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*Bacterial genera/species isolated from blood cultures
in the university hospital microbiology unit*

Drobnoustroje izolowane z posiewów krwi w laboratorium mikrobiologicznym
szpitala klinicznego

INTRODUCTION

Nosocomial bloodstream infections are the most common hospital-associated infections in pediatric or adult intensive care units and a significant source of in-hospital deaths, increased length of stay and added medical costs. These infections, usually leading to sepsis, are the main cause of high morbidity and mortality among critically-ill patients [4, 7, 11]. Hospital environment especially predisposes to bloodstream infections due to the severe clinical status and/or immunosuppression of patients hospitalized in intensive care units or oncology and transplantology wards and so-called independent risk factors associated with invasive therapeutic and/or diagnostic procedures [6].

A blood culture is one of the main laboratory tests in hospitalized patients due to its clinical importance in diagnosis of bloodstream infections [10]. Isolation and identification of the pathogen together with determination of its sensitivity to antimicrobials are the basis of the therapy [6]. The frequency, etiology and epidemiology of nosocomial bloodstream infections have changed for several years. Currently, most causes of these infections are coagulase-negative staphylococci associated with the presence of indwelling medical devices such as catheters or prostheses [5]. In this paper an analysis concerning the prevalence of various groups of microorganisms isolated from blood cultures in 2009 in the University Hospital microbiology unit was presented.

MATERIALS AND METHODS

Blood samples were taken from the patients hospitalized in the University Hospital No. 1 in Lublin in 2009. The blood specimens were analyzed according to the laboratory guidelines in the microbiology unit of Department of Medical Microbiology in the University Hospital No. 1 in Lublin.

The peripheral vein blood samples had been taken from adults twice in 30 minutes before the peak of fever was expected or one hour before the antibiotics were administered depending on the clinical manifestations; from newborns the blood samples were taken once. The blood samples from adults were inoculated into two bottles used for cultivation of aerobic and anaerobic bacteria, but from newborns – to pediatrics bottles. The detection of bacterial growth in blood samples was performed using colorimetric Bact/Alert system (BioMerieux). The positive samples were streaked onto appropriate bacteriological media. The isolated strains were identified by using the biochemical ID microtests and miniAPI analyzer (BioMerieux).

RESULTS

A total of 180 different microbial species/genera were isolated from positive blood cultures. Bacteria, belonging to aerobes or facultative anaerobes, predominated – 179 (99.44%) isolates, while 1 isolate was classified as yeasts belonging to *Candida parapsilosis*. No isolates of anaerobic bacteria were cultured.

It was found that Gram-positive bacteria were isolated more frequently than Gram-negative bacteria – 106 (59.22%) or 73 (40.78%) isolates, respectively (Table 1 and Table 2).

Table 1. Gram-negative bacteria isolated from blood cultures

Group of bacteria	Number (%) of isolates n = 73
Rods from <i>Enterobacteriaceae</i> family	45 (61.64%)
Non-fermentative rods	28 (38.36%)

Table 2. Gram-positive bacteria isolated from blood cultures

Group of bacteria	Number (%) of isolates n = 106
Staphylococci	75 (70.76)
Enterococci	15 (14.15)
Streptococci	13 (12.26)
<i>Corynebacterium</i> spp.	3 (2.83)

Among Gram-negative bacteria the following species belonging to the *Enterobacteriaceae* were identified: *Escherichia coli* (24 isolates), *Enterobacter cloacae* (9 isolates), *Klebsiella pneumoniae* subsp. *pneumoniae* (4 isolates), *Serratia marcescens* (3 isolates), *Citrobacter koseri* (1 isolate), *Klebsiella oxytoca* (1 isolate), *Proteus vulgaris* (1 isolate), *Proteus mirabilis* (1 isolate) and *Salmonella* spp. (1 isolate). Besides, species from Gram-negative nonfermentative rods were isolated: *Acinetobacter baumannii* (14 isolates), *Pseudomonas aeruginosa* (13 isolates) and *Stenotrophomonas maltophilia* (1 isolate).

Among Gram-positive bacteria, cocci, represented by staphylococci, streptococci and enterococci dominated – 103 (97.17%) isolates. Besides, 3 isolates were identified as *Corynebacterium* spp.

(Table 2). Among Gram-positive cocci, staphylococci predominated – 75 isolates; these isolates consisted of 70.76% of all Gram-positive bacteria and 41.90% of bacterial isolates in general. Besides, 15 isolates of enterococci and 13 isolates of streptococci were isolated (Table 2). Streptococci were represented by *Streptococcus oralis* (5 isolates), *Streptococcus agalactiae* (3 isolates), *Streptococcus mitis* (2 isolates), *Streptococcus pyogenes* (2 isolates) and *Streptococcus pneumoniae* (1 isolate), while enterococci by – *Enterococcus faecalis* (11 isolates) and *Enterococcus faecium* (4 isolates).

Table 3. Staphylococci isolated from blood cultures.

Species	Number (%) of isolates n = 75
<i>Staphylococcus aureus</i>	12 (16.0)
<i>Staphylococcus epidermidis</i>	61 (81.34)
<i>Staphylococcus haemolyticus</i>	1 (1.33)
<i>Staphylococcus hominis</i>	1 (1.33)

According to Table 3, among staphylococci, coagulase-negative staphylococci were isolated the most frequently – 63 isolates, consisting of 84% of staphylococcal isolates and 35.20% of bacterial isolates in general. Besides, 12 isolates were classified as *Staphylococcus aureus*. The predominant species of coagulase-negative staphylococci was *Staphylococcus epidermidis* – 61 isolates, consisting of 81.33% of staphylococcal isolates and 34.08% of bacterial isolates in general. Besides, 2 isolates were identified as *Staphylococcus haemolyticus* and *Staphylococcus hominis*.

DISCUSSION

Nowadays, Gram-positive bacteria may be regarded as important pathogens associated with nosocomial infections, especially with bloodstream infections [2, 4, 9]. The data presented in this paper are in agreement with the general tendency recently observed that Gram-positive bacteria were isolated from blood specimens more frequently than Gram-negative bacteria; among Gram-positive bacteria, coagulase-negative staphylococci predominated [1, 3, 6, 8].

Although coagulase-negative staphylococci are more likely to be isolated from cultures of blood specimens from hospitalized patients, their role as a cause of morbidity and/or mortality is difficult to ascertain. Because these microorganisms commonly contaminate blood specimens, identifying patients with true bacteremia may be difficult [4]. Therefore, two or more blood cultures are typically ordered and collected as consecutive samples. When multiple cultures are obtained and return positive, the positive predictive value for true bacteremia has been shown to improve [10].

Staphylococcus epidermidis, the most frequently isolated coagulase-negative staphylococcus, is probably the most common species found in laboratory tests due to frequent contamination of clinical specimens. Although this staphylococcal species is usually regarded as non-pathogenic, patients with a compromised immune system are often at a risk of developing an infection. Recently, *S. epidermidis* has been the leading cause of infections related to implanted medical devices, e.g. central venous catheter, due to the ability of this opportunistic pathogen to form a complex structure

– biofilm. This structure provides a microenvironment that protects bacteria from attack by the host immune system and antibiotics.

CONCLUSIONS

Our data are in agreement with a general statement that *S. epidermidis* can be still regarded as an important etiologic agent of bloodstream infections.

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SUMMARY

Blood cultures are one of the most important microbiological procedures performed in the hospitalized patients. In this paper an analysis concerning the prevalence of various groups of microorganisms isolated from blood cultures in the university hospital in Lublin was presented. From 180 positive blood culture samples, 106 (59.22%) isolates of Gram-positive bacteria and 73 (40.78%) isolates of Gram-negative bacteria were obtained. Among Gram-positive bacteria, 75 (70.76%) belonged to staphylococci, 15 (14.15%) – to enterococci and 13 (12.26%) – to streptococci.

Among staphylococci, coagulase-negative staphylococci predominated – 63 (84.0%) isolates, while the most frequently isolated species was *Staphylococcus epidermidis* – 61 (81.34%) isolates. Our data are in agreement with the general statement that *S. epidermidis* can be still regarded as an important etiological agent of bloodstream infections.

Keywords: blood cultures, coagulase-negative staphylococci, *Staphylococcus epidermidis*

STRESZCZENIE

Posiew krwi jest jednym z najważniejszych badań mikrobiologicznych wykonywanych u pacjentów hospitalizowanych. W pracy przedstawiono analizę udziału różnych grup drobnoustrojów izolowanych z posiewów krwi wykonanych w jednym ze szpitali klinicznych w Lublinie. Ze 180 dodatnich posiewów krwi wyizolowano 106 (59,22%) izolatów bakterii Gram-dodatnich oraz 73 (40,78%) izolatów bakterii Gram-ujemnych. Wśród bakterii Gram-dodatnich 75 (70,76%) izolatów należało do gronkowców, 15 (14,15%) do enterokoków oraz 13 (12,26%) do paciorkowców. Wśród gronkowców dominowały gronkowce koagulazo-ujemne – 63 (84,0%) izolaty, przy czym najczęściej izolowanym gatunkiem był *Staphylococcus epidermidis* – 61 (81,43%) izolatów. Uzyskane wyniki zgodne są z danymi literatury, wskazującymi, że *S. epidermidis* nadal pozostaje ważnym czynnikiem etiologicznym zakażeń krwi.

Słowa kluczowe: posiewy krwi, gronkowce koagulazo-ujemne, *Staphylococcus epidermidis*