Available online on www.ijpcr.com

International Journal of Pharmaceutical and Clinical Research 2023; 15 (6); 842-851

Original Research Article

Incidence of Macular Edema Following Cataract Surgery among Diabetic Patients in A Tertiary Care Centre

Arathy S Menon¹, Sija S², Manoj Venugopal³

¹Junior Resident Department of Ophthalmology, Govt T.D. Medical College Alappuzha ²Assistant Professor Department of Ophthalmology, Govt T.D. Medical College Alappuzha ³Additional Professor Department of Ophthalmology, Govt T.D. Medical College

Alappuzha

Received: 29-03-2023 / Revised: 30-04-2023 / Accepted: 30-05-2023 Corresponding author: Dr Arathy S Menon Conflict of interest: Nil

Abstract

Purpose: To find the incidence of macular edema following cataract surgery among diabetic patients.

Method: This study will be carried out in outpatient department at Govt. T D Medical College, Alappuzha for 18 months from start of the study. All patients with T2DM undergoing cataract surgery for whom preoperative OCT is possible will be enrolled in the study. After taking history, BCVA(best corrected visual acuity), Colour vision and IOP will be assessed. Examination of anterior segment & posterior segment of the eyes are done with the help of a slit lamp biomicroscope. Central foveal thickness by OCT will be measured. HbA1c within 2 weeks of cataract surgery will be collected. BCVA(best corrected visual acuity), Fundus and central foveal thickness will be assessed at 1 and 3 months during follow-up.

Results: Incidence of macular edema following cataract surgery in diabetic patients is 6.9% with 95% CI 0-16.1%. Among those who had macular edema, 7 patients (24.1%) had cystoid macular edema. 3 patients(10.3%) had spongiform like diffuse retinal thickening . 2 patients (6.9%) had mixed type. CFT in uncontrolled diabetic eyes (>7 HbA1C) increased by 35.1 + -34.1 at 1 month post operatively, which was greater when compared with eyes with controlled diabetes [29.0 +/-19.3] at the same time periods. P=0.573. CFT in diabetic eyes with duration >10 years increased by 43.6 + -39.4 at 1 month post operatively, which was greater when compared with diabetic eyes with duration <10 years [24.45 +/-12.4] at the same time periods. P=0.069. This was not statistically significant even though there was large increase. This may be due to small sample size. CFT in diabetic eyes with retinopathy increased by 43.9 + -39.7 at 1 month post operatively, which was greater when compared with eyes operatively, which was greater site eyes with retinopathy [24.2 +/-11.2] at the same time periods. P=0.061. CFT increase after SICS or phacoemulsification type of cataract surgery were comparable from pre-operative to 1 month post-operative period. (p=0.928). After surgery, CFT decrease from 1 month to 3 month were greater in phacoemulsification compared to SICS.(P=0.68).

Conclusion: Incidence of macular edema following cataract surgery in diabetic patients is 6.9% with 95% CI 0-16.1%. increase in CFT up to I month after cataract surgery is observed in all patients. HbA1c at the time of surgery may be taken as a predictor of increase in CFT after cataract surgery (p=0.0573). Increase in CFT was more in patients with diabetic retinopathy(p=0.061), with uncontrolled diabetes (p=0.573) and with diabetes of more than 10 years duration(p=0.069). In those who had macular edema majority was cystoid macular

Menon et al.

International Journal of Pharmaceutical and Clinical Research

edema followed by spongiform like diffuse retinal thickening followed by mixed type. Eventhough it is statistically insignificant we found that in phaco emulsification, decrease in CFT from 1month to 3 month was greater when compared to SICS. So in diabetes phaco emulsification would be better than SICS.

Keywords: Diabetes, Cataract Surgery, Macular Edema.

This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (http://creativecommons.org/licenses/by/4.0) and the Budapest Open Access Initiative (http://www.budapestopenaccessinitiative.org/read), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

Introduction

Cataract is one of the leading cause of blindness in world and cataract surgery is one among the most common operations performed globally.

Phacoemulsification is relatively a newer method of cataract surgery and is the preferred surgical technique worldwide. Sutureless small incision cataract surgery (SICS) as it is less expensive, faster and less technology dependent, it is popular in developing world where bulk cataract surgeries are performed. SICS has all the advantage of closed chamber surgery the disadvantage of SICS being more disruption of blood retinal barrier compared to phacoemulsification as the larger incision size and more iris manipulation.[1,2]

Macular edema is one among the most common complications which causes vision following decreased cataract surgery. Inflammation is the major etiologic factor in the development of CME following cataract surgery. An uneventful cataract surgery carries less chance of release of inflammatory mediators and cystoid macular edema development. Since blood retinal barrier is more disturbed in SICS type of cataract surgery, the incidence of macular edema will be more in SICS. [1][2]

Diabetes mellitus is the most common disorder affecting energy metabolism. India is considered as the diabetic capital of world. Type 2diabetes comprises about 90% of all patients, and rest have type1 diabetes. Glycemic control is critical for these patients ,since over time poor control leads to development of microvascular complications.[5]

In patients with diabetes mellitus and diabetic retinopathy, macular edema is the major reason for poor visual outcome after cataract surgery. Duration of diabetes mellitus, level of diabetic retinopathy, glycaemic control, and preexisting macular edema increases the risk for postoperative persistent cystoid macular edema(CME). Also it is seen that post-operative CME is more frequent in patients with non-insulin dependent diabetes mellitus(Type 2) than in those with insulin dependent diabetes mellitus(type1). Some reports says, in retinopathy diabetics. and macular alterations are accelerated by cataract and surgery some says, these complications are more likely because of natural course of diabetic disease. But it is often difficult to distinguish cystic macular changes caused by cataract surgery from edema due to pre-existing diabetic retinopathy.[6]

In eyes with diabetic retinopathy, the blood retinal barrier is often impaired to variable degree, which can cause the eyes to be more prone to develop post cataract surgery macular edema. However diabetes mellitus without diabetic retinopathy as a risk factor for the development of postoperative macular edema has not been adequately discussed.[7]

OCT is a non-invasive non-contact imaging modality that produces micrometer resolution tissue images. With the help of optical coherence tomography (OCT), macular edema can be evaluated both qualitatively and quantitatively.

Objectives

Primary objective

Incidence of macular edema following cataract surgery among diabetic patients.

Secondary objective

To correlate the changes in macular thickness following cataract surgery with preoperative HbA1c level.

To analyze the morphological patterns of macular edema following cataract surgery in diabetic patients.

Materials And Methods

Study Design: Hospital based prospective non comparative observational study

Study Setting: Ophthalmology outpatient department of Government TD Medical College Alappuzha.

Inclusion criteria

• Patients with type 2 diabetes mellitus undergoing cataract surgery for whom preoperative OCT is possible.

Exclusion criteria

- Patients with macular edema due to diabetes or any other causes who has taken intravitreal injection within 3 months of surgery.
- Patients with any other macular pathology
- Patients with intraoperative cataract surgery complication
- Those who are not willing.

Sample Size: 29

Sampling Method: Nonprobability sampling – Convenient sampling

Study variables: Variables used in this study includes visual acuity, color vision, IOP, anterior segment, fundus, OCT, HbA1c within 2 weeks.

Macular thickness will be analysed with CIRRUS HD-OCT machine. Based on the 6mm×6mm data cube captured by the macular cube 512×128 this analysis provides qualitative and quantitative

evaluation of the retina. Early Treatment Diabetic Retinopathy Study grid is automatically centered on the fovea with fovea finder. Retinal thickness values, from ILM to RPE, in microns, are compared to normative data. Central Subfield normal range 220.5-294.8 microns.

Macular edema: For clinical purposes, 'macular edema' is defined as retinal thickening within two disk diameters of the center of the macula. Retinal thickening or hard exudates with adjacent retinal thickening that threatens or involves the center of the macula is considered to be clinically significant.

Data collection tools: Snellen's visual acuity chart, Ishihara color vision chart, non-contact tonometry, Slit lamp bio microscopy using 90 Dioptre lens, direct and indirect ophthalmoscope, OCT macula

Data collection procedure: This study carried out in outpatient department at Govt. T D Medical College, Alappuzha for 18 months from start of the study. All patients with T2DM undergoing cataract surgery for whom preoperative OCT is possible will be enrolled in the study. After taking history, BCVA(best corrected visual acuity) will be assessed. Examination of anterior segment & posterior segment of the eyes are done with the help of a slit lamp biomicroscope. Central foveal thickness by OCT will be measured. HbA1c within 2 weeks of cataract surgery will be collected. BCVA(best corrected visual acuity), Fundus and central foveal thickness will be assessed at 1 and 3 months during followup.

Data Analysis

Data collected will be entered into Microsoft excel. Categorical and quantitative variables were expressed as frequency (percentage) and mean \pm SD respectively. Prevalence of edema was

Menon et al.

expressed using 95% CI. Independent t test was used to compare quantitative parameters between categories. Wilcoxon Signed Rank Test was carried out to compare VA between two interval of time. For all statistical interpretations, p<0.05 was considered the threshold for statistical significance. Statistical analyses was performed by using a statistical software package SPSS, version 27.

Results

A total of 29 eyes were included in the study. Maximum number of patients were in age group 60-69 (62.1%) only 17.2% were of age group less than 60. 20.7 % were older than 70. mean age of patients was $63.9+/_{-}7.2$. According to duration of

diabetes, 12 patients(41.4%) had duration more than 10 years. 17 patients (58.6%) had duration less than 10 years. Mean duration of diabetes was 9.6+/ 7.9. 13 patients (44.8%) had HbA1c below 7% that means controlled diabetes. 16 patients (55.2%) had uncontrolled diabetes (HbA1c >7%). Mean HbA1c was 7.5 +/ 1.9. 41.4% had diabetic retinopathy. 58.6% did not have diabetic retinopathy. 21 patients (72%) underwent SICS.[8] Patients (27.6%) underwent phacoemulsification surgery. Both were done by a single and surgeon every surgerv were uncomplicated. Depending upon grades of cataract, SICS done for higher grades of cataract.

 Table 1: Percentage distribution of the sample according to macular edema after 3 months cataract surgery based on morphology

| Macular edema | Count | Percent | 95% CI |
|---------------|-------|---------|-------------|
| No | 17 | 58.6 | 23.5 - 59.3 |
| Yes | 12 | 41.4 | |



Macular edema following cataract surgery among diabetic patients

Figure 1: Percentage distribution of the sample according to pattern of edema

Among 29 patients, 10 had pre-existing diabetic macular edema for which they have taken treatment either laser or intravitreal injection or both but before 3 months of cataract surgery which persisted in the post op period.2 patients developed cystoid macular edema after cataract surgery whose CFT were more than normal limits after 3 months of cataract surgery. That means 12 patients (41%) had macular edema after cataract surgery. 17 patients (58.6%) did not develop macular edema. Prevalence of macular edema after cataract surgery in diabetic patients is 41.4% with 95% CI 23.5 – 59.3 this large interval in 95%CI may be due to small sample size. Incidence of macular edema following cataract surgery in diabetic pathents is 6.9% with 95% CI 0-16.1%. Among those who had macular edema 7 patients (24.1%) had cystoid macular edema. 3 patients(10.3%) had spongiform like diffuse retinal thickening. 2 patients (6.9%) had mixed type. Comparison of changes in macular thickness following cataract surgery with preoperative HbA1c level:

Table 2: Comparison of Difference in CFT at 1 month from Pre Op based on diabetes control

| Hba1c | Mean | SD | Ν | t | р |
|------------------------|------|------|----|------|-------|
| Controlled Diabetes | 29.0 | 19.3 | 13 | 0.57 | 0.573 |
| Un controlled Diabetes | 35.1 | 34.1 | 16 | | |



Figure 2: Comparison of Difference in CFT at 1 month from Pre Op based on diabetes control

CFT in uncontrolled diabetic eyes (>7 HbA1C) increased by 35.1 ± 34.1 at 1 month post operatively, which was greater when compared with eyes with controlled diabetes [29.0 ± 19.3] at the same time periods. P=0.573

| Table 3: Comparison of Difference in CFT at 3 month from 1 month based on diabetes |
|--|
| control |

| Hba1c | Mean | SD | Ν | t | р |
|------------------------|-------|------|----|------|-------|
| Controlled Diabetes | -25.5 | 23.5 | 13 | 0.68 | 0.499 |
| Un controlled Diabetes | -13.7 | 58.5 | 16 | | |



Figure 3: Comparison of Difference in CFT at 3 month from 1 month based on diabetes control

Decrease in CFT from 1 month post op to 3 month post op was greater in controlled diabetes 25.5 +/- 23.5 when compared to uncontrolled diabetes 13.7+/- 58.5

| Table 4: Comparison of Difference in CFT at 1 month from Pre Op based on duration |)n |
|---|----|
| of diabetes in years | |

| Duration | Mean | SD | N | t | р |
|----------|------|------|----|------|-------|
| <10 | 24.4 | 12.4 | 17 | 1.89 | 0.069 |
| >=10 | 43.6 | 39.4 | 12 | | |



Figure 4: Comparison of Difference in CFT at 1 month from Pre Op based on duration of diabetes in years

CFT in diabetic eyes with duration >10 years increased by 43.6+/-39.4 at 1 month post operatively, which was greater when compared with diabetic eyes with duration <10 years [24.45 +/-12.4] at the same time periods. P=0.069. This was not statistically significant even though there was large increase. This may be due to small sample size.

 Table 5: Comparison of Difference in CFT at 3 month from 1 month based on duration of diabetes

| Duration | Mean | SD | Ν | t | р |
|----------|-------|------|----|------|-------|
| <10 | -13.8 | 19.2 | 17 | 0.72 | 0.480 |
| >=10 | -26.3 | 68.7 | 12 | | |



Figure 5: Comparison of Difference in CFT at 3 month from 1 month based on duration of diabetes

CFT in diabetic eyes with duration >10 years decreased by a mean value of 26.3 from 1 month to 3 month after cataract surgery which was greater when compared to the eyes with <10 years duration (13.8) at the same time periods. This may be due to greater increase in CFT in the immediate post op period in patients with longer duration of diabetes P=0.061. This was not statistically significant. this may be due to small sample size.

| Table 6: Com | parison of Differen | ice in CFT at 1 mo | onth from Pre O | p based on DR |
|--------------|---------------------|--------------------|-----------------|---------------|
|--------------|---------------------|--------------------|-----------------|---------------|

| DR | Mean | SD | Ν | t | р |
|---------|------|------|----|------|-------|
| Present | 43.9 | 39.7 | 12 | 1.95 | 0.061 |
| Absent | 24.2 | 11.2 | 17 | | |



Figure 6: Comparison of Difference in CFT at 1 month from Pre Op based on DR

CFT in diabetic eyes with retinopathy increased by 43.9+/-39.7 at 1 month post operatively, which was greater when compared with eyes without diabetic retinopathy [24.2 +/-11.2] at the same time periods. P=0.061 which was not statistically significant even though there was a 2x increase.

| | Table 7: Co | mparison of | f Difference in | CFT at 3 mon | nth from 1 m | onth based on DR |
|--|-------------|-------------|-----------------|--------------|--------------|------------------|
|--|-------------|-------------|-----------------|--------------|--------------|------------------|

| DR | Mean | SD | Ν | t | р |
|---------|-------|------|----|---|-------|
| Present | -19.0 | 72.5 | 12 | 0 | 1.000 |
| Absent | -19.0 | 8.6 | 17 | | |



Figure 7: Comparison of Difference in CFT at 3 month from 1 month based on DR

Decrease in CFT from 1 month to 3 month after cataract surgery were equal among patients with diabetic retinopathy and without DR

| Table 8: Comparison of Difference in CFT at 1 month from Pre Op based on type of |
|--|
| cataract surgery |

| Type of cataract surgery | Mean | SD | Ν | t | р |
|--------------------------|------|------|------|------|-------|
| SICS | 32.0 | 31.8 | 21.0 | 0.09 | 0.928 |
| Phacoemulsification | 33.1 | 16.6 | 8.0 | | |



Figure 8: Comparison of Difference in CFT at 1 month from Pre Op based on type of cataract surgery

CFT increase after SICS or phacoemulsification type of cataract surgery were comparable from pre-operative to 1 month post-operative period. (p=0.928)

Table 9: Comparison of Difference in CFT at 3 month from 1 month based on type of cataract surgery

| Type of cataract surgery | Mean | SD | Ν | t |
|--------------------------|-------|------|------|------|
| SICS | -15.4 | 50.4 | 21.0 | 0.68 |
| Phacoemulsification | -28.5 | 32.2 | 8.0 | |



Figure 9: After surgery, CFT decrease from 1 month to 3 months were greater in phacoemulsification compared to SICS. (P=0.68)

Discussion

In our study results revealed that in every patients there was increase in CFT up to I month of cataract surgery in which 12 patients had macular edema based on morphology. This increase was more in patients with diabetic retinopathy, with uncontrolled diabetes (HbA1c >7) and with diabetes of more than 10 years duration. Followed by there was decrease in CFT from 1 month to 3 month in every patients. This decrease was more in controlled diabetes and in patients with duration of diabetes > 10 years. The latter may be due to the greater increase in CFT from post op to 1 month. But could not find any statistical significance in any of the above categories this may be because of the small sample size of the study. CFT increase was comparable in SICS and phacoemulsification.

Study done by Chaudhary et al., have shown that there is statistically significant increase in macular thickness post operatively at 1 week, 1 month in all patients. It returned to near normal values by 3 month post operatively. This increase was mostly subclinical. The incidence of CME was comparable in SICS and phacoemulsification. In those who developed macular edema majority was cystoid macular edema followed by spongiform like diffuse retinal thickening followed by mixed type. Could not differentiate between pseudophakic cystoid macular edema and diabetic macular edema.

Prevalence of macular edema after cataract surgery in diabetic patients is 41.4% with 95% CI 23.5 – 59.3.this large interval in 95%CI may be due to small sample size.

Incidence of macular edema following cataract surgery in diabetic pathents is 6.9% with 95% CI 0-16.1%

In our study eyes with > 10 years duration had greater increase in CFT. This was in contrast to the study done by flesner et al. In our study we found that CFT in uncontrolled diabetic eyes (>7 HbA1C) increased considerably, which was greater when compared with eyes with controlled diabetes at the same time periods. This was in contrast to the study done by Wang et al. Decrease in CFT from 1 month post op to 3 month post op was greater in controlled diabetes when compared to uncontrolled diabetes. These results indicates that maintaining HbA1c < 7 preoperatively can prevent from increasing CFT after cataract surgery.

Hayashi et al in their study have shown that foveal thickness and macular volume in diabetic patients increases after cataract surgery in eyes both with and without diabetic retinopathy. Increase in foveal thickness and macular volume was more in eyes with DR than without DR. Diabetic macular edema worsens after cataract surgery and this is more in eyes with diabetic retinopathy. Their quantitative study also suggests that HbA1c at the time of surgery may be taken as a predictor of progression of macular edema. our study results were in accordance with the study done by Hayashi et al. The reason for the above finding can be, pseudo phakic cystoid macular edema is caused by inflammatory cytokines like prostaglandin and VEGF which are released after cataract surgery from BRB. Breakdown of BRB in diabetic eyes with DR found to be greater than without DR.[6,7,8]

Visual acuity depends on many factors including cataract grade. Since I have studied only CFT and morphology of DME, I did not study change in visual acuity.

Conclusions

Incidence of macular edema following cataract surgery in diabetic patients is 6.9% with 95% CI 0-16.1% increase in CFT upto I month after cataract surgery is observed in all patients HbA1c at the time of surgery may be taken as a predictor of increase in CFT after cataract surgery (p=0.0573).

Increase in CFT was more in patients with diabetic retinopathy (p=0.061), with uncontrolled diabetes (p=0.573) and with diabetes of more than 10 years duration (p=0.069).

Followed by there was decrease in CFT from 1 month to 3 month in every patients. This decrease was more in controlled diabetes and in patients with duration of diabetes > 10 years.

In those who had macular edema majority was cystoid macular edema followed by spongiform like diffuse retinal thickening followed by mixed type.

Even though it is statistically insignificant we found that in phaco emulsification, decrease in CFT from 1month to 3 month was greater when compared to SICS. So in diabetes phaco emulsification would be better than SICS.

Suggestions

- To conduct study including more number of subjects.
- To correlate outcomes with visual acuity.

References

- 1. Chaudhary C, Bahadhur H, Gupta N. Study of cystoid macular edema by optical coherent tomography following uneventful cataract surgery. Int Ophthalmol. 2015 Oct 1;35(5):685–91.
- Ruit S, Tabin G, Chang D, Bajracharya L, Kline DC, Richheimer W, et al. A Prospective Randomized Clinical Trial of Phacoemulsification vs Manual Sutureless Small- Incision Extracapsular Cataract Surgery in Nepal. Am J Ophthalmol. 2007 Jan; 143(1): 32-38. e2.

- Flach AJ. The incidence, pathogenesis and treatment of cystoid macular edema following cataract surgery. Trans Am Ophthalmol Soc. 1998; 96:557–634.
- Kelkar A, Kelkar J, Mehta H, Amoaku W. Cataract surgery in diabetes mellitus: A systematic review. Indian J Ophthalmol. 2018 Oct;66(10):1401– 10.
- 5. Charles P. Wilkinson. Ryan's Retina: 3 Volume Set 6th Edition.
- 6. Degenring RF, Vey S, Kamppeter B, Budde WM, Jonas JB, Sauder G. Effect of uncomplicated phacoemulsification on the central retina in diabetic and non-diabetic subjects. Graefes Arch Clin Exp Ophthalmol. 2006 Nov 30;245(1):18– 23.
- Wang KY, Cheng CK. Central retinal thickness changes and visual outcomes following uncomplicated smallincision phacoemulsification cataract surgery in diabetic without retinopathy patients and nondiabetic patients. Taiwan J Ophthalmol. 2014 Mar 1;4(1):33–9. AAO 2020-2021, Retina and Vitreous.pdf.
- Eriksson U, Alm A, Bjärnhall G, Granstam E, Matsson AW. Macular edema and visual outcome following cataract surgery in patients with diabetic retinopathy and controls. Graefes Arch Clin Exp Ophthalmol. 2011 Mar;249(3):349–59.
- Chu CJ, Johnston RL, Buscombe C, Sallam AB, Mohamed Q, Yang YC. Risk Factors and Incidence of Macular Edema after Cataract Surgery: A Database Study of 81984 Eyes. Ophthalmology. 2016 Feb 1; 123(2): 316–23.