

EFFECT OF STIMULATION OF THE GONADS ON THYROID REGENERATION

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Aseptic inflammation of the ovaries in rabbits produces thyroid hypofunction, while stimulation of the testes is accompanied by activation of the thyroid parenchyma. After partial thyroidectomy, stimulation of the testes is almost without effect on thyroid regeneration, while the rate of regeneration of the thyroid parenchyma in females with inflamed ovaries is considerably increased.

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The basic principles governing growth and regeneration of the thyroid have been studied in adequate detail [1-6]. However, diseases accompanied by the development of epithelial goiter, i.e., by hyperplasia of the thyroid parenchyma (parenchymatous goiter and thyrotoxicosis), affect women much more often than men. The suggestion has therefore been made that the female reproductive system has some influence on proliferation of the thyroid gland.

To test this hypothesis the present investigation was therefore undertaken to study the effect of stimulation of the gonads (ovaries and testes) on regeneration of the thyroid gland.

EXPERIMENTAL METHOD

Experiments were carried out on 82 sexually mature male and female rabbits. The gonads were stimulated by transfixing them with a viscose thread. Five days after this procedure, partial thyroidectomy was performed on the experimental animals, the left lobe of the thyroid and the lower half of its right lobe being removed. The resected areas were immediately weighed on torsion scales. Regeneration of the thyroid was studied on the 7th, 10th, and 15th days after resection.

The regenerating thyroids and gonads were fixed in Zenker's fluid with formalin, embedded in celloidin-paraffin, and sections cut to a thickness of 4μ were stained by the Mallory-Heidenhain method. Statistical analysis of the experimental results was by the Student-Fisher method.

EXPERIMENTAL RESULTS

Inflammation produced by introduction of the thread led to the formation of a thin fibrous capsule in both males and females around the foreign body. In the inflamed ovary, however, massive atresia of the follicles and marked proliferation of the interstitial tissue took place, displacing the cortical substance almost completely. In the testes, on the other hand, the reaction was limited to comparatively moderate hyperplasia of the interstitial tissue, and slight degenerative changes of the spermatogenic epithelium were observed only in a few seminiferous tubules.

Inflammation of the ovaries led to depression of function of the intact thyroid, as shown by the large size of the follicles, distended with thick, stagnant homogeneous colloid, and by the decrease in the mean height of the follicular epithelial cells (5.39μ compared with 7.56μ normally). In males, on the other hand, the thyroid reacted to inflammation of the testes by mild excitation: the height of the follicular epithelial cells increased from a normal 8.39μ to 9.15μ .

Consequently, the thyroid responded differently to stimulation of the testes and ovaries.

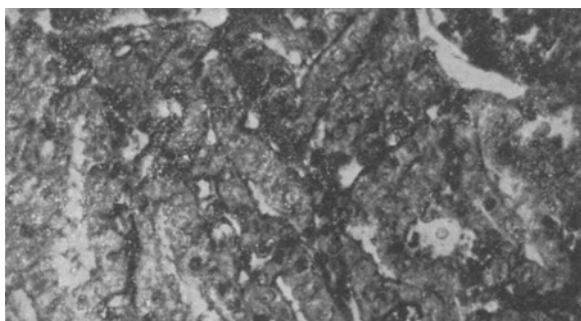
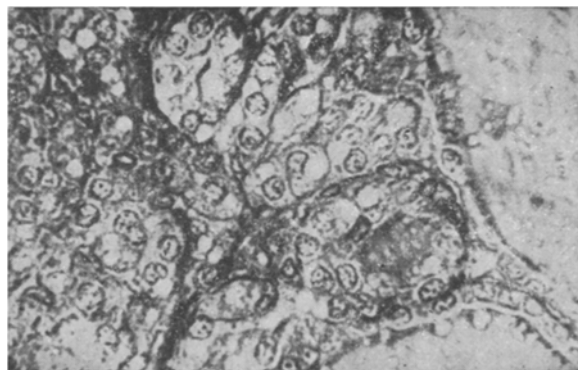
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TABLE 1. Mean Relative Increase in Weight of Thyroid after Partial Thyroidectomy in Males (mg/kg)

Nature of procedure	Time of expt. (in days)	No. of animals	Mean relative weight of thyroid			Regenerating gland + resected part of right lobe	Mean rel. increase in wt. of thyroid $\bar{x} \pm S_{\bar{x}}$	P
			on day of operation		on day of sacrifice			
			resected left lobe	resected part of right lobe	regenerating gland			
Partial thyroidectomy (control)	7	4	47.1	22.9	26.9	49.8	2.7 \pm 0.74	—
	10	4	39.0	22.2	23.9	43.7	4.7 \pm 0.48	—
	15	4	41.5	23.1	24.8	47.9	6.4 \pm 0.41	—
Partial thyroidectomy + stimulation of testes	7	4	25.9	9.8	18.9	28.7	2.8 \pm 0.77	>0.05
	10	4	31.1	11.3	25.9	37.2	6.1 \pm 0.68	>0.05
	15	4	25.4	10.7	23.4	34.1	8.7 \pm 1.36	>0.05

TABLE 2. Mean Relative Increase in Weight of Thyroid (in mg/kg) after Partial Thyroidectomy in Females

Nature of procedure	Time of expt. (in days)	No. of animals	Mean relative weight of thyroid			Regenerating gland + resected part of right lobe	Mean rel. increase in wt. of thyroid $\bar{x} \pm S_{\bar{x}}$	P
			on day of operation		on day of sacrifice			
			resected left lobe	resected part of right lobe	regenerating gland			
Partial thyroidectomy (control)	7	4	31.8	15.1	20.1	35.2	3.4 \pm 0.31	—
	10	4	26.2	16.1	16.1	32.2	6.0 \pm 0.79	—
	15	4	32.3	11.8	26.9	38.7	6.4 \pm 0.51	—
Partial thyroidectomy + stimulation of ovaries	7	8	33.1	16.5	23.1	39.6	6.5 \pm 0.78	<0.001
	10	8	32.8	15.1	28.0	43.1	10.3 \pm 1.08	<0.001
	15	12	31.0	17.6	25.3	42.9	11.9 \pm 1.12	<0.001

Fig. 1. Thyroid of a male rabbit after partial thyroidectomy performed during stimulation of testes. 200 \times .Fig. 2. Thyroid of a female rabbit after partial thyroidectomy performed during stimulation of the ovaries. 200 \times .

In animals with intact gonads partial thyroidectomy was followed by the development of compensatory functional stimulation of the remaining part of the thyroid in males and females equally; the increase in weight of the regenerating thyroid also was equal in both cases (Tables 1 and 2).

Stimulation of the testes in fact did not modify the course of thyroid regeneration. It continued in its state of functional activation (Fig. 1), and the difference in relative increase in weight of the thyroid lobe regenerating in animals with an intact testis and in those with inflammation was not statistically significant (Table 1).

The character of thyroid regeneration was different in females with inflammation of their ovaries (Fig. 2). Large follicles, filled with thick colloid, and the flattened follicular epithelial cells whose mean height was reduced to $6.5\ \mu$ are evidence of depression of thyroid function. Meanwhile the rate of regeneration of the thyroid parenchyma was considerably increased, so that the mean relative increase in weight of the regenerating lobe was almost twice that observed when the gonads were intact (Table 2).

According to some observations [7, 8], surgical trauma leads to thyroid hypofunction. Although in the experiments described above, inflammation in the ovaries and testes was associated with identical surgical trauma to these organs, the response of the thyroid differed in the males and females. The effect of stimulation of the ovaries of the thyroid was much greater than the corresponding effect of stimulation of the testes, and its influence was felt in particular by growth of the regenerating thyroid parenchyma.

The results of these experiments confirm that influences exerted by the ovaries on the thyroid play an important role in the regulation of proliferative processes taking place in the gland.

LITERATURE CITED

1. B. V. Aleshin, Abstracts of Proceedings of the 2nd All-Union Conference of Endocrinologists [in Russian], Moscow (1962), p. 21.
2. B. V. Aleshin, Parenchymatous Goiter and Thyrotoxicosis [in Russian], Kiev (1965).
3. B. V. Aleshin, in: Physiology and Pathology of the Endocrine System [in Russian], Khar'kov (1965), p. 35.
4. A. A. Voitkevich, *Uspekhi Sovr. Biol.*, 60, No. 1, 90 (1965).
5. A. A. Voitkevich, in: Physiology and Pathology of the Thyroid Gland [in Russian], Tashkent (1966), p. 68.
6. N. S. Demidenko, Effect of Certain Procedures Applied to the Nervous System on Regeneration of the Thyroid Parenchyma, Author's Abstract of Candidate Dissertation, Khar'kov (1961).
7. V. V. Mamina, in: Problems in Endocrinology [in Russian], Khar'kov (1958), p. 7.
8. I. A. Ėskin and Yu. B. Skebel'skaya, *Dokl. Akad. Nauk SSSR*, 68, No. 4, 801 (1949).