



Analysis of the Microbiological Spectrum and Antimicrobial Resistance of Pathogens in Patients of Paediatric Department of Anesthesiology and Intensive Care



Halyna Bulak* and Dzwenyslava Kopanska

Danylo Halytsky Lviv National Medical University, Ukraine

***Corresponding author:** Halyna Bulak, Lviv City Children's Clinical Hospital, Department of Paediatrics № 2, Orlyk Street, 4, 79059, Lviv, Ukraine

Submission: 📅 December 17, 2017; **Published:** 📅 February 02, 2018

Abstract

Today the issue of antimicrobial resistance is growing, as there is a dramatic growth of multi- and pan-resistant bacteria. The paper examines the microbial spectrum of pathogens in newborn babies who were treated in the Paediatric Department of Anesthesiology and Intensive Care. The dominance of the gram-positive flora (*St. epidermidis* and *St. aureus*) has been established. From gram-negative flora most often sowed *Kl. pneumoniae* and *E. coli*. The analysis of antibiotic regimens showed high resistance to a big number of antibiotics: penicillin, erythromycin, amoxiclav and other.

Keywords: Antimicrobial resistance; Infection; Gram-positive flora

Abbreviations: AMR: Antimicrobial Resistance

Introduction

In modern conditions control of infectious diseases goes far beyond the purely medical problems and takes the value of national security, especially when it concerns the child population - the future of our state. Increasing the risk of developing epidemics, the pathomorphosis of the clinical course of many infections, increasing the frequency of registration of diseases that were previously considered endemic in remote areas of our country, the development of antimicrobial resistance (AMR) of pathogens and reducing the immune defense of the organism under the influence of various exogenous and endogenous factors - these challenges need to combine efforts of clinicians, scientists and health organizers. Today the issue of AMR is growing, as there is a dramatic growth of multi- and pan-resistant bacteria. The percentage of infections resistant to antibiotics increased from 0.2% in 2007 to 1.5% in 2015 and this trend continues to grow. At the VIII th European Congress of Pediatricians in Bucharest (Romania) and Harel Seidenweg (Germany), held on June 7-10, 2017, was presented on the risk of bacteria resistant to antibiotics, especially for pediatrics. It has become known that 25 thousand deaths per year in the countries of the European Union are due to antibiotic resistance.

Resistance of microorganisms to antibiotics can be true and acquired [1,2]. True (natural) stability is characterized by the absence of antibiotic action in target microorganisms or by the inaccessibility of the target due to initially low permeability

or enzymatic inactivation. If bacteria have natural resistance, antibiotics are clinically ineffective. By the acquired stability, the property of individual strains of bacteria is maintained viable at those concentrations of antibiotics that suppress the bulk of the microbial population. The appearance of acquired resistance in bacteria is not necessarily accompanied by a decrease in the clinical effectiveness of the antibiotic. The formation of resistance in all cases is due to genetically - the acquisition of new genetic information or a change in the level of expression of their own genes.

The aim of our study was to evaluate the results of bacteriological examination in patients in the first month of life who were treated in the Paediatric Department of Anesthesiology and Intensive Care and to assess the dynamics of AMR with the definition of the group of the most effective antibacterial drugs.

Materials and Methods

A retrospective analysis was carried out of 428 histories of diseases of children who were treated in the Paediatric Department of Anesthesiology and Intensive Care of the Lviv City Children's Clinical Hospital during the period from January 2016 to January 2017. Microbiological studies were performed in the bacteriological laboratory of Lviv City Children's Clinical Hospital, the disc diffusion method. The method is based on the ability of

antibiotics to diffuse from impregnated paper in a positive medium and suppress the growth of microorganisms sowed on the surface of the agar [3,4]. Internationally recognized growth media for determining the sensitivity of microorganisms to antibiotics is agar or Mueller-Hinton broth and the medium is prepared on their basis. Determination of the types and sensitivity of antibiotics of gram-positive and gram-negative bacteria was carried out on a bacteriological analyzer VITEK 2 COMPACT (Biomerie, France) using the AES software: Global CLSI-based + Phenotypic. Sensitivity to antibiotics was taken into account according to SLSI and EUCAST tables. All patients conducted microbiological research spectrum of blood, conjunctiva and navel.

Results and Discussion

Under our supervision, there were 428 newborn babies who were treated in the Paediatric Department of Anesthesiology and Intensive Care of the Lviv City Children's Clinical Hospital during the period from January 2016 to January 2017. It was found that the most common risk factors for patients in which revealed a variety of pathogens in the blood:

- Central venous catheter (100%)
- Urinary catheter (83.6%)
- Ventilation > 5 days (82.4%)
- Parenteral nutrition > 7 days (77.1%)
- Large operation (74.2%)
- Congenital birth defects (66.8%)

Now we provide you with data on the number of sowed

pathogenic bacteria in the appropriate group of children with certain diseases. The number of children with respiratory distress syndrome, pneumonia was 140 children, of which the pathogens in the blood were sown in 32 newborn (22.9%). Among 102 premature infants and those who were on parenteral nutrition for more than 7 days, pathogenic bacteria were sown in 18 children (17.6%). Among children with congenital malformations, which numbered 79 children, the causative agents were sown in 22 children (27.8%). In 14 children with congenital malformations of the gastrointestinal tract pathogens were sown in 7 newborn (50%). Among 32 children with verified intrauterine infection, pathological pathogens were sown in 7 children (21.9%). Also, pathogens were instilled among patients with diseases such as sepsis, jaundice of newborns, but their number was not significant, compared with the previous indicators. According to research data, among all 428 children in 86 of them, gram-positive flora was sown from blood. As for the gram-positive flora, the two most common pathogens were *St. aureus* and *St. epidermidis*. The greatest sensitivity of these bacteria was to: vancomycin and oxacillin, and resistant to erythromycin and penicillin.

Gram-negative flora during the study was sown only from the navel and conjunctiva of children. The number of such children was 40 persons. However, the most common pathogens were *Kl. pneumoniae* and *E. coli*. In the third place was *Ps. aeruginosa*. The distribution in this category was as follows: *Kl. pneumoniae* was sown in 15 children, *E. coli* - in 22 children, *Ps. aeruginosa* - in 3 children. The greatest sensitivity of these pathogens was shown to: cefoperazone and ceftriaxone, while resistant to ampicillin and amoxiclav. As for *Ps. aeruginosa* sensitive to this pathogen was to cefepime, and resistant to gentamicin (Table 1).

Table 1: Sensitivity to antibiotics among the most common pathogens in patients of Paediatric Department of Anesthesiology and Intensive Care.

Pathogen	Antibiotic			
	Sensitive to	Mode of action	Resistant to	Mode of action
Gram-Positive				
<i>St. aureus</i> <i>St. epidermidis</i>	Vancomycin	Inhibitor of cell wall synthesis	Erythromycin	Inhibitor of protein synthesis
	Oxacillin	Inhibitor of cell wall synthesis	Penicillin	Inhibitor of cell wall synthesis
Gram-Negative				
<i>Kl. pneumoniae</i> <i>E. coli</i>	Cefoperazone	Inhibitor of cell wall synthesis	Ampicillin	Inhibitor of cell wall synthesis
	Ceftriaxone	Inhibitor of cell wall synthesis	Amoxiclav	Inhibitor of cell wall synthesis
<i>Ps. aeruginosa</i>	Cefepime	Inhibitor of cell wall synthesis	Gentamicin	Inhibitor of protein synthesis

Conclusion

Analysis of the microbial spectrum of pathogens in newborn babies testified to the dominance of gram-positive flora - *St. aureus* and *St. epidermis*. There is documented high sensitivity to vancomycin, oxacillin. Revealed high rates of resistance to penicillin and erythromycin. From the gram-negative flora, such pathogens

as *Kl. pneumoniae* and *E. coli* dominated. High sensitivity to cefoperazone and ceftriaxone was detected in this group of pathogens, and they were resistant to ampicillin and amoxiclav.

This problem concerns equally well both highly developed and industrial, and developing countries. Excessive use of antibiotics in many developed countries, insufficient duration of treatment

for the poor - in the end, creates the same threat to humanity as a whole. Antibiotic resistance is a global problem. There is no country that could afford to ignore it, and there is no country that could not respond to it. Only simultaneous actions to curb the growth of antibiotic resistance in each individual country will be able to give positive results throughout the world.

Conflict of Interest

The authors do not report any financial or personal connections with other persons or organizations, which might negatively affect the content of this publication and/or claim authorship rights to this publication.



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