

Epidemic studies of diabetic retinopathy in China—a review

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Abstract

• The prevalence of diabetic retinopathy (DR) is increasing dramatically as the population of patients with diabetes continues to rise. This paper wants to investigate the prevalence and risk factors of DR in China through reviewing the research from Pubmed about population-based epidemic studies. The results of observational studies suggested that the overall prevalence of DR was 1.6%-6.5% in population, 19.9%-43.1% in diabetes and 13.6% in population without diabetes, most of the DR were the mild type, macular edema and vision-threatening were 5.2% and 1.2%. The risk factors for DR were longer duration of diabetes, plasma glucose concentration, concentrations of HbA_{1c} level, higher systolic blood pressure (BP), higher diastolic BP, male gender, rural region, and methods of diabetic treatment and so on. The prevalence of DR which was strongly related to duration of diabetes was higher with the increase of diabetes. DR would be the major leading cause of visual impairment in China, it is very important to prevent DR by early screening and any other methods.

• **KEYWORDS:** diabetic retinopathy; prevalence; prevention; risk factors

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INTRODUCTION

China is the most populous country in the world. As a result of the rapid change of lifestyle in China, there is concern that diabetes may become epidemic. The burden of diabetes and diabetic retinopathy (DR) are of most interests to the world public health. Furthermore several well designed population-based studies are available. The study

by Yang *et al*^[1] has revealed that the age-standardized prevalence of total diabetes (which included both previously diagnosed diabetes and previously undiagnosed diabetes) and prediabetes were 9.7% (10.6% among men and 8.8% among women) and 15.5% (16.1% among men and 14.9% among women), respectively, accounting for 92.4 million adults with diabetes (50.2 million men and 42.2 million women) and 148.2 million adults with prediabetes (76.1 million men and 72.1 million women). With the prevalence of diabetes arise rapidly, the complications of diabetes have been common, DR as a common microvascular complication in diabetes has been to the leading cause of blindness among working-aged people in the United-States^[2], DR was the second leading causes of visual impairment in Japan^[3]. In order to investigate the prevalence of DR, many population-based epidemic studies had been done. The studies also revealed many risk factors for DR especially the duration of diabetes.

Prevalence of DR To date, the epidemic studies about DR has been done in hospital^[4] and social-community, the hospital's prevalence is higher than social one, but the social-community is more reliable because it is population-based. So valid and clearly gener-alizable prevalence estimates of diabetic retinopathy are best achieved when data are derived from population-based samples and assessment of diabetic retinopathy is achieved. In total social-community study population, the overall prevalence of DR was 1.6% -6.5%^[5,6], 19.9%-43.1% in diabetes^[5,7,8] which contained 37.1%-65.2% in subjects with known diabetic mellitus (KDM) and 33.5% in subjects with new diabetic mellitus(NDM)^[5,9], 5.2% macular edema^[5] and 2.6% significant macular edema in KDM^[9], 5.2%-12.1% with KDM having untreated vision-threatening DR^[5,9]. India is also a big developing country of Asia, diabetes and diabetic complication are epidemic in India. Compared with it, the overall prevalence of DR in China is higher^[10], but it is lower than Western countries^[11-17]. With the high prevalence of DR in China, accurate and reliable assessment of the population burden of DR associated with this condition is important for public health planning and the delivery of treatment services. But the most reliable

prevalence for DR will be the result from multiple-center study, China need this study for preventing DR from now on.

Risk Factors for DR Investigations have revealed that Chinese people with such risk factors would catch DR, which included duration of diabetes^[9,18], region, blood pressure and so on. This paper talks about the main common factors.

Duration Many studies investigated that the duration of DM is the strongest risk factor for DR. This is in accordance with Western countries. The Wisconsin Epidemiologic Study of Diabetic Retinopathy (WESDR) has revealed the prevalence of any retinopathy was 8% at 3 years, 25% at 5 years, 60% at 10 years, and 80% at 15 years. The prevalence of PDR was 0% at 3 years and increased to 25% at 15 years^[19]. So annual retinal examination and early detection of DR can considerably reduce the risk of visual loss in diabetic individuals.

Region Region is another factor for DR^[18], Xie *et al*^[9] have revealed that the ratio of DR was higher in rural than urban. The causes of the difference between rural and urban maybe relevant to their income increase leading to the changes of dietary structure, the low recognized rate of disease, lack of the preventive knowledge, poor medical conditions in rural *et al*. Though the conditions are better in urban than rural, less healthy awareness, delayed treatment are also common in Chinese cities. Although it is difficult to improve the medical conditions, it is necessary to conduct healthy education, with a view to improving the sense of health and the ability of self-health care.

Blood Pressure Xie *et al*^[6] have suggested that arterial hypertension is risk factor for DR, which is because many diabetic always have hypotension, the renin-angiotensin system is activated by chronic hyperglycemia, and then the vitreous fluid level of angiotensin II (AII) is elevated in patients with proliferative diabetic retinopathy and diabetic macular edema. AII increases vascular permeability and promotes neovascularization. Recent studies have suggested that hypertension is a risk factor for the development and progression of DR and that blood pressure reduction can delay the progression of retinopathy^[20].

Blood Glucose Many studies have reviewed that high blood glucose is a risk factor for DR, which is in accordance with The Diabetes Control and Complications Trial (DCCT) and UK Prospective Diabetes Study (UKPDS). Hyperglycemia is one of the based-etiologicals for DR. DCCT and UKPDS have studied glycaemic control as well as other risk factors in preventing the progression of DR^[21,22]. Xu *et al*^[23] also found that blood pressure was a risk factor for DR.

HbA_{1c} Zhang *et al*^[8] suggested that glycosylated hemoglobin A_{1c} (HbA_{1c}) level was independently associated

with DR. HbA_{1c} is levels of glycemic exposure for 3 months. It is very important for doctors to know the diabetes' glycemic levels. Epidemiological analysis of the UKPDS data showed a continuous relationship between the risk of microvascular complications and glycemia, such that for every percentage point decrease in HbA_{1c} (for example, from 8 to 7%), there was a 35% reduction in the risk of microvascular complications^[21,24].

Diabetic Treatment Diabetic treatment contains no treatment- diet-oral antidiabetics-insulin. The study by Xie *et al*^[18] suggested that insulin treatment was the high risk factor for DR, early study also reported this result^[25,26].

Male Gender Male gender was observed to be associated with the presence of any DR^[27], but not its severity. Similar observations were made by Pradeepa *et al* in an urban Indian population and in the Los Angeles Latino Eye Study^[28,29]. The reason for this may be gene or life style.

With the public health planning requires accurate estimation of disease for major disorders, we previously estimated the number with DR would be more than 30 million in China in 2010, with the increasing of diabetes, there will be more than 50 million DR in 2020. So there is a need for formulating effective preventive strategies to minimize avoidable blindness due to diabetes in China.

As the result of visual loss is generally irreversible at stages when non-perfusion regions, neovascularization, or both are clearly identified by ophthalmoscopy, fluorescein angiography and any else diagnostic methods. Early detection, treatment and prevention of DR are necessary for saving sight.

Because of preventing diabetic retinopathy could through control of systemic factors as intensive glycemic and blood pressure^[30] and many studies have reviewed clinicians in primary care settings played a critical role in reducing visual disability by managing systemic disease with ocular consequences which contained risk factors for DR such as blood glucose and so on and ensuring that patients receive timely specialty eye care. They may be the only health care professionals to recognize the need for an eye examination because of a new onset visual disability^[31].

Body Mass Index Body mass index (BMI) is an index for obesity; Cheung and Wong^[32] revealed that among different eye diseases, obesity has been linked with age-related cataract, glaucoma, age-related maculopathy, and DR. The study found that BMI was another risk factor for DR also in China.

To date, China has been in elderly social society, there are more and more diabetes, with longer life of them DR which is perhaps the most threatening of the chronic microvascular complications of diabetes maybe the burden for their visual

sight. The strongest predictor of retinopathy is the duration of diabetes.

- The DR is very epidemic in China; we must focus on the prevention of DR.

- Regular retinal examination and early detection of DR can considerably reduce the risk of visual loss in diabetic individuals.

- General Doctor or community doctor can play an important role in screening DR and diabetic care apart from treating eye disease.

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