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Research Article

Functional activity of hemostasis in piglets who have undergone prolonged transportation

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ABSTRACT

Objective:to find out the dynamics of platelet activity, hemocoagulation and fibrinolysis in piglets who have undergone prolonged transportation.

Material and methods: The study took healthy piglets of the large white breed at the age of 2 months, who transferred long-term transportation in a closed van from the breeding pig farm of the Kostroma State Agricultural Academy to the farms of the Kostroma region of Russia after they were sold for further cultivation with a total of 56 animals. The control group consisted of 27 healthy piglets of 2 months of age, a large white breed that could not tolerate transportation and kept in standard conditions of the breeding pig farm of the Kostroma State Agricultural Academy. In work hematologic and statistical methods of research are applied.

Results:Platelets and coagulation hemostasis are very sensitive to many negative environmental influences. Under these conditions, the rapid development of hemostasiopathy, leading to a deterioration of blood flow in small vessels and weakening of tissue trophism, is possible. These changes in the activity of hemostasis are of rather great economic importance, since they can lead to serious economic damage due to the development of growth inhibition in animals. In this regard, the hemostasis reaction of piglets to an adverse environmental factor often affecting them – transport stress – is of great interest. It arises during their transportation from breeding farms to other pig-breeding complexes and to various farms. This situation is quite common, which dictates the need for its additional study in terms of the dynamics of the activity of hemostasis indicators, which can affect the perfusion of their tissues.

Conclusion:It was established that, against the background of transport stress in piglets, there is an increase in platelet activity and hemocoagulation with a weakening of the fibrinolysis process. The developing situation can be considered as the reaction of the organism to the environmental factor of excessive intensity. Under these conditions, they develop hemostasis activation and create the risk of pathology formation.

Keywords: Platelets, Hemocoagulation, Anticoagulation, Fibrinolysis, Piglets, Traffic stress.

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INTRODUCTION

The functional state of the organism at any stage of ontogenesis depends on a large number of external and internal factors simultaneously affecting it.[1,2] In some situations, it is possible for an organism to exert a factor of extraordinary power[3,4] that can cause various disruptions in its functioning[5]. This situation is of great interest in medicine[6,7]and in practical biology.[8,9] In the first case, the study of this issue on a person has great social significance[10]and ultimately aims to increase their average life expectancy.[11,12] In the second case, it is connected with the preservation of the potential severity of economically useful traits in productive animals during their breeding and

rearing and is of great food and economic importance.[13,14]

It becomes clear that the optimal functioning of the body of young productive animals is possible in conditions of a balanced diet, an optimal microclimate and the absence of stressful situations.[15,16] However, during early ontogenesis in productive animals, strict adherence to the necessary conditions is not always possible.[17] In these cases, there is a very high risk of developing various dysfunctions, which can lead to a deterioration of the general condition and a decrease in the level of gains.[18]

It becomes clear that the basis for reducing the viability of a living organism is often a violation of the optimum blood circulation in all organs.[19,20,21] To a large extent, this situation is determined by a violation of hemocirculation in the capillary bed, where the processes of tissue metabolism.[22] It has been firmly established that the success of the microcirculation is largely determined by the properties of the blood cells[23], including platelets[24], which are functionally closely related to the other components of the hemostasis system.[25]

It has been previously established that platelets and coagulation hemostasis are very sensitive to many negative environmental influences.[26,27] Under these conditions, the rapid development of hemostasiopathy, leading to a deterioration of blood flow in small vessels and weakening of tissue trophism, is possible.[28] These changes in the activity of hemostasis are of rather great economic importance, since they can lead to serious economic damage due to the development of growth inhibition in animals.[29]

In this regard, the hemostasis reaction of piglets to an adverse environmental factor often affecting them — transport stress — is of great interest. It arises during their transportation from breeding farms to other pig-breeding complexes and to various farms. This situation is quite common, which dictates the need for its additional study in terms of the dynamics of the activity of hemostasis indicators, which can affect the perfusion of their tissues.

It is recognized that the optimum functioning of the body is largely determined by the severity of the influence of environmental factors on it and the degree of reaction of the components of the hemostasis system to them.[30,31] It has been noticed that a dysfunction of the body often occurs with the excessive activation of hemostatic mechanisms as a result of the gradual development of rheological blood disorders and deterioration of tissue trophism on this background.[32] In this regard, transport stress in piglets is justified to check for the possibility of a violation of hemostasis activity against its background. In this regard, in the study, the goal was set: to find out the dynamics of platelet activity, hemocoagulation and fibrinolysis in piglets who have undergone prolonged transportation.

MATERIAL AND METHODS

The study was conducted in strict accordance with the ethical principles established by the European Convention for the Protection of Vertebrates, used for experimental and other scientific purposes (adopted in Strasbourg on March 18, 1986 and confirmed in Strasbourg on June 15, 2006).

The study took healthy piglets of the large white breed at the age of 2 months, who transferred long-term transportation in a closed van from the breeding pig farm of the Kostroma State Agricultural Academy to the farms of the Kostroma region of Russia after they were sold for further cultivation with a total of 56 animals. The control group consisted of 27 healthy piglets of 2 months of age, a large white breed that could not tolerate transportation and kept in standard conditions of the breeding pig farm of the Kostroma State Agricultural Academy.

In the work with the help of a micromethod, platelet aggregation was evaluated in response to ADP in the standard dose. In this study, the state of coagulation hemostasis was also assessed by a number of indicators. The kefalin-kaolin time value was recorded in the test for activated partial thromboplastin time, fibrinogen level was estimated, the level of soluble fibrin-monomer complexes was determined using the orthophenanthroline method[33]. The plasma revealed the activity of a type 1 plasminogen activator inhibitor using a specific chromogenic substrate using the Coatest PAI-1 test system

manufactured by Chromogenix. Fibrinolytic properties of blood were evaluated using the traditional method[33]. Statistical processing of the obtained digital results was carried out using a standard software package. Differences were considered significant at $p < 0.05$.

RESULTS AND DISCUSSION

In animals that have undergone transport stress, there are violations of the hematological parameters taken into account. The work found that the piglets of the main group have no differences with the control of the content in the blood platelets. However, their aggregation activity in the main group in response to ADP was accelerated by 33.9%.

This hemostatic disorder was aggravated by shortening the activated partial thromboplastin time (by 29.3%). In addition, in piglets undergoing transport stress, the amount of fibrinogen in the blood was increased by 77.3%, and their plasma fibrinolytic activity was reduced by 38.2%. The number of soluble fibrin-monomeric complexes in their blood exceeded the control level by 41.5%. The situation was aggravated by a sharp increase (by 87.3%) in the blood of animals that had undergone transportation of a type 1 tissue activator plasminogen inhibitor.

Table. Considered indicators in the examined piglets

Registeredindicators	**Control group, M±m, n=27**	**Core group, M±m, n=56**
Plateletcount, 10^9/l	196.5±1.33	210.1±1.62
Platelet aggregation with ADP, s	49.7±0.34	37.1±0.29 p<0.01
The value of activated partial thromboplastic time, s	40.1±0.53	31.0±0.43 p<0.01
Fibrinogen, g/l	2.2±0.34	3.9±0.19 p<0.01
Plasma fibrinolytic activity, min	7.6±0.47	5.5±0.27 p<0.01
Soluble fibrin monomeric complexes, mg%	4.1±0.34	5.8±0.42 p<0.01
The amount of inhibitor of tissue activator plasminogen type 1, ng/ml	29.2±0.48	54.7±0.75 p<0.01

Note: p - significance of differences between the main and control groups.

It is known that the activation of hemostasis is very characteristic of many dysfunctions and pathologies. This is due to the fact that its occurrence is strongly provoked by various environmental factors. Hemostasiopathy is very dangerous in terms of the development of vascular spasm and deterioration of blood rheology on its background, especially during the period of active growth.[33,34] It is almost always manifested by the activation of platelets and coagulation hemostasis, which was traced in piglets who suffered a transport stress.[35] Increased platelet aggregation inevitably worsened their microcirculation in the capillaries and was a serious threat to the inhibition of growth. The increase in plasma hemostasis activity evidently occurred as a result of an increase in the activity of most blood coagulation factors, which ensured a significant increase in procoagulation effects along both coagulation pathways.[36]

The weakening of the blood fibrinolytic mechanisms in animals created additional conditions for microthrombus formation. At the same time, an increase in the amount of fibrinogen was one of the important mechanisms for the simultaneous enhancement of platelet activity and hemocoagulation. In the first case, it acted as molecules that bind the platelets to each other, and in the second, as the main substrate for the effects of all the mechanisms of hemostasis and as the structural basis of the developing thrombus.[37,38]

There is every reason to believe that plasma lipid peroxidation was activated in the observed piglets, which stimulated the synthesis of α_2-antiplasmin.[39] This situation further weakened the fibrinolytic activity of the liquid part of the blood.[40] The imbalance of hemostatically important substances formed under these conditions ensured the initiation of hemostasis mechanisms, the development of hemostasiopathy with the rapid deterioration of microcirculation.

CONCLUSION

The optimum functioning of the body is largely determined by the severity of the influence of

environmental factors on it and the degree of reaction of its components of the hemostasis system to them. In the case of excessive activation of hemostatic mechanisms, the development of rheological blood disorders with the subsequent deterioration of tissue trophism is possible. In the study, it was established that, against the background of transport stress in piglets, there is an increase in platelet activity and hemocoagulation with a weakening of the fibrinolysis process. The developing situation can be considered as the reaction of the organism to the environmental factor of excessive intensity. Under these conditions, they develop activation of hemostasis and create the risk of the formation of pathology.

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