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Research Article

BIOCHEMICAL EVALUATION OF THE EFFICACY OF COMPLEX TREATMENT OF EYE BURN

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ABSTRACT

Chemical burns of the eye occur mainly in the working-age population, and the development of various complications as a result of non-compliance with international standards in the provision of emergency medical care leads to disability.

Goals and objectives. Determination of the effectiveness of photodynamic therapy and complex treatment of chemical spectacle lenses using biochemical indicators of tears.

Materials and methods. In 2019 - 2022 110 patients (155 eyes) treated with GKBSMP with a diagnosis of chemical eye disease of I-II-III degree were divided into 3 groups: in the comparison group - patients who received standard therapy; the patient of the main group I additionally underwent PDT on the apparatus "Vostok"; in the II main group, methylethylpyridonol was added to the glass cap.

Quantitative biochemical method for the determination of superoxide dismutase (SOD), catalase (CT), malondialdehyde (MDA) and slezax.

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Results and discussion. In treatments and all groups of treks, the amount of SOD and CT decreases by 1-2 times, and MDA increases by 3.5 times.

The activity of SOD below 7 was similar to that of PDT by 1.43 times, and in the treatment with methylated pyridinol - by 1.78 times, it was significantly higher than the comparison group and by 1.06 times. It was found that in patients of the main group II, activation of CT was 1.25 times, and the level of MDA was significantly reduced by 2.08 and 2.97 times compared with the values before treatment in both groups.

Conclusions. It has been proven that when using photodynamic therapy and complex treatment of chemical glasses, activation of the antioxidant system and increased epithelialization of damaged areas of the eye surface are more effective than with traditional treatment.

KEYWORDS

Chemical burn; photodynamic therapy; superoxidedismutase; catalase; malondialdehyde.

INTRODUCTION

Chemical burns of the eye are urgent cases in ophthalmology, and these injuries account for up to 22% of eye injuries [1, 5].

In case of a chemical burn of the eye, it is recommende to immediately wash the eye with a large amount of water to eliminate the harmful chemical factor, to remove it and to reduce possible complications [2, 3, 4].

According to standard medical therapy, the focus is on the use of agents that improve epithelization and reduce inflammation on the injured surfaces [6, 8].

Cleaning of necrotic tissue, tenonoplasty and keratoplasty are effective in surgical treatment. However, since it is not possible to use it everywhere, it is recommende to use optimal options of conservative treatment [7, 9, 10].

Many effective, etiopathogenetically oriented methods of treatment of chemical burns of the eye have been proposed. Despite the many options offered, there is no single effective treatment method that leads to the best results [11]. Given this fact, there is a need to search for complex methods of treatment with high clinical efficacy, reducing the number and degree of complications that develop after chemical eye burns [12].

Goals and objectives. Improving the complex treatment of chemical burns of the eye based on clinical and laboratory data of the lacrimal fluid.

Materials and methods. The object of the study were 110 patients (155 eyes) who were treated with a diagnosis of chemical burns of the eye of I-II-III degree from 2019 to 2021 and 12 people (12 eyes) - practically healthy individuals who made up the control group.

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Depending on the therapy, the patients were divide into three homogeneous groups.

In the first (control) group, 37 patients received traditional therapy according to ophthalmological standards.

38 patients of the second (main) group on the basis of traditional therapy received photodynamic therapy (PDT) on the Vostok laser device in the developed therapeutic doses of 300 mJ (630 nm, pulsed radiation) for 3 minutes once a day. The duration of treatment was 5-7 days, depending on the severity of the burn.

35 patients of the third (main II) group, along with therapy of the main group I, were added methylethylpyridinol in the form of eye drops, 1 drop x 3 times a day in the affected eye, for 10 days.

The study used biochemical research methods, in particular, superoxide dismutase (SOD), catalase (CT), malondialdehyde (MDA) was determined.

RESULTS AND DISCUSSION

In all patients of the three groups, the initial biochemical parameters in the lacrimal fluid before treatment did not differ from each other ($p>0.05$). At the same time, in the control group, the amount of SOD was 6.79 ± 0.89 conventional units / ml, in the comparison group 3.53 ± 0.79, in I and II main groups 3.62 ± 0.81 and 3.39 ±0.86 respectively. The level of catalase was 0.17±0.04; 0.16±0.05; 0.18±0.06; 0.16±0.06 μmol/l for the above groups. Both of these biochemical parameters determined the level of the antioxidant system of the ocular surface during inflammatory processes. MDA as an indicator of inflammation was 1.49±0.29 nmol/ml before treatment in the control group, and 5.13±1.57 in the other studied groups, respectively; 5.04±1.40; 5.49±1.69. At this time, in all three groups, the number of SOD and CT decreased from 1 to 2 times, and the MDA indicators increased to 3.5.

On day 7, the low activity of SOD in the lacrimal fluid in the treatment of eye burn with PDT significantly increased by 1.43 times ($p<0.05$), but when it was used with methyl etidpyridinol, it increased by 1.78 times ($p<0.05$), and was higher than the values of the comparison group by 1.06 and 1.24 times, respectively.

Analysis of catalase activity at the local level during the complex treatment of eye burns showed a tendency to its activation by 1.25 times in patients of the main group II.

In the main group I, this indicator, while maintaining stability, did not change, and in the comparison group, it tended to decrease.

In both main groups, the activity of the catalase enzyme even slightly exceeded that of practically healthy individuals. Such activation of catalase in SF contributed to a more pronounced neutralization of peroxide radicals, which was manifeste by a decrease in the level of MDA. The level of MDA significantly decreased by 2.08 and 2.97 times ($p<0.05$) relative to the values before treatment in the main groups. We can see that the values of SOD and MDA are inversely proportional to each other, that is, in inflammatory processes, mainly SOD decreased due to an increase in MDA.

Meanwhile, along with positive shifts in the level of MDA, this value was still significantly exceede in relation to the values of practically healthy individuals by 1.89 and 1.62, 1.24 times, respectively, in the comparison group and the main groups. These results indicate the presence of inflammatory processes in the eye in accordance with their values.

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The combined use of PDT and methylethylpyridonol effectively attenuated the chemical burn-induced upregulation of angiogenesis-related factors such as MDA. Since an increased level of MDA has a positive correlation with the level of oxidative stress and a decrease in antioxidant status. At the same time, a correlation was establishe between an increase in the level of MDA and a decrease in CT, SOD. The presence of a direct relationship between the imbalance in the lipid peroxidation system and the buffer system of the anterior surface of the eye has been confirme, especially in patients with moderate burns.

CONCLUSION

In the complex treatment of chemical burns of the eye, a higher efficiency of epithelialization of injured surfaces has been prove due to the enhancement of the antioxidant system of the eye surface by photodynamic therapy compared to traditional methods of treatment. At the same time, the effectiveness of the treatment of chemical burns of the eye is based on the monitoring of biochemical markers such as superoxide dismutase, catalase, malondialdehyde in the lacrimal fluid.

It has been establishe that in the lacrimal fluid of patients with eye burns, the level of MDA increases, against the background of a decrease in the activity of CT and SOD. The use of PDT and methylethylpyridonol in the complex treatment of patients with eye burns activates CT, reduces free radicals, improves the antioxidant system, reduces the high level of MDA and the degree of endogenous intoxication, and accelerates the reparative processes of the ocular surface of post-burn lesions. The antioxidant effects of methylethylpyridinol resulted in increased secretion of a native antioxidant enzyme such as SOD, which neutralizes toxic free radicals produced during inflammation.

Based on the results obtained, an algorithm for the complex treatment of chemical eye burns was develope.

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