

**$\beta$ -LAKTAM RING ANTIBIOTIC SENSITIVITY PATTERNS  
BACTERIA *Klebsiella pneumoniae*  
VITEK 2 COMPACT RESULTS FOR ISPA PATIENTS**

Diah Lestari<sup>1\*</sup>; Husyain Djajaningrat<sup>1</sup>; Mutohar Fadila<sup>2</sup>

<sup>1</sup> Poltekkes Kemenkes Jakarta III, Indonesia

<sup>3</sup>RSUD Pasar Minggu, Indonesia

*Email corresponding: diahtari1411@gmail.com*

**ABSTRACT**

**Background :** *Data reports on the incidence of infection cases caused by ESBL-producing *Klebsiella pneumoniae* bacteria at Pasar Minggu Hospital, South Jakarta are increasing every year. This shows the incidence of multidrug resistant (MDR) bacteria which must be immediately controlled by implementing wise use of antibiotics and optimal infection control prevention.*

**Objective:** *The aim of the study was to determine the comparison of antibiotic sensitivity patterns of  $\beta$ -lactam rings read on the Vitek 2 Compact against *K. pneumoniae* ESBL bacteria in patients with acute respiratory tract infections (ARI) at Pasar Minggu Hospital, and can be used by doctors as a reference for determining the right antibiotic .*

**Methods and Materials :** *This research is observational analytic with a cross-sectional design approach. Secondary data from the identification of bacteria in sputum culture of all ISPA patients at Pasar Minggu Hospital for the period January – December 2022, totaling 129 patients. Statistical analysis uses the Wilcoxon Sign Rank Test with a confidence level (CI) of 95%.*

**Results and Conclusions :** *Results of statistical analysis showed a significant difference in the sensitivity of *Klebsiella pneumoniae* ESBL growth between antibiotics in the ampicillin class and amoxicillin clavulanate p-value 0.000 ( $p < 0.05$ ). There was no significant difference in sensitivity to the growth of *Klebsiella pneumoniae* ESBL between the antibiotics imipenem and meropenem, p-value 0.317 ( $p > 0.05$ ). The best antibiotic sensitivity in inhibiting the growth of *Klebsiella pneumoniae* ESBL bacteria in ARI patients at Pasar Minggu Regional Hospital was in the Imipenem and Meropenem groups with sensitivity percentages of 90.7% and 91.5%. Meanwhile, Ampicilin is resistant to the growth of *K. pneumoniae* ESBL bacteria. The results of this antibiotic sensitivity test can be used by doctors to carry out appropriate treatment for ARI patients to prevent the occurrence of antibiotic resistance and multidrug-resistance (MDR).*

**Keywords :** **Klebsiella pneumoniae* ESBL ;  $\beta$ -Lactam, Multidrug Resistant (MDR); Acute Respiratory Infections (ARI); Vitek 2 Compact*

## ABSTRAK

**Latar Belakang :** Laporan data kejadian kasus infeksi yang disebabkan oleh bakteri *Klebsiella pneumoniae* penghasil ESBL di RSUD Pasar Minggu Jakarta Selatan semakin meningkat setiap tahunnya. Hal ini menunjukkan timbulnya bakteri multidrug resisten (MDR) yang harus segera dikendalikan dengan menerapkan penggunaan antibiotik secara bijak dan pencegahan pengendalian infeksi yang optimal.

**Tujuan:** Tujuan penelitian adalah untuk mengetahui perbandingan pola sensitivitas antibiotik cincin  $\beta$ -laktam yang terbaca pada Vitek 2 Compact terhadap bakteri *K. pneumoniae* ESBL pada pasien infeksi saluran pernafasan akut (ISPA) di RSUD Pasar Minggu, dan dapat digunakan oleh dokter sebagai acuan dalam menentukan antibiotik yang tepat.

**Metode dan Bahan :** Penelitian ini bersifat observasional analitik dengan pendekatan desain cross-sectional. Data sekunder identifikasi bakteri pada kultur dahak seluruh pasien ISPA RSUD Pasar Minggu periode Januari – Desember 2022 berjumlah 129 pasien. Analisis statistik menggunakan Wilcoxon Sign Rank Test dengan tingkat kepercayaan (CI) sebesar 95%.

**Hasil dan Kesimpulan :** Hasil analisis statistik menunjukkan terdapat perbedaan sensitivitas pertumbuhan ESBL *Klebsiella pneumoniae* yang signifikan antara antibiotik golongan ampisilin dan amoksisilin klavulanat p-value 0,000 ( $p < 0,05$ ). Tidak terdapat perbedaan sensitivitas terhadap pertumbuhan *Klebsiella pneumoniae* ESBL yang bermakna antara antibiotik imipenem dan meropenem, p-value 0,317 ( $p > 0,05$ ). Sensitivitas antibiotik terbaik dalam menghambat pertumbuhan bakteri *Klebsiella pneumoniae* ESBL pada pasien ISPA di RSUD Pasar Minggu terdapat pada kelompok Imipenem dan Meropenem dengan persentase sensitivitas sebesar 90,7% dan 91,5%. Sedangkan Ampicilin resisten terhadap pertumbuhan bakteri *K. pneumoniae* ESBL. Hasil uji sensitivitas antibiotik ini dapat digunakan dokter untuk melakukan pengobatan yang tepat pada pasien ISPA guna mencegah terjadinya resistensi antibiotik dan multidrug-resistance (MDR).

**Kata Kunci:** *Klebsiella pneumoniae* ESBL ;  $\beta$ -Lactam, Multidrug Resistant (MDR); Infeksi Saluran Pernafasan Akut (ISPA); Vitek 2 Compact

## INTRODUCTION

The pathogenic bacteria that often causes ARI is *Klebsiella pneumoniae* as a germ that produces Extended-spectrum  $\beta$ -lactamases (ESBL). Gram-negative *K. pneumoniae* from the Enterobacteriaceae group which already has resistance to  $\beta$ -lactam antibiotics. These ESBL-producing bacteria are nosocomial pathogens and are increasingly being found as infectious agents in the community (Wekesa *et al.*, 2020). Historically *K. pneumoniae* is referred to as the agent of Friedlander's pneumoniae, namely severe lung inflammation from lobar pneumonia with a high mortality rate (Dorawati *et al.*, 2021).

Management of ARI treatment by *Klebsiella pneumoniae* bacteria is carried out by administering antibiotic therapy containing a  $\beta$ -lactam ring, namely meropenem, ciprofloxacin, ampicillin and chloramphenicol (Tarina, Kusuma, 2017). However, in recent years there has been an increase in cases of multidrug-resistant infections caused by inappropriate use of  $\beta$ -lactam antibiotics, one of the resistances that can occur is resistance to ESBL (Manuaba *et al.*, 2021)

Based on research conducted at RSUD Prof. DR. Margono Soekarjo Purwokerto regarding resistance to *Klebsiella sp.* against meropenem, results were obtained from 3 positive samples for *Klebsiella sp.*, including resistance to meropenem (Afifah *et al.*, 2017). Another study also showed that 4 out of 200 samples were identified as ESBL and all were resistant to meropenem (Biswas *et al.*, 2014). In research conducted at RSUP DR. Muhammad Hoesin in 2021 against *Klebsiella pneumoniae* bacteria producing ESBL, the results were 100% resistant to the antibiotic ampicillin and 76.5% resistant to the antibiotic

ciprofloxacin (Siregar, 2021). So it is necessary to evaluate the analysis of germ sensitivity patterns and their sensitivity to antibiotics (Andari *et al.*, 2021).

Antibiotic susceptibility testing uses an automatic method with VITEK 2 COMPACT colorimetric and turbidimetric technology, which has the advantage of taking 5-8 hours compared to the conventional method which takes longer, around 24 hours (Muztika *et al.*, 2020). The results of the antibiotic sensitivity test are used by doctors as a reference for determining the appropriate antibiotic for patient treatment, so that they can identify which antibiotics have the potential to be used as treatment (Muztika *et al.*, 2020; Soleha, 2015).

#### **Problem Formulation and Purpose :**

Data reports on the incidence of infection cases caused by ESBL-producing *K. pneumoniae* bacteria at the Pasar Minggu Regional General Hospital, South Jakarta are increasing every year. This shows the incidence of multidrug-resistant bacteria which must be immediately controlled by implementing wise use of antibiotics and optimal prevention of infection control (RI Ministry of Health, 2021). Based on this, the antibiotic sensitivity pattern of the  $\beta$ -lactam ring read on the Vitek 2 compact is formulated for *K. pneumoniae* ESBL bacteria in patients with acute respiratory tract infections (ARI) and is used by doctors as a reference to determine the appropriate antibiotic for patient treatment in accordance with patient indication?

## **METHOD**

Ethical clearance is issued by the Ethics Commission of the RSUD Pasar Minggu with Ethics Review Number: 40/KOMETHUK/V/2023.

#### **Design, Subjects, and Research Variables**

This research is observational analytic with a cross-sectional design approach. Research variables were the antibiotic sensitivity patterns of  $\beta$ -lactam rings against *Klebsiella pneumoniae* ESBL bacteria and comparison of the sensitivity patterns of  $\beta$ -lactam ring antibiotics against the growth of *Klebsiella pneumoniae* ESBL bacteria from sputum culture specimens of ISPA patients.

#### **Data Collection and Measurement**

Secondary data from the identification of bacteria in the sputum culture of all ISPA patients from Pasar Minggu Regional Hospital for the period January – December 2022 was 129 patients. Sensitivity pattern of growth of *Klebsiella pneumoniae* ESBL bacteria to  $\beta$ -lactam ring antibiotics as read on the Vitek 2 compact device. Susceptibility pattern categories are measured based on resistant and sensitive.

#### **Statistical Analysis**

Statistical analysis uses the Wilcoxon Sign Rank Test with a confidence level (CI) of 95% or a value of  $\alpha$  0.05. With a p value < 0.05 there is a significant difference and a p value > 0.05 there is no significant difference between the sensitivity patterns of  $\beta$ -lactam antibiotics to the growth of *Klebsiella pneumoniae* ESBL bacteria.

## **RESULTS AND DISCUSSION**

The antibiotic sensitivity pattern of the  $\beta$ -lactam ring against the growth of *K.pneumoniae* ESBL bacteria are in table 1.

**Table 1. The Antibiotic Sensitivity Patterns Of The B-Lactam Ring of *K. pneumoniae* ESBL**

The Antibiotic Sensitivity / Type of $\beta$ -lactam antibiotic	Frequency (N)	Percentage (%)
<b>Ampicilin</b>		
Resistant	129	100
Sensitive	0	0
<b>Amoxicillin klavulanat</b>		
Resistant	18	14,0
Sensitive	111	86,0
<b>Ceftazidime</b>		
Resistant	62	48,1
Sensitive	67	51,9
<b>Ceftriaxone</b>		
Resistant	87	67,4
Sensitive	42	32,6
<b>Imipenem</b>		
Resistant	12	9,3
Sensitive	117	90,7
<b>Meropenem</b>		
Resistant	11	8,5
Sensitive	118	91,5

Source : results of examination by the author.

In table 1, The sensitivity of the antibiotics meropenem and imipenem had a high sensitivity of 90.7% and 91.5%, followed by Amoxicillin clavulanate. Meanwhile, Ampicilin is resistant to the growth of *Klebsiella pneumoniae* ESBL bacteria.

**Table 2. Differences in Antibiotic Sensitivity Patterns Wilcoxon Test**

Antibiotic Group	n	p-value
<b>Group Penicillins</b> Ampicilin	129	0,000
Amoxicillin Klavulanat		
<b>Group Cephalosporins</b> Ceftazidime	129	0,000
Ceftriaxone		
<b>Group Carbapenems</b> Imipenem	129	0,317
Meropenem		

N: number of samples.

Source : calculated by the author

In table 2. Statistical analysis of the Wilcoxon Sign Rank Test for differences in antibiotic sensitivity, it was found that there was a significant difference in sensitivity for the growth of *Klebsiella pneumoniae* ESBL between antibiotics in the ampicillin class and amoxicillin clavulanate p-value 0.000 ( $p < 0.05$ ). Meanwhile, there was no significant difference in sensitivity for the growth of *Klebsiella pneumoniae* ESBL between the antibiotics imipenem and meropenem, p-value 0.317 ( $p > 0.05$ ).

## CONCLUSION AND BENEFITS :

The best antibiotic sensitivity to inhibit the growth of *Klebsiella pneumoniae* ESBL bacteria in ARI patients at Pasar Minggu Regional Hospital is from the Imipenem and Meropenem groups with sensitivity percentages of 90.7% and 91.5%. The results of this antibiotic sensitivity test can be used by doctors to carry out appropriate treatment for ARI patients to prevent antibiotic resistance and multidrug-resistance (MDR) events.

## ACKNOWLEDGEMENT

The authors would like to thanks Poltekkes Kemenkes Jakarta III and The Pasar Minggu Regional General Hospital (RSUD Pasar Minggu), South Jakarta, Indonesia

## REFERENCES

- Admin, & Sherly Widianti. (2020). Penanganan Ispa Pada Anak Balita (Studi Literatur). *Jurnal Kesehatan Dan Pembangunan*, 10(20), 79–88. <https://doi.org/10.52047/jkp.v10i20.81>.
- Afifah, A., Purwonegoro, T. A., & Peramiarti, I. (2017). Resistensi terhadap meropenem di rsud prof. Dr. Margono soekarjo purwokerto. *Scripta Biologica*, 4(2), 135. <https://doi.org/10.20884/1.sb.2017.4.2.378>
- Andari, I., Pinatih, K., & Budayanti, N. (2021). Pola Kepekaan Kuman Dan Sensitivitasnya Terhadap Antimikroba Pada Pasien Infeksi Saluran Kemih Di Rsup Sanglah Periode Januari – Juni 2019. *Jurnal Medika Udayana*, 10(5), 33–38.
- Barni, & Mardiah, M. (2022). *Description of Knowledge Attitude and Behavior of Patients of*. 8(01), 45–50.
- Biswas, R., Rabbani, R., Ahmed, H. S., Sarker, M. A. S., Zafrin, N., & Rahman, M. M. (2014). Antibiotik sensitivity pattern of urinary tract infection at a tertiary care hospital. *Bangladesh Critical Care Journal*, 2(1), 21–24. <https://doi.org/10.3329/bccj.v2i1.19952>
- Dorawati, M., Herawati, I., & Fauziah, P. N. (2021). Identifikasi Bakteri Gram Negatif dari Sputum Penderita Infeksi Saluran Pernapasan Akut di Rumah Sakit Dustira Kota Cimahi. *Anakes : Jurnal Ilmiah Analis Kesehatan*, 7(1), 37–44. <https://doi.org/10.37012/anakes.v7i1.515>
- KEMENKES RI. (2021). Pedoman umum penggunaan antibiotik. In *Kementrian Kesehatan Republik Indonesia* (Vol. 1, Issue 2).
- Manuaba, I. A. S. P., Iswari, I. S., & Pinatih, K. J. P. (2021). Prevalensi Kuman Escherichia coli dan Klebsiella pneumoniae Penghasil Extended Spectrum B Lactamase (ESBL) yang Diisolasi dari Pasien Pneumonia di RSUP Sanglah Periode Tahun 2019-2020. *Jurnal Medika Udayana*, 10(12), 51–57.
- Muztika, S. A., Nasrul, E., & Alia, E. (2020). Prevalensi dan Pola Sensitivitas Antibiotik Klebsiella pneumoniae dan Escherichia coli Penghasil Extended Spectrum B Laktamase di RSUP Dr. M Djamil Padang. *Jurnal Kesehatan Andalas*, 9(2), 189. <https://doi.org/10.25077/jka.v9i2.1272>
- Siregar, N. S. (2021). Uji Sensitivitas Antibiotik Terhadap Kuman Penyebab Infeksi Saluran Kemih (ISK) Systematic Review. *Frontiers in Neuroscience*, 14(1), 1–13
- Soleha, T. U. (2015). Uji Kepekaan Terhadap Antibiotik. *Juke Unila*, 5(9), 121.
- Tarina, N. T. I., & Kusuma, S. A. F. (2017). Deteksi Kuman Klebsiella pneumonia. *Jurnal Farmaka*, 15(2), 119–126.
- Wekesa, Y. N., Namusoke, F., Sekikubo, M., Mango, D. W., & Bwanga, F. (2020). Ceftriaxone- and

ceftazidime-resistant *Klebsiella* species, *Escherichia coli*, and methicillin-resistant *Staphylococcus aureus* dominate caesarean surgical site infections at Mulago Hospital, Kampala, Uganda. *SAGE Open Medicine*, 8. <https://doi.org/10.1177/2050312120970719>