

ACTION OF UV RADIATION ON HUMAN BLOOD SERUM UNDER NORMAL
AND PATHOLOGICAL CONDITIONS

V. Yu. Kulikov, Academician
V. P. Kaznacheev*, and L. I. Kolesnikova

UDC 612.12.014.44+616.15-02]:535-31

The effect of a broad UV spectrum on the level of diene conjugates in blood serum lipids of donors and of patients with various diseases was studied. The level of diene conjugates in the blood serum lipids of the donors rose after UV irradiation, whereas in patients with inflammatory diseases it fell. In patients with benign and malignant tumors UV irradiation had virtually no effect on the level of diene conjugates in the blood serum lipids. This method can be used for the development of differential diagnostic criteria for diseases of neoplastic and inflammatory nature.

KEY WORDS: *UV radiation; tumors; blood serum; diene conjugates.*

Previous investigations [3, 4] have shown that in patients with malignant neoplasms the photochemiluminescence (PCL) regularly found in the sera of blood donors and patients with others diseases disappears. It has been suggested that the method of recording the PCL of human blood sera can be used for the differential diagnosis between neoplastic and nonneoplastic diseases.

However, the need to record very weak photic fluxes emitted by human and animal tissues [1, 5] has prevented the acceptance of this method in clinical practice.

In this investigation an attempt was made to modify the method of recording PCL of blood serum, by studying primary products formed in the serum lipids of patients with various diseases during UV irradiation.

EXPERIMENTAL METHOD

Human blood sera were irradiated with a broad UV spectrum from the UFO-4A lamp by the method described previously [4]. As primary products, the level of diene conjugates was determined spectrophotometrically [8]. Into different test tubes 1 ml of irradiated and 1 ml of unirradiated blood serum were poured together with 9 ml of a mixture of isopropyl alcohol and heptane (1:1) to extract the lipids. The resulting extracts were centrifuged for 5 min at 5000 rpm. To separate the phases of the supernatant it was treated with distilled water (1:10). The top layer was drawn off by means of a running water pump, and 1 ml of the bottom heptane layer was transferred to glass beakers, from which the solvent was removed by evaporation *in vacuo* (10^{-1}) at a temperature of not more than 40°C for 30 min. The lipids were dissolved in 3 ml of ethanol. The extinction was determined at $\lambda = 233$ nm.

EXPERIMENTAL RESULTS

Altogether 95 persons were tested: 19 blood donors, 23 patients with malignant neoplasms (carcinoma of the gastrointestinal tract in stage II-IV, carcinoma of the respiratory

*Academy of Medical Sciences of the USSR.

Institute of Clinical and Experimental Medicine, Siberian Branch, Academy of Medical Sciences of the USSR, Novosibirsk. Translated from *Byulleten' Éksperimental'noi Biologii i Meditsiny*, Vol. 83, No. 4, pp. 427-429, April, 1977. Original article submitted September 10, 1976.

This material is protected by copyright registered in the name of Plenum Publishing Corporation, 227 West 17th Street, New York, N.Y. 10011. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, microfilming, recording or otherwise, without written permission of the publisher. A copy of this article is available from the publisher for \$7.50.

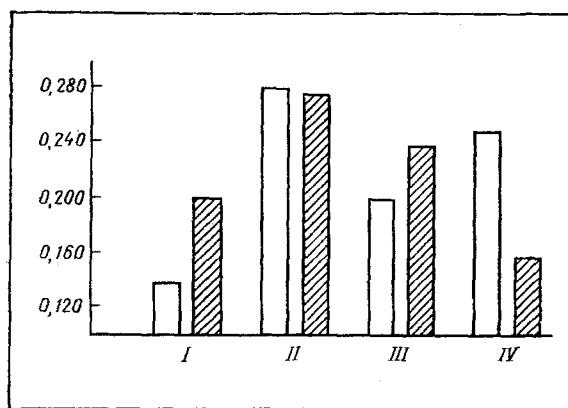


Fig. 1. Action of UV radiation on level of diene conjugates of blood serum lipids from normal subjects and patients. Ordinate, extinction value of blood serum lipids ($\lambda = 233$ nm); I) healthy subjects; II) patients with malignant tumors; III) patients with benign tumors; IV) patients with chronic inflammatory diseases. Unshaded columns before UV irradiation, shaded columns after irradiation.

organs in stage II-III), 23 patients with benign tumors (polyps of the gastrointestinal tract, fibromyomas), and 30 patients with chronic inflammatory diseases of the respiratory and digestive organs (chronic pneumonia in stage II-III, gastric and duodenal ulcer, chronic gastritis).

The results are given in Fig. 1. Clearly the effect of UV irradiation on the level of diene conjugates of the blood serum lipids differed significantly in different states. For instance, UV irradiation raised the level of diene conjugates in the blood donors ($P < 0.001$); in patients with benign tumors this increase did not reach statistical significance. After UV irradiation of the blood serum of patients with chronic inflammatory diseases the level of diene conjugates was significantly ($P < 0.001$) reduced, whereas in serum from patients with malignant neoplasm UV irradiation had no effect whatsoever on the level of diene conjugates.

Since UV irradiation has the property of activating lipid peroxidation (LP) reactions [2, 7, 9], the differences in its effects on the level of diene conjugates in the blood serum of healthy person and patients may be due to changes in several factors controlling the rate at which the LP reactions take place in biological structures. In particular, it is evidently connected with differences in the level of hydroperoxides in the substrate on which the UV irradiation acts. These two types of reactions are manifested most clearly during UV irradiation of sera from blood donors and from patients with chronic inflammatory diseases. Whereas reactions of the first type were observed in the donors (i.e., the level of diene conjugates increased after UV irradiation), in patients with chronic inflammatory diseases the second type of reaction was observed (i.e., the level of diene conjugates fell after UV irradiation).

The predominance of one or another type of reaction depends on differences in the initial level of hydroperoxides in the blood serum lipids, as is clear from Fig. 1. A somewhat different effect was observed after UV irradiation of blood sera from patients with benign and malignant tumors. Despite differences in the level of diene conjugates in the blood sera of these patients, UV irradiation had no significant effect on it. Hence it follows that the pathways of exchange of the energy of UV irradiation in the blood sera of patients with tumors differs from those of blood donors and of patients with chronic inflammatory diseases. This could be attributed to a whole series of factors such as differences in the level of antioxidant activity of the serum lipids, the presence or absence of the oxidation substrate (free fatty acids), differences in protein conformation and protein-lipid interactions, and so on.

It thus appears that this method, like that of recording the PCL of blood sera, can be used for the development of differential diagnostic criteria for diseases of neoplastic and inflammatory nature for both out-patient and in-patient conditions.

LITERATURE CITED

1. G. M. Barenboim, A. N. Domanskii, and K. K. Turoverov, Luminescence of Biopolymers and Cells [in Russian], Moscow-Leningrad (1966).
2. Yu. A. Vladimirov and A. I. Archakov, Peroxidation of Lipids in Biological Membranes [in Russian], Moscow (1972).
3. V. P. Kaznacheev, V. Yu. Kulikov, V. V. Kamenskaya, et al., in: Physicochemical Mechanisms of Malignant Growth [in Russian], Moscow (1970), pp. 116-119.
4. V. Yu. Kulikov, "Diagnostic possibilities of the quantometry method in internal medicine," Author's Abstract of Candidate's Dissertation, Novosibirsk (1971).
5. N. A. Soboleva, A. G. Berkovskii, N. O. Chechin, et al., Photoelectronic Instruments [in Russian], Moscow (1965).
6. A. I. Marzoev, D. I. Roshupkin, and Yu. A. Vladimirov, in: Proceedings of the 24th Scientific Conference of the North-Ossetian Medical Institute [in Russian], Ordzhonikidze (1971), pp. 134-135.
7. A. I. Marzoev, D. I. Roshupkin, and Yu. A. Vladimirov, Biofizika, No. 2, 256 (1972).
8. Z. Placer, Nahrung, 12, 679 (1968).
9. L. D. Saslow, H. J. Anderson, and V. S. Waravdenar, Nature, 200, 1098 (1963).