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-Tazobactam and Cefaperzone 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 multdrug resistant.

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

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 3 months and thereafter in girls. Pyelonephritis is common in infants.

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.

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

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 2 months 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.

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

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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 Academy.

**Antibiotic sensitivity testing**

Done using Kirby Baeur disc diffusion method. Antibiotics were selected according to CLSI guidelines. The antibiotics 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), Amoxyccillin-clavulunic acid (30ug), Cotrimoxazol (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 Cefazidime 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**

<table>
<thead>
<tr>
<th>Age group</th>
<th>GPC</th>
<th>GNB</th>
<th>Fungi</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-6 years</td>
<td>17</td>
<td>118</td>
<td>2</td>
</tr>
<tr>
<td>7-12</td>
<td>3</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>13-15</td>
<td>10</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>20</td>
<td>146</td>
<td>4</td>
</tr>
</tbody>
</table>

Predominant organisms isolated among gram negative bacilli were *E. coli* 82(56.1%), followed by *Klebsiella spp* 35(23.97%), *Citrobacter spp* 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. Amoxyccillin 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 Amoxyccillin 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**

<table>
<thead>
<tr>
<th>Organism</th>
<th>Total no's (170)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Escherichio.coli (E.coli)</td>
<td>82</td>
</tr>
<tr>
<td>Klebsiella</td>
<td>35</td>
</tr>
<tr>
<td>Coagulase negative Staphylococcus</td>
<td>10</td>
</tr>
<tr>
<td>Citrobacter</td>
<td>8</td>
</tr>
<tr>
<td>Enterococcus</td>
<td>6</td>
</tr>
<tr>
<td>Acinetobacter spp</td>
<td>5</td>
</tr>
<tr>
<td>Proteus vulgaris</td>
<td>4</td>
</tr>
<tr>
<td>Staphylococcus aureus</td>
<td>4</td>
</tr>
</tbody>
</table>

**Table 3 Antibiotic sensitivity of common gram negative bacilli**

<table>
<thead>
<tr>
<th>Antibiotics</th>
<th>E. coli (82)</th>
<th>Klebsiella (35 )</th>
<th>Citrobacter (8 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amikacin</td>
<td>74</td>
<td>31</td>
<td>6</td>
</tr>
<tr>
<td>Cefotaxime</td>
<td>51</td>
<td>19</td>
<td>6</td>
</tr>
<tr>
<td>Nitrofurantoin</td>
<td>74</td>
<td>19</td>
<td>5</td>
</tr>
<tr>
<td>Norfloxacin</td>
<td>53</td>
<td>25</td>
<td>7</td>
</tr>
<tr>
<td>Cefaperazone-sulbactum</td>
<td>77</td>
<td>30</td>
<td>8</td>
</tr>
<tr>
<td>Piperacillin-tazobactum</td>
<td>77</td>
<td>31</td>
<td>8</td>
</tr>
<tr>
<td>Ofloxaclin</td>
<td>51</td>
<td>27</td>
<td>7</td>
</tr>
<tr>
<td>Amoxyccillin-clavulunic acid</td>
<td>21</td>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td>Imipenem</td>
<td>82</td>
<td>35</td>
<td>8</td>
</tr>
<tr>
<td>Nalidixic acid</td>
<td>47</td>
<td>20</td>
<td>6</td>
</tr>
<tr>
<td>Cotrimoxazole</td>
<td>46</td>
<td>18</td>
<td>5</td>
</tr>
</tbody>
</table>

**Table 4 Antibiotic sensitivity of gram positive cocci isolated**

<table>
<thead>
<tr>
<th>Antibiotic</th>
<th>Staph saprophyticus (10)</th>
<th>Enterococcus spp (6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrofurantoin</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>Teicoplanin</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>Amoxyccillin-clavulunic acid</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>Linezolid</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>Vancomycin</td>
<td>10</td>
<td>6</td>
</tr>
</tbody>
</table>
The age group 0-6 years 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. 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%) (Table 2) (Figure 1).

Five bacterial genera dominated the bacteriological profile: E. coli, Klebsiella sp., Proteus sp., Enterobacter sp., and Enterococcus were the important ones isolated here which is similar to what Marzouk M et al (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 (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 10 days of antibiotic treatment was effective in eliminating bacteriuria.15

In our study it was found that treatment was for a period of 7 days 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-clavulanic acid are the most utilized oral antibiotics which was similarly practiced in our hospital too where there was escalation of treatment after culture reports were sent13,13 (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 Piperacillin tazobactum (93%) for E. coli and Klebsiella. This finding correlates with the study done by Catalina et al in (2014) and Marzouk M et al in 2015.13,15

Rajabandri 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 clavulanic acid and Cotrimoxazole resistance were found to be at 74% and 52%.

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

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 Enterobacteria11 (Table 3) (Table 4).

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 (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) (Table 3).

![Figure 2: Distribution of gram negative organisms isolated.](image)

**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 Piperacillin tazobactum and cefoperazone 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**

None.

**Conflict of interest**

The author declares no conflict of interest.

**References**


