SUMMARY

Urinary tract infections (UTI) are one of the most common bacterial diseases among children and adolescents and a frequent cause of hospitalization in this age group. *Escherichia coli* is the most common etiological factor of UTI. Proceeding in accordance with the current medical knowledge regarding the treatment of UTI allows to prevent complications that may lead to nephrological and cardiovascular disorders. On the other hand, irrational and overused antibiotic therapy causes an alarming increasing trend in the percentage of bacterial strains resistant to antibiotics, including multidrug – resistance. Therefore, systematic analysis of UTI etiological factors and their sensitivity to antibiotics seems justified.

The aim of the study was retrospective assessment of the antibiotic sensitivity and the incidence of microbes isolated from urine samples of patients hospitalized because of UTI in the Department of Paediatrics and Nephrology (Children's Clinical University Hospital, Białystok) in 2010-2017.

The following analyzes were among the partial goals of the study:

1) Statistical analysis of anthropometric, individual, social and biochemical parameters of the group of patients included in the study.
2) Evaluation of the frequency of uropathogens in urine cultures.
3) Evaluation of the sensitivity of microorganisms to the most commonly used antibiotics and chemotherapeutics.
4) Evaluation of the increasing/decreasing trend of the susceptibility of microorganisms to antibiotics over the years covered by the study.
5) Evaluation of the dependence of bacteria sensitivity to antibiotics on the value of inflammatory markers.

The study included a group of 525 children with a total of 627 episodes of UTI. Anthropometric measurements, blood laboratory tests (blood counts, levels of inflammatory markers and serum creatinine) and general and microbiological urine tests were performed in the patients.

On the basis of performed statistical analyzes, it was demonstrated that *Escherichia coli* is still the most frequent etiological factor of UTI (72.7%) with a higher incidence in girls than in boys (p=0.001). In addition, the high percentage of *Pseudomonas aeruginosa* was reported in unburdened children (5.8%) and more than twice as high in patients with urinary tract defects (12.5%). The most frequently used antibiotic therapy in the first – line treatment was based on cefuroxime (37.8%), amoxicillin with clavulanic acid (25.85%) and ceftazidime (14.38%). The highest

percentage of bacterial resistance was observed in case of ampicillin (49.19%) and amoxicillin with clavulanic acid (29.60%). The analysis showed a statistically significant increase in microbial resistance to antibiotics over the years covered by the study ($p < 0.001$). In the entire study group, a statistically significant increase in bacterial resistance to amoxicillin with clavulanic acid, piperacillin with tazobactam, cefotaxime, ceftazidime, cefepime, gentamicin and ciprofloxacin was noted. In contrast, an increase in sensitivity was observed with nitrofurantoin. In children with urinary tract defects, a statistically significant increase in resistance was demonstrated for ampicillin, amoxicillin with clavulanic acid, piperacillin with tazobactam, cefotaxime, ceftazidime, cefepime, amikacin, ciprofloxacin and norfloxacin. Among patients receiving chemoprophylaxis of UTI, an increasing antibiotic resistance in amoxicillin with clavulanic acid, piperacillin with tazobactam, cefotaxime, ceftazidime, cefepime, amikacin, gentamicin, ciprofloxacin, norfloxacin and co – trimoxazole was reported. However, in the group of children with a history of recurrent UTIs, a statistically significant increase in resistance was observed in relation to amoxicillin with clavulanic acid, piperacillin with tazobactam, cefalexin, cefotaxime, ceftazidime, cefepime, amikacin, ciprofloxacin, norfloxacin and co – trimoxazole. In this study, an analysis of the differences in the values of inflammatory markers depending on the sensitivity status of the most frequently isolated bacteria (*E. coli*) was also undertaken. In the case of confirmed resistance to ampicillin, cefuroxime and nitrofurantoin statistically significantly lower WBC values were observed than in the case of the sensitive strains. Moreover, higher levels of CRP were observed in patients with isolated cefuroxime and nitrofurantoin sensitive *E. coli*. According to the CART method we were managed to estimate C – reactive protein (CRP), procalcitonin (PCT) and white blood cells (WBC) values, in which antibiotic sensitivity of *E. coli* was observed. In children with CRP > 97.91 mg/L, a high percentage of bacteria sensitive to amoxicillin with clavulanic acid was found (87.5%). A count of WBC > 14.45 K/µL was associated with more frequent isolation of bacteria sensitive to ampicillin (63.2%). In addition, 100% of study participants with CRP > 0.42 mg/L and PCT ≤ 6.92 ng/mL were susceptible to cefuroxime in the antibiograms. In the case of gentamicin, the optimal cut – off point suggesting obtaining of susceptible strains of *E. coli* was determined at the level of WBC > 7.80 K/µL (98.74%), while for nitrofurantoin it was the value of CRP > 0.11 mg/L (98 5%).

On the basis of the obtained results, the following conclusions were made:

1) The most common etiological factor of UTI still remains *Escherichia coli*, responsible for almost ¾ of all urinary infections, while at the same time an increase in the incidence of *Pseudomonas aeruginosa* in urine samples was noted.
2) In recent years, the unwanted trend of increasing bacterial resistance to antibiotics has been observed.
3) Incorrect classification of lower urinary tract infection as acute pyelonephritis and the use of an antibiotic instead of a chemotherapeutic in this case promotes increasing antibiotic resistance and may also be associated with the observed increase in sensitivity to nitrofurantoin.
4) The increasing percentage of strains resistant to higher generation antibiotics, e.g. III and IV generation cephalosporins, is alarming.
5) Knowing the values of inflammatory markers, there is a chance to initially assess whether the bacterium will be sensitive to used antibiotic and predict empiric antimicrobial treatment, until urine culture will be available. However, further studies are necessary to confirm the obtained results.