Results of Treatment of Terminal Neovascular Glaucoma Using the Micropulse Transscleral Cyclophotocoagulation Method

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Abstract. Refractory glaucoma is the most severe group of ocular diseases caused by increased ocular pressure. The group of patients with refractory glaucoma includes neovascular glaucoma, repeatedly unsuccessfully operated primary open-angle and closed-angle glaucoma, neglected and untreated primary glaucoma, uveal glaucoma, glaucoma in aphakic and pseudophakic eyes and congenital glaucoma. We studied the hypotensive effect of laser micropulse transscleral cyclophotocoagulation in terminal aching glaucoma. We analysed the results of treatment by micropulse transscleral cyclophotocoagulation in 32 patients with refractory aching glaucoma. Micropulse transscleral cyclophotocoagulation gives reliable hypotensive effect and elimination of chronic pain syndrome in patients with refractory painful glaucoma.

Key words: refractory glaucoma, micropulse transscleral cyclophotocoagulation

Introduction

It is often accompanied by chronic ongoing pain that cannot be controlled by conventional treatments. Another characteristic of this variant of the disease is that it is more common in elderly people who suffer from concomitant severe diseases, due to which traditional surgeries used in glaucoma are not available or these surgeries have exhausted their possibilities.

A wide range of ophthalmic surgeons are well aware of numerous complications arising when attempting to reduce intraocular pressure by using traditional antiglaucomatous operations of fistulising type: sinusotrabeculectomy with basal iridectomy, scleroanguloreconstruction, deep sclerectomy. When attempting to perform these operations on eyes with high ophthalmotonus, there are many intra- and postoperative complications. Hyphema appears already at the beginning of the operation, even if the iris is still intact. Further, if it is decided to continue the operation, the dome-shaped swollen iris falls out through the incision in the trabecular zone. Iridectomy leads to even more massive haemorrhagia, attempts to flush the hyphema may end up with expulsive haemorrhagia with unpredictable consequences, up to enucleation. But even if such development of events can be avoided due to good preparation of the patient, use of modern anaesthesiological aids, as a rule, in the postoperative period there is a high risk of cilio-choroidal detachment with small anterior chamber syndrome and gradual development of subatrophy of the eye. According to their observations the use of the method in patients with primary glaucoma with visual acuity exceeding 20 out of 40 gave good
compensation of intraocular pressure and stabilisation of visual functions. However, there is an opinion that in some cases the use of the MTCFC method may contribute to the deterioration of visual acuity with good compensation of intraocular pressure.

MTSCFC is a noninvasive, repeatable laser procedure, which implies both good and stable results of IOP reduction and reduces the frequency of antiglaucoma drugs use.

Analysis of the literature allows us to conclude that, in general, the effect of laser treatment on IOP control was relatively satisfactory, but the number of eyes of the examined patients was limited. Additional studies are needed to clarify the recommendations for treatment of refractory glaucoma by micropulse transscleral cyclophotocoagulation.

PURPOSE: To study the efficacy of micropulse transscleral cyclophotocoagulation (MTCPC) in patients with advanced stages of glaucoma accompanied by chronic eye pain.

Material and methods of research: Preoperative preparation and laser operation itself were carried out in the ophthalmological treatment and diagnostic centre of Prof. A.A.Yusupov, as well as at the Department of Ophthalmology of Samarkand State Medical University. Refractory painful glaucoma, where the pain syndrome was not controlled by traditional medication, was considered as an indication for the MTCFC procedure. Before the operation each patient signed his/her consent for the manipulation, where the purpose of the procedure was stipulated - only reduction of ophthalmic tone, but not visusity restoration. Also all peculiarities of the early postoperative period were explained to the patient, including possible cyclitis, short-term increase in pain, eye irritation, etc.

We have analysed the results of MTCFC treatment in 32 patients (32 eyes) with far advanced stages of painful glaucoma who came to us with complaints of constant pain in the eye. We analysed the distant results in terms of 12 to 50 weeks.

All patients underwent a thorough general clinical and ophthalmological examination before treatment. Visual acuity was determined by Snellen optotypes, the anterior eye was examined with a standard slit lamp, gonioscopy was performed with a three-mirror Goldman lens. The value of intraocular pressure was also determined with a slit lamp according to Goldman. The state of the anterior eye was additionally studied using ultrasound biomicroscopy (UBM).

The severity of the pain syndrome was estimated conditionally, based on the general condition of the patient, intensity of complaints, preservation of working capacity, presence or absence of sleep, intensity of accompanying headaches.

Thus, the severe degree of pain syndrome was estimated at (++++) and included constant aching pain in the eye, constant headache, insomnia, heaviness in the orbit and the corresponding half of the head, complete absence of any ability to work. It is noteworthy that traditional analgesic drugs, more often from the group of non-steroidal anti-inflammatory drugs (NSAIDs), helped insignificantly and for a short time, in combination with the maximum subjectively tolerated hypotensive regimen.

Moderately expressed pain syndrome (+++) included constant aching pain in the eye and heaviness in the orbit, occasionally aggravated by headaches, occasional insomnia, decreased interest in current events, depressive emotional background.

Mildly expressed pain syndrome (++) or (+) included periodically passing under the influence of NSAIDs and hypotensive drugs eye pain, heaviness in the orbit, episodic sleep disturbances. The patients could hardly perform their usual functions at work and at home. The main data on the dynamics of pain syndrome severity in the eye under the effect of MTCFC are shown in Table 1.
The possibility of lifetime registration of ciliary body parameters by ultrasound biomicroscopy (UBM) method attracted our attention. The main advantage of this technique is the possibility of quantitative assessment of the most important parameters of the anterior eye, such as the depth of the anterior chamber, the degree of ciliary body atrophy (its thickness) even in those eyes, ultrasound biomicroscopy (UBM) was performed on a Sonomed Escalon VuMax device (USA) using the standard immersion technique in the upper and lower meridians from 11 to 13 hours and from 17 to 19 hours. and from 17 and 19 hours (5 measurements in each sector) with the sensor placed parallel and perpendicular to the investigated structures of the iridociliary zone. The maximum measurement value was taken as a basis. The following linear parameters were studied: thickness of the ciliary body base (mm), which was measured along the perpendicular running 1500 µm from the scleral spur, from the inner surface of the ciliary body base to the outgrowth part, maximum length of the outgrowth part of the ciliary body (mm) was measured from the inner surface of the ciliary body base to the end part of the ciliary body.

Where possible, the ocular fundus was examined by direct and reverse ophthalmoscopy, but in the vast majority of cases this was prevented by severe corneal oedema and changes in the transparent media, including complicated cataract and destruction of the vitreous humour or partial haemophthalmos.

The state of optic disc excavation and peripapillary structures were examined on a computer retinotomograph (HRT, Heidelberg Engineering, Germany). It was technically possible only in 17 eyes, where the destruction of the anterior eye and disturbance in the transparent media did not prevent this diagnostic procedure. All patients underwent micropulse transscleral cyclophotocoagulation. The aim of the procedure was pain control.

The procedure was performed under local anaesthesia. A combination of epibulbar anaesthesia with 1% tetracaine solution and retrobulbar injection of 2% lidocaine solution was used. A diode laser with a wavelength of 810 nm in micropulse mode (Subcyclio method) was used. The laser parameters recommended by the manufacturer were used: power 2000 mW, duty cycle 31.3 %. Laser radiation was delivered by contact using a probe at a distance of 3 mm from the limbus.

The probe tip was placed perpendicular to the sclera surface. According to the manufacturer's instructions, it is necessary to draw an arc, without removing the probe from the eye, in the upper segment of the eyeball from 9:30 to 2:30 and in the lower segment of the eye from 3:30 to 8:30 for 80 seconds back and forth in each segment separately. The 3 and 9 o'clock meridian should be intact.

Our first procedures showed that this way of probe advancement often causes some discomfort due to the appearance of conjunctival folds, which make it difficult to move the probe tip without discontinuity. In connection with this circumstance it was decided to move the probe in the form of a pendulum in one small area, up to the borders of the appeared folds, for 10 seconds in each area. Then, switching off the laser, the probe was moved to the next section. After the probe was correctly positioned at the new site, the laser was switched on and irradiation was carried out in the same way. In this variant, the recommended one arc was divided into 4 sites on average. After the procedure was completed, 0.5 ml of dexamethasone solution was injected under the conjunctiva.

RESULTS: In 8 patients (25.0%) glaucoma developed on the background of retinal vein thrombosis, in 7 patients (21.9%) as a consequence of diabetic retinopathy and in 3 patients (9.4%) there was an operated primary terminal glaucoma. The remaining eyes had primary closed- and narrow-angle far-angle and terminal glaucoma (10 eyes or 31.3%), as well as aphakic or pseudophakic glaucoma due to vitreal block (4 eyes or 12.5%).

The preoperative intraocular pressure was 45 ± 13.5 mmHg. Visual acuity was absent in 15 patients, and in 17 patients it was below 0.08. The age of the patients was from 60 to 85 years. The general
condition of 10 patients was unsatisfactory, and in 3 patients it was severe. 2 patients were brought for examination and treatment on gurneys due to the severity of the general condition. 12 patients suffered from hypertension. Objectively, 12 patients had marked corneal oedema, all of them had ocular congestion.

The main purpose of the procedure was explained to all patients before the treatment, i.e. reduction of intraocular pressure and pain relief; no guaranteed improvement of visual functions was promised to the patients. Appropriate preoperative examinations (patients' consent to the procedure) were made out, certified by their signature, the signature of the doctor and the head of the treatment and diagnostic centre.

Almost all patients during the examination the next day mentioned the appearance of pain one hour after the procedure, which disappeared by morning, due to which they noted great satisfaction with the procedure. In one case, the patient noted an increase in pain that did not subside for 3 days. This patient underwent a 2nd session of the procedure, as a result of which the condition improved. During the follow-up period from 3 to 6 months the patients' condition was satisfactory, the frequency of hypotensive drugs injections decreased significantly.

The average value of intraocular pressure was 24.2 ± 4.6 mm Hg. Visual acuity in relatively sighted eyes slightly improved and averaged 0.1±0.03 (ρ≤0.05). In one patient in an eye with primary far angle closed-angle glaucoma, visual acuity increased from 0.1 preoperatively to 0.6 during the first month of follow-up.

At biomicroscopy already on the second day after the intervention in 28 eyes out of 32 (82.5 %) (87.5 %) there was a clinically significant reduction of corneal edema and the degree of congestive hyperaemia of the ocular vessels. The study by ultrasound biomicroscopy revealed statistically reliable deepening of the anterior chamber, on average by 0.91±0.07 mm (ρ≤0.01) and a steady tendency to deblocking of the filtration zone. It should be noted that atrophy of the ciliary body, expressed in its thinning, was determined both before and after the laser procedure and has a tendency to further thinning in remote terms.

In 8 eyes (25.0%) it was possible to examine the eye fundus as a result of the disappearance of corneal oedema. All eyes showed the expected widening and deepening of optic disc excavation, in 7 eyes (21.9%) - ophthalmological signs of proliferative phase of diabetic retinopathy with preretinal and epiteretinal neovascular membranes.

The following changes were noted in 17 eyes where it was possible to perform optical coherence tomography.

The area of neuro-retinal girdle (RA - rim area) and its volume dynamically decreased. Thus, RA, which was 1.38±0.32 square mm at the beginning of the observation, decreased to 1.29±0.18 square mm in later periods. The same dynamics was observed in the state of neuroretinal ring volume (RV) - from 0.37±0.12 at the beginning of observation to 0.21±0.17 cubic mm in later terms. This suggests, apparently, further progression of glaucoma neuropathy despite the achieved reduction in ophthalmotonus.

Iris rubeosis, which occurred in 10 eyes (31.3 %), naturally persisted after the intervention. Morphological signs of postoperative iridocyclitis were not revealed in any case. Opalescence of the anterior chamber moisture in 11 eyes (34.4 %) could be an indirect sign of iridocyclitis, but it is very difficult to provide such details because of the pronounced oedema of the cornea. Cyclic pain was not noted in any patient.
CONCLUSIONS. Preliminary results of the use of micropulse transscleral laser cyclophotocoagulation in the treatment of patients with far advanced and terminal stages of glaucoma, accompanied by pain, were successful in the sense of pain control in the nearest and distant periods of observation (12-50 weeks).

As a result of application of micropulse cyclophotocoagulation sub-cyclio, in addition to a noticeable decrease of ophthalmotonus (from initial 45.0±13.5 mm Hg to 23.3±1.9 mm (p≤0.05) in terms of up to 1 year), a reliable deepening of the anterior chamber from 1.10±10. 10 mm to 3.0±0.40 mm (p=0,05), decrease in the degree of congestive hyperaemia in the anterior chamber of the eye, but the main result is a decrease in the intensity of pain syndrome or complete disappearance of pain. So, if before the laser operation it was characterised at (++++) in all 32 patients, then at 5-10 weeks in 22 (68,7%) it was characterised as weakly expressed (+), and in 10 (31,3%) patients the pain was absent at all (-).

Thinning of the ciliary body progressing after laser treatment from initial 0,60±0,12 mm to 0,38±0,0,10 mm (p≤0,01) in terms up to 50 weeks allows us to assume that the determining factor of hypotensive effect is laser-induced progressive atrophy of the ciliary body, accompanied by a natural suppression of intraocular fluid secretion. The optical coherence tomography parameters, where it was technically possible, showed that the area of optic nerve excavation did not undergo statistically significant changes, from 1.15±0.54 sq.mm at the beginning of the observation to 1.38±0.41 sq.mm in terms of up to 50 weeks. The ratio of the area of excavation and disc, which was 0.41±0.20 at the beginning, changes up to 50 weeks to 0.51±0.17 (p≤0.05), which indicates slow progression of glaucoma neuropathy despite relatively compensated ophthalmotonus.

Severe complications in the postoperative period, both from the eye and general condition, were not observed in any case. Significant increase of visual acuity in sighted eyes after ophthalmotonus compensation makes us think about possible use of transscleral micro-pulse laser cyclophotocoagulation in earlier stages of glaucoma with relatively preserved visual functions. Perhaps, when using the method on sighted eyes with relatively low initial values of intraocular pressure, a more delicate effect with a comparatively lower energy mode is expected. However, this should be the subject of further detailed study.

The use of the micropulse transscleral laser photocoagulation method deserves further study and is encouraging.

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