VIROLOGY

Structural and Metabolic State of Peripheral Blood Mononuclear Cells during Infectious Mononucleosis

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Morphometrical and cytochemical analysis of peripheral blood mononuclear cells from patients with infectious mononucleosis was carried out. Structural and metabolic state of lymphocytes and monocytes during convalescence and in delayed period after recovery differed from normal. Cytochemistry of atypical mononuclear cells was evaluated.

Key Words: *interferometry; cytochemistry; mononuclear cells; infectious mononucleosis*

Infectious mononucleosis (IM) is a persistent viral infection caused by Epstein—Barr virus and occurring predominantly in children aging 2-10 years [4,5]. Virus-stimulated proliferation of lymphoid elements and transformation of cells are accompanied by changes in their metabolism and functional activity [4,7]. Present laboratory methods allow us to reveal structural and metabolic changes in mononuclear cells and reactions of the blood system in patients with IM.

Here we measured dry weight and cytochemical activity of peripheral blood mononuclear cells (PBMC) in patients with IM at various stages of the disease and in delayed period after recovery.

MATERIALS AND METHODS

We examined 46 children aging 3-15 years with mild and moderate acute IM: 27 children with pronounced clinical and hematological signs of the disease (acute stage, group I), 10 children during convalescence (group II), and 15 children 18 months after recovery (group III). The diagnosis of IM was confirmed by clinical and hematological signs [5] and by the presence of Epstein—Barr virus DNA in blood plasma (polymerase chain reaction). Twenty-five healthy children of the same age served as the control.

PBMC were isolated as described elsewhere [1]. The content of dense substances (proteins, nucleic acid, and enzymes) in lymphocytes and monocytes was measured by the method of homogenous interference field with wide double imaging on a polarization-interference microscope at a monochromatic light wavelength of 546 nm.

Peripheral blood smears were prepared after concentration of venous blood with ethylenediaminetetraacetic acid [2]. Acid phosphatase (AP) [1] and nonspecific esterase (NE) activities [6] were measured. Glycogen content was estimated using PAS reaction. Lipid content was measured by the method of Sheeman and Storey. The mean cytochemical coefficient (MCC) was calculated.

The results were analyzed by Mann—Whitney test [3].

RESULTS

Interferometry of PBMC from patients with acute IM revealed an increase in dry weight of lymphocytes, which was related to accumulation of lymphocytes with dense residual 50-60 pg and appearance of heavy

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lymphoid elements with a dry weight of more than 70 pg (Table 1). The dry weight of monocytes also surpassed the normal (Table 1). Heavy monocytes with a dry weight of more than 140 pg were found in the peripheral blood from IM patients, but not in healthy children (Table 1).

During convalescence and 18 months after recovery, the mean content of dense substances in lym-

TABLE 1. Dry Weights of Peripheral Blood Mononuclear Cells in Children with IM ($X \pm m$)

Cells	Control	Group I	Group II	Group III
Lymphocytes				
Dry weight, pg	40.98±0.56	53.05±1.79*	54.87±1.92*	53.84±1.00*
% cells with dry weight:				
30-40 pg	92.0	40.8	37.6	37.6
50-69 pg	8.0	54.4	52.8	60.8
70-89 pg	0	4.8	9.6	1.6
Monocytes				
Dry weight, pg	96.11±3.23	108.00±2.28*	110.75±5.53*	106.64±3.62*
% cells with dry weight:				
below 80 pg	8.89	3.34	3.80	0
80-99 pg	58.85	32.11	39.90	53.60
100-119 pg	18.90	31.52	32.80	30.40
120-139 pg	13.36	22.12	8.80	10.80
above 140 pg	0	10.91	14.70	5.20

Note. *p<0.001 compared to the control.

TABLE 2. Cytochemical Activity (MCC) of Peripheral Blood Mononuclear Cells in Children with IM ($X \pm m$)

Parameter	Control	Group I	Group II	Group III
AP activity				
lymphocytes	0.646±0.026	0.714±0.032	0.771±0.064	0.635±0.054
monocytes	0.685±0.029	1.318±0.035*	1.136±0.082*$^{++}$	0.798±0.043***^{oo}
atypical mononuclear cells	—	0.803±0.027	0.813±0.077	0.627±0.054
NE activity				
lymphocytes	0.198±0.009	0.303±0.012*	0.281±0.028**	0.191±0.019
monocytes	1.150±0.026	1.807±0.031*	1.797±0.083*	1.057±0.025**^{o}
atypical mononuclear cells	—	1.008±0.022	1.000±0.041	0.894±0.023
Glycogen				
lymphocytes	0.213±0.026	0.199±0.013	0.267±0.058^{++}	0.114±0.014**^{ooo}
monocytes	0.765±0.027	0.827±0.026	0.765±0.112	0.612±0.065***
atypical mononuclear cells	—	0.765±0.119	0.696±0.056	0.732±0.034
Lipids				
lymphocytes	0.012±0.002	0.026±0.004**	0.033±0.009***	0.020±0.005
monocytes	0.523±0.033	0.583±0.030	0.388±0.030***$^{+}$	0.360±0.047**
atypical mononuclear cells	—	0.326±0.036	0.337±0.051	0.254±0.025

Note. *p<0.001, **p<0.01, and ***p<0.05 compared to the control; ^{+}p<0.01 and ^{++}p<0.05 compared to group I; ^{o}p<0.001, ^{oo}p<0.01, and ^{ooo}p<0.05 compared to group II.

phocytes and monocytes remained above the normal (Table 1). However, in group III patients the count of heavy lymphocytes and monocytes decreased to a greater extent than in group II patients (Table 1).

Cytochemical assay revealed elevated NE activity and increased lipid content in lymphocytes from group I patients. AP and NE activities in monocytes from these patients were also higher than in healthy children (Table 2).

The content of glycogen increased during convalescence, but NE activity and lipid content in lymphocytes did not differ from these parameters in acute period of IM (Table 2). AP activity in monocytes decreased compared to that in group I patients, but remained above the control (Table 2). By contrast, lipid content in monocytes from group II patients was below normal (Table 2).

NE activity and lipid content in lymphocytes returned to normal 18 months after IM. The content of glycogen decreased compared to the control (Table 2). The content of glycogen and lipids and NE activity in monocytes decreased, while AP activity remained high (Table 2).

Atypical mononuclear cells found in the peripheral blood from patients with IM showed positive reaction to AP, NE, glycogen, and lipids. The intensity of cytochemical reaction was similar at various terms of observation (Table 2).

Our results indicate that dry weight and cytochemical activity of PBMC increased in patients with IM. These changes persisted during convalescence and in delayed periods after recovery. Atypical mononuclear cells showed positive reaction to AP, NE, glycogen, and lipids, which was similar at various terms of observation.

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