BLOOD SUPPLY CHANGES IN THE INTERNAL ORGANS OF GUINEA PIGS WITH EXPERIMENTAL ATHEROSCLEROSIS, SUBJECTED TO PROTEIN HYDROLYSATE TREATMENT

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The functional study on the state of individual microcirculation systems in various diseases is most frequently effected through radioisotope methods. The procedure of Kety allows for early and exact diagnosis of limb ischemia in a variety of vascular conditions, the development of atherosclerotic processes in particular (2). The outlooks of using 133-xenon in surgical practice with the purpose to detect promptly any changes in the state of microcirculation are very good (1). Under experimental conditions, the changes in the microcirculation of internal organs may be judged from the rate of blood filling. In this respect, the method elaborated by Sapirstein using 86-rubidium (11) offers definitive precision and convenience.

Studies performed by Tomova (5) show that protein hydrolysates exert a favourable effect on the blood supply of liver. intestines and kidneys under conditions of hemorrhagic shock. Tzekov and co-authors (7), using Hydroprot — a protein hydrolysate — published similar results in edema of the brain. Further researches (6, 8, 10) demonstrate that in animals treated in advance with protein hydrolysate, a stimulation of adaptive and compensatory mechanisms takes place after blood loss, and in consequence, pathological reactions develop much later than in the controls.

The purpose of the work submitted is to study changes in the blood supply of internal organs in animals with experimentally induced atherosclerosis, receiving protein hydrolysate in advance.

Material and Method

In male guinea pigs, weighing 350—500 g, maintained on a cholesterol diet over a five-month period, the distribution of the general blood flow (or relative blood flow — RBF) in the internal organs was studied according to Sapirstein's method (11) using 86-rubidium. The experiments were conducted on 28 male guinea pigs, divided up into three groups as follows: group I — fed daily cholesterol at dose 0.3 per cent of the total food amount, dissolved in 2 g cow butter, and treated with protein hydrolysate «Hydroprot» at dose 0.5 ml/100 g body weight, subcutaneously, every other day; Group II — fed cholesterol and injected with physiologic saline solution under conditions analogical to those in group I; group III — control animals, injected with physiologic saline solution.

The isotope solution was introduced into the right atrium of the heart via cannulation of v. jugularis, at dose 2 microcurie /100 g weight, 45 seconds prior to sacrification of the animals. Thiopental Spofa — 25 mg/kg weight — was used as a narcotic. The animals were killed with a lethal dose of the narcotic — 300 mg/kg weight — injected intracardially through the cannula. Death occurred instantly, with heart activity arrest in the systole. Radiometric analysis of whole organs or parts of bigger organs, well crushed small parts in physiologic saline, was made with gamma-scintillation counter, type NK 107 C-UNR, for one minute. The relative blood flow was calculated according to the formula:

$$RBF = \frac{\text{activity in gram tissue/min}}{\text{total injected activity/min}} \cdot 100.$$

Results and Discussion

The results obtained, illustrated in Fig. 1, show that among the examined internal organs in the control animals (heart, aorta, liver, intestine, kidney, lung, spleen and muscle), an adequate blood filling is established in the kidney — 2.89, heart — 1.77, small intestine — 1.03. The lowest RBF is recorded in the muscle — 0.18. The aorta too is comparatively well supplied with blood — 0.55.

The rather prolonged cholesterol alimentation of guinea pigs (group II) led to changes in the microcirculation state of internal organs. RBF decreased in all the organs under study. A statistically reliable reduction was recorded in the small intestine ($p < 0.01$), kidney ($p < 0.01$), heart ($p = 0.001$), spleen ($p < 0.01$), liver ($p < 0.02$).

Protein hydrolysate treatment of guinea pigs throughout the entire period of cholesterol feeding protects to a great extent the blood supply of organs against pathological changes. The results obtained are very similar to those in the control group. A reliably higher activity is established in comparison with the untreated atherosclerotic animals: small intestine ($p < 0.0001$); kidney ($p < 0.001$); heart ($p < 0.001$); liver ($p < 0.01$).

The functional changes observed in the atherosclerotic animals, manifested by a RBF decrease in the organs, confirm the electron microscope changes described by Klimenko and Pozdnyakov (3).

The effect of the protein hydrolysate «Hydroprot» on the relative blood flow of internal organs, although not fully elucidated, may be related to the trophic action of the amino acids in the hydrolysate on the cellular elements of the microcirculation bed. The favourable results referred to may be furthermore connected with the stabilization of protein structures in the organs proper, as well as with the stimulation of the topical compensatory and adaptation reactions (8, 10), under the conditions of a morbid process.

Finally, it is stressed that the properties of protein hydrolysate, already established in a separate work by the same authors (4), to improve the fle-

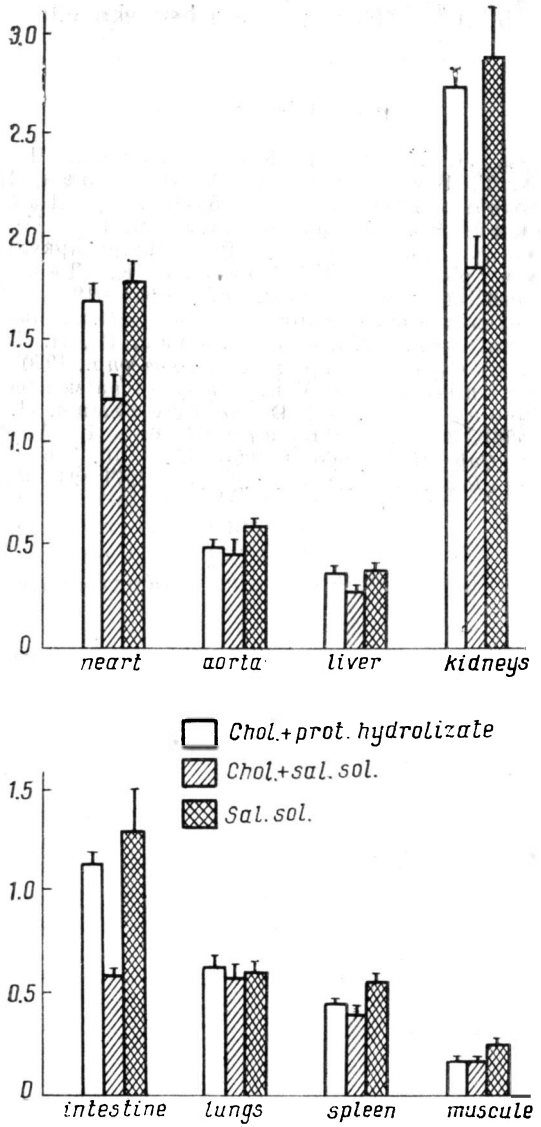


Fig. 1. Blood supply changes in the organs of guinea pigs with experimental atherosclerosis, treated with protein hydrolysate.

xibility of erythrocytes in hemorrhagic shock, atherosclerosis and burn disease similarly contribute to the interpretation of the results concerning the blood supply of internal organs described above.

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ИЗМЕНЕНИЯ В ОРОШЕНИИ ВНУТРЕННИХ ОРГАНОВ У МОРСКИХ СВИНОК С ЭКСПЕРИМЕНТАЛЬНЫМ АТЕРОСКЛЕРОЗОМ, ТРЕТИРОВАННЫХ ГИДРОЛИЗАТОМ БЕЛКА

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РЕЗЮМЕ

У морских свинок, весящих 350—500 г, находящихся на холестероловой диете в течение 5 месяцев, прослеживается кровонаполнение внутренних органов при помощи радиоизотопа 86 рубидий. Раствор изотопа вводится путем канюлирования яремной вены в правое предсердие в дозе 2 микрокюри/100 г веса, за 45 секунд перед умерщвлением животных.

Часть животных третировалась гидролизатом белка «Гидропрот» по 0,5 мл/100 г. телесного веса подкожно через день, в течение всего времени, пока длилась подкормка холестеролом.

Устанавливается достоверно более высокая активность в сердце, печени, почках, кишке, поджелудочной железе и других органах у животных, третированных гидролизатом белка, в сравнении с нетретированными атеросклеротическими животными.

Обсуждается возможность улучшения орошения органов при экспериментальном атеросклерозе под влиянием гидролизата белка «Гидропрот».