

## **Research Article**

### **Prevalence and Antibiotic susceptibility pattern of *Klebsiella pneumoniae* isolated from various clinical specimen in a tertiary care hospital of Tripura.**

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**Abstract:** *Klebsiella pneumoniae* are common causative agents of nosocomial and community acquired infections and are leading causes of morbidity and mortality. This study gives an account of isolation of *Klebsiella pneumoniae* from various clinical specimens and their antibiogram, in this geographical area of North East India. Various clinical samples like sputum, urine, pus and blood sent to Microbiology laboratory were processed for isolation of *Klebsiella pneumoniae* followed by their antibiogram. Out of 2273 samples that yielded positive culture, 29.5% isolates were identified as *Klebsiella pneumoniae*. The highest yield of *Klebsiella pneumoniae* (46.7%) were observed from sputum and other lower respiratory tract secretions followed by blood (31.3%). Most of the isolates were sensitive to Imipenem (91.5%) followed by Piperacillin tazobactam (88.1%), Amikacin (86.3%) and Cefoperazone-sulbactam (83.1%). Multi-drug resistance were observed in 21.5% isolates. *Klebsiella pneumoniae* can be stated as the major cause of lower respiratory infections followed by septicemia in young children. As majority of the infections were diagnosed in hospitalized patients, it indicates that *Klebsiella pneumoniae* is a potent nosocomial pathogen in our hospital. Amikacin and Cefoperazone sulbactam represents the choice of first line therapy for treatment of infections due to *Klebsiella pneumoniae* in this geographical area.

**Keywords:** *Klebsiella pneumoniae*, clinical specimen, Antibiotic susceptibility.

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#### **INTRODUCTION**

*Klebsiella* spp. is a gram negative, non-motile, encapsulated, lactose fermenting, facultative anaerobe belonging to the Enterobacteriaceae family [1]. They are ubiquitously present, reported worldwide and popular member of aerobic bacterial flora of human intestine. They are common causative agents of variety of nosocomial and community acquired infections. These bacteria have become important nosocomial pathogens and have replaced *E.coli* in many centres. Epidemic and endemic nosocomial infections caused by *Klebsiella* spp. are leading causes of morbidity and mortality [2]. In addition to being the primary cause of respiratory tract infection like Pneumonia, Rhinoscleroma, Ozaena, Sinusitis and Otitis, they also cause Urinary tract infection, Septicemia, Pyogenic infections and even infection of the alimentary tract [3].

Recently, WHO warned the community that Multi-drug resistant bacteria are emerging worldwide, which is a big challenge to healthcare and if immediate action is not taken, then antibiotics may lose their power to cure diseases. [4] In India, the reasons for development of antimicrobial resistance could be due to irrational use of antibiotics, over the counter availability of higher or broader antimicrobial agents, higher

prevalence of infection and poor monitoring of antibiotic susceptibility in hospitals [5]. Extensive use of broad spectrum antibiotics in hospitalized patients has led to both increased carriage of *Klebsiella pneumoniae* and development of multi-drug resistant(MDR) strains that produce Extended Spectrum Beta Lactamase(ESBL). Epidemic strains of Cephalosporin resistant *Klebsiella pneumoniae* have been associated with increased morbidity and mortality in hospitalized patients [6]. This study gives an account of isolation of *Klebsiella pneumoniae* from various clinical specimen, their antibiogram and presence of resistant strains in this geographical area of North East India.

#### **MATERIAL AND METHODS**

The study was conducted for a period of two years from January 2013 to December 2014 at Dr. BR Ambedkar Memorial Teaching Hospital, Agartala. Various clinical samples like sputum, urine, pus, blood, etc sent to Microbiology laboratory were processed for isolation of *Klebsiella pneumoniae* by following standard guidelines.

The samples were cultured in Mac Conkey agar and Blood agar and incubated overnight at 37°C.

The strains were identified by their morphology and biochemical characteristics. Characteristics of colonies on culture media revealed large, dome shaped mucoid colonies on blood agar and lactose fermenting colonies on Mac Conkey agar media. On gram staining, gram negative short plump bacilli were seen. The bacilli were found non-motile. The biochemical characteristics identified were negative Indole and Methyl Red test with positive Voges Proskauer test, Citrate utilization test and urease test. Abundant gas productions were seen following fermentation of sugars like glucose, lactose, sucrose, maltose and mannitol.

Antibiotic susceptibility test was done on Mueller Hinton agar plates by modified Kirby Bauer disc diffusion technique following CLSI guidelines.[7]

Multi-drug resistant strains were identified by resistance of a strain to three or more classes of antibiotics. The collected data was analyzed to find out the prevalence and pattern of antibiogram for further interpretation.

**RESULT**

During the study period of two years, 3989 samples were processed for Culture in Microbiology laboratory, out of which 2273 (56.9%) samples yielded positive culture. Out of the yielded bacteria, 671 (29.5%) isolates were identified as Klebsiella pneumoniae. The highest yield of Klebsiella pneumoniae (46.7%) were observed from sputum and other lower respiratory tract secretions followed by blood (31.3%). These facts may be referred from the Table-1 as shown below.

**Table - 1: Culture positivity and isolation of Klebsiella pneumoniae from various clinical samples.**

Sample	Total Number of samples	Number of positive culture N(%)	Number of Klebsiella pneumoniae isolated N(%)
Sputum/ET secretions	928	649 (69.9%)	303 (46.7%)
Urine	2117	1084 (51.2%)	214 (19.7%)
Pus / swabs	271	211 (77.8%)	51 (24.2%)
Blood	673	329 (48.9%)	103 (31.3%)
Total	3989	2273 (56.9%)	671 (29.5%)

The majority of organisms 525(78.3%) were isolated from hospitalized patients. The maximum number of organisms 177 (26.4%) and 153 (22.8%) were isolated in the age groups of 46-60 years and more

than 60 years respectively. The age wise distribution of the isolates of Klebsiella pneumoniae in relation to age groups is shown in Table – 2.

**Table - 2: Age wise distribution of the isolates.**

Age Group	No. of isolates n (%)
<1 years	84 (12.5%)
01 – 15 years	78 (11.6%)
16 – 30 years	63 (9.4%)
31 – 45 years	116 (17.3%)
46 -60 years	177 (26.4%)
>60 years	153 (22.8%)

The result of Antibiotic susceptibility pattern is depicted in Table-3. Most of the isolates were sensitive to Imipenem (91.5%) followed by Piperacillin tazobactam (88.1%), Amikacin (86.3%) and

Cefoperazone-sulbactam (83.1%). The least sensitive antibiotic for the isolates was Amoxycillin-clavulanic acid (20.8%) followed by Ciprofloxacin (38.7%).

**Table 3: Antibiotic sensitivity pattern of the isolates**

Antibiotic (disk concentration in µg)	Sputum / ET secretion N (%)	Urine N (%)	Pus / swab N (%)	Blood N (%)	Total N (%)
Imipenem (10)	271 (89.4%)	202 (94.3%)	47 (92.2%)	94 (91.2%)	614 (91.5%)
Meropenem (10)	201 (66.3%)	146 (68.2%)	38 (74.5%)	71 (68.9%)	456 (67.9%)
Piperacillin-tazobactam (100/10)	267 (88.1%)	191 (89.2%)	44 (86.2%)	89 (86.4%)	591 (88.1%)
Cefoperazone-sulbactam (75/30)	251 (82.8%)	183 (85.5%)	42 (82.3%)	82 (79.6%)	558 (83.1%)
Amoxycillin clavulanic acid (20/10)	57 (18.8%)	63 (29.4%)	9 (17.6%)	11 (10.7%)	140 (20.8%)
Cefepime (30)	229 (75.5%)	169 (78.9%)	39 (76.5%)	69 (66.9%)	506 (75.4%)
Ceftazidime (30)	192 (63.4%)	147 (68.7%)	31 (60.8%)	58 (56.3%)	428 (63.8%)
Ceftriaxone (30)	189 (62.4%)	133 (62.1%)	34 (66.6%)	57 (55.3%)	413 (61.5%)
Cefotaxime (30)	189 (62.4%)	133 (62.1%)	34 (66.6%)	57 (55.3%)	413 (61.5%)
Amikacin (30)	257 (84.8%)	189 (88.3%)	44 (86.2%)	89 (86.4%)	579 (86.3%)
Levofloxacin (5)	192 (63.4%)	147 (68.7%)	31 (60.8%)	58 (56.3%)	428 (63.8%)
Ciprofloxacin (5)	131 (43.2%)	87 (40.6%)	19 (37.2%)	23 (22.3%)	260 (38.7%)

Multi-drug resistance were observed in 151(21.5%) isolates of *Klebsiella pneumoniae*, out of which ESBL producing strains were screened to be positive in 117(17.4%) isolates.

## DISCUSSION

In the present study, culture positivity for *Klebsiella pneumoniae* in sputum was 46.7%, which is quite higher than those reported in other Indian studies reporting 30.9% and 28.4% [8, 9]. However, the isolation rate of *Klebsiella pneumoniae* from pus (24.2%) and urine (19.7%) can be compared with other references stating 21.1% and 26.6% respectively [10, 11]. *Klebsiella pneumoniae* is a leading cause of septicemia in India. Our observation reveals that 31.3% strains were isolated from blood culture which can be compared with observations reported by other authors ranging from 18.3% to as high as 68.8% [12,13]. Observation in this study indicates that *Klebsiella pneumoniae* can be stated as the major cause of different types of lower respiratory infections followed by septicemia. As majority of the infections were diagnosed in hospitalized patients, it indicates that *Klebsiella pneumoniae* is a potent nosocomial pathogen in our hospital.

The age wise distribution of the clinical isolates of *Klebsiella pneumoniae* showed that most of the patients were from the elderly age group. However,

the number of isolates from the infants (12.5%) and children (11.6%) need to be emphasized, as most of the isolates were from blood culture, thereby indicating it to be an important cause of septicemia in young children.

Statistical data and evidences from researches prove that multidrug resistant bacteria are emerging worldwide which causes many public health problems and challenges to healthcare. Antimicrobial resistance is a global concern not only because it kills but because it increases health costs and threatens patient care [14]. use of broad spectrum antibiotics, insufficient aseptic condition and inadequate control of spread of infection had aggravated this problem. In the present study, 21.5% isolates of *Klebsiella pneumoniae* exhibited multidrug resistance. This observation is quite low compared to recent Indian studies reporting 54% and as high as 80% strains to be multidrug resistant [14, 15].

In the present study, most of the isolates of *Klebsiella pneumoniae* were found susceptible to Imipenem (91.5%), which is similar to observations of other authors stating as high as 100% susceptibility.[11,16] On the contrary, low level of susceptibility (67.9%) was found to Meropenem. This observation has also been reported from South India.[11] This might be due to loss of porins and prevalence of plasmid mediated Beta-lactamases from irrational repeated use of Meropenem.

The Beta-lactam and Beta-lactamases inhibitor combinations were found significantly effective in the present study. Isolates susceptible to Piperacillin-tazobactam and Cefoperazone-sulbactam were 88.1% and 83.1% respectively. This observation can be compared to a report by Gupta *et al.*; stating 63% and 80% susceptibility of isolates to Piperacillin-tazobactam and Cefoperazone-sulbactam respectively [17]. Resistance may develop to Beta-lactamases inhibitor due to production of inhibitor resistance TEM $\beta$ -Lactamase.

The isolated strains of *Klebsiella pneumoniae* exhibited considerable susceptibility to Amikacin (86.3%) and Cefepime (75.4%), suggesting that amino glycosides and 4<sup>th</sup> generation Cephalosporins may be used as effective antibiotic agents against *Klebsiella pneumoniae*. This finding is consistent with a previous study reporting 70.5% and 78.5% isolates to be sensitive to Amikacin and Cefepime respectively [11].

The isolates in the present study showed low level of susceptibility to 3<sup>rd</sup> generation Cephalosporins as Cefotaxime (61.5%), Ceftriaxone (61.5%) and Ceftazidime (63.8%). Studies from Chandigarh (87-89%) and Nigeria (84.8-96%) reported high level of resistance to Cephalosporins [17, 18]. The decreased susceptibility of 3<sup>rd</sup> generation Cephalosporins could be due to production of ESBL and AmpC Beta-lactamases.

Among the fluoroquinolones tested, the isolates showed better sensitivity to Levofloxacin (63.8%), whereas only 38.7% isolates were sensitive to Ciprofloxacin. High resistance to Ciprofloxacin has been reported in other studies stating 63% to as high as 76.9% strains to be resistant.[17,19] In another Indian study, the isolates showed 59% susceptibility to Ciprofloxacin [11].

In the present study, 20.8% isolates were sensitive to Amoxicillin clavulanic acid. Such low level of sensitivity has also been reported in other Indian studies stating 49.3% to as low as 9% [11, 17].

IDSA guidelines recommend a bench mark of 10-20% resistance at which first line empiric therapy should be modified.[20] In the present study, the antibiotics that can be considered as first line therapy are Amikacin and Cefoperazone sulbactam, especially for Beta-Lactamase producers. The antibiotics like Imipenem and Piperacillin-tazobactam should be kept reserved and only administered in situations which warrants their use depending on the antibiotic susceptibility pattern of the isolate. This will prevent the irrational use of antibiotics and reduce the antibiotic pressure on the strains in this geographical area.

## CONCLUSION

*Klebsiella pneumoniae* can be stated as the major cause of different types of lower respiratory infections followed by septicemia in young children. As majority of the infections were diagnosed in hospitalized patients, it indicates that *Klebsiella pneumoniae* is a potent nosocomial pathogen in our hospital. The present data represents the effective first line antibiotic agents against *Klebsiella pneumoniae* to be Amikacin and Cefoperazone sulbactam. As variation in scenario of antibiotic susceptibility pattern exists from time to time and in different geographical areas, more studies need to be conducted at intervals, based on which hospital policies are to be modified.

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