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Distribution of microorganisms and antibiotic resistance in children with urinary tract infections: Retrospective case series

Çocuklarda idrar yolu enfeksiyonlarında mikroorganizmaların dağılımı ve antibiyotik direnci değerlendirmesi; Retrospektif vaka serisi

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Abstract

Aim: Urinary tract infection is one of the most common serious bacterial infections in children. Due to regional differences and past infections, the use of antibiotics has problems such as variability in microorganisms and antibiotic susceptibility. In this study, we aimed to determine the microorganisms detected in urinary tract infections in children and their antibiotic resistance status.

Methods: A retrospective observational study was planned. Demographic data, urine microscopy and urine culture results of patients who were hospitalized with urinary tract infection diagnosis in our pediatric clinic at hospital were recorded retrospectively through hospital automation system. The first culture results of the patients were used in the evaluation of the data.

Results: In the study group of 112 patients, Escherichia coli (E. coli) and Klebsiella were the most identified microorganisms in patients with urinary culture. Under 2 years old, Klebsiella was more frequent, and at 2 years of age there was a noticeable increase in the frequency of E. coli. The most common resistance of both microorganisms was found to be ampicillin.

Conclusion: Regional infectious agents and antibiotic resistance should be revised at regular intervals, appropriate empiric therapy should be considered. Thus, is predicted that the chance of success in treatment will increase and the speed of resistance development will decrease.

Keywords: Antibiotic resistance, Urinary culture, Urinary tract infection

Öz

Amaç:İdrar yolu enfeksiyonu çocuklarda sık görülen ciddi bakteriyel enfeksiyonların başında gelir. Bölgesel farklılıklar ve geçirilmiş enfeksiyonlar nedeniyle antibiyotik kullanımı beraberinde mikroorganizmalarda ve antibiyotik duyarlılığında değişkenlikler gibi sorunlar taşımaktadır. Bu çalışmada çocuklarda idrar yolu enfeksiyonlarında saptanan mikroorganizmaların ve bunların antibiyotik direnç durumlarının belirlenmesi amaçlanmıştır.

Gereç ve yöntem:Retrospektif gözlemsel bir çalışma planlandı. Hastanemiz çocuk kliniğinde 2013 yılında idrar yolu enfeksiyonu tanısı ile yatarak tedavi gören hastaların demografik verileri, idrar mikroskopileri ve idrar kültür sonuçları, retrospektif olarak hastane otomasyon sistemi üzerinden taranarak kayıt altına alındı. Verilerin değerlendirilmesinde hastaların ilk kültür sonuçları kullanıldı.

Bulgular:112 hastadan oluşan çalışma grubunda, idrar kültüründe üreme olan hastalarda en sık tespit edilen mikroorganizmalar Escherichia coli (E. coli) ve Klebsiella oldu. 2 yaş altında Klebsiella daha sık görülürken 2 yaş üstünde belirgin oranda E-coli sıklığı göze çarpmaktaydı. Her iki mikroorganizmanın da en sık direnç geliştirdiği antibiyotiğin ise ampisilin olduğu tespit edildi.

Sonuç:Bölgesel enfeksiyon etkenleri ve antibiyotik dirençleri belli aralıklarla gözden geçirilmeli, uygun ampirik tedaviler değerlendirilmelidir. Böylece tedavide başarı şansının artacağı ve direnç gelişim hızının azalacağı ön görülmektedir.

Anahtar kelimeler: Antibiyotik Direnci, İdrar Kültürü, İdrar Yolu Enfeksiyonu

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Introduction

Urinary tract infections (UTI) are very important because of being second most common infectious disease in children. Incidence is reported as 3-28/1000 in girls and 1.5-7/1000 in males [1]. UTI in childhood is a significant risk for the development of hypertension and renal failure in the advanced periods [2]. In Turkey, chronic renal failure due to recurrent UTI still plays an important role [3]. Especially, first infectious attack of under 2 years old, increases the incidence of scar in every new infection. The aim of the treatment is to prevent damage of the kidney parenchyma. For this reason, early diagnosis and correct treatment of UTI in children is very important [4].

The most reliable method we use in the diagnosis is the urine culture taken in sterile environment. But empirical antibiotic therapy may be required based on clinical diagnosis, especially in country-sides and primary care outpatient clinics when urine cultures cannot be performed [5-7]. The most important factors to consider in empirical treatment are the choice of the most appropriate antibiotic against the most common causes seen at UTI the most important issue at this stage is emerging antibiotic resistance. The widespread and inappropriate use of antibiotics also plays an important role for the increase of this resistance. Most of the studies so far observe that the frequency *Escherichia coli* (*E. coli*), the Gram (-) bacteria in UTI drawing attention at the first line [8]. The high rate of recurrence as well as frequent increases the importance of the treatment of the disease [9]. In this study, we aimed to determine the microorganisms that cause the most common childhood UTI and to determine the resistance they developed against antibiotics.

Material and methods

121 cases have been diagnosed as inpatient with the diagnosis of urinary tract infection in 2013 years at the pediatric clinic of the local tertiary hospital. nine cases of missing data were excluded from the study and 112 cases were enrolled. Demographic data of patients, urine microscopy, urine culture results and antibiotic results were retrospectively scanned through the hospital automation system. The first cultural results of the patients were used in the evaluation of the data. Predisposing causes of the underlying UTI were not considered, and such patients were included in the study.

Fisher's exact test was used for descriptive statistics and comparisons in the analysis of the data obtained in the study. It was statistically significant that the p value was less than 0.05.

Results

During the study period, after 9 cases have missing data were excluded from the study, study group was created with 112 cases. 75 (41.6%) of the cases were female, 37 (33.1%) were male and the average age was 2.32±3.37. In total 68 cases' urine cultures, microbial growth was observed. Frequently detected microorganisms were *E. coli* % 41.1 (n:45) and *Klebsiella* % 26.4 (n:18). Other factors *were Enterobacter*(n:2),

Pseudomonas (n:2), *Candida* (n:1). In patients under two years of age, *E. coli* was detected at the rate of 57% (n:28) and *Klebsiella* was detected at a rate of 34% (n:17). In patients, over two years of age, these rates were 89% (n:17) and 5% (n:1). After statistical evaluation, *Klebsiella* was found more frequently in patients younger than two years old and *E. coli* was found more frequently in patients older than two years old (p=0.014, p=0.011). When the antibiograms were evaluated, the antibiotic resistance rate of *E. coli* was 64.4% for ampicillin, 46.6% for trimethoprim-sulfomethoxazole and 28.8% for amoxicillin-clavulanate. The antibiotic resistance rate of *Klebsiella* was 66.6% for ampicillin, 33.3% for amoxicillin-clavulanate and 33.3% for nitrofurantoin. No resistance was detected to the selected *E. coli* and *Klebsiella* cases in which observed the antibiotics meropenem, imipenem and amikasin.

Discussion

UTI, especially in early childhood, if not treated with appropriate antibiotics, can lead to serious problems such as hypertension and renal failure in the coming period. In this sense, UTI still remains a very important health problem in children [10]. In our study, *E. coli* was detected at the rate of %66.1 as the most frequent UTI in children. Many studies on this subject also support our study [11-13]. The second most common cause was *Klebsiella* (26.4%). Although many publications in the literature supported this finding, *Enterococcus* and coagulation negative staphylococci were seen more frequently than *Klebsiella*, as the second most frequent factor in a study conducted by Güneş et al [14]. Following *E. coli* and *Klebsiella*, *Proteus* was frequently seen in the study conducted by Güner et al. [15]. However, in our study, Proteus was not observed, *E. coli* and *Klebsiella* were followed by *Enterobacteriacea*, *Pseudomanas* and *Candida*, respectively. In addition, during the statistical evaluation of our study, it was determined that the incidence of *Klebsiella* in children younger than 2 years old is higher than the children older than 2 years old even though *E. coli* is still the most common factor in children under 2 years old.

Although the most frequent factors in UTI are *E. coli* and there are numerous effective antibiotic groups that can be used against *E. coli*, inveteracy, recurrence or renal damage could not be completely eliminated in this infection. This is due to a variety of factors belonging to the host and microorganism, as well as the resistance to antibiotics [16-18]. The rate of ampicillin resistance of *E. coli*, which is the most common factor in the evaluation of antibiograms, is 64.4%. This is followed by trimethoprim-sulfomethoxazole with 46.6% and amoxycillin-clavulanate with 28.8%. In another study by Ekim et al. [19], the first two antibiotics developed resistance were found to be compatible with our findings, and also tobramycin, amikacin, cefixime and ceftriaxone resistances are detected at important rates. In our study, we see that the second most frequent factor, *Klebsiella* develop maximum resistance to the ampicillin with the ratio % 66.6. This was followed by amoxicillin-clavulanate with 33.3% and nitrofurantoin with the ratio 33.3%. However, both factors have not been detected resistance against the amikacin in our study.

Especially due to sociocultural conditions, the patients who treated without urinary culture cannot be followed up in primary health care centers. This situation increases the importance of selecting sensitive antibiotics in empirical

treatment. In certain periods, it is important to re-evaluate these agents and resistance developments, to update treatments and to apply the right treatment. For example, in a large-scale and comparative study conducted by Cetin et al. in 2006, attention was paid to the increased resistance to trimethoprim-sulfametaxazole, one of the commonly used agents, emphasizing that this agent should not be used in empirical therapy [20].

The data obtained in our study supports the literature information. In addition, antibiotics, such as meropenem, imipenem, which have not yet been detected for resistance, have been looked at in selected cases. There was no resistance to these antibiotics in *E. coli* and *Klebsiella* antibiograms. This finding is important and gratifying because it expresses that we still have strong weapons in the treatment of UTI that are important in children. Furthermore, avoiding the inappropriate use of these antibiotics is another interpretation that should be evaluated to prevent resistance development.

Although the importance of patient awareness about the use of antibiotics has recently been emphasized, the right choice of antibiotics by physicians in appropriate infections is particularly important in infections requiring empirical treatment, especially like in children with UTI. Our study aims to show guidance and update the current information in this election. The treatment scheme should be shaped according to the most frequent factors of the disease and the drugs susceptible to this effect.

It has also been observed in our study that *E. coli* and *Klebsiella* are still the most common causes of childhood UTI, ampicillin and trimethoprim-sulfamethoxazole resistance of these agents are high. Therefore, these two agents should not be preferred in the empirical treatment of UTI.

Also, given the potential complications of the disease, the antibiotic is an important helper because it still retains the importance of sensitivity in the determination. Therefore, after empirical treatment, if possible, effective treatment with urine culture and antibiogram should be determined and suitable antibiotic usage should be provided. If the necessary laboratory is not possible, the most appropriate empirical treatment should be determined, followed by importance.

As a result; when considering the above-mentioned situations, the selection of empirical treatments and the use of prophylactic antibiotics should be reevaluated. Urinary infections should be monitored with urine cultures if possible, and should be given direction with urine cultures in the treatment and prophylaxis. In cases where this is not possible, the most accurate treatment and follow-up plan should be determined with current literature information.

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