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## STRUCTURAL CHANGES OF THE THYROID GLAND OF LABORATORY RATS AS A RESULT OF THE INTRAVENOUS INTRODUCTION OF DIAGNOSTIC AND THERAPEUTIC DOSES OF RADIOIODINE

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*It is known that the thyroid gland plays significant role in neurohumoral regulation of human and animal organisms. Influence of ionizing radiation upon the structural elements of the thyroid gland is not investigated in full. Available scientific literature contains information concerning the influence of peroral introduction of radioactive iodine and other types of radioactive irradiation upon the thyroid gland. We tried to investigate morphologic changes in thyroid gland of laboratory rats after intravenous introduction of radioactive iodine in diagnostic and therapeutical doses.*

**Keywords:** gland, follicle, epithelial cell

It is known that the thyroid gland plays significant role in neurohumoral regulation of human and animal organisms. Influence of ionizing radiation upon the structural elements of the thyroid gland is not investigated in full. Available scientific literature contains information concerning the influence of peroral introduction of radioactive iodine and other types of radioactive irradiation upon the thyroid gland. We tried to investigate morphologic changes in thyroid gland of laboratory rats after intravenous introduction of radioactive iodine in diagnostic and therapeutical doses.

In our work we used males of three-month-aged laboratory rats. All the animals were divided into five groups, each of the groups included five rats. We formed two control groups (groups №1 and №2) which included intact animals. The rats of the group №3 were subjected to single intravenous introduction of diagnostic dose of radioactive iodine. The rats of the groups №4 and №5 were subjected single intravenous introduction of therapeutical dose of radioactive iodine. At the end of the third month after the beginning of the experiment the rats of the groups №1 and №4 were killed. The rats of the groups №2, №3 and №5 were killed at the end of the ninth month after the beginning of the experiment.

Thyroid glands were extracted and fixed in the solution of formalin. Histological sections were stained with hematoxylin-eosin and were investigated under the light microscope.

The outer surface of the rat's thyroid glands of the group №1 is covered by connective tissue capsule which consists of thin wavy fibres travelling along the surface of the gland, and of cellular elements containing elongated nuclei. The capsule gives rise to vascularised connective tissue septa which divide the thyroid parenchyma into lobules. Septal vessels contain formed elements of blood. Septal arteries are characterized by well developed media.

Parenchyma of the thyroid gland is made up of numerous different-sized follicles surrounded by thin connective tissue bundles. Small-sized follicles fill the central part of the gland and large follicles are located within its peripheral parts. The wall of each follicle is lined by unilayered epithelium, the boundaries of the epithelial cells are indistinct. The shape of the epithelial cells is mainly cuboidal, but in the largest follicles the epithelium is flattened. During the growth of the follicle the height of the epithelium doesn't undergo considerable changes. In the follicles which are twenty to fifty micrometers in diameter the height of the epithelium is  $7,43 \pm 0,37$  micrometers, in the follicles which are fifty-one to one hundred micrometers in diameter the height of epithelium is  $7,93 \pm 0,12$  micrometers in diameter, in the follicles which are one hundred and one to one hundred and fifty micrometers in diameter the height is  $7,13 \pm 0,21$  micrometers, in the follicles which are one hundred and fifty-one to two hundred micrometers in diameter the height is  $6,43 \pm 0,17$  micrometers.

Increase of the size of a follicle during its growth occurs chiefly because of increase of the specific volume of its cavity. In the follicles which are twenty to fifty micrometers in diameter the diameter of the cavity makes up  $56,52 \pm 2,3\%$  of its total diameter. In the follicles which are fifty-one to one hundred micrometers in diameter the diameter of the cavity makes up  $73,89 \pm 3,1\%$ . In the follicles which are one hundred and one to one hundred and fifty micrometers in diameter the diameter of the cavity is  $85,5\%$ . In the follicles which are one hundred and fifty-one to two hundred micrometers in diameter the diameter of the cavity is  $88,02 \pm 4,2\%$ .

Large follicles contain granular colloid, but in some largest follicles the colloid is dense and homogeneous.

During the growth of follicle the diameter of the nuclei of follicular cells doesn't change considerably. In the follicles which are twenty to fifty micrometers in diameter the diameter of nuclei of follicular cells is  $4,26 \pm 0,1$  micrometers. In the follicles which are fifty-one to one hundred micrometers in diameter the diameter of nuclei is  $4,51 \pm 0,11$  micrometers. In the follicles which are one hundred and one to one hundred and fifty micrometers in diameter the diameter of nuclei is  $4,13 \pm 0,1$  micrometers. In the follicles which are one hundred and fifty-one to two hundred micrometers in diameter the diameter of nuclei is  $4,37 \pm 0,13$  micrometers. Rounded and oval nuclei of follicular cells are closed-face and centrally situated.

In the thyroid gland of the rats of control group №2 the large follicles are found both within peripheral and central zones. The largest follicles are three hundred and fifty micrometers in diameter. Many of large follicles contain dense colloid. Small follicles are lined by cuboidal epithelium. As a whole the height of the follicular epithelium in the rats of the group №2 is less than that in the rats of the group №1. In the follicles which are more than seventy micrometers in diameter the epithelium gradually becomes flattened toward the largest follicles. In the follicles which are twenty to fifty micrometers in diameter the height of epithelium is  $5,92 \pm 0,19$  micrometers. In the follicles which are fifty-one to one hundred micrometers in diameter the height of epithelium is  $5,47 \pm 0,17$  micrometers. In the follicles which are one hundred and one to one hundred and fifty

micrometers in diameter the height of epithelium is  $5,42 \pm 0,15$  micrometers. In the follicles which are one hundred and fifty-one micrometers and more in diameter the height of epithelium is  $4,1 \pm 0,1$  micrometers.

As a result the specific volume of follicles of the animals of the group №2 is less than that of the animals of the group №1. In the follicles which are twenty to fifty micrometers in diameter the diameter of their cavity makes up 69,6%. In the follicles which are fifty-one to one hundred micrometers in diameter the diameter of their cavity make up 78,06%. In the follicles which are one hundred and one to one hundred and fifty micrometers in diameter the diameter of their cavity makes up 88,2%. In follicles which are one hundred and fifty-one micrometers and more in diameter the diameter of their cavity makes up 91,63%.

During growth of the follicle the diameter of the follicular cell nuclei doesn't change considerably. In the follicles which are twenty to fifty micrometers in diameter the diameter of the follicular cell nuclei is  $4,64 \pm 0,12$  micrometers. In the follicles which are fifty-one to one hundred micrometers in diameter the diameter of the nuclei is  $4,16 \pm 0,1$  micrometers. In the follicles which are one hundred and one to one hundred and fifty-one micrometers in diameter the diameter of the nuclei is  $4,21 \pm 0,1$  micrometers. In the follicles which are one hundred and fifty-one micrometers and more in diameter the diameter of the nuclei is  $4,04 \pm 0,14$  micrometers.

In different animals of the group №3 the thyroid glands show different reactions to the introduced preparation. In some of the animals the thyroid glands are made up of numerous follicles, large follicles are situated in the peripheral parts of the organ, small follicles are situated in the central zones. Large follicles contain in some cases granular colloid in other cases they contain dense colloid; the latter is pierced by fissures. The wall of any follicles is lined by cuboidal epithelial cells containing rounded and oval closed-face nuclei. In the other animals of the group №3 the thyroid glands don't contain any large follicles. Small follicles have dense cloddy colloid. Among follicular cells in the small follicles there are many anucleate and vacuolated ones. In some follicular cells the nuclei are pyknotic. In some cases the wall of the small follicles is destroyed.

In the rats of the group №4 the thyroid gland is characterized by absence of large follicles. The walls of small follicles show signs of degeneration: vacuolation and destruction of follicular cells. The nuclei of the follicular cells in some cases are pyknotic, in other cases they are enlarged and have prominent karyolemma and nucleoli. Some of the follicles are devoid of colloid, other follicles contain dense cloddy colloid.

In the rats of the group №5 the thyroid glands contain different-sized follicles. Small follicles are situated in the central parts of the organ, large follicles are situated in the peripheral parts. Some small follicles are lined by flattened follicular cells. In the most of the large follicles the colloid is granular in structure, and some of the large follicles contain dense colloid pierced by fissures. In some of the large follicles the peripheral zones of the colloid are dense, and central zone is granular. The wall of many of the follicles show some signs of degeneration: vacuolated and anucleate follicular cells, and the follicular cells containing pyknotic nuclei.

**Conclusion.** Intravenous introduction of diagnostic and therapeutical doses of radioiodine causes prominent desctructive changes in the thyroid glands of laboratory rats. In some cases the introduction causes absence of follicles.

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### **ТӘЖІРИБЕЛІК ЕГЕУҚҰЙРЫҚТАРҒА РАДИОАКТИВТІ ЙОДТЫҢ ДИАГНОСТИКАЛЫҚ ЖӘНЕ ТЕРАПЕВТІК ДОЗАСЫН ТАМЫРҒА ЕНГІЗГЕНДЕ ҚАЛҚАНША БЕЗІНІҢ ҚҰРЫЛЫМДЫҚ ӨЗГЕРІСТЕРІ.**

**Түйін:** Гистологиялық және морфометриялық әдістерді қолдана отырып авторлар тәжірибелік егеуқұйрықтарға радиоактивті йодтың диагностикалық және терапевтік дозасын тамырға енгізгеннен кейінгі әр түрлі кезеңдерінде қалқанша безінде байқалатын реакцияларын зерттеді. Соның нәтижесінде радиоактивті йодтың әсерінен қалқанша безде деструктивті өзгерістер айқын білінгені анықталды.

**Түйінді сөздер:** без, фолликул, эпителий жасушалары

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### **СТРУКТУРНЫЕ ИЗМЕНЕНИЯ ЩИТОВИДНОЙ ЖЕЛЕЗЫ ЛАБОРАТОРНЫХ КРЫС ПРИ ВНУТРИВЕННОМ ВВЕДЕНИИ ДИАГНОСТИЧЕСКИХ И ТЕРАПЕВТИЧЕСКИХ ДОЗ РАДИОАКТИВНОГО ЙОДА**

**Резюме:** С помощью гистологических и морфометрических методов авторами изучена реакция щитовидной железы в различные периоды после внутривенного введения диагностических и терапевтических доз радиоактивного йода. Были установлены выраженные деструктивные изменения в ткани щитовидной железы под действием радиоактивного излучения.

**Ключевые слова:** железа, фолликул, эпителиальная клетка