Relationship between Blood Cortisol Level and Blood Parameters in Animals with Experimental Bile Peritonitis

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We studied the relationship between blood cortisol level and hemogram parameters in animals with bile peritonitis. A strong correlation was revealed between variations in cortisol concentration and leukocyte count. We found differences in the hormonal regulation of individual cell populations in the peripheral blood.

Key Words: *experimental bile peritonitis; cortisol; blood cells*

The problem of bile peritonitis (BP) received little attention despite high mortality rate in patients with this condition (10 to 34%) [3,4]. The success of treatment for BP is determined by the selection of adequate detoxification methods. Intravenous injection of sodium hypochlorite (SHC) is extensively used for this purpose. Various quantum methods for blood treatment, including UV blood irradiation (UVBI), are also effective under these conditions.

The assessment of blood corticosteroid concentration is required to study the course of the disease [3]. However, this procedure is not a routine test in most medical institutions. Here we evaluated some leukogram parameters, which are in a reliable correlation with the level of this hormone.

MATERIALS AND METHODS

Experiments were performed on 28 male dogs weighing 16±4 kg. BP was produced as described elsewhere [5]. The animals were divided into 5 groups. Group 1 included 28 intact dogs. These animals were examined 24 h after the incidence of BP (group 2, *n*=28). All dogs were subjected to laparotomy and sanation of the abdominal cavity with Furacilin (1:5000, 200 ml). According to the goal and purpose of study, the animals were divided into 3 groups of 3-5 specimens each. Group 3 dogs (*n*=10) intravenously received 0.04% SHC immediately and 12 h postoperation ($^1/_{10}$ circulating blood volume). Combination therapy in group 4 dogs (*n*=10) included intravenous injection of 0.9% NaCl ($^1/_{10}$ circulating blood volume, immediately and 12 h postoperation) and UVBI (1.5-2.0 ml/kg, 24 h postoperation). Group 5 dogs (*n*=8) intravenously received 2 injections of 0.04% SHC and were subjected to UVBI.

Clinical blood tests were performed on a Medonic 620 blood analyzer. Differential cell count was estimated during a microscopic examination of smears stained by the method of Romanowsky. We evaluated the percentage of band neutrophilic granulocytes (BNG), segmented neutrophilic granulocytes (SNG), monocytes, and lymphocytes.

Changes in the ratio between various populations of white blood cells reflect the adaptive response of the organism [1]. The severity of endogenous intoxication was estimated by leukocyte intoxication index (LII, Kalf-Kalif).

Plasma cortisol concentration was measured by enzyme immunoassay, which allows evaluating trace amounts of the test substances [4]. The study was performed on an Amerlite device for enzyme immuno-

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assay (Amersham). Cortisol concentration was estimated using AmerCard kit for enzyme immunoassay. The test parameters were estimated in intact dogs and animals with 24-h BP on days 1, 2, 3, 7, 10, 15, 20, and 30 after sanation.

The data were processed by dispersion analysis of variance. Spearman correlation coefficients were calculated using Statistica 6.0 software.

RESULTS

Glucocorticoid hormones play an important role in the nonspecific adaptive response.

Blood cortisol level in dogs with 24-h BP was 1.8-fold higher than in intact animals ($p<0.001$, Fig. 1). Cortisol concentration in dogs of groups 3, 4, and 5 progressively decreased in the follow-up period. These changes were most pronounced in group 5 dogs. Cortisol concentration in these animals returned to normal 7 days after surgery. In group 3 and 4 dogs cortisol concentration decreased slowly and retuned to normal only on day 10.

Plasma cortisol concentration reflects the stress response in animals with BP. The nonspecific adaptive response in animals with BP is adequately illustrated by plasma cortisol concentration. It can be hypothesized that this parameter rapidly returns to normal in group 5 dogs (combination therapy with SHC and UVBI).

The percentage of leukocytes and changes in leukogram parameters corresponded to variations in blood cortisol level (Table 1, Figs. 1 and 2).

Correlation analysis of mean values was performed to estimate parameters of the hemogram that most adequately reflect variations in blood cortisol level.

The percentage of monocytes ($r=0.36$, $p=0.072$) and SNG ($r=0.12$, $p=0.555$) did not depend on blood cortisol level. However, changes in leukocyte count ($r=0.74$, $p<0.001$), LII ($r=0.68$, $p<0.001$), and BNG count ($r=0.62$, $p<0.001$) reflected variations in blood cortisol level. A strong negative correlation was found

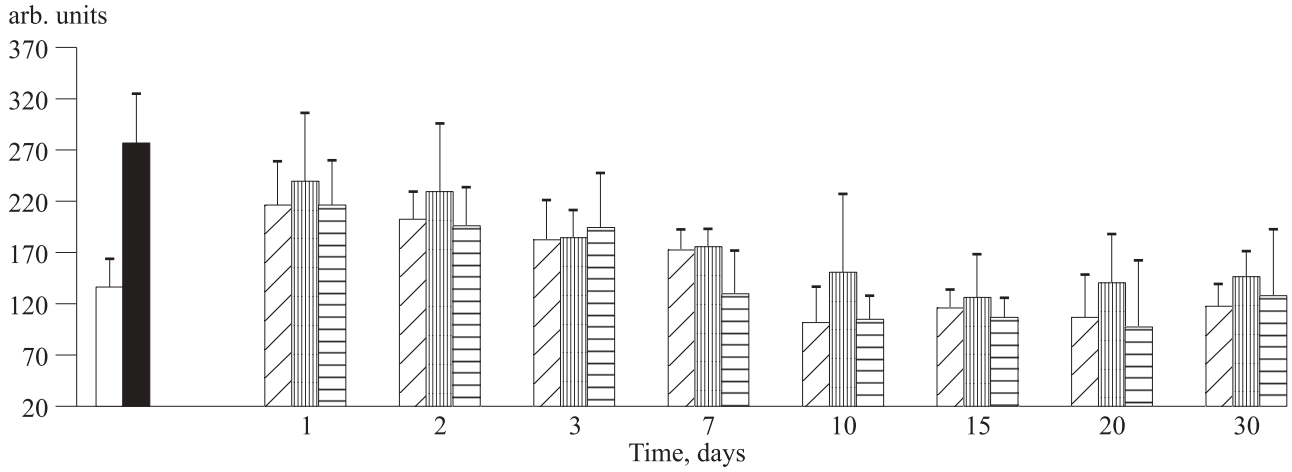

Fig. 1. Cortisol concentration in animals with bile peritonitis (BP) exposed to various methods of blood correction. Here and in Fig. 2: light bars, intact animals; dark bars, BP; slant shading, group 3; vertical shading, group 4; horizontal shading, group 5.

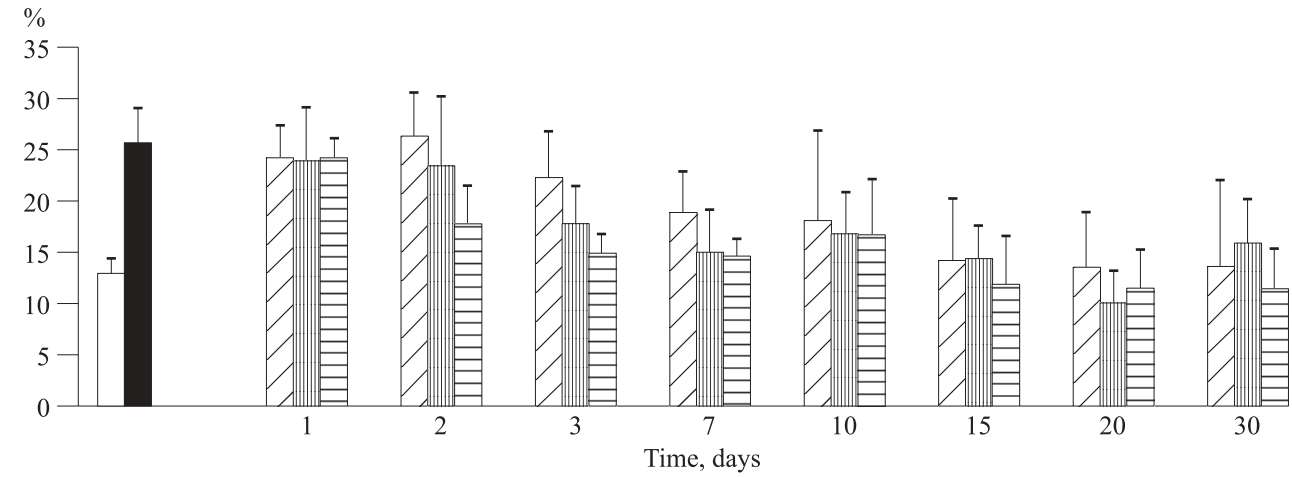

Fig. 2. Leukocyte count in animals with BP exposed to various methods of blood correction.

TABLE 1. Percentage of Blood Cells and LII with Separate Methods of Blood Correction for Experimental BP (*M*±*m*)

Period, days		Percentage of cells, %				
		SNG	BNG	Lymphocytes	Monocytes	LII
Intact		69.65±1.71	7.83±0.97	14.91±1.30	6.87±0.68	3.53±0.35
24-h BP		75.00±1.32*	18.15±1.09***	3.00±0.55***	3.95±0.52**	20.95±2.91***
Group 3	1	77.92±1.42***	12.08±1.31*	4.83±0.91***	5.08±0.56	10.36±0.74***
	2	76.22±2.25*	13.78±1.79**	4.56±0.63***	5.44±0.65	10.85±0.85***
	3	68.88±2.65	19.00±0.76***	6.50±1.15***	5.63±1.50	10.64±1.57***
	7	67.33±2.54	17.17±1.78***	8.83±1.05**	6.67±1.80	7.66±1.47*
	10	77.00±3.03*	13.40±3.40	5.00±0.55***	4.00±0.55**	9.69±2.10**
	15	70.00±2.14	7.14±0.74	13.00±1.83	9.71±1.51	4.04±0.51
	20	69.67±5.04	5.83±1.51	15.00±3.71	9.17±1.33	3.6±0.9
	30	67.86±3.96	6.00±1.23	18.14±2.98	7.57±1.91	3.08±0.63
Group 4	1	69.43±1.69	20.00±1.93***	6.29±0.89***	3.14±0.67*	13.17±2.11***
	2	65.90±3.36	16.80±3.33*	8.40±1.33**	8.60±1.15	5.74±0.92*
	3	68.57±2.03	16.43±1.88***	9.14±1.58**	5.43±1.04	6.07±0.99*
	7	73.43±3.06	14.43±2.22*	7.14±1.53***	4.57±0.72*	9.16±1.26***
	10	67.00±4.38	15.50±5.30	12.67±2.09	4.83±0.65*	6.28±1.09*
	15	73.00±2.28	8.29±1.30	12.00±1.76	6.71±1.15	5.01±0.52*
	20	62.50±3.99	7.17±1.42	20.67±1.94*	9.67±1.43	2.79±0.49
	30	71.50±2.38	8.83±0.75	13.00±2.11	6.67±0.88	4.8±0.5
Group 5	1	77.92±1.42***	12.08±1.31*	4.83±0.91***	5.08±0.56	10.36±0.74***
	2	68.45±1.37	14.91±1.63***	10.55±0.97*	5.91±0.96	6.1±0.45***
	3	71.29±3.25	11.43±2.89*	9.57±1.72*	7.71±1.27	5.79±0.69**
	7	67.00±3.18	14.20±6.12*	11.80±2.15	6.80±0.80	4.92±0.84
	10	64.00±3.42	14.00±6.12	15.75±3.07	6.25±1.11	4.66±1.25
	15	71.20±3.15	10.40±2.48	10.40±2.54	7.80±1.59	5.17±1.05
	20	71.80±3.68	7.60±1.66	14.60±2.82	6.00±1.52	4.75±0.91
	30	67.33±2.75	5.00±1.13	21.17±3.60	6.50±1.20	3.13±0.57

Note. *$p<0.05$, **$p<0.01$, and ***$p<0.001$ compared to intact animals.

between blood cortisol level and percentage of lymphocytes (r=-0.70, $p<0.001$).

Our results show that variations in blood cortisol level in animals with BP are most adequately reflected by changes in the count of leukocytes and percentage of lymphocytes. Differences in the relationship between blood cortisol level and percentage of cell populations demonstrate the existence of various mechanisms of regulation of these cells in the peripheral vascular bed [2]. The mechanisms of cellular homeostasis should be evaluated in further studies.

Experiments on the model of BP showed that the information about the concentration of the major stress hormone cortisol can be obtained by measuring some hemogram parameters.

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