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FUNCTIONAL PROPERTIES OF PLATELET IN CHILDREN WITH IRRITABLE BOWEL DISEASE

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ABSTRACT — The aim of the study was to evaluate platelet activation and aggregation in children with irritable bowel disease (IBD), as well as the effect of hyperbaric oxygenation on these processes. Platelet activation and aggregation in artificial shear flow were studied in 120 patients of both sexes aged 6 to 17 years with IBD. In pediatric patients with CD and UC, a significant increase in the activation and aggregation of platelets was revealed under shear flow conditions. The use of hyperbaric oxygen therapy leads to a decrease in the studied processes. It was found that IBD in children is characterized by significant changes in the functional properties of platelets (activation and aggregation processes).

KEYWORDS — children, irritable bowel disease, platelet, hyperbaric oxygen therapy (HBOT).

INTRODUCTION

Inflammatory bowel diseases (IBD) are accompanied by quantitative, morphological and functional changes in platelets. The activated, hyperaggregable platelets are a key factor in enhancing the thrombogenic potential and intestinal microinfarctions. In addition, platelets initiate an inflammatory phenotype in endothelial cells and white blood cells and promote increased inflammation by secreting numerous biologically active substances [1]. Therefore, it becomes clear that it is necessary to study first of all the activation of platelets, which underlies the performance of their functions. To date, platelet activation is evaluated by measuring the concentration of circulating activation markers (P-selectin, CD40, and GP53) not only in adult patients, but also in children [2, 3]. Platelet activation is determined by the mechanisms that cause calcium to enter platelets and lead to conformational changes in the GP IIb/IIIa receptor complex on the cell surface and, consequently, the final common pathway — platelet aggregation.

The aim of the study was to evaluate the activation of platelets in an artificial shear flow (in a calcium-

free environment) and their aggregation in children with IBD.

MATERIAL AND METHODS

The study used the blood samples of 120 patients of both sexes aged 6 to 17 years, suffering from IBD. The study was approved by the Local Ethics Committee of Privolzhsky Research Medical University. Informed consent to participate in the study was obtained from the parents of all children (or from the children themselves over the age of 15). The diagnosis of "IBD" was verified by the data of a comprehensive examination, which included clinical and laboratory data, as well as endoscopic examination of the intestinal mucosa with morphological analysis of biopsies. Blood sampling was performed at the time of hospitalization of patients in the acute stage and at the end of treatment, before discharge. The treatment was carried out with the use of 5-aminosalicylic acid derivatives, glucocorticosteroids, immunosuppressants, and genetically engineered biological therapy. The results of the studies were compared with similar indicators of 35 conditionally healthy children of both sexes of the same age, who made up the control group.

Spontaneous (flow-induced) platelet aggregation was studied under conditions of artificial shear flow on a rheoscope designed according to the principle [4] in the modification [5]. The blood plasma was placed in a chamber of the device, in which a flow was created with a shear rate of 40 s⁻¹. Discrete microphotography of the aggregation process was performed at an interval of 20 seconds after the start of aggregation for 400 seconds. The degree and speed of aggregation were determined by the number of aggregates (rel.units) after 400 s and 160 s, respectively, after the start of the process using a special program [6]. The determination of platelet activation in the artificial shear flow was carried out similarly to the above-described method. However, K3EDTA-stabilized blood plasma was used for this purpose. The determination of platelet aggregation under these conditions makes it possible to judge the presence of receptors on their membranes in high-affinity (the presence of platelet activation) or low-affinity (the absence of platelet activation) states. In the presence of platelet aggregation, its degree was estimated by the

number of aggregates (rel.units) 400 s after the start of the aggregation process [7].

Statistical processing of the results was performed using variation statistics algorithms using Microsoft Excel 2007 and Statistica 6.1 for Windows.

RESULTS

As shown by the conducted studies, when the EDTA blood was stabilized, spontaneous aggregation of platelets in the control group under shear flow conditions was practically absent (Table 1). In children with IBD, the degree of platelet aggregation in these conditions exceeded the control values by 9 times, and continued to increase at discharge (Table 1).

Table 1. Activation of platelets in children with IBD (at 400 sec)

		Count of aggregates (rel. un.)
control (n=35)		1,89±0,91
IBD (n=120)	Before treatment	17,41±3,30 **
	After treatment	19,80±3,95 **

* $p < 0,05$, ** $p < 0,001$ — comparison to control

During hospitalization of children with IBD, there was also a significant increase in the degree and rate of spontaneous (flow-induced) platelet aggregation (by 1.4 times and 1.3 times, respectively) (Table 2). Platelet aggregation indicators remained significantly elevated in IBD and as a result of treatment. In addition, a positive correlation was found between the number of aggregates formed during platelet activation and the same aggregation index during hospitalization of patients with IBD ($r = 0.50$, $p < 0.05$).

Table 2. Spontaneous (flow-induced) aggregation of platelets in children with IBD

		Count of aggregates (rel. un.)	
		160 sec	400 sec
control (n=35)		20,03±0,96	15,28±1,09
IBD (n=120)	Before treatment	25,60±0,92 **	21,05±1,08 *
	After treatment	23,60±1,11 *	19,73±1,25 *

* $p < 0,05$, ** $p < 0,001$ — comparison to control

CONCLUSION

IBD in children is characterized by a significant increase in platelet activation and aggregation. The use of HBOT in the treatment of IBD contributes to a significant reduction in these processes.

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