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Original article:

Clinical and microbiological study of urinary tract infection in children under five years of age

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ABSTRACT

Background: Urinary tract infection (UTI) is is one of the most common serious bacterial illnesses affecting children, particularly infants and young children of pediatric age group. There is a wide spectrum of clinical features in pediatric UTI that varies with different age group, leading to underdiagnosis and misdiagnosis. Timely diagnosis and targeted treatment decrease the risk of renal scarring and other complications. The microbiological profile of UTI and the antibiotic susceptibility of uropathogens in both the community and hospitals have been changing, and drug resistance has become a major problem. Delaying diagnosis and treatment of UTIs may result in long-term renal complications. For this purpose, empirical antibiotic is often prescribed even before the culture results are available. On the other hand, antibiotic resistance of urinary tract pathogens has been increasing globally.

Aim: To study the clinical presentation of UTI, identification of uropathogens and their antibiotic sensitivity pattern.

Materials and Methods: This is a prospective and cross sectional study was conducted at Department of Paediatrics and Department of Microbiology, N.C. Medical College and Hospital, Israna, Panipat, India, over a period of one year from January 2018 to December 2018. Total 200 children below 5 years of age, who presented with UTI, were included in the study. Detailed history, clinical examination, and laboratory investigations including culture and antibiotic sensitivity pattern were documented.

Results: Out of the 200 children below 5 years, who presented with UTI, 44.5% were below age 0 to 2 years, 32.5% were age 2 to 4 years and 23% were age 4 to 5 years. Sex wise distributions male and female were 40.5% and 59.5% respectively. The most common presenting symptom was fever 70% followed by increased frequency of micturition 40.5%, abdominal pain 39.5%, burning micturition 33%, chills and rigor 14% and vomiting 12.5%. Escherichia coli is the most common pathogen isolated (59%), followed by followed by *Klebsiella pneumoniae* (23.5%), *Enterobacter aerogenes* (5.5%), *Staphylococcus aureus* (4.5%) and Coagulase negative staphylococci and *Enterococcus* species (2.5%) each, *Proteus mirabilis* (1.5%) and *Proteus vulgaris* (1%). Maximum organisms were sensitive to ceftazidime, amikacin and gentamicin among the first line. Piperacillin-tazobactam was found to be a good second line antibiotic. .

Conclusion: Regular surveillance should be carried out to determine the local prevalence of organisms and their antimicrobial sensitivity pattern in order to guide the proper treatment of children.

Keywords: Fever, Escherichia coli, Pyuria, Urinary tract infection, Panipat.

INTRODUCTION

Urinary tract infection (UTI) are one of the commonest cause of febrile illness in pediatric population with a worldwide prevalence of 2–20% [1, 2]. They can be associated with high morbidity and long-term complications such as renal scarring, hypertension, and chronic renal failure [3, 4]. Pediatric UTI cases remain under-diagnosed in many instances due to absence of specific symptomsand signs, especially in infants and young children [5].

UTI involves invasion, lodgment, and multiplication of organisms in urinary tract which leads to an inflammatory response.[6] UTI is one of the most frequent infection in children. At least 8% of girls and 2% of boys will have a UTI in childhood.[7] UTI in pediatric age group differs in all the way from adults mainly by following congenital abnormalities of urinary tract namely posturethral valves, pelvi-ureteric junction obstruction, neurogenic bladder, stricture urethra, vesicoureteral reflux which is very true in infants (<1 year age group).[8]

Pediatric UTI often remains undiagnosed with nonspecific signs and symptoms.[9] It is very much essential to diagnose and treat the condition as it could be the first presentation of an underlying urological anomalies as already mentioned above or it may in itself lead to significant morbidity from renal scarring, hypertension, and eventually renal failure. [10]

Incidence, prevalence, and antibiotic sensitivity pattern of pediatric UTI differ from country to country and within the same country between different geographical areas and also in different age groups. [11,12]

MATERIALS AND METHODS

Study design: Prospective and cross sectional study.

Place of study: Department of Paediatrics and Department of Microbiology, N.C. Medical College and Hospital, Israna, Panipat, Haryana, India

Period of study: One year from January 2018 to December 2018.

Inclusion criteria:

1. Patients were included age group of 0 to 5 years.
2. Patient's urine samples showed significant growth in urine culture.

Exclusion criteria:

1. Patients were age more than 5 years were excluded.
2. Patients urine samples showed insignificant growth in absence of pus cells in the culture were excluded.

Patient's information was collected from requisition form, laboratory records and medical records.

A total of 200 urine samples (Midstream clean catch, nappy pad, catheter aspirated) of pediatric patients of age group 0–5 years suspected of UTI were collected and transported to the Microbiology laboratory. To minimize contamination, clean catch midstream method was employed wherever possible. In neonates and early infants, nappy pad method, described by Liaw et al. [13] was used. In case of catheterized patients, urine specimens were collected either through the catheter collection port or through puncture of the tubing with a sterile needle [14]. The samples were then processed by semi-quantitative streaking method using a calibrated inoculating loop (holding 0.001 ml urine) onto the blood agar and MacConkey's agar. The inoculated plates were incubated for 24 hours at 37°C. The isolates were identified using standard microbiological methods. [15] Antimicrobial susceptibility was

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tested by modified Kirby-Bauer disc diffusion method on Mueller Hinton agar (Hi-Media, India) following standard procedures recommended by the Clinical and Laboratory Standards Institute (CLSI) [16].

RESULTS

Age wise distribution among the 200 cases examined in the study 89 children belonged to 0-2 years of age constituted 44.5%, 65 children belonged to 2-4 years of age constituting 32.5% and 46 were belonged to 4-5 years of age constituting 23%. [Table 1]

Table 1: Shows age wise distribution of patients (n=200).

Age group	Number	Percentages
0-2 years	89	44.5%
2-4 years	65	32.5%
4-5 years	46	23%
Total	200	100%

Sex wise distributions in the total of 200 children 81 were male and 119 were female constituting 40.5% and 59.5% respectively. [Table 2]

Table 2: Sex wise distribution of patients (n=200).

Sex	Number	Percentages
Male	81	40.5%
Female	119	59.5%
Total	200	100%

Among 200 children 140 (70%) had fever history which the most common symptom observed in the study 39 children had less than 3 days fever which is around 19.5% of total children and 3 to 5 days history was in 47 children constituting 23.5% and fever was present for more than 5 days in 54 children constituting 27%, followed by increased frequency of micturition with small voids every time was present in 83 (40.5%) children, abdominal pain was present in 79 (39.5%) patients, burning micturition history was present in 66 (33%) children, chills and rigor were present in 28 (14%) patients with fever, vomiting was present in 25 (12.5%) patients. [Table 3]

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Table 3: Shows symptoms of patients. (n=200)

Symptoms		Number	Percentages
Fever	Less than 3 days	39	19.5%
	3-5 days	47	23.5%
	More than 5 days	54	27%
Increased frequency		83	40.5%
Abdominal pain		79	39.5%
Burning micturition		66	33%
Chills & Rigor		28	14%
Vomiting		25	12.5%
High coloured urine		17	8.5%

Total 200 cases with urine culture positive had significant pyuria were proceed for further identification and antibiotic sensitivity testing. *Escherichia coli* is the most common pathogen isolated 118 (59%), followed by *Klebsiella pneumoniae* 47 (23.5%), *Enterobacter aerogenes* 11 (5.5%), *Staphylococcus aureus* 9 (4.5%) and Coagulase negative staphylococci and *Enterococcus* species 5 (2.5%) each, *Proteus mirabilis* 3 (1.5%) and *Proteus vulgaris* 2 (1%). [Table 4]

Table 4: Shows bacterial isolates from urine samples.

Bacterial isolates	Number	Percentages
Escherichia coli	118	59%
Klebsiella pneumoniae	47	23.5%
Enterobacter aerogenes	11	5.5%
Staphylococcus aureus	9	4.5%
Coagulase negative staphylococci	5	2.5%
Enterococcus species	5	2.5%
Proteus mirabilis	3	1.5%
Proteus vulgaris	2	1%
Total	200	100%

Escherichia coli was maximum sensitive to pipercilline/tazobactam (98.31%) followed by amikacin (87.29%), ceftazidime (85.59%), gentamicin (74.58%) however ampicillin/sulbactam, ofloxacin, ofloxacin, lomifloxacin, tetracycline was around 60% and cefuroxime and co-trimoxazole was 40%. Antibiotic sensitivity test showed variable degree of resistance. *Klebsiella pneumoniae* was sensitive to pipercilline/tazobactam (93.62%) followed by gentamicin (87.23%) ceftazidime (78.72%), amikacin (70.21%), however ampicillin/sulbactam was 60% and ofloxacin, ofloxacin, lomifloxacin, tetracycline and cefuroxime was 48% to 55%. Ciprofloxacin and co-trimoxazole

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was showed least sensitivity i.e. (23.40%) each. *Enterobacter aerogenes* was maximum sensitive to pipercilline/tazobactam (93.62%) followed by amikacin, gentamicin and ceftazidime (81.82%) each, ampicillin/sulbactam and ofloxacin (54.55%) each, however ciprofloxacin, lomifloxacin, cefoperazone and tetracycline (36.36%) each. Cefuroxime and co-trimoxazole was showed least sensitivity i.e. (18.18%) each. *Staphylococcus aureus* was maximum sensitive to pipercilline/tazobactam (100%) followed by amikacin and gentamicin (77.78%) each, ampicillin/sulbactam and ceftazidime (66.67%) each, ciprofloxacin, ofloxacin, cefoperazone and tetracycline (44.44%) each, lomifloxacin (33.33%). Co-trimoxazole showed 100% resistance. [Table 5].

Table.2 Antimicrobial sensitivity pattern of isolated bacteria

Bacterial isolates	Antimicrobial sensitivity No. (%)											
	AK	AS	CP	GM	OF	LO	CU	CS	CA	PIT	TE	BA
Escherichia coli (n=118)	103 (87.29)	81 (68.64)	76 (64.41)	88 (74.58)	75 (63.56)	76 (64.41)	55 (46.61)	81 (68.64)	101 (85.59)	116 (98.31)	75 (63.56)	49 (41.53)
Klebsiella pneumoniae (n=47)	33 (70.21)	29 (61.70)	23 (48.94)	41 (87.23)	26 (55.32)	23 (48.94)	11 (23.40)	26 (55.32)	37 (78.72)	44 (93.62)	23 (48.94)	11 (23.40)
Enterobacter aerogenes (n=11)	9 (81.82)	6 (54.55)	4 (36.36)	9 (81.82)	6 (54.55)	4 (36.36)	2 (18.18)	4 (36.36)	9 (81.82)	10 (90.91)	4 (36.36)	2 (18.18)
Staphylococcus aureus (n=9)	7 (77.78)	6 (66.67)	4 (44.44)	7 (77.78)	4 (44.44)	3 (33.33)	2 (22.22)	4 (44.44)	6 (66.67)	9 (100)	4 (44.44)	0 (0)
CoNS (n=5)	5 (100)	4 (80)	4 (40)	5 (100)	3 (60)	4 (80)	3 (60)	4 (40)	4 (80)	5 (100)	4 (40)	0 (0)
Enterococcus species (n=5)	3 (60)	2 (40)	2 (66.67)	5 (100)	3 (60)	2 (40)	1 (20)	3 (60)	4 (80)	5 (100)	2 (66.67)	1 (20)
Proteus mirabilis (n=3)	2 (66.67)	1 (50)	2 (50)	3 (100)	2 (66.67)	3 (100)	1 (33.33)	3 (100)	3 (100)	3 (100)	2 (50)	0 (0)
Proteus vulgaris (n=2)	2 (100)	1 (65)	1 (58)	2 (100)	1 (50)	2 (100)	1 (50)	2 (100)	2 (100)	2 (100)	1 (58)	0 (0)

Abbreviations: AK= Amikacin, AS= Ampicillin/Sulbactam, CP=Ciprofloxacin, GM= Gentamicin, OF= Ofloxacin, LO= Lomifloxacin, CU=Cefuroxime, CS= Cefoperazone, CA= Ceftazidime, PIT= Piperacillin/Tazobactum, TE= Tetracycline, BA= Co-trimoxazole., CoNS= Coagulase negative staphylococci.

DISCUSSION

UTI is a common health problem in children and it is an important cause of morbidity and mortality, especially in the first 2 years of life [17] Total 200 cases were included in the study out of which 89 children belonged to 0-2 years of age constituted 44.5%, 65 children belonged to 2-4 years of age constituting 32.5% and 46 were belonged to 4-5 years of age constituting 23%. In our study sex wise distributions in the total of 200 children 81 were male and 119 were female constituting 40.5% and 59.5% respectively. A study by Taneja N et al. which studied 558 children with culture-proven UTI below 12 years age, noted a ratio of 4.3:1.0 among children <1 year, and 2.5:1 in

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children between 1 and 5 years age [8]. Similar study was Lee MD et al. which included a total of 699 children aged 2–24 months observed a male to female ratio of 2.2:1 [18].

In our study 140 children had fever history which constitute 70% of the total children and it was the most common symptom observed in the study 39 children had less than 3 days fever which is around 19.5% of total children and 3 to 5 days history was in 47 children constituting 23.5% and fever was present for more than 5 days in 54 children constituting 27%, followed by increased frequency of micturition with small voids every time was present in 83 (40.5%) children, abdominal pain was present in 79 (39.5%) patients, burning micturition history was present in 66 (33%) children, chills and rigor were present in 28 (14%) patients with fever, vomiting was present in 25 (12.5%) patients. This is comparable to the results noted in studies by Singh SD and Madhup SK, Saleh SI et al., and Bay A [19-21].

Total 200 cases with urine culture positive had significant pyuria were proceed for further identification and antibiotic sensitivity testing. *Escherichia coli* is the most common pathogen isolated 118 (59%), followed by *Klebsiella pneumoniae* 47 (23.5%), *Enterobacter aerogenes* 11 (5.5%), *Staphylococcus aureus* 9 (4.5%) and Coagulase negative staphylococci and *Enterococcus* species 5 (2.5%) each, *Proteus mirabilis* 3 (1.5%) and *Proteus vulgaris* 2 (1%). A study by Gupta et al. on 186 culture-proven UTI cases showed similar results with E. coli being the most common pathogen, seen in 52% cases. [22]

Escherichia coli was maximum sensitive to pipercilline/tazobactam (98.31%) followed by amikacin (87.29%), ceftazidime (85.59%), gentamicin (74.58%) however ampicillin/sulbactam, ofloxacin, ofloxacin, lomifloxacin, tetracycline was around 60% and cefuroxime and co-trimoxazole was 40%. Antibiotic sensitivity test showed variable degree of resistance. *Klebsiella pneumoniae* was sensitive to pipercilline/tazobactam (93.62%) followed by gentamicin (87.23%) ceftazidime (78.72%), amikacin (70.21%), however ampicillin/sulbactam was 60% and ofloxacin, ofloxacin, lomifloxacin, tetracycline and cefuroxime was 48% to 55%. Ciprofloxacin and co-trimoxazole was showed least sensitivity i.e. (23.40%) each. *Enterobacter aerogenes* was maximum sensitive to pipercilline/tazobactam (93.62%) followed by amikacin, gentamicin and ceftazidime (81.82%) each, ampicillin/sulbactam and ofloxacin (54.55%) each, however ciprofloxacin, lomifloxacin, cefoperazone and tetracycline (36.36%) each. Cefuroxime and co-trimoxazole was showed least sensitivity i.e. (18.18%) each. *Staphylococcus aureus* was maximum sensitive to pipercilline/tazobactam (100%) followed by amikacin and gentamicin (77.78%) each, ampicillin/sulbactam and ceftazidime (66.67%) each, ciprofloxacin, ofloxacin, cefoperazone and tetracycline (44.44%) each, lomifloxacin (33.33%). Co-trimoxazole showed 100% resistance. In our study maximum organisms were sensitive to ceftazidime, amikacin and gentamicin among the first line. Piperacillin-tazobactam was found to be a good second line antibiotic. A study by Gupta et al. found most of the organisms sensitive to nitrofurantoin followed by cefoperazone sulbactam and aminoglycosides [22]. According to the study on UTI by Singh SD and Madhup SK 80% of the cases were sensitive to amikacin, gentamicin, ceftriaxone, ofloxacin, nalidixic acid, imipenem, and vancomycin [19].

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CONCLUSION

In conclusion, UTI varies with age and gender, due to their higher incidence, extensive evaluation is required in boys below 1 year of age with UTI. Knowledge on local microbiological profile and its sensitivity pattern is essential to choose appropriate empirical antibiotics and to prevent long-term sequelae following UTI. High-level antimicrobial resistance was observed in pediatric UTI. Regular surveillance should be carried out to determine the local prevalence of organisms and their antimicrobial sensitivity pattern in order to guide the proper treatment of children.

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