Description Of Laboratory Results Of Patients With Co-Infection TB-HIV/AIDS at Dr. Mohammad Hoesin Palembang Period May 2022-May 2023

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Abstract : *Human Immunodeficiency Virus* (HIV) infection is a high-risk factor for the development of TB cases. TB and HIV co-infection is a problem with case rates globally and in Indonesia still high. Information regarding characteristics such as age, gender, and laboratory results including hemoglobin levels and CD4 cell counts is needed to support prevention and treatment programs for TB/HIV co-infection. This research aims to determine the description of the laboratory results of TB-HIV/AIDS co-infection sufferers at Dr.Mohammad Hoesin Hospital, Palembang for the period May 2022-May 2023. This research uses descriptive observational research by observing medical record data and laboratory data at Dr. Mohammad Hoesin Hospital. Mohammad Hoesin Palembang who met the inclusion criteria. The number of TB-HIV co-infection sufferers found at Dr. Mohammad Hoesin Palembang received 42 cases. The prevalence of sufferers is predominantly male (66%). Based on age, most were found at the age of 30-40 years (47.6%). From the results of the CD4 cell examination, most patients had a CD4 cell count <100 cells/mm3 (69%). Examination of hemoglobin levels was dominated by patients with low hemoglobin levels, namely (71.4%). The majority of cases of TB-HIV/AIDS co-infection at RSUP Dr. Mohammad Hoesin Palembang for the period May 2022-May 2023 is male, aged 30-40 years , has a CD4 cell count <100 cells/mm3, low hemoglobin level (<13 (L)/ <12(P) g/dl).

1. INTRODUCTION

Human immunodeficiency virus (HIV) is an enveloped retrovirus containing a single-stranded RNA genome copy, consisting of 2 groups, namely HIV-1 and HIV-2. The HIV-1 group causes the most disorders and is more virulent throughout the world. This infection can cause *Acquired Immune Deficiency Syndrome* (AIDS), which is the last stage of HIV disease which can cause a person suffering from HIV to be more susceptible to various types of opportunistic infections such as tuberculosis (TB), opportunistic infections in HIV/AIDS patients are caused by a decrease in the body's immune system due to presence of infection (Vaillant AJ, 2022).

In 2022 the number of HIV cases in the world will reach 39 million people, which is a problem that still needs to be optimized for prevention and treatment.(WHO, 2023) TB is one of the causes of death in people with HIV infection throughout the world. According to the Global Tuberculosis Report released by WHO globally, the estimated number of deaths due to TB will increase between 2019 and 2021, with 1.4 million HIV-negative deaths and 187,000 HIV-positive people with a combined total of 1.6 million, an increase compared to last year. 2020 (WHO, 2023).

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Data on TB-HIV sufferers in Indonesia in 2021 was found to be 8,344 thousand cases. (TBC Indonesia, 2023) *Human Immunodeficiency Virus (HIV)* infection is a high-risk factor for the development of TB cases. (WHO, 2021) In people with HIV, TB is one of the most frequent and potentially fatal opportunistic infections. The development of TB will accelerate as the immune condition of HIV patients worsens and will cause typical symptoms in TB sufferers such as coughing, shortness of breath, abnormal weight loss. TB infection in people with HIV can cause high mortality rates. HIV infection in a person causes a progressive decrease in the number of CD4 cells which can increase the risk of developing TB infection. CD4 cells are known as central facilitators for cellular and humoral immune responses to exogenous antigens and are maintained constant in the human body through homeostatic mechanisms. HIV binds to CD4 cell molecules on the surface of *T-helper cells* and replicates within them. This destroys CD4 cells and causes a steady decline in this T cell population (HamadaY, et. al, 2021). TB patients also experience decreased hemoglobin levels associated with HIV infection (Ibrahim K, et. al, 2023). A decrease in hemoglobin levels can occur as a result of opportunistic infections, or micronutrient deficiencies, or can also be triggered by side effects of ART treatment which causes blood cell formation to be disrupted and causes an acceleration in the development of the patient's HIV disease which will affect the patient's nutritional status (Vijayan KV, et. al, 2017). In patients with HIV, it is important to consider other aspects of management such as clinical screening for other opportunistic infections in patients that require close clinical monitoring (Ibrahim K, et. al, 2023).

The World Health Organization recommends that TB testing be carried out in patients with confirmed HIV. The most common examination carried out is the BTA examination on sufferers. This BTA examination can be carried out using the acid-fast staining method (*Ziehl Neelsen*) or the sputum molecular rapid test with a *GeneXpert machine* (Meintjes G, et al, 2019).

Based on research conducted by Abdillah EK, et al (2022), the majority of HIV/AIDS patients with TB co-infection have poor clinical conditions. This research was conducted at Buleleng Hospital from January to June 2020 and found that the majority of patients suffering from HIV/AIDS co-infection with pulmonary TB were aged 26-35 years and there were more men than women. Most patients work more than do not work and are undernourished as measured by BMI (body mass index). The results of supporting examinations showed low hemoglobin levels, CD4 cell count <100 cells/mm3, and negative BTA staining results.

TB and HIV co-infection is a serious problem with case rates globally and in Indonesia still very high, if not handled properly it can become a threat to global public health. Delays in diagnosis and treatment often occur, which ultimately results in increased cases of death.

Based on this background, it is hoped that it can reduce the negative impact of TB-HIV co- infection, that treatment of TB-HIV co-infection can be carried out more efficiently, including timely diagnosis and adequate treatment. Therefore, it is necessary to carry out research regarding the description of laboratory results of patients with TB-HIV/AIDS co-infection, including the characteristics of age, gender, and laboratory results including hemoglobin levels, CD4 cell counts in patients with TB-HIV co-infection at RSUP Dr. Mohammad Hoesin Palembang.

2. METHOD

This research is an observational descriptive study using secondary data from medical records of patients suffering from TB-HIV/AIDS co-infection. This aims to find out the laboratory description of TB-HIV/AIDS co-infection sufferers at Dr. RSUP. Mohammad Hoesin Palembang. The population in this study were patients suffering from HIV/AIDS co-infection with TB who underwent laboratory tests at the first visit including hemoglobin and CD4 cell levels. The sample used in this study was secondary data from patient medical records in the form of laboratory examination results of all patients suffering from HIV/AIDS co-infection with TB at the first visit including hemoglobin and CD4 cell levels that met the inclusion criteria. The inclusion criteria in this study were complete data from laboratory examination results of HIV/AIDS co-infected TB patients including gender, age, hemoglobin level and CD4 cell count contained in the medical record data at the first visit at RSUP Dr. Mohammad Hoesin for the period May 2022- May 2023. Data processing was carried out by checking data, inputting data, and editing data using a computer with the Microsoft Excel 2019 application and IBM *Statistical Program for Social Science* (SPSS) Statistics 27. Data analysis was carried out after there were no errors in the data.

3. RESULTS

Based on research obtained using secondary data from the medical records of RSUP Dr. Mohammad Hoesin Palembang. The number of HIV/AIDS sufferers co-infected with TB who underwent laboratory tests including hemoglobin and CD4 cell levels at the first visit for the period May 2022- May 2023 was 52 samples, 42 of which met the inclusion criteria.Based on the gender distribution of TB- HIV/AIDS co-infection

sufferers, it can be seen in Table 1. The distribution of sufferers based on gender showed that of the 42 samples, 32 samples (76.2%) were male and 10 samples (23.8%) were female. This table is dominated by male patients with 32 samples (76.2%).

Table 1 Gender distribution of patients suffering from TB HIV/AIDS co-infection at Dr. Mohammad Hoesin Palembang.

Gender	Number (n)	Percentage (%)
Man	32	76.2%
Woman	10	23.8%
Total	**42**	**100%**

Based on age distribution, TB-HIV/AIDS co-infection sufferers were dominated by patients aged 30-40 years with 20 samples (47.7%). followed by 12 samples (28%) aged 17-30 years, and 10 samples (23.8%) aged >40 years from the 42 total samples available.

Table 2 Age distribution of patients suffering from TB-HIV/AIDS co-infection at RSUP Dr. Mohammad Hoesin Palembang.

Age	Number (n)	Percentage (%)
17-30	12	28.6%
30-40	20	47.6 %
40>	10	23.8%
Total	**42**	**100%**

Based on the results of CD4 cell examination, the majority of CD4 cell results were <100 cells/mm3 with a total of 29 samples (69%). Followed by examination results of 100-200 cells/mm3, 7 samples were obtained (16.7%), then patients with CD4 cell examination results >200 were 6 samples (14.3%).

Table 3 Distribution of results of an examination of CD4 cell counts of patients suffering from TB-HIV/AIDS co-infection at RSUP Dr. Mohammad Hoesin Palembang.

CD4 cell count (cells/mm3)	Number (n)	Percentage (%)
<100 cells/mm3	29	69%
100-200 cells/mm3	7	16.7%
>200 cells/mm3	6	14.3%
Total	**42**	**100%**

In patients with TB-HIV/AIDS co-infection who underwent laboratory examination of hemoglobin levels, most of the results were low hemoglobin levels with a total of 30 samples (71.4%) with 23 male samples and 7 female samples. Followed by normal hemoglobin examination results, 12 samples (28.6%) were obtained.

Table 4 Distribution of hemoglobin level examination results of patients suffering from TB-HIV/AIDS co-infection at Dr. RSUP. Mohammad Hoesin Palembang.

Hemoglobin levels (Hb)(gr/dl)	Number (n)	Percentage (%)
Low: <13 (L)/ <12(P) g/dl	30	71.4%
Normal:13-18(L)/12-16(W) g/dl	12	28.6%
Total	**42**	**100%**

4. DISCUSSION

According to the study, men predominate over women in the number of TB-HIV/AIDS co- infection cases at RSUP Dr. Mohammad Hoesin between May 2022 and May 2023. In this study, there were 32 male cases (76.2%) and 10 female cases (23.8%). K. Krisnahasri. et al (2021) found that in 2015 the incidence of TB-HIV/AIDS co- infection in Bandung District Hospital was higher for men than women, namely 55 samples (78.5%) and 15 samples (21.4%) for women. TB-HIV co- infection patients at RSUD Dr. Chasan Boesoirie Ternate during the 2018–2021 period were also the subject of research by Nur Aini M. et al. (2023), who discovered that men accounted for the majority of these patients with 28 samples (71.8%), followed by women with 11 samples (28.2%). Another study also conducted by Zhou, et al (2023) in China's National TB Surveillance System during 2012–2021 found that there were 347 cases of with the risk of contracting various infectious diseases. This is different from women's activities and social roles, whose social activities and roles are fewer than men (Mar'iyah K, et al, 2021).

Gender also influences the number of CD4 cells in people with TB-HIV/AIDS co-infection. It was found that women have more CD4 cells than men, which is due to various immunomodulatory effects of the main female sex steroid hormones, namely estrogen and progesterone. Estrogen and progesterone receptors are expressed by most types of immune cells and hormone levels influence the expression of CCR5 (*chemokine receptor* 5), a chemokine receptor that plays an important role in regulating lymphocyte/cell migration to sites of inflammation and immune surveillance, involved in the pathogenesis of various health conditions, including inflammatory diseases, viral infections, cancer, and autoimmune diseases. This receptor functions as the primary coreceptor for HIV, facilitating entry of the virus into CD4+ T cells both during human infection and during transmission. This can affect the rate of HIV

replication. Exogenous administration of these hormones and their natural fluctuations during the ovulatory cycle has been shown to modulate innate and adaptive immune responses and can influence HIV replication rates (Aulia a, et al, 2021).

Data obtained from research results show that TB-HIV/AIDS co-infected patients are more likely to be in the age group of 30-40 years (47.6%). From the results of this study, TB-HIV/AIDS co- infection often occurs in cases of productive age and this is in line with the risk factors for TB- HIV/AIDS co-infection based on a person's socio- demographics such as behavior and daily activities that allow a lot of contact with other people. And People with HIV. The age of 20–40 years is considered the time when a person is most active, especially in important groups such as heterosexual men who frequently change partners, female commercial sex workers, homosexual men, transgender people, and injecting drug users (Gayatri AY, et al, 2019). There were similar results in research conducted by Dwiputra Y. et all (2019), which found the highest prevalence of age in the incidence of TB-HIV AIDS co-infection at Sanglah District Hospital in 2013, namely that the average patient age was 34 years from 130 existing cases (Gayatri AY, et al, 2019). During the 2018– 2021 period, it was discovered that the majority of TB–HIV co-infected patients at Dr. H. Chasan Boesoirie Ternate were between the ages of 26 and
45. Of the 39 samples collected, 26 (66.7%) belonged to this age group. Nur Aini, M., et al. carried out this study (2023). In another study involving 58 HIV-TB co-infected sufferers at Coastal Karnataka Hospital, Tiewsoh et al (2020), found that the 40-50 year age group was the most affected compared to other studies which reported the 30- 40 years in TB/HIV co-infection sufferers.

In research on CD4 cell counts, it was found that the majority of patients had CD4 cell counts <100 cells/mm3 with 29 samples (69%) out of 42 samples and this was the highest incidence. The same finding was made in a different study conducted by Abdillah EK, et al. (2022) on HIV/AIDS patients who also had TB co-infection at the Buleleng Regional Hospital in Bali between January and June 2020. The majority of patients had a CD4 cell count of less than 100 in 13 samples. out of 18 samples, 72%. [10] Adinda Riany Putri Sundari et al. (2022) found that among HIV/AIDS patients who had TB during that time at Al-Ihsan Hospital, the CD4 cell count was also determined. Of these patients, 51 samples (82%), had a CD4 cell count of less than 200 cells/µL, which was higher than the 11 samples of patients with normal CD4 cell counts.[19] Tiewsoh, et al (2020), also researched on the description of the results of CD4 cell examination in HIV-TB co-infected sufferers at Coastal Karnataka Hospital, India, involving 58 patients, it was found that the majority of our study had CD4 counts <250 cells/µL. (Tiewsoh, et al, 2020) HIV can replicate itself in the patient's host cells. HIV replicates itself including in lymphocyte cells, CD4 cells, CD8 cells and macrophages so that there can be a drastic reduction in the number of immune cells in sufferers. The decrease in CD4 and CD8 cells in HIV contributes to an increased risk of reactivation from various types of co- infectious diseases. When the HIV replicates in CD4 cells, it will disrupt the number of CD4 cells in the body, where CD4 cells have a central role in the immune system, the reduced number of CD4 cells can affect the body's immune function (Tiewsoh, et al, 2020). HIV uses CD4 cell surface molecules to infect and replicate within CD4 cells and cell lysis occurs so that the HIV virions can be released and infect other cells. As a result, CD4 lymphocytes gradually decrease and the immune system becomes weak, leading to the development *of acquired immunodeficiency syndrome* (AIDS). The number of CD4 cells will decrease over time and if not immediately treated with ART it can cause immunosuppression, thereby increasing the risk of various infections such as tuberculosis co-infection (Effendy E, 2019). Another mechanism that influences the reactivation of tuberculosis co-infection in people with HIV is by manipulating the macrophage bactericidal receptor pathway which is responsible for dealing with tuberculosis infection, chemotactic degranulation, interfering with *tumor necrosis factor* (TNF) which mediates the apoptotic response in cells infected with *M. tuberculosis*. Many other factors are also disturbed by HIV, such as interleukin-10 and interleukin-27, which will then reduce the activity of interferon- $\boldsymbol{\gamma}$ and interleukin-2 which will disrupt the control of these microbacteria in cells. Low CD4 cell values will increase the risk of acute infection and reactivation of TB. Apart from decreasing the number, HIV infection also makes the function of CD4 and CD8 cells abnormal. TB-HIV co-infection also accelerates the progression of HIV from initially being asymptomatic to the AIDS stage until death (Yogani I, et al, 2017).

Hemoglobin examination in patients suffering from TB-HIV/AIDS co-infection carried out in the period May 2022-May 2023 at RSUP Dr. Mohammad Hoesin Palembang found that there were more patients with low hemoglobin levels, namely 30 samples (71.4%) out of 42 samples. The results of this research are also in line with research conducted by Imanuel, LM (2022) on TB/HIV co- infected patients at the KRMT Wongsonegoro Hospital, Semarang in 2018, it was found that there were more patients with low hemoglobin conditions than normal ones with a total of 13 samples (65%) and 7 samples (35%) were found to have normal levels (Mulanto IL, 2022). Abdillah EK, et al (2022) also obtained the same results in HIV/AIDS patients with TB co-infection at the Buleleng District Hospital, Bali in the period January-June 2020, with patients having low hemoglobin levels <10 g/dl with a total of 9 samples (55%) being found. and hemoglobin levels of 10-13 g/dl there were 5 samples (27.8%) and >13g/dl there were 4 samples where patients with low hemoglobin levels

had the highest incidence rate. (Abdillah EK, et al, 2022). Other research conducted by Almeida DP, et al. (2021), at the *Evandro Chagas clinical research laboratory of the National Institute of Infectious Diseases* (INI), Brazil, obtained from 258 cases that there was a prevalence of anemia of 61.2% in TB-HIV co- infected patients (de Mendonça EB, et al, 2021). Autoantibodies against erythrocytes can cause hemolytic anemia, which is linked to a decrease in endogenous erythropoietin production and a decrease in hemoglobin levels in HIV-positive or HIV-TB patients. Malnutrition caused by deficiencies of iron, vitamin B12, and folic acid can also cause anemia. In HIV-infected patients, a decrease in folic acid generally occurs due to a lack of food or pathology in the jejunum. Vitamin B12 deficiency can be caused by intestinal malabsorption, gastric disorders caused by several opportunistic infections, or other disorders that affect the gastric mucosa (Arisena y, et al, 2019). Nausea and vomiting can also occur due to the side effects of administering ARV drugs, so there can be problems with nutrient absorption which will result in a risk of decreasing Hb levels due to disrupted blood cell formation and causing accelerated disease progression in HIV-infected patients (Ibrahim K, et al, 2017). Decreased hemoglobin levels in HIV patients can also be caused by activation of pro-apoptotic genes which is caused by a decrease in the number of CD4 cells and an increase in the number of monocytes. Red blood cell hematopoiesis can be inhibited by increased levels of cytokines and *tumor necrosis factor*, which is directly caused by HIV and can affect bone marrow stromal cells. Solutes such as HIV proteins and cytokines can inhibit the development of hematopoietic cells in the bone marrow of HIV/AIDS patients (Benyamin EK, 2018). Genetic polymorphisms can also influence the anemia experienced by people with TB-HIV/AIDS co-infection. The most common type of anemia in HIV patients is macrocytic anemia, which is closely related to folate and vitamin B12 deficiencies. The enzyme *methylene-tetra-hydrofolate reductase* (MTHFR) plays an important role in the transmethylation of homocysteine to methionine in DNA synthesis. Homocysteinemia indicates folate and vitamin B12 deficiency, while increased *methylmalonic acid* (MMA) levels are a specific parameter in vitamin B12 deficiency. The MTHFR C665T polymorphism can reduce MTHFR enzyme activity which can result in homocystemia. This condition can cause anemia in HIV patients (Pertiwi D,2019).

5. CONCLUSION

Based on the results of research regarding the description of laboratory results of TB-HIV/AIDS co-infection sufferers at RSUP Dr. Mohammad Hoesin Palembang for the period May 2022-May 2023, using secondary data from the Medical Records Installation and clinical laboratory of Dr.Mohammad Hoesin Palembang Hospital obtained 42 samples that met the inclusion criteria. The majority were male, 32 samples (76.2%) out of a total of 42 samples. The highest age group was 30-40 years old, 20 samples (47.6%). The prevalence of CD4 cell count examination results was obtained, patients with a CD cell count <100 cells/mm3 were more, namely 29 samples (69%), and the prevalence of hemoglobin (Hb) level examination results in patients was obtained, low hemoglobin levels were more than normal with the number 30 samples (71.4%) of 42 total samples.

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