

EFFECT OF HYDROCORTISONE ON ACID NUCLEASE ACTIVITY IN THE EYE TISSUES

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The effect of hydrocortisone on the activity of acid deoxyribonuclease (DNase) and acid ribonuclease (RNase) was investigated in the ciliary body and in the vitreous and aqueous humor of the rabbit eye. Hydrocortisone was shown to give rise to changes in activity of both DNase and RNase, and also to changes in permeability of the cell membranes to these enzymes, indicating a modification of nuclear metabolism in these tissues.

Hormones of the adrenal cortex and, in particular, hydrocortisone have an influence on the state of the eye [3]. In the modern view steroids act on the permeability of the cell membranes and thus modify enzymic processes [2, 4, 7, 9]. Although great importance has been attached to adreno-cortical hormones in ocular pathology in recent years, their influence on biochemical processes in the eye has received inadequate study.

The action of hydrocortisone on activity of the lysosomal enzymes – acid deoxyribonuclease (DNase) and ribonuclease (RNase) – in the ciliary body and the aqueous and vitreous humor of the eye was studied.

EXPERIMENTAL METHOD

Male chinchilla rabbits weighing 2–2.5 kg were used. Activity of acid DNase [6] and acid RNase [5] was determined in animals of the control group and in animals sacrificed 1 h or 4 h after administration of hydrocortisone. A single intraperitoneal injection of 10 mg/kg hydrocortisone was given. The total, free, and bound activity of the nucleases was determined. Free activity was estimated in a freshly prepared homogenate of the tissues, samples being incubated for 30 min. Total activity was investigated in the homogenates after complete disintegration of the subcellular structures by addition of the detergent Triton X-100 to the incubation medium in a final concentration of 0.1%. Bound activity was calculated as the difference between the total and free activities. The experimental results were subjected to statistical analysis in the usual way.

EXPERIMENTAL RESULTS AND DISCUSSION

Changes in the ratio between the free (functionally active) and bound (functionally latent) acid DNase activity were found in the ciliary body 1 h after injection of hydrocortisone (Fig. 1a). The free activity was reduced by 15.5% ($P < 0.05$) and the bound activity was increased by 53.3%; although there was no statistically significant change in the total activity. After 4 h the free activity was 64% of normal and the bound activity 216.5%, while the total activity of the enzyme was still unchanged. Since hydrocortisone acts in a similar manner on other typically lysosomal enzymes of the ciliary body (acid phosphatase, β -glucosidase, β -galactosidase) [1], presumably in this case the bond between acid DNase and the lysosomal membranes was strengthened. The action of hydrocortisone on the acid RNase activity in the ciliary body was expressed differently (Fig. 1b). All types of activity of this enzyme were significantly increased 1 h after injection of

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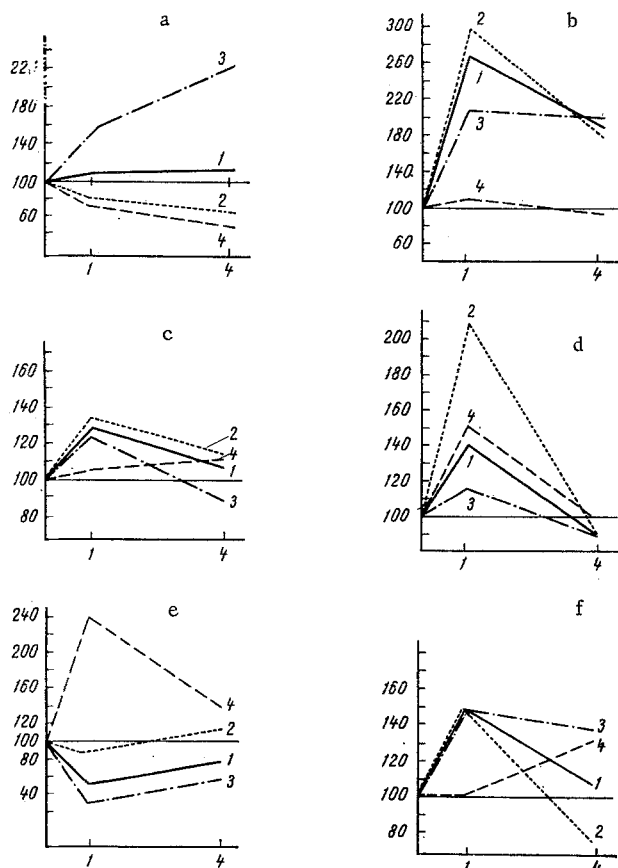


Fig. 1. Effect of hydrocortisone on activity of acid nucleases: a) DNase activity and b) RNase activity in the ciliary body; c) DNase activity and d) RNase activity in the vitreous body; e) DNase activity and f) RNase activity in the aqueous humor. Ordinate, percentage of normal; abscissa, time of investigation (in h). 1) Total intensity of enzyme activity, 2) free activity, 3) bound activity, 4) free activity as a percentage of the total.

the hormone, and there was no statistically significant change in their ratio; the free activity was 301.3% of normal, the bound activity 209.7%, and the total activity 265.1%. These indices were lowered 4 h after injection but they still remained higher than normal.

In the vitreous body all types of activity of acid DNase and RNase were increased 1 h after injection of hydrocortisone (Fig. 1c, d). The free DNase activity was 142.8% of normal and the bound activity 128.1% but there was no redistribution of activity between the free and bound forms; the free RNase activity was 209.9% of normal, the bound activity 113.7% ($P < 0.05$), and the total 139.5%, so that the ratio between the free and total activities showed an increase of 14.5% ($P < 0.05$). It thus follows that acid RNase reacts more sharply to injection of hydrocortisone than acid DNase in both these tissues. The writers have shown [1] that injection of hydrocortisone gives rise to an increase in total acid phosphatase activity and acid hyaluronidase activity in the vitreous body: this is evidence of stimulation of catabolism by hydrocortisone in this tissue.

Some stabilizing effect of hydrocortisone on the lysosomal enzymes was thus manifested in these experiments only by the study of acid DNase in the ciliary body. No such action of hydrocortisone could be found on the acid RNase of the ciliary body or the acid DNase and RNase of the vitreous body. These enzymes are perhaps localized not only in the lysosomes, but also in other cell structures. It was in this way that the presence of acid DNase was demonstrated in the liver nuclei [8].

The presence of acid nucleases in the aqueous humor revealed by these experiments can be explained by the migration of these enzymes from the ciliary body which secretes the aqueous humor, and also from other tissues bathed by the humor. The aqueous humor is responsible for the nutrition of the avascular tissues of the eye and for the removal of metabolic products from them. This may explain the need for the presence of hydrolytic enzymes in this intraocular fluid.

Under the influence of hydrocortisone considerable changes took place in the activities of acid DNase and RNase in the aqueous humor (Fig. 1e, f). The total DNase activity was reduced (by 65.4%) 1 h after injection of hydrocortisone at the expense of the bound form, whereas the free DNase was unchanged. Just as in the ciliary body, 1 h after injection of hydrocortisone the concentration of all fractions of acid RNase in the aqueous humor was increased (by about 50%), with no change in their relative proportions. Activity of RNase and DNase was restored to normal 4 h after injection of the hormone.

Hydrocortisone thus has a marked effect on activity of the acid nucleases in the tissues of the eye as well as on the migration of these enzymes into the aqueous humor. Presumably the hydrocortisone in the tissues of the eye gives rise to changes in the permeability of the cell and intracellular membranes, thus leading to modification of the nuclear metabolism.

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