

Surgical Management of Cataract in Diabetes Mellitus Patients

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Abstract

Background: The population is facing the threat of obesity and diabetes with cataracts being an associated disease and common cause of visual loss in diabetic patients. In the presence of co-morbid conditions, the progression to visual impairment would be sped up in uncontrolled glucose levels. The trend in cataract surgery and its insurgency against preventable visual impairment has been successful; nevertheless, surgery carries its own risks and may not benefit all types of patients. **Objectives:** We focus in this paper on cataract surgery in diabetic patients, and only relevant studies would be discussed. **Methodology:** PubMed database was used for articles selection and papers on diabetic cataract and cataract surgical intervention in diabetes were obtained and reviewed. **Conclusion:** Clinical progression of visual loss in diabetic cataract is often faster and worse relative to non-diabetic individuals. Cataract surgery has revolutionized the management of diabetic cataract. Improved visual prowess and acuity, with reduced risks of complications follow phacoemulsification surgery, the most common surgical intervention for cataract treatment. This phenomenon in ophthalmic surgery would help many patients afflicted with both diabetes and cataracts.

Keywords: Diabetes Mellitus, Cataract Surgery

INTRODUCTION

The prevalence of diabetes mellitus (DM) is steadily increasing worldwide, more than 439 million people will have DM by 2030 according to the International Diabetes Federation [1-3]. This increase in the prevalence of DM is attributed to population growth, aging, urbanization, sedentary lifestyles, and obesity [1, 4, 5]

DM is associated with various complications, most frequently cataract which is a major cause of blindness worldwide [6]. As a result of the increasing prevalence of DM worldwide, the incidence of diabetic cataracts has also increased. The association of cataract with diabetes mellitus should be sought and properly managed in order to prevent losing vision. In diabetic patients, the onset of cataracts occurs at a younger age, hence it leads to a worsened result on the young blinded patients with regard to socioeconomic status [7-9]. Currently, cataract surgery is one of the most common surgical procedures among the population and its number is increasing every year [10]. DM and cataract have significant economic and health impacts in developing countries, where the health care system is not easily accessible. There are

multiple recent studies in cataract surgery. However, since the focus of this paper is on cataract surgery in diabetic patients, complications and its outcomes.

METHODOLOGY

PubMed database was used for articles selection and the following keys were used in the MeSH (“Cataract Surgery”[MeSH]) AND (“Diabetes Mellitus”[MeSH]).

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According to the inclusion criteria, the articles were selected based on the inclusion of one of the following topics; diabetic cataract pathophysiology, cataract surgery evaluation and outcomes, and diabetic cataract management and diagnosis. Exclusion criteria were all other articles, which did not have one of these topics as their primary endpoint.

DISCUSSION

Diabetes is known for its multi-system effect whether it be long or short term, including the valuable eyes [11]. The microvascular and neurological complications are important as their features are often insidious and disastrous. Intensive care of serum glucose levels at near-normal levels can be achieved with glucose-lowering medication or insulin, as they significantly decrease microvascular injury [12-14]. Cataract has been proven to be more common in diabetic patients and the reason behind that is mainly a multi-factorial one related to increased glycosylated hemoglobin, increased age, and duration of disease.

The main issue in diabetes is uncontrolled high blood glucose –hyperglycemia that leads to the production of advanced glycation end products, increased oxidative stress, and increased activation of the polyol pathway, which finally can lead to the development of cataract [15]. Advanced glycation end-products (AGE) arise via non-enzymatic glycation and glycoxidation and include pentosidine, argpyrimidine, carboxymethyl lysine, etc. [16]. Over the years, many AGEs are formed and accumulated in the lens leading to its increased opacity. This accumulation consequently leads to an increase in the photo-oxidative stress of the crystalline lens proteins, an increase in the osmotic pressure and hydration of the lens. In diabetic patients, increased concentration of glucose in the blood eventually increases the levels of glucose even in the aqueous humor of lens, resulting in an increased level of free radicals via glycoxidation. This leads to oxidative stress due to inadequate antioxidative to neutralize the high levels of free radicals. Moreover, this process happens at the beginning of diabetic cataractogenesis [17]. Overall, each of these mechanisms is strongly contributing to the pathophysiology of cataract.

In the presence of co-morbid conditions, the progression to visual impairment would be sped up in uncontrolled cases. Certain diseases with systemic effects including severe renal dysfunction would rapidly deteriorate visual prowess, as elevated lipids cause macular exudates and eventual vision loss [18]. Diabetic retinopathy is preventable with appropriate patient follow-up and optimal intervention. Ophthalmic care in diabetic patients requires repetitive and routinely performed eye examinations [18]. This attentiveness is essential with optimized glycemic control, as unmanaged hyperglycemia would cause lens opacity [19]. On the other hand, some studies suggested that a rapid reduction of the elevated glucose level might induce a temporary or even an irreversible loss of lens transparency and edema ensues with transient hyperopia [20].

The preoperative care of patients with cataracts may play a key role in improving the management of retinopathy, in addition to modernized operative techniques, and factors pertaining to glycemic control as aforementioned. The prognosis of diabetic patients is equivalent to non-diabetic patients, except when diabetic retinopathy is present [21]. Many diabetic patients would present with cataracts and underlying retinopathy. Additionally, the increased serum glucose in diabetic conditions leads to increased cataractogenesis via the polyol pathway. In the state of normoglycemia, glucose is phosphorylated by hexokinase and metabolized through glycolysis and the pentose phosphate pathway. However, in states of chronically elevated serum glucose, hexokinase becomes saturated and excess glucose is metabolized via the sorbitol pathway. This results in sorbitol accumulating in the lens and creates an osmotic gradient. This osmotic gradient causes the lens to swell and become opaque [16, 17]. Preoperative patient education is signified when patients present with advanced retinopathy, where even after surgery the functional impairment may be mildly improved [22]. In other patients with milder diabetic retinopathy, the functional gains may be higher and significant, emphasizing the role of early detection and fastidious therapy [23]. Danni *et al.* evaluated the role of preoperative anti-inflammatory treatment on the outcomes of cataract surgery in the eyes of diabetic patients and found that the lack of preoperative anti-inflammatory treatment does not have any impact on recovery from surgery and also does not predispose diabetic patients to increased risk of pseudophakic cystoid macular edema if they postoperatively treated with combination therapy of prednisolone acetate and nepafenac [24].

The most commonly utilized surgical operation for cataract management is phacoemulsification, which leads to better results when compared to extracapsular or intracapsular cataract surgeries in diabetic patients [25, 26]. However, diabetic patients with cataract are often elderly, and damage from surgical intervention is probable on the aging corneal endothelium, leading to inevitable corneal endothelial dysfunction [27, 28]. Routine evaluation of corneal endothelium is hence recommended prior to intervention [28]. On the other hand, the former procedure dramatically increases visual acuity and reduces the risk of astigmatism [27, 29].

Intraocular lens implantation studies showed that placement in both eyes avoids undershooting and overestimating efficacy of lenses, these were found to be postoperatively safer with rare serious complications [30]. Many studies reported morphological transformation and functional injury in diabetic corneas, in addition to delayed postoperative edema [6].

Postoperatively, macular edema may develop in long-term diabetic patients, persist or deteriorate depending on overall patient status. Therefore, early surgery should be sought as to reduce retinopathy complications, along with 6 months of postoperative follow-up for rapid laser intervention to prevent

visual loss^[31]. Diabetes can be a factor in the type of cataract and evident while diagnosing it. Classically described “sugar cataract” or “snowflake” cataract, which is a sudden-onset, bilateral, and subcapsular opacification especially in the young population can be seen and can even be a presenting sign of diabetes^[15, 17]. However, diabetes has been associated with the increased prevalence of all types of cataracts with a significant increase in cortical, nuclear, and posterior sclerotic cataracts. Moreover, in diabetic patients with rapid changes between hyper- and hypo-glycemic states, glucose can easily migrate from the lens while sorbitol cannot. The differences in osmotic pressure result in the influx of aqueous humor and lens swelling manifesting with vacuoles leading to alterations of the vitreomacular interface, particularly thickening of the pre-macular cortical vitreous, which can be seen in cataract patients with diabetes^[15, 16]. An inkling of caution would be preoperative eyes necessitating laser coagulation, as these would significantly progress until laser treatment is performed^[32]. Poor glucose control in such diabetic patients is an important factor in this retinopathy progression post-operatively^[33].

CONCLUSION

The incidence of cataract will rise as the number of diabetic patients is increasing worldwide. Cataract in diabetic patients often has a faster and worse clinical progression relative to non-diabetic individuals with even more complications. Cataract surgery has revolutionized the management of diabetic cataracts, providing improved visual prowess and acuity, with reduced risks of complications following phacoemulsification surgery. This advent in ophthalmic surgery would help many patients afflicted with both diseases. Postoperative monitoring and management of surgical complications will help to improve the patient's outcomes.

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