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ANTIMICROBIAL RESISTANCE IN URINARY TRACT INFECTIONS AMONG CHILDREN AGED 0–5 YEARS IN MOTHER AND CHILD UNIVERSITY HOSPITAL CENTER, N'DJAMENA (CHAD)

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ABSTRACT

Introduction: Urinary tract infections (UTIs) are common in pediatrics and can lead to long-term renal complications. In resource-limited countries, management is challenging because of delayed diagnosis and increasing bacterial resistance. This study describes the clinical and bacteriological characteristics and the antibiotic resistance profiles of uropathogens in children. **Methods:** A descriptive cross-sectional study was conducted at the Mother and Child University Hospital Center in N'Djamena from January 1 to December 31, 2024. Children aged 0 to 5 years with a UTI confirmed by urine culture and urinalysis were included. Sociodemographic, clinical, and microbiological data were extracted from medical records and analyzed using STATA 14. Antimicrobial susceptibility testing was performed according to CA-SFM guidelines. **Results:** Fifty-one children were included, mostly girls (60.8%). Fever (86.27%) and abdominal pain (68.62%) were the most common presenting symptoms. *Escherichia coli* was the predominant pathogen (35.29%), followed by *Staphylococcus* spp. and *Proteus mirabilis*. High resistance was observed to beta-lactams, quinolones, and aminoglycosides. Imipenem showed preserved activity against most isolates. **Conclusion:** Pediatric UTIs remain a public health concern, exacerbated by multidrug-resistant bacteria. Routine antimicrobial susceptibility testing and regular updates of treatment protocols are essential to optimize management and reduce complications.

KEYWORDS: urinary tract infection; resistance; antibiotics; children; Chad.

INTRODUCTION

Urinary tract infections (UTIs) are a common reason for pediatric consultation and, if not appropriately managed, may lead to renal complications such as renal scarring or hypertension in adulthood.[1] In sub-Saharan Africa, UTI management in children is particularly hindered by delayed diagnosis and the growing burden of antimicrobial resistance, especially among Enterobacterales.[2]

Escherichia coli remains the leading cause of pediatric UTIs; however, the increasing emergence of extended-spectrum beta-lactamase (ESBL)-producing strains reduces the effectiveness of commonly used first-line antibiotics, including third-generation cephalosporins.[3,4] Hospital-based studies from Ghana, Ethiopia, and Uganda have reported concerning rates of multidrug resistance to beta-lactams, fluoroquinolones, and sometimes aminoglycosides among pediatric uropathogens.[4,5]

The WHO Global Antimicrobial Resistance Surveillance System (GLASS) reports also indicate a continuing decline in susceptibility of *E. coli* and *Klebsiella* spp. in pediatric UTIs, particularly in resource-limited settings.[6] In this context, documenting local epidemiological patterns and antimicrobial susceptibility profiles is essential to guide empirical therapy and improve treatment recommendations.

PATIENTS AND METHODS

The Mother and Child University Hospital Center in N'Djamena (CHU-ME), the main pediatric referral hospital in Chad, is a tertiary facility with general pediatrics, neonatology, pediatric surgery, and a microbiology laboratory capable of performing standard urine culture and antimicrobial susceptibility testing. The pediatric department receives children aged 0–15 years referred from health districts in N'Djamena and from provinces.

This was a descriptive cross-sectional study conducted from January 1 to December 31, 2024, including all children aged 0 to 5 years, either hospitalized or seen as outpatients, with a UTI confirmed by urine culture (ECBU). Data were extracted from pediatric ward registers and microbiology laboratory reports.

A UTI was defined as a positive urine culture ($\geq 10^5$ CFU/mL) associated with pyuria. Antimicrobial susceptibility testing was performed according to the recommendations of the Antibiogram Committee of the French Society for Microbiology (CA-SFM). Isolates were classified according to their susceptibility patterns, particularly to beta-lactams, aminoglycosides, quinolones, and sulfonamides.

Variables included age, sex, place of residence, prior antibiotic exposure, isolated pathogens, resistance profiles, prescribed treatment regimens, and clinical outcomes. Data were entered and analyzed using STATA version 14. Results were expressed as frequencies and percentages. Since the study was not designed to build predictive models or complex associations, no multivariable analysis was performed. Statistical significance was set at $p < 0.05$. Patient confidentiality was ensured, and approval from the CHU-ME scientific and ethics committee was obtained before study initiation.

RESULTS

Overall prevalence of urinary tract infection

A total of 120 children with suspected UTI were included. Among them, 51 had a confirmed UTI, corresponding to a prevalence of 42.50%.

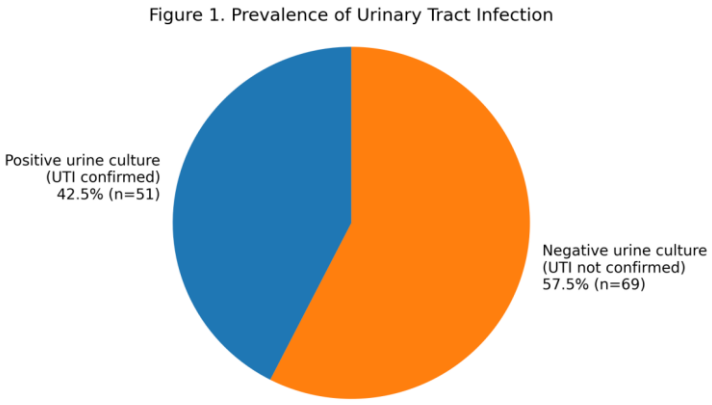

Figure 1: Prevalence of urinary tract infection.

1. Sociodemographic characteristics

Female predominance was observed. Most children came from urban areas, representing 60.78% of cases.

2. Reasons for consultation

Table 1: Distribution of children by presenting symptoms.

Presenting symptom	n	%
Fever	44	86.27
Abdominal pain	35	68.62
Vomiting	12	23.52
Diarrhea	10	19.60
Dysuria	3	5.88
Refusal to breastfeed	1	1.96
Total	**51**	**100.00**

3. Bacteria isolated on urine culture

Table 2: Bacterial isolates from urine culture (ECBU).

Isolated organism	n	%
Escherichia coli	18	35.29
Staphylococcus spp.	10	19.61
Proteus mirabilis	7	13.73
Serratia marcescens	6	11.76
Pseudomonas aeruginosa	5	9.80
Klebsiella oxytoca	4	7.84
Klebsiella pneumoniae	1	1.96

E. coli was the most frequently isolated pathogen.

4. Antibiotic resistance profile

Table 3: Susceptibility profile of major isolated organisms.

Isolates	Beta-lactams	3rd-gen cephalosporins	Quinolones	Aminoglycosides	Phenicols	Carbapenems (Imipenem)	Suspected ESBL?
E. coli (n=18)	High resistance (~50%)	50–60% R	55% R	55% R	Moderate susceptibility	Susceptible	Yes (presumptive ESBL)
P. mirabilis (n=7)	100% R to ticarcillin	57.14% R	57.14% R	Good susceptibility	71.43% R	100% S	Possible, unconfirmed
P. aeruginosa (n=5)	~60% R	Variable	60% R	Low resistance	Variable	20% S (reduced susceptibility)	Not applicable
Klebsiella spp. (n=5)	Frequently high resistance	Variable	Variable	Variable	Incomplete data	Variable	Probably ESBL
Staphylococcus spp. (n=10)	Variable resistance	Not applicable	50% R (fluoroquinolones)	30–40% R	Susceptible	Not applicable	Not applicable

DISCUSSION

The prevalence of UTIs in our study (42.50%) highlights the substantial burden of this condition in pediatric practice in resource-limited settings. This relatively high rate may be explained by delayed healthcare-seeking, limited access to reliable microbiological testing, and poor caregiver awareness of warning signs. Our findings are consistent with reports from Ghana and Uganda, where prevalence rates between 35% and 45% have been documented among preschool-aged children.[7,8] In such contexts, socioeconomic constraints, suboptimal hygiene, and self-medication or inappropriate antibiotic use may contribute to sustained community transmission. The predominance of cases in the 24–35-month age group is also notable; at this age, immune immaturity combined with toilet-training may predispose to urinary stasis and ascending infection, increasing susceptibility to UTIs.[9]

The female predominance (60.80%) aligns with most African and international studies.[9,10] and is mainly related to anatomical factors such as a shorter urethra and proximity to the perineal region, facilitating ascending colonization by enteric bacteria. However, the lack of a statistically significant association between sex and UTI occurrence in our sample may reflect limited statistical power due to the small sample size, or local variations in hygiene practices and environmental exposures. Larger studies are needed to clarify the relative contribution of risk factors.

Bacteriologically, *E. coli* remained the most frequently isolated organism (35.29%), consistent with global data where it accounts for 60–80% of pediatric uropathogens.[10,11] The lower proportion observed here could reflect local epidemiological variation or the influence of the hospital setting on pathogen distribution. The notable presence of *Staphylococcus* spp., *Proteus mirabilis*, and *Pseudomonas aeruginosa* may suggest nosocomial acquisition or prior antibiotic exposure altering urinary flora.[12] This broader pathogen spectrum is concerning because it complicates empirical diagnosis and treatment in settings where antibiotic options are already limited.

A particularly concerning finding is the high resistance to beta-lactams, quinolones, and aminoglycosides, especially among *E. coli* and *P. mirabilis*. This trend mirrors findings in Ethiopia, Uganda, and Nigeria, where resistance to third-generation cephalosporins reaches 50–80%.[8,11,13] These patterns likely reflect the increasing spread of ESBL-producing strains, driven by inappropriate or repeated antibiotic use, self-medication, and weak regulation of antimicrobial dispensing.[10,13] The clinical impact is substantial, limiting therapeutic

choices, increasing hospital stay and costs, and raising the risk of complications such as pyelonephritis and chronic kidney damage.

The preserved activity of imipenem in our series supports the role of carbapenems as last-resort antibiotics for complicated or resistant UTIs. This is consistent with recent WHO surveillance indicating that carbapenem effectiveness remains relatively acceptable in many African settings.[14] However, increasing reliance on these agents where alternatives exist may accelerate the emergence of multidrug- or pan-resistant strains, particularly in environments with limited antimicrobial resistance (AMR) surveillance and infection control programs.

These results underscore the urgent need to strengthen antibiotic stewardship programs, including rational prescribing, systematic susceptibility testing before treatment whenever possible, and regular updating of local treatment protocols based on resistance patterns. They also highlight the importance of caregiver education, early UTI screening in young children, and improved access to reliable microbiological diagnostics. Such measures are essential to reduce UTI-related morbidity and curb the progression of AMR in resource-limited settings.

CONCLUSION

UTIs remain a significant cause of morbidity in children in the hospital setting, and management is increasingly complicated by rising resistance to commonly prescribed antibiotics. While *E. coli* remains the main uropathogen, the emergence of multidrug-resistant strains—particularly among Enterobacterales—requires heightened vigilance. Antimicrobial susceptibility testing is essential to guide therapy and reduce inappropriate use of broad-spectrum antibiotics. Strengthening local antimicrobial stewardship policies, regularly updating treatment protocols, and implementing continuous AMR surveillance are crucial to optimize pediatric care and preserve the effectiveness of available treatments. Routine urine culture before prescribing antibiotics, limiting empirical use of third-generation cephalosporins, and reinforcing stewardship programs at CHU-ME are strongly recommended.

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