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THE IMPORTANCE OF ARGON LASER COAGULATION IN THE TREATMENT OF DIABETIC RETINOPATHY

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Abstract
Diabetes mellitus and its complications are one of the most important medical, social and economic problems of modern healthcare. In the structure of disability and mortality of patients suffering from diabetes, the leading position is given to its late complications. Since their likelihood increases with increasing life expectancy, this problem is very relevant, especially if we take into account the preventive focus of modern diabetology.

Keywords: diabetic retinopathy, laser coagulation, visual acquity.

Introduction

Diabetic retinopathy, a specific late vascular complication of diabetes mellitus, is the leading cause of blindness among people of working age in economically developed countries. It accounts for 80–90% of all visual impairment caused by diabetes.

The only effective way to treat diabetic retinopathy is timely laser photocoagulation of the retina. According to the WHO Study Group, early detection and treatment with laser photocoagulation stops the progression of diabetic retinopathy and preserves vision in more than 80% of cases.

Peripheral laser photocoagulation of the retina

In 1968, L. Aiello, A. Wessing et al. reported the first results of treatment of proliferative diabetic retinopathy using retinal coagulation. When developing this technique, the authors took into account their own observations of patients with diabetes mellitus, in whom, in addition to diabetes, changes associated with high myopia, chorioretinal dystrophy or optic nerve atrophy were identified. It was noted that in such cases, proliferating diabetic retinopathy, as a rule, does not develop, and if it does develop, it occurs in a much milder form. According to the researchers, this is due to the fact that with such changes, the retina's need for oxygen and the activity of retinal metabolic processes decreases. Under these conditions, the production of vasoproliferative factor is insufficient to trigger the proliferation mechanism. The authors used a coagulation method using a xenon photocoagulator or a ruby laser over a large area of the retina, destroying areas of hypoxic retinal tissue, to preserve the central zone in those eyes that would inevitably go blind without treatment. The results of these studies were encouraging, but this technique was not widely accepted because xenon coagulation led to significant changes in the visual field.

At the same time, F. Esperance proposed a technique using an argon laser, which consisted of direct exposure to areas of neovascularization. Direct impact on the network of newly formed vessels led to obliteration of neovascular conglomerates. This technique was not highly effective, since direct action on newly formed vessels did not eliminate the production of factors that

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stimulate neovascularization. In addition, this version of laser coagulation was accompanied by a large number of hemorrhagic complications.

In the course of further studies of the pathogenesis of proliferative diabetic retinopathy, much evidence was obtained that it is based on retinal ischemia, leading to the production of a vasoproliferative factor.

In 1971, H. Zweng and H. Little used panretinal laser photocoagulation of the retina to turn off ischemic areas of the retina in the middle and extreme periphery in order to eliminate the source of the release of factors that stimulate proliferation. At first, this method was used in combination with direct coagulation of newly formed vessels. However, subsequent studies showed that panretinal laser coagulation of the retina without direct exposure to newly formed vessels led to regression of neovascularization in almost the same percentage of cases as in combination with direct exposure, but a much smaller number of hemorrhagic complications occurred.

Despite the fact that the experience of many specialists confirmed the high effectiveness of panretinal laser photocoagulation in the treatment of proliferative diabetic retinopathy, it was only after large-scale studies performed by the Diabetic Retinopathy Study (DRS) group and the Early Treatment Diabetic Retinopathy Study group. Study (ETDRS), the indications for laser coagulation were precisely formulated and the method received worldwide recognition. These studies were conducted as part of the national program to combat complications of diabetes mellitus at 15 American clinics under the patronage of the government and the US National Eye Institute.

The DRS study was designed to evaluate the effectiveness of panretinal laser photocoagulation in preventing severe vision loss due to diabetic retinopathy.

For this purpose, 1758 patients with proliferative diabetic retinopathy in at least one eye or with preproliferative retinopathy in both eyes were selected. One eye was selected for panretinal laser photocoagulation of the retina using an argon or xenon coagulator, and the other eye was not treated.

The results indicated that panretinal laser photocoagulation of the retina reduces the risk of significant vision loss by approximately 50%. It was recorded in 16% of cases without treatment and in 6% of cases after laser photocoagulation of the retina in the group of patients with proliferative diabetic retinopathy during a 2-year follow-up (in the group of patients with high-risk proliferative diabetic retinopathy, significant vision loss was noted in 26 and 11% respectively).

At the same time, DRS and other numerous studies showed that the observed regression of newly formed vessels, as a rule, was not complete. Thus, in DRS, in eyes with proliferative diabetic retinopathy at high risk of significant vision loss, a year after panretinal laser photocoagulation of the retina, only 21% of cases showed complete disappearance of prepapillary newly formed vessels. The most frequently observed transition was from proliferative diabetic retinopathy with a high risk of significant vision loss to the level of proliferative retinopathy with residual neovascularization. In a study by B. Doft and G. Blankenship, within 3 weeks after completion of panretinal laser photocoagulation of the retina, in 72% of cases in eyes with proliferative diabetic retinopathy at high risk of significant vision loss, improvement and transition of the process to less severe categories were observed. After 6 months, the result was still maintained. In this group of patients, in 42% of cases, newly formed vessels were absent, and in 31%, residual neovascularization remained, but without signs of a high risk of significant vision loss. Thus, the data presented indicate that the effect of panretinal laser coagulation often manifests itself quite

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early - within 6–8 weeks after completion of laser exposure. However, the optimal amount of coagulates that is required for the complete emptying of newly formed vessels is still not known. G. Blankenship, observing 151 patients who were included in the DRS, concluded that the positive effect of panretinal coagulation was maintained for 15 years after the intervention.

DRS also defined criteria for a high risk of significant vision loss, which made it possible to more adequately assess the prognosis in terms of maintaining visual function in eyes with proliferative diabetic retinopathy and the required amount of panretinal laser photocoagulation of the retina.

In addition, DRS gave a comparative assessment of the effectiveness of argon and xenon coagulators. Both methods were equivalent in preventing significant vision loss, but the incidence of complications was higher in the group of patients treated with a xenon photocoagulator. Thus, in eyes treated with a xenon laser, a narrowing of the visual field was detected 5 times more often than in eyes treated with an argon laser. Other complications that occurred more frequently were: excessive foveal burns, vitreous hemorrhages, and serous macular detachment.

Particular attention was paid to the effect of panretinal laser coagulation of the retina on the condition of the retina in the macular zone. It was noted that panretinal laser photocoagulation of the retina aggravates the course of macular edema. Therefore, F. Ferris et al. for macular edema, it was proposed to first perform focal laser coagulation of the retina, and at the second stage - panretinal. Moreover, when performing the latter, it was recommended to avoid causing very intense burns and to do it not at once, but in several sessions.

The results of DRS have had a major impact on the use of panretinal retinal laser photocoagulation for the treatment of diabetic retinopathy. At the same time, the feasibility of laser coagulation of the retina at other stages of diabetic retinopathy remained unclear.

Therefore, in 1980, another group of scientists (ETDRS) was tasked with continuing research in this direction in order to answer the following questions:

• at what stage of development of diabetic retinopathy should laser treatment be started?

• is it advisable to perform laser photocoagulation of the retina in the presence of diabetic macular edema?

The ETDRS examined 3711 patients with nonproliferative diabetic retinopathy (minimal to severe) or early proliferative retinopathy in both eyes. In each patient, panretinal laser coagulation was immediately performed in one eye, while the other eye remained under observation (control). Either complete panretinal laser coagulation with an argon laser (1200–1600 coagulates of 500 μm) or minimal (400–600) was performed. In some patients with macular edema, one of these options was combined with focal coagulation or “grid” coagulation. The results of the ETDRS study were as follows:

• progression to high-risk retinopathy of significant vision loss was observed 2 times more often with minimal laser coagulation than with complete laser coagulation;

• there were no significant differences in terms of significant loss of visual acuity in the main and control groups with minimal or moderate non-proliferative retinopathy;

• For macular edema, focal or grid coagulation has been effective in reducing the risk of vision loss.

Given these data, it was considered inappropriate to perform panretinal laser coagulation for minimal or moderate nonproliferative diabetic retinopathy.

ETDRS also recommended that if panretinal coagulation is necessary in eyes with symptoms of macular edema, begin with treatment of edema, and postpone peripheral coagulation. This tactic should be followed in eyes with severe nonproliferative and initial proliferative diabetic

retinopathy. In eyes with proliferative diabetic retinopathy at high risk of significant vision loss, focal coagulation should be combined with the first session of panretinal laser photocoagulation of the retina.

In subsequent years, a huge number of reports appeared in the domestic and foreign literature about the positive effect of laser coagulation in the treatment of diabetic retinal lesions. From these works it follows that when coagulation is carried out against the background of proliferative diabetic retinopathy, stabilization of the process can be achieved in 37–80% of cases.

Concluding the presentation of this issue, it should once again emphasize the fact that laser exposure is certainly an effective method of treating diabetic retinopathy. This is confirmed by data from numerous studies (domestic and foreign) published over the past 30 years. It was information about the high effectiveness of retinal laser coagulation as a means of preventing vision loss that became the basis for the development of screening programs for diabetic retinopathy.

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