

EXPERIMENTAL METHODS FOR CLINICAL PRACTICE

Relationship between the Functional Status of Neutrophils and the Intensity of Peroxidation in the Lungs in Chronic Bronchitis and Ischemic Heart Disease

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Translated from *Byulleten' Eksperimental'noi Biologii i Meditsiny*, Vol. 126, No. 10, pp. 452-454, October, 1998
Original article submitted December 2, 1997

A relationship between the oxygen metabolism of circulating neutrophils and the intensity of lipid peroxidation in exhaled air condensate was studied in chronic bronchitis, ischemic heart disease, and in their combination. An increase in the functional reserve of neutrophils caused by ischemic heart disease promotes the realization of the bio-oxidant potential of these cells in the bronchoalveolar system and intensifies local processes of lipid peroxidation.

Key Words: *chronic bronchitis; ischemic heart disease; neutrophils; lipid peroxidation*

Sequestration of circulating phagocytes occurs predominantly in the lungs [3]. The intensity of sequestration increases in bronchopulmonary diseases, which is accompanied by neutrophilic leukocytosis and a decrease in the functional reserve of polymorph neutrophils. Opposite shifts in functional state of neutrophils have been described in ischemic heart disease (IHD). We have suggested that the information regarding the functional state of neutrophils in chronic bronchitis (CB) combined with IHD would be useful, since neutrophils are often responsible for intensification of lipid peroxidation and cell damage in the focus of inflammation [4].

In the present study we assessed the contribution of circulating neutrophils to the regulation of lipid peroxidation (LPO) in the bronchoalveolar system of patients with CB and IHD.

MATERIALS AND METHODS

Twelve male patients (age 40-60 years) with CB, IHD and their combination and ten healthy donors were included in the study. The intensity of LPO in the bronchopulmonary system was estimated by the content of heptane- and isopropanol-soluble LPO products in exhaled air condensate [1]. The count of segment neutrophils in peripheral blood was determined. The functional state of these cells was assessed by the TNB test [3]. The test was performed using intact cells (spontaneous) and cells stimulated with *St. aureus*. The functional reserve of neutrophils was calculated as the ratio between the results of induced and spontaneous tests. The data were analyzed by Student's *t* test and Wilcoxon-Mann-Whitney *U* test.

RESULTS

The functional reserve of neutrophils was increased in all studied patients (Table 1). An increase in the

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TABLE 1. Contents of LPO Products in Exhaled Air Condensate and Functional Status of Circulating Neutrophils (M±m)

Parameter	Donors	CB	IHD	CB+IHD
Heptane phase				
primary LPO products	0.5±0.16	0.41±0.1 ^{oo}	0.52±0.006 ^{oo}	0.9±0.36
secondary LPO products	0.25±0.09	0.2±0.005 ^{**}	0.237±0.06 [*]	0.6±0.15 [*]
Isopropanol phase				
primary LPO products	0.6±0.02	0.48±0.15 ^{oo}	0.8±0.13 ^{***}	0.18±0.09 ^{***}
secondary LPO products	0.27±0.01	0.51±0.3 ^{oo}	0.45±0.13 [*]	0.09±0.06 ^{**}
Neutrophil count and TNB-test data				
Neutrophil count	3.26±0.2	4.3±0.4 [*]	3.8±0.3	4.4±0.3 ^{**}
Spontaneous TNB-test, %	28.2±4.2	22.7±3.6	25.2±0.5	27.2±4.6
Induced TNB-test, %	54.4±3.1	55±4	65±3.9 [*]	58.3±4.1
Functional reserve, %	2.24±0.25	3.5±0.5 ^{**}	3.1±0.5 ^o	3±0.4 ^o

Note. The contents of heptane- and isopropanol-soluble LPO products is expressed in terms of oxidizing index which was calculated as the light absorbance ratio E_{232}/E_{220} for primary LPO products (diene conjugates) and E_{278}/E_{220} for secondary LPO products (ketodienes and conjugated trienes). * $p<0.005$, ** $p<0.02$, *** $p<0.001$ (Student's t test) ^o $p<0.05$ (Wilcoxon-Mann-Whitney U test) in comparison with the donors; * $p<0.05$, ** $p<0.01$, *** $p<0.001$ (t test), ^{oo} $p<0.05$ (U test) in comparison with CB-IHD patients.

peripheral blood neutrophil count coincided with an increase in the functional reserve, which argues with the reported findings that the biocidal potential of neutrophils decreases in CB. This discrepancy may be due to the fact that the therapy of CB is aimed predominantly at restricting local inflammation, which prevents the realization of neutrophil biocidal potential in the inflammation focus and may increase the functional reserve of these cells.

It is important to note that the functional reserve of circulating neutrophils in CB patients positively correlated ($r=0.96$, $p<0.05$) with the content of secondary (heptane-soluble) LPO products in exhaled air condensate. This indicates the contribution of neutrophils to local LPO induction in CB.

In IHD patients, an increase in the functional reserve of peripheral blood neutrophils coincided with significant increase in induced activity (TNB test) (Table 1).

Thus, in patients with IHD and CB increased functional reserve of neutrophils result from the anti-inflammatory therapy of CB and increased ability to respiratory burst caused by IHD. The realization of increased pro-oxidant potential of neutrophils in the focus of inflammation (tracheo-bronchial system) is accompanied by sharp increase in local LPO (Table 1). This is confirmed by significantly increased content of peroxidized heptane-soluble lipids in the condensate obtained from pa-

tients with CB and IHD. It should be noted that in patients with both CB and IHD this content was higher than in healthy subjects and in patients with CB or IHD.

Opposite changes were observed in the content of peroxidized isopropanol-soluble lipids. It is likely that the high-intensity LPO occurring in combination of CB and IHD promotes the elimination of readily oxidized phospholipids of the surfactant system [2], which causes the maximum decrease in the content of isopropanol-soluble LPO products. The functional reserve of neutrophils in CB combined with IHD negatively correlated ($r=-0.61$, $p<0.05$) with the contents of isopropanol-soluble LPO products in exhaled air condensate.

Thus, the content of peroxidized lipids in the condensate of exhaled air can be regarded as a parameter reflecting the functional state of circulating neutrophils.

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