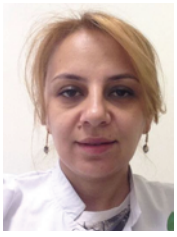
Comparative analysis of YAG laser vitreolysis and posterior vitrectomy in diabetic hemophthalmus



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SUMMARY

Purpose: To conduct a comparative analysis of YAG laser vitreolysis and posterior vitrectomy in diabetic hemophthalmus. **Materials and Methods.** The study included 86 patients (92 eyes), 51 women and 35 men, aged 43-72 with proliferative diabetic retinopathy (PDR) complicated by hemophthalmus. All the patients have been divided into 2 groups. Group I divided into 3 subgroups consisted of 61 patients (67 eyes) with YAG laser vitreolysis. Group II included 25 patients (25 eyes) with a retrospective analysis of the results of surgical vitrectomy for PDR complicated by hemophthalmus. Of them there were 10 men and 25 women with the average age of 59,4±9,2. All the patients were examined prior to the treatment and in the dynamics on the 10th day; 1, 3, 6, 9 and 12 months. Examination methods included: visometry, tonometry, biomicroscopy, ophthalmoscopy and ultrasound methods (B-scan and quantitative sonography performed to determine hemophthalmus density). **Results.** Visual acuity in I group before treatment in 1st subgroup was 0,169±0,05, in 2nd subgroup – 0,057±0,007, in 3rd subgroup – 0,012±0,003, in group II – 0,039±0,012 (Fig. 6). Visual acuity was significantly higher in 1st subgroup compared to the 2nd one ($p<0,005$), compared to the 3rd one ($p<0,001$) and to a comparison group ($p<0,005$). In 2nd subgroup it was significantly higher compared to the 3rd one ($p <0.001$), there was no significant difference with the group II ($p>0.05$). Compared with group II visual acuity in 3rd subgroup was significantly lower ($p<0,05$). Period of hemophthalmia in 1st subgroup was 1,71±0,62 months, in 2nd subgroup – 2,77±1,48, in 3rd subgroup – 2,64±1,32 months, in group II – 2,32±1,05 months. **Discussion and conclusions.** Vitreous surgery remains the treatment of choice, but complications after it can be observed in 15-46% cases, while recovery of visual functions is only in 45% cases. Vitrectomy being the gold standard and cardinal solution in the treatment of diabetic hemophthalmus has a number of complications and requires expectant tactics and satisfactory somatic status of the patients. Use of YAG laser vitreolysis at early stages, the possibility of repeated surgeries, a favorable safety profile and a narrow range of complications make it possible to recommend this method to treat patients with DR complicated by hemophthalmus. Vitrectomy is performed at later stages of hemophthalmus, however, YAG laser vitreolysis can be used at early stages as an alternative method to treat diabetic retinopathy complicated by recidivous hemophthalmus.

Disclosure of financial interest: None of the authors has financial interest in the submitted materials or methods.

There is no conflict of interest.

Keywords: YAG laser vitreolysis, hemophthalmus, diabetic retinopathy

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Implementation of vitreous surgery became a new stage in treatment of proliferative diabetic retinopathy (PDR) [1,2,3,4] thanks to Robert Machemer who became its founder in the early 70s of the last century [5,6].

Classic indications for vitrectomy in PDR included: hemophthalmus not absorbable within 6 months or more, massive fibrous proliferation in vitreous and traction retinal detachment involving macular area [7]. Removing opaque optical media (vitrectomy, as a rule, is combined with cataract extraction) creates conditions for intra- and postoperative retinal photocoagulation. Numerous studies expanded the indications for vitrectomy in this group of patients due to the surgeries at earlier stages.

Along with the advantages of vitrectomy in PDR the complications should be also noted: repeated hemophthalmus, iatrogenic retinal detachment, increased ophthalmotonus in the postoperative period, stimulation of anterior hyaloid fibrovascular proliferation leading to rubeosis.

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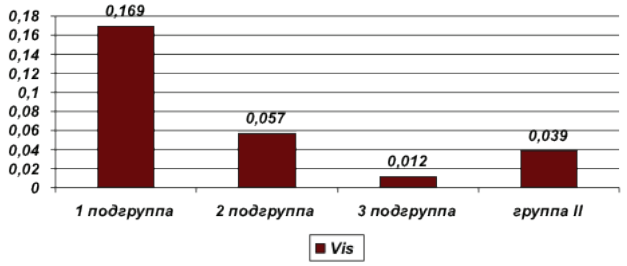

Fig. 1. Visual acuity prior to treatment

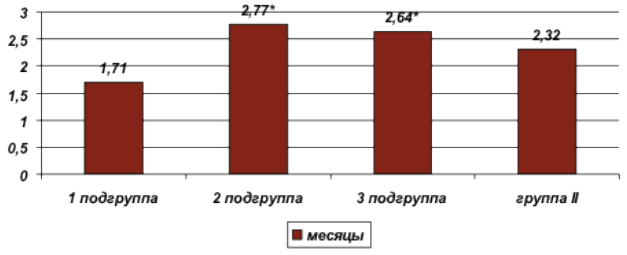

Fig. 2. Period of hemophthalmus in the groups (months)

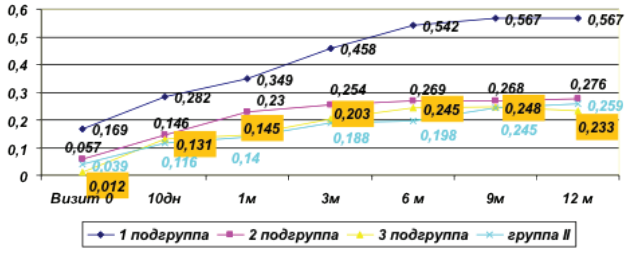

Fig. 3. Dynamics of visual acuity in groups I and II for 12 months

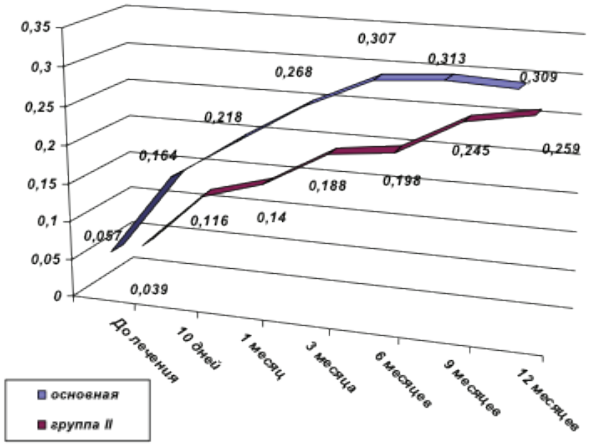

Fig. 4. Dynamics of the mean visual acuity in the main and control groups for 12 months

Surgical treatment of patients with advanced stage of PDR in most cases is not limited to surgery only.

The need for repeated surgeries is dictated by surgical technique or complications developing after vitreoretinal surgery in patients with PDR. All this often questions the ability to perform vitreoretinal surgeries in such category of patients because of their somatic status [8].

In this regard, the development of new methods to treat this pathology is extremely important.

Several reports on YAG laser hyaloidotomy refer to the 80s [9]. Fankhauser R. (1985) used YAG laser radiation to form an optical channel to reduce VB traction in retinal detachment.

Some authors believe that YAG laser surgery of VB cannot be an independent intervention, but merely a fragment of surgical vitrectomy, but at the same time they point out the efficacy of YAG laser exposure in 30-65% patients [10,11].

The purpose of the research was to conduct a comparative analysis of YAG laser vitreolysis and posterior vitrectomy in diabetic hemophthalmus.

PATIENTS AND METHODS

The study included 86 patients (92 eyes) aged 43-72 with PDR complicated by hemophthalmus (average age was 57,8±8,6). Of them, there were 51 women (59,3%) and 35 men (40,7%). The period of hemophthalmia varied from several days to 6/more months. All the patients have been divided into 2 groups.

Group I consisted of 61 patients (67 eyes) with YAG laser vitreolysis. After it the patients were examined on the 10th day; 1, 3, 6, 9 and 12 months.

The patients in group I, in turn, have been divided into 3 subgroups depending on hemophthalmus density. Classification by Ronni M.L., Gow J.A., Lisa R.G. was used [12] to define hemophthalmus by density. The patients with stage I hemophthalmus were excluded from our study, since the treatment plan for these patients did not involve YAG laser vitreolysis. Hemophthalmus stage II was characterized in our work as low-density hemophthalmus, stage III — medium density and stage IV — high density.

Based on the data of quantitative echography the patients of group I have been divided into the following subgroups:

The first subgroup consisted of 7 men (63.6%) and 4 women (36.4%) with a mean age of 57,3±4,1; 3 patients had type 1 diabetes (27.3%), 8 (72.7%) patients had type 2 diabetes.

The second subgroup consisted of 13 men (54.2%) and 11 women (45.8%) with a mean age of 57,5±9,1; 12 patients were diagnosed with type 1 diabetes and 12 with type 2 diabetes (by 50%).

The third subgroup consisted of 9 men (34.6%) and 17 women (65.4%) with a mean age of 56,9±9,1; 11 patients had type 1 diabetes (42.3%), 15 (57.7%) had type 2 diabetes.

Group II (comparison group) consisted of 25 patients (25 eyes) who had a retrospective analysis of the results of surgical vitrectomy for PDR complicated by hemophthalmus. Of them, 7 men (28.0%) and 18 women (72.0%) with a mean age of 59,4±9,2. 6 patients had type 1 diabetes

(24.0%), 19 (76.0%) had type 2 diabetes.

The following examination methods have been used: visometry, tonometry, biomicroscopy, ophthalmoscopy and ultrasound methods.

Ultrasonic studies included B-scan and quantitative echography. B-scan was performed on E-Z ScanAB5500 (Sonomed, USA) and «UltraScan Imaging System» by Alcon (USA) with 10 MHz sensor.

Quantitative echography was performed to define hemophthalmus density on ultrasound diagnostic system «Nemio XG SSA-580A» by «TOSHIBA» (Japan) with the linear sensor with frequency of 7.5 MHz.

RESULTS AND DISCUSSION

Visual acuity prior to treatment in 1 subgroup was 0,169±0,05; in 2 subgroup — 0,057±0,007, in 3 subgroup — 0,012±0,003, in group II — 0,039±0,012 (Fig. 1).

Visual acuity was significantly higher in 1st subgroup compared to the 2nd ($p<0.005$), compared to the 3rd one ($p<0.001$) and to group II ($p<0.005$). In 2nd subgroup it was significantly higher compared to the 3rd one ($p<0.001$), there was no significant difference with group II ($p>0.05$). Compared to group II visual acuity in 3rd subgroup was significantly lower ($p<0.05$).

Period of hemophthalmus in 1st subgroup was 1,71±0,62 months, in 2nd subgroup — 2,77±1,48, in 3rd subgroup — 2,64±1,32 months, in group II — 2,32±1,05 months (Fig.2).

As seen in Fig.2, the period of hemophthalmus was significantly longer in 2nd and 3rd subgroups compared to 1st subgroup. In general, in the main group the period of hemophthalmus was 2,37±1,29 months, in the comparison group — 2,32±1,05 months, and there was no significant differences between the groups for this indicator.

Fig.3-4 clearly show that the greatest visual acuity both initially and during the entire observation period was significantly higher in 1 subgroup of patients with low density hemophthalmus, which is quite logical.

Thus, comparing the main group and group II has revealed that in 1 subgroup and group II the initial visual acuity was significantly different, so the comparison with this very subgroup was not justified.

The initial visual acuity was comparable in 2, 3 subgroups and group II, but later on the curves converge and the difference becomes unreliable.

The curves of 2, 3 subgroups and comparison group are in close contact up to the 10th day, but during the 1st month there is some discrepancy between the curves: the comparison group showed less significantly improvement in visual acuity, unlike in 2 and 3 subgroups. Significant difference in visual acuity was received exactly while comparing the data of the subgroups with group II at 1 and 3 months follow-up period. Later on the curves gradually converge until the 9th month, reflecting a gradual comparable Visus increase in the evaluated groups of patients, at the 6th and 9th months the differences in visual acuity between the groups are not reliable any more. The graph clearly shows the cross of the curves of the visual acuity of the 3 subgroup and comparison group between 9 and 12 months of observation, which reflects the fact revealed — in the comparison group at the 12th month the visual acuity was higher than in 3 subgroup. This can be explained by initially higher visual acuity and less severe hemophthalmus in group II, while in 3 subgroup the patients had the highest density and volume of hemophthalmia.

Vitreous surgery remains the choice of treatment, but complications after it can be observed in 15-46% of cases, recovery of visual functions — only in 45% of cases [13].

Slightly better results of YAG laser vitreolysis were obtained by Degtyareva E. M. Partial hemophthalmus was removed in all cases; subtotal hemophthalmus — in 83.3% and total hemophthalmus was completely eradicated in 39.2% of cases. Best results can be explained by another genesis of hemophthalmus — the traumatic one when like in PDR there are neovascularization and violation of vitreoretinal relations that impede full hemophthalmus resorption [14].

Our findings can be compared with the results of treatment of DR patients when hemophthalmus resorption was achieved through medical methods — use of fibrinolytics prourokinase [15]. development of the processes of the hemorrhage While studying its activity in patients with DR having subtotal hemophthalmus the resorption with increased visual acuity could be observed in 43.3% of patients. According to the results of our research, in the 2 subgroup the comparable result was obtained — 38.5%.

The optimal timing for vitreous surgeries also remains debatable [16]. Some authors consider vitrectomy expedient at early stages of the disease, which does not only prevent, but also avoids the long-term toxic effect of the blood decay products on eye tissues; other authors believe that the two-month conservative treatment of hemophthalmus is quite enough to get positive results, and treatment failure should warrant the removal of VB surgically because in the early period the risk of complications is high [17].

Based on these criteria YAG laser vitreolysis is extremely promising, as it can be performed at early stages after hemophthalmus.

CONCLUSIONS.

Vitrectomy being the gold standard and cardinal solution in the treatment of diabetic hemophthalmus has a number of complications and requires expectant tactics and satisfactory somatic status of the patients.

Use of YAG laser vitreolysis at early stages, possibility of repeated surgeries, a favorable safety profile and a narrow range of complications make it possible to recommend this method to treat patients with DR complicated by hemophthalmus.

Given that vitrectomy is performed at later stages of hemophthalmus, YAG laser vitreolysis can be used at early stages as an alternative method to treat diabetic retinopathy complicated by recidivous hemophthalmus.

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