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Original Research

Blood Coagulation and Platelet Activation in the Athletes Specialized to Row and Canoe

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ABSTRACT:
The purpose of this study is to evaluate the functional status of platelets in athletes in rowing and canoeing. Researched 24 athletes, practicing in the section in rowing and canoeing for at least 1 year. All the patients examined counted the number of platelets in the capillary blood in the Goryaev chamber. Intravascular platelet activity (BAT) was determined visually using a Shitikov phase contrast microscope. It has been established that athletes maintain consistently high blood platelet activity, especially among those who regularly train in the sports section in rowing and canoeing, which is largely related to the constancy of their receptor sensitivity to exogenous influences with a constant number of receptors for them.
Key words: Rowing; canoeing; athletes` injury; blood coagulation; platelet activation; intravascular.

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INTRODUCTION

Currently, a close relationship has been revealed between the development of the morphofunctional state of the body and the rheological properties of blood, largely due to the level of platelet activity [1, 3]. It is known that the physical activity of the organism is able to influence the indicators of platelet functions [2]. Young people who regularly train do not fully understand the influence of physiological inducers on platelet activity and their combinations, the level of functioning of the systems providing them, and the severity of platelet morphological activity in the vessels.

Popularity of rowing and canoeinghas increased during the last few years. Nowadays, there are many professional row and canoeathletes in Uzbekistan, participate in sport competitions. Thrombembolic events have been reported in athletes during competition amounting tosignificant mortality and morbidity in otherwise healthy professionals even in the most experienced athletes [4]. In previous researches, activation of coagulation and platelets were studied during competitions [5]. Although during other persistence sports difficult exercise is carried out for several hours severe thrombembolic events occur only very rarely.

While most studies about coagulation changes during physical exercisesevaluated more or less isolated variables describing coagulation by measuring single clotting parameters or decomposition products, rotational thrombelastometry analyzes both, clotting times and the stability of the clot over the time. Since rotational thrombelastometry is carried out in whole blood, the results are affected byclotting factors, fibrin polymerization, interaction of platelets and fibrinolysis, providingdata about the last product of coagulation, the clot itself, displaying overall coagulation activity [6].

The purpose of this study is to study the functional status of platelets in athletes in rowing and canoeing.

MATERIALS AND METHOD

The study group included 24 healthy young people of college age, practicing in rowing and canoeing for at least 1 year (7 people 18 years old, 6 people 19 years old, 8 people 20 years old, 3 people 21 years old). All the patients examined counted the number of platelets in the capillary blood in the Goryaev chamber. Intravascular platelet activity (IPA) was determined visually using a Shitikov phase contrast microscope. To determine the intravascular activity of platelets, blood taken from the ulnar vein 2 ml into a siliconized centrifuge tube with 8

ml of glutaraldehyde solution was centrifuged for 6 minutes at 1000 rpm. The supernatant was stirred with a pipette and filled in the Goryaev chamber, which was then placed for 20 minutes in a moistened Petri dish. Under a phase contrast microscope, the percentage distribution of the different above platelet forms per 200 cells was determined. In the morphological study of platelets, the first visible manifestation of the activation of platelets is a change in their shape, which can serve to adequately assess this process as induced by *invitro*, and developing in the body. In the bloodstream, in the absence of pathological activating effects, the vast majority of intact platelets, called discocytes, have a characteristic discoid or lentil shape and an almost smooth surface. The characteristic shape change during the induction of hemostatic reactions of the blood plates reflects certain processes of their internal ultrastructural and biochemical rearrangement. At the same time, a typical sequence of changes develops: from the form of an intact platelet – a discocyte to activated cells - a disc echinocyte, in which processes appear on the surface, and further to a spherocyte or sphero-ehinocyte. In the latter, not only the form becomes more spherical, but also the number of processes grows. Thus, there are several options for inexpensive and reasonably fast methods for assessing the ability of platelets to aggregate in various biological objects. In samples of platelet-rich plasma, the ratio of four morphological cell types has its ratio to each other. As can be seen from the pattern of platelet morphology, discocytes usually contain 5-15 granules per cell, and among them are small (diameter 2.0-2.9 μm), medium (3.0-3.7 μm) and large (3.8 μm) cells (Fig. A-b). Among the discocytes, there are often cells containing only 1-2 granules, as well as cells without granules (Fig. E). In discocytes with 1 or 2 granules, contact of the granules with the cell wall is very often observed. In the course of adhesion on the glass platelets are spreading - their diameter increases 1.5-2 times in such cells individual granules become more clearly visible, the number of which can reach 20-30 per 1 cell. At the same time, there is a gradual displacement of the granules to the periphery of the platelets. The granules then bind to the cell wall and extend beyond the platelet. After the ejection of granules, the platelets change shape: from spreading, they become more rounded and form short outgrowths (Fig. E), which can later lengthen. Such platelets have locomotor (motor) activity and can gather in tight clusters on a glass slide. We emphasize that the adhesive activity of platelets with granules does not depend on their linear dimensions.

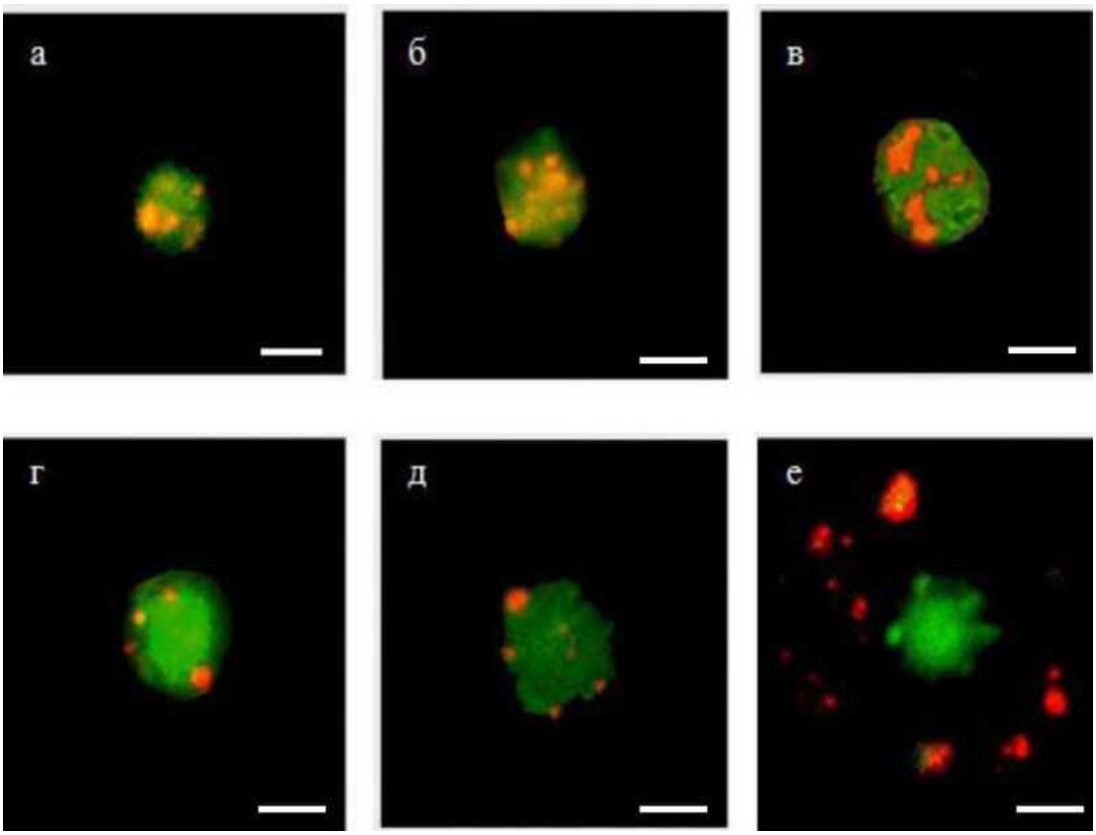

Figure A. Fluorescence microscopy of human platelets, vital stained with trypaflavin-AO. Top row - platelets with granules: a - small discocytes; b - average discocytes; in - large discocytes; g - large rounded platelet. The bottom row - platelets without granules: d - discocytes without granules; e - discocytes with 1-2 small granules; g - clear platelets; h - degenerative platelets. Scale line - 2 microns.

RESULTS

Table 1: Intravascular platelet activity in healthy young people exercising in kayak and canoe riding sections

Parameters	Sportsmen n=24	Healthy people n=12
Discocytes, %	75,0+0,19	85,1+0,10
Disco-echinocytes, %	16,2+0,15	9,1+0,14
Spherocytes, %	4,5+0,11	2,9+ 0,15
Sphero-echinocytes, %	3,2+0,11	1,8+ 0,18
Bipolarforms, %	1,1+0,09	1,1+0,10
Sum of activeforms, %	16,5,0+0,17	14,9+ 0,15
Plateletcountinaggregates, %	7,2+0,17	5,8+ 0,12
The number of small units of 2-3 platelets per 100 free platelets	4,9+0,09	2,8+ 0,14
The number of medium and large aggregates, 4 or more platelets, per 100 free-lying platelets	0,21+0,014	0,06+ 0,012

In healthy individuals included in the observation group when assessing the morphology of platelets, it was found that the main indicators were within the physiological norm. The level of discocytes in the blood of healthy people was 85.1±0.10%, the level of discoechinocytes was 9.1+0.14%, spherocytes– 2.9+0.15%, spheroehinocytes -1.8+0.18% and bipolar form – 1.1+0.10% of platelets also remained stable in the bloodstream (Table). The sum of the active forms of platelets averaged 14.9±0.15% in the examined patients. When analyzing the morphology of platelets in supervised athletes who train in a kayak rowing and canoeing section, the following picture is observed in blood smears: discoocytes-75.0+0.19%, disco-echinocytes- 16.2+0.15%, spherocytes –4.5+0.11% and spheroehinotsity- 3.2+0.11%. A slight increase in the sum of active forms of platelets and the number of platelets in the aggregates was also noted.

Consequently, athletes regularly exercising have consistently high platelet activity, able to maintain the rheological properties of blood at an optimal level.

DISCUSSION

Platelets (blood platelets) are nuclear-free blood cells that are involved in hemostasis [7]. To perform their specific functions, they need activation, carried out after damage to the endothelium and exposure of the subendothelial structures of blood vessels, as well as under the influence of hormones. The activation of platelets leads, along with a rapid change in their shape, which becomes spherical (spherocyte) with numerous processes on the surface (spheroechoinocyte), also to their ultrastructural reorganization, which consists in the disappearance of the microtubular ring and its subsequent restoration in the center of the cell, but of a smaller diameter, also in the formation of new actin structures [8].As a result of this restructuring, granulomer and hyalomer are formed. Platelets are called "floating muscles" because of their unique ability to contractile reactions, which are the basis for the majority of their functions in the body [9]. Platelets are capable of incorporating and storing a number of substances - serotonin, proteins, fibrinogen, etc. Finally, they are secretory cells and, in the activation process, are capable of releasing most of the stored active substances necessary for the performance of their functions [10]. A serious influence on the state of microcirculation has activity in the blood circulation of blood plates. In the present study, it was found that athletes maintain consistently high platelet activity, especially among those who regularly train in the sports section in rowing and canoeing. At the same time, the identified changes in platelets are probably largely due to the constancy of the sensitivity level of their receptors to exogenous influences (blood concentrations of aggregation inducers and von Willebrand factor, a co-factor of platelet adhesion, biogenic amines, etc.) with a constant number of receptors for them on the surface of the blood platelets [11]. The combination of the receptor apparatus on the surface of the blood plates with increased physical activity in this case during training are the result of complex adaptive reactions in the examined, leading eventually to the adaptation of the blood plates to the existing conditions of functioning [12].

CONCLUSION

The constancy of the level of high activity of thrombocytes in athletes who regularly train in the canoeing and canoeing section indicates a physiological level of aggregation inductors in the bloodstream with low platelet sensitivity to them. At the same time, the relatively stable level of the active forms of platelets is associated primarily with the constancy of the reduced expression of fibrinogen receptors on their membrane.

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