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Evaluation of *Staphylococcus Aureus* Presence and Meticillin Resistance in Nasal Swab Samples in Erzincan Mengucek Gazi Training and Research Hospital

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Abstract: To investigate the *Staphylococcus aureus* strains and methicillin resistance rates retrospectively isolated from nose swab samples sent from various clinics to our laboratory during the study period. 3002 nose swab samples were sent to Erzincan Mengücek Gazi Training and Research Hospital Microbiology Laboratory between January 2015 and January 2020. Samples were inoculated in 5% sheep blood and chromogenic MRSA medium. The media were incubated at 35 ºC for 24 hours. Colonies compatible with *S. aureus* in 5% sheep blood medium and forming pink color in MRSA medium were evaluated. Methicillin susceptibilities of isolates identified as *S. aureus* by conventional methods and subsequently by MALDI-TOF MS system were determined by Kirby-Bauer disc diffusion method in Mueller Hinton agar. Sensitivity results were interpreted according to EUCAST guidelines. *S. aureus* was isolated in 536 (17.8%) of the samples. 491 (91.6%) of the patients with reproduction were male and 45 (8.4%) were female. 504 (94%) of the 536 isolated *S. aureus* strains were found to be methicillin-sensitive *S.aureus* (MSSA) and 32 (6%) were methicillin-resistant *S.aureus* (MRSA). 31 of the MRSA isolated patients were male and the mean age was 26.3. The lowest number of MRSA cases was determined in 2015 and the highest in 2019. All MRSA isolates were isolated from outpatients. In our study, the nasal S. aureus carrier rate was 17.8%, and nasal MRSA carrier rate was 6%. Investigation of the nasal presence of S. aureus, an important pathogen for hospital and community-acquired infections, and determination of antibiotic sensitivity will be effective in preventing these infections. Especially for the prevention and control of MRSA transmission; It is necessary to reduce uncontrolled and excessive use of antibiotics, to comply with hand hygiene rules, to screen the carriers periodically and to pay attention to contact measures.

Keywords: *Staphylococcus Aureus*, Methicillin Resistance, Nasal Swab, Infection Control.

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1. Introduction

Staphylococcus aureus species, especially those which are resistant to methicillin (MRSA), have an important place among factors that cause both hospital-originated infections and society-acquired infections. *S. aureus* carriage that is usually in the form of nasal carriage plays a role in the epidemiology of staphylococcus infections. Nasal *S.aureus* colonization leads to certain problems such as high rates of resistance, predisposition to infections and high treatment costs (1, 2).

It was found that MRSAs are responsible for 30-38% of hospital-originated infections in Turkey (3). *S. aureus*, which can be an element of normal flora on the skin and mucosal surfaces, is consistently found in the nasal flora in 15% of healthy adults. However, 60% of the population carries *S. aureus* in their nasal flora at certain periods. The rate of infections caused by these factors is higher in healthcare professionals, hospitalized patients, patients with diabetes mellitus, patients with chronic renal failure, hemodialysis patients, those with eczema and drug addicts, compared to the normal population (4-6).

This study aimed to determine the presence of S*taphylococcus aureus* in the nasal swab samples sent by various clinics to our laboratories during the 5-year period, and to investigate the methicillin resistance rates of the strains retrospectively.

2. Material and Methods

The study was started after the approval was taken from the Clinical Research Ethics Committee of Erzincan Binali Yıldırım University (access number: E.25464-06/07) and included 3002 nasal swab samples which were sent to the Microbiology Laboratory of Erzincan Mengücek Gazi Training and Research Hospital between January 2015 and January 2020. The samples, which were assumed to have been properly taken from patients who applied to various clinics and had different pre-diagnoses, were inoculated in chromogenic MRSA Medium (bioMerieux ®, France) with 5% sheep blood. The mediums were incubated at 35 ºC for 24 hours, and then colonies which were mostly beta-hemolytic and golden-yellow and other suspicious colonies were evaluated. The colonies which had gram-positive coke morphology and positive catalase and coagulant test results and produced pink color in the MRSA Medium were defined as *S. aureus* by MALDI-TOF MS (Vitek MS system, bioMerieux, France) system. The methicillin susceptibilities of the isolates were determined using Mueller Hinton agar (bioMerieux ®, France) and 30 µg cefoxitin disk (bioMerieux ®, France) based on the Kirby-Bauer disk diffusion method. The susceptibility results were interpreted as susceptible/resistant per the EUCAST guidelines (7). *S. aureus* ATCC 25923 was used as a standard strain for quality control.

2.1. Statistical Analysis

Statistical analysis was performed using the Statistical package for Social ScienceS (SPSS) software package version 21.0 (IBM Corp. Armonk, NY, USA). Descriptive statistics as number and percentage parameters were calculated.

3. Results

During the study period, 3002 nasal swab samples were sent by various clinics to our laboratory. The samples which belonged to the same patient and had the identical susceptibility result were considered as a single sample. *S. aureus* was isolated in 536 (17.8%) of these samples. Of the patients with a positive culture, 491 (91.6%) were male and 45 (8.4%) were female. It was found that of the 536 isolated *S. aureus* strains, 504 (94%) were cefoxitin-susceptible (MSSA) and 32 (6%) were cefoxitin-resistant (MRSA). 31 of the MRSA isolated patients were male and the average age was 26.3 years. One of the MRSA isolates was isolated from a 61-years old female patient. The distribution of the patients with positive *S. aureus* culture by age, sex and methicillin susceptibility result was given in Table1.

Table 1: Distribution of patients with positive *S. aureus* culture by sex and methicillin susceptibility.

	n (average age)		Total
	MRSA	**MSSA**	
Men	31 (26.3)	460 (29.3)	491 (29.1)
Women	1 (61)	44 (39.5)	45 (40)
Total	**32 (27.4)**	**504 (30.2)**	**536 (30)**

MRSA: Methicillin-Resistant *S.aureus*, MSSA: Methicillin Susceptible *S.aureus*

When the distribution of MRSA strains by years was examined, it was found that the number of cases was directly proportional to time, the lowest number of cases was in 2015, while the highest number of cases was in 2019. The distribution of MRSA isolates by years is given in Figure 1.

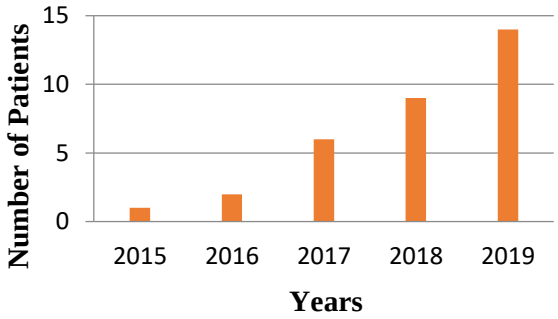

Figure 1. Distribution of MRSA strains by years.

Of 3002 samples included in the study, 14 (0.5%) were taken from hospitalized patients and *S.aureus* did not grow in any of these samples. Of MRSA isolates which were all isolated from patients applied to infectious diseases (n=29), nephrology (n=2) and family medicine (n=1) departments, 28 (87.4%) were detected in samples sent for general medical examination, 2 (6.3 %) in samples sent due to a bacterial infection such as abscess, furuncle, carbuncle, and 2 (6.3%) in samples sent with a diagnosis of chronic renal failure (CRF). The diagnoses of the majority of MRSA-colonized patients were general medical examination; however, when the results were examined in terms of proportion, it was found that the patient group where the probability of MRSA isolation was the highest was the CRF patients. The relationship between diagnosis and methicillin resistance rates is given in Table 2.

4. Discussion

S. aureus is among the leading causes of nosocomial and society-originated bacterial infections around the world. his pathogen is commensally present in approximately 10-40 % of healthy adults (8). MRSA is an important pathogen associated with both hospital- and society-originated infections. Determination of MRSA isolates in a timely and accurate manner is important for controlling the infection and preventing the nosocomial spread of bacteria. The increasing incidence of MRSA-related infections makes the treatment of such infections further difficult (2, 9, 10). MRSA isolates are highly resistant to many common antibiotics such as aminoglycosides, macrolides, chloramphenicol, tetracycline and fluoroquinolones (11). In our country, many studies to investigate the nasal carriage of *S. aureus* have been conducted, and it was found that there were differences in carriage and methicillin resistance rates (12).

A study performed in Denizli with 466 adult patients reported that *S. aureus* was isolated in 204 (43.8%) of the patients and 34 (16.7%) of them were resistant to methicillin. The rate of MRSA-colonized patients was found to be 7.3% (34/466) (13).

Table 2: Methicillin resistance rates of *S.aureus* strains by diagnoses.

Diagnosis	n (%)		
	MRSA	**MSSA**	**Total**
General Medical Examination	28 (5.5)	479 (94.5)	507 (100)
Bacterial Infection	2 (8.3)	22 (91.7)	24 (100)
CRF	2 (40)	3 (60)	5 (100)
Total	**32 (6)**	**504 (94)**	**536 (100)**

In another study conducted in İzmir Tepecik Training and Research Hospital, 1373 nasal swab samples from various polyclinics and wards were analyzed and *S. aureus* was detected in 112 (8.2%) samples, and 11 (9.8%) of them were found to be methicillin-resistant. 6 of the MRSA isolates were isolated from hospitalized patients, and 5 of them were isolated from outpatients (3).

In a study conducted in Antalya, a total of 15,600 nasal swab samples from individuals who were working in different food sectors and administered for a health check to the Antalya Hygiene Institute (ANHEM) between September 2009 and April 2010 were investigated. *S. aureus* was isolated in 526 (3.37%) of the samples and 28 (5.3%) of them were defined as MRSA (14).

In another study in Ankara, MSSA was isolated in 601 (16.6%) of 3,599 nasal cultures and MRSA was isolated in three (0.08%) (15). In a study conducted with the Kayseri Maternity Hospital staff, the nasal swab samples from 203 individuals were scanned. *S. aureus* was detected in 43 (21.2%) of the nasal cultures, and MSSA and MRSA were detected in 41 (95.3%) and 2 (4.7%) of them, respectively (12).

In a study conducted in Ethiopia, S. aureus was isolated in 52 (13%) of 400 nasal swab samples from pre-school children, and MSSA was detected in all the isolates (16). 299 patients were included in a study conducted in Germany. The MRSA rate was found to be 2.1% (17).

In our study, 3002 nasal swab samples from various polyclinics and wards to our laboratory were scanned, and *S. aureus* was isolated in 536 (17.8%) of the samples. It was found that of the 536 isolated *S. aureus* strains, 504 (94%) were MSSA and 32 (6%) were MRSA. This rate was similar to the local studies but found to be high compared to the foreign studies.

In a study with hemodialysis patients in Kırıkkale province, *S. aureus* was isolated in the nasal culture of 18 (15.2%) of 118 patients, and 13 (11%) of them was found to be MRSA (18). Karapınar et al. isolated MRSA from the lesion of one patient and from the nasal culture of one patient among 38 patients with pyodermia, and stated that the rate of MRSA incidence was lower in the patients with pyodermia (19). In our study. MRSA was isolated in 2 of 5 samples taken from hemodialysis patients and 2 of 24 samples from patients with the diagnosis of bacterial infection. The diagnoses of the majority of MRSA-colonised patients were

general medical examination; however, when the results were examined in terms of proportion, it was found that the patient group where the probability of MRSA isolation was the highest was the CRF patients. Many well-known risk factors such as advanced age, male sex, alcohol use, chronic lung diseases, cancer, diabetes, chronic kidney failure were defined for society-originated staphylococcus infection and nasal carriage. Considering the region where our hospital is located, it was thought that social living conditions and poor hygiene conditions have played a role in the high MRSA rates.

5. Conclusions

Consequently, it is important to determine the presence of *S.aureus* and the antibiotic susceptibility of strains as well as to determine the methicillin resistance in isolates and to raise awareness. Nasal staphylococcus carriage is a serious hazard not only for carriers but also for community health. To prevent and control the MRSA infection, the uncontrolled and unnecessary use of antibiotics should be reduced, the hand hygiene rules should be followed, the carriers should be scanned periodically and the contact measures should be followed.

Conflict of Interests
None
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Concept-Akyüz S; Design-Salcan İ, Akyüz S; Supervision-Salcan İ, Akyüz S; Resources-Salcan İ, Akyüz S; Materials-Akyüz S; Data Collection and/or Processing-Salcan İ, Akyüz S; Analysis and/or Interpretation-Salcan İ, Akyüz S; Literature Search-Salcan İ, Akyüz S; Writing Manuscript-Salcan İ, Akyüz S; Critical Review-Salcan İ.

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