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# The Effect of Raised Preoperative Serum Glucose Levels on Outcomes of Cataract Surgery

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**To cite this article:**

Sudhir Pendke, Iqbal Bombaywala, Saloni Singh. The Effect of Raised Preoperative Serum Glucose Levels on Outcomes of Cataract Surgery. *International Journal of Ophthalmology & Visual Science*. Vol. 4, No. 3, 2019, pp. 58-62. doi: 10.11648/j.ijovs.20190403.14

**Received:** July 16, 2019; **Accepted:** August 21, 2019; **Published:** September 5, 2019

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**Abstract:** Background: Cataract in diabetic patients is a major cause of visual impairment in the world. The aim of cataract surgery in diabetics with raised serum glucose levels is to achieve good postoperative vision and reduced complications. Purpose: The purpose of this study is to observe the intraoperative and postoperative complications and postoperative visual acuity after cataract surgery with intraocular lens implantation in diabetic patients with raised preoperative random blood sugar levels. Materials and method: A single surgeon carried out manual small incision cataract surgery followed by implantation of a posterior chamber intraocular lens. Patients were followed up at day 1, 6 weeks, 6 months and 1 year after surgery. At every visit Best Corrected Visual Acuity, measurement of intraocular pressure, anterior segment examination by slit lamp and dilated fundus examination was done. Result: Maximum number of patients was having excellent visual acuity (85.3%) at 6 weeks follow up and in accordance to WHO recommendations. The most common postoperative complications were early postoperative fibrinous exudates (28.2%), cystoid macular edema (23%), posterior capsular opacification (20.5%). Conclusion: In this study, we observed that over one year period, diabetic patients with raised serum glucose levels who underwent cataract surgery did not show any vision threatening complications. There was no influence of preoperative serum glucose levels on final visual outcome.

**Keywords:** Cataract, Diabetes Mellitus, Complications, Visual Outcome

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## 1. Introduction

Diabetes Mellitus (DM) refers to a group of common metabolic disorders that share the phenotype of hyperglycemia. Criteria for the Diagnosis of DM [1]:- Symptoms of diabetes plus random blood glucose concentration  $\geq 11.1$  mmol/L (200mg/dl) or Fasting plasmagluco $\geq 7.0$  mmol/L (126mg/dl) or HbA1c  $\geq 6.5\%$  or Two hour plasma glucose  $\geq 11.1$  mmol/L (200mg/dl) during an oral glucose tolerance test.

Three important micro vascular complications of DM are neuropathy, nephropathy and diabetic eye disease. Among various eye manifestations, cataract and diabetic retinopathy constitutes major portion of avoidable blindness. Worldwide, more than 285 million people are affected by diabetes mellitus. In India, approximately 69 million people are affected by diabetes mellitus in 2015 [2]. Individuals with DM are 25 times more likely to become legally blind than

individuals without DM [3]. Cataract is one of the major causes of visual impairment in diabetic patients [4]. In our rural population, most of the patients are unaware of this chronic disease and fail to receive timely treatment.

Diabetes affects all parts of the eye. Corneal manifestations include recurrent erosions, delayed wound healing, ulcers, and reduced corneal sensations. Diabetes also predisposes to cataract, glaucoma, rubeosis iridis, diabetic retinopathy, diabetic macular edema. Diabetics are more prone to develop cataract than others and at an early age also. Various mechanisms have been proposed for the pathogenesis of cataract in diabetes mellitus. In the lens, sorbitol is produced faster than it is converted to fructose by enzyme sorbitol dehydrogenase, a process that is increased in diabetics compared to nondiabetics [5]. In diabetics, lens opacities often progress following vitrectomy [6]. Snowflake cataract is seen commonly in type 1 diabetics. However, the most frequent type of cataract seen in diabetics is senile type

[7]. Posterior subcapsular cataract has been shown to be significantly common in diabetics [8]. Cataract surgery in diabetics is indicated for visual improvement or to allow assessment and treatment of retinopathy [9]. The recent introduction of optical coherence tomography (OCT), especially spectral domain models, into clinical practice has improved the noninvasive monitoring of retinal thickness changes in diabetic retinopathy including postcataract surgery [10].

Also, some intraoperative complications are more common in diabetics. Anterior capsular phimosis is common in diabetics [11]. Diabetes patients are more prone to develop posterior capsular opacification than non-diabetic [12]. There is also evidence of poor pupillary dilatation in diabetics [13].

Intraoperative hyphema risk is also more due to presence of rubeosisiris [14]. In diabetics corneal wound healing is delayed and corneal endothelial loss is more common in diabetics than non diabetics [15-18]. The impaired corneal wound healing has multiple etiologies including neurogenic (subbasal nerve abnormalities) and impaired corneal stem cell and epithelial cell division [19].

Patients with diabetes also have impaired immunity so more prone to postoperative infections.

## 2. Materials and Methods

This study was conducted at Shri Vasantrao Naik Government Medical College, Yavatmal, Maharashtra, India between December 2017 to December 2018. Total of 200 patients of type 2 diabetes mellitus were included in the study. The patients were either previously diagnosed diabetics or newly detected by blood sugar levels. The cataract grading was done with Lens Opacification Classification System 3 (LOCS 3).

Informed consent was taken, patient’s history and examination was done. Standard ocular examination included Best Corrected Visual Acuity (BCVA), slit lamp biomicroscopy, measurement of intraocular pressure and fundus examination. OCT was done if indicated to rule out any macular pathology. Patients were posted for manual small incision cataract surgery with clear corneal incision (incision length was 5.5-6.5mm), followed by a posterior chamber intraocular lens implantation. Patients were followed up at day 1, 6 weeks, 6 months and 1 year after

surgery. At every visit Best Corrected Visual Acuity, measurement of intraocular pressure, anterior segment examination by slit lamp and dilated fundus examination was done.

Inclusion criteria: All patients of Type2 DM with senile cataract coming to our hospital who underwent manual small incision cataract surgery.

Exclusion criteria: All patients with diabetic retinopathy, diabetic maculopathy, glaucoma, uveitis, traumatic cataract, hypertensive retinopathy, history of previous ocular surgery of study eye were excluded.

Ethical clearance: After approval from ethical committee.

## 3. Results

In this study, Out of 200 diabetic patients, maximum (124) patients were having random blood sugar levels between 200-300mg/dl. The upper limit for random blood sugar level in this study is 350mg/dl.

*Table 1. Preoperative random blood sugar levels.*

Random blood sugar level (mg/dl)	Number of cases	Percentage (%)
110-200	57	28.5
200-300	124	62
300-350	19	9.5
Total	200	100

*Table 2. Age and sex distribution.*

Age (years)	Sex Distribution	
	Male	Female
50-60	22	13
61-70	73	44
71-80	28	07
>81	11	02
TOTAL=200	134 (67%)	66 (33%)

*Table 3. Preoperative visual acuity.*

Visual Acuity	Number of Cases	Percentage (%)
Light perception-hand movement	16	08
1/60-5/60	178	89
≥6/60	06	03
TOTAL	200	100

Preoperative visual acuity in 89% patients was in range of 1/60-5/60. 8% patients were having mature cataract with visual acuity oh light perception to hand movement.

*Table 4. Postoperative visual acuity.*

Who category	Day one		Six weeks		
	Snellen acuity	n (%)	Who recommendation (%)	n (%)	Who recommendation (%)
1	6/6-6/18	119 (59.5)	40	157 (85.3)	85
2	6/24-6/60	59 (29.5)	50	22 (11.9)	10
3+4	<6/60	22 (11)	10	5 (2.7)	5
TOTAL	200 (100)			184 (100)	

Maximum number of patients was having excellent visual acuity (85.3%) at 6 weeks follow up and in accordance to WHO recommendations.

This finding is supported by previous reports, that those with maculopathy and retinopathy may have a valuable

visual improvement after cataract surgery [20]. Further in a study, they have said that extracapsular cataract extraction with intraocular lens implantation is well tolerated in diabetics [21] with an overall good visual outcome [22] as evidenced by an 84.2% rate of improvement in preoperative

visual acuity which correlates well with this study also. In this study we found that progression of diabetic retinopathy was not correlated with cataract surgery but with the natural course of diabetic vascular disease. A study done by Ostri et al they concluded that the cataract surgery improved the final visual outcome in patients with Diabetic Retinopathy and cataract regardless of the degree of Diabetic Retinopathy and the apparent progression of Diabetic Retinopathy reflect the masking of low grades of Diabetic Retinopathy by preoperative lens opacities [23].

**Table 5. Complications.**

Complications	Number of Patients	Percentage (%)
Posterior capsular rent	7	17.9
Vitreous loss	4	10.2
Fibrinous exudates	11	28.2
Posterior capsule opacification	8	20.5
Postoperative cystoid macular edema	9	23
Non healing wound	0	0
Endophthalmitis	0	0
	39	100

The most common intraoperative complication in this study was posterior capsular rent followed by vitreous loss. A similar result was obtained by a study conducted by Oluwatoyin H et al in diabetic patients [24].

The most common postoperative complications were early postoperative anterior segment inflammation, Posterior capsular opacification and cystoid macular edema. Similar results were seen by Menchini et al. they reported intraocular inflammation and its sequelae as the most common complication in their study [25]. Ivancic et al. reported that inflammatory reactions and bleeding which resulted in post-operative keratopathy, fibrinous uveitis and posterior capsule opacity as the common complications of cataract surgery amongst diabetics [26]. Till now, no studies have concluded a definite role of perioperative glycemia on cystoid macular edema rate [27]. These inflammatory complications were resolved in further follow-ups of patients and overall visual prognosis was good at the end of one year irrespective of poor glycemic control.

## 4. Discussion

In developing countries like India patients often present late for medical care with subsequent delay in diagnosis and treatment. In this study, the indication of cataract surgery was achievement of good postoperative vision. Diabetic patients presenting with dense cataract were benefited by cataract surgery followed by post-operative assessment and treatment of retinopathy. In this study we did not see any patient of postoperative endophthalmitis or poor wound healing in diabetics. Since, the role of perioperative hyperglycemia remains controversial in causation of postoperative endophthalmitis in patients of diabetes mellitus [28, 29], we cannot conclude that higher levels of blood glucose poses a higher incidence of endophthalmitis or poor wound healing

in diabetics.

A study involving 50 patients was studied by Krepler in which no influence on the progression of diabetic retinopathy and visual improvement was achieved in majority of patients with Non Proliferative Diabetic Retinopathy but poorer visual outcome was observed in patients developing macular edema following cataract surgery [30]. Rapid pre-operative glycemic control should be avoided as it may increase the risk of postoperative progression of retinopathy and maculopathy [31]. Cataract surgery can be performed in patients of moderate to severe non proliferative Diabetic Retinopathy instead of poor glycemic control.

The reason for poor postoperative visual acuity in our study was posterior capsule opacification and postoperative cystoid macular edema. Nascimento et al. reported that serum glucose level had no influence on peri-operative clinical complications and final visual outcome of cataract surgery amongst diabetic patients [23].

## 5. Conclusion

There are many considerations that must be addressed when performing cataract surgery in patients with diabetes with raised serum glucose levels. Major issues are aqueous humour inflammation, Posterior capsular opacification, progression of Diabetic Retinopathy, and development or worsening of macular edema. Presence of Diabetic Retinopathy is not a contraindication for cataract surgery but those with Diabetic Retinopathy should be closely monitored in postoperative period for early signs of progression. Cataract surgery in diabetics has an overall good visual outcome and should not be denied surgery irrespective of poor glycemic control. Modern surgical and pharmacologic therapies allow safer and effective surgery in diabetics even in raised serum glucose levels. In spite of poor glycemic control there were no serious postoperative complications in our study. This study did not show any influence on final visual acuity in diabetes patients. Many studies have also shown that the progression of Diabetic Retinopathy is related to the natural evolution of the disease rather than the role of cataract surgery itself. The postoperative final visual acuity and complications showed no correlation with the glycemic control in our study.

As cataract surgery is done under local anesthesia, stringent criteria for perioperative blood sugar should not be considered for postponement of the surgery. Up to date, the clinical evidences are lacking regarding tight intraoperative glucose control in mitigating the intraoperative and postoperative complications of cataract surgery.

## 6. Recommendations

By this study the author recommends that patients with raised preoperative serum blood glucose levels should not be denied of cataract surgery as there was no influence of uncontrolled sugar levels on complications and visual

outcome after cataract surgery. Still, further studies and more number of patients needed to be observed in this aspect.

## Conflict of Interest

All the authors do not have any conflicts of interest.

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