

SENSITIVITY TEST OF *KLEBSIELLA PNEUMONIAE* FROM SPUTUM OF SUSPECTED PNEUMONIA PATIENTS TO THE ANTIBIOTIC CIPROFLOXACIN

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Abstract: Pneumonia is a pulmonary infection that may result in moderate to severe sickness across all age groups. The predominant microorganisms responsible for pneumonia are *Streptococcus pneumoniae*, *Haemophilus influenzae*, *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Legionella* species, *Pseudomonas aeruginosa*, and *Acinetobacter* species. *Klebsiella pneumoniae* is the bacterium most often responsible for pneumonia relative to other bacteria. This research is to assess the susceptibility of *Klebsiella pneumoniae* isolated from the sputum of patients suspected of pneumonia to the medication Ciprofloxacin. Sputum samples were collected from patients suspected of pneumonia between May and June 2024 at the Syarifah Ambami Rato Ebu Bangkalan Madura District Hospital, with further analysis conducted at the Surabaya Public Health Laboratory Center. The used methodology is sputum cultivation using aerobic techniques. The study used was a descriptive survey, determined by simple random sampling of 30 samples. The test findings indicated that 1 out of 30 samples (3.3%) exhibited *Klebsiella pneumoniae* bacteria, generating an inhibition zone of 32 mm, classified as sensitive according to CLSI recommendations. This study recommends that future studies use *Klebsiella pneumoniae* isolate samples from the sputum of probable pneumonia patients aged 2 to 64 years.

Keywords: Pneumonia, *Klebsiella pneumoniae*, *Ciprofloxacin*

INTRODUCTION

Pneumonia is a lung infection that may cause moderate to severe sickness in persons of any age. Seniors aged 65 and older, children under the age of five, adults with specific medical disorders or comorbidities, and smoking all increase the chance of having pneumonia (Centers for Disease Control and Prevention, 2020).

According to WHO statistics (2019), pneumonia killed 740,180 children under the age of five in 2019, accounting for 14% of all fatalities in children under five and 22% of all deaths in children aged one to five years. Pneumonia affects children and families worldwide, although the most fatalities occur in South Asia and Sub-Saharan Africa. According to Riskesdas (2018), the number of pneumonia cases increases with age. It reached 2.5% in the 55-64 age group, 3.0% in the 65-74 age group, and 2.9% in the 75+ age group.

Bacteria, viruses, fungi, or parasites all cause pneumonia, although bacteria are the most common cause. *Streptococcus pneumoniae*, *Haemophilus influenzae*, *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Legionella* sp., *Pseudomonas aeruginosa*, and *Acinobacter* sp. are the most prevalent bacteria responsible for pneumonia. The pathogen spreads quickly by direct contact with sputum and droplets from pneumonia patients' coughs or sneezes (Agustina et al., 2019). Pneumonia is often caused by harmful microorganisms in the lower respiratory tract. According to Alfarizi (2017), the most common microbe that causes pneumonia is *Klebsiella pneumoniae*.

Sputum is a mucous substance (made up of cells and other components) that is released into the respiratory system (lungs, bronchi, and trachea) and evacuated by coughing or swallowing. Sputum is composed of 95% water and 5% organic components, including carbohydrates (such as sialic acid, which contributes to its high viscosity), proteins (enzymes, immunoglobulins), and glycoproteins, all of which contribute to sputum's viscoelastic qualities. Normal sputum is white or colorless, however greenish yellow might indicate pus or illnesses like pneumonia. Blood in sputum is referred to as hemoptysis (produced by lung cancer, TB, lung abscess, or hemorrhage), and the rust color is created by decaying hemoglobin. The status of hydration in the body influences sputum viscosity.

According to K., Thomas, and Ramyashree (2016), *Klebsiella pneumoniae* is the most sensitive to Ciprofloxacin. Ciprofloxacin is a second-generation fluoroquinolone that may be

used orally or intravenously. Fluoroquinolone has high effectiveness against gram-negative aerobic bacteria but is only effective against gram-positive species. Ciprofloxacin is active in vitro in clinical infections in most strains of bacteria, including *Klebsiella pneumoniae* (Sharma et al., 2017).

Based on this background, it is necessary to conduct research on the sensitivity test of *Klebsiella pneumoniae* from sputum of patients with suspected pneumonia to the antibiotic *Ciprofloxacin*.

METHOD

The research sample was a sputum sample of suspected pneumonia patients at the Syarifah Ambami Rato Ebu Bangkalan Madura Hospital. 30 sputum samples were collected from probable pneumonia patients at the Syarifah Ambami Rato Ebu Bangkalan Madura Hospital between May and June 2024.

The sort of study undertaken is descriptive research, which involves characterizing a societal phenomena (Notoatmodjo, 2018). The purpose of this research was to investigate the sensitivity of *Klebsiella pneumoniae* from sputum of suspected pneumonia patients to the medication *Ciprofloxacin*.

In this investigation, the Simple Random Sampling approach was used. Simple random sampling ensures that every member or unit of the population has an equal probability of being chosen. If the required sample size is different, the likelihood for each elementary unit to be picked likewise changes (Notoatmodjo. S, 2018).

RESULTS AND DISCUSSION

- Sputum quantity by gender
 - Man : 17
 - Woman : 13
- Sputum Amount by Age (Years)
 - 0-10 : 1
 - 11-20 : 2
 - 21-30 : 1
 - 31-49 : 7
 - >50 : 19
- Amount of *Streptococcus viridans* bacteria found (Normal flora): 30
- Number of pathogenic germs found : 13
 - *Klebsiella pneumoniae* : 1
 - *Acinobacter baumannii* : 1
 - *Staphylococcus aureus* : 9
 - *Streptococcus agalactiae* : 1
 - *Streptococcus pyogenes* : 1
 - *Streptococcus pneumoniae* : 1
 - *Pseudomonas aeruginosa* : 1

Notes:

There is 1 sample found 3 species of pathogenic germs, namely *Staphylococcus aureus*, *Streptococcus pyogenes*, *Pseudomonas aeruginosa*.

- Number of pathogenic germs not found : 17
- From the sensitivity test *Klebsiella pneumoniae* to *Ciprofloxacin* obtained a resistance of 32 mm with a sensitive category.
 To calculate the percentage of a result using the following formula (Sugiyono, 2018):

$$P = \frac{F}{N} \times 100 \%$$

Information:

P = Percentage

F = Frequency of the number obtained from the research results

N= Number of research samples

- By gender

Table 1 Amount of sputum by gender

Gender	Amount	Percentage (%)
Man	17	57
Woman	13	43
Total	30	100

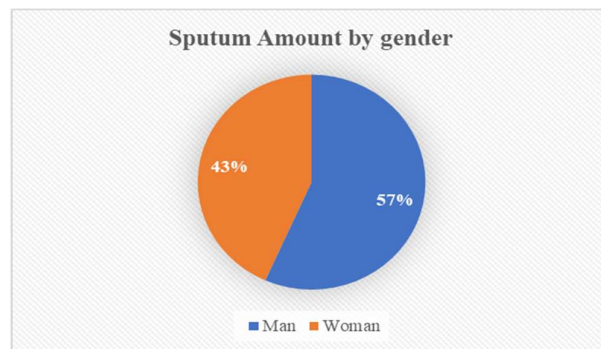


Figure 1. Diagram of the results of the percentage of sputum amount by gender

- By Age (Years)

Table 2 Amount of sputum by age (years)

Age (years)	Amount	Percentage (%)
0 – 10	1	3
11 – 20	2	7
21 – 30	1	3
31 – 49	7	23
>50	19	64

- Based on Type of Germs

Table 3 Amount of sputum by type germs

Types of Germs	Amount Germs	Percentage (%)
<i>Klebsiella pneumoniae</i>	1	3.3
<i>Acinetobacter baumannii</i>	1	3.3
<i>Staphylococcus aureus</i>	9	29.5
<i>Streptococcus agalactiae</i>	1	3.3
<i>Streptococcus pyogenes</i>	1	0.3

<i>Streptococcus pneumoniae</i>	1	3.3
<i>Pseudomonas aeruginosa</i>	1	0.3
No found pathogenic germs	17	56.7

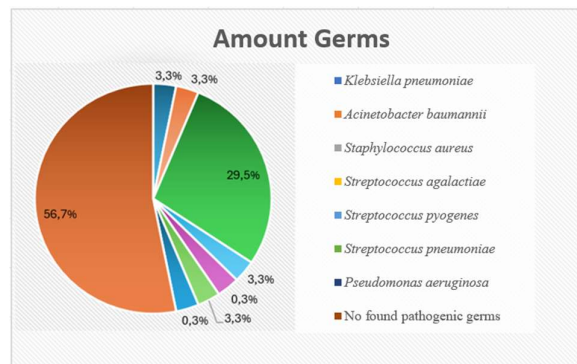


Figure 2. Diagram of the results of the percentage of sputum amount germs

All samples were positive for Viridans streptococci. *Klebsiella pneumoniae* was found in one out of every thirty samples (3.3 percent). Ciprofloxacin exhibited a 32 mm resistance to *Klebsiella pneumoniae* in the sensitivity test, placing it in the sensitive group. Results are classed as sensitive (≥ 21 mm), intermediate (16-20mm), and resistant (≤ 15 mm) based on Clinical and Laboratory Standards Institute (CLSI) guidelines.

The sensitivity test findings for *Klebsiella pneumoniae* in 30 sputum samples from suspected pneumonia patients at Syarifah Ambami Rato Ebu Bangkalan Madura Regional Hospital against the drug ciprofloxacin. Based on the gender of probable pneumonia patients, 17 samples (57%) were male and 13 samples (43%) were female. In this study, the youngest age was 8 years and the oldest age was 85 years with the largest age group at >50 years, namely 19 samples (64%). Advanced age is associated with decreased body defense mechanisms which make a person susceptible to infection. It was found that 1 out of 30 samples (3.3%) detected bacteria *Klebsiella pneumoniae*. From the sensitivity test *Klebsiella pneumoniae* to Ciprofloxacin obtained a resistance of 32 mm with a sensitive category.

The examination that of the 30 sputum samples suspected of pneumonia, 30 samples (100%) showed bacterial growth results *Streptococcus viridans* positive. *Streptococcus viridans* are normal flora bacteria in the oral cavity and upper respiratory tract of humans which can be pathogenic if there is a disruption of the immune system or changes in the balance of normal flora (Medicine & Universities, 2022).

For 13 samples showing the growth of pathogenic germs and 17 samples not showing the growth of pathogenic germs, this can be caused by the quality of the sample, including patients who cannot produce phlegm, thin phlegm samples and not purulent. However, it does not rule out the possibility of anaerobic bacteria that cannot be further examined. The culture findings revealed a variety of bacteria species, including *Klebsiella pneumoniae*, *Acinetobacter baumannii*, *Staphylococcus aureus*, *Streptococcus agalactiae*, *Streptococcus pyogenes*, *Streptococcus pneumoniae*, and *Pseudomonas aeruginosa*, a pathogenic bacterial species.

The microorganisms responsible for pneumonia include *Streptococcus pneumoniae*, *Haemophilus influenzae*, *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Legionella* sp., *Pseudomonas aeruginosa*, and *Acinetobacter* sp. (Agustina et al., 2019). Pneumonia is often caused by harmful microorganisms in the lower respiratory tract. According to Alfarizi (2017), the most microorganisms that cause pneumonia are *Klebsiella pneumoniae*. The same thing was also reported by Lubis et al (2016), that *Klebsiella pneumoniae* is the bacteria that most often causes pneumonia compared to other bacteria. However, in this study, the most

microorganisms were *Staphylococcus aureus* namely 9 sputum samples from 30 samples. While from 30 samples for bacteria *Klebsiella pneumoniae* found 1 sample (3.3%).

According to K., Thomas, and Ramyashree (2016), *Klebsiella pneumoniae* is often isolated from sputum samples and has a propensity to be resistant to antibiotics. *Klebsiella pneumoniae* was shown to be the most sensitive to Ciprofloxacin, by 68%. In this research, *Klebsiella pneumoniae* was tested for sensitivity to Ciprofloxacin, with an inhibitory power of 32 mm in the sensitive group. The CLSI M100 recommendations provide three levels of interpretation: sensitive (>21 mm), moderate (16-20 mm), and resistant (<15 mm) (Weinstein & Lewis, 2020). In comparison to other bacteria tested for susceptibility to Ciprofloxacin, *Klebsiella pneumoniae* is more sensitive.

Ciprofloxacin is a fluoroquinolone antibiotic with bactericidal properties. It prevents DNA replication by inhibiting bacterial DNA topoisomerase and DNA gyrase. Ciprofloxacin is the most effective fluoroquinolone against gram-negative bacteria (M. Zito, 2023). The enzyme DNA gyrase belongs to the topoisomerase class. DNA topoisomerase is an enzyme that catalyzes changes in DNA's topological state, including relaxed and supercoiled forms, linked species, and bound and unbound DNA (Wikipedia, 2023). *Klebsiella pneumoniae* is classified as a gram-negative bacterium and belongs to the Enterobacteriaceae family (John V. Ashurst; Adam Dawson, 2023). As a result, antibiotics are the most susceptible bacteria to Ciprofloxacin *Klebsiella pneumoniae*.

CONCLUSION

Based on the results of this study, it can be concluded with the following explanation:

1. Found 1 out of 30 samples (3.3%) detected bacteria *Klebsiella pneumoniae*.
2. From the sensitivity test *Klebsiella pneumoniae* to Ciprofloxacin forming an inhibition zone of 32 mm.
3. Results of sensitivity test analysis *Klebsiella pneumoniae* from sputum of suspected pneumonia patients to antibiotics *Ciprofloxacin* according to CLSI guidelines it is stated in the sensitive category.

So, suggestions for further researchers can be made by using isolate samples. *Klebsiella pneumoniae* from sputum of suspected pneumonia patients aged 2 to 64 years.

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