Original Research Article

Anti Microbial Resistance pattern of *Klebsiella* species in Tertiary care Hospital

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Abstract

Introduction: Klebsiella is the primary cause of respiratory tract infection like pneumonia, Rhinoscleromatis, sinusitis and cholecystitis. *Klebsiella pneumoniae* is primary pathogens and can cause a classic from of primary pneumoniae. *Klebsiella pneumonia* can also cause urinary tract infection, nosocomial infection, wound infection biliary tract infection, peritonitis, meningitis, bacteremia, enteritis, septicemia. Multidrug-resistant Klebsiella pneumoniae (MDRKP) has become an urgent risk to public health as its prevalence has sharply surged around the globe in recent decades. Therefore, to understand the antibiotic sensitivity pattern of K. pneumoniae from various specimens in West India and to provide a basis for the selection of appropriate antibiotics, this study was investigated.

Materials and methods: This study was conducted at Diagnostic Microbiology section of Central laboratory, Dhiraj General Hospital, SBKS MI and RC, Piparia, Vadodara over the period of April 2022 to September 2022. There were various sample should be collected according to site of infection like urine, blood, pus, sputum and other body fluids. Data collection was carried out based on a questionnaire that was previously designed in terms of gender, age, the type of antibiotic. Detection and differentiation of sensitive, semi-sensitive and resistant conditions from each other was performed based on the diameter of the around the colony as millimeters and according to the relevant table in laboratory. The data were collected, recorded and analyzed statistically.

Results: At the time study period, total 750 specimens was collected and 114 specimen was positive for Klebsiella isolates from various specimen. Most affected age group were 31-40 years (30), 41-50

years (23), 51-60 years (18). In the present study, out of 117 *Klebsiella* isolates, 91.87% resistant to Ampicillin, 58% to Amikacin, 88.03% to Cefuroxime, 69% to Ceftazidime, 63% to Cefepime, 86% to Ciprofloxacin, 61% to Imipenem, 62% to Gentamicin, 58% to Cotrimaxazole.

Conclusion: We may draw the conclusion that K. pneumoniae antibiotic resistance is a real threat and requires close monitoring to be controlled. This study indicated relatively high prevalence of multidrug resistance Klebsiella species. This data had important implication for the quality of patient care in hospital settings specially in antibiotics selection, infection control practices and need for additional studies.

Key words

Klebsiella, *Klebsiella pneumonia,* Antibiotic sensitivity, Patient care.

Introduction

Carl Friedlander initially identified Klebsiella pneumoniae in 1882 as a gram-negative, immotile, encapsulated bacterium that was present in the environment. Friedlander's bacillus was the original name before it was changed to Klebsiella in 1886 [1]. It often colonizes the gastrointestinal system and oropharynx of humans (GIT) [1]. Klebsiella pneumonia is implicated in serious healthcare-associated infections, such as pneumonia, bloodstream infections, wound or surgical site infections, and meningitis [2]. Klebsiella pneumonia is one of the most prevalent bacteria that cause nosocomial infections. It is grown on simple media, developed large, mucoid, dome shape colonies of varying degrees of stickiness. They are short, straight rods, plump, the capsule is often prominent and made out even in gram stained smears as holes around the bacilli. In addition to being the primary cause of respiratory tract infection like pneumonia, Rhinoscleromatis, sinusitis and cholecystitis; they are frequently associated with the infection of urinary tract genital [3]. *Klebsiella pneumoniae* is a primary pathogen and can cause a classic from of primary pneumoniae. *Klebsiella pneumonia* can also cause urinary tract infection, nosocomial infection, wound infection biliary tract infection, peritonitis, meningitis, bacteremia, enteritis, septicemia [4]. Its pathogenicity is caused by the lipopolysaccharide (LPS) layer of the cell envelope and cell wall protein receptors [5]. Multidrug-resistant Klebsiella pneumoniae (MDRKP) has become an urgent risk to public health as its prevalence has sharply surged around the globe in recent decades [6-9]. Therefore, to understand the antibiotic sensitivity pattern of K. pneumoniae from various specimens in West India and to provide a basis for the selection of appropriate antibiotics, this study was investigated.

Materials and methods

This study was conducted at Diagnostic Microbiology section of Central Laboratory, Dhiraj General Hospital, SBKS MI and RC, Piparia, Vadodara over the period of April 2022 to September 2022. There were various sample should be collected according to site of infection like urine, blood, pus, sputum and other body fluids (pleural fluid, ascetic fluid). Data collection was carried out based on a questionnaire that was previously designed in terms of gender, age, the type of antibiotic (including: imipenem, meropenem cefepim, ciprofloxacin, amikacin, ceftazidime, ceftriaxon, cefotaxime, ampicilin, cotrimoxazol, cefalotin and clarithromycin) and finally the type of sample (including: urine, blood, ulcer, sputum, pleural fluid, urethral discharge, eye secretions and fecal). Inclusion criteria were including all positive cultures for *Klebsiella pneumoniae*. The cases in which sample data was incomplete were excluded from study and were as exclusion criteria. Gram stain of direct smear was observed and noted. Culture was done on Nutrient agar, MacConkey agar and Blood agar after that plate was incubated at 37^0C for 24 hours and examined carefully on the next day and colony

characteristics will be noted as per standard guidelines. A suspected colony was subjected to standard identification protocol involving phenotypic characters and biochemical reactions. The antibiotic-sensitivity will be performed as per CLSI (Clinical and Laboratory Standard Institute) guidelines. In this study, the disc diffusion sensitivity test was used to evaluate the sensitivity and resistance of *K. pneumoniae* to antibiotics. In the disc diffusion method, a certain amount of bacteria is set according to the existing standards in terms of the degree of dilution and has already been identified. Special culture media add to the same plates in terms of diameter, depth, etc., and discs the standardized antibiotic filter paper is placed on the plate surface. After the time it takes to grow the microbes, if the antibiotic is able to prevent the growth of the microorganism, it does not grow around the bacterial disk, and the bacteria to the antibody the biotype is more sensitive, these will be no larger growth halo. Detection and differentiation of sensitive, semi-sensitive and resistant conditions from each other was performed based on the diameter of the around the colony as millimeters and according to the relevant table in laboratory. The data were collected, recorded and analyzed statistically.

Results

At the time study period, total 750 specimens was collected and 114 specimen was positive for Klebsiella isolates from various specimen.Most affected age group were 31-40 years (30), 41-50 years (23), 51-60 years (18). 9 patients were between 1 day-10 years of age, of which 6 were infants [5] (**Table - 1**). Majority of the *Klebsiella* isolates were from MICU (22, 19.46%), followed by MMW (15, 13.27%), recovery (9, 7.96%), FSW (4, 3.53%) and FMW (4, 3.53%) [6] (**Table - 2**). In the present study, fever was more common in 44 (37%), Abdominal pain 13 (11%), UTI 24 (21%), Sever coughing 18 (15%) and CKD (other than UTI) 10 (9%) patients (**Table - 3**). Highest isolates were obtained from urine (40, 34.18%) followed by pus (35, 29.91%), sputum (24, 20.51%) and blood (11, 9.40%). Lowest number of isolates was obtained from TIP and pleural fluid [6] (**Table - 4**).

Table – 1: Age and gender wise distribution of study group.

Age group (Years)	Male (n=78)	Female (n=36)	Total (n=114)
0-10	4(5.12%)	5(13.88%)	9(7.89%)
11-21	2(2.56%)	1(2.77%)	3(2.63%)
21-30	15(19.23%)	9(25.00%)	24(21.04%)
31-40	19(24.35%)	11(30.55%)	30(26.31%)
41-50	16(20.51%)	7(19.44%)	23(20.17%)
51-60	15(19.23%)	3(8.33%)	18(15.78%)
61-70	4(5.12%)	0	4(3.50%)
71-80	3(3.84%)	0	3(2.63%)
Total	78	36	114

In the present study, out of 114 patients, 23 (20%) had diabetes mellitus. It was the most common co-morbid condition. 11 (9.6%) person had alcoholic use disorder (AUD), 2 (1.75%) had Hepatitis, 1 (0.85%) had HIV and 1 (0.85%) had TB. In the present study, there were 114 patients with *Klebsiella* infection, out of which 50 (43.85%) were Community acquired and 64 (56.14%) were Hospital acquired. The most affected age were 41-60 (n=41), out of them 14 were diabetic patient. In the present study, out of 117 *Klebsiella* isolates, 91.87% resistant to Ampicillin, 58% to Amikacin, 88.03% to Cefuroxime, 69% to Ceftazidime, 63% to Cefepime, 86% to Ciprofloxacin, 61% to Imipenem, 62% to Gentamicin, 58% to Cotrimaxazole (**Table – 5**, **Photograph - 1**).

Table – 2: Distribution of study group according to type of admission.

HOSPITAL LOCATION	NO. OF ISOLATES	PERCENTAGE
MICU	22	19.46%
MMW	15	13.27%
RECOVERY	9	7.96%
CASUALTY	8	7.07%
MSW	7	6.19%
NICU	7	6.19%
UROLOGY	6	5.30%
SICU	6	5.30%
FMW	4	3.53%
FSW	4	3.53%
CARDIOLOGY	3	2.56%
MOW	3	2.56%
NEUROLOGY	3	2.56%
SPECIAL ROOM	3	2.56%
GENERAL MEDICINE	0	1.76%
NEPHROLOGY	1	1.76%
GENERAL SURGERY	0	0.88%
GYNECOLOGY	1	0.88%
OBST	1	0.88%
FOW	1	0.88%
ENT	1	0.88%
ORTHOPEDIC	1	0.88%
PAEDIATRIC	1	0.88%
PICU	1	0.88%
RESPIRATORY MEDICINE	1	0.88%
TOTAL	114	99.48%

Table – 3: Symptoms wise distribution of study group.

Clinical condition	No. of Patients	Percentage
Fever	44	37%
Abdominal pain	13	11%
Coughing	18	15%
Chronic Kidney diseases	10	9%
Other symptoms of UTI like dysuria, burning micturation, increase frequency of urine	24	21%
Chest pain and shortness of breathing	11	10%

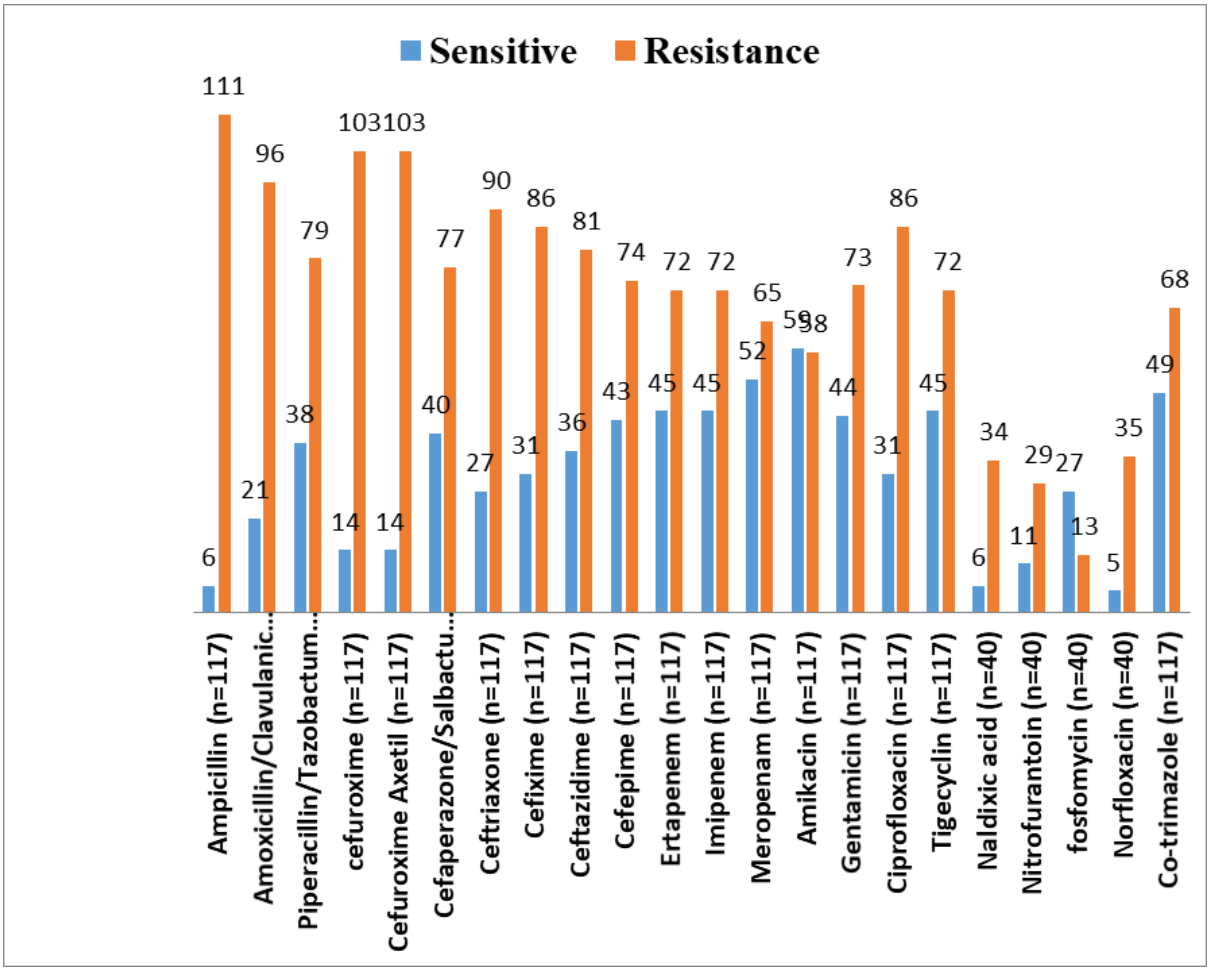
Table – 4: Distribution of study group according to samples received.

Type of sample	No. of sample (n=117)	Percentage
URINE	40	34.18%
PUS	35	29.91%
SPUTUM	24	20.51%
BLOOD	11	9.40%
ET TUBE	3	2.56%
PLEURAL FLUID	3	2.56%
TIP	1	0.85%

Table – 5: Antibiotic sensitivity pattern of the study group.

Antibiotics	Sensitive	Resistanc
Ampicillin (n=117)	6(5.12%)	111(91.87
Amoxicillin/Clavulanic acid (n=117)	21(17.94%)	96(82.05%
Piperacillin/Tazobactum (n=117)	38(32.47%)	79(67.52%
cefuroxime (n=117)	14(11.96%)	103(88.03
Cefuroxime Axetil (n=117)	14(11.96%)	103(88.03
Cefaperazone/Salbactum (n=117)	40(34.18%)	77(65.81%
Ceftriaxone (n=117)	27(23.07%)	90(76.92%
Cefixime (n=117)	31(26.49%)	86(73.50%
Ceftazidime (n=117)	36(30.76%)	81(69.23%
Cefepime (n=117)	43(36.75%)	74(63.24%
Ertapenem (n=117)	45(38.46%)	72(61.53%
Imipenem (n=117)	45(38.46%)	72(61.53%
Meropenam (n=117)	52(44.44%)	65(55.55%
Amikacin (n=117)	59(50.42%)	58(49.57%
Gentamicin (n=117)	44(37.60%)	73(62.39%
Ciprofloxacin (n=117)	31(26.49%)	86(73.50%
Tigecyclin (n=117)	45(38.46%)	72(61.53%
Naldixic acid (n=40)	6(15%)	34(85%)
Nitrofurantoin (n=40)	11(27.5%)	29(72.5%
fosfomycin (n=40)	27(67.5%)	13(32.5%
Norfloxacin (n=40)	5(12.5%)	35(87.5%
Co-trimazole (n=117)	49(41.88%)	68(58.11%

Photograph – 1: Antibiotic sensitivity pattern of the study group.



Discussion

The development of antimicrobial resistance (AMR) is on the rise, particularly among gram-negative microbes, Klebsiella spp. being no exception. Various studies have shown an increased incidence of resistance among Klebsiella species to higher antibiotics. It produces a variety of acute infections, making it problematic, particularly in an intensive care setting. This widespread resistance may be accounted for by the non-judicious use of higher antibiotics without proper sensitivity guidance. Also, India's higher population density may have contributed to the isolation of more multidrug-resistant K pneumoniae species [10]. In the present study most affected age group were 31-40 years (30), 41-50 years (23), 51-60 years (18). 9 patients were between 1 day-10 years of age, of which 6 were infants same as study in Connor B. Reid, et al. [11], it was found that majority of the patients belong to the age group < 40 years old patients.Male were commonly affected by Klebsiella, in our study 66.6% male and 33.3% female was affected, In the study of Enrico Magliano, et al. (2012), 820 (22.6%) were found to be positive for bacterial infection. Nearly 80% of all isolates were from women [12]. In our study, out of 114 patients, 23 (20%) had diabetes mellitus. It was the most common co-morbid condition. 11(9.6%) person had alcoholic use disorder (AUD), 2 (1.75%) and In the study of Ling Tang, et al. [13], The 57 *K. pneumoniae* liver abscess diagnosed patient's demographic manifestations, underlying disorder, and complications associated with diabetes (n=33, 57.9%). In the present study fever was more common in 44 (37%), Abdominal pain 13 (11%), UTI 24 (21%), Sever coughing 18 (15%) and CKD (other than UTI) 10 (9%) patients. There were 114 patients with *Klebsiella* infection, out of which 50 (43.85%) were Community acquired

and 64 (56.14%) were Hospital acquired. The most affected age were 41-60 (n=41) and correlated with the study of Cheol-In Kang, et al. [14], 377 consecutive patients Among these, 191 cases were classified to be community-acquired infection and the remaining 186 cases were classified to be nosocomial infection.

Conclusion

We may draw the conclusion that K. pneumoniae antibiotic resistance is a real threat and requires close monitoring to be controlled. This study indicated relatively high prevalence of multidrug resistance Klebsiella species. This data had important implication for the quality of patient care in hospital settings specially in antibiotics selection, infection control practices and need for additional studies.

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