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Research Article

Biochemical Features of Antibiotic-Resistant and Sensitive Strains Isolated in a Hospital Setting

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Abstract

The article presents the results of a study of the antibiotic resistance of bacteria isolated from different patients. A comparative study of the biochemical properties of resistant and non-resistant bacteria was carried out. The results obtained indicate the activity of certain biochemical properties of resistant bacteria, which makes it possible to formulate a hypothesis about a possible relationship between the mechanism of antibiotic resistance and the biochemical characteristics of bacteria.

Keywords: Biochemical Properties; Antibiotic Resistance; Bacteria

Introduction

The problem of resistance is largely due to the widespread and often irrational use of these drugs. Infections caused by resistant strains of microorganisms are characterized by a more severe course, more often require hospitalization of the patient, increase the length of his hospital stay, and require the use of combined antimicrobial therapy with the use of reserve drugs. All this leads to increased treatment costs, worsens the prognosis for the health and life of patients, and also creates conditions for the emergence of epidemics.

The issue of distinguishing antibiotic-resistant strains from sensitive strains by other characteristics is also an aspect on the agenda. A number of scientists associate the issue of bacteria gaining resistance to antibiotics with their living in stressful conditions and prove that there is a correlation between the change in the properties of microorganisms in that situation and the acquired resistance [3,5,14].

Scientific studies conducted by a number of scientists show that the role of bacterial enzymes belonging to different classes in the formation of resistance is great. It is known that in addition to the enzymes responsible for the synthesis of the structural elements of the bacterial cell, the enzymes that catalyze metabolic processes are also involved in the formation of resistance [11-13,15].

In the present study, some biochemical characteristics of resistant and sensitive bacterial strains isolated from children under 6 years of age at Bonadea Hospital were studied.

Material and Methods

From December 2022 to February 2023, 14 children were bacteriologically examined at Bonadea Hospital. Identification of pathogens was carried out with automated microbiological analyzer Vitek2 and mass spectrometry microbiological identification system Vitek Ms. Biochemical properties were determined through API tests.

Results and Discussion

In 3 of the examined patients *Klebsiella pneumonia* (in the blood), *Serratia marcescens* (in the blood), and *Acinetobacter baumanii* (in the bronchoalveolar aspirate) were detected.

All identified microorganisms were tested for sensitivity to the following antibiotics

- Amikacin - Imipenem
- Amoxicillin/Clavulanic Acid - Ertapenem
- Ampicillin - Levofloxacin
- Cefepıme - Meropenem
- Cefixime - Piperacıllın
- Ceftazidime - Piperacillin/Tazobactam

- Ceftriaxone - Colistin
- Cefuroxime - Gentamicin
- Cefuroxime Axetil
- Ciprofloxacin

In other 9 patients, *Kl. pneumonia*, *E. coli*, *Ps. aeuriginosa, S. enterica, St. hominis* has varying degrees of sensitivity to different antibiotics. detected. So, showing resistance to the above-mentioned antibiotics *Kl. pneumonia* and *E.coli* strains have higher catalase activity than susceptible bacteria. *Enterococcus faecalis* and E.coli detected in two children (4 and 6 years old) showed high sensitivity to all antibiotics.

Type of bacteria	Catalase	H_2S	Urease	Indole	Glucose	Mannose	Sorbitol	Arabinose
K.pneumoniae	+	-	+	-	+	+	+	+
K.pneumoniae	+	-	+	-	+	+	+	+
K.pneumoniae	+	-	+	-	+	+	+	+
P.aeuriginosa	+	-	+	-	+	+	+	+
S.marrescens	+	-	+	-	+	+	+	-
E.coli	+	-	-	+	+	-	+	+
A.baumannii	+	-	-	-	-	-	-	-
S.enterica	+	-	-	-	+	+	+	+
E.coli	+	-	-	+	+	-	+	+
E.coli	+	-	-	+	+	-	+	+

Table 1: Biochemical characteristics of resistant strains.

The resistant bacteria detected in the study belonged to the species included in the list of resistant bacteria considered dangerous for the human body published by the WHO in 2017 [7]. 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 the hypermucoid type of strains [1].

Catalase enzyme was detected in all resistant strains of E.coli bacteria studied (Table 1).

The activity of glucose, mannose, sorbitol and arabinose enzymes was related to the species characteristics in the studied strains (Table 2).

Type of bacteria	Catalase	H_2S	Urease	Indole	Glucose	Mannose	Sorbitol	Arabinose
E.coli	+	-	-	-	+	+	+	+
E.faecalis	-	-	-	-	+	+	+	-
St.hominis	+	+	+	-	+	-	-	-
K.pneumoniae	+	-	+	-	+	+	+	-

Table 2: Biochemical characteristics of non-resistant strains.

It is known that the effect of antibiotics on bacteria stimulates the formation of stress conditions and, accordingly, the formation of adaptive processes in bacteria.

Studies conducted by a number of scientists have shown that certain changes occur in the biochemical properties of bacteria in the state of stress. Functional changes are also noted in bacteria exposed to antibiotics according to stress conditions. An increase in catalase activity is observed in bacteria under stress, especially exposed to active forms of oxygen. In our study, antibiotic-resistant bacteria (*E.coli* and *Kl. pneumonia*) showed higher biochemical activity (catalase activity) (Table 1) [2,4,6]. In the non-resistant E.coli strains, the indole production characteristic of this species was not noted.

Changes in the biochemical characteristics typical for a certain bacterial species are explained by the reconstruction mechanisms that occur within the population under the influence of various factors.

Conclusion

Thus, as a result of the current study, it was noted that some biochemical characteristics of resistant strains are more active than sensitive strains, and it provides grounds for putting forward a certain opinion about the existence of a relationship with the mechanism of antibiotic resistance formation.

Proving the validity of this hypothesis requires more extensive research.

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