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Bacteriological Profile Of *Klebsiella Pneumoniae* In Medical Intensive Care Unit In Tertiary Care Hospital

Dr.Aquib R.Patel[1], Dr.Anil Gaikwad,[2] Dr.Jyoti Iravane[3]
[1,2,3.](Department Of Microbiology. Government Medical College,Aurangabad, Maharashtra)

Abstract:
Background:. *Klebsiella pneumoniae has become the most common pathogenic bacterium which account for nosocomial infection due to its virulence factor[1] It is seen with general occurrence of resistance to most of antibiotics.[1]Klebsiella pneumoniae is bacterium often found in human gastrointestinal tract and throat.[2] .Multidrug resistant strains of bacterium have become a global concern leading to increase morbidity and mortality.[2] .Klebsiella pneumoniae is associated with healthcare infection like pneumonia, blood stream infections, wound or surgical site infection and meningitis.[2].It's a major cause of nosocomial infection in critically ill patients[3].The emergence of multidrug resistant strain of Klebsiella pneumoniae (MDRKP) is a global concern[4] .Various retrospective study in MICU in tertiary care hospital analysed the multidrug resistant strains of Klebsiella pneumoniae[4,7,8.]*
Materials and methods: *The study was conducted at Department of Microbiology Government Medical college Aurangabad between January 2023 to December 2023. Clinical samples collected included endotracheal aspirate blood, and urine, from in MICU. The samples were inoculated on blood agar, MaCconkey agar and Cysteine lactose electrolyte deficient agar (CLED)Klebsiella pneumoniae isolates were identified by morphology, cultural characteristic's and standard biochemical reaction Antibiotic susceptibility test was performed by Modified Kirby-bauer disc diffusion method on Muller Hilton Agar and VITEK-2 compact automated system The plates were read out after overnight incubation and by measuring the zone of inhibition around antibiotics put on according clinical laboratory and scientific institute(CLSI) 2023. VITEK-2 compact result were analysed comparatively*
Results:.*Out of 1350 samples processed from MICU 174 samples were culture positive for Klebsiella pneumoniae.66 were female and 108 were Male(n=174) .Klebsiella pneumoniae mainly recovered from various samples like Tracheal aspirate=135(77%),Blood=24(13%),& Urine=15(10%).Klebsiella pneumoniae from MICU were highly resistance to Cephalosporins (93.25%) followed by Carbapenems(79%) ,Fluroquinolones(67%) and Aminoglycosides(73%)*
Conclusion:*Trends of antimicrobial susceptibility of Klebsiella pneumoniae continuously decreasing due to emergence of antibiotic resistance.The present study concludes that Klebsiella pneumoniae is major MICU pathogen causing nosocomial infection.*
Key Word*: Klebsiella pneumoniae, antibiotic susceptibility test ,multidrug resistance*

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I. Introduction

Klebsiella pneumoniae has become the most common pathogenic bacterium which account most of nosocomial infection due to its virulence factor. Its seen with general occurrence of resistance to most of antibiotics.[1.]*Klebsiella pneumoniae* is bacterium often found in human gastrointestinal tract and throat.[2] .Multidrug resistant strains of bacterium have become a global concern leading to increase morbidity and mortality[2] .*Klebsiella pneumoniae* is associated with healthcare infection like pneumonia, blood stream infections, wound or surgical site infection and meningitis.[2].It is a major cause of nosocomial infection in critically ill patients.[3].The emergence of multidrug resistant strain of *Klebsiella pneumoniae* (MDRKP) is a global concern.[4] .Some retrospective study in MICU in tertiary care hospital analysed the multidrug resistant strains of *Klebsiella pneumonia*[4.]*Klebsiellapneumoniae* is carbapenemase an Ambler class-A beta lactamase is the most globally prevalent carbapenemase resistance enzyme.[5] *Klebsiella pneumoniae* is common pathogen responsible for community acquired and nosocomial infections.[6] Extensive use of broad spectrum antibiotics in hospitalized patients has led to development of multidrug resistant , extensive drug resistance & pan drug resistant strain of *Klebsiella pneumoniae*.[7,8] This multidrug resistance developed due to drug effux.[9] Most of gram negative bacteria including *Klebsiella pneumoniae* were found multidrug resistant.[10] The highest incidence of bacterial resistance usually observed at intensive care unit.[11] Resistance to carbapenems in *Klebsiella pneumoniae* is primarily due to production of carbapenemase enzymes or in rare case due to production of

extended -spectrum β-lactamase (EsβL).[12,13,14.] However carbapenem antibiotics becomes more widely used which lead to worsen the status of MDR *Klebsiellapneumoniae*.Hence it is crucial to study antibiogram of *Klebsiellapneumoniae* in hospitalized patients.the objective of study was to determined antibiotic susceptibility pattern of *Klebsiella pneumoniae* in Medical intensive care unit.

II. Material And Methods

A hospital based retrospective study was conducted from January 2023 to December 2023 at GMC Aurangabad
Study design: Hospital based retrospective study
Study location: This was tertiary care teaching hospital based study done in department of microbiology , Government medical college, Aurangabad.
Study duration: Jan 2023 to December 2023
Sample size:All Samples including Endotracheal aspirate,Blood and Urine.

Inclusion criteria:
1) Patient admitted to MICU at GMC Aurangabad (Jan 2023-Dec 2023)
2) clinical samples including Endotracheal aspirate, Blood & urine
3) Samples confirmed positive for *Klebsiella pneumoniae*
4) Samples underwent antibiotic susceptibility testing (Modified Kirby-Bauer, VITEK-2)

Exclusion criteria:
1) Patients not in MICU or outside study period
2) Samples not confirmed for *Klebsiella pneumoniae.*
3) Samples without complete antibiotic susceptibility test

Procedure methodology:

All samples collected from medical intensive care unit were sent to the bacteriology section in the microbiology department for analysis. A total of 1350 samples were collected in sterile containers and sent to the lab without any delay. Samples received including endotracheal aspirate,blood& urine in the lab were processed as per Standard Operating Guidelines. Samples were subjected to direct microscopy and Gram staining for identification of pus cells, red blood cells, and microorganisms. Samples were inoculated on blood agar, a MacConkey agar, & cysteine lactose electrolyte deficient agar (CLED) followed by overnight incubation at 37 °C. Culture readings were done the next day, and samples without culture growth were reported as sterile. Out of 1350 samples received, growth were present on 174 samples growth on the agar plates was identified using conventional methods including Gram staining, hanging drop motility, biochemical reactions, and automated machines including vitek -2 (biomeriux/vitek-2 compact 60 system) and Maldi-tof (biomeriux-vitek-MS). Antimicrobial susceptibility testing (AST) was done for the identified organisms as per Clinical and Laboratory Standards Institute guidelines of the year 2023. Kirby Bauer Disc Diffusion Method and vitek 2 (biomeriux/vitek-2 compact 60 system) were used for antimicrobial susceptibility testing (AST). A standard 0.5 McFarland inoculum was prepared for each bacterial isolate and inoculated on Muller-Hinton agar by the lawn culture method, followed by overnight incubation at 37 °C. AST in the vitek-2 system was done as per the manufacturer's guidelines. AST readings were done the next day, and sensitivity patterns were identified for *Klebsiella pneumoniae* .

III. Result

Sample Distribution

Out of 1350 clinical samples collected from the Medical Intensive Care Unit (MICU) between January and December 2023, 174 samples (12.88%%) were culture-positive for *Klebsiella pneumoniae*. The distribution of these samples was as follows: 135 (77%) from tracheal aspirates, 24 (13%) from blood, and 15 (10%) from urine samples.

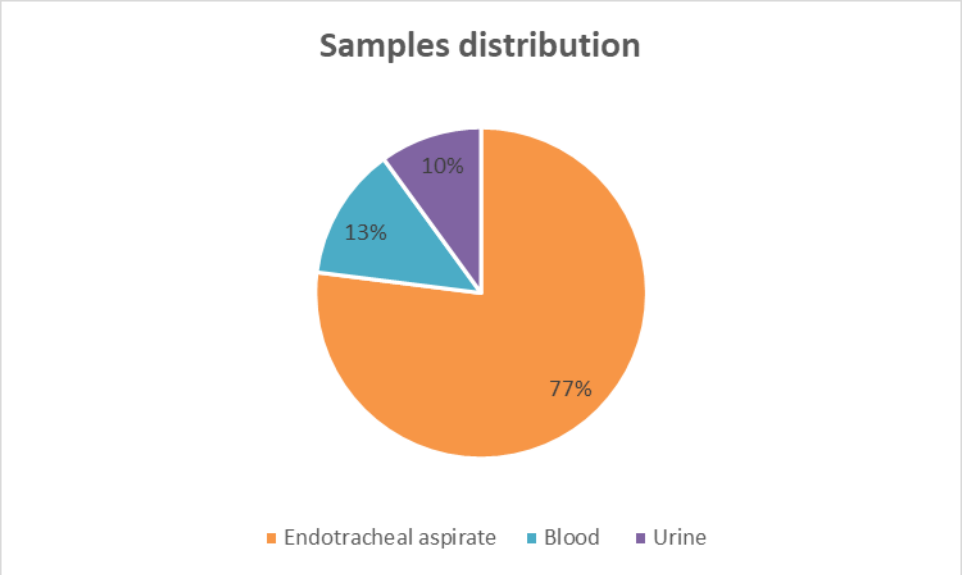


Figure 1 showing samples distribution showing positive growth for *Klebsiella pneumoniae* in MICU ,which shows 77% samples from endotracheal aspirate, 13% from Blood samples and 10% from Urine.

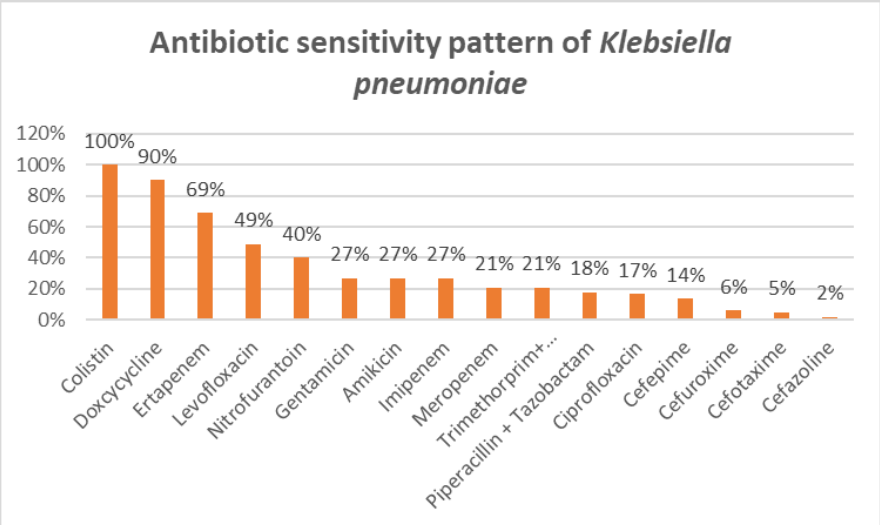
Age Distribution

The age distribution of patients with *Klebsiella pneumoniae* infections revealed that the age group 31-60 years had the highest number of cases, accounting for 97 out of 174 (56.1%). This was followed by the 15-30 years age group with 32 cases (18%), the above 60 years age group with 32 cases (18.7%), and the 0-15 years age group with 13 cases (7.2%).

Antibiotic Sensitivity

Despite the high resistance rates, the study identified several antibiotics to which *Klebsiella pneumoniae* showed higher sensitivity. Colistin, Doxcycycline,&Ertapenemdemonstrated the highest sensitivity rates at 100%,90% &69%.Sensitivity to other antibiotics included 49% for Levofloxacin,&40% for Nitrofurantoin.

Figure 2 showing the antibiotic susceptibility of *Klebsiellapneumoniae*to Colistin,Doxcycycline, Ertapenem&Levofloxacin.

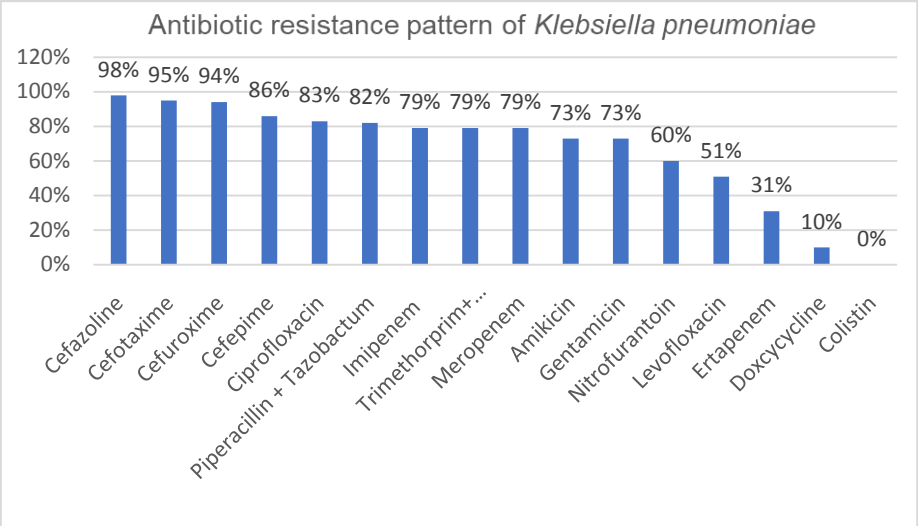


Antibiotic Resistance

The study highlighted a concerning level of antibiotic resistance among *Klebsiella pneumoniae* isolates. The resistance rates were notably high for several classes of antibiotics,93.25% for cephalosporins, 79% for carbapenems, 67% for fluoroquinolones, and 73% for aminoglycosides. These findings underscore the

significant challenge in treating infections caused by *Klebsiella pneumoniae* due to its multi-drug resistant nature.

Figure 3 showing antibiotic resistance pattern of *Klebsiellapneumoniae* to Cephalosporin,Fluroquinolone, Carbapenems& Aminoglycoside



IV. Discussion

This study provides a thorough analysis of the *Klebsiella pneumoniae* bacterial profile in a hospital's medical intensive care unit (MICU), providing important new information on the infection's prevalence, resistance trends, and therapeutic implications. Of the 1350 samples studied, 12.88% included *Klebsiella pneumoniae*, with the majority (77%) being isolated from tracheal aspirates. The widespread usage of invasive techniques like mechanical ventilation in intensive care units (ICUs) is largely accountable for the incidence of respiratory tract infections.The distribution of infections by age and gender shows that patients between the ages of 31 and 60 had a greater incidence of infections (56.1%), with males being more commonly affected (62.6%).[2,3,7]

These results correspond with those of Sharma et al. (2020),[3] indicating that middle-aged people may be particularly at risk because of comorbid conditions and extended hospital stays. Males are more susceptible than females for a variety of reasons, including variations in co-occurring disorders and patterns of seeking medical attention.The study's concerning conclusions about antibiotic resistance are especially concerning. *Klebsiella pneumoniae* demonstrated extensive resistance to commonly used antibiotics, with resistance rates of 93.25% to cephalosporins, 63% to carbapenems, 67% to fluoroquinolones, and 73% to aminoglycosides.[3,7,12,15.] Management of infections is made more difficult by these high rates of resistance, which also restrict available therapeutic alternatives.On the other hand, the study demonstrated that Ertapenem, Doxycycline, and Colistin all maintained greater sensitivity rates at 69%, 90%, and 100%, respectively. [2,4.]

Therefore, these antibiotics offer good therapeutic substitutes. But depending too much on just a few antibiotics increases the likelihood that resistance will emerge in the future, which highlights the significance of using these medications judiciously.

In MICU settings, controlling and preventing *Klebsiella pneumoniae* infections requires the implementation of effective infection control strategies. Important strategies consist of:

1. Improved Hand Hygiene: Healthcare personnel must adhere to strict hand hygiene protocols in order to stop the spread of diseases.
2. Use of Protective Equipment: To lower the danger of cross-contamination, personal protective equipment (PPE) should be used appropriately
3. Environmental Cleaning: The hospital's surroundings can be kept as clean as possible to reduce the presence of infectious agents there.

To stop antibiotic resistance from spreading, strong antibiotic stewardship programs must be put in place. Choosing the right antibiotic, dose, and duration while ensuring that they are only administered when absolutely necessary. It is essential to continuously monitor resistance patterns in order to inform treatment guidelines and policies.

It is important that healthcare personnel get education on the significance of antibiotic stewardship as well as the optimal practices for antibiotic prescription.The study emphasizes how important it is to continue conducting research and creating novel treatment approaches to deal with the problem of antibiotic resistance. It is necessary to conduct more research on bacteriophages, novel antibiotics, and other complementary therapies.

V. Conclusion

Klebsiella pneumoniae poses a substantial issue in the MICU because of its widespread incidence and drug resistance. Effective management necessitates severe infection control measures, such as hand hygiene, the use of personal protective equipment, and complete environmental cleaning. Antibiotic stewardship initiatives, which include sensible antibiotic usage and education on resistance patterns, are critical for preventing future resistance. Continuous monitoring and early reporting of resistance patterns are critical for making informed treatment decisions and policy changes. Additionally, research into novel antibiotics and alternative treatments, such as bacteriophage therapy, is required. Combating multi-drug-resistant *Klebsiella pneumoniae* necessitates collaboration among hospitals, researchers, and public health policy. Through a complex approach incorporating antibiotic stewardship, ongoing surveillance, and new therapy options can be included.

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