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ORIGINAL ARTICLE

Erythrocyte sedimentation rate in new cases of pulmonary tuberculosis patients

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ABSTRACT

This study focuses on the significant health issue of tuberculosis (TB), with Indonesia ranking as the second-highest country worldwide in TB incidence. Diagnostic advancements, including the Rapid Molecular Test (RMT), such as GeneXpert MTB/RIF Ultra, have been pivotal in identifying TB cases. In pulmonary tuberculosis, the Erythrocyte Sedimentation Rate (ESR) reveals an inflammatory process marked by elevated fibrinogen and plasma globulin levels linked to acute-phase reactions. This research, conducted at Waled Regional General Hospital, employs a quantitative descriptive approach with purposive sampling. Data on patient characteristics, new pulmonary TB cases, and ESR results are extracted from medical records, covering the period from January to June 2023. Among the 66 patients who meet the inclusion criteria, the majority (74.2%) belong to the adult age group, with males comprising 68.2%. ESR elevation is observed in 87.9% of cases, averaging 78.3 mm/hour, ranging from 5 to >140 mm/hour. ESR increase is prominent in adult males (83.7%), possibly linked to their higher daily activity and social interactions, enhancing exposure to Mycobacterium tuberculosis. Furthermore, ESR elevation in adult males may be attributed to a higher likelihood of smoking and alcohol consumption, potentially diminishing macrophage, CD4+, CD8+, and T cell activities and consequently intensifying inflammatory processes. This research sheds light on the prevalence and factors contributing to pulmonary tuberculosis, providing valuable insights for targeted interventions and public health strategies.

Keyword: Erythrocyte sedimentation rate, mycobacterium tuberculosis, new cases, pulmonary tuberculosis, rapid molecular test.

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INTRODUCTION

Tuberculosis (TB) is one of the most chronic infectious diseases and continues to be a global public health concern. Indonesia ranks as the second-highest country worldwide in terms of TB incidence, following India. In 2021, Indonesia estimated 969,000 cases, translating to 354 cases per 100,000 people. According to data from West Java Province, there were 37,846 TB cases in 2019. Erythrocyte Sedimentation Rate (ESR) is a laboratory test that measures the rate at which red blood cells settle in blood. ESR is widely used to assess the inflammatory process and monitor therapy success in pulmonary tuberculosis. In pulmonary tuberculosis, ESR examination indicates an increase in fibrinogen and plasma globulin levels associated with the acute phase reaction.[3,4]

Studies have shown significant ESR increases among TB patients, with variations based on gender and age, highlighting the higher susceptibility of adults and males to elevated ESR levels. Kasih and Sulastina's study in Palembang in 2019 found a 100% increase in ESR values in pulmonary TB patients. Among the male group, 57% showed a 100% increase, while among females, 43% showed the same. Regarding age groups, adults accounted for the highest percentage at 43%, experiencing a 100% increase, while the elderly group accounted for 46%, also with a 100% increase. Pratiwi et al. research in Madiun in 2019 on TB patients revealed that among 18 individuals (60%) aged 15-50 years and 12 individuals (40%) aged >50 years, there were 20 males (67%) and 10 females (33%), with an average ESR value of 71 mm/hour. The ESR value increased in 29 individuals (96.6%).[5,6]

The World Health Organization (WHO) recommends molecular methods, including the GeneXpert MTB/RIF Ultra test, for pulmonary TB examinations. This method diagnoses TB and swiftly and accurately identifies rifampicin resistance. The RMT GeneXpert MTB/RIF Ultra test demonstrates significantly better sensitivity and specificity for diagnosing pulmonary TB compared to microscopic examinations, approaching the diagnostic quality of culture tests.[7-10] This research aims to determine the results of the ESR examination in new cases of pulmonary tuberculosis patients at Waled Regional General Hospital in Cirebon Regency based on patient characteristics. Understanding these patterns could provide insights for targeted interventions and public health strategies in the hope of addressing TB more effectively.

METHODS AND SUBJECT

This study obtained data from medical records at Waled Regional General Hospital in Cirebon Regency from January 2023 to June 2023. The research design is a quantitative descriptive study with a purposive sampling technique.

The sample size was determined based on a power analysis to ensure it was sufficient to detect meaningful differences in ESR values among different demographic groups. Subjects meeting the inclusion criteria were new cases of pulmonary TB patients based on the results of the RMT GeneXpert MTB/RIF Ultra examination, with Erythrocyte Sedimentation Rate (ESR) test results from January to June 2023, and who had not received Anti-Tuberculosis Drug (ATD) treatment before. The ESR test was conducted using the Westergren method, with normal ESR values being 0-15 mm/hour for males and 0-20 mm/hour for females. This study obtained ethical approval from the Research Ethics Committee of Waled Regional General Hospital.

Data from this research were then processed and analyzed to describe characteristics based on age, gender, and ESR values in new cases of pulmonary tuberculosis patients.

RESULTS AND DISCUSSION

The following presents the results of the data analysis of the characteristics of new cases of pulmonary TB patients based on age, gender, and Erythrocyte Sedimentation Rate (ESR) values at Waled Regional General Hospital.

1. New Cases of Pulmonary TB Patients Based on Age

Age characteristics in this study were categorized into three categories: adolescents (10-19 years), adults (20-59 years), and the elderly (>60 years).[11,12] In this study, new cases of pulmonary TB patients were found based on age, with two individuals (3.0%) classified as adolescents, 49 individuals (74.2%) as adults, and 15 individuals (22.8%) as elderly, as shown in Table 1.

Table 1. New Cases of Pulmonary TB Patients Based on Age

Characteristic	Number of (n)	Percentage (%)
Age (year)		
Teenager (10-19)	2	3.0
Adult (20-59)	49	74.2
Elderly (>60)	15	22.8
Total	66	100

2. New Cases of Pulmonary TB Patients Based on Gender

According to this study, the majority of new cases of pulmonary TB patients were males, with 45 individuals (68.2%), while females accounted for 21 individuals (31.8%), as shown in Table 2.

Table 2. New Cases of Pulmonary TB Patients Based on Gender

Characteristic	Number of (n)	Percentage (%)
Sex		
Male	45	68.2
Female	21	31.8
Total	66	100

3. Erythrocyte Sedimentation Rate (ESR) Results in New Cases of Pulmonary TB Patients

Results of the Erythrocyte Sedimentation Rate (ESR) examination in new cases of pulmonary TB patients at Waled Regional General Hospital showed an increase in 58 individuals (87.9%). The average ESR value was 78.3 mm/hour, with a range from the lowest ESR value of 5 mm/hour to the highest ESR value exceeding >140 mm/hour, as presented in Table 3. The normal ESR values are 0-15 mm/hour for males and 0-20 mm/hour for females.

Table 3. Erythrocyte Sedimentation Rate (ESR) Results in New Cases of Pulmonary TB Patients

ESR (mm/hour)	Number of (n)	Percentage (%)
Normal	8	12, 1
Increasing	58	87, 9
Mean: 78,3		
Range: 5 - >140		
Total	66	100

4. Erythrocyte Sedimentation Rate (ESR) Results in New Cases of Pulmonary TB Patients Based on Age and Gender

In this study, the results of the Erythrocyte Sedimentation Rate (ESR) examination that showed an increase in new cases of pulmonary TB patients based on age and gender were as follows: for adolescents, 2 individuals (100%); for adults, 41 individuals (83.7%); for the elderly, 15 individuals (100%). Based on gender, the increase was observed in males with 40 individuals (88.9%) and females with 18 individuals (85.7%), as shown in table 4.

Table 4. Erythrocyte Sedimentation Rate (ESR) Results in New Cases of Pulmonary TB Patients Based on Age and Gender

Characteristic	ESR		Total	Total of Subject
	Normal	Increasing		
Age				
Teenager	0 (0%)	2 (100%)	2	66 (100%)
Adult	8 (16,3%)	41 (83,7%)	49	
Elderly	0 (0%)	15 (100%)	15	
Sex				
Male	5 (11,1%)	40 (88,9%)	45	66 (100%)
Female	3 (14,3%)	18 (85,7%)	21	

Discussion

Based on the research results, the characteristics of age in pulmonary TB patients show a higher prevalence in adults compared to teenagers and the elderly. According to the Indonesian Ministry of Health's report on the tuberculosis control program in 2022, the highest age group affected is 45-54 years. Tanti's study in Purwokerto in 2023 stated that the age range of 15-50 years is considered productive and susceptible to pulmonary TB due to the tendency of adults to have high activity and social interactions.[14,15]

Regarding the gender characteristics of TB patients, males are more affected than females. This is likely because males are more prone to smoking and alcohol consumption compared to females. Exposure to excessive tobacco and alcohol can damage the mucosal secretion process in the tracheobronchial region and harm alveolar macrophages. Kumar's study in India in 2019 found a male-to-female ratio of TB patients of 5:1. The Ministry of Health's report in 2022 showed a higher prevalence of male TB patients compared to females, with 57.7% males in 2021 and 57.8% in 2022. This aligns with Ningrum WL's research in Tangerang Selatan in 2017, stating that male patients with pulmonary TB are more numerous due to their higher social activities, alcohol and tobacco consumption, which can reduce the activity of macrophages, CD4+ lymphocytes, CD8+ lymphocytes, and T cells, thus lowering the body's immune system and making them more susceptible to Mycobacterium tuberculosis exposure, potentially increasing ESR values.[14,16,17]

Based on the examination results, the ESR values of new pulmonary TB patients often show an increase. Sonti's study in India in 2022 found that all 324 individuals diagnosed with pulmonary TB had increased ESR values. Bashir's research in Sudan in 2014 with a sample of 100 individuals showed a 100% increase in ESR values, ranging from 50 mm/hour to 155 mm/hour. Martins' study in Brazil in 2014, with a sample of 51 individuals, found an 88.24% increase in ESR values. This could be due to the inflammatory process in pulmonary TB, leading to acute-phase proteins with positive charges that neutralize erythrocyte membranes, reducing resistance and causing erythrocyte aggregation, forming rouleaux, and resulting in an increased ESR.[4,18,19]

In conclusion, the research on ESR results in new pulmonary TB patients with increased ESR values is predominantly observed in males and adults. Kasih's study in Palembang in 2019 found that 57% of male patients had a 100% increase in ESR values, and 43% of female patients had the same. Pratiwi et al.'s research in Madiun in 2019 showed that 67% of male patients and 43% of adults had a 100% increase in ESR values. This could be attributed to the higher prevalence of smoking and alcohol consumption among males and adults, leading to increased inflammation in the body.[5,6,20]

CONCLUSION

Based on the findings of this study, the majority of new cases of pulmonary TB occurred in adults (20-59 years old) with 49 individuals (74.2%), comprising 45 males (68.2%) and 21 females (31.8%). Erythrocyte Sedimentation Rate (ESR) values increased in 58 individuals (87.9%), with an average ESR value of 78.3 mm/hour and a range of ESR values from 5 to >140 mm/hour. The increase in ESR values was predominant in adults, with 41 individuals (83.7%), and in males, with 40 individuals (88.9%).

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DECLARATION OF INTEREST

There is no conflict of interest with any party involved in the writing of this scientific work.

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