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Description Blood Profile In Hemorrhagic Shock Rabbits Treated With Ringer's Lactate and Gelatin Resuscitation

Waode Santa Monica[a,*], Magfira Satya Apada[b], Muhammad Nur Amir[c],Nurul Sholihah Budiyana[d], Anggini Putri Husada[d]

[a]Division of Internal Medicine and Clinical Pathology, Hasanuddin University, Jl. Perintis Kemerdekaan campus Tamalanrea Km. 10 Makassar
[b]Division of Infectious pathology, Hasanuddin University, Jl. Perintis Kemerdekaan campus Tamalanrea Km. 10 Makassar
[c]Faculty of Pharmacy, Hasanuddin University, Makassar, Indonesia
[d]Student of Veterinary Profession Education Program, Hasanuddin University, Jl. Perintis Kemerdekaan campus Tamalanrea Km. 10 Makassar\

*Corresponding author: waodesanta@gmail.com

Abstract

Hemorrhagic shock is a condition that causes rapid and significant loss of intravascular blood volume, further leading to hemodynamic instability, decreased oxygen delivery, decreased tissue perfusion, cellular hypoxia, organ damage, and death. In conditions of hemorrhagic shock, measures are needed to prevent death in both humans and animals, one of which is by providing fluid therapy such as lactate ringer and gelatin. The purpose of the study to see the effect of resuscitation of lactate and gelatin ringer fluid from the aspect of animal blood profile includes total erythrocytes, hematocrit (HCT) and hemoglobin (Hb). Research method: the sample in the study using male rabbits as many as 12 rabbits was divided into four groups: The negative control group (NC) was a healthy group without bleeding, the positive control group (PC) was the group given the bleeding treatment, the treatment group 1 (TG1) was the bleeding group and was treated with lactate ringer, and the treatment group 2 (TG2) was the bleeding group and treated a combination of lactate ringer and gelatin. Rabbits are bleeding with a presentation of 30% until they reach a state of hemorrhagic shock then shock is maintained for 45 minutes before resuscitation of fluid and for 60 minutes given fluid resuscitation. The results of the study showed that in the NC, PC, TG1, and TG2 groups, respectively, they showed a decrease in values of 1.6%, 12%, 6% and 12% While the Hb value in rabbits in the NC, PC, and TG1 groups decreased on average to 1.7 gr / dl, 3.7 gr / dl, 7.3 gr / dl and in the TG2 group increased by 3.8 gr / dl. Meanwhile, the total erythrocyte value showed a decrease in values in the NC and PC groups with an average of 0.25 x 106 / µL, and 0.76 x 106 / µL, while in the TG1 & TG2 group it increased with an average of 0.33 x 106 / µL and 0.3 x 106 / µL. The subtraction that occurs in the NC group is normal because the decrease that occurs is influenced by blood sampling, however, in the PC group, TG1, and TG2 are affected by the bleeding process. Based on the results of the study, it showed an increase in the Hb and Total Erythrocyte indicators, this showed a change in blood profile after giving fluid resuscitation to rabbits who experienced hemorrhagic shock.

Keywords: Gelatin, Crystalloid, Shock Hemorrhagic

Introduction

Bleeding is the discharge of blood from blood vessels accompanied by accumulation in tissues or body spaces. Bleeding (Hemorage) is the discharge of blood from a blood vessel, usually occurring as a result of an injury. Bleeding will result in reduced oxygen transport to body tissues due to decreased erythrocytes accompanied by decreased hemoglobin and hematocrit. Bleeding will lower blood viscosity, leading to a decrease in systemic vascular resistance and an increase in venous return. Increased blood volume increases cardiac output by increasing the gradient for flow to the right atrium and by slowing down blood vessels, which decreases resistance to blood flow (Funk et al., 2013). The occurrence of a severe decrease in intravascular volume due to bleeding, then the blood that returns to the heart (venous return) is also greatly reduced, so that cardiac output decreases. A severe decrease in intravascular plasma volume is the main factor leading to the occurrence of shock (Hardisman, 2013). Hemorrhagic shock is one of the most common and frequent types of shock. Bleeding is the main cause of morbidity and mortality in surgical patients and trauma of the occurrence of hemorrhagic shock. As a result of blood loss, ventricular diastolic filling becomes insufficient and the heart is unable to provide optimal blood flow to cells and tissues (Fulop et al., 2013).

Hemorrhagic shock becomes the cause of disability and Death. Deaths from hemorrhagic shock are an important global problem, with over 60,000 deaths per year in the United States and an estimated 1.9 million deaths worldwide per year, as well as 1.5 million deaths from trauma that generally occur at a young age (Cannon, 2018). Reports related to the incidence of hemorrhagic shock in pets are still rarely reported globally, In Indonesia reports related to cases of hemorrhagic shock in small animals are still difficult to find, in addition, the fact that the availability of blood banks is still limited. Therefore, it is necessary to consider alternative measures that need to be studied for the treatment of hemorrhagic shock.

In conditions of hemorrhagic shock, measures are needed to prevent death, which aims to stop bleeding and restore circulating blood volume (Gutierrez et all, 2004). One of the efforts with which can be done with fluid resuscitation which is an effort to replace body fluids in critical condition and lose too much fluid, both in the form of water and blood. Fluid therapy is generally the most life-saving and important therapeutic measure in critical pets (Schaer, 2005). Fluid therapy is important for many medical conditions in animals. An assessment of the patient's history, key complaints, physical examination findings, and additional examination indications will determine the need for fluid therapy. The selection of fluid is determined by the needs of the patient, including the volume, speed, composition of the fluid required, and the location of the fluid needed (for example, interstitial versus intravascular). All animals should be assessed for three types of fluid disorders: volume changes, content changes, and/or distribution changes (Davis, 2013). In general, the liquids that are often used are lactic ringer as isotonic crystalloids & gelatin liquids as colloidal liquids.

To determine the effect of fluid resuscitation, the author conducted a study on "The Effect of Ringer Lactate and Gelatin Fluid Resuscitation for the Treatment of Hemorrhagic Shock in Rabbits in terms of blood profile". The results of this study are expected to provide information and become a reference related to emergency actions in small animals.

Meterials and Methods

Material

The material in the study is based on the needs in the treatment of experimental animals and laboratory examinations that will be studied in the study. The materials used during the maintenance period are commercial feed, mineral water and vitamins. Materials during treatment research alcohol, atropine, xylasien, ketamine, syringe, IV Cath 26, hipafix, infusion set, ringer lactate, gelatin, and gauze. The Blood Examination Set consists of a syringe, tube plan/EDTA, HB Sahli Haemometer, Haemocytometer, blood cell counting device, microcapillary hematocrit & hematocrit reader. The tools used in this study were a set of physical examinations, namely thermometers, stethoscopes, penlights, and digital scales. A set of vital examinations of the body, that is, the vital monitor of the body, and ultrasound. Laboratory Examination Devices are microscopes, centrifuges, microtomes, and computers.

Method

All rabbits to be studied first examined to record the rabbit include temperature checks, respiratory frequency, heart rate, body condition score, CRT, skin turgor, oral mucosal color, body weight, gender, and age of the animal. Next shave the rabbit's fur on the part of the body that the venous catheter will insert, and attach vital sign electrodes when the animal begins to be anesthetized. In addition, the hair in the abdominal and chest area is also shaved in preparation for the examination of the ecogenicity of the organ through ultrasound. Animals that have been satisfied for 6 hours are then prepared to be anesthetized by intramuscular injection consisting of atropine 0.25 mg/kg, ketamine 30 mg/kg and Xylasine 3 mg/kg (Gourdon, 2021), the next stage of the animal is cantalouted with a 26 gauge venous catheter inserted The auricular artery aims to drain blood and is placed in the femoral vein/saphena vein/venacephalica for the purpose of introducing resuscitation fluid. Animals will be euthanized using phenobarbital injected intravenously. Furthermore, animals are necropsied for observation of internal organs and sampling of organs, namely the brain, liver, kidneys, heart, and intestines. The acquired organs will be measured and assessed based on the macro-anatomy of the organ or the observation of the anatomical pathology of the organ. Organs will be assessed in organoleptic or pathological anatomical observations by looking at organ color indicators, organ measurements, and observing abnormalities that can be found. Next is taken organ specimen for histopathological examination. Organ samples will be stored in 10% formalin liquid.

Blood examination on a sample of rabbits is carried out by calculating hematocrit values, hemoglobin levels and total erythrocytes. This examination aims to find out the general picture of blood in rabbits experiencing hemorrhagic shock. The rabbits were divided into 4 groups, namely group 1 negative control, group 2 positive control, group 3 rabbits who had bleeding and were given ringer lactat fluid resuscitation and group 4 rabbits who had bleeding and were given resuscitation of ringer lactat fluid and gelatin. Group 1 was a negative control rabbit without treatment, the rabbit was anesthetized and a blood sample was taken according to the time of collection based on categories w1, w2, and w3. Group 2 was a positive control rabbit with a treatment where the rabbit was anesthetized and blood samples were taken according to the time of collection based on categories w1, w2, and w3 and bleeding 30%. Group 3 is the group of rabbits with treatment, rabbits are anesthetized and blood samples are taken according to the time of collection based on categories w1, w2, and w3 and bleeding 30% then allowed to stand for 30 minutes and then resuscitation of fluids for 30 minutes. Group 4 is rabbits who experienced bleeding and were given resuscitation of ringer lactat and gelatin fluids with treatment, rabbits were anesthetized and blood samples were taken according to the collection time based on categories w1, w2, and w3 and bleeding 30% then allowed to stand for 30 minutes and then resuscitation of ringer lactat and gelatin fluids for 30 minutes simultaneously.

Results and Discussion

Research on the effect of fluid resuscitation on the handling of hemorrhagic shock cases in rabbits was seen from the aspect of blood profile in 4 treatment groups, namely the negative control group (NC), positive control group (PC), treatment group 1 (TG1) and treatment group 2 (TG2). The negative control group shows the results in table 1.

Table 1. The result of the calculation of hematocrit, hemoglobin and erythrocytes in rabbits negative control

Group Negative Control (NC)	Sampling	Hct (%)	Hb (gr/dl)	Total Erythrocyte (x 10^6/µL)
NC R1	W1	21%	24	2,78
	W2	21%	24	2,78
	W3	20%	22	2,48
NC R2	W1	20%	21	3,56
	W2	20%	21	3,56
	W3	18%	18,6	3,24
NC R3	W1	22%	16,8	3,28
	W2	22%	16,8	3,28
	W3	20%	16	3,1

Based on table 1, it shows the blood profile in NC group rabbits, both R1, R2 and R3, showing a decrease in hematocrit, haemoglobin and erythrocytes in w3 blood sampling. This is thought to be caused by a blood draw of 3 ml at each time of blood draw, namely w1, w2, and w3 so that the total blood that comes out is 9 ml at 3 times. This can cause a reduction in blood volume so that it will have an impact on blood profile values both at hematocrit, hemoglobin & total erythrocyte values. This is in accordance with the theory according to Rezende et al. (2010), which states that erythrocytes function in transporting hemoglobin so that the tissue's need for oxygen can be met. Hemoglobin functions as a transport of oxygen and carbon dioxide from the lungs to the tissues so that if erythrocyte levels decrease, it will affect hemoglobin and cause hematocrit to also decrease. The occurrence of a decrease in erythrocyte values is suspected to be due to the occurrence of anemia. Anemia is a condition where erythrocyte deficiency occurs, low hemoglobin concentration or both. Common causes of anemia are bleeding, hemolysis, reduced blood formation or lack of several blood-forming factors (Rumlaklak et al., 2018).

Table 2. The results of the calculation of hematocrit, hemoglobin and blood erythrocytes in rabbits positive control

Positive Control Group (PC)	Sampling	Hct (%)	Hb (g/dl)	Total Erythrocytes (x 106/µL)
PC R1	W1	30%	16,5	3,82
	W2	-	-	-
	W3	17%	12,4	3,14
PC R2	W1	32%	17	4,77
	W2	10%	15,3	3,62
	W3	15%	13	3,28
PC R3	W1	31%	16,8	3.2
	W2	-	-	-
	W3	25%	13,6	3,06

Blood profile in control positive (PC) rabbits based on table 2. in R1 the hematocrine value decreased by 13%, while in R2 the hematocrit value was reduced by 15% while in R3 it showed a decrease in hematocrit presentation by 6% with an average hematocrit reduction value of 11.3%. Low hematocrit values are affected by the process of the bleeding process. This condition is in line with research conducted by Susandi and Rosmawati (2017), the hematocrit value is influenced by the number of erythrocytes in the blood and is the percentage of erythrocytes in the blood drops. The decrease in hematocrit value is suspected to be due to rabbit anemia after taking 3 ml of blood 3 times accompanied by 30% bleeding which causes a decrease in erythrocytes and affects the hematocrit value. This condition is in line with research conducted by Rumayar et al. (2016), a decrease in hematocrit values can be caused by indicators of anemia, leukemia and the occurrence of very large amounts of blood loss.

Hemoglobin values in rabbits of the PC group both on R1, R2 & R3 also show a decrease, based on table 2. Diatal hemoglobin values of 16.5 g/dl, 17 gr/dl, and 16.7 gr/dl respectively decreased to 12.4 gr/dl, 13 gr/dl and 13.6 gr/dl. The bleeding process during the study that reached the average blood that came out up to 28.8 ml resulted in a decrease in hemoglobin caused by red blood cells coming out too much from the body. This is in line with the opinion of Alipin and Sari (2020), the decrease in hemoglobin levels in the blood is related to the low value of erythrocytes caused by bleeding. The number of erythrocytes and hemoglobin levels are positively correlated, meaning that the higher the number of erythrocytes, the higher the hemoglobin level and if the erythrocytes decrease, the hemoglobin level also drops.

Table 2. also showed the total value of erythrocytes that decreased in value in the PC group in both R1, R2, and R3 rabbits. Successively showed results of 3.84 x 10 6/µL, 4.77 x 10 6/µL, and 3.2 x 10 6/µL with a decrease in the total value of erythrocytes up to 3.14 x 10 6/µL, 3.28 x 10 6/µL and 3.06 x 10 6/µL. The decrease in the total value of erythrocytes is influenced by bleeding in experimental animals that reach up to 30% of the body's total blood volume so that it decreases both in total erythrocytes, hemoglobin and hematocrit presentation. similar to Hardisman (2013) revealed that, at the beginning of the bleeding, the hematocrit (PCV) was still within the normal range, but after the bleeding caused the hematocrit (PCV) number of red blood cells (RBC), hemoglobin and blood plasma to decrease.

Rabbits in the PC group on both R1 & R3 for blood samples taken at W2 time could not be counted because the blood obtained had clots. this is due to less blood coming out at the time of taking W2 less and slower after the bleeding process bleeding so as to speed up the time of cloaking. According to Iwanaga et al. (2021), the blood clotting process occurs due to the narrowing of blood vessels to limit blood flow. Then, platelets will form blockages in the blood vessels to stop the bleeding. Next, the fibrin will stick and form a clot that will close the wound. Blood clots that occur in the EDTA tube are caused by a lack of blood in the EDTA tube used, causing faster blood clots. In accordance with research that has been carried out by Setiyaningsih et al. (2017), the ratio of the amount of blood with the anticoagulants used must be correct, because if the blood used is more than it should be, the blood will coagulate and get mycothrombin in the reservoir which causes platelet count to decrease and can clog the examination device. Conversely, if you use less blood and the anticoagulants are excessive, it will cause erythrocytes to wrinkle so that the hematocrit and MCV values decrease.

Table 3. The result of the blood calculation of rabbits who have been given resuscitation of ringer lactat fluid

Treatment Group 1 (TG1)	Sampling	Hct (%)	Hb (g/dl)	Total Erythrocytes (x 10^6/µL)
TG1 R1	W1	31%	29,8	3,97
	W2	-	-	-
	W3	27%	27,6	4,05
TG1 R2	W1	32%	33,5	4,07
	W2	-	-	-
	W3	22%	25	4,26
TG1 R3	W1	30%	32	4,54
	W2	17%	16,4	4,21
	W3	26%	20,8	5,27

Results Table 2. In the PC sample group R1 and R3 and Table 3 in the TG1 group sample R1 and R2 where both groups at the time of sampling W2 showed 0 results both on the indicators of Hct, Hb and Total Erythrocyte values this was due to the blood undergoing hemolysis so that There is damage to the cell membrane of the erythrocytes so that the hemoglobin enters the plasma. Hemolysis can result from lysis of red blood cells at various stages including during phlebotomy, handling and processing of samples and during storage. Wilson (2012) stated that hemolysis is a disruption of the erythrocyte membrane, which causes the release of hemoglobin. Hemolysis is also defined as erythrocyte necrosis and occurs at the end of each erythrocyte's life. The results of the calculation of hematocrit values in treatment group 1 (TG1) based on table 3. degrading in all treatment rabbits. The decrease in hematocrit values in R1, R2, and R3 respectively showed a decrease in presentation by 4%, 10% and 4% with an average decrease in hematocrit presentation of 6%. According to Sari et al. (2022), a decrease in the percentage of low hematocrit is due to the occurrence of anemia, hemorrhagic, red blood cell damage and factors of decreased erythrocytes in the blood. A decrease in hematocrit values is also often caused due to the occurrence of blood deposition. Blood will affect the shape of erythrocytes so that erythrocytes will shrink then the Hematocrit value becomes low which will cause LEDs to increase due to faster erythrocyte deposition (Liswanti, 2014).

The blood profile of the TG1 group in table 3 generally shows a decrease in Hb values in all rabbits seen before bleeding and after the resuscitation phase. The TGR 1 group in R1, R2 & R3 also showed successive decreases in Hb values of 2.2 g/dl, 8.5 g/dl and 11.2 g/dl with an average decrease of 7.3 g/dl. According to Purnomosidi et al. (2017) An increase in plasma volume causes a decrease in hematocrit concentration, hemoglobin value, and erythrocyte count, but does not decrease the absolute amount of hemoglobin and the number of erythrocytes in circulation. In addition, fluid resuscitation can also increase the average number of erythrocytes, the average hemoglobin value, and the average hematocrit value. This tendency of increase occurs because the fluid used is a small molecule liquid so that this fluid can penetrate the membrane of blood vessels and enter the interstitial compartment.

While the indicator of the total value of erythrocytes shows an increase in values on R1, R2, R3 respectively is 0.08 x 10 6/µL, 0.19 x 10 6/µL and 0.73 x 10 6/µL with an average increase of 0.33 x 10 6/µL. According to Hidayati et al. (2018), resuscitation of ringer lactat fluid can improve hemodynamic parameters after the occurrence of hemorrhagic shock. Ringer lactat fluid has the same amount of electrolyte as blood has. This fluid belongs to the group of crystalloids that can

be used in patients who experience fluid and blood loss caused by burns, trauma or surgery.

Table 4. The results of the calculation of bleeding given resuscitation of ringer lactat and gelatin fluids

Treatment Group 2 (TG2)	Sampling	Hct (%)	Hb (g/dl)	Total Erythrocytes (x 10^6/µL)
TG2 R1	W1	30%	23,8	4,62
	W2	26%	19.4	3,89
	W3	20%	25,37	4,33
TG2 R2	W1	27%	15	5,51
	W2	26%	12,6	4,08
	W3	12%	19,4	4,33
TG2 R3	W1	28%	12,4	3,98
	W2	21%	10,4	2,83
	W3	17%	18	3,06

The results of the calculation of hematorkit values in treatment group 2 (TG2) based on table 4. showed a decrease in hematocrit values in both R1, R2, and R3 experienced successive decreases in hematocrit presentation, namely 10%, 15%, and 11% with an average decrease of 12%. The blood that comes out during the treatment phase in experimental animals that reaches up to 30% of the total blood of the animal's body thus affects the hematocrit value to be low. According to Dewi et al. (2018), hematocrit decreased due to a decrease in erythrocyte values due to excessive bleeding, so the percentage of erythrocytes in 100 ml of blood is strongly influenced by total erythrocytes.

Hb & Total Erythrocyte values in the TG2 group in both R1, R2, and R3 showed an increase in values after being given gelatin liquid resuscitation. Successively, the Hb value increased by 1.57 gr/dl, 4.4 gr/dl and 5.6 gr/dl with an average increase of 3.8 gr/dl. This can be influenced by the administration of gelatin fluid therapy that can correct plasma pressure. According to Evans et al. (1998), gelatin is able to restore and maintain blood volume, blood pressure and oxygen delivery. The administration of gelatin fluid to restore blood volume due to bleeding because gelatin is able to improve plasma pressure in the blood. Meanwhile, the total erythrocyte values in R1, R2 and R3, namely in the W2 to W3 phase, also increased after being treated with gelatin successively, namely 0.44 x 10 6 / µL, 0.23 x 10 6 / µL and 0.23 x 10 6 / µL with an average increase of 0.3 x 10 6 / µL. According to Smart (2021), gelatin has a polygelin core, isoonkotic plasma substitution, with the physiological pH of this fluid and containing low chlorine so that it can correct the occurrence of hypovolemia where the accredited gelatin fluid has a higher anaphylactic reaction effect so that gelatin can reduce the quality of blood clotting formations. In addition, gelatin can also help in increasing plasma volume in patients. Gelatin is a macromolecule that is metabolized slowly.

The average data of the experimental animal treatment group related to the picture of blood profiles that have been given resuscitation of lactate and gelatin ringer fluids based on indicators of hemothycry, haemoglobin, and total erythrocyte values are presented in figure 1. Below.

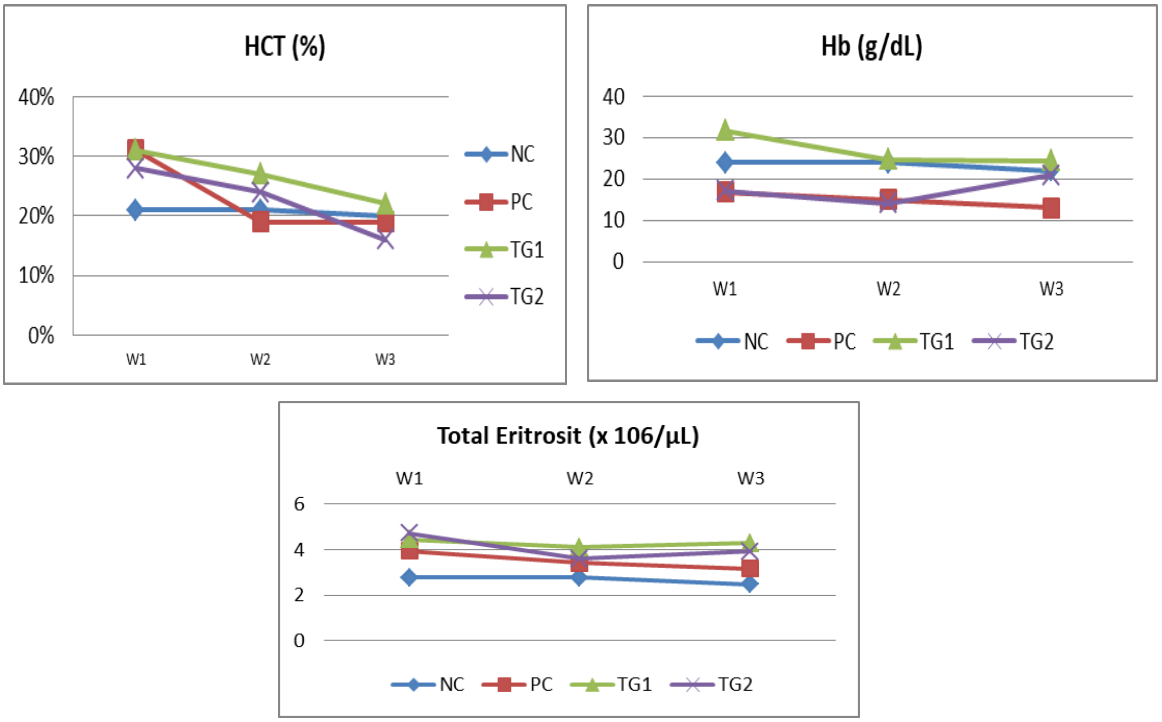

Figure 1. Hematocrit (HCT), Hemoglobin (Hb) and Total Erythrocytes showed a graph of the average group in the NC, PC, TG1 and TG2 Groups

Figure 1 above shows the average blood profile values of rabbits on indicators of hematocrit, hemoglobin and total erythrocyte values in the NC, PC, TG1, and TG2 groups respectively showing HCT values of 1.6%, 12%, 6% and 12 % While the Hb values in rabbits in the NC, PC, and TG1 groups experienced an average decrease of up to 1.7 gr/dl, 3.7 gr/dl, 7.3 gr/dl and in the TG2 group experienced an increase of 3.8 gr/dl. While the Total Erythrocyte values showed a decrease in values in the NC and PC groups with an average of 0.25 x 106/µL, and 0.76 x 106/µL, while the TG1 & TG2 group experienced an increase with an average of 0.33 x 106/µL and 0.3 x 106/µL. The decrease in value in the NC group was influenced by the number of blood samples taken, which was 9 ml or 11% of the total body blood. Based on Wingfield and Raffe (2002) bleeding <15% is classified as class I so that it affects the blood profile. Within 1 hour after light bleeding, interstitial fluid begins to move into the capillaries. This fluid shift continues for 36 to 40 hours. Loss of fluid from the interstitial space causes an interstitial fluid deficit. While in the PC group, the decrease in TG1 and TG2 was influenced by the bleeding process which reached 30% of the total body blood. This will affect the blood profile so that it decreases. This is in accordance with the theory according to Rezende et al. (2010), which states that erythrocytes play a role in transporting hemoglobin so that the tissue's need for oxygen can be met. Hemoglobin functions as the transport of oxygen and carbon dioxide from the lungs to the tissues so that if the erythrocyte level decreases it will affect hemoglobin and cause the hematocrit to also decrease. According to Widyawati et al. (2021), a decrease in blood profile is a pathological factor due to bleeding which can affect the value of erythrocytes in the blood. Decreased erythrocytes is the main factor causing a decrease in hematocrit and hemoglobin.

Based on the graph above, rabbits that experienced hemorrhagic shock after being given Ringer's lactate and gelatin fluid resuscitation showed an increase in the value of the indicator Hb value and total Erythrocytes. This is influenced by the fluid molecules present in crystalloid and colloid

fluids. Prior to fluid resuscitation, there was a decrease in hematocrit, hemoglobin and erythrocytes due to severe bleeding, which triggered hemorrhagic shock. In accordance with research conducted by Hardisman (2013), repeated blood sampling and 30% bleeding will result in decreased blood pressure, the body will reflexively increase the activation of the sympathetic nervous system resulting in an increase in vascular resistance and heart rate rate which aims to restore blood pressure to a normal level. A decrease in the number of erythrocytes is usually accompanied by a decrease in hemoglobin levels as an indication of a decrease in red blood cells. In addition, a decrease in erythrocytes also affects a decrease in hematocrit. The increase in the TG2 group was influenced by a combination of colloid fluid and the presence of fluid content, namely gelatin, which remained intravascular. After being given fluid resuscitation, there was an increase in hematocrit, hemoglobin and erythrocytes because this decrease was immediately corrected in the form of giving Ringer lactate and gelatin fluid resuscitation. This is in accordance with the theory according to Posangi et al. (2012), Ringer lactate fluid has the same amount of electrolytes as blood. In addition, Ringer's lactate also functions to regulate blood pH and act as a substitute for electronic fluids. Gelatin is a slow metabolized macromolecule. This substance can be used to maintain blood volume in shock due to excessive bleeding. In addition, gelatin also has the function of preventing reduced blood volume in the body so that when given to patients who have experienced shock it will help maintain blood volume due to shock.

Conclusion

This study showed better results in rabbits who experienced hemorrhagic shock after resuscitation of lactate and gelatin ringer fluid to the blood profile picture, namely in the indicator of total erythrocytes showing an increase in values in the TG1 and TG2 groups and an increase in Hb values in the TG2 group. Based on the results of research for the treatment of hemorrhagic shock in animals, it can be recommended to be treated with Ringer's lactate and gelatin. Better results were shown by the TG2 group, namely a combination of Ringer's lactate as a crystalloid fluid and colloid fluid which can survive intravascularly so that blood volume is restored and there is an improvement in plasma pressure and hemodynamics.

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