ARAŞTIRMA MAKALESİ / *RESEARCH ARTICLE*

Evaluation of Frequency and Etiological Factors in Pterygium and Pinguecula Cases in Bolu Region

Bolu Bölgesinde Pterjiyum ve Pingekula Olgularındaki Sıklık ve Etiyolojik Faktörlerin İncelenmesi

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ABSTRACT

Aim: *To evaluate the frequency of pterygium and pinguecula in patients living in Bolu region and to assess the relationship between advanced age, UV exposure, smoking status, education level, systemic disease and presence of pterygium and pinguecula.*

Material and Method: *This study comprises 1014 patients between 18–80 years of age. Demographic data, including age and sex, occupation, education level, systemic disease, smoking status and UV exposure, are questioned. A comprehensive ophthalmological examination was performed, and the presence of pterygium and pinguecula was evaluated. A p-value under 0.05 was taken to be statistically significant.*

Results: *Among 1014 patients included in this study, 553 patients were in the control group (54.5%); 101 patients had pterygium (9.96%) and 360 patients had pinguecula (35.5%). Three hundred eighty-two patients were men and 632 were women. The mean age of patients was 46.33±15.83 years. Bilaterality was more evident in the pinguecula group compared to the pterygium group (p<0.001). Patients with outdoor occupation were higher in the pterygium and pinguecula group compared to the control group (p<0.001). UV exposure time was significantly different between groups (p<0.001). While UV exposure time was the highest in the pterygium group (median: 3.0, IQR: 0–4.5), it was approximately 2 hours in the pinguecula group (median: 2, IQR: 0–4). Education levels were lower in the pterygium and pinguecula group compared to the control group (p<0.001).*

Conclusion: *Advanced age, extended UV exposure, outdoor occupation and low education levels are associated with developing pterygium and pinguecula. This cross-sectional study could contribute to prevalence studies with large series that would be held in our country in the future.*

Keywords: *pterygium; pinguecula; UV exposure; age; education level*

ÖZET

Amaç: *Bolu bölgesindeki hastalarda pterjiyum ve pingekulanın sıklığını değerlendirmek ve ileri yaş, UV maruziyeti, sigara kullanımı, eğitim durumu, sistemik hastalık gibi faktörlerin pterjiyum ve pingekula ile ilişkisini araştırmak.*

Materyal ve Metot: *Kliniğimize başvuran 18–80 yaş arası 1014 hasta çalışmaya dâhil edildi. Hastaların yaş ve cinsiyet gibi demografik bilgileri, meslekleri, eğitim düzeyleri, sistemik hastalıkları, sigara kullanımları ve gün içerisindeki UV maruziyetleri sorgulandı. Tam bir oftalmolojik muayene yapılarak, pterjiyum ve pingekula varlığı değerlendirildi. Sonuçlar p <0,05 düzeyinde anlamlı kabul edildi.*

Bulgular: *Çalışmaya dâhil edilen 1014 hastanın 553'ü kontrol grubunda (%54,5); 101'i pterjiyum grubunda (%9,96) ve 360'ı pingekula grubunda yer aldı (%35,5). Hastaların 382'si erkek; 632'si kadındı. Hastaların yaş ortalaması 46,33±15,83 idi. Pingekulanın pterjiyuma göre daha fazla oranda bilateral seyrettiği izlendi (p<0,001). Pterjiyum ve pingekula grubunda dış mekanda çalışanların oranı kontrol grubuna göre belirgin olarak yüksekti (p<0,001). UV maruziyetine bakıldığında gruplar arası anlamlı farklar tespit edildi (p<0,001). Pterjiyum grubundaki hastaların gün içindeki ortalama UV maruziyeti en üst sıradayken (median: 3,0, IQR: 0–4,5); pingekula grubunda bu süre ortalama iki saat olarak tespit edildi (median: 2, IQR: 0–4). Kontrol grubuyla karşılaştırıldığında eğitim düzeyinin pterjiyum ve pingekula grubunda daha düşük olduğu saptandı (p<0,001).*

Sonuç: *İleri yaş, uzamış UV maruziyeti, dış mekanda çalışma ve düşük eğitim seviyesi pterjiyum ve pingekula gelişimi ile yakından ilişkilidir. Bu kesitsel çalışma ileride ülkemizde yapılabilecek geniş serili prevalans çalışmalarına katkı sağlayabilecek niteliktedir.*

Anahtar kelimeler: *pterjiyum; pingekula; UV maruziyeti; yaş; eğitim seviyesi*

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Introduction

Pterygium, which usually extends to the cornea, is a degenerative, hyperplastic, and fibrovascular tissue originating from the interpalpebral bulbar conjunctiva[1]. Patients with pterygium frequently apply to the ophthalmology clinics with ocular irritation and blurred vision that results from corneal astigmatism[2].

Pinguecula presents as a yellowish, slightly elevated, lipid-like degeneration frequently seen in the conjunctiva on the nasal side of the limbus[3]. Although pinguecula is often asymptomatic, it can lead to chronic irritation by disrupting the tear film layer[4].

It is known that exposure to ultraviolet light (UV) plays an important role in the development of both conditions[5,6]. While there are many studies in the literature about the prevalence of pterygium ranging from 1.2% to 33%, the data on the frequency of pinguecula are relatively limited. Available data indicate a higher prevalence than pterygium; this rate may reach 70% in some regions[7,8].

This study aimed to evaluate the frequency of pterygium and pinguecula in patients who applied to an ophthalmology clinic in the Bolu region. In addition, we aimed to assess the relationship between advanced age, ultraviolet light (UV) exposure, smoking status, education level, systemic disease and the presence of pterygium and pinguecula.

Materials and Methods

This study consists of 1014 patients between 18–80 years of age who applied to our ophthalmology clinic between February 2020 and February 2021. This prospective cross-sectional study is held in Bolu, in the western Blacksea Region of Türkiye.

Demographic data, including age, sex, occupation, education level, systemic diseases, smoking status and daily UV exposure, were questioned. Patients' workplaces are considered outdoors if they spend most of their working hours in the open air; they are defined as indoor if they spend most of their working hours inside buildings. Patients were divided into groups according to their educational status as primary school graduate, high school graduate, university graduate and above.

A complete ophthalmological examination was performed, and pterygium and pinguecula were evaluated. The bilaterality of the lesions was examined.

Patients under the age of 18 and over the age of 80 and those with a history of pterygium/pinguecula excision were excluded from the study.

Ethical Board Approval

Before the study, ethical board approval was obtained from the Scientific Research Ethics Committee (Decision no: 2020/20). The study was carried out in accordance with the Declaration of Helsinki, and informed consent was obtained from each patient.

Statistical Analysis

Data distribution presents descriptive data as numbers (percentage) or median (interquartile range, IQR: 25th to 75th percentile) or mean ± standard deviation. One-way ANOVA and post-hoc Games-Howell tests were used to compare normally distributed variables. Group comparisons were made with the Kruskal Wallis test and post-hoc Dunn's test for nonnormal data. Single logistic regression models were used to estimate the effect of each variable on the diagnosis of pterygium and pinguecula. In addition, multiple logistic regression analysis was performed to identify independent risk factors for these diseases. In the multiple regression analysis, variables with $p<0.20$ in the simple regression model were included in the model as independent variables. Odds ratios (OR) were calculated with 95% confidence intervals. Hosmer Lemeshow tests confirmed the goodness of fit of the models. Statistical analyses were performed using Statistical Package for Social Sciences 25.0 for Windows (IBM Inc., Chicago, Illinois, USA) and R 4.0.2 statistical software. The results were considered significant at the $p<0.05$ level.

Results

While 553 of 1014 patients included in the study did not have pinguecula or pterygium (54.5%), 101 patients (9.96%) were in the pterygium group and 360 patients (35.5%) were in the pinguecula group. Overall, 382 of the patients were male and 632 of them were women. The mean age of the patients was 46.33±15.83 years. The clinical and demographic characteristics of the patients included in the pterygium and pinguecula group and those without pterygium or pingueculae are shown in Table 1 comparatively.

It was observed that there was a significant difference between the groups in terms of age ($p<0.001$).

Table 1. *Comparison of clinical characteristics of the groups*

	Group without pterygium/ pinguecula (n=553)	Pterygium (n=101)	Pinguecula (n=360)	p
Age	41.37±16.58[a,b]	54.99±12.68[a]	51.52±12.39[b]	**<0.001**
Sex				**0.004**
Male	183 (33.1)	42 (41.6)	157 (43.6)	
Female	370 (66.9)	59 (58.4)	203(56.4)	
Laterality				**<0.001**
Right	NA	34 (33.7)	105 (29.2)	
Left	NA	31 (30.7)	48 (13.3)	
Bilateral	NA	36 (35.6)	207 (57.5)	
Working place				**<0.001**
Indoor	515 (93.1)	72 (71.3)	295 (81.9)	
Outdoor	38 (6.9)	29 (28.7)	65 (18.1)	
UV exposure, hour/day	0 (0–0) [a]	3 (0–4.5) [a]	2 (0–4)[a]	**<0.001**
Smoking				0.600
No	369 (66.7)	68 (67.3)	225 (62.5)	
Yes	116 (21.0)	19 (18.8)	79 (21.9)	
Ex-smoker	68 (12.3)	14 (13.9)	56 (15.6)	
Education level				**<0.001**
Elementary school	200 (36.2)	82 (81.2)	217 (60.3)	
Middle-school	58 (10.5)	6 (5.9)	55 (15.3)	
High-school	162 (29.3)	7 (6.9)	60 (16.7)	
University	133 (24.1)	6 (5.9)	28 (7.8)	
Hypertension	74 (13.4)	35 (34.7)	88 (24.4)	**<0.001**
Asthma	17 (3.1)	2 (2.0)	16 (4.4)	0.376
Diabetes Mellitus	47 (8.5)	20 (19.8)	66 (18.3)	**<0.001**
Coronary Artery Disease	14 (2.5)	9 (8.9)	23 (6.4)	**0.002**
Hypothryoidism	34 (6.1)	4 (4.0)	14 (3.9)	0.272
Hyperthryoidism	3 (0.5)	1 (1.0)	3 (0.8)	0.812
Rheumatoid Arthritis	6 (1.1)	2 (2.0)	2 (0.6)	0.415
Hyperlipidemia	5 (0.9)	2 (2.0)	14 (3.9)	**0.008**

Pearson's chi-square or Fisher exact test was used for categorical variables. If mean values are given, one-way ANOVA; if median values are given, the Kruskal-Wallis test was used. The a, b values show significant differences between the two groups evaluated with the Games-Howell or Dunn's test; CAD: Coronary Artery Disease; Bold p values indicate statistical significance at p<0.05.

It was shown that the mean age was higher in the pterygium and pinguecula groups. A significant relation was found between gender distribution and groups (p=0.004). It was observed that pinguecula was seen more frequently bilateral when compared to pterygium (p<0.001). The rate of patients who work outdoors in the pterygium and pinguecula groups was significantly higher than the control group (p<0.001). Considering the UV exposure, a significant difference was detected between the groups (p<0.001). While the patients in the pterygium group had the highest mean daily UV exposure (median: 3 hours), the duration of UV exposure was 2 hours in patients with pinguecula.

It was determined that the education level was lower in the pterygium and pinguecula groups (p<0.001). Systemic diseases such as hypertension, diabetes, coronary artery disease and hyperlipidemia were observed more frequently in the pterygium and pinguecula groups.

Occupational distributions among the groups are shown in Table 2. Notably, the rate of farmers in the pterygium group is 18.6%.

Pterygium

A significant correlation was found in simple regression analysis between advanced age, working outdoors, prolonged UV exposure, low education level, hypertension, diabetes, coronary artery disease and the risk of developing pterygium (Table 3). When variables with p<0.20 in the simple regression model were added and other factors were controlled with the multiple regression model, gender and working outdoors lost their significance. (Table 2). It was determined that 1 hour

Table 2. *Distribution of occupation according to groups*

Occupations	Group without pterygium/pinguecula (n=553)	Pterygium (n=101)	Pinguecula (n=360)
Chef	11 (2.8%)	1 (1.2%)	6 (2%)
Farmer	12 (3.1%)	16 (18.6%)	33 (10.9%)
Retired worker	9 (2.3%)	5 (5.8%)	20 (6.6%)
Retired office worker	23 (5.9%)	5 (5.8%)	23 (7.6%)
Tradesman	14 (3.6%)	0 (0%)	11 (3.6%)
Housewife	186 (48.1%)	42 (48.8%)	140 (46.1%)
Factory worker	43 (11.1%)	5 (5.8%)	33 (10.9%)
Construction worker	5 (1.3%)	3 (3.5%)	6 (2%)
Unemployed	13 (3.4%)	0 (0%)	1 (0.3%)
Office worker	24 (6.2%)	1 (1.2%)	9 (3%)
Teacher	24 (6.2%)	1 (1.2%)	7 (2.3%)
Driver	10 (2.6%)	7 (8.1%)	12 (3.9%)
Medical technician	13 (3.4%)	0 (0%)	3 (1%)
Other	166 (30.0%)	15 (14.8%)	56 (15.5%)

Table 3. *Simple and multiple logistic regression analysis of risk factors for pterygium (n=101)*

	Simple logistic regression			Multiple logistic regression		
Variables	OR	95% CI	p	OR	95% CI	p
Age	1.053	1.038–1.068	**<0.001**	1.001	0.978–1.025	0.914
Sex						
Female	Reference					
Male	1.439	0.933–2.220	0.100	1.725	0.940–3.168	0.079
Working Place						
Indoor	Reference					
Outdoor	5.459	3.173–9.391	**<0.001**	0.745	0.335–1.656	0.470
UV exposure, hour/day	1.986	1.745–2.259	**<0.001**	1.824	1.556–2.138	**<0.001**
Smoking						
No	Reference					
Yes	0.889	0.513–1.540	0.674			
Ex-smoker	1.117	0.595–2.099	0.731			
Education level						
Elementary school	Reference			Reference		
Middle-school	0.252	0.105–0.608	**0.002**	0.254	0.093–0.696	**0.008**
High-school	0.105	0.047–0.234	**<0.001**	0.155	0.057–0.417	**0.000**
University	0.110	0.047–0.259	**<0.001**	0.233	0.082–0.665	**0.006**
Hypertension, yes	3.433	2.130–5.533	**<0.001**	1.618	0.830–3.153	0.158
Asthma, yes	0.637	0.145–2.800	0.550			
Diabetes Mellitus, yes	2.658	1.498–4.717	**0.001**	1.039	0.491–2.199	0.920
Coronary artery disease, yes	3.766	1.584–8.955	**0.003**	0.788	0.246–2.524	0.688
Hypothyroidism, yes	0.629	0.218–1.814	0.391			
Hyperthyroidism, yes	1.833	0.189–17.802	0.601			
Rheumatoid arhritis, yes	1.842	0.366–9.256	0.458			

OR: Odds ratio; CI: Confidence Interval; Dependent variable: Pterygium; Goodness of fit of the models were confirmed with Hosmer-Lemeshow tests (p>0.05); Bold p-values indicate statistical significance at p<0.05.

Table 4. *Simple and multiiple logistic regression analysis of risk factors for pinguecula (n=360)*

	Simple logistic regression			Multiple logistic regression		
Variables	OR	%95 CI	p	OR	%95 CI	p
Age	1.044	1.035–1.054	**<0.001**	1.017	1.003–1.030	**0.014**
Sex						
Female	reference			reference		
Male	1.564	1.190–2.055	**0.001**	0.761	0.535–1.084	0.131
Working Place						
Indoor	reference					
Outdoor	2.986	1.952–4.568	**<0.001**	0.747	0.431–1.297	0.300
UV exposure, hour/day	1.617	1.480–1.766	**<0.001**	1.474	1.327–1.638	**<0.001**
Smoking						
No	reference					
Yes	1.117	0.803–1.554	0.512			
Ex-smoker	1.351	0.914–1.996	0.132			
Education level						
Elementary school	reference			reference		
Middle-school	0.874	0.577–1.325	0.526	1.085	0.671–1.753	0.739
High-school	0.341	0.240–0.486	**<0.001**	0.589	0.375–0.926	**0.022**
University	0.194	0.124–0.304	**<0.001**	0.396	0.231–0.679	**0.001**
Hypertension, yes	2.094	1.486–2.951	**<0.001**	0.938	0.609–1.442	0.769
Asthma, yes	1.466	0.731–2.941	0.281			
Diabetes mellitus, yes	2.417	1.619–3.608	**<0.001**	1.309	0.828–2.07	0.250
Coronary artery disease, yes	2.628	1.334–5.177	**0.005**	1.157	0.536–2.495	0.710
Hypothyroidism, yes	0.618	0.327–1.168	0.238			
Hyperthyroidism, yes	1.541	0.309–7.675	0.598			
Rheumatoid Arthritis, yes	0.509	0.102–2.537	0.410			
Hyperlipidemia, yes	4.435	1.583–12.421	**0.005**	2.537	0.82–7.853	0.106

OR: Odds ratio; CI: Confidence Interval; Dependent variable: Pinguecula; Goodness of fit of the models were confirmed with Hosmer-Lemeshow tests (p>0.05); Bold p-values indicate statistical significance at p<0.05.

more daily exposure to UV light increased the probability of developing pterygium by 82.4% (OR=1.824, 95% CI: 1.556–2.138, p <0.001). In addition, it was observed that the risk of developing pterygium was lower in patients with higher education levels. In multiple logistic regression analyses, systemic comorbidities such as age, hypertension, diabetes and coronary artery disease lost their significance.

Pinguecula

In simple regression analysis, a significant correlation was found between advanced age, male gender, working outdoors, prolonged UV exposure, low education level, hypertension, diabetes, coronary artery disease and hyperlipidemia, and the risk of developing pinguecula (Table 4). According to the multiple logistic regression model, age (OR=1.017, 95% CI: 1.003–1.030, p=0.014), UV exposure (OR=1.474, 95% CI: 1.327–1.638, p <0.001) and education level (high school vs. primary school: OR=0.589, 95% CI: 0.375–0.926, p=0.022; university and above vs. primary school) were found as independent risk factors for pinguecula.

Discussion

There are many studies interested in the prevalence of pterygium in different geographies. The rate is 9.5% in South India[5], 1.3% in Tehran[9], 6.1% in China[10] and 5.9% in Spain[6]. According to a cross-sectional study by Tuncer et al. 11. from Türkiye, the frequency of pterygium was approximately 12.1%. In a cross-sectional study conducted by Gümüş et al.[12], the incidence of pterygium was reported to be 7.8%. Although our study was not a prevalence study, the frequency of pterygium among patients admitted to our clinic was found to be similar to many studies in the current literature (9.9%).

Considering the studies on the prevalence of pinguecula in the literature, the rates are in a wide range, reported as 11.3% in South India[5], 22.5% in Tehran[9], 75.5% in China[13], and 47.9% in Spain[6]. Tuncer et al.[11] reported the incidence of pinguecula among the patients admitted to the outpatient clinic to be 87.7%. In our study, the frequency of pinguecula was 35.5% among the patients who applied to our clinic. In the study of Viso et al.[6], the rate of bilateral involvement was reported as 33.3% and 88.9% for pterygium and pinguecula, respectively. In a

study from Türkiye, bilaterality was found to be 34.6% for pterygium[12]. Similar to these studies, we found the rate of bilaterality in the pterygium group to be 35.6%. However, we found the incidence of bilaterality to be 57.5% in the pinguecula group. Our findings support that pinguecula is more frequently seen bilaterally than pterygium. It has been suggested that the incidence of pterygium is higher in the region, including 37° south and north of the equator, also known as the pterygium belt[14]. Increased UV exposure causes limbal ischemia by damaging Langerhans cells in the limbus. As a result, the conjunctival epithelium undergoes hyperplasia and progresses towards the cornea.[15] High amounts of sunlight exposure and particles that may cause microtrauma, such as sand and dust in the working places, may also contribute to developing pterygium[14]. Publications suggest that the incidence of pterygium and pinguecula is higher, especially in rural areas[5,13,16,17]. A study conducted in our country found that pterygium is most common in agricultural workers and farmers; the pterygium size has also been larger in this occupational group[12]. Our study detected the pterygium group farmers' rate as 18.6%. It was also observed that patients with pterygium and pinguecula were exposed to higher amounts of sunlight (an average of 3 and 2 hours for pterygium and pinguecula, respectively). Bolu province is located at 40° north latitude, relatively far from the equatorial belt. Nevertheless, it can be said that besides the agricultural activities in the province, the marketing made outdoors throughout the year increases UV exposure and increases this frequency. Many studies suggest a strong relationship between pterygium and pinguecula and advanced age[5,6,11,18]. In our study, the mean age in the pterygium and pinguecula groups was significantly higher than in patients without pterygium or pinguecula ($p<0.001$). It was observed that age may be an independent risk factor, especially for developing pinguecula. Since exposure to environmental risk factors will increase as age increases, other data can interpret this result. While many studies suggest that pterygium and pinguecula are more common in males, there are also studies claiming the opposite[6,7,9,13,19,20]. Although it is possible to explain the higher prevalence of pterygium and pinguecula in men by spending more time under the sun, this may not be true for all geographic regions. In this study that we conducted in Bolu province, the rate of pterygium and pinguecula were lower in the female sex group. When the other variables were evaluated, it was found that gender was not a significant risk factor for either group. Many studies have investigated the possible relationship between developing pterygium and pinguecula and smoking, but no significant relationship was found in multivariate analysis[9,13]. Our study did not find a correlation between pterygium, pinguecula, and smoking. Several publications suggest that a low education level is related to developing pterygium and pinguecula[6], while others claim that education level is not important[5,9]. Our study found that the education level and the development of pinguecula and pterygium were inversely proportional in both groups. This data was also correlated with other results of our study (increased UV exposure, outdoor work, occupational distribution). As explained in the literature, it can be assumed that patients with higher education levels prefer jobs that can be carried out indoors[6] The presence of systemic disease in patients with pterygium and pinguecula was also investigated in several studies[5,13]. Although systemic conditions such as diabetes, hypertension, and coronary artery disease were more common in the pterygium and pinguecula groups, in our research, this data lost its significance in multivariate analysis.

The study's limitations are that since it was conducted with patients who applied to our clinic, it does not reflect the real prevalence of pterygium and pinguecula in the normal population.

Conclusion

Advanced age, prolonged UV exposure, outdoor work, and low education are closely associated with developing pterygium and pinguecula. Although Bolu province is located far from the equator, these risk factors have significantly affected the development of pterygium and pinguecula. This cross-sectional study is the first in the literature to examine the frequency and risk factors of pterygium and pinguecula in Bolu.

This study will contribute to the prevalence studies with a large series that can be done in our country in the future.

Statement of Ethics

Before the study, ethical board approval was obtained from the Scientific Research Ethics Committee (Decision no: 2020/20). The study was carried out in accordance with the Declaration of Helsinki, and informed consent was obtained from each patient.

Conflict of Interest Statement

All the authors declare no conflict of interest.

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