



Isolation and Antibiotic Sensitivity of *Klebsiella pneumoniae* among Urinary Tract Infected Patients in Dalhatu Araf Specialist Hospital Lafia, Nasarawa State Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Background and Objectives: *Klebsiella pneumoniae* complications with limited therapeutic options is considered as one major health issues concerning healthcare professionals worldwide. It is one of the leading nosocomial bacterial pathogen that causes most urinary tract infection, and recently the antibiotic resistance of *Klebsiella pneumoniae* has totally increased dramatically. Cross-sectional study was performed from September 2021 to the end of December 2021. This aimed at the isolation and antibiotic sensitivity of the *Klebsiella pneumoniae* among patients with signs and symptoms of UTI.

Materials and Methods: Cross-sectional study was performed from September 2021 to the end of December 2021. About 120 urine specimens collected were analysed to detect the presence of *Klebsiella pneumoniae*. The Disc diffusion method was used to determine the antibiotic sensitivity pattern of the isolates.

Results: Of the 120 specimens collected, only 72 (60%) produced growth. The sensitivity test revealed that all the isolates were sensitive to levofloxacin, 30 isolates (14.2%) were sensitive to ciprofloxacin, 28 isolates (13.2%) were sensitive to gentamycin, 20 isolates (9.4%) were sensitive to travid, while Augmentin has the sensitivity of 17 (8.1%). It revealed that levofloxacin has the lowest resistance of 0 (0%) while travid has the highest resistance of 15(21.7%).

Conclusion: The antibiotic sensitivity pattern of the isolate revealed that all the isolates were completely sensitive to levofloxacin and more resistant to Augmentin and travid.

Keywords: Urinary tract infections; antibiotic sensitivity test; *Klebsiella pneumoniae*.

1. INTRODUCTION

Klebsiella pneumoniae is presently considered one of the common causes of infections in people with immunocompromised [1]. The established site of predilection of the *K. pneumoniae* infection is the urinary tract including the urethra, bladder, ureters, and kidney. *Klebsiella* UTIs occur using a urinary catheter for a long time in older women.

The bacterium *Klebsiella Pneumoniae* is presently displays serious resistance to beta-lactam antibiotics such as fluoroquinolones, and aminoglycosides [2]. This resistance is becoming a global problem regarding the choice of effective antibiotic treatment for hospital-acquired infections [2].

Beta-lactam are commonly prescribed worldwide and include penicillins, cephalosporins, monobactams, and carbapenems [3]. β -lactamase enzymes production by the presence of β -lactam-insensitive cell wall or the active expulsion of β -lactam molecules from Gram-negative bacteria represents the most important reason for β -lactam antibiotic resistance [4] β -lactams such as Carbapenems are of choice for the treatment of infections caused by extended-spectrum beta-lactamase (ESBL)-producing bacteria such as *K. pneumoniae* [5]. Those antibiotics are believed as last resort for the

management of life-threatening healthcare-associated infections [6]. Bacterial resistance to carbapenems has been increased and is well documented [7], and has also been further complicated by the production of β -lactamases, efflux, and mutations that alter the expression and/or function of porins and penicillin-binding proteins (PBPs) [8].

The spread of transmissible plasmids and the acquisition of resistance genes that normally occur by horizontal gene transfer, which may also carry virulence, are as the result of antimicrobial resistances [3]. For pathogen survival, the acquisition of resistance and virulent traits are, and some reports suggest that such may have an important role in the pathogenesis of *K. pneumoniae* infections [9]. The study aimed to isolate and investigate the antibiotic resistance of *K. pneumoniae* from urine specimens.

2. MATERIALS AND METHODS

Cross-sectional study was performed from September 2021 to the end of December 2021 in Lafia, Nasarawa state capital at Dalhatu Araf Specialist Hospital Lafia among patients suspected of signs and symptoms of UTI..

2.1 Collection of Urine Specimens

The urine specimens were collected from 120 patients out of which 37 males and 83 females

with sign and symptoms of UTIs at different aged and sent to the microbiology laboratory for proper examinaion. The patients with positive samples were detected and recorded.

2.2 Isolation, Identification, and Antibiotic Sensitivity Test

The one hundred and twenty (120) Urine specimens were collected and inoculated aseptically on MacConkey blood agar and incubated at 37°C overnight to detect bacterial colonies if presences. The colony's morphological characteristic were identified by Gram staining of bacterial colonys and biochemical tests. Antimicrobial Susceptibility test was done using the method of disk diffusion based on the guidelines of Clinical and Laboratory Standards Institute

3. RESULTS

Individuals in the age range 46 years and above (27.7%) had the highest percentage of *K. pneumoniae* isolates followed by age range 36-40 years (20.8%), 26-30 years (16.6%) and then

between 31-35 years and 15-35 years had (9.7%). The prevalence age group of UTIs were in the 41-45years (5.5%) (Table 1).

K. pneumoniae isolated from the sexes were 35. High isolate was among female aged 46 and above had (42.1%), followed by Male aged 36-40 had (37.5%), followed by Male aged 26-30 had (18.7%) , Female aged 21-25 and 36-40 with (15.7%) each and the least isolated from both sex aged 41-45 had (0%).The overall percentage of isolation of *K. pneumonia* from urine was (29.2%) (Table 2).

Thirty five (35) *K. pneumoniae* were isolated and examined for their antimicrobial resistance and sensitivity towards some antibiotics. 16.5% levofloxacin was the highest sensitivity recorded, followed by 15.1% to imipenem. While the other tested antibiotics showed less than 15% (Table 3). *K. pneumoniae* isolates showed high resistance against Augmentin 26.1%, while levofloxacin showed no resistance. The overall 29.2% of isolation of *K. pneumonia* from urine was recorded [10,11].

Table 1. Uropathogenic *K. pneumoniae* distribution according to age and sex

Patients Age	patients gender with the number of samples collected from each		Number of samples collected from both sex (%)	Number of samples with growth (%)	Number of samples without growth (%)	<i>Klebsiella pneuminia</i> morphology (%)
	Male (%)	Female (%)				
15-20	4 (10.8)	6 (7.2)	10 (8.3)	7 (9.7)	3 (6.25)	3 (8.5)
21-25	5 (13.5)	7 (8.4)	12 (10)	5 (6.9)	(14.5)	1 (2.8)
26-3	12(32.4)	8 (9.6)	20 (16.6)	12 (16.6)	8 (16.6)	7 (20)
31-35	1 (2.7)	14 (16.8)	15 (12.5)	7 (9.7)	8 (16.6)	5 (14.2)
36-40	7 (18.9)	18 (21.6)	25 (20.8)	15 (20.8)	10 (20.8)	9 (25.7)
41-45	0 (0)	8 (9.6)	8 (6.6)	4 (5.5)	4 (8.3)	0 (0)
46 & above	8 (21.6)	22 (26.6)	30 (25)	20 (27.7)	8 (16.6)	10 (28.5)
Total	37(30.8)	83(69.2)	120	72	48	35

Table 2. *K. pneumoniae* isolated from both sex

Patients Age	Number of <i>Klebsiella pneumoniae</i> isolated from the gender		No of <i>klebsiella pneumonia</i> isolated from both sex
	Male	Female	
15-20	1 (6.5%)	2 (10.5%)	3 (8.5%)
21-25	0 (0%)	1(15.7%)	1 (2.8%)
26-30	3 (18.7%)	4 (21.1%)	7 (20%)
31-35	4 (25%)	1 (5.3%)	5 (14.2%)
36-40	6 (37.5%)	3 (15.7%)	9 (25.7%)
41-45	0 (0%)	0 (0%)	0 (0%)
46 and above	2 (12.5%)	8 (42.1%)	10 (28.5%)
Total	16(13.3)	19(15.8)	35(29.2)

Table 3. Susceptibility of *K. pneumonia* isolated against different antibiotics

Antibiotic agents (disc content)	Total isolate (n= 35) (%)	
	Resistant	Sensitive
Levofloxacin	0 (0)	35 (16.5)
Ciprofloxacin	5 (7.5)	30 (14.2)
Gentamycin	7 (10.1)	28 (13.2)
Augmentin	18 (26.1)	17(8.1)
Travid	15 (21.7)	20 (9.4)
Reflacin	12 (17.3)	23 (10.9)
Nitrofurantoin	9 (13.0)	26 (12.3)
Imipenem	3 (4.3)	32 (15.1)

4. DISCUSSION

Klebsiella pneumonia is among of the common causes of Urinary tract infections in human beings. In this study, 120 specimens were collected and investigated for urinary tract infections. (15.8%) Female showed a significant rate of UTIs compared to (13.3%) Male. The result of this study showed that Female are more prone to UTI (urinary tract infection) compared to the Male, this may be due to their anatomy and reproductive function that give bacterial the right to enter the bladder [12,13]. Closeness of the genital tract and the urethra and anus could be possible reason that could enable the transmission and increase the rate of urinary tract infections [14,15].

The prevalence of *K. pneumonia* (29.2%) in this study is almost high compared to other studies such as the percentages reported in Ethiopia (19-21%) [16] and Cameroon (18.5%) [17]. In Morocco, urinary *K. pneumoniae* was isolated in 10% and 28% of the urine samples in the Meknes [18] and Rabat [19] regions, respectively.

There has been wide use of extended broad-spectrum antimicrobial agents in two past decades to eliminate the rising challenge of preventing and treating urinary tract infections referable to gram-negative bacilli. Nevertheless, *K. pneumonia* and other microbes have developed multiple antimicrobial resistance mechanisms such as enhanced drug efflux, alterations of the drug target and the production of plasmid-mediated β -lactamases [20]. The distinctive feature of antimicrobial resistance is that there are often big differences temporally and regionally [21,22].

Antibiotic sensitivity screening was determined by the zones of inhibition using the disc diffusion method for sensitivity test. For sensitivity to

antibiotics, the isolates gave the following results, levofloxacin 16.5%, ciprofloxacin 14.2%, gentamycin 13.2%, Augmentin 8.15, travid 9.4%, reflacin 10.9%, nitrofurantoin 12.3%, imipenem 15.1%. The pathogen was resistance to the antibiotics as follows levofloxacin 0%, ciprofloxacin 7.3%, gentamycin 10.1%, Augmentin 26.1%, travid 21.7%, reflacin 17.3%, nitrofurantoin 13.0%, imipenem 4.3%.

The resistance rate in *K. pneumonia* was 14.2% to ciprofloxacin which is lower than other studies conducted in India [23] and United State of American [24].

Multi- drug resistance (MDR) is a major concern in the management of uropathogens [25]. This MDR may be due to the plasmids harboring several resistance genes which are transferred from one bacterium to another. Multidrug Resistance (MDR) in *K. pneumoniae* is of high increase throughout the world [26].

The pathogen has the highest sensitivity to levofloxacin probably because levofloxacin is not commonly used in treating *K. pneumoniae* infections, so strains resistant to it has not emerged.

The highest resistance found against Augmentin followed by travid can probably be as a result of development of multidrug resistance due to prolonged use of these drugs against the pathogen within or outside the hospitals. Travid and reflacin produced a limited amount of sensitivity respectively probably due to multi-drug resistance that may be acquired from drug resistance plasmids and the frequent use of these antibiotics.

5. CONCLUSION

Indiscriminate intake of antibiotics has resulted in the growth and survival of resistance strains of

bacteria isolates, thus antibiotic sensitivity is crucial for determining the choice of antibiotics. Levofloxacin as revealed by this work was effective against most of the bacterial isolates and would do well if used in therapy.

CONSENT AND ETHICAL APPROVAL

Prone to the study approval was given from Dalhatu Araf Specialist Hospital Lafia and the patients consent was sorted before the commencement of the study

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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