

CHANGES IN THE EOSINOPHIL COUNT AND CORTICOSTERONE AND CATECHOLAMINE LEVELS DURING REGENERATION OF THE RESECTED LIVER

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Changes in the eosinophil count in the blood and in the catecholamine and corticosterone concentrations in the plasma, adrenals, and heart were found after partial hepatectomy in experiments on albino rats. Responses of the pituitary-adrenal system to resection and regeneration of the liver were phasic in character, as reflected by the eosinophil count.

KEY WORDS: resection of the liver; corticosterone; catecholamines; eosinophils.

Regeneration of the liver after resection is accompanied by various structural and functional changes which are associated with changes in homeostasis [2, 6]. The eosinopenic effect, an indicator of the response of the pituitary-adrenal system (PAS) to stress [8], is connected with the liberation of adaptive hormones [4, 13]. The secretion of hormones is coordinated with the rate of their inactivation, which takes place mainly in the liver [3, 12]. Participation of the liver, in different functional states, in the development of the general adaptation syndrome has been inadequately studied. Information likewise is not available on the dynamics of the eosinophil count as an indicator of the state of the PAS during regeneration of the liver after resection. On this question there are only individual reports of a decrease in reactivity of the adrenal cortex accompanying injury to the parenchyma of the liver [5] and of disturbances of the hormonal balance of the body after resection of the liver [10].

The object of the present investigation was a dynamic study of the eosinophil count in the peripheral blood and of the concentration of catecholamines and corticosterone in the plasma, adrenals, and heart of rats during regeneration of the liver after partial hepatectomy.

EXPERIMENTAL METHOD

Experiments were carried out on 54 male albino rats weighing 200-220 g with an initial eosinophil count of 220-340/ μ l peripheral blood at 9 a.m. Two-thirds of the liver was resected by the method of Higgins and Andersen [10]. Eosinophils were counted (in a Goryaev chamber after staining by Hinkelman's method) every 4 h for 192 h after resection of the liver. The concentration of corticosterone [1] in the plasma, adrenals, and heart and the concentrations of adrenalin, noradrenalin, dopa, and dopamine in the heart and adrenals [7] were determined 4, 12, 24, 48, 56, and 192 h after resection of the liver. Intact animals served as the controls. The results were subjected to statistical analysis.

EXPERIMENTAL RESULTS

Three time periods with different levels of eosinophils were identified in the dynamics of the peripheral blood eosinophil count of the experimental rats (Fig. 1): A first period of eosinopenia (0-48 h), a second period of eosinophilia (48-56 h), and a third period when, after transient eosinopenia, the eosinophil count gradually returned toward the control level (56-192 h).

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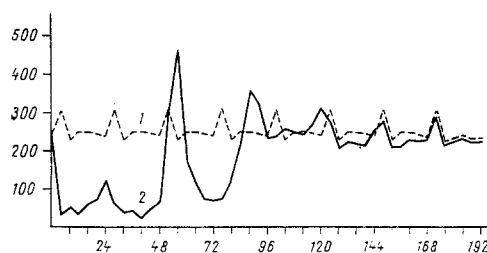


Fig. 1. Changes in eosinophil count in peripheral blood of rats after resection of liver. 1) Control; 2) experiment. Abscissa, time after resection of liver (in h); ordinate, eosinophil count in 1 μ l blood.

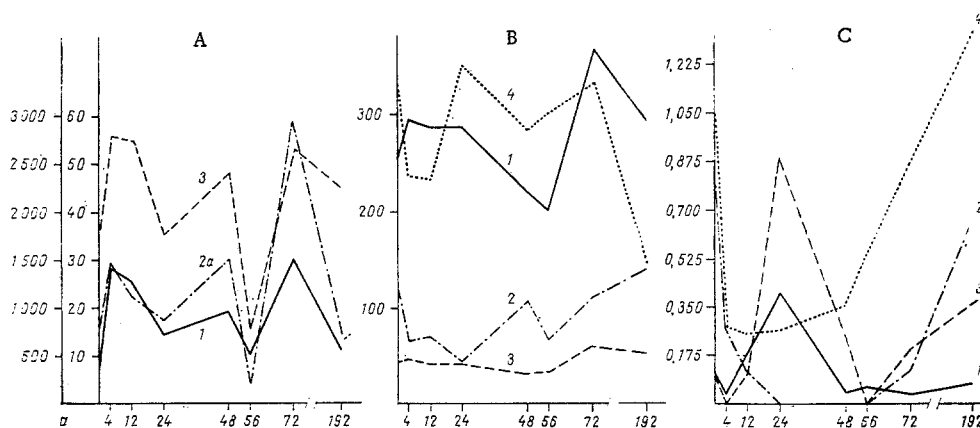


Fig. 2. Dynamics of corticosterone and catecholamine concentrations after resection of liver. A) Corticosterone in plasma (1), adrenals (2a), and heart (3). B and C) Catecholamines in adrenals and heart, respectively: 1) Adrenalin; 2) noradrenalin; 3) dopa; 4) dopamine. Abscissa, time after resection of liver (in h); ordinate, corticosterone (in μ g %) and catecholamines (in μ g/g tissue).

Analysis of the corticosterone and catecholamine concentrations showed that the period of eosinopenia corresponded to activation of the PAS (Fig. 2). Fluctuations in the corticosterone and catecholamine concentrations during this period also were due to the general response of the PAS to the extremal situation (resection of the liver), and also to a decrease in the hormone-inactivating function of the liver [14]. Accumulation of dopa and adrenalin in the myocardium and the sharp decline in the noradrenalin and dopamine concentrations indicate complex interrelations in the neuroendocrine regulation of the heart during this period.

In the period of eosinophilia (48–56 h) a sharp decrease in the corticosterone and catecholamine concentrations in the adrenals and a fall in the concentration of these hormones in the heart were observed. According to Yudaev [9], the intensity of hormone metabolism in the liver determines the secretion of steroids by the adrenal glands. It can therefore be postulated that inhibition of activity of the PAS takes place by a feedback mechanism, as a result of the reduction in the hormone-inactivating function of the liver.

In the third period a transient eosinopenic effect and repeated activation of the PAS are observed. These phenomena reflect the onset of a new stress reaction, probably largely due to the critical functional state of the liver. The indices studied later returned gradually toward their initial levels.

The phasic character of the dynamics of the hormone concentration established in these investigations was thus due not only to the general response of the PAS to the extremal situation (resection of the liver), but also evidently to differences in the structural and functional state of the liver during its regeneration. The dynamics of the blood eosinophil count is an objective indicator of PAS activity. The results described above reflect the adaptive reorganization of biorhythms of neuroendocrine regulation of homeostasis after resection of the liver.

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RESPONSE OF THE THYROID GLAND TO EXPERIMENTAL PARTIAL AND TOTAL PANCREATECTOMY

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The terminal or central part of the pancreas was resected or the whole gland removed in dogs. At different times after the operation the morphological and functional state of the thyroid gland was studied by histological, histochemical, and morphometric methods. The changes discovered indicate that structural and functional transformations of the thyroid gland are determined primarily by the type of operation on the pancreas: Resection of the terminal portions causes temporary and slight changes in the thyroid gland, whereas after total pancreatectomy marked degenerative and atrophic changes develop in the glands, leading to a state of functional exhaustion.

KEY WORDS: thyroid gland; partial resection of the pancreas; pancreatectomy.

Functional connections between the thyroid gland and pancreas have frequently been described both clinically and experimentally, but most attention has been paid to the study of the response of the pancreas to hypo- and hyperproduction of thyroid hormones. The direction of adaptation of the thyroid gland and the extent of its reserves in states of partial or total pancreatic deprivation have not been specially studied. Yet such information would be interesting in connection with the study of the rationale of the use of hormones and drugs acting on the thyroid gland after partial and total pancreatectomy.

EXPERIMENTAL METHOD

Experiments on 50 dogs were carried out by the method described previously [5]. In series I the terminal part of the pancreas was resected (15 dogs); in series II the central part of the pancreas was resected and the main efferent ducts ligated and divided (15 dogs), whereas in series III total pancreatectomy was performed (20 dogs). Between 3 days and 1 year after the operation the dogs were killed and the thyroid gland

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