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The Correlation Between Widal Diagnostic Test, Total Leukocyte Count, and Platelet Count in Suspected Typhoid Fever Patients at RS Aura Syifa Kediri

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Abstract

Typhoid fever is an acute systemic infectious disease that is related to poor personal hygiene and environmental sanitation. The diagnosis of typhoid fever is established through laboratory examinations, including serological, hematological, and bacteriological tests. This research aims to determine the correlation between the Widal diagnostic test and the total leukocyte count and platelet count in suspected typhoid fever patients at RS Aura Syifa Kediri. The study design used in this research is quantitative descriptive analysis with a cross-sectional approach. The data was collected retrospectively from secondary sources, specifically medical records of patients from August 1, 2021, to March 31, 2022, at RS Aura Syifa Kediri. The total population comprised 157 patients, and a purposive sampling method was used to select 41 patients who met the inclusion and exclusion criteria. The statistical analysis using the Spearman correlation test resulted in p-values $\geq \alpha = 0.05$ for the following correlations: Widal test O with leukocytes ($0.538 \geq 0.05$), Widal test H with leukocytes ($0.915 \geq 0.05$), Widal test O with platelets ($0.476 \geq 0.05$), and Widal test H with platelets ($0.965 \geq 0.05$). These findings indicate that there is no significant correlation between the Widal test O and H with the platelet count in patients with typhoid fever. Therefore, it can be concluded that there is no significant relationship between the Widal test O and H results and the platelet count in typhoid fever patients.

Keywords: Widal; leukocytes; platelets; *S. Typhi*.

INTRODUCTION

Typhoid fever is a frequently occurring infectious disease caused by an infection (Mudiono, 2019). One of the infectious diseases is Typhus, which includes Typhoid fever, Abdominal Typhus, and Enteric Fever (Oktaviana, 2021) caused by the gram-negative bacterium Salmonella (S.) enterica serovar Typhi (Jong et al., 2018). According to Law Number 6 of 1962 on Epidemiological Diseases, typhoid fever is classified as a communicable disease. Communicable diseases are easily spread and can affect many people, leading to outbreaks (Idrus, 2020). In 2020, the Indonesian Ministry of Health listed typhoid fever as one of the communicable diseases in the Action Plan for Control and Prevention of Communicable Diseases 2020-2024 (Kemenkes RI, 2020).

According to the World Health Organization (WHO), there are 11-20 million cases of typhoid fever worldwide each year, with 128,000 to 161,000 deaths annually (WHO, 2018). Based on data from the East Java Provincial Health Office in 2013, there were 1,774 typhoid patients in East Java, and 1,489 of them tested positive for Widal (Awa, 2019). In Kediri City, data from the Health Office showed that there were 908 typhoid patients between 2015 and 2016, with 158 patients testing positive for Widal (Farodis, 2020).

Typhoid fever is an acute systemic infectious disease (Ardiaria, 2019) transmitted through the fecal-oral route, often through the consumption of contaminated food or drink containing *S. typhi* bacteria (Radhakrishnan et al., 2018). The bacteria enter the digestive tract, intestines, and intestinal lymph nodes, then travel through the bloodstream to the liver and spleen. Typhoid fever can occur at any age, from infants and children to adults (Renowati, 2019).

Clinical symptoms of typhoid fever are characterized by prolonged high fever (Jong et al., 2018). The fever typically occurs in the evening or at night and may start without clinical symptoms (Handayani, 2017). Children usually have milder symptoms compared to adults. The incubation period is 10 to 20 days, and prodromal symptoms appear during this period, manifesting as fatigue, fever, weakness, dizziness, and headaches. The clinical symptoms of typhus patients range from mild to severe, from asymptomatic cases to those with complications and even death (Kasim, 2020). Therefore, maintaining a clean lifestyle is crucial (Renowati, 2019).

There are three types of laboratory tests for diagnosing typhoid, including serological, blood, and bacteriological examinations (Priskila, 2021). Hematological changes often occur in typhoid fever, including anemia, leukopenia, eosinophilia, and thrombocytopenia. Leukopenia and thrombocytopenia are characteristic findings in the total leukocyte count examination (Syahniar et al., 2020). Serological tests used for diagnosing typhus include the Widal test and the IgM *S. typhi* test (Cerqueira, 2019).

Based on the data on the number of typhoid patients (including cases and deaths), it is essential to establish the diagnosis of suspected typhoid fever. Therefore, the researcher is interested in the title "The Relationship between the Widal Diagnostic Test and the Total Leukocyte and Platelet Counts in Suspected Typhoid Fever Patients at RS Aura Syifa Kediri".

MATERIALS AND METHODS

This study employed a quantitative descriptive analysis, specifically a cross-sectional research design, to explore the relationship between Widal diagnostic test results and the total leukocyte and thrombocyte counts in suspected typhoid fever patients at RS Aura Syifa Kediri. The data were collected from secondary sources through a retrospective approach, involving medical records of patients from August 1, 2021, to March 31, 2022. Retrospective research refers to studying past events (Nur, 2021). The sampling method used was purposive, selecting 41 patients who met the inclusion and exclusion criteria. Data processing involves statistical analysis using the Spearman correlation test to identify the relationship between the two variables, which will be presented in percentage form. Data analysis was facilitated through computerized software, specifically SPSS 26.0 (64-bit). Data processing steps included editing, coding, entry, data cleaning, and saving.

RESULTS AND DISCUSSION

Table 1. Distribution of Respondents Based on Widal Test, Leukocyte Count, and Thrombocyte Count in Suspected Typhoid Fever Patients.

Variable	F	%
Titer O		
Positive 1/160	9	82
Positive 1/320	2	18
Total	11	100
Titer H		
Positive 1/160	31	78
Positive 1/320	9	23
Total	40	100
Leukocyte		
Leukopenia (<3.500 Sel/cmm)	1	25
Normal (3.500 – 10.000 Sel/cmm)	24	59
Leukocytosis (>10.000 Sel/cmm)	16	39
Total	41	100
Thrombocyte		
Thrombocytopenia (<150.000 Sel/cmm)	7	17
Normal (150.000-450.000 Sel/cmm)	32	78
Thrombocytosis (>450.000 Sel/cmm)	2	5
Total	41	100

In the total leukocyte count, there was a decrease in leukocytes (leukopenia) in 1 patient (25%), which is attributed to leukocytes fighting against infections or high fever. There were 24 patients (59%) with normal leukocyte counts, and 16 patients (39%) showed an increase in leukocytes (leukocytosis). The increase in leukocyte count (leukocytosis) in patients with typhoid fever indicates the presence of an infection in their bodies, as leukocytes increase to initiate and maintain the body's defense mechanism against the infection. This study is consistent with research conducted by Wibawati (2017), which reported a leukopenia rate of 17%, a normal leukocyte count in 48% of patients, and leukocytosis in 35% of patients. In this study, the majority of patients had a normal leukocyte count, which aligns with the theory that patients with typhoid fever can have a normal leukocyte count.

In the case of a decrease in the number of platelets (thrombocytopenia), there were 7 patients (17%) affected. Thrombocytopenia is caused by the endotoxin from Salmonella bacteria directly attacking the bone marrow, leading to a halt in the maturation phase of platelets. The study found that 32 patients (78%) had a normal platelet count, and 2 patients (5%) showed an increase in platelets (thrombocytosis). The increase or decrease in platelet count in patients with typhoid fever depends on the patient's immune condition and the bacterial infection attacking the body.

This study is supported by research conducted by Wibawati (2017), which reported that 87% of patients had a normal platelet count (>150,000), while 13% of patients had decreased platelet count (thrombocytosis) with a count ≤ 150,000. The study results indicated mild leukopenia and thrombocytopenia, mild leukocytosis, mild thrombocytosis, and average leukocyte and platelet counts within the normal range.

The statistical analysis using Spearman correlation between Widal test titer O and the total leukocyte count resulted in a correlation coefficient of -0.209, indicating a weak correlation between Widal test titer O and the total leukocyte count (below 0.5). The negative sign ('-') indicates that higher Widal titers correspond to a decrease in the total leukocyte count. The output Sig. (2-tailed) for the correlation of Widal test titer O with the total leukocyte count yielded a probability value of 0.538. As this value is above 0.05, Ho is accepted and Hi is rejected, indicating that there is no significant relationship between Widal test titer O and the total leukocyte count.

The statistical analysis using Spearman correlation between Widal test titer O and the platelet count resulted

in a correlation coefficient of -0.241, indicating a weak correlation between Widal test titer O and the platelet count (below 0.5). The negative sign ('-') indicates that higher Widal titers correspond to a decrease in the platelet count. The output Sig. (2-tailed) for the correlation of Widal test titer O with the platelet count yielded a probability value of 0.476. As this value is above 0.05, Ho is accepted and Hi is rejected, indicating that there is no significant relationship between Widal test titer O and the platelet count.

The statistical analysis using Spearman correlation between Widal test titer H and the total leukocyte count resulted in a correlation coefficient of -0.017, indicating a weak correlation between Widal test titer H and the total leukocyte count (below 0.5). The negative sign ('-') indicates that higher Widal titers correspond to a decrease in the total leukocyte count. The output Sig.(2-tailed) for the correlation of Widal test titer H with the total leukocyte count yielded a probability value of 0.915. As this value is above 0.05, Ho is accepted, and Hi is rejected, indicating that there is no significant relationship between Widal test titer H and the total leukocyte count.

The statistical analysis using Spearman correlation between Widal test titer H and the platelet count resulted in a correlation coefficient of 0.007, indicating a weak correlation between Widal test titer H and the platelet count (below 0.5). The positive sign ('+') indicates that higher Widal titers correspond to an increase in the platelet count. The output Sig. (2-tailed) for the correlation of Widal test titer H with the platelet count yielded a probability value of 0.965. As this value is above 0.05, Ho is accepted, and Hi is rejected, indicating that there is no significant relationship between Widal test titer H and the platelet count.

Discussion

The results of the Spearman correlation analysis showed that there is no relationship between the Widal test and the total leukocyte count, as the statistical analysis yielded a significant value of p≥α=0.05 for both Widal O with leukocytes (0.538≥0.05) and Widal H with leukocytes (0.915≥0.05). Therefore, the relationship between the two variables indicates that Widal O and H are not related to the total leukocyte count in typhoid fever patients.

These findings are consistent with a study conducted by Wulandari (2019), which also showed no significant relationship between the total leukocyte count and Widal H and O, using the chi-square test for the relationship between the total leukocyte count and Widal H (0.36≥0.05) and the total leukocyte count with Widal O (0.58≥0.05).

The relationship of the Widal test with the total leukocyte count in this study is represented by several suspected typhoid fever patients, wherein a higher Widal titer results in a decrease in total leukocyte count, while a higher Widal titer is associated with an increase in the total leukocyte count. However, some suspected typhoid fever patients exhibited high Widal titers with normal total leukocyte counts. This occurs due to variations in patients' immune responses and the level of resistance to the bacteria.

The results of the Spearman correlation analysis showed that there is no relationship between the Widal test and the platelet count, as the statistical analysis yielded a significant value of p≥α=0.05 for both Widal O with platelets (0.476≥0.05) and Widal H with platelets (0.965≥0.05). Therefore, the relationship between the two variables indicates no significant correlation with the platelet count in Widal O and H tests in typhoid fever patients.

These findings are consistent with a study conducted by Widary (2021), which stated that there is no significant relationship between Widal titer and the quantity and index of platelets in typhoid fever patients, as the statistical tests yielded P ≥ 0.05, with a platelet titer value of p = 0.429, index of platelet MPV of p = 1.000, and PDW of P = 0.291, based on Spearman correlation analysis with results (p) ≥ α = 0.05.

The results of this study are also in line with a study by Fitriani (2021), which demonstrated no relationship between Widal titer and lymphocytes and platelet count in typhoid fever patients at Puskesmas Gunungsari Lombok Barat, as the Pearson Correlation test showed that $p > \alpha = 0.05$ for lymphocytes and the antigen was $p = 0.758$, while for platelets and the antigen was $p = 0.098$. Lymphocyte titer was $p = 0.051$, and platelet titer was $p = 0.035$.

The relationship between the Widal test and the platelet count in this study is indicated by the examination of several cases of suspected typhoid fever patients, wherein a higher Widal titer leads to a decrease in platelet count. Conversely, a higher Widal titer results in an increase in platelet count. However, some suspected typhoid fever patients exhibited high Widal titers with normal platelet counts.

Several factors influence the variation in platelet count in each blood sample of typhoid fever patients, such as variations in individual immunity, nutritional intake, the duration of the disease, the presence of other illnesses, the intake of antibiotics, and vaccination. Errors in pre-analytical factors can also occur due to inadequate and imprecise sample homogenization, potentially leading to pseudo thrombocytopenia (false thrombocytopenia) caused by platelet aggregation (clumping of platelets) (Widary, 2021).

The serological parameters of the Widal test depend on the time of specimen collection and the increase in lectin titers against *S. typhi* antigens. The best increase in antibody titers detected by the serological Widal test typically occurs in the second and third weeks, at 95.7%, while the increase in titers in the first week is only 85.7%. The Widal test requires two examinations, the acute phase, and the convalescent phase (recovery

phase), separated by 10-14 days. The diagnosis is confirmed by a four-fold or higher increase in titers during the acute phase. However, in this study, patients were in both the acute and convalescent phases (healing phase).

CONCLUSIONS

There is no significant relationship between the Widal diagnostic test and the total leukocyte count and platelet count in patients with suspected typhoid fever at RS Aura Syifa Kediri. The statistical analysis showed significant values of $p \geq \alpha = 0.05$ for Widal test titer O compared to the total leukocyte count ($0.538 \geq 0.05$), Widal test titer H compared to the total leukocyte count ($0.915 \geq 0.05$), Widal test titer O compared to the platelet count ($0.476 \geq 0.05$), and Widal test titer H compared to the platelet count ($0.965 \geq 0.05$). This may be due to the lack of information on patients' acute and convalescent phases in this study.

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