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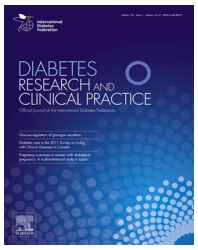

Review

Myopia and diabetic retinopathy: A systematic review and meta-analysis

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ABSTRACT

Aims: Myopia may have protective effects against diabetic retinopathy (DR). However, the data from epidemiologic studies are inconsistent. We aimed to examine the association between myopia and DR by conducting a meta-analysis.

Methods: We identified studies by searching the PubMed and EMBASE databases. Study-specific odds ratios (ORs) were pooled using a fixed or random effects model. Myopic eyes were defined as having a spherical equivalent (SE) < -0.5 diopters (D). Myopic SE, each diopter decrease in SE toward myopia, and each millimeter increase in axial length (AL) were used as independent surrogate variables for myopia.

Results: Data from 6 population-based and 3 clinic-based studies were included in the analyses. Myopic SE (compared with emmetropic eyes) and each millimeter increase in AL were associated with a decreased risk for DR (pooled odds ratio [OR], 0.80 and 0.79, respectively; 95% confidence interval [CI], 0.67–0.95 and 0.73–0.86, respectively; $P = 0.011$ and 0.000, respectively). Each millimeter increase in AL was also associated with a decreased risk for vision-threatening diabetic retinopathy (VTDR) (pooled OR, 0.70; 95% CI, 0.60–0.82; $P = 0.000$). No significant association between each diopter decrease in SE and DR was observed.

Conclusions: Our meta-analysis suggests that individuals with myopia exhibit a decreased risk of developing DR or VTDR. An increased AL plays a critical role in this protective effect.

Contents

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1. Introduction

Diabetic retinopathy (DR), a common and specific microvascular complication of diabetes, remains the leading cause of preventable blindness in working-aged people [1]. Previous studies have demonstrated that myopia protects against DR [2,3]. However, population-based studies have revealed inconsistent and conflicting results. For example, the Singapore Malay Eye Study reported that eyes with more severe myopia were less likely to exhibit DR [2]. In contrast, the Beijing Eye Study reported no association between myopia and DR [4]. Recently, an observational review from Man et al. indicated that axial elongation, not myopia, may be primarily responsible for the protective relationship between myopia and DR [5].

A better understanding of the relationship between myopia and DR may provide insight into the pathophysiology of DR. However, a meta-analysis of the results of all available studies that have evaluated the association of myopia with DR has not been performed to date. The aim of this systematic review and meta-analysis is to examine the association between myopia and DR based on data from available population-based and clinic-based studies. Where data were available, we evaluated this relationship using the myopic spherical equivalent (SE), each diopter decrease in SE toward myopia, and each millimeter increase in AL as independent surrogate variables for myopia.

2. Methods

2.1. Search strategy

First, we performed a systematic search of PubMed and EMBASE to identify all relevant population-based and clinic-based studies published up to March 2015 using the following search items: (''myopia'' [MeSH Terms] OR ''myopia'' [All Fields]) OR (myopic [All Fields]) OR (''refractive errors'' [MeSH Terms]) OR (''refractive'' [All Fields] AND ''errors'' [All Fields]) OR (''refractive errors'' [All Fields]) OR (''refractive'' [All Fields] AND ''error'' [All Fields]) OR (''refractive error'' [All Fields]) OR (''axial length'' AND (DR [All Fields] OR proliferative DR (PDR) [All Fields]) OR (''diabetes'' [MeSH Terms] and ''retinopathy'' [MeSH Terms] OR ''diabetic macular edema'' [All Fields]). English-language articles were retrieved, and duplicate citations were excluded after a review of the titles and abstracts. The full texts of the remaining articles were reviewed to ensure that the studies met the inclusion and exclusion criteria. In addition, the reference lists of all of the identified studies were examined. Two authors (WX and YYJ) independently conducted the search; any disagreements were resolved by adjudication with two additional reviewers (GL and TLS).

2.2. Inclusion and exclusion criteria

Studies were included if they met the following criteria: (i) explored the associations among myopia, AL and DR; (ii) used DR as an outcome measure, which was assessed based on fundus photographs according to standardized protocols, such as the Early Treatment Diabetic Retinopathy Study (ETDRS) or the Airlie House classification system; and (iii) reported a measure of the association either as an odds ratio (OR) or a hazard ratio (HR) with a 95% confidence interval (CI) or allowed for the calculation of such metrics from the raw data presented in the article. We excluded (i) studies published in non-English languages and (ii) studies without a clear threshold definition of myopia or lacking fundus photography results according to standardized protocols. When multiple publications from the same study population were available, we identified any duplicate analyses and included only the most recent publication.

2.3. Data extraction and quality assessment

Using a standardized data extraction sheet, the following information (if available) was extracted from the studies and recorded: (i) last name of the first author, (ii) year of publication, (iii) study name, (iv) study design, (v) race/ethnicity of the study population, (vi) number of subjects included in the analysis, (vii) age range of the study participants, (viii) case definition of DR and myopia, (ix) effect estimate(s), and (x) the confounding factors for which adjustment was performed. We assessed the study quality using the tool described by Sanderson and colleagues [6]. The variables examined included the methods for selecting the study participants, the methods for measuring exposure (myopia) and outcome (DR), design-specific sources of bias (excluding confounding variables), the methods that were used to control for confounding variables, the statistical methods (excluding the control of confounding variables), and potential conflicts of interest.

2.4. DR assessment and definition

In all of the studies, DR was graded using fundus photographs according to the modified ETDRS grading scale or the Airlie House classification system. DR severity was categorized as non-proliferative DR (NPDR; levels 20–53) or proliferative DR (PDR) (level $\geq$60). Diabetic macular edema (DME) was categorized as absent or present. The primary outcomes for this study were based on the severity in the worse eye or in the