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SURVEILLANCE OF DRUG RESISTANT *Klebsiella pneumoniae* AMONG INTERNALLY DISPLACED PERSONS ADMITTED TO STATE SPECIALIST HOSPITAL MAIDUGURI NIGERIA

Microbiology

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ABSTRACT

Due to the wide use of antibiotics, drug resistance among *Klebsiella pneumoniae* strains is increasing and rate of infection has been rising rapidly. This study seeks to ascertain the prevalence and antibiogram of *Klebsiella pneumoniae* among internally displaced persons attending State Specialist Hospital Maiduguri. 100 samples were collected and processed for the isolation of *Klebsiella pneumoniae* followed by antibiogram. Of the 77 culture positive samples, 57 were gram negative bacteria out of which 40 (70.2%) isolates were identified as *Klebsiella pneumoniae*. The highest yield of 26.3% was observed in stool samples and least in urine samples (21.1%). Patients within 41-60 years age group recorded the highest isolation rate of 40%, while patient within 2-20 years recorded the least (22.5%). Isolates were highly resistant to Augmentin (77.5%) and least resistant to Tarivid (40%). Thus it is warranted that surveillance of resistant isolates should be done regularly.

KEYWORDS

prevalence, drug-resistance, *Klebsiella pneumoniae,* internally displaced persons.

INTRODUCTION

Klebsiella pneumoniae (K. pneumoniae), although found in the normal flora of the mouth, skin, and intestine, can cause destructive changes to human lung if aspirated, especially to the alveoli resulting in bloody sputum. It is also an opportunistic pathogen causing chronic pulmonary disease, enteric pathogenicity, nasal mucosa atrophy and rhinoscleroma. In the clinical setting, it is the most significant member of the genus *Enterobacteriaceae*. Transmission easily occurred among patients via the hands of healthcare personnel.

Basically, an unprecedented migration among humans allow bacterial plasmids and clones to be transported rapidly between countries and continents. Much of this dissemination is undetected, with resistant clones carried in the normal human flora and only becoming evident when they are the source of endogenous infections. Due to poor living conditions and inappropriate use of antibiotics, people are thus at higher risk of being colonized by *K. pneumoniae* in the new environment where they seek refuge since the organism rapidly develop antibiotic resistance. Moreover, bacteria from clinical and non-clinical settings are becoming increasingly resistant to conventional antibiotics and are developing resistance at a much faster pace than new drug development. Having protocols in place to control infectious disease transmission in hospitals is good practice to ensure patient safety and should be the focus of preventive effort.

This study seeks to carry-out the surveillance of drug resistant *K. pneumonia*e among internally displaced persons attending State Specialist Hospital, Maiduguri.

MATERIAL AND METHODS
STUDY AREA
The study was conducted in Maiduguri, the capital of Borno state. The city is located in the northeastern part of Nigeria which lies within latitude 11.15 ºN and longitude 30.05 ºE in the sudano-sahelian savanna zone.

SAMPLE POPULATION
The sample population are in-patients and out-patients that are IDPs living in Maiduguri Metropolitan Council, attending the State Specialist Hospital, Maiduguri.

SAMPLE COLLECTION AND PROCESSING
A total of 100 samples (urine, stool and sputum samples) were collected from IDP patients into sterile universal containers from the period of March to June 2017.

ISOLATION OF BACTERIA
The plating techniques used was streak plate method for isolating pure culture of single species. A loopful of the urine and sputum samples were streaked onto the surface of MacConkey agar and Blood agar (Oxoid,UK), Stool samples were streaked onto the surface of XDL, SSA and DCA and incubated at 37°C for 24hrs. Isolates were further identified according to morphological and biochemical properties.

ANTIBIOGRAM DETERMINATION
This procedure was done using the Kirby Bauer disc diffusion method and interpreted according to the Clinical Laboratory Standards Institute guidelines.

RESULTS
Of the 100 samples, 77 yielded bacterial growth, out of which 57.0% were gram negative bacteria and 20.0% were gram positive bacteria (Table 1).

Of the 57 gram negative bacteria isolated, 40 were identified as *K. pneumoniae*. 12 (21.1%) were isolated from urine samples, 13 (22.8%) from sputum samples and 15 (26.3%) from stool samples (Table 2).

Table 1: Gram Stain Reaction of Total Samples Collected from Patients attending SSHM

Bacterial Growth	Frequency (%)
Gram negative	57 (57.0)
Gram positive	20 (20.0)
No bacterial growth	23 (23.0)
Total	100 (100)

Key: SSHM: State Specialist Hospital Maiduguri

Table 2: Percentage Frequency of Occurrence of *K. pneumoniae* in relation to Sample Types Collected

Sample Type Collected	Gram Negative Bacteria Isolated	*K. pneumoniae* Isolated (%)
Urine	20	12 (21.1)
Sputum	13	13 (22.8)
Stool	24	15 (26.3)
Total	57	40 (70.2)

The age distribution of patients in relation to culture positivity revealed that patients within 41-60years had the highest (40%) and the least was among patients of 2-20years (22.5%) (Table 3).

Table 3: Age Distribution of patients and the Rate of Isolation of K. pneumoniae among IDP Patients attending SSHM

Age Group	Number of Isolate (%)
2-20years	9 (22.5)
21-40years	15 (37.5)
41-60years	16 (40.0)
Total	40 (100)

Key: SSHM: State Specialist Hospital Maiduguri; IDP: Internally Displaced Persons

The result of antimicrobial susceptibility test on isolates obtained from urine samples shows that isolates were most-sensitive/least-resistant to Ciprofloxacin (75.0%/25.0%), followed by Sparfloxacin and Tarivid (66.6%/33.3% respectively), Pefloxacin (50.0%/50.0%), and Streptomycin, Amoxicillin, Augmentin (16.7%/83.3% respectively) (Table 4).

Table 4: Antimicrobial Susceptibility Pattern of K. pneumoniae Isolated from the Urine of IDP Patients attending SSHM

Antibiotics	Sensitivity	Resistance
Ciprofloxacin	9 (75.0%)	3 (25.0%)
Pefloxacin	6 (50.0%)	6 (50.0%)
Streptomycin	2 (16.7%)	10 (83.3%)
Amoxicillin	2 (16.7%)	10 (83.3%)
Augmentin	2 (16.7%)	10 (83.3%)
Gentamicin	3 (25.0%)	9 (75.0%)
Tarivid	8 (66.6%)	4 (33.3%)
Cotrimoxazole	3 (25.0%)	9 (75.0%)
Chloramphenicol	3 (25.0%)	9 (75.0%)
Sparfloxacin	8 (66.6%)	4 (33.3%)

Key: SSHM: State Specialist Hospital Maiduguri

Isolates from sputum samples were most-sensitive/least-resistant to Streptomycin and Tarivid (38.5%/61.5% respectively), Ciprofloxacin and Sparfloxacin (30.8%/69.2% respectively), followed by Pefloxacin (23.1%/76.2%), Cotrimoxazole (15.0%/85.0%) and Amoxicillin, Augmentin, Gentamicin, Chloramphenicol (7.7%/92.3% respectively) (Table 5).

Isolates from stool samples were most-sensitive/least-resistant to Pefloxacin and Tarivid (73.3%/26.7% respectively) followed by Ciprofloxacin (53.3%/46.7%), Augmentin, Gentamicin, Sparfloxacin (40.0%/60.0% respectively) and Cotrimoxazole (33.3%/66.7%) (Table 6).

Comparative analysis of antibiotic resistance pattern of K. pneumoniae isolated from the different samples collected is as shown in Table 7. Isolates have shown marked resistance towards Augmentin (77.5%), followed by Amoxicillin, Gentamicin, Cotrimoxazole (75.0% respectively), Chloramphenicol (72.5%), Streptomycin (65.0%), Sparfloxacin (55.0%) and Pefloxacin (50.0%).

Table 5: Antimicrobial Susceptibility Pattern of K. pneumoniae Isolated from the Sputum of IDP Patients attending SSHM

Antibiotics	Sensitivity	Resistance
Ciprofloxacin	4 (30.8%)	9 (69.2%)
Pefloxacin	3 (23.1%)	10 (76.2%)
Streptomycin	5 (38.5%)	8 (61.5%)
Amoxicillin	1 (7.7%)	12 (92.3%)
Augmentin	1 (7.7%)	12 (92.3%)
Gentamicin	1 (7.7%)	12 (92.3%)
Tarivid	5 (38.5%)	8 (61.5%)
Cotrimoxazole	2 (15.0%)	11 (85.0%)
Chloramphenicol	1 (7.7%)	12 (92.3%)
Sparfloxacin	4 (30.8%)	9 (69.2%)

Key: SSHM: State Specialist Hospital Maiduguri

Table 6: Antimicrobial Susceptibility Pattern of K. pneumoniae Isolated from the Stool of IDP Patients attending SSHM

Antibiotics	Sensitivity	Resistance
Ciprofloxacin	8 (53.3%)	7 (46.7%)
Pefloxacin	11 (73.3%)	4 (26.7%)
Streptomycin	7 (46.7%)	8 (53.3%)
Amoxicillin	7 (46.7%)	8 (53.3%)
Augmentin	6 (40.0%)	9 (60.0%)
Gentamicin	6 (40.0%)	9 (60.0%)
Tarivid	11 (73.3%)	4 (26.7%)
Cotrimoxazole	5 (33.3%)	10 (66.7%)
Chloramphenicol	7 (46.7%)	8 (53.3%)
Sparfloxacin	6 (40.0%)	9 (60.0%)

Key: SSHM: State Specialist Hospital Maiduguri

Table 7: Comparative Analysis of Antibiotic Resistance Pattern of K. pneumoniae Isolated from the Different Samples Collected from IDPS attending State Specialist Hospital Maiduguri

Antibiotics	Urine	Stool	Sputum	Total
Ciprofloxacin	3 (25.0%)	7 (46.7%)	9 (69.2%)	19 (47.5%)
Pefloxacin	6 (50.0%)	4 (26.7%)	10 (76.2%)	20 (50.0%)
Streptomycin	10 (83.3%)	8 (53.3%)	8 (61.5%)	26 (65.0%)
Amoxicillin	10 (83.3%)	8 (53.3%)	12 (92.3%)	30 (75.0%)
Augmentin	10 (83.3%)	9 (60.0%)	12 (92.3%)	31 (77.5%)
Gentamicin	9 (75.0%)	9 (60.0%)	12 (92.3%)	30 (75.0%)
Tarivid	4 (33.3%)	4 (26.7%)	8 (61.5%)	16 (40.0%)
Cotrimoxazole	9 (75.0%)	10 (66.7%)	11 (84.6%)	30 (75.0%)
Chloramphenicol	9 (75.0%)	8 (53.3%)	12 (92.3%)	29 (72.5%)
Sparfloxacin	4 (33.3%)	9 (60.0%)	9 (69.2%)	22 (55.0%)

DISCUSSION
Unless routine surveillance of drug resistant organisms are conducted, control strategies cannot be as effective as is required. This study reported the isolation of drug resistant K. pneumoniae from various samples collected from IDP patients.

In total, 40 (70.2%) K. pneumoniae isolates were detected in this study. The high prevalence of K. pneumoniae in clinical samples is no longer a doubt but a true assertion as seen from the findings of this research. However, considering that some of the patients are critically ill, possible prior exposure to antibiotic treatment might have resulted in an increased chance of the emergence of drug resistance. Similar trend was reported by Archana, et al.

The recovery rate of K. pneumoniae observed was higher among patient within the age group of 41-60years (40.0%) and least among 2-20years (22.5%). Such differences could be due to compromised/weak immune system among the elderly, as Klebsiella infections are seen mostly in people with weakened immune system (Postgate, 2004).

Most of the isolates identified were highly resistant to Augmentin (77.5%), Amoxicillin, Gentamicin and Chloramphenicol (75.0% respectively). While low level of resistance (40.0%) was found against Tarivid. K. pneumoniae has been found capable of resisting many antibiotics especially third generation Cephalosporins (Yehet al., 2007). The increased incidence of drug resistant strains observed in our study may be associated with indiscriminate prescription of antibiotics by general practitioners, or self-medication by patients which happens to be a common practice in this part of the world.

K .pneumoniae strains from urine, sputum and stool were found to be highly susceptible to Ciprofloxacin, Tarivid and Sparfloxacin. Isolates from sputum samples exhibited partial susceptibility to the promising aforementioned antibiotics commonly prescribed in hospitals. Nevertheless, the varied distribution of antibiotic susceptibility to Quinolones in our study was very similar to that described by Archana, et al.

CONCLUSION
The findings of this study is of clinical importance due to the role played by K. pneumoniae as a nosocomial pathogen. Our investigation provides evidence of high level of spread of drug resistant K. pneumoniae among internally displaced individuals. As such, the importance of enhancing the living standard of those residing in the IDP camps is emphasized and standard measures of hygiene be adopted so as to checkmate the spread and transmission of drug resistant K. pneumoniae.

CONFLICT OF INTERESTS
The authors declare no conflict of interest

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