

Antibiogram of *Klebsiella pneumoniae* isolated from various clinical samples of hospitalized patients in a tertiary care hospital of North India

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Background: *Klebsiella pneumoniae* is an important cause of nosocomial and community acquired infections worldwide. It exhibits high antibiotic resistance due to production of Extended Spectrum Beta Lactamases (ESBLs) and Carbapenamases. The aim of present study was to know its resistance pattern of *Klebsiella pneumoniae* so as to help local physicians choose appropriate antibiotics for effective infection control. **Materials and Methods:** It was a prospective study carried out from January 2019 to July 2019 in the department of Microbiology of a tertiary care hospital in North India. The study comprised of a total of 194 non-repeat isolates obtained from various clinical samples received in Microbiology lab for culture & sensitivity testing. All isolates were processed to determine their antimicrobial sensitivity profile. For data analysis SPSS software, version 17.0 and MS excel 2007 were used. **Results:** Out of total 2155 (22.43%) positive cultures 194 (9%) isolates were that of *Klebsiella pneumoniae* Most of the isolates obtained were multi-drug resistant, ESBL and Carbapenamase producers. 100% isolates showed resistance to Ampicillin. **Conclusion:** Since the frequency of multiple drug resistance among *Klebsiella pneumoniae* is alarmingly high, therefore periodic monitoring of antimicrobial susceptibility profile of these agents is much needed. This will help physician in selection of appropriate chemotherapy and thus help in effective management of the infections and better patient care.

Keywords: *Klebsiella pneumoniae*, Clinical samples, Antimicrobial resistance profile

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Introduction

Klebsiella pneumoniae is a gram negative, encapsulated, non-motile lactose fermenting, facultative anaerobic bacteria belonging to family Entero-bacteriaceae [1, 2]. It is one of the most common causative agents of hospital and community acquired infections. It is usually associated with pneumonia, septicaemia, urinary tract infection but can also cause various other pyogenic infections [3].

Klebsiella pneumoniae is resistant to a wide range of antibiotics. It is intrinsically resistant to ampicillin [4]. A steady increase in Extended Spectrum Beta Lactamase (ESBL) producing *Klebsiella pneumoniae* and its co-resistance to other antimicrobial agents like quinolones and aminoglycoside antibiotics has been observed over past years. These organisms acquire resistance via different pathways mediated by plasmids, transposons, and gene cassettes in integron setc [5,6]. Carbapenems are preferred to treat the infections caused by multi drug resistant (MDR) isolates of *Klebsiella pneumoniae* but recently carbapenem-resistant *Klebsiella pneumoniae* has been reported (CRKP) [7]. These multi drug resistant organisms (MDROs) poses a serious threat in terms of morbidity and mortality associated with them.

Emergence of resistance of *Klebsiella* to previously sensitive antibiotics is greatly due to non judicious use of antimicrobial agents [8]. This study was therefore undertaken to update our knowledge on recent trends in resistance patterns among *Klebsiella pneumoniae* isolates obtained from various clinical samples of the patients suffering from infections. This will help clinicians in a rational selection of antimicrobial agents and thus help in better patient management.

Material and Methods

The study was carried out after taking ethical approval from the ethical committee of the institution.

Study design & data collection: It was a prospective study carried out from January 2019 to July 2019. Data collection included information about, age & sex of the patients and a brief clinical history of illness.

Settings: The study was carried out in the Department of Microbiology, S.G.R.D Institute of

Medical Science and Research, Amritsar, Punjab, a tertiary care hospital.

Sample size: The study comprised of a total of 194 non-repeat isolates obtained from various clinical samples received in Microbiology lab for culture & sensitivity testing

Inclusion criteria: All isolates which formed lactose fermenting mucoid colonies on MacConkey agar and further confirmed as *Klebsiella pneumoniae* by Vitek-2 Compact (Biomerieux) were included in the study.

Exclusion criteria: Species of *Klebsiella* other than *Klebsiella pneumoniae* were excluded from the study.

Method: All samples were processed as per standard bacteriological techniques for aerobic cultures [9]. They were inoculated on to Blood and MacConkey agar plates and incubated at 37°C for 24-48 hours. Isolates of *Klebsiella* were identified by their colony morphology as it forms large dome shaped colonies on Blood agar and lactose fermenting mucoid colonies on MacConkey agar. Gram staining was performed on the growth obtained in positive cultures which showed Gram negative short and stout rods. Isolates were further identified to species level by Vitek-2 Compact (Biomerieux) using gram negative identification cards (as per manufacturer's guidelines).

Antimicrobial sensitivity testing was also determined by same system using Vitek-2 AST N 280 cards. Antibiotic sensitivity results were interpreted as per CLSI guidelines [10].

Statistical analysis: SPSS version 17.0 software and MS excel 2007 were used for statistics. Chi-square test was used to know the association between the variable.

Results

A total of 9604 clinical samples were processed for culture and sensitivity testing from January to July 2019. Bacterial growth was obtained in 2155 (22.43%) samples out of which 194 (9%) isolates of the positive cultures, were that of *Klebsiella pneumoniae*.

The present study comprised of 194 Isolates of *Klebsiella pneumoniae*. Of these 194 samples 112 (57.73%) were obtained from male patients and 84 (42.26%) from female patients (table.1).

Isolation rate was highest in patient aged between

41-60 years followed by those above 60 years of age (table 2). Maximum number of isolates were obtained from pus samples (table 3).

Table-1: Gender wise distribution n=194

Sex	Patients with cultures positive for <i>K. pneumoniae</i>
Males	58%
Females	42%

Odds Ratio: 2.078; CI: 1.755-2.450; p <0.001; highly significant

Table-2: Age wise distribution n=194.

Patient's age group	Culture Positive n (%)
less than 1 year	4 (2.06%)
1-20 years	8 (4.12%)
21-40 years	47 (24.22%)
41-60 years	73 (37.62%)
> 60 years	62 (31.95%)

Table-3: Isolation rate of *Klebsiella pneumoniae* from various clinical samples n=194

Sample	Culture positive n (%)
Pus	54 (27.8%)
Urine	42 (21.64%)
Blood	15 (7.73%)
Sputum	15 (7.73%)
Other	68 (35.05%)

Table-4: Antibiogram of *Klebsiella pneumoniae* n=194.

Antibiotic	% Sensitive	% Resistant
Ampicillin	0	100
Amoxy- clav	5	95
Gentamicin	11	89
Amikacin	15	85
Cefoperazone-Sulbactam	11	89
Piperacillin-Tazobactam	11	89
Cefepime	4	96
Ceftriaxone	4	96
Imipenem	19	81
Ertapenem	11	89
Ciprofloxacin	4	96
Tegicycline	26	74
Colistin	84	16

Most of the isolates obtained were multi-drug resistant and ESBL and Carbapenamase producers. 100% isolates showed resistance to Ampicillin (table 4).

Discussion

Klebsiella pneumoniae is worldwide one of the most

Frequently isolated gram negative bacteria from clinical specimens of hospitalized patients [11].

There has been an increase in the incidence of infections with this bacteria during the past decade, probably due to an increase in the number of hospitalized or immune-compromised individuals. Also a trend towards greater antibiotic resistance is seen [12,13]

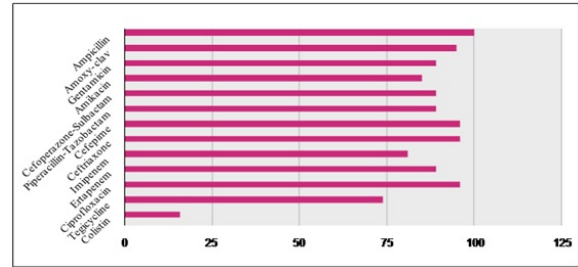


Figure 1: Resistance of *Klebsiella pneumoniae* isolates to antibiotics

The present study highlights an alarming situation of high antibiotic resistance among the isolates of *Klebsiella pneumoniae*. In the present study (Table 3, Figure 1), 100% isolates showed resistance to Ampicillin. The cause may be chromosomally encoded β -lactamases responsible for intrinsic resistance [14]. A high level of resistant is also observed to the fluoroquinolones and aminoglycosides. Ciprofloxacin was found resistant in 96% where as Amikacin resistance was 85% and Gentamicin 89% respectively. The resistance to fluoroquinolones could be due to mutations in the chromosomal genes encoding DNA gyrase of the bacteria or due to efflux of the drug [13]. Cephalosporins like Cefepime and Ceftriaxone were sensitive in 4% only. In a similar study, Anubhuti Khareet al have also reported high resistance to these groups of antibiotics [15].

Among Carbapenems, Imipenem resistance was in 81% and Ertapenem in 89%. It has been documented that enzyme KPC carbapenamase confers resistance to carbapenems, penicillins, and extended-spectrum cephalosporins as well [16]. A high levels of carbapenam resistance has also been reported in a study by Yi Liet al [17]. Since CRKP is resistant to most of the antimicrobial agents, therefore it poses a serious threat to public health [18]. Usually to treat carbapenam-resistant *Klebsiella pneumoniae* (CRKP) infections, polymyxins and tigeicycline are used as they are mostly susceptible to these drugs [19,20].

Unfortunately, in the present study high resistance to tetracycline is seen leaving only colistin as treatment option which also shows 16% resistance. Resistance to colistin has also been reported, with a 17% resistance rate in Taiwan [21] and also in our previous study on pus isolates [22].

The present study also reveals that, there is a predominance of males (58%) over females (42%) ($p < 0.001$) w.r.t. isolation of *Klebsiella pneumoniae* also the infection was observed to be more common in age group 41-60 years. (Table 1&2). This has been documented by other studies also [23]. The highest percentage of *Klebsiella pneumoniae* were isolated were from pus (27.8%) followed by urine (22%), blood (8%) and sputum (8%) (Table 3) which is also in concordance with other studies [24].

Limitation- This study was conducted in only one tertiary care teaching hospital so the situation may differ in other parts of the countries. A multi centric study should be conducted to have a more reliable data.

Conclusion

To conclude, high resistance of *Klebsiella pneumoniae* to commonly used antibiotics is the major reasons for high morbidity and mortality associated with its infections in hospitalised patients. Therefore a regular surveillance of antibiotic susceptibility pattern is needed to prevent indiscriminate use of antibiotics which is a major cause of emergence of drug resistance among pathogens.

What the study adds in the existing knowledge?

The data obtained from the present study can be used to determine trends in antimicrobial resistance of *Klebsiella pneumoniae*, an important nosocomial pathogen and to formulate local antibiotic policy. This will assist clinicians in the rational selection of antibiotic therapy for effective management of patients.

Author's contribution

Dr. Manmeet Kaur Gill: Research Question framing, Literature search, Study design, Research work, Data collection and data analysis, Manuscript preparation

Dr. Ashish Khanna: Assisted in Data analysis

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