STUDY OF THE OPSONIZING PROPERTIES OF SERUM AND THE PHAGOCYTE RESPONSE IN CANCER PATIENTS

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UDC 616-006.6-07:616.15-097-078

The phagocyte response of the blood leukocytes is reduced in patients with carcinoma of the breast and carcinoma of the stomach in stage I of the disease. In stages II-IV phagocytosis is reduced further and the opsonizing action of the blood serum is also depressed.

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According to published data [1-3, 9, 10] patients with malignant neoplasms have lowered general immunobiological reactivity, including a depressed phagocytic function of the circulating blood leukocytes [4-8, 11]. The present investigation was carried out in an attempt to discover what lies at the basis of the depression of phagocytosis observed in patients with malignant neoplasms.

EXPERIMENTAL METHOD

Leukocytes and sera of 168 patients (99 with carcinoma of the breast and 69 with carcinoma of the stomach) in different stages of the disease and of 50 healthy persons (blood donors from the Odessa Regional Blood Transfusion Station) were used in the experiments to study opsonizing and phagocytic activity.

Blood for investigation was taken from all patients before any treatment was given. The test microorganisms consisted of a 24-h culture of Staphylococcus aureus (strain No. 209). The following were determined: a) phagocytic activity of the patient's leukocytes in the presence of his own serum, b) phagocytic activity of the patient's leukocytes in the presence of healthy human serum (normal serum), c) phagocytic activity of the healthy person in the presence of sera from patients with malignant neoplasms in different stages of the disease, d) phagocytic activity of leukocytes of a healthy person in the presence of normal serum.

The opsonic index was determined by Wright's method: citrated blood was poured into centrifuge tubes and the citrate washed off with physiological saline. With a Pasteur pipet, 0.1 ml of blood cells was then carefully transferred to an agglutination tube, efforts made to take the upper layer with the largest number of leukocytes, and to it were added 0.2 ml of the corresponding serum and 0.1 ml of a 24-h culture of S. aureus containing 2 billion cells/ml. After careful mixing of the ingredients, the tubes were incubated for 20 min (the tubes were shaken twice or three times again in the incubator). Films were then made in the usual way, fixed with Nikiforov's mixture and stained with Manson's blue; 100 neutrophils were counted under the microscope and the phagocytic index calculated. The opsonic index, the ratio between the phagocytic index obtained in the presence of patients' serum and the phagocytic index obtained in the presence of healthy human serum, was then calculated. An opsonic index greater than 1 indicated high opsonic activity of the sera, while an index less than 1 indicated lowering of the opsonic properties of the sera. Each serum was investigated twice. The results obtained were analyzed by statistical methods.

TABLE 1. Indices of Phagocytic Response in Patients with Malignant Neoplasms (M ± m)

Disease	Stage of disease	No. of tests	Phagocytic index in presence of sera: own serum	Phagocytic index in presence of sera: healthy human serum	Opsonic index
Carcinoma of breast	I	72	2,96±0,38	2,84±0,22	1,04
	II	78	1,82±0,19	2,66±0,26	0,68
	III	36	0,84±0,12	1,78±0,16	0,47
	IV	12	0,52±0,1	1,36±0,11	0,38
Carcinoma of stomach	II	74	1,86±0,18	2,72±0,21	0,67
	III	48	0,92±0,13	1,86±0,19	0,49
	IV	16	0,48±0,12	1,3 ±0,14	0,36

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TABLE 2. Indices of Phagocytic Response in Leukocytes from Healthy Persons in the Presence of Sera from Patients with Malignant Neoplasms (M ± m)

Disease	Stage of disease	No. of tests	Healthy human leukocytes	
			mean phagocytic index	opsonic index
Carcinoma of breast	I	72	4,44±0,51	0,99
	II	78	3,08±0,36	0,65
	III	36	2,16±0,24	0,48
	IV	12	1,94±0,18	0,43
Carcinoma of stomach	II	74	3,22±0,28	0,72
	III	48	2,36±0,21	0,52
	IV	16	1,88±0,16	0,42
Healthy		100	4,46±0,39	

EXPERIMENTAL RESULTS

Analysis of the experimental results given in Tables 1 and 2 showed that the decrease in opsonic properties of the serum of cancer patients (irrespective of the location of the tumor) went parallel with the stage of development of the malignant tumor. Comparison of the results of a study of phagocytic activity of the leukocytes from patients and healthy persons clearly showed inhibition of phaogocytic activity of the leukocytes in patients with carcinoma of the breast (Table 1) in stage I of the disease (addition of healthy human serum to the reaction caused no increase in the phaogocytic index: 2.96 and 2.84), the opsonic index being 1.04. Meanwhile, the index of phagocytic activity of healthy human leukocytes in the presence of serum from a patient with stage I disease was equal to that of the control: 4.46 and 4.44, the opsonic index being 0.99.

These results suggest that the development of a malignant tumor in the body elicits a response in the first place from the leukocytes, in the form of inhibition of their physiological functions – their phagocytic activity. Lowering of the phagocytic indices in stage I of development of a malignant neoplasm is due entirely to inhibition of phagocytic activity of the leukocytes, the opsonizing properties of the serum remaining unchanged. Later, in stages II, III, and IV of development of the neoplasm, the opsonic action of the sera falls parallel with the phagocytic activity. In stage II of the disease, for instance, the mean index of phagocytic activity of the leukocytes in patients with carcinoma of the breast was 1.82, while in the presence of healthy human serum it was 2.66, i.e., 1.5 times higher; the opsonic index was 0.68, i.e., less than 1. A similar pattern was observed in patients with carcinoma of the stomach. The index of phagocytic activity of healthy human leukocytes in the presence of sera from patients in stage II of the disease also was lowered: to 3.08 in the case of carcinoma of the breast and 3.22 for carconoma of the stomach (control index 4.46; Table 2), the opsonic index being 0.65 and 0.72 respectively, i.e., less than 1.

In stage I of development of a malignant neoplasm, the intensity of phagocytosis is thus depressed as a result of lowered phagocytic activity of the leukocytes, but in stages II, III, and IV the change in intensity of phagocytosis is due both to depressed phagocytic activity of the blood cells and a decrease in the opsonizing action of the sera.

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