

# CHANGES IN THE PERMEABILITY OF THE HEMATO-OPHTHALMIC BARRIER IN ADRENALECTOMIZED ANIMALS

A. G. Reznikov

Department of Pathological Physiology of the Odessa Medical Institute

(Presented by Active Member of the AMN SSSR V. V. Parin)

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The hemato-ophthalmic barrier plays an important role in supporting the constancy of the internal medium of the eye, and in the regulation of the intraocular pressure. It is of special interest to study the role of neural and humoral influences on the permeability of the vessels and tissues of the eye.

Our purpose was to study the permeability of the hemato-ophthalmic barrier under conditions of acute adrenal insufficiency.

## EXPERIMENTAL METHOD

The investigations were carried out on 20 cats and 32 rats. The adrenals were removed under ether narcosis. In order to study the permeability, we used  $P^{32}$  as an indicator. The permeability of the hemato-ophthalmic barrier in the cats was determined 2 days after the adrenalectomy, and in the rats, on the 3rd-7th day after the operation, at the height of the clinical manifestations of adrenal insufficiency.  $Na_2HP^{32}O_4$  was injected intraperitoneally in a dosage of 15-30 microcuries per kg of weight. One hour after injection of the indicator, the cats were sacrificed by electrocution, and the rats were decapitated. For the investigation in the cats, we took the chamber fluid and all tissues of the eye (cornea, iris and ciliary body, retina, crystalline lens, vitreous body, vascular capsule, sclera). In the rats, we investigated the activity of the chamber fluid and the entire eyeball after puncture of the anterior chamber. A suspension of the tissues and media was applied to a target, the activity of which was measured on the B-2 radiometer. The results of the measurements were expressed in the form of relative activity, which is presented as the percent relation of the activity of the investigated tissue to the activity of the same amount of serum. The results of the experiments were compared with the normal indices of permeability which were established on control groups of animals. In the comparison of experimental and control results, the significance of the differences was determined with the aid of the index  $t$  and the distribution table of Student.

## EXPERIMENTAL RESULTS

The investigations showed that acute adrenal insufficiency in cats and rats is accompanied by a significant elevation in the permeability of the hemato-ophthalmic barrier to  $P^{32}$ . Under these conditions, penetration of  $P^{32}$  into the chamber fluid of the cats increased by an average of 3.8 times, as compared with the control ( $P < 0.05$ ). The same pattern was also observed in the investigation on the activity of the sclera, cornea, iris, and the other tissues (Fig. 1).

It was noted that the increase in permeability occurred to a varying degree in the individual structural elements of the eye. In the chamber fluid, cornea, vascular capsule, and sclera, the concentration of  $P^{32}$  as compared with the serum increased relatively more than in the retina, iris, and ciliary body. There was an especially marked increase in the permeability of the crystalline lens (by 5 times) and the vitreous body (by 4 times), into which there is normally a negligible amount of penetration of the indicator. Figure 1 shows that the permeability to  $P^{32}$  changes least in the retina.

According to their sorption properties, the individual structures of the eye differ markedly from one another. In the normal animals, they can be arranged in an order of descending sorption properties in the following manner: iris and ciliary body, sclera, vascular capsule, retina, chamber fluid, cornea, vitreous body, crystalline lens. After removal

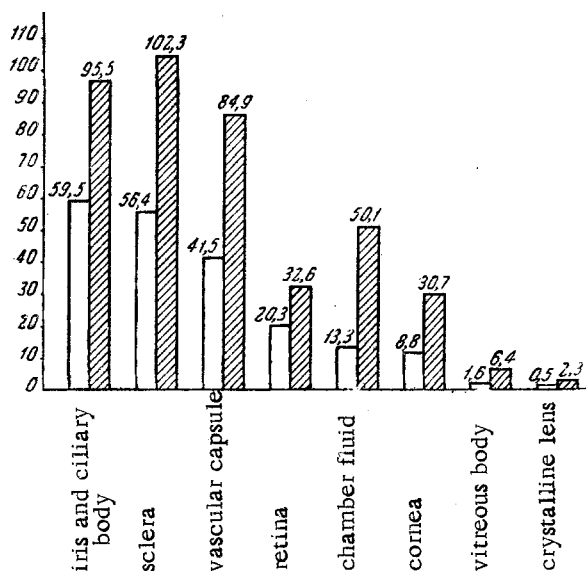


Fig. 1.

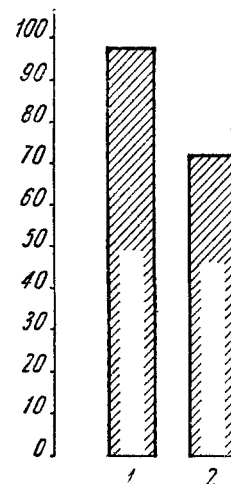


Fig. 2.

Fig. 1. Permeability of the vessels and tissues of the eye to  $P^{32}$  in cats, under normal conditions (light columns) and 48 h after bilateral adrenalectomy (crosshatched columns). The indices are given in percents of the activity of the serum, which is taken to be 100.

Fig. 2. The concentration of  $P^{32}$  in the chamber fluid (1) and the eyeball (2) of rats, one hour after intraperitoneal injection of the isotope, under normal conditions (clear portion) and after adrenalectomy (crosshatched area). Indices are the same as in Fig. 1.

of the adrenals, there is a manifest tendency toward obliteration of the differences in the sorption properties of the different tissues and media of the eye.

Analogous results were obtained in the experiments on the rats. In the adrenalectomized rats, the permeability of the chamber fluid to  $P^{32}$  increased by 2 times ( $P < 0.001$ ), and the relative activity of the eye as a whole, by 1.5 times (Fig. 2).

The described increase in permeability may be connected with atonia of the capillaries. The possibility is not excluded that this is made possible by a change in the aggregate state of the ground substance, caused by removal of the inhibitory properties of the steroid hormones in relation to hyaluronidase.

On the basis of the obtained facts, it may be concluded that the hormones of the adrenal glands participate in regulating the permeability of the vessels and tissues of the eye.

#### SUMMARY

In experiments on cats and rats, a study was made of the effect produced by adrenalectomy on the penetration and distribution and radiophosphorus in the eye tissues. It was found that acute adrenal insufficiency is accompanied by a considerable rise in the permeability of the hemato-ophthalmic barrier to  $P^{32}$ . Under these conditions, there was a tendency toward obliteration of the normal differences in the sorptive properties of the different structural elements of the eye. The data presented indicate the participation of the adrenal gland hormones in regulating the permeability of the vessels and tissues of the eye.