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RESEARCH ARTICLE

PRIMARY OPEN-ANGLE GLAUCOMA IN PATIENTS WITH DIABETIC RETINOPATHY IN TYPE 2 DIABETES

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ABSTRACT

Background: The common mechanisms of diabetic retinopathy (DR) in type 2 diabetes mellitus (DM2) and glaucoma optic neuropathy (GON) in primary open-angle glaucoma (POAG) justify the need to study possible clinical variants of their combination. **Objective**: to study the clinical features of the combination of POAG and DR in diabetes mellitus2 and their mutual influence on the progression of diseases by stages. **Material and Methods**: 301 patients with diabetes mellitus 2 and POAG were examined, 164 patients who had diabetes mellitus2 and DR but did not have POAG; 81 patients who had POAG but no diabetes mellitus and 103 patients who had neither diabetes mellitus nor POAG. A total of 649 patients (649 eyes) were examined. The stage of DR was established according to the classification of the American Academy of Ophthalmology (2002); stage POAG – for the classification of perimetric changes by stages of glaucoma. MedStat and MedCalc v.15.1 (MedCalc Software bvba) were used for statistical research. **Results**. Among patients with a combination of DR and POAG, 42.9% initially developed diabetes mellitus, which was joined by POAG after 1-7 years. Another 57.1% of patients first developed POAG, and later (after 1-8 years) – diabetes mellitus2. The vast majority of patients with diabetes mellitus2 and POAG (79.1%) had stage II and III POAG. Stage IV POAG had 14.6% of patients who initially developed POAG with a disease duration of 10 to 30 years (average 20.5±0.8 years). Among patients with diabetes mellitus and POAG, the proportion of normotensive glaucoma (NTG) was 18.6%. All of these patients had stage II or III. The calculation of the progression index in relation to the stage of the disease to its duration showed, that the burden of POAG development of diabetes mellitus does not accelerate the progression of either GON or DR. With the development of POAG in patients with diabetes mellitus, the progression of GON significantly (2.8 times) accelerated. **Conclusion**. Thus, the clinical features of the combination of POAG and DR in diabetes mellitus and the phenomenon of mutual burdening of their course have been established.

INTRODUCTION

Medical and statistical studies show a steady increase in the prevalence and incidence of type 2 diabetes mellitus (DM2) worldwide [1-3]. Almost 94 million people have diabetogenic eye disease [4, 5]. Today, diabetes is considered a metabolic disease with a violation of carbohydrate and all other types of metabolism, as well as nervous and humoral regulation [6]. One of the most common manifestations of eye damage in diabetes mellitus2 is diabetic retinopathy (DR) [4, 5]. Glaucoma currently affects more than 75 million people, and its prevalence among people aged 40 to 80 years is 3.54%; more than 75% of such patients have primary open-angle glaucoma (POAG) [7]. It is believed, that the main mechanism of development of a specific pathological process for POAG – glaucoma optic neuropathy (GON), as well as DR, are metabolic and regulatory disorders [8]. A small number of publications have been devoted to the study of glaucoma status in patients with DM2 and DR.

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The prevalence of glaucoma in patients with diabetes mellitus was found to be 15.6%, and its presence is associated with the duration of diabetes [9]. Meta-analysis data showed that diabetes increased the incidence of glaucoma by 36% [10]. The prevalence of POAG in patients with diabetes mellitus was 5-6 times higher than in the general population [11]. It has also been shown that patients with DM2 had twice the relative risk of developing glaucoma, and the presence of DR increased this risk [12], indicating a strong association between diabetes mellitus and glaucoma.

Objective: To determine the clinical features of the combination of POAG and DR in diabetes mellitus2 and their mutual influence on the progression of diseases by stages.

MATERIAL AND METHODS

The study was conducted in the period 2016-2020. It examined 1,450 patients with DM2 aged 45 to 75 years, among whom there were 970 (66.9%) men and 480 (33.1%) women. The duration of DM2 was from 2 to 15 years. Of the examined 301

patients (301 eye) had DM2 and DR of different stages and POAG; 164 patients had DM2 and DR of different stages, but did not have POAG. In addition, the study included 81 patients who had POAG but no diabetes mellitus and 103 patients who had neither diabetes mellitus nor POAG and were examined and treated for age-related cataracts. All patients underwent conventional ophthalmological examinations, which included visometry, refractometry, tonometry, static computer perimetry, gonioscopy, biomicroscopy, and ophthalmoscopy. Ophthalmoscopy was performed using an aspherical Volk Super/Field lens (NC USA) and a Goldman three-mirror contact lens. Patients also underwent spectral domain optical coherence tomography (OCT) on Optopoltechnology, SOCT, Copernicus REVO (used Retina 3D, Retina Raster, Retina Angio, Retina Angio Wide protocols; if necessary, performed anterior segment examination – Anterior Raster protocol; applied the regime "Follow up"; studied the structure and reflectivity of the retinal layers, CRT – central retinal thickness, MT – macular thickness, MV – macular volume; investigated the parameters of FAZ – foveolar avascular zone, and VBFA – vascular blood flow area; RNFL – retinal nerve fibro layers; GCL – a complex of ganglion cells, studied the area and volume of the neuroretinal girdle, excavation, maximum and minimum depth of excavation, asymmetry of damage, the ratio of excavation/disk on the parameters of area, vertical and horizontal, and DDLS – disc damage lesion scale. If necessary, applied the fundus camera, sometimes with photography in 7 standard fields, according to the modified ETDRS system of clinical signs Airlie House [13]. The International Clinical Scale of Diabetic Retinopathy of the American Academy of Ophthalmology (2002) was used to determine the stage of DR [14]. The 1st group included 107 patients with stage I with DR level on the final ETDRS scale 10, 14, 15 (no retinopathy). The 2nd group included 205 patients with non-proliferative DR (NPDR) with the level of DR on the ETDRS scale from 20 to 53 (DR II-IV stages). The 3rd group included 153 patients with proliferative DR (PDR) with a DR level on the ETDRS scale of 61 or more (stage V DR).

After the Kolmogorov-Smirnov, Anderson-Darling and χ-squares tests, the distribution of variation series different from the normal one was found ($p<0.05$). In this regard, the median (Me) and the first and third quartiles (QI-QIII) of variation series were used for descriptive statistics of quantitative data. Comparison tables and non-parametric Pearson's χ2 criterion were used to compare categorical variables. In all cases, statistical evaluation of $p<0.05$ was considered plausible. **Results**. Of the total number of subjects with diabetes mellitus (n=1 450), stage I DR (no retinopathy) was detected in 330 (22.8%) patients, NPDR – in 635 (43.8%) patients and PDR – in 485 (33.4%) patients. Among all these patients, 1 149 (79.2%) had no glaucoma. In the remaining 301 patients (20.8%) was diagnosed with POAG. Data from these 301 patients were selected for further analysis (Table 1). Among patients of the 1st group (stage I DR), stage I of the POAG had 19 people (6.3% of the number of patients with POAG and DM2), stage II had 29 patients (9.6%), stage III had 15 patients (5.0%) and stage IV had 4 (1.3%) patients. In patients of the 2nd group (with NPDR), POAG of the I stage was not established at any person (0%), the II stage was established at 54 (17,9%), the III stage – at 66 (21.9%) and stage IV – in 17 (5.6%). In patients of the 3rd group (with PDR), POAG stage I was also not found in any person (0%), stage II – in 21 (7.0%), stage III–- in 53 (17, 6%) and stage IV – in 23 (7.6%).

Thus, among patients with stage I DR, the maximum number (48 people out of 67 –71.6%) had stage I and II POAG, among patients with NPDR most (120 people out of 137 – 87.6%) had stages II and III POAG, and among patients with PDA – III and IV stages of POAG (76 people out of 97 – 78.4%). Differences in Pearson's xi-square test were statistically significant ($p<0.01$). Thus, we can say that the general trend was the correspondence of the progression of the stages of DR and POAG. The Table 2 shows the general clinical indicators of patients in groups of DR. By age, patients in the control, 1st and 2nd groups did not differ significantly (given Me (first and third quartiles – QI-QIII)): 72 (64-76), 68 (61-74) and 71 (62-74) years, while patients of the 3rd group who had PDA were

Table 1. Distribution of patients by groups (by stages of DR) and by stages of POAG (n=649)

Stages of POAG		Control of DR, n=184	Groups			Multiple intergroup comparisons
			1st (DR I), n=107	2nd (NPDR), n=205	3rd (PDR), n=153	
0 (Control of POAG)		103 56,0±3,7%	40 37,4±4,7%	68 33,2±3,3%	56 36,6±3,9%	χ^2=162,47; p<0,001
I		0 -	19 17,8±3,7%	0 -	0 -	
II		42 22,8±3,1%	29 27,1±4,3%	54 26,3±3,1%	21 13,7±2,8%	
III		39 21,2±3,0%	15 14,0±3,4%	66 32,2±3,3%	53 34,6±3,8%	
IV		0 -	4 3,7±1,8%	17 8,3±1,9%	23 15,1±2,9%	
PP	Control of DR	-	χ^2=47,70; p<0,001	χ^2=31,56; p<0,001	χ^2=43,54; p<0,001	-
	1st group		-	χ^2=47,89; p<0,001	χ^2=51,01; p<0,001	
	2nd group			-	χ^2=10,67; p=0,014	

Notes: χ^2 – Pearson's criterion; PP – paired intergroup comparisons.

To establish the stage of POAG used the classification of primary glaucoma A.P. Nesterov & A.Ya. Bunin (1976) and the classification of perimetric changes by stages of glaucoma [15]. There were initial (stage I); developed (stage II); the far-reaching one (stage III) and the terminal one (stage IV). Glucose content in blood was determined by glucose oxidase method and glycated hemoglobin (HbA1c) by chromatographic method. MedStat and MedCalc v.15.1 (MedCalc Software bvba) were used for statistical research. younger – 63 (55-66) years ($p<0.001$). By sex, the distribution of patients in all three groups did not differ: men were 59.8-72.9%, women – 27.1-40.2% ($p=0.144$). The duration of DM2 by groups significantly increased and amounted to, respectively, 4 (2-7) years, 7 (3-11) years and 12 (8-15) years ($p<0,001$). The duration of POAG also increased and amounted to groups, respectively: 2 (0-5) years, 4 (0-9) years and 5 (0-16) years ($p<0,001$). This indicated the dependence of the severity of DR and POAG on the duration of the

pathological process and the acceleration of their development under conditions of their combination. By stages of POAG patients of the 1st group had mainly I, and patients of the 2nd and 3rd groups – mainly II stage.

the number of patients with DM2 and POAG) in the anamnesis first noted the development of DM2, which joined 1-7 years of POAG (in table. 2, this subgroup is designated DM2+POAG), and 140 people (57.1%) had at first the development of

Table 2. General clinical indicators of patients by groups of DR

Indicators		Control of DR	Groups			Multiple intergroup comparisons
			1st	2nd	3rd	
Age, years		72 (64-76)	68 (61-74)	71 (62-74)	63 (55-66)	H=91,08; p<0,001
PP	Control of DR	-	0,056	0,240	<0,001	-
	1st group		-	1,000	<0,001	
	2nd group			-	<0,001	
Sex	men	110 59,8±3,6%	78 72,9±4,3%	131 63,9±3,3%	102 66,7±3,8%	χ^2=5,42; p=0,144
	women	74 40,2±3,6%	29 27,1±4,3%	74 36,1±3,3%	51 33,3±3,8%	
Duration of DM2, years		0 (0-0)	4 (2-7)	7 (3-11)	12 (8-15)	H=471,46; p<0,001
PP	Control of DR	-	<0,001	<0,001	<0,001	-
	1st group		-	0,003	<0,001	
	2nd group			-	<0,001	
Duration of POAG, years		0 (0-6)	2 (0-5)	4 (0-9)	5 (0-16)	H=38,34; p<0,001
PP	Control of DR	-	1,000	<0,001	<0,001	-
	1st group		-	0,127	0,003	
	2nd group			-	0,806	
Stages of POAG		0 (0-II)	I (0-II)	II (0-III)	II (0-III)	H=41,09; p<0,001
PP	Control of DR	-	1,000	<0,001	<0,001	-
	1st group		-	0,021	0,004	
	2nd group			-	1,000	

Notes: image format for discrete data – Me (QI-QIII), for nominal – n, %; H – Kruskel-Wallis criterion for multiple comparisons; χ_2 – Pearson's criterion; PP – paired comparisons (performed under the established probability of differences of multiple intergroup comparisons; bilateral levels of significance with Bonferroni correction are given).

Table 3. Distribution of patients by glaucoma status by groups of DR

Glaucoma status		Groups			Multiple intergroup comparisons
		1st	2nd	3rd	
Control of POAG (DM2 without of POAG)		40 (37,4±4,7%)	68 (33,2±3,3%)	56 (36,6±3,9%)	χ^2=28,59; p<0,001
DM2+POAG		25 (23,3±4,1%)	52 (25,4±3,0%)	28 (18,3±3,5%)	
POAG+DM2		31 (29,0±4,4%)	57 (27,8±3,1%)	52 (34,0±3,8%)	
DM2+NTG		5 (20,8±2,0%)	8 (33,3±1,3%)	11 (45,9±2,1%)	
NTG+DM2		6 (18,7±2,2%)	20 (62,6±2,0%)	6 (18,7±1,6%)	
PP	1st group	-	χ^2=1,15; p=0,765	χ^2=1,34; p=0,720	-
	2nd group		-	χ^2=3,81; p=0,283	

Notes: χ^2 – Pearson's criterion; PP – paired intergroup comparisons.

Table 4. Distribution of patients by stages of POAG at different combinations of DR and POAG

Stages of POAG		Control of DR, n=184	DM2+ POAG, n=105	POAG+ DM2, n=140	NTG+ DM2, n=56	Multiple intergroup comparisons
0 (Control of POAG)		103 56,0±3,7%	-	-	-	χ^2=689,61; p<0,001
I		-	19 18,0%3,8±	-	-	
II		42 22,8±3,1%	43 41,0±4,8%	31 22,1±3,5%	30 53,6±6,7%	
III		39 21,2±3,0%	43 41,0±4,8%	65 46,4±4,2%	26 46,4±6,7%	
IV		-	-	44 31,5±3,9%	-	
PP	Control of DR	-	χ^2=108,74; p<0,001	χ^2=151,98; p<0,001	χ^2=54,97; p<0,001	-
	DM2+POAG		-	χ^2=65,77; p<0,001	χ^2=11,67; p=0,003	
	POAG+DM2			-	χ^2=30,29; p<0,001	

Notes: χ^2 – Pearson's criterion; PP – paired intergroup comparisons.

Analysis of glaucoma status (Table 3) showed that patients were distributed as follows: without glaucoma – 164 (35.3%), and with glaucoma – 301 (64.7%) patients; among the latter with POAG were 245 people (81.4%) and with normotensive glaucoma (NTG) – 56 (18.6%). Detailed distribution of patients by glaucoma status by groups of DR are presented in table. 3. At the same time, patients with a combination of DR and POAG had the following feature: 105 people (42.9% of

POAG, and later (after 1-8 years) – DM2 (in Table 2 marked POAG+DM2). Among patients with NTG, the duration of DM2 and POAG was also different: in 32 (57.1%) NTG lasted longer, and in 24 (42.9%) – DM2. Thus, among all patients with DM2 and POAG (n=301), 129 (42.9%) initially developed DM2, and the remaining 172 (57.1%) – POAG. In our opinion, this feature of the clinical combination was important because it allowed to identify the primary

pathological process, and the analysis of such cases separately should indicate certain features of the pathogenesis, diagnosis and treatment. According to this observation, the distribution of patients by stages of POAG at different combinations of DR and POAG was analyzed separately (Table 4). The vast majority of patients (79.1%) had stage II and III POAG. Among all patients with stage IV had only 44 people (14.6% of patients with a combination of DM2 and POAG, n=301) from the subgroup POAG+DM2, who had the maximum duration of the disease (from 10 to 30 years, an average – 20.5±0.8 years). This observation suggested that the stage of POAG directly depends on its duration, but in combination with CD2 progression of GON is faster. In addition, from the analysis of Tables 5 and 6 it follows that the stage of POAG depends on its clinical combination with DR. The distribution of patients in groups by POAG stages (subgroup DM2+POAG) are given in Table 5, and the subgroup POAG+DM2 – in Table 6. Thus, in the subgroup DM2+POAG patients mostly had stage I or II POAG (62 out of 105 – 59.0%), while in the subgroup POAG+DM2 – mainly stage III and IV (109 out of 140 – 77.9%), the difference is significant at p<0,001.

more thorough analysis of the interdependence of stages DR and POAG. The table 7 shows the distribution of patients in groups by stages of POAG (subgroup NTG+DM2). All patients with DM2 and NTG had stage II or III POAG, with the independence of the distribution from clinical variants of DM2 and NTG (p=0.100). To objectify the data on the progression of DR and POAG in this study, the indices of progression of DR and POAG were determined. Indices are defined as the simple ratio of the stage of the disease to its duration. The table 8 shows the progression indices of DR and POAG depending on their clinical combinations. Analysis in this context showed that no significant difference was found in the progression of DR. The maximum progression index was determined in the subgroup NTG+DM2, but this difference was not statistically significant (p=0.094). In contrast, the progression of POAG was dependent on association with DM2. Thus, it was the fastest in the subgroup DM2+POAG, and the smallest – in the subgroup POAG+DM2. The difference in the progression index between these subgroups was 2.8 times (p<0,001). Interestingly, the index of progression in the control (POAG without DM) was higher than in the subgroup POAG+DM2 (1.8 times; p<0.001).

Table 5. Distribution of patients in groups by stages of POAG (subgroup of DM2+POAG)

Stages of POAG		Groups			Multiple intergroup comparisons
		1st, n=25	2nd, n=52	3rd, n=28	
I		19 (76,0±8,5%)	-	-	χ^2=108,24; p<0,001
II		5 (20,0±8,0%)	31 (59,6±6,8%)	7 (25,0±8,2%)	
III		1 (4,0±3,9%)	21 (40,4±6,8%)	21 (75,0±8,2%)	
PP	1st group	-	χ^2=54,01; p<0,001	χ^2=37,46; p<0,001	-
	2nd group		-	χ^2=8,64; p=0,003	

Notes: χ^2 – Pearson's criterion; PP – paired intergroup comparisons

Table 6. Distribution of patients in groups by stages of POAG (subgroup of POAG+DM2)

Stages of POAG		Groups			Multiple intergroup comparisons
		1st, n=31	2nd, n=57	3rd, n=52	
II		15 (48,4±9,0%)	12 (21,1±5,4%)	4 (7,7±3,7%)	χ^2=38,57; p<0,001
III		12 (38,7±8,7%)	28 (49,1±6,6%)	25 (48,1±6,9%)	
IV		4 (12,9±6,0%)	17 (29,8±6,1%)	23 (44,2±6,9%)	
PP	1st group	-	χ^2=7,78; p=0,020	χ^2=20,29; p<0,001	-
	2nd group		-	χ^2=4,85; p=0,088	

Notes: χ^2 – Pearson's criterion; PP – paired intergroup comparisons.

Table 7. Distribution of patients in groups by stages of POAG (subgroup NTG+DM2)

Stages of POAG		Groups			Multiple intergroup comparisons
		1st, n=11	2nd, n=28	3rd, n=17	
II		9 (81,8±11,6%)	11 (39,3±9,2%)	10 (58,8±11,9%)	χ^2=6,24; p=0,100
III		2 (18,2±11,6%)	17 (60,7±9,2%)	7 (41,2±11,9%)	
PP	1st group	-	χ^2=5,57; p=0,018	χ^2=1,56; p=0,211	-
	2nd group		-	χ^2=1,59; p=0,208	

Notes: χ^2 – Pearson's criterion; PP – paired intergroup comparisons.

Table 8. Indices of progression of DR and POAG depending on their clinical combinations

Clinical subgroups	Indices of progression of DR, stages per year	Indices of progression of POAG, stages per year
DM2 without of POAG	0,33 (0,25-0,50)	-
POAG without DM2	-	0,43 (0,37-0,50)
DM2+POAG	0,36 (0,25-0,60)	0,67 (0,43-1,00)
POAG+DM2	0,33 (0,25-0,55)	0,24 (0,18-0,33)
NTG+DM2	0,50 (0,28-0,50)	0,41 (0,28-0,50)
NTG without of DM2	-	0,50 (0,43-1,00)
Intergroup comparisons	H=6,37; p=0,094	H=28,69; p<0,001

Notes: H – Kruskel-Wallis test; differences in the index of progression of POAG when conducting paired comparisons are significant when comparing subgroups: POAG without DM2 against POAG+DM2 (p<0,001); NTG without DM2 versus NTG+DM2 (p=0.020); DM2+POAG against POAG+DM2 (p<0.001); other comparisons are significant (p>0.05).

In addition, when comparing these subgroups, the tendency to increase the number of patients of the 3rd group in the subgroup POAG+DM2 compared with the subgroup DM2+POAG was noteworthy, which raised the question of a

The progression index was slightly higher in the subgroup NTG without DM2 than in the subgroup NTG+CD2 (1.2 times; p=0.020). Thus, the burden of POAG development of DM2 did not accelerate the progression of either GON or DR.

With the development of POAG in patients with DM2, the progression of GON significantly (2.8 times) accelerated.

DISCUSSION

According to our data, in patients with different stages of DR, the prevalence of POAG was 20.8%. In the world, the prevalence of glaucoma among people aged 40 to 80 years is 3.54% [7]. According to 2009 data, the prevalence of glaucoma among the population of Ukraine is 4.43% [17]. Therefore, our result on the prevalence of POAG among patients with diabetes mellitus showed that its frequency is increased compared to population data by 4-6 times, which is also consistent with the data [11]. In Ukraine, the prevalence of NTG at the age of 40 is 0.2% and 16% of all cases of POAG [17]. In EU countries, the prevalence of NTG is 11 to 30% of all glaucoma cases [18]. In our study, the prevalence of NTG was 18.6%, which did not differ from population studies. From this we can conclude that the share of NTG among all cases of POAG under the conditions of DM2 was not changed. The results are consistent with the data on the close relationship between the development of GON and the duration of diabetes, which was an independent predictor of the development of POAG [9, 16]. Also, a meta-analysis showed that the overall association between POAG and diabetes was 1.36 (95% CI 1.24-1.50) [10]. Thus, it is possible to consider a well-founded opinion about the existence of mechanisms of mutual burdening of GON and DR. In this regard, our data clarify the features of the clinical combination of these diseases: if the burden of POAG development of DM2 did not accelerate the progression of either GON or DR, then with the development of POAG in patients with DM2 GON progression significantly (2.8 times) accelerated.

In general, the prevalence of NTG is 16% of all cases of POAG [17]. In EU countries, this figure is from 11 to 30% of all cases of glaucoma [18]. According to our study, the share of NTG in patients with diabetes mellitus2 was 18.6%, which did not differ from the results of these studies. Thus, the prevalence of NTG among all cases of POAG in patients with DR and diabetes mellitus did not differ from the data obtained in patients without DM2. Our studies found that all patients with DM2 and NTG had stage II or III glaucoma. Among 1 200 patients with diabetes, POAG was found in 7.0%, ocular hypertension in 3.33% and NTG in 2.33%, and the prevalence of POAG was 5-6 times higher than in the general population of the south-eastern India [11]. Also according to this study, in all patients with NTG was found PDA. According to our results, the percentage of patients with POAG was higher (20.8%), and among 56 patients with a combination of NTG and DM2 only 17 (30.4%) had PDA, which can be explained by the difference in the design of the study. Thus, according to a small Indian study (75 patients with diabetes), 20% had glaucoma [19]. Also in this study, it was found that among all patients with diabetes mellitus and POAG, 42.9% initially developed DM2, and the remaining 57.1% – POAG. We did not find similar observations, but this feature was important for the progression of POAG in stages. Thus, with the development of POAG in a patient with DM2, the progression of GON was 2.8 times faster than in patients with the addition of DM2 to POAG. Thus, the clinical features of the combination of POAG and DR in DM2 and the phenomenon of mutual burdening of their course have been established.

Conclusions

1. In patients with DMs2 and DR of different stages, the prevalence of POAG was 20.8%, which was 4-6 times higher than in the general population.
2. Among patients with a combination of DR and POAG, 42.9% initially developed DM2, which was joined by POAG after 1-7 years. The other 57.1% of patients first developed POAG, and later (after 1-8 years) – DM2.
3. The vast majority of patients with DM2 and POAG (79.1%) had stage II and III POAG. Stage IV POAG had 14.6% of patients who initially developed POAG with a disease duration of 10 to 30 years (average 20.5±0.8 years).
4. Among patients with DM2 and POAG, the proportion of normotensive glaucoma was 18.6%. All of these patients had stage II or III.
5. The calculation of the progression index in relation to the stage of the disease to its duration showed that the burden of POAG development of DM2 does not accelerate the progression of either GON or DR. With the development of POAG in patients with DM2, the progression of GON significantly (2.8 times) accelerated.

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