PERIPHERAL PREVENTIVE LASER COAGULATION OF THE RETINA IN PATIENTS WITH HIGH DEGREE MYOPIA

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Abstract

High degree myopia is accompanied by peripheral retinal degeneration, which is often accompanied by the appearance of microtears in thinning areas with the risk of retinal detachment and is difficult to treat, which can subsequently result in irreversible loss of vision. 34 patients (40 eyes) with stable myopia from 16.0 to 24.0 diopters (D) were examined. The study of the fundus of the was carried out under conditions of maximum mydriasis by reverse and direct ophthalmoscopy. The ophthalmoscopic picture of the fundus was extremely diverse. There were some changes in the central and paracentral areas of the fundus in the form of a myopic cone, scleral or pigment sickle, atrophy of the choriocapillary layer of the choroid, and chorioretinal foci. If necessary, for a more detailed study of the identified changes in the periphery, the fundus was additionally examined with a special therapeutic Goldman triangular lens after complete drug-induced cycloplegia and mydriasis, which made it possible to see the most extreme areas of the retina, to identify the presence or absence of peripheral vitreochorioretinal dystrophies (PVCRD), which are often found in high degree myopia. In order to prevent retinal detachment, a two-stage peripheral prophylactic laser coagulation (PPLC) of the retina of retinoschisis, cystic atrophy and retinal tears was performed in 16 patients in 18 myopic eyes: unilateral in 14 (14 eyes), bilateral in 2 - in 4 eyes. The remaining 22 eyes were not procoagulated due to contraindications. The procedures were performed on the diode laser Visulas-532s (green laser). The diameter of the coagulation spot was 200–300 μm, the exposure time was 0.15–0.2 sec.

The first stage is the delimitation of areas of the degeneratively changed retina by a barrier of coagulation foci, the second stage is the impact on the degeneration zone itself. The essence of the method of laser coagulation was to strengthen the weak tissues of the retina with a laser beam, with the help of which the so-called "gluing" of the weak points of the retina and its soldering with the underlying tissues is performed. Complications after prophylactic peripheral laser coagulation of the retina were not observed.

Keywords: *high degree myopia, peripheral vitreochorioretinal dystrophy, prophylactic retinal laser photocoagulation, retinal detachment.*

INTRODUCTION

Vitreochorioretinal dystrophy of the retina is a special form of the pathological process on the extreme periphery of the retina, which is diagnosed during a special examination of the fundus [3, 5, 9, 11, 15, 16, 19]. It is this pathology that can eventually lead to retinal detachment [12]. The insidiousness of PVCRD is that before the appearance of irreversible complications, it proceeds almost imperceptibly.

With the advent of excimer laser eye surgery at the end of the 20th century, visualization of the periphery of the fundus in conditions of mydriasis and cycloplegia has acquired considerable clinical significance [17]. PVCRD is especially often revealed in people with high degree myopia [1, 2, 7, 8]. Under the influence of weight lifting, head tilt, eye injury, visual stress, stress and depression, breaks occur in weak areas of the retina (on the periphery), which further leads to rhegmatogenous retinal detachment and visual disability [11,14,20].

In most patients, PVCRD is detected at a young working age, which requires early diagnosis, as well as timely prevention of retinal detachment. This pathology is currently a significant medical and social problem. The increase in the frequency of PVCRD at a young age is influenced by such factors as prolonged intensive work at the computer, environmental degradation, the presence of chronic ongoing diseases of the body, beriberi, and chronic anemia. Among all the possible causes of disability, blindness, which occurs against the background of retinal detachment, takes 6-7th place. As indicated by a number of authors, in 45–75% of patients with retinal detachment, refraction is short-sighted. Therefore, the number of retinal detachments among the myopic is 4-8% [1, 2, 18]. Laser surgery is a modern trend in the treatment and prevention of PVCRD in patients with myopia [10]. PPLC of the retina is one of the indispensable and affordable methods of treating retinal detachment; it is used to strengthen its peripheral zone [4, 6, 13]. At the same time, it can act as the main method of treatment in patients with retinoschisis and local retinal detachment complicated by a high degree of myopia. To date, there are no clear indications and contraindications for PPLC as an independent method of treatment for retinal breaks with local retinal detachment.

MATERIALS AND METHODS

We examined 34 patients (40 eyes) with high degree myopia, of whom peripheral laser coagulation of the retina was performed in 18 (45%) eyes to prevent retinal detachment. The remaining 22 eyes were not procoagulated due to contraindications. The age of the patients was 18-30 (22.42 ± 0.74) years. More than half of all patients were under 25 years of age.

Anamnestic questioning included the main questions of identifying the first signs of visual impairment, the presence of myopia among relatives (heredity). They asked at what age the

first glasses were worn, the power of the first glasses in diopters, the nature of vision correction, whether contact lenses were used, previous treatment, what the patient does, arrangement of affairs, the patient's personal life, tolerance and comfort of glasses or contact lenses, as well as incapacity for professional activity.

To assess the state of the functions of the organ of vision and the refractive apparatus, all patients underwent the following ophthalmological research methods: determining visual acuity using the Golovin-Sivtsev table (visometry), determining the clinical refraction of the eye using skiascopic rulers (skiascopy) and an autorefractometer Supore – RMK-200 (China), examination of the peripheral field of vision on a spheroperimeter manufactured by Carl Zeiss Jena (perimetry), measurement of intraocular pressure (IOP) using a Maklakov tonometer (tonometry) and pneumotonometer "Huvitz", examination of the fundus with direct and reverse ophthalmoscopy with maximum medical mydriasis, measurement of the anteroposterior axis (APA) of the eye using ultrasound in the A-B scanning mode, optical coherence tomography of the retina (OCT) of the eyes, which is, today, a modern method for diagnosing pathological processes in the periphery fundus with high degree myopia.

According to the clinical course, myopia was stable in all patients.

Visual acuity without correction did not exceed 0.01-0.09 (M=0.039±0.004), with full spectacle correction 0.04-0.4 (M=0.164±0.016).

Refractometry data showed that symmetrical myopic refraction (16.0-24.0 diopters) in both eyes was observed in 5 (14.8%) patients (10 eyes). Myopic anisometropia was observed in 29 (85.2%) patients (58 eyes). In 18 patients (32 eyes), myopic astigmatism was observed, the degree of which ranged from 1.0 to 6.0 diopters (D).

The size of the APA of 40 eyes was in the range of 26.6-31.7 mm (average 28.82±0.20).

The range of IOP values was 16-26 mm Hg (mean was 21.4±0.41).

Table 1. The relationship between the degree of myopia, ophthalmotonus and the length of the ACL, (n =40).

No.	IOP level, mm Hg.	Degree of myopia, diopters			APA of the eye, mm	Number of eyes
		16.0-18.5	19.0-22.0	24.0		
1.	Low (16-17)	-	3	-	28.2-28.3	3 (7.5%)
2.	Average (18-23)	10	15	2	31.7-26.9	27 (67.5%)
3.	Relatively high (24-26)	3	7	-	29.4-26.6	10 (25%)
Total		13 (32.5%)	25 (62.5%)	2 (5%)	28.82±0.20	40 (100%)

Table 1 shows that, with high degree myopia from 16.0 to 24.0 diopters, IOP is in the range of 18-23 mm Hg. However, in 3 cases (7.5%), despite the high degree of myopia refraction, the ophthalmotonus of the eyes remained low, equal to 16-17 mm Hg.

Thus, in stationary myopia of a high degree, IOP does not have a direct dependence on the

level of the degree of myopia refraction. With an increase in refraction, the anteroposterior axis of the eye lengthens (Table 1).

The presented materials make it possible to note that in patients with high degree myopia of more than 18.0 diopters, ophthalmotonus is within the above average values. In eyes with a relatively high IOP (24-26 mm Hg), the APA of the eye is shorter than in eyes with an average IOP (18-23 mm Hg), where the APA of the eye reaches high values. Therefore, IOP is not directly dependent on the APA of the eyes.

Studies of the boundaries of the peripheral visual field showed that in most eyes (34%) the boundaries of the visual field (in total) were narrowed to 495°-400° (Table 2). The narrowing or reduction of the boundaries of the field of view, in our opinion, is associated with the presence of dystrophic changes in the periphery of the fundus, that is, with organic changes in the retinal tissue due to elongation of the eyeball.

Table 2. The number of eyes according to the size of the total peripheral field of vision of patients (n = 40)

Visual field	Number of eyes	Statistical indicators	R
560°-500°	1	352.9 ±15.2	>0.05
495°-400°	14		
395°-300°	10		
295°-200°	12		
195°-165°	3		
Total	40		

The study of the fundus was carried out under conditions of maximum mydriasis by reverse and direct ophthalmoscopy (in the absence of mydriasis, the visibility of the fundus worsens). The ophthalmoscopic picture of the fundus was extremely diverse. There were some changes in the central and paracentral areas of the fundus, which are typical for high degree myopia in the form of a myopic cone, scleral or pigment crescent, atrophy of the choriocapillary layer of the choroid, chorioretinal foci.

Myopic cone was observed in 15 patients (30 eyes). Of these, in 22 eyes of 11 patients, the cone had the shape of a narrow strip in the form of a sickle, located on the temporal side of the optic nerve head, and sharply limited from the adjacent part of the fundus. In 4 eyes of 4 patients, the cone had a circular shape.

The optic disc (OD) was reduced in size in 5 eyes of 5 patients. In 26 eyes of 18 patients, it had a monotonously pink color, in 19 eyes of 13 patients, the optic disc was pale on the temporal side.

Atrophy of the choriocapillary layer of the choroid was observed in 21 eyes of 19 patients. Of these, in 15 eyes of 10 patients, it was found in the parapapillary region, in 6 eyes of 9 patients, atrophic changes were revealed throughout the fundus. The latter took the form of "parquet". In the zone of atrophy of the choroid, retinal pigment was sprayed, as a result of which this zone of the fundus had a lighter background, in contrast to the surrounding areas.

Chorioretinal pigmented lesions were observed in 17 eyes of 14 patients.

For a more detailed study of the changes detected by direct and reverse ophthalmoscopy in the periphery, the fundus was additionally examined with a Goldman three-mirror lens to identify the presence or absence of peripheral vitreochororetinal dystrophies, which are often found in high degree myopia, since the extreme periphery of the retina is poorly visible with conventional ophthalmoscopy. And it is on this part of the fundus, starting 3 mm posterior to the equator, where the vorticose veins pass from the choroid to the sclera, further located anterior to the equator, and ending on the dentate line, that dystrophic (degenerative) processes often develop, which are complicated by ruptures and detachment of retina.

Lattice dystrophy was revealed in 12 patients in 13 (32.5%) eyes, retinoschisis in 9 patients in 11 eyes (27.5%). The location and size of retinoschisis was different. Of these, circular peripheral retinoschisis was diagnosed in the 1st (10%) eye. Local retinoschisis was revealed in 9 (90%) eyes. Both planar and bullous forms of retinoschisis have been observed. Hyperpigmentation in the form of multiple pigmented foci of various sizes and shapes was found in 7 (17.5%) eyes of 7 patients, of which in 4 eyes (57.1%) it occupied ¾ of the fundus. Cystic retinal dystrophy, resembling multiple eggs with sharply defined edges, was present in 3 (7.5%) eyes of 3 patients. Chorioretinal atrophy was found in the 1st (2.5%) eye of the 1st patient. A mixed form of retinal dystrophy (a state of lattice dystrophy with hyperpigmentation) was also noted in the 1st (2.5%) eye of the 1-st patient. Single perforated retinal breaks were noted in the lattice form of dystrophy in 4 (10%) eyes of 4 patients. The greatest localization of vitreochorioretinal dystrophies was noted in the upper outer quadrant of the fundus (Table 3). Thus, in both eyes, PVCRD was found in 6 patients, and in one pair eye, in 28 patients.

Table 3. Localization of retinal PVCRD (n =40)

Types of PVCRD	Localization (number of eyes)							
	Top-external quad.	Upper inner square	Lower-outer quadr.	Upper inner square	2 quadrants	3 quadrants	Circular	Total (in%)
Lattice Dystrophy	5	-	3	1	3	1	-	13 (32.5)
Hyperpigmentation	2	-	1	-	-	4	-	7 (17.5)
Retinal Breaks	2	2	-	-	-	-	-	4 (10)
Cystic Dystrophy	2	-	1	-	-	-	-	3 (7.5)
Retinoschisis	5	1	2	-	2	-	1	11 (27.5)
Chorioretinal Atrophy	-	-	-	-	1	-	-	1 (2.5)
Mixed Form	-	-	-	-	1	-	-	1 (2.5)
Total (In %)	16 (40)	3 (7.5)	7 (17.5)	1 (2.5)	7 (17.5)	5 (12.5)	1 (2.5)	40 (100)

An analysis of the clinical and functional parameters of the eyes in patients showed that high degree myopia is characterized by:

- dependence between the degree of myopia and the decrease in corrected visual acuity. The lowest visual acuity corresponds to the highest myopia. Spectacle correction and contact

vision correction are ineffective due to gross pathological changes in the fundus. The reason for the decrease in visual acuity in the absence of marked changes in the fundus can be either the presence of refractive and anisometropic amblyopia.

- atrophy of the choriocapillary layer of the choroid, the presence of a myopic cone, a decrease in the size of the optic nerve head, peripheral chorioretinal degeneration in the fundus;

- significant elongation of the APA eye

- narrowing of the peripheral field of vision.

So, in order to prevent retinal detachment, PPLK of retinoschisis, cystic atrophy and retinal tears was performed in 16 patients in 18 eyes: in 14 of them (14 eyes) - in one eye. The pathological process was localized in the equatorial region. With bilateral degeneration in 2 patients in 4 eyes, the changes, as a rule, were in symmetrical areas of the fundus, of the same type in nature and extent.

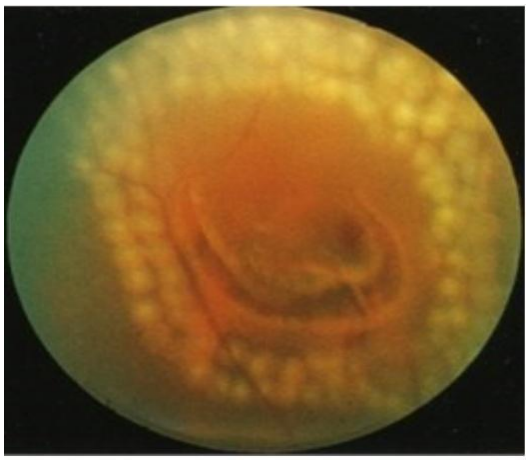
Operation technique. The PPLK procedure was performed under local epibulbar anesthesia under conditions of maximum drug-induced mydriasis, after three instillations of a 1.0% solution of tropicamide. A three-mirror lens was inserted into the eye a Goldmann goniolens that was previously filled with viscoelastic. It provides focusing of the laser beam directly on the affected area.

To fix the zones of dystrophy, we chose a more gentle coagulation tactic. The attachment of the retina occurs without blood loss, unnecessary incisions and without penetration into internal structures.

All procedures were performed by us on the diode laser Visulas-532s (green laser).

The diameter of the coagulation spot was 200–300 μm, the exposure time was 0.15–0.2 sec. The power was selected individually depending on the pigmentation of the fundus and the transparency of the optical media. In the presence of multiple "dangerous" zones of PVCRD, the treatment was carried out in two stages, in order to avoid the development of a reactive syndrome.

Fig. 1. The picture of fundus of the eye in the patient with high degree of myopia after barrier laser coagulation.



At the first stage, at the beginning, a barrier was created, consisting of 2-3 chains of laser photocoagulation foci, delimiting the zone of peripheral dystrophies from healthy areas of the fundus. In this case, an energy of 0.04-0.08 J was used. The second stage was laser coagulation along the zone of peripheral changes. For this purpose, the laser radiation energy was increased by 2-3 times and was equal to 0.12-0.25 J. (Fig. 1). As a result of coagulation, a kind of framework is formed that prevents detachment and fixes the retina in the area of the tear.

RESULTS AND DISCUSSION

The results were evaluated 2-3 weeks after the last session. It should be noted that in 3 patients with peripheral retinoschisis at the second

stage, laser coagulation was performed transsclerally, using a special nozzle on the lens of a laser coagulator. With this technique, the energy of the radiation used was equal to 1.5-2 J. As a result of the treatment, in all patients, the retinoschisis zone was delimited from healthy areas of the fundus. In 2 eyes, including in patients with transscleral laser coagulation marked complete subsidence of the retinoschisis cavity. Some flattening of retinoschisis was observed in 6 eyes.

In the absence of signs of progression of the dystrophic process, patients were discharged under the supervision of an ophthalmologist of the district polyclinic with recommendations for dynamic fundus examination and, if necessary, consultations with a laser surgeon.

After the PPLKS, patients complained of the presence of flashes before their eyes, which tired the patients and completely disappeared after 2-3 days. This is apparently due to photocoagulation of the retinal tissue.

After the procedure, the patient's visual acuity was re-examined. Contrary to our expectations, there were no positive dynamics. If during the initial examination visual acuity without correction was within 0.039±0.004 without correction, and with full spectacle correction 0.164±0.016, then after laser coagulation of the retina it remained unchanged. This, in our opinion, is associated with the location of dystrophic changes along the periphery of the retina.

Studies of the boundaries of the peripheral visual field showed that in most eyes (34%) the boundaries of the visual field (in total) expanded by 30-40 degrees, which is associated with an improvement in the blood supply to the retinal tissue due to its own choroid. However, the appearance of scotoma in the projection of the laser coagulation of the retina is observed.

The value of APA, refraction indices did not change significantly. All patients were under dispensary observation.

Complications and retinal detachment after preventive laser treatment were not observed in any patient.

A comprehensive objective analysis of our own clinical material of 18 procoagulated eyes made it possible to determine the indications for PPLC of the retina in high degree myopia: any high degree myopia of more than 16.0 diopters with gross dystrophic changes on the periphery of the retina in the form of PVCRD, namely the presence of retinal tears, areas of retinoschisis and cystic dystrophy.

CONCLUSION

Timely diagnosis of the periphery of the retina is the main way to detect its vitreochorioretinal dystrophies in patients with high degree myopia. Gradual prophylactic peripheral laser coagulation of the retina strengthens the thinning of its areas, normalizes its blood circulation and nutrition, and prevents the onset of serious complications. This method is an effective, least traumatic way to prevent the development of retinal detachment.

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