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Original article

Antibiogram of klebsiella pneumoniae recovered from blood stream infection at tertiary care hospital, Rohtak, Haryana

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Abstract

Introduction: Antimicrobial abuse is a serious risk factor for the emergence of multi-drug-resistant (MDR) organisms. Multidrug resistant (MDR) *Klebsiella pneumoniae* is an increasing cause of blood stream infections in India and in many developing countries.

Aim: This study was undertaken to determine the prevalence of *Klebsiella pneumoniae* in blood stream infections and their susceptibility pattern at PT. B.D. Sharma Hospital, Rohtak.

Material and Methods:84 isolates of *Klebsiella pneumoniae* were obtained from blood culture samples received from hospitalized patients admitted in various ICU/wards. K.pneumoniae species were identified on the basis of biochemical reactions. Their sensitivity pattern was checked by Kirby-bauer disc diffusion technique as per CLSI guideline. Antimicrobial discs used were, Imipenem (10 µg), ciprofloxacin (5 µg), Aztreonam (30 µg), Ampicillin (10 µg), Amikacin (30 µg), Ceftazidime (30µg), Cefotaxime (30µg), Gentamicin (10 µg).

Results: Among 7510blood culture sample bottles in the study period, K.pneumoniae was found in 84 blood culture samples. Imipenam shows highest sensitivity among isolates and Ampicillin shows least sensitivity.

Conclusion: Infections with *K.pneumoniae* are increasing adding, particularly among paediatric cases admitted in ICU. This pathogen is generally multidrug-resistant and there are limited treatment options available. This result warns us of perpetration infection control measures to limit intra-institutional spread of these organisms.

Keywords: *K.pneumoniae*, Blood culture, Infection control.

Introduction

Klebsiella pneumoniae belongs to the family of *Enterobacteriaceae*. In addition to the ability to colonize nasopharynx, gastrointestinal tract, and skin, *K. pneumoniae* could cause various infection syndromes, including urinary tract infection, intra-abdominal infection, skin and soft tissue infection, and pneumonia and rarely diarrhoea in both community and healthcare-associated settings[1,2,3]. *Klebsiella pneumoniae* is resistant to a wide range of antibiotics. It is intrinsically resistant to ampicillin[4]. A gradual increase in Extended Spectrum Beta-Lactamase (ESBL) producing *Klebsiella pneumonia* 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 inintegronsetc[5,6]. Carbapenemsare 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) are difficult to treat and poses a serious threat in terms of morbidity and mortality associated with them. The inadvertent use of broad-spectrum antibiotics has led to the emergence of multidrug resistant Gram-negative bacteria.[8] Klebsiella species are of significant importance in this regard.[9] Microbiological culture of blood remains gold standard for the diagnosis of bacterial agents and antibiotic susceptibility providing essential information for the evaluation of broad range of diseases like pneumonia, endocarditis, pyrexia of unknown origin and helpful particularly in patients with suspected septicaemia allowing for successful recovery of bacteria in 99% patients with bacteraemia.[10]

Early and prompt initiation of appropriate antimicrobial treatment is critical in decreasing morbidity and mortality among patients with

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bloodstream infections. Knowledge of local epidemiology is crucial for optimal management of sepsis. This study was done to monitor the change in prevalence of *K. pneumoniae* as a causative organism for septicaemia and its antimicrobial sensitivity patterns from blood cultures of patients admitted to different ICU/wards at Pt. B.D. Sharma, Rohtak which would be helpful for the selection of appropriate antibiotic therapy and determination of empiric antimicrobial strategies guiding in infection control and rational use of antibiotics in this region.

Material and Methods

Study duration and Sample size: This retrospective study was conducted from June 2021 to December 2021 at PT. B.D. Sharma Hospital, Rohtak. During this period total 7510 samples of blood culture were tested, of which 84 samples showed growth of *K. pneumoniae*.

Ethical clearance: All these samples were a part of diagnosis, so ethical consideration is not necessary.

Methodology

Blood samples from culture were collected following aseptic precautions. The venous site was cleaned with 70% alcohol and 2% chlorhexidine with allowing it to dry for 1- 2 minutes. One milliliter (neonates) and 5 ml (children) blood were collected and inoculated into 10 and 50 ml of brain heart infusion broth with 0.025% of Sodium polyanethol sulphonate as anticoagulant (1:10 dilution) respectively. The culture bottles were incubated at 37°C aerobically and periodic subcultures were done day 2, day 4 and finally on day 6 onto blood agar and Mac Conkey's agar. Plates were examined for the growth of bacteria. All positive cultures were identified by their characteristic appearance on their respective media, Gram staining reaction and were confirmed by the pattern of biochemical reactions using the standard methods.[11] Antibiotic susceptibility test were performed against locally available antibiotics by using disk diffusion methods in accordance with Clinical and Laboratory Standards Institute (CLSI) criteria.[12] Control strains, Escherichia coli ATCC 25922 (Beta – Lactamase negative) disc diffusion method as per CLSI guidelines. Antimicrobial used were Cefotaxime (30µg), Imipenem (10 µg), Ceftazidime (30µg), Ciprofloxacin (5µg), Aztreonam (30 µg), Ampicilin (10 µg), Gentamicin (10 µg), Amikacin (30 µg).

Results and Analysis

7510 blood cultures were studied from suspected patients and the prevalence of *K. pneumoniae* among them was checked with its antimicrobial susceptibility at Department of Microbiology, Tertiary care hospital, Rohtak. Among 7510 suspected patients in the study period, *K. pneumoniae* was found in 84 blood culture samples. Statistical analysis was done using SPSS version 20 software and MS excel 2007 were used for statistics. Chi-square test was used to know the association between the variable.

Table 1: Gender wise distribution of patients

Gender of patients	No. of positive blood cultures (n=84)	% of positive blood culture (n=84)
Male	52	61.90%
Female	32	38.90%
Total	84	100%

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Figure 1: Gender wise distribution of patients

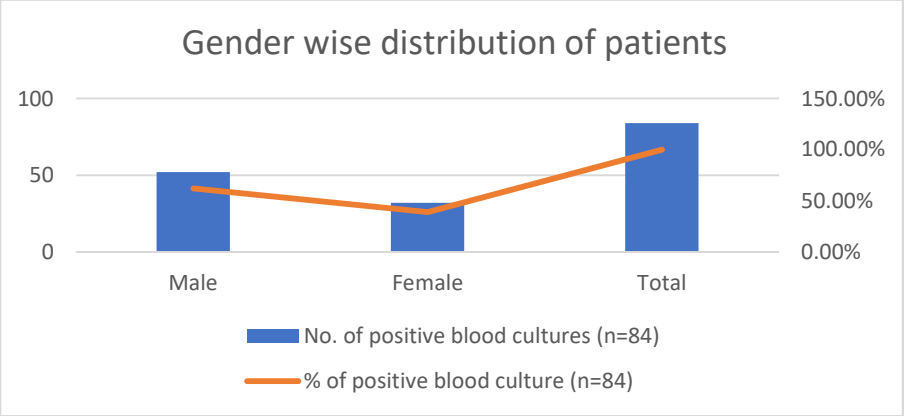

Table 1 and fig.1 shows gender wise distribution of samples. *Klebsiella pneumoniae* was isolated from (61.9%) males and (38.1%) females.

Table 2: ICU/Ward-wise distribution of *Klebsiella pneumoniae* from blood culture.

ICU/Wards	No. of *Klebsiella pneumoniae* isolate (n=84)	% of *Klebsiella pneumoniae* isolate (n=84)
Paediatric ICU/Neonatal ICU	25	29.70%
Paediatric ward	20	23.80%
Medicine ward	9	10.70%
Trauma ICU	8	9.50%
Medicine ICU	5	5.90%
Surgery ward	5	5.90%
CTVS	2	2.30%
Others	10	11.90%

Figure 2: ICU/Ward-wise distribution of *Klebsiella pneumoniae* from blood culture.

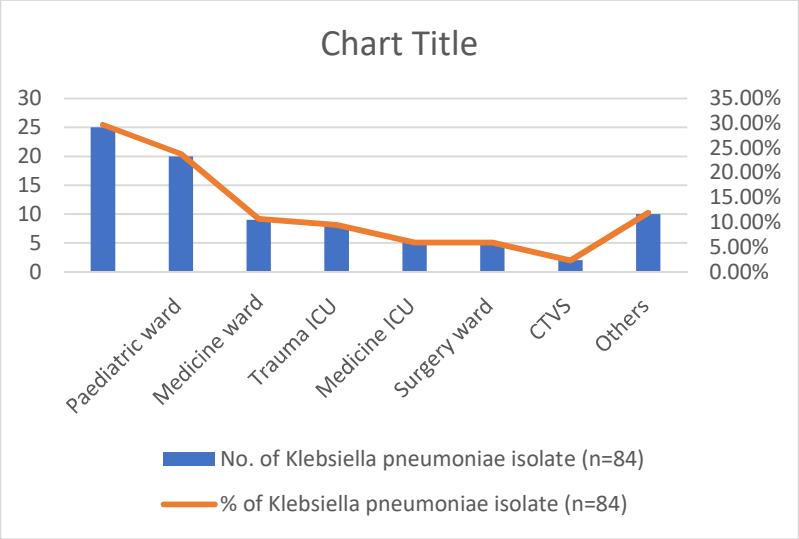

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Table 2 and fig. 2 shows Ward- wise distribution of *Klebsiella pneumoniae*. Maximum *Klebsiella pneumoniae* were isolated from Paediatric/Neonatal ICU (29.7%) followed by Paediatric ward (23.8%) then Medicine ward (10.7%), Trauma ICU (9.5%), Medicine ICU (5.9%), Surgery ward (5.9%), CTVS (2.3%) and Others (11.9%).

Table 3: Antibiotic sensitivity pattern of *Klebsiella pneumoniae* recovered from blood culture.

Antibiotic drugs	**Sensitivity pattern of *Klebsiella pneumoniae* (n=84)**
Imipenem	76 (90.4%)
Aztreonam	72 (85.7%)
Cefotaxime	71 (84.5%)
Ceftazidime	64 (76.1%)
Amikacin	53 (63.09%)
Gentamicin	51 (60.7%)
Ciprofloxacin	48 (57.1%)
Ampicillin	7 (8.3%)

Table 3 shows Antibiotic sensitivity of *Klebsiella pneumoniae* isolated from blood culture.
Klebsiella pneumoniae isolated from blood culture samples were sensitive to Imipenem (90.4%), Aztreonam (85.7%) followed by Cefotaxime (84.5%), Ceftazidime (76.1%), Amikacin (63.09%), Gentamicin (60.7%), Ciprofloxacin (57.1%), Ampicillin (8.3%).

Discussion

Rapidly changing trends in microbiology and epidemiology of the disease-causing micro-organism has impact on treatment outcomes. The timely detection of bacteraemia can have a profound influence on the clinical outcome.[13] The study shows bacteraemia caused by *Klebsiella pneumoniae* isolates and their antibiotic susceptibility pattern to the most commonly used oral and parenteral antimicrobial agents.

Klebsiella pneumoniae (*K. pneumoniae*) is a major cause of hospital acquired infections among all Enterobacteriaceae and also in community acquired infection. It is associated with various clinical conditions like septicaemia, Respiratory Tract Infection, urinary tract infections and Diarrhoea. But the usual transmissibility of the responsible plasmids has led to the spread of this resistance to other members of Enterobacteriaceae. The implementation of rational antibiotic use and newly under study changes in the hospital antibiotic policies such as antibiotic cycling and class restriction for a time period have been reported beneficial.[14] A sincere effort on the part of the clinicians to restrict the use of empirical therapy is of great use.

Lack of infection control procedures, understaffing, inadequate sterilization of multiuse instruments and crowded nurseries in developing country provide means for transmission of neonatal infections.[15]

In the present study sex wise prevalence of clinical isolates shows that infections caused by *Klebsiella pneumoniae* are more common in males (61.9%) compared to females (38.9%). This is comparable with study of Venkatesh et al.[12]

In present study the highest percentage 60 (71.4%) of *Klebsiella pneumoniae* infections were observed in the paediatric and neonatal ward and ICU, followed by medicine and surgery ward. This is comparable with study of Ramy et al.[16]

Klebsiella pneumoniae isolated from blood culture samples were sensitive to Imipenem (90.4%). This study shows that the clinical isolates of *Klebsiella pneumoniae* are becoming resistant to commonly used antibiotics and gaining more and more resistance to newer antibiotics. The antimicrobial agents are less effective because of the spread of resistant organisms due to lack of awareness, indiscriminate use of antibiotics, patient non-compliance and unhygienic condition. It is the need of the hour that antibiotic stewardship policies

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should be formulated and strictly implemented to resist and overcome this emerging problem.

Conclusion

It is critically important to have strict antibiotic policy, surveillance programmes for multidrug resistant organisms and strict infection control procedures policies to prevent the spread of the resistant bacteria. It is advisable that the antibiotic susceptibility pattern of bacterial pathogens like *Klebsiella pneumoniae* in specialized clinical units should be continuously monitored and the results readily made available to clinicians so as to minimize resistance. The solutions can be planned and implemented by continuous efforts of microbiologist, clinician, pharmacist, infection control nurse and community to promote greater understanding of this problem. Frequent hand washing by health care personnel should be encouraged to prevent spread of organism.

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