

MORPHOLOGICAL STUDY OF RABBIT EYES AFTER CARRYING OUT SCLERO-STRENGTHENING OPERATIONS FOR SCLEROMALACIA EYES

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Abstract. *In this article, the results of a study of the morphological status of scleromalacia in the sclera of the eyeball of rabbits with developing myopia represented a comparative assessment of the morphological characteristics of connective tissue, that is, the reaction of the sclera, the latter after the introduction of an experimental xenograft.*

Keywords: *myopia, experiment, xenograft, LLC.*

Scleromalacia is a rare bilateral disease that occurs predominantly in older women with a history of severe, progressive, long-standing rheumatoid arthritis with extra-articular manifestations. Recent data indicate progressive disturbances in the structure of the elastic fibers of the sclera, mainly in adolescence, as well as during the development of the myopic process.

V.V. Serov and co-authors showed that the collagen of the sclera's own substance belongs to types I, VI, VIII with a predominance of type I collagen. Type III collagen is present mainly in the episclera. An interesting fact is that the distribution of collagen in the thickness of the sclera of myopic eyes, especially in progressive stages, has features that cannot be ignored in the development of surgical techniques. For example, researchers Andreeva L.D. and co-authors recorded facts of accumulation of type III collagen in the sclera, which is normally not characteristic of its structure. The specificity of immunomorphological changes in the connective tissue of the sclera is also expressed in the fact that intense focal accumulation of type III collagen, as well as fibronectin and glycosaminoglycans, occurs in its middle and deep layers. According to Keeley F. et al., the difference between the anterior and posterior parts of the eyeball the typical composition of collagen in the sclera is absent.

The literature contains various information regarding the parameters of the thickness of the sclera in its different parts. In the optic nerve, according to various authors, its thickness ranges from 0.8 to 1,2 mm, and its thinnest part is recorded in the area of attachment of the external muscles of the eye - 0.3-0.5 mm. Thus, Richarrd E. Normann and co-authors (2009 y.) We studied 11 human cadaver eyes, 4 of which were obtained from deceased persons who suffered from glaucoma during life. The average thickness of the entire sclera according to their observations was 670.8 μm (with a range from 564 μm to 832 μm), and the thickness in the region of the limbus and posterior pole was, on average, 588.6 μm and 996.18 μm , respectively. According to Olsen T. et al., the thickness of the sclera on average in the limbus region is about $0.53 \pm 0,14$ mm, in the equator region – $0.39 \pm 0,17$ mm, and in the region of the posterior pole of the eye near the optic nerve – from 0.9 to 1,0 mm.

Shevchenko M.V. and co-authors in 2009 also conducted studies of pieces of sclera taken intravitally from patients who underwent posterior trepanation of the sclera during antiglaucoma surgery, 10- 13 mm from the limbus. The thickness of the sclera in this zone ranged from 1.2 to 2,2 mm. Egorova E.V. and co-authors in 2015 published the results of acoustic measurements of the

sclera in the region of the limbus and in 4 mm the scleral spur, carried out in patients suffering from high myopia. It turned out that in the equatorial zone the thickness of the sclera ranged from 0.21 to 0,23 mm, and in the limbus region - from 0.42 to 0,63 mm. Research by V.V. Strakhov. and co-authors confirmed a decrease in scleral thickness with the progression of the myopic process. The thickness of the sclera in the area of the ora serrata in normal eyes averaged 1,32 mm. 1,14 mm The final results directly depend on measurement methods, methods of sampling and processing of material, as well as on concomitant pathologies of the organ of vision and intravital refraction.

The sclera is directly involved in the outflow of aqueous humor through both the main and additional pathways. Thus, the main element of the drainage zone of the eye - Schlemm's canal - is located in the thickness of the sclera, in the posterolateral part of the internal scleral groove. It is connected to the intra- and episcleral veins through collector tubules, the number of which varies from 37 to 49, and the diameter from 20 to 45 μm . Collecting tubules, or graduates, vary in size and direction. These conductors of aqueous humor can flow into the vessels of the intra- and episcleral venous plexus, into the vessels of the venous network of the ciliary body, or, moving away from the sinus in a parallel direction, flow back into it. By connecting with each other, the collector tubules of the first type form water veins. They contain aqueous humor, pure or mixed with blood.

The sclera is also involved in the outflow of aqueous humor through an additional pathway. The first experiments proving the permeability of the sclera to intraocular fluid were carried out by scientists in the 60-70s of the last century.

The well-known term uveoscleral outflow arose after describing the movement of radioactive particles from the anterior chamber of the eyeball through the ciliary muscle into the suprachoroidal space, and then through emissaries into the sclera. Researchers injected various substances, such as koalin, ferritin and Indian ink, labeled proteins into the anterior chamber, which then, as a result of radiological, histological and autoradiographic methods, were found not only in the drainage system of the eye, but also in the ciliary muscle, suprachoroidal space, sclera, epibulbar tissues and in the anterior parts of the vitreous body.

Purpose: to conduct a comparative morphological assessment of the reaction of rabbit eye tissues after experimental use xenografts.

Material and methods. The tissue reaction after experimental scleroplasty was studied on histological sections of the eyes of 8 rabbits (16 eyes). The animals were divided into 2 groups. In group 1, sclera-strengthening operations were performed using xenografts pre-treated at length waves 370 nm and a power of 5 mW/cm² for 20 minutes on one side and after a 30-minute exposure to a 0.5% aqueous solution of riboflavin (right eyes of 4 rabbits). The remaining animals (group 2) were operated on the same technique using xenografts. The left eyes of the rabbits were left intact and taken as control.

The enucleated eyes of the animals were subjected to macroscopic and histological examination after 2 weeks (2 rabbits from each group) and 1 month after surgery.

Results. Morphological study of enucleated eyes after 2 weeks after surgery revealed a mild aseptic inflammatory reaction in form scanty rim of lymphocyte cells in thicker than the sclera.

For histological research conducted through 1 month, signs were found formation connective tissue capsule. Severe aseptic inflammation was visualized in sections of the sclera of enucleated rabbit eyes using a xenograft 2 weeks after surgery at the border with the graft. With

massive lymphomacrophage infiltration and the presence of a large number of fibroblasts, after 1 month - the appearance of only individual sections of granulation tissue.

Comparative characteristics of the studied morphometric parameters between groups

Group	Number of eyes	Age, years	Morphometric parameters of the anterior segment of the eye				
			biometrics			Scheimpflug camera (Pentacam)	
			PZO, mm	TX, mm	PC depth, mm	PC depth at the periphery, mm	PC volume, mm ³
1st (patients with Hm up to 40 years old)	54	35 [30; 38]*	21.71 [20.99; 21.92]	4.15 [4.0; 4.32]*	2.68 [2.55; 3.15]*	1.00 [0.92; 1.24]	131 [98; 155]
2nd (patients with Hm 41-50 years old)	54	47 [44; 48]	21.73 [21.44; 22.14]	4.32 [4.09; 4.52]	2.56 [2.34; 2.69]	0.99 [0.86; 1.19]	131 [101; 143]
Comparison group (patients with PACG)	52	47 [45; 49]	21.79 [21.51; 22.22]	4.71 [4.55; 4.91]*	2.43 [2.35; 2.59]	0.37 [0.24; 0.74]*	98 [71; 110]*

Note. *—significant differences with group 2 ($p < 0.05$).

Conclusions. Histological examination of enucleated eyes 2 weeks after experimental scleroplasty revealed a less pronounced tissue reaction to the introduction of a xenograft. 1 month after surgery performed using xenografts were discovered histological signs of the formation of a connective tissue framework against the background of mild inflammatory reactions of eye tissues.

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