

A STUDY OF THE FUNCTIONAL CONDITION OF THE THYROID GLAND DURING EXPERIMENTAL ATHEROSCLEROSIS

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The works of our own and of foreign scientists have proven that the thyroid gland plays an essential role in the development of atherosclerosis. In an experiment with animals, it was established that an injection of the thyrotropic hormone inhibits the development of experimental atherosclerosis [3,4]. But, when injected simultaneously with cholesterol thionacil (a substance which reduces the efficiency of the thyroid gland), it sharply intensifies the atherosclerosis development [1,5].

That atherosclerosis develops early and extensively in myxedema and that it develops weakly in thyrotoxicosis patients are known facts.

The purpose of our work was to study the functional condition of the thyroid gland during experimental cholesterol atherosclerosis.

EXPERIMENTAL METHODS

We studied the function of the thyroid gland by means of radioactive iodine. Atherosclerosis was produced by N. N. Anichkov's method.

The experiment was done on 21 mature rabbits of the same type, weighing from 2 to 2.3 kg, kept in the same conditions and receiving the same food ration. Before the experiment began, the cholesterol content in the blood was determined in all of the rabbits by the Grigo method, and the functional condition of the thyroid gland was studied by means of radioactive iodine. We used iodine with an atomic number of 53 and an atomic weight of 131 (I^{131}).

The disintegration period of I^{131} is 8 days. I^{131} was injected subcutaneously into all the rabbits in a dose of 0.75–1.0 microcuries and, after 24 hours, when a Geiger counter count had been made, the figures obtained of I^{131} absorption were expressed in percentages. After thyroid gland absorption of I^{131} had been determined, cholesterol dissolved in vegetable oil (0.3 g of cholesterol per 1 kg of animal weight) was administered daily to 18 rabbits, for a period of 6 months. To exclude the effect of the vegetable oil on the function of the thyroid gland, 3 rabbits were given daily for 6 months the same amount of vegetable oil at the same time as the other 18 rabbits, but without the cholesterol.

The cholesterol content in the blood was determined in all of the rabbits every 15 days. After 6 months, the thyroid gland absorption of I^{131} was again examined in all of the rabbits, after which the rabbits were sacrificed, the aorta and heart extracted and the aorta stained in toto with Sudan III; the heart was cut into a series of consecutive sections, the fat was stained with Sudan III and the degree of atherosclerosis in the coronary arteries was examined. We arbitrarily designated the degree of atherosclerotic changes in the aorta and coronary arteries thus: + weak, ++ moderate and +++ sharp changes.

EXPERIMENTAL RESULTS

Before cholesterol and vegetable oil ingestion started, I^{131} absorption was 15-27% in all of the rabbits.

The cholesterol content in the blood increased rapidly after cholesterol administration began in most of the rabbits and, by the end of the first month, had reached 620-680 mg%, while the cholesterol content in the blood remained within normal limits (26-36 mg%) throughout the experiment in the rabbits which were receiving vegetable oil alone.

In most cases, hypercholesteremia reached 1,100-1,400 mg% 3-4 months after the beginning of cholesterol administration, and, in 2 rabbits, 1,580 and 1,730 mg%. In two other rabbits, however, the blood cholesterol content never exceeded 470-600 mg% throughout the period of cholesterol administration. Towards the end of the 6th month of cholesterol ingestion, the cholesterol content in the blood was considerably lower, in some cases, 320-422 mg%.

When thyroid gland absorption of I^{131} was examined for the second time, after 6 months of cholesterol ingestion, it was found to be greatly reduced in all 18 rabbits and was, in some cases, 0.10-0.22% instead of the original (before cholesterol ingestion began) 15.4-20.0% (rabbits No. 9, 10, 15, Table 1).

TABLE 1

Thyroid Gland Absorption of I^{131} in Connection with Hypercholesteremia and Atherosclerosis of the Aorta and the Coronary Arteries

No. of rabbit	Thyroid gland absorption of I^{131} in %		After 6 months period of cholesterol ingestion	Cholesterol content in blood at end of 6 month period in mg%	Degree of atherosclerosis of the aorta	Degree of atherosclerosis of the coronary arteries
	before cholesterol ingestion	after 6 month period of cholesterol ingestion				
1	24.1	13.2	470	320	++	+
2	19.5	5.2	1212	1030	+++	++
3	17.9	4.25	1340	1136	+++	++
4	18.2	4.8	1280	1025	+++	++
5	16.3	3.88	1320	714	+++	++
6	17.2	5.1	805	612	+++	++
7	20.7	6.2	1270	615	+++	++
8	19.5	8.2	1110	422	++	+
9	19.1	0.22	1580	1124	+++	+++
10	15.4	0.10	1730	1250	+++	+++
11	22.1	6.4	950	618	+++	++
12	22.3	6.55	912	518	+++	+
13	21.2	4.5	1370	816	+++	++
14	27.6	8.7	780	604	++	+
15	20.0	0.22	1400	1010	+++	++
16	25.1	11.6	600	410	+	+
17	24.2	3.8	1450	1116	+++	++
18	22.1	4.2	1380	810	+++	++

Upon examination of the aorta and the coronary arteries, acute atherosclerosis of the aorta and moderate atherosclerosis of the coronary arteries were observed in most cases.

We observed no atherosclerosis of either the aorta or the coronary arteries in the rabbits which had received vegetable oil without cholesterol. In these rabbits, thyroid gland absorption of I^{131} remained within normal limits after the 6 month period of vegetable oil ingestion (Table 2).

Consequently, vegetable oil without cholesterol does not affect the function of the thyroid gland.

When I^{131} absorption is compared with the high hypercholesteremia and the degree of atherosclerosis in the aorta and coronary arteries, the relation between the thyroid gland absorption of I^{131} and the degree of atherosclerosis is obvious (Table 1). In those cases when I^{131} absorption was sharply reduced, acute hypercholesteremia and atherosclerosis of the aorta were observed. When I^{131} absorption was not so markedly reduced (rabbits No. 1, 8, 14, 16), hypercholesteremia and atherosclerosis of the aorta and coronary arteries were less acute. V. V.

Tatarsky [2] who examined the basal metabolism in rabbits with experimental atherosclerosis, also discovered that basal metabolism in animals with high hypercholesteremia and marked atherosclerosis declined sharply.

TABLE 2

Thyroid Gland Absorption of I^{131} in Rabbits which Received Vegetable Oil Without Cholesterol

No. of rabbit	Thyroid gland absorption of I^{131} in %		Cholesterol content in blood before vegetable oil ingestion in mg%	Cholesterol content in blood after 6 month period of vegetable oil ingestion in mg%	Degree of atherosclerosis of aorta	Degree of atherosclerosis of coronary arteries
	before vegetable oil ingestion	after 6 month period of vegetable oil ingestion				
19	18.7	17.6	78	64	—	—
20	21.7	20.4	65	82	—	—
21	17.8	17.1	76	88	—	—

Therefore the function of the thyroid gland is weakened in cholesterol atherosclerosis, and the weaker the glandular function, the stronger the atherosclerosis.

Thyroid gland absorption of I^{131} depends directly on the level of hypercholesteremia and the degree of atherosclerosis.

The ingestion of vegetable oil without cholesterol does not cause hypercholesteremia and atherosclerosis to develop and does not affect thyroid gland absorption of I^{131} .

SUMMARY

The functional state of the thyroid gland of rabbits with experimental atherosclerosis of the aorta and coronary arteries was studied with the aid of I^{131} .

After six months of cholesterol ingestion, absorption of I^{131} decreased from the initial 15.4-20.0% to 0.10-0.22%. Under conditions of hypercholesterinemia and atherosclerosis, absorption of I^{131} diminished and the functional state of the thyroid gland degraded.

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