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Original Research Article

Comparative Assessment of Quantitative Changes in Macular Thickness Using Spectral Domain OCT in Diabetic Patients Undergoing Cataract Surgery

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Abstract

Aim: To evaluate the quantitative changes in macular thickness using spectral domain OCT in diabetic patients undergoing cataract surgery pre and post operatively and its relation with diabetic retinopathy (DR).

Material & Method: This was a prospective comparative study, comprised of 100 patients conducted in the Department of Ophthalmology, Patna Medical College & Hospital, Patna, Bihar, India over a period of 15 months.

Results: 31 patients had Mild NPDR followed by 12 patients had Moderate NPDR. Severe NPDR With macular edema in 5 patients and pre op macular edema is seen in 2 patients. Preoperatively 90% patients had a vision of 6/60 or lesser. Over all visual acuity improved postoperatively at 4th and 12th week after small incision cataract surgery to 6/12 and 6/9 in majority of the patients. A statistically significant increase could be detected in central subfield macular thickness though the increase was mild. ($P<0.002$).

Conclusion: After cataract surgery, there was a statistically significant rise in CSMT, notably in individuals with preoperatively confirmed macular edema. Associated retinopathy is a risk factor as well. However, after straightforward minor incision cataract surgery, there was no statistically significant increase in mild and moderate NPDR preoperatively or in the postoperative term.

Keywords: optical coherence tomographic analysis, cataract surgery, macula

Introduction

Cataract is the leading cause of blindness in the world and the most prevalent ocular disease. With the advancement in surgical methods and instrumentation, the visual outcome following cataract surgery has become much better. Phacoemulsification and implantation of a foldable intraocular lens (IOL) is currently the preferred technique of surgery among cataract surgeons. [1]

The term cataract refers to opacity of any part of the crystalline lens which is normally almost completely transparent. Cataract accounts for 47.8% of the world's

roughly 37 million blind individuals. Of note, approximately 90% of the contribution of cataract to blindness was seen in developing countries. The visual outcome of cataract surgery depends upon various factors like condition of the cornea, type of cataract, manipulation of iris, presence of pre-existing ocular conditions like chronic uveitis, any associated systemic disease, and occurrence of intra-operative complications and also experience of the surgeon.[2]

Optical Coherence Tomography (OCT) was introduced in 1991 and since then it has become an invaluable tool in the diagnosis and management of different retinal disorders. OCT is a method of analyzing the *in-vivo* retinal architecture. It is particularly useful and accurate for measuring retinal nerve fiber layer (RNFL) thickness and macular thickness.[3] OCT uses light reflectance signal from the retina to measure its thickness. Macular edema (ME) occurs in a variety of pathological conditions and accounts for different degrees of vision loss. Early detection of ME is therefore critical for diagnosis and management. OCT has been routinely used in measuring retinal thickness for the evaluation of ME caused by diseases such as age-related macular degeneration, diabetic retinopathy, central serous retinopathy, hereditary retinal degenerations, retinal vein occlusion, after cataract surgery, epiretinal form of diffuse retinal thickening, cystoid macular edema and serous retinal detachment.[4] Management of macular edema by intravitreal injection of anti-VEG- F agents and need for repeat injections are decided based on foveal thickness by OCT.

In diabetic macular edema (DME), ME is induced by hyperglycemia-induced oxidative stress, deposition of advanced glycation end products (AGES), impaired blood flow, hypoxia, pericyte loss, endothelial cell loss, up regulation of vesicular transport, down regulation of glial cell–derived neurotropic factor and inflammation.

OCT is a method of analyzing the in-vivo retinal architecture. It is particularly useful and accurate for measuring retinal nerve fiber layer (RNFL) thickness and macular thickness. This study is undertaken to evaluate the quantitative changes in macular thickness using spectral domain optical coherence tomography in diabetic patients undergoing cataract surgery pre and post operatively and its relation with diabetic retinopathy.

Material & Method:

This was a prospective comparative study, comprised of 100 patients conducted in the Department of Ophthalmology, Patna Medical College & Hospital, Patna, Bihar, India over a period of 15 months.

Inclusion criteria:

All Type 2 diabetic patients irrespective of duration of diabetes of age group 55-75 years with senile immature cataract with varying levels of retinopathy including absence of retinopathy underwent uncomplicated small incision cataract surgery done by an experienced surgeon were included in the study.

Exclusion Criteria:

1. Diabetic patients where pre-op OCT is not possible
2. Subluxated lens
3. Pseudo exfoliation
4. Glaucoma
5. Intraoperative any complication
6. Diabetic patients with prior intraocular surgery in the same eye
7. Uveitis
8. Presence of any retinal or choroidal disease, other than diabetes, that could affect retinal thickness.

Preoperative evaluation:

1. Visual acuity testing for distance and near using Snellen's distant chart and near vision chart respectively.
2. Refraction and correction where ever required.
3. External ocular examination
4. Slit lamp bio microscopic examination done with dilated pupilar
5. Tonometry using applanation tonometer
6. Lacrimal patency test
7. Keratometry
8. A-scan and Intraocular lens power calculation by SRK-2 formula
9. Fundus examination with indirect ophthalmoscopy with 20D Lens after dilatation. The level of diabetic retinopathy was recorded as No, mild, moderate, and severe non proliferative; or proliferative, as described in the early treatment diabetic retinopathy study.

Other investigations included: RBS, FBS, PPBS, HBA1C.

Optical coherence tomography testing was done preoperatively and repeated at the POD day1, POD1 week, and 4th and 12th week postoperative visits. Best-corrected visual acuity (BCVA) was recorded at each visit.

Results:

Graph 1 shows Distribution of cases according to duration of DM in which majority of cases 73% belonged to <65 years of age.

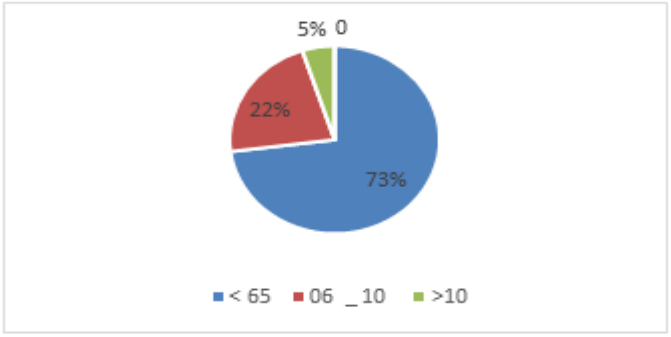
Graph 2 demonstrates no Diabetic retinopathy detected preoperatively in 41% of diabetic eyes. 31 patients had Mild NPDR followed by 12 patients had Moderate NPDR. Severe NPDR With macular edema in 5 patients and pre op macular edema is seen in 2 patients.

Graph 3 Preoperatively 90% patients had a vision of 6/60 or lesser. Over all visual acuity improved postoperatively at 4th and 12th week after small incision cataract surgery to 6/12 and 6/9 in majority of the patients. Post operatively 1 month 70% patients achieved vision of 6/6– 6/12. By Postoperative 3 months 87% patients achieved a vision of 6/6 – 6/12.

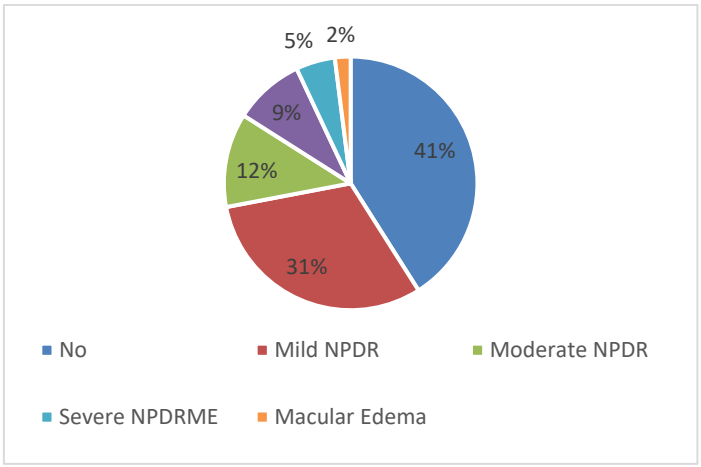
Graph 4 The central subfield mean thickness in all patients irrespective of diabetic retinopathy increased 16.2 µm and 29 µm at 1 month and 3 months follow up. A statistically significant increase could be detected in central subfield macular thickness though the increase was mild. (P<0.002)

In this study, level of diabetic retinopathy was associated with increased foveal thickening. The study group with no diabetic retinopathy developed increases in foveal thickening, of 15.8 µm and 20.1 µm at 4th and 12th week after surgery, respectively. Among patients with no diabetic retinopathy developed thickening from a preoperative mean value of 244.6±11.62 to 280.28±12.77 µm at 3rd month of follow up with a P-value of 0.030*(p<0.05)

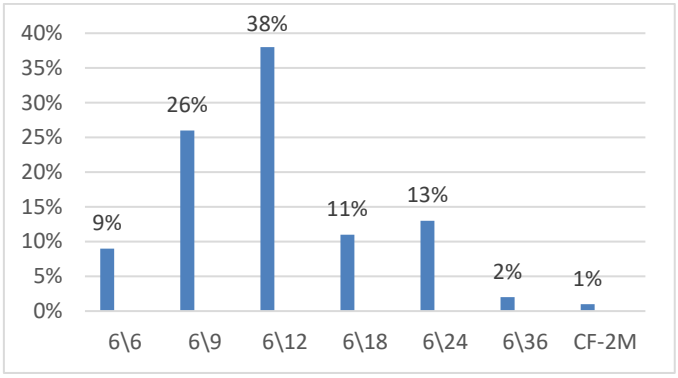
Graph 1: Distribution of cases according to duration of DM



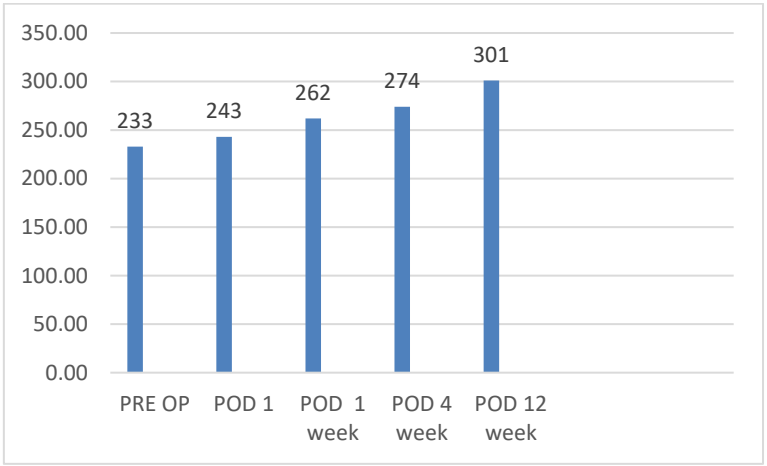
Graph 2: Distribution of cases according to diabetic retinopathy



Graph 3: Distribution of cases according to BCVA at POD 12week



Graph 4: Distribution of Mean OCT according to Pre and Post-operative among all cases 12 weeks.



Discussion:

In a study by Garbhiya M et al, at day 1 after surgery, mean retinal thickness of all macular subfields of the operated eyes decreased significantly in comparison to the fellow eyes. [5] There was a significant increase in retinal thickness of the outer macular area from one week postoperatively onwards with a peak at 1 month, while retinal thickness of the central fovea began to increase from the first month, with a peak at 2 months. At 6

months after surgery, retinal thickness tended to normalize in the central fovea, whereas it remained increased in the outer macular area.

The study by Akçay BİS, Bozkurt TK, Güney E, et al. In the present study, none of the patients in controls (Group 1) developed CME whereas the incidence of CME was 13.33% in the controls (Group 2). This was in correlation with the studies done by Akçay BİS, Bozkurt TK, Güney E, et al where none of the patients in Group 1 and 10% of Group 2 patients developed CME.[6]

Most of the studies in the literature showed6–8 that mean CMT is statistically significant increase at 1 month after cataract surgery, which was maintained after 3 months, pointing out a possible leakage. Also, baseline CMT was thicker in eyes developing PCME, suggesting that increased CMT thickness may be a predisposing factor for Pseudophakic Cystoid Macular Edema (PCME) or the presence of subclinical PCME, which may not be detected by OCT imaging systems. [7-9]

Ching HY et al, in their study found that the mean preoperative thickness was higher than postoperative thickness.[10]

Hayashi et al. have shown that the foveal thickness and macular volume in diabetic patients increases after small incision cataract surgery in eyes both with and without DR: the percent increase from baseline was greatest at 3 months after surgery, and then decreased gradually.[11]

Furthermore, the increase in foveal thickness was greater in eyes with DR than in eyes without DR. These results indicate that, on average, diabetic macular edema worsens after cataract surgery, and the worsening is more pronounced in eyes with DR.[12]

Alastair K Denniston, Usha Chakravarthy et al. reported that rate of developing treatment-requiring DMO increases sharply in the year after cataract surgery for all grades of retinopathy, peaking in the 3–6 months' postoperative period. Patients with moderate and severe NPDR are at particularly high risk.[13,14]

Conclusion:

After cataract surgery, there was a statistically significant rise in CSMT, notably in individuals with preoperatively confirmed macular edema. Associated retinopathy is a risk factor as well. However, after straightforward minor incision cataract surgery, there was no statistically significant increase in mild and moderate NPDR preoperatively or in the postoperative term.

All diabetic patients should be closely monitored for at least 6 months after surgery in order to intervene with laser photocoagulation and anti-VEGF therapy if needed to prevent visual loss from diabetic maculopathy and other diabetic retinopathy complications.

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