EPIDEMIOLOGICAL FEATURES OF DRY EYE SYNDROME IN PATIENTS WITH TYPE II DIABETES

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ANNOTATION

This paper revealed the assessment of the prevalence of Dry Eye Syndrome (DES) and its relationship with the course of the disease in patients with Diabetes Syndrome (DS). A total of 1240 patients with Type II DS were examined. The experience of DS in the examined patients ranged from 4 to 25 years. All patients underwent a comprehensive ophthalmological examination, which began with the study of DES indicators. The survey included questioning patients using an adapted Ocular Surface Disease Index (OSDI) questionnaire, a study of general tear production (Schirmer's test), and determination of the tear film break-up time (TFBUT). The examination results revealed the presence of DES in 795 (64.1%) patients with type 2 diabetes. When analyzing the occurrence of DES types, depending on destructions of the component of the lacrimal complex, it was found that the most common type of DES encountered in patients was mixed type. Patients with less than 10 years of illness were more likely to have pronounced subjective symptoms (86%) of DES than patients with more than 10 years of diabetes (54%), which reflected in the OSDI survey results. In patients with a disease duration of more than 10 years, a pronounced decrease in objective indicators was often determined: tear film stability (decrease in tear film break-up time (TFBUT) in 56% of cases about 27% with an experience of fewer than 10 years) and tear production (decrease in 18, 6% about 14.4% with less than 10 years of experience).

Keywords: сахарный диабет 2 типа, синдром сухого глаза, распространенность синдрома сухого глаза, стаж сахарного диабета.

I. INTRODUCTION

According to the statistical calculations of the International Diabetes Federation (IDF), today, there are approximately 425 million people with Diabetes Syndrome (DS) in the world, and by 2045 their number is expected to increase to 629 million [1]. The problem of diabetes is also relevant for the Republic of Uzbekistan since there has been a tendency for an increase in the incidence of diabetes over the past two decades. According to the IDF, in Uzbekistan, in 2019, there were 1,121,700 patients with diabetes, but only 230,000 of them were officially registered [2].

Metabolic changes in the body in diabetes are the basis for developing its complications. An important place occupied by ophthalmological complications is diabetic retinopathy and Dry Eye Syndrome (DES) [3,4,5]. When it comes to eye damage in diabetes, much attention is usually paid to diabetic retinopathy, while the manifestations of DES in diabetes are not well covered in the scientific literature. Nevertheless, today DES is one of the most widespread chronic diseases of the ocular surface. According to foreign studies, 35-55% of patients with diabetes have DES [6,7,8,9].

DES in diabetes, according to the generally accepted theory, develops due to the pathology of the Lacrimal Function Unit (LFU), which is the system that protects and maintains the tear film and the normal function of the ocular surface. This system includes many components, including the cornea, conjunctiva, lacrimal glands, meibomian glands, eyelids, and the sensory and motor nerves that connect them. In addition, SFU directly includes the tear film, which consists of 3 layers: lipid, water and mucin. These 3 layers also include enzymes, signalling molecules and metabolites necessary to maintain the physiological function of the ocular surface10,11,12. In this regard, given the variety of morphofunctional changes that develop in the eyeball structures and its adnexa in diabetes, the problem of studying the features of the prevalence and manifestation of DES in this disease is relevant.
**The aim of the research**

The purpose of the research is to assess DES and its connection with the disease course in patients with DS.

**II. MATERIALS AND METHODS**

The study carried out in the Department of Ophthalmology of the Republican Specialized Scientific and Practical Medical Center for Endocrinology, named after Academician Y.Kh. Turakulov from 2016 to 2020. A total of 1240 patients with type II diabetes examined, and the patients' age ranged from 32 to 65 years. Separation by gender: 760 women (61.3%) and 480 men (38.7%). The experience of diabetes mellitus in the examined patients ranged from 4 to 25 years.

Patient inclusion criteria for the study:

- the presence of a confirmed diagnosis of type II diabetes;
- the length of the disease is more than 3 years;
- the absence of concomitant diseases of the ocular surface in the form of conjunctivitis, keratitis, scleritis and pterygium;
- the absence of concomitant diseases of the organ of vision, requiring constant instillation of eye drops;
- lack of data on the use of medicines in the form of eye drops for at least 1 month;
- lack of data on the postponed procedure of laser coagulation of the retina within 1 month.

All patients underwent a comprehensive ophthalmological examination, which began with the study of DES indicators (all of the following research methods carried out before starting formal ophthalmological studies and installation of mydriatics).

The survey included:

- Patient questioning using the adapted Ocular Surface Disease Index (OSDI) questionnaire;
- study of general tear production (Schirmer's test);
- determination of the tear film break-up time (TFBUT).

The adapted OSDI questionnaire was a classic version of this questionnaire, translated into Russian and Uzbek languages, and included 12 questions, assessed on a 4-point system (the criterion for the presence of DES was a total score of $>25$).

Schirmer's test carried out using test strips made of filter paper from Bausch & Lomb (Germany) (the criterion for the presence of DES was the indicator of staining of the test strip $<15$ mm in 15 min). To determine TFBUT, the TFBUT (tear film break up time) mode used on an HRK-9000 Huvitz automatic refractokeratometer (South Korea) (the criterion for the presence of DES was the TFBUT indicator $<10$ sec).

Statistical data processing carried out using the standard MS Office 2019 software package with the definition of the Student criterion ($\leq0.05$) and the correlation coefficient.

**III. RESULTS**

When analyzing the data obtained, the criterion for the presence of DES was the deviation from the average values of any of the 3 leading indicators. The examination results revealed the presence of DES in 795 (64.1%) patients with type 2 diabetes. When analyzing the occurrence of DES types depending on disorders of the component of the lacrimal complex, it was found that the least often in patients with type 2 diabetes was the secretory type of DES (6%), in which the symptom complex develops due to a decrease in the secretion of the lacrimal fluid.
Evaporic DES, in which there was an isolated defilement of the stability of the tear film (rapid evaporation of tears from the surface of the cornea), occurred in 36% of patients. Finally, the most common in patients was the mixed type of DES, in which both components occur (Fig. 1).

The distribution of patients in whom DES by the duration of diabetes mellitus showed that in 312 cases (39.2%), the duration of the disease was less than 10 years, and in 483 cases (60.8%), the duration of the disease was more than 10 years. At the same time, if we analyze the changes in the leading indicators of DES, it could be seen that in patients with the duration of the disease less than 10 years, pronounced subjective symptoms (86%) of DES more often detected in comparison with patients with the experience of DS more than 10 years (54%), which reflected in the results OSDI questionnaires. In patients with a disease duration of more than 10 years, a pronounced decrease in objective indicators was more often determined: the stability of the tear film (a decrease in TFBUT in 56% of cases about 27% with an experience of fewer than 10 years) and tear production (a decrease in 18.6% about 14, 4% with less than 10 years of experience) (Fig. 2).

The correlation between the average indicators in the studied groups from the duration of type 2 diabetes presented in Table 1. Statistical analysis showed a strong inverse correlation between the duration of the disease and the severity of subjective and objective indicators of DES. If TFBUT and total tear production indicators with an increase in diabetes mellitus significantly decrease ($r = -0.64$; $r = -0.84$), then the severity of subjective symptoms with an increase in the duration of diabetes significantly decreased ($r = -0.87$).

![Figure 1. The prevalence of DES in type I and II diabetes](image1)

![Figure 2. Features of the course of DES, depending on the experience of DS](image2)
IV. DISCUSSION

According to the latest 2019 studies, the prevalence of DES in the population ranged from 5% to 45% [14]. The frequency of DES was currently largely dependent on factors of a human-made nature (long-term work with various gadgets). Thus, in the United States, in the general population, the prevalence of DES, confirmed by objective ophthalmological studies, was 6.8%. At the same time, the conducted questionnaires of various social groups showed significantly higher numbers among the population.

In the literature, there were quite a few studies devoted to the dynamics of the clinical symptoms of DES in diabetes, depending on the level of glycemia and dyslipidemia. According to foreign studies, 35-55% of patients with diabetes had DES [16,17,18]. The Eissa study found that the prevalence of objective-based DES in DM is 54% 16. Other authors argued that the prevalence of DES in diabetic patients increases with age and is 50% more common in women than in men [8,9].

Some works indicated that the incidence of DES correlated with glycated haemoglobin level; that was, the higher the level of glycated haemoglobin, the higher the severity of DES [14]. The Beaver Dam Eye Study found that approximately 20% of DES cases occurred in people with type 2 diabetes between 43 and 86 years18. There were reports that 53% of patients with diabetes or pre-diabetes had clinically significant DES with severe subjective symptoms [16].

The results of our study showed that the prevalence of DES among patients with type 2 diabetes was 64%, which was significantly higher than the data of foreign authors. It should be noted that most of the identified cases were confirmed by objective research data - determination of total tear production and TFBUT. At the same time, attention drew to most of the patients of the mixed type of DES, which indicated that with diabetes, a complex lesion of the entire SFU occurs.

Noteworthy was the change in the clinical course of DES in patients with a different experience of diabetes mellitus. It was found that the prevalence of DES in individuals with more than 10 years of diabetes is almost 3 times higher in comparison with those with less than 10 years of the disease. At the same time, a feature of the course of DES with a diabetes duration of more than 10 years was a more prominent presence of objective signs in the form of reduced tear production and TFBUT, while in patients with a disease duration of fewer than 10 years, greater severity of subjective symptoms revealed. The results obtained can be explained by the gradual development of lesions of the sensitive nerve endings of the cornea, which were the development of diabetic polyneuropathy [8,12]. At the same time, in patients with less experience of diabetes, the cornea's sensitivity, as a rule, was preserved, as a result of which the subjective sensations of dryness, itching and other symptoms were more pronounced in them. In a patient with a relatively long history of the disease, due to a decrease in corneal sensitivity, the severity of subjective symptoms also decreased, even though SFU disorders continue to progress.

V. CONCLUSION

Thus, the data on the prevalence of DES in diabetes showed that the frequency of this ophthalmic pathology among this contingent of patients was relatively high. Even though DES did not lead to such noticeable visual impairments as diabetic retinopathy, it was the second most crucial ophthalmic complication of diabetes mellitus, necessitating its in-depth study. There was an increase in the prevalence of DES reported in recent years. In clinical practice, patients with diabetes mellitus regularly underwent fundus examinations. Examining the ocular surface and tear function suggested part of the ophthalmic assessment of diabetics and follow-up. Artificial tears and anti-inflammatory drugs without preservatives recommended to improve the hyperosmolar state of tears and reduce the local inflammatory response. In addition to the relevant DS, more attention should be paid to DES, the most common diabetic complication of eye disease in clinical practice, which was the leading cause of blindness. The pathogenesis of DES associated with diabetes remains unclear, and limited specific measures were available.

CONFLICT OF INTERESTS AND CONTRIBUTION OF AUTHORS

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