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Short communication

Serum malondialdehyde level and activity of total antioxidant status of dogs with age-related cataract

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Abstract

Study objective: determination of malondialdehyde (MDA) level and total antioxidant status (TAS) in the serum of dogs with age-related cataract.

Material and methods: Forty dogs, 10-16 years of age, which were diagnosed with age-related cataract were examined. The control group consisted of 12 dogs, 8-13 years of age, without cataract. MDA was determined using a Perkin-Elmer LS 30 luminescence spectrometer using the method with thiobarbituric acid (TBA). TAS was determined using the colorimetric method with a set of Randox Total Antioxidant Status reagents.

Results: The results show a higher level of MDA with statistically significant difference and lower activity of TAS in the serum of dogs with age-related cataract.

Conclusions: The results obtained indicate higher systemic lipid peroxidation and weakening of the general defense system in dogs with age-related cataract. These results suggest that such conditions may have an effect on the development of age-related cataract and are consistent with the theory of free radical age-related cataract development.

Key words: dogs, age-related cataract, serum malondialdehyde, total antioxidant status

Introduction

Cataract is a change in the structure, biochemical processes and method of light ray transfer through the lens of the eye. Age-related cataract (ARC) is the main cause of decrease in visual acuity and blindness in people. In dogs a similar situation is observed and therefore a study was performed to demonstrate that cataract of different degrees occurs in all dogs over 13.5 years of age and its prevalence has increased in

the last 40 years by 255% (Gelatt 2005). Currently, a hypothesis of multifactorial pathogenesis of age-related cataract is proposed and oxidative stress seems to be the most probable factor of biochemical mechanisms which initiate the formation of opacities in lenses (Gelatt 2005, Kałużny 2007).

This study determines MDA level and TAS in the serum of dogs with diagnosed age-related cataract at different stages and without general diseases.

Table 1. MDA level and TAS activity in serum of dogs with age-related cataract and control dogs.

Dog group	MDA $\mu\text{mol/L}$ $\bar{x} \pm \text{SD}$ (min. – max.)	TAS mmol/L $\bar{x} \pm \text{SD}$ (min. – max.)
Age-related cataract n = 40	10.5 ± 3.63^a (2.30 – 15.8)	0.49 ± 0.27^a (0.05 – 0.98)
Control group n = 12	5.26 ± 0.90^b (0.98 – 13.9)	0.60 ± 0.27^a (0.05 – 0.93)

Statistically significant differences ($p < 0.05$) are marked with different letters.

Materials and Methods

The study was conducted on 40 dogs of various breeds and both sexes, 10-16 years of age, in which cataract was diagnosed. Opacities in lenses at various levels of development were determined based on direct and indirect ophthalmoscopy. The control group consisted of 12 dogs of different breeds and both sexes, 8-13 years of age, without cataract, from which blood was collected during control visits in the clinic.

The study material included blood serum. Blood was obtained from the external jugular or from small saphenous vein. MDA level was determined using a Perkin-Elmer LS 30 luminescence spectrometer, which utilizes the method of reaction with thiobarbituric acid (TBA) according to Yagi. Total antioxidant status was determined using the colorimetric method with a set of Randox Total Antioxidant Status (TAS) reagents – United Kingdom. Study results were processed statistically with average values and standard deviation (SD) provided in Tables. Differences between the studied groups were analyzed using student t-test.

Results and Discussion

MDA level and TAS value in the serum of dogs with age-related cataract and in control dogs is presented in Table 1.

The average MDA level is considerably higher in the group of dogs with cataract; the level is almost two times higher compared to the control group and differences between groups are statistically significant. In dogs with cataract, in all the studied dogs except for one, the results were higher than the average MDA level in the control group. The results are in agreement with results obtained from the serum of humans with age-related cataract (Kaur et al. 2012, Chang et al. 2013, Karalezli et al. 2015). Also, a higher MDA level was determined in the lenses and aqueous humor in human age-related cataract (Kłos-Rola 2004, Miric et al 2013, Karalezli et al. 2015). A gradual increase in MDA level was also found with

progression of opacities in lenses (Kłos-Rola 2004). However, are not found in the literature results on MDA level in the serum of dogs with age-related cataract. Only our previous study is in agreement with the data obtained in this study and demonstrate a significantly higher MDA level in aqueous humor in dogs with age-related cataract (Madany 2014). Results obtained in this study show, with MDA level in the aqueous humor in dogs, as well as data from humans, suggest that in the course of age-related cataract intensive systemic and intraocular lipid peroxidation occurs, which supports the participation of reactive oxygen species in the development of lens changes.

TAS indicator is used in evaluation of the ability of the organism to resist the attack of free radicals. Also, together with other indicators, TAS informs on „team” defense possibilities of an organism. In this study the analysis of TAS activity indicates that its average activity in the serum of dogs with age-related cataract is lower compared to dogs in the control group. However, these differences are not statistically important. In the literature no information on TAS activity in dogs with age-related cataract was found and therefore species confrontation is not possible. Only in our previous study was a similarly lower TAS activity in the aqueous humor in dogs with age-related cataract observed and the demonstrated differences were statistically significant (Madany 2014). In similar studies, which were conducted mainly on humans and which examined the activities of enzymes of oxidative stress in serum in age-related cataract, activity of the following enzymes decreased: superoxide dismutase (SOD) and glutathione peroxidase (GPX) (Kaur et al. 2012). On the basis of the above mentioned observations, it seems appropriate to state that a decrease in TAS activity in the serum of dogs with age-related cataract indicates weakening of the systemic defense mechanisms and depletion of the set of non-enzymatic antioxidants in the blood, which, together with higher MDA level in the serum supports the dominance of peroxidation processes over processes of free radical neutralization.

Analysis of the obtained results, on MDA and TAS in the serum of dogs, suggests that the deter-

mined changes confirm the presence of systemic conditions with the participation of free radicals and oxidation-reduction processes leading to opacities in lenses.

However, recent considerations on age-related cataract are more far-reaching. There has been an attempt to use age-related cataract, understood as an effect of general weakening of the antioxidant status of the organism, as a biological marker, which, combined with an analysis of the size of dogs, may indicate their life expectancy (Urfer et al 2011). However, the foregoing, single observations require confirmation in a further series of studies.

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