Original Article

Causative Organisms and their Sensitivity Patterns in Urinary Tract Infection in Children

Deve Das, Muhammad Nadeem Chohan, Srichand Talreja

ABSTRACT

OBJECTIVE: To determine causative organisms and their sensitivity patterns in urinary tract infection in children, attending Pediatric Department Dow University Karachi.

METHODOLOGY: This Cross sectional study was conducted at pediatric Department, Civil Hospital Karachi from July to December 2014. A total of 150 children between age 1 month to 15 years having the probable Urinary Tract Infection, attending the Pediatric OPD or admitted to ward were enrolled. Urine Culture and Sensitivity sample was collected aseptically. In infants and younger children's, it was collected by urethral catheterization and in older children collected by mid-stream clean catch void, after proper local cleaning, while in young infant collected by suprapubic bladder aspiration.

RESULTS: Among a total of 150 children, mean age of participants was 4.4±3.4 years, 70.7% were above five years of age, 52% were males with male to female ratio were 1.1:1. Urine culture was positive in 29.3% cases, among them 55% were positive for E. coli, 18% for Pseudomonas, 16% for Proteus and 11% for Klebsiella. 70.8% E. coli were not sensitive to amoxicillin and ampicillin. 75% pseudomonas was resistant to ampicillin and amoxicillin.There was no difference in in-vitro and in-vivo response of E. coli to ampicillin and amoxicillin.

CONCLUSION: It is concluded from this study that most common organism in Pediatric UTI was E. coli especially in 1-5 years' age group and most of it were resistant to amoxicillin and ampicillin.

KEYWORDS: Organism, Antibiotic sensitivity, Children.

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INTRODUCTION

Urinary tract infection (UTI) cause significant morbidity in children.[1] Prevalence of UTI in children is 3-5%, prevalence is different in various age groups and sex of child. Male: female ratio is 2.8 to 5.4:1 in first year of life, but it significantly increased in females with male: female ratio of 1:10 after 1 year of age. Prevalence of UTI is 3-7% in girls and 1-2% in boys[15]. Prevalence rate is 2.1% in males and 2.4% in females[16].

First episode of UTI in female usually occurs by the age of 5 years, with peaks during toilet training and infancy. Within 18 months of first UTI, 60 to 80% of females will develop second episode of UTI[2,3].

UTI is more common in uncircumcised boys. Organisms responsible for UTI are variable in children and particularly depend upon factors such as age and geographic location of patient[4]. Escherichia Coli is reported as the most common organism (43.3-71%) so far followed by Klebsiella (13-30%), Pseudomonas (16.66%) and Proteus (11%)[4,5]. Escherichia Coli, Klebsiella and Proteus are responsible for 75 to 90% of all infection in females. Some reports suggest Proteus is more common as E. Coil in males during 1st year of age while other reports indicate grams' positive organisms are more prevalent.[2]Gold standard test for the diagnosis of UTI is Urine Culture[2,6].

Although standard treatment of acute cystitisincludes cotrimoxazole, Nitrofurantoin and amoxicillin while ceftriaxone, ampicillin, gentamicin, and Cefixime are used for pyelonephritis[2,4]. As organism causing UTI vary in different geographical areas, so aim of this study is to know the causative organism of UTI and their sensitivity and resistance patterns in our locality to recommend antimicrobials use in accordance with the results.

METHODOLOGY

A Cross sectional study done by Non-probability consecutive sampling in 150 children, from July to December 2014 at Department of Pediatrics Dow University Karachi. Approval was taken from the Ethical review committee of institute. All patients visiting Pediatric Out Door Department fulfilling inclusion criteria: Children aged one month to fifteen year of age with either sex with clinical features suggestive of UTI such as, Foul-smelling urine,

abdominal pain, Irritability, Vomiting, Enuresis, dysuria, urgency, frequency, Fever, Flank/back pain, Incontinence, poor feeding, were advised for Urine Analysis. Children whose Urine analysis report showed Pus Cell > 10 along with Presence of Nitrates were enrolled in the study. Written and Verbal consent was taken from the parents. Sample size calculated by using the open Epi software, taking 95% confidence interval, prevalence 15% error at 5%.

Children having recurrent UTI, congenital renal anomalies, Nephritic/Nephrotic syndrome/Chronic renal failure, Malaria, Typhoid, Sepsis, and Meningitis were excluded from the study. Patients who had already received antibiotics and those having perianal rash were also excluded from the study.

For urine C/S, sample was collected aseptically (in infants and younger children it was collected by urethral catheterization and in older children collected by clean mid-stream void after proper local cleaning while in young infant it was collected by suprapubic bladder aspiration) in sterile container and were sent to pathology laboratory of Civil Hospital Karachi.

Specimens were cultured on cystine-, lactose- and electrolyte-deficient (CLED) agar plates followed by incubation under aerobic conditions at 37ºC for 24 hours. Those bacterial cultures containing bacterial growth of $>10^5$ colony forming unit (CFU)/ ml were considered significant, while CFU count of less than 10^5 were considered non-significant for the analysis of bacteriuria. Bacterial colonies were identified by their morphological characteristics and biochemical characterisation through gram's staining, catalase test and bile aesculin hydrolysis test. Antimicrobial susceptibility profiling was done by modified Kirby Bauer disc-diffusion method. Bacterial suspensions having turbidity comparable to that of 0.5 McFarland standard were applied on Mueller-Hinton agar plates. Antibiotic discs of analytical grade (Oxoid, UK) used as follows: ampicillin (10 µg), amoxicillin (10 µg), gentamicin (10 µg), ciprofloxacin (5 µg), nitrofurantoin (300 µg), fosfomycin (200 µg). Sensitivity of bacterial strains was assessed by measuring the zones of inhibition in millimeters following the Clinical and Laboratory Standards Institute guidelines. American type culture collection (ATCC® 25923) strain of Staphylococcus aureus was used as quality control standard. Positive Urine Cultures were further tested for their sensitivity and resistance to various antibiotics.

Data was entered and analyzed in SPSS version 22.0. Quantitative variables like age and duration of UTI were calculated by using Descriptive statistics i.e. mean+standard deviation. Qualitative variables like gender, type of bacteria, drugs resistance and sensitivity were calculated by Frequency and percentage. Stratification was done with regard to age, gender and duration of UTI to see effect of this on outcome.

Operational Definitions

Proven Urinary tract infection: Defined as presence of single organism colony count $>10^5$ CFU/ml in freshly voided mid- stream urine sample and urethral catheterization or any number of single organism in urine sample collected through supra –public puncture method.

Probable Urinary Tract Infection: Having features of UTI (Fever, Abdominal Pain, Dysuria, Urinary Frequency) and the Presence of >10 Pus Cell and Nitrates in Urine.

Susceptibility testing: It was performed in isolated microorganisms that are responsible for infectious process requiring antimicrobial therapy. On the basis of these testing bacteria were divided into categories “Sensitive”, “Intermediate” and “Resistant”.

RESULTS

A total of 150 children were enrolled during study period. The mean age was 4.4±3.4 years (Table II), 44 (70.7%) were ≥ five years of age, 78 (52%) were males with male to female ratio 1.1:1 (Table II). Duration of UTI is summarized in table 2. Urine culture was positive in 44 (29.3%) cases (Table I). Most common clinical presentation was Fever that was present in 58 (38.66) children (Table III). The most commonly isolated organism was E. coli in 24 (55%) cases followed by Pseudomonas 8 (18%). 70.8% E. coli were resistant to both ampicillin and amoxicillin (Graph I). 75% of pseudomonas was resistant to ampicillin and amoxicillin (Graph II). There was no difference in in-vitro and in-vivo response of E. coli to ampicillin and amoxicillin response. Antimicrobial sensitivity pattern of Proteus and Klebsiella were summarized in Graph III and IV).

TABLE I: STRATIFICATION OF URINE CULTURE POSITIVE CASE BY AGE (n=150)

Urine culture	Age Group*				Total
	< 1 year	1-5 Years	6-10 years	>10 years	
Positive	2 (4.5%)	25 (54.5%)	12 (27.3%)	6 (13.6%)	**44**
Negative	16 (15.1%)	64 (60.4%)	20 (18.9%)	6 (5.7%)	**106**
Total	**18**	**88**	**32**	**12**	**150**

TABLE II:
DEMOGRAPHY OF STUDY PARTICIPANTS (n=150)

Age group	Frequency	Percentage
< 1 year	18	12.0
1-5 years	88	58.7
6-10 Years	32	21.3
>10 years	12	8.0
Male	78	52.0
Female	72	48
Duration of UTI ≤5 days	83	55.3
Duration of UTI >5 days	67	44.7
Urine Culture (Positive)	44 Males 24(54.5%) Females 20(45.5%)	29.3
Urine Culture (No growth)	106	70.7

TABLE III: CLINICAL MANIFESTATION (n=150)

Complaints	Frequency	Percentage
Fever	58	38.66
Abdominal Pain	34	22.66
Dysuria	25	16.66
Enuresis	6	4.00
Vomiting	9	6.00
Urinary Urgency	18	12.00

sensitivity test should be performed in every case to know the sensitivity pattern of specific bacteria. After getting the Urine C/S result antibiotic with narrowest spectrum and little adverse effect should be selected.

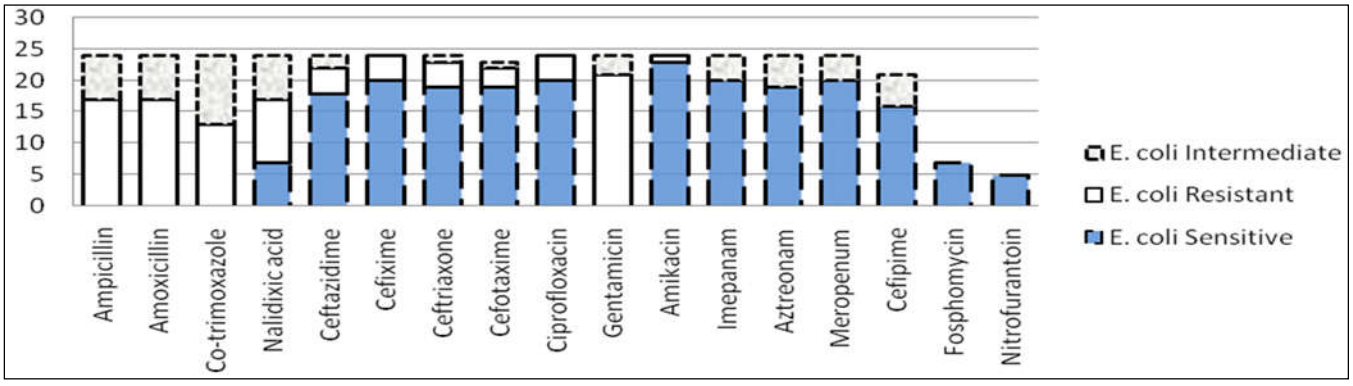
In this study urine culture was positive in 29.3% cases. E. coli was most common organism isolated accounting for 55% of cases. Amongst E. coli 70.8% were resistant to ampicillin and amoxicillin, 54.2% resistant to co-trimoxazole, 13-16.7% resistant to third generation cephalosporin, and 12.5% resistant to gentamicin. E. coli was sensitive to Fosphomycin and nitrofurantoin. Our study is compatible with a study done at Pakistan Institute of Medical Sciences, Islamabad in which E. coli (57.2%) was the commonest isolate, among them only 38.5 % E coli were sensitive to ampicillin[18].

Similarly, in a study ampicillin and Cotrimoxazole had the high resistance rates, while nitrofurantoin had low resistance rates. Unlike this study coamoxiclav or third-generation cephalosporin had no bacterial resistance[10].

In another local study, unlike to our study E. coli was present in 14.84%, Klebsiella Pneumoniae, 10.32%, Staphylococcus Saprophyticus 2.58% urine Culture but like our study these bacterial pathogens were sensitive to Amoxycillin-Clavulanic acid but unlike our study it was also sensitive to Trimethoprim-Sulfamethoxazole[17].

In another similar local study, E. coli (57.3%) was frequent organism, followed by Klebsiella (18.8 %), Staphylococcus aureus (13.7 %), Pseudomonas (5.1%) and Proteus (3.4%). All isolates were sensitive to ciprofloxacin, amikacin, cefixime and imepenem.

GRAPH I: SENSITIVITIES OF E. COLI (n=24)



Note: Not tested (NT) for Cefotaxime (1), Cefipime (3), Fosphomycin (17) and Nitrofurantoin (19)

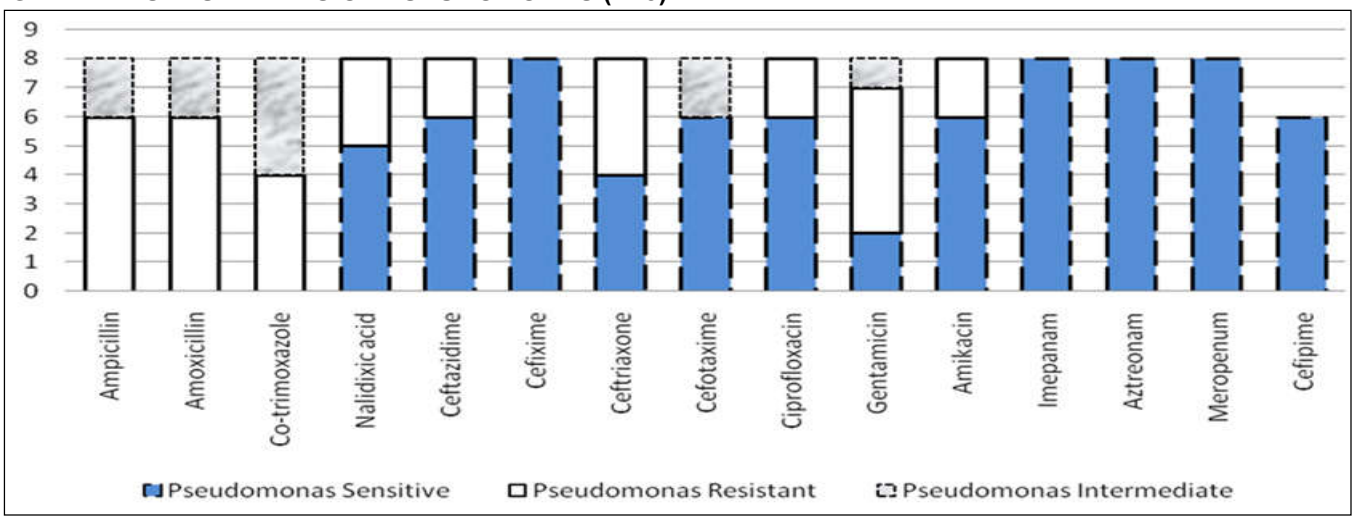
DISCUSSION

While selecting antibiotics, its resistance pattern is a big concern. Bacteria are getting resistant to antibiotics used for the treatment of UTI[7]. Studies showed the various resistance patterns of pathogens causing UTI[8,9]. While treating UTI; routine Urine culture and

Similarly, 38.5% E coli and 37.5% Klebsiella were sensitive to Ampicillin, and 14.3% E coli and 9.1% Klebsiella were sensitive to Trimethoprim-sulphamethoxazole[18].

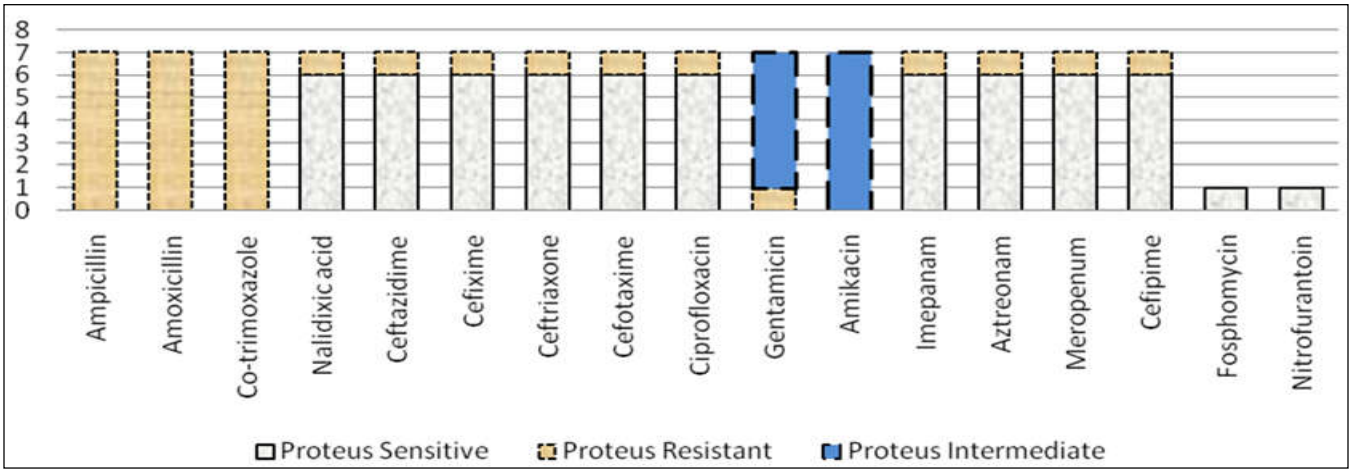
In another similar local study, isolates were Escherichia coli (50%), E. faecalis (22.5%),

GRAPH II: SENSITIVITIES OF PSEUDOMONAS (n=8)



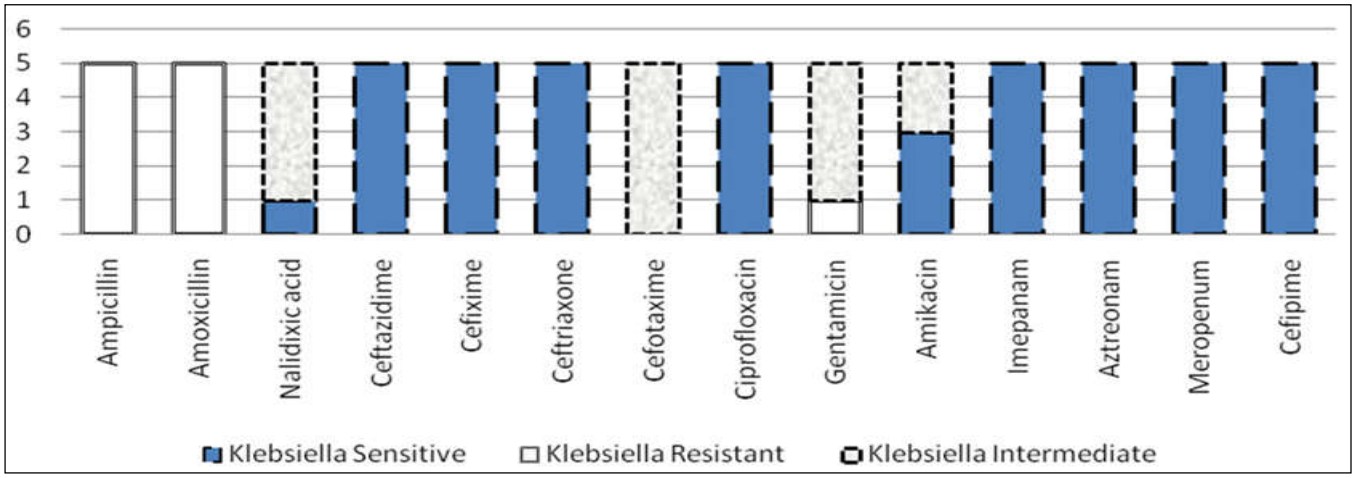
Note: Not tested (NT) for Cefipime (2), Fosphomycin (8) and Nitrofurantoin (8)

GRAPH III: SENSITIVITIES OF PROTEUS (n=7)



Note: Not tested (NT) for Fosphomycin (6) and Nitrofurantoin (6)

GRAPH IV: SENSITIVITIES OF KLEBSIELLA (n=5)



Note: Not tested (NT) for Fosphomycin (5) and Nitrofurantoin (5)

P. aeruginosa (12.5%), S. aureus (10%) and Klebsiella (5%). Importantly Amoxillin was resistance to almost all pathogens. Similarly, Fosfomycin and Linezolid showed 100 % sensitivity pattern, in patients with E. coli and E. faecalis[19].

In another different local study E-coli was found in 11 (18.33%) males and 21(35%) females, citrobacter 2 (3.33%) in males and 12(20%) in females, enterobactericae 9(15%) in males, proteus 1(1.66%) in males and 2(3.33%) in females, pseudomonas 2 (3.33%) in males and 1(1.66%) in females, salmonella 1(1.66%) in males and none in females[20].

In another similar international study, E. coli was (54.80%) causing UTI. However, the resistant patterns were different from this study. Resistance rates of E. coli isolates were 85.9% to co-trimoxazole, 80.0% to penicillin, 77.0% to ampicillin, 68.0% to chloramphenicol, 12.9% to ciprofloxacin, 12.9% to ceftriaxone, 12.9% tocephalothin, and 14.0% to amikacin[11]. In another different study E. coli was the most common isolated organism accounted for 71% cases unlike this study the number is higher[5].

Pseudomonas causes UTI in children; worldwide antibiotic susceptibility patterns are different in different countries[12]. In this study Pseudomonas was second common pathogen accounted for 18% cases. Pseudomonas was resistant to both ampicillin and amoxicillin, each accounted for 75% cases. This was also resistant to co-trimoxazole in 50% cases, nalidixic acid in 37.5% cases, and ceftazidime in 25% and ciprofloxacin in 25% cases. Similar study in Iran reported same resistant patters except all pathogens were sensitive to ciprofloxacin[11].

In another similar local study most common uropathogens were E. coli (72.7%) and Klebsiella pneumonia (8.3%), among them E. coli was resistant to ampicillin in 63.3% of cases and to co-trimoxazole in 42.6% of cases[13]. In another study E. coliwas not sensitive to ampicillin (44, 8%) and to first generation cephalosporin (36%) while in our study resistant pattern is different[14].

In another local study E. coli was the predominant isolate (165/225) followed by Klebsiella sp (30/225) and Pseudomonas (13/225). Similarly, all gram negative bacteria in general were found to be resistant to the commonly used antibiotics and were sensitive to amikacin, nitrofurantoin, imipenem, cefoperazone/ sulbactam and piperacillin/tazobactam[21].

In another similar study isolated organism were E. coli (65.1%) followed by E. fecalis (20.8%). Similarly, there was good sensitivity with Vancomycin, Amikacin, Nitrofurantoin and Impinime while there was high resistance with Ampicillin and Ceftriaxone[22].

In another similar study 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%)[23].

CONCLUSION

It is concluded from this study that most common organism in Pediatric UTI was E. coli especially in 1-5 years' age group and most of it were resistant to amoxicillin and ampicillin.

Ethical Permission: CPSP REU No. 5451 dated: 25-05-2015.

Conflict of Interest: All authors have no conflict of interest and none to declare.

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