DIRECT ACTION OF ALLERGEN ON ADRENAL CORTICAL FUNCTION IN DOGS

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The action of an allergen (normal horse serum) on the adrenals of sensitized dogs perfused in situ leads to changes in the level of secretion of cortisol and corticosterone.

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Changes in function of the pituitary–adrenal system have a marked effect on the immunologic and allergic reactivity of the animal [2, 3, 5]. Biologically active substances liberated in the pathochemical stage of allergic reactions–histamine [7, 11], acetylcholine [3, 4], catecholamines, [9, 10]–stimulate hypothalamic function and, with the participation of the pituitary, increase the secretion of corticosteroids by the adrenals [3, 4]. However, it has been observed that the direct action of an allergen on the tissue of the sensitized adrenals may disturb the secretion of catecholamines by the adrenal medulla [1].

The possibility of a direct influence of allergen on adrenal cortical function was investigated.

EXPERIMENTAL METHOD

Experiments were carried out on 31 male dogs weighing 17-23 kg. The adrenals were isolated from the circulation [8] and perfused in situ with a 2.4% solution of dextran containing electrodes as in Tyrode solution (pH 7.36). The perfusion solution, saturated with oxygen and warmed to 38°, was passed through both isolated adrenals under a pressure of 70-90 cm water. Perfusion fluid escaping from the adrenals was collected in portions every 3 min. The content of cortisol in each portion of perfusion fluid was determined by the Porter–Silber method, and the total corticosteroids by the reaction with tetrazolium blue; corticosterone was determined by the Weichilbaum principle [6]. Sixteen dogs were sensitized with normal horse serum (NHS), and 15 acted as controls. Sensitization was carried out by 3 injections of the allergen (NHS) on alternate days in doses of 1 ml/kg body weight, the first time subcutaneously, and the second and third times intravenously. The animals were used in the experiment 21 days after the last injection. A certain time after the beginning of perfusion, NHS was injected into the perfusion fluid in a dose of 0.15 ml/10 kg body weight.

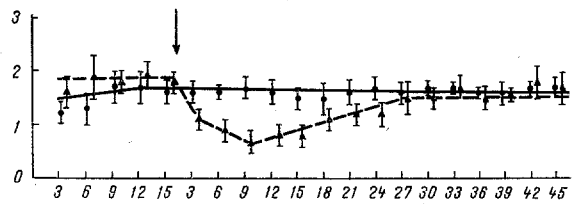

Fig. 1. Secreton of cortisol in control dogs and dogs sensitized with horse serum after administration of allergen (NHS). Abscissa: 3-min time intervals; ordinate: quantity of hormone in μg%/kg. Continuous line denotes control animals; broken line sensitized animals; arrow denotes time of injection of allergen.

EXPERIMENTAL RESULTS

In control dogs perfusion of the adrenals with NHS did not change the level of corticosteroid secretion. The secretion of cortisol by sensitized dogs was modified by the action of the allergen as follows: in 12 animals (75%) a significant decrease in cortisol secretion was observed (Fig. 1), and in 4 of them secretion stopped altogether. In three dogs no changes in cortisol secretion took place, while in one dog the cortisol secretion was increased. The decrease in secretion of cortisol by sensitized dogs after injection of the allergen was statistically significant ($P < 0.001$) starting immediately after contact for 3 min between the gland and the allergen, and continuing for 15-18

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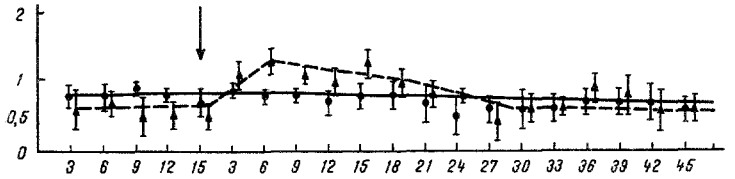

Fig. 2. Secretion of corticosterone by control dogs sensitized with horse serum after administration of the allergen (NHS). Legend as in Fig. 1.

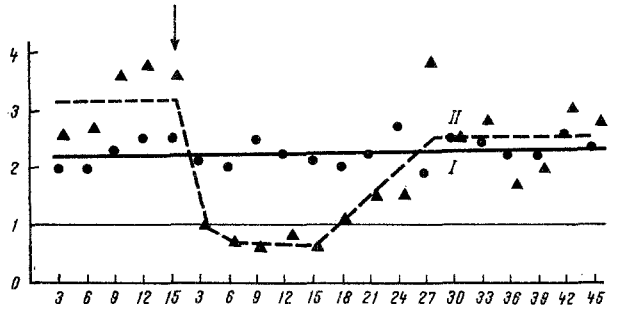

Fig. 3. Cortisol/corticosterone ration in control dogs and dogs sensitized with horse serum after administration of the allergen (NHS). Abscissa: 3-min time intervals; ordinate: cortisol/corticosterone ratio. Points denote results of individual determinations in control animals (mean indicated by straight line; triangles show results of individual determinations in sensitized animals (mean indicated by broken line). Arrow indicates time of injection of allergen.

min. The secretion of cortisol fell on the average by 59% from its initial level and by 50% compared with the secretion in the control animals. The cortisol level then returned to normal.

In most (75%) of the sensitized dogs the secretion of corticosterone increased significantly through the action of the allergen, reaching 209% compared with the original level and 128% compared with the corticosterone secretion by the adrenals of the control animals ($P < 0.05$). The increase in corticosterone secretion persisted for 15 min, after which its level returned to normal (Fig. 2).

The cortisol/corticosterone ratio in the sensitized dogs fell significantly after injection of the allergen, on account of a decrease in the secretion of cortisol and an increase in the secretion of corticosterone (Fig. 3). The quantity of corticosterone secreted by the sensitized dogs sometimes exceeded that of cortisol. The difference between control and experimental animals was statistically significant ($P < 0.05$).

Disturbance of function of the hypothalamo-hypophyseo-adrenal system in allergy may thus be brought about not only through the hypothalamus, but also by the direct action of allergens on the adrenal cortex.

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