Andrology & Gynecology: Current Research

Research Article

A SCITECHNOL JOURNAL

Bacterial Uropathogens in Urinary Tract Infections and antibiotic Susceptibility patterns in Banadir Hospital, Mogadishu-Somalia

Mohamed Hayir Tahlil Mohamud*, Yusuf Omar Mohamed, Abdullahi Adan Shaba, Samira Nur Elmi, Abdulahi Suleiman Hassan, Maryam Ahmed Mohamoud and Mohamed Omar Abdikadir

Abstract

Background: Urinary tract infection (UTI) is one of the commonest infections encountered by clinicians and despite the widespread availability of antimicrobial agents. UTI has become difficult to treat because of appearance of pathogens with increasing resistance to antimicrobial agents.

This study aimed to demonstrate the bacterial Uropathogens causing UTI and their antimicrobial susceptibility patterns.

Methods: A descriptive cross-sectional study was used. A non-probability convenient sampling was used for recruitment participants. Clinically suspected patients complaining about UTI were instructed to collect mid-stream urine in a sterile leak proof container. Dipstick, microscopy and culture and sensitivity were performed for each of the urine samples. CLED medium was used for the isolation of bacterial Uropathogens. Susceptibility test was conducted for the bacteria isolated using Kirby-Bauer disk diffusion method.

Results: The prevalence of UTI was found to be 81.9% with 70.8% from Female and 11.1% from Male. The isolated Uropathogens were *Escherichia coli* (56.4%), *Klebsiella pneumoniae* (30.7%), *Enterococcus fecalis* (3.6%), *Enterobacter* (3.6%), *Pseudomonas aureginosa* (2.8%), *Staphylococcus saprophyticus* (2.8%). The major antibiotics found to be resistant to isolates were; Ampicillin (93.6%), Augmentin (87.2%), Cotrimazole (85.7%). All isolates of *E.coli* and *Klebsiella pneumonia* showed the highest percentage of resistance to Ampicillin and Augmentin while the least resistance was observed against drugs such as nitrofurantoin and Ciprofloxacin.

Conclusion: In this study, the prevalence of UTI was 81.9%. *Escherichia coli* and *K. pneumoniae* are the major Uropathogens causing UTI among studied patients. Ampicillin showed the highest resistance against the isolated Uropathogens. Nitrofurantoin was the most sensitive followed by ciprofloxacin and ceftriaxone as compared with other antibiotics used in this study.

Keywords

Urinary tract infection; Antibiotic susceptibility; Banadir hospital

***Corresponding author:** Mohamed Hayir Hayir Tahlil Mohamud, Faculty of Medicine & Surgery, Jazeera University, Mogadishu-Somalia. Tel: + 252615445949, E-mail: xayir070@gmail.com

Received: Octoberl 01, 2019 **Accepted:** Octoberl 13, 2019 **Published:** October 19, 2019

Introduction

A urinary tract infection is the colonization and invasion of any part of urethral tract tissue by bacteria. Globally, it affects nearly 150 million people each year. Only respiratory and gastrointestinal infections affect more people than Urinary Tract Infections (UTIs) [1,2].

Most UTIs cases are caused by Gram-negative bacteria, with *Escherichia coli* being the most common etiological agent. Other UTI causative bacteria include *Klebsiella pneumoniae*, *Proteus mirabilis*, *Staphylococcus saprophyticus*, *Pseudomonas aureginosa*, *Enterobacter species*, Enterococicus *species*, *Group B Streptococcus* [1].

However, there are differences in microbial spectrum and patterns of susceptibility in different areas. A key predictor of resistance is prior use of antimicrobial agents [3]. The high incidence of urinary tract infections and the necessity of starting treatment before culture and sensitivity results mean that empirical treatment is often adopted [4]. Many newly conducted studies in different parts of the world had showed increasing resistance UTIs causative agents to commonly used antimicrobials [5].

Around the world, prevalence of UTIs ranges between 5% and 30%. Pathogenic UTIs affect nearly 14% of humanity throughout their lives. UTIs can be simple uncomplicated or complex complicated infections which may lead to dangerous pathogenic diseases like pyelonephritis, cystitis, and urethritis [6]. A recent hospital-based prospective study on UTIs in Nigeria had documented a prevalence rate of 11% [7]. Another study evaluating urinary tract infection in malnourished black children in South Africa had found a prevalence of 34.7%. Male children were highly affected (81%) than female children (19%).

Equality in prevalence for UTIs between the sexes is accepted epidemiologically during infancy. However, there is a pattern of male predominance during the neonatal period and female predominance during toilet training and early childhood [8].

Uropathogenic *Escherichia coli* (UPEC) which are gram-negative facultative anaerobe bacillus in the Enterobacteriaceae family are considered to be the most significant causative agents for UTIs in both humans and non-humans. UPEC are responsible for 30%-70% of UTIs cases [9,10]. UTIs from UPEC strains normally require antibiotic treatment [11]. Proper prescription of aminoglycosides, beta-lactams, tetracycline's, quinolones, sulfonamides, is essential for effective treatment and control of UTIs [12]. The prevalence of antibiotic resistance in UPEC strains as reported by a different study was 85-100% to commonly prescribed antibiotics [13].

In many parts of Africa including Somalia, antibiotics are widely used in the empirical treatment of clinically diagnosed Urinary tract infections. Thus, there might be an increasing incidence of microbial resistance to commonly used antibiotics for the treatment of UTIs. Thus, knowing the magnitude of drug resistance is of critical importance since the changing levels of antibiotic resistance has a large impact on the empirical therapy of UTIs [14,15].

This study aimed at determining the bacterial etiologic agents responsible for urinary tract infection and to evaluate their *in-vitro*

antimicrobial susceptibility patterns to commonly used antimicrobial agents. Findings will be key in facilitating the effective treatment and management of patients with symptoms of urinary tract infection referred to the clinical laboratories.

Material and methods

A hospital based cross-sectional study was carried out to determine the etiological Bacteria of UTI and Antibiotic Susceptibility Pattern of the isolates. All outpatients with suggestive symptoms of a UTI attending at Banadir Hospital from June to August 2018 were recruited into this study through a non-probability convenient sampling. Symptoms of interest included supra-pubic pain, a burning sensation while voiding (dysuria), urine frequency and urge incontinence. A predesigned standard form was used to collect relevant socio-demographic and medical history information, as well as important clinical and laboratory findings. Participants were asked to provide an on-the-spot urine sample for investigation to determine true cases of UTI. Bacterial isolates from true infections were identified and subjected to antibiotic susceptibility testing using the Kirby-Bauer disk diffusion method. The commonly prescribed antibiotics for UTI were included in the tests which were performed at the microbiology laboratory of the Jazeera University.

Urine Sample collections

A total of 171 clean catch urine samples were collected. Each subject were led into a clean toilet facility and asked to wash hands with soap and water before urine collection. They were handed a well-labeled, sterile, wide mouth urine container (50 ml) and were asked to give midstream urine. Then a team of the researchers collect the urine and labeled prior to the laboratory examination.

Bacterial isolation and identification procedures

A measured amount of urine, using calibrated loop method was inoculated to nutrient agar medium (Merck, Germany) for colony count. Equal or more than 104 CFU/ml of a single potential pathogen or for each of two potential pathogens interpreted as positive UTI and a result of 102 CFU/ml to 104 CFU/ml was repeated. A less than 102 CFU/ml was interpreted as negative UTI. Urine specimens were cultured for isolation of the microbial agents of UTI on blood agar and MacConky Agar media. The plates were then incubated at 37°C aerobically for 24 hours. They were then examined for bacterial growth. All the bacteria isolated from urine in this study were identified using conventional biochemical tests.

Susceptibility testing

Antimicrobial susceptibility was tested for all bacterial Uropathogens of the isolates by the disk diffusion method according to Clinical Laboratory Standards Institute (CLSI) guide lines16. The antibiotic discs and their concentrations were: Ampicillin (10µg), Ciprofloxacin (5µg), Ceftriaxone (30µg), Cotrimoxazole (25/125µg), Nitrofurantoin (300µg) and Amoxacillin/clavulinic acid 2:1 (30µg).

Data entry and analysis

Laboratory entries were made in a laboratory book each day. The data was constantly checked for completeness and cleaned during the study. Each measurement of the inhibition zone diameter was interpreted as 'sensitive', 'intermediate' or 'resistant' according to CLSI standard interpretative charts 17. At the end of collection, data was double-entered into SPSS Version 16. Descriptive analysis was performed.

Ethical considerations

Ethical clearance was obtained prior to data collection from Ministry of Health, Federal Republic of Somalia and the Jazeera University Ethical Review committee. All the study subjects were enrolled after written informed consent was obtained.

Results

Significant bacterial isolates identified from urine samples and their distribution by Sex of study participants

E.coli and *Klebsiella pneumoniae* were dominated among the isolates contributing 56.4% and 30.7% respectively. Majority of the pathogens were isolated from female patients (86.4%) while only 13.6% of the isolated were from male patients **(Table 1).**

Antibiotic Susceptibility pattern of the isolates

As illustrated in Figure 1, the isolated bacteria were more resistance to Ampicillin (93.6%), Augmentin (87.2%), and cotrimazole (85.7%) **(Figure 1).**

Distribution of antibiotic susceptibility among the bacterial isolates from urine specimens

Bacterial Uropathogens isolates from patients with UTIs **(Table 2)** revealed the presence of high levels of single and multiple antimicrobial resistances against commonly prescribed drugs. Except

Table 1. Distribution of bacterial isolates identified from urine samples and their relation to sex in this study.

Isolates	Female (%)	Male (%)
E.coli	68 (86.1)	11 (13.9)
Klebsiella pneumoniae	38 (88.4)	5(11.6)
Enterobacter species	3 (60)	2(40)
Enterococcus fecalis	5(100)	0 (0)
Pseudomonas aureginosa	3 (75)	1 (25)
Staphylococcus saprophyticus	4 (100)	0 (0)
Total	121 (86.4)	19(13.6)

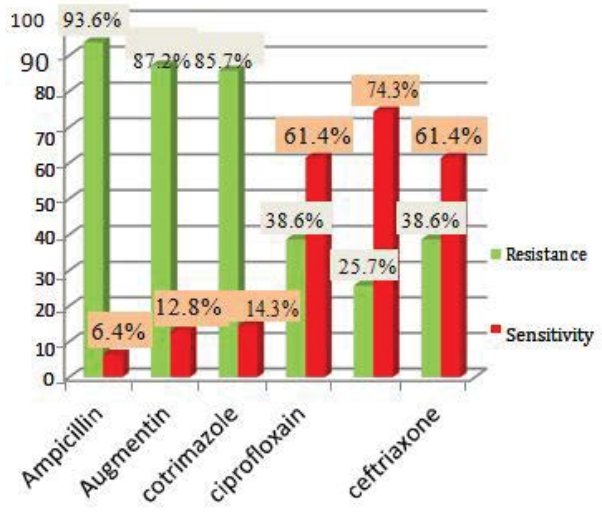

Figure 1. Overall Antibiotic Sensitivity and resistance of the isolates.

Table 2. Distribution of antibiotic susceptibility amongst the bacterial isolates from urine specimens.

Isolates	ANTIBIOTIC					
	AMP	AUG	CTO	CIP	F	CRO
E.coli (n=79)	93.7% R	82.3 R	86% R	45.6% R	16.5% R	49.4% R
	6.3% S	17.7	14% S	54.4% S	83.5% S	50.6% S
Klebsiella pneumoniae (n=43)	97.7% R	90.7% R	81.4% R	25.6% R	37.2% R	65.1% R
	2.3% S	9.3% S	18.6% S	74.4% S	62.8% S	34.9% S
Enterobacter Species (n=5)	100% R	100% R	80% R	40% R	20% R	100% R
	---	---	20% S	60% S	80% S	---
Enterococcus fecalis (n=5)	40% R	100% R	100% R	20% R	---	80% R
	60% S	---	---	80% S	100% S	20% S
Pseudomonas aureginosa (n=4)	100% R	100% R	100% R	25% R	100% R	100% R
	---	---	---	75% S	---	---
Staphylococcus Saprophyticus (n=4)	100% R	100% R	100% R	75% R	50% R	75% R
	---	---	---	25% S	50% S	25% S

AMP: Ampicillin, **AUG**: Augmentin, **CTO**: Cotrimoxazole, CIP: Ciprofloxacin, F: Nitrofurantoin, CRO: Ceftriaxone, R: Resistance, S: Sensitivity

Enterococcus fecalis which was sensitive to Ampicillin, all other isolates were more resistance to Ampicillin, Augmentin and Cotrimoxazole with *Pseudomonas aureginosa* and *Staphylococcus* 100% resistance to them. Only *E.coli* was sensitive Ceftriaxone with 50.6% sensitivity. Ciprofloxacin and Nitrofurantoin were found to be the least resistance UTI drugs.

Discussion

This study found the prevalence of UTI was 81.9%. A study in Bushenyi District, Uganda has found that the prevalence of UTI in that district was 32% [18]. Another study on low socio-economic strata of Karachi, Pakistan has showed a prevalence of UTI was 92% [19]. But neither of these studies ad inclusion similar to these in this study.

In this study, the proportion of female with UTI was about 6 times higher than the proportion of male with UTI (86.4% and 13.6%) respectively. A study, a Riyadh Hospital on urinary tract infections reported that the majority of the isolates were from female patients (60.35%) [20]. Similarly a study on Antibiotic susceptibility patterns of bacteria among urinary tract infection patients in Chittagong, Bangladesh by Chowdhury showed that UTI was higher among females than male 68% and 32% respectively [21].

Other studies validate the findings in this study that *E.coli* (56.4%) and *K.pneumoniae* (30.7%) were the most frequently isolated bacteria in patients with urinary tract infection. A study by Samina and colleagues reported that *Escherichia coli* and *K.pneumoniae* were the main etiological agents causing urinary tract infection at 59% and 11% respectively [19].

The antibiotic susceptibility profile for all the UTI bacterial isolates in this study was ciprofloxacin (54.4%), nitrofurantoin (83.5%), ceftriaxone (50.6%), co-trimoxazole (14%), augmentin (16%), and ampicillin (6.3%). Sensitivity to nitrofurantoin was relatively high. This is in tune study by Rangari and colleagues where sensitivity by *E.coli* to nitrofurantoin was 83.7% [22]. Most of the isolates demonstrated considerable resistance to ampicillin, augmentin, co-trimoxazole, and ceftriaxone. These results are consistent with a study conducted in the USA by Sahm and colleagues they reported resistant strains to co-trimoxazole, ciprofloxacin, and ampicillin [23].

This study revealed that sensitivity of *E.coli* to ciprofloxacin was 54.4%. This was slightly different from study conducted in Iran, which reported a sensitivity of 40.2% by disk diffusion and only 4.9% by MIC [24].

Conclusion

E.coli and *Klebsiella pneumoniae* were dominated among the isolates. Isolated bacteria were more prevalent in females. Most of the isolated bacteria revealed resistances against commonly prescribed drugs with Ampicillin, Augmentin and cotrimazole to had highest resistance rates whereas Ciprofloxacin and Nitrofurantoin had the least resistance respectively. Only *E.coli* was found to be sensitive to Ceftriaxone. Enterococcus fecalis was the only UTI Isolate sensitive to Ampicillin.

Recommendations

- Antimicrobial stewardship programs should be developed by healthcare institutions to reduce inappropriate antimicrobial use, improve patient outcomes, and reduce adverse consequences of antimicrobial use.
- All clinicians are encouraged to obtain a sample culture of the organism prior to initiating treatment.
- Healthcare practioners should prescribe Ciprofloxacin and Nitrofurantoin as ideal UTI drugs.

Intervention studies of the commonly prescribed UTI drugs should be done to allow health practioners to take evidence based decisions.

References

1. Saadeh SA, Mattoo TK (2011) Managing urinary tract infections. Pediatr Nephrol 26: 1967-1976.
2. Hooton TM (2012) Uncomplicated urinary tract infection. N Engl J Med 366:1028-1037.
3. Kiffer CR, Pignatari AC (2011) Pharmacodynamic evaluation of commonly prescribed oral antibiotics against respiratory bacterial pathogens. BMC Infect Dis 11:286.
4. Odongo CO, Anywar DA, Luryamamoi K, Odongo P (2013) Antibiograms from community-acquired uropathogens in Gulu, northern Uganda - a cross-sectional study. BMC Infect Dis 13.
5. Rocha JL, Tuon FF, Johnson JR (2012) Sex, drugs, bugs, and age: Rational selection of empirical therapy for outpatient urinary tract infection in an era of extensive antimicrobial resistance. Brazilian J Infect Dis 16: 115-121.
6. Flores-Mireles AL, Walker JN, Caparon M, Hultgren SJ (2015) Urinary tract

infections: Epidemiology, mechanisms of infection and treatment options. Nat Rev Microbiol 13: 269-284.

7. Rabasa AI, Shattima D (2002) Urinary tract infection in severely malnourished children at the University of Maiduguri Teaching Hospital. J Trop Pediatr 48: 359-361.
8. Page AL, de Rekeneire N, Sayadi S, Aberrane S, Janssens AC, et al. (2013) Infections in Children Admitted with Complicated Severe Acute Malnutrition in Niger. PLoS One 8: e68699.
9. Momtaz H, Farzan R, Rahimi E, Dehkordi FS, Souod N (2012) Molecular characterization of Shiga toxin-producing Escherichia coli isolated from ruminant and donkey raw milk samples and traditional dairy products in Iran. Sci World J pp: 1-13.
10. Mashayekhi F, Dormanesh B, Moghny M, Yahaghi E, Darian EK, et al. (2014) Molecular Characterization and Antimicrobial Resistance of Uropathogenic Escherichia coli. Iran J Biotechnol 12: 32-40.
11. Barber AE, Norton JP, Spivak AM, Mulvey MA (2013) Urinary tract infections: Current and emerging management strategies. Clin Infect Dis 57: 719-724.
12. Windahl U, Holst BS, Nyman A, Gronlund U, Bengtsson B (2014) Characterisation of bacterial growth and antimicrobial susceptibility patterns in canine urinary tract infections. BMC Vet Res 10: 1-10.
13. Chang SK, Lo DY, Wei HW, Kuo HC (2015) Antimicrobial resistance of Escherichia coli isolates from canine urinary tract infections. J Vet Med Sci 77: 59-65.
14. Ferede G, Yismaw G, Wondimeneh Y, Sisay Z (2012) The Prevalence and Antimicrobial Susceptibility pattern of Bacterial Uropathogens Isolated from pregnant women. Eur J Exp Biol 2: 1497-1502.
15. Taneja N, Rao P, Arora J, Dogra A (2008) Occurrence of ESBL & Amp-C β-lactamases & susceptibility to newer antimicrobial agents in complicated UTI. Indian J Med Res 127: 85-88.
16. Clinical and Laboratory Standards Institute (2015) M02-A12: Performance Standards for Antimicrobial Disk Susceptibility Tests; Approved Standard-Twelfth Edition 35: 73.
17. Medium HT (2013) Antimicrobial Susceptibility Test Discs Zone Size Interpretative Chart pp: 1-12.
18. Odoki M, Aliero AA, Tibyangye J, Maniga JN, Wampande E, et al. (2019) Prevalence of Bacterial Urinary Tract Infections and Associated Factors among Patients Attending Hospitals in Bushenyi District, Uganda. Int J Microbiol 2019: 1-8.
19. Kidwai SS, Nageen A, Ghaznavi S, Bashir F, Ara J (2017) Antibiotic susceptibility in commonly isolated pathogens from urinary tract infection in a cohort of subjects from low socioeconomic strata. Pak J Med Sci 33: 254-259.
20. Al Mijalli SH (2017) Bacterial Uropathogens in Urinary Tract Infection and Antibiotic Susceptibility Pattern in Riyadh Hospital, Saudi Arabia. Cell Mol Med 3: 1-5.
21. Chowdhury S, Parial R (2015) Antibiotic susceptibility patterns of bacteria among urinary tract infection patients in Chittagong, Bangladesh. SMU Medical Journal 2: 114-127.
22. Das UK, Bhattacharjee P, Debnath S, Chakraborty M, Ghosh R, et al. (2018) Antibiotic sensitivity pattern of bacterial isolates from urine samples of admitted patients with urinary tract infection in a tertiary care teaching hospital of Tripura, India: a hospital record based study. Int J Basic Clin Pharmacol 7: 585-589.
23. Sahm DF, Thornsberry C, Mayfield DC, Jones ME, Karlowsky JA (2001) Multidrug-resistant urinary tract isolates of Escherichia coli: Prevalence and patient demographics in the United States in 2000. Antimicrob Agents Chemother 45: 1402-1406.
24. Nakhjavani FA, Mirsalehian A, Hamidian M, Kazemi B, Mirafshar M, et al. (2007) Antimicrobial susceptibility testing for Escherichia coli strains to fluoroquinolones, in urinary tract infections. Iranian Journal of Public Health 36: 89-92.

Author Affiliation

Top

Faculty of Medicine & Surgery, Jazeera University, Mogadishu-Somalia