Evaluation of Antibiotic Resistance in Pediatric Urinary Tract Infection in Shahid Beheshti University Hospitals During 2016-2017

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Abstract

Background and Aim: Urinary tract infection (UTI) is one of the most common and important childhood diseases that may lead to complications such as acute pyelonephritis, renal scaring, and renal failure if not diagnosed and treated properly. The antibiotic resistance rate has increased recently because of unnecessary antibiotic consumption. In order to prescribe an appropriate drug as empirical therapy, it is necessary to know the prevalence of pathogens causing UTI and their antibiotic resistance rate in the community. Therefore, this study was conducted to present an appropriate guideline for UTI empirical therapy through evaluating the rate of antibiotic resistance in a sample of hospitalized patients suffering from UTI.

Methods: This retrospective descriptive analytical study was conducted in 130 children with UTI whose medical records included antibiogram results in hospitals affiliated with Shahid Beheshti University during 2016-2017.

Results: Of 130 patients, 73.07% were girls and 26.92% were boys. About 50% of the patients were under one-year-old, 33.07% were 1-3 years old, and 16.15% were over 3 years old. The detected pathogens were E. coli in 63.07%, Enterococcus in 14.61%, Klebsiella in 13.07%, Pseudomonas aeruginosa in 5.38%, and Enterobacter in 3.84%.

Conclusion: Based on the data of the present study, ampicillin, co-trimoxazole and first-generation cephalosporins are not appropriate for UTI empirical therapy.

Keywords: Antibiogram; Antibiotic resistance; Urinary tract infection.

Introduction

Urinary tract infection (UTI) is one of the most common important diseases in children (1). About 8% of girls and 2% of boys develop a UTI by 11 years old (2). Boys comprise about 75% of the infants under 3 months with bacteriuria while this rate decreases to 10% within 3 to 8 months. After 1 year, UTI may occur in healthy girls (2).

The main organism causing UTI is E.coli, which is responsible for 90% of the cases; other organisms include staphylococcus, klebsiella, enterococcus, proteus and citrobacter (3).

UTIs may lead to kidney scarring, hypertension, and chronic kidney diseases if not diagnosed and treated properly; therefore, starting empirical therapy is recommended in the first 72 hours to prevent complications (3, 5, 7).

Due to an increased antibiotic resistance in UTI organisms, empirical therapy should be prescribed based on antibiotic resistance in the community and E.coli should be covered as the main organism (5). Previous studies have shown that E.coli is resistant to ampicillin and amoxicillin in 60% of the cases and the rate of resistance to antibiotics such as first-

generation cephalosporins, co-trimoxazole, co-amoxiclav, and ampicillin-sulbactam has an increasing trend. Therefore, it currently seems that an appropriate empirical therapy should include a third-generation cephalosporins and aminoglycosides (8).

Methods

The data of this retrospective descriptive analytical study were collected from registered records of patients in the hospitals affiliated with Shahid Beheshti University of Medical Sciences.

Infants and children diagnosed with UTI in Shahid Beheshti university hospitals during 2016-2017 whose antibiogram results were available in their records were included in the study.

Exclusion criteria were lack of antibiogram results, growth of more than one colony, and probability of sample contamination due to incompatibility with clinical or laboratory findings. According to urine culture and antibiogram results, the type of pathogen(s) causing UTI and the antibiotic resistance for each of them were recorded. Finally, the data were analyzed and the resistance rate of the identified pathogens against each common antibiotic was calculated.

Results

One hundred and thirty subjects were investigated in this study, of whom 95 (73.07%) were girls and 35 (26.92%) were boys. About 50 % of the patients were under one-year-old, 33.07% were 1-3 years old, and 16.15% were over 3 years old.

The detected pathogens included E.coli in 82 (63.07%), Enterococcus in 19 (14.61%), Klebsiella in 17 (13.07%), Pseudomonas aeruginosa in 7 (5.38%), and Enterobacter in 5 patients (3.84%).

For E.coli, as the most common pathogen, the highest resistance rates were related to cefazolin (64.63%), co-trimoxazole (60.97%), ampicillin (59.75%), and cefotaxime (59.75%).

The highest resistance rates for all pathogens were seen in ampicillin (59.22%), cefazolin (55.38%), cefotaxime (51.53%), ceftazidime (47.68%), co-trimoxazole (46.91%), and ceftriaxone (41.53%) (Table 1).

Table 1. Antibiotic resistance rate based on the organism causing UTI

Organism / Antibiotics	E.coli N=82	Enterococcus N=19	Klebsiella N=17	Pseudomonas N=7	Enterobacter N=5	Total N=130
Ciprofloxacin	26.82%	100%	41.17%	-	-	-
Cefazolin	64.63%	-	70.58%	28.57%	100%	55.38%
Ceftazidim	56.09%	-	64.7%	28.57%	60%	47.68%
Cefotaxime	59.75%	-	70.58%	28.57%	80%	51.53%
Ceftriaxone	46.34%	-	58.82%	28.57%	80%	41.53%
Cefepime	42.68%	-	47.05%	14.28%	20%	34.61%
Ampicillin	59.75%	89.47%	47.05%	14.28%	40%	59.22%
Co-trimoxazole	60.97%	-	41.17%	42.85%	20%	46.91%
Gentamycin	32.92%	78.94%	29.41%	14.28%	60%	39.22%
Amikacin	9.75%	-	35.29%	28.57%	40%	13.84%
Tobramycin	-	-	5.8%	28.57%	-	-
Imipenem	-	-	23.52%	-	-	-
Meropenem	-	-	23.52%	28.57%	-	-
Vancomycin	-	73.68%	-	-	-	-

Discussion

In the present study, E.coli was the most common pathogen causing UTI (63.07%) followed by Enterococcus and Klebsiella.

For E.coli, as the most common pathogen, the highest resistance rates were seen in cefazolin (64.63%), co-trimoxazole (60.97%), ampicillin (59.75%), and cefotaxime (59.75%), while the lowest resistance rates were related to amikacin (9.75%), ciprofloxacin (26.82%), and gentamycin (32.92%).

In 2014, Puladfar and colleagues conducted a study in 202 children with UTI aged 2 months to 18 years in Namazi Hospital, Shiraz, Iran. The results showed that the most common organisms in the urine culture of these patients were E.coli in 51.5%,

Klebsiella in 16.8%, and Enterococcus in 9.9% of the cases. The overall resistance rate to antibiotics was 81.2% for ampicillin and 79.2% for co-trimoxazole, and the sensitivity rate was 90.1% for imipenem and 65.3% for gentamycin (9).

Rezaei and colleagues conducted a 5-year study in hospitals affiliated with Tabriz Medical University and found that the prevalence of UTI was 3.6% in children and the prevalence of UTI organisms was as follows: E.coli 71.4%, Klebsiella 9.6%, Enterococcus 6.4%, Pseudomonas aeruginosa 4.2%, Serratia 4.2% and Enterobacter 4.2%. The rate of antibiotic resistance against E.coli was as follows: nitrofurantoin 11%, ciprofloxacin 15%, lalidixic acid 25%, and amikacin, gentamycin, ceftriaxone, ceftizoxime, cefotaxime, and co-trimoxazole 30% to 75%. The most active and effective antibiotics against gram positive and negative organisms were amikacin followed by ciprofloxacin. Moreover, the results showed that co-trimoxazole and third-generation cephalosporins were not appropriate for empirical therapy for children of this region (13).

Kocak and colleagues found that the prevalence of UTI with ESBL (+) bacterial strains with multi-drug resistance had an increasing trend in the hospitalized pediatric population (14). Marzouk and colleague collected 1234 positive urine cultures from the community. The results showed that the resistance rate of Enterobacteriaceae to beta-lactam antibiotics was high, especially in the neonatal population. The production of extended-spectrum beta-lactamase (ESBL) was noted in 12.8% of pediatric Enterobacteria vs. 22.6% of the neonatal strains. For community Enterobacteriaceae, the activity of beta-lactam antibiotics was limited with 11.2% resistance to third-generation cephalosporins, including 8.6% ESBL production (15).

Cullen and colleagues studied 38,530 positive urine samples in the community of which 23,838 (56.7 %) were positive for E. coli as the infecting organism. Ampicillin and trimethoprim were the least active agents against E. coli with mean 11-year resistance rates of 60.8 and 31.5%, respectively. A significant resistance was identified against trimethoprim, co-amoxiclav, cefuroxime, and gentamicin over the 11-year period. Higher antibiotic resistance rates were identified in the male population and in children (16).

Echeverri and colleagues found that E. coli had a high resistance rate against TMP SMX and ampicillin-sulbactam (17).

Conclusion

Considering the results of the present research, which are consistent with other studies, and the fact that E.coli is the most common organism causing UTI, first-generation cephalosporins, ampicillin and co-trimoxazole are not recommended for UTI empirical therapy due to the high antibiotic resistance rate.

Conflict of Interest
The authors declare no conflicts of interest.

Authors Contributions
Not declared.

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