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Original Research Article

Prevalence, identification and frequency of uropathogens causing urinary tract infection in children in Ujjain (M.P.)

Kaina Bhonsle^{1,*}, Alka Vyas¹, Harish Vyas², Abhiraj Ramchandani³, Kirti Hemwani⁴¹School of Studies in Microbiology, Vikram University, Ujjain, Madhya Pradesh, India²Government Kalidas Girls PG College, Ujjain, Madhya Pradesh, India³Dept. of Pathology, Amaltas Institute of Medical Sciences, Dewas, Madhya Pradesh, India⁴Dept. of Microbiology, R. D. Gardi Medical College, Ujjain, Madhya Pradesh, India

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ABSTRACT

Background: Urinary tract infection is one of the most common infectious disease found in all population and has become a major health problem. The urinary tract infection also affects pediatric population especially in the age group of 0-5 years.

Aim: The aim of this study to find out prevalence of UTI in children, its occurrence in different gender and seasons along with identification of causative agent of UTI in children in Ujjain.

Materials and Methods: The study was carried out in SRL laboratory Ujjain center and total 881 suspected patients urine sample were collected and tested by conventional methods for prevalence of significant bacteriuria.

Results: It was seen that 550 samples were positive and out of these, positive case 111 belonged to children of 0-5 years of age. Thus, 20.18% positive cases were of children. The percentage of UTI in female children was high (54.0%) while in male children it was low (45.9%) and high number of cases were recorded in rainy season (39.6%), followed by summer and winter seasons which were (34.2%) and (26.1%) respectively. The six major uropathogens present in urine sample were isolated and identified and among them four were gram negative in which *E. coli*, *K. pneumoniae*, *P. aeruginosa*, *P. mirabilis* were gram negative while and *S. aureus* and *E. faecalis* were gram positive UTI causing bacteria in children.

Conclusion: In our study frequency of *E. coli* was highest (60.3%) while *S. aureus* was present in very low frequency (3.6%) so the prevention of UTI in children should be done by proper care of children by mothers.

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1. Introduction

The urinary tract infection (UTI) occurs due to entry, attachment and colonization of pathogenic microorganisms in any part of the urinary tract and causes inflammatory response in the epithelium of this tract.¹ UTI's affect both gender in all age groups and usually starts from neonates group and female are more prone to UTI due to female anatomy of urinary tract.² Urinary tract infection is one

of the most common infections in pediatric group. Each year approximately 0.7% children visit, clinics and about 5%-14% are admitted in emergency unit of hospitals.³ Among children, prevalence of UTI is high in the first two year of life and incidence is low in older children.⁴ The most common symptoms of UTI in children are fever with chills and in some cases poor feeding, recurrent vomiting, abdominal pain also occurs.⁵

Urinary tract infection may be hospital acquired or community acquired and responsible for 1.8%

* Corresponding author.

E-mail address: kainabhonsle@gmail.com (K. Bhonsle).

hospitalizations.⁶ In children, community acquired urinary tract infection changes according to season and its occurrence shows seasonal variations.⁷

In pediatric population causative agent of causing UTI's are same as other population. In all microorganisms, bacteria are the most common etiological agents and responsible for causing more than 95% of UTI cases.⁸ In children community the most common uropathogenic bacteria is *E. coli* and about 85% of UTI cases are caused by it.⁹ Other bacteria causing UTI are *K. pneumoniae*, *P. aeruginosa*, *P. mirabilis*, *Citrobacter*, *Acinetobacter*, *Staphylococcus* species, *Streptococcus* species and *Enterococcus* species. Viruses cause lower UTI in immunosuppressed patients mainly children having bone marrow or kidney transplantation and who are receiving chemotherapy are at high risk of cystitis.¹⁰ In fungi *Candida albicans* may infect kidney and causes UTI¹¹ and beside this parasitic diseases such as schistosomiasis and trichomoniasis are also responsible for causing renal and lower UTI's in children.¹² The prevalence of uropathogens vary with patients age, gender and local geographic area therefore the proper management of UTI can be done by getting knowledge of locally prevalent uropathogens.¹³

The UTI may be symptomatic or non-symptomatic. In pediatric age group, several risk factors are associated with UTI such as age, gender, previous antibiotic use, fever, constipation, frequency in urination, bladder dysfunction, obstructive uropathy and nitrates in urine.¹⁴ In developing countries, UTI is observed in threadworm infection, unhygienic condition and immunocompromised children.¹⁵ In recent study, it was found that obesity is related with UTI in children.¹⁵ The prevalence of UTI was high in those children having complicated malnutrition.¹⁶ If UTI is not diagnosed timely and treatment is not done properly then it causes high rate of morbidity and mortality in children and it becomes chronic which results in scarring of kidney, hypertension and renal failure. It also causes financial burden to society and affect population economically.⁶

2. Material and Methods

The objective of this study was to study prevalence of UTI in children and identification of major bacterial uropathogen in Ujjain. This study was done in SRL laboratory Ujjain center. The urine samples collected from different hospitals of Ujjain were processed in lab. The urine samples from suspected patients were collected from November 2018 to October 2019 in three different seasons which were winter (November-February), summer (March-June) and rainy (July-October). Total 881 samples from all age groups were collected. The collected 0.5 ml of urine sample was inoculated on three different selective and differential media which were Blood agar, MacConkey agar and Chrome agar with the help of sterilized loop by streak plate method. The plates were incubated at 37°C for 24 h and after incubation

colony forming unit were counted, if colony count is more than 10⁵ colony forming unit/ml than it indicated significant bacteriuria and was considered as positive urine culture. The single pure colonies were selected and subjected to morphological, microscopic and biochemical examinations as per the standard procedure for confirmation of isolated uropathogenic bacteria.¹⁷ In morphological examination shape, size, color and margin of colony was observed. In microscopic examination gram staining was done for differentiation between gram positive and gram negative bacteria and the shape, color, arrangement of bacteria were also examined. The biochemical tests included Catalase, Oxidase, Coagulase, Indole production, Methyl Red, Voges-Proskauer, Citrate utilization, Triple sugar iron, Urease, Mannitol fermentation, Bile Esculine Hydrolysis test and motility tests.

3. Results and Discussion

3.1. Prevalence of UTI in patients of Ujjain during 2018-19

It was seen that out of 881 urine sample, 550 were positive and 111 positive patients belonged to pediatric age group. Further 51 children having UTI were male and 60 were female. This shows (20.18%) of the positive cases of UTI were of children belonging to pediatric group. The UTI cases in female children was (54.0%) while in male children was 45.9%. The prevalence of UTI was slightly higher in female children in comparison to male due to anatomical structure differences (Figure 1). This results shows that occurrence of UTI was high in children of 0-5 year of age, the higher prevalence in pediatric group may be due to excessive use or unhygienic use of diapers and improper cleaning of urinogenital area of children.

In Nigeria found UTI prevalence was 13.7% in children.¹⁸ Other studies done by in India have shown that UTI cases are higher in female children than male children.^{19,20}

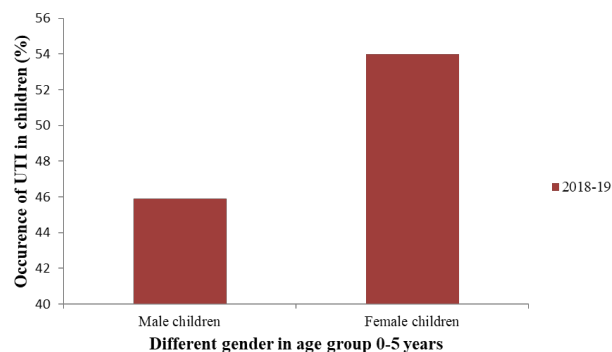


Fig. 1: Prevalence of UTI in children (0-5 years)

3.2. Occurrence of UTI in different seasons

In the study, the maximum cases of UTI in children were observed in rainy season (39.6%) which was followed by summer season (34.2%), and winter season (26.1%). The higher number of cases of UTI found in children in rainy season may be due to humidity, sudden change in temperature and decrease immunity of human body, which increases the chances of infection in body (Figure 3). These results of our study were very different from the study done in Turkey, who recorded maximum UTI cases in summer season.⁷

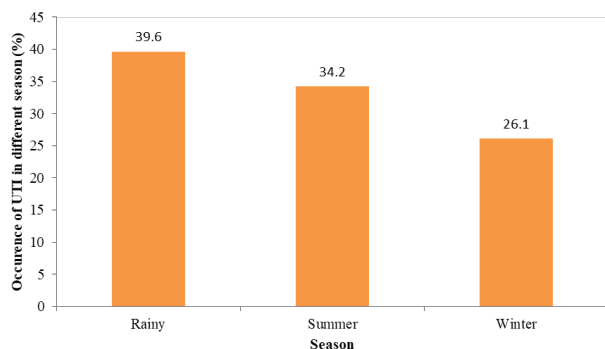


Fig. 2: Occurrence of UTI cases in children during different seasons

3.3. Identification of isolated uropathogens and their frequency of occurrence

During this study number of uropathogenic bacteria were isolated and confirmation of these uropathogens was done by conventional methods. In isolated bacteria *Escherichia coli* cultures were most frequently occurring gram negative, rod shaped motile bacteria. In blood agar, they produced circular, convex, smooth, grayish white opaque or translucent colonies. On MacConkey agar, they produced convex, smooth, pink, opaque, lactose fermenting colony and on chrome agar, they formed dark pink to reddish colony. The *E. coli* cultures were Catalase, Indole and Methyl Red positive and Oxidase, Vogus Proskauer, Simmons citrate, Urease, and Phenylalanine negative and in Triple Sugar Iron test acid and gas was produced. The second commonly isolated uropathogenic cultures were of *Klebsiella pneumoniae*. The culture were gram negative, rod shaped and non motile. In blood agar they formed circular dome shaped, mucoid grey white colonies and in MacConkey agar they produced circular pink lactose fermenting colonies and in chrome agar they formed mucoid metallic blue colony. The culture were Catalase, Voges proskauer, Simmon's Citrate, Urease positive and Oxidase, Indole, Methyl Red, Phenylalanine negative and in Triple Sugar Iron test produced both acid and gas.

The *Pseudomonas aeruginosa* cultures were also isolated and they were gram negative rod shaped motile bacteria. In blood agar they showed grayish white colonies, in MacConkey agar they produced smooth, colorless non-lactose fermenting colony and on chrome agar they produced transparent, yellow diffused colonies which were Catalase, Oxidase, Simmon's citrate positive and Indole, Methyl Red, Voges Proskauer, Phenylalanine and Urease negative and in Triple Sugar Iron test produced alkaline products without gas. The *Proteus mirabilis* bacteria were also detected in urine samples the culture were gram negative motile rod shaped bacteria, producing swarming growth on blood agar with foul smelling colonies, on MacConkey agar they produced small, irregular, colorless, non-lactose fermenting colonies and on chrome agar they produced clear, diffusible brown halo colonies which were Catalase, Methyl Red, Simmon's Citrate, Phenylalanine, Urease positive and Oxidase, Indole, Voges Prauskar negative. In Triple Sugar Iron test, the cultures produced acidic and alkaline products with gas. The gram positive *Staphylococcus aureus* culture were gram positive, round shaped, motile bacteria, in blood agar they produced circular, golden or light yellow colony, on MacConkey agar they produced circular, smooth pink colony and on chrome agar they formed white to golden yellowish colony. The Cultures were Catalase and Mannitol Fermentative test positive and Oxidase negative. The *Enterococcus faecalis* culture were also isolated and they were gram positive, round shaped and non motile bacteria. On blood agar they produced translucent colonies, on MacConkey agar they produced red colored lactose fermenting colonies and on chrome agar they produced dry turquoise blue colonies and showed positive Bile Esculine Hydrolysis test and gave negative test for Catalase, Oxidase and Mannitol fermentation test. The number of these all uropathogens were recorded to determine their frequency of occurrence. It was seen that most predominant and frequently found uropathogen was *E. coli* and its percentage was 60.3%. The frequency of *K. pneumoniae* was 10.8%, *P. aeruginosa* was 9.9% and *E. faecalis* was 9.0% and these bacteria were moderately present. The less frequently found bacteria were *P. mirabilis* (6.3%) and *S. aureus* (3.6%). The results are shown in Figure 3.

In the study, the frequency of occurrence of causative uropathogenic organism in pediatric group was recorded and it was found that *E. coli* was predominant causal agent of UTI in children and the frequency of *K. pneumoniae*, *P. aeruginosa*, *E. faecalis* was much less than *E. coli* and was approximately 10%. The frequency of *P. mirabilis* and *S. aureus* were less than 10%. These findings showed similarity with the study done in India.²¹

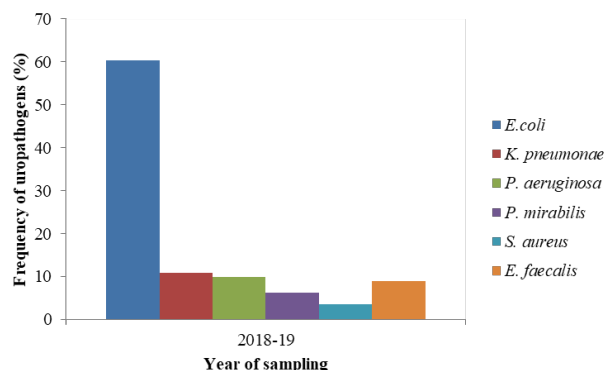


Fig. 3: Frequency of isolated uropathogens in children

4. Conclusion

We conclude that in our study, the prevalence of UTI in children was high in 0-5 age group and maximum cases were recorded in female children during rainy season followed by summer and winter season. The frequency of *E. coli* was highest in children of Ujjain suffering with UTI. Mother can play effective role in preventing UTI in children by increasing awareness about children's health, keeping proper hygiene and frequently changing diapers.

5. Source of Funding

None.

6. Conflict of Interest

The authors declare no conflict of interest.

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Author biography

Kaina Bhonsle, Research Scholar

Alka Vyas, Professor and Head

Harish Vyas, Professor and Head

Abhiraj Ramchandani, Assistant Professor

Kirti Hemwani, Assistant Professor

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