Original Article

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Visual Outcome and Complications after Cataract Surgery in Diabetic and Non-Diabetic Patients

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Abstract

Background: Cataracts are a leading cause of visual impairment globally, with higher prevalence and higher risks of complications with variable visual recovery among diabetic patients. The aim of the study is to compare the visual outcomes and postoperative complications of cataract surgery in diabetic versus non-diabetic patients attending Chittagong Medical College Hospital (CMCH).

Materials and methods: This prospective comparative study was conducted from January to December 2022 and included two groups: 104 diabetic and 105 non-diabeticpatients.Visual acuity and complications were assessed preoperatively and at 1 week, 1 month and 3 months postoperatively. Data were analyzed using SPSS v25.

Results: The diabetic group (n=104) had a significantly lower mean age (56.7±5.7 years) than the non-diabetic group (n=105) (60.4±6.3 years) ($p<0.001$). Diabetic patients had slightly poorer BCVA at 1 week (0.74 LogMAR) 1 month (0.49 LogMAR) and 3 months (0.30 LogMAR) compared to non-diabetics (0.68, 0.45, 0.27 LogMAR, respectively) though the overall visual gain was evident in both. Intraoperative complications (e.g. posterior capsular rent, vitreous loss) and postoperative complications (e.g. anterior chamber reaction, corneal edema, posterior capsular opacity, cystoid macular edema) were numerically higher in diabetics, but none reached statistical significance.

Conclusion: Diabetic patients can achieve similar visual outcomes after cataract surgery, with slightly higher complication rates, but modern surgical techniques remain safe and effective.

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Introduction

Globally, cataracts are a major cause of blindness and visual impairment. It has been shown that 35.1 million out of 191 million persons with impaired vision worldwide suffer from cataracts, which account for 10.8 million of the 32.4 million blind people.[1] Cataract prevalence rises with age, from 3.9% in those aged 55–64 to 92.6% in people aged 80 and beyond.[2]

People who have diabetes are more likely to acquire cataracts and eventually require cataract surgery. With a frequency that is around two to five times greater than in individuals without diabetes, cataracts are more common in diabetic patients.[3] One of the most frequent surgical operations carried out worldwide is cataract surgery, which has been estimated to happen at a rate of 4,000–10,000 per million in developed countries.[4]

Although cataract surgery significantly improves visual function and quality of life, diabetic patients often face surgical challenges and a higher risk of intraoperative and postoperative complications due to factors like small pupils, lower endothelial cell density and coexisting diabetic retinopathy or macular edema.[5] However, with advancements in surgical techniques such as phacoemulsification and small-incision cataract surgery, along with better diabetes management, visual outcomes have improved in recent years.[6] Despite these global improvements, there is a scarcity of studies from Bangladesh evaluating visual outcomes in diabetic patients post-cataract surgery.

Diabetes is one of the world's leading causes of morbidity and mortality, with an estimated 462 million individuals are affected by type 2 diabetes corresponding to 6.28% of the world's population.[7] Bangladesh is no exception to the general worldwide trend in the growing prevalence of diabetes. Type 2 diabetes became more than double compared to the 1995-2010 period.[8]

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This increasing incidence of diabetes in Bangladesh necessitates an assessment of the surgical outcome of cataracts among the diabetic population. This study was aimed to investigate the outcome of cataract surgery in diabetic as well as non-diabetic patients attending in the Department of Ophthalmology at Chittagong Medical College Hospital (CMCH) and make recommendations for improved care.

Materials and methods

This is a prospective comparative observational study was conducted from January to December 2022.

Patients aged 40–80 years with type 2 diabetes mellitus on anti-diabetic treatment and no diabetic retinopathy were included in the diabetic group. Age- and sex-matched non-diabetic individuals with normal HbA1C levels comprised the comparison group. Exclusion criteria included complicated or secondary cataracts, uncontrolled systemic conditions, significant ocular pathologies affecting vision, recent intraocular surgery, major systemic illness, or unwillingness to participate.

Data was collected from the department of Ophthalmology at CMCH. All the consecutive patients were assessed for the eligibility. After giving written informed consent, demographic, clinical, laboratory and ocular assessments were documented, and biometry was performed preoperatively. All patients underwent cataract surgery—either Small Incision Cataract Surgery (SICS) or phacoemulsification with Posterior Chamber Intraocular Lens (PCIOL) implantation—under peribulbar anesthesia by experienced surgeons. SICS with PMMA PCIOL was performed via a 6–8 mm scleral tunnel incision and 1 mm side port, while phacoemulsification with foldable PCIOL used a 2.8–3 mm clear corneal incision and two 1 mm side ports. Pupils were dilated preoperatively with phenylephrine 5% and tropicamide 0.8%. Intraoperative complications were recorded. Postoperatively, patients received topical antibiotics and steroids, oral antibiotics, mydriatics, analgesics, and antiulcer agents as needed. Follow-ups were conducted at 1 week, 1 month and 3 months post-surgery, including BCVA (Converted to logMAR) slit-lamp examination, IOP measurement via Goldman applanation tonometry and fundus evaluation. OCT was performed in selected cases to assess cystoid macular edema. All clinical findings were recorded at each visit. Data was collected through a structured case record form containing questionnaire and checklist.

Data were analyzed using SPSS version 25.0. Continuous variables were expressed as mean ± SD, and categorical variables as frequency and percentage. Group comparisons used Chi-square or Fisher's exact test for categorical data and independent sample t-test for continuous data. A p-value <0.05 was considered significant.

Ethical approval was taken before starting the study from the Ethical Review Committee of CMCH (memo no. CMC/PG/2022/818 Dated 08/02/2022).

Results

In this comparative study between diabetic and non-diabetic cataract patients, several demographic, clinical, surgical, and outcome-related variables were analyzed.

The mean age of diabetic patients (56.7 ± 5.7 years) was significantly lower than that of non-diabetic patients (60.4 ± 6.3 years) ($p < 0.001$). However, sex distribution was comparable between the groups, with males comprising 55.8% in the diabetic group and 54.3% in the non-diabetic group ($p = 0.829$).

As expected, diabetic patients exhibited significantly higher fasting blood glucose (5.1 ± 0.3 mmol/L vs. 4.6 ± 0.4 mmol/L) 2-hour postprandial glucose (7.0 ± 0.2 mmol/L vs. 6.7 ± 0.3 mmol/L) and HbA1C levels (5.7% ± 0.7 vs. 4.8% ± 0.6) all with p-values < 0.001.

The type of cataract (Immature being most common in both groups) side of involvement (Right and left nearly equal) and type of surgical procedure (SICS+PCIOL vs. Phaco+PCIOL) did not differ significantly between the groups (All $p > 0.05$), indicating matched operative variables.

Although diabetic patients had a slightly higher incidence of intraoperative complications such as posterior capsular rent (4.8% vs. 1.9%) and vitreous loss (3.8% vs. 1.9%) the differences were not statistically significant. Postoperative complications at one week, including anterior chamber reaction, corneal edema, and pigment dispersion, were more frequent among diabetics,

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but again, not significant. At one and three months postoperatively, posterior capsular opacity and cystoid macular edema were more prevalent in diabetics, however, no statistical significance was observed in these comparisons.

Both groups demonstrated steady improvement in Best Corrected Visual Acuity (BCVA) over time. At 1 week, 1 month and 3 months post-surgery, diabetic patients had slightly poorer BCVA (0.74, 0.49, 0.30 LogMAR) compared to non-diabetics (0.68, 0.45, 0.27 LogMAR) although the overall visual gain was evident in both groups. The preoperative vision was equally impaired (1.3 LogMAR) in both cohorts.

Table I Age and sex distribution of the patients by their study group

Variables		Study group		
		Diabetic (n=104)	Non-diabetic (n=105)	p value
Age (Years)	Mean ±SD	56.7±5.7	60.4±6.3	<0.001*
	Range	48.0-73.0	47.0-74.0	
Gender	Male	58 (55.8)	57 (54.3)	0.829†
	Female	46 (44.2)	48 (45.7)	

Data are expressed as frequency (Percentage) if not otherwise indicated. SD: Standard Deviation. *: p value derived from Independent sample t test, †: p value derived from Chi-square test.

Table II Blood glucose and HbA1C of the studied patients

Variables	Diabetic (n=104)	Non-Diabetic (n=105)	p value†
FBS, mmol/L	5.1±0.3	4.6±0.4	<0.001
Blood sugar 2 hours postprandial, mmol/L	7.0±0.2	6.7±0.3	<0.001
HbA1C (%)	5.7±0.7	4.8±0.6	<0.001

Data are expressed as mean±SD. †: p value derived from Independent sample t test.

Table III Surgical information of the studied patients

Variables		Diabetic (n=104)	Non-Diabetic (n=105)	p value*
Cataract type	Immature	77 (74.0)	75 (71.4)	0.079
	Mature	18 (17.3)	10 (9.5)	
	Hypermature	8 (7.7)	16 (15.2)	
	Morgagnian	1 (1.0)	4 (15.2)	
Side of involvement	Right	55 (52.9)	55 (52.4)	0.942
	Left	49 (47.1)	50 (47.6)	
Type of operation	SICS & PCIOL	53 (51.0)	54 (51.4)	0.946
	Phaco & PCIOL	51 (49.0)	51 (48.6)	

Data are expressed as frequency (Percentage) *: p value derived from Chi-square test.

Table IV Complications of Cataract surgery between two groups

Complications	Diabetic (n=104)	Non-diabetic (n=105)	p value
Intra-operative complications			
No complications	93 (89.4)	98 (93.3)	0.344*
Posterior capsular rent	5 (4.8)	2 (1.9)	0.568**
Vitreous loss	4 (3.8)	2 (1.9)	0.564**
Hyphema	2 (1.9)	3 (2.8)	0.669**
Postoperative complications (1 week)			
ACR	12 (11.5)	7 (6.7)	0.332*
Corneal oedema	14 (13.5)	9 (8.6)	0.221*
Pigment dispersion	11 (10.6)	8 (7.6)	0.654*
Striate keratopathy	9 (8.6)	3 (2.8)	0.225*
Endophthalmitis	3(2.9)	1(1.0)	0.414*
Iris prolapse	2(1.9)	2(1.9)	0.687**
Raised IOP	1 (1.0)	0 (0)	1.0**
IOL dispalcement	2 (1.9)	0 (0)	1.0**
Postoperative complications (1 month)			
Posterior capsular opacity	3 (2.9)	1 (1.0)	0.214*
Postoperative complications (3 months)			
Cystoid macular oedema	4 (3.8)	1 (1.0)	0.671**
Posterior capsular opacity	11 (10.6)	4 (3.8)	0.224*
Raised IOP	1 (1.0)	1 (1.0)	1.0**

Data are expressed as frequency (percentage), p value derived from *Chi-square test; **Fisher's exact test.

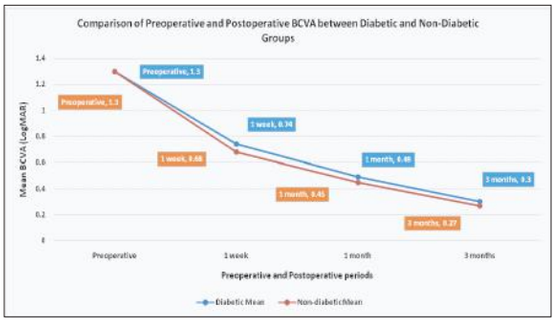

Figure 1 Visual Acuity Outcomes in Diabetic vs Non-Diabetic Patients

Discussion

Recent studies on cataract surgery in diabetics generally reports improved visual results and a decreased incidence of complications because of improved glycaemic and hypertensive control, improved surgical technique, and improved preoperative care of retinopathy.[9–12] Present study results agreed with recent studies and confirmed that cataract surgery in diabetic patients is an efficient procedure, resulting in highly significant BCVA improvement. Cataract surgery either SICS or phacoemulsification with PCIOL implant in

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diabetics with good glycemic control and without diabetic retinopathy and other complications yields similar visual outcomes as non-diabetics three months after cataract surgery.

In this study, mean age of the diabetic and non-diabetic patient was 56.7±5.7 and 60.4±6.3 years respectively, which was similar to the study of Sowmyaand Vallabha where the mean age group of the patients in diabetic group was 56.5±7.4 and 59.6±5.2 years in control group.[11] There was male predominance (55.8% and 54.3%, respectively in diabetic and no-diabetic group) in both groups in the current study without any statistical significance (p=0.829). The male to female ratio was 1.5:1 in the Wisconsin Epidemiologic Study of Diabetic Retinopathy.[13] Males are more concerned than females as a working group and the low overall number of female patients in hospitals in this region of the world may be the reason for the larger proportion of male cohort members.

Both diabetic and non-diabetic patients demonstrated significant postoperative improvement in BCVA (Figure 1) from a preoperative median of 1.30 LogMAR in both groups to 0.30 and 0.27, respectively, at three months. Non-diabetic patients showed slightly better early outcomes at one week (0.68 vs. 0.74) and one month (0.45 vs. 0.49) but the difference was not statistically significant, indicating comparable long-term visual recovery. At one month after surgery, the post-surgical visual acuity in the diabetic and non-diabetic groups was 0.30 and 0.37, respectively, according to a similar study conducted by Gupta et al. that included 50 diabetics and 50 non-diabetics.[9] Shaike et al. found that 90% of non-diabetic eyes and 65% of diabetic eyes had postoperative visual acuity of 0.3 Log MAR or greater, with a significant difference when eyes with diabetic retinopathy or other ophthalmic diseases were excluded (p = 0.0049).[12] Patients with diabetes who have little to no retinopathy have a favourable visual prognosis, comparable to that of people without the disease.[14] Most patients maintained their subjective visual function and BCVA for up to 20 years following cataract surgery.[15]

Cataract surgery may have some complications in all diabetic and non-diabetic patients, the most common intraoperative ocular complications were posterior capsular rent, vitreous loss or both followed by retained lens fragment.[9] The most common postoperative complication was PCO and cystoid macular oedema.[16] Even though cataract surgery has advanced significantly in recent years, individuals with diabetes who have cataract surgery are more than 30% more likely to experience intraoperative and postoperative complications than those without diabetes.[16,17] However, in the present study, very few patients had intraoperative complications. The rate of posterior capsule rent and vitreous loss was found to be higher in diabetic patients compared to non-diabetic group but hyphema were observed higher in non-diabetic group. However, none of the difference failed to reach statistical significance.

In the postoperative period, corneal edema was found in 13.5% and 8.6% of the cases in diabetic and non-diabetic groups respectively, in the current study. According to Larsson et al. polymegathism and pleomorphism, two structural alterations in ocular endothelial cells, have been linked to diabetes.[18] It has been noted that diabetes individuals' eyes have thicker corneas than those of non-diabetic people.[19] In addition to causing corneal oedema, cataract extraction and PCIOL implantation affect the already vulnerable corneal endothelium. As a result, diabetes individuals' eyes demonstrated higher damage to corneal endothelial cells during cataract surgery and a delayed recovery from corneal oedema relative to non-diabetic patients.

In this study the development of PCO in diabetics was 10.6% compared to 3.8% in non- diabetics, at the end of 3 months and slightly higher PCO found in diabetes compared to non-diabetics at the end of 1 month of follow up, but the difference was not statistically significant that confirming the findings of increase incidence of PCO in diabetics as shown in previous studies. Study by Sowmya and Vallabha also showed increase number of PCO occured in diabetic compared to non-diabetic patients.[11]

A total of 11 (10.6%) eyes in the diabetic group and 8 (7.6%) eyes in the non-diabetic group had increased pigment dispersion in the current study. Previous studies have demonstrated that diabetic individuals having cataract extraction and IOL

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implantation had enhanced pigment dispersion.[11,20] In this study, total 12 (11.5%) eyes in the diabetic group and 7 (6.7%) eyes in the non-diabetic group had anterior chamber reaction. Patients with diabetes had a greater anterior chamber reactivity than those without the disease. Similar findings were reported in earlier studies.[11,20]

In this study cystoid macular edema was seen in 4 (3.8%) diabetic and 1 (1.0%) non-diabetic patients which agreed with a recent study of Sowmyaand Vallabha (2020) where cystoid macular edema is seen in 3 (5.2%) diabetic and 1 (1.7%) non-diabetic patients.[11]The compromised blood-aqueous barrier in diabetics, whether or not they manifest evidence of diabetic retinopathy, causes inflammation and the development of cystoid macular oedema, a condition that develops exacerbated after cataract surgery.[21]

The occurrence of endophthalmitis in this study were higher in diabetics 3(2.9%) compared to non-diabetics 1(1.0%) but iris prolapse rate was same in this two groups. IOL displacement and increase IOP rate were slightly higher in this diabetics group compared to non-diabetics group but none of the difference failed to reach statistical significance.

In the present study half of the patients had SICS and another half had phaco surgery and both the groups were similar in terms of their cataract surgery technique. In diabetics without diabetic retinopathy, SICS produces visual results comparable to those of non-diabetics, according to Sowmya and Vallabha.[11] However, diabetics have a statistically non-significantly greater incidence of post-operative sequelae, which may be controlled conservatively. According to Shaikh et al. if diabetics have adequate glycaemic control and no retinopathy, their visual results following phacoemulsification with a PCIOL implant are nearly as good as those of non-diabetic patients.[12]

Because cataract surgery is one of the most commonly performed surgeries in our country and a substantial proportion of cataract patients are diabetic, present study results may well influence clinical practice. The presented data would allow more accurate planning and counseling of patients regarding the visual outcome and the risk of intraoperative complications in the setting of cataract surgery having diabetes.

Limitation

The study's limitations include its single-center design, a relatively small sample size, a short follow-up period, and the involvement of multiple surgeons.

Conclusions

Visual outcomes after SICS or phacoemulsification with PCIOL were comparable in well-controlled diabetics without retinopathy and non-diabetics, despite a higher but statistically insignificant rate of complications in diabetics.

Recommendation

Diabetic patients with good glycemic control and no complications can achieve excellent visual outcomes from cataract surgery, though extra precautions are warranted due to their higher risk of surgical complications.

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Contribution of authors

KNM- Acquisition of data, data analysis, drafting & final approval.

DB- Data analysis, drafting & final approval.

ANA-Interpretation of data, critical revision & final approval.

MSA-Conception, acquisition, data analysis, interpretation of data, critical revision & final approval.

US-Design, interpretation of data, critical revision & final approval.

TT- Conception, design, critical revision & final approval.

Disclosure

All the authors declared no conflict of interest.

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