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Intraoperative complications and visual outcomes of cataract surgery in diabetes mellitus: a multicenter database study

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Purpose: To compare the visual outcome and the rate of intraoperative complications in eyes of diabetic and non-diabetic patients undergoing phacoemulsification over a period of 15 years

Design: Retrospective, non-randomized, multicenter comparative study. Data of 179,159 eyes that received phacoemulsification cataract surgery from 8 centers were analyzed for complications and demographics information. Further exclusion criteria were used to select a subset of 90,729 eyes for visual acuity (VA) analysis.

Methods: Eyes were classified based on the presence or absence of a diagnosis of diabetes mellitus. For the VA analysis, eyes with any co-pathology, previous ocular surgery, or combined surgical procedures (except for intravitreal injection of steroid or anti-vascular endothelial growth factor), were excluded. Main outcome measures were logarithm of the minimum angle of resolution (logMAR) VA at 4-12 weeks postoperatively, and the rate of intraoperative complications between eyes of diabetic and non-diabetic patients.

Results: Cataract surgery in eyes of diabetic patients was associated with an improvement in mean VA of 0.48 LogMAR (5 Snellen lines) and a substantial gain (≥ 0.30 LogMAR units; ≥ 3 Snellen lines) in 56.6%. Mean postoperative visual acuity was slightly worse in diabetic compared to non-diabetic groups (logMAR 0.23 vs. 0.13; Snellen 20/30 vs. 20/25; $p < 0.0001$) and the proportions of eyes achieving a visual gain of ≥ 3 Snellen lines (≥ 0.3 logMAR) was lower in the diabetic group (56.6% vs. 63.5%; $p < 0.0001$). There was a linear relationship between increased degree of diabetic retinopathy and worse postoperative visual acuity (β coefficient 0.098 to 0.288; $p < 0.0001$). We observed higher rates of posterior capsule rupture (2.3% vs. 1.6%; $p < 0.001$) and dropped nuclear fragments (0.3% vs. 0.2%; $p < 0.001$) in the diabetic group compared to non-diabetic group, but the rate of zonular dialysis was not different between the 2 groups.

Conclusions: We found a significant improvement in postoperative vision with diabetic cataract surgery. However, the postoperative VA negatively correlated with diabetes and the severity of diabetic retinopathy. Eyes of diabetic subjects had higher risks of posterior capsular rupture compared to non-diabetics.

Introduction

Diabetes mellitus (DM) is a leading cause of morbidity and mortality worldwide.^{1, 2} There are approximately 23.1 million people in the United States diagnosed with diabetes, accounting for 7.2% of the population.³ The United Kingdom has a comparable prevalence of diabetic patients of approximately 5.7%.⁴ A significant cause of morbidity from diabetes is the development of diabetic retinopathy. A meta-analysis involving 35 studies from 1980-2008 estimated the prevalence of diabetic retinopathy to be 35.4%.¹

Meanwhile, cataract is the leading overall cause of blindness worldwide.⁵ Cataract surgery is one of the most common surgical procedures performed globally with reported rates of 4,000-10,000 per million in developed countries.⁶ Cataracts are more frequent in diabetic patients, with an incidence that is approximately 2-5 times higher than in non-diabetics.⁷⁻⁹ The Wisconsin Epidemiologic Study of Diabetic Retinopathy demonstrated that the ten-year incidence of cataract surgery in patients with type 1 DM was 8.3% and in type 2 DM was 24.9%.⁸ Cataract surgery can effectively restore visual function and have a significant impact on a patient's quality of life. However, surgery in diabetic patients may be associated with surgical challenges and increased risk of intraoperative complications.¹⁰ Small pupils and more advanced cataracts at the time of surgery may lead to increased risk of posterior capsular rupture and vitreous loss. Also, the presence of diabetic retinopathy or maculopathy may impact the improvement of vision after surgery.¹¹ There have been several contemporary studies looking at the visual outcome of cataract surgery in diabetic patients. On average, the visual improvement achieved after surgery ranged from 0.1 to 0.4 logarithm of the minimum angle of resolution (logMAR).¹¹⁻¹⁴ However, most of the studies were limited by their sample size,^{11, 12} the absence of control groups,^{11, 12, 14} or included only patients with specific levels of diabetic retinopathy, or type 2 DM.^{11-13, 15}

We conducted this large-scale study to answer the following questions. What is the visual outcome and the rate of intraocular complications of cataract surgery in eyes of diabetic subjects compared to non-diabetics? How does diabetic retinopathy grade influence the visual outcomes of modern cataract surgery?

Methods

Data Extraction

Data sets from 8 United Kingdom ophthalmology departments using the same electronic medical record system (Medisoft Ophthalmology; Medisoft Limited) were automatically pooled to a centralized database for analysis. A study period of 15 years (July 2000 to May 2015) was selected to provide a large cohort with sufficient follow-up information. All sites performed phacoemulsification surgery. The sites in this study routinely provided a tapering post-operative course of topical steroid and antibiotic drops for 4 weeks. Routine postoperative care included at least one visit 4–6 weeks following surgery conducted by a specialist nurse or optometrist. Eyes identified as high risk, such as those with known diabetic retinopathy, were more likely to be reviewed earlier by an ophthalmologist.

Data fields extracted from pre-and postoperative visits included: age, gender, laterality, preexisting co-pathology, pre- and postoperative visual acuity, diabetic status and ETDRS grading when applicable, presence of postoperative macular edema, and time of follow up. Because some eye had more than one co-pathology recorded, we analyzed this characteristic individually, and presented the aggregate number of co-pathologies for each eye (single or multiple). Data on the indication, date and type of all procedures or surgeries prior to or after the time of cataract surgery were also available. Fields extracted from the operative record for cataract surgery included: pupil size, surgeon grade, type of surgery performed including combined surgery and details of intraoperative complications. Recording of complications in the electronic medical record (EMR) was a compulsory field. The surgeon was mandated to record whether or not there were any intraoperative complications before they could save the operation record. If a complication occurred, the surgeon had to select from a prespecified list of well-recognized cataract surgery complications.

This study was conducted in accordance with the Declaration of Helsinki. The Caldicott Guardian (who oversees data protection) and lead clinician at each center gave approval for data extraction.¹⁶ The extracted patient information was de-identified and therefore was not classified as human subject research and institutional board review was waived.

Exclusion Criteria and Data Categorization

Figure 1 is a flowchart illustrating the filtering process used to obtain the two groups that we analysed for analysis of preoperative comorbidities and intraoperative complication. It also demonstrates the additional filtering used for VA analysis. We identified an initial database of total of 217,107 eyes of patients who were 18 years or older and underwent phacoemulsification from July 2000 to May 2015. Of this, we excluded 37,948 eyes due to lack of recording of the diabetic status. Of the 179,159 eyes remaining for the analysis, 55,091 eyes represented surgery on the fellow eye of the same patient (30.7%). For the purpose of the analysis, we divided the study eyes based on the diabetic status into: 41,059 eyes of patients with diabetes (diabetic group) and 138,100 eyes of patients without diabetes (reference group). We compared multiple preoperative, intraoperative and postoperative characteristics and outcomes between the two groups. For the analysis of the visual outcomes and the occurrence of postoperative cystoid macular edema (CME), we applied additional filtering criteria to the data to avoid the confounding effect of coexisting ocular co-morbidities on these outcomes. Specifically, we excluded from these analyses 18,967 eyes of patients that lacked precise ETDRS grading for diabetic retinopathy, preoperatively and/or postoperatively. Additionally, we excluded all eyes with any co-pathology (14,317 in the diabetic group and 53,689 in the reference group) and eyes that underwent previous intraocular surgery, or those where cataract surgery was combined with additional intraocular procedures, except for intravitreal injections (321 and 1,136, respectively). Intravitreal injections are almost uniformly performed after the completion of the cataract surgery, therefore would not be expected to have an impact on intraoperative complications. This left available for the analysis of the visual acuity 7,454 eyes in diabetic group and 83,275 eyes in the reference group.

Follow-up and Study Outcomes

The main outcome variables for this study were the VA and the incidence of intraoperative complications, and the development of postoperative CME. Visual acuity was recorded using Snellen fractions or logarithm of the minimal angle of resolution (logMAR) units, and Snellen acuities were converted to logMAR for the purpose of analysis. Visual acuity was defined as the best value of uncorrected or corrected distance VA available at each time period. If pinhole visual acuity improved the VA values, this was used for VA. If more than one assessment of VA was made during that period, the VA demonstrating the greatest improvement from baseline (peak effect) was used in the analysis. Preoperative VA was that recorded closest to the date of cataract surgery, no more than 3 months prior. Follow-up was recorded as occurring during 3 different time periods: 0-4 weeks, 4-12 weeks, and 12-24 weeks. Visual acuity at 4-12 weeks was selected as the primary postoperative VA time period.

Postoperative CME was defined as a recorded diagnosis of CME within 90 days of the time of cataract surgery. For the purpose of the analysis, we excluded eyes with preoperative diabetic macular edema (462/7,454) when analyzing the proportions of eyes from diabetic subjects developing postoperative CME, since we were not able to determine from the extracted data if postoperative edema in an eye of a patient with diabetes with pre-existing edema was representative of new edema or persistent DME (Figure 1). Although optical coherence tomography and/or fluorescein angiography (FA) were likely used for the diagnosis of CME, interpretations of these studies were not recorded consistently in the EMR limiting their analysis.

Statistical Analysis

We used the chi-square test to analyze differences in proportions as indicated, with a p-value threshold for statistical significance of 0.05. To account for multiple testing in VA between groups, we used the t-test with Bonferroni correction, with conservative p-values listed in the

tables (Table 3 and 4). We fitted a linear regression analysis model to analyze the predictive factors for postoperative vision, and binary logistic regression models for the development of posterior capsule rupture and postoperative CME. To examine the impact of bilateral cataract surgery within the same individual (clustering), we performed sensitivity analysis on both adjusted and unadjusted models for monocular surgery vs. binocular surgery. We observed no difference between clustered and non-clustered analyses.

Results

Demographics of Study Eyes

There were 41,059 eyes in the diabetic group and 138,100 in the non-diabetic reference group. Eyes of patients with diabetes represented 22.9% of all eyes undergoing cataract surgery. Table 1 summarizes the preoperative characteristics of the study eyes. The diabetic group belonged to patients with a slightly younger age (73 [10.3SD] years) compared to 75 [10.7 SD] years. $p < 0.001$) and had denser cataract at the time of surgery reflected in a larger number of eyes with brunescient or white cataracts (4.7% vs. 3.8%; $p < 0.0001$), and eyes with no fundal view (1.3% vs. 0.9%; $p < 0.0001$). Eyes of patients with diabetes also had a higher prevalence of small pupil (4.2% compared to 3.3%; $p < 0.0001$). The reference group had a higher prevalence of corneal pathology, age-related macular degeneration, glaucoma, and previous retinal and glaucoma surgery. There were no differences in the prevalence of amblyopia or pseudoexfoliation / lens subluxation between the two groups. Regarding the grade of the operating surgeon, 56.6% of eyes were operated by attending (consultant) grade surgeon and 43.3 % were operated by non-attending surgeons, of whom 64,042 (35.7% of total eyes) were residents/trainees and 14,026 (7.8% of total eyes) were middle grade surgeons.

Visual Acuity Assessment

The mean preoperative visual acuity in the diabetic group was slightly worse, 0.61 logMAR [approximately 20/80 Snellen] (0.597-0.618 95% CI), than in the reference group, 0.56 logMAR [approximately 20/70 Snellen] (0.553-0.559 95% CI) (Table 3). Postoperatively, we observed a worse mean vision at the 4-12-week time point, in the diabetic group compared to the reference group (0.23 vs. 0.13 logMAR [approximately 20/30 vs. 20/25 Snellen]; $p < 0.0001$). We performed a subgroup analysis of the study eyes as stratified by preoperative VA (better than or

equal to 20/40 vs. worse than 20/40) (table 3). In eyes with baseline vision of <20/40 (>0.3 logMAR), there was significantly worse vision at 4-12 weeks postoperatively in eyes of diabetic patients compared to reference eyes (logMAR 0.25 vs. 0.15 [approximately 1 Snellen line]; $p < 0.0001$). In eyes with baseline good vision, better than or equal to 20/40 (≤ 0.3 logMAR), eyes in diabetic patients still fared worse (logMAR 0.12 vs. 0.07; $p < 0.0001$), but the difference in the mean VA was smaller between the 2 groups. A significantly smaller proportion of eyes of diabetic patients gained 15 or more letters (≥ 0.3 logMAR) compared to eyes in the reference group, at 4-12 weeks (56.61% vs. 63.48%; $p < 0.0001$) (Table 4). Overall the number of eyes that lost 15 letters or more (≥ 0.3 logMAR) after cataract surgery was small; 4.13% in the diabetic group vs. 2.53% in the non-diabetic group ($p < 0.0001$).

We analyzed the effect of preoperative vision, diabetic retinopathy grading, and the presence of preoperative DME on postoperative visual acuity at 4-12 weeks, using a multivariate linear regression model (Table 5). We found a significant effect of the preoperative vision (β coefficient 0.123; $p < 0.0001$) and the preoperative DME (β coefficient 0.193; $p < 0.0001$) on the postoperative acuity. We also observed a significant effect of diabetes without retinopathy (β coefficient 0.043; $p < 0.0001$) and a worse postoperative visual acuity with worsening stages of retinopathy, from mild NPDR to PDR (β coefficient 0.098 to 0.288, all $p < 0.0001$). To test whether the grading of diabetic retinopathy modifies the relation between preoperative and postoperative vision, we included the interaction between preoperative vision and the grading of diabetic retinopathy in the linear regression model; the interaction term was significant ($p < 0.05$). Figure 3 shows that the effect of diabetic retinopathy is additive to the effect of preoperative vision. The regression lines have different slopes, which indicates that the effect of preoperative vision on postoperative vision differ by the severity of diabetic retinopathy.

Intraoperative Complications

Table 2 details the intraoperative characteristics and complications we observed between the 2 groups. We found the rate of posterior capsular (PC) rupture among all surgeons to be significantly higher in the diabetic group compared to the reference group (2.1% vs. 1.6%; $p < 0.0001$). For senior surgeons, these rates were lower but still different between the two groups (1.6% vs. 1.3%, respectively; $p < 0.0001$). The rate of dropped lens fragment was slightly higher in the diabetic vs. non-diabetic group (0.3% vs. 0.2%; $p < 0.0001$). The rate of corneal edema was

also slightly higher in the diabetic vs. non-diabetic group (0.18% vs. 0.10%; $p < 0.0001$). We did not observe any significant difference in other complications including zonular dialysis, iris damage, choroidal hemorrhages, or hyphema between the two groups. To further analyze the risk factors for PC rupture, we conducted a logistic regression analysis (Figure 2). Diabetes, with or without retinopathy, was a significant risk factor for PC rupture (OR 1.263 [1.165-1.370, 95% CI]). Brunescant or white cataract was the most significant risk factor with an odds ratio of 2.090 (1.832-2.385, 95% CI). Other significant risk factors included surgeon being at a non-attending (non-consultant) level (OR 1.724 [1.603-1.853 95%CI]), small pupil (OR 1.367 [1.159-1.612, 95% CI]), and the use of pupil dilating device (OR 1.459 [1.067-1.996, , 95% CI]). Eyes who received 10 or more intravitreal injections prior to surgery also had increased risk of PC rupture (OR 1.932 [1.106-3.376, 95% CI]).

Postoperative Cystoid Macular Edema

Excluding 462 (6.2%) of the 7,454 eyes of diabetic patients that had preoperative DME, we noted that 142 (2.0%) of the 6,991 eyes of diabetic patients (without preoperative DME) developed postoperative CME, compared to 696 (0.8%) of the 83,275 eyes of non-diabetic patients ($p < 0.0001$). Our logistic regression analysis of postoperative CME showed that DM without retinopathy had an increased risk of developing postoperative edema compared to the reference group (OR 1.844 [1.424-2.387, 95% CI]; $p < 0.001$). There was a near linear relationship for increased risk of developing CME with increasing retinopathy from mild NPDR (OR 2.375 [1.700-3.320, 95% CI]; $p < 0.0001$) to moderate NPDR (OR 6.556 [4.149-10.358]; $p < 0.0001$) to severe NPDR (OR 7.428 [2.997-18.413]; $p < 0.0001$). There was a significant effect of PDR (including 389/516 eyes [75.4%] with treated PDR [ETDRS Grade 61]) on postoperative edema (OR 4.031 [2.423-6.707, 95% CI]; $p < 0.0001$), however it was lower than the OR for moderate and severe NPDR. We found that the preoperative visual acuity level had no significant effect on the development of postoperative CME (OR 1.011 [0.868-1.178, 95% CI]; $p = 0.884$).

Discussion

This multicenter database study evaluated the visual outcome and the rate of intraoperative complications in eyes of diabetic patients undergoing phacoemulsification. We found that

surgery in eyes of patients with diabetes was associated with an improvement in the mean VA by 0.48 LogMAR units (4-5 Snellen lines) and a substantial gain (≥ 0.30 LogMAR units [≥ 3 Snellen lines]) in 56.6% after 4-12 weeks. Compared to eyes of non-diabetic patients, there was a slightly worse mean postoperative vision of approximately 1 Snellen line, and a higher rate of posterior capsular rupture and dropped nuclear fragments.

We noted a worse preoperative vision in the diabetic group. This is likely due to a combination of more advanced cataract and the presence pre-existing retinal pathology in eyes with diabetic retinopathy or maculopathy. Postoperatively, we found the visual outcome of eyes of diabetic patients to be only slightly inferior to eyes of non-diabetic patients based on our analysis of mean postoperative visual acuity (logMAR 0.23 vs. 0.13 [approximately 1 Snellen line]; $p < 0.0001$) and the proportions of eyes achieving a visual gain of ≥ 3 Snellen lines (≥ 0.3 logMAR) (56.6% vs. 63.5%; $p < 0.0001$). We observed a linear relationship between the degree of diabetic retinopathy and visual acuity (Table 5), such that advanced degree of retinopathy resulted in worse postoperative acuity. Comparison of our visual results with other studies may be possible despite variations in study sizes and reporting. Ostri et al retrospectively evaluated 285 eyes of diabetic patients who underwent cataract surgery and determined that 75% had better VA post-surgery.¹¹ Average vision change ranged from of 0.4 logMAR (20/50) to 0.1 logMAR (20/25). Of note, their study included eyes with other coexisting ocular co-pathology such as glaucoma and excluded those with untreated diabetic macular edema from the analysis. Yang et al in a single center retrospective study of 1,002 eyes with diabetes, demonstrated vision improvement of 0.33 logMAR (approximately 3 Snellen lines) at 1 month and 0.32 logMAR at 6 months.¹⁴ However, their study excluded patients with proliferative retinopathy, or pre-existing DME. Eriksson et al observed in a study of 34 eyes of patients with type 2 diabetics and 35 controls that BCVA was slightly worse in eyes of diabetics compared to control (approximately 0.1-0.12 logMAR (1 Snellen line) at 6 weeks but similar at 6 months.¹⁵ Their diabetic group only included eyes with mild or moderate non-proliferative retinopathy and excluded pre-existing macular edema. Liu et al conducted a retrospective case series of 65,370 eyes that underwent cataract surgery with 34% of their patients having type 2 diabetes, from Kaiser Permanente Health Plan in California.¹³ They observed nearly similar levels of vision improvement in eyes of diabetic patients (-0.44 vs. -0.50 logMAR [approximately 4-5 Snellen lines]) and non-diabetic

patients (-0.43 logMAR), however, eyes with diabetic retinopathy were less likely to achieve 20/20 vision compared to those without retinopathy. Their study did not include patients with type 1 DM and used a single vision measurement for postoperative vision that was recorded at any point between 3 weeks and 12 months after surgery.

To further assist surgeons with preoperative patient counseling and informed consent, we fitted a post-linear regression interaction model for the diabetic status and the preoperative visual acuity on the postoperative visual acuity at 4-12 weeks (figure 4). We found that as preoperative vision gets worse, the gap between the different grades of retinopathy increases with the more advanced retinopathy grades exhibiting worse vision postoperatively. For example, this model predicts that a change of the preoperative vision from 0.6 to 0.9 LogMAR [Snellen 20/80 to 20/160] preoperatively, will result in worsening of the postoperative vision by +0.05 logMAR (1/2 Snellen line) in eyes with mild NPDR, and +0.1 LogMAR (1 Snellen line) in eyes with PDR.

There is a scarce number of studies that specifically analyzed the intraoperative complications of diabetic cataract surgery.¹⁷ Our results demonstrate that cataract surgery in diabetic individuals may be surgically more challenging due to higher prevalence of advanced cataract and small pupil at the time of surgery. Previous large-scale cataract surgery studies demonstrated increased rates of PC rupture in diabetic patients by about 1.6-fold.¹⁰ In the current study, we found the rate of the posterior capsular rupture to be higher in eyes of diabetic patients vs. non-diabetic patients (2.1% vs. 1.6%; $p < 0.0001$). We also determined that diabetes, with or without retinopathy, was an independent risk factor for PC rupture (OR 1.263). Mitra et al found a PC rupture rate of 12% for all surgeons, and 4% for senior surgeons in a small retrospective study of 150 eyes of diabetic patients.¹⁷ While the risk of PC rupture was lower in the eyes operated by senior surgeons in our study, the observed difference between diabetic and non-diabetic groups remained. It has been proposed that diabetes may increase the rate of PC rupture due to increased surgical complexity from inadequate pupillary dilatation or prior vitrectomy.¹⁸ We found the presence of small pupil (OR 1.367) and dense cataract (OR 2.09) to be associated with a higher risk for PC rupture, but there was no increased risk associated with prior PPV surgery. In keeping with previous studies,¹⁹ we also noted that eyes that received previous multiple (≥ 10) intravitreal injections were at increased risk of PC rupture during cataract surgery (OR 1.932). In

addition to the increased risk of PC tear in eyes of diabetic patients, we also observed a slightly higher instance of dropped lens fragments at the time of cataract surgery (0.3% vs. 0.2%; $p < 0.0001$). We attribute this observation to the increased risk of PC tear in eyes of diabetic patients, since the rate of zonular dialysis was not different between the diabetic and non-diabetic group.

The logistic regression model for the development of postoperative macular edema confirms previous work that demonstrated diabetes mellitus is an independent risk factor CME and that increasing levels of retinopathy result in a higher risk of edema.^{7, 11, 15, 20-22} It is likely that the relatively lower odds of postoperative edema in eyes with PDR represents the quiescent state of many of these eyes (75.4%) following treatment with panretinal photocoagulation.

There are limitations to this study. First, the study is limited by its retrospective, non-randomized design which may introduce bias to the visual outcome analyses. To minimize the influence of possible confounding factors on the visual outcome, only eyes with precisely defined preoperative and postoperative ETDRS grading and no operative complications or significant preoperative ocular co-morbidities were included in the VA analysis and compared to a similar subset of eyes from non-diabetic subjects. Second, similar to other database studies, not all variables were available for analysis: we had no information on some patients' and physicians' characteristics such as exact the cataract grading, or phacoemulsification technique details. Also, in contrast to clinical trials, patients are not refracted at each clinic visit in retrospective studies, and thus our visual acuities are more representative of best recorded habitual refraction rather than strict best corrected measures at all time visits. Although this may potentially introduce some bias to the results, we expect this to be similar across both groups. Finally, not all patients in our study had follow-up data for all postoperative time points. However, 74,117 eyes (81.7% of preoperative sample) had at least one follow up exam during our 24-week postoperative study period. This included 6,529 eyes of diabetic patients (87.6% of preoperative eyes) and 67,588 control eyes (81.2% of preoperative eyes), an excellent resource from a single study.

There are advantages to this study. Our study provides a large resource of eyes of diabetic patients from multiple centers. While a prospective randomized controlled study represents the

gold-standard level of evidence, the conduction of such a study for diabetic cataract surgery is difficult. A pilot study performed by the Diabetic Retinopathy Clinical Research network (DRCR) was terminated early due to difficulty recruiting sufficient numbers of participants for such a prospective study.¹² We were able to evaluate postoperative vision in a large sample and develop a model for predicting visual outcomes based on preoperative vision and ETDRS grading. We expect the rates of reported complications in this study to be accurate and under-reporting bias to be minimal. Recording of intraoperative complications in the EMR was a mandatory field and thus physicians could not forget or omit to record a complication unless they make a false declaration. Because cataract surgery is one of the most commonly performed surgery globally, and a substantial proportion of cataract patients are diabetic,¹³ our results may well influence clinical practice. The presented data will allow more accurate planning and counselling of patients regarding the visual outcome and the risk of intraoperative complications in the setting of diabetic cataract surgery.

In summary, this study defines and quantifies the visual outcome and rate of intraoperative complications after diabetic cataract surgery. We observed a significant improvement in postoperative vision with diabetic cataract surgery; approximately 56.6% of eyes of diabetic patients experienced improved vision of 3 Snellen lines or more at 4-12 week, postoperatively. However, the final VA negatively correlated with the presence of diabetes, and eyes with more advanced ETDRS grading or pre-existing DME had worse postoperative vision. Eyes of diabetic patients exhibited a higher risk of posterior capsular rupture at the time of surgery.

Table Legends:

Table 1: Preoperative nominal data characteristics of the diabetic and the non-diabetic group

Table 2: Intraoperative characteristics and complications of the diabetic and the non-diabetic group

Table 3: Student's T-test comparing the preoperative mean vision and postoperative mean vision.

Table 4: Chi-Square test of the frequency of postoperative vision improvement or worsening in the diabetic and the non-diabetic group

Table 5: Multivariate linear regression analysis for the postoperative vision at 4-12 weeks

Figure Legends:

Figure 1. Flow chart illustrating the filtering process used for data categorization into diabetic and non-diabetic group

Figure 2: Logistic regression analysis (Odds ratio with 95% confidence interval) for posterior capsule rupture at the time of cataract surgery

Figure 3: Post-linear regression interaction model for the diabetic status, preoperative visual acuity, and postoperative visual acuity at 4-12 weeks, with 95% confidence interval. The X axis demonstrates preoperative visual acuity. The Y axis demonstrates how much worse a diabetic patient's vision will be after cataract surgery for a given preoperative level of vision, based on their level of retinopathy, compared to a patient without diabetes.

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