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Research Article

Evaluation of the Effectiveness of Contact Transscleral Diode Laser Cyclocoagulation Drainage after Surgery Neovascular Glaucoma

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Abstract

Relevance: Lately becoming more common in the treatment of neovascular glaucoma drainage surgery get. Unfortunately, their effectiveness according to various authors does not exceed 70-80%. Before the attending physician during the postoperative period, again the question of the search of means for the normalization of high IOP.

Target: To evaluate the effectiveness of contact transscleral diode-laser cyclocoagulation drainage after surgery neovascular glaucoma, which did not lead to normalization of elevated intraocular pressure.

Material and Methods: The study included 8 patients observed in the ophthalmic branch of Endocrinology Research Center. All of them were previously carried out drainage operation concerning uncompensated secondary neovascular glaucoma on the background of diabetic retinopathy. In the postoperative period intraocular pressure to stabilize failed and was performed contact transscleral diode-laser cyclocoagulation according to the original methodology.

Results: All patients after execution of contact transscleral diode-laser cyclocoagulation intraocular pressure was compensated, any complications in the period up to six months were noted.

Conclusion: Contact transscleral diode-laser cyclocoagulation can be used to normalize a normal IOP after drainage surgery neovascular glaucoma in patients with diabetes mellitus.

Keywords: *Contact Transscleral Diode-Laser Cyclocoagulation; Neovascular Glaucoma; Diabetes Mellitus*

Introduction

Secondary neovascular glaucoma (NG) and tractional retinal detachment - severe forms of diabetic retinopathy (DR) [1]. Proliferative DR is characterized by occlusion of capillaries, there are several extensive areas of impaired blood supply of the retina [2]. The retina secrete vasoproliferative substances. They trigger the growth of new blood vessels - neovascularization. Neovascularization in the body normally performs a protective function, but in other cases it has a negative impact. Newly formed vessels are characterized by fast growing, have increased fragility and lead to intraocular hemorrhage [3-5]. Small hemorrhages into the retina and vitreous undergo spontaneous resorption. Massive (hemophthalmus) - is a cause of irreversible proliferation [6].

Heavy hemophthalmus is not the only cause of vision loss. In the development of blindness is significantly more important are the processes of scarring and fibrosis of the retina and vitreous [7,8]. They lead to the rupture of newly formed vessels and recurrent hemophthalmus. This further strengthens the process of scarring in the vitreous body. Eventually leads to traction retinal detachment.

Neovascularization of the anterior segment of the eye leads to rubeosis of the iris and the violation of the outflow of intraocular fluid due to block of the anterior chamber angle [9,10]. Move secondary glaucoma diabetic. According to our dates [11] the efficiency of drainage surgery in the treatment of neovascular glaucoma in patients with diabetes mellitus (DM) is in the range of 75 - 77%. Foreign authors say about 70 - 80% success rate [12,13]. Thus, almost every fourth patient [14] in the postoperative period after drainage surgery is required to solve the issue of how to compensate for elevated intraocular pressure (IOP).

In these cases, use combined eye drops, but the hypotensive effect is not always [15,16]. Conducting laser surgery on the iris and anterior chamber angle is difficult because of the pronounced rubeosis (neovascularization) of these structures [17]. Performing classical antiglaucoma interventions (such sinustrabeculoectamia) is inefficient because of the increased scarring of tissues and hypertrophy of the outflow pathways in the postoperative period because of the peculiarities of metabolism in patients with diabetes [18].

Many authors have shown that the use of contact transscleral diode-laser coagulation (CTDLC) is effective in the treatment of various forms of refractory glaucoma [19,20]. Cyclodestructive related to a number of complications both in the early (pain, time of postoperative rise of IOP, inflammatory reaction, gifema, hemophthalmus) and late (hypotension and atrophy of eyeball) postoperative period [21].

Purpose

The purpose was to evaluate the effectiveness of CTDLC after drainage surgery of uncompensated neovascular glaucoma in patients with diabetes mellitus, which did not lead to normalization of elevated intraocular pressure in the postoperative period.

Material and Methods

In patients with noncompensated IOP after previously performed drainage surgery about the NG and the DM in 2 - 4 weeks CTDLC carried out on a pulsed semiconductor diode laser «ALOD-01» company «ALKOM» (St. Petersburg, Russia). All patients signed informed consent for participation in the experiment (protocol №9 of 18/05/2016 of Ethics Committee of Endocrinology Research Center). The specified device operates in continuous mode with a wavelength of 810 nm, radiation power from 0.6 to 1.8 W, pulse duration 0.1-4.0 seconds and the standard diameter of the working tip - 2.5 mm.

A specific preoperative medical preparation have not been conducted. Patients were buried only the previously prescribed medications that reduce IOP. Intervention were performed under standard sterile operating room, with the processing operating margins of 10% solution of povidone-iodine and local treatment of the eyeball the same solution with 2% concentration. After this, in the conjunctival sac buried 2 - 3 times a local anesthetic (for example, «ALCAIN» company «ALCON»).

The exposure of a single laser exposure was 3.0 sec, power – 1200 mW, the energy impact of 3.6 Dj and the total number of applications from 16 to 24 (depending on the size of the eyeball, so that areas of applications do not overlap each other). Application was applied in the 1.5 - 2.0 mm from the limbus in the upper (10 to 14 hours on the clock face or from 300 to 60 degrees on a circle) and lower (4 to 8 o'clock on the watch dial or 120 to 240 degrees of a circle) quadrants. The projection area of the tubes from a previously installed drainage or valve (AHMED, MOLTENO etc.) are not affected and the application of the laser there not applied. Therefore, the number of laser applications at the top and bottom could be different quantitatively.

The procedure is ended by injection of 0.3 ml of corticosteroid («DEXAMETAZONE» company «KRKA») under the conjunctiva. Then drip was prescribed non-steroidal anti-inflammatory eye drops (for example, «NEVANAC» company «ALCON») consistently 3 - 4 times daily for 3 - 4 days or until removal of the inflammatory response. IOP control was carried out after 1, 3, 7 and 14 days after exposure and then as needed, but not less than 1 time in 2 - 3 months (under normal IOP).

If in the early postoperative period the IOP is above 25 mm Hg article, then the above procedure was repeated in the same manner and with the same impact parameters. This need has arisen in 2 of our patients (25%).

Diagnostic studies and treatment of all patients was performed at Department of ophthalmology of Endocrinology Research Center (Moscow, Russia). According to the above method were operated on 8 patients (8 eyes). Among them were 6 men (75%) and 2 women (25%). It was the patients with diabetes of the 2nd type has a history which has already been performed panretinal laser coagulation of the retina and the drainage surgery about uncompensated secondary neovascular glaucoma (table 1).

№№	Gender	Age (years)	Duration of diabetes (years)	HbA1c (%)	Date drainage surgery (months ago)
1.	Man	67	12	8.9	6
2.	Man	72	15	9.1	3
3.	Woman	71	14	8.7	12
4.	Man	78	11	10.2	36
5.	Man	72	12	9.7	6
6.	Woman	81	15	8.9	60
7.	Man	73	14	8.5	3
8.	Man	76	18	10.1	6

Table 1: *General data on the patients included in the study.*

The average age of the patients was 74.0 ± 5.6 years, diabetes duration – 12.1 ± 2.7 years, the level of HbA1c (glycated hemoglobin) was 9.3 ± 1.1% (severe decompensation of diabetes), and the average time elapsed from the previous drainage surgery 16.5 months.

Data on visual acuity are presented in table 2. The average uncorrected distance visual acuity (UDVA) was 0.075 (the range of values from 0.01 to 0.2), and corrected distance visual acuity (CDVA) – 0.17 (range 0.02 to 0.4).

Kinetic perimetry was performed on an automated perimeter «Humphry Field Analizer 750» (USA) on white. Estimated amount in degrees for the 8 major meridians. The average amount of patients of the same age, but no signs of glaucoma, normal is about 500 - 520 degrees.

№№	Patient	UDVA	CDVA	Field of view* (degrees)	IOP** (mm Hg)
1.	Patient 1	0.1	0.2	310	28.4
2.	Patient 2	0.05	0.05	300	31.4
3.	Patient 3	0.2	0.4	340	29.2
4.	Patient 4	0.1	0.3	300	30.6
5.	Patient 5	0.02	0.05	290	33.5
6.	Patient 6	0.02	0.02	270	35.2
7.	Patient 7	0.1	0.3	310	28.6
8.	Patient 8	0.01	0.05	290	34.6
	Average value	0.075	0.17	301.25	31.4

Table 2: *Ocular parameters of patients included in the study.*

*Notes: * - the sum of the degrees for 8 major meridians on white.*

*** - average IOP for 2 days stay in hospital before surgery.*

Tonometry was performed on the non-contact tonometer «CT-80» (company «Topcon» Japan). The average IOP before executing CT-DLC amounted to 31.4 ± 2.3 mm Hg. 6 out of 8 patients (75%) used a mix of eye drops, and 2 (25%) - were without any drug therapy.

Statistical analysis of results was performed using the programs mathematical statistics with «Microsoft Excel 2013». Quantitative data are presented as M ± σ, where M is the mean value, and σ - standard deviation. To calculate the reliability of differences used the nonparametric Mann-Whitney test. Differences between samples were considered significant at $p < 0.05$.

Results

Execution CTDLC did not affect the degree of compensation of carbohydrate metabolism. Throughout the observation period patients were on the same (previously selected) mode of insulin therapy. If before surgery, the average level of glycated hemoglobin was 9.3 ± 1.1%, after 3 months after surgery - 9.2 ± 1.2% and after 6 months - 9.1 ± 1.3%, These changes are statistically significant relative to baseline ($p > 0.05$).

Ophthalmological data on some indicators after conducting CTDLC presented in table 3. The results by UDVA, CDVA and field of view presented 1 month after the intervention, when the operated patients were completely disappeared konjuktivi injection and eyeball "calmed down".

№№	Patient	UDVA	CDVA	Field of view (degrees)
1.	Patient 1	0.1	0.15	300
2.	Patient 2	0.1	0.05	310
3.	Patient 3	0.2	0.4	350
4.	Patient 4	0.1	0.3	300
5.	Patient 5	0.05	0.05	300
6.	Patient 6	0.02	0.05	270
7.	Patient 7	0.1	0.3	300
8.	Patient 8	0.01	0.05	310
	Average value	0.085	0.17	305

Table 3: *Eye care indicators of patients after CTDLC.*

Analyzing these data in comparison with preoperative values, we can conclude that they improved slightly, but these changes were not statistically significant (table 4).

Patient	UDVA	CDVA	Field of view (degrees)	IOP (mm Hg)
Before intervention	0.075	0.17	101.25	31.4
After intervention	0.085	0.17	105	12.3
Correlation coefficient	$p > 0.05$	$p > 0,05$	$p > 0.05$	$p < 0.05$

Table 4: *Compare the average ophthalmic performance before and after CTDLC.*

Indicators of postoperative IOP was significantly different from preoperative values. If you do not take into account the data of patients №5 and №6 (they are a month after the intervention was re-operated), the change in IOP 1 day after the intervention decreased 2.5 times and amounted to 12.2 mm Hg (table 5).

№	Patient	Source IOP	After 1 day	After 7 day	After 14 day	After 1 month	After3 month
1.	Patient 1	28.4	12.5	14	12	13	13
2.	Patient 2	31.4	15.5	15	15.5	14	14
3.	Patient 3	29.2	10	11	11	10	10.5
4.	Patient 4	30.6	10	9	9.5	10	11
5.	Patient 5	33.5	18	22	26.5	27.5	-
6.	Patient 6	35.2	19	23	27	26.5	-
7.	Patient 7	28.6	11	10	10	11.5	11
8.	Patient 8	34.6	14	15	17	15.5	14.5
Average value *		31.4	12.2	12.3	12.5	12.3	12.3
Correlation**			p < 0.05	p < 0.05	p < 0.05	p < 0.05	p < 0.05

Table 5: *The dynamics of IOP in the postoperative period (in mm Hg).*

*Notes: * - the average value of IOP with the exception of patients №5 and №6.*

*** - the correlation with the average value of IOP before surgery.*

In the future, the IOP was kept at average figures 12.2 - 12.5 mm Hg that speaks about stability of production of the ciliary body reduced the volume of intraocular fluid.

Stand out the cases of patients №5 and №6, in which the IOP within one month after execution CTDLC offset was not required repeat the procedure. It was performed for the same parameters as the first intervention. Dynamic IOP are presented in table 6.

№	Patient	1 month after the first CTDLC	1 day after re-CTDLC	7 days after re-CTDLC	14 days after re-CTDLC	1 month after re-CTDLC	3 months after re-CTDLC
1.	Patient 5	27.5	21	16	12.5	10.5	11
2.	Patient 6	26.5	19	16.5	13	12	12
Average value *		27.0	20.0	16.25	12.75	11.75	11.5
Correlation**			p < 0.05	p < 0.05	p < 0.05	p < 0.05	p < 0.05

Table 6: *The dynamics of IOP in the postoperative period (in mm Hg).*

*Notes: * - the average value of IOP is only in these two patients.*

*** - correlation with a mean IOP after the first surgery.*

The procedure CTDLC some patients (6 eyes, 75%) was accompanied by an unpleasant subjective sensations as tingling, burning, and discomfort. In the early postoperative period during biomicroscopy was observed hyperemia of the conjunctiva of the eyeball, which took place within 2 - 4 weeks when using-steroidal anti-inflammatory drugs (for example, «NEVANAC» company «ALCON»).

Conclusion

All patients had a sustained IOP compensation at the level of 11 - 13 mmHg, which remained stable for at least 3 months after the procedure. The observation period for some patients, approaching a year and IOP they are stable without additional drug therapy.

Indicators such as UDVA, CDVA and field of vision as a result of CTDLC did not change significantly (a small extension of the field of view was statistically significant).

Thus, the contact transscleral diode laser cyclocoagulation can be seen as the tool of choice for normalization of elevated IOP in patients with diabetes after previously performed drainage surgery neovascular glaucoma.

Conflict of Interest

No conflict of interest.

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