

KINETICS OF THE NUMBER OF LEUKOCYTES IN PERIPHERAL BLOOD AND THEIR ADHESION TO LUNG CAPILLARY ENDOTHELIUM IN EXPERIMENTAL VAGUS NEURITIS

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The lungs are known to participate in the regulation of a constant number of leukocytes in the blood, and act as a kind of "leukostat" [2]. This regulation is effected through constant exchange of cells between the marginal and circulating granulocytes, but their quantitative composition is stable. In different pathological situations this exchange may shift in various directions, manifested as transient "leukopenia" and "leukocytosis" in the peripheral blood [3, 6]. The opposite relationship is found in circadian rhythms between the time of the highest blood leukocyte count and the size of the leukocyte migration zone in capillaries [7].

The object of the present investigation was to study the adhesive power of the capillary endothelium relative to leukocytes in the course of experimental inflammation, with a parallel study of the number of leukocytes in the peripheral blood. "Vagus" pneumonia, induced by Chernukh's method [5], served as the model of the inflammatory process.

EXPERIMENTAL METHOD

Experiments were carried out on 196 noninbred albino rats weighing 180-220 g. Neuritis of the right vagus nerve was induced in the cervical portion in 140 animals by application of a ligature soaked in resinified turpentine; 56 intact animals served as the control. Tests were carried out daily for 14 days from the time of intervention on the nerve, at the same time of day. To count the number of leukocytes in the peripheral blood a "Picoscale" (Hungary) apparatus was used. Blood was taken from the caudal vein. The number of leukocytes adherent to the lung capillary endothelium was counted by the method of intravital biomicroscopy suggested by the writers previously [4]. For this purpose, every 15 sec for 1 min a photograph was taken (objective 95, ocular 4) of the same region of the lung. To determine the dynamics of this process, the given area was again photographed after 5, 15, and 30 min. Only those leukocytes which remained at the same place in all negatives were taken into account. The number of leukocytes "fixed" to the lung capillary endothelium was counted in 7 fields of vision, the total area of which, according to the instructions for use of the MBI-15U microscope, was 0.1 mm^2 .

EXPERIMENTAL RESULTS

The experimental results showed that the mean number of leukocytes in the peripheral blood of the intact animals was $12,560 \pm 146$. The number of adherent leukocytes did not exceed 0-2 (Fig. 1), and the total for 7 fields of vision was 9.4 ± 0.43 . The picture changed sharply in the experimental animals (Fig. 2). For instance, by the day after intervention on the vagus nerve, described as the first day of inflammation, the animals developed leukocytosis. The number of leukocytes increased to $20,920 \pm 707$ ($P < 0.001$). Under these circumstances the number of adherent leukocytes in the lung capillaries (Fig. 3) rose sharply to 19.8 ± 0.54 ($P < 0.001$). Next day the leukocytosis ($21,980 \pm 999$) and the number of "fixed" leukocytes (18.8 ± 0.6) showed no significant change. On the 3rd day the leukocyte count in the peripheral blood fell to $16,100 \pm 567$ ($P < 0.001$). This sharp decrease in the number of leukocytes after application of the irritant has not yet been explained in the accessible literature, and it is known as the "3 day phenomenon" [1]. The number of adherent leukocytes, on the other hand, rose significantly ($P < 0.001$) to 28.2 ± 1.08 (Fig. 2). The lung capillaries were literally

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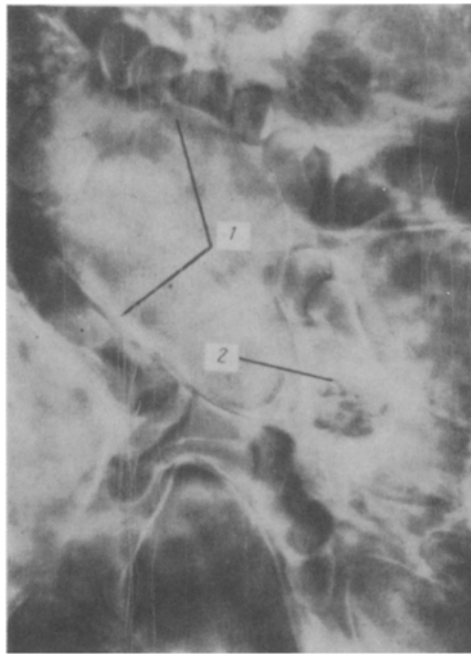


Fig. 1. Single "fixed" leukocyte (2) in lung capillary (1) of intact animal. Magnification here and in Fig. 3: objective 95, ocular 4.

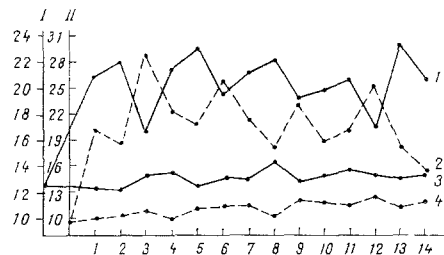


Fig. 2. Changes in number of leukocytes (1, 3) and their adhesion (2, 4) in lung capillaries in experimental vagus neuritis. Abscissa, time of investigation (in days); ordinate: I) number of leukocytes in peripheral blood (in thousands), II) number of adherent leukocytes in field of vision. 1, 2) experiment; 3, 4) control.

"stuffed" with these cells (Fig. 3), so that the blood flow was retarded or the capillaries were even completely excluded from the circulation. Such a sharp decline in the peripheral blood leukocyte count with a parallel increase in the number of cells adherent to the lung capillaries was observed at intervals of 3 days (Fig. 1), i.e., on the 6th, 9th, and 12th days. The study of correlation between the peripheral blood leukocyte count and the adhesive power of the capillary endothelium in the control animals (4 animals on each day of observation) showed that this correlation is weak in intact animals. Throughout the period of observation of both control and experimental animals, settling of the platelets at the periphery of the vessel was not observed. Nevertheless, their passage along the lung capillaries could be clearly traced.

It was concluded from these results that the kinetics of the total number of leukocytes in albino rats showed temporal organization in inflammation. The wave-like character of the reactive leukocytosis is a reversible reflection of the intensity of the adhesive properties of the capillary endothelium relative to leuko-

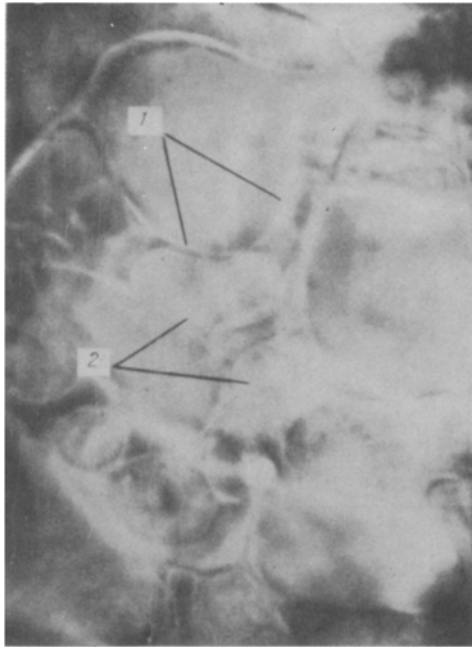


Fig. 3. Group of "fixed" leukocytes (2) in lung capillaries (1) on 3rd day after intervention on nerve.

cytes under both normal and pathological conditions. This reversible dependence has the character of a functional association, which is most marked in acute inflammation.

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