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Review Paper

The effect of smoking on the risk of primary open-angle glaucoma: an updated meta-analysis of six observational studies

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ABSTRACT

Objectives: Several studies have investigated the role of smoking on primary open-angle glaucoma (POAG), but the results still remain controversial. We therefore aimed to estimate the effect of smoking on developing POAG.

Study design: A meta-analysis was conducted from 1 January 1966 to 1 December 2015.

Methods: We systematically retrieved the relevant studies reporting the association between smoking and POAG using the Cochrane Library, PubMed, and Embase databases. Data were extracted from applicable articles, and effect values were pooled by RevMan 5.3 software.

Results: Six observational studies (three cohort and three case-control studies) fulfilled the inclusion criteria. We found no evidence of publication bias or heterogeneity among all the included studies. A fixed-effects model was performed to pool the relative risks [RRs] with 95% confidence intervals [CIs]. Both current smokers (pooled adjusted RR = 0.97, 95% CI 0.81–1.16, $P = 0.74$, $I^2 = 38\%$) and former smokers (RR = 0.97, 95% CI 0.83–1.13, $P = 0.66$, $I^2 = 46\%$) had no statistical significant association with POAG compared with never smokers. The sensitivity analysis indicated the pooled results were not significantly changed.

Conclusions: Our meta-analysis results suggest that there may be not a causal association between smoking and development of POAG.

Introduction

Glaucoma has been established as the second most frequent cause of blindness after cataract worldwide. Primary open-angle glaucoma (POAG), also sometimes called open-angle glaucoma, is the most common type. Although the aetiology of POAG is not fully understood, many epidemiological risk factors for developing POAG have been investigated. The classical ocular risk factors, mainly including ocular hypertension, myopia,[1] and thin central corneal thickness[2] have been widely accepted. In recent years, other non-ocular

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factors playing a role in the genesis of POAG have also gained attention, including age, family history, ethnicity and cigarette smoking. Among them, cigarette smoking is a preventable risk factor for many ocular diseases including age-related macular degeneration,[3] age-related cataract[4] and thyroid eye disease.[5] A number of prior studies suggested that smoking was also associated with the development of POAG. However, the association between cigarette smoking and POAG remained controversial. In several studies,[6–8] smoking was not independently associated with development of POAG, while other studies[9–11] demonstrated the inverse effects of smoking on incidence of POAG. In 2004, an earlier meta-analysis performed by Bonovas et al.[12] indicated that current smoking increased the risk of developing POAG and former smoking was not associated with developing POAG. Nevertheless, this meta-analysis did not include any prospective cohort studies, and it was not appropriate to pool results from cross-sectional studies and case-control studies. Moreover, several data extracted from the included studies were not adjusted for any potential risk factors. Another systematic review provided a qualitative analysis and found no causal association between smoking and development of POAG.[13] However, this review included limited data of cohort studies and some included studies were in poor quality. We therefore conducted an updated quantitative analysis to estimate the association between smoking and POAG.

Methods

Study design

A meta-analysis was conducted from 1 January 1966 to 1 December 2015. The protocol and reporting of the results of this meta-analysis were based on the PRISMA statement.[14]

Eligibility criteria

For inclusion, a study fulfilled the following criteria: a) evaluate the effect of smoking on developing POAG; b) classify individuals as 'current smokers,' 'former smokers' and 'never smokers'; c) have a cohort or case-control study design; and d) provide sufficient effect values (adjusted relative risks [RRs] or odds ratios [ORs] with its 95% confidence intervals [CIs]). The following exclusion criteria were applied: a) cross-sectional studies; b) certain publication types (e.g. letters, case reports, comments); c) the disease studied was not specifically designated as POAG; and d) studies with insufficient or duplicate data.

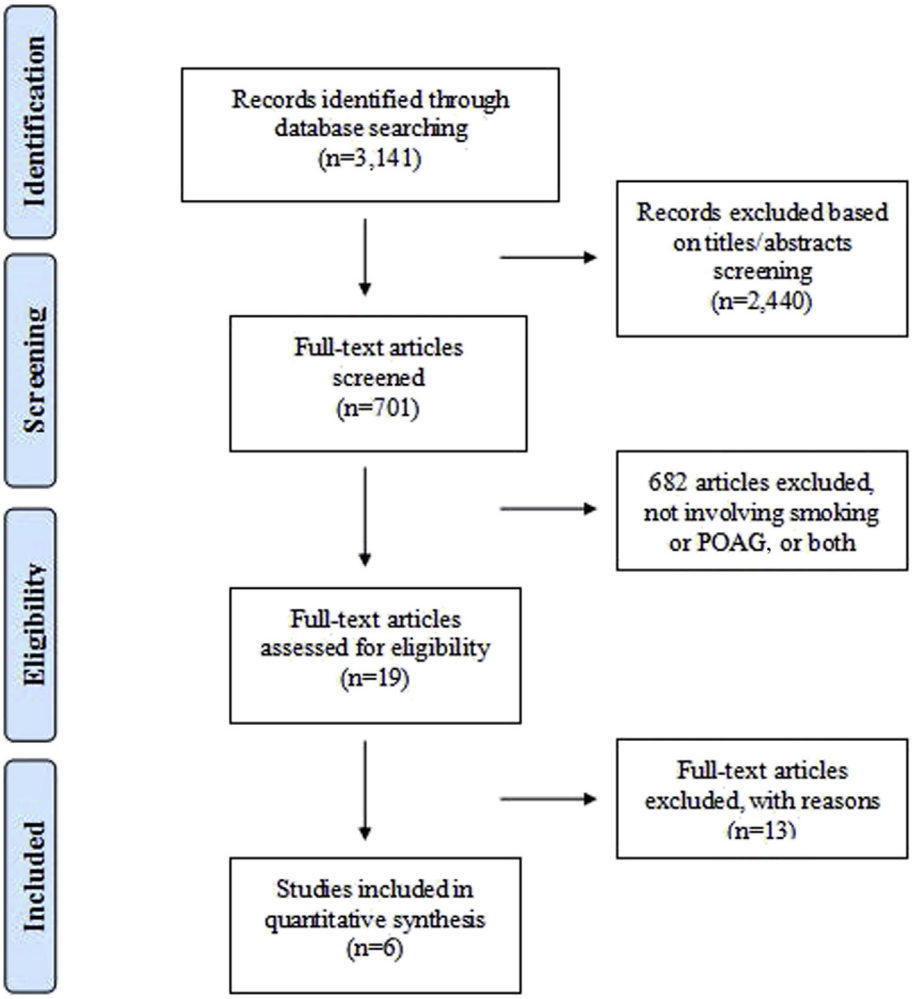

Fig. 1 – Overview of the research strategy. This is an overview of the number of articles included during each stage of the systematic review process. POAG = primary open-angle glaucoma.