Effect of Natural Antioxidants on Antioxidant Activity and Lipid Peroxidation in Eye Tissue of Rabbits with Chemical Burns

F. S. Gakhramanov

Translated from *Byulleten' Eksperimental'noi Biologii i Meditsiny*, Vol. 140, No. 9, pp. 269-271, September, 2005
Original article submitted June 2, 2005

Chemical eye burns were accompanied by free radical oxidation of lipids and dysfunction of the antioxidant protection system. The decrease in antioxidant activity of blood plasma reflected a generalized type of these processes. The concentration of thiobarbituric acid-reactive substances increased in blood plasma from rabbits with eye burns. The severity of disturbances was maximum at the stage of trophic disorders. Combination therapy with antioxidants and standard pharmaceuticals effectively inhibited lipid peroxidation in eye tissue of experimental animals.

Key Words: *chemical burn; lipid peroxidation; antioxidants; lipids*

The pathogenesis of degenerative, inflammatory, and infectious diseases involves free radical lipid peroxidation (FRLP) [1-4]. Chemical eye burns are accompanied by a decrease in the effectiveness of antioxidant protection and activation of FRLP. Much attention is given to natural antioxidants preventing the development of irreversible dystrophic changes in eye tissue [5]. Changes in antioxidant activity of eye tissue, role of FRLP end products in the pathogenesis of experimental eye burns, and variations in the concentration of these substances under the influence of natural antioxidants remain unknown.

Here we studied antioxidant activity in the aqueous humor of the anterior chamber, vitreous body, retina, and blood plasma under various regimens of antioxidant therapy.

MATERIALS AND METHODS

Series I was performed on 18 rabbits (36 eyes). We studied antioxidant activity in the aqueous humor of the anterior chamber, vitreous body, retina, and blood plasma. Measurements were performed before (intact eyes) and 3, 14, and 30 days after burn (treated and control eyes). Combination therapy was applied to animals of the main group 2 h after burn. The rabbits received standard antiinflammatory drugs. Histochrome was administered into the conjunctival fornix (0.02%

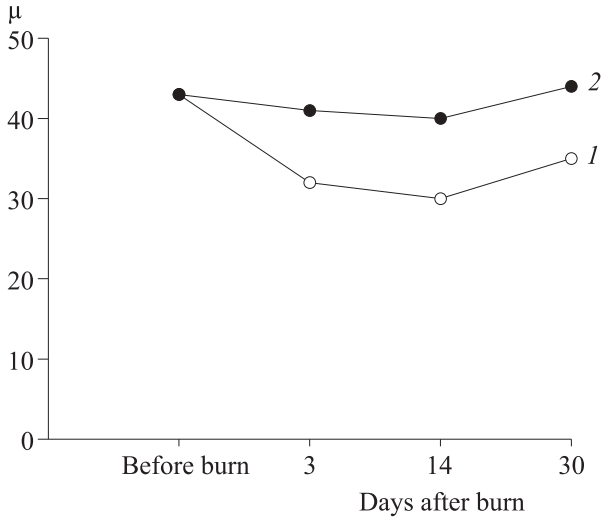

Fig. 1. Total antioxidant activity of blood plasma from rabbits with chemical burns of grade III. Here and in Fig. 2: control (*1*) and main group (*2*).

Z. A. Alieva Azerbaijan Institute of Eye Diseases

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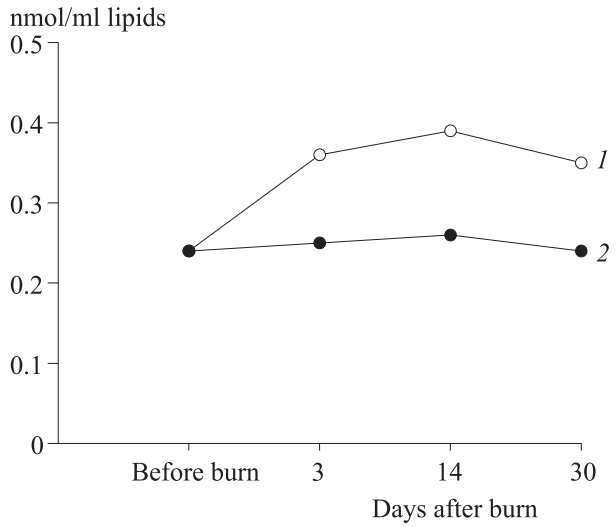

Fig. 2. MDA concentration in rabbits at various stages of burn disease.

histochrome, 2 drops, 6 times a day), subconjunctivally (0.3 ml 0.02% histochrome), and in the ear vein (1.0 ml 1% histochrome in 10 ml physiological saline, daily intravenous drop infusions). Antioxidants gingko biloba and diquertin were given perorally with food (daily doses 3.5 and 2.5 mg/kg, respectively). Control animals (6 rabbits, 12 eyes) were treated with standard antiinflammatory drugs.

The rabbits were killed by air embolism on days 3, 14, and 30 after burn (stages of necrosis, trophic disorders, and cicatrization, respectively). The eyes were enucleated. Antioxidant activity was determined in the aqueous humor of the anterior chamber, vitreous body, and retina. We measured the concentration of thiobarbituric acid-reactive substances (malonic dialdehyde, MDA).

In series II antioxidant activity of blood plasma from rabbits with chemical eye burns of grade III was measured at various stages of the disease and after treatment with natural antioxidants. Experiments were performed on 29 rabbits (58 eyes). The regimen of treatment and scheme of the study with control and experimental animals were described above (Series I). Clinical signs of eye burns were evaluated on days 3, 14, and 30. Examination was performed under a binocular microscope. Conjunctival health was determined by the severity of eyelid edema, hyperemia, and discharge. Corneal health was estimated by the degree of infiltrate, area of corneal erosions, and depth of ulcers.

RESULTS

Series I showed that total antioxidant activity in the aqueous humor of the anterior chamber and vitreous body of rabbits receiving antioxidant therapy is much higher compared to control animals, but does not differ from that in intact specimens (Table 1). MDA concentration in the eyes of rabbits with chemical burns of grade III was lower than in control animals, but higher than in intact animals (Table 2).

Series II demonstrated that antioxidant activity of blood plasma from rabbits of the main group is higher than in control animals (Fig. 1). MDA concentration in control rabbits surpassed that in animals of the main group (Fig. 2).

TABLE 1. Total Antioxidant Activity in Aqueous Humor of Anterior Chamber, Vitreous Body, and Retina of Rabbits Receiving Antioxidant Drugs (*M*±*m*, μ)

Eye structure	Intact eyes	Control eyes			Treated eyes		
		Day 3	Day 14	Day 30	Day 3	Day 14	Day 30
Aqueous humor of the anterior chamber	17.82±0.03	9.84±0.28	4.02±0.57	9.78±1.48	16.92±0.03	12.52±0.58	13.68±2.38
Vitreous body	8.34±0.78	4.82±1.58	3.57±1.22	6.88±2.48	7.96±0.02	6.38±0.08	8.00±1.18
Retina	20.32±1.13	12.84±2.37	9.85±1.37	14.92±1.58	19.98±0.06	15.78±0.08	17.83±2.78

TABLE 2. MDA Concentration in Aqueous Humor of Anterior Chamber, Vitreous Body, and Retina of Rabbits with Chemical Eye Burn of Grade III Receiving Natural Antioxidants (*M*±*m*, nmol/mg lipids)

Eye structure	Intact eyes	Control eyes			Treated eyes		
		Day 3	Day 14	Day 30	Day 3	Day 14	Day 30
Aqueous humor of the anterior chamber	1.28±0.12	1.98±0.48	2.37±0.57	1.39±0.25	1.45±0.12	1.58±0.18	1.31±0.18
Vitreous body	0.06±0.28	0.08±0.02	0.09±0.02	0.07±0.04	0.070±0.002	0.080±0.004	0.060±0.012
Retina	1.18±0.55	1.98±0.02	2.12±0.04	1.45±0.03	1.26±0.46	1.46±0.53	1.21±0.32

Anterior eye inflammation in control rabbits disappeared on days 21-26. In these animals the severity of corneal edema decreased on days 18-24. The cornea was completely epithelialized on days 30-35. Leukomas of grades I, II, III, and IV were revealed in 1, 3, 2, and 2 eyes, respectively.

Anterior eye inflammation in rabbits of the main group disappeared on days 7-10. The severity of corneal edema decreased on days 6-8. Corneal transparency was recovered in 4 eyes. Grade I leukoma was detected in 4 eyes.

Our results show that combination therapy with antioxidants and standard pharmaceutical drugs improves regeneration of eye tissue during chemical burns.

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