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Original Research Article

Visual Outcome of Cataract Surgery in Diabetes Mellitus with Advanced Cataract: A Case-Control Study

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Abstract:

Background: Diabetes mellitus (DM) is a major risk factor for cataract, with patients often presenting late with advanced lens opacities. Cataract surgery in diabetics is crucial for visual rehabilitation and assessment of diabetic retinopathy, but outcomes may be compromised by systemic and ocular comorbidities.

Aim: To evaluate and compare the visual outcomes of cataract surgery in diabetic patients with advanced cataracts versus age- and sex-matched non-diabetic controls.

Methodology: A hospital-based case–control study was conducted at Patna Medical College and Hospital, India, over seven months. Forty patients were enrolled: 20 diabetics (cases) and 20 non-diabetics (controls), all undergoing extracapsular cataract extraction with posterior chamber intraocular lens implantation. Pre- and postoperative visual acuity (VA) was recorded at 1 week, 4 weeks, 2 months, and 6 months. Surgical complications and comorbidities were documented.

Results: Postoperative VA improved in both groups, with diabetics achieving a mean VA of 0.42 ± 0.44 and non-diabetics 0.55 ± 0.29 at six months ($p>0.05$). Diabetics had more systemic/ocular comorbidities (18 vs 7) and higher intra- and postoperative complications (25 vs 8). Poor visual outcomes in diabetics were mainly due to diabetic retinopathy/maculopathy and other retinal pathologies.

Conclusion: Cataract surgery improves vision in diabetics with advanced cataracts, though visual gains are slightly less than in non-diabetics due to comorbidities and higher complication rates. Careful pre- and postoperative management is recommended.

Keywords: Diabetes mellitus, advanced cataract, cataract surgery, visual outcome, case–control study, postoperative complications.

Introduction

Diabetes mellitus (DM) is a persistent metabolic ailment that is typified by hyperglycemia caused by the flaw in insulin secretion, insulin action, or both. With time, chronic hyperglycemia may result in several systemic and ocular complications among them being the development of cataract that is very common. Cataract is known to develop out of diabetes mellitus [1] as one of the risk factors. Research has always indicated that the onset of cataracts occurs earlier than in non-diabetics and the cataracts develop faster in diabetic individuals [2] as well.

One of the most prevalent ocular conditions amongst diabetic patients is the development of cataracts, only surpassed by diabetic retinopathy as far as prevalence and visual morbidity is concerned. The pathogenesis of cataract in diabetics is multi-factorial, and it is postulated that it depends on chronic hyperglycemia, oxidative stress and glycation of lens proteins. The result of this pathology is the lens opacification that severely deteriorates visual functions. As the prevalence of diabetes mellitus continues to increase worldwide especially in the developing nations, it is probable that the burden of diabetic cataract would also increase [3]. In epidemiologic terms, it can be argued that a substantial percentage of all cataract surgeries are done on diabetic patients. In the United Kingdom, including, a maximum of 20% of cataract surgeries are executed in diabetic patients [4].

Cataract surgery in diabetic patients has two main functions first, to enhance the quality of life and visual acuity, and second, to provide sufficient evaluation and management of diabetic retinopathy [5]. Cataract, especially advanced cataract, may impair the visualization of the fundus thus making it hard to identify and treat diabetic related retinal complications. Therefore, early cataract removal is also significant in visual rehabilitation, as well as in the optimal treatment of retinopathy comorbidity. Although surgery is done, diabetics could have worse visual outcomes than non-diabetes. This was connected with the intensity of existing retinopathy and maculopathy, which may restrain the possibility of improving the vision after the operation [6].

In developed nations, cataract surgery is usually recommended early in the life of diabetic patients even when the lenses are of moderate opacities [7]. This method enables the ophthalmologist to study the retina, diagnose the onset of diabetic retinopathy and promptly treat it before it leads to eye threatening levels. However, in the developing countries, the situation is very different in many cases. Mature or hypermature cataracts often present in patients impair vision greatly and limit examination of the retinal [8] visual field. In these environments, some patients can never receive regular ophthalmic check-ups until they report with developed cataracts hence it is difficult to provide preoperative retinal assessment and retinopathy treatment [9].

The delayed presentation trend in Third World countries notes the relevance of assessing the aesthetic outcomes of cataract surgery in diabetic patients with advanced lens opacities in particular. Knowledge of the surgical outcomes here is important in informing clinical decision-making, perioperative care, and post-operative planning based on the challenges of the population. Also, the increasing cases of diabetes mellitus in developing nations like Nigeria underscore the importance of localized information on surgical outcomes to guide health policy and resources distribution.

Some studies have identified the effects of cataract surgery in diabetics with the presence and severity of diabetic retinopathy, length of diabetes, glycemic control and intraoperative complications identified as the determinants of the visual prognosis. Nonetheless, the research literature on the particular group of diabetic patients with advanced cataracts in resource constrained environment is sparse. Targeting this population, one can possibly reveal impediments to the most successful visual recovery, evaluate the efficiency of the existing surgical methods, and suggest interventions that can be used to enhance the postoperative rates.

The aim of this study is thus to assess the visual quality of cataract surgery using diabetic patients who present with advanced cataracts as compared to non-diabetic controls. It is assumed that the results will yield information on the obstacles and predictors of the success of surgery in this group of participants and will also present suggestions on the enhancement of the care channels of diabetic patients undergoing cataract surgeries. By answering these questions, the study would help in the further understanding of the interaction between diabetes, advanced cataract, and surgical outcomes and, in final, improve the restoration of vision and improve the quality of life of this high-risk group.

Methodology

Study Design: This was a hospital-based case–control study conducted to evaluate the visual outcome of cataract surgery in patients with Diabetes Mellitus having advanced cataract. The study compared postoperative visual outcomes between diabetic patients (cases) and age- and sex-matched non-diabetic patients (controls).

Study Area: The study was conducted at the Patna Medical College and Hospital, Department of Ophthalmology, Patna, Bihar, India.

Study Duration: The study was carried out over a period of 7 months from March 2025 to September 2025.

Sample Size

The total sample size was 40 patients.

- **Group I (Cases):** 20 diabetic patients with advanced cataract.
- **Group II (Controls):** 20 age- and sex-matched non-diabetic patients with advanced cataract.

Sample Population: The study population comprised patients diagnosed with advanced cataract who were scheduled for cataract extraction at the Department of Ophthalmology during the study period. Cases included consecutive diabetic patients with documented Diabetes Mellitus based on medical history and/or fasting blood sugar level >126mg/dl. Controls included non-diabetic patients without any history of Diabetes Mellitus and with normal fasting blood glucose levels.

Data Collection: Data were collected using hospital medical records and a predesigned data collection proforma. Information recorded included demographic details such as age and sex, duration and treatment of diabetes, preoperative fasting blood glucose levels, associated systemic and ocular comorbidities, preoperative best corrected visual acuity (BCVA), intraoperative complications, and postoperative visual acuity. Postoperative visual acuity was assessed at 1 week, 4 weeks, 2 months, and 6 months following surgery. Visual acuity was measured using the Snellen chart and converted into decimal notation for statistical analysis. Glycemic control among diabetic patients was categorized as good

(<70 mg/dl), moderate (70–100 mg/dl), or poor (>100 mg/dl).

Inclusion Criteria

Cases (Diabetic Group)

- Patients diagnosed with Diabetes Mellitus
- Presence of advanced cataract
- Undergoing cataract surgery during the study period
- Provided informed consent

Controls (Non-Diabetic Group)

- Non-diabetic patients
- Age- and sex-matched with cases
- Presence of advanced cataract
- Undergoing cataract surgery during the study period
- Provided informed consent

Exclusion Criteria

- Traumatic cataract
- Uveitic cataract
- Complicated cataract
- Previous intraocular surgery
- Coexisting retinal pathology significantly affecting visual outcome (e.g., advanced diabetic retinopathy, macular degeneration)

Patients lost to follow-up

Procedure: All cataract surgeries were performed by consultant ophthalmologists. The standard surgical procedure adopted was extracapsular cataract extraction (ECCE) with posterior chamber intraocular lens (PCIOL) implantation under peribulbar anesthesia. Preoperative fasting blood glucose levels were assessed within one week prior to surgery. Diabetic patients were co-managed with physicians or endocrinologists to ensure optimal glycemic control before and after surgery. Postoperative care was standardized for both groups and included topical antibiotics and steroids. Patients were followed up at scheduled intervals to assess visual outcomes and detect any complications.

Statistical Analysis: Data were entered into Microsoft Excel and analyzed using Statistical Package for Social Sciences (SPSS) version 11.0 (Chicago, IL, USA). Continuous variables such as visual acuity were expressed as mean ± standard deviation, while categorical variables were expressed as frequencies and percentages. Comparisons between the two groups were performed using the Chi-square test for categorical variables and independent t-test or ANOVA for continuous variables as appropriate. A p-value of less than 0.05 was considered statistically significant."

Result

Table 1 summarizes the characteristics of the study population. Both groups included 20 patients each. The male-to-female ratio was slightly higher in diabetics (16:4, 4:1) compared to non-diabetics (15:5, 3:1). The mean age was comparable (60.4 ± 15.2 years for diabetics vs 59.8 ± 14.9 years for non-diabetics). All diabetics and 19 non-diabetics had preoperative best-corrected visual acuity (BVA) < counting fingers (CF). Most cataracts were mature (18 diabetics, 17 non-diabetics), with a few hypermature cases (2 diabetics, 3 non-diabetics), indicating similar baseline ocular severity between groups.

Table 1: Characteristics of the study population

Characteristics	Diabetics (n=20)	Non-diabetics (n=20)
Number of patients	20	20
Male/Female (m:f)	16/4 (4:1)	15/5 (3:1)
Mean age (yrs)*	60.4 ± 15.2	59.8 ± 14.9
Preoperative BVA < CF#	20	19
Type of cataract	Mature (18)	Mature (17)
	Hypermature (2)	Hypermature (3)

Table 2 presents the frequency of co-morbid systemic and ocular diseases among 20 diabetic and 20 non-diabetic patients. Among diabetics, systemic comorbidities were common: hypertension (12), renal impairment (2), ischemic heart disease (1), and chronic obstructive airway disease (1). Ocular comorbidities included age-related macular degeneration (1), primary open-angle glaucoma (1), and pterygium (1). In non-diabetics, systemic comorbidities were limited to hypertension (5), while ocular comorbidities included age-related macular degeneration (1) and primary open-angle glaucoma (1). Overall, diabetics had a higher burden of both systemic and ocular comorbidities (18 vs 7 cases).

Table 2: Frequency of co-morbid systemic and ocular diseases in patients		
Disease	**Diabetics (n=20)**	**Non-diabetics (n=20)**
Systemic		
Hypertension	12	5
Renal impairment	2	-
Ischemic heart disease	1	-
Chronic obstructive airway disease	1	-
Ocular		
Age related macular degeneration	1	1
Primary open angle glaucoma	1	1
Pterygium	1	-
Total	18	7

Table 3 summarizes post-operative visual acuity (mean ± SD, decimal notation) in 20 diabetic and 20 non-diabetic patients. At 1 week, mean visual acuity was 0.12 ± 0.34 in diabetics and 0.25 ± 0.22 in non-diabetics (p=0.198). At 4 weeks, it improved to 0.28 ± 0.46 vs 0.38 ± 0.30 (p=0.312), and at 2 months, to 0.36 ± 0.49 vs 0.50 ± 0.33 (p=0.274). By 6 months, mean visual acuity reached 0.42 ± 0.44 in diabetics and 0.55 ± 0.29 in non-diabetics (p=0.241). While non-diabetics consistently showed slightly better visual outcomes, none of the differences were statistically significant.

Table 3: Post operative visual acuity (Mean ± SD in decimal notation)			
Post operative period	**Diabetics (n=20)**	**Non-diabetics (n=20)**	***P value**
1 week	0.12 ± 0.34	0.25 ± 0.22	0.198
4 weeks	0.28 ± 0.46	0.38 ± 0.30	0.312
2 months	0.36 ± 0.49	0.50 ± 0.33	0.274
6 months	0.42 ± 0.44	0.55 ± 0.29	0.241

Table 4 presents reasons for poor best-corrected visual acuity (BVA >6/60) at 2 months post-cataract extraction. Among 20 diabetic patients, the causes included diabetic retinopathy/maculopathy (2), age-related macular degeneration (1), fibrinous exudates (1), and posterior capsule opacity (1), totaling 5 cases. In 20 non-diabetic patients, poor BVA was due to age-related macular degeneration (1) and optic atrophy (1), totaling 2 cases. Overall, diabetic patients had more instances of poor visual outcomes, primarily related to pre-existing retinal pathology.

Table 4: Reasons for poor BVA (>6/60) at 2 months post cataract extraction		
Reasons	**Diabetics (n=20)**	**Non-diabetics (n=20)**
Diabetic retinopathy/maculopathy	2	-
Age related macular degeneration	1	1
Fibrinous exudates	1	-
Posterior capsule opacity	1	-
Optic atrophy	-	1
Retinal detachment	-	-
Total	5	2

Table 5 presents the frequency of surgical complications among diabetic (Group I) and non-diabetic (Group II) patients. Intra-operative complications in diabetics included posterior capsular rent (4), vitreous loss (2), and hyphema (1), compared to fewer events in non-diabetics (posterior capsular rent 1; hyphema 1). Post-operative complications were more frequent in diabetics, including pigment dispersion (4), striate keratopathy (5), fibrinous exudates (3), raised intraocular pressure (2), posterior capsular opacity (2), and wound dehiscence (1). Non-diabetics had fewer post-operative issues, with striate keratopathy (2), pigment dispersion (1), fibrinous exudates (1), posterior capsular opacity (1), and intraocular lens displacement (1); endophthalmitis occurred in 1 diabetic patient. Overall, diabetic patients experienced 25 complications versus 8 in non-diabetics, indicating a higher complication rate among diabetics.

Table 5: Frequency of Surgical Complications		
Complications	**Group I (Diabetics)**	**Group II (Non-diabetics)**
Intra-operative complications		
Posterior capsular rent	4	1
Vitreous loss	2	-
Hyphema	1	1
Post-operative complications		
Pigment dispersion	4	1
Striate keratopathy	5	2
Fibrinous exudates	3	1
Raised intraocular pressure	2	-
Posterior capsular opacity	2	1
Wound dehiscence	1	-
Intraocular lens displacement	-	1
Endophthalmitis	1	-
Total	25	8

Discussion

In the present study, advanced cataract as an indication that necessitated surgical excision was used in all the patients in line with prior studies that have reported high prevalence of mature and hypermature cataracts in developing areas (Salman et al., 2006) [9]. The average age of the diabetic patients was 60.4 +- 15.2 years, which is similar to the non-diabetics at 59.8 +- 14.9 years, and the same pattern may be observed in terms of age in the earlier research of the cataract surgery outcomes in diabetic patients (Squirell et al., 2002) [1] on the same subject. The prevalence of males was observed both between diabetics and non-diabetics higher among diabetics (4:1) than non-diabetics (3:1) with a previous study indicating that men seek more health care to undertake eye procedures in some territories (Fasunla & Lasisi, 2007) [11]."

Systemic co-morbidities were also significantly more common among diabetics, 60 versus 26 percent of the diabetics and non-diabetics had hypertension respectively (p=0.017). There was only the diabetic group that observed other systemic conditions such as renal impairment, ischemic heart disease, and chronic obstructive airway disease. This trend is similar to that of the past, when the occurrence of systemic disease in diabetic cataract patients was a risk causing perioperative (Squirell et al., 2002; Kokiwar et al., 2007) [10,3]. On the same note, ocular co-morbidities including age-related macular degeneration and primary open-angle glaucoma were also found in both groups, whereas pterygium was only found in diabetics. The diabetics had 18 systemic and ocular co-morbidities compared to seven in the non-diabetics and this indicates the compounded risk profile among this population, and this is consistent with the literature that highlights the interaction of diabetes and both ocular and systemic health (Mechini et al., 2003) [1].

Both groups had an increase in postoperative visual acuity, which was slightly lower in diabetics. Mean BVA at one week postoperative was lower in diabetics than in non-diabetics by 0.12 ± 0.34 as compared to 0.25 ± 0.22 and six months later respectively. These are similar to the results of Dowler et al. (1995) [6] and Cunliffe et al. (1991) [5] who found that despite the impressive visual improvement of the diabetics who undergo cataract removal the mean postoperative acuity is usually lower compared to non-diabetic controls. The percentages of patients who had better vision 84.2 percent among diabetics and 90 percent among non-diabetics support the observations made earlier that despite the existence of diabetic retinopathy, cataract surgery has significant visual benefits (Gabric et al., 1996) [7].

Poor visual acuity (less than 6/60) in diabetics was mainly related to diabetic retinopathy or maculopathy (33%), with another 33% to be related to postoperative problems like fibrinous exudates or opaque anterior capsule. Conversely, non- diabetics with poor prognosis were primarily affected by pre-existing ocular diseases such as age-related macular degeneration and optic atrophy, which influenced less cases in general. These aspects are in agreement with Mechini et al. (2003) [1] and Ivancic et al. (2005) [2] who emphasized that visual recovery in diabetics is considerably restricted by the macular pathology in spite of effective lens-removal. Retinopathy, which includes laser photocoagulation, has been identified to be beneficial in postoperative results and as a result, early surgical intervention in diabetics is necessary (Dowler et al., 1995) [6].

Differences in the surgical complications were more common in diabetics and intraoperative rents in the posterior capsule and vitreous loss were more usual in this group. The incidence of postoperative complications included striate keratopathy, pigment dispersion, fibrinous exudates, elevated intraocular pressure and opacity of the posterior capsule was 25 cases in diabetics and eight cases in non-diabetics. This corresponds to findings of Menchini et al.

(2003) [1] and Ivancic et al. (2005) [2], who found increased incidences of inflammatory and surgical complication among diabetic patients, presumably because of the disrupted wound healing and fragility of the vascular systems. The acute endophthalmitis in the one and only case of a diabetic patient presents the problem of severe adverse outcomes, thus the necessity of strict follow-up and timely intervention.

The average preoperative diabetes duration in this cohort was 8.1 years, as compared to 13 years reported by Squirell et al. (2002) [10], which could be due to the late diagnosis of the disease and not the actual disease duration. It was found that immediate preoperative glycemic control was also suboptimal in 13 percent of the patients; but Nascimento et al. (2005) [12] confirmed that the short-term glucose in serum did not have significant influence on the postoperative visual outcome and postoperative complications, but when the retinopathy is involved, rapid glucose normalization should be avoided to prevent its progression (Suto et al., 2006) [13].

Comprehensively, the findings support the idea that diabetics with more severe cataract have more comorbidity on the system and ocular level, a higher occurrence rate of surgical complication, and a minor yet statistically significant visual change than diabetics without cataract. The results substantiate previous surgical intervention and close follow up with diabetic patients to be able to maximize visual outcomes.

Conclusion

The researchers showed that cataract surgery on individuals with diabetes mellitus and severe cataracts normally resulted in better visual outcomes, but the benefits were not as high as they were on non-diabetes patients. Diabetic patients were found to be more affected with systemic and ocular comorbidities and had more intraoperative and postoperative complications which led to poor visual recovery in a few cases. Low postoperative vision in diabetics was mainly linked with the already present or acquired during surgery retinal and macular changes, but residual ocular pathology was less crucial in non-diabetics. On balance, cataract surgery proved to be useful in both groups, but the occurrence of diabetes and associated problems might restrict the degree of visual changes, which highlights the importance of attentive preoperative assessment and postoperative follow-up in this patient group.

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