Section: Ophthalmology

Original Research Article

IMPACT OF DIABETES MELLITUS ON VISUAL ACUITY AND COMPLICATION RATES AFTER SMALL INCISION CATARACT SURGERY: A CLINICAL EVALUATION

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ABSTRACT

Background: Diabetes mellitus can influence cataract surgery outcomes, potentially affecting visual acuity and postoperative complications. This study compares visual outcomes and complication rates following minor incision cataract surgery (SICS) in diabetic and non-diabetic patients.

Materials and Methods: A prospective comparative study included 200 patients (100 diabetic and 100 non-diabetic) undergoing SICS at MES Medical College. The ocular examination and systemic evaluation were performed at the preoperative stage. One-week, one-month, and three-month postoperative visual acuities and complications were noted. Data were analyzed statistically by SPSS version 25.0 using chi-square and t-tests, and $p<0.05$ was considered significant.

Results: Postoperative vision acuity improvement of diabetic patients was significantly lower than that of non-diabetic cases ($p<0.001$). The incidence of postoperative complications such as corneal edema, anterior uveitis, and delayed wound healing was significantly greater in patients with diabetes ($p<0.01$). Poor control (HbA1c <8%) was associated with low rates of complications ($p=0.002$).

Conclusion: Diabetes mellitus harms postoperative visual acuity and complication rates after small-incision cataract surgery. Reasonable glycemic control in diabetic patients and appropriate perioperative management are essential for better surgical results.

Keywords: Cataract Surgery, Diabetes Mellitus, Small Incision Cataract Surgery, Visual Acuity, Postoperative Complications.

INTRODUCTION

Introduction Diabetes mellitus (DM) is a lifelong metabolic disorder characterized by hyperglycemia due to a deficiency in insulin secretion, action, or both.[1] Diabetes prevalence is increasing worldwide and has affected nearly 537 million adults around the world, and is expected to increase further in the following decades.[2] Diabetic ocular complications, such as cataract, retinopathy, glaucoma, and maculopathy, significantly affect the health-related quality of life (HRQOL) and visual function of patients with DM.[3] Cataracts, in particular, are more common, more severe, and diagnosed at a younger age in diabetics than in the general population.[4]

Small-incision cataract surgery (SICS) has become a promising procedure because of its reasonable safety, efficacy, and economy, especially in low-income countries.[5] Although technical innovations have been made in cataract extraction, patients with diabetes still have significantly worse visual acuities and higher complication rates.[6] Such complications are primarily the result of the systemic effects of long-term hyperglycemia, including inflammation, oxidative stress, Wound healing, and endothelial cell dysfunction.[7]

Earlier cataract surgery outcomes had been studied, but the effect of diabetes alone on visual outcome and complication rates following SICS has not been well studied. There exists a critical knowledge gap regarding the comparative outcomes between

diabetic and non-diabetic patients undergoing SICS. Addressing this gap is crucial to improving perioperative management and surgical outcomes in diabetic individuals.

Therefore, this study compared visual acuity outcomes and postoperative complications between diabetic and non-diabetic patients undergoing minor incision cataract surgery. The primary objectives were to evaluate the differences in visual improvement and complication rates postoperatively and determine glycemic control's influence on surgical outcomes.

MATERIALS AND METHODS

Study Design and Setting: This prospective comparative study was conducted over two years at the Department of Ophthalmology, MES Medical College.

Ethical Considerations: The Institutional Ethics Committee granted ethical clearance. The study adhered to the principles outlined in the Declaration of Helsinki. After explaining the study procedures, benefits, and potential risks, each participant provided informed consent.

Participant Selection: 200 patients were enrolled, comprising 100 diabetic and 100 non-diabetic patients undergoing small-incision cataract surgery. Patients between 40 and 80 diagnosed with cataracts and willing to participate were included. Patients with glaucoma, uveitis, recent ocular surgeries (within the past 6 months), systemic inflammatory diseases, and autoimmune conditions were excluded to avoid confounding effects.

Preoperative Assessment: Comprehensive ophthalmic examination included assessment of best-corrected visual acuity (BCVA) using Snellen charts converted to LogMAR, slit-lamp bio microscopy, measurement of intraocular pressure (IOP) with Goldmann applanation tonometry, fundus examination using direct and indirect ophthalmoscopy, and systemic evaluation including fasting blood glucose levels, glycosylated hemoglobin (HbA1c), and other relevant blood investigations.

Surgical Procedure: All surgeries were performed by experienced ophthalmologists using standard SICS techniques. The procedure included a superior conjunctival peritomy, creation of a scleral tunnel, anterior capsulotomy, hydro dissection, nucleus delivery using viscoelastic substances, cortical aspiration, and insertion of a polymethylmethacrylate (PMMA) intraocular lens implant. Surgical details and intraoperative complications, if any, were meticulously documented.

Postoperative Evaluation: Patients underwent regular postoperative follow-ups at one week, one month, and three months. Assessment comprised: BCVA, anterior segment for corneal edema and anterior chamber inflammation, IOP, fundus examination, and identification of complications, e.g., delayed wound healing, infection, etc.

Data Collection and Analysis: All the findings were recorded in a pre-designed proforma. Data was entered and analyzed using SPSS version. 25.0. Continuous data were reported as means and standard deviations, and categorical variables were reported as frequencies and percentages. Chi-square test and independent t-test were also used during inferential statistical analysis of categorical and continuous data, respectively. P value <0.05 was taken as statistically significant.

Outcome Measures: The postoperative BCVA at 3 months was defined as the primary goal. The secondary endpoints were the incidence and severity of postoperative complications, including corneal edema and anterior uveitis. They delayed wound healing, and the effects of glycemic control (as measured by HbA1c levels) on these endpoints.

Ethical Considerations: The study was approved by the Institutional Ethics Committee (IEC) of MES Medical College, Perinthalmanna, Malappuram, Kerala. The study complied with the Declaration of Helsinki. All subjects gave their informed consent after the nature of the study had been explained. Data analysis was conducted to ensure patient confidentiality and that all personal details were kept anonymous in the data to protect patient privacy.

Outcome Measures: The primary outcome measures were the prevalence and severity of DED in diabetic patients and the correlation between DED severity and DR progression. Secondary outcomes included calculating the relationship between DED severity and the duration of diabetes and other clinical factors that may impact the severity of DED.

RESULTS

The results of this study provide detailed insights into the impact of diabetes mellitus on postoperative outcomes following minor incision cataract surgery. The findings are presented systematically through four comprehensive tables and corresponding diagrams, clearly demonstrating demographic characteristics, visual acuity improvements, complication rates, and the influence of glycemic control.

Table 1: Baseline Demographic and Clinical Characteristics of Patients.

Characteristic	Diabetic (n=100)	Non-Diabetic (n=100)	p-value
Mean age (years)	62.5 ± 8.4	63.2 ± 7.8	0.56
Male (%)	52	48	0.56
Mean preoperative BCVA (LogMAR)	1.05 ± 0.22	0.98 ± 0.18	0.12
Mean HbA1c (%)	8.7 ± 1.2	5.8 ± 0.5	<0.001

This table presents the demographic and clinical baseline characteristics of diabetic and non-diabetic patients. It illustrates that the diabetic group had significantly higher mean HbA1c levels than non-diabetics. At the same time, other baseline characteristics, such as age, gender distribution, and preoperative visual acuity, showed no significant differences.

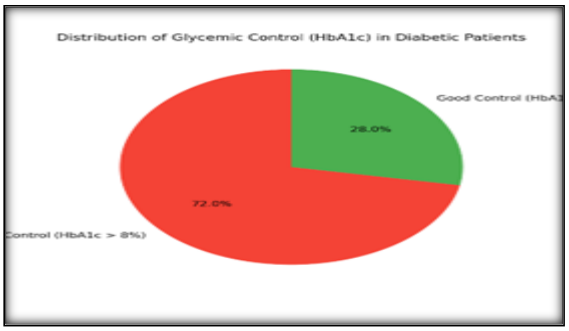

Figure 1: Distribution of Glycemic Control (HbA1c) in Diabetic Patients (Pie chart showing good control HbA1c ≤8% vs poor control HbA1c >8%)

[Table 2] demonstrates the improvement in visual acuity at different postoperative intervals. Diabetic patients consistently showed significantly lower visual acuity improvements at one week, one month, and three months compared to non-diabetics, highlighting the negative impact of diabetes on visual recovery post-surgery

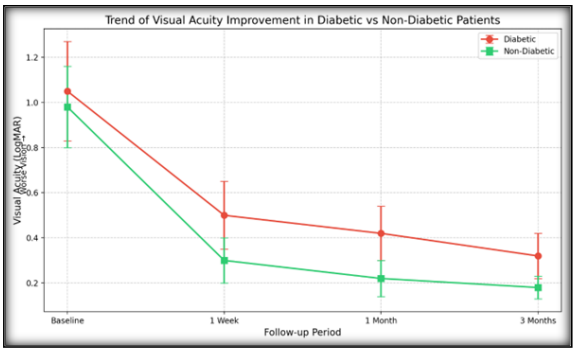

Figure 2: Trend of Visual Acuity Improvement in Diabetic vs Non-Diabetic Patients

Table 2: Postoperative Visual Acuity (BCVA) Improvement at Follow-ups.

Follow-up Period	Diabetic (LogMAR)	Non-Diabetic (LogMAR)	p-value
1 Week	0.50 ± 0.15	0.30 ± 0.10	<0.001
1 Month	0.42 ± 0.12	0.22 ± 0.08	<0.001
3 Months	0.32 ± 0.10	0.18 ± 0.05	<0.001

Table 3: Incidence of Postoperative Complications

Complication	Diabetic (%)	Non-Diabetic (%)	p-value
Corneal Edema	25	8	<0.001
Anterior Uveitis	20	5	0.003
Delayed Wound Healing	15	3	0.001
Raised IOP	10	4	0.10

The incidence of postoperative complications such as corneal edema, anterior uveitis, and delayed wound healing is detailed in Table 3. Diabetic patients had significantly higher complication rates compared to non-diabetic patients, emphasizing the increased risk associated with diabetes

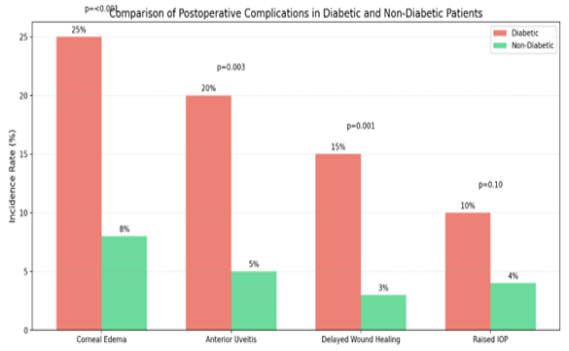

Figure 3: Comparison of Postoperative Complications in Diabetic and Non-Diabetic Patients

[Table 4] evaluates the association between glycemic control and postoperative complications within the diabetic cohort. Patients with poor glycemic control (HbA1c >8%) experienced significantly higher complication rates, emphasizing the importance of optimal glycemic management in reducing postoperative complications.

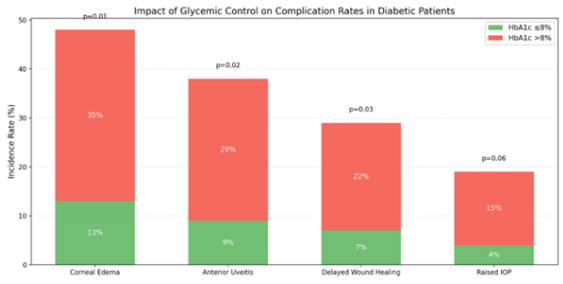

Figure 4: Impact of Glycemic Control on Complication Rates in Diabetic Patients

Table 4: Association of Glycemic Control with Complications in Diabetic Patients

Complication	HbA1c ≤8% (n=45)	HbA1c >8% (n=55)	p-value
Corneal Edema	13%	35%	0.01
Anterior Uveitis	9%	29%	0.02
Delayed Wound Healing	7%	22%	0.03
Raised IOP	4%	15%	0.06

DISCUSSION

In the present study, compared to non-diabetic patients with minor incision cataract surgery, diabetic patients had poorer postoperative visual acuity and a higher incidence of complications, including corneal edema, anterior uveitis, and delayed wound healing. And uncontrolled glucose status (HbA1c > 8%)24 was also similarly associated with high risks of postoperative complications, highlighting the importance of diabetes control in surgical outcomes.

Our study complies with prior research indicating the difficulty of diabetic individuals in attaining the best possible surgical results after cataract interventions. As in this study, Chan et al. (2023) identified significantly increased corneal edema and anterior chamber inflammation frequencies in DM patients after cataract surgery.[8] Furthermore, Chancellor et al. (2021) found poorer postoperative visual acuities in diabetic patients, consistent with our report.[9] Chronic complications are related to chronic hyperglycemia-induced inflammation, endothelial dysfunction, and dysregulation of wound healing.[10] However, we can only make comparisons with the series with the most significant number of patients, from Raina et al., and, in these data, our figure for complications is slightly lower. (2022) who found a lower incidence of delayed wound healing, potentially reflecting divergent surgical approaches and glycemic control between study populations.[11]

The present study has the advantage of being prospective, with sufficient participants, and systematic follow-up assessments, thus thoroughly comparing diabetics and non-diabetics in those who had undergone SICS, stratifying diabetic patients according to glycemic control. Moreover, such differentiation of glycaemic levels in diabetic patients might offer important hints to better address diabetes in the preoperative period and improve surgery results. Limitations of this study include being a single-center study that might impact generalizability and the short follow-up duration of 3 months, which does not allow for evaluation of long-term visual results and complications.

Briefly, diabetes mellitus was not only associated with decreased visual acuity, but also increased the postoperative complications in less invasive cataract surgery. Reasonable glycemic control and careful perioperative management are critical for reducing complications and achieving good visual outcomes for cataract surgery in DM patients. Additional multicentric and long-term studies are warranted to validate these findings and formulate grave clinical recommendations.

CONCLUSION

The present study emphasizes the substantial adverse effect of diabetes mellitus on the outcomes of MICS regarding VA improvement and postoperative complications. Diabetics had significantly less visual gain than the non-diabetics and higher postoperative complication rates, including corneal edema, anterior uveitis, and delayed wound healing. Poor glycemic control was highlighted as an important factor in the pathogenesis of these complications; Maintaining tight glycemic control is essential to reduce the adverse events peri- and post-operatively. These results highlight the importance of specialized care plans for reducing risk and improving surgical success following cataract procedures in diabetic patients.

Sugars enhance the chances of less improvement in postoperative visual acuity and complications after micro-incision cataract surgery. Reasonable glycemic control and specific perioperative care plans are the key to reducing complications and achieving the best visual prognosis for diabetic patients. The findings support the inclusion of tight diabetic control measures in everyday ophthalmic surgical practice to provide better postoperative patient outcomes. Further multicentre, prospective studies are warranted to confirm these results and better define management criteria.

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