A Study on Culture and Sensitivity Pattern in Urinary Tract Infections of Febrile Children

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ABSTRACT

Introduction: Urinary tract infection (UTI) is one of the most common source of infection in febrile children under 5 years of age. Early diagnosis and appropriate treatment can significantly decrease late serious complications. Knowledge of the sensitivity and resistance pattern of uropathogens in specific geographical locations is an important factor for choosing suitable antibacterial treatment.

Material and methods: This observational study was conducted in order to evaluate the culture and sensitivity pattern of uropathogens at a tertiary care teaching hospital over a period of 18 months after institutional ethical committee approval. Cultures were performed on urinary samples collected by sterile urine bags in infants and mid-stream urine in children with blood and Mac Conkey agar plates at 35-37 C under aerobic coditions. Antibiotic sensitivity was measured by using the clinical laboratory standard institute (CLSI) guidelines. All the data was recorded in a pre-designed proforma after taking consent from the parents and analysed using the appropriate statistical methods.

Results: Out of 422 febrile children, 85(20.1%) cases showed more than 5 pus cells per high power field on microscopy, 38 cases were found to be culture positive giving rise to an incidence of 9% in our study. UTI was more common in males in first year of age and in females beyond 1 year. The most common organism isolated was E.coli in 25 (65.7%) cases, followed by Klebsiella in 6(15.8%) and other organisms in few cases. These organisms were mostly sensitive to gentamycin (94.7%), ciprofloxacin (92%), ceftriaxone (89.4%) and resistant to the common urinary tract antibiotics like ampicillin (13.1%), amoxy-clavulinic acid (18.4%) and co-trimoxazole (26.3%).

Conclusion: All children with febrile UTI should be started with early and appropriate antibiotics to prevent long term complications especially end stage renal disease in the future. This requires regular monitoring of antimicrobial culture and sensitivity patterns to know the appropriate common local antibiotics for febrile UTI, so that empiric therapy with antibiotics could be started early to prevent long term complications in children.

Keywords: Febrile Children, Urinary Tract Infection, Microbiological Profile, Culture Sensitivity, Incidence.

INTRODUCTION

Fever is one of the most common symptoms for which a child under 5 years of age is brought to the hospital. Unlike other severe bacterial infections, not much attention has been focused on the identification of urinary tract infection (UTI) in febrile children despite the fact that UTI account for a significant proportion of cases of unexplained febrile illness and is associated with significant morbidity.[1] If not diagnosed early and treated adequately, UTI leads to chronic ill health and long term renal damage.[2]

UTI is defined as the growth of significant number of organisms of a single species in the urine, in the presence of symptoms. Significant bacteriuria is a growth with colony count of $>10^5$/ml of a single species in a mid-stream clean catch urine sample.[3] It's incidence varies in early infancy and childhood, being more common in boys in first three months of life with reported distribution of 5:1 with male predominance[4], in contrast to childhood in which male to female ratio is 1:10.[5]

Fever, may be the only significant symptom in children with urinary tract infections and all children with otherwise unexplained fever merit evaluation for possible UTI.[6] It is essential to identify urinary tract infections in febrile children and institute prompt treatment to reduce the potential for lifelong morbidity. Progressive renal damage from unrecognized pyelonephritis in childhood may lead to hypertension and chronic renal failure in later life.[7] Approximately 13% to 15% of end stage renal disease is thought to be related to urinary tract infection in childhood that is often unrecognized and therefore under treated.[8]

Seeking laboratory confirmation of the diagnosis of UTI requires the initial step of collecting uncontaminated urine sample. Knowledge of the sensitivity and resistance pattern of uropathogens isolated in a specific geographical location is an important factor for choosing appropriate antibiotic treatment as the emergence of resistant bacteria is growing worldwide with epidemiological significance.

The aim of the present study was to determine the local culture sensitivity pattern of common microorganisms responsible for UTI in young children (1 month to 5 years) as there is a significant incidence of young febrile children in our institute so that the future complications related to UTI can be minimized.

MATERIAL AND METHODS

This was a hospital based, observational study conducted in the department of paediatrics of a tertiary care teaching hospital in central Andhra Pradesh, South India over a period of 18 months from January 2014 to June 2015 after institutional ethical committee approval. All febrile (>37.8^{0}c) children with UTI symptoms between the age group of 1 month to 5 years who were admitted in the hospital were included in the study. Children aged below 1 month and above 5 years of age; who had received

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antibiotics 48 hours prior to hospital visit and those with known anatomic abnormalities of the genitourinary tract were excluded from the study. Detailed history and physical examination with relevant investigations was carried out and documented in a predesigned proforma after taking the informed consent.

The urinary specimens collected in a standard method were centrifuged in a standard manner and sent for urine microscopy. Those urine samples showing pus cells >5 per high power field were sent for culture to microbiology department after collection with sterile urine bags in infants and mid-stream urine in children and they were incubated on blood and Mac Conkey agar plates with a 0.01ml calibrated loop. All plates were incubated at 35-37^{0}c for 24 hrs under aerobic condition to obtain accurate colony count. A colony count of more than 10^5 cfu/ml organisms of a single species was considered significant. Samples showing insignificant growth, mixed growth of 2 or more pathogens or non-pathogens were not considered as culture positive. Antibiotic sensitivity was put up by the Kirby Bauer disc diffusion method following the clinical laboratory standard institute (CLSI) guidelines.[9]

STATISTICAL ANALYSIS

The collected data was analysed descriptively by using appropriate statistical methods in Microsoft excel 2013 format.

RESULTS

A total of 422 children (1 month to 5 years) were admitted in the study, in which 190 (45%) were males; 232 (55%) were females. Among febrile UTI children, males outnumbered females in <1 yr age group and females were more than males in 2-5 yr age group (table 1).

Culture positive cases were more common in males of less than1 year of age and beyond 1 year with female predominance (table-2).

Out of 422 febrile children, 85(20.1%) found to have pus cells >5 per hpf under urine microscopy, in which 38(44.7%) children turned to be culture positive. The number of culture positive cases were increasing with increasing pus cells in urine as per table 3.

Table 4 shows that Escherichia coli was the commonest bacterium found in 25 (65.7%) children followed by Klebsiella in 6(15.8%), Proteus in 4 children (10.5%), 2(5.3%) showed the growth of Staphylococcus and Pseudomonas was isolated in one (2.6%) child.

From the table 5, it was observed that among the culture positive cases; gentamycin (94.7%), ciprofloxacin (92.1%), ceftriaxone (89.4%) and cefixime (84.2%) drugs were found to be the most sensitive antibiotics. The least sensitive drugs were co-trimoxozole (26.3%), amoxy-clavulinic acid (18.4%) and ampicillin (13.1%).

E.coli was found to be the most common (65.7%) isolated organism among the culture positive cases and was highly sensitive to gentamycin (100%) followed by ceftriaxone (84%), cefixime (84%), ciprofloxacin (80%), nalidixic acid (72%) and nitrofurantoin (68%) and least sensitive to amoxy-clavulinic acid (4%), ampicillin (8%) and co-trimoxazole (20%) (table-6).

DISSCUSION

It is essential to identify UTI in febrile children and start appropriate treatment to reduce the potential for lifelong morbidity. Out of 422 febrile children; 38 cases were found to be culture positive making the incidence rate of 9% which was almost similar to the study done by Kaushal RK et al[10] who reported it as 8.4% in children <5years. A study by Francis Fredrick[11] in febrile children <5 years observed the rate of 16.8% which was found to be higher than in our study. Various studies[12-16] showed the incidence of UTI among febrile children which ranges from 1.5% to 10%. Such variations might be due to differences in sample size, inclusion of only pyuria cases in the study, lower nutritional status and other socio economic factors etc.

Age	Male	Female
<1 Year	50 (11.8%)	24 (5.68%)
1-2 Years	96 (22.7%)	108 (25.5%)
2-5 Years	44 (10.63%)	100 (23.69%)
Total	190 (45%)	232 (55%)

Table-1: Age and sex distribution of study group

Age	Male	Female	Total
<1Year	6	2	8
1-2 Years	1	11	12
2-5 Years	6	12	18
Total	13	25	38

Table-2: Distribution of culture positive subjects in Relation to age and sex (n=38)

PUS cells count	No of cases	Culture positive cases n(%)
5-10	42	08 (19.04%)
10-15	26	13 (50.0%)
Plenty (>15)	17	17 (100%)
Total	85	38 (44.7%)

Table-3: Comparision between PUS cells by urine microscopy and culture sensitivity in study subjects

Organism	No. of cases	Percentage %
E. Coli	25	65.7
Klebsiella	06	15.8
Proteus	04	10.5
Staphylococcus	02	05.3
Pseudomonas	01	02.6
Total	38	100

Table-4: Microbiological profile of culture positive UTI cases (n=38)

Antibiotics	Percentage (%)
Gentamycin	94.7
Ciprofloxacin	92.1
Ceftriaxone	89.4
Cefixime	84.2
Cefuroxime	73.6
Nalidixic acid	73.6
Nitrofurantoin	68.4
Cephalexin	50.0
Co-trimoxazole	26.3
Amoxy-clavulinic acid	18.4
Ampicillin	13.1

Table-5: Antibiotic sensitivity pattern of culture positive subjects

Antibiotics	Percentage
Gentamycin	100%
Ceftriaxone	84%
Cefixime	84%
Ciprofloxacin	80%
Nalidixic acid	72%
Nitrofurantoin	68%
Cefuroxime	60%
Cephalexin	44%
Co-trimoxazole	20%
Ampicillin	08%
Amoxy-clavulinic acid	04%

Table-6: E.Coli sensitivity to different antibiotics

UTI was found to be the frequent problem in children and was more common in males than females in first year of life and was more seen in females after one year of age. In the present study (table 2), out of 38 positive UTI cases; 14 males and 24 females were seen. Among them, 6 males and 2 females were below one year of age (more in male), 1 male and 11 females were found between the age of 1-2 years (more in females) and 6 males and 12 females were found above 2 years. Our findings were similar to other studies.[14,17-19] The reason behind low percentage of UTI among males was longer course of urethra and bacteriostatic secretion by prostate gland as mentioned by Malla KK et al[20], Akram M et al.[21] UTI is more common in females because female children have short urethra which is in close proximity to the anus, thus facilitates easy ascent of bacterial pathogens from the gastro intestinal tract to the urinary tract. Urinary tract infection is reported to be more common in early childhood and this is probably because of immature immune system. Structural anomalies which are known to resolve spontaneously later in childhood may also account for UTI in early childhood.

In the present study (table 3), out of 38 culture positive cases; around 17 (44.7%) cases had plenty of pus cells (>15), 13(34.2%) cases had 10-15 pus cells and 8 (21.1%) cases had>5 pus cells and around 34 cases with pus cells of more than 5-10 had no culture positive UTI cases. According to Hoberman et al[22] more than 5 pus cells/high power field had a sensitivity of 54%, specificity of 96%, positive predictive value of 45% and negative predictive value of 97%. Significant pyuria had a sensitivity and specificity of 30-50% according to sanjeev G, Vijay K et al.[23] Hence pyuria alone is not satisfactory for making a diagnosis, but it constitutes a strong supportive evidence of urinary tract infection.

In the present study, the most common isolated microorganism was E.coli in 25 (65.7%) cases. This was in accordance with the other studies done by Aravind Bagga[24], Bryan CS et al[25], Manohar BB et al[26], Taneja et al[17], Sharma A et al[18], Akram M et al[21] in which E.coli was isolated from 51.1% to 72.8% of cases. In the present study, the second most common isolated microorganism was klebsiella in 6 (15.8%) cases. Studies by Manohar BB[26], Akram M[21] showed similar data (18% to 22%) which is in contrast to the study done by Taneja et al.[17] Proteus was the third most common isolate in 4 (10.5%) cases which was similar to the study done by Bouskraoui Met al[27] in contrast to the study by Gautam et al[28] who observed 21% of Proteus species which was higher than in our study. Other organisms identified in the present study were Staphylococcus in 2 (5.3%) and Pseudomonas in 1 (2.6%) subject.

There was a high sensitivity to gentamycin (94.7%), ciprofloxacin (92.1%), ceftriaxone (89.4%), cefixime (89.2%), cefuroxime (73.6%), nalidixic acid (73.6%) and nitrofurantoin (68.4%). The most important finding in this study was increased frequency of resistance to the common urinary tract antibiotics like ampicillin (13.1%), amoxy-clavulinic acid (18.4%) and co-trimoxazole (26.3%).

In the present study, E.coli was found to be sensitive to gentamycin (100%) followed by ceftriaxone (84%) and cefixime (84%). Malla KK et al[20], Kumari N et al[29] reported gentamycin as the most sensitive drug, which is in agreement with the present study. Gautam et al[28] observed in his study that E.coli was found to be sensitive (69.2%) to gentamycin which was lesser than the present study. E.coli sensitivity rate was <50% to ampicillin, amoxy-clavulinic acid, co-trimoxazole and cephalexin and this is comparable with the studies done by Schlager TA et al[30] and Kot B et al.[31]

Study Limitations

This was a highly selective hospital based study, so the results may not be generalized to the entire community. Children more than 5 years were excluded in the study. Some of the complicated UTI cases might have been missed as the known cases with renal abnormalities were excluded from the study group.

CONCLUSION

Our tertiary care teaching hospital serves to the high risk febrile children with UTI with the culture positive rate of 9%. Febrile UTI was common in children below 5 years of age with more incidence in boys of <1 year of age and in girls of >1 year of age. Children presenting with fever and suspected UTI should first undergo urine culture and sensitivity testing before presumptive antimicrobial therapy. E. coli and Klebsiella were the most common organisms causing UTI in children coming from the community. In vitro sensitivity urine cultures showed high sensitivity to gentamycin, ceftriaxone, ciprofloxacin, cefixime and cefuroxime; but very low sensitivity to co-trimoxazole, amoxy-clavulanate and ampicillin. Regular monitoring of antimicrobial sensitivity is recommended to know the local resistance pattern of uropathogens. So the major goal for the young child with UTI is early diagnosis with appropriate antibiotic treatment in order to eradicate infection in the growing kidney so as to prevent the long term complications and end stage renal disease in the future.

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