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Factors Associated with Age-Related Macular Degeneration in Chinese American Adults

The Chinese American Eye Study (CHES)

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Objective: To assess associations between age-related macular degeneration (AMD) and multiple factors comprising a conceptual model of AMD risk in a population of Chinese Americans, and to draw comparisons with a similar risk assessment of a Latino population.

Design: A cross-sectional population-based study.

Participants: We enrolled 4582 Chinese Americans aged ≥50 residing in Monterey Park, California.

Methods: Participants completed a comprehensive eye examination, including stereoscopic fundus photography and ocular biometric measurements. Fundus images were graded using a modified version of the Wisconsin Age-Related Maculopathy Grading System.

Main Outcomes and Measures: Odds ratios for factors significantly modifying the risk of AMD and its related retinal lesions.

Results: Of the eligible participants, 4172 (72%) had fundus photographs gradable for AMD. Early AMD was present in 375 eyes (4.6%), and late AMD was present in 17 (0.2%). Shorter axial length, male sex, older age, and family history of AMD were identified as independent risk factors for prevalent AMD and its characteristic retinal lesions using a conceptual model of potential AMD risk factors. Of 4 AMD risk factors identified for Latinos, 3 (older age, male sex, shorter axial length) overlapped with those identified for Chinese Americans, with an association similar in magnitude and direction. Lower levels of education were a risk factor specific to Latinos. Based on a multivariable logistic regression model, the predicted probability of early AMD was 31% lower among Chinese Americans relative to Latinos (95% confidence interval [CI], 17%−43%). Chinese Americans also had statistically significantly lower odds of any AMD and 2 types of early retinal lesions symptomatic of AMD.

Conclusions: Factors associated with prevalent AMD are similar for Chinese Americans and Latinos. Chinese Americans who were older, were male, had a family history of AMD, and had a shorter axial length were at an increased risk for AMD compared with those without these risk factors. We observed a significantly lower predicted prevalence of AMD among Chinese Americans compared with Latinos, even after controlling for all relevant covariates, suggesting that additional genetic or lifestyle differences may play an important role in determining AMD risk. *Ophthalmology Retina 2017;■:1−8 © 2017 Published by Elsevier Inc. on behalf of the American Academy of Ophthalmology*

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Age-related macular degeneration (AMD), a progressive and incurable eye disease, is the leading cause of visual impairment and blindness among those aged ≥55 in industrialized countries.[1] Cases of visual impairment and blindness in the United States directly attributable to AMD have been estimated at 0.62 million in 2010 and, in the absence of treatment, are expected to increase to 1.6 million by 2050.[2] The public health burden of AMD is manifested on a personal level in decreased quality of life, and in the public sphere by increased health care expenditures and productivity losses. The annual global cost of visual impairment due to AMD is estimated at $343 billion in US dollars,[3] and is expected to increase substantially as countries shift toward having larger proportions of elderly individuals.

The Chinese American Eye Study (CHES) is the first large, population-based study of eye disease in Chinese Americans. It offers an opportunity to identify factors that modify AMD risk in a population in which the burden and characteristics of the disease are still unknown, and to

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increase awareness among susceptible Chinese Americans about the importance of eye care. To serve as a framework for our analysis, we developed a conceptual risk model that groups factors known or presumed to be associated with AMD, based on prior knowledge and clinical experience, into 4 categories: sociodemographic, lifestyle, health care access and use, and biological (Fig 1, available at www.ophthalmologyretina.org). Factors in each category may have a direct effect on AMD risk, and/or an indirect effect via modification of factors in other categories.

To determine the extent to which there may be inter-ethnic differences in AMD risk factors and susceptibility to AMD, we used data from the Los Angeles Latino Eye Study (LALES), a large, population-based study of the prevalence of ocular disease in a nationally representative cohort of adult Latinos living in La Puente, California. LALES used the same study design and methodology as CHES, including masked grading of AMD performed by the same expert graders using identical standardized outcome definitions, thereby minimizing threats to internal validity. Risk factors in a multivariable model developed using the conceptual model framework were compared with CHES risk factors, and a combined CHES and LALES dataset was generated to test for an effect of race/ethnicity on AMD risk.

Methods

CHES is a population-based cohort study designed to identify risk factors and estimate prevalence for common eye diseases in an urban population of Chinese Americans. Data were collected from February 2010 to October 2013 from a study population composed of individuals with self-identified Chinese ancestry aged ≥50 years, residing in 10 census tracts in Monterey Park, California. More detailed information on the study design and methods has been published previously.[4]

The CHES protocol was approved by the University of Southern California Health Science Institutional Review Board. This study complied with the Health Insurance Portability and Accountability Act of 1996, and adhered to all Declaration of Helsinki guidelines. All study participants provided written, informed consent.

Interview and Examination Procedures

Individuals meeting eligibility requirements were invited to participate in the study through neighborhood canvassing. Participants completed an interviewer-assisted questionnaire that collected information on demographic characteristics, medical and ocular histories, insurance status, access to care, and acculturation to Western culture as measured with the Suinn-Lew Asian Self-Identity Acculturation scale.[5]

After the home interview, participants visited the study's local eye examination center (LEEC), where they underwent a comprehensive eye examination conducted by trained ophthalmologists and technicians, and completed a clinical interview that collected data on quality of life and visual function. A Topcon TRC retinal camera (Topcon, Tokyo, Japan) captured detailed fundus photographs for each eye (3 stereoscopic fields for nondiabetics, 7 for diabetics), which were sent to the Ocular Epidemiology Reading Center in Wisconsin for independent, masked grading of AMD and other retinal lesions.

Factor Assessment

Data for factors comprising the conceptual model variables were obtained from the 2 questionnaires (in-home and clinical) and the clinical eye examination. Sociodemographic factors included age, sex, height, income, education, marital status, employment status, country of birth, family history of AMD, and acculturation (less than or greater than the sample median Suinn-Lew Asian Self-Identity Acculturation value of 1.76). Lifestyle factors included the use of cigarettes, alcohol, anti-inflammatory drugs, and statins, and, for females, oophorectomy and the use of contraceptive pills and female hormones.

Health care access and use factors included insurance status, access to regular care, and barriers to care (cost, transportation, wait time, language barrier, and uncertainty about service provider location). Biological risk factors included axial length (AL), myopia (spherical equivalent <-0.5 diopters), hyperopia (spherical equivalent >0.5 diopters), body mass index, systolic and diastolic blood pressure, pulse pressure, mean ocular perfusion pressure, total cholesterol, low- and high-density lipoprotein cholesterol, total triglycerides, arteriolar narrowing, lens opacities, history of cataract, and number of self-reported comorbidities (cardiovascular disease, hypertension, hyperlipidemia, asthma, diabetes, and cancer). The AL was recorded as the average of 3 successive measurements obtained by a single technician using A-scan ultrasound (Ultrasonic A-SCAN pachymeter, Exton, PA).

AMD Grading

The AMD lesions were graded according to a modified version of the Wisconsin Age-Related Maculopathy Grading System.[6] A detailed explanation of all grading procedures and definitions is presented elsewhere.[7,8] Briefly, 2 graders assessed each eye for AMD-associated lesions using a transparent grid overlay of 3 concentric circles (radii of 500, 1500, and 3000 μm) applied to field 2 macula-centered stereo photographs. Drusen size was estimated by visually comparing drusen with standard circles. Early AMD was diagnosed if 1 of the following lesions was present in the absence of advanced lesions: (1) soft indistinct (SI) drusen >125 μm in size, or (2) drusen of any size or type in combination with pigmentary changes. Late AMD was defined as either geographic atrophy or exudative AMD not resulting from retinopathies due to other established causes.

Data and Statistical Analyses

Frequencies of each variable were tabulated by the AMD outcome of interest, which included AMD (early, late, and any) and AMD-associated retinal lesions, namely, SI drusen, increased retinal pigment, and retinal pigment epithelium (RPE) depigmentation. Multivariable models were developed for each outcome except late AMD, which had too few cases.

Two-sided chi-square and *t* tests were used to evaluate univariate associations between AMD outcomes and categorical or continuous variables, respectively. Bivariate logistic regression analyses were performed to estimate odds ratios (ORs) and 95% confidence intervals (CIs) for associations between individual model variables and dichotomous AMD phenotypes, controlling for age.

Multivariate logistic regression was used to identify independent AMD risk factors. To increase statistical power and the precision of parameter estimates, analyses were performed using data from both left and right eyes, with between-eye correlation adjusted for with generalized estimating equation models (exchangeable correlation, robust estimators). Each conceptual model category represents a separate dimension of disease risk and thus was modeled separately. Backward selection was used to