

CURRENT MEASURES AGAINST OPHTHALMIC COMPLICATIONS OF DIABETES MELLITUS-A SHORT REVIEW

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ABSTRACT

Diabetes mellitus (DM) is a metabolic disorder, whose prevalence is predicted to rise shortly. The present review focuses on the various ocular complications associated with DM, and the various ophthalmic formulation approaches developed to treat the same. Diabetic macular edema (DME), diabetic retinopathy, cataracts, and glaucoma are some of the major vision-threatening complications linked to DM. The ocular route of drug delivery has undergone several advancements in recent decades, the introduction of various novel drug delivery systems (DDS), various modifications in the existing formulation approaches, development of custom-designed personalized medications, being some of the major developments introduced in the field of ocular drug delivery. Due to the application of state-of-the-art technologies in the field of innovations related to ocular DDS, patients have been immensely benefited by the current modes of ocular treatment imparting fewer side effects, enhanced penetration, sustained drug effect, and so on. The present review includes and emphasizes the gradual development that has occurred from the conventional ophthalmic dosage forms to the currently reported novel ocular drug delivery approaches along with the related clinical research works.

Keywords: Ophthalmic formulations, Diabetes mellitus, Ocular complications, Cataracts, Glaucoma, Diabetic retinopathy, Macular edema

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INTRODUCTION

Diabetes has affected approximately 285 million people around the world to date. According to the International Diabetes Federation, this number is predicted to rise to 439 million by 2030 [1]. In 1997, the American Diabetes Association (ADA) has reported the categorization scheme for type 1 (insulin-dependent), Type 2 (insulin-dependent), and gestational diabetes mellitus (GDM), which have now been approved by the FDA also [2]. Diabetes mellitus (DM) is a metabolic disorder caused by the lack of insulin production, insulin activity, or both. Further, chronic hyperglycemia is caused by insulin insufficiency, impairing carbohydrate, lipid, and protein metabolisms [3, 4]. It is one of the leading global health issues that have arisen as a chronic non-communicable disease (CNCD). The major complications associated with DM, include cataracts, glaucoma, diabetic retinopathy (DR), and diabetic macular edema [5]. It also sometimes leads to amputation of limbs, blindness, and vascular brain diseases [3]. Further, due to the occurrence of long-term hyperglycemia, the basement membrane of the eye accumulates enough toxic products, which cause irreversible damage to ophthalmic cells leading to cell death, ophthalmic opacity, and finally, vision impairment [4].

The present review has highlighted the development of various types of eye complications associated with diabetes, like diabetic cataracts, macular edema, formation of diabetic retinopathy and few others. It has also elaborated the methods of prevention of various ophthalmic complications resulting from diabetes, the development of various conventional and novel formulations used for the treatment of the same, as well as the associated clinical studies reported till date. The review has resulted from a thorough search on the literature available on the matter since 1969.

Ocular complications associated with DM

Diabetic cataracts

This disease is the most prevalent cause of blindness in the world, as it arises when the natural lens of the eyes becomes obscured, and hence, light does not move clearly through the latter, with the development of cataracts, finally resulting in loss of vision, if not treated at the early stage of its development. The lens clouding and

development of cataracts are caused by unwanted protein aggregation on the lens due to prolonged, and uncontrolled persistence of DM [6, 7]. The diabetics are reported to be five times more prone to get cataracts, especially at a young age. As the duration of diabetes increases, the chance of the development of diabetic cataracts also increases [8].

Glaucoma

The term glaucoma refers to a group of eye illnesses that affects the optic nerves. Diabetic patients are twice as likely to develop glaucoma, which can cause loss of vision, and the development of blindness, if not treated early [9]. Various types of glaucoma have been reported during the last few decades. They are as follows:

Open-angle glaucoma (OAG)

Diabetes mellitus has been linked to an increased risk of OAG in various studies. The risk factors associated with DM causing OAG, include the development of high intraocular pressure (IOP), vascular abnormalities, such as malformed optic nerve vessels, and oxidative damages to the eye. It has been reported that the probability of developing OAG increases with the uncontrolled prolongation of type 2 DM. The disease has been reported to be painless, persistent, and asymptomatic at its early stages of development. In the advanced stages of the disease, the resistance imparted by the developed trabecular meshwork to the aqueous outflow within the eye, gradually increases, resulting in a gradual increase in IOP [10].

Closed-angle glaucoma (CAG)

In CAG, the access to the drainage route from the eye is obstructed, resulting in the development of severe local pain, redness of the eye, nausea, and hike in IOP [10, 11].

Neovascular glaucoma (NVG)

This type of glaucoma is associated with the development of new blood vessels in the eye, obstructing the normal flow of ophthalmic fluid, thereby causing a rise in intraocular fluid pressure [12]. It is quite difficult to treat this type of condition of the eye by usual treatment with medicines, thus categorizing NVG as an uncommon kind of glaucoma [10].