Prevalence and antibiogram of bacterial isolates from urinary tract infections at Dessie Health Research Laboratory, Ethiopia

Mulugeta Kibret[1*], Bayeh Abera[2]

[1]*Department of Biology, Science College, Bahir Dar University, P.O.Box 79 Bahir Dar, Ethiopia*

[2]*Department of Microbiology, Parasitology and Immunology, College of Medicine and Health Sciences, Bahir Dar University, P.O.Box 79, Bahir Dar, Ethiopia*

PEER REVIEW

ABSTRACT

Objective: To determine the prevalence and antimicrobial susceptibility of bacteria from suspected urinary tract infections.
Methods: A retrospective analysis of bacterial pathogens and their antimicrobial susceptibility was done on urine samples at Dessie Regional Laboratory in the period 2003 to 2010. Antimicrobial susceptibility tests were done using disc diffusion technique as per the standard of Kirby−Bauer method.
Results: The male to female ratio of the patients was 1:1.96. Of the total 1 404 samples, 319 (22.7%) were culture positive. *Escherichia coli* was the dominant isolate (63.6%) followed by *Klebsiella* spp. (8.5%) and *Proteus* spp. (8.2%). The overall resistance rates to erythromycin, amoxycillin, and tetracycline were 85.6%, 88.9% and 76.7%, respectively. The three most frequently isolated bacteria had resistance rates of 80.1%−90.0% to, amoxycillin, and tetracycline and sensitivity rates of 0 to 25% to nitrofurantoin, ciprofloxacin and gentamicin. Antibiogram of isolates showed that 152 (47.85%) isolates were resistance to two and more antimicrobials.
Conclusions: In the study area resistance rates to erythromycin, amoxycillin and tetracycline were high. Since most isolates were sensitive to nitrofurantoin and gentamicin, they are considered as appropriate antimicrobials for empirical treatment urinary tract infections.

1. Introduction

Urinary tract infection (UTI) is a term applied to a variety of clinical conditions ranging from asymptomatic presence of bacteria in the urine to severe of the kidney with sepsis[1]. UTIs are one of the most common bacterial infections in humans both in the community and hospital settings[2]. Worldwide, approximately 150 million people are diagnosed with UTIs resulting in USD 6 billion health care expenditures[1]. UTIs are the most common bacterial infections encountered by clinicians in developing countries[3].

Most UTIs are caused by Gram−negative bacteria like *Escherichia coli* (*E. coli*), *Klebsiella* spp., *Proteus mirabilis*, *Pseudomonas aeruginosa*, *Acinetobacter* spp., and *Serratia* spp. and Gram−positive bacteria such as *Enterococcus* spp. and *Staphylococcus* spp[3,4]. *E. coli* is responsible to most

UTIs[5,6]. Drug resistance among bacteria causing UTI has increased since introduction to UTI chemotherapy[7–11]. The etiological agents and their susceptibility patterns of UTI vary in regions and geographical location. Besides, the etiology and drug resistance change through time[12]. Knowledge of the local bacterial etiology and susceptibility patterns is required to trace any change that might have occurred in time so that updated recommendation for optimal empirical therapy of UTI can be made[13]. In Ethiopia, a number of studies have been done on the prevalence and antimicrobial resistance patterns of UTIs[3,4,7]. However, no data have been reported from the present study area. The aim of the present study was therefore to determine the prevalence of local bacterial isolates from suspected UTI and susceptibility to the most commonly used antimicrobials.

2. Materials and methods

2.1. Study design

A retrospective analysis of culture results of urine was performed at Dessie Regional Health Research Laboratory. The sex and age of patients, the organism isolated and the antimicrobial susceptibility profiles were collected from the registration records using a standard data collection form. The data were entered into Excel for analysis.

2.2. Culture and identification

As the standard operation procedures show clean–catch midstream morning urine specimens were collected using sterile wide mouth glass container. Urine samples were plated on cystine lactose electrolyte–deficient medium, MacConkey agar and, blood agar (Oxoid, Basingstoke, UK) using calibrated wire loops and then incubated aerobically at 37 °C for 24 h. From positive cultures, uropathogens were identified according to the standard operational procedures as per the standard microbiological methods[14]. A significant bacterium was considered if urine culture yield ≥10^5 CFU/mL.

2.3. Antimicrobial susceptibility tests

According to the standard operational procedures, antimicrobial susceptibility tests were done on Mueller–Hinton agar (Oxoid, Hampshire, England) using Kirby–Bauer disk diffusion method[15]. The antimicrobial agents tested were: tetracycline (30 μg), nitrofurantoin (300 μg), erythromycin (15 μg), chloramphenicol (30 μg), gentamicin (10 μg), ciprofloxacin (5 μg), cephalothin (30 μg), doxycycline (30 μg), cotrimoxazole (25 μg), ceftriaxone (30 μg) and amoxycillin (10 μg) (Oxoid, England). Resistance data were interpreted according to Clinical laboratory Standards Institute. Reference strains of *E. coli* ATCC 25922 and *Staphylococcus aureus* ATCC 25923 (*S. aureus*) were used for quality control for antimicrobial susceptibility tests[16].

2.4. Data analysis

Chi–square test was employed to compare the proportion of bacterial isolates between sex and age and comparison of antimicrobial resistances. *P*–value of less than 0.05 was considered to indicate statistically significant difference.

2.5. Ethical considerations

Ethical approval was secured from Research Ethics Committee of Bahir Dar University. Permission from Dessie Regional Health Research Laboratory was also obtained.

3. Results

During 2003 to 2010, a total of 1 404 urine samples from suspected UTIs were analyzed for isolation and identification of bacteria and antimicrobial susceptibility testing. The age of the patients ranged from 1 year to 85 years, with mean age of 32.26 (SD=14.45) years. The mean ages of male and female patients were 35.1 (SD=15.8) and 30.78 (SD=12.4) years, respectively. Nine hundred thirty (62.2%) urines samples were from female and 474 (33.8%) were from male patients with male to female ratio of 1:1.96. The demographic characteristics of the patients are shown in Table 1.

Table1
Age and sex distribution of patients with suspected UTI.

Demographic characteristics		Positive No. (%)	Negative No. (%)	Total (%)	P value
Age (years)	< 4	14 (48.3)	15 (51.7)	29 (100)	P=0.011
	5−14	22 (21.2)	82 (78.8)	104 (100)	
	15−25	84 (23.7)	270 (76.3)	354 (100)	
	26−44	128 (20.1)	509 (79.9)	637 (100)	
	> 44	71 (25.4)	209 (74.6)	280 (100)	
Gender	Male	67 (14.1)	407 (85.9)	474 (100)	P<0.001
	Female	252 (27.1)	678 (72.9)	930 (100)	
	Total	319 (22.7)	1 085 (77.3)	1 404 (100)	

The overall prevalence of the uropathogens was 319 (22.7%). Majority of the pathogens were isolated from females with isolation rate of 27.1% and 14.1% (95% *CI*=0.14) were from males. The highest isolation rate was observed in the age group between 26 to 44 years of age (Table 1). *E. coli* was the most predominant pathogen isolated from urine samples with prevalence of 203 (63.6%). *Klebsiella* spp., *Proteus* spp., *Pseudomonas* spp., coagulate negative staphylococci (CNS), *S. aureus*, *Enterobacter* spp. and *Citrobacter* spp. accounted for 36.4% of the isolates (Table 2). Gram negative and Gram positive bacteria were responsible for 91.9% and 9.1% of the isolates, respectively.

The overall susceptibility profiles of bacterial isolates are shown in Table 3. Erythromycin had the highest overall resistance of 85.6%, followed by amoxycillin (83.9%) and tetracycline (76.7%). Nitrofurantoin, gentamicin and ciprofloxacin had overall resistance rates of 5.5%, 24.3% and