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A STUDY OF THE CARRIAGE OF METHICILLIN RESISTANT STAPHYLOCOCCUS AUREUS IN NASAL SECRETION

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ABSTRACT

Antibiotic resistance among bacteria is an important problem that leads to extra costs and longer treatment of patients. The problem is of great importance for nosocomial infections, which are caused by MDROs (multi-drug resistant organisms)-MRSA (Methicillin Resistant Staphylococcus aureus, ESBLs (Extended Spectrum Beta Lactamases) producing Enterobacteriaceae and others. The aim of this recent investigation is to determine and compare the frequency of the carriage of MRSA in nasal secretion among hospital personnel, medical smdents and ambulatory patients with acute respiratory diseases. Conventional methods have been used for the isolation of S.aureus from nasal secretion. The antimicrobial susceptibility testing has been performed by Bauer-Kirby Disk Diffusion Method with Cefoxitin disk along with Oxacillin screen agar. It has been determined that 3 from 100 probes of nasal secretion of hospital personnel are positive for MRSA, 1 from 100 among students and there is no carriage of MRSA in the nose among ambulatory sick patients (0 from 100). In conclusion, we could say that the screening of nasal carriage of MRSA among hospital personnel is an important key moment for reducing the spreading of such multi-resistant microorganisms among personnel and patients.

Key words: nosocomial infections, MDROs, VISA, VRSA

INTRODUCTION

Antibiotic resistance among bacteria is a problem of great concern. The problem is of great importance for nosocomial infections, which are caused by MDRO - MRSA, VRE (Vancomycin Resistant Enterococci), ESBL producing Enterobacteriaceae, P.aeruginosa, A.baumannii and others.

MDRO are defined as microorganisms, predominantly bacteria, that are resistant to one or more classes of antimicrobial agents. These highly resistant organisms deserve special attention, because they can spread easily from patient to patient via hospital personnel and surroundings. These mechanisms of transfer can be stopped by appropriate desinfectious and hygiene procedures, which reduce the risk of spreading of MDRO among patients and help avoiding the serious consequences if infected by them (i).

Soon after the bringing of Penicillin into clinical practice in the mid 40 of XX c. the first P-lactamase was reported. Nowadays, approximately 100% from hospital and 90% from ambulatory strains of S.aureus are resistant to penicillin and the other penicilinase-labile penicillines (2). Most of the strains, however, are still susceptible to penicillinase- stable penicillins (Oxacillin,Methicillin), p -lactam/ P -lactamase inhibitor combinations, relevant cephems and carbapenems - so called Methicillin Susceptible Staphylococcus aureus - MSSA.

In contrast to MSSA, MRSA are those strains of Staphylococcus aureus that are resistant to Methicillin and Oxacillin. Those strains express mec-A gene, which is responsible for the synthesis of penicillin binding proteins

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(PBPs) with low affinity not only to Methicillin and Oxacillin, but to all currently available (3 -lactam antibiotical agents, including p -lactam/ P-lactamase inhibitor combinations, relevant cephems and carbapenems (3).

First MRS A were reported in 1961 just one year after bringing Methicillin into clinical use. Vancomycin was brought into clinical use in 1956 for the treatment of serious infections, caused by MRSA. Due to the use of Vancomycin, first Vancomycin Intermediate Staphylococcus aureus (VISA) was registrated in 1996 and in 2002 - first Vancomycin Resistant Staphylococcus aureus (VRSA) (3).

The infections that are caused by MRSA are divided into two groups:
1. Health care acquired (HA-MRSA) infections. These strains of MRSA are resistant not only to P-lactams, but also to many other groups of antibiotics, which are frequently used, such as macrolides, lincozamides, quinolones.
2. Community acquired (CA-MRSA) infections. These strains of MRSA are resistant only to P-lactams and erythromycin .

The relative share of MRSA nasal carriage in hospital units varies from 1% in the Netherlands, Denmark, Sweden to 40% in Asia, Latin America. The biggest relative share is in USA, France and Japan (4). In surgical and intensive care units, with great consummation of antibiotics, the percentage of MRSA colonization in the nose of the medical staff is bigger than that in other hospital units. Also the risk of epidemic outbreaks in these units is greater than others (5).The screening for MRSA nasal carriage among medical staff is a key moment for prevention and control of nosocomial infections, caused by MRSA. These strains can be easily selected in surgical and intensive care units and can easily spread from person to person (6). MRSA are of great concern in hospitals, where patients with open wounds, invasive devices and poor immune system are at a greater risk for development of serious infections, caused by MRSA compared to the other part of the society.

PURPOSE

The aim of our investigation is to determine and compare the percentage of MRSA nasal carriage among ambulatory patients with acute respiratory diseases, healthy hospital personnel and medical students.

MATERIALS AND METHODS

100 probes of nasal secretion were investigated prospectively. They belong to medical students from second and third grade for the period February- March 2011. The 200 probes of nasal secretion were investigated retrospectively as follows:
*100 from ambulatory sick patients
*100 from healthy medical staff

The nasal secretion was taken by sterile cotton swab. The culture was made on blood agar. The biochemical identification was carried out by using conventional methods, such as the morphology of the colonies on blood agar, the morphology of the bacteria on Gram stain, test for DNA-ase.

The most accurate methods for prediction of Oxacillin resistance are tests for mec A gene or for the protein expressed by mec A, the penicillin- binding protein 2a (PBP 2a, also called PBP 2'). Those methods are used to confirm isolates of Staphylococcus aureus from serious infections. Isolates that carry mecA gene or produce PBP 2a (the mec A gene product) should be reported as Oxacillin resistant. Isolates that do not carry mecA gene or do not produce PBP 2a should be reported as Oxacillin susceptible. (3)

Routinely, disk Cefoxitin (CN) is used as a surrogate of Oxacillin to determine Oxacillin (Methicillin) resistance by the standard Bauer-Kirby Disk- Diffusion Method (DDM).When the zone of inhibition of the growth of S.aureus around disk Cefoxitin is more than 22 mm., it is an isolate of MSSA **(Figure** l).When the zone of inhibition of the growth of S.aureus around disk CN is less than 21mm it is probably an isolate of MRSA **(Figure 2)**. As a confirmatory test Oxacillin screen agar, containing 6 jig/ml Oxacillin, is used. If there is a spot of growth or even separate colonies on the agar the identification of MRSA is confirmed. **(Figure 3)** (3).

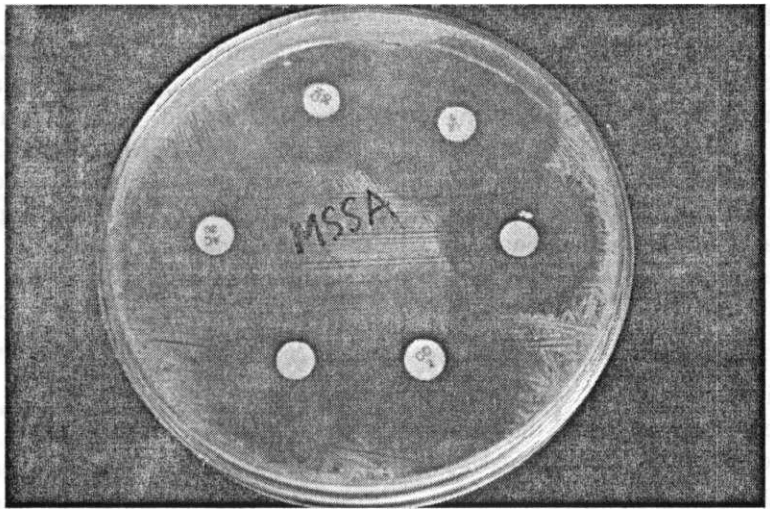

Figure 1 . Antibiotic susceptibility plate showing MSSA.
The zone of inhibition of the growth of S.aureus around disk Cefoxitin (CN) is 27 mm

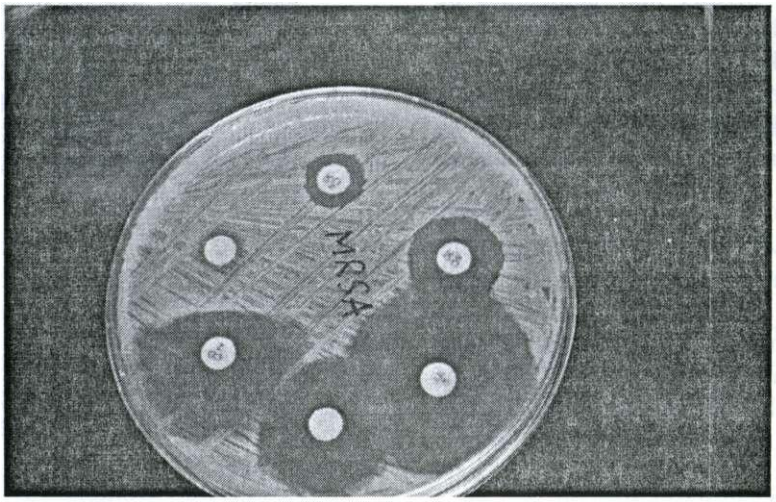

Figure 2. Antibiotic susceptibility plate showing MRSA.
The zone of inhibition of the growth around disk Cefoxitin (CN) is 12 mm.

Figure 3. Oxacillin screen agar. It contains Mueller-Hinton agar, 4% NaCl, Oxacillin 6 jug/ml or Methicillin 10 Hg/ml. It is incubated 24 hours at 35° C.

RESULTS AND DISCUSSION

In our study we determined that there was no MRSA in the nose of ambulatory sick patients (0 from 100). One from 100 tested students had MRSA in the nasal secretion. The highest percentage of MRSA nasal carriage was among medical staff (3 from 100) - all of them working in surgical units. These data correlate with the data about countries with low percentage of nasal carriage. (6, 7, 8)

When MRSA is isolated from medical staff from risky hospital units, they should be temporally removed from work until the nasal carriage is sanated. This is accomplished by using nasal unguent, containing Mupirocin three times a day on a cotton swab in each nostril for seven days. After that, control microbiological cultures should be made. Although rarely, MRSA may sometimes be resistant to Mupirocin. In these cases antiseptics like Chlorhexidine are recommended for use. After 3 negative results from nasal secretion on three consecutive days, medical staff can be safely returned to work **(i).**

The effect of Mupirocin is temporal, thus regular and control examinations of nasal secretion should be performed. If MSSA is isolated in the nose of the medical staff, they should not be treated, because there is a risk of colonization with MRSA (replacement of MSSA with MRSA).

CONCLUSIONS

We determined that:

1. The nasal carriage of MRSA among medical students is 1%.
2. 3% of MRSA nasal carriage among medical staff.
3. The screening for MRSA nasal carriage among hospital personnel four times a year in risky health care units allows systematic registration and sanation of the MRSA nasal carriage.

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