Original Article

Visual acuity outcome of cataract surgery in diabetic patients

Afroz Khan, Snober Yousuf, Asif Mohd Sofi, Shahnawaz Shafi, Afnan Showkat , Farhat Akhter

Abstract

Background

Worldwide, more than 285 million people are affected by diabetes mellitus. This number is expected to increase almost twofold to 439 million by 2030 according to the International Diabetes Federation. Diabetic patients are 2–5 times more likely to develop cataracts at an earlier age.

Materials and Methods

The observational prospective study included a cohort of 100 patients. After a detailed history and pre-operative assessment, phacoemulsification with intraocular lens implantation was done by an experienced surgeon. Patients were followed up till 4 weeks postoperatively. All data was tabulated and interpreted using SPSS software

Results

A total of 100 patients were included in this study. Post phacoemulsification surgery, best corrected visual acuity of 6/6 or better was seen in 90% of patients without diabetic retinopathy (No DR) . Those with mild non-proliferative diabetic retinopathy (NPDR) achieve 6/9 vision in 80% of cases, while the percentages drop for patients with moderate and severe NPDR to 74% and 60%, respectively. This trend suggests an inverse correlation between the severity of diabetic retinopathy and the likelihood of achieving optimal visual acuity post-surgery. The most common complication post-surgery seen was the development of cystoid macular edema

Conclusion

Cataract surgery benefits all patients with diabetes but the degree of improvement is limited by the severity of the retinal pathology. The percentage of diabetic patients achieving BCVA of 6/9 or better was more in those without any diabetic retinopathy changes. Diabetic patients with diabetic retinopathy and cataracts were less likely to achieve BCVA of 6/9 or better when compared with patients with no diabetic changes in fundus.

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Introduction

Worldwide, more than 285 million people are affected by diabetes mellitus. This number is expected to increase almost twofold to 439 million by 2030 according to the International Diabetes Federation[1]. Diabetic patients are 2–5 times more likely to develop cataracts and it tends to happen more so at an earlier age[2]. Recently, retinal neurodegeneration has been described in diabetes and has been suggested to precede or occur concurrently and aggravate retinal vasculopathy[3]. DM

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Keywords

Cataract, Visual acuity, diabetes

is a modifiable risk factor for nuclear, cortical, posterior subcapsular and mixed type cataracts.

Cataract occurs earlier and progresses faster in diabetic than in nondiabetic patients. Positive correlations have been described between higher glycosylated haemoglobin levels at baseline and lens opacification[4]. It has been found that AGEs, including N-carboxyethyl lysine (CEL), pentosidine, N-(carboxymethyl)-L-lysine (CML), pyrraline, and fluorophore LM-1 are found at higher levels in cataractous lenses of diabetic patients when compared to the normal ageing population. It was also found that higher levels of b-crystallin in the lenses of diabetic patients indicate more prominent glycation, which further emphasises the benefits of good glycemic control. The increased glucose levels in the aqueous humor induce glycation of lens proteins and therefore increase the level of free radicals. This process, also known as ‘‘glucoxidation,’’ further opacifies the lens as a result of increased oxidative stress, especially given impaired antioxidant capacity in diabetic lenses[5].

It has been seen that even after uneventful phacoemulsification surgery and intraocular lens (IOL) implantation, there are significant increases in vascular endothelial growth factor (VEGF), hepatocyte growth factor, interleukin1 (IL1). These cytokines may induce clinical or subclinical worsening of DR and maculopathy[6]. Visual recovery after uncomplicated phacoemulsification and IOL implantation is governed by the macular perfusion status, presence of ME, and stage of DR[7]. The tendency to severe post-operative uveitis is particularly marked in patients with proliferative retinopathy, and fibrin membranes may form[8].

The purpose of this study was to evaluate visual acuity outcomes of cataract surgery and factors associated with good visual outcomes in diabetic patients.

Methods

This prospective and observational study included a cohort of 100 patients and was conducted in Post Graduate Department of Ophthalmology, Shri Maharaja Hari Singh (SMHS) Hospital, Srinagar, after obtaining ethical clearance from institutional ethical committee. The patients requiring cataract surgery with type 2 diabetes mellitus were included in the study. Patients with proliferative diabetic retinopathy or with complicated cataracts were excluded. A complete ocular examination including anterior segment and fundus evaluation was meticulously done. Optical coherence tomography was done to rule out macular edema. Assessment of blood sugar control was done with fasting blood sugar and HbA1c levels. All the patients underwent phacoemulsification surgery with intraocular lens implantation by a single experienced surgeon. Patients were followed till four weeks after surgery. Recording of best corrected visual acuity, slit lamp examination and fundus evaluation was done at every follow-up visit. The collected data was analysed using SPSS.

Results

Demographics

A total of 100 patients were included in this study. Most of the patients(44%) were in 60-70 year age group (Figure1) emphasizing the prevalence of cataract surgery in this demographic population. 56% of patients were females while males accounted for 44% of patients (Figure 2). The most prevalent cataract grade was posterior Subcapsular Cataract (PSC), with 25% patients diagnosed with this type, indicating it as a significant condition among the study population. Following closely, Nuclear Sclerotic Grade 3 with PSC (NSG3+PSC) was observed in 24% patients, reflecting its substantial occurrence as well (Figure 3). The cohort was divided into two categories: patients with a duration of diabetes less than 10 years and those with diabetes for 10 years or more. 60% patients had diabetes for less than 10 years, making up the majority of the study population suggesting a significant representation of individuals with relatively recent onset of diabetes in the cohort (Figure 4).

The distribution of patients' HbA1c levels, a key indicator of long-term glycemic control, was an important parameter in study. The patient cohort was stratified into three categories based on their HbA1c levels: less than 6.5%, between 6.5% and 8.9%, and 9% or higher. Majority of patients, 48% in total, fell within the 6.5-8.9% HbA1c range, suggesting that while their diabetes was managed, it was not optimally controlled according to standard guidelines. This group constituted the largest portion of the cohort, indicating a prevalent need for improved glycemic management in these patients to prevent further complications (Figure 5).

Table 1 Statistical Metrics of Preoperative and Post-operative VA

Group	Pre-operative VA (logMAR)		Post-operative VA (logMAR)		Change
	Mean	Standard Deviation	Mean	Standard Deviation	Mean
No DR	0.68	0.14	0.11	0.15	-0.57
Mild NPDR	0.74	0.14	0.19	0.22	-0.55
Moderate NPDR	0.78	0.18	0.28	0.11	-0.50
Severe NPDR	0.95	0.10	0.48	0.31	-0.47

Figure 1 Histogram of Age

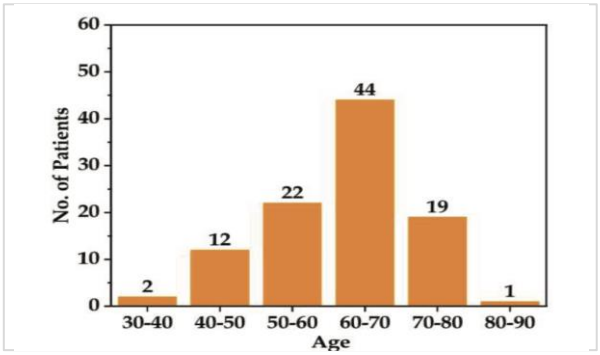
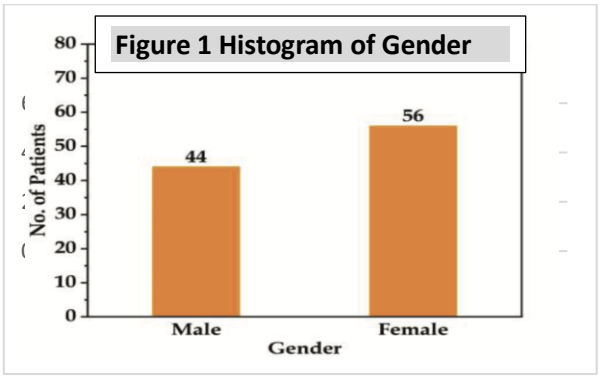


Figure 1 Histogram of Gender



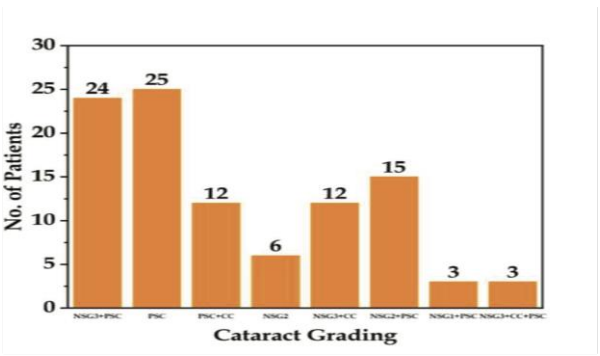


Figure 3 Histogram of Cataract Grading

The pie charts (Figure 6) depict the prevalence of various clinical parameters among diabetic patients undergoing cataract surgery, offering a comprehensive overview of the study population's characteristics.

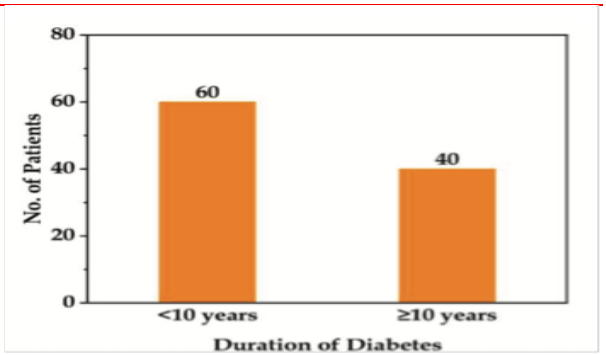


Figure 4 Histogram of Duration of Diabetes

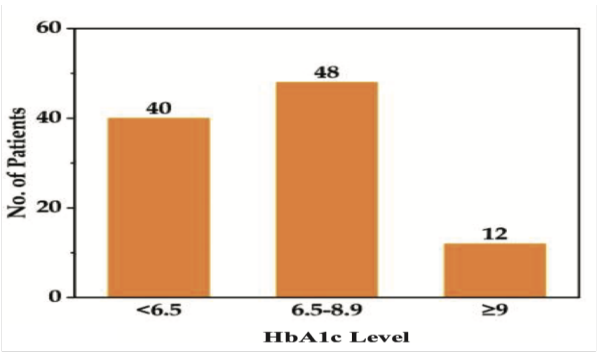


Figure 5 Histogram of HbA1c level

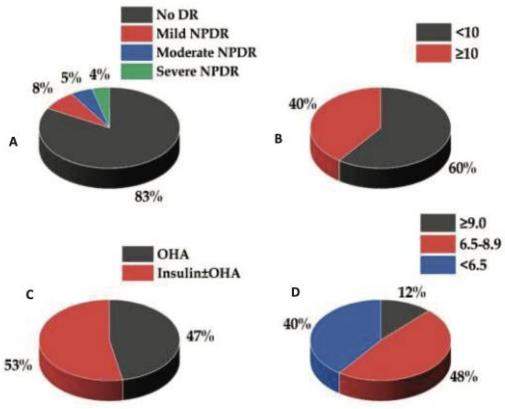


Figure 6 Prevalence among patients

Change in VA of Cohort from Preoperative to Postoperative Condition

Table 1 presents the mean and standard deviation of pre-operative and post-operative visual acuity (VA) in logMAR for different groups of patients categorized by the severity of diabetic retinopathy (DR).

The preoperative and postoperative visual acuity (VA) outcomes provide important insights into the effectiveness of cataract surgery in diabetic patients with varying severities of diabetic retinopathy (DR).

Post-operative BCVA of 6/9 or Better

Patients without diabetic retinopathy (No DR) showed the highest success rate, with 89% reaching visual acuity of 6/9 or better . Those with mild non-proliferative diabetic retinopathy (NPDR) achieve 6/9 vision in 80% of cases, while the percentages dropped for patients with moderate and severe NPDR, to 74% and 60%, respectively. This trend suggests an inverse correlation between the severity of diabetic retinopathy and the likelihood of achieving optimal visual acuity post-surgery. Patients who have had diabetes for less than 10 years are more likely to achieve a BCVA of 6/9 or better, with 76% of them reaching this goal. In contrast, only 63% of patients with a diabetes duration of 10 years or more achieve the same outcome.This indicates that the longer a person has diabetes, the less likely they are to attain optimal visual outcomes following cataract surgery. Patients with better pre-operative glycemic control, as indicated by an HbA1c level below 6.5% achieved a BCVA of 6/9 or better, with 83% reaching this benchmark. In comparison, those with HbA1c levels between 6.5-8.9% and 9.0% or higher had slightly lower success rates, at 74% and 72% respectively. Tighter glycemic control before surgery is associated with better visual outcomes post-operatively.

P**ost-Operative Complications causing low vision**

Two primary complications were seen in patients: cystoid macular edema (CME) and posterior capsular opacification (PCO). CME was observed in 4% patients, making it the most common postoperative complication causing low vision in this cohort. PCO, affecting 2% patients, was the second most common complication noted. Although less frequent than CME, PCO remains a significant concern, as it can markedly diminish visual acuity post-surgery. Identifying and managing CME and PCO promptly can significantly enhance the quality of life for diabetic patients undergoing cataract surgery, as these complications can substantially impair visual recovery if left untreated.

DiscussionThis study assessed the relationship between NPDR severity, duration of diabetes and preoperative HbA1c with visual outcome after phacoemulsification for cataract with type 2 diabetes mellitus. The study's finding that the majority of patients undergoing cataract surgery fall within the 60-70 year age range aligns with broader epidemiological trends. The higher prevalence of females (56%) compared to males (44%) undergoing cataract surgery reflects established gender disparities in cataract incidence[9]. Posterior Subcapsular Cataract (PSC) being the most prevalent grade among the study population is supported by findings that PSC is commonly associated with diabetes[10].The significant portion of the cohort (83%) without signs of diabetic retinopathy suggests that many diabetic patients undergoing cataract surgery may not have this complication. This finding is consistent with research indicating that a substantial number of diabetic patients undergoing cataract surgery do not exhibit DR. However, patients with varying degrees of non-proliferative diabetic retinopathy (NPDR) emphasize the importance of early detection and management. A study exploring DR development after cataract surgery found an increased risk of NPDR development in diabetic patients (Jeng *et al*)[11]. The distribution of HbA1c levels among patients emphasizes the need for improved glycemic management. Research indicates that poor glycemic control is a significant risk factor for cataract development. It has been seen that lower HbA1c levels were associated with a reduced risk of cataract progression (Srinivasan *et al*). Cystoid macular edema (CME) and posterior capsular opacification (PCO) being the primary postoperative complications reflect common postoperative complications noted in the literature. Research indicates that these complications are significant causes of low vision post-surgery, underscoring the need for vigilant postoperative monitoring (Chen *et al*) The significant variability in preoperative visual acuity among patients with different severities of diabetic retinopathy underscores the impact of DR on visual impairment. The substantial improvements in visual acuity across all DR severity levels post-cataract surgery indicate the efficacy of the procedure. This finding aligns with research demonstrating that cataract surgery leads to significant visual improvement in diabetic patients, regardless of DR severity.

The mean preoperative and postoperative visual acuity data highlights the effectiveness of cataract surgery. Research indicates that cataract surgery results in significant visual improvement, even in patients with severe NPDR.

The clinical profiles of diabetic patients undergoing cataract surgery, including those without DR, highlight the need for comprehensive preoperative assessments

and individualized management plans. This aligns with findings that highlight the importance of regular eye examinations and individualized care for diabetic patients . This study findings emphasizes the importance of age, gender and preoperative assessments in understanding cataract surgery outcomes in diabetic patients.

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