REACTION OF ARTERIES IN THE EARLY STAGE OF DEVELOPMENT OF EXPERIMENTAL CHOLESTEROL ATHEROSCLEROSIS IN DOGS

UDC 616.13-002.2-07:616.13-008-07\textsuperscript{092.4/9}

A. N. Fedoseev

Institute of Human Morphology (Director — Corresponding Member AMN SSSR
Professor A. P. Avtsyn) of the AMN SSSR, Moscow
(Presented by Active Member AMN SSSR V. V. Parin)
Translated from Byulleten’ Éksperimental’noi Biologii i Meditsiny, Vol. 57, No. 4,
pp. 42-46, April, 1964
Original article submitted April 6, 1963

With the appearance and development of a pathological process, including experimental atherosclerosis, defensive reactions arise in the body, and the central nervous system plays a part in their formation and regulation. These reactions are masked by the developing pathological process both during their formation and at a time when they are definitively established. Meanwhile, during the study of atherosclerosis in experimental animals it is mainly the late stages of the condition that are investigated, when marked morphological changes are present in the vessels. In consequence of this, the earliest stages of the process, i.e., when the defensive reactions are evidently being formed, have escaped investigation. Yet at the same time it would be of the utmost interest to know which links in the complex chain of reactions of the organism during the development of the pathological process are in fact adaptive and defensive.

In previous investigations certain conclusions have been drawn regarding the purpose and character of the influences of the nervous system on the arterial wall in experimental atherosclerosis [7]. The object of the present investigation was to study the reactivity of the vasoconstrictor center, and also the contractile power of the arterial walls in the intact organism and in the isolated heart during the early stage of development of experimental cholesterol atherosclerosis in dogs and in association with the administration of adrenalin, which plays an active part in the regulation of vascular tone.

EXPERIMENTAL METHOD

Experiments were conducted on 14 male dogs aged 2-4 years, weighing from 16 to 27 kg, divided into two groups. The main group consisted of 10 dogs, receiving a 20% solution of cholesterol in sunflower oil daily for 45-60 days in a dose of 1 g cholesterol/kg body weight and 1.5 g 6-methylthiouracil daily in powder form. These substances were given to the animals mixed with minced meat. A control group consisted of 4 dogs, of which two (Nos. 3 and 11) received 6-methylthiouracil alone and two (Nos. 9 and 13) cholesterol alone in the same doses and for the same periods of time. The cholesterol concentration in the venous blood (by Abel’s method) and the lipoprotein concentration, followed by electrophoresis on paper, were estimated regularly in all the animals, not less often than once every 3 weeks.

EXPERIMENTAL RESULTS

The weight of the animals of the experimental group increased during the experiment by 2-3 kg, and that of the control animals by 1-2 kg. The blood cholesterol concentration of the animals of the experimental group rose 5-10 fold, of dog No. 5-17-fold, and of dog No. 6 - 20-fold, while at the same time the \( \alpha \)-lipoprotein concentration fell and the \( \beta \)-lipoprotein concentration rose. The blood cholesterol concentration of the dogs receiving cholesterol alone rose by 50-100%, and that of the dogs receiving 6-methylthiouracil alone — by 100-200%. At the end of the experiment the dogs were sacrificed by exsanguination under morphine anesthesia and after injection of 5000 units
Arterial pressure of dogs before production of atherosclerosis (a), in an early stage of atherosclerosis (b). Marker on line of stimulation – moment of intravenous injection of adrenalin; time marker (1 sec).

of heparin. Postmortem examination of 2 dogs of the experimental group, receiving both cholesterol and 6-methylthiouracil, showed lipoidosis of the branches of the thyroid artery, visible to the naked eye (dogs Nos. 5 and 6). Marked lipoid infiltration of the juxtamedullary zone of the kidneys was found in the dogs of the experimental group, and also in the dogs of the control group.

In the heart very slight changes were seen in the coronary vessels, in the form of a focal lipoidosis of the intima and, to some extent, of the media. Neither macro- nor microscopic changes were found in the cardiovascular system of the dogs of the control group.

In some experiments the changes in arterial pressure were investigated after intravenous injection of adrenalin. For this purpose the arterial pressure in the femoral artery was measured by means of a mercury manometer in each of the 14 animals. The animals were anesthetized with morphine, and the site of the skin incision was anesthetized with ethyl chloride. Adrenalin was injected several times in each experiment, in fairly high doses (0.2-0.3 ml of 1:1,000 solution) in relation to the body weight. After the animals had been fed on cholesterol and 6-methylcholesterol for 45-60 days, the arterial pressure remained at its previous level, but in response to the injection of adrenalin, instead of the increase in the maximal arterial pressure by 200-250% observed in the experiments performed before cholesterol feeding began, it increased by not more than 100-150%. The minimal pressure now rose by a smaller