

## Original article

# Corneal edema after phacoemulsification surgery in patients with type II diabetes mellitus

Shakya K, Pokharel S, Karki KJD, Pradhananga C, Pokharel RP, Malla OK  
Department of Ophthalmology, KMC Teaching Hospital, Kathmandu

### Abstract

**Introduction:** Corneal edema delays early visual recovery after phacoemulsification surgery in diabetes mellitus. **Objective:** To compare corneal edema of eyes in patients with type II diabetes mellitus and in non-diabetics after phacoemulsification surgery. **Materials and methods:** A hospital-based, retrospective study involving 96 eyes that underwent phacoemulsification surgery for immature cataract at the Department of Ophthalmology, Kathmandu Medical College Teaching Hospital, Kathmandu, Nepal was carried out. Evaluation was performed of 33 eyes in patients with diabetes mellitus (diabetic group) and of 63 eyes in patients without diabetes mellitus (non-diabetic group). All diabetic patients had controlled blood glucose for at least one week prior to the surgery. The operated eye was examined before surgery and on one day, one week, and one month after surgery. Intraocular pressure was measured on each visit. **Main outcome measures:** The findings of post-operative corneal edema and visual acuity between the diabetic and non-diabetic groups were studied and compared. **Results:** There was no difference clinically in any pre-operative corneal examination between the diabetic and non-diabetic groups. The corneal edema after surgery was significantly higher in the diabetic group than in the non-diabetic group ( $p < 0.001$ ). The number of patients with corneal edema one day and one week after surgery was significantly higher in the diabetic group than in the non-diabetic group (after 1 day, OR = 62.5; 95 % CI = 15.31 - 255.11,  $p < 0.000$ ) and after 1 week, OR = 6.77; 95 % CI = 1.28 - 35.76,  $p < 0.006$ ). **Conclusion:** Corneal edema following phacoemulsification surgery in diabetic eyes is likely to be more frequent than in non-diabetic eyes.

**Key words:** diabetes mellitus, phacoemulsification surgery, corneal edema

### Introduction

The prevalence of type II diabetes mellitus is increasing in Nepal (White F et al, 2002). Patients with diabetes mellitus develop cataract at an earlier age than non-diabetics do (Nielsen et al 1984). Phacoemulsification is an ideal technique for diabetic cataract. Phacoemulsification had an advantage over previous cataract surgical procedures because of the quick recovery of vision (Zheng L et al,

1997) and the less post-operative inflammation (Laurell CG et al, 1997). Transient corneal edema is a common post-operative complication following phacoemulsification (Junejo SA et al 1999). Based on the slit-lamp examination findings, corneal edema is defined as an increase in the central corneal thickness (Lundberg B et al 2005) with or without descemet folds. The OCTET graded corneal edema as transient corneal edema, transient corneal edema with descemet membrane folds of  $< 10$ , and transient corneal edema with descemet membrane folds of  $> 10$ . Diabetic corneas do not recover from

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**Address for correspondence:** Dr Kiran Shakya, MD  
Department of Ophthalmology, Kathmandu Medical College, Nepal  
Email: kiranshakya2001@yahoo.com

edema as quickly as normal corneas because of the decreased regulation of fluid balance, enzymatic dysfunction of bicarbonate pump, and involvement of aldose reductase with build-up of sorbitol in the corneal stroma. Endothelial cell loss and fragility lead to impaired barrier function (Morikubo S et al, 2004). The present retrospective study was undertaken to evaluate the corneal edema of phacoemulsification cataract surgery in a type II diabetic group and in a non diabetic group.

### **Materials and methods**

A hospital-based, retrospective study involving 96 eyes that underwent phacoemulsification surgery for immature cataract at the Department of Ophthalmology, Kathmandu Medical College Teaching Hospital, Kathmandu, Nepal was carried out. Evaluation was performed of 33 eyes in patients with type II diabetes mellitus (diabetic group) and of 63 eyes in patients without diabetes mellitus (non-diabetic group). The operated eye was examined before surgery and after one day, one week, and one month after surgery. Immature cataract was defined as nucleus sclerosis up to 2 +, cortical cataract 2 + and posterior sub-capsular cataract of any grade. The study was carried out to compare corneal edema after phacoemulsification surgery of eyes in patients with and without type II diabetes mellitus.

Patients having immature cataract that had undergone uneventful phacoemulsification were selected for the study, and those with corneal pathology, ocular hypertension, glaucoma, uveitis, small pupil and intra-operative complications were excluded.

An informed consent was obtained from every subject before enrollment in the study. Ethical clearance was obtained from the institutional research committee.

All the diabetic patients had controlled blood glucose since one week prior to the surgery. Initial screening examinations consisted of uncorrected visual acuity (UCVA), pinhole visual acuity, pupil and slit-lamp examination with Haag Streit 900, fundus examination under mydriasis (FEUM) with 90 D and 20 D,

intraocular pressure measurement, blood glucose measurement and blood pressure measurement. In the slit-lamp examination, corneal edema was defined as an increase in the central corneal thickness (Lundberg B et al, 2005) with or without descemet folds. The intraocular pressure was found to be normal throughout the study in all the cases. Biometry was performed before the operation on all patients with the use of a keratometer and a A scan (Tomey) for the axial length calculations and determination of the IOL power. All patients were advised to install Ofloxacin eye drop four times/day one day prior to surgery. A peri-bulbar block was administered and a balanced weight applied to soften the eye. The patients were brought to the operating room where the eye was painted with betadine and draped for cataract surgery.

### **Surgical method**

All surgeries were performed by a single surgeon (KS).

The clear corneal tunnel incision was fashioned. A continuous curvilinear capsulorhexis was performed under a viscoelastic material (HPMC). The lens nucleus was mobilized using a balanced salt solution and a blunt hydro-dissection cannula. Phacoemulsification was performed using the Oertli (Catarhex) phacoemulsifier with the phaco chop and endocapsular techniques by a operating microscope, CarlZeiss-S7. A TECSOFT foldable acrylic IOL with a 6 mm phacoemulsification lens (Flex) was inserted under the viscoelastic material through a 3 mm opening. The viscoelastic material was aspirated. The wound was hydrated and an approximate physiological intraocular pressure was restored with a balanced salt solution injection through a side port. An intra-cameral injection of cefuroxime 1mg was given at the conclusion of the surgery. A pad was then placed over the eye. No ocular antihypertensive agents were used.

### **Follow up**

All the patients had their dressing removed and eye cleaned on the first post-operative day. They were examined unaided and with a pinhole

internal illuminated Snellen visual acuity chart. The intraocular pressure was recorded by Goldmann applanation tonometry. The wound integrity, corneal edema grading according to OCTET, anterior chamber activity, and lens position were also noted. A set post-operative prescription of ofloxacin 0.3 % eye drops four times daily and prednisolone acetate 1 % eye drops six times daily was given to all the patients. All the patients' appointment was made for one week and one month after surgery. A complete ocular examination including refraction was done on each of these visits. The topical steroid, in a tapering dose, and the antibiotic was prescribed for a total of four 4 weeks.

### Statistics

The SPSS version 14.0 was used for data analysis. A value of  $p < 0.05$  was considered significant. A statistician was consulted as and when necessary.

### Results

In this study, 96 eyes (63 non-diabetes and 33 type 2 diabetes) were enrolled. The mean age of the patients was  $67 \pm 11.22$  years (Table 1). The laterality was 57 right eye 39 left. Among the type 2 diabetes patients, 23 eyes had no diabetic retinopathy and eight eyes had mild NPDR and two moderate NPDR. Of all the patients, 7 % were both diabetic and hypertensive while 26 % were only hypertensive. The mean IOP throughout the study was  $16 \pm 2$  mm Hg in all cases. The mean phaco time was  $7.81 \pm 4.01$ . The phaco time was not significant for corneal edema between the diabetic and non-diabetic groups ( $p < 0.07$ ).

**Table 1**

| Age interval | Frequency | Percentage |
|--------------|-----------|------------|
| 31-40        | 2         | 2          |
| 41-50        | 4         | 4          |
| 51-60        | 24        | 25         |
| 61-70        | 25        | 26         |
| 71-80        | 31        | 32.25      |
| 81-90        | 10        | 10.75      |
| Total        | 96        | 100        |

Clinically, no significant differences in any pre-operative corneal examination findings were observed between the diabetic and non-diabetic groups. The corneal edema after surgery was significantly higher in the diabetic group than in the non-diabetic group ( $p < 0.000$ ). The corneal edema one day and one week after surgery was significantly higher in the diabetic group than in the non-diabetic group; after one day, the odds ratio was 62.5, 95 %; CI 15.31 - 255.11;  $p < 0.000$ ; and after one week, the odds ratio was 6.77, 95 %; CI 1.28 - 35.76;  $p < 0.006$ .

**Table 2: Corneal edema on the first post-operative day**

| Diabetes (n) | Corneal edema (n) |           | Total | P value     |
|--------------|-------------------|-----------|-------|-------------|
|              | Present           | absent    |       |             |
| Yes          | 25(75.8%)         | 8(24.2%)  | 33    | $p < 0.000$ |
| No           | 3(4.8%)           | 60(95.2%) | 63    |             |
| Total        | 28                | 68        | 96    |             |

**Table 3: Corneal edema grading**

| Diabetes (n) | Transient corneal edema | Transient corneal Descemet folds $< 10$ | Total     |
|--------------|-------------------------|---|-----------|
| Yes          | 19(57.7%)               | 6(18.1%)                                | 25(75.8%) |
| No           | 1(1.6%)                 | 2(3.2%)                                 | 3(4.8%)   |
| Total        | 20(59.3%)               | 8(21.3%)                                | 28        |

**Table 4: Corneal edema on the 7<sup>th</sup> postoperative day**

| Diabetes (n) | Corneal edema (n)       |           | Total | P value     |
|--------------|-------------------------|-----------|-------|-------------|
|              | Transient corneal edema | absent    |       |             |
| Yes          | 6(18.2%)                | 27(81.8%) | 33    | $p < 0.006$ |
| No           | 2(3.2%)                 | 61(96.8%) | 63    |             |
| Total        | 8                       | 88        | 96    |             |

On the first post-operative day, the non-diabetic group had a better UCVA ( $6/6$  to  $6/12 = 98.5\%$ ) than the diabetic group ( $6/6$  to  $6/12 = 87\%$ ); and as the transient corneal edema was recovered after one week, both groups had a similar visual acuity.

**Table 5: Post-operative visual acuity among the non-diabetics and the diabetics**

| UCVA  | 1POD        |           |              | 1wk POD     |           |              |
|-------|-------------|-----------|--------------|-------------|-----------|--------------|
|       | NoDM (n=63) | DM (n=33) | Total (n=96) | NoDM (n=63) | DM (n=33) | Total (n=96) |
| 6/6   | 54 % (34)   | 15 % (5)  | (39)         | 55.5 % (35) | 33 % (11) | (46)         |
| 6/9   | 36.5 % (23) | 42 % (14) | (37)         | 36.5 % (23) | 42 % (14) | (37)         |
| 6/12  | 8 % (5)     | 30 % (10) | (15)         | 6 % (4)     | 25% (8)   | (12)         |
| 6/18  | 0           | 10 % (3)  | (3)          | 2 % (1)     | 0         | (1)          |
| 6/24  | 0           | 3 % (1)   | (1)          | 0           | 0         |              |
| 6/36  | 1.5 % (1)   | 0         | (1)          | 0           | 0         |              |
| 6/60  | 0           | 0         |              | 0           | 0         |              |
| <6/60 | 0           | 0         |              | 0           | 0         |              |
| Total | 100% (63)   | 100% (33) | (96)         | 100% (63)   | 100% (33) | (96)         |

After four weeks post-operative, 48 % had uncorrected visual acuity of 6/6 and the remaining 52 % had the following causes for uncorrected visual acuity of less than 6/6.

**Table 6**

| Causes of decrease vision less than 6/6 | Non diabetics (n=63) | Diabetes (n=33) | Total |
|---|----------------------|-----------------|-------|
| Refractive error                        | 15% (19)             | 9% (13)         | (32)  |
| AMD                                     | 14% (9)              | 0               | (9)   |
| Diabetic maculopathy                    | 0                    | 27% (9)         | (9)   |
| Total                                   | (28)                 | (21)            | (50)  |

### Discussion

Patients with diabetes mellitus develop cataract at an earlier age than non-diabetics do. Phacoemulsification is an ideal technique for diabetic cataract. Phacoemulsification has an advantage over previous cataract surgical procedures because of the quick recovery of vision and the less post-operative inflammation. Transient corneal edema is a common post-operative complication following phacoemulsification.

In this study, the corneal edema after surgery was significantly higher in the diabetic group than in the non-diabetic group ( $p < 0.000$ ). The corneal edema at one day and one week after surgery was significantly higher in the diabetic group than in the non-diabetic (after one day, the odds ratio was 62.5, 95 %; CI 15.31 - 255.11;  $p < 0.000$ ; and after one week, the odds ratio was 6.77, 95 %; CI 1.28 - 35.76;  $p < 0.006$ ). Similarly, S Morikubo et al found that the corneal endothelial cell losses one day and one week after surgery

were significantly higher in the diabetic group than in the non-diabetic group (after one day,  $P = .03$ ; and after one week,  $P = .04$ ), thereby delaying the post-operative recovery of corneal edema (Morikubo S et al, 2004). R J Antcliff et al also found that there was an increased incidence of transient corneal edema post-operative complications in the phacoemulsification group of diabetes (Antcliff R J et al, 1996). S A Junejo et al concluded that corneal edema cleared within one to two weeks (Junejo SA et al, 1999). The outcome of cataract surgery in diabetics is largely determined by the degree of maculopathy (Lundberg B et al, 2005).

After four weeks post-operative, 67.7 % of the patients had a visual acuity of 6/6 and the remaining 32.3 % had a visual acuity of less than 6/6. Among the diabetics, 27 % had impairment of vision after four weeks due to diabetic maculopathy. Antcliff et al concluded that the outcome of cataract surgery in diabetics is largely determined by the degree of maculopathy (Antcliff R J et al, 1996). Anna Zaczek et al at St Erik's Eye Hospital, Karolinska Institutet, Stockholm, Sweden found that the VA of 46 diabetic eyes (88 %) improved one year after surgery and that of only six eyes (12 %) was unchanged or worse. Forty-one diabetic eyes (79 %) achieved a VA of 0.5 or better and 11 eyes (21 %) had a final VA of lower than 0.5. They concluded that the final visual outcome was improved in the majority of diabetic eyes. Eyes with CSMO (clinically significant macular edema) at the time of surgery had the worst prognosis regarding postoperative VA (Zaczek A et al, 1999).

### Conclusion

Corneal edema following phacoemulsification surgery in diabetic eyes occurs more frequently than in non-diabetic eyes.

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