GENERAL PATHOLOGY AND PATHOPHYSIOLOGY

Modulation of Phagocytic Activity of Blood Polynuclear Leukocytes with Ozonized Physiological Saline

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We studied the effect of ozonized physiological saline on phagocytic properties of polymorphonuclear neutrophilic leukocytes from dog blood. Intravenous infusion of the examined doses of ozonized saline stimulated phagocytosis. Repeated intravenous infusion (48 h after) of the same dose was followed by a significant decrease in phagocytic capacity of polynuclears.

Key Words: *ozonized physiological saline; polymorphonuclear leukocytes; phagocytosis*

Non-drug methods for correction of organism's resistance to various diseases attract much recent attention [1,3,5,9,12]. Various methods of ozone prophylaxis and ozone therapy are successfully used for improving the efficiency of medical procedures [7,11].

Exposure to minor ozone doses produces a wide range of therapeutic effects (detoxificating [14], anti-inflammatory, and bactericidal effects), improves microcirculation, stimulates activity of neuronal structures [6], endocrine system [10], *etc*. Infusion of ozonized saline (OS) optimizes the adaptation, defense, and compensatory mechanisms of the body [2]. This primarily manifests in normalization of the function of the antioxidant and proteolytic systems, activation of energy metabolism, and improvement of non-specific organism's resistance [8].

However, exposure to high dozes of ozone is fraught with activation of free-radical oxidation, can cause or aggravate pathological processes, and can lead to exacerbation of chronic diseases [4]. In light of this, the choice of the doses of ozone and ozone solutions and schemes of ozone therapy for obtaining optimum therapeutic effect is an important problem.

Phagocytic response is a central element of non-specific defense mechanisms. Phagocytic activity can be used as indicator of total organism's resistance.

Our previous studies showed that optimum therapeutic effect is produced by solutions with ozone concentration of 2-4 mg/liter [4]. Experimental studies on rats showed that phagocytic activity of blood polynuclears after single administration of OS is a dose-dependent response. In clinical practice repeated (course) administrations of ozone are routinely used, therefore it was interesting to study body response to repeated OS exposures.

Here we evaluated the effect of single and repeated intravenous infusion of OS on phagocytic capacity of polymorphonuclear leukocytes.

MATERIALS AND METHODS

Ozone therapeutic apparatus with ozone decomposer UOTA-60-01-Medozon (Medozon, FC 022a1561/

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3532-06) was used for obtaining OS. The experiment was conducted on 5 intact dogs. OS with ozone concentration 4 mg/liter was administered intravenously in a volume of 5 ml/kg. Repeated infusion of the same OS dose was made after48 h.

Phagocytic response of blood neutrophils was estimated before ozone administration, 5 and 10 min, 2, 24, and 48 h, and 3 days after the start of the experiment and 5 min after repeated OS administration.

RESULTS

The percent of active phagocytes increased by 7.7% 5 min after intravenous OS infusion, while absorbing and digestive capacities decreased, which was quite expectable for such a short period. After 10 min all indices of phagocytic activity of polynuclears sharply increased by 1.7-2.3 times compared to the initial values and remained at this level for 2 hours (Fig. 1).

The number of phagocytic neutrophils and the number of captured bacteria remained elevated after 24 h, but approximated the initial level by day 2; the index of phagocytosis completion decreased below the normal. It is interesting that 2 days after the first OS infusion to dogs all indices of phagocytosis synchronically increased (without additional stimulation), which can be considered as a positive sign of prolonged action of single OS infusion and is in line with the data on phagocyte activation after intraperitoneal administration of LPS from salmonella to mice (this activation was maximum on day 3 and ceased after 3 weeks).

By contrast, repeated intravenous infusion of OS after 2 days sharply decreased the percentage of phagocytic neutrophils (to 38% from the initial value) and captured bactreria (to 26.7% compared to initial value); incomplete recovery was observed after 1 day (to 84.6 and 50%, respectively). At the same time, repeated ozonation significantly stimulated digestive function of phagocytes (to 161.5% compared to initial value). Individual differences in phagocytosis were revealed for polynuclear blood leukocytes from different dogs, which affected statistical significance of the obtained data.

Thus, intravenous infusion of OS activated phagocytic response, which manifested in higher relative number of phagocytic neutrophils and better absorption and digestion of the test bacteria. The increase in all indices of phagocytosis was most pronounced at the early stages (10-15 min) after OS infusion. However, individual differences in this response were noted. Delayed activation of phagocytosis after ozone administration into blood should be taken into account when choosing the doses of ozone and scheme of ozone therapy.

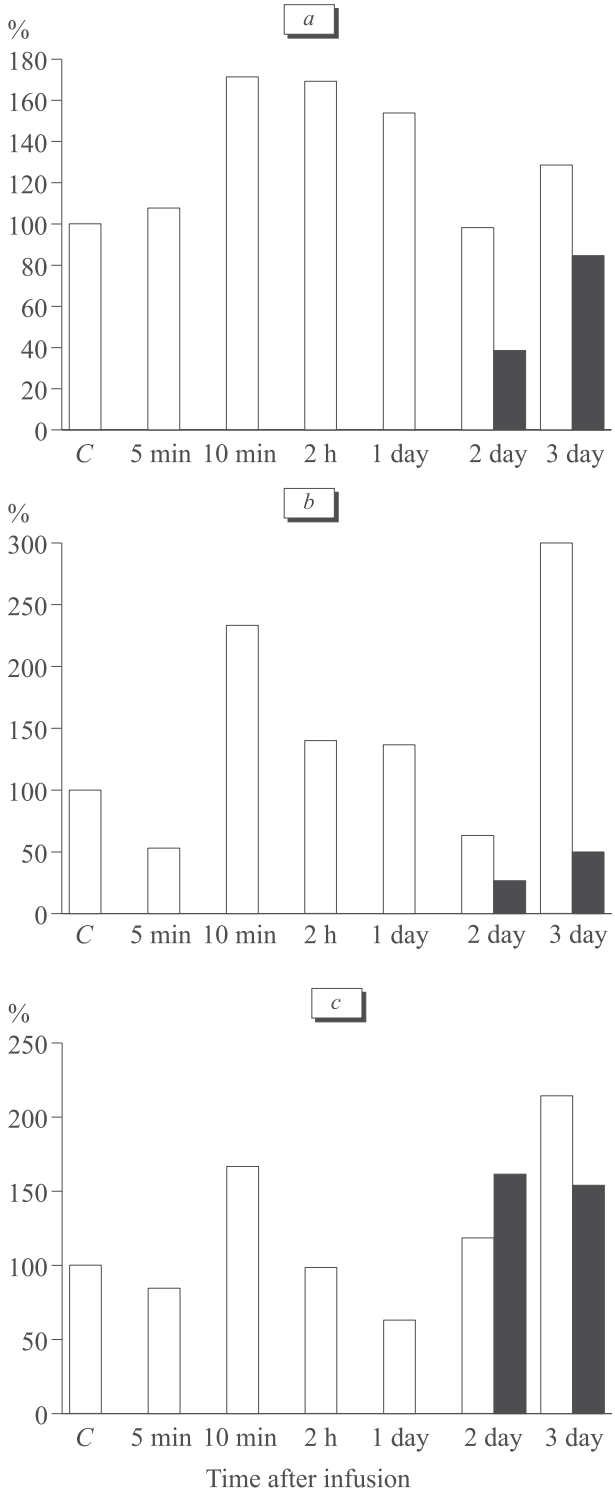

Fig. 1. Effect of intravenous infusions of OS on phagocytic activity of polymorphonuclear neutrophils in dogs. *a*) number of phagocyting neutrophils; *b*) number of captured bacteria; *c*) index of phagocytosis completion. Light bars: single OS administration; dark bars: repeated administration; *C*: control.

Repeated OS infusion after 48 h was attended by a significant decrease in phagocytic capacity of polynuclears. It is our opinion that the obtained data attest to appreciable strain in the nonspecific defense system in intact animals after intravenous infusion of ozone.

It is known that phagocyte preactivation (physiological doses of activators) induces initial stimulation of various functions (increase in chemotactic activity, respiratory burst, *etc*.) followed by a decrease in phagocytic activity. Hyperactivation dramatically suppresses phagocytosis [13]. A phagocytic pulse of certain intensity is necessary for the development of full-value response. Insufficient or excessive stimulation induces weak response or inhibits phagocytosis. The substantial suppression of phagocytic response after repeated OS administration observed in our experiments attests to reduced adaptative and compensatory capacities of the organism. Stimulation of phagocytes *in vivo* after intravenous administration of the applied OS dose to intact dogs requires a recovery period longer than 48 h. Therefore, longer intervals between ozone therapy sessions are necessary in clinical practice for improvement of nonspecific defense system by means of OS exposure.

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