Abstract

Introduction:
Nosocomial infections are referred to the infections that occur during the patient's hospitalization or owing to his hospitalization in hospitals. Nosocomial infections are associated with numerous complications, high mortality rate, and high costs. Moreover, nosocomial infections will increase the length of hospitalization in the wards.

Material and methods: Personal information was collected by using a questionnaire that was filled out by the patient during the sampling. In this questionnaire, age, gender, occupational experience, the ward they work at, and taking antibiotics in the last 72 hours are specified.

Results: The entire personnel of the clinical wards of Imam Hussein Hospital was 372. From the entire personnel, as many as 278 individuals (75%) entered the present study. The individuals excluded from the study (94 individuals) were those who were on vacation at the time of sampling, were on a treatment course of antibiotics, or were unwilling to cooperate in the project.As many as 83 individuals (29.8%) were males, and 195 individuals (70.2) were females.

Conclusion: It is important to adopt the necessary measures towards diagnosing nasal carriers of methicillin-resistant staphylococcus, isolating the colonized individuals, eradicating this strain, and following the healthcare principles such as washing hands and using disinfectants in hospital, so that the risk of nosocomial infections will be reduced.
This strain is still highly susceptible to vancomycin, it is of significant importance to prevent the resistant strains.

Key words: Staphylococcus aureus, nasal carriers, clinical wards

INTRODUCTION

Nosocomial infections are referred to the infections that occur during the patient's hospitalization or owing to his hospitalization in hospitals. Nosocomial infections are associated with numerous complications, high mortality rate, and high costs. Moreover, nosocomial infections will increase the length of hospitalization in the wards.There are numerous factors associated with the increased risk of suffering from nosocomial infections including age and the severity of underlying diseases that cannot be prevented by adopting therapeutic measures. There are also other intervening factors the infection risks of which can be minimized by treatments and adopting necessary measures. They include long duration of hospitalization, taking a wide range of antibiotics, using intravascular tools for a long time, failing to preserve the sanitary measure by the personnel, and the presence of individuals carrying strains of nosocomial infections among the personnel and the patients hospitalized (1).Staphylococcus is included as a non-spore-forming that is very resistant and can survive in many non-physiological conditions. This microorganism keeps growing even after months in dried clinical samples. This gram-positive bacterium is resistant to heating and can bear environments high in salt concentration. For this reason, despite the application of strong antibiotics, improved public health condition, and controlling nosocomial infections, staphylococcus aureus is still used as a basic pathogenesis of humans (2). One of the pathways for disseminating staphylococcus aureus to the patient is from the personnel's noses. The colonization of this microorganism in the nose and failure to follow health principles especially washing hands by the personnel can be the potential reservoirs for the dissemination of nosocomial infections. However, according to the environmental and seasonal epidemiological factors, as many as 30% of the population are always nasal carriers of staphylococcus aureus, and as many as 60% of the population are potential carriers at times. As many as 20% of the population are never colonized (2-3).

DATA COLLECTION METHOD

Personal information was collected by using a questionnaire that was filled out by the patient during the sampling. In this questionnaire, age, gender, occupational experience, the ward they work at, and taking antibiotics in the last 72 hours are specified. Moreover, the findings of sample culture as well as antibiotic sensitivity were recorded in the questionnaire. When the samples were collected, morning-shift, evening-shift, and night-shift personnel were on duty at their wards. The samples collected were cultured by using sterile swabs for 48 hours, and if the nasal culture was positive, antibiogram was conducted as well. Given the coordination made with the technical specialist of the laboratory (as one of the colleagues of the project), the result of the tests were followed.

FINDING

The entire personnel of the clinical wards of Imam Hussein Hospital was 372. From the entire personnel, as many as 278 individuals (75%) entered the present study. The individuals excluded from the study (94 individuals)

were those who were on vacation at the time of sampling, were on a treatment course of antibiotics, or were unwilling to cooperate in the project. As many as 83 individuals (29.8%) were males, and 195 individuals (70.2) were females.The age of the individuals entered the study was at least 21 and at most 56 years old. The mean age with the standard deviation was 33.74±8.43 years. Moreover, 28 was the most frequent age with 21 individuals. The individuals were divided into three age groups: 20-29 years old; 30-39 years old; and +40 years old. The age group of 20-29 was the most frequent with 113 individuals (40.6%).In terms of educational level, the individuals studied were divided into the following groups: illiterate; junior high school diploma; high school diploma; associate degree; bachelor's degree; and master's degree. Master's degree group was the least frequent with 2 individuals (0.71%), and bachelor's degree group was the most frequent with 160 individuals (57.5%). In terms of their occupational title, the individuals were divided into the following groups: matrons; nurses; paramedics; ward assistants; service personnel; secretary; and laboratory personnel. The highest frequency belongs to the nurses' group with 138 nurses (49.6%), and the lowest frequency is for the matrons' group with 14 matrons (5%). With respect to occupational experience, the individuals were divided into the following groups: less than 2 years; 2-10 years; 11-15 years; 16-20 years; and more than 20 years. The most frequent group was 2-10 years with 95 individuals (34.2%). From the 278 cultured samples collected, as many as 65 samples (23.4%) were positive in terms of staphylococcus aureus, and 213 samples (76.6%) were negative.From among the men (83 samples), 19 samples (22.9%) were positive, and 64 samples (77.1%) were negative. As for women (195 samples), 46 samples (23.6%) were positive, and 149 samples (76.4%) were negative. This indicates that the rate of positive culture is higher in women than that of men. However, the difference is not statistically significant.The comparison of the individuals in terms of the determined age groups and positive/negative culture results indicated that the 20-29 age group had the least frequency of positive culture with only 24 individuals (21.2%). Moreover, +40 age group had the most frequency of positive culture with 20 individuals (29.9%). However, this difference is not statistically significant, and there is no special relationship between age group and positive nasal culture. The comparison of the individuals in terms of the educational level and positive/negative culture results indicated that the illiterate group had the highest relative frequency of positive culture with 3 individuals (100%). Moreover, in terms of positive culture, the bachelor's degree group had the lowest relative frequency with 30 individuals (18.8%) (P=0.0014).

The comparison of the individuals in terms of the occupational ward and positive/negative culture results indicated that women's orthopedic ward had the highest relative frequency of infection with 55.6%, and the infection ward had the lowest frequency of infection with 0% (P=0.380). The comparison of the individuals in terms of the personnel title and positive/negative culture results indicated that ward assistants had the highest relative frequency of infection with 38.9%, and the paramedics had the lowest relative frequency of infection with 16.7% (P=0.126).The comparison of the individuals in terms of being employed in other hospitals indicated that from among the 278 individuals sampled, 13 individuals (4.7%) were also employed in another hospital. Out of these 13 individuals, as many as 2 individuals had a positive culture (this difference was not statistically significant).For the 65 individuals that had a positive nasal culture an antibiotic sensitivity test (antibiogram) was conducted, and their status was reported as being resistant, sensitive (susceptible), and intermediate to antibiotics.

The findings of the antibiotic sensitivity test are as follows:

As many as 65 individuals (100%) were resistant to penicillin, 19 individuals (29.2%) to oxacillin, 8 individuals (12.3) to erythromycin, 3 individuals (4.6%) to co-trimoxazole, 0 individuals to ciprofloxacin, 5 individuals (7.7%) to clindamycin, 2 individuals (3.1%) to cefazolin, 0 individuals (0%) to vancomycin, 1 individual (1.5%) to gentamicin, and 1 individual (1.5%) to cloxacillin.

DISCUSSION

Humans are the natural reservoir of staphylococcus aureus, and the asymptomatic colonization by this bacteria is much more prevalent than the infection. Colonization is likely to be transient or permanent, or it can also last for years. Patients as well as hospital personnel that are colonized with methicillin-resistant Staphylococcus aureus in the hospitals or other healthcare centers can transmit this bacterium to those they have close contact or their family members as a result of direct contact (4). Nosocomial infections are significantly involved in the increase of mortality rate, complications, and patients' hospitalization costs, since staphylococcus aureus infection epidemics are likely to rapidly transmitted to wards such as ICU, burn, and surgery (5). Thus, studying the prevalence of staphylococcus nasal carriers among the hospital personnel is of significant importance, since it can be eradicated by simple methods such as washing hands with soap and disinfectants, using mupirocin 2% nasal ointment, and even using the systemic antibiotic treatment (6).In the present study, from among 372 personnel of Imam Hussein Hospital with the occupational titles of matron, nurse, paramedic, ward assistant, and patient transporter, 278 individuals (75%) entered this project. A specimen of nasal discharge of this patients was taken by using sterile swab to be cultured. The abovementioned personnel were selected from all clinical wards of the hospital (internal, surgery, neurosurgery, pediatrics, neonatal, ICU, CCU, obstetrics and gynecology, orthopedics, radiotherapy, emergency, neurology and psychiatric, infection, and eye). In the present study, the statistical population includes 195 males (70.2) and 83 females (29.8%). Most of the individuals studied were in the age group of 20-29 years; they account for 40.6% of the entire population (113 individuals). In terms of working experience, most of the participants were in the group of 2-10 years; they accounted for 34.2% of the entire population (95 individuals). The result of the nasal discharge culture of the individuals studied indicate that as

many as 65 individuals (23.4%) was positive; the result of 213 individuals (76.6) was negative. Abedini et al (1999) conducted a similar study in Rafsanjan. In their study, from among the entire nursing personnel (341 individuals) of Rafsanjan hospitals (Ali ibn Abi Talib, Moradi, and Niknafs Maternity Hospital) 150 (43%) were randomly selected from all clinical wards and entered their study. The nasal culture of 6 individuals (4%) were reported to be positive (7). The increase in the number of nasal carriers in our study (in comparison to the study conducted by Abedi et al) is likely owing to the increased cases of Staphylococcal infections in the hospitals, especially cases resistant to antibiotics and failure to follow health principles by the personnel that are all significant and preventable.In another study conducted by Alavi Naeini et al, 63 individuals of surgery wards (general, neurosurgery, urology, orthopedics, and otorhinolaryngology) entered the study (8). As many as 71.4% of these participants were nasal carrier of staph. This high rate of infection (in comparison to our study) is possibly owing to the fact that fewer individuals were studied, and they were all selected from the surgery wards where there is a higher risk of nosocomial infections. In terms of positive cases, the findings of the present study are consistent with those of the study conducted by Zorelli et al. They reported the nasal carriers of staph aureus between 20-55% (9).In terms of gender distribution, in the present study, 19 men (22.9%) and 46 women (23.6%) had positive culture, and this indicates that positive culture is higher in women than that of men. However, this difference is not statistically significant. In the study conducted by Abedini et al, the rate of positive culture was higher in women than that of men. This is consistent with the finding of the present study, but it is not significant (33). Thus, one cannot define a special relationship between gender and being a nasal carrier.In terms of age distribution, the participants with positive culture were mostly in the age group of over 40 years old. They account for 29.9% of positive culture cases (20 individuals). However, it was not statistically significant.

In the study conducted by Abedini et al, most of the participants with positive culture were mostly in the age group of 30-39 years old (33). This is consistent with the findings of the present study.Another variable studied was working experience in the hospital. Most of the individuals with positive culture had 15-20 years of experience that accounted for 40% (12 individuals) of those having positive culture. However, this was not statistically significant.

In the studied conducted by Abedini et al, in terms of working experience in the hospital, most of the individuals with positive culture enjoyed over 20 years of experience (7). This was somehow consistent with the findings of the present study.In terms of occupational title, nurses accounted for most of the individuals having positive culture with the frequency of 26 individuals (40%). Since nursing is one of the key professions among healthcare services. Moreover, nursing has a significant role in admission, preparation, and treatment of patients, and it has the most contact with the patients. Thus, nurses have a significant role in transmitting the disease from themselves to the others or from one patient to another, and this high rate is statistically significant.With respect to the occupational ward, the frequency distribution of individuals with positive culture is as follows. The following had the highest relative frequency of infection: women's orthopedic ward, 55.6%; neonatal, 42.9%; delivery ward, 40%; gynecology, 33%; and emergency, 31.8%. Since the abovementioned wards had a high level of infection, they are considered as susceptible (sensitive) wards of the hospitals in terms of nosocomial infections. Thus, this rate of infection in these wards are significant and calls for adopting appropriate measures for its treatment.In the study conducted by Abedini et al, the rate of infection in different wards was as follows: ICU with 33.3% and delivery with 22.2%.In the present study, the individuals with positive culture were studied in terms of resistance and susceptibility to 10 different antibiotics.In the study conducted by Abedini et al, antibiotic sensitivity test (antibiogram) was conducted on 9 antibiotics. In the present study, the findings of the antibiotic sensitivity test (antibiogram) are as follows:

As many as 100% of the cases were resistant to penicillin, and 92.2% were resistant to oxacillin. The rate of susceptibility (sensitivity) for other antibiotics was as follows: 100% to vancomycin and ciprofloxacin; 93.8% to co-trimoxazole; 98.5% to cloxacillin; 93.8% to cefazolin; 92.3% to gentamicin; 73.8% to clindamycin; and 62.2% to oxacillin. There was relative resistence to other antibiotics.In the study conducted by Abedini et al (1999), in terms of antibiotic resistance, as many as 100% of the cases were resistant to penicillin and oxacillin. Moreover, as many as 100% of the cases had an intermediate susceptibility to vancomycin. The samples had the best susceptibility to chloramphenicol and clindamycin with 50% susceptibility. For other kinds of antibiotics the following rates of resistance has been reported: 33.3% to cefazolin; 50% to erythromycin; 66.6% to tetracycline; and 33.3% to gentamicin (7). In the study conducted by Ranjbar et al (2005), in terms of antibiotic resistance, staph aureus had a 43% resistance to cefazolin and 70% resistance to cloxacillin, and it had a 100% susceptibility to vancomycin (10). In the aforementioned studies conducted, the increased resistance to methicillin and oxacillin was significant. It is important to adopt the necessary measures towards diagnosing nasal carriers of methicillin-resistant staphylococcus, isolating the colonized individuals, eradicating this strain, and following the healthcare principles such as washing hands and using disinfectants in hospital, so that the risk of nosocomial infections will be reduced.

This strain is still highly susceptible to vancomycin, it is of significant importance to prevent the resistant strains.

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