Original Research Article

A Study on Urinary Tract Infections and Antimicrobial Susceptibility Pattern in the Pediatric Age Group

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Abstract

Introduction: Urinary tract infections (UTIs) are the most prevalent bacterial infections in the pediatric age group. With these a study was undertaken to find the antimicrobial sensitivity pattern of various UTI causing bacterial pathogens in the pediatric age group.

Materials and Methods: Study was conducted in the department of Microbiology, GSL Medical College from September 2021 to February 2022. Children <14 years presented with symptoms suggestive of UTI were included in the study. Clean, mid-stream urine samples were collected and cultured on blood agar, MacConkey agar and CLED media. Culture of the samples, identification of isolates and antibiotic sensitivity testing were done as per the available report, the empiric treatment for pediatric age group is not well established.

Results: During study period, total 385 urine samples were collected, culture positivity was 72 (18.7%). In the culture positive cases, 35 (48.1%) were boys and 37 (51.4%) were girls. Among the 72 (100%) isolates, 65.3% (47) were gram negative bacilli, 29.1% were gram positive cocci and 4 (5.6%) fungi isolates are Candida species. No significant drug resistance was identified.

Conclusion: The prevalence of UTI was 18.7%. Among the gender, it was 51.4% in girl children and 48.6% in boys. *Esch. coli* was the predominant UTI causing isolate followed by Klebsiella species. No significant drug resistance was reported.

Keywords: Urine, Bacteria, infection, Antibiotic

Introduction

Urinary tract infections (UTIs) are one of the most prevalent bacterial infections in the pediatric age group. [1] In the recent years, the UTI cases have been increased especially among the pediatric age group. [2] Use of proper and appropriate antimicrobial treatment surely will reduce not only the severity of UTI but also prevents the long term complications.

Escherichia coli, Klebsiella species are the common UTI causing gram negative bacilli and Enterococous, *Staphylococcus aureus* are the common gram positive cocci that case UTI. Culture and antimicrobial susceptibility testing is the commonly used methods for the diagnosis of UTI. But in most of UTI cases, empirical antimicrobial treatment is usually initiated before the availability of culture and sensitivity report. Increased drug resistance is the major issue due to the indiscriminate use of these antibiotics. [3]

Due to the non-specific symptoms as well as minimal symptoms, the diagnosis of most of the UTI cases is missed especially in the pediatric cases. Moreover, as per the available report, the empiric treatment for pediatric age group is not well established. [4]

With these a study was undertaken to find the antimicrobial sensitivity pattern of various UTI causing bacterial pathogens in the pediatric age group.

Materials and Methods

It was a prospective study, conducted in the department of Microbiology, GSL Medical College. Study was conducted from September 2021 to February 2022. Random sampling was considered in this study. Children <14 years presented with symptoms suggestive of UTI were included in the study. The hospitalized and catheters children and children who were on antibiotic treatment. All the individuals who satisfy the inclusion criteria during the study period were included in the study.

Clean, mid-stream urine samples were collected in sterile sample containers and samples were transported immediately to the microbiology laboratory for culture and sensitivity testing. If there is any delay in sample processing, refrigerated at 2 – 8^{0}C for up to 6 hours.

For culture and sensitivity testing, urine samples were inoculated on blood agar, MacConkey agar and CLED media. Urine samples were inoculated using semiquantitative technique with calibrated bacteriological 4 mm loop (0.05 ml) and incubated at 37^{0}C. After overnight night incubation, colonies were counted, 10^5 colonies per ml urine is considered significant bacteriuria. Growth was identified by gram stain and various biochemical reactions such as Coagulase, Catalase, Indole, methyl red, voges proskauer, TSI, Urease, citrate. Further, antibiotic susceptibility testing for the isolates was done by Kibry bauer disc diffusion test.[5]

Results

During study period, total 385 urine samples were collected, culture positivity was 72 (18.7%). In the culture positive cases, 35 (48.1%) were boys and 37 (51.4%) were girls.

Among the 72 (100%) isolates, 65.3% (47) were gram negative bacilli (GNB), 29.1% (21) were gram positive cocci (GPC) and 5.6% (4) were fungi. Among 47 (65.3%) GNB, 15.3% (11) were Klebsiella species, 11.1% (8) were Proteus species, 23.6% (17) were *Esch. coli* and 15.3% (11) were pseudomonas species. Out of 21 (29.1%) GPC, 6.9% (5) were CoNS, 11.1% (8) each were *Staph. Aureus* and *Enterococcus.* All the 4 (5.6%) fungi isolates are Candida species.

Among the GNB, most of the isolates were sensitive to piptaz, imipinem, amikacin. Good sensitivity was identified to nitrofurantoin, gentamicin, Ciprofloxacin, aminoglycosides (Table 2). Among the GPC, all isolates were sensitive to vancomycin, nitrofurantoin, cefoxitin. Good sensitivity was identified to ciprofloxacin, cotrimoxazole, gentamicin, linezolid (Table 3). Due to difficulty, antimicrobial susceptibility was not practiced for fungal isolates.

Table 1: Various UTI causing agents according to the gender in the study; n (%)

Isolate	Boys	Girls	Total
GNB			47 (65.3)
Klebsiella species	6 (8.3)	5 (6.9)	11 (15.3)
Proteus species	3 (4.2)	5 (6.9)	8 (11.1)
Escherichia coli	8 (11.1)	9 (12.5)	17 (23.6)
Pseudomonas species	5 (6.9)	6 (8.3)	11 (15.3)
GPC			21 (29.1)
CoNS	1 (1.4)	4 (5.6)	5 (6.9)
Staph.aureus	5 (6.9)	3 (4.2)	8 (11.1)
Enterococcus	5 (6.9)	3 (4.2)	8 (11.1)
Fungi			4 (5.6)
Candida species	2 (2.8)	2 (2.8)	4 (5.6)
Total	35 (48.6)	37 (51.4)	72 (100)

Table 2: Antibiotic susceptibility pattern for GNB

Isolate	Antibiotic sensitivity (%)
E. coli (n = 17)	100 – imepenem, gentamicin, amikacin; 88 – piptaz; 82 – nitrofurantoin; 76 – ciprofloxacin, amoxiclav, cotrimoxazole; 53 – norfloxacin, ceftazidime, cefotaxime; 17.7 – cefoxitin, ampicillin.
Klebsiella (n = 11)	100 – piptaz, imepenem, amikacin; 82 – nitrofurantoin, ciprofloxacin, gentamicin; 54.5 – cotrimoxazole, norfloxacin; 36 – cefotaxime, ceftazidime, amoxiclav; 18 – cefoxitin; 0 – ampicillin.
Proteus species (n = 8)	100 – cotrimoxazole, ciprofloxacin, Piptaz, imepenem, gentamicin, amikacin; 75 – amoxiclav, cefotaxime, ceftazidime; 25 – cefoxitin, ampicillin; 0 – norfloxacin, nitrofurantoin.
Pseudomonas species (n = 11)	100 – netilmicin, gentamicin, amikacin, piptaz, imepenem, tobramycin; 82 – ciprofloxacin, levofloxacin; 36 – aztreonam, ceftazidime, cefepime.

Table 3: Antibiotic susceptibility pattern for GPC

Isolate	Antibiotic sensitivity (%)
CoNS (n = 5)	100 – vancomycin, nitrofurantoin, gentamicin, linezolid, cefoxitin; 80 – ciprofloxacin, cotrimoxazole, teicoplanin, doxicycline, clindamycin; 40 – norfloxacin, erythromycin; 0 – penicillin.
Staph. aureus (n = 8)	100 – vancomycin, nitrofurantoin, gentamicin, linezolid, cefoxitin; 75 – ciprofloxacin, cotrimoxazole, teicoplanin; 50 – doxicycline, clindamycin; 25 – norfloxacin, erythromycin; 0 – penicillin.
Enterococcus (n = 8)	100 – vancomycin, nitrofurantoin, norfloxacin, linezolid, cefoxitin; 75 –teicoplanin, doxicycline, clindamycin; 50 – ciprofloxacin, cotrimoxazole; 33 – gentamicin, erythromycin; 0 – penicillin.

Discussion

As per the available reports, UTIs are considered to be the most common type of bacterial infection of man. [6, 7] It was reported that UTIs are common among female. [8 – 11] In this study the prevalence of UTI and its antibacterial pattern was studied among the pediatric age group. Among the symptomatic cases, culture positivity was 18.7%. Among the culture positive cases, 48.6% were male and 51.4% were female. The high prevalence of UTI among the female was due to anatomical structure of female urethra, short urethra, proximaty to the anal region. [12, 13]

Gender wise, among female, Esch.coli was the predominant isolate [12.5% (9)], followed by Klebsiella species and proteus species 6.9% (5) each, pseodomonas species 8.3% (6), CoNS 5.6% (4) and Staph.aureus, Enterococcus 4.2% (3) each. Among male, Esch.coli was the predominant isolate [11.1% (8)], followed by Klebsiella species 8.3% (6), pseodomonas species, Staph.aureus, Enterococcus 6.9% (5) each, proteus species 4.2% (3) and CoNS 1.4% (1). Patwardhan et al. reported that Esch.coli was the common UTI causing agent among the pediatric age group. [2] Similar to our study, Kanellopoulos et al., the prevalence of Esch.coli was more among the girl children. [14] This may be due to flora of the genital region. [15] Pateal et al., studied UTI among adults; the investigators reported that Esch.coli (36%) was the predominant UTI causing agent followed by Klebsiella (18%), Pseudomonas (14%) species. [16]

When compared to the available studies the prevalence of the UTI among the symptomatic cases was identified to be low in this study. [17] For this low prevalence, it was reported that the prevalence and antimicrobial susceptibility of uropathogens depend on the time and also geographical distribution. [18, 19]

This could be the reason for the low prevalence of UTI in this study.

When antimicrobials susceptibility was considered, the isolates were sensitivity to most of the commonly used antibiotics. It was reported that trimethoprim is the common first line antibiotic used for UTI. [15, 20] Even in this report also most of the stains were sensitive to this. Usually empirical therapy is common practice followed by purchasing drugs from the market by getting the advice from the pharmacist. But this study was on pediatric age group and as a part of the study when we asked the parents of the participants we were informed that no such practice was followed for their children. Moreover, as study protocol, children on antibiotic treatment were excluded in the study.

Conclusion

The prevalence of UTI among the symptomatic cases in this study was 18.7%. Among the gender, it was 51.4% in girl children and 48.6% in boys. Esch.coli was the predominant UTI causing isolate followed by Klebsiella species. No significant drug resistance was reported.

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