



Features of Rheological Properties of Animal Blood in the Dynamics of Experimental Cholestasis

KH Akhmedov^{1*}, JS Surabova² and NL Allanazarova³

¹Ph D Associate Professor, Head of the Department of Normal Physiology, Pathological Physiology and Hygiene of the Termez Branch of the Tashkent Medical Academy, Uzbekistan

²3rd year student of the Faculty of General Medicine, direction "Pediatrics" of the Termez branch of the Tashkent Medical Academy, Uzbekistan

³2nd year student of the Faculty of General Medicine, direction "General Medicine" of the Termez branch of the Tashkent Medical Academy, Uzbekistan

***Corresponding Author:** KH Akhmedov, Ph D Associate Professor, Head of the Department of Normal Physiology, Pathological Physiology and Hygiene of the Termez Branch of the Tashkent Medical Academy, Uzbekistan.

Received: May 09, 2022

Published: July 04, 2022

© All rights are reserved by **KH Akhmedov, et al.**

Abstract

Relevance of the study: The problem of effective treatment of patients with mechanical jaundice remains relevant, despite the impressive results of biliary surgery. The main cause of mortality in patients with mechanical jaundice of benign genesis is the progression of liver failure after performing surgery on the biliary tract [3].

Objective of the study: To determine the features of the blood velocity of animals in the dynamics of experimental cholestasis

Material and Methods: The experiments were conducted on 69 white mongrel rats-males of a mixed population with an initial mass of 180-200 grams, contained in the laboratory diet in the conditions of the vivarium.

Outcomes: In the experimental group of animals, we revealed an even greater increase in blood hyperviscosity, while the shear rate increased slightly relative to the values of the previous study period. Thus, the shear rate was at applied pressure values of 8-, 12- and 16-mm. water station below the value of intact rats by 60; 80.56 and 73.5%, respectively.

Conclusion: The results of the studies indicate that the violation of the rheological properties of the blood as a result of ligation of the common bile duct is transient. These results to a certain extent explain the disturbances in the microcirculation system of the organs studied.

Keywords: Experiment; Cholestasis; Blood Flow Rate; Obturation of the Bile Ducts

Introduction

In recent years, there has been a significant increase in the hepatopancreatobiliary system, which in turn increases the number of diseases increases the incidence of complications of this pathology. Mechanical jaundice is a fairly common complication, which is characterized by a violation of the outflow of hepatic bile into the duodenum, which is caused by pathological processes at various levels of the bile ducts.

Changes in the rheological properties of blood are an important factor in microcirculation disorders in the development of various diseases. The structure of blood flow in microvessels is determined by a number of factors: the uneven distribution of the concentration of erythrocytes, the uneven distribution of velocities across the vascular lumen, the deformability of erythrocytes, the viscosity of plasma.

According to dann, a number of authors of the rheological properties of blood in the pathogenesis of disorders of microcirculation of internal organs in disorders of the outflow of bile. The study of the dynamic speed of blood in experimental cholestasis showed the presence of significant changes in almost all values of pressure applied to the blood flow [4].

Experiments were conducted on 68 white mongrel rats-males of a mixed population with an initial mass of 180-200 grams, contained in the laboratory diet in vivarium conditions. In 36

rats, extrahepatic cholestasis was reproduced by ligation of the common bile duct [2]. The overall mortality rate in this group was 30.3%. Control was falsely operated animals (2 4 rats), which underwent only laparotomy under aseptic conditions. No mortality was observed in these groups. The intact group consisted of 8 rats. Studies were conducted 1, 3, 7 and 15 days after the reproduction of the models. The choice of study timing is associated with the development of significant morpho-functional changes in the liver in experimental cholestasis [2].

A breakdown of the experience is presented in table 1.

Series of experiments	Terms of the experiment, day				Altogether	Lethality, %
	1	3	7	15		
Episode 2:						
Intact	2	2	2	2	8	-
Control	6/6	6/6	6/6	6/6	24/24	-
Extrahepatic cholestasis	9/6	9/6	9/6	9/7	36/25	30,6

Table 1: Scheme of the experiment.

Note: the numerator contains the initial number of animals in groups; in the denominator - the number of animals taken for research, taking into account mortality.

The rheological properties of blood have been studied by determining the viscosity and rate of blood shift. One of the main indicators of the rheological properties of blood - viscosity or fluidity was determined by the Copeli method with a modification by V.M. Udovichenko [5]. On the basis of copeli’s viscosimeter, a system consisting of a preostat, a measuring capillary and a thermostatic installation was assembled. Shear rate indicators were determined by applying various values of hydrostatic pressure (2,4,8,12,16, mm.water.st), since these values correspond to the pressure in vessels of different calibers.

The rate of blood shift was calculated by the formula

$$V = \frac{4 * R^2 * L}{R^3 * t}$$

V - blood shift rate (sec⁻¹)

Results of the Study

One day after the beginning of the experiment, both in the group of control and experimental animals was characterized by

a decrease in the rate of shift of flow. Thus, in the group of control animals, the rate of shift decreased in relation to the values of intact animals under the water station by 45.14%, at the water layer by 43.07%. This indicator was higher than the values of intact animals at the water station by 21.16%, at the water article by 84.51%. In the group of experienced animals, the changes were of the same nature. So, the shear rate was lower than the corresponding values of intact animals at water. by 79.81%, at water level. by 87.58%. These results may be a consequence of the pronounced activation of the blood coagulation system in response to tissue damage during surgery. 4 mm16 mm4 mm16 mm4 mm16 mm Dynamics of blood flow rate of rats with extrahepatic cholestasis (M ± m), c⁻¹

Day 3 studies were characterized by a tendency to normalize the studied rheological parameters of blood in the control group, but their complete recovery was not noted. Thus, the rate of blood shear at high values of applied pressure (12.16 mm water. st) remained low (a decrease of 53.14 and 67.57%, respectively).

Group	Pressure, mm. water. Art.			
	4	8	12	16
Intact	22,60 ± 0,12	35,65 ± 0,10	68,43 ± 0,23	107,45 ± 0,34
Obturation, through:				
1 night	<u>11,75 ± 0,09</u> ^{a,b} 12.40 ± 0.09 ^A	<u>6,70 ± 0,09</u> ^{a,b} 19.40 ± 0.04 ^A	<u>5,25 ± 0,12</u> ^{a,b} 21.70 ± 0.31a	<u>13,35 ± 0,17</u> ^{a,b} 21.70 ± 0.09 ^A
3 overnights	<u>20,00 ± 0,14</u> ^{a,b} 22,00 ± 0,33	<u>14,25 ± 0,14</u> ^{a,b} 31.72 ± 0.32 ^A	<u>13,30 ± 0,16</u> ^{a,b} 32.07 ± 0.13 ^A	<u>28,48 ± 0,13</u> ^{a,b} 34.85 ± 0.37 ^A
7 overnights	<u>31,11 ± 0,18</u> ^{a,6} 35.40 ± 0.15 ^A	<u>33,17 ± 0,28</u> ^{a,b} 65.80 ± 0.09 ^A	<u>28,45 ± 0,10</u> ^{a,b} 65.75 ± 0.24 ^A	<u>66,65 ± 0,16</u> ^{a,b} 68.63 ± 0.45 ^A
15 overnights	<u>58,75 ± 0,32</u> ^{a,6} 61.19 ± 0.37 ^A	<u>49,97 ± 0,40</u> ^{a,b} 91.79 ± 0.03 ^A	<u>40,10 ± 0,31</u> ^{a,b} 98.55 ± 0.01a	<u>100,03 ± 0,27</u> ^{a,b} 103.43 ± 0.20 ^A

Table 2

Notes: 1. The indicators of the experimental group are placed in the numerator, and the control group is placed in the denominator.
 2. Reliable difference (R < 0.05); a - from the intact group, b - from the control group.

Thus, the shear rate was lower than the values at the values of the applied pressure of 8, 16 mm. by 49.56% and 56.74%, respectively. Compared with intact rats, the blood shear rate was maintained lower by 58.43% and 38% at 12.16 mm. respectively. The final period of research was characterized by a marked improvement in the studied blood parameters. Thus, the shear rate was equal at 4 mm. 58,750,32 ±^{s-1}, with 16 mm. water level. - 100,030,27 ±^{s-1}. But, despite such dynamics, these indicators differed significantly from both the indicators of intact and control groups of animals.

Conclusion

The generalized nature of changes in the rheological properties of blood becomes one of the important reasons for the involvement in the pathological process of internal organs and tissues not directly related to the liver. Such dynamics of changes in the rheological properties of the blood exacerbates the disorganization of the microvasculature, impaired gas exchange at the level of «capillary-cell». Slowing down the linear speed of blood flow increases the accumulation of toxic metabolites, contributing to intoxication of

the body. That is why correction of altered rheological properties of blood becomes important in conditions of liver pathology, the main organ of the body’s detoxification system.

Bibliography

1. Akhmedov KKh and Yuldashev NM. “The main mechanisms of development of multiple organ failure in the modeling of acute obturation of the biliary tract”. *Medical Journal of Uzbekistan* 4 (2010): 87.
2. Zufarov KA and Sadridinov AF. “Sclerotic changes in the liver in experimental cholestasis and their reversibility after restoration of bile outflow”. *Bulletin of Experimental Biology and Medicine* 52.7 (1986): 105-108.
3. Magomedov MM., et al. “Diagnostics and treatment of mechanical jaundice syndrome”. *International Research Journal* 4.106 (2021).

4. Styazhkina SN., *et al.* "Actual problems of mechanical jaundice in surgery". *International Journal of Applied and Fundamental Research* 7.3 (2016): 427-430.
5. Udovichenko VI. "Improved Copeli viscometer for determining viscosity in small blood samples under thermostable conditions". *Pathological Physiology and Experimental Therapy* 1 (1978): 73-75.