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ORIGINAL ARTICLE

A Tertiary Care Hospital's Observations on the Prevalence and Antibiotic Sensitivity of the Most Common Organisms Causing Urinary Tract Infections in Children

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ABSTRACT

Objective: The purpose of this research was to evaluate the antibiotic resistance profile of urinary tract infection-causing bacteria and their prevalence among children presenting to a tertiary care hospital.

Study Design: Cross-sectional/ Descriptive study

Place and Duration: This study was carried out at Khyber Teaching Hospital, Peshawar from June, 2021 to May 2022.

Methods: Total 112 suspected cases (children) of UTI with ages 6-months to 14 years were presented. After receiving parental agreement, we documented the children's age, gender, residence, and parental education level.It was decided to perform a urine dipstick test to check for nitrites and leucocytes, and then analyze the leucocytes and bacteria under the microscope. Antimicrobial resistance was tested using the modified Kirby-Bauer disc diffusion technique with a panel of antimicrobials.SPSS 20.0 was used to analyze all data.

Results: Among 112 included cases, 58 (51.8%) were males and the rest were 54 (48.2%) female children. Frequency of leucocytes and nitrites by urine dipstick method was 30 (26.8%) and 12 (10%) but under the microscope, number of leucocytes were 15 (13.4%) and bacteria was 9 (8.03%). There were 65 (58.04%) gram positive and majority were females and 47 (41.96%) were gram negative cases. We found E.coli was the most prevalent microorganism found in 46 (70.8%) cases, 5 (7.7%) Klebsiella spp. and Pseudomonas spp. was 4 (6.2%). We found that microorganism were highly resistant (100%) to antibiotics ceftazidime, cefoperazone, ampicillin and ofloxacin while ciprofloxacin, cefuroxime and ceftriaxone showed high sensitivity.

Conclusion: We observed that E.coli was the most frequent bacteria in UTI urine samples. Antimicrobial resistance in UTI-causing pathogens is worrying. It's crucial to monitor UTI-causing microbes' antibiotic susceptibility trends.

Keywords:UTI, E.coli, Klebsiella spp., Resistance, Sensitivity

INTRODUCTION

At least 5% of young girls and 1%-2% of young boys will get a urinary tract infection (UTI) each year. [1] There may be as many as 7 million yearly visits to outpatient clinics, 1 million annual trips to emergency rooms, and 100,000 annual hospitalizations due to symptomatic UTIs worldwide. Ten percent of kids with fever, 13.6 percent of babies with fever, and 7 percent of newborns with fever had urinary tract infections (UTIs), according to [2]. The immediate consequences of UTIs, including neonatal mortality, and the chronic sequelae, like hypertension and chronic renal failure after chronic pyelonephritis, give UTIs significant clinical relevance [3]. In some regions of the world, pyelonephritis is the leading cause of kidney failure. [4] Since the aetiology of kidney lesions following a UTI is heavily dependent on the initiation of tissue invasion by bacteria, early detection and rapid, efficient antimicrobial therapy for acute renal infection can prevent or considerably slow the development of renal damage. [1]

The bacteria that cause urinary tract infections show a wide range of antibiotic resistance. Isolates showed sensitivity to gentamicin in excess of 93%, whereas it was detected in 60% of cases when exposed to chloramphenicol, ceftriaxone, nitrofurantoin, ciprofloxacin, TMP-SMX, and nalidixic acid [5]. Another study [6] found that susceptibility to these antimicrobial medications was decreasing; indicating that resistance to these antibiotics is increasing. It is becoming an increasingly serious problem because bacteria that cause urinary tract infections (UTIs) are becoming resistant to medicines [5,6]. This is particularly true in developing nations where adequate monitoring is absent and pharmaceuticals are often overused.

A far wider variety of organisms may cause complex UTI as opposed to basic UTI, which is caused by a smaller number of bacteria. Gram-negative bacteria, such Escherichia coli, Citrobacter species, Enterobacter aerogenes, Pseudomonas aeruginosa, and Proteus vulgaris, are far more prevalent than Gram-positive bacteria, like Staphylococcus aureus, Klebsiella species, and Salmonella species [7].

Major and increasing danger to public health is posed by the dissemination of uropathogenic bacteria resistant to many antimicrobials. Specific bacteria and viruses have been singled out by the Infectious Diseases Society of America as being amenable to experimental therapy approaches (IDSA). Enterococcus faecium is part of a collection of bacteria known as ESKAPE, which also includes Klebsiella spp., Staphylococcus aureus, Acinetobacter spp., Pseudomonas spp., and Enterobacter spp.[7] Urinary tract infections (UTIs) are on the rise, and with them comes the need to frequently evaluate the antibiotic susceptibility of uropathogens in a given region, since antibiotic resistance is becoming more common among UTI bacteria. The UTI subtype (complex vs. uncomplicated), patient gender, age, and antibiotic treatment history are only a few of the factors that must be considered in order to get accurate global data on susceptibility [8]. Bacterial antimicrobial susceptibility information for urinary tract infections (UTIs) changes over time and among locations [9]. It is true that susceptibility data provided by local microbiology labs assists in the empirical choice of antimicrobials for treating UTI; however, this is often only the case for complicated UTI, since samples of basic UTI are seldom submitted to laboratories [10,11].A common cause of antibiotic overuse [12] is that therapy with antimicrobials is usually started before test findings are available. Community-acquired uropathogens' (CAPs) resistance pattern has not been well examined in India [13-15]. Most UTIs are treated empirically, therefore it's important to have criteria in place for choosing antibiotics based on the likely causative organism and the predicted resistance trend in the area. As a result, it's important to

keep an eye on the prevalence of UTIs and the patterns of resistance to common antibiotics in the area.

Our research intends to catalogue the prevalence of UTI-causing agents and the levels of antibiotic resistance currently seen in these pathogens. We anticipate that this will enhance current understanding of antibiotic resistance/sensitivity and lead to better treatment options for those with UTIs.

MATERIAL AND METHODS

This cross-sectional study was conducted at Khyber Teaching Hospital, Peshawar from June, 2021 to May 2022 and comprised of 112 children. After receiving parental agreement; we documented the children's age, gender, residence, and parental education level. Patients who had co morbid conditions, those who were immunocompromised, cases who had received corticosteroid therapy, and patients who had a history of using broad-spectrum antibiotics within the preceding 15 days were all excluded from the study.

Included children were aged between 6-months to 14 years. A sterile, plastic, standard-sized container with a wide opening was made available to the participants. They were instructed to wet the region surrounding the urethra, wait for it to dry, and then collect the sample by holding the container a couple of inches away and capturing it in the middle of the stream. Urine sample of 50 ml was collected and dropped on a clean slide and covered with a coverslip. After that, we put the slide under a microscope to examine it. Cast bodies, pus cells, epithelium cells, and blood cells were all recorded. Ten or more pus cells per high-magnification field indicated severe pyuria. This time, gramme staining was used. To be statistically significant, the detection of one or more bacteria with a comparable morphology in each oil immersion field was required.

Using a calibrated loop technique, 10 ml of the material was deposited onto a MacConkey Agar plate. To separate lactose-fermenting bacteria from other bacteria, the agar plates were kept in an incubator at 35-37 °C for 24 hours. Results were considered positive for a urinary tract infection if even a single organism could be cultured at a concentration of 105 colony-forming units/ml or greater. Cysteine lactose electrolyte deficient (CLED) medium were used for the detection and isolation of uropathogens. Antimicrobial susceptibility was evaluated using a modified Kirby-Bauer disc diffusion technique. An inoculating wire loop was used to safely transfer the colonies to agar plates. They used sterile forceps to insert antibiotic discs. There was an hour of room temperature time given for the antibiotics to diffuse from the discs onto the plates. For another 24 hours at 37 °C, the agar plates were kept warm and humid. Susceptibility and resistance to several antibiotics were determined by testing with different antibiotics.

Numerous bacteria and yeasts were counted and recorded based on their abundances in the collected urine samples. The percentages representing the antibiotic resistance profiles of the isolated organisms were reported. We used SPSS Statistics 20.0 to do the analysis on the data.

RESULTS

Among 112 included cases, 58 (51.8%) were males and the rest were 54 (48.2%) female children. Mean age of the children was 9.18±12.67 years. Majority of the children was from rural areas 78 (66.9%) and 34 (33.1%) were from urban areas. As per education status of parents, 50 (44.6%) were literate and 62 (55.4%) were not-literate.(table 1)

Table-1: Demographics of included children

Variables	Frequency	Percentage
Gender		
Male	58	51.8
Female	54	48.2
Mean age (years)	9.18±12.67	
Place of living		
Urban	78	66.9
Rural	34	33.1
Parental Education Status		
Literate	50	44.6
Un-educated	62	55.4

Frequency of leucocytes and nitrites by urine dipstick method was 30 (26.8%) and 12 (10%) but under the microscope the number of leucocytes were 15 (13.4%) and bacteria was 9 (8.03%).(table 2)

Table-2: Results of dipstick method and urine microscope

Variables	Frequency	Percentage
Dipstick Method		
leucocytes	30	26.8
nitrites	12	10
Urine Microscope		
leucocytes	15	15
bacteria	9	8.03

There were 65 (58.04%) gram positive and majority were females and 47 (41.96%) were gram negative cases.(table 3)

Table-3: Association of UTI among all cases

Variables	Frequency	Percentage
UTI		
Gram Positive	65	58.04
Gram Negative	47	41.96
Gender		
Female	45	69.2
Male	20	30.8
Total	65	100

We found **E.coli** was the most prevalent microorganism found in 46 (70.8%) cases, 5 (7.7%) Klebsiella spp., Pseudomonas spp. was 4 (6.2%) and the rest were morganella spp., Staphylococcus spp, Citrobacter spp. And Proteus spp.(Figure 1)

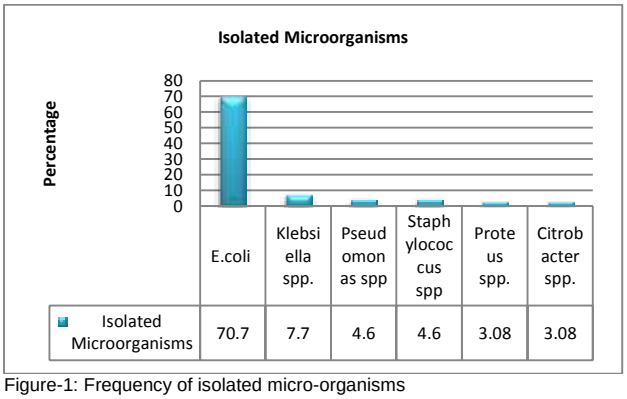

Figure-1: Frequency of isolated micro-organisms

We found that microorganism were highly resistant (100%) to antibiotics ceftazidime, cefoperazone, ampicillin and ofloxacin while ciprofloxacin, cefuroxime and ceftriaxone showed high sensitivity.(table-4)

Table-4: Resistant and sensitivity of isolated microorganism with antibiotics

Variables	E.coli	Klebsiella spp.	Pseudomonas spp	Staphylococcus spp	Proteus spp.	Citrobacter spp.	Morganellaspp
Antibiotics	Res/Sensitivity (%)	Res/Sensitivity (%)	Res/Sensitivity (%)	Res/Sensitivity (%)	Res/Sensitivity (%)	Res/Sensitivity (%)	Res/Sensitivity (%)
ceftazidime	100/65	100/78	100/59	100/62	100/72	100/80	100/43

cefoperazone	100/27	100/28	100/39	100/66	100/50	100/37	100/44
ampicillin	100/45	100/50	100/50	100/70	100/60	100/50	100/50
ceftazidime	100/30	100/35	100/85	100/36	100/42	100/91	100/82
ofloxacin	46/85	50/60	70/60	90/85	80/50	46/85	70/90
ciprofloxacin	80/100	50/90	55/70	80/75	60/60	40/33	60/85
cefuroxime	50/80	60/70	80/92	50/70	70/87	30/40	30/87
ceftriaxone	46/85	50/60	70/60	90/85	80/50	46/85	70/90
Fosfomycin	80/80	50/90	55/90	80/75	60/60	40/33	60/50
ciprofloxacin	80/70	60/70	80/92	50/70	70/87	30/40	45/80
Cefoperazone + sulbactam	50/80	80/100	70/100	60/90	70/50	40/80	80/60

DISCUSSION

It is crucial for treating professionals to be aware of the local prevalence of the bacterium responsible for any infectious illness in order to provide proper treatment. There is a discrepancy between the prevalence of infections and their antibiogram, highlighting the need for constant surveillance. All of these considerations will help doctors prescribe the most effective antibiotics to their patients. The goals of this investigation were to identify causative microorganisms for SUTI and to determine the antibiotic resistance profile of these infections. [16]

Urinary tract infections (UTIs) are extremely prevalent, placing a considerable strain on healthcare systems worldwide [17]. In our research, we found that many different types of bacteria may cause UTIs, and that these bacteria exhibit a wide range of resistance to broad-spectrum antibiotics.[18] As antibiotic resistance rises and the global illness burden rises, urinary tract infections (UTIs) are becoming increasingly challenging to treat. Resistance to broad-spectrum antibiotics is a global concern [19]. The class of antibiotics that falls under this category comprises fluoroquinolones, carbapenem, and extended-spectrum beta-lactams.

In current study 58.04% patients were positive for UTI's infection. The frequency of E. coli in our examined urine samples was 70.7%, making it the most prevalent isolated pathogen. In another study, 53.6% of samples were found to be culture-positive for E. coli, proteus 14.6% ,Klebsiella 13.9%, Enterococcus 4.5%, and Staphylococcus 4.1% [20]. In addition, research has shown that E. coli makes up 60% of urine isolates, Klebsiella represents 12%, and Enterococcus represents 8%. [21]In the same vein, other study found an unacceptably high frequency of 69.8% for E. coli, 7.9% for Klebsiella, 4.8% for Staphylococcus, and Staphylococcus aureus (MRSA) resisted by using 1.6% methicillin [22].

The principal bacterial isolates obtained from this analysis demonstrated low levels of resistance to the antibiotics that are most often used in the empirical treatment of urinary tract infections (UTI) (penicillin, aminoglyco-sides,quinolones ampicillin, co-trimoxazole, andcephalosporin). The moderate to high susceptibility was shown by the generic versions of gentamicin, ciprofloxacin, ceftriaxone, ceftazidime, and nalidixic acid. We discovered that among all of the isolated organisms, clindamycin had the lowest susceptibility; nevertheless, amoxicillin-clavulanate and chloramphenicol had a good chance of being effective. In the United Kingdom, Bean and colleagues found that the bacteria had a low susceptibility to ampicillin and co-trimoxazole, but a high susceptibility to nitrofurantoin and gentamicin. Ceftriaxone was also shown to be effective against the bacteria. [23]An American investigation found that nitrofurantoin resistance was lowest among E. coli isolates from urine samples (1%) [27].In our study, we found that microorganism were highly resistant (100%) to antibiotics ceftazidime, cefoperazone, ampicillin and ofloxacin while ciprofloxacin, cefuroxime and ceftriaxone showed high sensitivity.

UTIs were more common among girls than boys, with a 2:1 female-to-male ratio. This finding agrees with those of research conducted in Gaza (4:1), Tanzania (1.7:1), and India (1.5:1), where females outnumber males. [24-26]The increasing frequency with which E. coli strains are resistant to commonly used antibiotics is cause for serious concern and emphasizes the need of following recommended dosing schedules while taking any medication. There is a rise in antimicrobial resistance because doctors don't strictly adhere to antibiotic stewardship, leading to an increase in the use of broad-spectrum antibiotics [27]. Quality improvement initiatives have been advised by researchers to guarantee proper antibiotic usage according to the established standards, particularly in developing countries like ours. It is of great worry to physicians that the most prevalent germs responsible for UTIs are becoming increasingly resistant to current treatments, since this might leave patients vulnerable to the terrible side effects of the most widely used antibiotics. [28]

CONCLUSION

We observed that E.coli was the most frequent bacteria in UTI urine samples. Antimicrobial resistance in UTI-causing pathogens is worrying. It's crucial to monitor UTI-causing microbes' antibiotic susceptibility trends.

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