Prevalence of Multidrug resistant Klebsiella *pneumoniae* in a tertiary care hospital

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Abstract

Klebsiella *pneumoniae* is a Gram-negative, non-enveloped bacterium in the family Enterobacteriaceae. This organism is one of the most common opportunistic bacteria associated with hospital-acquired and community-acquired infections, especially in immuno-compromised patients causing urinary tract, respiratory tract, and lower biliary tract infections. , soft tissue, blood, surgical wound and liver. All penicillins and cephalosporins, and monobactams like aztreonam, are resistance to extended-spectrum -lactamases (ESBLs). Carbapenemases are beta-lactamases capable of hydrolyzing penicillins, cephalosporins, carbapenems and monobactams, and are in the Ambler group A, D . These bacteria-producing enzymes cause serious infections in which beta-lactams are in effective . Drug resistance in developing countries like India has several reasons including over use of antibiotics, easy availability of antibiotics.

Keywords: Drug resistance, *Klebsiella pneumoniae,* Antibiotic-resistant.

Introduction:

Klebsiella *pneumoniae* is a Gram-negative, non-enveloped bacterium in the family Enterobacteriaceae. It is commonly found in the mouth, on the skin, and in the intestines, as well as in natural environments such as water and soil (1). This organism is one of the most common opportunistic bacteria associated with hospital-acquired and community-acquired infections, especially in immune compromised patients causing urinary tract, respiratory tract, and lower biliary tract infections. , soft tissue, blood, surgical wound and liver (2).

In recent years, multidrug-resistant Klebsiella *pneumoniae* (MDR-KP) has been a major problem for physicians in the treatment of infections. MDR K. *pneumoniae* has developed resistance to at least one agent from three antibiotics (3,4). All penicillins and cephalosporins, and monobactams like aztreonam, are resistance to extended-spectrum -lactamases (ESBLs).(ESBL-KP) and carbapenem-resistant strains of K. pneumoniae (CRKP) have been reported to cause serious infections in humans. Most ESBL-KP and CRKP have contributed to the emergence of multidrug-resistant strains,

reducing treatment options for patients [5]. The production of ESBLs is plasmid-mediated and can easily be transferred to the Enterobacteriaceae group, leading to the accumulation of resistance genes in strains harboring multi-resistance plasmids. Carbapenemases are beta-lactamases capable of hydrolyzing penicillins, cephalosporins, carbapenems and monobactams, and are in the Ambler group A, D . These bacteria-producing enzymes cause serious infections in which beta-lactams are ineffective (5) Drug resistance in developing countries like India has several reasons including overuse of antibiotics, easy availability of antibiotics. The aim of the study was to detect the prevalence of MDR K. pneumoniae

Materials & Methods:

The study was conducted at Malla Reddy Narayana Multi specialty hospital, Hyderabad during a period of one year. A total of 800 *Gram negative bacilli* strains were isolated from various clinical samples (Pus, urine, blood, sputum,) Out of 800 *Gram negative bacilli* ,150 isolates from Klebsiella *pneunoniae.* were included in this prospective study after obtaining permission from the Institutional Ethics Committee. *Klebsiella pneumoniae* strain was identified by standard phenotypic methods such as Gram's stain , growth characteristics on solid media, and results of biochemical tests (6). Antimicrobial susceptibility testing carried out by the disc diffusion method on Mueller-Hinton agar as a lawn culture, as per the Clinical and Laboratory Standards Institute guidelines using discs of standard concentration (HiMedia, Mumbai, India) (7). The procedure as follows: Bacterial suspension was prepared by comparing its turbidity with that 0.5 McFarland turbidity standard tube. Five antibiotic discs are placed in each plate The plates were incubated at 37 ^{0}C for 18-24 hours. The following antibiotics are tested Amoxicillin–clavulanate (AMC), Amikacin (AK), Aztreonam (AT), Ceftazidime (CAZ), Cefixime (CXM), Cefazolin (CZ), Ciprofloxacin (CIP), Chloramphenicol (C), Colistin (CL),), Ceftriaxone (CTR), Cefuroxime (CXM), Cefotaxime (CTX),), Gentamicin (GEN), Imipenem (IPM), Meropenem (MRP), Nalidixic acid (NX), Nitrofurantoin (NIT), Piperacillin–Tazobactam (PIT), Cotrimoxazole (COT), Tobramycin (TOB),Polymyxin-B(PB).

Results A total of 800 *Gram negative bacilli* strains were isolated from various clinical samples (Pus, urine, blood, sputum,) . A total of 800 *Gram negative bacilli* ,150 isolates from Klebsiella *pneunoniae.* Of these 150 samples, 104 (69.3%) were male and 46 (30.7%) were female, making the male to female ratio 2.26:1.

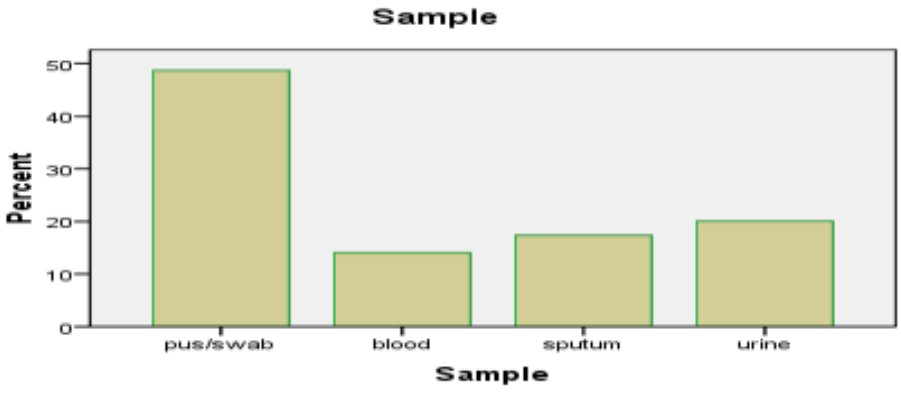
Statistical analysis of data was performed by using (Statistical Package for Social Science) SPSS software version 20.A p value <0.05 was considered statistically significant and p > 0.05 was considered non-significant.

Figure 1 Represents Multidrug resistant Klebsiella pneumoniae

Table 1: Clinical specimens and source of samples

Source	Frequency	Percent
pus/swab	73	48.7
blood	21	14.0
sputum	26	17.3
urine	30	20.0
Total	150	100.0

Figure2: Clinical specimens and source of samples

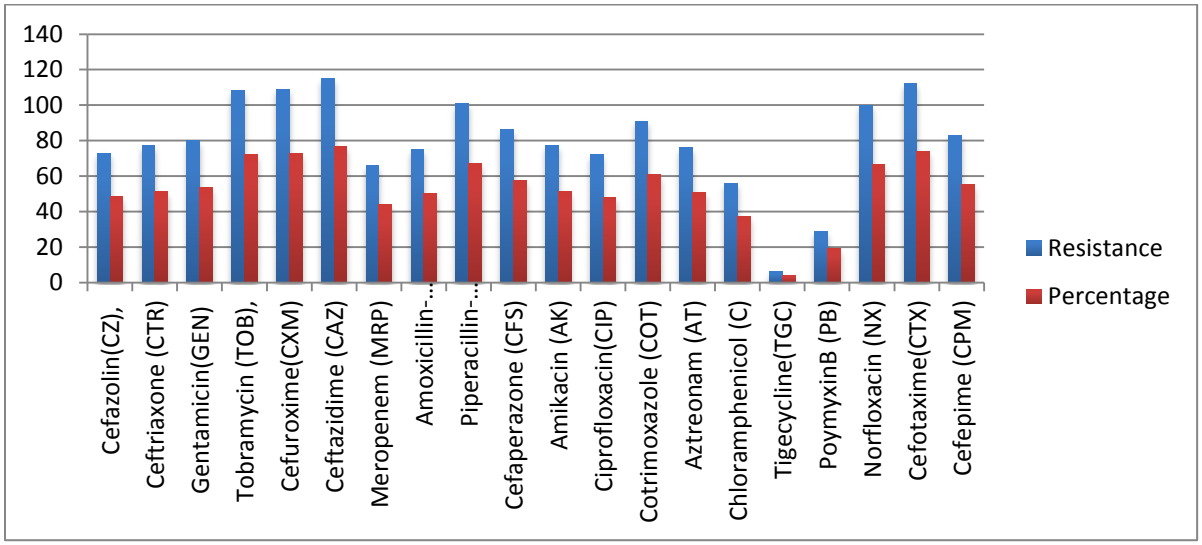


Klebsiella *pneumoniae* were isolated from pus/swab (48.7%), followed by urine (20%), sputum17.3% and 14% of blood.

Table 2: Antibiotic Resistance pattern *among the isolates of K. pneumoniae* is shown in

	Resistance	Percentage
Cefazolin(CZ),	73	48.67
Ceftriaxone (CTR)	77	51.3
Gentamicin(GEN)	80	53.33
Tobramycin (TOB),	108	72
Cefuroxime(CXM)	109	72.67
Ceftazidime (CAZ)	115	76.67
Meropenem (MRP)	66	44.0
Amoxicillin-Clavulanic Acid (AMC)	75	50
Piperacillin-tazobactam (PIT)	101	67.33
Cefaperazone (CFS)	86	57.33
Amikacin (AK)	77	51.33
Ciprofloxacin(CIP)	72	48
Cotrimoxazole (COT)	91	60.67
Aztreonam (AT)	76	50.67
Chloramphenicol (C)	56	37.33
Tigecycline(TGC)	6	4
PoymyxinB (PB)	29	19.33
Norfloxacin (NX)	100	66.67
Cefotaxime(CTX)	112	74.07
Cefepime (CPM)	83	55.3

Figure 3: Antibiotic Resistance pattern *among the isolates of K. pneumoniae*



It can be seen that highest resistance was observed for the antibiotic Ceftazidime (76.67%) Cefotaxime (74.07%), and Tobramycin (72%) and Meropenam (44%) the least resistance Tigecycline (4%), Poymyxin B (19.33%). The Tigecycline and Poymyxin B will be more effective for the microbes.

Discussion:

One of the most significant multi-drug resistant pathogenic bacteria is Klebsiella *pneumoniae,* which is responsible for a number of disorders including infections of the urinary and respiratory tracts, burn infections, and *pneumonia*, blood infections, and wounds.

All Klebsiella *pneumoniae* isolates used in this investigation were obtained from a tertiary-care hospital in different wards, where various samples from various clinical conditions were evaluated and collected. Klebsiella pneumoniae were isolated from pus/swab(48%),followed by urine(20%),sputum17.3% and 14% of blood .

In this study higher percentage of pus sample 48.3%, this indicate that pus (wound) infection is the most common infection in hospitals. The likelihood of Klebsiella *pneumonia*e hospital-acquired infections is greatly increased by the presence of invasive devices, such as sepsis and fever associated *pneumonia* in hospitalized patients. Second highest percent sample is urine (20%).

Multidrug resistance (MDR) is defined as insensitivity or resistance of a microorganism to the administered antimicrobial medicines (which are structurally unrelated and have different molecular targets) despite earlier sensitivity to it (8). Studies from WHO report has shown very high rates of resistance in bacteria such as *K. pneumoniae* against cephalosporin and carbapenems (9).

In our study prevalence of Klebsiella *Pneumoniae* was 18.75%, Goli, H.R. *et al.* (10) reported 58% of MDR, Rafael, et al reported 61% (11).

61% MDR- K. *Pneumoniae* from Brazil. Aminoglycoside and cephalosporins show high resistance in our study. Rahimi,et al. (12) reported similar results to our study.

In current study most of the MDR strains were isolated from IP departments' particularly medical wards, where the antibiotic usage is high. In our study multi drug resistant strains were isolated from urine pus sputum samples. Out of 150 Klebsiella *pneumonia* strains the carbapenem resistance was 44%. which was similar to studies conducted by by other researchers, *Namita et al.* reported prevalence of 53.9% in north India (13), *Sreeja Vamsi. K et al.* reported 56% prevalence (14).

K. pneumoniae detection among different specimens, other studies observed the highest rate in sputum samples, followed by samples of urine and blood, which is consistent with nation-wide findings in China (15). This suggests that *K. pneumoniae* is one of the main pathogenic bacteria of respiratory tract infections, which should be taken into account during diagnosis. Several studies have analyzed *K. pneumoniae* isolated from blood or urine specimens (16,17).

In our study showing resistance Ceftazidime (76.67%) Cefotaxime (74.07%), and Tobramycin (72%), Gentamicin53%, ciprofloxacin 48%, Amikacin 51% Piperacillin67%. Other studies showing high resistance rates in commonly used antibiotics like amoxicillin/clavulanic acid 72% Ampicillin showed a resistance rate of 99.9% . Piperacillin showed a high resistance rate 80.4% . ciprofloxacin

at 61.1% . Aminoglycosides also showed lower resistance rates, especially with amikacin at 36.3% , Gentamicin resistance rate of 52.2%.(18).

Conclusion:

Multidrug resistance is associated with high mortality and high medical costs and has a significant impact on the effectiveness of antimicrobial agents. MDR interferes with disease control by enhancing the transmissibility of drug-resistant pathogens, thereby reducing the effectiveness of treatment and thus leading to a prolonged infection time in patients. Prevalence studies were important to identify the resistance pattern which is required for controls of antibiotic resistant epidemic

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