Short Communication

Microbial Sensitivity Pattern in Urinary Tract Infections in Children: A Single Center Experience of 1,177 Urine Cultures

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SUMMARY: Urinary tract infection is one of the most common diseases in children. Early diagnosis and comprehensive treatment can significantly decrease late serious complications. Knowledge of the sensitivity and resistance pattern of uropathogens in specific geographical locations is an important factor for choosing suitable antibacterial treatment. This study was conducted in order to evaluate the antibacterial resistance of urinary pathogens at Mofid Children’s Hospital between March 2000 and August 2001. Positive urine cultures from 1,177 children aged less than 12 years (mean age, 31.7 months; female to male ratio, 2:1) were studied. Cultures were performed on urine samples obtained by sterile urine bags in infants and midstream urine in older children; if samples were contaminated then a suprapubic sample was taken in infants. Sensitivity was measured by the disc diffusion method using the NCCLS protocol. The most prevalent urinary pathogen was Escherichia coli (666 cases, 56.6%). Overall, the lowest resistance rate of microorganisms was that against ciprofloxacin (6.7%) and the highest resistance rate was that against penicillin (83%). A comparison of these data with those of other countries shows that there is considerable geographic variation in bacterial patterns of sensitivity and resistance properties. Therefore, the selection of antibiotics for empiric therapy should be based on the sensitivity and resistance pattern of uropathogens in the respective city.

Urinary tract infection (UTI) is one of the most common infections in children. The reported incidence of UTI is 7.8% in girls (1-3), and up to 88% in transplant patients (4). UTI has great clinical significance due to its high acute mortality rate (20% in infants at the beginning of 20th century), malignant and chronic hypertension, and the chronic renal failure that follows chronic pyelonephritis (reflux nephropathy accounts for 7-30% of end stage renal failure in different countries). However, with the sophisticated antimicrobial agents, the mortality of UTI has been reduced to zero (5).

Early and effective antimicrobial therapy for UTI significantly reduces renal scars and their consequences, such as renal failure and hypertension (3). Miller and Phillips (6) have delineated the percentage of renal scars in relation to delay in treatment of acute pyelonephritis. Same as these data, Winberg et al. (7) reported that delayed treatment had serious consequences. According to their study, among 440 patients who received adequate treatment, only 20 (4.5%) developed renal scars; while among 41 patients with delayed therapy, 7 patients (17%) had renal scars.

Based on these data, in acute pyelonephritis and other serious conditions arising from UTI, we need to start empiric therapy. With appropriate treatment of acute pyelonephritis, the urine should be sterile after 24 h, fever should subside in 2-3 days, leukocyturia should disappear in 3-4 days, and C-reactive protein should become negative (<20 m/L) in 4 to 5 days (7). If these goals are not fulfilled, complicated UTI and inappropriate treatment – particularly resistance to antibiotics – should be considered.

As the emergence of resistant bacteria is growing worldwide, the choice of antimicrobial empiric therapy should be based on local experience of the resistance and sensitivity patterns. The aim of the study was to determine the local sensitivity pattern of microorganisms responsible for UTI based on our experience with childhood cases in our center. This cross-sectional study was conducted between March 2000 and August 2001 at the Mofid Children's Hospital in Tehran, Iran.

A total of 1,177 positive urine cultures of children under 12 (outpatients and inpatients) who had pyuria and/or hematuria, with signs and symptoms of UTI were studied. Positive urine culture was defined as more than 105 colony forming units (cfu)/ml of urine or more than 104 cfu of a single organism with pyuria or symptoms of UTI.

Cultures were performed on urine samples obtained by sterile urine bags in infants after disinfecting the perineum and midstream urine samples in older children; if equivocal results were obtained then a suprapubic sample was taken in infants or the test was repeated in older children and cultured immediately.

Pyuria and hematuria were defined as the presence of more than five leukocytes or erythrocytes per high power field (HPF) in centrifuged urine, respectively. The frequency of responsible microorganisms was recorded and the sensitivity and resistance patterns of these microorganisms was assessed by the disc diffusion method using the NCCLS protocol (Table 1). The definitions of sensitivity and resistance to the various antibiotics based on this protocol are listed in Table 1.

Among the 1,177 patients, 391 (33.2%) were males, 782 (66.4%) were females, and 4 neonates (0.3%) had ambiguous genitalia. At the time of diagnosis, the average age of the patients was 32 months (range, 1 - 12 years).

The microorganisms isolated from urine cultures were

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Escherichia coli in 666 (56.6%), Klebsiella in 133 (11.3%), Proteus in 105 (8.9%), Staphylococcus aureus in 39 (3.3%), Enterococcus in 37 (3.1%), Enterobacter in 27 (2.3%), Streptococcus in 24 (2%) including Streptococcus group A in 2, S. gamaemolyticus in 2, and S. viridans in 20, Citrobacter in 22 (1.9%), and other germs in 25 cases (2.1%) including Morganella in 15, Acinetobacter in 6, Providencia in 2, Edwardsiella in 1, and Corynebacterium in 1 case.

E. coli, the most common germ producing UTI, had a sensitivity rate of 97.8% to ceftriaxone, 95.8% to ceftizoxime, and 95.2% to cefotaxim. In the present study, the highest resistance rate of this germ was to penicillin (95.2%), followed by amoxicillin and cotrimoxazole (79 and 74.2%, respectively).

Pseudomonas, which has a high resistance rate worldwide, was 100% resistant to ampicillin, amoxicillin and cotrimoxazole in this study. It showed the highest sensitivity to ciprofloxacin (94.7%), followed by amikacin and gentamycin (83.9 and 76%, respectively). Klebsiella spp. showed the highest sensitivity to ciprofloxacin (95.1%) and ceftriaxone (90.7%) and the highest resistance to ampicillin and amoxicillin (81.5 and 77%, respectively). Staphylococcus had the highest sensitivity to cephalaxin and ciprofloxacin (90.5 and 89.7%, respectively) and showed the highest resistance rate to oxacillin and penicillin and ampicillin (88.7, 82.7, and 79.3%, respectively).

The etiologic causes of UTI, and the sensitivity and antibiotic-resistance patterns of E. coli, Pseudomonas spp., and the total group of microorganism studied are presented in Figures 1 to 4.

As in several previous reports, our study showed the predominance of E. coli in the etiology of UTI (1.9). This study also revealed a very high microbial resistance rate to antibiotics. This was especially indicated for Pseudomonas spp., which was totally resistant to ampicillin, amoxicillin and cotrimoxazole that are much higher than many studies in several countries (9-17).

In a study conducted between1992 and 1995, Kapoor et al. reported Pseudomonas spp. had a resistance rate of 27% to ampicillin, 10% to cotrimoxazole and 1% to ciprofloxacin and aminoglycosides (14), and in a study conducted in London (4) in 1998, the resistance rates of Pseudomonas spp. to ampicillin, trimethoprim and cephradine were 48, 44 and 43%, respectively. Better sensitivity in this study belonged to nitrofurantoin (87%), which is the first choice for antimicrobial prophylaxis against UTI and the first choice of
treatment for cystitis but is poorly tolerated by children and cannot be used for pyelonephritis. Other studies in Iran have also indicated a high resistance rate to antibiotics. For example, Khotaii et al. reported resistance rates of 87.5% to ampicillin, 39.5% to both ampicillin and gentamycin, 67.5% to cotrimoxazole, and 57.7% to cephalothin in 2002 in Tehran (18). This significantly higher bacterial resistant rate to antibiotics in our country in comparison with other countries seems to be the result of two factors: first, a higher rate of antibiotic usage by families even in the absence of a prescription, and second, a population with a high percentage of young individuals, since UTI is more common in the early years of life (UTI is most common in girls aged 3 to 5 years).

Because the pattern of the sensitivity of microorganisms to antibiotics varies over time and among different geographical locations, antibiotic treatment of infections, especially pyelonephritis, should be based on local experience of sensitivity and resistance patterns. In this study, third-generation cephalosporins and amikacin were shown to be the most appropriate antibiotics for empirical therapy of pyelonephritis, and ampicillin, amoxicillin and cotrimoxazole were found to have high resistance rates and to be inappropriate for treatment or prophylaxis against UTI in children.

Although the disc diffusion method for sensitivity and resistance assessment may be correlated clinically, further studies employing the minimum inhibitory concentration method will be needed to obtain more reliable results.

REFERENCES


