

REGENERATION OF THE RAT OVARY AFTER REPEATED RESECTION

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UDC 612.6.03:612.621

Repeated resection of the regenerating half of the ovary (after removal of the whole of one ovary and half of the other) is not accompanied by any marked increase in weight of the organ, and three months after the operation cystic degeneration of the ovary is observed.

Analysis of the published data indicates that regeneration takes place most intensively after resection of half of one ovary and simultaneous total removal of the opposite ovary [1-8].

The object of the present investigation was to study whether the proliferative ability of the ovarian cells is exhausted after intensive regeneration has taken place in the residual half of the gland after removal of half of one ovary and simultaneous total removal of the other.

EXPERIMENTAL METHOD

Experiments were carried out on sexually mature female Wistar rats weighing 150-160 g, which were divided into four groups. From the animals of groups 1, 2, and 3, half of the left ovary and the whole of the right ovary were removed simultaneously in order to stimulate intensive regeneration of the partially resected organ. The ovary of the animals of group 1 was removed 4 months after the beginning of the experiment for histological study. In the animals of group 2, half of the regenerating ovary was removed 4 months after partial resection of the left ovary and total resection of the right. The animals of group 3 were left as controls for comparison of the course of regeneration in the ovaries of the different groups of animals. The animals of group 4 remained intact (control).

EXPERIMENTAL RESULTS

The weight of the ovaries from rats of the different groups are given in Table 1, and it is clear that four months after the operation the weight of the regenerating ovary (52 mg) was 1.5 times greater than the weight of the control ovary. Histological examination of ovaries from the rats of this group revealed intensive proliferation. At the time of the second operation, for example, the ovaries had already undergone regeneration. Later in the investigation, 7 months after the first and 3 months after the second resection, no significant increase in the weight of the ovaries was found in the animals of groups 2 and 3. During this period, the signs of regeneration were very slight. The weight of the regenerating ovary (24 mg) in the animals of group 2 was considerably less than the weight of the ovary of the control animals (33 mg), but almost equal to the weight of the regenerating ovary which had not undergone repeated resection (21 mg).

In the rats of group 2, three months after the second resection of the ovary, regenerative processes were accompanied by degenerative changes in the organ. Cystic degeneration of the ovary was observed, and affected most of the follicles. Frequently the follicles were filled with blood-stained fluid (Fig. 1). Hypertrophy of the stroma of the organ was observed and it was invaded by bands of connective tissue, with

Institute of Experimental Biology, Academy of Medical Sciences of the USSR, Moscow. (Presented by Academician of the Academy of Medical Sciences of the USSR N. N. Zhukov-Verezhnikov.) Translated from *Byulleten' Éksperimental'noi Biologii i Meditsiny*, Vol. 69, No. 3, pp. 110-112, March, 1970. Original article submitted October 2, 1969.

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TABLE 1. Weight of Rat Ovaries 4 and 7 Months after Operation

Group of animals	Beginning of experiment					After 4 months					After 7 months				
	Wt. of rat (ing)	absolute weight of ovaries (in mg)		relative weight of ovaries (in ‰ of body weight)		Wt. of rat (ing)	absolute weight of ovaries (in mg)		relative weight of ovary (in ‰ of body weight)		Wt. of rat (ing)	absolute weight of ovaries (in mg)		relative weight of ovary (in ‰ of body weight)	
		right	half of left	right	half of left		right	half of left	right	half of left		right	half of left	right	half of left
1	156	23	12	0.14	0.08	235	—	52	—	0.22	—	—	—	—	—
2	174	33	15	0.18	0.08	232	—	25*	—	0.10	244	—	24	—	0.10
3	158	25	11	0.15	0.07	—	—	—	—	—	248	—	21	—	0.08
4	—	—	—	—	—	246	34	39	0.13	0.15	244	32	33	0.15	0.16

*Resected half of ovary.

TABLE 2. Number of Generative Structures in Ovaries of Rats of Different Groups

Group of animals	Total number of primary follicles	Number in section				
		follicles			corpora lutea	all generative structures
		primary	ripening	atretic		
1) 4 months after resection of right ovary and half of left	120	3.0	5.0	8.8	6.0	22.8
2) Second resection of regenerating ovary	37	0.9	2.5	12.0	2.2	19.6
3) 7 months after removal of right ovary and half of left	82	2.0	2.6	10.2	5.2	20.0
4) Control	130	3.6	7.6	6.5	5.8	23.5

evidence of luteinization in some places. Many traces of scar formation in follicles as a result of atresia were present in the stroma of the ovaries. Counting showed (Table 2) that few corpora lutea were present in the ovary after the second resection (2.2 per section), but they were more numerous in the regenerating ovary of the rats of group 3 (5.2), and in the intact ovary of the control animals (5.8). In most cases the remaining ripening follicles (2.5 per section) also showed signs of atresia. The corpora lutea were undergoing degeneration, and some of them contained cavities filled with fluid. Very few primary follicles were counted (0.9 per section), whereas in the regenerating ovaries of the animals of group 1 they were much more numerous (3 per section) 4 months after resection. However, after 7 months there were fewer of them in the regenerating ovaries than in the early periods (2), although they were still more numerous than in the ovaries which had undergone a second resection. Most of the primary follicles at this time already showed traces of degenerative changes.

It will also be noted that the regenerating ovaries 7 months after the operation (group 3) also showed signs of degeneration. The stroma of the ovary was sclerosed, and contained many cavities and scars (traces of atresia of the follicles). Of all the generative structures, follicles undergoing atresia were the most numerous (10.2). Ripening of the follicles was considerably depressed, and the number of ripening follicles (2) was fewer than in the ovaries of the control animals (7.6). Exhaustion of the proliferative processes was apparent.

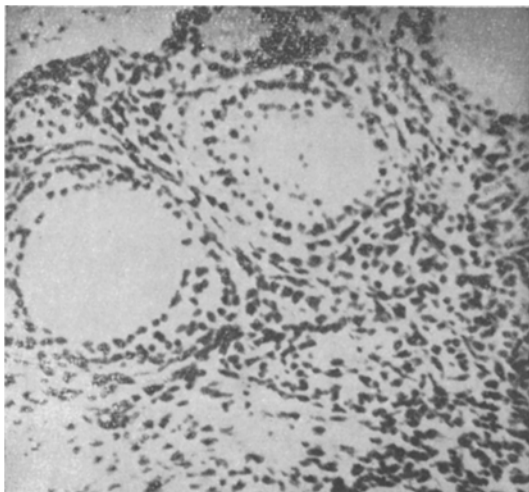


Fig. 1. Cystic degeneration of follicles after repeated resection of ovary, 200 \times .

Age changes in the gonads with increasing atresia of the follicles were also observed in the control animals. The stroma of the ovary was hypertrophied, and signs of atresia and numerous cavities were present, but all the structural components of the ovary were clearly outlined and easily distinguishable, in contrast to the ovaries undergoing regeneration.

A study of indices of ovarian function in the animals of groups 2 and 3, in which the ovaries were undergoing regeneration, revealed disturbances of the rhythm of the reproductive cycles, prolongation of the resting phase, early onset of the menopause, and a decrease in the reproductive power of the animals.

Cystic degeneration of the ovaries and depression of their function were thus observed 3 months after a second resection of the previously partially resected ovary. This is evidently the

result of stimulation of processes taking place in the ovary after the first partial resection accompanied by total resection of the other ovary.

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