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Bacteriological profile and Antibiogram of Urinary Tract Infections in children in a Tertiary Care Hospital in North India.

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Abstract

Introduction: Urinary tract infection (UTI) is a common bacterial infection in childhood that occurs in 1-3%of girls and 1% of boys. Complications of UTI include renal parenchymal damage and renal scarring that can lead to hypertension and progressive renal insufficiency in later life. Gram negative organisms especially E coli are the most common causative organisms. These microorganisms present different susceptibility patterns to antimicrobial agents. So the prime aim of this study was to assess the etiological agents and susceptibility patterns of urinary pathogens in children admitted with UTI in this center.

Methods: The study was a retrospective study undertaken on 213 children in the age group of 1 month to 18 years having culture positive urinary tract infection hospitalized in Pediatrics Department of Government Medical College, Amritsar over a period of one year from January 2016 to December 2016.All these cases fulfilled the inclusion criteria required for the study. Urine culture of these cases was performed by Mackie and McCartney method and antibiotic sensitivity by Kirley-Baner's disc diffusion method.

Results: Out of 945 samples sent for urine culture and sensitivity, 213 cases showed positive urine culture for bacterial agents (22.5%). Gram negative bacteria(86.8%) were more frequent causes of community acquired urinary tract infection than gram positive bacteria(13.2%). Most common isolate was E. Coli (N=101,47.4%) followed by Kliebsella Pneumoniae (N=52, 25.8%) and Coagulase negative staphylococcus (CONS) (N=11, 5%). In this study, 69% of urinary pathogens were sensitive to amikacin and 51% were sensitive to ceftriaxone and sulbactam combination. Sensitivity to ceftriaxone alone was seen in only 15% implying production of Beta lactamases by the bacteria. Amongst the oral drugs, 37% of total isolates were sensitive to Nitrofurantoin.

Conclusions : Gram negative organisms are the most common cause of urinary tract infections. Both gram positive and negative isolates showed poor sensitivity towards conventional first line antibiotics, rather were mainly susceptible to higher antibiotics. So, the knowledge of the pattern of bacteriological isolates and their antimicrobial susceptibility pattern can be very helpful for the prompt empirical treatment of such patients. This can go a long way to decrease morbidity and mortality as well as reducing the emergence of multi-drug resistant organisms in urinary tract infections.

Keywords: Antibiotic susceptibility; Bacterial isolates; Bacterial resistance; urinary tract infection.

Introduction

Urinary tract infection (UTI) is a common bacterial infection in childhood that occurs in 1-3% of girls and 1% of boys. The prevalence of UTI 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 urinary tract infections (UTI's) occur during the 1st yr of life and are much more common in uncircumcised boys[1]. Dangerous complications of UTI include renal parenchymal damage and renal scarring that can lead to hypertension and progressive renal insufficiency in later life. In children, UTI may be the first presentation of an underlying congenital anomaly of the urinary tract. Therefore rapid diagnosis, institution of early treatment and further evaluation by imaging modalities is important to preserve the function of the growing kidney.

Gram negative bacillus, especially Escherichia coli and Klebsiella spp. are the leading pathogens in UTI. Proteus species, Staphylococcus saprophyticus and Enterococcus are other important pathogens that can cause UTI[123]. These microorganisms present different susceptibility patterns to antimicrobial agents. Nowadays, due to irrational antibiotic usage, antibiotic resistance has become an increasingly important problem in many countries including India[4,5].

So, the prime aim of this study was to assess the etiological agents and especially susceptibility of urinary pathogens to commonly used antibiotics in children admitted with UTI in this center.

Materials and Methods

This study is a retrospective study done by evaluating file records and microbiological records of pediatric patients in the age group of one month to eighteen years who had either presented or subsequently developed signs or symptoms of urinary infection after being admitted in Department of Pediatrics of Government Medical College, Amritsar from January 2016 to December 2016.

Urine samples of patients with symptoms of suspected urinary tract infection such as fever without focus, dysuria, pyuria, increased frequency of micturition or pain lower abdomen were sent to laboratory for microscopy and culture. The urine samples were taken by different methods (catheterization or mid stream) according to age of patients and were sent to Department of Microbiology, Government Medical College, Amritsar. For urine culture each sample was inoculated with a 0.01 ml platinum loop onto blood agar and Mc Conkey agar plates. The plates were incubated at 37°C for 18 to 24 hours. Positive culture was defined if bacterial colony counts were more than 10^4 colony forming units/ ml of a single pathogen. The growth of isolates were identified by colony morphology, gram staining and standard biochemical tests described in Mackie and McCartney Practical Medical Microbiology[6]. For identification of gram positive isolates catalase and coagulase tests were done; for gram negative organisms, Simons's citrate test, motility indole test, urea (MIU) test and triple sugar iron test (TSI) were done. Antibiotic susceptibility test was performed on the identified isolates using commercially prepared antibiotics discs (High media Co.Mumbai, India) on Muller Hinton agar by Kirby-Baur Disk Diffusion method as recommended in the Clinical Laboratory Standard Institute (CLSI) guidelines[7]. The antibiotic disks and their concentrations per disk (micrograms) comprised of Ampicillin (10), Amikacin (30), Gentamycin (10),High dose Gentamycin (120), Ciprofloxacin (5), Linezolid (30), Vancomycin (30), Ceftazidime (30),Cefotaxime (30), Amoxicillin (30), Cefperazone (75), Cefpodoxime (11), Piperacillin+Tazobactum (100), Imipenem (11) and Polymyxin-B (300). Multidrug resistant (MDR) isolates were phenotypically characterized into Methicillin resistant S.aureus (MRSA), Vancomycin resistant enterococci (VRE), Metallo β lactamase (MBL) and Extended spectrum β Lactamase (ESBL) producers.

Results

Out of total 945 samples sent for urine culture, total of 213 cultures were positive for bacteriological agents in urinary tract infection (22.5%). Gram negative organisms (185, 86.8%) were isolated more than gram positive organisms (28, 13.2%). E. Coli (101, 47.4%) was the most causative organism responsible for urinary tract infections followed by Kliebsella species (52 , 25.8%). Coagulase negative staphylococcus (CONS) caused UTI in 11 Cases (5%). (Table 1 and Figure 1).

Table 1 shows different organisms isolated as per their frequency.

Table 1

Organism	Number (Percentage)
E coli.	101 (47.4)
K pneumonia	52 (24.4)
K.oxytoca	3 (1.4)
CONS	11 (5.1)
Proteus	9 (4.2)
Citrobacter	8 (3.7)
Enterococcus	8 (3.7)
S aureus	8 (3.7)
Pseudomonas	7 (3.2)
Acinetobacter	3 (1.4)
MRSA	1 (0.46)
Enterobacter	2 (0.92)
Total	**213 (100%)**

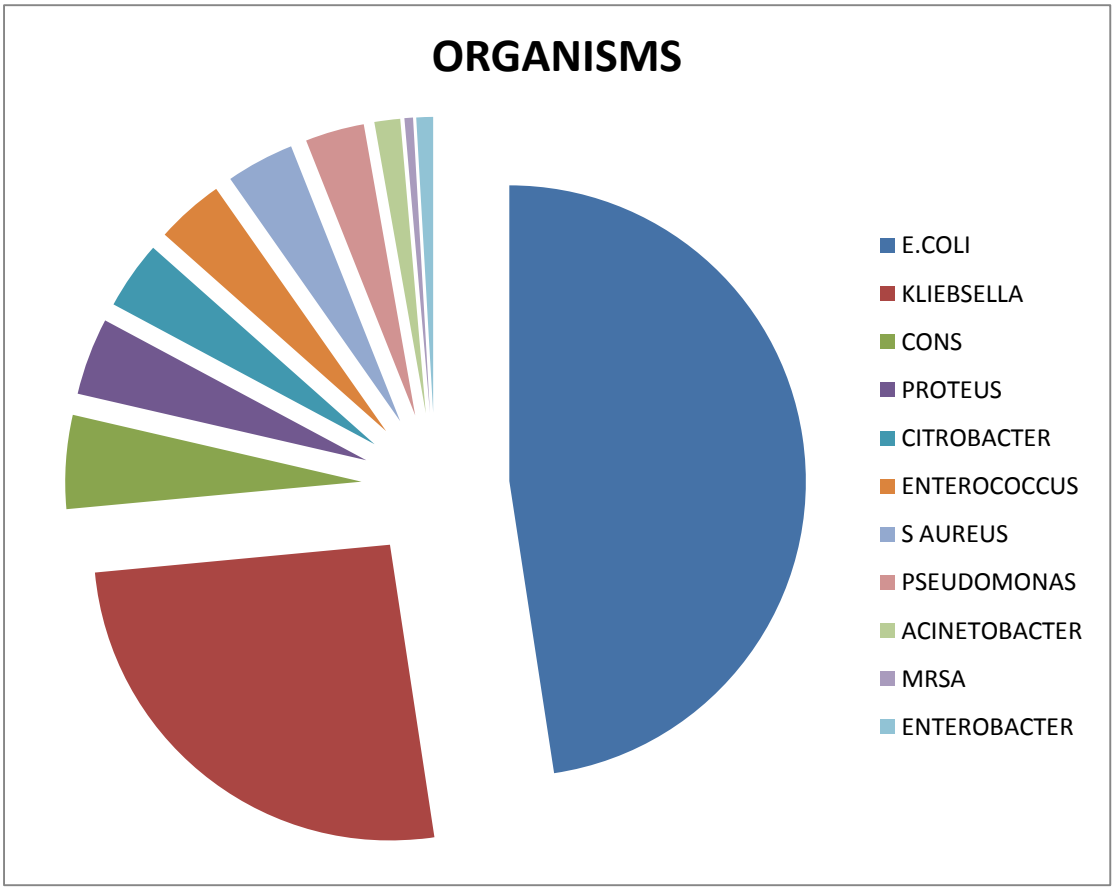

Fig. 1. Pictorial diagram showing different organisms isolated from urine culture.

In our study 108 (69%), urinary pathogens were sensitive to amikacin and 80 (51%) were sensitive to ceftriaxone and sulbactam combination. Sensitivity to ceftriaxone alone was only 15% (23) implying production of beta-lactamases by the bacteria. Amongst the oral drugs, 37% (58) of total isolates were sensitive to Nitrofurantoin. (Table 2)

Table-2 shows bacterial sensitivity to common antibiotics used for treatment of UTI

Table 2 Sensitivity profile of E Coli and Kliebsella.

Antibiotic	E coli (n=101)	Kleibsella (n=55)
Amoxyclav	2 (2%)	3(5.45%)
Amikacin	71 (70%)	37 (67%)
Ceftriaxone	17 (17%)	6 (11%)
Ceftraxione/sulbactam	51 (50%)	29 (52.7%)
Ceftazidime	14 (15%)	7 (12.7%)
Ceftazidime/sulbactam	23 (22.5%)	12 (22%)
Piperacillin/tazobactam	5 (4.8%)	3 (5.45%)
Gentamicin	44 (43.5%)	28 (51%)
Nitrofurantion	46 (45.5%)	12 (22%)
Cotrimoxazole	2 (2%)	2 (3.6%)
Imipenem	13 (12%)	8 (14.5%)
Ciprofloxacin	10 (10%)	7 (12.7%)
Norfloxacin	12 (12%)	10 (18%)
Polymyxin B	9 (9%)	6 (10%)
Cefoperazone	8 (8%)	3 (5%)
Tobramycin	-	-

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

Discussion

Urinary tract infection is a serious cause of morbidity in pediatric age group. Many cases of pyrexia without focus turn out to be due to urinary tract infection. If untreated it can lead to many serious complications and can ultimately progress to renal failure[1]. Therefore, correct knowledge of urinary tract infection is very important to prevent renal damage. For this reason bacteriological profile of UTI and their susceptibility pattern is of immense importance so that appropriate empirical antibiotics can be given at the earliest. This may prevent emergence of resistant organisms which is becoming a big threat due to irrational use of antibiotics.

Out of total 945 specimens sent for urine culture and sensitivity, 213 (22.5%) were culture positive. In the study done by Raghubanshi et al [8] (2014) out of total 719 samples, 133 were found to be culture positive (18.5%). In the study done by Pooja Patel and Garala[9] ,32.14% of specimens were found to be culture positive. Malla et al[10] found the culture positivity rate to be 57%. Other studies found different rate of culture positivity (Taneja et al[2] (28.3%) , Rai et al[19]. (28.6%) and Sohely et al[20] (46.6%). Such variations might be due to inclusion of only hospitalized cases in studies with higher culture positivity rate and inclusion of all suspected cases including presenting with non specific symptoms in studies showing lower culture positivity rate.

In our study, amongst organisms causing UTI, Gram negative organisms (86.8%) were isolated more commonly than gram positive organisms (13.2%). E coli was the most causative organism responsible for (n=101, 47.4%) of urinary tract infections followed by Kliebsella species (n=52, 25.8%). Coagulase negative staphylococcus (CONS) caused UTI in 11 cases(5.1%). In the study done by Raghubanshi *et al*[8] , the most common organism causing the urinary tract infection was Escherichia coli (n=86, 64.66%). followed by Klebsiella pneumoniae (n=17, 12.78%), Staphylococcus aureus (n=8, 6.01%) and Coagulase negative Staphylococcus (n=5, 3.75%).

Similarly, Alia and Osman[11] (60.0%) and Shahla Afsharpaiman et al[12] (71.7%) also reported E. coli as the most common isolate. In the study done by Neha et al[21], E coli was isolated in 8 cases (40%) followed by Citrobacter in 4 cases(20%) and Staphylococcus aureus in 3 cases (15%).

In the study done by Dnyaeshwari P et al[23], Gram negative organisms(82.6%) were most common etiological agents responsible for urinary tract infections. Amongst Gram negative organisms, *E coli* was most common uropathogen found in 41.3%of isolates followed by Klebsiella spp (18.5%) followed by Enterococcus (12%). Similarly in the study done by V.P. Sarasu et al[24] , E Coli was predominant pathogen isolated from patients with community acquired UTI(57%) followed by Klebsiella (20%) and CONS(7%).

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 69% of urinary pathogens were sensitive to amikacin and 51% were sensitive to ceftriaxone and sulbactam combination. Antimicrobial sensitivity testing of Gram negative isolates showed that amongst aminoglycosides, amikacin was most effective antibiotic. This finding has also been observed in study done by Abida Khatoon and Meher Rizvi[13] where they found amikacin sensitivity to be 62.5%(n=50). Neha et al[12] found amikacin sensitivity to be 75% (N=12.) V P Sarasu et al[24] found amikacin sensitivity to be 84% in culture positive isolates followd by levofloxacin in 83% of isolates.

Amongst the oral drugs, 37% of total isolates were sensitive to Nitrofurantoin. This has also been found in study done by Abida Khatoon and Meher Rizvi[13],where they found nitrofurantoin to be sensitive in 52.5% (n=42) of cases of gram negative culture positive UTI. Neha et al[12] found nitrofurantoin sensitivity in 12 (75%) of gram negative culture positive cases. Similarly, V P Sarasu et al[24] reported nitrofurantoin sensitivity to be 61%. Jitendrananth et al[22] found nitrofuntoin to be sensitive in 79.4 % (n=93) of culture positive isolates. Rajabhandri et al[14] reported nitrofurantoin as the most sensitive drug. Nitrofurantoin is a bactericidal agent for Gram positive cocci and bacteriostatic agent for gram negative. Nitrofurantoin has adequate renal excretion and can be used for complicated renal infections. However, there may be non compliance for Nitrofurantoin due to its bitter taste[14,15].

Ceftriaxone sensitivity alone was seen in only 15% of observed cases. This may be due to production of Beta lactamases by the bacteria. However Singh et al[16] and Ibeneme et al[17] have reported higher sensitivity of E. Coli to ceftriaxone (80% and 85.7%, respectively) in their regions. This difference might be due to changing sensitivity of organism to the antibiotic due to resistance developed after injudicious use of antibiotics.

Conclusion

Urinary tract infection is a common bacterial infection in children. Diagnosis must be based on a positive urine culture. E coli as the most common causative organism for UTI has not changed but its sensitivity for cephalosporins, ciprofloxacin and amoxicillin-clavulanic acid is low in this region. Extended spectrum beta lactamase (ESBL) producing organisms are now being increasingly isolated.

A possible cause of increased resistance might be widespread and inappropriate use of antibiotics. To overcome this problem, irrational antibiotic therapy should be limited. Large scale studies are required to monitor the pattern of antibiotic resistance to help formulate appropriate empirical pharmacotherapy for UTI.

In vitro tests of drug sensitivity done in microbiological laboratory can help to assess drug response in the patient. Although, in vitro tests are only one fraction of the clinical scenario, yet the correlation between the test result and patient response is usually positive[18].

Continuous monitoring of changes in bacterial pathogens causing UTI and antibiotic sensitivity in each area should be done to improve the knowledge of physicians for effective treatment of urinary tract infections.

The best choices of antibiotics in our hospital for empirical treatment of UTI before culture reports are available are amikacin, ceftriaxone+ sulbactam, and for out patient therapy nitrofurantoin can be given as first choice drug.

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