Pterygium Prevalence and Its Associations in a Russian Population: The Ural Eye and Medical Study

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- PURPOSE: To assess the prevalence of pterygia and its associations in a population in Russia.
- DESIGN: Population-based cross-sectional study.
- METHODS: The Ural Eye and Medical Study was performed in a rural and urban area in Ufa/Bashkortostan 1300 km east of Moscow. Out of 7328 eligible individuals aged 40+ years, 5899 (80.5%) individuals participated and underwent an ocular and systemic examination. Pterygia, defined as conjunctival extensions onto the clear cornea, were diagnosed upon slit-lamp examination and on corneal photographs.
- RESULTS: Mean pterygium prevalence (per individual) was 138/5888 (2.3%; 95% confidence intervals [CI]:2.0, 2.7), with bilateral occurrence in 45 individuals (32.6% of patients with pterygium; 0.8% of study population). Pterygium prevalence increased from 0.8% (95% CI: 0.02, 1.6) in the age group from 40 to <45 years to 3.6% (95% CI: 2.1, 5.1) in the age group of 75+ years. In multivariable analysis, higher pterygium prevalence was associated with older age ($P = .006$; odds ratio [OR]: 1.03; 95% CI: 1.01, 1.04), rural vs urban region of habitation ($P < .001$; OR: 2.33; 95% CI: 1.57, 3.46), and lower level of education ($P = .03$; OR: 0.89; 95% CI: 0.81, 0.99), while the pterygium prevalence was statistically independent of sex ($P = .34$), Russian vs non-Russian ethnicity ($P = .59$), presence of diabetes mellitus ($P = 1.00$), arterial hypertension ($P = .86$), vegetarian vs mixed diet ($P = 1.00$), blood lipid concentration ($P > .30$), history of cardiovascular disease ($P = .49$), or axial length ($P = .52$).
- CONCLUSIONS: In this rural and urban, typically multiethnic Russian study population aged 40+ years, a higher pterygium prevalence (mean: 2.3%) was correlated with older age, rural region of habitation, and lower educational level, while it was statistically independent of most other systemic or ocular parameters. A pterygium was not a biomarker for an internal medical disease. (Am J Ophthalmol 2019;205:27–34. © 2019 Elsevier Inc. All rights reserved.)

PTERYGIUM IS A WEDGE-SHAPED FIBROVASCULAR dysplasia of the bulbar conjunctiva.[1] It extends onto the corneal surface and is usually located in the nasal horizontal or, more rarely, in the temporal horizontal part of the limbus. Various therapeutic modalities have been suggested and compared with each other for the treatment of pterygia, and pterygia have been reported to be indicators of an increased risk of developing cutaneous melanomas.[2,3] The prevalence of pterygia has been assessed in numerous previous investigations, which were carried out in various world regions and which revealed that the main risk factors were older age and a geographic location closer to the equator.[4–37] Since the frequency of pterygia has not been examined yet in the world region of Central and East Europe and Russia, and since the associations of the pterygium prevalence with other systemic parameters has not been fully explored yet, we conducted this study to evaluate the prevalence of pterygia in a Russian population that additionally underwent an ophthalmologic and detailed internal medical examination.

METHODS

THE URAL EYE AND MEDICAL STUDY IS A POPULATION-based study that was performed in the urban region of Kirovskii of the city of Ufa and in villages of the rural region of the Karmaskalinsky District within a distance of 65 km from Ufa.[38,39] The Ethics Committee of the Academic Council of the Ufa Eye Research Institute approved the study and all participants gave informed written consent. The ethics committee confirmed that all methods were performed in accordance with the relevant

guidelines and regulations, including the Declaration of Helsinki. Inclusion criteria for participation in the study were an age of 40+ years and living in the study region. There were no exclusion criteria. The Republic of Bashkortostan has a population of about 4.07 million people and it is geographically located in the west of the southern Ural Mountains about 1300 km east of Moscow. Its capital, Ufa, is an economic, scientific, and cultural center and has a population of 1.1 million inhabitants, including Russians, Bashkirs, Tatars, Ukrainians, and other ethnicities.[40]

The series of examinations started with a standardized interview, held by trained social workers, that included more than 250 questions on socioeconomic variables such as the educational level, family income and family estate including ownership of a house, living conditions (such as toilet availability in the house, lighting source in the house), size of the family, diet (such as frequency and amount of intake of vegetables, fruits, and meat), smoking of cigarettes or other types of tobacco products, alcohol consumption, daily physical activity, depression and suicidal ideas, and medical history, including known diagnosis and therapy of major disorders such as diabetes mellitus, arterial hypertension, and cardiovascular diseases (Table 1). The questions included in the interview had been validated in previous investigations, such as the Folstein test or Zung's self-rated depression scale.[41] We applied the Guidelines for Accurate and Transparent Health Estimates Reporting (GATHER statement guidelines).[42]

The examinations included assessment of arterial blood pressure; pulse rate; the anthropomorphic parameters of body height, body weight, and circumference of the hip and waist; and the dynamometric handgrip strength (dynamometer - dk 140; ZAO Nizhnetagilskiy Medical Instrument Plant, Nizhniy Tagil, Russia). Using blood samples taken under fasting conditions, we measured the serum concentrations of various substances and molecules, including glucose, blood lipids, and C-reactive protein (Table 1). Devices used were a photoelectrocolorimeter (KFK-3; Zagorsk Optical and Mechanical Plant, Zagorsk, Russia), Abbe refractometer (IRF-45; Kazan Optical and Mechanical Plant, Kazan, Russia), coagulometer (ASK 2-01 Astra; NPZ Astra, Ufa, Russia), and semiautobiochemical analyzer (BS-3000P; Sinnowa, Nanjing, China). We measured the pulmonary function by spirometry (Riester spirotest; Riester Company, Jungingen, Germany) and defined chronic obstructive pulmonary disease by a cut-off value of the ratio of forced expiratory volume in 1 second divided by the forced vital capacity of less than 0.7. Asthma was defined by a self-reported diagnosis or physician-made diagnosis of asthma. Arterial hypertension was characterized by a systolic blood pressure ≥140 mm Hg and/or a diastolic blood pressure ≥90 mm Hg, and/or self-reported history or current treatment of arterial hypertension with antihypertensive medication. Diabetes mellitus was defined by a fasting glucose concentration ≥7.0 mmol/L or a self-reported

history of physician diagnosis of diabetes mellitus or a history of drug treatment for diabetes (insulin or oral hypoglycemic agents). Depression was assessed by applying the Center for Epidemiologic Studies Depression Scale scoresheet. The design of the Ural Eye and Medical Study has been described in detail previously.[38,39]

The list of ophthalmologic examinations included the assessment of best-corrected visual acuity by automated refractometry (Auto-Ref/Keratometer HRK-7000A; HUVITZ Co, Ltd, Gyeonggi-do, Korea) and subjective refractometry, static perimetry (PTS 1000 Perimeter; Optopol Technology Co, Zawercie, Poland; screening test program: 50 degrees in all directions; 82 test points), anterior segment imaging using the Scheimpflug camera (Pentacam HR, Typ70900; OCULUS, Optikgeräte GmbH Co, Wetzlar, Germany), slit-lamp biomicroscopy of the anterior and posterior ocular segment, noncontact tonometry (Tonometer Kowa KT-800; Kowa Company Ltd, Hamamatsu City, Japan), examination of the presence of pseudoexfoliation of the lens after medical mydriasis, photography of the cornea and lens (Topcon slit lamp and camera; Topcon Corp, Tokyo, Japan), and photography of the optic disc and macula (VISUCAM 500; Carl Zeiss Meditec AG, Jena, Germany), spectral-domain optical coherence tomography (RS-3000; NIDEK Co, Ltd, Aichi, Japan) of the optic nerve head and macula, and measurement of the axial length by sonography (Ultra-compact A/B/P ultrasound system, Compact touch; Quantel Medical, Cournon d'Auvergne, France) (Table 2).

A pterygium was defined as an extension of the conjunctiva onto the clear cornea without an alternative explanation, such as ocular trauma or ocular surgery, for the lesion. It was diagnosed during the slit-lamp examination by an ophthalmologist (N.A.N.) and the diagnosis was confirmed by assessing the corneal photographs by a group of ophthalmologists.

Only those individuals with assessment of the presence of a pterygium were included into the study described herein. Using a commercially available statistical software package (SPSS for Windows, version 25.0; SPSS, Chicago, Illinois, USA), we first calculated the mean value (presented as mean and 95% confidence interval [CI] or as mean ± standard error) of the main outcome parameters and conducted a univariate analyses of the associations between the presence of a pterygium and other ocular and systemic parameters (Tables 1 and 2). A subsequent binary multivariable regression analysis included the presence of a pterygium as the dependent parameter and as independent parameters all those variables that were associated significantly with the presence of a pterygium in the univariate analyses. In a step-by-step manner, we dropped those variables out of the list of independent parameters that were no longer significantly associated with the prevalence of a pterygium. We determined the odds ratio (OR) and its 95% CI. All P values were 2-sided and considered statistically significant when the values were less than .05.

TABLE 1. Associations (Univariate Analysis) Between the Prevalence of a Pterygium and Systemic Parameters in the Ural Eye and Medical Study

Parameter	P Value	OR	95% Confidence Interval of OR
Age (y)	.002	1.02	1.01, 1.04
Urban/rural region of habitation	<.001	2.11	1.44, 3.10
Ethnicity: Russian/any other ethnicity	.06	0.63	0.39, 1.02
Body height (cm)	.06	0.98	0.96, 1.00
Body weight (kg)	.09	0.99	0.98, 1.00
Socioeconomic parameters			
Level of education	<.001	0.83	0.76, 0.92
Monthly income (below poverty line/average/above average/high)	.007	0.63	0.45, 0.88
Does your work involve physically vigorous activity or moderate-intensity activity (like brisk walking or carrying light loads) (yes/no)	.03	1.53	1.05, 2.24
Does your work involve physically moderate-intensive activity, like brisk walking or carrying light loads for at least 10 minutes at a time?	.06	1.48	0.98, 2.24
Do you walk or use a bicycle (pedal cycle) for at least 10 minutes continuously to get to and from places?	.07	0.66	0.41, 1.04
History of arthritis	.07	1.40	0.98, 2.00
History of thyreopathy	.02	0.39	0.17, 0.88
History of menopause	.003	3.90	1.42, 10.8
Blood concentrations (mmol/L) of:			
Aspartate aminotransferase (IU/L)	.05	1.01	1.00, 1.02
Bilirubin, total (μmol/L)	.02	1.01	1.003, 1.03
Urea (mmol/L)	.002	1.14	1.05, 1.24
Prothrombin time (%)	.03	1.02	1.002, 1.04
Alcohol consumption			
How often do you have 6 or more drinks on 1 occasion? (never/rarely/sometimes/often/cannot say)	.04	1.58	1.03, 2.43

OR = odds ratio.

Other variables that were studied and were nonsignificantly associated with the prevalence of a pterygium were sex; family status and family type; body mass index; waist circumference; own ownership of a house without lease, refrigerator, second house, telephone, smartphone, television set, car, 2-wheeler, tractor, bullock cart, and computer/laptop; questions on physical activity ("How long is your usual work day?" "Does your work involve mostly sitting or standing with less than 10 minutes of walking at a time?" "How many days a week do you do such physically vigorous activity during work?" "On a usual day how much time do you spend on such physically vigorous work during work?" "In your leisure time, do you do any moderate-intensity activities like brisk walking, cycling, or swimming for at least 10 minutes at a time?" and "Over the past 7 days, how much time did you spend sitting or reclining on a typical day?"); history of disorders (such as angina pectoris, asthma, arterial hypertension, cancer, previous bone fractures, low back pain, thoracic spine pain, neck pain, headache, cardiovascular disorders including stroke, heart attack, dementia, diabetes mellitus, diarrhea, iron-deficiency anemia, low blood pressure and hospital admittance, osteoarthritis, skin disease, tumbling, and unconsciousness); blood concentrations of alanine aminotransferase, bilirubin, high-density lipoproteins, low-density lipoproteins, cholesterol, triglycerides, rheumatoid factor, glucose, creatinine, urea, residual nitrogen, total protein, and hemoglobin; international normalized ratio; prothrombin time; erythrocyte sedimentation rate; counts of erythrocytes, leukocytes, rod-core granulocytes, segment nuclear granulocytes, eosinophil granulocytes, lymphocytes, and monocytes; prevalence of diabetes mellitus; systolic, diastolic, and mean blood pressure; prevalence of arterial hypertension and chronic obstructive pulmonary disease; questions on diet (vegetarian diet/mixed diet, number of meals per day, "In a week how many days do you eat fruits?" "In a week how many days do you eat vegetables?" Type of oil used for cooking: vegetable oil/nonvegetable oil?" salt consumed per day, degree of processing of meat); questions on current, former, and daily smoking and pack-years of smoking; questions on alcohol consumption (any alcohol consumed, "How many alcoholic drinks do you have on a typical day when you are drinking?" "How often do you have 6 or more drinks on one occasion?"); depression score; State-Trait Anxiety Inventory Score; and dynamometry (details are included in Supplemental Table 1, available at AJO.com).

RESULTS

OUT OF AN ELIGIBLE POPULATION OF 7328 SUBJECTS, THE Ural Eye and Medical Study included 5899 participants (2580 [43.7%] men) (participation rate: 80.5%). The present investigation consisted of 5888 (or 99.8% of the total study population) participants with available information on the presence of pterygia. The group of participants (n = 5888) in the present study as compared with the group of nonparticipants (n = 11) did not differ significantly in age (P = .85), sex (P = .22), region of habitation (P = .06), level of education (P = 0.32), or

TABLE 2. Associations (Univariate Analysis) Between the Prevalence of a Pterygium and Ophthalmologic Parameters in the Ural Eye and Medical Study

Parameter	P Value	OR	95% Confidence Interval of OR
Best-corrected visual acuity (logMAR)	.01	1.37	1.07, 1.76
Intraocular pressure (mm Hg)	.08	0.95	0.90, 1.01
Refractive error, spherical value (diopters)	.02	1.13	1.02, 1.24
Refractive error, cylindrical value (diopters)	.09	0.84	0.68, 1.03
Refractive error, spherical equivalent (diopters)	.05	1.10	1.00, 1.22
Axial length (mm)	.10	0.85	0.70, 1.03
Central corneal thickness (μm)	.01	0.99	0.988, 0.998
Macular pigment density volume	.04	1.00	1.00, 1.00
Nuclear cataract	.001	1.37	1.13, 1.67
Cortical cataract	.17	1.42	0.88, 2.29
Age-related macular degeneration, any	.16	0.55	0.26, 1.19
Age-related macular degeneration, early stage	.47	0.67	0.29, 1.53
Age-related macular degeneration, intermediate stage	1.00	1.00	1.00
Age-related macular degeneration, late stage	.58	1.19	0.16, 8.73

OR = odds ratio.

Other variables that were studied and were nonsignificantly associated with the prevalence of a pterygium were corneal refractive power, corneal volume, anterior chamber depth, anterior chamber volume and angle, lens thickness, macular pigment density area, retinal thickness at the fovea and at 300 μm temporal and nasal to the fovea, retinal nerve fiber layer thickness, prevalence of subcapsular cataract, myopic maculopathy, diabetic retinopathy, polypoidal choroidal vasculopathy and central serous choroidopathy, degree of fundus tessellation in the macula and peripapillary region, and prevalence of epiretinal membranes, macular holes, and pseudoexfoliation (details are included in Supplemental Table 2, available at AJO.com).

anthropomorphic parameters such as body height ($P = .12$), body weight ($P = .99$), or body mass index ($P = .40$). The sex and age distribution in the study population corresponded to the sex and age distribution in the Russian population according to the most recent census carried out in 2010.[40]

The mean prevalence of pterygia (per individual eye) was 138 out of 5888 (2.3%; 95% CI: 2.0, 2.7). Its occurrence was bilateral in 45 individuals (32.6% of the patients with pterygium; 0.8% of the total study population) and unilateral in 93 individuals (67.4% of the patients with pterygium; 1.5% of the total study population).

In univariate analyses, the prevalence of pterygia increased from 0.8% (95% CI: 0.02, 1.6) in the age group from 40 to <45 years, to 1.3% (95% CI: 0.5, 2.2) in the age group from 45 to <50 years, to 2.9% (95% CI: 1.8, 4.0) in the age group from 60 to <65 years, and to 3.6% (95% CI: 2.1, 5.1) in the age group of 75+ years (Figure). In univariate analyses, a higher prevalence of a pterygium was associated ($P < .10$) with the systemic parameters of older age ($P = .002$); rural region of habitation ($P < .001$); non-Russian ethnicity ($P = .06$); shorter body height ($P = .06$); lower body weight ($P = .09$); lower level of education ($P < .001$); lower monthly income ($P = .007$); higher frequency of vigorous activities ($P = .03$) and of moderate-to-intensive activities at work ($P = .06$); higher frequency of walking or bicycling ($P = .01$); lower prevalence of a positive history of arthritis ($P = .07$), thyreopathy ($P = .02$), and menopause ($P = .003$); higher blood concentrations of aspartate aminotransferase ($P = .05$), bilirubin ($P = .02$), and urea ($P = .002$), longer prothrombin time ($P = .03$), higher prevalence of consumption of more than 6 drinks on a typical day with alcohol consumption ($P = .04$), and a lower dynamometric force in the right hand ($P = .06$) (Table 1). A higher prevalence of a pterygium was correlated with the ocular parameters of a worse best-corrected visual acuity ($P = .01$), lower intraocular pressure ($P = .08$), higher cylindrical refractive error ($P = .09$), higher spherical refractive error ($P = .02$) and higher refractive error (spherical equivalent) ($P = .05$), thinner central corneal thickness ($P = .01$), lower volume of macular pigment ($P = .04$), higher degree of nuclear cataract ($P = .001$), and lower degree of fundus tessellation in the macular region ($P = .08$) (Table 2).

In a next step of the statistical analysis, we performed a multivariable binary regression analysis with the prevalence of pterygium as the dependent parameter and, as independent parameters, all variables that were significantly associated with the prevalence of pterygium in the univariate analysis (Tables 1 and 2). Owing to a lack of statistical significance, we dropped step by step the parameters of prevalence of consumption of more than 6 drinks on a typical day with alcohol consumption ($P = 1.00$), history of menopause ($P = .99$), body weight ($P = .93$), monthly income ($P = .21$), body height ($P = .91$), blood concentration of aspartate aminotransferase ($P = .64$), intraocular pressure ($P = .0.99$), macular pigment density volume ($P = .79$), frequency of
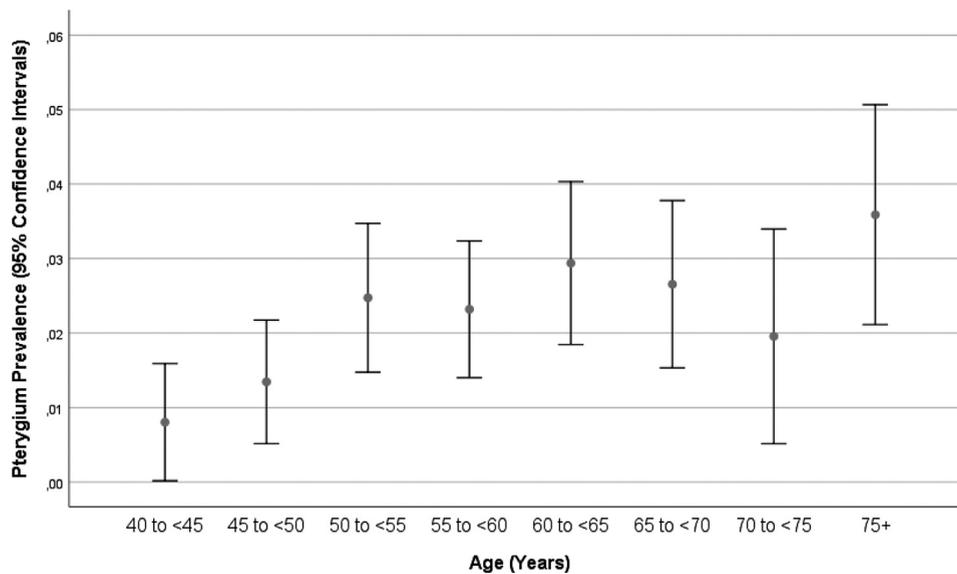
FIGURE. Graph showing the pterygium prevalence in the Ural Eye and Medical Study.

moderate-to-intensive activities at work ($P = .92$), blood concentration of aspartate aminotransferase ($P = .85$), history of thyreopathy ($P = .49$), frequency of vigorous activities at work ($P = .78$), ethnicity ($P = .59$), blood concentration of urea ($P = .14$), best-corrected visual acuity ($P = .66$), dynamometric force of the right hand ($P = .32$), frequency of walking or bicycling ($P = .08$), prothrombin time ($P = .09$), spherical refractive error ($P = .08$) and spherical equivalent ($P = .08$), central corneal thickness ($P = .08$), level of education ($P = .10$), nuclear cataract ($P = .09$), macular fundus tessellation ($P = .06$), history of arthritis ($P = .06$), and cylindrical refractive error ($P = .16$). Eventually, the prevalence of pterygium was significantly associated only with older age and rural vs urban region of habitation. When the parameter of the level of education was re-added to the model, it was associated with prevalence of pterygium while sex ($P = .34$) was not (Table 3). In the final model, a higher prevalence of pterygium was associated with older age ($P = .006$; OR: 1.03; 95% CI: 1.01, 1.04), rural vs urban region of habitation ($P < .001$; OR: 2.33; 95% CI: 1.57, 3.46), and lower level of education ($P = .03$; OR: 0.89; 95% CI: 0.81, 0.99).

DISCUSSION

IN THIS URBAN AND RURAL POPULATION OF RUSSIA, THE mean prevalence of pterygia (per individual) was 2.3% (95% CI: 2.0, 2.7) with a bilateral occurrence in 45 individuals (32.6% of the patients with pterygium; 0.8% of the total study population). In multivariable analysis, a higher

TABLE 3. Associations (Multivariable Analysis) Between the Prevalence of a Pterygium and Systemic and Ocular Parameters in the Ural Eye and Medical Study

	P Value	OR	95% Confidence Interval of OR
Age (y)	.006	1.03	1.01, 1.04
Rural vs urban region of habitation	<.001	2.33	1.57, 3.46
Level of education	.03	0.89	0.81, 0.99

OR = odds ratio.

pterygium prevalence was associated with older age (OR: 1.03; 95% CI: 1.01, 1.04), rural vs urban region of habitation (OR: 2.33; 95% CI: 1.57, 3.46), and lower level of education (OR: 0.89; 95% CI: 0.81, 0.99), while the pterygium prevalence was statistically independent of all other systemic or ocular parameters examined in this study.

The pterygium prevalence of 2.3% (per individual) in our study population was lower than the pterygium frequency in rural Central India, where the prevalence was 15% (95% CI: 13.68, 16.01) per individual. Similar to our study, a bilateral pterygium occurrence was noted in 31.3% of the patients with pterygium. In rural Central India, the pterygium prevalence increased from 6.9% (95% CI: 5.1, 8.6) in the age group from 40 to <45 years, to 13.8% (95% CI: 10.7, 16.9) in the age group from 50 to <55 years, and to 24.9% (95% CI: 18.4, 31.3) in the age group of 75+ years. A similar trend with age was observed in our study population, although at a markedly lower level, with an increase in the pterygium prevalence from 0.8% (95% CI: 0.02, 1.6) in the age group from 40 to <45 years to 3.6% (95% CI: 2.1,

5.1) in the age group of 75+ years (Figure). In both study populations, the pterygium prevalence increased by a factor of approximately 3 from the age group of 40 to<45 years to the age group of 75+ years. In rural Central India, higher pterygium prevalence was associated with male sex, lower body height, higher number of hours spent with vigorous outdoors activity, and higher cylindrical refractive error, in addition to older age and lower level of education, as it was in our study population. The pterygium prevalence in our study population was also lower than the pterygium prevalence in the South Indian Andhra Pradesh Eye Disease Study (11.7%); in a South Indian study from Tamil Nadu (9.5%); in the Australian Blue Mountains Eye Study (7.3%); in Greenland (8.6%); and in Singapore (7%), rural Sumatra, Indonesia (10.0%), and rural Dali, China (39%).[4,6,9,11,26,29,34] It was higher than in studies from Copenhagen, Denmark (0.7%) and from Kyoto, Japan (1%).[4] It was comparable with the findings made in Greater Beijing, China (2%) and in Victoria, Australia (2.8%).[8,22] Reasons for the marked differences in the pterygium prevalence between the various investigations may be differences in the study populations, including differences in the lifestyle and exposure to ultraviolet light, and geographic and socioeconomic differences between the various world regions.[43] Corresponding to the lower pterygium prevalence in our study region as compared to India and Singapore, the mean sunshine duration in Russia with about 2000 hours/year is lower than in India with about 2500 hours/year.[44] One may also have to take into account that populations can differ in their exposure to ultraviolet light even if living in the same geographic region, if their socioeconomic background and lifestyle (mostly being indoors vs spending most of the time outdoors) varies profoundly. Accordingly, rural region of habitation in our study population was associated with a higher prevalence of pterygia, presumably owing to open-door professional activities of the rural population. By the same token, a lower educational level was correlated with higher pterygium prevalence, potentially owing to an association between lower level of education and outdoor professional activities.

As in our cross-sectional study, the pterygium prevalence was correlated with rural region of habitation; a 10-year follow-up population-based study revealed that a higher incidence of pterygia was correlated with rural region, while age was not associated with the incidence of pterygia.[33] In a similar manner, the 9-year incidence of pterygia reported in the Barbados Eye Study on an African Caribbean population was higher in the rural region than in the urban region.[15] The reason for the discrepancy may be that the pterygium incidence was age-independently constant so that the pterygium prevalence increased with older age in a cumulative manner.

Previous studies and our investigation agree in the associations between higher pterygium prevalence and older age and living in a rural region.[3,7–9,21] The relationship between pterygia and older age and rural region of habitation as a presumed surrogate of ultraviolet exposure appear to be unequivocal. It fits with the association between higher pterygium prevalence and a lower level of education as found in our study, since an outdoor activity is more likely with lower educational level.

As in the previous studies, a higher pterygium prevalence was correlated with a lower level of education in our study.[10,16,19,20,26,27,34] It may be related to associations of educational level–associated differences in the professional activities, with a high level of education usually correlated with white-collar professions, which are carried out indoors with a low ultraviolet light exposure.[43]

With respect to systemic diseases, we did not detect associations between the pterygium prevalence and any major systemic disease, including diabetes mellitus, arterial hypertension, chronic obstructive pulmonary disease, kidney dysfunction, and other diseases (Table 1). Our study agrees with the results obtained in other investigations performed in India and China.[26,29,34] In contrast, the Singapore Malay Eye Study reported on an increased pterygium prevalence with higher systolic blood pressure.[23] Neither alcohol consumption nor smoking was correlated with pterygium prevalence in our study, nor in in other previous investigations, except for a study from North America in which an association between smoking and a lower pterygium prevalence was found, and except for the Indian Andhra Pradesh Eye Disease Study, in which alcohol consumption was correlated with a lower pterygium prevalence in a multivariable model.[19,24,26,29]

In contrast to the study from rural Central India and other studies, in which men as compared to women had a higher frequency of pterygia, we did not find an association between pterygium prevalence and sex.[6,8,9,14,18,22–24,27,30,36] Our result agrees with the observations made in studies from South India such as the Andhra Pradesh Eye Disease Study.[29,34] In 2 studies from rural Dali in West China and from Tibet, the pterygium prevalence was higher in women than in men.[16,26] Differences in lifestyles and in particular differences in the culture-related gender-specific daily activities between the various study populations may be the reasons for the variations in the association between the pterygium prevalence and sex.

When interpreting the results of our study, its limitations of our study have to be taken into account. First, as for any population-based study, the participation rate is of essential importance. The participation rate in the Ural Eye and Medical Study was, however, acceptable with 80.5% to assume that the nonparticipation did not have major effect on the results of the investigation. Second, the composition of the study population was characteristic for a typical multicultural society in Russia. The study regions with a major city and a rural region in the Southern Russian republic of Bashkortostan west of the Ural Mountains mirrored the whole region of Southern Russia. The distribution of age and sex of our study population was

comparable to the results of the Russian census 2010. In addition, Russian vs non-Russian ethnicity was not significantly ($P = .59$) associated with the pterygium prevalence in the multivariable analysis. Third, the prevalence and associated factors of pterygia have already been addressed in previous investigations.[4–37] The novelty of the present study, however, is that it was conducted in Russia, from where no population-based information about the frequency of pterygia and their related parameters has been available so far. Fourth, in contrast to some of the previous studies, we did not assess the use of sunglasses, so their potential effect on the prevalence of pterygia could not be examined.[10,16,29] Strengths of our investigation were the relatively large sample size, the relatively high number of disorders and other parameters examined and tested in their relationship with the pterygium prevalence, and the study location in a world region in which a population-based study on ophthalmologic parameters has not been conducted yet.

In conclusion, in this rural and urban, typically multi-ethnic Russian study population aged 40+years, a higher pterygium prevalence (mean: 2.3%) was correlated with older age, rural region of habitation, and lower educational level, while it was statistically independent of most other systemic or ocular parameters. A pterygium was not a biomarker for an internal medical disease.

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