Etiologies and Antibiotic Resistance Patterns in Infants With Urinary Tract Infections Hospitalized in Children Medical Center, Rasht, Iran

Fatemeh Aghamahdi*, Houman Hashemian, Masumeh Shafiei, Zahra Akbarian, Maryam Rostam Nejad, Morteza Fallah Karkan

Department of pediatrics, Medicine Faculty, Guilan University of medical science, Rasht, Iran

Abstract

Introduction

Urinary tract infection (UTI) is one of the most common infections in childhood. Appropriate treatment of UTI requires to knowledge about antibiotic resistance patterns of common uropathogens. The aim of this study was to determine demographic, symptoms, signs and antibiotic resistance pattern in admitted infants with clinically diagnosis of UTI in 17 Shahrivar Hospital of Rasht

Materials and Methods

This retrospective study was performed on 77 patients less than 2 years old from March 2006 to march 2011. They were admitted with clinical diagnosis of UTI and posilive. Urine cultures data (demographic, symptoms, signs and the results of urine analysis and urine cultures) were analyzed by SPSS and Chi-squart

Results

From 77 patients, 53.2% were female, with mean age of 8.07 ± 6.84 months. The most common symptom was fever(48.1%) vomiting and diarrhea were second and third prevalent symptom. 18.1% had leukocytosis and CRP was positive in 67.3%. Leukocyturia in 58.4% and hematuria in 19.5% of them were seen. The most common agent was E coli (59.7%) followed by Klebsiella and Enterobacter (14.3%) and Coagulase negative Staphylococcus (5.2%). Isolated pathogens were resistance to ampicillin (94.1%), amoxicillin (88.9%), cefalexin (70.5%), co-trimoxazole (66.7%), cefixime (75%). This antibiotic resistance was less for nalidixic acid (37%), ceftriaxone (20%), aminoglycosids (24.6%), nitrofurantoin (22.4%) and ciprofloxacin (14.8%).

Conclusion

Ecoli was the most frequent pathogen in our study. Resistance to all antibiotics used to treat UTI was common. Due to the low sensitivity of ampicillin, amoxicillin, cefalexin and co-trimoxazole, use of them is not recommended for the treatment of UTI. It seems that the best choices include ceftriaxone, aminoglycosids, nalidixic acid, and nitrofurantoin

Key words

Urinary tract infection, Antibiotic resistance, children, Rasht

* ***Corresponding author, Email:*** *aghamahdi79@yahoo.com*

Introduction:

Urinary tract infection is one of the most common bacterial infections in childhood that occurs in 1-3% of girls and 1% of boys. The prevalence of UTIs varies with age. During the first year of life, the male-female ratio is 2.8-5.4: 1. Beyond 1-2 yr, there is a female preponderance, with a male: female ratio of 1: 10. In boys, most UTIs occur during the 1st yr of life; UTIs are much more common in uncircumcised boys, especially in the 1st year of life[1].

Gram negative enteric bacillus, especially *Escherichia coli* and *klebsiella spp*. are the leading pathogens. *Proteus spp*, *Staphylococcus saprophyticus* and *Enterococcus* are other pathogens that can cause UTI [1,2,3].

These microorganisms present different susceptibility patterns to antimicrobial agents, which vary according to the place where the study is performed and also over time. Nowadays, antibiotic resistance has become an increasingly pressing problem in many countries [4,5].

So the aim of this study was to assess demographic, signs, symptoms and especially susceptibility of urinary pathogens to commonly used antibiotics in children admitted with UTI in five –year period in our center.

MATERIAL AND METHODS:

From March 2006 to March 2011 in 17 Shahrivar Hospital, Rasht, Iran, We found 195 cases that were admitted clinically with UTI. The result of urine cultures that were performed in the hospital was positive in 77 of them. So we studied the files of these patients and recorded demographic data, symptoms, signs, past medical history and results of laboratory tests. The urine samples were taken by different methods (urine bag, catheterization or mead stream) according to age of patients and were sent to hospital laboratory. In our hospital laboratory urine analysis was performed by using a dip stick in fresh uncentrifuged urine. Microscopy for bacteria and pyuria was performed on a centrifuged urine specimen in all children. For urine culture each sample was inoculated with a 0.01 ml platinum loop onto blood agar and EMB agar plates. The plates were incubated at 37°C for 24 to 48 hours. Positive culture was defined if bacterial colony counts were more than 10^4 colony forming units/ ml of a single pathogen. All bacteria were identified by using direct smears and differential biochemical tests. Antibiotic susceptibilities were determined by disk diffusion method on Mueller Hinton agar.

Statistical analysis was performed by SPSS version 16 and using Chi Square test (P value of less than 0.05 was considered statistically significant).

RESULTS:

From 77 cases that had clinical and laboratory UTI, 53.2% were female and 46.8% were male, with mean age of 8.07 ± 6.84 month.18.1% of them were under 30 days and 81.8% more than 1 month to 2 years old. The most common symptom was fever and after that vomiting and diarrhea. 48.1% of patients had fever (T>37°C axillary) and 10.4% were ill. In past medical history, 10.4% had mentioned previous UTI and 10.4% had urinary system anomaly. 80.6% of boys were not circumcised. Leukocytosis was seen in 18.1% of patients. 67.3% of patients had positive CRP and the mean of ESR was 31.44+33.98. In urine analysis 17.5% had positive nitrite. On microscopy 51.9 % had bacteriuria (presence of bacteria in the urine) and 62.3% had pyuria (presence of ≥5 leukocyte in high power field of centrifuged urine). Ecoli was the most frequent bacteria in urine cultures (table-1). Table-2 shows bacterial sensitivity to common antibiotics used for treatment of UTI. There was a significant difference between the age group and gender. Most children under the age of 30 days were male and after that there was a female predominance (P=0.0005) (table-3). Only there was a significant difference between males and females about *Klebsiella* and it was frequent in males (P=0.012). *Enterobacter* (P=0.001), *Klebsiella* (0.012) and *E.coli* (0.001) was significantly related to age group and other uropathogens were not significantly in age groups.

Table 1: Frequency of bacterial pathogens isolated from urine cultures

Organisms	**Number**	**Percent (%)**
Escherichia Coli	46	59.7
Staphylococci spp	4	5.2
Klebseiella spp	11	14.3
Enterobacter spp	11	14.3
Proteus spp	1	1.3
Providensia spp	1	1.3
Neisseria gonorea spp	1	1.3
Pseudomonas spp	2	2.6
total	77	100

Table2: Antibiotic Susceptibility of bacterial pathogens isolated from urine cultures*

Antibiotics	Resistance (%)	Intermediate (%)	Sensitive (%)
Co-trimoxazole	38(66.7)	0(0)	19(33.3)
Nalidixic acid	20(37)	1(1.9)	33(61.1)
Nitrofurantoin	11(22.4)	6(12.2)	32(65.3)
Cefalexin	31(70.5)	3(6.8)	10(22.7)
Cefixime	3(75)	0(0)	1(25)
Ceftriaxone	1(20)	0(0)	4(80)
Cefotaxime	19(50)	0(0)	19(50)
Amoxicillin	8(88.9)	0(0)	1(11.1)
Ampicillin	48(94.1)	1(2)	2(3.9)
Ciprofloxacin	8(14.8)	2(3.7)	44(81)
Aminoglycosids	16(24.6)	5(7.7)	44(66.7)

*Antibiotic disks used for antibiograms were not similar, in the other words some disks were not used in some patients.

Table3: Correlation between age group and gender of patients with UTI

Gender / Age	Male		Female		Total		P Value
	Number	Percent	Number	Percent	Number	Percent	
Under 30 days	11	78.6	3	21.4	14	100	ChiSquare= 8.03 P= 0.005
1 month to 2 years	20	36.4	35	63.6	55	100	
total	31	38.8	38	61.2	77	100	

Discussion:

As expected, UTI was more frequent in females and in both sexes it was more common in infancy like many studies have been done before [1,6-8]. In our study, only 20% of boys with UTI were circumcised. As already proven, uncircumcised boys are at risk of UTI[1,9,10]. Moreover 78.6% of neonates were boy (P=0.0001). One study in Sweden revealed that most of infections in neonates occurred among males, but after six month of age, most of infections were seen in females [11].In Naseri's study, UTI was more common in boys with age less than one month and in girls above 6 years old [8]. Therefore male gender is a risk factor for UTI in neonatal period.

Urine culture is a gold standard test for diagnose of UTI but pyuria was seen in more than 80% of positive cultures, so it can help us to diagnose UTI before culture results are available. This agrees with Gorelick and Hoberman's opinion that pyuria is a predictor of UTI [12,13].

Ecoli was the most causative organism responsible for 66.3% of urinary tract infections. The results of this study are in agreement with previous findings [1,5-7,14-18].To choose the best empiric antibiotic for treatment of UTI, we need to know antibiotic sensitivity pattern of common bacterial causes of UTI. In our study,95% of urinary pathogens were resistance to ampicillin and 69.4% to co-trimoxazole but resistance to aminoglycosids (amikacin or gentamicin), ceftriaxone and ciprofloxacin was much less. Kumamato in 2000 in Japan revealed that most of *Ecolies* were sensitive to ampicillin and co-trimoxazole[19]but this bacterium showed high rates of resistance to these antibiotics in other places [4,7,17,18,20-22]. In addition antibiotic susceptibility is changing over time [5]. A possible cause of increased resistance might be widespread and inappropriate use of antibiotics. To overcome this problem unnecessary antibiotic therapy should be limited.

In this study *Klebsiella* was significantly more frequent in males, in a study by Esmaeili *Klebsiella* was seen more in males than females but was not statistically significant[7]. Further investigations is needed to determine the cause of higher incidence of *Klebsiella* in boys.

We could not compare the in vivo and in vitro effectiveness of antibiotics in this study. We should remember that in vitro tests are only one fraction of the clinical scenario, yet the correlation between the test result and patient response is usually positive [23].

Finally to prevent the spread of antibiotic resistance, physicians should use them appropriately. We also recommend continuous monitoring of changes in bacterial pathogens causing UTI and antibiotic sensitivity in each area to improve the knowledge of physicians for effective treatment of urinary tract infections. It seems that the best choices for treatment of UTI in our region include ceftriaxone, aminoglycosids, nalidixic acid, and nitrofurantoin.

References:

1. Elder JS.Urinary tract infection. In: Kliegman, et al. Nelson Text book of Pediatrics.19th ed. Philadelphia, Saunders. 2011 Pp: 1829-34.
2. Taneja N, Chatterjee SS, Singh M, Singh S, Sharma M. Pediatric urinary tract infection in a tertiary care center from north India. Indian J Med Res 2010; 131:101-105.
3. Zorc JJ, Kiddoo DA, Shaw KN. Diagnosis and management of pediatric urinary tract infections. Clin Microbiol Rev 2005; 18(2): 417-22.
4. Goldraich NP, Manfroi A. Febrile urinary tract infection: Escherichia coli susceptibility to oral antimicrobials. Pediatr Nephrol.2002; 17: 173-176.
5. Catal F, Bavbek N, Bayrak O, Karabel D, Odemis E, Uz E. Antimicrobial resistance patterns of urinary tract pathogens and rationale for empirical therapy in Turkish children for the years 2000-2006. Int Urol Nephrol 2009; 41: 953-957.
6. Vaezzadeh F, Sharifi MK. Laboratory evaluation of urine culture and drug resistance in children clinically suspected of urinary tract infection. Iranian J. Publ. Health 2001; 30: 123-124.
7. Esmaeili M. Antibiotics for causative microorganisms of urinary tract infection. Iran J Pediatr 2005; 15(2): 165-173.
8. Naseri M, Alamdaran A. Urinary tract infection and predisposing factors in children. Iran J Pediatr 2007; 17: 263-270.
9. Esmaeili M. Decreased incidence of urinary tract infection in circumcised boys. Iran J Pediatr 2005; 15(3): 203-208.
10. Nayir A. Circumcision for the prevention of significant bacteriuria in boys. Ped Nephrol. 2001; 16(12): 1129-34.
11. Chen JJ, Mao W, Homayoon K, et al. A multivariative analysis of dysfunctional elimination syndrome and its relationships with gender, urinary tract infection and vesicoureteral reflux in children. J Urol. 2004; 171(5): 1907-10.
12. Gorelick MH, Show KN. Screening test for urinary tract infection: a meta-analysis. Pediatr J. 1999; 104: e 54.
13. Hoberman A, Wald ER, Reynolds EA, Penchanhasky L, Charron M. Pyuria and

bacteriuria in urine specimens obtained by catheter from young children with fever. Pediatr J. 1994; 24: 513-9.
14. Ayazil P, Daneshi M. Comparison of urine culture and urine dipstick analysis in diagnosis of urinary tract infection. Acta Medica Iranica. 2007; 45(6):501-504.
15. Khalili MB, Sharifi yazdi MK, Ebadi M, Sadeh M. Correlation between urine analysis and urine culture in the diagnosis of urinary tract infection in Yazd central laboratory. Tehran University Medical Journal. 2007; 65(9): 53-58.
16. Akram M, Shahid M, Khan AU. Etiology and antibiotic resistance patterns of community- acquired urinary tract infection in JNMC Hospital Aligarh. India Ann Clin Microbiol Antimicrob. 2007; 6: 4.
17. Sharma A, Shrestha S, Upadhyay S, Rijal P. Clinical and bacteriological profile of urinary tract infection in children at Nepal Medical College Teaching Hospital. Nepal Med Coll J. 2011; 13(1): 24-6.
18. Senel S, Karacan C, Erkek N, Gol N. A single- center experience of antimicrobial resistance patterns in pediatric urinary tract infection. Med Princ Pract. 2010; 19(5): 359-63.
19. Kumamato V, Tsukamoto T, Matsukawa M, et al. Comparative studies on activities of antimicrobial agents against causative organisms isolated from patients with urinary tract infections. Jpn J Antibiot. 2002; 55(6): 568-655.
20. Mazzulli T. Resistance trends in urinary tract pathogens and impact on management. J Urol. 2002; 168(4): 1720-2.
21. Borsari AG, Bucher B, Brazzola P, Simonetti GD, Dolina M, Bianchetti MG. Susceptibility of Escherichia coli strains isolated from outpatient children with community-acquired urinary tract infection in southern Switzerland. Clinical Therapeutics. 2008; 30(11): 2090-2095.
22. Haghi-Ashteiani M, Sadeghifard N, Abedini M, Soroush S, Taheri-Kalani M. Etiology and antibacterial resistance of bacterial urinary tract infections in children's medical center, Tehran, Iran. Acta Medica Iranica. 2007; 45(2): 153-157.
23. Fritzsche M, Ammann RA, Droz s, Bianchetti MG, Aebi C. Changes in antimicrobial resistance of Escherichia coli causing urinary tract infections in hospitalized children. Eur J Clin Microbiol Infect Dis. 2005; 24(3): 233-235