

TESTING THE RESISTANCE TO CEPHALOSPORINS IN SOME BACTERIAL PATHGENS ISOLATED FROM ANIMALS

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Abstract

The susceptibility of bacterial pathogens isolated from animals in Transylvania was tested through the disk diffusion method. The resistance to cephalosporins was registered for all examined pathogens, the highest percentage in genus Pseudomonas (100%) and Streptococcus (92.31%). Genus Corynebacterium and Klebsiella showed resistance in 75% and had intermediate strains of 25%; no strain was sensitive to cephalosporins. In staphylococci was found a lower resistance of 66.66%, compared with other gram-positive bacteria: streptococci, corynebacteria. Gram-negative bacteria were resistant $\leq 50\%$: Citrobacter, Enterobacter, Morganella - 50%, Proteus - 40%, Escherichia coli - 37.5% and Pasteurella - 33.33%. The highest sensitivity to cephalosporins had had Pasteurella (66.66%), Citrobacter, Enterobacter, Morganella (50%) and Proteus strains (40%).

Key words: cephalosporins, bacteria, resistance

INTRODUCTION

Cephalosporins are an important class of antibacterial agents in use today for both humans and animals. All generations of cephalosporins that have evolved contain the beta-lactam sub-structure first found in penicillin (Hornish RE et al., 2002).

Cephalosporins are used in both human and animal medicine because they are very effective and have few side-effects. The first to fourth generations are used in animal health, while first to sixth generation cephalosporins are used in human medicine (NOAH, 2011).

First generation of cephalosporins are generally effective against most gram-positive aerobic cocci and some gram-negative bacteria, including *Escherichia coli*, *Proteus*, *Klebsiella*, *Salmonella*, *Shigella* and *Enterobacter spp.* The second generation of cephalosporin have a broader spectrum of activity against gram-negative microorganisms, but are somewhat less active against gram-positive species. This trend continues in the third generation of cephalosporins, which can be active even against *Pseudomonas aeruginosa*. The newest members of this group are extremely resistant to betalactamase (MERCK, 2005).

Antimicrobial spectrum of cephalosporins, especially from III and IV generation, varies - so it should be confirmed before the use on certain microorganisms (Mărculescu Anca, 2007).

MATERIAL AND METHOD

Pathological materials were represented by corpses, organs with lesions - liver, lungs, spleen, intestine - and also purulent exudates, faeces, urine collected from animals in Transylvania. Samples were examined at Veterinary Medicine Cluj, on the usual culture media (broth and agar), enriched with serum, glucose, blood for most bacterial strains isolated.

Isolation and differentiation of gram-negative bacteria were made on special, selective media (Levine, Istria-Meitert, MacConkey, Leiffson, Smith Baskerville). For isolation and differentiation of gram-positive bacteria were used agar glucose, blood agar, hyperchlorinated media (Răpuntean Gh. et al, 2005).

Antibiogram is a relatively simple method by which it can be appreciated the sensitivity of pathogens to several antibiotics (Răpuntean Gh. et al, 2001).

In this study the antibiograms made with discs containing cephalosporins were registered, diffusion method being interpreted according to international standards (NCCLS, M31-A, M31-T, 1999).

RESULTS AND DISCUSSIONS

Cephalosporin susceptibility testing had been made by investigating 71 bacterial strains and involved the use of many antibiotics from this group, selected on the basis of the antibacterial spectrum and clinical needs (cephalothin, cefuroxime, ceftriaxone, ceftazidime, ceftiofur, cefquinom, cefixime). However, the generation of cephalosporin was not taken into account for the recording of results, the antibiogram data being globally interpreted, as a response of the pathogens to cephalosporin group.

Although cephalosporins from the third-generation (ceftriaxone and ceftiofur) were tested on strains of the genus *Pseudomonas*, resistance was noted for all strains investigated in this study.

In general, cephalosporins are relatively stable to the action of plasmid-mediated betalactamase produced by gram-positive bacteria such as *Staphylococcus aureus* and this can be seen in the present research, in that the staphylococci were found less resistant - 66, 66% - in comparison with with other gram-positive pathogens: streptococci - 92.31%, corynebacteria - 75%.

Second-generation and especially third generation of cephalosporins have greater stability against gram-negative pathogens' betalactamases. Moreover, it can be seen in table 1 that apart from strains of *Klebsiella* genus, which showed resistance of 75%, 25% intermediate values and no susceptible strains, other gram-negative microorganisms were resistant \leq 50%: *Citrobacter* , *Enterobacter*, *Morganella* - 50%, *Proteus* - 40%, *Escherichia coli* - 37.5% and *Pasteurella* - 33.33%.

Highest sensitivity to cephalosporins had *Pasteurella* strains (66.66%), *Citrobacter*, *Enterobacter*, *Morganella* (50%) and *Proteus* (40%) (table 1).

Table 1

Susceptibility/resistance to cephalosporins

Crt. no.	Strain	No.	Sensibility/resistance					
			R	%	I	%	S	%
1	<i>Streptococci</i>	13	12	92,31	-	-	1	7,69
2	<i>Staphylococci</i>	12	8	66,66	-	-	4	33,33
3	<i>Corynebacterium</i>	4	3	75	1	25	-	-
4	<i>Clostridium</i>	3	1	33,33	1	33,33	1	33,33
5	<i>E. coli</i>	16	6	37,50	4	25	6	37,50
6	<i>Citrobacter</i>	2	1	50	-	-	1	50
7	<i>Enterobacter</i>	4	2	50	-	-	2	50
8	<i>Klebsiella</i>	4	3	75	1	25	-	-
9	<i>Proteus</i>	5	2	40	1	20	2	40
10	<i>Morganella</i>	2	1	50	-	-	1	50
11	<i>Pasteurella</i>	3	1	33,33	-	-	2	66,66
12	<i>Pseudomonas</i>	3	3	100	-	-	-	-
No. pathogens		71	43	60,56	8	11,27	20	28,17

Although the sensitivity of staphylococci to cephalosporins was 33.33% and only 7.69% in streptococci in this study, H. Leon Thacker, however, while testing several antibiotics in this group, in 2003, generally noted a very good efficiency of cephalosporins on *Streptococcus* and *Staphylococcus* pathogens isolated from dogs and cats; while, as in this study, strains of *Pseudomonas aeruginosa* showed resistance in a high percentage - 80-100% - with the exception of cefotaxime, that caused a small percentage of resistance to these bacterial strains - 0-20%. In horses, however, although resistance in *Staphylococcus epidermidis* was registered in a low percentage (0-25%), *Staphylococcus aureus* had a different behavior towards cephalosporins, with 43-71% resistant strains (Thacker H. Leon, 2003).

The general behavior of the 71 strains tested with cephalosporins showed that were at a rate of 60.56% resistant, 11.27% had intermediate values and only 28.17% of the strains were sensitive to these antibiotics.

CONCLUSIONS

- ❖ Resistance to cephalosporins was registered for all the examined pathogens, the highest percentage existing in *Pseudomonas* - 100% - and *Streptococcus* - 92.31%
- ❖ *Corynebacterium* and *Klebsiella* genus showed resistance in 75% percentage of the strains, and had also intermediate strains 25%, no strain was sensitive to cephalosporins
- ❖ Highest sensitivity to cephalosporins had had *Pasteurella* strains (66.66%), followed by *Citrobacter*, *Enterobacter*, *Morganella* (50%) and *Proteus* (40%)
- ❖ 60.56% of the strains were resistant, 11.27% had intermediate values and only 28.17% of the strains showed sensitivity to cephalosporins, from the totality of the investigated pathogens
- ❖ The recommendation resulting from this study is to test the sensitivity of pathogens whenever possible, because of the variable resistance of microorganisms

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