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Guest Editorial

Some Aspects of the Hydrodynamics of the Eye

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The problem of glaucoma remains unresolved until now for the whole world, despite the significant achievements of modern ophthalmology. However, in fairness, it should be noted that these achievements were not aimed at studying glaucoma, but mainly concerned the surgical treatment of cataracts, refractive disorders and other eye diseases that are not comparable in their social significance with glaucoma. It is glaucoma that is the second cause of blindness and the fourth cause of poor vision in the world. So, in the world among people over 50 years of age, glaucoma caused blindness in 3.6 million and the cause of vision loss in 4.1 million cases. According to the forecast, by 2040 about 111.8 million people in the world may suffer from glaucoma, but already 10 years ago it became known that more than 108 million people have glaucoma. Thus, it is necessary to realize that the problem of glaucoma should become the most urgent for ophthalmology worldwide for the next decade.

Interest in the problem of glaucoma can be actualized by new studies of the physiology of the organ of vision and, in particular, the study of the hydrodynamics of the eye in normal and glaucoma. For the 20th century, it was characteristic to consider the pathogenesis of glaucoma and its primary open-angle form, as the most common in Caucasoids, inseparably from changes in the ease of outflow of intraocular fluid through the structures of the angle of the anterior chamber, then into the Schlemmov canal and epi- and intrascleral veins. The dominant role in the pathogenesis of primary open-angle glaucoma was assigned to a violation of the outflow of intraocular fluid due to sclerosis of the corneoscleral trabecula, which led to an increase in intraocular pressure. Thus, the primary open-angle glaucoma "began" and "ended" with changes in the corner of the anterior chamber, the elimination of which was aimed at surgical treatment in the form of penetrating operations with a fistula.

We believe that in the outflow of intraocular fluid along the anterior pathway, the Schlemmov canal plays a very important role. Until now, it is assigned a passive role - it seems to be a simple reservoir for the accumulation of intraocular fluid passed through the corneoscleral trabecula. However, the data currently obtained allow us to consider this process from a slightly different angle. The Schlemmov canal has the form of a thick venous plexus, located in the depth of the corner of the anterior chamber, in the limb area. It can be assumed that the Schlemmov canal is nothing more than a part and continuation of the choroid of the eyeball. Proceeding from this, having ceased to be just a reservoir, the Schlemmov canal must function according to the "laws" of the choroid with the inherent vascular tissue system of autoregulation of its own vital activity.

At the turn of the 70s of the last century, an alternative path of outflow of intraocular fluid was discovered, called uveoscleral. However, the proportion of this outflow pathway in the total volume of outflow of intraocular fluid from the eyeball is still unknown. The uveoscleral outflow pathway involves the flow of intraocular fluid along the corneoscleral trabecula (paratrabecular), then along the fibers of the ciliary muscle with a terminal point in the suprachoroidal space. Isolated attempts were made to calculate the volume of intraocular

fluid flowing down the uveoscleral pathway. According to available data, the volume varies from 4 - 27% to 10 - 20%. On the main path of outflow, therefore, the authors allocate from 80 to 96%.

We believe that the uveoscleral path of outflow of intraocular fluid is more complex than is commonly thought. As part of the choroid of the eye, the iris is involved in this outflow pathway from its very beginning, from the moment when the intraocular fluid from the posterior chamber enters through the pupil into the anterior chamber of the eye. Through the perivascular spaces of the iris, the intraocular fluid goes into the spaces between the fibers of the ciliary muscle, since the iris and the ciliary body are an extension of each other, the iris passes into the ciliary body without clear boundaries, continuing in it, both structures are parts of a single whole - the choroid of the eyeball. In addition to the above, the iris, as a vascular tissue, "sucks" the intraocular fluid.

Thus, the anterior, "classical" or "traditional" path of outflow of intra-ocular fluid from the eyeball can be represented as a path from the posterior chamber to the anterior, then through the angle of the anterior chamber and the corneosclerosis trabecula into the Schlemmov canal, which is the venous plex-us and part of the choroid of the eye, then into the intra- and episcleral veins and the general venous outflow from the eyeball. Based on this, the anterior outflow path of intraocular fluid smoothly "flows" into the middle, uveoscleral outflow path.

The middle (uveoscleral) outflow path begins with the perivascular spaces of the iris and its stroma, then goes paratrabecularly, along the corneoscleral trabecula, into the spaces between the fibers of the muscles of the ciliary body, then into the suprachoroidal space, partly through the sclera into the orbital cavity, partly smoothly "flows" into another path of outflow of intraocular fluid. We plan to write about the latter later.

The small number of studies and the lack of confirmed data over the past 50 years are a reflection of the difficulty of "separating" the anterior and uveo-scleral outflow pathways of intraocular fluid. From our point of view, this is an insoluble problem for one simple reason - in the eyeball there are no separate anterior and uveoscleral pathways for the outflow of intraocular fluid. They are inseparable, since nowhere does one or another path of outflow begin and nowhere ends, they smoothly "flow" one into another, and are a single outflow path in the anterior part of the eyeball. In contrast, there is another way of outflow from the eyeball, but this will be the subject of the next message.

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