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Short Commentary

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An Overview of Diabetic Retinopathy

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Abstract

Diabetic retinopathy is a significant cause of visual impairment and blindness in patients with diabetes mellitus aged between 20 and 74 years. It refers to retinal changes that occur due to hyperglycemia leading to devastating complications if not managed early. Unfortunately, the majority of patients present late due to the absence of symptoms in the early stages.

Because of the delayed onset of symptoms and the rapid progression of the retinopathy, many screening tools are used to detect early retinal changes in an attempt to improve symptoms and delay progression. Various preventive and therapeutic methods have been used to reduce the morbidity correlated to diabetic retinopathy and diabetic macular edema. The management of diabetic retinopathy depends on the grade, severity, and presence or absence of diabetic macular edema.

Keyword: Diabetes mellitus; Diabetic retinopathy; Hyperglycemia; Preventable blindness; Prevalence; Screening

List of abbreviation

DM: Diabetes mellitus; DR: Diabetic retinopathy; NPDR: Nonproliferative diabetic retinopathy; PDR: Proliferative diabetic retinopathy; FA: Fluorescein angiography; OCT: Optical coherence tomography; OCTA: Optical coherence tomography angiography; FAZ: Foveal avascular zone; Anti-VEGF: Anti–vascular endothelial growth factor.

Short note

Diabetes mellitus (DM) affects about 463 million adults worldwide, a number that is expected to rise by 2035 to 592 million (1). Diabetic eye disease is a group of ocular problems that affect patients with DM. It consists of diabetic retinopathy (DR), diabetic maculopathy, cataract, and glaucoma [1]. Despite the preventable nature of DR, it is a leading cause of blindness in adults between 20 and 74 years of age [2]. In 2017, a review by Bourne et al estimated that about 2.2 billion people suffered from visual impairment or blindness, and at least half of them had a preventable or unaddressed visual impairment. DR is the fifth most common cause of moderate or severe distance visual impairment and preventable blindness after refractive error, cataract, glaucoma, and corneal opacities [3].

Depending on the results of the analysis of 35 studies that were conducted worldwide between 1980 and 2008, the overall prevalence of DR in diabetic patients by retinal imaging was approximately 35% with vision-threatening DR present in 12%. The prevalence of DR in type 1 and type 2 diabetes was affected by the duration of diabetes, uncontrolled hyperglycemia, and elevated blood pressure. DR was more common in patients with type 1 diabetes, while in type 2 diabetes, differences were evident between African Americans (55.7%), Caucasians (44.7%), and Asians (20.8%) [1]. This review did not include data from low- and middle-income countries [1] where the prevalence of distance vision impairment is estimated to be four times higher than high-income regions due to the high influence of diabetes and the limited access to screening and management of DR [3]. In 2019, an analysis of 32 studies from 2015 to 2018 was conducted by Thomas et al to assess the global prevalence of DR. The results revealed that the overall global prevalence of DR was 27%. Variations between regions were noticed with the highest prevalence in each of Africa, the Middle East, and North Africa (33.8%), followed by the Western Pacific region (36.2%), Europe (20.6%), and South-East Asia (12.5%) [4].

Visual loss or impairment in DR may be caused by macular edema, hemorrhage from fragile new vessels, neovascular glaucoma, or retinal detachment. DR is the result of interactions between several genetic and environmental factors, particularly high levels of blood glucose, which is the primary adjustable risk factor [5-7]. The main factors implicated in the pathogenesis of DR are excessive permeability of the retinal capillaries, vascular occlusion, proliferation of fragile new vessels, and contraction of fibrovascular membranes [6]. The duration and severity of hyperglycemia are the major risk factors for developing retinopathy.

Hyperglycaemia, pregnancy, and hypertension increase the retinal blood flow, which results in the formation of microaneurysms in capillaries, precapillary arterioles, and venules leading to obstruction of these tiny vessels and transudation of fluid and lipids in to the retina. The occlusion of the capillaries causes retinal ischemia, which considered the key trigger for the formation of new vessels (neovascularization) on the retina, optic disc, and iris. Proliferative retinopathy may result

in vitreous hemorrhage and formation of fibrous tissue that increase the risk of retinal detachment. Cotton wool spots occur secondary to retinal microinfarcts, while flame-shaped and blot hemorrhages resulted from the rupture of microaneurysms in superficial and deep retinal layers, respectively. The macular edema and hard exudates occur due to leakage of fluids, lipid-filled macrophages, and lipoprotein from damaged retinal capillaries [5-7].

DR is classified into nonproliferative (NPDR) and proliferative (PDR) according to the absence or presence of abnormal neovascularization in the eye. The PDR has been subdivided into early and high-risk grades to assign patients who need urgent intervention. Most patients present with a combination of different features of DR and should be approached individually depending on the stage, risk of progression, and the grade of DRP [8].

The presence of microaneurysms is the earliest clinical sign of DR that can be detected byfundoscopy [9]. Fluorescein angiography (FA), Optical coherence tomography (OCT), and OCT angiography (OCTA) are more sensitive methods that used for early detection of DR. Fluorescein angiography is a very sensitive but invasive method that depends on the intravenous injection of a fluorescent dye to detect microaneurysm and vascular abnormalities caused by injury of the inner and/or outer blood-retinal barrier [10].

Optical coherence tomography is a noninvasive method that provides detailed and high-resolution images for retinal layers, choroid, and vitreous. Nowadays, it is used widely for the diagnosis, management, evaluation of treatment response, and prognosis of DR. OCT angiography (OCTA) is a new noninvasive and fast imaging technique that provides high-resolution images depending on volumetric blood flow without using fluorescein [11]. It gives a detailed view of the retinal vasculature resulting in a better delineation of the foveal avascular zone (FAZ) and easier detection of tiny or subtle microvascular abnormalities. Moreover, it can identify areas of ischemia or capillary nonperfusion, FAZ enlargement, and intraretinal fluids collection [12]. OCTA is a very promising technique for screening and early diagnosis of DR because of its ability to detect early microvascular changes before the clinical detection of microaneurysms by ophthalmoscopy [13].

Optimizing blood glucose levels, blood pressure, and serum lipid levels are essential to reduce the risk and slow the progression of DR. According to the stage and severity of DR, different methods of treatment are used separately or combined including laser photocoagulation, intravitreal antiangiogenic agents or steroids, and surgery for the treatment of complications [14,15].

Treatment of DR with laser photocoagulation (panretinal and focal) is indicated mainly for the treatment of retinal neovascularization and clinically significant macular edema. It is indicated only in severe NPDR and not in mild or moderate NPDR because of the low risk of progression to proliferative stages. Thus, patients with mild or moderate NPDR need only observation [14,15]. Intravitreal injections of anti-VEGF agents such as bevacizumab, ranibizumab, and aflibercept besides intravitreal injections of corticosteroids such as dexamethasone and fluocinolone acetonide have a role in treating and improving the prognosis of DR [14].

In patients with vitreous hemorrhage, tractional retinal detachment, or tractional macular edema, vitrectomy is indicated. Initially, neovascular glaucoma can be managed with extensive panretinal photocoagulation or intravitreal injections of anti-VEGF. If there was no reduction in intraocular pressure or regression of neovascularization, tube-shunt surgery should be considered [14].

Screening for DR is essential because the vast majority of patients present in the late stages with macular edema (ME) and/or proliferative disease. Therefore, early detection and referral for management are crucial to prevent complications and blindness. Dilated fundus examination or retinal photography by an expert (an experienced ophthalmologist or optometrist) is the first step in screening for DR. A detailed examination and regular followups should be conducted when any abnormalities are noticed.

Briefly, these are the current recommendations for screening of DR [15]:

- Patients with type 1 diabetes should undergo a proper dilated eye examination by an expert within 5 years from the diagnosis.
- Patients with type 2 diabetes should undergo a proper dilated eye examination by an expert at the time of diagnosis.
- If no evidence of retinopathy is detected for one or more annual dilated eye exams along with well-controlled hyperglycemia, then screening is considered every 1-2 years. If any level of diabetic retinopathy is detected an annual or more frequent examination may be needed.
- Women with type 1 or type 2 diabetes who are pregnant or planning a pregnancy should be counseled about the chance of developing and/or progression of DR in addition to planned examinations before pregnancy, during, and after pregnancy.

Conclusion

Delay in the diagnosis or management of diabetic retinopathy may lead to serious complications that carry a high rate of morbidity. Therefore, health care providers and diabetic patients should be aware of the importance of screening of diabetic retinopathy by experienced ophthalmologists. Uncontrolled hyperglycemia, hypertension, dyslipidemia, and pregnancy are considered risk factors for rapid progression of diabetic retinopathy in diabetic patients. Thus, screening and counseling are significant for patients with these conditions.

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