

Microorganisms and Drug Sensitivity Patterns in Urinary Tract Infections

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ABSTRACT

Objective: To determine the microorganisms and their drug sensitivity patterns in children with urinary tract infection.

Setting: Department of Pediatrics, Federal Government Services Hospital (FGSH), Islamabad.

Duration: 8th April 2009 to 7th October 2009.

Sample size: 57 cases with positive urine culture

Study design: Cross sectional study.

Data collection: Patients who fulfilled the inclusion criteria with positive urine cultures presenting from 08-4-2009 to 07-10-2009 were included in the study after taking informed consent. 57 patients had positive urine cultures.

Data analysis: Results were analyzed by SPSS version 10.0.

Results: Of the 57 cases of urinary tract infections studied, the most common microorganism isolated was *Escherichia coli* 41 (71.9%) followed by *Klebsiella* 7(12.3%), *Proteus* 5(8.8%), *Pseudomonas* 2(3.5%), *Staphylococcus aureus* 1(1.8%) and *Candida albicans* 1(1.8%). The microorganisms were most resistant to Ampicillin 37(90%), Trimethoprim sulphamethoxazole 35(85.4%). The most sensitive drugs were Gentacyn 35(85.4%) and Nitrofurantoin 34(82.9%).

Conclusion: The understanding and awareness of the resistance patterns of the uropathogens in our region is essential in order to provide the best and most effective antibiotic regimen to our patients.

Keywords: Urinary tract infections, Drug resistance, *Escherichia coli*.

INTRODUCTION

Urinary tract infection (UTI) is defined as the presence of 10^5 colony forming units (CFU/ml) of a single organism on urine culture or more than 10^4 CFU/ml of a single organism with pyuria or symptoms of UTI¹. Urinary tract infections are one of the most common diseases diagnosed in the out patients as well as in hospitalized patients². The incidence of the UTI in children is 3-7% in girls and 1-2% in boys³. The prevalence rate is 2.1% in males and 2.4% in females⁴. UTI accounts for 40% of nosocomial infections⁵. The clinical presentation of UTI in infants and children can be very subtle and atypical, and a high index of suspicion must be kept in order to diagnose UTI⁶. Children who present with fever without focus should be investigated for UTI. Fever is the commonest clinical presentation followed by pain abdomen, dysuria, and failure to thrive⁷. An altered voiding pattern is recognized as a symptom of UTI as early as the second year after birth in some children. Non specific signs and symptoms such as irritability, vomiting and diarrhea also reflect the presence of UTI⁸. Keeping in view the high incidence of UTI in children, it is imperative to diagnose the UTI early⁹.

Awareness of the importance of timely diagnosis and treatment of childhood UTI is growing. Without timely treatment, renal scarring can occur, which is likely to affect approximately 5-15% of young children with UTI. Renal scarring is associated with serious health problems in later life such as hypertension, complications during pregnancy and renal failure¹⁰. Apart from renal scarring; UTI carries a high risk of recurrent infection. Within one year after the first infection, approximately 30% of boys and 40% of girls develop a repeat UTI. This rate becomes even higher after subsequent infections¹¹. Bacterial resistance in UTI continues to be a great problem¹². Knowledge of the sensitivity patterns and appropriate use of antibiotics can limit the increasing rate of drug resistance among bacteria in UTI¹³. Increasing rates of resistance among bacterial uropathogens has caused growing concerns in both developed and developing countries. There is a paucity of literature concerning antibiotic therapy for uncomplicated UTI in the developing world¹⁴. Despite the impact of resistance on empiric antibiotic choice, there is little data on multi drug resistance in pediatric patients with urinary tract infection¹⁵. Policies for treating UTI in children should be reevaluated every 5 years according to local resistance patterns¹⁶. In children with UTI in Pakistan, the most common microorganism (71%) isolated was *Escherichia coli*

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(E.coli), followed by Klebsiella (13%), Proteus mirabilis (11%), Staphylococcus aureus (4%) and Pseudomonas (1%)¹⁷. A study in Latin America showed Aminoglycosides and second or third generation Cephalosporins as the most suitable agents for empiric therapy in UTI¹⁸.

Keeping in view the frequency and increasing resistance of urinary tract pathogens, and the morbidity associated with UTI, I have carried out the study and analyzed the microorganisms isolated in urinary tract infections and their sensitivity patterns to various drugs. As there is paucity of literature concerning UTI in developing world, the results of this study will help to provide future guidelines for effective prescribing practices and management of UTI for our population based on local resistance rates. This will in turn help to decrease the morbidity associated with UTI and will have important and positive financial implications associated with UTI in terms of decrease in hospital visits, antibiotic prescriptions, hospitalization expenses as well as costs connected with travel and sick days.

PATIENTS AND METHODS

This was a cross sectional study conducted from April 2009 to October 2009 at Federal Government Services Hospital, Islamabad. The inclusion criteria for this study was all children between the ages of 1 month to 12 years of age of either sex, all children who presented with either one or more symptoms of dysuria, frequency of micturition, flank pain, fever, vomiting, failure to thrive and with positive urine culture on investigation. The exclusion criteria was all children who have already taken antibiotics in the past 24 hours for the present illness, children already catheterized on presentation, all critically sick children in whom collection of specimen for urine C/S was not possible prior to starting antibiotics, uncircumcised males, children with phimosis and paraphimosis. All children presenting with urinary tract infection and positive urine culture on investigation from April 8, 2009 to October 7, 2009 according to inclusion criteria were included after taking informed consent. Fifty seven cases of proven urinary tract infection were taken for final analysis.

The urine samples were collected under absolute aseptic technique. Samples were collected by midstream in children older than 2 years and by adhesive paediatric urine bag in children under the age of 2 years. The samples of urine were transported immediately to the laboratory for urinalysis and culture and sensitivity. Cultures were

done directly on Cystine Lactose Electrolyte Deficient (CLED) agar medium using calibrated platinum loop following standard bacteriological technique for 48 hrs. Bacterial identification and determination of the drug sensitivities were done by the disc diffusion method performed according to the National Committee for Clinical Laboratory Standard (NCCLS) using commercially available discs. Antimicrobial susceptibility was checked for Trimethoprim Sulphamethoxazole, Amoxycillin, Ampicillin, Cephadrine, Ceftriaxone, Gentamycin, Nalidixic acid, Nitrofurantoin, Urxin, Ofloxacin and Ciprofloxacin and the results were interpreted in accordance with the criteria established by the International Committee on Laboratory Standardization. Basic demographic information including name, age and gender was collected. Urine culture and sensitivity report was evaluated and microorganisms isolated in the urine and their sensitivities to the above mentioned drugs were entered in a proforma already designed.

All data was entered and analyzed by SPSS 10. Percentages and frequencies were calculated for, microorganisms isolated (Escherichia Coli, Klebsiella, Proteus, Pseudomonas, Staphylococcus aureus and Candida albicans) and their sensitivity patterns to various drugs (Trimethoprim Sulfamethoxazole, Amoxycillin, Ampicillin, Cephadrine, Ceftriaxone, Gentamycin, Nitrofurantoin, Nalidixic acid, Urxin, Ofloxacin and Ciprofloxacin).

RESULTS

An overall number of 57 children presented with urinary tract infection at Federal Government Services Hospital, Islamabad in the 6 month period of this study. Of the patients seen 39(68.4%) were females and 18(31.6%) were males. The mean age of presentation was 5.70 ± 3.7 years. The minimum age of presentation was 0.08 year, while maximum age was 12 years. The most common microorganism isolated from urine of children with UTI was E.coli (71.9%). The frequency of Klebsiella and Proteus was 16.7% in males and was greater than the females. The most sensitive drugs for UTI were Gentamycin (85.4%) and Nitrofurantoin (82.9%). Microorganisms showed maximum resistance to Ampicillin (90.2%) and TMP-SMX (85.4%). Klebsiella showed 100% resistance to TMP-SMX. Proteus was 100% resistant to TMP-SMX, Ampicillin, Amoxycillin and Nalidixic acid. There is increasing bacterial resistance to the commonly used drugs in UTI.

Fig. 1: Microorganisms in urinary tract infection

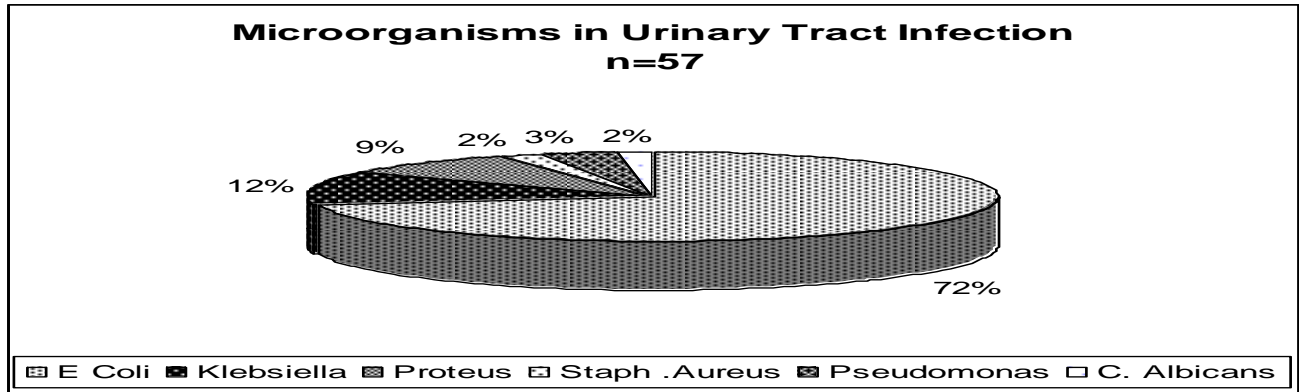


Fig. 2 :

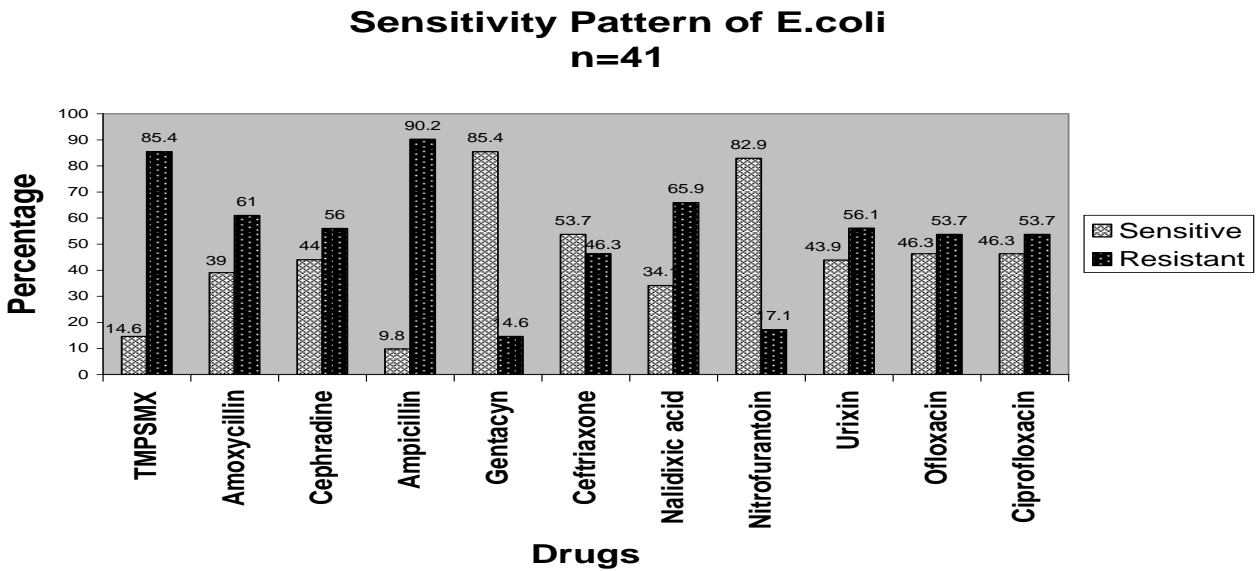


Fig. 3:

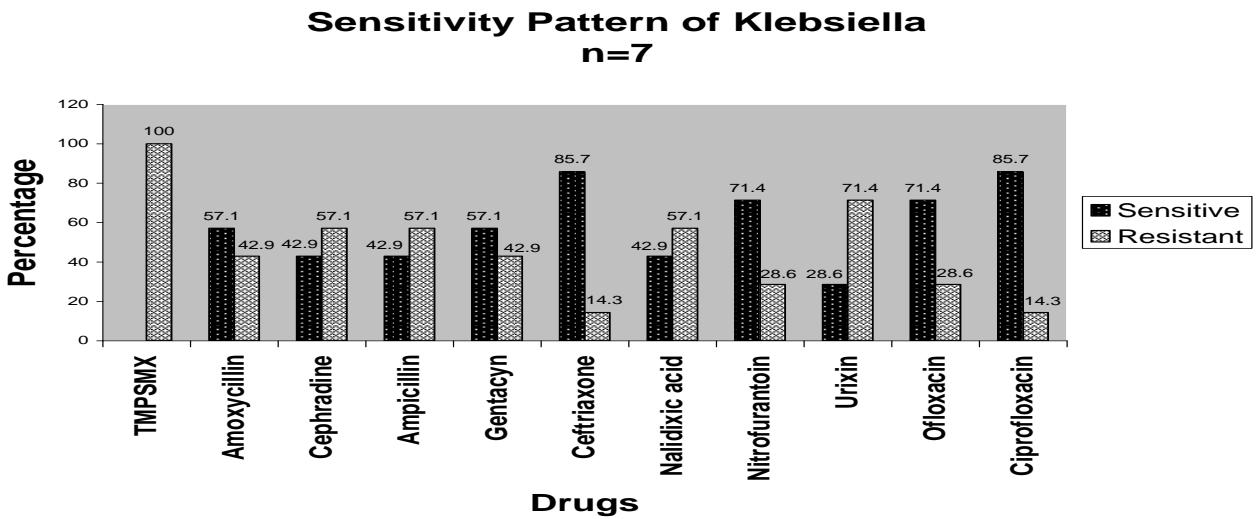


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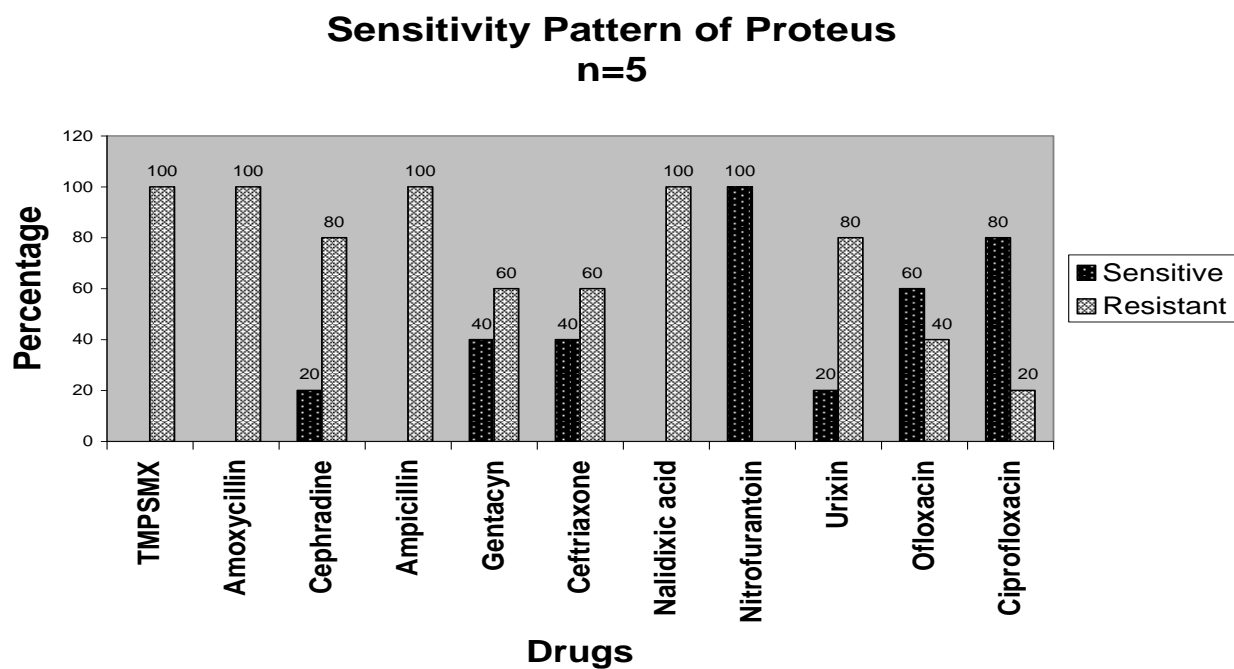
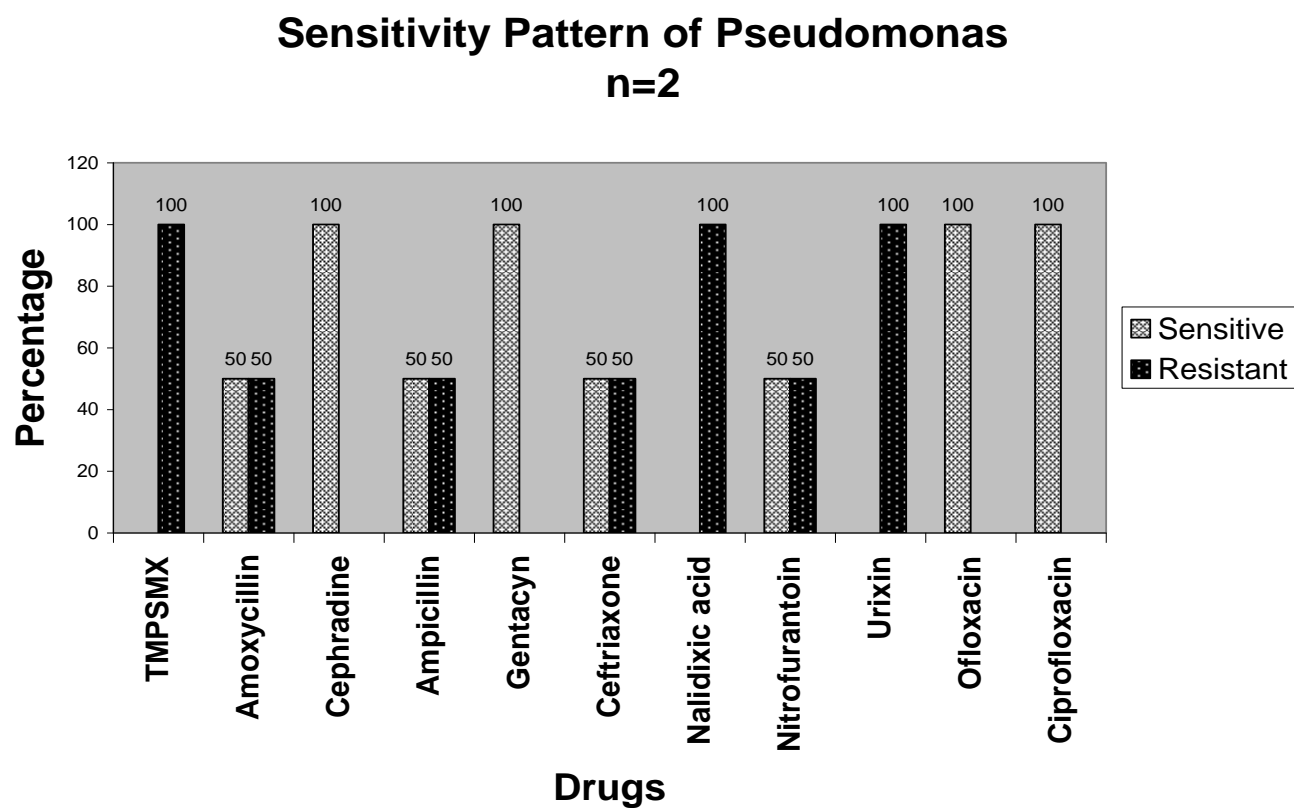


Fig. 5



DISCUSSION

Antibiotic resistance of microorganisms is a great disaster in clinical medicine. Resistance to antibiotics is highly prevalent in microorganisms all over the world especially in developing countries including Pakistan. In our study out of 57 patients with positive urine cultures 39(68.4%) were females and 18(31.6%) males which showed females to be more predisposed to UTI. Another study in Pakistan showed the same proportion as in our study¹⁹. The proportion of females in our study was lower than the studies carried out in Iran⁵, Brazil¹⁴ and Hazara division in Pakistan²⁰ in which females constituted 72%, 74% and 90.4% respectively which was higher than our results. The higher percentage of females affected by UTI may be attributed to the anatomically short urethra in females.

The mean age of presentation in our study was 5.7±3.7 years. The minimum age at presentation was 0.08 years, whereas the maximum age was 12 years¹². Two studies carried out in Iran and another in Taiwan reported mean age of presentation at 40.1±3.4 months¹ 32 months²¹ and 21.3 months²² which was much lower than our result.

In our study, the most common microorganisms isolated in children with UTI was *E.coli* (71.9%). The percentage calculated in our study was almost similar to the study carried out in Kuwait (77.1%)⁶, Romania (74%)⁸ and Iran (75%)⁵. However, our percentage was lower than that reported in Brazil (82%)¹⁴ and Jordan (81.1%)²³. The result of our study was higher in comparison to the studies carried out in Latin America which was 66.6%²⁴.

In our study, the next common microorganism isolated in children with UTI was *Klebsiella* (12.3%). In males the percentage was much higher and was found to be 16.7% as compared to females which was only 10.3%. The result of our research work conformed to the studies done in Iran, Turkey and Jordan which showed results to be 11.3%, 10% and 12.9% respectively^{1,12,25}. Our result was higher than that in Nepal, Taiwan and Brazil where the rates were reported to be 1.5%, 4.7% and 7% respectively^{26,22,24}.

In our study, *Proteus mirabilis* was isolated in 8.8% of patients. In males, the frequency of *Proteus* was found to be similar to that of *Klebsiella* (16.7%), whereas in females it was isolated in only 5.1% of patients. Most of the studies done in different regions reported a lower proportion of *Proteus* as compared to our study. Three studies were done in Iran and all of them reported lower results than our study and comprised of 3.9%, 4.6% and 5.4% respectively^{21,27,28}.

Pseudomonas aeruginosa was found to be only 3.5% of the microorganisms isolated in our study.

Our result was lower than that reported in Iran which was 8.8%²⁸. *Staphylococcus aureus* was 1.8% of the uropathogens isolated. *Candida albicans* was 1.8% of the pathogens isolated in our study.

In our study, *E.coli* was found to be most sensitive to Gentamycin (85.4%), followed by Nitrofurantoin (82.9%). *E. coli* was found to be most resistant to Ampicillin. In males, TMP-SMX and Ampicillin showed 100% resistance, followed by Urxin which showed 80% resistance. In males *E.coli* showed a sensitivity of 90% for both Gentamycin and Nitrofurantoin. In females also the most sensitive drugs were Gentamycin and Nitrofurantoin which showed sensitivities of 83.9% and 80.6% respectively. *E.coli* was most resistant to Ampicillin (87.1%) and TMP-SMX (80.6%). Another study in Jordan also showed that *E.coli* was most resistant to Ampicillin (81.6%) and TMP-SMX (72%)²³. In our study Gentamycin and Nitrofurantoin were found to be the most effective drugs. A study in Nepal by Rai GK showed the sensitivity of Nitrofurantoin to be 47% only²⁶, which was much lower than our result. A study in Brazil showed Aminoglycosides to be the most effective drugs against *E.coli*¹⁴. In our study also Gentamycin an aminoglycoside was found to be the most effective drug against *E. coli* in UTI. A study in Iran²⁸ showed the sensitivity of Gentamycin to be 97%, which was much higher than our sensitivity reported. In our study Ceftriaxone showed a sensitivity of 53.7%. This was not in conformity with a study in Iran which showed the sensitivity of Ceftriaxone to be 97.8%¹. This sensitivity was much higher than our study which showed that there is increasing resistance in our region against Ceftriaxone. The reason for the increasing resistance to Ceftriaxone in our region could be the improper and irrational use of the drug.

In our study the sensitivity rate of Ciprofloxacin was found to be 46.3% in children with UTI. A study in Saudi Arabia reported a resistance of only 14% for Ciprofloxacin²⁹ which was again much lower than that in our study.

In our study *Klebsiella* was found to have 100% resistance to TMP-SMX, followed by Urxin (71.4%). The most sensitive drugs for *Klebsiella* were Ceftriaxone and Ciprofloxacin both of which had a sensitivity of 85.7%, followed by Nitrofurantoin and Ofloxacin both of which demonstrated a sensitivity of 71.4%, Ciprofloxacin (95.1%) and Ceftriaxone (90.7%)¹. In our study *Proteus* showed 100% resistance to TMP-SMX, Amoxycillin, Ampicillin and Nalidixic acid. The most sensitive drug for *Proteus* was Nitrofurantoin, which showed a sensitivity of 100%, followed by Ciprofloxacin (80%). A study done in Iran showed 100% sensitivity to Ciprofloxacin²⁷, which was higher than our finding.

In our study *Pseudomonas* showed 100% resistance to TMP-SMX, Nalidixic acid and Urxin. *Pseudomonas* was 100% sensitive to Gentamycin, Ofloxacin and Ciprofloxacin. A study in Nigeria showed Ofloxacin and Ciprofloxacin to be effective antibiotics in UTI³⁰ like our study. A study done in Iran showed the resistance to Ciprofloxacin to be 25%²⁷ which was higher than our result. The results of these studies showed that Ciprofloxacin has better sensitivity in our country as compared to Iran.

It is evident that there is increasing resistance of microorganisms to various drugs and antibiotics such as TMP-SMX and Ampicillin have lost their role in UTI. The rapidly increasing resistance to drugs can be due to the irrational use of the drugs and self prescription which leads to use of the drug for a shorter duration than the clinically accepted time length, which leads to the development of resistance to the drug. As it is evident that different areas have different drug sensitivity patterns, it is necessary that the choice of antibiotics should also be based on the local drug sensitivity pattern.

CONCLUSION

Urinary tract infections are one of the most common diseases in children. UTI is more common in females. The most common microorganism isolated is *E.coli* in both genders. The most effective drugs for UTI are Gentamycin and Nitrofurantoin. Microorganisms have maximum resistance to Ampicillin and Trimethoprim sulphamethoxazole and these two drugs should not be used in children with UTI as they have lost their sensitivity.

Only drugs with a high sensitivity to uropathogens should be used and the resistant drugs should be avoided as they may lead to greater morbidity in terms of ineffective treatment and developing further resistance.

The drug sensitivity patterns vary in different geographical areas and these should be reevaluated from time to time and antibiotics should be prescribed according to the frequency of microorganisms and local drug resistance patterns in a particular region.

The understanding and awareness of the sensitivity patterns of the uropathogens is essential in order to provide the best and most effective antibiotic regimen to patients.

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