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The frequency of occurrence of certain corneal conditions by age and sex in Iranian adults

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ABSTRACT

Purpose: To determine the prevalence of posterior embryotoxon, corneal opacity, pigment on endothelium, corneal dystrophy, and corneal vascularization in a middle-aged Iranian population, and their association with age and sex.
Methods: In a cross-sectional study with multistage cluster sampling, subjects were chosen from 40 to 64-year-old residents of Shahroud in northern Iran. Participants had ophthalmic examinations before and after pupil dilation. Corneal abnormalities were diagnosed by an ophthalmologist using a slit lamp.
Results: Of the 6311 invitees, 5190 people (82.2%) participated; 58.6% ($n = 3040$) were female. The prevalence of posterior embryotoxon, corneal opacity, and pigment on endothelium were 14.7% (95% CI: 13.4–16.0), 4.1% (95% CI: 3.4–4.7) and 1.2% (95% CI: 0.9–1.5), respectively, and corneal dystrophy and corneal vascularization were seen in 0.3% (95% CI: 0.2–0.5) and 3.7% (95% CI: 3.0–4.3), respectively. Unlike posterior embryotoxon, the prevalence of all studied abnormalities increased with age after adjusting for sex. The prevalence of posterior embryotoxon ($p = 0.023$) and corneal dystrophy ($p = 0.038$) was significantly higher in women, and the prevalence of corneal opacity ($p < 0.001$) was significantly higher in men. After adjusting for age, sex, and cataract, cases with corneal opacity and corneal vascularization demonstrated significantly worse uncorrected and corrected visual acuity ($p < 0.001$).
Conclusion: This report is the first to explore the prevalence of a variety of corneal conditions in a Middle-Eastern population. The findings indicate that one out of five people may have some sort of corneal conditions, and some can impact corrected visual acuity.

1. Introduction

The human cornea can be affected by a variety of disease and conditions. While conditions, such as posterior embryotoxon and pigment on endothelium, can be helpful in the diagnosis of glaucoma [1,2], some others, such as corneal opacity, corneal dystrophy, and corneal vascularization can reduce vision and cause blindness when severe [3–6]. There is limited information about the epidemiology of corneal conditions and their prevalence rates vary in different studies [1,2,7,8]. Reported rates are 5–32% for posterior embryotoxon [1,2,9], 3–4% for corneal opacity [7,10,11], and less than 0.1% for the overall prevalence of corneal dystrophies [8].

Since most ocular diseases occur after the age of 40 and the need for ocular surgery is more common after this age, it is important to have knowledge about the prevalence of corneal abnormalities in the 40–64 years old population.

In addition, some abnormalities may cause blindness, and thus, conducting epidemiologic studies in this area can provide ophthalmologists with valuable information [3,4,8,12,13].

Few studies have looked into the epidemiology of these problems. In Iran, although several studies have investigated the epidemiology of eye conditions in the past 10 years, there are no reports concerning certain corneal conditions [14,15].

The Shahroud Eye Cohort Study (ShECS) is designed to investigate visual impairment [14], major eye conditions, and related issues in the 40–64-year-old citizens of the city of Shahroud as a

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Middle-Eastern population. Here, data from the first phase of ShECS were examined to determine the prevalence of certain corneal conditions in this population and determine possible associations and risk factors.

2. Subjects and methods

The present study is part of the cross-sectional Shahroud Eye Cohort Study; details of its methodology have been published previously [14], and a brief summary was presented here. The target population of the study was the 40–64-year-old residents of Shahroud, a city in the north-west of Iran. Potential participants were selected through multistage cluster sampling from nine health care centers in Shahroud. Three hundred clusters were randomly selected, and from each cluster, at least 20 people were chosen systematically. To enroll these participants, interviewers first started with the head household that was chosen by random and then proceeded in a clockwise direction with adjacent households. If there was no response on the first contact, the household was approached again in the evening or another day. All study enrollees were invited to the study site which was equipped with ophthalmic, optometric, and imaging facilities. After obtaining consents, they had an interview to collect demographic data such as age, gender, and education, and they were asked about their medical and ocular history, as well as their smoking and dietary habits.

2.1. Ophthalmic examinations

All examinations were done between 9:00 am and 3:00 pm. Vision was tested with and without correction and recorded on the LogMAR scale. Objective refraction (autorefraction with the Topcon AR 8800 and static retinoscopy using the Heine retinoscope) and subjective refraction were determined for all participants.

Ophthalmic exams were done in two stages before and after pupil dilation. Before pupil dilation, slit lamp biomicroscopy with the Haag-Streit BM900 and measurement of intraocular pressure with Goldmann applanation tonometry was done. Examinations conducted after dilation (cyclopentolate 1%, instilled twice, 5 min apart) included clinical grading of lens opacities and assessment of vitreous opacities at the slit lamp, and examinations of the retina using direct and indirect ophthalmoscopy. Corneal conditions of interest in this study included posterior embryotoxon, corneal opacity, pigment on endothelium, corneal dystrophy, and corneal vascularization.

2.2. Definitions

The diagnosis of corneal conditions was made by an ophthalmologist through slit lamp microscopy based on the following procedures and definitions:

Posterior embryotoxon: Examination of the posterior peripheral cornea and observing a ring in the corneal periphery at the margin of Decemet's membrane which is displaced closer to the center of the cornea in this condition and can be seen with direct light at the slit lamp.

Corneal opacity: Examination of the entire cornea, at various depths in different areas to observe areas of lost transparency ranging from superficial to deep opacities which may be central or peripheral in the cornea.

Pigment on endothelium: Observing deposits in the corneal endothelium which often appear colored and may be found in the center of the cornea, its periphery, or both.

Corneal dystrophy: Observing bilateral hereditary structural disorders in different layers such as the epithelium, basal membrane, stroma, and endothelium which appear as various opacities, vesicles, rings, and streaks.

Corneal vascularization: observing the presence of blood vessels in different layers of the cornea, especially the corneal stroma.

2.3. Statistical analyses

All statistical analyses were done using the STATA software version 12. Any person with one of the studied corneal conditions in at least one eye was counted as one case. The prevalence rates of these conditions were summarized as percentages and 95% confidence intervals (CI). The effect of cluster sampling was taken into consideration in calculating the 95% CI. Multiple logistic regression models were used to examine possible relationships with age and sex. Also, to assess the relationship of each type of corneal condition with uncorrected and corrected visual acuity, they were entered in simple linear regression models as dependent variables after adjusting for age, sex, and cataract.

3. Results

In the first phase of ShECS, 6311 people were invited and 5190 of them (82.2%) participated. Mean age of the participants was 50.9 ± 6.3 (range, 40–64) years and 58.6% ($n = 3040$) of them were female. The overall prevalence rates of posterior embryotoxon, corneal opacity, and pigment on endothelium in at least one eye were 14.7% (95% CI: 13.4–16.0), 4.1% (95% CI: 3.4–4.7), and 1.2% (95% CI: 0.9–1.5), respectively. The prevalence of corneal dystrophy in at least one eye was 0.3% (95% CI: 0.2–0.5) and corneal vascularization was observed in 3.7% (95% CI: 3.0–4.3). Table 1 summarizes the prevalence of these corneal conditions by age and sex.

Results of the multiple logistic regression model (Table 2) indicated that the prevalence of all types of corneal conditions increased with age after adjusting for sex, except for posterior embryotoxon whose prevalence significantly decreased with age. According to this model, the prevalence of posterior embryotoxon and corneal dystrophy was significantly higher in women, and corneal opacity was significantly more common in men (Table 2). As for bilateral cases, the prevalence of posterior embryotoxon

Table 1
Prevalence of corneal abnormalities in the 40–64-year-old population of Shahroud by age and sex.

	Posterior embryotoxon, % (95% CI)	Corneal opacity, % (95% CI)	Pigment on endothelium, % (95% CI)	Corneal dystrophy, % (95% CI)	Corneal vascularization, % (95% CI)
Total	14.7 (13.4–16.0)	4.1 (3.4–4.7)	1.2 (0.9–1.5)	0.3 (0.2–0.5)	3.7 (3.0–4.3)
Female	16.0 (14.4–17.5)	2.6 (2.0–3.2)	1.1 (0.8–1.5)	0.5 (0.2–0.7)	3.4 (2.7–4.1)
Male	12.9 (11.2–14.6)	6.1 (5.1–7.2)	1.3 (0.8–1.8)	0.1 (0.0–0.3)	4.0 (3.1–5.0)
40–44	19.5 (17.0–22.0)	1.9 (1.0–2.8)	0.2 (0.1–0.8)	0.2 (0.1–0.8)	0.8 (0.3–1.4)
45–49	16.6 (14.5–18.7)	3.5 (2.5–4.4)	0.9 (0.6–1.6)	0.2 (0.1–0.7)	1.3 (0.7–1.9)
50–54	14.1 (12.1–16.2)	3.9 (2.7–5.1)	1.0 (0.5–1.6)	0.3 (0.0–0.6)	3.2 (2.3–4.1)
55–59	11.9 (9.7–14.0)	5.0 (3.6–6.5)	1.7 (0.8–2.6)	0.4 (0.0–0.8)	5.9 (4.3–7.5)
60–64	8.4 (5.7–11.0)	7.7 (5.4–10.0)	3.0 (1.6–4.4)	0.7 (0.0–1.3)	11.0 (8.3–13.8)

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