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Original article

Central retinal thickness changes and visual outcomes following uncomplicated small-incision phacoemulsification cataract surgery in diabetic without retinopathy patients and nondiabetic patients

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ABSTRACT

Objective: To compare the visual outcomes and central retinal thickness (CRT) 1 week, 2 weeks, and 4 weeks after surgery in diabetic patients without retinopathy and nondiabetic patients. The relationships between glycated hemoglobin (HbA1c) and visual outcomes and changes in CRT were also evaluated.
Methods: Patients who underwent uncomplicated phacoemulsification cataract surgery were enrolled from May 2009 to December 2010, excluding those with preoperative retinal diseases. CRT and best-corrected visual acuity were obtained preoperatively and at 1 week, 2 weeks, and 4 weeks.
Results: There were 101 eyes in the nondiabetic group and 58 eyes in the diabetic without retinopathy group. There was no difference in preoperative CRT between the two groups. A significant increase in thickness was observed at postoperative Week 4 ($p < 0.001$) in both groups. However, there were no significant differences in CRT and best-corrected visual acuity before surgery and in all postoperative periods between the groups. In the diabetic without retinopathy group, CRT and visual outcomes were not statistically related to HbA1c level at any time point.
Conclusion: There were no significant differences in improvements in postphacoemulsification CRT and visual outcomes between the groups. In the diabetic without retinopathy group, the visual outcomes and CRT were not related to the level of HbA1c. Therefore, as long as there is no diabetic retinopathy, the early postoperative visual recovery and central retinal thickness may not be different from patients without diabetes mellitus.

1. Introduction

Macular edema is a well-known complication after cataract surgery.[1–4] Even uncomplicated cataract surgery may induce postsurgical inflammation and vitreous instability that may subsequently cause postoperative macular edema in normal individuals.[5] When the post cataract macular edema is associated with a decrease in visual acuity, it can be categorized as clinical pseudophakic cystoid macular edema. It usually appears as a petaloid pattern of leakage in fluorescein angiography, and has been referred to as Irvine–Gass syndrome.[6,7] Clinical cystoid macular edema (CME) is not frequently encountered with a reported incidence after phacoemulsification of 0.1–2% in healthy participants.[3–5] However, angiographic macular leakage is more commonly detected in patients who do not have visual impairment. This is referred to as subclinical macular edema, with a reported incidence of 9–19% after uncomplicated phacoemulsification.[1,2]

Diabetic retinopathy has long been implicated as a risk factor for more prominent postoperative macular edema and poorer visual outcomes.[8–15] In eyes with diabetic retinopathy, the blood–retina barrier is often impaired to a variable degree, which may cause the eyes to be more prone to develop postoperative macular edema. Depending on the disease severity, duration, presence of pre-existing macular edema, and previous treatment with panretinal photocoagulation or macular laser, the incidence of

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postphacoemulsification macular edema in diabetic retinopathy has been reported to range from 31% to 81%,[8–10] which is much higher than the incidence of postphacoemulsification in nondiabetic patients. However, whether diabetes mellitus without retinopathy is also a risk factor for macular edema has still not been adequately discussed.[16,17] In the present study, we evaluated changes in CRT and visual outcomes in diabetic patients without retinopathy and in nondiabetic controls at the preoperative examination and 1 week, 2 weeks, and 4 weeks after small-incision clear-corneal phacoemulsification. For quantitative comparisons, we used optical coherence tomography (OCT) to measure macular thickness. To further evaluate the relationship of recent treatment to control diabetes and the degree of postoperative edema, we also compared the preoperative glycated hemoglobin (HbA1c) level and the increase in macular thickness in the diabetic without retinopathy group.

2. Methods

2.1. Participants

This is a retrospective chart review of 358 eyes that received phacoemulsification and intraocular lens insertion by one of the authors (C.K.C.) from May 2009 to December 2010 at Shin Kong Wu Ho-Su Memorial Hospital, Taipei, Taiwan. Detailed medical/ocular histories were recorded for all of the patients, and all patients initially received ocular examinations including tonometry, slit-lamp examinations of the anterior segment, and dilated retinal biomicroscopy. Best-corrected visual acuity (BCVA) was checked by Snellen chart and presented as logarithm of minimal angle resolution (logMAR). OCT (Stratus III; Carl Zeiss, Dublin, CA, USA) was performed during each visit. CRT was obtained using six diagonal, 6-mm radial line scans, with the manufacturer's macular thickness map software (version 4.0). The mean retinal thickness of the central 1-mm-diameter area was recorded for analysis. All examinations were performed preoperatively, and then 1 week, 2 weeks, and 4 weeks after the surgery.

The inclusion criteria were patients who: (1) had uneventful surgery; (2) followed the scheduled postoperative examinations at postoperative Day 1, Week 1, Week 2, and Week 4; and (3) had a reliable medical history of having or not having diabetes mellitus within 3 months prior to the operation. Excluded were patients who: (1) had documented diabetic retinopathy, preoperative macular edema, previous intraocular surgery, and other ocular diseases such as macular hole, epiretinal membrane, retinal detachment, retinal vein occlusion, retinal artery occlusion, age-related macular degeneration, optic neuritis, and other macular diseases according to their medical/ocular history or preoperative examinations by preoperative dilated retinal biomicroscopy, OCT, and/or fluorescein angiography; and (2) did not have clear preoperative or postoperative OCT documentation. In total, 58 eyes in 58 patients with type II diabetes mellitus without diabetic retinopathy (diabetic without retinopathy group), and 101 eyes of 101 nondiabetic patients (control group) were included in this study. The study was conducted in accordance with the guidelines of the Declaration of Helsinki. No approval of the institute review board was required for this chart review retrospective study.

2.2. Surgical procedures

All of the eyes included in this study received uncomplicated phacoemulsification cataract extraction surgery by one experienced surgeon. All patients signed an informed consent for receiving the operation. The operation was done under topical anesthesia and topical povidone iodine disinfection. A clear cornea small-incision, capsulorhexis, phacoemulsification, and implantation of a foldable acrylic posterior chamber intraocular lens were performed. Postoperatively, topical prednisolone 1.0% and antibiotics were prescribed for 1 week.

2.3. Statistical methods

Analyses were performed using SPSS version 17.0 (SPSS Inc, Chicago, IL, USA). LogMAR was used to compare the BCVA between two groups by the Mann–Whitney *U* test. The pre- and postoperative intraindividual differences were analyzed with the paired sample *t* test, and the independent *t* test was used when comparing central retinal thickness between the groups. Statistical significance was defined as $p < 0.05$.

3. Results

3.1. Demographic data

Fifty-eight eyes of diabetic patients and 101 eyes of control patients that fulfilled the inclusion and exclusion criteria were enrolled in this study. The average age of the patients was 67.11 years, and 54.1% were male. The demographic data of both groups are shown in Table 1. There were no differences in age, sex, laterality, initial BCVA, and baseline CRT between the groups.

3.2. Postoperative CRT changes

Box plots of differences between post- and preoperative CRT in both groups are depicted in Figs. 1 and 2, respectively. In the nondiabetic group, there was a statistically significant increase in CRT at postoperative Week 2 ($p = 0.04$), and postoperative Week 4 ($p < 0.001$; Fig. 1). In the diabetic without retinopathy group, the CRT at postoperative Week 4 increased significantly compared to the baseline value ($p < 0.001$; Fig. 2).

Table 2 shows the comparison of pre- and postoperative CRT between both groups. There were no significant differences in mean CRT between the groups preoperatively ($p = 0.93$) and at postoperative Week 1 ($p = 0.79$), Week 2 ($p = 0.62$), and Week 4 ($p = 0.20$).

3.3. Postoperative visual outcomes

To compare the visual outcomes between the groups, the BCVA in logMAR was used. As expected, there were significant improvements in BCVA at all postoperative examination time periods. However, there was no significant difference in median BCVA between the groups preoperatively ($p = 0.15$) and at postoperative Week 1 ($p = 0.52$), Week 2 ($p = 0.12$), and Week 4 ($p = 0.14$; Fig. 3).

3.4. Correlation between HbA1c and CRT and visual outcome in the diabetic without retinopathy group

The relationship between CRT and HbA1c is shown in Fig. 4. There was no statistically significant correlation between CRT and

Table 1
Demographic data.

	Nondiabetic	Diabetic without retinopathy	*p*
Number of patients	101	58	
Men	59	44.83	0.64
Age (y)	68.91 ± 10.68	66.09 ± 9.84	0.09
OD	58	59	0.94
Preoperative BCVA (logMAR)	0.78 ± 0.45	0.67 ± 0.44	0.15
Preoperative CRT (μm)	200.30 ± 22.81	200.74 ± 27.68	0.93

Data are presented as mean ± SD or %, unless otherwise indicated.
BCVA = best-corrected visual acuity; CRT = central retinal thickness; logMAR = logarithm of minimal angle resolution; OD = right eye.