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Meibomian gland dysfunction and its determinants in Iranian adults: A population-based study

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ABSTRACT

Purpose: To estimate the prevalence of Meibomian gland dysfunction (MGD) and determine the associated factors in the general population in Iran.

Methods: This cross-sectional study is based on the data from the second phase of the Shahroud Eye Cohort Study conducted in 2014. Of the 4737 participants of the second phase, data was available for 4700 people; their mean age was 55.9 ± 6.2 years and 2768 (58.9%) were women. Diagnosis of MGD was made based on the classification of the International Workshop on MGD as judged by the examining ophthalmologist. The prevalence of MGD was summarized as percentage and 95% confidence intervals (CI), and related factors were studied through simple and multiple logistic regressions.

Results: The diagnosis of MGD in at least one eye was recorded for 1235 (26.3%) participants; the prevalence of unilateral and bilateral MGD was 26.3% (95% CI: 24.5-28.1) and 26.1% (95% CI: 24.3–27.9), respectively. In the multiple logistic regression analyses, MGD significantly correlated with pinguecula [odds ratio (OR) = 1.3, 95% CI: 1.12–1.50], hypertension (OR = 1.34, 95% CI: 1.11–1.61), high-density lipoprotein (HDL) level (OR = 0.0992, 95% CI: 0.986–0.999), diabetes mellitus (OR = 0.83, 95% CI: 0.71–0.97), and years of education (OR = 0.98, 95% CI: 0.96–0.99).

Conclusions: MGD prevalence in this study was lower than the rates reported in other studies on Asian populations. Besides HDL level, MGD is associated with another ocular surface disorder, namely pinguecula, as well as certain systemic diseases such as hypertension and diabetes mellitus. These associations should be taken into consideration when diagnosing MGD.

1. Introduction

Meibomian gland dysfunction (MGD) is one of the most common disorders of the eyelids which is often overlooked [1]. The pathogenesis is not completely understood, but in general, it appears that changes in the quality and quantity of Meibomian gland secretions (Meibum) and the resulting changes in the tear lipid composition increases tear evaporation and osmolality, and hence, the ocular surface becomes more prone to many diseases [1–3]. MGD has been shown to be the leading cause of evaporative dry eye [4] which is commonly detected in patients with aqueous-deficient dry eye [4]. MGD, with or without inflammation, can cause discomfort and visual symptoms due to tear film instability. Prolonged inflammation or obstruction of meibomian glands may lead to their atrophy or loss of functioning glands [5].

It is estimated that the prevalence of MGD in the general population is high (range: 39–50%) [6] and is associated with different systemic diseases such as diabetes mellitus, hypertension, hypercholesterolemia, atopy, and atopic dermatitis [6–11]. The few population-based studies available on this topic have reported MGD prevalence in association with dry eye which ranges from 3.5% in the Salisbury Eye Evaluation Study [12] to 68.3% in the Beijing Eye Study in China [13]. Some fewer studies have investigated potential risk factors related to MGD, although they have mostly studied patients who have MGD and dry eye [14]. In this population-based study, the prevalence of MGD and its association with other ophthalmic and systemic diseases is investigated in an adult population of Shahroud, Iran

2. Methods

In this study, data were used from the second phase of the Shahroud

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Eye Cohort Study conducted in 2014. The Shahroud Eye Cohort Study is an epidemiological study on a random sample of 40–64 year old adult residents of Shahroud, which aims to identify the causes of eye disease and visual disorders. The details of the methodology and population sampling are described elsewhere [15]. In brief, from the total population of 40 to 64 year old adults of about 28,000 people, 6311 individuals were selected through random cluster sampling, and 5190 participated in phase I of the study in 2009 (response rate: 82.2%). In the second phase of the study, all baseline participants (5190 people) were invited to have follow-up examinations and 4737 participated (response rate: 91.3%). After completing the interviews, all participants had comprehensive eye examinations including near and distance vision testing, refraction, slit lamp exam, and direct and indirect ophthalmoscopy. For each individual the necessary information in relation to anthropometric measures, blood pressure, lipid profile, fasting blood sugar, and hemoglobin A1c level was recorded. The diagnosis of MGD was based on the clinical judgment of the study ophthalmologist. According to the international workshop on Meibomian gland dysfunction: Report of the diagnosis subcommittee [16], MGD can be clinically categorized into:

1. Asymptomatic MGD, 2. MGD with ocular surface damage, 3. MGD-related evaporative dry eye, and 4. MGD associated with other ocular disorders.

In this study all subtypes of above definition were considered as MGD. MGD cases included both hypersecretory and hyposecretory types and the cases with Meibomian gland diseases excluded from MGD definition.

This study was approved by the Ethics Committee of Shahroud University of Medical Sciences, and all study procedures adhered to the tenets of the Declaration of Helsinki for human research. Informed written consents were obtained from all participants.

2.1. Statistical analysis

In this study, the prevalence of MGD and 95% confidence intervals (CI) are provided for the total population as well as study subgroups. In order to investigate the relation between MGD with potential risk factors, simple and multiple logistic regression analyses were used. In the multiple logistic regression analysis model, the forward likelihood ratio method was used to remove non-significant variables. Thus, the final model with the remaining variables provided the adjusted odds ratio and 95% CI. In all analyses, the design effect was calculated to correct for the effect of cluster sampling on calculating the confidence intervals. In all statistical tests, a significance level of 0.05 was considered.

3. Results

Of the 4737 participants, 37 cases had missing data and the final analyses were therefore performed with data from 4700 people with a mean age (± SD) of 55.9 ± 6.2, and 2769 (58.9%) of them were women. In total, 1235 participants (26.3%, 95% CI: 24.5–28.1) were diagnosed with MGD in at least one eye, and in more than 99% of these cases, MGD was bilateral. Therefore, the prevalence rates of unilateral and bilateral MGD were 26.3% (95% CI: 24.5–28.1) and 26.1% (95% CI: 24.3–27.9), respectively. Considering MGD in at least one eye as the outcome measure, MGD prevalence was higher in men (27.8%, 95% CI: 25.4–30.2) than woman (25.2%, 95% CI: 23.2–27.2). Among the studied age groups, the 60–64 year age group (39.9%, 95% CI: 26.4–5.4) and among education categories, illiterate people (29.5%, 95% CI: 25.2–33.4) had the highest MGD prevalence rates. The prevalence of MGD was lower in people with body mass index (BMI) > 25 (25.6%, 95% CI: 23.8–27.5) compare to those with BMI < 25 (28.6%, 95% CI: 25.3–31.8). MGD was more common among smokers than non-smokers (28.0% vs. 26.0%). Table 1 shows the prevalence of MGD in at least one eye in the total study population and subgroups.

Table 1
Prevalence of Meibomian gland dysfunction in at least one eye by gender, age, and other variables in the Shahroud, Iran, 2014.

Independent Variables		Number of participants	Prevalence% (95% Confidence Intervals)
Totals		4700	26.3 (24.5–28.1)
Gender	Male	1931	27.8 (25.4–30.2)
	Female	2769	25.2 (23.2–27.2)
Age group	45–49	870	25.4 (22.2–28.5)
	50–54	1262	24.6 (21.8–27.5)
	55–59	1179	25.2 (22.6–28.0)
	60–64	857	39.9 (26.4–33.5)
	65–69	531	27.6 (24.0–31.3)
Education level	illiterate	525	29.5 (25.2–33.4)
	primary	1483	26.9 (24.0–29.8)
	secondary	712	27.1 (23.6–30.6)
	high school	1454	24.7 (21.9–27.5)
	college	522	24.2 (20.4–28.0)
BMI group	< 25	992	28.6 (25.3–31.8)
	≥25	3736	25.6 (23.8–27.5)
Current Smoker	no	4023	26.0 (24.2–27.8)
	yes	669	28.0 (24.4–31.5)
Diabetes	no	3547	26.8 (24.9–28.6)
	yes	1115	24.5 (21.5–27.4)
Hypertension	no	1803	23.1 (20.8–25.5)
	yes	2896	28.2 (26.1–30.3)
Losartan Use	no	2578	24.6 (22.5–26.7)
	yes	2114	28.2 (25.9–30.5)
Pinguecula	no	3509	24.7 (22.9–26.5)
	yes	1193	30.7 (27.7–33.7)
Pterygium	no	4312	26.3 (24.5–28.1)
	yes	390	24.9 (20.1–29.6)

All variables of gender, age, years of education, BMI, and diabetes, as well as hypertension, Losartan use, HDL, and pinguecula were entered in simple logistic regression models. The first 5 variables showed a $p < 0.20$ and were fit in the multiple logistic regression model. The odds ratios obtained from univariate and multivariable logistic regression models are presented in Table 2. Variables which maintained their significance in the final model, in the order added to the model, were pinguecula (OR = 1.30, 95% CI: 1.12–1.50), hypertension (OR = 1.34, 95% CI: 1.11–1.61), HDL level (OR = 0.992, 95% CI: 0.986–0.999), diabetes mellitus (OR = 0.83, 95% CI: 0.71–0.97), and years of education (OR = 0.98, 95% CI: 0.96–0.99).

4. Discussion

The MGD prevalence rates reported in the available literature broadly vary, but they generally point to higher rates in Asian populations compared to predominantly Caucasian populations [14]. In the present study, the prevalence of MGD in the 45–69 year old population was 26.3% (95% CI: 24.5–28.1) which is lower compared to other studies conducted on Asian populations (from 46.2% in the Bangkok Study to 69.3% in the Beijing Eye Study) [13,17–19], but higher than population-based studies on Caucasians (from 3.5% in the Salisbury Eye Evaluation Study [12] to 19.9% in the Melbourne Visual Impairment Project [20]). Genetic predisposition of Asians or racial differences may be the cause of the higher prevalence of this disorder in the Asian race. However, due to differences in the study populations and definitions, it is difficult to estimate the exact MGD prevalence rate in the general population, and drawing any comparison between studies or an overall conclusion must be done with caution.