E-ISSN 2250-0944
ISSN 2250-1150
doi: 10.31838/ijprt/15.02.157

Research Article

A prospective case-controlled study on the outcome of cataract surgery in diabetic and non-diabetic patients

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Received: 13.06.25, Revised: 12.07.25, Accepted: 04.08.25

Abstract
Background: Diabetes mellitus (DM) significantly influences cataract development and may adversely affect visual outcomes and postoperative recovery. This study aimed to evaluate and compare the outcomes of small incision cataract surgery with intraocular lens implantation in diabetic and non-diabetic patients.
Methods: A prospective case-controlled study was conducted at the Department of Ophthalmology, Government Medical College, Chittorgarh, Rajasthan, involving diabetics and non-diabetics patients). Patients were evaluated for preoperative visual acuity, intraoperative and postoperative complications, and visual outcomes at 4 weeks post-surgery. Statistical comparisons between the groups were performed using chi-square and t-tests, with $p < 0.05$ considered significant.
Results: The mean age was 51.39 years in the diabetic group and 52.88 years in the non-diabetic group. Preoperative best corrected visual acuity (BCVA) was poorer among diabetics (logMAR 1.72 ± 0.48) than non-diabetics (1.51 ± 0.51), though not statistically significant ($p > 0.05$). Postoperative complications were significantly higher in diabetics (72%) compared to non-diabetics (36%) ($p = 0.001$), with corneal oedema, anterior chamber reaction, and posterior capsular opacification more prevalent in the diabetic cohort. Despite this, visual improvement was substantial in both groups, and no complication led to permanent vision loss.
Conclusion: Cataract surgery in diabetic patients, even with a higher rate of postoperative complications, yields comparable visual outcomes to non-diabetics when diabetic retinopathy is absent. Complications are generally self-limiting and manageable with conservative treatment. Enhanced perioperative care and monitoring in diabetic individuals are recommended to optimize outcomes.

Keywords: Cataract Surgery, Diabetes Mellitus, Visual Acuity, Postoperative Complications, Posterior Capsular Opacification.

INTRODUCTION

Cataract-induced blindness is a significant issue in India, impacting both human morbidity and resulting in economic loss and social cost. [1] The yearly occurrence of cataract-induced blindness in India is approximately 3.8 million. Approximately one-sixth of the global population with visual acuity greater than 3/60 resides in India. Globally, about 285 million individuals are impacted by diabetes mellitus, with projections indicating an increase to 439 million by 2030, as reported by the International Diabetes Federation.[2] Cataracts are the foremost cause of blindness worldwide, impacting over 18 million individuals. Individuals with diabetes mellitus exhibit a heightened risk of cataract development compared to non-diabetics, with over two-thirds of the diabetic population demonstrating cataract evidence. Research indicates a heightened risk of ocular problems in diabetics post-cataract surgery; nevertheless, contemporary surgical methods have mitigated these risks, resulting in generally favourable visual outcomes.[3] Preoperative macular oedema is the predominant factor that hinders visual recovery after surgery. Cataract surgery in diabetic patients is warranted for the enhancement of vision or to facilitate the evaluation and management of posterior segment disorders. It is believed that up to 20% of all cataract surgeries are conducted on diabetic patients, many of whom also have concurrent diabetic eye disease.[4] Diabetes mellitus affects the function and structure of the eye lens. Suboptimal visual outcomes in diabetics have been associated with the severity of retinopathy and maculopathy

preceding cataract surgery. Pre-operatively, it is acknowledged that diabetics have a higher incidence of pigment dispersion and fibrinous reaction in the anterior chamber, along with the formation of posterior synechiae, as well as an elevated risk of capsule rupture and vitreous loss.[5]

Diabetic patients exhibit a heightened susceptibility to postoperative sequelae, including rubeosis, neovascular glaucoma, macular oedema (both diabetic and cystoid), severe inflammation (iritis, uveitis, endophthalmitis), vitreous haemorrhage, synechiae to intraocular lens, retinal detachment, and corneal decompensation.[6] Diabetics are at an increased risk of developing posterior capsule opacification postoperatively. The rising prevalence of diabetes in emerging nations like India requires an evaluation of the surgical outcomes of diabetic cataract within the study population. This study is being carried out to assess and understand the visual outcome of surgery in diabetic cataracts with the intention of making recommendations for improved care.

MATERIAL AND METHODS

A Prospective case-control study was conducted at Department Of Ophthalmology, Government Medical College, Chittorgarh Rajasthan.

Sample size: 50 non diabetics (controls) and 50 diabetic (cases) Patients.

Inclusion Criteria

1. Patients who have given informed consent.
2. Patients with Type II diabetes mellitus.
3. Age group 18- 65 years

Exclusion Criteria

1. Patients with traumatic or complicated cataract.
2. Neovascularisation of iris
3. Secondary glaucoma
4. Iridocyclitis
5. Uncontrolled diabetes
6. Posterior segment causes of visual loss in diabetics.

METHODOLOGY

Demographic data (age, sex, occupation, address). All patients underwent ocular examination before and after Small incision cataract surgery with intraocular lens implantation.

Statistical Analysis

Descriptive statistics such as mean, SD and percentage was used to present the data. Comparison between control and diabetic groups was done using chi square test for qualitative data and t-tests for quantitative data. A p-value less than 0.05 was considered as significant. Data was analysed by using software SPSS v16.0

RESULTS

In the diabetic group, 42 (42%) were male and 58 (58%) were female. Among the non-diabetic patients, 34 (34%) were male and 66 (66%) were female.

In the diabetic cohort, 52 (52%) patients had a recent diagnosis of diabetes with a disease duration of less than 3 years. 24 (24%) had diabetes for over 10 years. Regarding glycaemic control, 44 (44%) of diabetics had satisfactory fasting blood sugar levels (FBS: 70–100 mg/dl), while 56 (56%) had levels above 100 mg/dl, including those both on and off treatment. A total of 98 (98%) diabetic patients were on treatment with either oral hypoglycemic agents or insulin, while 2 (2%) were not on any medication.

Systemic hypertension was the most common comorbidity in both groups. It was observed in 40 (40%) of diabetic patients and 10 (10%) of non-diabetic patients—a statistically significant difference. Other comorbid conditions in the diabetic group included hypothyroidism in 4 (4%) patients and ischaemic heart disease in 2 (2%) patients. In the non-diabetic group, 1 (1%) patient had ischaemic heart disease.

Regarding visual acuity, 60 (60%) of diabetics and 50 (50%) of non-diabetics presented with vision less than counting fingers at 2 meters (<2/60). A majority of patients, 78 (78%) in the diabetic group and 76 (76%) in the non-diabetic group, had visual acuity worse than 6/60. Only 22 (22%) of diabetics and 24 (24%) of non-diabetics had visual acuity between 6/36 and 6/24 based on the Snellen chart. The differences were not statistically significant ($p > 0.05$).

The average pre-operative best corrected visual acuity (BCVA) in logMAR units was 1.72 ± 0.48 for diabetics and 1.51 ± 0.51 for non-diabetics, which did not reach statistical significance ($p > 0.05$).

Postoperative complications showed a higher incidence in the diabetic group. Corneal oedema was observed in 12 (12%) diabetics and 8 (8%) non-diabetics. Striate keratopathy occurred in 14 (14%) diabetics versus 8 (8%) non-diabetics. Pigments on the intraocular lens (IOL) were noted in 6 (6%) diabetics and 4 (4%) non-diabetics. Anterior chamber reaction

was seen in 20 (20%) diabetic patients compared to 12 (12%) in the non-diabetic group.

At the 4-week follow-up, posterior capsular opacification (PCO) developed in 14 (14%) diabetics compared to 2 (2%) non-diabetics, indicating a higher incidence among diabetics.

All patients in both cohorts had various grades of immature cataracts. The prevalence of mixed cataracts was higher (66%) compared to monotype cataracts (24%). Among the mixed types, the combination of nuclear cataract (NC), cortical cataract (CC), and posterior subcapsular cataract (PSC) was most common (70%), followed by CC + PSC (26%). Among monotype cataracts, CC was most frequent (35%), followed by NC (15%), and PSC (10%).

Postoperative complications were observed in 72 (72%) of diabetic patients and 36 (36%) of non-diabetic patients. This difference was statistically significant ($p = 0.001$).

Table 1: Demographic Characteristics of Study Participants

Variable	Diabetic Group (n=100)	Non-Diabetic Group (n=100)
Mean Age (years)	51.39 ± —	52.88 ± —
Age Group 60–65 yrs (%)	Majority	Majority
Gender - Male (%)	42 (42%)	34 (34%)
Gender - Female (%)	58 (58%)	66 (66%)

Table 2: Diabetes-Related Characteristics

Parameter	Diabetic Group (n=100)
Duration <3 years (%)	52 (52%)
Duration >10 years (%)	24 (24%)
Good glycaemic control (FBS 70–100)	44 (44%)
Poor glycaemic control (>100 mg/dl)	56 (56%)
On treatment	98 (98%)
Not on treatment	2 (2%)

Table 3: Co-Morbid Conditions

Co-morbidity	Diabetic Group (n=100)	Non-Diabetic Group (n=100)
Systemic Hypertension	40 (40%)	10 (10%)
Hypothyroidism	4 (4%)	0 (0%)
Ischaemic Heart Disease	2 (2%)	1 (1%)

Table 4: Pre-Operative Visual Acuity (Snellen's Chart)

Visual Acuity Level	Diabetic Group (n=100)	Non-Diabetic Group (n=100)
<2/60	60 (60%)	50 (50%)
<6/60	78 (78%)	76 (76%)
6/36 to 6/24	22 (22%)	24 (24%)
Mean BCVA (logMAR)	1.72 ± 0.48	1.51 ± 0.51
Statistical significance	p > 0.05	

Table 5: Post-Operative Complications

Complication	Diabetic Group (n=100)	Non-Diabetic Group (n=100)
Corneal Oedema	12 (12%)	8 (8%)
Striate Keratopathy	14 (14%)	8 (8%)
Pigments on IOL	6 (6%)	4 (4%)
Anterior Chamber Reaction	20 (20%)	12 (12%)
Posterior Capsular Opacification (PCO)	14 (14%)	2 (2%)
Overall Complications	72 (72%)	36 (36%)
Statistical significance	p = 0.001	

Table 6: Type of Cataract

Cataract Type	Diabetic Group (%)	Non-Diabetic Group (%)

Mixed Type (Total)	66 (66%)	66 (66%)
NC + CC + PSC	70% of mixed	70% of mixed
CC + PSC	26% of mixed	26% of mixed
Monotype (Total)	24 (24%)	24 (24%)
Cortical Cataract (CC)	35% of monotype	35% of monotype
Nuclear Cataract (NC)	15% of monotype	15% of monotype
Posterior Subcapsular Cataract (PSC)	10% of monotype	10% of monotype

DISCUSSION

The present study aimed to evaluate and compare the outcomes of cataract surgery in diabetic and non-diabetic patients, focusing on demographic distribution, visual acuity outcomes, and postoperative complications. Our findings align with previously published literature but also reveal noteworthy differences that provide further insight into the specific surgical challenges and prognostic considerations for diabetic individuals. The average age of patients in both groups (diabetic: 51.39 years; non-diabetic: 52.88 years) was comparable, with a slight predominance of female participants. This aligns with the demographic trends observed in several Indian and international studies, where females often outnumber males in cataract cohorts, likely due to increased healthcare-seeking behavior and longer life expectancy in females.[7,8] More than half of the diabetic patients (52%) had recently been diagnosed with diabetes (<3 years), while 24% had a duration of diabetes exceeding 10 years. Glycaemic control remained suboptimal in more than half (56%) of the diabetic cohort, despite the fact that 98% were on pharmacological treatment. Poor glycaemic control has been previously associated with increased risk of postoperative inflammation and delayed wound healing after ocular surgeries.[9] The metabolic state of patients, particularly those with longstanding uncontrolled diabetes, often contributes to greater surgical morbidity and poorer visual outcomes.[10] Systemic hypertension was the most common co-morbidity and was significantly more prevalent among diabetics (40%) than non-diabetics (10%), which is consistent with the known clustering of cardiovascular risk factors in diabetes mellitus.[11] These comorbidities are known to potentiate microvascular damage, including in ocular tissues, which may explain the higher baseline vision impairment and postoperative complications observed in diabetic individuals.[12] Other co-morbidities, such as hypothyroidism and ischaemic heart disease, although less prevalent, may also influence surgical recovery, either through systemic inflammation or via pharmacological interactions with perioperative medications.[13] In the preoperative phase, a higher proportion of diabetic patients (78%) presented with severe visual impairment (<6/60) compared to non-diabetics (76%), with 60% diabetics presenting vision less than 2/60. Although the intergroup differences were not statistically significant ($p > 0.05$), this finding supports earlier studies which report more advanced cataracts and poorer visual acuity at presentation among diabetics due to delayed intervention and associated retinopathies.[14] The average preoperative best-corrected visual acuity (BCVA) measured in logMAR units was poorer among diabetics (1.72 ± 0.48) compared to non-diabetics (1.51 ± 0.51). This is consistent with previous data suggesting that diabetics have worse baseline vision and may not achieve the same degree of visual improvement postoperatively as their non-diabetic counterparts.[15] However, visual recovery after surgery is still substantial in most diabetic patients when appropriate glycaemic control and surgical precision are ensured.[16] A notable finding in this study was the significantly higher incidence of postoperative complications in the diabetic cohort (72%) compared to the non-diabetic group (36%), with a p-value of 0.001. This reinforces earlier observations that diabetes predisposes patients to increased inflammation and delayed tissue healing after intraocular procedures.[17] Among the specific complications observed, corneal oedema (12% in diabetics vs. 8% in non-diabetics) and striate keratopathy (14% vs. 8%) were more frequent in diabetics. These findings can be attributed to compromised endothelial cell function and reduced corneal clarity in diabetic patients.[18] Additionally, anterior chamber reaction was seen in 20% of diabetics compared to 12% of non-diabetics, suggesting heightened postoperative inflammation. Posterior capsular opacification (PCO) was also significantly more common in diabetics (14%) than in non-diabetics (2%). The higher incidence may be due to increased fibroblastic proliferation and epithelial cell migration, both of which are influenced by the

DM.[19] Pigmentation on intraocular lenses (IOLs) was slightly more prevalent among diabetics (6%) than in non-diabetics (4%), although the difference was minor. These observations call for meticulous postoperative monitoring in diabetic patients and, where possible, the use of adjunct therapies such as anti-inflammatory agents, corticosteroids, or Nd:YAG capsulotomy to improve long-term visual outcomes.[20] The most common cataract type in both groups was mixed morphology (66%), with the NC+CC+PSC combination being the most prevalent (70% of mixed). This supports earlier research indicating that diabetic cataracts tend to be more heterogeneous in morphology, likely due to complex pathophysiological processes such as osmotic lens swelling, glycation of lens proteins, and oxidative stress.[21] Interestingly, cortical cataract (35%) was the most common monotype variant, followed by nuclear and posterior subcapsular subtypes. Previous studies have suggested that cortical and posterior subcapsular cataracts occur more frequently in diabetic patients compared to age-related nuclear cataracts.[22] However, our study found no striking difference in cataract type distribution between the two groups, suggesting that while diabetes influences cataract density and progression, the morphologic types may still be influenced by age and environmental exposures

CONCLUSION

This is a prospective case-control study comparing visual results after minor incision cataract surgery with intraocular lens implantation in diabetics and non-diabetics. Each group, diabetic and nondiabetic, comprised 100 eyes. The pre-operative best corrected visual acuity was compared with the post-operative best corrected visual acuity in both groups, yielding a statistically significant P value ($p=0.01$). The post-operative problems reported during this investigation were corneal oedema, striate keratopathy, anterior chamber reaction, pigment dispersion on the intraocular lens, and posterior capsular opacification. The diabetic group had significantly higher levels compared to the nondiabetic group. None of the conditions were visually impairing and resolved during follow-up without surgical intervention. Consequently, we determined that short incision cataract surgery in diabetics devoid of diabetic retinopathy produces comparable visual outcomes to those in nondiabetics. A higher prevalence of postoperative complications among diabetics exists, which can be addressed conservatively. The limitations of this study included a limited sample size and a brief follow-up period.

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