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Antibiotic Sensitivity Pattern of Uropathogenic *Escherichia coli* and *Klebsiella* spp Isolated from Clinical Samples in Wukari, Taraba State, Nigeria

Tolulope Iorwuese Ade*, Ebuara Francis Ushie

Department of Microbiology, Faculty of Pure and Applied Sciences, Federal University, Wukari, Nigeria

Email address

tolulope.iorwuese@gmail.com (T. I. Ade)

*Corresponding author

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Abstract

The emergence of antibiotic resistant bacteria has over the years risen to become a major and significant issue in public and community health. Urinary tract infection is one of the major causes of morbidity in humans especially in developing countries. The etiology of UTI and antibiotic sensitivity pattern varies with the widespread availability of antimicrobial agents. The research study was conducted to assess the sensitivity and resistance patterns of uropathogenic *Escherichia coli* and *Klebsiella* spp isolated from urine samples of patients suffering urinary tract infection in Wukari, Taraba State. Of the one hundred and twelve (112) patient-respondents, females represented the major part with 56.25% while the male gender was in the minority with 43.75%. From the collected urine specimen, *E. coli* and *Klebsiella* spp were recovered seventy-three (73) and fifty-four (54) times respectively and were tested against different concentrations of antibiotics. Of the tested antibiotics, the uropathogens were more sensitive to Tarivid, Nalidixic acid, Gentamicin, Augmentin, Ciprofloxacin, Streptomycin and Reflacine. While *E. coli* was resistant to Septrin, *Klebsiella* was sensitive. Both bacteria isolates were resistant to Ceporex and Ampicillin. In this study, females were the most affected with UTI and the most common organisms were *E. coli* and *Klebsiella* spp. It is therefore important to consider the sensitivity pattern of uropathogens to local antibiotics when it comes to the selection of treatment regimen for urinary tract infection.

Keywords

Antibiotics, Sensitivity, Uropathogens, *E. coli*, *Klebsiella* spp

1. Introduction

One of the most commonly encountered diseases in developing countries is urinary tract infections (UTI). UTIs have an estimated annual global incidence of at least 250 million and are indicated by the growth of more than 105 CFU/ml for asymptomatic individual and 10^3CFU/ml for symptomatic individual from a properly collected midstream "clean-catch" urine sample [5, 14, 16]. The etiologic agents of UTI are variable and usually dependent on time, geographical location and age of the patients [5]. The vast majority of UTIs are caused by Gram-negative bacteria including *Escherichia coli*, *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, *Enterococcus* spp, *Enterobacter* spp, *Acinetobacter* spp, and *Staphylococcus* spp [2, 13].

The introduction of antimicrobial agents has contributed majorly to the management of common UTIs [15]. In UTI cases, antibiotic treatment is often preferably treated with an antibiotic to which resistance is low and there exists a low capacity for co-selection of resistance and a low impact on the normal intestinal flora [14]. Knowledge of the antimicrobial resistance pattern of uropathogens is highly beneficial in directing towards optimal choice of antimicrobial agents in the initial approach of the patient. The most commonly used antimicrobial agents in the treatment of UTIs include cell wall inhibitors like penicillin and third generation Cephalosporin (Cefotaxime, Ceftazidime and

Cefaclor), DNA gyrase inhibitors like Fluoroquinolones (Ciprofloxacin, Ofloxacin and Sparfloxacin) and Aminoglycosides (Amikacin, Gentamicin and Kanamycin) which are protein synthesis inhibitors [5, 20].

The aim of the study is to assess the antibiotic sensitivity pattern of uropathogenic *Escherichia coli* and *Klebsiella* spp isolated from outpatients with urinary tract infection attending General Hospital Wukari.

2. Materials and Methods

Sample collection and cultivation: a total of one hundred and twelve (112) outpatients with symptoms suggestive of UTI (frequency, urgency, nocturia, dysuria, suprapubic or loin pain with or without fever) that fulfilled the inclusion criteria on presentation at general hospital, Wukari were selected for the purpose of this study. The inclusion criteria for this study included patients presenting with symptoms referable to UTI at the hospital whilethe exclusion criteria included patients who reported to have been on antibiotics within 2 weeks prior to the study. Patients within the age of 25-35 years formed the major population.

The urine samples collected into sterile universal bottles were transported to the Microbiology laboratory of Federal University Wukari for processing within 1 hour and where immediate processing was not possible, the samples were promptly refrigerated at 4°C to avoid multiplication of bacteria at room temperature. These samples were subjected to routine microscopy, culture, and sensitivity according to standard practice.

Microscopy involved centrifugation of 5mL of urine sample in a test tube at 1,500 revolutions per minute. The sediments were poured on to a clean slide and observed under a microscope for casts, pus cells, and red blood cells. Culture of the urine was carried out by inoculating a portion of the urine samples which had been well mixed into Cystein-Lactose-Electrolyte Deficient Agar (CLED) and Eosin Methylene Blue (EMB) agarusing standard wire loop. The specimens were well streaked on the plate to allow for discrete colonies. Inoculated agar plates were incubated at 37°C overnight and read after 24 hours to assess growth of significant bacteriuria.

Bacterial isolation and identification: distinct bacterial colonies were plated out on freshly prepared nutrient agar plates using the streak plate method of bacterial isolation. Target pathogens (*Escherichia coli* and *Klebsiella* spp) were identified using morphological features of the colonies, and standard biochemical and sugar utilization tests [6].

Antibiotic sensitivity test: characterized isolates of *Escherichia coli* and *Klebsiella* spp were subjected to antibiotic sensitivity test using the Kirby-Bauer disk diffusion methodand interpreted in accordance with the zone size interpretative chart. Commercially marketed antibiotic sensitivity discs, Optudisc (TP 34-948) for Gram negative bacteria was purchased and contained Tarivid (OFX: 10µg), Reflacine (PEF: 10µg), Ciproflox (CPX: 10µg), Augmentin (AU: 30µg), Gentamicin (CN: 10µg), Ceporex (CEP: 10µg), Streptomycin (S: 30µg), Nalidixic acid (NA: 30µg), Septrin (SXT: 30µg), and Amplicin (PN: 30µg).

3. Results

Of the one hundred and twelve (112) urinary tract infection patients assessed, 49 (43.75%) were male while 63 (56.25%) were female. Within the period of study, a total of seventy-three (73) *Escherichia coli* isolates were recovered while only fifty-four (54) isolates of *Klebsiella* spp were recovered. The bacterial isolates displayed different sensitivity patterns to the different tested concentrations of antibiotics. From tables 2 and 3, it can be noted that *E. coli* showed its least susceptibility against Ceporex (44.3%) and highest susceptibility against Augmentin (97.6%) while *Klebsiella* spp displayed its highest susceptibility against Streptomycin (89.8%) and highest resistance against Ampicillin (100%). Figures 1 and 2 depict the resistance and susceptibility patterns of the uropathogens against the tested concentrations of antibiotics. Isolates of *E. coli* displayed more susceptibility to the tested antibiotics as compared to *Klebsiella* spp that displayed more resistance to the antibiotics.

Table 1. *Distribution of outpatients based on gender.*

Gender	Number	Percentage (%)
Male	49	43.75
Female	63	56.25

Table 2. *Antibiotic sensitivity pattern of Escherichia coli (n = 73).*

Antibiotics	Percentage susceptible (%)	Percentage resistant (%)
Tarivid	74.4	25.6
Reflacine	71.2	28.8
Ciproflox	77.8	22.2
Augmentin	97.6	2.4
Gentamicin	86.1	13.9
Ceporex	44.3	55.7
Streptomycin	95.2	4.8
Nalidixic acid	71.0	29.0
Septrin	49.1	50.9
Ampicillin	47.4	52.6

Table 3. *Antibiotic sensitivity pattern of Klebsiella spp (n = 54).*

Antibiotics	Percentage susceptible (%)	Percentage resistant (%)
Tarivid	59.8	40.2
Reflacine	88.8	11.2
Ciproflox	75.4	24.6
Augmentin	54.4	45.6
Gentamicin	67.3	32.7
Ceporex	37.2	62.8
Streptomycin	89.8	10.2
Nalidixic acid	52.6	47.4
Septrin	63.3	36.7
Ampicillin	0.0	100

The figure below has shown that *Klebsiella* spp was slightly more resistant to some of the antibiotics most notably, Ampicillin.

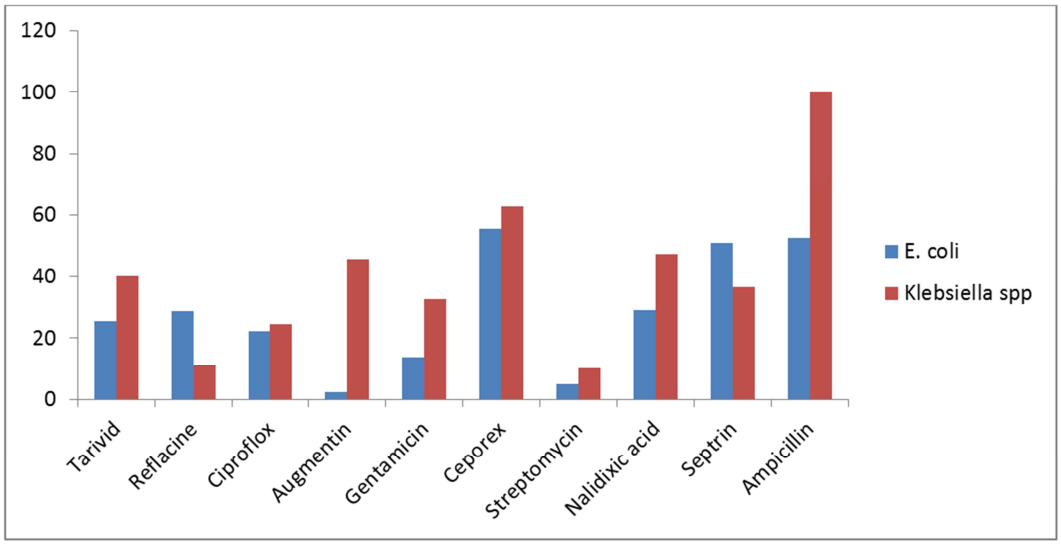

Figure 1. *Comparison of antibiotic resistance pattern between uropathogenic E. coli and Klebsiella spp.*

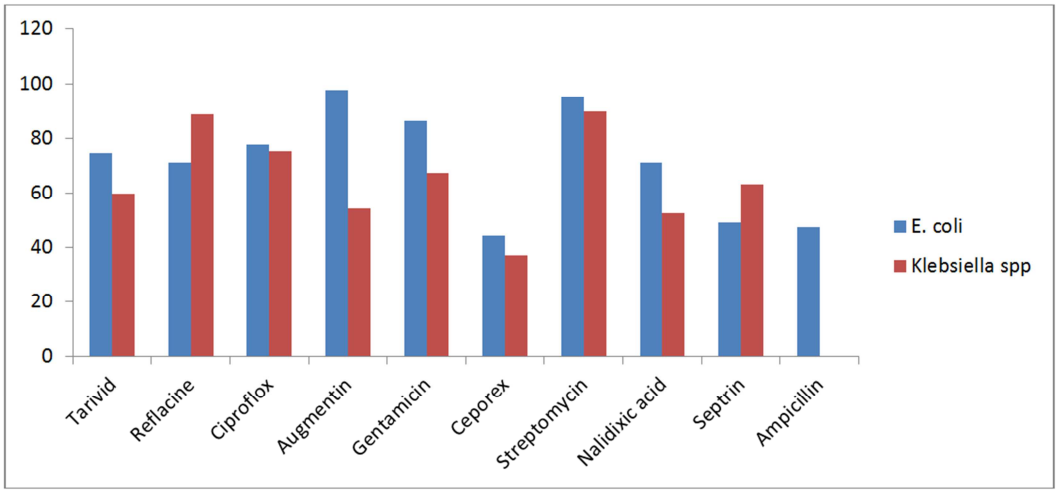

Figure 2. *Comparison of antibiotic susceptibility pattern between uropathogenic E. coli and Klebsiella spp.*

Figure 2 above presents a comparison as to the susceptibility pattern of both uropathogens. Obviously, *E. coli* showed greater susceptibility than the *Klebsiella* spp against the commercial antibiotics.

4. Discussion

The medical significance of antibiotic resistant bacteria strains in the management of infectious diseases is worrisome. The implementation of regular surveillance systems for monitoring the sensitivity patterns of uropathogens to antibiotics at local levels is important in combating emerging problems of antibiotic resistance while also providing assistance in managing efficient initial therapy [4]. This present study assesses the sensitivity patterns of uropathogenic *Escherichia coli* and *Klebsiella* spp to different concentrations of antibiotics. Gender-wise, more females were affected with UTI than males; this study is in agreement with other similar studies [5, 12, 17, 21].

E. coli was very common in the study and this is similar to most other studies [1, 9, 10, 18]. This supports the fact that most organisms causing UTI are from the lower gastrointestinal tract which acts as a reservoir for organisms like E. coli [8]. *E. coli* was sensitive to most of the tested antibiotics except Ceporex, Septrin and Ampicillin; *Klebsiella* spp was sensitive to all tested antibiotics except Ceporex and Ampicillin. Similar studies also recorded high resistance rates of the isolates to Ampicillin [5, 7, 17]. Cunha *et al.* reported sensitivity of the isolates to Gentamicin, ciprofloxacin and Nalidixic acid [7, 18].

The antibiotics with the overall highest sensitivity pattern in this study were Augmentin and Streptomycin for *E. coli* and *Klebsiella spp* respectively which respectively belong to the penicillin and aminoglycoside groups of antibiotics. This contradicts other reports where quinolones were the most effective and sensitive antibiotics to the organisms causing UTI [3, 11]. Ampicillin was the only antibiotic with susceptibility of less than 50% for both test organisms. This

suggests its less efficacy against UTI at least in vitro. Furthermore, the slightly higher resistance of the *Klebsiella* spp may suggest how the pathogen is gaining prominence as regards UTIs and why appropriate measures must be put in place to discountenance.

5. Conclusion

This present study has shown that females were mostly affected with urinary tract infection in Wukari metropolis and might have as well confirmed that E. coli is still the most common bacteria causing UTI with *Klebsiella* spp gaining prominence. The uropathogenic bacteria *E. coli* and *Klebsiella* spp recovered were most sensitive (in no specific order) to Tarivid, Nalidixic acid, Gentamicin, Augmentin, Ciprofloxacin, Streptomycin and Reflacine. They were predominantly resistant to Ampicillin.

6. Recommendation

In the selection of effective treatment regimen for UTI, it is of the utmost importance to consider the sensitivity and resistance pattern of the uropathogens at least in vitro to common antimicrobial agents.

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