Research Article

Microbiological profile of urinary tract infection in pediatric population from a tertiary care hospital in South Kerala

Abstract

Introduction: Urinary tract infection (UTI) is one of the most common bacterial infections seen in children. It is estimated that at least 1% of boys and 3% of girls develop urinary tract infection during first ten years of life. UTI is mainly due to the ascending infection from the urethra. The diagnosis of UTI in young children is important as it may be the marker of urinary tract abnormalities especially in males. Early diagnosis is important to preserve renal function of the growing kidney.

Objectives: To study the microbiological profile of urinary tract infection (UTI) in children.

Materials and methods: Study period June 2013 to May 2014. A total of 932 cases of suspected UTI in children who attended pediatric department was submitted for urine culture, isolation and identification of organism were done by standard microbiological methods. Antibiotic susceptibility testing was done by Kirby Bauer disc diffusion method by following CLSI guidelines.

Results: Out of 932 cases, 170 were culture positives, where females were 100 and males were 70. 85% of them were Gram negatives, 11.56% were Gram positives were 11.56% and 2.35% were Fungal. Most common GNB isolate identified was *E coli* (56.16%), followed by *Klebsiella spp*. (23.97%), while GPC was CONS (58.8%) and *Enterococci* (35.3%). 99% of gram negative organisms were susceptible to Imipenem, and 96% of organism were susceptible to Piperacillin-Tazobactum and Cefaperozone sulbactum. All gram positive cocci were 100% susceptible to Vancomycin.

Conclusion: Gram negative bacilli were predominant than Gram positive cocci. *E. coli* was commonest organism with 15.3% of ESBL positive. 26.47% of total cultures positive were multidrug resistant.

Keywords: urinary tract infection, *e. coli, klebsiella,* multidrug resistant, esbl, amikacin, cephalosporins

Ashish Jitendranath, Radhika R, Bhargavi L, Geetha Bhai, Ramla Beevi
Department of Microbiology, Sree Gokulam Medical College, India

Correspondence: Dr. Ashish Jitendranath, Assistant Professor, Department of Microbiology, Sree Gokulam Medical College, Trivandrum, India, Email ashishjit11@gmail.com

Introduction

The problem of UTI spans all age groups beginning with Neonates. The frequency of UTI in infants is 1 to 2% much more common in boys during the first 3months and thereafter in girls. Pyelonephritis is common in infants[1]

UTI is mainly due to the ascending infection from the urethra. The diagnosis of UTI in young children is important as it may be the marker of urinary tract abnormalities. Diagnosis based on clinical features is difficult because of the varied non specific clinical features. Early diagnosis is important to preserve renal function of the growing kidney.[2]

In the past (30-50) years natural history of pediatric UTI has changed because of evolution of antibiotic and improvement in antibiotic care.[3]

This study was undertaken to know the clinical and bacteriological profile of urinary tract infection in children in Sree Gokulam Medical College and Research Hospital, Trivandrum.

Material and methods

This was a prospective study done in Sree Gokulam medical college, Trivandrum from June (2013), to May (2014). Children aged 2months to (12)years attending pediatric outpatient department with symptoms like fever, abdominal pain, dysuria, smelly urine were subjected for urine routine and microscopic examination. Those with Pus cells more than 5 per high power field were then sent for urine culture and sensitivity.

Sample collection

Urine was collected by clean catch mid stream technique after cleaning the perineal area and taken to the microbiology laboratory.

The choice of sampling (evacuating bladder catheter vs. spontaneous voiding) was done in accordance with accepted guidelines for each age group.[14]

Procedure

The urine was cultured on Cysteine lactose electrolyte deficient (CLED) and Mac Conkey agar using **Semi quantitative method** of culture.

The diagnosis of UTI was made by means of a positive urine culture for one organism with a count greater than or equal to 50,000 colony forming units (CFU) if it was collected by a urinary evacuating

Microbiological profile of urinary tract infection in pediatric population from a tertiary care hospital in South Kerala

Copyright:
©2015 Jitendranath et al.   **5**

catheter and greater than or equal to 100,000 UFC, if it was collected by spontaneous voiding, according to criteria established by the American Pediatric Academy14.

Antibiotic sensitivity testin

Done using Kirby Baeur disc diffusion method. Antibiotics were selected according to CLSI guidelines. The anitbiotics discs used for testing were selected according to CLSI (2014) schedule were Amikacin (30ug), Nitrofurantoin (300ug), Nalidixic acid, Cefotaxime (30ug), Norfloxacin (10ug), Piperacillin (100ug), Piperacillin-Tazobactum (100/10ug), Amoxycillin-clavulunic acid (30ug), Cotrimoxazole (1.25/23.75ug), Imipenem (10ug), Vancomycin (30ug) and Teicoplanin (30ug).

Antibiotic discs were bought from *Hi-Media diagnostic laboratory,* **Mumbai.**

Minimum Inhibitory Concentration (MIC) was not done

Extended spectrum beta lactamase (ESBL) detection

Suspected ESBL isolates were tested and confirmed using Combined disc diffusion test with Ceftazidime and Ceftazidime clavulunic acid. Multiple drug resistant isolates were those which were shown to be resistant to 2 or more group of antibiotics. An isolate was considered Multi drug resistant if it was found to be resistant to 2 or more family of drugs.

Results

932 cases of suspected cases were screened 170 were culture positive. Among them girls were 100 (58%) and boys were 70 (42%).

Majority of the isolates were Gram negative bacilli (85%), followed by gram positive cocci (11.5%) and the rest were yeast (Figure 1).

The age group which had the maximum no's of cases were in the 0-6 age group with 80% of all cases (Table 1). 17 (85%) of Gram positive cocci were seen predominantly in 0-6 age group (Table 1).

Table 1 Age group distribution of organism isolated

Age group	GPC	GNB	Fungi
0-6 years	17	118	2
7-12	3	18	
13-15		10	2
Total	20	146	4

Predominant organisms isolated among gram negative bacilli were *E. coli* 82(56.1%), followed by *Klebsiella spp* 35(23.97%), *Citrobacterspp* 8(5.5%), *Acinetobacter spp* 5(3.47%), *Proteus vulgaris* 4 (2.7%) with *Morganella morganii, Pseudomonas aeruginosa* and Non fermenting Gram Negative Bacilli forming the rest. (Table 2).

Among gram positive cocci most predominant organism was *Staphylococcus saprophyticus* 10(50%), *Enterococcus* 6 (30%) and *Staphylococcus aureus* 4 20%) (Table 2).

All the gram negative organisms showed a high degree of sensitivity to Imipenem, Cefaperazone sulbactum, and Piperacillin tazobactum. Amoxycillin clavulunic acid showed a high level of drug resistance (Table 3).

The gram positive cocci were found to be of the sensitive variety with high degree of sensitivity to Nitrofurantoin followed by Amoxycillin clavulunic acid (Table 4).

Maximum percentages of ESBL were seen in *Klebsiella* with 20%. *Klebsiella* also had a high percentage of Multi drug resistant strain of organism with resistant pathways different to ESBL (Table 5).

Table 2 Distribution of organism from urine sample

Organism	Total no's (170)
Escherichia.coli (E.coli)	82
Klebsiella	35
Coagulase negative Staphylococcus	10
Citrobacter	8
Enterococcus	6
Acinetobacter spp	5
Proteus vulgaris	4
Staphylococcus aureus	4

Table 3 Antibiotic sensitivity of common gram negative bacilli

Antibiotics	*E. coli* (82)	*Klebsiella* (35)	*Citrobacter* (8)
Amikacin	74	31	6
Cefotaxime	51	19	6
Nitrofurantoin	74	19	5
Norfloxacin	53	25	7
Cefaperazone-sulbactum	77	30	8
Piperacillin-tazobactum	77	31	8
Ofloxacin	51	27	7
Amoxycillin-clavulunic acid	21	10	3
Imipenem	82	35	8
Nalidixic acid	47	20	6
Cotrimoxazole	46	18	5

Table 4 Antibiotic sensitivity of gram positive cocci isolated

Antibiotic	Staph saprophyticus (10)	Enterococcus spp (6)
Nitrofurantoin	10	6
Teicoplanin	10	6
Amoxycillinclavulunic acid	8	5
Linezolid	10	6
Vanomycin	10	6

Microbiological profile of urinary tract infection in pediatric population from a tertiary care hospital in South Kerala

Copyright:
©2015 Jitendranath et al.   6

Table 5 Isolates having MDR and ESBL

Organism	ESBL	MDR (Multi drug resistant)	Total no's (67)
E .coli	17	20	37
Klebsiella	7	23	30

Table 6 Associated clinical condition

Clinical condition	Total no's 38
Posterior urethral valve disorder	18
Vesico urethric valve disorder	13
Congenital disorder of Urinary tract	5
Neurogenic bladder	2
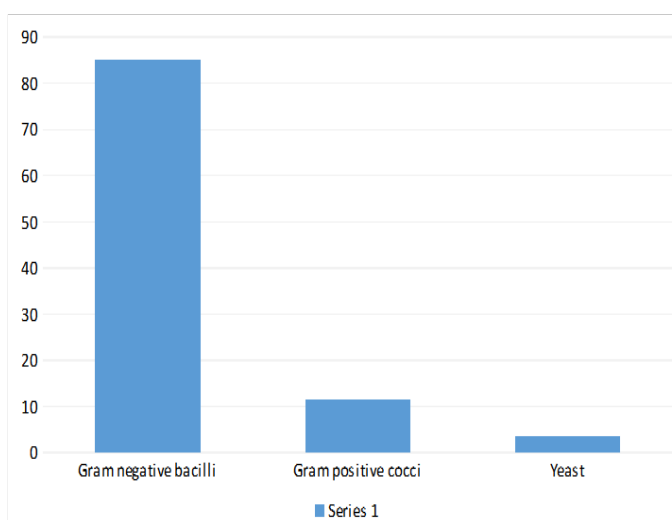
Figure 1 Distribution of organism isolated.

Recurrence

Out of the 170 culture positive 38 patients experienced recurrence. This was associated with underlying pathological conditions. The remaining cases didn't have any underlying pathological conditions (Table 6).

Out of the 38 cases who were followed up for recurrence of UTI, 36 (94%) cases were resolved completely with intensive and longer duration treatment. 2 cases of neurogenic bladder had repeat infection with different microbe with different organism (Table 6).

Discussion

The appropriate choice of antibiotic for UTI requires an adequate understanding of epidemiology and profiles of local antimicrobial resistance of associated uropathogen. Antibiotic sensitivity change over a period of time.[4]

Therefore pediatrician awareness of rising resistance of urinary pathogen needs to be done on a periodic basis.[5]

There is variation regarding age group of children with higher prevalence in this study of girls to boys. This is in accordance with various studies.[6]

The age group 0-6years is the most affected in the study conducted. This can be attributed to the fact majority of children of this age group are not toilet trained[7] (Table 1).

E. coli and Klebsiella form the bulk of the organism isolated and constitute 80% of all cases. This was less than what G.K Rai et al reported (93%)[9] (Table 2) (Figure 1).

Five bacterial genera dominated the bacteriological profile: *E.coli*, Klebsiella sp., Proteussp, Enterobacter sp., and Enterococcus were the important ones isolated here which is similar to what Marzouk M etal[15](Table 2) (Figure 1).

Gram positive cocci were few in comparison to gram negative bacilli. Staph saprophyticus was the predominant gram positive cocci isolated. This is similar to most studies conducted[9] (Table 1) (Figure 1).

At present it is not clear what is the most effective therapy and appropriate antibiotic treatment time for a UTI, but a review of the Cochrane collaboration of (2012) found that 10days of antibiotic treatment was effective in eliminating bacteriuria.[15]

In our study it was found that treatment was for a period of 7days which was found to be effective in almost all cases of UTI except for 2 cases of recurrent UTI which didn't resolve and had infection with a different microbe with a different sensitivity pattern.

Sulfamethoxazole trimethoprim and amoxicillin-clavulanate are the most utilized oral antibiotics which was similarly practiced in our hospital too where there was escalation of treatment after culture reports were sent[9,13] (Table 3) (Table 4).

Empirically for severe UTI in pediatric patients here are given Cefotaxim was given intravenous. According to sensitivity pattern if it comes resistant there will be escalation of treatment to Cefaperazone sulbactum.

Adult antibiotic profile in UTI cases in this institute has a higher resistance pattern to antibiotics. It shows sensitivity to Imipenem (90%), followed by Piperacillin tazobactum (82%) (Table 3).

In this present study there was total sensitivity (100%) to Imipenem, followed by Cefaperazone sulbactum and Piperacillintazobactum (93%) for E.coli and Klebsiella. This finding correlates with the study done by Catalina et al in (2014) and Marzouk et al in 2015.[13,15]

Rajabhandri et al. earlier reported nitrofurantoin as a most sensitive drug. Nitrofurantoin showed 90% sensitivity in this study. Nitrofurantoin is a bactericidal agent for Gram positive cocci and bacteriostatic agent for gram negative.

Some studies indicate that Nitrofurantoin has adequate renal excretion and can be used for complicated renal infections. However, there may be non compliant for Nitrofurantoin due to its bitter taste.[10,15]

Amoxicillin clavulunic acid and Cotrimoxazole resistance were found to be at 74 % and 52%.

Resistance of Enterobacteriaceae to beta-lactam antibiotics has increased in the past 30years.

This was first detected in Germany in (1980) and was quickly reported in the United States. This resistance is principally observed in *E. Coli* and Klebsiella, but can also be identified in other Enterobacteria[11] (Table 3) (Table 4).

Microbiological profile of urinary tract infection in pediatric population from a tertiary care hospital in South Kerala

Copyright:
©2015 Jitendranath et al. 7

The results obtained from this study showed a high resistance of *Enterobacteria* to Amoxycillin clavulunic acid and Cotrimoxazole. This is similar to recent articles in which Several authors report resistances that fluctuate between 24 and 58% for Amoxycillin clavulunic acid and are up to 36% for Cotrimoxazole[12](Table 3).

Multi drug resistance along with ESBL production was seen in 67 (37%) of the isolates. They were seen only in Klebsiella and E.coli. ESBL production was seen 24(14.1%) cases of the total isolates. This was in accordance with the study done by Ismail et al (2011) and Catalina et al (2014)[12,13] (Table 6).
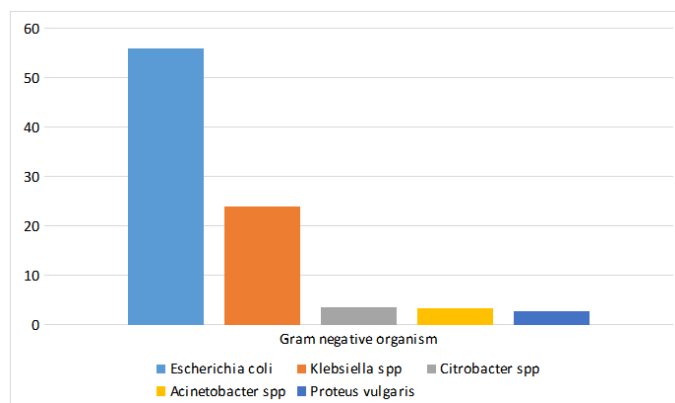
Figure 2 Distribution of gram negative organisms isolated.

Conclusion

This was a prospective study done in SreGokulam medical college, Trivandrum from June 2013 to May 2014. *E.coli* was found to be the most common organism with Imipenem, Piperacillin tazobactum and Cefaperozone sulbactum found to be the most effective antibiotics.

Important facts emanating from the present study include:

i. Girls and infants in age group 0-6years were more commonly affected (Table 1).

ii. Underlying surgical and indwelling catheter were the most important causes of recurrent UTI (Table 6).

iii. Empirical treatment with cotrimoxazole and amoxicillin clavulunic acid for UTIs were the drugs of choice initially and they may be insufficient due to the elevated rate of resistance of *E. coli* and other isolated uropathogens (Table 3) (Table 4).

iv. Conversely, amikacin, and nitrofurantoin would be therapeutic alternatives in pediatric patients with uncomplicated UTI and Piperacilin tazobactum and cefeoperazone sulbactum in those with more severity, as in the case of urosepsis (Table 3) (Table 4).

Present study along with previous studies indicate the need for periodic monitoring of organisms with antibiotic sensitivity of the same.

Acknowledgements

Conflict of interest

The author declares no conflict of interest.

References

1. Shrestha B, Basnet RB, Shrestha P, et al. Prevalence of urinary tract infection in female patients attending Kathmandu Model Hospital. *J Nepal Assoc Med Lab Sci*. 2005;7:10–14.

2. Chon CH, Lai FC, Shorthffe LM. Pediatric urinary tract infections. *Pediatr Clin North Amer*. 2001;48:1447–1459.

3. Pooja P, Garala RN. Bacteriological profile and antibiotic susceptibility pattern (antibiogram) of urinary tract infections in pediatric patients. *J Res Med Den Sci*. 2014;2(1):20–23.

4. Palikhe N. Prescribing pattern of antibiotics in pediatric hospital of Kathmandu Valley. *Kathmandu Univ Med J*. 2014;2(1):6–12.

5. Oreskovic NM, Sembrano EU. Repeat urine cultures in children who are admitted with urinary tract infections. *Pediatrics*. 2007;119(2):325–329.

6. Wald Ellen. Urinary tract infections in infants and children: a comprehensive overview. *Curr Opin Pediatr*. 2004;16(1):85–88.

7. Elder JS. Urinary tract infections. In: Kliegman RM, Behrman RE, Jenson HB, Stanton BE, editors. *Nelson Textbook of Pediatrics*. Philadelphia: Saunders; 2007. p. 2223–2228.

8. Montini G, Tullus K, Hewitt I. Febrile urinary tract infections in children. *N Engl J Med*. 2011;365(3):239–250.

9. Rai GK, Upreti HC, Rai SK, et al. Causative agents of urinary tract infections in children and their antibiotic sensitivity pattern: a hospital based study. *Nepal Med Coll J*. 2008;10(2):86–90.

10. Rajbhandari R, Shrestha J. Bacteriological study of urinary tract infection and its antibiotic sensitivity test: a hospital based study. *J Nepal Assoc Med Lab Sci*. 2002;4:26–32.

11. Pai V, Nair B. Etiology and sensitivity of uropathogens in outpatients and inpatients with urinary tract infection: Implications on empiric therapy. *Ann Trop Med Public Health*. 2012;5(3):181–184.

12. Ismaili K, Wissing KM, Lolin K, et al. Characteristics of first urinary tract infection with fever in children: a prospective clinical and imaging study. *Pediatr Infect Dis J*. 2011;30(5):371–374.

13. Vélez Echeverri C, Serna–Higuita LM, Serrano AK, et al. Resistance profile for pathogens causing urinary tract infection in a pediatric population, and antibiotic treatment response at a University Hospital, (2010–2011). *Colomb Med (Cali)*. 2014;45(1):39–44.

14. Roberts KB. Urinary tract infection: clinical practice guideline for the diagnosis and management of the initial UTI in febrile infants and children 2 to 24months. *Pediatrics*. 2011;128(3):595–610.

15. Marzouk M, Ferjani A, Haj Ali M. Profile and susceptibility to antibiotics in urinary tract infections in children and newborns from 2012 to 2013: Data from 1879 urine cultures. *Arch Pediatr*. 2015;22(5):505–509.