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Rheological disorders in juvenile rheumatoid arthritis and rheumatoid arthritis in adults

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Abstract

We conducted a comparative analysis of the rheological properties of blood in juvenile rheumatoid arthritis and rheumatoid arthritis in adults. In order to determine the rheological properties, we examined the aggregability of erythrocytes and the deformability of erythrocyte membranes in all patients using original methods. The article presents preliminary research data at the initial level. A multidisciplinary team consists of clinical rheologists, internists, rheumatologists, pediatricians, epidemiologists, health professionals, the compliance of research methods is encouraging that by the end of the project it will be possible to reveal new pathophysiological aspects of juvenile rheumatoid arthritis and rheumatoid arthritis in adults, which will favorably affect the treatment and personification of patients.

KEYWORDS: Juvenile rheumatoid arthritis; aggregation; deformation; RBC

Introduction

Inflammatory diseases of the joints are closely related to changes in the composition, blood coagulation, erythrocyte-platelet link of the rheological properties of blood [1,2,3,4], also inflammatory diseases of the joints are closely related and with hyperviscosity syndrome [1,5,6].

Hyperviscous syndrome in juvenile rheumatoid and rheumatoid arthritis in adults is determined by serum proteins' molecular composition and configuration [7,8].

Molecular composition and configuration are the focus of molecular rheology, but our interest is directed to the study of micro and macro blood rheology.

Our work aimed to study microrheology and macrorheology based on erythrocyte aggregation and erythrocyte membrane deformability and their comparative analysis in juvenile rheumatoid arthritis and rheumatoid arthritis in adults.

Methods

The study was started this year in Georgian clinics in Tbilisi and Batumi and will continue for 5 years. We studied 12 adults with adult rheumatoid arthritis (6 males and 6 females, mean age 42±12 years, mean duration of illness 10±2.9 years) and 12 children with juvenile rheumatoid arthritis (6 girls and 6 boys, mean age 8±3.4 years, mean duration of illness 3±1.9 years). All patients, after the declaration of the diagnosis, took blood for studies of erythrocyte aggregation and deformability of erythrocyte membranes. All patients signed informed consent. Patients underwent X-ray examination of the peripheral joints, sacroiliac joints and spine (MultixCompact-Siemens, Germany), ultrasound of the peripheral joints (Envisor-Philips, the Netherlands), and dual-energy X-ray osteodensitometry was performed (QDR-4500Delphi-Hologic, USA) in adult patients with rheumatoid arthritis, For control, we selected two groups: healthy children and healthy adults of the appropriate age.

Evaluation of Erythrocytes Deformability Index: Evaluation of erythrocytes deformability was performed with an aid of the nucleopore membrane filter method, which is based on assessing the velocity of the erythrocytes passage through the very small pores (5 μm, which is a diameter of the smallest capillary) of the filter, at constant pressure (10 cm of water column) and temperature (37°C). Obtaining the

pure erythrocytes was performed by centrifuging the blood sample at 3000 rpm, for 15 min. The resulting plasma was aspirated with a micropipette and the remaining blood cells were added with bovine serum albumin (0.2 mg per 5 ml) dissolved in the phosphate buffer. Then the blood was centrifuged a second time at 1000 rpm for 5 min. The precipitated erythrocytes, as well as a thin layer of leukocytes and thrombocytes, were separated from the phosphate buffer. This procedure was repeated three times. Purified erythrocyte mass was diluted in the phosphate buffer, with a hematocrit of 10%. Evaluation of the deformability index implied measuring the velocity of the erythrocyte passage through the filter (mm/min) was recorded. The high-quality polycarbonate filters (with 5 μm diameter pores) were used in measuring procedures [9,10].

The index of erythrocytes aggregability, which represents aggregated erythrocytes area ratio against whole area of the erythrocytes. Erythrocyte aggregation was evaluated with the recently developed “Georgian technique” providing us with direct and quantitative data., Blood samples (4ml) from the cubital veins were centrifuged and about 0.1 ml blood was diluted 1:200 in own plasma in the Thoma pipettes preliminary rinsed with 5% sodium citrate solution without addition of any other anticoagulants to the blood under study. Following standard mixing the diluted blood was placed into a glass chamber 0.1 mm high. The quantitative index of erythrocyte aggregation, which was assessed with a special program at the Texture Analysis System (TAS-plus, “Leitz, Germany), represented itself the relationship of the aggregated and unaggregated red cells [11].

Results

The seropositive variant was diagnosed in 2 patients with juvenile rheumatoid arthritis; X-ray examination revealed changes in the joints in 19 out of 24 patients.

It turned out that in all patients with juvenile rheumatoid arthritis and rheumatoid arthritis, erythrocyte aggregation and erythrocyte membrane deformability were changed compared to the control, moreover, in the control group, the control indicators were lower than in the control group of adults. Also, the percentage change in erythrocyte aggregation and erythrocyte membrane deformability in adult patients was more changed compared to the corresponding control group.

Discussion

It can be seen from the literature that with a high degree of activity of the pathological process, the greatest decrease in the fluid properties of the blood, and hence hemorheological disorders in vessels of various calibers, is observed [1,12]. An increase in the volumetric viscosity of whole blood with an unchanged Caisson viscosity indicates that disturbances in blood rheology are mainly observed in the vessels of the microvasculature [1].

At the same time, an increase in the viscose properties of blood is an integral indicator of hyperaggregation syndrome in adults. In patients with juvenile rheumatoid arthritis and rheumatoid arthritis. due to violations of the rheological properties of blood serum, an increase in spontaneous aggregation of erythrocytes can occur. The high hydrodynamic strength of aggregates is noted as the main factor in the syndrome of increased viscosity. As part of this study, many questions are still open.

This may be due to the fact that the focus group is small. This may be due of different mean of disease age in different groups. This may also be due to the fact that we did not study other hemorheological parameters, and the article did not discuss the features of the coagulation / anticoagulation mechanism in this disease. However, the research team, which includes clinical rheologists, internists, rheumatologists, pediatricians, epidemiologists, health professionals, and the continuation of the research strategy in this direction is encouraging that rheological mechanism in juvenile rheumatoid arthritis and rheumatoid arthritis will be fully understood in the near future. That will give an opportunity to improve the tactics of treatment and personification of patients.

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