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MRSA – a problem in the treatment of ambulatory patients?

MRSA stands for Methicillin-Resistant *Staphylococcus aureus*, a species of Gram-positive, catalase-positive cocci, that is also cross-resistant to all Beta-lactam antibiotics. *Staphylococci* are microbiologically characterized as non-spore-forming, facultative anaerobes – not requiring oxygen. The term “*staphylococcus*” refers to the cell’s colony structure reassembling grapelike clusters. The *S. aureus* cells average 1 μm (0.001 mm) in diameter. Methicillin is a synthetic penicillin, which means that it contains the Beta-lactam ring and acts like penicillin that is grown naturally. Penicillin was first discovered by a Scottish scientist Alexander Fleming in the 1920’s. It is derived from the mould named *Penicillium notatum*. Penicillins are active against a variety of bacteria by affecting the synthesis of the bacterial cell wall and disrupting it.

Staphylococcus aureus is commonly found in healthy people, and usually causes no symptoms. It is a natural habitant of skin and mucous membranes of humans, harbored in the nose and the rest of the body. MRSA strains, which until recently were isolated only in hospitals, now can be found throughout the natural world – even on pets (!). In some hospital wards MRSA make 80% of *S. aureus* isolations (8, 11). It is responsible for 15% of Hospital Acquired Infections (HAI’s) in Poland (5). Sometimes, mostly in immuno-deficient patients, they can cause a life-threatening infections in overall population, including epidermitis, gastrointestinal tract infections, arthritis, endocarditis or even septicemia (1, 3, 9, 10).

The aim of the study was to characterize drug resistance of the *S. aureus* strains isolated from clinical materials obtained from ambulatory patients, and to evaluate the problem of Methicillin resistance in the analyzed group. Our investigation was designed to answer:

- who gets infected with *S. aureus*?
- what is the most common location of *S. aureus* colonization?
- how many of the isolated strains are resistant to Methicillin?
- are they resistant to other antibiotics?

MATERIAL AND METHODS

The study comprised 302 randomly chosen individuals, both men (157) and women (145), who were tested positive for *S. aureus*. Materials included specimens from a nose, pharynx, ears, skin changes and wounds. They were collected with cotton swabs and cultured on Columbia blood agar in 37°C. The organisms were identified by using API Staph identification system (bioMerieux, France). 305 strains of *S. aureus* were isolated.

Antimicrobial susceptibility to several antibiotics (Penicillin, Doxycycline, Erythromycin, Co-trimoxazole, Clindamycin, Ciprofloxacin, and Oxacillin) was determined by Kirby Bauer disk diffusion method using Becton Dickinson disks, according to NCCLS (National Committee for Clinical Laboratory Standards).

RESULTS

In the studied materials, 305 catalase-positive bacterial strains belonging to the species *S. aureus* were found. There was no significant difference in the frequency of isolations of *S. aureus* between male and female subjects: 52% of strains were isolated from men, and 48% from women.

The most common locations of *Staphylococcus aureus* isolations were (Fig. 1): the nose (47%, 144 isolations), pharynx (24%, 73 isolations), both nose and pharynx (18%, 54 isolations). In 34 cases (11% of isolations) *S. aureus* strains were isolated from different parts of the body (skin, external auditory canal, wounds).

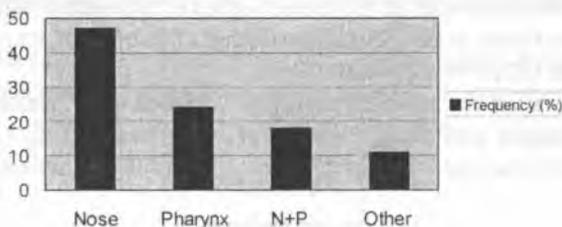


Fig. 1. Frequency of isolations of *Staphylococcus aureus* from different materials

Among the tested strains isolated from ambulatory patients, methicillin-resistant *S. aureus* (MRSA) strains were identified in 20 cases, making 6.5% of isolations. In 285 cases (93.5%) isolated strains were susceptible to Oxacillin (MSSA – Methicillin-Susceptible *Staphylococcus aureus*). Some of the isolated MRSA strains were additionally resistant to antistaphylococcal drugs: Teicoplanin (13 resistant strains), Tetracycline (three resistant strains), and Mupirocin (two resistant strains). No VRSA (Vancomycin-Resistant *Staphylococcus aureus*) or VISA (Vancomycin Intermediate *Staphylococcus aureus*) strains have been found.

The drug susceptibility of the isolated strains to other, more commonly used antibiotics have also been tested (Fig. 2). The most widespread resistance occurred against Penicillin (266 resistant strains, which makes 87% of isolations!), Doxycycline (118 [39%] resistant strains), and Erythromycin (23%, 71 isolations). Most strains remain susceptible to Co-trimoxazole (only 25 resistant [8%] strains), Clindamycin (12%, 37 resistant strains) and Ciprofloxacin (14%, 42 resistant strains).

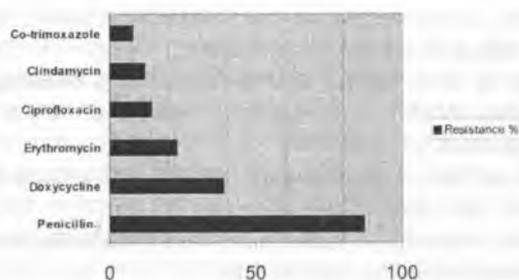


Fig. 2. Antimicrobial resistance of isolated *Staphylococcus aureus* strains (%)

DISCUSSION

To our knowledge, this is the first report of the antimicrobial susceptibility of *S. aureus* strains acquired from ambulatory patients in Poland. According to Hryniewicz (5) methicillin-resistant *S. aureus* is responsible for 15% of Hospital Acquired Infections (HAI's) in Poland. Although little is known of its prevalence in the general population in Poland, we do have some data from other countries. Price et al. (10) reported an increase in the frequency of MRSA isolations from 1.5% in 1988 to 11.9% in 1996 in a dermatology outpatient population in the USA. Kayaba et al. (7) reported that of all the Japanese patients colonized with MRSA, outpatients accounted for 4.5% in 1990 and 34.9% in 1994. Hussein et al. (6) studied a group of 500 healthy children who attended a primary care outpatient facility in the USA and showed that 122 of them (24.4%) were colonized with *S. aureus*. Three of the 122 (2.5%) isolates were MRSA.

Our study has revealed that infections caused by MRSA do occur outside hospitals, and can cause therapeutical failures with classic, empirical pharmacotherapy (1, 2, 4, 12). Those results demonstrate the need for the aimed antimicrobial therapy in ambulatory patients.

CONCLUSIONS

1. The number of men nad women in the investigated, randomly chosen group, was almost even (52:48).

2. The most widespread resistance occurred against Penicillin (87% of isolated strains were resistant!). In 20 cases (6.5%) isolated strains showed resistance against Oxacillin (MRSA strains). Some of the isolated strains were additionally resistant to antistaphylococcal drugs (Teicoplanin – 13 strains resistant).

3. *S. aureus* remains fairly susceptible to Co-trimoxazole (only 8% of strains resistant), Clindamycin (12% of resistant strains) and Ciprofloxacin (14% of resistant strains).

4. Further investigation of antimicrobial susceptibility of various bacterial strains isolated from ambulatory patients is necessary for effective empirical therapy.

REFERENCES

1. Bishara J. et al.: Co-trimoxazole-sensitive, Methicillin-resistant *Staphylococcus aureus*, Israel, 1988–1997. *Emerg. Infect. Dis.*, 9, 1168, 2003.
2. Dominguez M. A. et al.: Spread and maintenance of a dominant Methicillin-resistant *Staphylococcus aureus* (MRSA) clone during an outbreak of MRSA disease in a Spanish hospital. *J. Clin. Microbiol.*, 32, 2081, 1994.
3. Enright M. C. et al.: The evolutionary history of Methicillin-resistant *Staphylococcus aureus* (MRSA). *PNAS.*, 99, 7687, 2002.
4. Howe R. A. et al.: Vancomycin susceptibility within Methicillin-resistant *Staphylococcus aureus* lineages. *Emerg. Infect. Dis.*, 10, 855, 2004.
5. Hryniewicz W.: Antybiotykooporność – narastający problem kliniczny, *Terapia.*, 2, 147, 2004.
6. Hussain F. M. et al.: Community-acquired Methicillin-resistant *Staphylococcus aureus* colonization in healthy children attending an outpatient pediatric clinic. *Pediatr. Infect. Dis. J.*, 20, 763, 2001.
7. Kayaba H. et al.: The spread of Methicillin-resistant *Staphylococcus aureus* in a rural

- community: will it become a common microorganism colonizing among the general population? Surg. Today, 27, 217, 1997.
8. Kluytmans J. et al.: Nasal carriage of *Staphylococcus aureus*: epidemiology, underlying mechanisms, and associated risks. Clin. Microbiol. Rev., 10, 505, 1997.
 9. Perez-Roth E. et al.: Tracking Methicillin-resistant *Staphylococcus aureus* clones during a 5-year period (1998 to 2002) in a Spanish hospital. J. Clin. Microbiol., 42, 4649, 2004.
 10. Price M. F. et al.: Prevalence of Methicillin-resistant *Staphylococcus aureus* in a dermatology outpatient population. South. Med. J., 91, 369, 1998.
 11. Sato Y. et al.: 6,7-Dihydroxyflavone dramatically intensifies the susceptibility of Methicillin-resistant or -sensitive *Staphylococcus aureus* to Beta-lactams. Antimicrob. Agents Chemother., 48, 1357, 2004.
 12. Van Griethuysen A. et al.: High percentage of Methicillin-Resistant *Staphylococcus aureus* isolates with reduced susceptibility to glycopeptides in the Netherlands. J. Clin. Microbiol., 41, 2487, 2003.

SUMMARY

MRSA stands for Methicillin-Resistant *Staphylococcus Aureus*. Strains of *S. aureus* are commonly found in healthy people, sometimes, however, this microorganism can cause a variety of infections. The aim of the study was to characterize drug resistance of the *S. aureus* strains isolated from ambulatory patients. Materials included specimens from nose, pharynx, ears, skin changes and wounds. Drug susceptibility tests were carried out according to NCCLS standards. In the studied materials 305 catalase-positive bacterial strains belonging to the species *S. aureus* were found. The most widespread resistance occurred against Penicillin (87%), Doxycycline, and Erythromycin. Most strains remain susceptible to Co-trimoxazole, Clindamycin and Ciprofloxacin. In 20 cases (6.5%) isolated strains showed resistance against Oxacillin (MRSA). The study revealed that infections caused by MRSA do occur outside hospitals, and can cause therapeutical failures with classic, empirical pharmacotherapy. Those results demonstrate the need for the aimed antimicrobial therapy in ambulatory patients.

MRSA – problem w leczeniu chorych ambulatoryjnych?

MRSA oznacza gronkowca złocistego opornego na metycylinę. Szczepy *S. aureus* często wykrywa się u ludzi zdrowych, jednak mikroorganizm ten może wywoływać różnorodne infekcje, zwłaszcza u osób z obniżoną odpornością. Celem pracy była charakterystyka oporności szczepów *S. aureus* izolowanych od chorych leczonych ambulatoryjnie. Materiał stanowiły wymazy z nosa, gardła, uszu, zmian skórnych i ran. Wrażliwość na leki badano zgodnie z zaleceniami NCCLS. W badanych materiałach wykryto 305 koagulazo-dodatnich szczepów należących do gatunku *S. aureus*. Najczęściej występowała oporność na Penicylinę (87%), Doksycylinę i Erytromycynę. Większość szczepów zachowuje wrażliwość na Ko-trimoksazol, Klindamycynę i Ciprofloksacyne. W 20 przypadkach (6,5%) izolowane szczepy wykazały oporność na Oksacylinę (MRSA). Wyniki pracy udowadniają, że infekcje spowodowane przez MRSA zdarzają się poza szpitalami i mogą być przyczyną niepowodzeń terapeutycznych, co świadczy o konieczności stosowania leczenia celowanego w warunkach ambulatoryjnych.