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# DEPOSITS OF URIC ACID CRYSTALS IN THE OCULAR STRUCTURES OF PATIENTS WITH GOAT

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**ABSTRACT** — AIM. To study the features of eye manifestations with gout.

**METHODS.** The study included 170 male patients with cataracts, aged 30 to 75 years, who were divided into two groups: the first group (control) — 60 patients without gout (100%), the second group (study) — 110 patients with cataract accompanied by gout (100%). In addition to standard ophthalmic testing, the level of uric acid in blood serum, in a tear and in the vagina of the anterior chamber was studied in all patients. These parameters allow to analyze deviations from the normal, a comparison of two independent groups using the non-parametric Mann-Whitney test. Data were median (25%; 75% percentile). Differences at which  $p < 0.05$  are considered statistically significant.

**RESULTS.** In the study group, deposits of uric acid crystals on the surface of the eye structures were found in 14 (13%) patients.

**CONCLUSIONS.** 15-year or more experience with gout associated with its regular therapy and prolonged hyperuricemia leads to an elevated level of uric acid in the tear and in the moisture of the anterior chamber and development of sodium monourate crystals and microtofuses on the ocular surface.

**KEYWORDS** — cataract, uric acid, gout, hyperuricemia, tophi.

## INTRODUCTION

Ophthalmic tophi for gout can be found on the conjunctiva, upper eyelid, lateral palpebral fissure, sclera, cornea, orbit, iris, lens and anterior chamber of the eye in patients with gout (Morris & Fleming, 2003; Ferry et al., 1985; Topping et al., 2003; Coassin et al., 2006; Lo et al., 2005). Corneal tophi was found in the epithelium and stroma of the cornea (Slansky & Kubara, 1968; Fishman & Sunderman, 1966). Mono-sodium urate crystals were confirmed in the cornea using polarized light microscopy (Bernad et al., 2006; Sarma et al., 2010), and a histopathological study confirmed gouty tophi in one of the latest studies (Sarma et al., 2010). Although ocular manifestations of gout have been reported, most of them are reports of isolated cases. The pathogenetic and clinical features

of the ophthalmic manifestations of gout are still not well understood.

## MATERIALS AND METHODS

The study was carried out at the Department of Ophthalmology of the RUDN University and at the Department of Ophthalmology at the Sin State Medical University named after Sino, Dushanbe.

The study included 170 patients with male cataracts, aged 30 to 75 years, who were divided into two groups: the first group (control) — patients without gout 60 patients (100%), the second group (study) — patients with cataract complicated gout 110 patients (100%). All patients signed an informed consent to participate in the study and the processing of personal data.

The exclusion criteria from the study were: glaucoma, history of surgery and eye injuries, general diseases (autoimmune, diabetes mellitus), coronary heart disease, chronic renal failure.

In addition to standard studies of ophthalmic methods, all patients were also determined: the level of uric acid in blood serum, in a tear and in the vagina of the anterior chamber. The diagnosis of gout is established by signs of ACR/EULAR (2015). Microsoft Excel 2019 and Statistic 20. These parameters allow you to analyze deviations from the normal, a comparison of two independent groups using the non-parametric Mann-Whitney test. Data were median (25%; 75% percentile). Differences at which  $p < 0.05$  are considered statistically significant.

## RESULTS

Deposition of uric acid crystals on the surface of the eye.

In the control group, no changes were found in the form of deposition of uric acid crystals on the surface of the eye structures.

In the study group, deposits of uric acid crystals on the surface of the eye structures were found in 14 (13%) patients. On the cornea in 3 (2.7%) patients, deposits were found in the epithelium and superficial stroma of the cornea, the crystals had an irregular shape, each measuring about  $0.2 \times 0.4$  mm, separated by a transparent ring-shaped zone of high density. Fluorescein staining of the deposits was negative. There were no clinical signs of inflammation in or around the crystals.

Uric acid crystals were found in the sclera in 3 (2.7%) patients, chalky-white irregularly shaped, approximately  $2 \times 3$  mm in size, separated from the other sclera by a transparent ring-shaped zone of high density. No clinical signs of inflammation were found in or around the crystals.

Gonioscopy revealed translucent material in 2 (1.8%) patients of the study group in the lower part of the anterior chamber angle.

Numerous transparent gelatinous deposits were found on the surface of the iris and on the edge of the pupil of 2 (1.8%) patients.

On the conjunctiva of the eyeball in 4 (3.6%) patients, clusters of refractory and cuboid subconjunctival crystals were found, each approximately 1 mm in the bulbar conjunctiva near the upper and lower limbs, separated from the cornea by a clean zone. There were no clinical signs of inflammation in or around the crystals.

In patients of the study group with the presence of crystalline deposits on the structures of the eyes, multiple tophi of the auricle, massive tophi in the area of the elbow joints, joints of the hands and feet were observed. The duration of gout disease was more than 15 years. These patients did not receive regular therapeutic treatment for gout.

In all patients of the control and study groups, the level of uric acid in the blood serum, in daily urine, in the tear and in the moisture of the anterior chamber (MIC) was determined (Tabl. 1).

**Table 1.** The concentration of uric acid in various environments in the control and study groups.

The concentration of uric acid in various environments	Control group	Study group	P
In the blood, $\mu\text{mol/l}$	277.0 (251.0-304.3) <sup>2</sup>	697.55 (426.7-801.65) <sup>2</sup>	< 0.0001 <sup>1</sup>
In a tear, mcg/ml	10.9 (10.6-11.3) <sup>2</sup>	23,65 (17.2-27.6) <sup>2</sup>	< 0.0001 <sup>1</sup>
In the MIC, mcg/ml	8.0 (7.7-8.3) <sup>2</sup>	19.15 (11.925-23.025) <sup>2</sup>	< 0.0001 <sup>1</sup>

**Note:** 1- Mann-Whitney criteria are used for statistical analysis; 2 — median (25% quartile, 75% quartile)

The concentration of uric acid in various media in patients of the study group was significantly increased compared with patients in the control group ( $p < 0.0001$ ) (Tabl. 1).

## DISCUSSION

A large number of epidemiological studies show that in recent years the incidence of gout has been increasing. But despite this, little attention is paid to eye complications caused by gout. With an increase in the level of uric acid in blood serum  $> 360 \mu\text{mol/l}$ , it saturates biological fluids, which leads to its crystallization in the form of monosodium salt when the super-saturation point is reached. Clinically, this is manifested by the formation of tophi. Tophi are nodules formed during the deposition of sodium monourate in tissues, during which a slow epitaxial growth of crystals occurs with the formation of crystalline structures.

In the eye, precipitation of urate crystals has been described in the eyelids, tarsal plates, conjunctiva, cornea, sclera, tendons of extraocular muscles, orbit, lens, anterior chamber (Morris & Fleming, 2003; Topping et al., 2003; Martinez-Cordero et al., 1986; Slansky & Kubara, 1968; Fishman & Sunderman, 1966; Margo, 2004). Eye structures may be a weaker solvent for sodium monourate than plasma; with hyperuricemia, urate becomes oversaturated, especially at lower temperatures. With prolonged hyperuricemia, urate crystals and micro tophi develop in the eye structures.

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