

# The Prevalence of Klebsiella Species Causing Urinary Tract Infections in Murtala Muhammad Specialist Hospital, Kano, Nigeria

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**Abstract:** Urinary tract infections (UTIs) are among the most commonly encountered infections, both in the community and in hospitals. The study investigated the Prevalence of Klebsiella species among patients suspected of UTI in Murtala Muhammad Specialist Hospital, Kano, Nigeria. Two hundred urine specimens of patients comparing of 135(67.5%) outpatients and 65(32.5%) inpatients and classified into 125(62.5%) females and 75(37.5%) males were bacteriologically evaluated. A total of 61(30.5%) yielded significant growth on culture of which 50(25%) were from females and 11(5.5%) from males. The age distribution of the patients with significant bacterial growth showed that patients within the age group of 21-30 years had the highest (UTI) cases of 33(16.5%) but those within the age group of less or equal to 10 years and those within the 51 to 60 years age bracket had 3(1.5%) UTI cases each. Of the uropathogens isolated, *Escherichia coli* was the most frequent organism responsible for UTI with 29(14.5%), followed by Klebsiella species with 16(8.0%). Other organisms isolated were Staphylococcus species 9(4.5%), proteus species 5(2.5%) and Pseudomonas species 2(1.0%) respectively. The speciation of Klebsiella species isolated showed that 14(7.0%) were *Klebsiella pneumoniae* and 2(1.0%) were *Klebsiella oxytoca*. The antibiotic susceptibility testing for Klebsiella species isolates showed Ofloxacin as the best drug of choice with all the 16 isolates susceptible to Ofloxacin but at the same time all were resistant to ampicillin.

**Keywords:** Prevalence, Urinary Tract Infections, Klebsiella, Kano

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## 1. Introduction

The Urinary tract is the name given to the internal organs that collect, store and expel urine from the body, while the urinary tract infection (UTI) can be defined as condition in which bacteria are multiplying and attacking the urinary tract regardless of the position along the tract. It has been observed that untreated asymptomatic bacteriurea, if not treated has the tendency of leading to cystitis and/or pyelonephritis, which will cost more to treat and cause more havoc [1]. Symptoms associated with urinary tract infection include – pain or burning (discomfort) sensation at urinating; a feeling of urgency at urination; cramps or pain in the lower abdomen; the need to urinate more often

than usual; urine that looks turbid and has foul smell; pain, pressure or tenderness in the area of the bladder and when bacteria spread to the kidneys, there can be back pain, chills, fever, nausea and vomiting [2]. UTI has become the most common hospital-acquired infection, accounting for as many as 35% of nosocomial infections, and it is the second most common cause of bacteraemia in hospitalized patients [3, 4, 5]. Urinary tract infections (UTIs) are common among inpatients and outpatients, ranking second only to respiratory infections. In the United States, it is estimated, from surveys of office practices, hospital-based clinics and emergency departments that UTIs account for over eight million cases annually and more than 1 million hospitalizations, with an overall annual cost in excess of \$1

billion [6, 7, 8]. Factors that predispose an individual to UTI include: (a) Stasis; a major cause of UTI during pregnancy. (b) Obstruction of the flow of urine, which could be caused by stone. (c) Presence of foreign body such as in-dwelling bladder catheter. (d) A decrease in general body resistance as observed in malnourished individuals, use of immunosuppressive drugs and disease conditions e.g. diabetes [9, 10]. Females are believed to be more affected than males except at the extremes of life, because bacteria can reach the bladder more easily in women, partially due to the short and wider female urethra, and its proximity to the anus [11, 5]. According to [7] an estimated 40% of women reported having had a UTI at some point in their life time. Urinary tract infections (UTIs) are a major cause of morbidity worldwide. In a study done in other parts of the world on outpatient infections, UTIs were the second most common diagnosis after upper respiratory tract infections [28].

## 2. Materials and Methods

### 2.1. Study Area

The study was carried out in Kano metropolis (the capital city of Kano State, Nigeria). The state was created on May 27, 1967 from part of the then Northern region. It is known for high commercial activities as the second largest industrial center in Nigeria and the largest in Northern Nigeria. Commercial activities in Kano first developed with the establishment of Kurmi market by the Emir of Kano Muhammadu Rumfa, in the 16th Century. The people in the state also had the history of large scale agricultural activities leading to groundnut pyramid, which though not in existence now, but still remain part of the state's symbols. People of Kano are predominantly Hausa/Fulani and practice Islam as their religion.

### 2.2. Specimens Collection and Processing

A total of two hundred patients whom were clinically suspected of urinary tract infections in Murtala Muhammad Specialist Hospital, Kano were given sterile universal bottles and instructed on how to produce a clean catch early morning mid stream urine. All samples submitted were processed immediately, but where delay was anticipated the samples were kept in the fridge at 4°C before processing. Macroscopy was done before inoculations onto Cysteine lactose electrolyte deficient agar and Chocolate agar. After culturing about 10 mls of each sample was spun in the centrifuge and a drop of the deposit of each was put on a clean grease free slide and examined under light microscope using 10x and 40x objectives for bacteria, pus cells, RBCs, yeast cells etc. Part of these deposits were also used for direct gram staining. All inoculated samples were incubated at 37°C for 24 hours [12, 13]. Observed colonies were identified using colonial morphology and biochemical characteristics. Discrete colonies (pure culture) were

sought for by subculture onto McConkey agar and incubated at 37°C for 24 hours.

### 2.3. Antibiotic Susceptibility Testing

The pattern of susceptibility of the isolates to various antibiotics was determined according to modified Kirby-Bauer disc diffusion method [14]. The inoculated plates carrying the antibiotic discs were incubated at 37°C for 24 hours [13].

### 2.4. Statistical Analysis

Statistical analysis was carried out using computer database software from the statistical package from social sciences (SPSS version 16) to generate frequency distribution and percentage prevalence scores of the various parameters. Descriptive analysis of the percentages of continuous variables was reported.

## 3. Results

Two hundred specimens of patients suspected of urinary tract infections (UTI), consisting of 135(67.5%) from outpatients and 65(32.5%) from inpatients were used. Out of the total, 75(37.5%) and 125(62.5%) were males and females respectively (Table 1). The culture yielded a total of 61(30.5%) significant bacteriuria of which 50(25%) were from females and 11(5.5%) from males (Table 2). The significant growth of specimens in relation to age groups showed that patients within the age group of 21-30 years has the highest growth 33(16.5%) while patients within the age group of ≤ 10 years and those of 51-60 had 3(1.5%) growth each (Table 3). The prevalence of the organisms isolated in the study showed that close to half of the total number of isolates recovered was *Escherichia coli* with the prevalence of 29(14.5%). This was followed by Klebsiella species, Staphylococcus species, Proteus species and Pseudomonas species with prevalence of 16(8.0%), 9(4.5%), 5(2.5%) and 2(1.0%) respectively (Table 4). The occurrence of Klebsiella Species among the age groups of the patients in the study showed that, patients within the age group of 21-30 years had the highest prevalence of 7(3.5%) in which 2(1.0%) were males and 5 (2.5%) were females (Table 5). Out of the 16 Klebsiella species isolated, 14 (7.0%) were biochemically identified as *Klebsiella Pneumoniae* and 2(1.0%) were *Klebsiella oxytoca* (Table 6). All the 16 Klebsiella species isolated were susceptible to Ofloxacin while 15(93.75%) and 14(87.5%) were susceptible to nitrofurantoin and Nalidixic acid respectably. The study showed that all the Klebsiella species were resistant to ampicillin (Table 7).

**Table 1.** Distribution of patients suspected of UTI in relation to gender.

Group	Number (%)	Female (%)	Males (%)
Outpatients	135(67.50)	100(50.00)	35(17.50)
Inpatients	65(32.50)	25(12.50)	40(20.00)
Total	200(100)	125(62.50)	75(37.50)

**Table 2.** Distribution of specimens with significant growth on culture.

Group	Females (%)	Males (%)	Total (%)
Outpatients	40(20.00)	6(3.00)	46(23.00)
Inpatients	10(20.00)	5(2.50)	15(7.500)
Total	50(25.00)	11(5.50)	61(30.50)

**Table 3.** Significant bacteriuria in relation to age.

Age Group (Years)	Number Examined (%)	Number of Significant Growth (%)
≤10	20(10.00)	3(1.50)
11-20	24(12.00)	6(3.00)
21-30	79(39.50)	33(16.50)
31-40	35(17.50)	11(5.50)
41-50	20(10.00)	5(2.50)
51-60	14(7.00)	3(1.50)
≥61	8(4.00)	0(0.00)
Total	200(100.00)	61(30.5)

**Table 4.** Prevalence of uropathogens isolated from the specimens.

Organisms	Number of Specimens	Percentage (%)
<i>Escherichia coli</i>	29.00	14.50
<i>Klebsiella</i> species	16.00	8.00
<i>Staphylococcus</i> species	9.00	4.50
<i>Proteus</i> species	5.00	2.50
<i>Pseudomonas</i> species	2.00	1.00
Total	61.00	30.50

**Table 5.** Occurrence of *Klebsiella* species in relation to age and sex.

Age Group	Male	Female	Total
≤10	0(0.00)	1(0.50)	1(0.50)
11-20	1(0.50)	1(0.50)	2(1.00)
21-30	2(1.00)	5(2.50)	7(3.50)
31-40	1(0.50)	2(1.00)	3(1.50)
41-50	1(0.50)	1(0.50)	2(1.00)
51-60	0(0.00)	1(0.50)	1(0.50)
≥61	0(0.00)	0(0.00)	0(0.00)
Total	5(2.50)	11(5.50)	16(8.00)

**Table 6.** Speciation of *Klebsiella* species isolated.

<i>Klebsiella</i> species	Number isolated	Percentage (%)
<i>Klebsiella pneumoniae</i>	14.00	7.00
<i>Klebsiella oxytoca</i>	2.00	1.00
Total	16.00	8.00

**Table 7.** Susceptibility pattern of the *Klebsiella* isolates to Antimicrobial agents.

Antibiotics	Number of susceptible isolates	Percentage of susceptible isolates
	(N=16)	
Nalidixic acid	14.00	(87.50)
Nitrofurantoin	15.00	(93.75)
Ofloxacin	16.00	(100.00)
Colistin phosphate	13.00	(81.25)
Gentamycin	13.00	(81.25)
Streptomycin	8.00	(50.00)
Cotrimoxazole	5.00	(31.00)
Ampicillin	- 0.00	(0.00)

## 4. Discussion

UTI is one of the most common infectious diseases [15]. *Escherichia coli* and *Klebsiella* species have been reported to be the most common organisms causing UTI. The study on *Klebsiella* species was carried out on specimens of 200 patients suspected of urinary tract infection of which 135(67.50%) were out-patients and 65(32.5%) were in-patients. The overall prevalence of the uropathogens was 61(30.5%) in the study which is in agreement with work of [16] that used 200 urine samples and got 70(35%) prevalence of UTI. But the study of [17] which also used 200 urine samples had a lower prevalence of 21%. Females were observed to have higher cases of UTI than the males with 50(25.00%) as the significant growth recorded. This conformed to work [18] with prevalence of 46(34.4%) and 17 (12.7%) for females and males respectively. The other work of [19] recorded infection rates of 68(30.2%) and 49(21.8%) for females and males respectively.

The age group with highest prevalence was 21-30 with 33(16%) out of the 79(39.5%) specimens examined in the group which is in agreement with the findings [20] where patients with the age group of 21-25 had the highest infection rate of 20(51.3%) against the other groups used. *Escherichia coli* was the predominant uropathogens with 29(14.50%) of the total 61(30.50%) isolates, followed by *Klebsiella* species 16(8.00%) isolates, then *Staphylococcus* species, *Proteus* species and *Pseudomonas* species with 9(4.50%), 5(2.50%) and 2(1.00%) isolates respectively. This compares favourably with *Escherichia coli* 55(48.7%) followed by *Klebsiella* species 27(23.9%) in the study of [21]; *Escherichia coli* 323(54.5%), *Klebsiella* species 127(21.5%) in the study of [22]. But the study contrasts the work titled *Klebsiella* has taken the lead by [23] with relative prevalence of 93(33.3%) and 90(32.3%) for *Klebsiella* species and *Escherichia coli* respectively and that of [24] with prevalence of *Klebsiella* species (26%) followed by *Escherichia coli* (19%). Out of the different uropathogens isolated in this

study, *Klebsiella* species encountered were *Klebsiella pneumoniae* and *Klebsiella oxytoca*. Same species were also isolated by [25] with six (6) *Klebsiella Pneumoniae* and only one (1) *Klebsiella oxytoca* isolate as against the fourteen (14) and two (2) *Klebsiella Pneumoniae* and *Klebsiella oxytoca* isolated respectively in this study. [26] also isolated similar species in urine samples they used in their study but with higher frequency of 33 and 19 for *Klebsiella pneumonia* and *Klebsiella oxytoca* respectively. One thing that cross wisd all the three studies was that *Klebsiella pneumonia* was the predominant isolate in all the studies.

The antimicrobial susceptibility pattern of *Klebsiella* species isolated in the study revealed Ofloxacin and Nitrofurantoin to be the most promising drug of choice for the treatment of UTI. According to the finding [27], ofloxacin also proved effective against UTI isolates with efficacy of (79.8%) but second to Gentamycin (80.6%). Ampicillin and cotrimoxazole had the lowest efficacy of (8.0%) and (21.0%) respectively, in this study.

## 5. Conclusion

Conclusively, an overall prevalence of 16(8.0%) of *Klebsiella* species was observed in this study. Females had a 4 – 18 fold increase risk of having UTI, and *Klebsiella* species were the second predominant isolates causing UTI in Kano, Nigeria. Although the flouroquinolones were the most active antibacterial agents, prudent use of antibiotics is advocated.

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## Ethical Issues

Ethical permission was obtained from the Ethical Committee of Murtala Muhammad Specialist Hospital.

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