



The state of the humoral and cellular links of immunity of recipient rabbits following allogeneic transfusion of erythrocyte mass

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The study of activation of the humoral link of immunity of recipient rabbits following allogeneic transfusion of erythrocyte mass is important for a fundamental understanding of the formation of immunity in model species of animals. We measured the contents of B-lymphocytes, immunoglobulins of M, G, A classes, circulating immune complexes in blood of the recipient rabbits and antibody-dependent cytotoxic activity of lymphocytes. Number of B-lymphocytes in the blood of the rabbits was determined according to Bianco. Immunoglobulin content in blood serum of the rabbits was measured based on the Mancini method. The spectrophotometry method was used to measure circulating immune complexes. The antibody-dependent cytotoxic activity of lymphocytes was identified by the colorimetric method. Modeling of erythrocyte mass transfusion was performed on five clinically healthy rabbits by intravenous injection of allogeneic erythrocyte mass in the dose of 5.5 mL/kg of body weight. The materials for the study were the blood samples, gathered on the 3rd, 7th, and 23rd days after transfusion. We found that the content of B-lymphocytes in blood of the recipient rabbits increased throughout the research: on the 3rd day the content of B lymphocytes, compared with the initial state (11.4%), increased by 1.94 times and was 22.2%; on the 7th day their content increased by 2.22 times and was 25.4%; and on the 23rd day of the experiment the content of lymphocytes increased by 2.46 times, compared with the initial state, equaling 28.6%. The content of IgM on the 3rd day after transfusion of erythrocyte mass increased by 54.9% and was 2.20 ± 0.70 g/L. On the 7th day it increased by 19.0%, equaling 1.69 ± 0.44 g/L, and on the 23rd day the content of immunoglobulins decreased by 54.2% compared with the initial state (1.42 ± 0.18 g/L, intact rabbits), accounting for 0.77 ± 0.25 g/L. The content of immunoglobulins of class G on the 3rd, 7th, and 23rd days of the experiment was nearly the same as in the initial state. The content of class A immunoglobulins decreased 4.16-fold on the 3rd day of the experiment, approaching the control values afterwards. After the transfusion of erythrocyte mass to the recipient rabbits, the content of circulating immune complexes was higher compared with the initial state throughout the research: on the 3rd day the CICs content increased by 2.13 times, measuring 6.40 conventional units, and on the 7th and 23rd days it approached the initial values of the control group. On the 3rd day after transfusion, the antibody-dependent cytotoxic activity of blood lymphocytes of erythrocyte mass of the rabbits increased compared with the initial state (15.9%), measuring 17.3%; on the 7th day it was 19.4%; and on the 23rd day it increased to 27.9%. The results revealed presence of characteristic immunological changes after allogeneic transfusion of erythrocyte mass to the recipient rabbits, which were a consequence of progressive increase in the activity of the humoral link of immunity.

Keywords: transfusion; erythrocyte mass; immune reaction; B-lymphocytes; immunoglobulins; antibody-dependent cytotoxic activity.

Introduction

The main purpose of hemotransfusion in animals and humans is to restore the oxygen capacity of their blood, which was reduced due to dyserythropoiesis, hemolysis or blood loss, which caused the development of tissue hypoxia. Transfusion of whole blood and its components (erythrocyte mass (EM), platelet mass (PM), fresh frozen plasma) is an effective way to save the lives of seriously ill patients. However, allogeneic blood transfusion is not without immunological risks for recipients, as it can cause an acute immune reaction, which are evidenced by a post-transfusion increase in inflammatory biomarkers, including leukocytes, C-reactive protein, interleukins (IL-6, IL-8), as well as monocyte chemoattractant protein-1 (MCP-1) (Fenwick et al., 1994; Izbicki et al., 2004; McMichael et al., 2010; Callan et al., 2013; Dani et al., 2017). Thus, it has been established that reactions to blood transfusion are immune and non-immune, which are mediated or not mediated by the immune system. They can appear either immediately after the transfusion of blood and its components, or some time after the transfusion (Harrell & Kristensen, 1995; Sreethu et al., 2022). Clinical signs in animals, particularly dogs, may include fever, redness, swelling in the muzzle, shortness of breath, which

may resolve without specific treatment or complications (Davidow et al., 2021). The immune response is a process that involves various cellular elements for the elimination of an antigen with the obligatory participation of both specific (antibodies) and non-specific (cytokines, proteins of the complement system, etc.) humoral factors. Different types of cells take part in cellular reactions and constantly interact with each other – both circulating in the blood and lymph (lymphocytes, neutrophils, monocytes, eosinophils, platelets), and fixed (endothelial cells, epithelial cells, fibroblasts, etc.). Their degree of participation is determined by the type of antigen, the way it enters the body, the frequency and duration of its effect on the cellular and tissue structures of the immune organs (Drannik et al., 2006).

The immune response that can develop during the transfusion of allogeneic blood is clinically manifested by acute and chronic post-transfusion complications, in particular in the form of a febrile non-hemolytic transfusion reaction (Holowaychuk et al., 2014; Davidow et al., 2018; Davidow et al., 2021). Although the latter is not directly life-threatening, the physiological mechanisms that generate fever can negatively affect the health of the animal by accelerating metabolic needs and oxygen consumption (Kiekkas et al., 2013). This situation can be particularly detrimental if oxygen delivery is impaired due to anemia or hypovolemia. It has been

established that the post-transfusion immune reaction in recipient mammals can be a consequence of inflammatory mediators entering their bloodstream, which accumulate in preserved blood components during storage. In particular, IL-1 β , IL-6, IL-8 and tumor necrosis factor- α accumulate in human blood components during storage (Kristiansson et al., 1996; Shanwell et al., 1997; Hartwig et al., 2002; Izbicki et al., 2004).

It was established that after 28 and 35 days of storage of preserved erythrocyte mass of dogs, the concentration of IL-8 in it increases reliably (Corsi et al., 2014; Purcell et al., 2015; Purcell et al., 2017).

Blood transfusion in recipient rabbits also causes a number of immunological changes. In particular, the changes relate to the phagocytic activity of blood neutrophils according to indicators of the phagocytic index, phagocytic number and oxygen-dependent bactericidal activity, as well as the level of antibody-dependent cytotoxic activity of lymphocytes in recipient rabbits after allogeneic whole blood transfusion (Maliuk et al., 2022). It was also found that the number of leukocytes in the blood of recipient rabbits after allogeneic whole blood transfusion on the 3rd, 7th and 23rd days of the experiment increased by 35.3%, 74.5% and 43.1% respectively, which indicates a post-transfusion leukocytosis in the blood of the recipient animals. It should be noted that the increase in the number of leukocytes in experimental animals did not go beyond the physiological parameters (Maliuk et al., 2023).

Therefore, despite the fact that blood transfusion is a necessary therapeutic manipulation that saves life, it can lead to life-threatening immune complications in the recipient animal. Some of these immune responses are subclinical. It should be noted that quite often there are acute immune reactions, which are manifested by an increase in body temperature, swelling, as well as redness of non-pigmented areas of the body. Such reactions lead to complications of the primary disease and can also lead to the death of recipient animals (Brand, 2002; Tocci, 2010; Davidow, 2013).

Acute post-transfusion reactions are observed mainly in complex clinical cases. At the same time, it is necessary to distinguish between a reaction to transfused blood or blood components and a complication of the primary disease, which is observed during or immediately after blood transfusion. Severe post-transfusion reactions are usually associated with immune-mediated hemolytic reactions that are caused by IgM. Relatively mild extravascular hemolytic reactions are associated with immune-mediated transfusion reactions caused by IgG (Ogedegbe, 2002). Allergic reactions after blood transfusion, which are mediated by IgE and IgA, should also be noted (Yu & Sandler, 2003; Takaaki et al., 2011). Such reactions do not differ from most food or drug allergies.

Often the result of hemotransfusion is a violation of the function of the respiratory and cardiovascular systems. It is believed that the main cause of non-cardiogenic pulmonary reaction to blood transfusion is transfusion of leukocyte antibodies (Bux & Sachs, 2008). It has been established that the overload of the cardiovascular system occurs due to violations of blood transfusion protocols and its components, when the volume of erythrocyte mass and any accompanying infusions is greater than the ability of the cardiopulmonary system to pump blood, which can lead to acute heart failure (Gosmann et al., 2018).

Also during hemotransfusion a non-immune hemolytic transfusion reaction may occur due to damage to donor erythrocytes before transfusion or their improper storage, which leads to hemoglobinemia and hemoglobinuria without significant clinical symptoms (Patterson et al., 2011).

It has been found that minor immunological reactions caused by transfusion are not clinically manifested. Allogeneic blood transfusions likely initiate some degree of immune response in all recipients, but evidence for this is not always clinically evident. Minor immunological reactions caused by blood transfusion can be detected only by determining immunological indicators. In addition, in critically ill patients, blood transfusions can cause clinical signs in the form of allergic reactions. It should be noted that during the therapeutic measures to which critically ill patients are subjected, blood transfusion can cause significant immunological changes in the recipient's body. Thus, it was clinically confirmed that in seriously ill people, blood transfusion causes an acute immune reaction, which is confirmed by post-transfusion leukocytosis and an increase in pro-inflammatory cytokines (Muyllé et al., 1993; Fenwick et al., 1994; Shanwell et al., 1997). Transfusion of allogeneic blood is likely to initiate some degree of immunological reactions in all recipients, but such reac-

tions are not always clinically evident. Immune changes in the body of recipient animals that occur due to blood transfusion can be diagnosed with the presence of some biomarkers. In addition, the main disease in critically ill animals can also manifest itself in the form of leukocytosis and fever. Under such conditions immune changes caused by transfusion of blood and its components may go unnoticed. Finally, the use of drugs during therapeutic interventions in critically ill patients at the same time as transfusions can provoke an immune response with pronounced clinical signs (Muyllé et al., 1993; Shanwell et al., 1997; McFaul et al., 2009).

The aim of this study was to evaluate the effect of transfused erythrocyte mass on post-transfusion changes in immunological indicators (content of B-lymphocytes, immunoglobulins of M, G, A classes, circulating immune complexes and antibody-dependent cytotoxic activity of lymphocytes) in the blood of recipient rabbits.

Materials and methods

The experiments were carried according to the requirements of the General Ethical Principles of Performing Experiments on Animals, approved by the 1st National Congress of Bioethics and the Positions of the European Convention for the Protection of Vertebrate Animals used for Experimental and other Scientific Purposes, and the Law of Ukraine on Protection of Animals from Abuse. Permission for use of animals in the experiments according to the developed scheme was received from the local commission of Bioethics of the National University of Life and Environmental Sciences of Ukraine (as of 10/27/2020), Protocol No. 31-1.

The studies were carried out during 2022–2023 at the basis of the Bank of Animal Blood NNL of the Department of Surgery and Pathophysiology named after academician I. O. Povazhenko of the National University of Life and Environmental Sciences of Ukraine and in the conditions of the Vetmedservis Education-Research Center.

In the experiments we used clinically healthy non breed rabbits. The diet of the experimental animals was corresponded to their need in nutrients and biologically active compounds. The animals had free access to water and fodder. During the research the main clinical parameters of the experimental animals (body temperature, heart rate, respiratory rate) were monitored.

The materials for research were blood serum samples, obtained from 5 rabbits on the 3rd, 7th and 23rd days after erythrocyte mass transfusion.

Blood of the donor rabbits was drawn from the jugular vein using semi-closed method. In the place from which blood was to be drawn, the hair was shaved, and the skin was treated with 70 % alcohol solution. The samples of donor blood were collected into polymer containers with anticoagulant CPDA.

Separation of whole blood into components was carried out using a Rotanta 460R refrigerated centrifuge (Hettich GmbH, Germany). The speed of centrifugation was 2500 rpm, the time of centrifugation was 20 min. Centrifugation time does not include braking time. The temperature during centrifugation was 5 °C. After centrifugation the bag was carefully removed from the centrifuge and transferred to a plasma extractor to separate the plasma from the erythrocyte mass (Kenichiro & Holowaychuk, 2016).

Allogeneic transfusion of erythrocyte mass in estimation of 5.5 mL/kg of body weight to recipient rabbits was performed once (Kenichiro & Holowaychuk, 2016).

Before hemotransfusion, in order to avoid complications during the transfusion of erythrocyte mass, the compatibility of the blood of the donor rabbit and the recipient rabbit was determined using a large crossover test. A large crossover test was carried out *in vitro* at a temperature of 37 °C using a water bath Micromed BV-4 (Ukraine). On a slide, the serum of the recipient animal and the blood of the donor animal were mixed in a ratio of 1:5; 1:10. After a 5-minute exposure, microscopic studies were performed. In the absence of agglutination, also a biological (*in vivo*) test was conducted for individual compatibility.

Determination of the number of B-lymphocytes in the blood of rabbits was carried out according to Bianco. The principle of the method is based on that B-lymphocytes have receptors for the C₃-component of complement on their surface, but do not have receptors for ram erythrocytes, so direct interaction of such erythrocytes with B-lymphocytes is im-

possible. In order for erythrocytes to attach to B-lymphocytes, the mediation of complement and anti-erythrocyte antibodies is required. For this purpose, erythrocytes are treated with hemolytic serum, which contains anti-erythrocyte antibodies. An antigen-antibody complex is formed, with which complement binds. Since all B-lymphocytes have receptors for the C₃-component of complement, the number of such lymphocytes that formed rosettes (attached three or more erythrocyte-antibody-complement complexes) reflects the number of B-lymphocytes in a certain volume of the animal's blood (Mazurkevych et al., 2014).

Determination of immunoglobulins content in blood serum of rabbits is based on the Mancini method, which is based on measuring the diameter of the precipitation ring formed when the tested serum is introduced into the wells cut in the agar layer, in which the monospecific serum was previously dispersed, which is used to assess the functional state of the B-link of the immune system. Diameter of precipitation rings is directly proportional to the concentration of the studied immunoglobulin (Mazurkevych et al., 2014).

Determination of circulating immune complexes was carried out by a method based on selective precipitation of high molecular weight immune complexes, contained in blood serum, with polyethylene glycol with a molecular weight of 6000 Da, followed by determination of optical density by spectrophotometry at $\lambda = 450$ nm (Mazurkevych et al., 2014).

The antibody-dependent cytotoxic activity of lymphocytes was determined by the colorimetric method.

Microscopic studies of cells and their photography were carried out using a microscope Sigeta Biogenic LED (China) with a built-in camera Sigeta MDS-560 CCD (China).

Data in the tables are given as mean average \pm standard error ($x \pm$ SD). The statistical processing of the obtained results was carried out using the Tukey test with Bonferroni correction.

Results

The content of B-lymphocytes in the blood of recipient rabbits increased during the entire period of research. Thus, on the 3rd day the content of B lymphocytes compared to the initial state (11.4%) increased by 1.94 times and was 22.2%, on the 7th day their content increased by 2.22 times and was 25.4%, on the 23rd day of the experiment the content of lymphocytes increased by 2.46 times compared to the initial state and was 28.6% (Table 1).

Table 1

Immunity indicators of rabbits after allogeneic transfusion of erythrocyte mass ($x \pm$ SD, $n = 5$)

Indicators	Intact rabbits	3 day after transfusion	7 day after transfusion	23 day after transfusion
B-lymphocytes,%	11.4 \pm 2.4 ^d	22.2 \pm 3.0 ^b	25.4 \pm 2.1 ^c	28.6 \pm 1.1 ^d
Circulating immune complexes, c.u.	3.00 \pm 1.00 ^a	6.40 \pm 0.89 ^b	3.20 \pm 0.45 ^a	5.60 \pm 0.89 ^b
Antibody-dependent cytotoxic activity of lymphocytes, %	15.9 \pm 3.2 ^a	17.3 \pm 5.5 ^a	19.4 \pm 1.5 ^a	27.9 \pm 12.6 ^{ab}

Note: different letters indicate a significant difference between each other within one row of the table according to Tukey's test ($P < 0.05$) with Bonferroni correction.

The dynamics of the amount of circulating immune complexes (CICs) in the blood serum of recipient rabbits after transfusion of erythrocyte mass is shown in Table 1. The formation of circulating immune complexes during the entire period of the study exceeded the content of CICs in intact animals at initial state which was 3.00 conditional units (c.u.). Thus, on day 3 the CICs content increased by 2.13 times and was 6.40 c.u., on the 7th day – by 6.66% and was 3.20 c.u., on the 23rd day – by 86.7% compared to initial state and was 5.60 c.u. The antibody-dependent cytotoxic activity of rabbit blood lymphocytes on day 3 after transfusion of erythrocyte mass had grown on day 23 by 75.9% (Table 1).

The content of IgM on the 3rd day after transfusion of erythrocyte mass (Table 2) increased by 54.9% and was 2.20 ± 0.70 g/L, on the 7th day – by 19.0% and was 1.69 ± 0.44 g/L, and on the 23rd day the content of immunoglobulins decreased by 54.2% compared to the initial state (1.42 ± 0.18 g/L, intact rabbits) and was 0.77 ± 0.25 g/L.

Table 2

The dynamics of the content of immunoglobulins (g/L) in the blood serum of rabbits after allogeneic transfusion of erythrocyte mass ($x \pm$ SD, $n = 5$)

Immunoglobulins	Intact rabbits	3rd day after transfusion	7th day after transfusion	23rd day after transfusion
IgM	1.42 \pm 0.18 ^a	2.20 \pm 0.70 ^b	1.69 \pm 0.44 ^{ab}	0.77 \pm 0.25 ^c
IgG	8.66 \pm 0.16 ^a	8.29 \pm 0.02 ^b	8.40 \pm 0.12 ^{ab}	8.28 \pm 0.04 ^b
IgA	0.752 \pm 0.153 ^a	0.184 \pm 0.061 ^b	0.664 \pm 0.070 ^{ac}	0.512 \pm 0.076 ^c

Note: see Table 1.

Content of IgG showed a slight decrease in the course of the experiment (Table 2). Content of class A immunoglobulins has decreased by 4.16 times on the 3rd day of experiment and was 0.184 ± 0.061 g/L, by 12.0% – on the 7th day and was 0.664 ± 0.070 g/L, and by 32.0% – on the 23rd day and was 0.512 ± 0.076 g/L (Table 2).

Discussion

It should be noted that the study of content of B-lymphocytes in the peripheral blood of recipient animals has important clinical significance. Thus, B-lymphocytes are transformed into plasma cells with the subsequent production of antibodies, which forms the basis of the development of humoral immune reactions (Fal, 2020; Leone & Richeldi, 2020).

An increase of the content of B-lymphocytes on days 3, 7 and 23 after the transfusion of erythrocyte mass in recipient rabbits indicates the activation of the humoral link of immunity. Our research coincides with the research of a number of scientists (Shanwell et al., 1997; Izbicki et al., 2004; McFaul et al., 2009; McMichael et al., 2010; Callan et al., 2013).

IgM make up 5–10% of all serum antibodies. IgM belong to the "early" immunoglobulins. The half-life of this class of immunoglobulins is 4–6 days. They have high avidity, activate complement through the classical pathway. IgM is formed against each new antigen which enters the body. On the 4 to 6 days, the biosynthesis of antibodies switches to the synthesis of IgG (Tizard, 2016).

The increase in the content of IgM on the 3rd day after the transfusion of erythrocyte mass in recipient rabbits occurs due to the primary immune response. IgM are pentamers that have five active antigen-binding sites, forming large but unstable antigen-antibody complexes. Of course, such large molecular circulating immune complexes are phagocytosed by the system of mononuclear phagocytes and eliminated from the body of animals. It should be noted that on the 7th day, the IgM content exceeded the initial state by only 19.0%. This indicator indicates the transition of the primary immune response to a more specific – secondary one, due to the synthesis of IgG. On the 23rd day of the experiment the IgM content decreased by 54.9% compared to the initial state. A decrease in the content of IgM on day 23 indicates that the primary immune response had completely ended.

Class G immunoglobulins make up 70% of all serum immunoglobulins. The half-life is about 21 days. This class of immunoglobulins is thymus-dependent: synthesis of IgG takes place with the obligatory participation of T-lymphocytes (Tizard, 2016). A slight decrease of IgG on the 7th and 23rd days of the experiment is obviously due to the activation of proteins of the complement system and the formation of immune complexes with allogeneic leukocytes and platelets during transfusion of erythrocyte mass.

Class A immunoglobulins exist in two forms – serum and secretory. In blood serum IgA is about 15%. The half-life of serum IgA is 5–6 days. Serum form of IgA activates proteins of the complement system by an alternative pathway (Tizard, 2016). A decrease in the content of serum IgA on day 3 of the experiment in recipient rabbits is obviously due to the activation of the synthesis of IgM during the first days after transfusion of erythrocyte mass. In our opinion, the decrease in the content of IgA on days 7 and 23 after transfusion of erythrocyte mass in the peripheral blood of recipient rabbits compared to the initial state occurred due to the activation of IgG synthesis and formation of a large number of circulating immune complexes.

It should be noted that the content of IgM, G, A was decreased on the 23rd day after transfusion of erythrocyte mass. At the same time, the

number of B-lymphocytes and the content of circulating immune complexes in the peripheral blood of recipient rabbits was higher compared to the initial state. Our research coincides with the research of a number of scientists (Dean, 2005; Poh, 2018).

One of the important indicators that characterises the state of the humoral immune response is the level of circulating immune complexes (CICs), which are formed during the direct connection between antigens and antibodies.

The formation of CIC is a physiological defense mechanism of the animal body, which leads to rapid removal of antigens by phagocytic cells of the system of mononuclear phagocytes. CICs consist of antigen, antibody and components of complement (C_3 , C_4 , C_1). However, when the size of CICs increases (due to an excess of antigens and the presence of IgM, the C_{1q} component of complement in their structure), such complexes can be deposited in the perivascular space and the cortical layer of the kidneys, causing complement activation and inflammatory processes, which is a negative factor for the organism of recipient animals (Patalakha, 2016; Stepura et al., 2020). Therefore, the determination of the level of immune complexes in blood serum after transfusion of erythrocyte mass is important in the diagnosis of acute inflammatory processes, in which the level of CICs increases.

A high level of CICs after transfusion of erythrocyte mass is probably the result of the activation of the humoral link of immunity and may indicate a high load on system of mononuclear phagocytes, which is responsible for their removal.

The increase in content of circulating immune complexes in the peripheral blood of rabbits during the entire period of research compared to the initial state indicates the activation of the humoral link of immunity. Along with this, a gradual increase of content of B-lymphocytes in the blood was observed, which also is a manifestation of the activation of the humoral link of the immune system. The data, obtained by us, coincide with the data of other researchers, who studied changes in the content of CIC, their quantitative and qualitative composition during inflammatory processes (Patalakha, 2016; Gajdash et al., 2017; Verbytskyi et al., 2017).

As is known, NK cells are capable of neutralizing target cells, including foreign erythrocytes, without any prior activation. In addition, thanks to the expression of Fc receptors, NK cells can participate in reactions of antibody-dependent cell cytotoxicity, that is, neutralize antigens opsonized by IgG. Involvement of Fc receptors in the process of recognition of antigen epitopes significantly increases the efficiency of cytolysis (Tizard, 2016). On the 3rd day of experimental studies the antibody-dependent cytotoxicity of lymphocytes increased by 8.9% relative to the initial state. It is likely that the gradual increase in the antibody-dependent cytotoxic activity of lymphocytes in the peripheral blood of recipient rabbits on the 3rd day of experimental studies compared to the initial state is due to the activation of the immune system and the beginning of the synthesis of class G immunoglobulins (Keir et al., 2012; Kenichiro & Holowaychuk, 2016). On the 7th day of experimental studies the antibody-dependent cytotoxic activity of blood lymphocytes had increased by 21.9% compared to the initial state. The increase in antibody-dependent cellular cytotoxicity on the 7th day of the experiment should be associated with the progression of active synthesis of antibodies of the late phase of the immune response (IgG), which interact with Fc domains on surface receptors of NK cells. Immunoglobulins of class G have only two antigen-binding centers and a smaller molecular weight, thereby providing greater specificity with epitopes of corpuscular and humoral antigens (erythrocytes, leukocytes, platelets, blood plasma proteins), thereby ensuring stable avidity (Tizard, 2016). On day 23 of the experiment the cytotoxic activity of blood lymphocytes significantly had increased by 75.9% compared to the initial state. The increase in antibody-dependent cellular cytotoxicity on day 23 of the experiment is probably associated with the active synthesis of class G immunoglobulins by plasma cells, which actively opsonize transplanted antigens, forming an antigen-antibody complex, and thereby activate the reactions of antibody-dependent cellular cytotoxicity (Tizard, 2016).

Conclusions

It was established that content of B-lymphocytes in the blood of recipient rabbits increased during the entire period of research from 11.4% in

the control group of animals to 28.6% on day 23 of the experiment. Changes in the remaining characteristics studied by us were not as strongly expressed. The obtained results allow us to assert the presence of characteristic immunological changes after allogeneic transfusion of erythrocyte mass to recipient rabbits, which are a consequence of progressive increase in the activity of the humoral link of immunity. The perspectives for further studies are study of allogeneic transfusion of blood components and parameters of specific and non-specific links of immunity in the recipient animals.

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