

THE NOSOCOMIAL SEPSIS AT THE PATIENTS FROM THE INTENSIVE CARE UNIT

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Keywords: sepsis
nosocomialitate,
antibiotic resistance

Abstract: The sepsis is a systemic inflammatory response resulting from the inability of the immune system to limit bacterial invasion after the onset of the infection. We conducted a study over a period of 4 years and 9 months in an intensive care unit of an emergency clinical county hospital to identify the frequency and aetiology of the nosocomial sepsis. The case definition for the selection of the patients was adapted according to the definition of the nosocomial septicaemia proven etiologically by laboratory testing of CDC Atlanta. The population at risk was composed of patients who had been hospitalized in ATI with the duration of at least 48 hours. We identified a total of 30 episodes of nosocomial sepsis cases with positive blood cultures, from a total of 3297 patients hospitalized in the range indicated, representing an incidence of 9.1%. Of these, 23 cases were mono-etiological and 7 – bi-etiological (2 microbial species). We found that the isolated bacterial strains present in a significant percentage, resistance to antibacterial agents, which raises problems because of the treatment limitations and of the failures in the clinical course of cases.

Cuvinte cheie: sepsis,
nosocomialitate,
antibiorezistență

Rezumat: Sepsisul este răspunsul inflamator sistemic care rezultă din incapacitatea sistemului imunitar de a limita invazia bacteriană după debutul unei infecții. Am efectuat un studiu pe o perioadă de 4 ani și 9 luni într-o unitate de terapie intensivă a unui spital clinic județean de urgență pentru a identifica frecvența și etiologia sepsisului nosocomial. Definiția de caz pentru selectarea pacienților a fost adaptată după definiția septicemiei nosocomiale dovedite etiologic prin examene de laborator a CDC Atlanta. Populația la risc a fost formată din pacienți care au avut internare în ATI cu o durată de cel puțin 48 de ore. Am identificat un număr de 30 de episoade de sepsis nosocomial, cazuri cu hemoculturi pozitive, dintr-un total de 3297 de pacienți internați în intervalul precizat, reprezentând o incidență de 9,1%. Dintre acestea, 23 de cazuri au fost monoetiologice și 7 – plurietiologice (2 specii microbiene). Am constatat că tulpinile bacteriene izolate prezintă într-un procent important rezistență la agenții antibacterieni, ceea ce ridică probleme din cauza restricțiilor de tratament și a eșecurilor în evoluția clinică a cazurilor.

INTRODUCTION

The nosocomial sepsis is an important cause of morbidity and mortality (1). Most episodes of nosocomial bacteraemia occur endemically, being secondary bacteraemia caused by wound infections, pneumonia or urinary infections; the primary bacteraemia often occur following the use of the intravascular devices, but in many cases the source remains unknown. The immune-compromised host is at risk of developing bacteraemia manifested endemically, but the epidemic ones occur at the immune-competent individuals being linked to specific therapeutic measures: the segregation of these patients in intensive care units where the risk is increased, the intravenous therapies, the invasive manoeuvres which involve the blood torrent.

PURPOSE OF THE STUDY

The identification of the incidence, aetiology and of the antibiotic susceptibility of the germs which cause the nosocomial septicaemia in intensive care units.

MATERIAL AND METHOD

We realized a prospective study between January 2005

- September 2009 in the ATI section of the Emergency County Hospital Sibiu; there were taken to be studied the patients during the hospitalization period and who showed clinical signs of sepsis proven etiologically by blood cultures positive for the micro-organisms which were not the cause together with other infections of the patient, infections which were already present in the moment of the internment in ATI (to meet the criterion of disease); the pseudo-bacteraemia were excluded (transient bacteraemia or through the supra-infection of the samples collected or transported incorrectly). The data source was the patient case report forms, supplemented by the laboratory analysis. There were recorded germ / isolated germs from blood cultures and their antibiotic resistance. The collecting of the blood cultures was done in the moment of the maximum febrile/chill ascension, taking into account the protocol recommended by the medical microbiologist. Excel programme was used to meet the database and graphics processing. The following abbreviations have been used for the graphic representation of the antibiotic diagrams: P = penicillin, amp = ampicillin, amc = amoxicillin + clavulanic, Sat = amoxicillin + sulbactam, ox = oxacilina, ipm = imipenem, mem = meropenem, atm = aztreonam, tzp = piperacillin + tazobactam, prl =

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Articol intrat în redacție în 11.03.2010 și acceptat spre publicare în 18.03.2010

ACTA MEDICA TRANSILVANICA Iunie2010; 2(3)278-280

ASPECTE CLINICE

piperacillin, fox = cefoxitin, cec = cefaclor, event = ceftazidime, ctx = cefotaxime, cpo = ceftiofloxacin, fep = cefepime, cro = ceftriaxone, g = gentamicin, ak = amikacin, str = streptomycin, cip = ciprofloxacin, lev = levofloxacin, mox = moxifloxacin, ofx = ofloxacin, nor = norfloxacin, e = erythromycin, da = clindamycin, lzd = linezolid, te = teicoplanin, va = vancomycin, te = tetracycline, dox = doxycycline, rd = rifampicin, c = chloramphenicol, sxt = sulfamethoxazole trimethoprim.

RESULTS

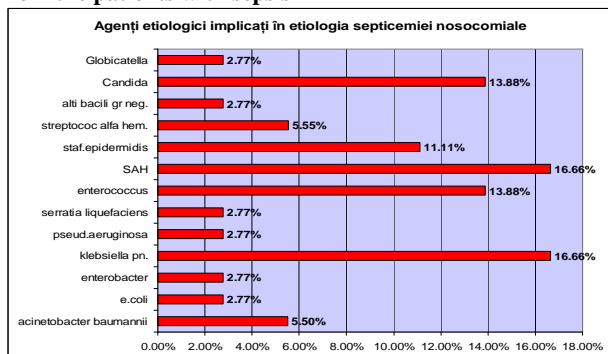
In the period under review a total of 3297 patients were admitted to the ATI, department of S.C.J.U.S., of which 30 patients were diagnosed with nosocomial sepsis (table 1) as defined by the case, the incidence of the illness being of 9.1%; 23 cases were mono-etiological, the remaining of 7 being bi-etiological, (2 germs isolated in the blood cultures):

Table no. 1. The aetiology of the nosocomial sepsis

TOTAL SEPSIS			
30 cases			
MONO-ETIOLOGIC		BI-ETIOLOGIC(2 germs)	
23 cases		7 cases	
Bacterial	Fungicide	Twp bacterial species	Mixed (bacterial +fungicide)
19 cases	4 cases	6 cases	1 cases

13 gram-negative bacilli were isolated from blood cultures: 6 strains of *Klebsiella pneumoniae*, 2 strains of *Acinetobacter Baumannii*, 1 strain of *Escherichia coli*, 1 *Enterobacter* strain, 1 strain of *Pseudomonas aeruginosa*, 1 *Serratia liquefaciens* strain and 1 strain of unidentified Gram-negative bacilli. Also, 18 gram positive hull were isolated: 10 *Staphylococcus* (of which 6 haemolytic staphylococci aureus - SAH - and 4 staphylococci epidermidis), 5 *Enterococcus*, 1 *Globicatella sanguine* and 2 alpha haemolytic streptococci. *Candida albicans* was isolated in 5 blood cultures (in 4 as the sole etiologic agent of septicaemia and 1 case in combination with SAH) (Figure No. 1).

Figure no. 1. The proportion of the isolated etiologic agents from the patients with sepsis



The Resistance to Antibiotics of the Isolated Bacteria Strains from Blood Cultures

1. Strains of *staphylococcus* (Figure no. 2)

For the 10 strains of staphylococcus isolated from the blood culture, the antibiotics diagram was performed only in 7 cases (3 strains of white staphylococci were not tested). From the tested SAH strains, 100% of them showed resistance to oxacilina and cefoxitin, being classified as methicillin resistant strains (MRSA) (cefotaxime with a higher potential of sensitivity than oxacilina to detect methicillin-resistance). These strains showed concomitantly high resistance to amino-glycosides (over 70%), macro-lides (including clindamycin-phenotype MLSBI-over 50%), rifampicin and fluoro-quinolones. All MRSA strains

were susceptible to vancomycin, teicoplanin and linezolid.

1. Strains of *enterococci* (figure no.3)

I found an increased resistance to aminoglycosides and fluoroquinolones at the strains of enterococci isolated from septicaemia. 100% of strains were susceptible to linezolid, vancomycin and teicoplanin.

Figure no. 2. The resistance to the antibiotics of the staphylococcus strains

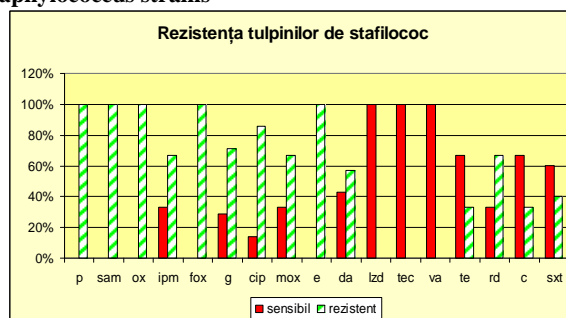
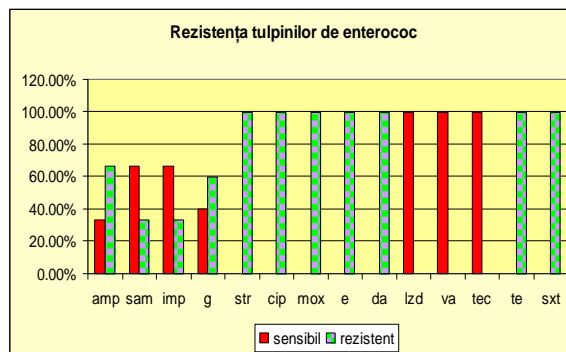


Figure no. 3. The resistance to the antibiotics of the enterococci strains



3. Strains of *Acinetobacter baumannii* (figure no.4)

The two strains of *Acinetobacter baumannii* isolated from blood cultures are extremely resistant to an impressive number of antibiotics: combinations of clavulanat or of sulbactam, the combination of tazobactam with piperacillin, cephalosporin of I, II, III, IVth generation, fluoro-quinolones, aminoglycosides, chloramphenicol. Both strains were sensitive to colistin, but this antibiotic (even if it has an excellent in vitro activity) should be administered in large therapeutic doses, puts problems of toxicity and pharmacokinetics and its use by first intention in septicaemia is questionable.

4. Strain of *E. coli*

E. coli strains isolated from blood cultures was resistant to combinations containing beta lactamase inhibitors (clavulanic and sulbactam) in combination with piperacillin tazobactam to all cephalosporins and aztreonam, being a strain which produces extended spectrum beta lactamases (ESBLs +), what affects its sensitivity to a wide range of classes of antibiotics. The strain was sensitive to carbapeneme to ciprofloxacin, colistin and chloramphenicol. From the aminoglycoside, it was resistant to gentamicin, but sensitive to amikacin.

5. Strains of *Klebsiella pneumoniae* (figure no.5)

Over 80% of strains of *Klebsiella* isolated from blood cultures were strains which secrete beta lactamases with a large spectrum. This explains the high level of resistance to penicillins (including combinations with clavulanic) and all classes of cephalosporins. The sensitivity of the tested strains was 100% for colistin and chloramphenicol.

ASPECTE CLINICE

Figure no. 4. The resistance to the antibiotics of the acinetobacter strains

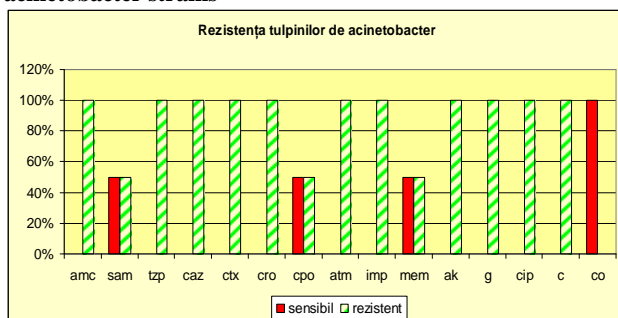
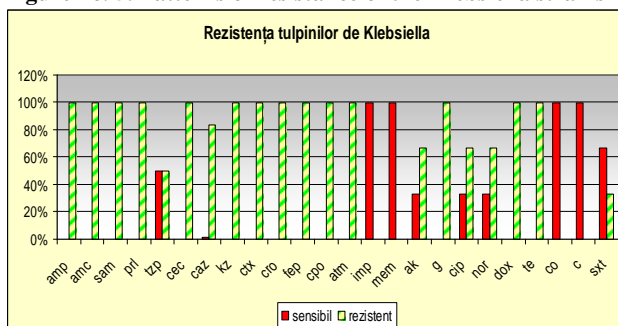


Figure no. 5. Patterns of resistance of the Klebsiella strains



6. Strain of *Serratia liquefaciens*

It was a strain with high sensitivity, being the only resistance to colistin.

7. Strain of *Pseudomonas aeruginosa*

The strain was sensitive to common anti-piocratic antibiotics (piperacillin, ticarcilină, ticarcilină with clavulanic), cephalosporins and fluoro-quinolones

DISCUSSIONS

Although the blood cultures provide an important number of information for the diagnosis of sepsis, there are some problems which should be avoided, one of them being the contamination of the samples collected. The contamination can occur from the moment of the collection, one of the common mistakes being related to the collecting of the central catheter or peripheral vein catheter mounted. Therefore, one of the first steps in this study was to formulate a protocol for proper blood cultures, the blood cultures collected incorrectly were not taken into study, even if they were positive.

Besides this aspect, the diagnosis of sepsis may be significantly delayed because of the time passing between the issue of clinical suspicion and the results of blood cultures; that is the reason for which it is necessary an empirical antibiotic therapy administered until a precise identification of aetiology. The more therapy is started later, the more difficult the patient's healing becomes (2) and therefore it seemed to be important to identify the most frequently involved germs in the aetiology of the septicaemia in Section ATI and their sensitivity to antibiotics.

In this study we found that during the studied period, the septicaemias were produced by more than 10 bacterial species, both gram positive and gram-negative and by the fungus (*Candida*), part of the infections having dual or mixed bacterial aetiology (bacterial and fungal).

The species of the *Staphylococcus* type were isolated with the biggest frequency from the blood cultures (over 27% of cases); all the strains of the *staphylococcus aureus* (involved in over 16% of septicaemias) were methicillin-resistant strains.

These strains showed high resistance towards the aminoglycosides, macrolides (including clindamycin - phenotype MLSBI), rifampicin and fluoroquinolones. On the second place in frequency was located the septicaemia caused by *Klebsiella pneumoniae* (over 16%), over 80% of the strains isolated from the blood cultures were ESBLs +, resistant to all classes of cephalosporins. *Klebsiella* resistance to aminoglycosides is also very high (only 2 of 6 isolates were sensitive to amikacin), fluoroquinolones and tetracyclines. Enterococci and *Candida* occupied the third place in frequency in the aetiology of septicaemia (each about 14%). *Acinetobacter baumannii* was isolated in 5.5% of cases; the frequency is not high, but the strains have been particularly resistant in an impressive number to the antibiotics. The strains of *Acinetobacter* can easily produce septicaemia in the immunocompromised bodies, and the resistance in an inert environment of the hospital is very high, which is why it puts serious problems related to the easy spread among patients.

E. coli strain isolated from blood cultures was a resistant strain, ESBL +, which affects its sensitivity to penicillins and cephalosporins. The only "wild" strain, with almost full sensitivity to the tested antibiotics were those of *Serratia liquefaciens* and *piocianic bacillus* which caused one case each of sepsis.

The resistance to the antibacterial agents involved in the aetiology of the septicaemia is a matter of current, well documented and growing importance, due to the restrictions of the treatment and the failures in the clinical course of cases (2, 3).

CONCLUSIONS

1. The incidence of nosocomial sepsis documented by positive blood cultures in the period studied was 9.1 cases per 1000 hospitalizations.
2. The most common etiologic agent involved was *Staphylococcus* (over 27% of cases); 100% of strains of *staphylococcus aureus* were methicillin resistant (MRSA).
3. On the second placed, was septicaemia caused by *Klebsiella pneumoniae* (over 16%), over 80% from the strains isolated from the blood cultures secrete extended beta lactamases with a large spectrum.
4. Only two cases of sepsis were caused by "wild" strains, with almost full sensitivity to tested antibiotics: *Serratia liquefaciens* and *bacillus piocianic*; the rest of the septicaemias were caused by resistant "hospital" germs.
5. The situation of multiple resistances of the germs to septicaemia is alarming and requires close supervision to isolate and control of the existing strains, with the respect of the guidelines and antibiotic therapy to reduce new variants resistant to antibiotics.

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