REACTION OF THE RAT SUBMANDIBULAR SALIVARY GLAND TO INJURY TO THE CONTRALATERAL GLAND

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UDC 616.316.1-031.74-092.9

After burns of resection of the submandibular salivary gland the intact contralateral gland in rats responds by increased proliferative activity. The number of mitoses reached a maximum 72 h after injury in the case of burns and 48 h after resection. Burns of the salivary gland cause lasting but weak compensatory hypertrophy of the contralateral gland. Hypertrophy of the gland is accompanied by an increase in size of the cells and nuclei, the area of which rises by 10 and 17% respectively. Resection of the salivary gland causes an increase in weight of the intact gland only in the early period of observation; by the 30th and 45th days after the operation the weight of the experimental glands was not significantly different from the control. Differences in compensatory growth of the intact glands observed after two types of injury of the contralateral gland evidently depend on the quantity of tissue breakdown products and the duration of their presence in the body.

KEY WORDS: compensatory hypertrophy; submandibular salivary gland; resection; burns.

Extirpation of one or more salivary glands in adult animals has no significant effect on the weight of the residual intact gland [2-4,8,10]. Meanwhile, ligation of the duct or of the neurovascular bundle of one salivary gland leads to an increase in weight of glands not directly affected by trauma [3, 9].

The object of this investigation was to study whether compensatory hypertrophy of the submandibular salivary gland is produced by burns or resection of the contralateral gland.

EXPERIMENTAL METHOD

The submandibular salivary gland of male albino rats weighing 150-205 g was used as the test object. One third of one gland was removed from 80 rats. A burn was inflicted at the lower pole of the gland in another 70 rats by means of a hot needle 1 mm in diameter. The control consisted of 70 intact rats and 20 rats subjected to unilateral sialadenectomy.

The animals were killed with ether vapor 24-120 h and 14, 30 and 45 days after the operation. Each group contained at least 10 rats. The glands were weighed on torsion scales and fixed in Carnoy's mixture. The change in weight of the glands was expressed as a percentage of the weight of the homonymous gland in the control. Sections 4-5 μ thick were stained with hematoxylin and eosin. Mitotic activity was determined in 19,000 acinar cells under the MBI-3 binocular microscope (objective 90×, ocular 7×) with a diaphragm aperture measuring 7 × 7 mm. The mitotic index (MI) was expressed in promille. The dimensions of the cells and nuclei were measured with an Abbé apparatus under magnifications of 800× or 1800× respectively; the height of the fully extended tube was 190 mm. In each animal 100 nuclei and 100 cells were measured.

Statistical analysis of the numerical results was carried out by the Fisher–Student method.

EXPERIMENTAL RESULTS

Unilateral extirpation of the submandibular and sublingual glands, as the results of weighing showed, was not accompanied by any significant change in weight of the residual homonymous glands. Their weight was in-

Department of Biology and General Genetics, Moscow Medical Stomatological Institute. (Presented by Academician of the Academy of Medical Sciences of the USSR A. P. Avtsyn.) Translated from Byulleten' Éksperimental'noi Biologii i Meditsiny, Vol. 82, No. 9, pp. 1108-1110, September, 1976. Original article submitted February 12, 1976.

TABLE 1. Changes in Weight of Intact Salivary Gland (in % of control) in Experiments with Injury to Contralateral Gland

Time after operation	wt. of gland, % of wt. of control gland			
	Resection	P	burns	P
24 h	104	0,30	108	0,04
48h	108	0,15	107	0,02
72 h	109	0,04	109	0,003
120 h	109	0,01	113	0,001
14 days	109,5	0,01	113	0,001
30 days	105	0,13	110	0,001
45 days	105	0,20	116	0,001

Legend. Weight of one gland in control taken as 100%.

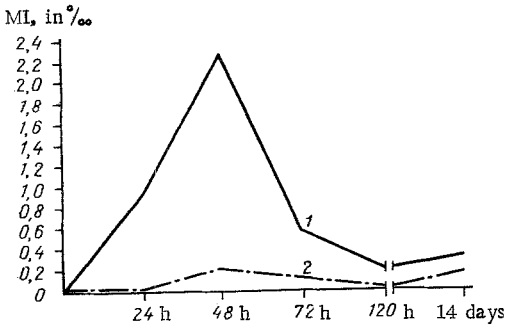

Fig. 1

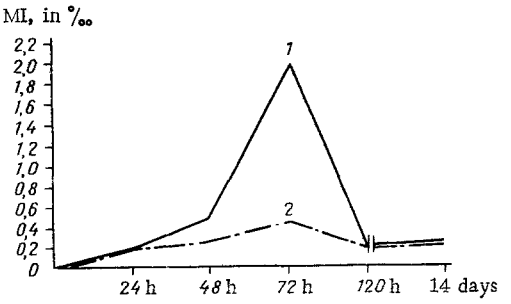

Fig. 2

Fig. 1. Mitotic activity of acinar cells and duct cells of submandibular salivary gland at various stages after resection of one-third of contralateral gland: 1) epithelium of acini; 2) epithelium of duct. Ordinate, MI (in ‰); abscissa, time after operation.

Fig. 2. Mitotic activity of acinar cells and duct cells of submandibular salivary gland at different times after burning of contralateral gland. Legend as in Fig. 1.

distinguishable from the control not only in the early period after the operation, as was shown previously [2,8], but also in the later stages: 45 days after unilateral sialadenectomy their weight was 101% compared with the control. Resection of one gland led after 5 and 14 days to a small but significant increase in weight of the intact, contralateral gland (Table 1). Meanwhile hypertrophy of the salivary gland under these experimental conditions was not enduring, and after 30 and 45 days the weight of the gland in the rates of this group was indistinguishable from the control ($P = 0.13$, $P = 0.20$).

Somewhat different results were obtained in the experiments with burns of the salivary gland. As Table 1 shows, under these experimental conditions the weight of the intact gland at all times of observation was higher than the control. The increase in wight was significant and persisted until the late stages of the investigation. However, the relatively small increase in weight of the glands (only 16%) will be noted, a fact previously observed by other workers in experiments with ligation of the ducts [3].

Histological analysis of the glands at different periods of observation shows that both resection and burns of the submandibular gland caused an increase in proliferative activity not only in the injured organ [5], but also in the intact contralateral (Figs. 1 and 2). The largest number of mitoses in the resection experiments was observed 48 h after the operation, and in the experiments with burns, 72 h thereafter.

Comparison of the changes in MI with fluctuations in proliferative activity after unilateral sialadenectomy [1,5] indicates that, despite differences in the outcome of regeneration, the level of mitotic activity in all the experiments was low and about equal. This suggested that hypertrophy of the cells plays the more important role in the recovery process.

Special measurements showed that a lasting increase in weight of the gland was accompanied by a definite increase in size of the cells and nuclei. For instance, 45 days after burning the area of the cells and nuclei

was significantly greater, by 10 and 17% respectively, than the control (85.2 and 21.4 μ^2 in the control, 94.4 and 25.2 μ^2 in the experiment). Consequently, hypertrophy of the intact gland under these experimental conditions used took place through the same cellular mechanisms as regeneration hypertrophy, i.e., through cell multiplication and, especially, by hypertrophy of the cells.

These results indicate that, although unable to undergo compensatory hypertrophy after extirpation of one or more salivary glands, the submandibular salivary gland clearly enlarges after injury of the paired organ. In the experiments with burns compensatory hypertrophy of the salivary gland, just as during regeneration [6,7], was more marked than after resection.

The view has been expressed that an important factor in the outcome of regeneration of the salivary glands is the presence of their tissue breakdown products in the body [3]. This investigation confirms the validity of this hypothesis to some extent. Resection of one gland, accompanied by the appearance of a narrow band of necrosis and, consequently, by the appearance of only a small quantity of gland tissue breakdown products, leads to a weaker and less prolonged increase in size of the contralateral gland than burns.

Although after burns the same quantity of gland tissue (above one-third) perished as after resection, the necrotic masses remained for a longer time in the body and the tissue breakdown products were present in greater amount and took longer to be absorbed.

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