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ГЛАУКОМА С НИЗКИМ ВНУТРИГЛАЗНЫМ ДАВЛЕНИЕМ СРЕДИ ЖИТЕЛЕЙ ГОРОДА ДУШАНБЕ, РЕСПУБЛИКИ ТАДЖИКИСТАН

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Аннотация. Актуальность. Артериальная гипотензия негативно влияет на функцию глаз. Известно, что «глаукома» и «повышенное внутриглазное давление» не являются синонимами. Глазная гипертензия может наблюдаться без признаков глаукомы, а глаукома может возникать без повышения внутриглазного давления. Повышенное ВГД не является безусловным признаком глаукомы. Этот факт побуждает исследователей изучать другие причины глаукоматозной оптической нейропатии. **Цель исследования.** Изучить клиническое течение глаукомы с низким офтальмотонусом у жителей Душанбе. **Материалы и методы.** В ходе исследования было установлено, что у 16,1% пациентов с нормотензивной глаукомой наблюдалась артериальная гипертензия, у 64,5% - артериальная гипотензия и у 19,4% - нормальное артериальное давление. Пациентам были проведены стандартные обследования: биомикроскопия, офтальмоскопия, измерение остроты зрения, гониоскопия, периметрия, тонометрия и эхобиометрия. Толерантное давление определяли по методу А.М. Водозова, при котором пациенты получали смесь глицерола-аскорбата (50%-го глицерина в дозе 1,5 г/кг массы тела с аскорбиновой кислотой 0,1 г/кг). После трёхкратного закапывания анестетика измеряли ВГД с помощью тонометра Маклакова (10 г) каждые 30 минут в течение одного часа. Допустимый уровень был определён как уровень, при котором показатели давления стабилизировались. Индекс непереносимости рассчитывался как разница между тонометрическим и толерантным давлением. Обязательным условием для включения в исследование было отсутствие предшествующих лазерных или хирургических вмешательств на исследуемом глазу. **Результаты и заключение.** Из 40 пациентов (80 глаз) угол передней камеры был открыт у 32 пациентов (64 глаза) и закрыт у 8 пациентов (16 глаз). Острота зрения снижалась по мере прогрессирования глаукомы, при этом острота зрения составляла 0,9-1,0 в 14% глаз, 0,7-0,8 в 25%, 0,4-0,6 в 29% и 0,1-0,3 в 32% глаз. Артериальная гипотензия негативно влияет на сосудистую систему глаза, приводя к сужению поля зрения. Микроскотомы были обнаружены в нижнем внутреннем сегменте у 57% пациентов, одиночные скотомы наблюдались у 13% пациентов с нормальным артериальным давлением, а носовые скотомы были обнаружены у 30% лиц с низким артериальным давлением. У пациентов в возрасте 40-49 лет ВГД было зафиксировано на уровне $17 \pm 1,0$ мм рт. ст. Глаукома с низким внутриглазным давлением характеризуется ранним началом и значительными изменениями, включая дистрофические изменения угла передней камеры, изменения диска зрительного нерва и сужение периферического поля зрения.

Ключевые слова: первичная открытоугольная глаукома, глаукома с низким офтальмотонусом, артериальная гипотензия, артериальное давление.

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GLAUCOMA WITH LOW OPHTHALMOTONUS AMONG RESIDENTS OF THE CITY OF DUSHANBE, REPUBLIC OF TAJIKISTAN

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Abstract. Relevance. Arterial hypotension negatively affects eye function. It is known that 'glaucoma' and 'elevated intraocular pressure' are not synonymous. There can be ocular hypertension without signs of glaucoma, and glaucoma can occur without elevated intraocular pressure. Elevated IOP is not an absolute sign of glaucoma. This fact drives researchers to explore other causes of glaucomatous optic neuropathy. **Purpose of the study.** To study the clinical course of glaucoma with low ophthalmotonus among residents of Dushanbe. **Materials and methods.** The study established that 16.1% of individuals with normotensive glaucoma had arterial hypertension, 64.5% had arterial hypotension, and 19.4% had normal arterial pressure. Patients underwent standard examinations: biomicroscopy, ophthalmoscopy, visual acuity measurement, gonioscopy, perimetry, tonometry, and echobiometry. Tolerant pressure was determined using A.M. Vodovozov's method, where patients received a mixture of glycerol ascorbate, 50% glycerin at a dose of 1.5 g/kg body weight, with ascorbic acid 0.1 g/kg. After three cycles of dicainization, IOP was measured with a Maklakov tonometer (10 g) every 30 minutes for one hour. The tolerance level was established as the level at which pressure readings stabilized. The intolerance index was calculated as the difference between tonometric and tolerant pressures. A mandatory condition for inclusion in the study was the absence of prior laser or surgical interventions on the examined eye. **Results and conclusion.** Among 40 patients (80 eyes), the anterior chamber angle was open in 32 patients (64 eyes) and closed in 8 patients (16 eyes). Visual acuity decreased with the progression of glaucoma, with visual acuity of 0.9-1.0 in 14% of eyes, 0.7-0.8 in 25%, 0.4-0.6 in 29%, and 0.1-0.3 in 32% of eyes. Arterial hypotension negatively affected the vascular system of the eye, leading to a constriction of the visual field. Microscotomas were detected in the lower inner segment in 57% of patients, single scotomas were observed in 13% of patients with normal blood pressure, and nasal scotomas were found in 30% of individuals with low blood pressure. In patients aged 40-49 years, IOP was recorded at 17 ± 1.0 mm Hg. Glaucoma with low intraocular pressure is characterized by early onset and significant changes, including dystrophic changes in the anterior chamber angle, optic disc alterations, and peripheral visual field narrowing.

Key words: primary open-angle glaucoma, glaucoma with low ophthalmotonus, hypotension, blood pressure.

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Relevance. The relationship between blood pressure (BP) and ophthalmotonus has long attracted the attention of ophthalmologists. Observations have shown that among residents of Tajikistan's capital, people with relatively low blood pressure predominate. Arterial hypotension negatively affects eye function. More than 106 million people suffer from glaucoma, with over three million becoming blind as a result (WHO report, Quigley HA, Dr. Tedros, 2019). The issue of glaucoma with low ophthalmotonus is not sufficiently covered, and the available information is scarce and contradictory. The frequency of this pathology in primary open-angle glaucoma (POAG) ranges from 11 to 50%, according to various authors. In Russia, the frequency of glaucoma with low ophthalmotonus is 27.2% (Abramova T.V. et al., 2019), and in Central Asia, it reaches 28% (WHO 2019). This is due to the polymorphism of the clinical picture and the lack of uniform diagnostic criteria. The hidden course of the disease leads to rapid visual function loss. Early detection of GNO and subsequent clinical observation with systematic therapy help stabilize the process.

Risk factors for glaucoma include circulatory disorders, high or low blood pressure, orthostatic hypotension, excessive nighttime BP reduction, and Raynaud's syndrome. Refractive errors such as hyperopia and myopia increase the risk of glaucoma. There is no consensus on the role of diabetes mellitus in primary open-angle glaucoma pathogenesis. Some authors consider diabetes mellitus a risk factor, while others note no connection. Optic neuropathy progression is more pronounced in myopic patients. Among glaucoma patients, myopia cases from -1.0 to -5.0 diopters are 2-6 times more common than among healthy individuals.

Thinning of the cornea is also considered a risk factor for glaucoma development and progression due to its influence on the true level of intraocular pressure. Individuals with corneal thickness below 520 microns are at increased risk of primary open-angle glaucoma. A direct connection between corneal thickness and the condition of the lamina cribrosa has been suggested. Corneal thickness decreases by 40 microns with age, increasing glaucoma risk by 71%. The optic nerve head size is also important in glaucoma development. It was found that with each decade of life, the horizontal ratio of optic disc diameter and disc excavation (C/D) increases by 0.1, raising the risk of glaucoma by 32%. Larger optic nerve heads are more likely to be damaged, but they also contain more nerve fibers, providing a structural reserve.

According to A.P. Nesterov, «the more developed the vascular network and supporting tissue of the optic nerve head, the more resistant it is to increased IOP. Proponents of the vascular nature of optic nerve atrophy believe that increased IOP damages the 3rd retinal neuron due to ischemia caused by compression of vessels supplying the optic nerve head».

Purpose of the study. To study the clinical course of glaucoma with low ophthalmotonus in residents of Dushanbe.

Materials and methods. The study was conducted in the eye department of the State Institution National Medical Center of the Republic of Tatarstan «Shifobakhsh».

Inclusion criteria:

- Age 18 and older
- Patients with primary glaucoma with low ophthalmotonus at the initial, developed, and advanced stages.

Exclusion criteria:

- Age 0-17 years
- Diagnosis of secondary glaucoma or glaucoma with high IOP

Forty people (80 eyes) were under our supervision. In 18 patients (36 eyes), glaucoma with low ophthalmotonus was detected, in 6 (12 eyes) - POAG at various stages, and in 16 patients (32 eyes) with different blood pressure levels. All subjects were aged 42 to 82 years. Women – 28 (70%) aged 43 to 79, men – 12 (30%) aged 42 to 82.

The patients included in the study were distributed into groups as follows: the group with the initial stage of GNO included 34 individuals (42 eyes) aged 42 to 72 years, with an average age of 63 ± 8.0 years. The group with an advanced stage of GNO consisted of 19 patients (16 eyes) aged 65 to 79 years, with an average age of 70 ± 6.2 years. Additionally, 26 individuals (22 eyes) with an advanced stage of the glaucomatous process were aged 62 to 82 years, with an average age of 73 ± 6.4 years.

The diagnostic criteria for normal pressure glaucoma were as follows: changes in the optic nerve head (ONH) and visual field typical of glaucoma; intraocular pressure (IOP) without treatment within the average statistical norm but exceeding the value of individually tolerable pressure; an open anterior chamber angle during gonioscopy; and the absence of any secondary causes of glaucoma. All patients with normal tension glaucoma were examined by a physician. Based on the data obtained, arterial hypertension was found in 16.1% of patients with normotensive glaucoma, arterial hypotension in 64.5%, and arterial normotension in 19.4%.

The patients underwent standard research methods, including biomicroscopy, ophthalmoscopy, visometry, gonioscopy, perimetry, tonometry, and echobiometry. Tolerant pressure was also determined using A.M. Vodovozova's method. The patient was given a mixture of glycerascorbate (glycerol 50% at 1.5 g/kg body weight) and ascorbic acid (0.1 g/kg). After three applications of dicainization to the eyes, IOP was measured with a Maklakov tonometer (10 g) an hour later, and then every 30 minutes until the values were recorded and this level was found to be tolerable. The intolerance index, calculated as the difference between tonometric and tolerance pressures, was used as an indicator. A prerequisite for inclusion in the study was the absence of a history of laser or surgical interventions on the studied eye.

State of the Anterior Chamber Angle in Patients with GNO. Of the 40 patients (80 eyes) studied, the anterior chamber angle was open in 32 patients (64 eyes) and closed in 8 patients (16 eyes).

State of Visual Acuity in Patients with GNO: As glaucoma progresses, the visual field narrows. The following data were observed: narrowing of the visual field by 50-100 degrees in 42 eyes (52.5%); 100-350 degrees in 16 eyes (20%); and more than 350 degrees in 22 eyes (27.5%).

The state of the peripheral visual field in patients with GNO. Arterial hypotension negatively affects the vascular system of the eye, which leads to a narrowing of the visual field. According to A.P. Nesterov, "the more developed the vascular network and supporting tissue of the optic nerve head, the more resistant it is to the effects of increased IOP. Proponents of the vascular nature of optic nerve atrophy believe that increased

Table 1. The gender distribution of the patients

Floor	Quantity	Age	r
Men	70% (28)	43-79	<0.001 (p =0.000; df =1; χ^2 =17.45)
Women	30% (12)	42-82	

Table 2. Stages of glaucoma, number and age of patients

Type of glaucoma	Number of eyes	Age	r
Initial stage of GNO	n=42 (52.5%)	From 42 to 72 years (average age 63 ± 8.0 years)	>0.05 (=0.216; df =1; χ^2 =1.53)
Advanced stage of GNO	n=16 (20%)	From 65 to 79 years (average age 70 ± 6.2 years)	>0.05 (=0.210; df =1; χ^2 =1.53)*
Advanced stage of GNO	n=22 (27.5%)	From 62 to 82 years (average age 70 ± 6.2 years)	>0.05 (=0.324; df =1; χ^2 =0.97)*

Table 3. Stages of glaucoma and the number of patients' eyes

Type of glaucoma	Number of eyes	r
Initial stage of GNO	n=42 (52.5%)	>0.05 (=0.216; df =1; χ^2 =1.53)
Advanced stage of GNO	n=16 (20%)	>0.05 (=0.210; df =1; χ^2 =1.53)*
Advanced stage of GNO	n=22 (27.5%)	>0.05 (=0.324; df =1; χ^2 =0.97)*

IOP causes damage to the 3rd retinal neuron due to ischemia, which occurs due to compression of the vessels providing blood supply to the head of the optic nerve.

Microscotomas were detected in 57% of patients in the lower internal segment, single scotomas were observed in 13% of patients with normal blood pressure, and nasal scotomas were observed in 30% of patients with low blood pressure. Indicators of tolerant and tonometric IOP in patients with GNO. When studying tolerance pressure in subjects aged 40-49 years, an IOP of 17 ± 1.0 mm Hg. Art., and when studying tonometric pressure, IOP was 21 ± 1.0 mm Hg. Art. In patients aged 50-59 years, when measuring tolerant pressure, the IOP was 19 ± 1.0 mm Hg. Art., and the level of tonometric pressure is 23 ± 1.0 mm Hg. Art. In subjects aged 60-69 years, the tolerant IOP was 21 ± 1.0 mm Hg. Art., and tonometric IOP – 24 ± 1.0 mm Hg. Art. In the examined individuals aged 70-80 years, when measuring tolerance pressure, the IOP indicator was 23 ± 1.0 mm Hg. Art., and tonometric IOP was 26 ± 1.0 mm Hg. Art. Based on the above data, we can conclude that the level of tolerant pressure is lower than tonometric pressure, although it is within the average statistical norm. Condition of the optic nerve head and visual field in patients with GNO. Optic disc atrophy was observed in 17 patients, optic disc drusen – in 8 patients, ischemic neuropathy was observed in 10 patients, neuritis – in 5 examined individuals. Comparison of the magnitude of optic disc excavation depending on the field of view in patients with GNO showed that as excavation of the optic disc increases, the field of vision narrows. A comparison of ocular

hydrodynamics indices in glaucoma with normal pressure and POAG revealed the following features. The overall coefficient of ease of outflow with GNO is higher in comparison with POAG. This is achieved due to a compensatory increase in the outflow of intraocular fluid along the uveoscleral pathway in normal pressure glaucoma. While with POAG this figure will decrease as the disease progresses. The dynamics of changes in the coefficient of ease of outflow along the drainage path with GNO are similar to those with POAG. However, the degree of decrease in outflow along the drainage path in normal-tension glaucoma is more pronounced than in typical glaucoma. Accordingly, the uveoscleral coefficient in normal-tension glaucoma is higher than in POAG. Summarizing the presented data, it should be noted that in the climate of Dushanbe, people with general arterial hypotension predominate, which has a pathogenetic effect on the manifestation and course of glaucoma with low ophthalmotonus.

Conclusions. Thus, the clinical features of glaucoma with low ophthalmotonus in residents of Dushanbe are characterized by the early manifestation and severity of dystrophic changes in the anterior chamber angle, atrophic changes in the optic nerve head and narrowing of the boundaries of the peripheral and central visual field.

In patients with glaucoma with normal IOP and arterial hypotension, a more pronounced decline in visual functions is observed compared to normotensive and hypertensive patients, who have cases, visual acuity and peripheral vision boundaries remained stable.

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