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Microorgansims isolated from the blood of patients hospitalized in clinical hospital department

Drobnoustroje izolowane z krwi pacjentów hospitalizowanych w szpitalu klinicznym

Sepsis is still one of the most serious hospital infections [4, 10]. In the course of the advancement of the diagnostic, therapeutic and surgical techniques, the profile of the hospitalized patients changes radically. Simultaneously with the change in the population of the hospitalized patients, there occur changes in the frequency of isolation from blood cultures of different microorganism species [11].

Blood infections constitute 7–10% depending on the hospital profile [8]. In accordance with its definition, sepsis is the immunological response of the organism to infection, revealing itself in the syndrome of the generalized inflammatory reaction with clinically and microbiologically proved infection [2]. Sepsis pathogenesis is conditioned by many factors connected with the presence of microorganisms and the host organism characteristics.

Bacteremia, according to American College of Chest Physicians, is a state in which in the blood one can find living bacteria (in case of fungi – fungemia and in case of a viral infection – viremia). Bacteremia may occur as a hospital infection but also as an extra-hospital infection. Extra-hospital infections are connected with the transition of the microorganisms to the blood placenta from the inflamed site, e.g. in the case of a perforation of the alimentary canal, perforation of the appendix, nephritis or pneumonia. Transient bacteremia is in most cases a short-term illness which subsides by itself and significantly depends on natural defense mechanisms of the patient [11], and sepsis is still a fatal condition [5, 7, 8, 11].

In the diagnostic process of blood infections, the key significance is ascribed to laboratory investigations, both analytical and microbiological ones [6]. Unquestionable importance is attached to microbiological studies. Blood culturing and the isolation of the etiological factor is the basis for the target antibiotic therapy [7, 8], especially in the time of an increasing resistance of microorganisms, the implementation of the antibiotic therapy in the first hour of the onset of the problem is of crucial importance and conditions therapeutic success. To lower the risk of failure in the sense of a bad choice of an antibiotic, one should effectively direct the therapy to its target character. Verification of the treatment applied should be implemented in the time of up to 72 hours since its start. That is why an effectively acting microbiological lab plays a key role in the recognition of the specificity of an etiological factor and its susceptibility to anti-microrganic drugs [3, 6, 11]. Periodic microbiological analysis of blood cultures aids better and more specific decisions pertaining to the drug choice in

empirical therapy, which has a significant meaning in therapy success and is the basis of the Hospital Antibiotic Policy.

The aim of the study was the microbiological analysis of blood cultures made in the Microbiological Diagnostics Lab in the period of 2003–2007.

MATERIAL AND METHODS

In the conducted studies a retrospective analysis of the evaluation of results of blond culture tests was made. The studies were conducted in the Microbiological Diagnostics Laboratory in the period of 01.01.2003 to 31.12.2007 at the Clinical Hospital No. 1 in Lublin. For blood culturing, an automatic system of microorganisms' growth detection was used, and the identification as well as drug resistance tests were made according to the recommendations of the National Recommendation Centre for Microorganic Drug resistance. The analysis did not evaluate the secondary isolates from the same patient. In the studies, the questionnaire by the authors was used for the collection of microbiological data.

RESULTS AND DISCUSSION

In the years of 2003–2007, 7049 blood cultures were made. The number of commended tests in the specific years is presented in Fig. 1. In specific years, one can observe a rise in the numbers of recommended blood cultures. The greatest number of materials was from the Clinic of Hematooncology and Bone Marrow Transplantation, Neonatal Intensive Care Unit and the Postoperative Care Intensive Unit of the General Surgery Clinic and the Clinic of Intensive Therapy.

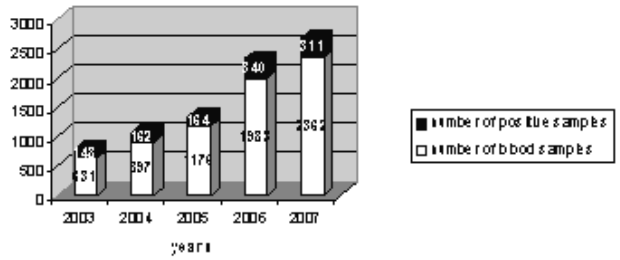

Fig. 1. The number of prepared blood cultures in the years of 2003–2007, for specific hospital departments

In the studied period, totally, disease carrying microorganisms were cultured from the blood of 1125 patients (Table 1). The percentage of positive samples was 15.9%. The frequency of microorganisms discovery in blood increases with the increase of the blood samples taken from one patient with the symptoms of sepsis. Unfortunately, the doctors conducting the therapy recommended only a single blood testing for the culture, usually in the heat of the fever. Among the cultured microorganisms Gram positive bacteria were the the dominating species, constituting in the specific years from 44.77 to 70.73%. A high percentage of Gram positive bacteria is connected with highly specialist therapeutic procedures applied in the hospital. From this particular group of bacteria, most often isolated strains of bacteria were *Staphylococcus epidermidis.* The presence of this strain in blood was most often concerned with the infection of vesicular placenta, which is connected with the colonization of catheters by these strains belonging to skin flora.

Table 1. Microorganisms groups isolated from blood cultures in years of 2003–2007

Bacteria	Years				
	2003	2004	2005	2006	2007
Gram-positive cocci	90	96	117	223	199
Enterobacteriaceae	31	27	21	49	57
Nonfermentative Gram-negative bacteria	2	7	16	46	30
Fungi	24	31	13	26	20

One can also observe an increasing percentage of isolation of *Enterococcus faecalis* and *Enterococcus faecium* (Table 2). Blood infections of *Enterococcus spp*. etiology are caused by the translocation of microorganisms to the vesicular placenta from the alimentary canal or reproductive-urinary paths. Patients undergoing the therapy at the intensive care units of hematooncology are often colonized with the non-fermenting bacteria strains usually-*Pseudomonas, Acinetobacter, Stenotrophomonas* (Table 4) and also *Enterobacter, Serratia, Klebsiella.* These microorganisms have a natural resistance to many commonly applied antibiotics [4].

Table 2. The frequency of isolation of specific Gram-positive microorganisms

Bacteria	Years				
	2003	2004	2005	2006	2007
Staph. epidermidis	66	49	46	96	111
Staph. aureus	6	5	5	23	16
Micrococcus luteus	6	3	2	4	3
Str. agalactiae	3	0	1	2	3
Str. mitis	2	1	2	0	0
Corynebacterium spp.	2	5	4	14	16
Str. bovis	1		5	0	0
Staph. haemolyticus	1	25	10	8	10
Staph. warneri	1	1	7	5	0
Staph. hominis	0	2	7	6	4
Entero. faecalis	0	2	4	36	7
Entero. faecium	0	1	2	7	18
Str. pyogenes		1	1	1	
Str. oralis		1	11	2	4
Staph. xylosus	0	0	1	6	0
Bacillus spp	0	0	0	6	0
Other	2	0	9	7	7
Total	90	96	117	223	199

Analyzing *Enterobacteriaceae* rods isolated from blood infections, one could confirm *Escherichia coli* infection (from 9 do 22%) and subsequently – *Enterobacter cloaceae* and *Klebsiella pneumoniae* (Table 3). Blood infections caused by *Escherichia coli* are often discovered in the newborns and also in adults as complications of the urinary system, the inflammation of the gall pathways and in case of an acute pancreatitis.

Table 3. The frequency of isolation of specific Gram-negative microorganisms of *Enterobacteriaceae* family

Bacteria	2003	2004	2005	2006	2007
Escherichia coli	12	13	9	22	17
Serratia marcescens	10	9	8	6	2
Enterobacter cloacae	3	2	0	10	20
Klebsiella pneumoniae	3	2	3	7	7
Other	3	1	1	4	11

Table 4. The frequency of isolation of nonfermentative Gram-negative bacteria

Bacteria	2003	2004	2005	2006	2007
Acinetobacter baumannii	1	3	6	30	15
Pseudomonas aeruginosa	1	1	6	14	13
Stenotrophomonas maltophilia	0	3	4	2	2
Total	2	7	16	46	30

A more recent and frequent problem of a diagnostic-therapeutic character are fungal infections (Table 5). In the analyzed period of time, the fungal infections of blood constituted from 11% to 32% of isolates. Among the fungi, most often isolated was *Candida albicans* – from 3 to 25%. Fungemia caused by yeast-like fungi mainly pertains to patients with the impaired functioning of the immunological system [1, 5]. The risk factors are the stay at the intensive unit departments due to the postoperative complications, intense antibiotic therapy and in case of heamtooncology patients. Fungal infections are most often preceded by a massive colonization of the mucous membranes. Systemic infections of *Candida* etiology are often accompanied by fungemia. Fungal sepsis is burdened with high mortality [9].

Table 5. The frequency of isolation of fungi

Fungi	2003	2004	2005	2006	2007
Candida krusei	0	0	0	0	1
Candida albicans	16	25	6	18	13
Candida tropicalis	4	0	0	2	0
Candida glabrata	2	0	0	0	0
Candida parapsilosis	2	6	5	6	6
Candida tropicalis	0	0	2	0	0
Total	24	31	13	26	20

CONCLUSIONS

1. A close cooperation of a clinic doctor and a microbiologist in the process of preventing hospital infections and also in implementation of the proper antibiotic therapy is a great challenge and a strong necessity for the properly run antibiotic therapy.

2. The knowledge of the bacterial flora and the description of resistance patterns aids the right decision about the empirical therapy to the time of the acquisition of the results of the microbiological tests.

3. It is necessary to implement knowledge as well as observe the procedures of a nursing-therapeutic character by the medical staff.

4. A significant thing is to understand the involvement and the help of the hospital management in the development of microbiological diagnostics.

REFERENCES

1. Asmundsdottir L. R., Erlendsdottir H., Gottfredsson M.: Increasing incidence of candidemia: Results from a 20-year nationwide study in Iceland, J. Clin. Microbiol., 40, 3489, 2002.
2. Bone R. C., Balk R. A., Cerra F. D. et al.: Definitions for skepsis and organ failure and guidelines for use of innovative therapies in sepsis. The ACCP/SCCM Consensus Conference Committee, American Collage of Chest Physicans/Society of Clinical care Medicine, Chest, 101, 1644, 1992.
3. Borowiec D., Semczuk K., Dzierżanowska D.: Czynniki etiologiczne zakażeń krwi u pacjentów hospitalizowanych. Zakażenia, 6 (5), 98, 2006.
4. Chien J. W.: Optymalne wykorzystanie posiewów krwi. Med. po Dypl., 8 (2), 24, 1999.
5. Gospodarek E.: Zakażenia krwi – strategie diagnostyczne. Mag. Med., 8, 24, 2002.
6. Juszczyk J., Samet A.: Posocznica. Wyd. Via Medica, Gdańsk 2006.
7. Łopaciuk U., Semczuk K., Dzierżanowska D.: Mikrobiologia zakażeń szpitalnych zakażenia, 1–2, 98, 2002.
8. Łopaciuk U., Dzierżanowska D.: Bakteryjne zakażenia krwi współczesne poglądy na etiologię, rozpoznanie i leczenie. Com. Med., 1, 11, 2001.
9. Rizzato G.: Zakażenia grzybicze u pacjentów po przeszczepie: rola liposomalnej postaci Amfoterycyny B, w erze nowych leków przeciwgrzybiczych. Sarcoidosis Vasc. Lung Dis., 21 (supl. 1), 3, 2004.
10. Seferyńska I., Warzocha K.: Leczenie grzybic układowych u chorych z neutropenią. Zakażenia, 1, 83, 2007.
11. Semczuk K., Łopaciuk U., Dzierżanowski D.: Posocznica – patogeneza i leczenie. Nowa Klinika, 9 (3–4), 367, 2002.
12. Wingard J. R.: Infections due to resistant *Candida species* in patients with cancer who are receiving hemotherapy. CID, 19, 49, 1994.

SUMMARY

The aim of the study was the microbiological analysis of blood cultures made in the Microbiological Diagnostics Lab in the period of 2003–2007. In the conducted studies a retrospective analysis of the evaluation of results of blood culture tests was made. The studies were conducted in the Microbiological Diagnostics Lab at the clinical Hospital No. 1 in Lublin. Blood for culturing was obtained from all departments of the hospital. For blood culturing, an automatic system of microorganisms' growth detection was used, and the identification as well as drug resistance tests were made according to the recommendations of the National Recommendation Centre for Microorganic Drug Resistance. Generally, in the years of 2003–2007, 7049 of blood cultures were prepared. In total, in the given period, 1125 disease causing microorganisms were detected. The analysis did not evaluate the secondary isolates from the same patient. A secondary isolate was a subsequent culture of the same microorganism of the same antibiotic pattern in the period of 21 days. In the studies, the questionnaire by the authors was used for the collection of microbiological data.

STRESZCZENIE

Celem pracy była analiza mikrobiologiczna posiewów krwi wykonywanych w Laboratorium Diagnostyki Mikrobiologicznej w latach 2003–2007. Badania przeprowadzono w Laboratorium Diagnostyki Mikrobiologicznej Szpitala Klinicznego Nr 1 w Lublinie i dokonano w nich retrospektywnej oceny wyników posiewów krwi, którą otrzymywano na posiew ze wszystkich jednostek szpitala. Do posiewu krwi wykorzystywano automatyczny system detekcji wzrostu drobnoustrojów. Identyfikacje i lekowrażliwość drobnoustrojów wykonano zgodnie z zaleceniami Krajowego Ośrodka ds. Lekowrażliwości Drobnoustrojów. Ogółem w latach 2003–2007 wykonano 7049 posiewów krwi. Łącznie w badanym okresie wyhodowano 1125 drobnoustrojów chorobotwórczych. W analizie nie oceniano powtórnych izolatów od tego samego pacjenta. Jako wtórny izolat uważano kolejną hodowlę tego samego drobnoustroju o tym samym wzorze antybiotykowym w ciągu 21 dni. W badaniach wykorzystano kwestionariusz własnego autorstwa do gromadzenia danych mikrobiologicznych.