



Antibiotic Resistance in Neonatal Children

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Abstract

The problem of neonatal mortality from bacterial infections is exacerbated by the growing resistance to antimicrobials reported throughout the world. In our country, the problem of antimicrobial resistance, especially in children under 5 years old, is one of the most urgent.

Keywords: Antibiotic Resistance; Neonatal Children; Multiresistant Bacteria

Introduction

The aim of this study was to investigate the antibiotic resistance of bacterial isolates isolated from urine (6), blood (4), faeces (2), sputum (1) and bronchoalveolar lavage (1) of 14 children aged 1 week to 6 years. The study was conducted from December 2022 to February 2023 at Liv Bonadea Hospital.

The pathogen was detected using an analyzer Vitek2 and a Vitek MS, sensitivity to antibiotics was detected by the disk diffusion method.

Resistant bacteria to all tested antibiotics were found in 3 neonatal children. These were *S.marcescens* in blood, *Kl.pneumonia* in blood, and *A.baumannii* in bronchoalveolar lavage. *E.coli* (4) and *Kl.pneumonia* (3) resistant to cephalosporins of the 2nd and 3rd generations were found in 7 children aged 2 months to 4 years. Only in 2 children aged 4 and 6 years, *E.faecalis* and *E.coli* sensitive to all of the above antibiotics were identified.

The detection of multidrug-resistant bacterial strains in neonatal children is extremely alarming. There is a need for a detailed study of the development of antibiotic resistance in early neonatal age.

Methodology

According to the WHO, infections caused by multidrug-resistant bacteria cause 700,000 deaths each year, of which about 200,000 are newborns. In Europe, infections in children caused by multidrug-resistant bacteria can account for up to 30% of the total number of cases. In regions of the Middle East, 90% of newborns with sepsis admitted to intensive care units were found to have resistant bacteria [1]; in some areas of Southeast Asia, *E. coli* resistant to first-line antibiotics was found in 83% of children [2]; in sub-Saharan Africa, 66% of neonatal sepsis and meningitis were found to be caused by antibiotic-resistant bacteria.

According to the WHO forecast, if the trend of increasing antimicrobial resistance remains unchanged, by 2050, drug-resistant diseases could cause 10 million deaths annually, with an estimated annual cost to health systems and economic losses of about 300 billion US dollars [4,5]. With increasing antibiotic resistance, the world is facing a post-antibiotic era in which common infections once again prove to be deadly, especially for children who are frequently exposed to infections and therefore to selective antimicrobial treatment. Newborns under one week of age (early neonatal age) are at particular risk due to the presence of populations of multidrug-resistant bacteria in their gastrointestinal tract, likely

due to exposure to bacteria entering their bodies during and immediately after birth.

The problem of antimicrobial resistance has become relevant in recent years in our country (Azerbaijan) as a result of the abuse of antibiotics in medicine, agriculture, animal husbandry, and veterinary medicine.

The above led to the conduct of this study, the purpose of which was to study the resistance of bacterial isolates obtained from children under the age of 5 years. The study was conducted from December 2022 to February 2023.

The studied bacterial strains were isolated from the urine, sputum, blood and bronchoalveolar aspirate of 14 sick children

at the Liv Bonadea hospital. The pathogen was detected using an automated microbiological analyzer Vitek2 and a Vitek MS mass spectrometer, sensitivity to antibiotics was detected by the disk diffusion method. Muller-Hinton, Sabouraud, blood and eosin-methylene agars were used for cultivating bacteria.

Results

Resistant bacteria to all tested antibiotics were found in 3 neonatal children, namely *Serratia marcescens* in blood, *Klebsiella pneumoniae* in blood and *Acinetobacter baumannii* in bronchoalveolar aspirate. *Escherichia coli* (4 children) and *Kl.pneumoniae* (3 children) resistant to cephalosporins II and III generations were found in 7 children aged 2 months to 4 years. *Enterococcus faecalis* and *E. coli* sensitive to all of the above antibiotics were detected only in 2 children aged 4 and 6 years.

Antibiotics	<i>Kl.pneumoniae</i>		<i>A.baumannii</i>		<i>S.marcescens</i>		<i>Ps.aeruginosa</i>	
	Sensitive	Resistant	Sensitive	Resistant	Sensitive	Resistant	Sensitive	Resistant
Amikacin	0	100	0	100	0	100	100	0
Amoxicillin/Clavulanic Acid	0	100	0	100	0	100	100	0
Ampicillin	0	100	0	100	0	100	100	0
Cefepime	0	100	0	100	0	100	100	0
Cefixime	0	100	0	100	0	100	100	0
Ceftazidime	0	100	0	100	0	100	100	0
Ceftriaxone	33,3	66,6	0	100	0	100	100	0
Cefuroxime	0	100	0	100	0	100	100	0
Cefuroxime Axetil	0	100	0	100	0	100	100	0
Ciprofloxacin	33,3	66,6	0	100	0	100	50	50
Ertapenem	66,6	33,3	0	100	0	100	100	0
Gentamicin	33,3	66,6	0	100	0	100	50	50
Imipenem	66,6	33,3	0	100	0	100	100	0
Levofloxacin	33,3	66,6	0	100	0	100	100	0
Meropenem	66,6	33,3	0	100	0	100	100	0
Piperacillin	33,3	66,6	0	100	0	100	100	0
Piperacillin/Tazobactam	33,3	66,6	0	100	0	100	50	50
Colistin	66,6	33,3	0	100	0	100	100	0

Table 1: Antibiotic susceptibility of bacteria isolated from children at the Liv Bonadea hospital, %.

Antibiotics	<i>S. enterica</i>		<i>St. hominis</i>		<i>E. faecalis</i>		<i>E.coli</i>	
	Sensitive	Resistant	Sensitive	Resistant	Sensitive	Resistant	Sensitive	Resistant
Amikacin	0	100	0	100	100	0	0	100
Amoxicillin/Clavulanic Acid	0	100	100	0	100	0	0	100
Ampicillin	0	100	100	0	100	0	0	100
Cefepime	100	0	100	0	100	0	0	100
Cefixime	0	100	100	0	100	0	0	100
Ceftazidime	25	75	100	0	100	0	0	100
Ceftriaxone	50	50	100	0	100	0	0	100
Cefuroxime	0	100	25	75	100	0	0	100
Cefuroxime Axetil	50	50	25	75	100	0	50	50
Ciprofloxacin	25	75	100	0	100	0	50	50
Ertapenem	75	25	100	0	100	0	25	75
Gentamicin	0	100	100	0	100	0	0	100
Imipenem	75	25	100	0	100	0	25	75
Levofloxacin	50	50	100	0	100	0	25	75
Meropenem	50	50	100	0	100	0	50	50
Piperacillin	25	75	25	75	100	0	0	100
Piperacillin/Tazobactam	25	75	100	0	100	0	25	75
Colistin	100	0	100	0	100	0	50	50

Table 2: Antibiotic susceptibility of bacteria isolated from children at the Liv Bonadea hospital, % (continued).

As can be seen from the results of the study, microorganisms from the list of “priority pathogens” recognized by WHO in 2017 as posing the greatest threat to human health - bacteria of the species *A. baumannii*, *Kl. pneumonia*, *E.coli* - showed a high degree of resistance to antibiotics [12]. Bacteria of the species *Acinetobacter baumannii*, which until recently were isolated only from water bodies, from the skin of the armpits and feet of residents of hot climates, are now often the causative agents of various infections and are characterized by a high level of resistance to antibiotics, as was also found in our study [13].

In the scientific literature of recent years, the detection of gram-negative flora in blood and urine isolates of patients is approximately 53%, with *E. coli* leading in the number of occurrences, then *Kl.pneumoniae* and *A.baumannii*. In our study, more *Kl.pneumoniae* (43.2%) was sown in isolates from sick children.

Discussion

Currently, *Kl.pneumoniae* among opportunistic microorganisms is distinguished by the largest number of resistance determinants, which, according to some authors, is often combined with virulence genes and hypermucoid type of strains [14-17].

Multidrug-resistant gram-negative bacteria were detected in 3 neonatal children, which causes extreme concern and requires an immediate search for ways to solve this problem. Children at this age can become infected with resistant strains of bacteria from mothers during or immediately after childbirth or in medical hospitals.

The rather high sensitivity to the studied antibiotics, found in the bacterium of the species *St.hominis*, is apparently associated with the infrequent diagnosis of this pathogen in routine labora-

tory studies, since this type of opportunistic staphylococcus is part of the normal human microflora, and the trigger for its colonization of other tissues and organs of the body is a significant decrease in immunity [18].

E. faecalis and *E. coli* sensitive to all used antibiotics were found in children 4 and 6 years old who did not have a history of long-term hospital stay.

Conclusion

Thus, the multiresistant bacterial strains identified in this study in neonatal children require the development of an antimicrobial drug management strategy, including regular audit and revision of local antimicrobial prescriptions, antibiotic dosing accuracy, taking into account the physiological processes of child development, rapid and accurate determination of antimicrobial susceptibility drugs to prevent the spread of AMR and timely selection of an adequate antimicrobial agent.

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