Nasal Carriage of Uncommon Coagulase-Negative Staphylococci in Nurses and Physicians of Tehran University Hospitals

Elaheh Salimi[1], Zahra Pakbaz[2], Mohammad Reza Pourmand[1,2], Payman Avakh Majelan[2], and Sanaz Dehbashi[2]

[1] *Urology Research Center, Tehran University of Medical Sciences, Tehran, Iran*

[2] *Department of Pathobiology, School of Public Health, Tehran University of Medical Sciences, Tehran, Iran*

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Abstract- Coagulase-negative staphylococci (CoNS) have been identified as a major cause of nosocomial infections. Nasal carriage of CoNS in nurses and physicians is known to be an important risk factor for potential hospital infections. This study was carried out to investigate the prevalence of nasal carriage of uncommon coagulase-negative staphylococci among nurse and physician staffs of Tehran University Hospitals. A total of 116 CoNS were isolated from anterior nares of the study participants working in different wards of the hospitals. Thirteen uncommon CoNS were identified using phenotypic and biochemical methods, were subsequently confirmed by API kits. *Staphylococcus xylosus, Staphylococcus haemolyticus, and Staphylococcus capitis* species *accounted for* 53.85%, 30.77%, and 15.38% from the isolates, respectively. Six isolates (46.15%) were found to be resistant to methicillin. In conclusion, screening of healthcare workers for uncommon CoNS colonization along with identification and testing for susceptibility of cultured isolates is of paramount importance in strengthening effective nosocomial infection control and prevention measures.

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Keywords: Healthcare workers; Nasal carriage; Coagulase negative staphylococci

Introduction

Healthcare workers may carry pathogenic and opportunist bacteria in their nasal cavity, and subsequently transmit these organisms to patients and other healthcare workers (1,2). Staphylococci are frequent opportunist pathogens and important commensal bacteria residing in human nasal mucosa (3). Nasal carriage of these organisms in physicians and nurses has been identified as a risk factor for nosocomial infections (4).

To date, coagulase-negative staphylococci (CoNS) are generally recognized as an important cause of severe infections among community and healthcare workers (5). Nonetheless, there are clinical microbiology laboratories still not practicing the detection of CoNS based on the species of bacteria. The asymptomatic carriage of CoNS species and the increasing incidence of complications from infections other than the *S. epidermidis species,* such as *S. haemolyticus, S. capitis, S. warneri* and *S. lugdunensis*, laid the ground for learning more about the epidemiology and pathogenic potential of the different Staphylococcal species (6,7).

Furthermore, the ability of CoNS species to develop resistance against a wide spectrum of antibiotics needed consideration in the control and prevention of infections. These microorganisms may also have the potential to transfer their resistance to methicillin resistant *S. aureus* (MRSA). Thus, understanding antibiotic resistance of bacterial species is not only limited to isolates from patients but also is imperative to the carriers as well (8,9). Decolonization is considered to be one of the methods for controlling transmission of methicillin or vancomycin resistant Staphylococcus strains from healthcare workers to patients. However, complete eradication of nasal carriage is not possible but with their reduction, the risk of transfer within the healthcare system can be decreased (10,11).

This study was aimed at detecting the uncommon species of staphylococci residing in the anterior nares of physicians and nurses working in Tehran University hospitals, and determining the susceptibility of isolates

Corresponding Author: M.R. Pourmand
Department of Pathobiology, School of Public Health, Tehran University of Medical Sciences, Tehran, Iran
Tel: +98 21 8895491, Fax: +98 21 88954910, E-mail address: mpourmand@tums.ac.ir

against antibiotics.

Materials and Methods

Collection of samples and identification of bacteria

The samples were collected from nurses and physicians working in different wards of the hospitals. The swabs taken from the anterior nares were subsequently cultured on blood agar. Plates were incubated at 35°C for 24 hours. The elementary identification of staphylococcal isolates was performed using phenotypic and biochemical methods (catalase, oxidase, mannitol fermentation, DNase, coagulase and different disk tests). Suspicious types of any CoNS isolates were further identified at species level using API STAPH kit test according to the manufacturer's instructions.

Susceptibility to antimicrobial agents

According to the guidelines of the Clinical and Laboratory Standards Institute (CLSI), disc diffusion susceptibility testing was performed on uncommon CoNS isolates using Mueller Hinton agar. Depending on the zone size, each antimicrobial agent was recorded and interpreted as resistant, susceptible or intermediate (Table 1).

Table 1. The antibacterial susceptibility in uncommon CoNS isolates among nurses and physicians of Tehran University Hospitals

Antibiotics	*S. xylosus*		*S. haemolyticus*		*S. capitis*		Total	
	Susceptible No %	Resistant No %	Susceptible No %	Resistant No %	Susceptible No %	Resistant No %	Susceptible No %	Resistant No %
Penicillin	5(71.4)	2(28.6)	2(50.0)	2(50.0)	0(0.0)	2(100)	7(53.85)	6(46.16)
Oxacillin	5(71.4)	2(26.4)	2(50.0)	2(50.0)	0(0.0)	2(100)	7(53.85)	6(46.16)
Mupirocin	6(85.7)	1(14.3)	4(100.0)	0(0.0)	1(50.0)	1(50.0)	11(84.61)	2(15.39)
Tetracycline	4(57.1)	3(42.9)	2(50.0)	2(50.0)	0(0.0)	2(100)	6(46.15)	7(53.85)
Erythromycin	5(71.4)	2(26.4)	2(50.0)	2(50.0)	0(0.0)	2(100)	7(53.85)	6(46.16)
Clindamycin	4(57.1)	3(42.9)	3(75.0)	1(25.0)	1(50.0)	1(50.0)	8(61.53)	5(38.47)
Rifampin	4(57.1)	3(42.9)	4(100.0)	0(0.0)	1(50.0)	1(50.0)	9(69.23)	4(31.77)
Tobramycin	4(57.1)	3(42.9)	4(100.0)	0(0.0)	1(50.0)	1(50.0)	9(69.23)	4(31.77)
Ciprofloxacin	7(100)	3(42.9)	4(100.0)	0(0.0)	0(0.0)	2(100)	11(84.61)	2(15.39)
Co-trimoxazole	7(100)	0(0.0)	4(100.0)	0(0.0)	1(50.0)	1(50.0)	12(92.30)	1(7.70)

Results

From total of 116 identified CoNS from the anterior nares of the nurses and physicians, 13 of them were identified to be uncommon CoNS. Further analysis revealed that *S. xylosus, S. haemolyticus* and *S. capitis* accounted for 53.85% (n=7), 30.77% (n=4). 15.38% (n=2) of 13 uncommon CoNS isolates *respectively*.

A high rate of resistance was observed against tetracycline (53.85%), penicillin (46.15%) and erythromycin (46.15%). Whereas the lowest resistance identified was for co-trimoxazole (7.7%) and ciprofloxacin (15.38%). The pattern of antimicrobial susceptibility of uncommon CoNS isolates to other antimicrobial agents is summarized in the Table 1.

The oxacillin resistance in uncommon CoNS accounted for 46.15%. Six isolates (46.15%) were found to be resistant to methicillin. That is, two isolates from each the three species were resistant to oxacillin.

Discussion

This study explored the nasal carriage of uncommon CoNS in nurses and physicians of Tehran University hospitals. Thirteen isolates of uncommon CoNS were detected consisting of *S. xylosus* (53.85%), *S. haemolyticus* (30.77%) and *S. capitis* (15.38%).

In this study, *S. xylosus* was the most prevalent uncommon CoNS among the nurses and physicians. *S. xylosus* is a commensal bacterium on the skin and mucous membranes of mammalians and birds. It is more common in animals than humans (12,13). *S. haemolyticus* has the highest level of antibiotic resistance among the CoNS. *S. haemolyticus* has a tendency to develop multiple antibiotic resistance. Moreover, the expression of glycopeptide resistance is common among the strains. Based on the results of our study, *S. haemolyticus* isolates were susceptible to certain antibiotics. These rates are different from those reported by other authors (14-17). These variations may

be explained by differences in the local infections control measures and the sample size. *S. capitis* is a human commensal bacterium with the capacity of causing endocarditis on native and prosthetic heart valves (18). In the current study, *S. capitis* strains showed a high rate of antibiotic resistance. Similarly, Cui *et al.,* reported a high level of resistance to oxacillin, erythromycin and penicillin in *S. capitis* (19) but Sandoe *et al.,* reported methicillin-resistance as uncommon among the *S. capitis* isolates (18).

Although many studies have been conducted on the prevalence of CoNS nasal carriage in healthcare workers (20-22), there is not enough data to show the frequency of uncommon CoNS, and nearly all the isolates of CoNS are reported without any further identification at species level. However, many details have been released about coagulase positive staphylococci such as *S. aureus* (23).

The presence of uncommon CoNS nasal carriers among nurses and physicians has raised many concerns. Therefore, screening healthcare workers for uncommon coagulase negative staphylococcal colonization along with the identification and testing for susceptibility of cultured isolates are of paramount importance in strengthening nosocomial infection control and prevention measures.

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