A Clinical Evaluation of OCT proven Macular Edema in Post operative Cataract patients operated by Conventional ECCE and SICS techniques

*Dr. Nikhil Balakrishnan, **Dr. Kishor Badhe

*Resident, **Professor, Department of Ophthalmology
Rural Medical College, Pravara Institute of Medical Sciences, Loni (DU), Maharashtra, India

Corresponding author: Dr. Nikhil Balakrishnan

Abstract

Introduction: Various types of Cataract Surgeries have evolved over the years, of which the three types of Extra Capsular Cataract Extraction (ECCE) namely Conventional ECCE, Small Incision Cataract Surgery (SICS) and Phacoemulsification are routinely performed. Cystoid macular edema (CME) following cataract surgery, also known as Irvine-Gass syndrome, is an important differential diagnosis of painless suboptimal vision following uneventful cataract extraction. The diagnosis of CME was previously made with fluorescein angiography, after the patient became symptomatic. However, the emergence of Optical coherence tomography (OCT) has provided a quick and noninvasive means of diagnosis.

In this study we determine the incidence of OCT proven Macular Edema in post operative cataract patients operated by Conventional ECCE and SICS techniques.

Materials and Methods

100 cases of Post operative Cataract, 50 operated by the Conventional ECCE method and 50 by the SICS technique were evaluated by OCT at 1 month follow up to examine for the presence of Pseudophakic Cystoid Macular Edema (PCME).

Results: Of the 100 cases studied, 13 showed presence of PCME, 8 of whom were operated by the Conventional ECCE method and 5 by SICS method.

Conclusions: SICS was found to be a superior technique than Conventional ECCE for Cataract surgery in terms of development of PCME. OCT is an excellent non-invasive tool for macular thickness measurement, which can be used in routine practice for greater diagnostic accuracy in PCME.

Key Words: Cataract, Conventional Extra Capsular Cataract Extraction (ECCE), SICS, Post Cataract Macular Edema (PCME), Optical Coherence Tomography (OCT)

Introduction

Cataracts are the major cause of blindness and visual impairment in developing countries and contributes to more than 90% of the total disability adjusted life years. Various types of Cataract Surgeries have evolved over the years, of which Extra Capsular Cataract Extraction (ECCE) has gained popularity as it involves retention of Posterior Capsular support for Intra Ocular Lens (IOL) implantation. Three types of ECCE surgeries namely Conventional ECCE, Small Incision Cataract Surgery (SICS) and Phacoemulsification are routinely performed. Conventional ECCE is an open sky procedure which requires closure of the wound with sutures. SICS is a self-sealing, sutureless small incision surgery. Phacoemulsification consists of an even smaller incision, which is also self-sealing, but is machine dependent.

SICS is precise, effective and less time consuming without maintenance demand of equipments. Also it has been proved safe and effective in all types and grades of cataract.

It has been observed that SICS gives lesser postoperative astigmatism and better postoperative visual
outcome, comfort and faster rehabilitation than the conventional ECCE technique and it gives nearly the similar outcome as that of Phacoemulsification. Cystoid macular edema (CME) following cataract surgery, also known as Irvine-Gass syndrome, is an important differential diagnosis of painless suboptimal vision following uneventful cataract extraction. The pathogenesis is most likely multifactorial, ultimately leading to the breakdown of the blood-retinal barrier and cystic accumulation of extracellular intraretinal fluid. Visual loss occurs from retinal thickening and fluid collection that distorts the architecture of the rod and cone photoreceptors.

The introduction of modern surgical techniques including phacoemulsification and small incision cataract surgery has contributed to a reduction in the incidence of CME since it was initially reported by Irvine in 1953. The diagnosis of CME was previously made with fluorescein angiography (which uses a dye that has high probabilities of Anaphylactic Shock) after the patient became symptomatic. However, the emergence of OCT has provided a quick and noninvasive means of diagnosis.

OCT (Optical coherence tomography) offers a non-invasive imaging technique that provides high resolution cross sectional images of the macula. OCT is similar to ultrasound imaging, only using light rather than sound. The advantage of OCT is that we can detect minute changes in the thickness of retina especially in the macular area, which is concerned with best visual acuity.

OCT works on the principle of directing a beam of near-infrared light from a broadband coherent light source, (e.g., a superluminescent diode) at a target tissue, and capturing light that is back-scattered from that tissue.

Patient factors predisposing to CME include comorbidities with high vasoactive profile (diabetic retinopathy, uveitis), while surgical factors include inflammation-inducing complications such as retained lens material, posterior capsular rupture, vitreous loss and vitreous incarceration into the incision site and anterior chamber and vitreomacular traction. Advanced age has been also reported as a risk factor for the development of the syndrome. However, many otherwise healthy patients who undergo routine surgery continue to develop the condition.

Aims and Objectives
To study the incidence of Macular Edema in cases operated by the Conventional Extra Capsular Cataract Excision(ECCE) and Small Incision Cataract Surgery methods using Optical Coherence Tomography(OCT)

Materials and Methods
Study was a hospital based simple observational study conducted over a span of 1year. 100 cases of postoperative cataract, 50 operated by the conventional ECCE, and 50 operated by the SICS technique were evaluated during the study. The proposal of the study was approved by the Institutional Ethical Committee. Cataract Surgery Patients operated by any other (ICCE or Phacoemulsification) method, Patients with Diabetes Mellitus (because patients may have preoperative diabetic maculopathy), Cases of Traumatic Cataract, Cases of Developmental Cataract, Cases of Complicated Cataract were excluded from the study. Patients selected were those fulfilling the inclusion and the exclusion criteria. The patients included in the study were thoroughly examined and evaluated regarding the postoperative visual outcome. OCT of patients selected in the study was done 4 weeks post operatively. Detailed Records of the following were noted to see which patients fall into the study criteria.

Preoperative systemic evaluation (which will include – General health of the patient, proper control of systemic diseases e.g. Diabetes and Hypertension,
Detailed preoperative evaluation of the patient was obtained from records which included Visual Acuity, Anterior Segment Examination with diffuse light and Slit lamp Examination (to rule out any ocular disease and septic focus), Intraocular Pressure, Sac Syringing, Grading of cataract, Fundus Examination with 90 D lens whenever possible, Macular Function Tests for Visual prognosis and IOL power calculation.

Postoperative examination included Post operative visual acuity with Pin hole improvement at discharge and at the time of follow up at 4 weeks, Positive Anterior segment findings and Posterior segment examination with 90 D lens with special attention to macular area at time of discharge and at the time of follow up at 4 weeks. OCT was performed at the time of 4 weeks follow up.

Patients did not have to bare any extra cost for the OCT examination.

OCT was performed on the Zeiss Primus 200 machine after the patient was explained the procedure and an informed written consent was taken. Pupil was dilated before the examination with 1% tropicamide and 5% phenylephrine eye drops. The patient was seated comfortably at the Zeiss primus 200 Optical Coherence Tomography machine in the Out Patient Department (OPD) and his/her chin was placed on the chin rest and forehead rested against the head rest. The patient was asked to observe the light (fixation point) with minimal blinking. The eye was scanned using specific programs (Macular Thickness Analysis). The Central subfield Macular Thickness was measured and correlated clinically.

Data was entered in Microsoft Office Excel for analysis.

Statistical analysis was done by using percentages, mean and standard deviation. The two groups were compared using paired and unpaired t tests, chi square test and the Z test for difference between two sample proportions.

**Observations and Results**

A total of 100 subjects, 50 operated by the Conventional ECCE method and 50 by the SICS method were included in the final statistical analysis.

The mean age of patients was 65±16.78 years and Maximum number of patients were in the age group of 61-70.

% of Males was 62% and % of Females was 38% (Table 1).
Table 1: Age and Sex Distribution

<table>
<thead>
<tr>
<th>Age Groups (Years)</th>
<th>Males No of Cases &amp; in %</th>
<th>Females No of Cases &amp; in %</th>
<th>Total No of Cases &amp; in %</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;=50</td>
<td>3</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>51-60</td>
<td>14</td>
<td>8</td>
<td>22</td>
</tr>
<tr>
<td>61-70</td>
<td>32</td>
<td>19</td>
<td>51</td>
</tr>
<tr>
<td>71-80</td>
<td>12</td>
<td>7</td>
<td>19</td>
</tr>
<tr>
<td>81-90</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>&gt;90</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>62</td>
<td>38</td>
<td>100</td>
</tr>
</tbody>
</table>

56 patients (56%) underwent surgery in the right eye and 44 patients (44%) underwent surgery in the left eye. (Graph1).

Graph 1: Laterality Distribution

The mean Central Macular Thickness was 201.89 ± 96.79 microns.

The central macular thickness in patients operated by the Conventional ECCE method was 198.22 ± 57.60 microns and in those operated by SICS method was 205.56 ± 124.56 microns(Graph 2).
13 of the 100 (13%) developed OCT proven Post Cataract Macular Edema (PCME) at 1 month with Average Macular Thickness of 396.33 ± 174.48 microns of which 8 (16%) patients underwent Conventional ECCE with Average Macular Thickness of 351.7 ± 92.24 microns. 5 (10%) patients underwent Small Incision Cataract Surgery (SICS) with Average Macular Thickness of 451.3 ± 237.89 microns (Graph 3). 

Graph 3: OCT proven Macular Edema

---

**Discussion**

Pseudophakic Cystoid Macular Edema (PCME) or Irvine-Gass syndrome – is an extracellular accumulation of fluid in the fovea in the center of the retina. PCME is the most common course of unexpected postoperative visual reduction in patients who experienced an otherwise uncomplicated cataract operation with initially excellent visual results. The advent of phacoemulsification and small incision cataract surgery has reduced the incidence of PCME, but the sheer volume of cataract surgery still makes PCME a prevalent morbidity.
PCME pathogenesis is likely multifactorial, but inflammation caused by surgical manipulation appears to be the major cause. Inflammatory mediators break down the blood–aqueous and blood–retinal barriers, leading to increased vascular permeability. Transudate accumulates in the outer plexiform and inner nuclear layers of the retina and microcysts coalesce into cysts.

Surgical complications that predispose eyes to PCME include vitreous loss, vitreous traction at incision sites, vitrectomy for retained lens fragments, iris trauma, posterior capsule rupture, intraocular lens (IOL) dislocation, early postoperative capsulotomy, and the use of iris-fixated or anterior chamber IOLs. Eyes with diabetic maculopathy, uveitis, retinal vein occlusions (RVO), epiretinal membranes, and prostaglandin analogs were also risk factors for PCME.

The symptoms of PCME are various degrees of visual acuity reduction and in some cases distorted vision or metamorphosis.

The incidence of clinical PCME peaks at approximately 4–6 weeks postoperatively. Most patients with clinical PCME will present with blurry vision, and biomicroscopy will show retinal thickening and loss of the foveal depression. Findings are best observed using a fundus contact lens, and red-free light may allow better visualization of cystic changes. Fluorescein angiography findings include retinal telangiectasis, capillary dilatation, and leakage from perifoveal capillaries in the early frames developing into the classic ‘petalloid’ pattern in late frames. OCT has become widely adopted and allows convenient monitoring of disease activity. PCME is characterized by loss of the foveal depression, retinal thickening, and cystic hyporeflective lesions.

Clinically significant PCME is supposed to occur in less than 2% of the patients. However, 11-40% are reported to have some degree of, often subclinical, PCME in the early postoperative period. The difference in reported incidence in different studies is probably due to an ambiguous definition of the early stages of PCME and variation in patient characteristics.

In our study 50 patients operated by the Conventional ECCE method and 50 by the SICS method were studied. The mean age of the subjects in the study was 65±16.78 years. Maximum number of patients (51%) were in the age group of 61-70. 2% of subjects were male and 38% female. This was similar to most studies conducted in rural India. The reason for the same being the illiteracy, the gender bias and the ignorance about the health issues which prevails among the rural population, more so among women.

56% underwent Cataract surgery in the right eye and 44% underwent Cataract surgery in the left eye. The Mean Central Subfield Macular thickness was 201.89 ± 96.79 microns. The central macular thickness in patients operated by the Conventional ECCE method was 198.22 ± 57.60 microns and in those operated by SICS method was 205.56 ± 124.56 microns. Our findings are consistent with Neumaier et al who found the macular thickness four weeks after surgery to be 173 µm ± 14. Our results also correlated with Wang et al who found the Macular thickness 1 month after surgery to be 207.98 ± 26.99.

13 of the 100 (13%) developed OCT proven Pseudophakic Cystoid Macular Edema (PCME) at 1 month. Our findings were consistent with Baker et al who found the incidence of PCME in non diabetic patients to be 10%. Manjet al found the incidence of PCME to be 9.87% 1 month following Cataract surgery.

Average Macular Thickness of 396.33 ± 174.48 microns of which 8 (16%) patients underwent Conventional ECCE with Average Macular Thickness of 351.7 ± 92.24 microns. 5 (10%) patients underwent Small Incision Cataract Surgery (SICS)
with Average Macular Thickness of 451.3 ± 237.89 microns. These results show that SICS is a superior technique than Conventional ECCE as far as PCME is concerned. This may be due to the shorter duration of surgery and lesser handling of Intraocular tissue in SICS, leading to lesser release of pro-inflammatory factors, that are thought to be associated with causation of PCME.

We used OCT as a diagnostic tool in our study to compute the central macular thickness and to detect the presence of Macular edema. Besides being non-invasive and easy to operate, we found it to be very useful in uneducated rural population who would not be very cooperative for a detailed Fundus Examination on Slit Lamp Biomicroscopy with 90D lenses or an invasive procedure like FFA. Brown et al.\textsuperscript{27} reported that OCT is in good agreement with contact lens biomicroscopy for detecting the presence or absence of Macular Edema and possibly superior in mild cases. In addition, a comparison by Antcliff\textit{et al.}\textsuperscript{28} demonstrated that OCT is as effective as fluorescein angiography in detecting Macular Edema in uveitic patients.

OCT provides objective, quantifiable, and continuous measurements of macular thickness in contrast to the subjective and categorical interpretation of leakage shown by fluorescein angiography or clinical examination. Furthermore, several researchers have reported that increased retinal thickness correlates more strongly with visual acuity than the presence of leakage shown by fluorescein angiography.\textsuperscript{29-32} Topographical studies have shown that subclinical ME caused by different diseases may only be detected by OCT. The advantages of OCT over other imaging modalities available include its non-invasive approach, quick imaging acquisition and safety profile.\textsuperscript{33}

Besides identifying CMO, OCT enables quantitative evaluation of macular thickness over time, a feature not possible with FA. The visualization of patients serial data using the heat map allows the possibility of correlating patterns of change in macular thickness with other clinical symptoms of interest in the future. Such analyses are missed and not possible with routine statistical tests.\textsuperscript{34}

We had few limitations in our study. Since our study was conducted in rural area of Maharashtra some patients were lost to follow up and hence had to be excluded from the study. The outlook of rural patients towards their health was skewed. Some patients did not comply with the postoperative treatment regimen which may have led to sustained inflammation post operatively.

**Conclusion**

Incidence of Pseudophakic Cystoid Macular Edema at 1 month postop was 13%.

SICS was found to be a superior technique than Conventional ECCE for Cataract surgery in terms of development of PCME (10% in SICS as compared to 16% in Conventional ECCE)

OCT is an excellent non-invasive tool for macular thickness measurement, which can be used in routine practice for greater diagnostic accuracy in PCME.

**References**


Leslie Burling-Phillips. After Cataract Surgery: Watching for Cystoid Macular Edema. aao.org


A F Fercher, W Drexler, C K Hitzenberger and T Lasser. Optical coherence tomography—principles and applications.

Basic Principles of Optical coherence tomography. Medscape view article no 750856_2.


Carl W. Baker, MD1; TalatAlmukhtar, MBChB2; Neil M. Bressler, MD3; Adam R. Glassman, MS2; Sandeep Grover, MD4; Stephen J. Kim, MD5; Timothy J. Murtha, MD6; Michael E. Rauser, MD7; Cynthia Stockdale, M Eph2. Macular Edema After Cataract Surgery in Eyes Without Preoperative Central-Involved Diabetic Macular Edema. JAMA Ophthalmol. 2013;131(7):870-879.


