

Comparison of Macular Oedema after Cataract Surgery in Diabetic and Non-Diabetic Patients using OCT**Preeti Singh¹, S K Kachhwaha², Chitra Sunov³, Ankit Gupta^{4*}**¹Senior Resident, Department of Ophthalmology, Government Medical College, Dungarpur, Rajasthan, India²Senior Deputy Director, Department of Ophthalmology Jawaharlal Nehru Hospital and research centre, Bhilai, Chhattisgarh, India³Senior Consultant, Department of Ophthalmology Jawaharlal Nehru Hospital and research centre, Bhilai, Chhattisgarh, India⁴Assistant Professor, Department of Pathology, Government Medical College, Dungarpur, Rajasthan, India

Received: 30-06-2020 / Revised: 20-08-2020 / Accepted: 08-09-2020

Abstract

Background: Diabetes is a major cause of blindness in developed and developing world. Cataract is increased in frequency in diabetics and makes an important contribution to diabetic blindness. With OCT various parameters of macula can be obtained which helps in understanding of relationship of macular status before and after cataract surgery. **Objectives:** This study uses OCT to compare cystoid macular oedema after cataract surgery in diabetic and non diabetic patients. **Methods:** This prospective, comparative study was conducted on 100 patients during October 2017 to September 2018. Patients were divided into Group I (50 eyes of metabolically controlled diabetic patients) and Group II (50 eyes of non diabetic patients). OCT was used to assess macular oedema in both groups preoperatively and postoperatively at 1st and 3rd month. **Results:** In Group I, the mean foveal thickness significantly increased by 13% and 8.9% from the baseline at 1 and 3 months respectively (p= 0.001, 0.003). In Group II the mean foveal thickness increased by 10.4% and 7% from the baseline at 1 and 3 months. (p= 0.001, p=0.022). The difference in increase in mean foveal thickness between Group I and Group II was statistically significant at 1 and 3 months (p=0.005, p=0.001) respectively. **Conclusion:** The results in our study suggest that OCT is effective tool in estimating the post operative macular oedema and should be done if available to get baseline macular status and diagnosis. The preoperative evaluation of macular status in diabetics by OCT is important in determining post operative visual gain.

Keywords: macular oedema, optical coherence tomography, diabetes, cataract surgery

This is an Open Access article that uses a fund-ing 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 the

original work is properly credited.

Introduction

Diabetes mellitus is emerging as the single largest cause of blindness in developing countries[1,2]. Diabetes currently affects more than 62 million

Indians, which is more than 7.1 % of adult population[3-5]. Macular oedema (ME) is a common cause of blindness after cataract surgery. Macular oedema is caused by increased vascular permeability in retinal capillaries as well as from microaneurysms[6]. Macular oedema can be observed with slit lamp biomicroscopy using +78D lens, while Optical Coherence Tomography (OCT) delineates the lesion much better. In diabetic adults, cataract is more prevalent and progression is more rapid. There is controversy regarding effects of phacoemulsification on retina in diabetics, with some studies suggesting

Correspondence*Dr. Ankit Gupta**

Assistant Professor, Department of Pathology, Government Medical College, Dungarpur, Rajasthan, India

Email: ankitchd1988@gmail.com

adverse effect on progression of diabetic retinopathy and macular oedema and others suggesting it is due to natural history of the disease. Due to altered blood retinal barrier and presence of diabetic retinopathy, incidence of macular oedema is also increasing[7]. Optical Coherence Tomography is a new digital imaging technique first described in 1991. OCT provides high resolution and cross-sectional imaging of macula[8]. OCT compared to other tests is objective and takes only few seconds to perform. OCT quantifies the macular thickness at a resolution of approximately 10 µm axial resolution. Thus by using OCT we can obtain the relationship of macular status before and after cataract surgery in diabetic patients[9,10]. This study was designed to compare cystoid macular oedema after cataract surgery in diabetic and non diabetic patients by using OCT.

Material and methods

Ethics: The study topic was approved from the institutional research ethical committee with reference number EC/NEW/INST/2019/440. Prospective cases were counselled regarding the objectives and methodology of the study and their written consent was obtained.

Study design:

A hospital based, comparative, prospective study based on descriptive research design was done during October 2017 to September 2018. Patients attending department of ophthalmology who were willing for cataract surgery, after satisfying the inclusion and exclusion criteria were enrolled into the study.

Inclusion criteria:

1. All the patients above 40 years with visually significant cataract who were scheduled for cataract surgery.
2. Patients with metabolically controlled diabetes before surgery.
3. Grade I and II nuclear sclerosis and cortical cataract were included according to LOC III classification.

Exclusion Criteria:

1. History of trauma, ocular surgery in past 3 months.
2. Ocular illness like glaucoma, uveitis, vascular occlusion, retinitis pigmentosa, retinal detachment.
3. Patients not completing 3 months of follow-up.
4. Age <18 years.
5. Significantly dense cataract which preclude fundus photography and optical coherence tomography.
6. Patient who had received local or systemic steroids and local NSAID's in previous 3 months.

7. Patients with vitrectomised eyes.

Sample size calculation: From previous study: Torron-Famandez –Blanco C, Rutz-Moreno O, Ferrer-Novella E, Sanchez-Cano A, Honrubia-Lopez FM. Pseudophakic cystoid macular edema- Assessment with optical coherence tomography. Arch Soc Esp Oftalmol 2006; 81(3):147-53

N = minimum required sample size in each of the groups

Mean central macular thickness in Diabetic Group = 241.6 ± 56.3 microns

Mean central macular thickness in Non diabetic Group = 204.6 ± 21.8 microns

D = difference in mean central macular thickness between Diabetic and Non diabetic Group = 37.6 microns

SD^2 = Squared pooled deviation = 3042.34

1.96 = conventional multiplier for alpha 0.05

1.26 = conventional multiplier for power 90%

Minimum sample size is $N = \frac{2(1.96+1.26)^2 SD^2}{d^2}$
 $= 2(10.36) (3042.34) / (37.6)^2 = 45$ (minimum) in each group

Group I = 50

Group II = 50

Methodology

- **Proforma designing** – After detailed review of literature, preparation of proforma was done, to collect cases.
- **Selection & enrolment of cases** – The cases those fulfilled predefined inclusion and exclusion criteria, enumerated earlier, were enrolled in the study.

Baseline data collection – By using pretested proforma, all details were recorded. After getting informed consent, preoperative examination was done. Standard phacoemulsification with acrylic foldable IOL in the bag was performed. OCT was done in all the patients preoperatively and postoperative 1 and 3 months. Foveal thickness was calculated and comparison was done between Group I and Group II.

Relevant investigations – A detailed physical, general examination was done. All the patients were subjected to systemic investigation including haemoglobin, total blood count, differential count, urine albumin and sugar, fasting blood sugar, ECG, blood pressure. Diabetics were subjected to other tests like 24 hour urinary protein; post prandial blood sugar, renal function tests, lipid profile. Slit lamp biomicroscopy was performed for detail anterior segment examination for iris neovascularisation,

pupillary reaction, location of cataract, grading of cataract according to LOC III.

At 1 and 3 month visit they had undergone complete ocular examination including visual acuity, intra-ocular pressure, IOL position, anterior and posterior segment examination and OCT.

Statistical analysis: Data was compiled in MS excel and checked for its completeness and correctness. Statistical analysis was performed with SPSS 18.0 [Trial version, IBM Statistics]. For continuous data, descriptive statistics like mean, mode, median, standard deviation, range was calculated. For categorical data number and percentage was analyzed. Data was checked for Normality using Shaipro – Wilk test of Normality. For Non- Normal data, Mann-Whitney U test and Wilcoxon signed rank test was used. P Value of <0.05 was taken as significant.

Results

In Group I, 28 (56%) patients were below 60 years and 22 (44%) were above 60 years and in Group II, 34 (68 %) patients were below 60 years and 16 (32%) were above 60 years. The mean age of Group I patients was 57.82 ± 7.9 years (range 43-81) and of Group II was 55.80 ± 6.6 years (range 47-71). There were 20 (40%) females and 30(60%) males in Group I, while in Group II there were 18(36%) females and 32 (64%) males. Both the groups were comparable for age and sex distribution. It is evident from Table 1 that, Group I, the mean foveal thickness was $205.86 \mu\text{m}$ preoperatively which increased to $233.14 \mu\text{m}$ at 1 month and $224.14 \mu\text{m}$ at 3 months. The increase was significantly higher by 13% and 8.9% from the baseline at 1 and 3 months respectively ($p = 0.001, 0.003$). In Group II the mean preoperative foveal thickness was $165.18 \mu\text{m}$ which increased to $182.28 \mu\text{m}$ at 1 month and $176.66 \mu\text{m}$ at 3 months. The increase was significantly higher by 10.4% and 7% from the baseline at 1 and 3 months. ($p = 0.001, p = 0.022$). As shown in Table 2, the difference in increase in foveal thickness between Group I and Group II was statistically significant at 1 and 3 months ($p = 0.005, p = 0.001$) respectively. From Table 3 it is clear that, the difference between final visual acuity at 1 and 3 months between the two groups was not significant. ($p = 0.657, 0.359$). It is evident from Table 4(a) that the incidence of post operative cystoid macular oedema in Group I is 22% ($n = 11$). As shown in Table 4(b) the incidence in Group II is 8% ($n = 4$).

Discussion

The mean age in our study was 57.82 and 55.80 in Group I and Group II respectively, which was younger

age group as compared to other studies [11,12] where the mean age was ranging between 68 to 76 years. Male to female ratio was 1.6:1 in our study which is comparable to other study. In our study foveal thickness was maximum at 1 month and decreased at 3 month but did not return to baseline which was consistent with the result by Kim SJ et al [11]. In a study by Jurecka T et al [10] they did 6 month follow up and found normalisation of retinal thickness at 6 months. Jurecka T et al [13] did similar comparison among diabetics and non diabetics which was similar to our study. The difference in increase in foveal thickness between Group I and Group II was statistically significant at 1 and 3 months ($p = 0.005, p = 0.001$) respectively. In our study the difference in final visual acuity between diabetics and non diabetics was not statistically significant ($p = 0.359$). In a study by Jurecka T et al the results were comparable to our study. The incidence of CME in diabetic was 22% in present study which was similar as compared to study by Kim SJ et al [11] on diabetics (22%). However Kim SJ et al [11] defined CME as increase of foveal thickness by greater than 30% from the baseline and did not consider cystoid spaces as our study did. The incidence of CME in diabetics in a report by Pedro Romero- Aroca et al [14] was very less as compared to our study (1.52%). The incidence of CME in non-diabetics was 8% in the present study, similar to study by Menetes J et al (9%) and higher than a study by Jurecka T et al (3%) on non-diabetics [15]. The increased incidence of CME is attributed to defective blood retinal barrier and higher levels of VEGF in diabetics [13]. It was thus observed that all the patient's diabetic and non diabetic showed increase in foveal thickness after uncomplicated phacoemulsification. The incidence of CME was statistically more in diabetics as compared to non diabetics after uncomplicated phacoemulsification. The diabetic CME eyes had significantly less final visual acuity than non diabetic CME eyes at three months.

Conclusion

The results in our study suggest that OCT is effective tool in estimating the post operative macular oedema and should be done if available to get baseline macular status and diagnosis. The preoperative evaluation of macular status in diabetics by OCT is important in determining post operative visual gain.

Table 1: Foveal thickness preoperatively, at 1month and 3 months

Foveal thickness	Preoperative	1 month	3 month
Group I	205.86±111.67	233.14±134.62	224.14±105.87
Group II	165.10±29.13	182.28±44.20	176.66±38.43

Table 2: Comparison of foveal thickness between group I and group II at 1 and 3 months

Comparison of foveal thickness between Groups at 1 and 3 months								
	Group	N	Mean	SD	Std. Error Mean	Mann-Whitney U	Z	P value
FT1	Group I	50	233.14	134.623	19.039	840.000	-2.827	0.005
	Group II	50	182.28	44.209	6.252			
FT3	Group I	50	224.14	105.875	15.125	759.000	-3.262	0.001
	Group II	50	176.66	38.437	5.436			

Table 3: Comparison of visual acuity in both groups at 1 and 3 months postoperatively

Comparison between groups								
	Group	N	Mean	SD	Std. Error Mean	Mann-Whitney U	Z	P value
VN1	Group I	50	0.13	0.246	0.035	1193.500	-0.444	0.657
	Group II	50	0.11	0.178	0.025			
VN3	Group I	50	0.10	0.225	0.032	1149.000	-0.917	0.359
	Group II	50	0.05	0.113	0.016			

Table 4(a): Cystoid macular edema in group I

CME IN GROUP I	Frequency	Percent
Absent	39	78.0
Present	11	22.0
Total	50	100.0

Table 4(b): Cystoid macular edema in group II

CME IN GROUP II	Frequency	Percent
Absent	46	92.0
Present	4	8.0
Total	50	100.0

References

1. Forouhi NG, Wareham NJ. Epidemiology of diabetes. *Medicine* 2014; 42:698-702.
2. Kaveeshwar SA, Cornwall J. The current state of diabetes mellitus in India. *Australas Med J* 2014; 7:45-8.
3. Klein R, Klein BEK, Moss SE. The Wisconsin Epidemiological Study of Diabetic Retinopathy III. Prevalence and risk of diabetic retinopathy when age at diagnosis is less than 30 yrs. *Arch Ophthalmol* 1984; 102:520-6.
4. Klein R, Klein BEK, Moss SE. The Wisconsin Epidemiological study of Diabetic Retinopathy III. Prevalence and risk of diabetic retinopathy when age at diagnosis is 30 or more years. *Arch Ophthalmol* 1984; 102:527-32.
5. Klein R, Klein BEK, Moss SE. The Wisconsin Epidemiological study of Diabetic Retinopathy IV. Diabetic Macular edema. *Ophthalmology* 1984; 91:1464-74.
6. Fatih C Gundogan, Umit Yolcu, Fahrettin Akay, Abdullah Ilhan, Gokhan Ozge, Salih Uzun. Diabetic Macular edema. *Pak J Med Sci* 2016; 32:505–10.
7. Menten J, Erakgun T, Afrashi F, Kerci G. Incidence of cystoid macular edema after uncomplicated phacoemulsification. *Ophthalmologica*. 2003; 217:408–12.
8. Browning DJ, McOwen MD, Bowen RM, Jr, O'Marah TL. Comparison of the clinical diagnosis of diabetic macular edema with diagnosis by optical coherence tomography. *Ophthalmology* 2004; 111:712–5.
9. Romero-Aroca P, Fernandez-Ballart J, Almena-Garcia M, Mendez-Marín I, Salvat-Serra M, Buil-Calvo JA. Nonproliferative diabetic retinopathy and macular edema progression after phacoemulsification: prospective study. *J Cataract Refract Surg* 2006; 32:1438–44.
10. Virgili G, Menchini F, Murro V, Peluso E, Rosa F, Casazza G. Optical coherence tomography (OCT) for detection of macular oedema in patients with diabetic retinopathy. *Cochrane Database Syst Rev* 2011; 7:8081.
11. Kim SJ, Equi R, Bressler NM. Analysis of macular edema after cataract surgery in patients with diabetes using optical coherence tomography. *Ophthalmology* 2007; 114:881-9.
12. Torron-Famandez –Blanco C, Rutz-Moreno O, Ferrer-Novella E, Sanchez-Cano A, Honrubia-Lopez FM. Pseudophakic cystoid macular edema-Assessment with optical coherence tomography. *Arch Soc Esp Oftalmol* 2006; 81(3):147-53.
13. Jurecka T, Batkova Z, Ventruba J, Synek S. Macular edema after cataract surgery in diabetic patients without retinopathy. *Cesk Slov oftalmol* 2007; 63(4):274-84.
14. Pedro Romero-Aroca, Juan Fernandez-Ballart, Matias Almena-Gracia, Isabel Mendez-Marrin, Merce Salvat-Serra et al. Non proliferative diabetic retinopathy and macular edema progression after phacoemulsification. *J Cataract Refract Surg* 2006; 32:1438-44.
15. Menten J, Erakgun T, Afrashi F, Kerci G. Incidence of cystoid macular edema after uncomplicated phacoemulsification. *Ophthalmologica*. 2003; 217:408–12.

Source of Support: Nil

Conflict of Interest: Nil