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Preliminary epidemiological screening of Staphylococcus aureus carriage in the upper respiratory tract of healthy people living in Lubelszczyzna region

Wstępny skrining epidemiologiczny nosicielstwa *Staphylococcus aureus* w górnych drogach oddechowych u zdrowych ludzi z terenu Lubelszczyzny

INTRODUCTION

Staphylococcus aureus is one of the most common human pathogens. This microorganism can exist as normal flora of the skin or mucous membranes within the upper respiratory tract [1]. It has been established for several years that *S. aureus* preferably colonizes the nasal epithelium [4, 6–8]. Three types of *S. aureus* nasal carriers can be distinguished: persistent carriers almost always carry one strain (10–35% of healthy individuals), intermittent carriers harbor *S. aureus* transiently (20–70% of healthy individuals) and non-carriers almost never carry *S. aureus* (5–50% of healthy individuals) [14].

Recently, it has been emphasized that *S. aureus* may also readily colonize the epithelium of throat [9, 11]. However, data on the throat carriage of *S. aureus* are still scanty. The aim of this paper was to compare the rate of colonization of mucous membranes within the upper respiratory tract, i.e. vestibules of the nose and the posterior vault of pharynx of healthy people.

MATERIALS AND METHODS

Microbiological material. Throat and nasal specimens were obtained from 179 people living in Lubelszczyzna region – 103 people from Zwierzyniec district within the age range from 2.5 to 87 years old (mean age 45.49 years) and 76 people from Wilków district with the age range from 2 to 81 years old (mean age 48.45 years). Throat specimens were obtained with sterile cotton swabs by swabbing the posterior vault of pharynx, while nasal specimens – by swabbing both vestibules of the nose.

Growth media and culture conditions. Swabs were streaked onto Petri dishes with Columbia Agar with 5% blood sheep and nutrient agar. Plates were incubated for 18–24 hours at 37°C.

Identification of *S. aureus*. Colonies suspected of being *S. aureus* isolated on the above mentioned solid media were identified by both microscopy method and rapid commercial latex agglutination test – Slidex Staph-Kit (BioMerieux, France), detecting specific surface *S. aureus* antigens – clumping factor or/and the protein A.

Statistical analyses. Results were analyzed with Fisher's test using commercially available statistical software GraphPad InStat Version 3.10. Also, relative risk (RR) with 95% confidence interval (95% CI) was calculated. The differences were considered as statistically significant if p was < 0.05 .

RESULTS

Epidemiological screening of *S. aureus* carriage in the upper respiratory tract was performed in healthy people living in two districts from Lubelszczyzna – Zwierzyniec and Wilków. Both populations studied were similar in respect of age with significant domination of adults. Data on the rate of the upper respiratory tract *S. aureus* carriage in healthy people from both districts and from the pooled population, including both persistent and intermittent carriers, are presented in Table 1. Three types of carriage were found: exclusive nasal carriage, “mixed” nasal and throat carriage and exclusive throat carriage. The rates of the carriage in healthy people from Zwierzyniec, Wilków or the pooled population were 19.42%, 32.90% or 25.14% in case the of exclusive nasal carriage, 5.83%, 11.84%, 8.35% in the case of “mixed” carriage and 12.62%, 5.26% or 9.50% in the case of exclusive throat carriage; the rates of nasal carriage, including exclusive nasal carriage plus “mixed” nasal and throat carriage were the following – 25.25%, 44.74% or 32.49%.

Table 1. The rate of *Staphylococcus aureus* carriage within the upper respiratory tract in the studied population of healthy people

The studied population	Type of carriage – number (%) of carriers			Nasal vs throat carriage	
	Nasal carriage		Exclusive throat carriage	p	RR (95% CI)
	Exclusive nasal carriage	„Mixed” nasal and throat carriage			
Zwierzyniec n = 103	20 (19.42%)	6 (5.83%)	13 (12.62%)	0.0319	2.0 (1.10-3.67)
Wilków n = 76	25 (32.90%)	9 (11.84%)	4 (5.26%)	< 0.0001	8.5 (3.17-22.79)
The pooled population n = 179	45 (25.14%)	15 (8.35%)	17 (9.50%)	< 0.0001	3.529 (2.15-5.80)

As shown in Table 1, statistical analyses concerning the upper respiratory tract *S. aureus* carriage in the studied population were performed including nasal carriage (exclusive nasal carriage plus “mixed” nasal and throat carriage) and throat carriage (exclusive throat carriage). The rates of

nasal *S. aureus* carriage in healthy people from both districts and from the pooled population were statistically significantly higher than those of throat carriage.

DISCUSSION

The anterior nares have been recognized for several years as the primary, predominant and representative colonization site of *S. aureus* in human body [1, 13, 14]. However, according to recent literature data [9, 10–12], epidemiological screening of *S. aureus* carriage within the upper respiratory tract should include not only nasal but also throat carriage. Despite this, such screening is usually restricted to the anterior nares, while screening of the throat is considered unnecessary [2, 7]. Our preliminary data concerning the rates of the upper respiratory tract *S. aureus* carriage in healthy people from Zwierzyniec and Wilków indicate that throat colonization may be not only a consequence of primary nasal carriage due to secondarily throat colonization by staphylococci migration from the anterior nares but also the may occur as an independent phenomenon – primary throat colonization.

As found by other authors [9, 10], the rates of exclusive throat *S. aureus* carriage, including both persistent and intermittent carriage, ranged from 4% to 64%. According to our data, the exclusive prevalence of *S. aureus* in the throat of healthy people from Zwierzyniec and Wilków, also including both persistent and intermittent carriers, varied from 5.27% to 12.62%, compared to that of nasal carriage ranging from 25.25% to 44.74%; the observed differences were statistically significant.

It should be noted that Nillson and Ripa [12] found that throat was a more common carriage site than the anterior nares in adult patients upon admission to an orthopedic ward and in staff members of the same ward. Also Nakamura et al. [11] found higher prevalence of *S. aureus* in throat than that in the anterior nares in hospitalized children admitted to intensive care units.

Since *S. aureus* is the most common nosocomial pathogen, identification of *S. aureus* carriers, especially methicillin-resistant *S. aureus* (MRSA) carriers, is a key component of a hospital infection control program [2, 5]. In the light of recent literature data [11, 12], the principles of the screening should include both nasal and throat carriage. Moreover, it should be noted that throat carriage is more difficult to eradicate than nasal carriage.

CONCLUSIONS

In order to improve the likelihood of detection of *S. aureus* carriage within the upper respiratory tract both nasal and throat carriage must be considered.

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SUMMARY

Epidemiological screening of *Staphylococcus aureus* carriage in the upper respiratory tract was performed in healthy people living in two districts from Lubelszczyzna region – Zwierzyniec and Wilków. Three types of carriage were found: exclusive nasal carriage, “mixed” nasal and throat carriage, as a consequence of staphylococci migration from anterior nares to throat, and exclusive throat carriage. The rates of the carriage in healthy people from Zwierzyniec, Wilków or the pooled population were 19.42 %, 32.90%, 25.14% in the case of exclusive nasal carriage, 5.83%, 11.84%, 8.35% in the case of “mixed” carriage or 12.62%, 5.26%, 9.50% in the case of exclusive throat carriage; the rates of nasal carriage, including exclusive nasal carriage plus “mixed” nasal and throat carriage were the following – 25.25%, 44.74%, 32.49%. The rates of nasal *S. aureus* carriage were statistically significantly higher than those of throat carriage. In order to improve the likelihood of

detection of *S. aureus* carriage within the upper respiratory tract both nasal and throat carriage must be considered.

Keywords: *Staphylococcus aureus*, nasal carriage, throat carriage

STRESZCZENIE

Skrining epidemiologiczny nosicielstwa *Staphylococcus aureus* w górnych dróg oddechowych u zdrowych ludzi z terenu Lubelszczyzny przeprowadzono w dwóch gminach – Zwierzyniec i Wilków. Stwierdzono trzy rodzaje nosicielstwa – wyłącznie nosicielstwo nosowe, „mieszane” nosicielstwo nosowo-gardłowe oraz wyłącznie nosicielstwo gardłowe. Częstość występowania *S. aureus* u zdrowych ludzi ze Zwierzynca, Wilkowa oraz w łącznej populacji wynosiła 19,42%, 32,90%, 25,14% w przypadku nosicielstwa nosowego, 5,83%, 11,84%, 8,35% w przypadku nosicielstwa nosowo-gardłowego oraz 12,62%, 5,26%, 9,50% w przypadku nosicielstwa gardłowego. Częstość ogólnego nosicielstwa nosowego, obejmującego nosicielstwo nosowe i nosowo-gardłowe, wynosiła odpowiednio 25,25%, 44,74%, 32,49%. Częstość występowania *S. aureus* w przedsionkach nosa była znamienne statystycznie wyższa niż w gardle. W celu wiarygodnej oceny nosicielstwa *S. aureus* w górnych dróg oddechowych powinno uwzględniać się badania w kierunku zarówno nosicielstwa nosowego, jak i gardłowego.

Słowa kluczowe: *Staphylococcus aureus*, nosicielstwo w przedsionkach nosa, nosicielstwo w gardle