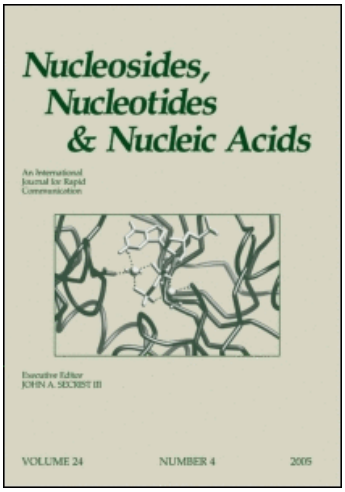

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Characteristics of Lipids Imbalance in Patients with Tick-Borne Encephalitis

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ABSTRACT

Using a novel approach, we have analyzed 30 parameters characterizing detailed spectrum and fractional content of LPs in plasma of patients with tick-borne encephalitis (TBE). The blood plasma of all TBE patients (30 patients), as compared with that of healthy individuals (120 patients), is characterized by decreased concentrations of many LP subfractions and of the total concentration of all plasma LPs (hypolipoproteinemia). The observed difference in some parameters was statistically significant. Using computer-assisted factor analysis, we have shown that according to these 30 parameters TBE patients are similar to patients with multiple sclerosis and systemic lupus erythematosus. The results provide grounds for using data on blood plasma LPs as additional criteria for diagnosis of TBE.

Key Words: Lipoproteins; Blood plasma; Tick-borne encephalitis; Small-angle X-Ray scattering.

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INTRODUCTION

We have shown recently that a considerable decrease in concentrations of LP components is observed in patients with such autoimmune diseases as multiple sclerosis (MS)[1] and systemic lupus erythematosus (SLE).[2] Tick-borne encephalitis (TBE) is an acute infectious transmissible disease, damaging the central nervous system and characterized by high mortality; the pattern of infection is seasonal and nidal. TBE is also associated with immune system disorder. At present, some of the clinically defined stages of TBE are very hard to differentiate. Therefore, any additional criteria would be very useful in improving TBE diagnostics.

MATERIALS AND METHODS

We used a novel algorithm for determination of concentrations of all main lipids and apolipoproteins in each LP fraction and subfraction based on a mathematical model and on analysis of human blood plasma LPs using the small-angle X-ray scattering (SAXS) method.[3] The results were analyzed using the Microsoft Excel statistical package and the computer-assisted factor analysis (Statistica 5.0 software package).

RESULTS AND DISCUSSION

The fractional content of LPs in the blood plasma from TBE patients was never studied before. Therefore, we performed analysis of 30 parameters characterizing LPs for a control group of healthy donors and TBE patients (Table 1) in comparison with those for MS, SLE, and coronary atherosclerosis patients.[1,2]

Table 1 demonstrates that the concentrations of many lipids in separate LP fractions and subfractions detected in patients with TBE, as well as in patients with MS and SLE, and in contrast to atherosclerosis, were significantly lower as compared with healthy donors (difference in 14 marked in boldface parameters was statistically significant). The pattern of concentration changes for many LPs from patients with MS and TBE was similar, although there were detectable variations in some of them (parameters marked with ** in Table 1). However, the fractional content of LPs from blood plasma of TBE patients does not significantly differ from that of SLE patients (3 parameters marked with + in Table 1). The computer-assisted factor analysis has shown that according to these 30 parameters the TBE patients are similar to patients with MS and SLE (Fig. 1). We have shown that different forms of TBE (feverish, meningeal, chronic and residual phenomena) differ from each other in some of LP characteristics (1, 3, 10, 11, 13, 21, 22, 23, Table 1) and these differences are statistically significant. These data provide the evidence that the development of degenerative processes, including autoimmune processes, in patients with TBE is associated with lipid imbalance and is similar to typical autoimmune diseases.

Table 1. A comparison of the average concentrations (mg/dl) of cholesterol (etherifying and free cholesterol) triacylglycerol (TG), and of other components (phospholipids and apoliproteins) in different LPs obtained by the SAXS method for healthy donors and for patients with tick-borne encephalitis (TBE), coronary atherosclerosis (AS), multiple sclerosis (MS), and systemic lupus erythematosus (SLE).

No.	LP fractios	Norm (n = 120)	Coronary atherosclerosis (n = 63)		Multiple sclerosis (n = 102)		Systemic lupus erythematosus (n = 30)		Tick-borne encephalitis (n = 30)	
		mg/dl	mg/dl	C.i., %	mg/dl	C.i., %	mg/dl	C.i., %	mg/dl	C.i., %
Cholesterol										
1	HDL_3	19,6 ± 3,0	8,3	**−57,6**	11.7	**−40,4**	5,8	**−70,4**	6.7 ± 1.7	**−65.9****
2	HDL_2	46,7 ± 3,7	23,8	**−49**	34.1	**−26,9**	20,2	**−56,7**	29.4 ± 4.5	**−37.0**
3	HDL	66,2 ± 4,1	32,1	**−51,5**	45.8	**−30,8**	26,1	**−60,6**	36.1 ± 4.5	**−45.5****
4	LDL_{1-3}	68,1 ± 5,0	122,2	**79,4**	96.0	**41,0**	86,8	27,4	51.9 ± 7.5	**−23.7***,+**
5	IDL	23,3 ± 3,3	38,4	**64,8**	17.2	−26,1	21,3	−8,6	23.8 ± 5.2	2.0*,**
6	LDL	91,5 ± 5,1	160,6	**75,5**	113.2	**23,7**	108,2	18,2	75.7 ± 8.4	**−17.3***,+**
7	$VLDL_{3-5}$	12,8 ± 1,6	27,8	**117,2**	11.5	−10,2	10,4	−18,7	8.9 ± 4.0	−30.8*
8	$VLDL_{1-2}$	1,2 ± 0,1	2,6	**116,6**	1.1	−8,3	0,9	−25	1.0 ± 0.2	−20.2*
9	VLDL	14,0 ± 1,6	30,3	**116,4**	12.6	−10,4	11,3	−19,3	9.8 ± 4.0	−29.9*
10	LP(ALL)	171,7 ± 6,8	223,1	**30**	171.6	−0,1	145,5	−15,2	121.6 ± 7.8	**−29.2*****
Triacylglycerol										
11	HDL_3	7,4 ± 1,2	3,1	**−58,1**	4.3	**−41,4**	2,0	**−72,9**	2.4 ± 0.6	**−67.6****
12	HDL_2	17,8 ± 1,5	8,9	**−50**	12.8	**−28,1**	7,4	**−58,4**	10.8 ± 1.7	−39.4
13	HDL	25,2 ± 1,6	12,0	**−52**	17.3	**−31,3**	9,4	**−62,7**	13.2 ± 1.7	**−47.7****
14	LDL_{1-3}	30,9 ± 2,4	57,8	**87**	43.9	**42,1**	36,2	17,1	25.4 ± 4.7	−17.7***
15	IDL	31,1 ± 4,5	51,2	**64,4**	22.9	**−26,3**	28,4	−8,7	31.7 ± 6.9	1.8*,**
16	LDL	62,0 ± 3,9	109,0	**75,8**	66.8	7,8	64,6	4,2	57.1 ± 7.5	−7.9*

(*continued*)

Table 1. Continued.

No.	LP fractios	Norm (n = 120)	Coronary atherosclerosis (n = 63)		Multiple sclerosis (n = 102)		Systemic lupus erythematosus (n = 30)		Tick-borne encephalitis (n = 30)	
		mg/dl	mg/dl	C.i., %	mg/dl	C.i., %	mg/dl	C.i., %	mg/dl	C.i., %
17	$VLDL_{3-5}$	33,5 ± 3,7	71,7	**114**	30.5	−9,0	27,6	−17,6	23.6 ± 9.4	−29.4*
18	$VLDL_{1-2}$	11,2 ± 1,1	23,6	**110,7**	10.2	−9,3	9,2	−17,8	8.9 ± 1.6	−23.3*
19	VLDL	44,6 ± 4,4	95,3	**113,7**	40.5	−9,2	36,8	−17,5	32.2 ± 10.5	−27.7*
20	LP(ALL)	131,9 ± 6,9	216,3	**64**	124.5	−5,6	110,9	−15,9	102.4 ± 12.1	**−22.3*****
Sum of all lipid and protein components of LPs										
21	HDL_3	208,0 ± 29,5	88,6	**−57,4**	127.8	**−38,6**	71,8	**−65,5**	83.0 ± 20.4	**−60.1****
22	HDL_2	327,6 ± 29,1	154,9	**−52,7**	225.0	**−31,3**	123,4	**−62,3**	181.0 ± 29.3	**−44.7****
23	HDL	536,4 ± 36,6	243,5	**−54,6**	352.7	**−34,2**	195,3	**−63,6**	259.0 ± 29.7	**−51.7****
24	LDL_{1-3}	227,1 ± 15,9	406,6	**79**	320.0	**40,9**	303,8	33,7	179.6 ± 25.6	**−20.9***,+**
25	IDL	100,8 ± 14,4	165,9	**64,6**	74.3	−26,3	92,1	−8,6	102.6 ± 22.5	1.8*,**
26	LDL	327,8 ± 17,7	572,5	**74,6**	394.3	**20,3**	395,9	20,8	282.2 ± 31.7	−13.9*
27	$VLDL_{3-5}$	74,4 ± 8,6	160,3	**115,4**	67.8	−8,9	61,0	−18	52.0 ± 21.7	−30.1*
28	$VLDL_{1-2}$	15,5 ± 1,5	33,1	**113,5**	14.1	−9,1	12,5	−19,3	12.1 ± 2.3	−21.9*
29	VLDL	89,9 ± 9,5	193,4	**115,1**	81.2	−9,9	73,5	−18,2	64.1 ± 23.3	−28.7*
30	LP(ALL)	954,2 ± 43,1	1009,3	**5,8**	828.2	**−13,2**	664,7	**−30,3**	605.2 ± 37.7	**−36.6*****

Notes: C.i.—interval of confidence (P > 0.95); see the main text for other table of symbols used.

LP—lipoprotein, HDL—high density LP, LDL—law density LP, IDL—intermediate density. LP, VLDL—very law density LP.

Bold type—differ from healthy donors (norm) with statistical confidence.

*Differ from CA with statistical confidence.

**Differ from MS with statistical confidence.

+Differ from SLE with statistical confidence.

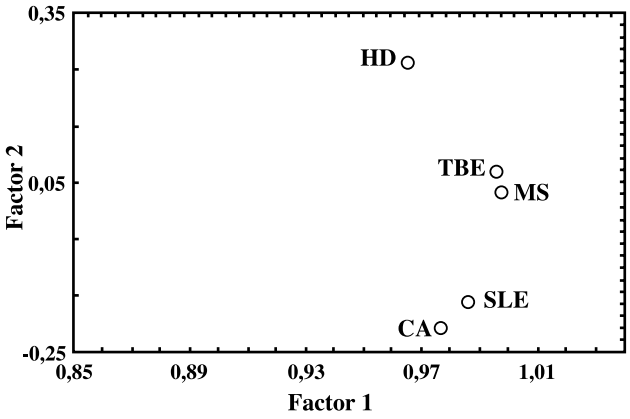

Figure 1. Results of the computer-assisted factor analysis (which permits to reduce the data, combining two parameters in linear dependence and to present the results in two-dimensional space factor 1 and factor 2) of 30 parameters characterizing LP content in patients with tick-borne encephalitis (TBE), multiple sclerosis (MS), systemic lupus erythematosus (SLE), coronary atherosclerosis (CA) and in healthy donors (HD).

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