

# EFFECT OF CRYOTHERAPY APPLIED TO THE CILIARY BODY ON PERMEABILITY OF THE BLOOD-EYE BARRIER

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The effect of cold applied to the ciliary body on permeability of the blood-eye barrier and of the refractory media of the eye was studied in experiments on 30 rabbits by the use of radioactive indicators. The results show that cryotherapy applied to the ciliary body causes a marked increase in permeability of the blood-eye barrier.

The mechanism of lowering of the intraocular pressure after application of cold to the ciliary body has been inadequately studied [2, 5, 6]. Bietti [5] attributes the lowering of intraocular pressure to a change in colloid-osmotic pressure in the tissues of the ciliary body under the influence of cold. According to Polak and de Roeth [6], after application of cold to the ciliary body the production of aqueous humor is reduced.

It was decided to study permeability of the blood-eye barrier and refractory media of the eye during application of cold to the ciliary body, because changes in permeability of the blood vessels of the eye play an important role in the regulation in intraocular pressure.

## EXPERIMENTAL METHOD

Experiments were carried out on 30 rabbits of the same breed and roughly equal in age and body weight. In the experimental groups cryotherapy of the ciliary body of the right eye was carried out with a stick of carbon dioxide snow ( $-79^{\circ}$ ) for 1 min at six points around the limbus. Radioactive isotope ( $P^{32}$ ) was injected intraperitoneally, as an aqueous solution of disodium hydrogen phosphate ( $Na_2HP^{32}O_4$ ) in a dose of 25-30  $\mu Ci/kg$  body weight, 4, 24, 48, and 72 h and 14 days after cryotherapy. The animals were sacrificed 1 h after injection of isotope, and both eyes were enucleated. Radioactive  $P^{32}$  was determined in the aqueous humor, the tissues of the eye, and the blood serum. The relative radioactivity of the specimens was measured with a type SI-3B counter, in a standard lead housing, on a PP-8 scaler. The error of the arithmetical mean was determined, and the significance of the differences calculated by means of Moldenhauer's formula [3].

## EXPERIMENTAL RESULTS

In the control groups, 1 h after intraperitoneal injection of the radioactive isotope ( $P^{32}$ ) its content was highest in the blood of the animals, not quite so high in the ciliary body, the fluid in the anterior chamber, and cornea, and lowest in the lens and vitreous body (Table 1). No differences could be found between the distribution of  $P^{32}$  in the right and left eyes.

An increase in permeability of the blood-eye barrier was observed 4 h after application of cold to the ciliary body. The absorptive properties of the cornea, lens, and vitreous body were increased at the same time.

A sharp increase in permeability of the blood-eye barrier was observed 48 h after cryotherapy of the ciliary body. Absorption by the cornea and lens was considerably increased. The permeability of the vitreous

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TABLE 1. Changes in Radioactivity of Eye Tissues after Application of Cold to the Ciliary Body (M±m)

Tissues investigated	Before cryotherapy (control)	After cryotherapy									
		4 h	P	24 h	P	48 h	P	72 h	P	14 days	P
Blood	1328±37,5	1716±54,6	<0,05	1669±55,9	0,05	1581±51,2	<0,05	1836±45,6	<0,05	1465±30,3	<0,05
Ciliary body	532±36,4	888±48,1	<0,05	1191±54,6	<0,01	1562±35,9	<0,01	1656±56,5	<0,01	840±22,0	<0,01
Aqueous humor	243±15,4	558±28,6	<0,01	776±32,5	<0,01	1004±25,8	<0,01	954±21,7	<0,01	528±18,5	<0,01
Cornea	84±3,1	309±19,0	<0,01	438±17,5	<0,01	605±29,3	<0,01	613±26,8	<0,01	302±12,5	<0,01
Vitreous body	40±2,3	118±5,3	<0,01	216±11,8	<0,01	389±11,4	<0,01	273±16,5	<0,01	95±3,1	<0,01
Lens	32±3,4	87±4,0	<0,01	118±6,3	<0,01	123±8,3	<0,01	73±7,2	<0,01	55±3,4	<0,01

body also was sharply increased, and in the control groups it contained only a small quantity of radioactive  $P^{32}$ .

Later the permeability of the blood-eye barrier and the absorptive power of the eye membranes began to decrease gradually. For instance, 72 h after application of cold to the ciliary body the permeability of all investigated tissues showed only a tendency to fall. This tendency was stronger 14 days after cryotherapy, although compared with the control group the permeability of the blood-eye barrier and the absorptive power of the eye membranes were still significantly higher.

After cryotherapy of the ciliary body some increase in permeability of the blood-eye barrier and in the absorptive properties of the cornea and lens of the opposite eye also was observed.

Pathomorphological investigations [1, 4] showed that after application of cold to the ciliary body, changes are observed in the endothelium of the blood vessels, together with cell degeneration and marked hyperemia of the blood vessels. Later, these changes are supplemented by exudation of serous fluid and of cells. These inflammatory and degenerative changes in the tissues of the eye are presumably associated with the increased radioactivity of the blood after cryotherapy of the ciliary body.

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