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Case Report

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What to do if You Need to Postpone the Surgical Treatment of Cataracts in Covid-19

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Abstract

This article highlights the current possibilities of diagnosis and pharmacotherapy in the treatment of patients in the conditions of COVID-19 pandemic with various types of metabolic disorders of the body that lead to the development of cataracts. Such therapy is the preferred choice among patients for the prevention and treatment of lens opacities, which is associated with lower material costs and ease of use of drugs. Currently, the latest strategy for the use of drugs for the treatment of cataracts has been developed.

Keywords: Predictive Preventive Personalised Medicine; Clinical Proteomics; Differential Omics; Patient Stratification; Biomarker Patterns; In-Depth Diagnostics; Tailored Therapy; Liquid Biopsy; Tear Fluid; Risk Assessment; Cataract; Oxidation; Antioxidant Defence; Diabetes Mellitus; Ageing; Peroxiredoxin; Pirenoxine

Introduction

Diabetes mellitus (DM) is a complex metabolic disorder leading to a cascade of collateral pathologies, including cardiovascular and neurological diseases, cancer as well as diabetic retinopathy as the worldwide leading cause of blindness in humans.

Despite the rapid development of cataract surgery technology over the years, surgery remains challenging due to its cost and the increasing number of patients with different types of cataracts. Long waiting times for surgery are also associated with anti-epidemic measures and restrictions currently associated with the COVID-19 pandemic [1].

Accumulated evidence demonstrates the tear fluid analysis as a clinically relevant tool to predict disease development based on the molecular make-up providing the targets which can be further used for preventive measures and treatments tailored to the

person [2]-the concepts known as 3P medical approach [3]. Visual impairments are characteristic for DM patients, whereby pathological processes linked to the DM related cataract appear to be more complex compared to the ageing-related non-diabetic one. In contrast to the ageing-related non-diabetic cataract, the diabetes-related cataract is considered to result mainly from the antioxidant protection dysfunction. Indeed our previous investigations revealed peroxiredoxin 6 to be underrepresented in the tear fluid of patients affected by diabetic cataract [4,5]. The results of the studies convincingly show that Catalin (pirenoxine eye drops) has an anti-cataract effect on all layers of the lens, especially on its cortical layers and the posterior capsule with prolonged and safe use. High therapeutic efficacy and safety with long-term use make it possible to recommend Catalin eye drops to slow the progression of age-related cataracts, especially in the initial stages up to the age of 59 years. Further research on the use of pirenoxine in patients with various types of cataract and the risk of its occurrence should be continued. This study was devoted to the comparative analysis of the content of Peroxiredoxin-6 in the lacrimal fluid in patients with treated versus untreated diabetic cataract. They were compared to the subtype of non-diabetic cataract. Healthy individuals were taken as a control group.

Patients' recruitment and examination

Patients recruited for the study were 64.1 years old on average.

Three groups were created:

- The first group was diabetes-free; all 50 patients were diagnosed with the ageing-related cataract; age in the group was 66.5 ± 4.3 years.
- The second group comprised 50 patients with diabetic history and DM-related cataract; age in the group was 59.4 ± 1.2 years.
- The control group comprised 25 healthy individuals; age in the group was 44.3 ± 2.4 years.

Ophthalmological examinations were carried out according to the generally accepted standard methodology [6].

Tear fluid sampling and analysis

Of the tear fluid, 0.1 ml per patient was taken without additional stimulation using a disposable sterile polymer cannula, which was placed in the lower part of the conjunctival sac. The tear fluid was frozen immediately and stored at −20°C.

The tear protein composition was analysed using mass spectrometry as described elsewhere [7]. Mass spectra were obtained on a MALDI time-of-flight mass spectrometer Ultraflex II BRUKER (Germany) equipped with a UV (Nd) laser in the mode of positive ions using reflectron. Protein identification was carried out using the Mascot program (www.matrixscience.com).

The expression level of PRDX6 was determined after a thorough analysis of the data obtained with the spectrophotometer, which represented the overall level of antioxidant expression active enzymes and the level of expression common to all antioxidants other than PRDX6. There were additionally visualized and quantified by Western blotting assay as described in [8], peroxiredoxin levels 6.

Statistical analysis

For statistical processing of the research results, the STATISTICA 10 software package from StatSoftInc was used. A statistically significant difference is noted below as *p ≤ 0.05.

Results Interpretation

Protein concentrations in the tear fluid are presented in table 1 for each group of comparison.

Indicators (expression units)	Group 1 (n = 50)	Control group (n = 25)
Peroxiredoxin 6 before surgery	3.57* ± 0.35	2.74 ± 0.4
Peroxiredoxin 6 after surgical treatment	6.92* ± 0.2	2.74 ± 0.4

Table 1: The level of peroxiredoxin 6 expression in the tear fluid of group 1 patients before and after surgical treatment compared to the control group.

*p ≤ 0.05 - significantly higher than in the control group.

Protein concentrations in the tear fluid are presented in table 2 for each group of comparison.

Indicators (expression units)	Group 2 (n = 50)	Control group (n = 25)
Peroxiredoxin 6 to surgical treatment	1.12* ± 0.3	2.74 ± 0.4
Peroxiredoxin 6 with the use of Pirenoxine to surgical treatment	3.25* ± 0.5	2.74 ± 0.4
Peroxiredoxin 6 with Pirenoxine after surgical treatment	4.07 ± 0.2	2.74 ± 0.4

Table 2: The level of peroxiredoxin 6 expression in the tear fluid of group 2 patients before and after surgical treatment compared to the control group.

*: p ≤ 0.05 - Significantly higher than in the control group.

The level of expression of peroxiredoxin 6 in the tear fluid:

- Healthy controls: 2.74 ± 0.4 activity nMol/mg/10.
- Group 1: Before surgical treatment 3.57* ± 0.35; after surgical treatment 6.92 ± 0.2.
- Group 2: Before surgical treatment 1.12* ± 0.3; with Pirenoxine before surgical treatment 3.25* ± 0.5; with Pirenoxine after surgical treatment 4.07 ± 0.2.
- *p ≤ 0.05 - Significantly higher than in the control group.

Case Report

- A 52-year-old patient with compensated DM type 2.
- Complains of dryness and itching of the skin.
- Ophthalmic complaints: complaints of lack of vision of the right eye; visual acuity of the right eye is 0.01; visual acuity of the left eye is 0.7 n/a.
- Diagnosis: OD - Complete Diabetic Cataract; OS - in-complete diabetic cataract, non-proliferative diabetic angio-retinopathy.

The tear protein spectrum was determined for the patient: the average tear protein concentration was 7.85 μg/ml; active peroxyredoxin 6 (14 kDa) is not detectable (See figure 1).

Figure 1: Western blot analysis of the tear fluid proteins: peroxyredoxin 6 is undetectable before surgical treatment.

The patient was treated with pirenoxine to stabilize the clouding of the lens and to increase the antioxidant protection (See figure 2). The average concentration of tear proteins was 7.35 μg/ml, active peroxyredoxin 6, 14 kilodaltons - 4.01; an increase in the activity of peroxyredoxin 6 was recorded.

Figure 2: Western blot analysis of the tear fluid proteins after pirenoxine treatment: peroxyredoxin 6 (14 kDa) is well detectable.

Conclusions and Recommendations of Experts

This study has demonstrated significant qualitative and quantitative indicators.

Significant differences in protein profiles between non-diabetic age inhalation and diabetic cataract. Also an antioxidant protection in the eyes of diabetics is clearly suppressed as shown for the peroxiredoxin system, which is overall purpose for both diagnostic analysis and prevention active measures to restore antioxidant protection and protection lens against oxidative haze.

As a prophylaxis for antioxidant disorders in patients with age-related and diabetic cataracts, the recommended treatment with pirenoxine has been shown to be beneficial in compensating for the antioxidant deficiency associated with diabetes. Personalized algorithms can be useful to optimize treatment before and after a cataclysm cancer surgery. It is recommended to further investigate the molecular-biological parameters of the lacrimal fluid both with aging and with diabetes for predicting and prophylactic approach to these diseases.

Conflict of Interest

There is no conflict of interests.

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