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CHANGES IN THE HEMOSTASIS SYSTEM DURING THE RECOVERY PERIOD AFTER COVID-19 IN CHILDREN

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COVID-19 is a multisystem disease, and there is a high risk of thrombotic complications. The development of thrombotic complications in COVID-19 is due to an increase in the level of cytokines as a result of a pronounced inflammatory response. COVID-19 has a specific procoagulant effect, which is explained by its tropism for ACE2 in the vascular endothelium. The pathogenesis of thrombosis is associated with a decrease in endogenous fibrinolysis and an increase in platelet aggregation, as well as with the direct toxic effect of some drugs on the endothelium. Scientists warn that SARS-CoV-2 can damage blood vessels in children and lead to the development of hypertension, pulmonary hypertension, stroke and chronic kidney disease in the future.

Objective of the study: To identify changes in the hemostasis system during the recovery period of children who have had COVID-19.

Inspection objectives:

1. Assessment of the state of the hemostasis system after COVID-19 in children; 2. Determine at what stage changes in the hemostasis system occur in children;
3. Predict complications caused by hemostasis disorders after COVID-19 in children.

In accordance with the objectives, an examination plan was developed and the necessary laboratory tests and clinical studies were carried out.

Materials and methods

The study involved 92 children aged 1 to 17 years who had recovered from COVID-19 and 30 healthy children of the same age as the control group. All patients underwent the following examinations: collection of complaints and anamnesis, objective examination, general blood test, biochemical blood test, study of the hemostasis system:

Test results

A comparative analysis of blood coagulation parameters in children under supervision during the recovery period after COVID-19 revealed a number of changes compared to healthy children, which, in turn, manifested themselves in the form of hypercoagulation and hypocoagulation. When analyzing the hemostasis system parameters in children with hypercoagulation states during the convalescence period, an increase in the platelet count by 1.6 times was revealed (362.1 ± 7.7 x 109 / l in the main group compared to 281.3 ± 11.3 x 109 / l in the control group).

QIV - blood clotting time is one of the indicators of the general state of the thrombus formation process and statistically significantly decreased in the main group by 2.4 times to 138.6±5.1 sec, and in the control group to 308.9±3.2 sec $p<0.001$, which indicates a continuing increase in the general coagulation activity of the blood in sick children during the recovery period.

Bleeding time (BT) indicates the level of platelet activity,

It was found that in sick children during the recovery period this indicator decreased to 108.0±1.81 seconds in the control group and to 76.2±1.3 seconds in the main group.

The average FQTV value in the blood is manifested by a decrease in the control group to 33.9±1.8 sec, and in the main group to 22.6±0.62 sec. In the PTV-control group it decreased to 13.8±1.2 sec, and in the main group to 10.4±0.32 sec, an increase in PTI to 148.6±3.2% and a decrease in XMN by 0.65±0.02 units were observed. Analysis of the average thrombin time showed that it decreased from 27.8±1.1 seconds in the control group to (15.4±0.48 seconds) in the main group. The decrease in this indicator indicates an acceleration of the coagulation process, i.e.

the formation of fibrin from fibrinogen, which naturally led to an increase in the average amount of fibrinogen by 1.2 times compared to the control group (3.38 ± 0.21 g / l, and in the main group up to 7.8 ± 0.18 g / l). EFMC, a soluble fibrin-monomer complex, i.e. one of the fibrin degradation products, showed a very clear, reliable increase of 3.5 times (9.85 ± 0.31 in the main group compared to 2.81 ± 0.05 g / l in the control group), and D-dimer by 4.8 times (0.96 ± 0.03 μg / ml in the main group compared to 0.20 ± 0.05 μg / ml in the control group). Such a high increase in the level of EFMC and D-dimer in sick children during the convalescence period indicates pronounced hypercoagulation. In addition, as we have already mentioned above, during the recovery period, there were cases of children entering the hypocoagulation phase, and for the reliability of the analysis, we divided individual patients into groups. Thus, during the recovery period, 14 of the total number of children (n=128) showed signs of hypocoagulation. During the recovery period, children in the main group showed a decrease in blood clotting activity, a decrease in the number of platelets (in practically healthy children) by 2.58 times (from 284.8±15.52 x 109/l to 110.2±3.8 x 109/l) compared to the control group, which was accompanied by an increase in QIV (from 303.1±3.2 s to 392.4±12.5 s) and QKV (from 106.1±1.22 s to 128.0±4.1 s) (see Table 3.3.2). However, similar changes with increasing time were noted in the QFTV indices, which increased in the healthy group (32.4±1.6 seconds versus 42.4±1.4; $P<0.05$) and PTB (13.4±1.16 seconds versus 16.4±0.54 seconds). The PTI index decreased (from 91.03±1.2% to 70.4±2.5%), and the XMN index increased from 0.99±0.04 to 1.42±0.05. All this was due to the fact that blood was spent in the hypocoagulation phase of the blood coagulation system, a significant decrease in fibrinogen content from 3.43±0.25 g/l to 2.4±0.11 g/l and an increase in TV (from 26.2 seconds to 34.2±1.3 seconds) were observed. In connection with these changes, an increase in the EFMC indices to 9.24±0.32 g/l and D-dimer to 0.78±0.03 μg/ml was also observed compared to patients with a hypocoagulation phase of fibrinogen breakdown products.