CASE REPORT

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Effect of uncontrolled glycemic on cataract surgery outcome in patient with diabetic retinopathy

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ABSTRACT

Objective: This study aims to report a case of cataract surgery outcome in cataract diabetic patient with uncontrolled glycemic.

Case Presentation: A 54-year-old woman has cataract on both eye and history of diabetes mellitus for 15 years. The patient was planned for cataract surgery when blood sugar below 200mg/dL in left eye, blood sugar patients from 248 mg/dL become 168 mg/dL.

One week post operation evaluation revealed corneal edema, due to phaco time intra surgery in this patient increased. Visual acuity was 6/120 BCVA on the right eye and 6/18 BCVA on the left eye. Visual acuity has decreased in 2 months after surgery, 1/60 BCVA on the right eye and 6/18 BCVA on the left eye, as well as funduscopy presence of dot blot, flame-shaped, and traction on both eyes. This outcome was contributed by an uncontrolled blood glucose of the patient.

Conclusion: Preoperative preparations in diabetic cataract patients are mandatory, including blood sugar and HbA1C control, to achieve a better outcome of ocular surgery in patients with diabetes mellitus.

Keywords: cataract, phacoemulsification, glycemic control, diabetic retinopathy, outcome.


INTRODUCTION

Diabetes mellitus is a chronic systemic disease which a prevalence of about 2.8% in 2000 and is expected to reach 4.4% in 2030. Cataract is one of the earliest diabetes mellitus ocular complication which causes 51% of blindness worldwide. Patients with diabetes mellitus less than 65 years old, 3-4 times easier to develop cataracts and two times easier at if aged more than 65 years than non-diabetes mellitus patients.¹ ²

Patient with diabetes mellitus 2-5 times earlier develop cataracts than the non-diabetic group. Impaired fasting glucose in pre-diabetic patients is considered a risk factor for cortical cataracts.²

Cataract extraction is the most commonly performed procedure for all cataract cases. Good results are still being debated in diabetic patients, where many studies revealed complications of cataract surgery in diabetic patients. Cataract surgery may contribute to development of retinopathy, vitreous hemorrhage, iris neovascularization, and visual impairment.³ Therefore, a good and proper presurgical preparation should be carried out, not only to improve blood sugar and HbA1C but also to assess other parts of the eyes such as the cornea, anterior chamber, lens opacity, vitreous, retina. We reported a case to describe the effect of high blood sugar on the outcome of cataract surgery in a diabetic patient.

CASE ILLUSTRATION

A 54-years-old female came with chief complaints of blurred vision in both eyes since three years ago. The patient had histories of retinal hemorrhage two years ago, diabetes mellitus (DM) (use insulin regularly), and hypertension (HT) since 15 years ago and hypertension medication did not taken routinely. She had got four times laser two years ago.

Examination revealed visual acuity of the right eye was 6/120 BCVA and left eye was 1/60 BCVA. There were lens opacity on both eyes, the right eye lens was NO2NC2P3, and the left eye was NO3NC3P4 (Figure 1). Funduscopic examination revealed retinal exudate and dot blot on both eyes, laser injury, and decreased macular reflex in the right eye, but the details could not be evaluated in the left eye. Optical Coherence Tomography (OCT) examination on the right eye revealed signal strength (SSI) 5/10, vitreomacular traction, and decreased reflection in the right subretinal eye (Figure 2.A). Meanwhile, OCT examination on the left eye revealed SSI 2/10 (Figure 2.B). Specular results showed the number of endothelial cells in the right eye was 2,508 cell/mm² and the left eye was 2,328 cell/mm². Then, patient was then diagnosed with diabetic cataract on both eyes with high risk proliferative diabetic retinopathy and clinically significant macular edema in the right eye.

Laboratory examination showed level of glycated hemoglobin (HbA1C) 7.5%, random blood glucose 238 mg/dl, ureum 27.90 mg/dl, serum creatinine 1.39 mg/dl, sodium 134 mmol/L, and potassium...
Finally, the patient underwent phacoemulsification and intraocular lens (IOL) implantation with local anesthesia in the left eye on random blood glucose of 168 mg/dl. Phacoemulsification was performed with phaco chop technique, with 60% power, flow 25 ml/minute, vacuum 450 mmHg, and irrigation 80 cm. Duration of phacotime was 1 minutes. A single-piece hydrophobic acrylic intraocular lens 20.0 D with a refractive target of -0.07 was placed in the capsular bag. After the procedure, the patient received postoperative therapy with combained steroid and antinotic drop one drop every 4 hours on the left eye and paracetamol 500 mg every 8 hours. Postoperative random blood glucose was re-checked and revealed 225 mg/dl. Then, the patient was administered insulin drip 1 IU every hour for 4 hours, Lantus 16 IU subcutaneously, and Novo rapid 8 IU every 8 hours subcutaneously. Regular ophthalmology examination was carried out until two weeks postoperatively and revealed improved visual acuity (Table 1) and clinical condition (Figure 3).

Two months after the procedure, the patient complained blurred vision in both eyes and had increased blood glucose a week before coming to the hospital. Ophthalmological examination revealed visual acuity in the right eye was 1/60 BCVA, and left eye 6/18 BCVA. Funduscopy showed neovascular disease, retinal exudate, laser injury, dot blot, flame-shaped, traction, and decreased macular reflex in both eyes. The patient was diagnosed with Pseudophakia on the left eye with advanced PDR on both eyes and CSME with immature senile cataract on the right eye. The patient was planned for retinal surgery in both eyes and cataract extraction in the right eye, but the patient refused and did not come back for further examination.

**DISCUSSION**

Cataract is a cause of visual disturbances which its incidence and progression increase in diabetes mellitus patients. Patient with diabetes mellitus were 2-5 times more likely to develop cataract than non-diabetic patients. Risk factors of developing a cataract are influenced by duration and severity of hyperglycemia,
besides age, the severity of retinopathy, and systemic hypertension. In this case, advanced age (54-years-old) and long duration of diabetes mellitus (for 15 years) with a large dose of insulin therapy accompanied by hypertension were a risk factor for developing cataracts.

The development of cataracts in diabetic patients is multifactorial and is associated with increased glycosylation of hemoglobin, age, and duration of disease. Hyperglycemia leads to the production of glycosylation endings, increases oxidative stress, and activates the polyol pathway, with an important role of aldose reductase (AR) enzyme, which catalyzes glucose reduction to sorbitol. Increased intracellular sorbitol accumulation causes hyperosmotic changes and makes hydric lenses, a change in lens protein which results in protein aggregation and denaturation, which make the cloudy lens. Accumulation of sorbitol induces stress on the endoplasmic reticulum (ER), and increasing the concentration of glucose in the aqueous humor of diabetic patients can increase free radicals, which cause osmotic stress. Furthermore, the lens of diabetic patients shows impaired antioxidant capacity, increasing susceptibility to antioxidants.

The other ocular complications in the diabetic patients were diabetic retinopathy and macular degeneration. Funduscopy examination of this patient revealed retinal exudate and dot blot in both eyes, which developed in high risk of proliferative diabetic retinopathy. Proliferative type diabetic retinopathy is a condition where the continuous ischemia in the retina causes the formation of new blood vessels resulting in leakage of serum proteins. The walls of these new blood vessels consist of only a layer of endothelial cells without pericytic cells and a basement membrane therefore they are very fragile and prone to bleeding. If the bleeding continues repeatedly, scar tissue and fibrosis will be formed in the retina and predispose retinal detachment.

Patients with proliferative diabetic retinopathy are more likely to experience worsening and high incidence of central fovea thickness after cataract surgery therefore it is advisable to perform a panretinal laser photocoagulation (PRP) laser before cataract extraction. In this patient, PRP laser was performed on both eyes previously. Laser photocoagulation has given good results in diabetic retinopathy accompanied by CSME, retinal neovascularization, and patients with a high risk of proliferative disease. The progression of diabetic retinopathy can be effectively reduced by about 90% with laser photocoagulation.

**Pre Evaluation Should be Mention**
Surgical treatment is the main approach in the management of diabetic cataracts is by surgery. The patient was planned to undergo phacoemulsification with intracocular lens implantation. Diabetic cataracts are susceptible to surgical trauma and prone to worse visual acuity. In some studies, cataract extraction is not recommended for eyes with diabetic retinopathy until visual acuity deteriorates to 20/100-20/200. A previous study revealed that corneal endothelial cell density was significantly decreased, and the coefficient of variation of cell size was increased in high-risk PDR undergoing phacoemulsification at six months postoperatively compared to non-diabetic patients. To prevent the adverse outcome, good preoperative, intraoperative, and postoperative preparation are mandatory, including well-controlled blood glucose. Factors that influence postoperative inflammation in diabetic patients are the duration of surgery, wound size, posterior capsular rupture, or vitreous loss. The phacoemulsification technique is preferred because of the smaller incision size and shorter period of surgery.

Changes in refractive status in diabetic patients are influenced by morphological and functional changes of the crystalline lens observed in unstable blood glucose. Hyperglycemia induces myopia, and lens become more hyperopic when medical therapy is performed. Differences in corneal topography also occur during hyperglycemia which becomes a potential source of error when measuring keratometry and biometry. Hyperglycemic conditions can also induce postoperative inflammation. The American Diabetes Association and the American Association of Clinical Endocrinologists recommend a target blood glucose in diabetic patients undergoing surgery is 100-180mg/dL. Patient, in this case, was performed phacoemulsification in blood glucose 165 mg/dL and her visual acuity improvement after two weeks postoperatively. The shorter duration of phacoemulsification results in lower postoperative inflammation and less damage to the blood-retinal barrier.

**Intrasurgery Plan and Real**
Unfortunately, two months after the procedure, the patient complained of worsened visual acuity and was then diagnosed with advanced PDR on both eye and CSME with immature senile cataract on the the right eye. The presence of CSME is a predictor of the patient’s visual acuity after simple cataract surgery. As retinopathy progresses, the risk of macular ischemia or edema increases. Cystoid macular edema (CME) is more common after cataract surgery in diabetic patients with retinopathy because damaged of the blood-retinal barrier or increased inflammation in diabetic patients after cataract surgery. Another study showed the highest levels of glycosylated protein were found in hypermature senile cataracts when compared with different types of cataracts, including diabetic cataracts. It concluded that high glucose levels were not the only determining factor in lens protein glycosylation. Meanwhile, rapid correction of blood sugar should not be performed if the duration of diabetes is ten years or more, especially moderate to severe non-proliferative diabetic retinopathy (NPDR) patients with HbA1C levels more than 9% for three months. Rapid correction of blood sugar can lead to an increased risk of retinopathy and maculopathy progression.

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**Table 1. Improvement of Visual Acuity after Procedure.**

<table>
<thead>
<tr>
<th>Day after procedure</th>
<th>Right Eye</th>
<th>Left Eye</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 1</td>
<td>6/90 BCVA</td>
<td>1/300 BCVA</td>
</tr>
<tr>
<td>Day 7</td>
<td>6/120 BCVA</td>
<td>6/24 BCVA</td>
</tr>
<tr>
<td>Day 14</td>
<td>6/120 BCVA</td>
<td>6/18 BCVA</td>
</tr>
</tbody>
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affecting the patient's visual acuity prognosis. A previous prospective study by Squirrell et al. has reported that elevated HbA1C affect the development of diabetic retinopathy after phacoemulsification. On the other hand, several studies in diabetic patients undergoing phacoemulsification showed a rate of progression almost two times over 12 months compared to eyes that underwent surgery.

Uncontrolled blood sugar could induce the progression of diabetic retinopathy in this patient. Poor preoperative visual acuity and severity of diabetic retinopathy also play a role in the outcome of the patient's visual acuity. According to the Early Treatment of Diabetic Retinopathy Study (ETDRS), the severity of diabetic retinopathy at the time of surgery is also a determinant of visual acuity.

More severe retinopathy may be associated with an increased prevalence of macular ischemia or a decreased tendency for spontaneous resolution of postoperative macular edema. The patient was advised to return for further management of his diabetic retinopathy and cataract in the right eye, but the patient and family refused.

CONCLUSION

Cataract is a type of lens's ocular disease, and diabetic patients are especially prone to develop it. Phacoemulsification procedure in diabetic cataract patients should be carried out with good preoperative preparation by controlling blood sugar, HbA1C, and the patient's lifestyle to get a good visual acuity outcome. Preoperative examination includes cataract screening such as specular, anterior, and macular OCT should also be done. Meticulous preoperation, intraoperation and treatment postoperation.

FUNDING

This study received no external funding.

CONFLICT OF INTEREST

None declared.

ETHICAL CONSIDERATION

The patient has provided informed consent for his information to be included in a scientific medical publication prior to any data collection.

AUTHORS CONTRIBUTION

All authors contributed equally to the study and has approved the final version of the manuscript for publication.

REFERENCES


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