

EFFECT OF NOCICEPTIVE STIMULATION ON PHAGOCYTTIC ACTIVITY OF THE LEUKOCYTES IN POSTNATAL ONTOGENESIS

Yu. T. Chernikov

UDC 612.884:612.112.3]:612.65

Phagocytic activity of the leukocytes was studied in rabbits of different ages exposed to transient nociceptive stimulation by an induction current. In the first days after birth, stimulation caused no significant changes in the intensity of phagocytosis. As the rabbits developed, phagocytic activity of the leukocytes was first lowered, passed through a period of indefinite changes, and finally was raised.

Investigations [3, 5, 7] have shown the effect of nociceptive stimulation on phagocytic activity of the blood leukocytes. The experiments cited above were carried out on adult animals, and it was therefore necessary to study the character of changes in the nociceptive phagocytic response in animals during development.

The object of the present investigation was to study the effect of transient nociceptive stimulation on the phagocytic activity of the leukocytes in rabbits of different ages.

EXPERIMENTAL METHOD

Experiments were carried out on rabbits of 15 different age groups, starting from a few hours after birth and up to the age of 1 year. Nociceptive stimulation was applied for 30 sec by an induction current (RC 6.5/7 cm, voltage in primary circuit 5 V) to the preliminarily shaved hind limb, moistened with physiological saline. The animals responded to this stimulation by a well-marked generalized movement and by a cry. Blood was taken for testing before and 2 min after nociceptive stimulation. The material for phagocytosis was a killed 24-h culture of *Staphylococcus aureus* (strain No. 209). The phagocytic activity of the leukocytes was determined on the basis of three criteria: the phagocytic index (number of microorganisms ingested on the average by one pseudoeosinophil), the phagocytic number (the number of pseudoeosinophils engaged in phagocytosis as a percentage of their total number), and the absolute content of phagocytes (determined from the phagocytic number and the absolute content of pseudoeosinophils in 1 mm³ blood). The changes in the experimental results before and after nociceptive stimulation were taken as significant when $P \leq 0.05$.

EXPERIMENTAL RESULTS

The tests showed that in young rabbits under 4-5 days old the phagocytic activity of the pseudoeosinophils was not significantly changed by nociceptive stimulation ($P > 0.05$).

Experiments on rabbits aged from 6 days to 2 months revealed a decrease in the phagocytic index and phagocytic number ($0.02 > P > 0.001$; Fig. 1). Animals aged 3 months exposed to nociceptive stimulation responded either by a decrease or by an appreciable increase in the phagocytic index and phagocytic number ($P > 0.05$). Starting from the age of 4 months, the differences between values of the phagocytic index and phagocytic number before and after nociceptive stimulation indicated stimulation of the phagocytic function of the pseudoeosinophils and an increase in their relative number ($0.01 > P > 0.001$).

Department of Physiology and Anatomy, T. G. Shevchenko Pedagogic Institute, Voroshilovgrad. (Presented by Academician V. V. Parin.) Translated from *Byulleten' Éksperimental'noi Biologii i Meditsiny*, Vol. 71, No. 1, pp. 18-20, January, 1971. Original article submitted April 6, 1970.

©1970 Consultants Bureau, a division of Plenum Publishing Corporation, 227 West 17th Street, New York, N. Y. 10011. All rights reserved. This article cannot be reproduced for any purpose whatsoever without permission of the publisher. A copy of this article is available from the publisher for \$15.00.

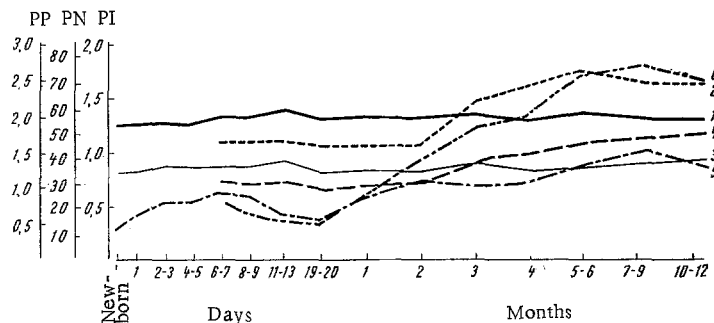


Fig. 1. Effect of nociceptive stimulation on phagocytic activity of pseudoeosinophils (neutrophils) in rabbits of different age groups. PP) Number of phagocytes counted in 1 mm^3 blood; PN) phagocytic number; PI) phagocytic index; 1) PI before stimulation; 2) PI after stimulation; 3) PN before stimulation; 4) PN after stimulation; 5) PP before stimulation; 6) PP after stimulation.

The absolute phagocyte count was reduced in rabbits aged 6-13 days after nociceptive stimulation by 15-27% ($0.05 > P > 0.001$). From the age of 19-20 days until 2 months, the changes in the phagocyte count in the rabbits after nociceptive stimulation were indefinite ($P > 0.05$). In older animals the absolute phagocyte count was increased by 61-89% after stimulation ($0.05 > P > 0.001$).

The absence of a phagocytic response to transient nociceptive stimulation in young rabbits on the first few days after birth can evidently be attributed to the fact that the neuro-humoral factors responsible for controlling the intensity of phagocytosis in the presence of nociceptive stimulation have not yet reached the required level of development in rabbits during the first days of postnatal life. This suggestion is confirmed by investigations [1, 2] showing the influence of nociceptive stimulation on various functional indices (catalase and carbonic anhydrase activity, the shock reaction) in rabbits, but only from 6-13 days after birth. The increased phagocytic activity of the leukocytes in adult rabbits can be regarded as the result of mobilization of the protective factors of the body by the sympathetic nervous system. According to the mediator theory [6], stimulation of phagocytosis is possibly produced by accumulation of products of nervous excitation (sympathin, adrenalin), with a specific effect on phagocytosis, in the blood stream. The possibility cannot be ruled out that depression of the intensity of phagocytosis by nociceptive stimulation at certain stages of age development of rabbits may be due to the "immaturity" of the sympathico-adrenal system, and also to the secretion of endogenous substances depressing the phagocytic activity of leukocytes into the blood stream.

LITERATURE CITED

1. I. I. Agarkov, Effect of Transient Nociceptive Stimulation on Catalase and Carbonic Anhydrase Activity of the Blood in Postnatal Ontogenesis, Author's Abstract of Candidate's Dissertation, Petrozavodsk (1967).
2. É. I. Arshavskaya, *Fiziol. Zh. SSSR*, **36**, No. 4, 268 (1950).
3. N. I. Golovkova, *Byull. Éksperim. Biol. i Med.*, **24**, No. 4, 268 (1947).
4. D. G. Pel'ts, Effect of Pain on the Basic Reactions of Immunity, Candidate's Dissertation, Leningrad (1954).
5. S. S. Polushkina, Abstracts of Proceedings of the Seventh North-Caucasian Conference of Physiologists, Biochemists, and Pharmacologist [in Russian], Rostov-on-Don (1945), p. 53.
6. N. V. Puchkov, *Dokl. Akad. Nauk SSSR*, No. 5, 945 (1948).
7. G. Ludany, J. Reczeu, and G. Vajda, *Z. Immun.-Forsch.*, **107**, 548 (1950).