El-Hayah

Original research article

Effect of Blood Bags Storage Time on The Quality of HIV Pre Transfusion Test Result: Preliminary Study in Blood Bank's dr. Ben Mboi Ruteng Manggarai District, East Nusa Tenggara Province

Yani Suryani[1], Opik Taupiqurrohman[1,3], Yohanes Reynerius[2]

[1]Department of Biology, Faculty of Science and Technology, UIN Sunan Gunung Djati Bandung, Jl. A.H. Nasution No. 105 Bandung, 40614
[2]Department of Chemistry, Sekolah Tinggi Analis Bakti Asih Bandung, Jl. Padasuka No. 233 Bandung, 40192
[3]Department of Medical Laboratory Technology, Sekolah Tinggi Analis Bakti Asih Bandung, Jl. Padasuka No. 233 Bandung, 40192

*Corresponding author
Email: yani.suryani@uinsgd.ac.id
DOI: 10.18860/elha.v8i4.15801

A r t i c l e   I n f o

A b s t r a c t

Research on the effect of storage time on blood quality has been conducted. The purpose of this study is to determine the quality changes caused by the length of storage. The test parameter is the change in blood to become HIV positive. The blood testing process is carried out by immune chromatography on blood that has been stored for 2 weeks, 3 weeks, 4 weeks and 5 weeks. Test results show changes in blood quality during storage. Time does not show a difference in changes in blood quality, however it needs to be aware, because the stored blood changes.

1. INTRODUCTION

Blood transfusion is the process of taking blood from someone voluntarily to be stored in a blood bank and then used in blood transfusions by medical personnel [17]. Blood transfusion is a therapeutic procedure in which it functions as a healing, but contaminated blood transfusion can transmit infectious diseases and can endanger life rather than save lives]. Safe blood transfusion services are the foundation of an effective health care system [2]. Blood for transfusion is considered safe when it is: 1) Donated by a carefully selected, healthy donor; 2) Free from infections that could be harmful to the

recipient; 3) Processed by reliable methods of testing, component production, storage and transportation; and 4) Transfused only upon need and for the patient's health and wellbeing [18].

One of the deadly diseases that are at risk of being transmitted through blood donation is HIV (Human Infectious Disease). Transmission of HIV through blood transfusion was first known in late 1981 and early 1983 [18]. Blood banks have also begun to ask donors about various high-risk behaviors, even before HIV antibody screening was carried out, which in fact has been able to reduce the number of HIV infections transmitted through transfusions [3]. In Indonesia, East Nusa Tenggara is one of the areas with high HIV patients [19], so blood donor needs to be considered. An important aspect of managing blood for transfusion/donation is storage. According to the Naim report (2014) storage time affects the quality of platelets, erythrocytes and hemoglobin.

There is a real case of a kidney failure patient in East Nusa Tenggara who was HIV positive after receiving a blood transfusion. In 2015, a 38-year-old man was convicted of Kidney Failure at RSUD dr. Ben Mboi Manggarai District, East Nusa Tenggara Province, for 9 months recorded 47 blood bags that have been transfused to the man, after being transfused as many as 47 blood bags (whole blood) the man was convicted of HIV & AIDS. In 2017 there is a 23-year-old man who has been donated from him twice as long as the last 10 months, when he was about to donating the blood the third time he was convicted of having the HIV virus. Based on this fact it is necessary to test related to the effect of bag storage time on HIV test.

2. MATERIALS AND METHODS

Tools and Materials

The tools used in this study include dropper pipettes, pin pliers, refrigerators, scissors, centrifuges, test tubes, test tube racks. While the research material consisted of Whole blood, sd rapid test, oncoprobe rapid test, inteck rapid test..

Research procedure

This research is an experimental study conducted at the Blood Bank of RSUD dr. Ben Mboi Ruteng. Manggarai Regency East Nusa Tenggara Province is preliminary to determine the effect of the time of storage of blood bags on blood quality, in this case seen from the presence or absence of the HIV virus in the blood. The design of this study is a Case Study (Case Study Design) that is by comparing the differences in the results of immuno chromatographic tests on blood bags (whole blood) that have been screened for HIV (free of HIV) by PMI, then stored in a refrigerator at a temperature of 2° C to 6 ° C. [6]; [20]. The treatment given is storage time which is 2 weeks, 3 weeks, 4 weeks and 5 weeks. It is based on a modification of Naim's (2014) study and considers the incubation period of HIV [21].

Screening work procedures [4]:
➢ Prepare equipment and materials as well as PPE (Personal Protective Equipment) for re-screening
➢ Performed at room temperature, the test should be done in less than 20 minutes to get the best results.
➢ Place the test kit on a flat, clean surface. The dropper pipette is held vertically and then drop 1 drop of serum or plasma (± 30-40 μl) into the specimen well (S), then add 2 drops of buffer. Avoid air bubbles.
➢ Wait until the red line appears, the results should be read within 15 minutes.
Note: results are not interpreted after 20 minutes.

Interpretation of results
Positive (reactive): if a red line appears on the control line and the test line. Negative (non-reactive): Only one red line appears on

the control, and invalid: no red line appears at all or appears only on the test (T) [4].

Data analysis

After the data is collected then the data is processed using data analysis with Kruskal Wallis test which is part of static non parametric which aims to assist researchers in distinguishing the performance results of groups contained in the sample into two groups with two different criteria [5].

3. RESULTS

Immuno chromatography uses the principle of chemistry in its work so it is also called immunochemistry. Immuno chemistry offers simple, rapid, robust yet sensitive, and in most cases, easily automated methods applicable to routine analyses in clinical laboratories. Immunochemical methods do not usually require extensive and destructive sample preparation or expensive instrumentation [1;7;22]. In fact, most methods are based on simple photo-, fluoro-, or luminometric detection. Immunochem- ical methods have rapidly replaced chromatographic techniques in clinical diagnostics, offering fast detection of antibodies associated with specific diseases, disease biomarkers, hormones, and pharmaceuticals [8].

All immunochemical methods are based on a highly specific and sensitive reaction between an antigen and an antibody. Antigen is a substance that induces the production of antibodies [ie, proteins from the class of immunoglobulins (MW about 150 kDa) that are produced in the immune system of any vertebrate or human as a result of a defense reaction (immunity) to this for- eign substance[11]. Antibodies are a large family of glycoproteins that share key structural and functional properties. Functionally, they can be characterized by their ability to bind both to antigens and specialized cells or proteins of the immune system. Assay specificity and sensitivity is determined by the quality of antibodies used in the method. Polyclonal antibodies are isolated from the serum of immunized animals, usually rabbits, and the serum is a combination of numerous antibodies with different specificities and affinities. Monoclonal antibodies are more homogenous in terms of specificity and affinity because of the production method involving immunization of mice followed by hybridoma technologies [11]; [12].

The results of the examination affect the storage period of blood bags (whole blood) on the results of pre-transfusion HIV tests using immunochromatography methods at Blood Bank RSUDdr. Ben Mboi Ruteng Manggarai Regency, NTT Province. The study was conducted with repeated measurements (repeated measure of anova) where the initial screening conducted by the PMI for 15 whole blood from the donor in a period of 1 week, 2 weeks, 3 weeks, 4 weeks, to 5 weeks, the following results were obtained:

Table 1. List of results of examination of the storage period of whole blood

Recepient	Control	2nd Weeks	3th Weeks	4th Weeks	5th Weeks
1.	1	1	1	1	1
2.	1	1	1	1	1
3.	1	1	1	1	1
4.	1	1	1	1	1
5.	1	1	2	2	2
6.	1	1	1	1	1
7.	1	1	1	1	1
8.	1	1	1	1	1
9.	1	1	1	1	1

10.	1	2	2	2	2
11.	1	1	1	1	1
12.	1	1	1	1	1
13.	1	1	1	1	1
14.	1	1	1	1	1
15.	1	1	1	1	1

Note: 1 = non-reactive, 2 = reactive

4. DISCUSSION

Based on the table 1 that of the 15 blood bags (whole blood) there were found 2 who were reactively convicted of HIV. From the table 1, 1 is shows non-reactive and is shows reactive in each recipient 1-15, shows that at weeks 2 through 5 of the blood bag (whole blood) of the donor recepient 10 becomes reactive and the donor recepient becomes reactive from week 3 to week 5 among the people of Manggarai Regency, East Nusa Tenggara at the Blood Bank of RSUD dr. Ben Mboi Ruteng Manggarai Regency, NTT Province, which was initially non-reactive with HIV, has changed to become reactive to HIV after being re-screened for a period of 2 to 5 weeks in the blood transfusion unit.

The function of red cell storage is to maintain the functionality and viability of red cells throughout the approved storage period [15;16]. The difficulty that is shared by modern storage mediums, however, is that red cell functionality and viability are progressively impaired during storage by three interrelated mechanisms: altered metabolism; increased oxidative stress; and membrane damageinitially interact with lipopolysaccharide, a highly anionic outer membrane, and glycolipid and then disrupt the membrane locally [5].

With the data quality results of the category (1-2) for the data analysis using non-parametric analysis, namely the kruskall walis method. Where, the critical test of the walis is a non-parametric test used to compare three or more groups of sample data. Based on kruskall walis test, known that no significant difference even the second and fifth weeks there are HIV reactive blood bags.

Changes can occur in the structure of stored blood [6,7], including the blood of donated HIV patients. This research shows that even though people who contain HIV are initially negative (incubation period), HIV will be active even if the blood is stored. In 4°C liquid storage, the biochemical and mechanical properties of red blood cells (RBCs) deteriorate progressively. When blood is stored in blood bank, biochemistry and physical properties of RBCs are altered because of storage conditions. These are referred to as storage lesions. Under normal conditions in the body's circulation, these do not occur as optimum temperature, pH, nutrient concentration and waste product removal are maintained [13;14].

Beside that storage has a negative effect on RBC oxygen delivery [8] and emerging evidence suggests that allogenic RBC infusion may actually harm some recipients. Considerable evidence suggests that transfusion increases the risk of serious complications and death in critically ill patients, especially in patients who are undergoing cardiac surgery. Current research indicated that the RBC hypothermic storage lesion is responsible for the association of blood transfusion with an increased length of stay in the hospital, impaired tissue oxygen use, pro-inflammatory and immunomodulatory effects, increased infections, multiple organ system failure, and ultimately increased morbidity and mortality [9]. Clinical implications, collectively known as the RBC storage medium lesion, is in part related to bioreactive substances released by leucocytes in the storage medium, such as histamine, lipids, and cytokines, which may exert direct effect on metabolic and physical changes associated with the senescence, such

as membrane reticulation, decrease in cell size, increase of cell density, alteration of cytoskeleton, enzymatic desilylation, and phosphatidylserine exposure, RBCs lose potassium 2,3-diphosphoglycerate (2, 3-DPG), Adenosine Triphosphate (ATP) stores, lipids and membrane, while becoming more rigid and demonstrating reduced oxygen off-loading [10].

5. CONCLUSION

Blood storage time does not affect the results of immunochromatographic HIV testing.

6. REFERENCES

1. Eamsobhana P A, Tungtrongchitr, and D. Wanachiwanawin, 2018. *International Journal of Infectious Diseases Immunochromatographic test for rapid serological diagnosis of human angiostrongyliasis*, Int. J. Infect. Dis., vol. 73, pp. 69–71, 20, doi: 10.1016/j.ijid.2018.06.005.

2. Adisasmito W. 2008. *Government Draft Regulation on Blood Servants. Faculty of Public Health*. University of Indonesia. Jakarta.

3. Gaol H L, Tanto C, Pryambodho. 2014. *Capita Selekta Medicine: Blood Transfusion"* Jakarta, Indonesia: Media Aesculapius.

4. Liu L, L Luo, S. Suryoprabowo J. Peng, H Kuang, and C. Xu, 2014. *Development of an Immunochromatographic Strip Test for Rapid Detection of Ciprofloxacin in Milk Samples.* pp. 16785–16798, 2014, doi: 10.3390/s140916785

5. Kiswari. 2014. *Simple haematologist.* Jakarta: FKUI

6. Adias, T C. 2014. Beatrice Moore-Igwe & Zaccheaus A Jeremiah. 2012. *Storage Related Haematological and Biochemical Changes of CPDA-1 Whole Blood in a Resource Limited Setting*. Adias et al., J Blood Disorders Transf vol 3 (3)

7. Hart S. Serti-Gazdewich & S. A. Mc Cluskey. 2015. *Red Cell Transfusion and The Immune System*. Anaesthesia, Vol 70 (Suppl. 1), 38–45.

8. Bonaventura J. 2007. *Clinical implications of the loss of vasoactive nitric oxide during red blood cell storage.* Proc Natl Acad Sci U S A 104: 19165-19166.

9. Bennett–Guerrero E, Veldman TH, Doctor A, Telen MJ, and Ortel T L. 2007. *Evolution of adverse changes in stored RBCs*. PNAS 104: 7063-7068.

10. Hess J R. 2006. *An update on solutions for red cell storage.* Vox Sanguinis 91:13-19. 5.

11. D. Orlov and K. Karkouti, 2015. *The pathophysiology and consequences of red blood cell storage.* Anaesthesia, vol. 70, pp. 29–37, 2015, doi: 10.1111/anae.12891.

12. M. Verma and K. Dahiya, 2015. *Effect of Blood Storage on Complete Biochemistry.* J. Blood Disord. Transfus., vol. 06, no. 06, doi: 10.4172/2155-9864.1000329.

13. Harlow E and Lane D. 1988. *Antibodies - a laboratory manual*. Cold Spring Harbor, NY: Cold Spring Harbor Laboratory Press.

14. Goding JW. 1983. *Monoclonal antibodies: principles and practice.* London: Academic Press; 1983:276.

15. Rudmann S V. 2005. *Textbook of blood banking and transfusion medicine. Blood component preservation and storage.* (2nd edn) 269 Elsevier Health Sciences.

16. Luo, S. Suryoprabowo, J. Peng, H. Kuang, and C. Xu. 2014. *Development of an Immunochromatographic Strip Test for Rapid Detection of Ciprofloxacin in Milk Samples.* pp. 16785–16798, doi: 10.3390/s140916785.

17. Mamak, N. 2012. *"Principle of Blood Transfusion".* Intech. 32-350

18. WHO. *"Safe Blood ad Blood Product".* 2009. World Health Organization.

19. BPS**.** 2020. *Jumlah Kasus HIV.* available at [https://ntt.bps.go.id/indicator/30/226/1/jumlah-kasus-hiv-aids-dbd-diare-tb-dan-malaria.html] [accesed 25th March 2022]

20. Van den Berg, G.E.L., Frissen, P.H.J., Regez, R.M. & Reitra, J.G.M. 2003. *Evaluation of the Rapid Immunoassay Determine HIV 1/2 for Detection of Antibodies to Human Immunodeficiency Virus Types 1 and 2.* Journa of Clinical Microbiology. 41(8): 3868-3869.

21. Naim, N. 2014. *Pengaruh lama penyimpanan darah donor terhadap hasil pemeriksaan trombosit, eritrosit dan hemoglobin pada unit transfuse darah rumah sakit umum lasinrang kabupaten pinrang.* Media Analis Kesehatan. 5(1):43-50

22. *Byzova, N.A.,* Zherdev, A.V., Sveshnikov, P.G., Sadykhov, E.G., & Dzantiev, B.B. 2015. *Development of an Immunochromatogrhahic test system for the detection of Helicobacter pylori antigen.* Applied Biochemistry and Microbiology. 51(5) 608-617.