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IRRATIONAL USE OF ANTIBIOTICS IN FOOD PRODUCTION AND THE EMERGENCE OF BACTERIAL RESISTANCE TO ANTIBIOTICS IN CHILDREN

Smajil Durmisević
Institute for Health and Food Safety Zenica
Fra Ivana Jukica 2, Zenica
Bosnia and Herzegovina

Jasminka Durmisević-Serdarević
Health Centre Zenica
Fra Ivana Jukica 2, Zenica

Melita Lelić
Institute for Health and Food Safety Zenica
Fra Ivana Jukica 2, Zenica
Bosnia and Herzegovina

Jasmin Durmisević
student of medicine
Medical Faculty of Sarajevo

ABSTRACT:
Introduction: Since the emergence of bacterial strains resistant to antibiotics is typically tied to specific geographical areas, it is very important to know the sensitivity of some bacteria to antimicrobial drugs in that particular area for the application of appropriate empiric treatment of certain infections. Children, especially very young children, are at high risk of developing infections caused by microorganisms resistant to antibiotics. This is directly related to the use of antimicrobial agents in food production. Objective: Determine the relationship between the emergence of urinary tract infections' resistance causative agents to antibiotics in children aged up to 6 years in relation with animal origin nutrition of a child. Methods: Observational cross-sectional method was used to study the frequency of antibiotic resistance in bacteria triggering urinary tract infections in relation with children consuming animal products during the surveyed period. Results: Correlating the survey data on children's nutrition and laboratory tests of resistance in bacteria causing urinary tract infections in children, a statistically significant incidence of antibiotic resistant infections in children who consumed animal products (meat, milk, fish and eggs) was found. Resistance was found to: cefazoline in 26 (31%) patients (p = 0.008), cefuroxime axetil in 15 (18%) (p = 0.048), cefotaxime in 9 (11%) (p = 0.010), ceftazidine in 5 (6%) (p = 0.001), cefepime in 3 (3.5%) (p = 0.001), cefixime in 12 (14%) (p = 0.046) cefpodoxime in 17 (20%) (p = 0.025), to kanamycin 15 (18%) (p = 0.004), and to ciprofloxacin in 2 (2.3%) children (p = 0.018). Conclusions: The investigation found a statisticly significant link between the rate of antibiotic resistance in urinary tract infections triggerng bacteria and consumption of animal products. More stringent scrutiny of antibitic use in agriculture, veterinary practice and food industry is needed.
Keywords: bacterial resistance, antibiotics, children, food of animal origin.

1. INTRODUCTION

Since the emergence of bacterial strains resistant to antibiotics is typically tied to specific geographical areas, it is very important to know the sensitivity of some bacteria to antimicrobials in a

particular area, for the sake of application of the appropriate empiric treatment of certain infections [1, 2, 3, 4]. Antibiotic resistance of microorganisms varies according to geographical areas, and is directly proportional to the use and misuse of antimicrobial agents [5]. Understanding the impact of drug resistance is crucial because a changed rate of antibiotic resistance has a major impact on the treatment of infections [5]. Resistance of agents has important implications for clinical outcomes [6]. The antibiotic resistance of pathogens can result in delay in treatment which increasing the risk of disease progression, as well as increased health care costs as compared to infections caused by susceptible organisms [6].

Over the past 30 years, research has shown that the use of antimicrobials in animal nutrition of livestock production, encourages the development of resistant micro-organisms and subsequent expansion among humans [7]. Children, especially very young children, are at high risk of developing infections caused by microorganisms resistant to antibiotics, directly related to agricultural use of antimicrobial agents.

This applies particularly to the extraintestinal infections and disseminated diseases caused by intestinal pathogens including the urinary tract infections (UTI) [7].

It is necessary to legally regulate and sanction the control and supervision of the use of antibiotics in agriculture, veterinary medicine and food industry [8].

2. OBJECTIVE OF RESEARCH

Determine the relationship between the emergence of urinary tract infections (UTI) resistance causative agents on antibiotics in children aged up to six years in relationship with the child's nutrition comprising food originating from animals, as well as risk factors for the development of resistant infections.

3. PATIENTS AND METHODS

In the given study, the incidence of resistance of IMS bacterial pathogens in relation with child nutrition comprising animal originating food was investigated over the period surveyed. The investigation was done by virtue of observational-sectional method . Data on children nutrition were obtained by interviewing the parents or guardians of children subjected to the research. A questionnaire was designed for the survey.

The questionnaire included the data on the diet of the child over the last six months. Personal data of respondents and the number of microbiological findings with antibiogram were excluded.

3.1. Research period

The survey was conducted during the period from 1.1. 2012 - 30.6. 2012.

3.2. Research site

The survey was conducted among children aged up to six years, who were treated in the Department of preschool and school children of the Health Centre Zenica.

4. RESULTS

4.1. The frequency of resistance of isolated pathogens to specific antibiotics

The most frequently isolated pathogens was *E. coli.* at 61.1% (93) of children, and the least isolated was ESBL-producing *K. pneumoniae,* ESBL-producing *Citrobacter freundii* and *Enterobacter cloaca* at 0.7% (1) of children.

Out of 26 antibiotics in total, the highest incidence of resistance of the isolated pathogens was determined on ampicillin at 86.8% (131) of children and the smallest resistance of pathogens to imipenem at 1.9% (3) of children.

4.2. Resistance of IMS pathogen to antibacterial medications in relation to nutrition with foods of animal origin

While analyzing the survey data on children's nutrition, we found a statistically significant occurrence of resistance of UTI pathogens in children consuming animal products (meat, milk, fish and eggs) to cefazolin in 26 ($p = 0.008$) children, cefuroxime axetil in15 ($p = 0.048$), cefotaxime in 9 ($p = 0.010$), ceftazidime in 5 ($p = 0.001$), cefepime in 3 ($p = 0.001$), cefixime in 12 ($p = 0.046$), cefpodoksin in 17

(p = 0.025), kanamycin in15 (p = 0.004), and ciprofloxacin in 2 (p = 0.018) children. Resistance of *E. coli* was significantly corelated to consumption of animal products to cefalexin in 20 (p = 0.044) children, norfloxacin in 3 (p = 0.007), cinoxacin in 6 (p = 0.003) and in one child to ceftazidime (p = 0.032), cefepime (p = 0.003) and nitrofurantoin (p = 0.32).
Resistance of ESBL producing *E. coli* was statistically significantly associated to nutrition with animal food to cefepime in one child (p = 0.025). There was a significant occurrence of resistance of *P. vulgaris* in children who used in their nutrition food of animal origin (meat, milk, fish and eggs) to gentamicin in one (p = 0.011) child and doksacilin in two (p = 0.038) children.
Resistance of *P. mirabilis* was statistically significantly associated with nutrition of animal foods to nitrofurantoin at 6 (p = 0.048) children.

5. DISCUSSION

The aim of this study was to determine the most common bacterial pathogens of urinary tract infections in children of preschool age, to determine the incidence of antimicrobial resistance of isolated pathogens, overall and each of the isolated pathogens, and to examine the factors involved in the emergence of resistance. In this study that encompassed 84 children, whose nutrition included food originating from animals (meat, eggs, milk, fish), a statistically significant correlation with the occurrence of resistance of pathogens to cephalosporins, kanamycin, norfloxacin and ciprofloxacin was ascertained. The presence of antibiotics in food contributes to increasing resistance of pathogens to antibiotics [8].
Antibiotics (tetracycline, fluoroquinolones, gentamicin) are used for incitement of growth, disease prevention and treatment of infections in livestock and poultry [8]. The first approval of the use of antibiotics by the US Food and Drug Administration (FDA) in the early fifties was introduced with the aim of accelerating the growth of livestock, shorter time of fattening and cost reduction of manufacturers [7]. The use of fluoroquinolones was approved ten years ago in animal originating nutrition in the United States [7].
The fact that around the world larger amounts of antibiotics are used in healthy animals than for treating sick people, is cause for great concern [9]. In the last 10 -15 years a multiple increase in resistance of IMS pathogens in the US and Europe to cephalosporins, sulfonamides, streptomycin, ampicillin, carbenicillin and lately to quinolones was established [7, 8]. The presence of antibiotics in food originating from animals contributing to increasing resistance of bacteria to antimicrobial drugs in China, the use of antibiotics in poultry production has contributed to the development of resistance to Tetracycline, etc. [7].
Since tetracycline and chloramphenicol have not been used in the treatment for almost 10 years for the treatment of human infections in children, the emergence of resistance is associated with their consumption in the nutrition of poultry and chicken treated with antibiotics, which enter the human food chain [8]. Dr. George Khachatourians believes that the use of antibiotics in agriculture has a significant impact on the resistance of human pathogens, as well as the transmission of resistant pathogens through the food chain [10].

6. CONCLUSIONS

The rate of resistance to pathogens was significantly associated with children's nutrition related to the food originating from animals, while in the cases in which the children were exclusively breastfed, the prevalence of resistance was lower. This is also the case with the children whose mothers took antibiotics.

7. LITERATURE

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