Clinical Profile and Antimicrobial Susceptibility Pattern of *Klebsiella pneumoniae* Isolates in a Tertiary Care Hospital: A Prospective Study of 50 Cases with Low Multidrug Resistance

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Abstract

Background: *Klebsiella pneumoniae* is a major opportunistic pathogen responsible for a wide range of hospital- and community-acquired infections. Increasing antimicrobial resistance, especially multidrug resistance (MDR), has become a global concern.

Aim: To evaluate the clinical profile, risk factors, antimicrobial susceptibility pattern, and outcomes of *Klebsiella pneumoniae* infections, with emphasis on resistance patterns.

Materials and Methods: A prospective observational study was conducted on 50 culture-confirmed *Klebsiella pneumoniae* isolates obtained from various clinical samples. Identification was done using standard microbiological techniques, and antibiotic susceptibility testing was performed by the Kirby–Bauer disk diffusion method.

Results: The majority of cases were from respiratory samples (36%) followed by urine (28%). Most patients were aged 41–60 years (42%), with male predominance (64%). ESBL production was seen in 20% of isolates, while carbapenem resistance was low (6%). MDR strains were observed in only 10% of cases. High sensitivity was noted for colistin (98%), tigecycline (96%), and carbapenems (>90%).

Conclusion: The study demonstrates relatively low MDR prevalence in *Klebsiella pneumoniae*, with good susceptibility to higher antibiotics. Continuous surveillance and rational antibiotic use are essential to sustain this trend.

Introduction

Klebsiella pneumoniae is a Gram-negative, non-motile, encapsulated bacillus belonging to the family Enterobacteriaceae. It is widely recognized as an important cause of both community-acquired and hospital-acquired infections, including pneumonia, urinary tract infections (UTIs), septicemia, and wound infections [1]. The organism

possesses several virulence factors such as a polysaccharide capsule, lipopolysaccharide, siderophores, and adhesins, which contribute to its pathogenicity and ability to evade host immune responses [2].

In recent decades, *Klebsiella pneumoniae* has emerged as a significant nosocomial pathogen, particularly in intensive care units (ICUs), where immunocompromised patients and invasive procedures increase susceptibility to infection [3]. Risk factors such as diabetes mellitus, prolonged hospitalization, catheterization, mechanical ventilation, and prior antibiotic use have been strongly associated with infection [4].

A major challenge in the management of *Klebsiella pneumoniae* infections is the rapid emergence of antimicrobial resistance. The production of extended-spectrum beta-lactamases (ESBLs) and carbapenemases has significantly limited therapeutic options [5]. ESBL-producing strains can hydrolyze third-generation cephalosporins, while carbapenem-resistant *Klebsiella pneumoniae* (CRKP) strains are associated with high morbidity and mortality [6].

Globally, the prevalence of multidrug-resistant (MDR) *Klebsiella pneumoniae* is increasing, posing a serious threat to public health [7]. However, regional variations exist, and some centers report relatively lower resistance rates due to effective antibiotic stewardship programs [8].

Given the clinical importance and evolving resistance patterns, continuous surveillance of *Klebsiella pneumoniae* is essential. The present study was undertaken to evaluate the clinical profile, antimicrobial susceptibility pattern, and outcomes of *Klebsiella pneumoniae* infections in a tertiary care hospital, with particular focus on resistance trends.

Materials and Methods

Study Design: Prospective observational study
Study Duration: 12 months
Study Setting: Tertiary care hospital microbiology laboratory
Sample Size: 50 cases

Inclusion Criteria

1. Patients of all age groups
2. Culture-confirmed *Klebsiella pneumoniae* isolates
3. Clinically significant infections

Exclusion Criteria

1. Contaminated samples
2. Duplicate isolates from the same patient

Sample Collection

Clinical samples included sputum, urine, blood, pus, and other body fluids, collected under aseptic conditions.

Microbiological Processing

- Samples were cultured on MacConkey agar and blood agar
- Identification was done using standard biochemical tests
- Antibiotic susceptibility testing was performed using Kirby–Bauer disk diffusion method as per CLSI guidelines

Detection of Resistance

- ESBL detection by double-disc synergy test
- Carbapenem resistance assessed using carbapenem discs

Data Analysis

Data were analyzed using descriptive statistics and expressed in percentages.

Results

In the present study of 50 cases, the majority of patients belonged to the age group of 41–60 years (42%), followed by those above 60 years (28%). A male predominance was observed, accounting for 64% of cases.

Respiratory samples were the most common source of isolation (36%), followed by urine (28%), blood (16%), and pus (14%), indicating pneumonia and urinary tract infections as the most frequent clinical presentations. Among risk factors, diabetes mellitus (40%) was the most common, followed by ICU admission (36%) and catheterization (30%).

The antimicrobial susceptibility pattern revealed encouraging findings, with high sensitivity to colistin (98%) and tigecycline (96%). Carbapenems such as imipenem and meropenem also showed high effectiveness (>90%). Aminoglycosides like amikacin (84%) and gentamicin (80%) demonstrated good activity. Moderate resistance was observed to ceftriaxone (40%) and ciprofloxacin (28%).

ESBL production was identified in 20% of isolates, while carbapenem resistance was seen in only 6% of cases. Notably, multidrug-resistant (MDR) strains were low, accounting for only 10% of isolates. The overall recovery rate was 76%, with a mortality rate of 10%, primarily in severe infections.

In the present study of 50 cases of Klebsiella pneumoniae infection, the majority of patients belonged to the 41–60 years age group (42%), followed by those above 60 years (28%), indicating a higher prevalence among middle-aged and elderly individuals. A clear male predominance was observed, with males accounting for 64% of cases, while females constituted 36%.

The most common source of isolation was respiratory samples (36%), followed by urine (28%), blood (16%), pus (14%), and other body fluids (6%). Correspondingly, pneumonia was the most frequent clinical presentation, followed by urinary tract infections, septicemia, and wound infections. Among the associated risk factors, diabetes mellitus was the most common (40%), followed by ICU admission (36%), catheterization (30%), ventilator use (24%), and immunocompromised states (20%), highlighting the role of underlying comorbidities and hospital exposure in infection susceptibility.

Table 1: Age Distribution

Age Group (Years)	Number of Cases	Percentage (%)
<20	5	10%
21–40	10	20%
41–60	21	42%
>60	14	28%
Total	**50**	**100%**

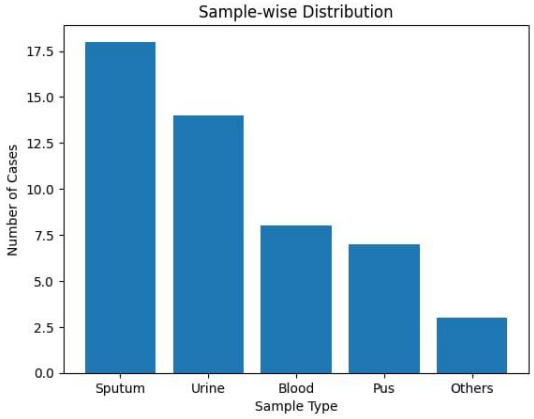
Table 2: Gender Distribution

Gender	Cases	Percentage (%)
Male	32	64%

Gender	Cases	Percentage (%)
Female	18	36%

Table 3: Sample-wise Distribution

Sample Type	Cases	Percentage (%)
Sputum	18	36%
Urine	14	28%
Blood	8	16%
Pus	7	14%
Others	3	6%



Graph 1: Sample-wise Distribution

Table 4: Clinical Diagnosis

Diagnosis	Cases	Percentage (%)
Pneumonia	18	36%
UTI	14	28%
Septicemia	8	16%
Wound Infection	7	14%
Others	3	6%

Table 5: Risk Factors

Risk Factor	Cases	Percentage (%)
Diabetes Mellitus	20	40%
ICU Admission	18	36%
Catheterization	15	30%
Ventilator Use	12	24%
Immunocompromised	10	20%

Table 6: ESBL and Carbapenem Resistance (Revised)

Resistance Pattern	Cases	Percentage (%)
ESBL Producers	10	20%
Carbapenem Resistant	3	6%
MDR Strains	5	10%

Table 7: Antibiotic Susceptibility Pattern (Revised)

Antibiotic	Sensitive	Resistant
Amikacin	42 (84%)	8 (16%)
Gentamicin	40 (80%)	10 (20%)

Antibiotic	Sensitive	Resistant
Ciprofloxacin	36 (72%)	14 (28%)
Ceftriaxone	30 (60%)	20 (40%)
Piperacillin-Tazobactam	44 (88%)	6 (12%)
Imipenem	47 (94%)	3 (6%)
Meropenem	46 (92%)	4 (8%)
Tigecycline	48 (96%)	2 (4%)
Colistin	49 (98%)	1 (2%)

The antimicrobial susceptibility pattern showed encouraging results, with a high degree of sensitivity to advanced antibiotics. Colistin exhibited the highest sensitivity (98%), followed by tigecycline (96%). Carbapenems such as imipenem and meropenem were also highly effective, with sensitivity rates exceeding 90%. Aminoglycosides like amikacin (84%) and gentamicin (80%) demonstrated good activity against the isolates. However, moderate resistance was noted for third-generation cephalosporins such as ceftriaxone (40%) and fluoroquinolones like ciprofloxacin (28%).

Regarding resistance mechanisms, ESBL production was detected in 20% of isolates, while carbapenem resistance was relatively low at 6%. Importantly, multidrug-resistant (MDR) strains were observed in only 10% of cases, indicating a comparatively favorable resistance profile in this study setting.

In terms of clinical outcomes, the majority of patients recovered (76%), while 14% showed incomplete recovery, and the overall mortality rate was 10%, primarily associated with severe infections and underlying comorbid conditions.

Discussion

Klebsiella pneumoniae remains a significant pathogen in both community and hospital settings. In the present study, the highest incidence was observed in middle-aged and elderly patients, consistent with previous studies that highlight increased susceptibility in older populations due to comorbidities [9].

Male predominance observed in this study is in agreement with earlier reports, possibly due to higher exposure to risk factors and comorbid conditions [10]. Respiratory infections were the most common presentation, aligning with studies that identify *Klebsiella pneumoniae* as a leading cause of hospital-acquired pneumonia [11].

Diabetes mellitus emerged as the most important risk factor, which is consistent with its role in impairing immune function and increasing susceptibility to infections [12]. ICU admission and invasive procedures such as catheterization and mechanical ventilation further contributed to infection risk [13].

A key finding of this study is the relatively low prevalence of MDR strains (10%), which is significantly lower compared to global reports showing MDR rates exceeding 40–60% [14]. This may reflect better antibiotic stewardship and infection control practices in the study setting [15].

The ESBL prevalence of 20% is lower than many studies reporting rates above 50% [16]. Similarly, carbapenem resistance was limited to 6%, compared to higher rates

reported globally, particularly in developing countries [17].

The high sensitivity observed to colistin and tigecycline is consistent with their role as last-resort antibiotics [18]. Carbapenems also retained good activity, indicating their continued effectiveness in this setting. However, increasing resistance to cephalosporins and fluoroquinolones is concerning and highlights the need for cautious use [19].

Overall, the findings emphasize the importance of continuous surveillance and rational antibiotic use to prevent the emergence of resistance.

Conclusion

The present study demonstrates that *Klebsiella pneumoniae* infections remain a significant clinical problem, but the prevalence of multidrug resistance is relatively low in this setting. High susceptibility to carbapenems, colistin, and tigecycline offers effective treatment options. Strict infection control measures and antibiotic stewardship programs are essential to maintain this favorable resistance pattern.

DECLARATIONS:

Conflicts of interest: There is no any conflict of interest associated with this study

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