Original Research Article

Result Analysis of Erythrocyte Sedimentation Rate (ESR) For Tuberculosis (TB) Patient with Anti-Tuberculosis Drug

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ABSTRACT

This research is based on information about the different and varied determination result of Erythrocyte Sedimentation Rate (ESR) from clinical laboratories in Makassar on pulmonary tuberculosis (TB) patients pre- and post-treatment with Anti-Tuberculosis drug. Determination of ESR on the diagnosis of Tuberculosis (TB) patients provides an illustration about the occurrence of inflammatory process, due to an increase in levels of fibrinogen and plasma globulin which are closely related to the presence of acute phase reactions so that causes ESRs values rise. On the other hand, it turns out that the value of ESR also increases in various conditions of infection or inflammation in some other cases of disease, so that ERS become not specific for TB. While, ESR are very useful in monitoring the success of Anti-Tuberculosis treatment. The problem of research that until now the determination of Erythrocyte Sedimentation Rate (ESR) for Tuberculosis (TB) patients the difference in the determination results of Erythrocyte Sedimentation Rate (ESR) for Tuberculosis (TB) patients pre- and post-treatment with Anti-Tuberculosis drugs is clearly unknown. The type of research is laboratory observational that aimed to determine the differences in the determination results of Erythrocyte Sedimentation Rate (ESR) for TB patients pre- and post-treatment with Anti-Tuberculosis drugs in 2 weeks at the Center for Lung Health. The population of research were TB patient TBA positive at the Center for Lung Health. The sampling uses a purposive sampling with a sample of 20 patients consisting of 10 patients (do not undergone Anti-Tuberculosis treatment) and 10 patients (undergone Anti-Tuberculosis treatment). The results of research indicate that $t_{count} > t_{table}$, it means H_0 rejected and H_a accepted, it can be concluded that there were significant differences in the determination results of Erythrocyte Sedimentation Rate (ESR) pre- and post-treatment with Anti-Tuberculosis drugs in 2 weeks.

Keywords: Erythrocyte Sedimentation Rate, Tuberculosis, Anti-Tuberculosis drugs.

INTRODUCTION

Tuberculosis is still one of the causes of death in several countries in the world today, although there are efforts and available cheaper and more effective Anti-Tuberculosis drugs. Even it is still found in various developed countries and high-income and dominant in a number of developing countries. Advancement in diagnostics, Anti-Tuberculosis drugs treatment, vaccines and implementation of disease prevention has repaired TB care and prevention globally. [1]

Data reported by the Indonesian Ministry of Health (2016) that 95% of pulmonary TB (tuberculosis) patients were in various developing countries and 75% of TB patient were in productive age category (15-50 years) with a low socio-economic level. Pulmonary TB in Indonesia is a main cause of death after heart and respiratory diseases. The risk of transmission each year by *the Annual Risk of Tuberculosis Infection* (ARTI) states that TB cases in Indonesia are considered to be still quite high and vary between 1-2%. [2] This means that in the region of 1%, every year among 10.000 populations, 100 (one hundred) people at risk of infection. Most of the people infected will not become pulmonary TB sufferers, only 10% of those infected will become pulmonary TB sufferers. Factors that affect the likelihood of a person becoming a

pulmonary TB sufferer are low immunity. [3,4]

Hematological scoring is a way that can be used as a supporting diagnosis related to therapy and prognosis. To get the right diagnosis, need careful and precise results. In determining the disease or diagnosis is very important and helps control the disease and monitor Anti-Tuberculosis drugs treatment or monitor the illness history.

The Erythrocyte Sedimentation Rate (ESR) is a process of determining erythrocyte sedimentation measured by inserting a blood sample into a special pipette for one hour. The higher of red-blood cells that settle, the higher of erythrocyte sedimentation rate of the patient. Diagnosis of pulmonary TB is important, especially the diagnosis is made more precise and Anti-Tuberculosis drugs treatment can be given more quickly. The important determinations are radiological (chest X-ray), bacteriological (from sputum/phlegm), and blood.

One of the supporting examinations for diagnosis of pulmonary TB infection is the determination of the *Erythrocyte Sedimentation Rate* (ESR). The use of ESRs in the diagnosis of pulmonary TB up to now is still widely used in clinical laboratories in Indonesia, it is a simple, fast, and inexpensive determination. Determination of ESR in pulmonary diagnosis shows that in pulmonary TB infection there is an inflammatory process, which in the inflammatory process, there is an increase in levels of fibrinogen and plasma globulin associated with acute phase reactions causing ESRs values rise. ESRs values also increase in various other conditions of infection or inflammation, so that ESRs are not specific to TB. However, ESR value is useful for monitoring the success of Anti-Tuberculosis therapy for TB patients. [5]

The problems of this research are the differences of the determination result of the *Erythrocyte Sedimentation Rate* (ESR) for pulmonary tuberculosis (TB) patients pre- and post-treatment with Anti-Tuberculosis

drugs in 2 weeks have not been clearly and definitely known, especially for patients treated at the Center of Lung Health of Makassar. Based on the background above, the authors are interested in examining the extent of the determination results of *Erythrocyte Sedimentation Rate* (ESR) for pulmonary TB patients pre- and post-treatment with Anti-Tuberculosis drugs in two weeks at the Center of Lung Health.

MATERIALS AND METHODS

The research is a descriptive laboratory observational to determine differences the determination result of *Erythrocyte Sedimentation Rate* (ESR) for pulmonary tuberculosis (TB) patient pre- and post-treatment with Anti-Tuberculosis drugs in two weeks at the Center of Lung Health.
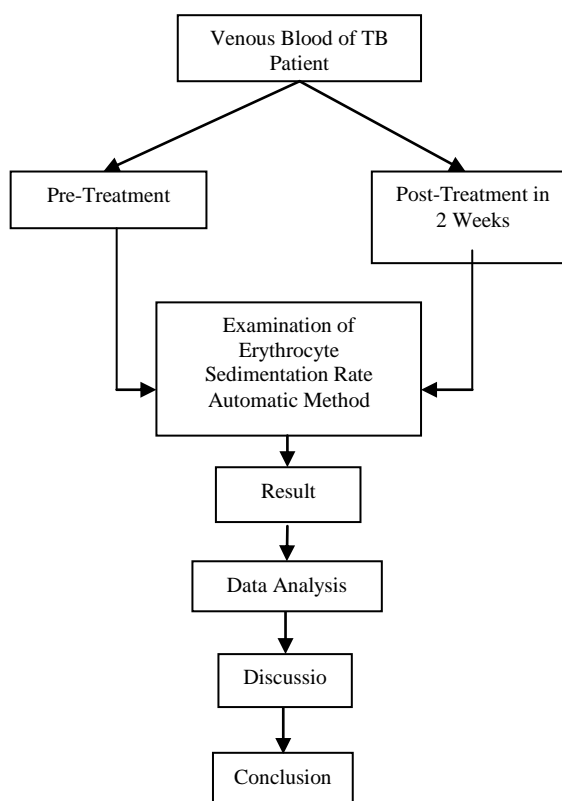
Operational Framework

Figure 1. Scheme of operational framework

This research was conducted on 26 November to 21 December 2018. This research was conducted at the laboratory of the Center of Lung Health (Balai Besar Kesehatan Paru Masyarakat - BBKPM)

Makassar. The population of research were tuberculosis patients newly diagnosed with TB disease. The sample of research was patients/outpatients who visit to conduct Anti-Tuberculosis drugs treatment at the Centre of Lung Health of Makassar. The sample size used in this research is 20 samples, consisted of 10 samples of patients who had not undergone Anti-Tuberculosis drugs treatment and 10 samples of patients who had undergone Anti-Tuberculosis drugs treatment. The sampling technique in this research was purposive sampling. The sample criteria in this research were TB patients who had not undergone Anti-Tuberculosis drugs treatment and who had undergone Anti-Tuberculosis drugs in 2 weeks.

Erythrocyte Sedimentation Rate (ESR) is an erythrocyte determination routinely. The process of erythrocyte determination is measured by inserting anticoagulant erythrocyte into a special tube for one hour. The higher of red blood cells that settle, the higher of ESR. The height of ESR is strongly influenced by the condition of the body, especially if there is inflammation. Tuberculosis is a direct infectious disease caused by *Mycobacterium tuberculosis*, majority of TB germs attack the lungs, but can also affect other organs. *Mycobacterium tuberculosis*, this germ is rod-shaped, has special characteristics that are resistant to acid in coloration. Therefore, it is also called an acid resistant bacillus. TB germs die quickly in direct sunlight, but can last several hours in dark and humid sites.

The method used in this research is automatic method. Reading of erythrocyte reduction by infrared which includes the length of the vertical reading area of the cuvette. When cuvettes are inserted in automatic devices (spectrophotometers), readings by infrared rays are started. Analysis is performed by devices of each decreasing interval 0.2 mm from erythrocytes decrease. Reading is performed continuously automatically every interval 3 minutes until the specified measurement time (30 minutes). Microprocessor processes the results of reading by infrared and calculates the results of the reading.

2.1 Pre-analytical

2.1.1 Tools and Materials

Vesmatic, ESR tube containing citrate (3.8% sodium citrate), venous blood sample, vacuum tube, Tourniquet, cotton, alcohol 70% 3 ml, tube rack and label, watch glass, beaker glass, 100 ml distilled water.

2.1.2 Making a solution (3.8% sodium citrate)

Weighting 3.8 grams of sodium citrate using a scale and watch glass, then it is inserted into a beaker glass. Dissolve into distilled water to 100 ml, then homogenized. Then, it is inserted into a reagent bottle and labeled.

2.1.3 Sample preparation (venous blood collection)

The position of patient is set as comfortably as possible, then the patient is asked to clench his/her fist, then the tourniquet is attached ±3-4 inches over cubital fossa vein, palpating the puncture area vertically and horizontally to look for large vessels and to determine needle depth, direction and size. Mediana fossa cubiti vein is the first choice followed by cephalic vein. Tourniquet is removed and the patient is asked to open his/her fist, then the puncture marks are cleaned with 70% alcoholic cotton in concentric circles moving outward and left to dry, prepare a needle, then the set area that has been determined is punctured by pushing the needle barrel. Suck blood by pulling the plunger. When blood flows remove the tourniquet and ask the patient to open his/her fist. Cover the puncture site with clean gauze. Pull the needle out and ask the patient to press the gauze, stick the tape over the gauze. Then, 2 ml of blood is put in a prepared container bottle and has been filled with 0.5 sodium citrate 3.8% with a ratio of 4 parts of blood: 1 part sodium citrate 3.8%. Dispose of needles into sharps containers. [6]

2.2. Analytic

Prepares tools and materials, on the display screen information and instructions will appear, identify samples by writes the name or ID of the patient on the tube, and the

number of tube position, after homogenized for 5 minutes insert the tube into the tool, after 30 minutes, read the results shown on the display, and remove the tube from the tool after the ESR results are obtained.

2.3 Post-Analytic

Interpretation of results: [7]

Men : 0-10 mm/hour

Women : 0-15 mm/hour

Data is presented in table and analyzed statistically. To obtain a statistical value, all data are tabulated by treatment group which is then tested statistically with T-test two samples, as the following formula:

$$t \; hit = \frac{d}{\frac{s}{\sqrt{n}}}$$

$$d = \Sigma \; di$$

$$s = \sqrt{\frac{n \sum di^2 - (\sum di)^2}{n(n-1)}}$$

Where:

s = standard deviation of samples

d = difference in average values 1 and 2

n = sample size

RESULT AND DISCUSSION
3.1 Result

As research conducted on 26 November to 21 December 2018, that aimed to find out the determination result of *Erythrocyte Sedimentation Rate* (ESR) for pulmonary tuberculosis (TB) patient pre- and post-treatment with Anti-Tuberculosis drugs in two weeks at the Center of Lung Health, we obtain the following results:

Table 1. Determination result of *Erythrocyte Sedimentation Rate* (ESR) for pulmonary tuberculosis (TB) patient pre- and post-treatment with Anti-Tuberculosis drugs in two weeks at the Center of Lung Health.

No	Sample	Determination Result of ESR / (mm/hour)	
		Pre-treatment with Anti-Tuberculosis Drugs	Post-treatment with Anti-Tuberculosis Drugs in 2 Weeks
1.	A	97	93
2.	B	73	68
3.	C	43	38
4.	D	83	78
5.	E	86	80
6.	F	35	28
7.	G	89	85
8.	H	21	17
9.	I	64	61
10.	J	71	67

Source: Primary data, 2017

Table 2. The result of T-test two-sample on the determination result of Erythrocyte Sedimentation Rate (ESR) for pulmonary tuberculosis (TB) patient pre- and post-treatment with Anti-Tuberculosis drugs in two weeks at the Center of Lung Health.

Result of ESRs	N	x̄	SD	t_{count}	t_{table}
Pre-	10	60,20	25,324	12,818	-1,734
Post	10	61,55	25,575		

Source: Primary data, 2017

As table 2 above shows that the data analysis of 10 sample using (t-test) with a significance level 95% (α= 0.05%) is obtained $t_{count} > t_{table}$, then H_0 rejected and H_a accepted, it concludes that there is a significant difference of the determination result of *Erythrocyte Sedimentation Rate* (ESR) for pulmonary tuberculosis (TB) patient pre- and post-treatment with Anti-Tuberculosis drugs in two weeks.

3.2 Discussion

The research is descriptive that aimed to find out the determination result of *Erythrocyte Sedimentation Rate* (ESR) for pulmonary tuberculosis (TB) patient pre- and post-treatment with Anti-Tuberculosis drugs in two weeks at the Center of Lung Health. The determination of erythrocyte sedimentation rate is often done to support the diagnosis of pulmonary tuberculosis (TB) and evaluate the results of Anti-Tuberculosis drugs or the healing process pre- and post-treatment with Anti-Tuberculosis drugs.

Erythrocyte Sedimentation Rate (ESR) is a test to determine the speed of erythrocyte in the blood that has been given anticoagulants falls to the bottom of a vertical tube within a certain time measuring distance from the top of the erythrocyte column that settles up to the fluid limit in a certain period of determining the sedimentation rate.

Mycobacterium tuberculosis is a bacterium that causes *tuberculosis* in humans. These bacteria move from the human body to other humans through the respiratory tract, out through the air which is exhaled in the process of respiration and are sucked in when someone breathes in. It is an intracellular pathogen that is mainly located in macrophages then B-cells will stimulate humoral antibody responses. [8,9]

The sample used in this research was venous blood with a sample size of 10, consisting of 10 samples of pre-treatment with Anti-Tuberculosis drugs and 10 samples of post-treatment with Anti-Tuberculosis drugs. The sampling technique in this research was purposive sampling where samples were collected after fulfilling the inclusion criteria and signed the informed consent. A method for determining erythrocyte sedimentation rate is automatic method. This test is based on a decrease in erythrocytes in blood samples with anticoagulants placed in cuvettes detected by infrared light which works periodically every 3 minutes from the microprocessor reading.

As the results of data analysis performed using statistical tests, namely t-test on the determination results of erythrocyte sedimentation rate (ESR) and obtained that $t_{count} > t_{table}$, then Ho is rejected and Ha is accepted, it means that there are significant differences in the results pre- and post-treatment with Anti-Tuberculosis drugs in 2 weeks. As results of the research it was found that there were differences in the value of erythrocyte sedimentation rate in pulmonary tuberculosis (TB) patients pre- and post-treatment with Anti-Tuberculosis drugs where pre-treatment the value of erythrocyte sedimentation rate (ESR) increases and post-treatment decrease in two weeks and not returned to normal.

Pre-treatment of Anti-Tuberculosis drugs, the value of erythrocyte sedimentation rate increases, the increase of ESR is caused by increased aggregation of red blood cells due to changes in plasma proteins associated with acute or chronic phase reactions caused by mycobacterium. Then, the results obtained post-treatment with Anti-Tuberculosis drugs decrease due to a response to the treatment of Anti-Tuberculosis drugs as well as the possibility of detecting the rate of healing of patients. [9] By adhering to taking Anti-Tuberculosis drugs, and having a counterpart for taking drugs (PMO – *Pengawas Minum Obat*) to monitor Tuberculosis patient in taking their medicine regularly and thoroughly in accordance with the dosage and schedule as prescribed, [10] so the drug works well and breaks the chain of transmission and prevents bacterial resistance to Anti-Tuberculosis drugs and the body responds to Anti-Tuberculosis drugs as an antibiotic that can kill the mycobacterium germs that infect the lungs.

In addition to adherence to taking medication, there are some that cause a decrease in Erythrocyte Rate (ESR), namely nutrition intake, health care behavior and environmental health behavior. This greatly helps the success of Anti-Tuberculosis drug treatment.

CONCLUSION

As results of the research on the determination result of Erythrocyte Sedimentation Rate (ESR) for Tuberculosis patient pre- and post-treatment with Anti-Tuberculosis drugs in 10 samples and data analysis uses t-test obtained t_{count} (12,818) > t_{table} (-1,737), with a significance level of 95% ($\alpha = 0.05$) which means that Ho is rejected and Ha is accepted, it can be concluded that there are differences in the value of Erythrocyte Sedimentation Rate (ESR) pre- and post-treatment with Anti-Tuberculosis drugs in 2 weeks.

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