Irvin-gass syndrome following phacoemulsification and small incision cataract surgery: A comparitive study

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Abstract
The incidence of subclinical macular edema after uneventful cataract surgery has become an issue of safety for this frequent operation. It was reported that the incidence of leakage sites was most prominent after 6 weeks. There are studies which show increased OCT–measured foveal thickness following cataract surgery due to subclinical changes of the macular blood retinal barrier (BRB) in the postoperative period.
Spectral domain OCT has been used to measure macular thickness in the present study which was demonstrated to be superior to time domain OCT in the investigation of retinal response to cataract surgery. The present study is a prospective interventional study done to evaluate the incidence.

Keywords: IRVIN-GASS syndrome, Phacoemulsification, Smallincision cataract surgery.

Introduction
Cystoid macular edema (CME) is one of the most common postoperative complication following cataract surgery. Pseudophakic cystoid macular edema (CME) first described by Irvine in 1953 and later elucidated with fluorescein angiography by Gass and Norton in 1966 leading to the term Irvine-Gass syndrome.[1-3]

CME is characterized by cystic fluid–filled spaces between outer plexiform (Henle's layer) and inner nuclear layer of macula. CME following cataract surgery has been postulated due to release of inflammatory mediators that affect the blood retinal barrier and results in increased permeability of the parafoveal and perifoveal capillaries with fluid accumulation in retina.

CME also occur in variety of pathological conditions such as intraocular inflammation, central or branched retinal vein occlusion, diabetic retinopathy etc.

CME has peak incidence at 4 to 6 weeks following cataract surgery,[4-5] but can occur any time between 4 and 16 weeks after surgery. Most cases will spontaneously resolve within weeks to months. An uneventful cataract surgery carries less chance of release of inflammatory mediators and development of CME. An advantage of constant positive intraocular pressure during all stages of cataract surgery is said to be helpful in prevention of CME.[6] The incidence of clinical CME has been reported to be between 1% and 6% after cataract surgery.[7-10] Optical coherent tomography (OCT) evidence of CME after phacoemulsification is 4%[11] to 11%,[12] but also reported to be as high as 41%.[13,14]

The detection of CME can be either through Clinical examination, fluorescein angiographic examination[15] or optical coherent tomography (OCT).Clinical signs of CME are cystic thickening of the macula, perifoveal splinter hemorrhages, central foveal cyst, subtle surface wrinkling of the macula etc.[16] More recently, OCT has emerged as a less invasive, more sensitive tool for detection of CME.

The present study evaluates the cystoid macular edema (CME) clinically and using, in subjects undergoing cataract surgery.

Objectives of the Study
To detect cystoid macular edema following phacoemulsification and small incision cataract surgery. This study was undertaken to detect incidence of cystoid macular edema following phacoemulsification and small incision cataract surgery and, also to analyse macular thickness using, before and after cataract surgery.

Study Population: Patients with age related cataract attending the outpatient department of Jayapriya Eye Hospital

Design of Study: Prospective interventional study

Sample Size (Estimated Minimum): 45 Patients in phacoemulsification cataract surgery group and 45 in small incision cataract surgery group was the minimum sample size advised by statistician.

Formula used:

$S=z^2pq/d^2$

S-sample q=1-p z-standard value d=margin of error

P-proportion of prevalence

Sampling Method: Purposive sampling

Time Frame: February 2015 to July 2016

Inclusion Criteria:

1. Patients Age > 40 years with age related cataract (senile) undergoing cataract surgery (small incision cataract surgery /phacoemulsification), where

fundoscopy and OCT evaluation of macular thickness are possible.

Exclusion Criteria:

1. Present or past history of uveitis.
2. Presence of Diabetic maculopathy and Cataract with Diabetic retinopathy without macular involvement.
3. Presence of macular scars, macular edema, age related macular degenerative changes involving macula, Choroidal Neovascular Membrane (CNVM).
4. Central corneal opacities.
5. High myopic >5D or Axial length more than 26.5mm
6. Glaucoma patient.

Methodology

All patients selected for cataract surgery based on the above mentioned criteria are evaluated by taking detailed history. Thorough ocular examination has been done, which include slit lamp biomicroscopic examination, intraocular pressure by Goldmann applanation tonometer, fundoscopy using 90D, A-scan biometry noting axial length of eye and IOL power. Macular thickness assessment done before and after cataract surgery using Spectral domain OCT by a single person, who is kept unaware of the type of cataract surgery.

Surgical technique is as per patient's choice, determined by their economic status.

Informed written consent taken from all patients for inclusion in the study, and for cataract surgery. Need for post operative medical and regular follow ups explained to each patient

Patients were given antibiotic eye drops one day prior to operation day and adviced to install one drop hourly, during day time.

Preoperatively, Tab. acetazolmide 250 mg, given in all patients 1hour prior to surgery.

Preoperative macular thickness measurement was done using spectral domain OCT. The 3D macula protocol was used for macular thickness measurements. Regular Topographic Map covers an area of 9.0mm x 9.0mm and the ZOOM Topographic Map covers an area of 5.5mm x 5.5mm. Both cover a fixed scanning depth of 1.49 mm in tissue (2.0 mm in air). It reconstructs a false-color topographic image displayed with numeric averages of thickness measurements for each of the 9 map regions within a 9.0mm x 9.0mm area centered on the fovea, as defined by the ETDRS.[17] According to ETDRS map, macula is divided into 9 regions with 3 concentric rings measuring 1 mm (innermost ring), 3 mm (inner ring) and 6 mm in diameter (outer ring) centered on the fovea. The innermost 1 mm ring is the fovea while the 3 mm inner ring and 6 mm outer ring are further divided into four equal regions (Fig. 1). It identifies the layers of the retina and determines macular thickness by measuring the distance between the inner limiting membrane (ILM) and the inner boundary of retinal pigment epithelium (RPE) in each of the 9 regions.

(CC-central circle, SI- superior inner, SO – superior outer, TI – temporal inner, TO – temporal outer, II – inferior inner, IO –inferior outer, NI – nasal inner, NO – nasal outer)

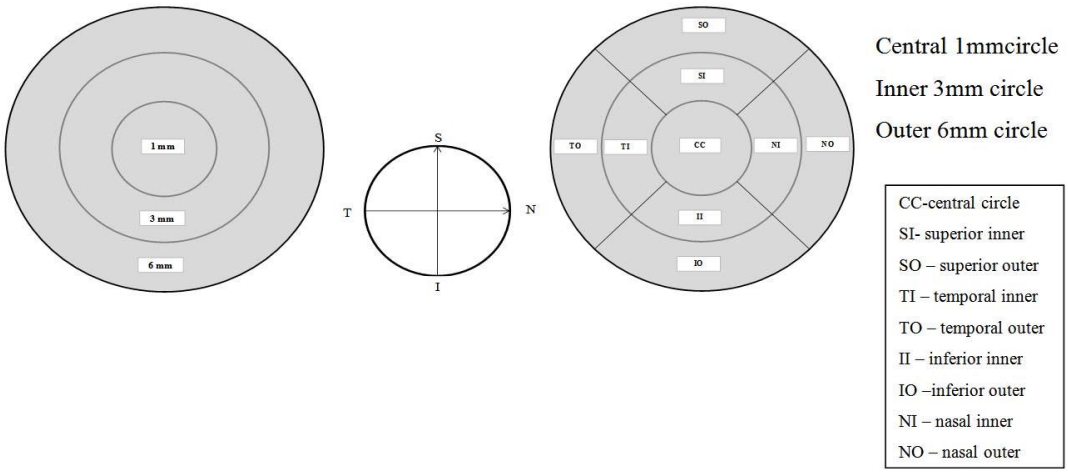


Fig. 1:

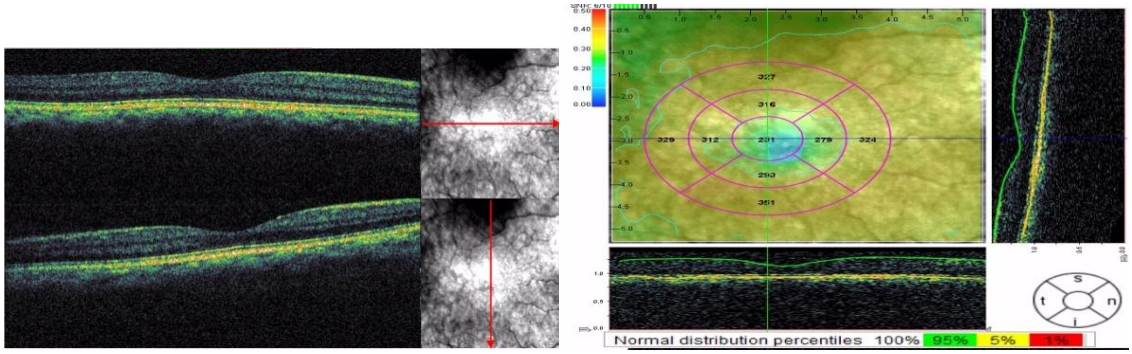


Fig. 2: 3D Macular topography map (ETDRS)
Peribulbar anesthesia is given in all cases

Conventional Phacoemulsification using Alcon laureate machine done through a 3mm temporal clear corneal incision. A side port is made at 12 o'clock position in right eye &, at 6 o'clock position in left eye. Hydroxypropyl methylcellulose used in all patients, 1.4% Sodium hyaluronidase viscoelastic material used in intumesent and hard cataracts. A continuous curvilinear capsulorrhexis of about 5mm is done with the help of capsulotomy needle. After proper hydro dissection &/or hydro delineation direct chop technique is performed with appropriate machine parameters according to the density of nucleus. Epinucleus & cortical matter are removed keeping suitable machine parameters; posterior capsule is polished & either a single piece hydrophobic acrylic IOL/aspheric IOL is placed in the bag using cartridge & an injector; viscoelastic substance is aspirated & anterior chamber is formed using balance salt solution. Any complication during surgery is noted.

Small incision cataract surgery is performed through a superior scleral tunnel of 6 mm using a crescent blade and 3.2mm keratome. A side port is made at 9 0' clock position; viscoelastic substance Hydroxy propyl methyl cellulose is injected. With the help of a capsulotomy needle continuous curvilinear capsulorrhexis of 6-7mm is performed. After good hydro dissection, nucleus is rotated & brought into the anterior chamber using a sinskey hook & removed using irrigating vectis, using adequate viscoelastic substance to protect corneal endothelium & underlying iris. Cortical matter is aspirated using a two-way irrigation aspiration cannula. A single piece/three piece PMMA IOL is inserted in-the-bag / in sulcus, if relaxing incisions are made earlier in order to remove hard nucleus. Viscoelastic substance is thoroughly aspirated & anterior chamber is formed with Ringer lactate solution.

At the end of the surgery a subconjunctival injection of 0.5ml of gentamycin & 0.5ml of dexamethasone is given in all cases.

Post operatively all patients are prescribed Dexoren-s(dexamethasone+chloramphencol) eye drops 8 times per day for 8 weeks in tapering doses and cyclopentolate eye drops once a day for 1 week.

Post operative slit lamp findings are noted down, best corrected visual acuity and fundus examination recorded in all cases on 1st post operative day and 6th weeks.

OCT done during 6th week of postoperative period.

Pseudophakic clinically significant CME is defined differently by various authors. When it is associated with a decrease in visual acuity of 6/12 or worse, it is categorized as clinically significant.[18]

Statistical Analysis: All data were analyzed by a descriptive analysis. Cramer's v test (cross tabs) was used for age, gender and eye laterality. OCT results were analyzed by using crosstabs (contingency tab analysis) and repeated measure ANOVA. Its mean values were analyzed by student T test. One way ANOVA procedure was used to analyze nucleus grading and effective phaco time. Pearson Product moment correlation was used to correlate LogMAR BCVA, Effective phaco time and macular thickness. p value less than 0.05 were considered to be statistically significant. All the data was compiled and analyzed statistically with help of following methods:

1. Descriptives
2. Cramer's V test (cross tabs)
3. Independent samples t test
4. Paired samples t test
5. Pearson's product moment correlation
6. One-way ANOVA
7. Repeated Measure ANOVA

All the statistical calculations were done through SPSS for windows

Results

Ninety five patients were included in study group, out of which 50 patients underwent phacoemulsification (PHACO) and 45 underwent small incision cataract surgeries (SICS).

Age ranged from 44-77 yrs in PHACO group and from 42-85 yrs in SICS group.

Mean age ± SD (yrs) was 61.2±8.64 yrs in PHACO group and 61.6±9.28yrs in SICS group. Majority of patients that is 78% in PHACO group and 82.2% in SICS group had nuclear sclerosis grade 2 and 3.

The mean effective phaco time (mean±SD) in seconds for grades NS1, NS2, and NS3 were 0.94 ± 1.43 sec, 3.48 ± 1.62 sec and 5.04 ± 1.40sec respectively.

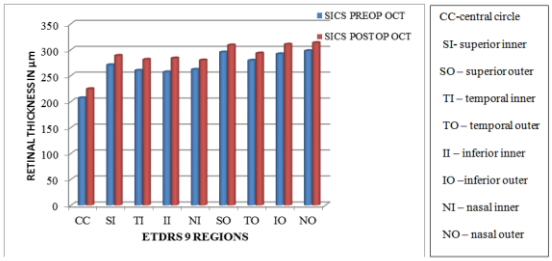
There is significant increase in effective phaco time between NS1 vs NS2, NS2 vs NS3 and NS1 vs NS3 (***P*** value =0.00).

64% patients in PHACO group and 86.7% patients in SICS group had preoperative visual acuity of 6/18 or less.

Table 1: Pre and post-operative BCVA in LogMar in both groups

Groups	No. of Patients	BCVA In LogMar (MEAN ± SD)			***P*** value
		Pre Op	Ist Day Post Op	5th, Week Post Op	0.000
Phaco	50	O.53±0.31	0.09 ± 0.10	0.009 ± 0.04	
Sics	45	0.91±0.41	0.16 ± 0.10	0.03 ± 0.08	
Total	95	0.71±0.41	0.13 ± 0.11	0.02 ± 0.07	

Graph: Comparison of preoperative and postoperative mean macular thickness in subfields in SICS group



In SICS group preoperative and post operative mean macular thickness in central 1mm subfield is 206.80 ±19.76 µm and 224.24 ±49.57 µm, the difference being significant (p=0.010). Besides central 1mm, significant difference was observed between preoperative and post operative mean macular thickness in superior inner (p=0.002), temporal inner (p=0.000), inferior inner (p=0.000), nasal inner (p=0.001), superior outer(p=0.000), inferior outer (p=0.000) and nasal outer (p=0.000) subfields except temporal outer (p=0.057) subfield.

Details of patients with cme in the present study

In the present study out of 95 patients who underwent cataract surgery, three cases showed CME;

One case in PHACO group and two cases in the SICS group.

Details of these three patients are shown in this table:

Table 2: Details of patients with CME in the present study

S.No	Mode of surgery	Preop OCT of central 1mm and 3mm parafoveal area in (µm).					Post Op OCT of central 1mm and 3mm parafoveal area in (µm).					Preop BCVA	6th Week Postop BCVA	Predisposing factors
		CC	SI	TI	I I	NI	CC	SI	TI	I I	NI			
1	PHACO (PH50)	231	316	312	293	279	288	379	370	336	398	CF1M	6/12	idiopathic
2	SICS (S17)	197	245	271	274	264	273	331	332	357	343	CF2M	6/12	idiopathic
3	SICS (S32)	226	271	272	237	249	504	430	453	458	425	6/12	6/12	one haptic of IOL in sulcus

CC - central 1mm circle.

Inner 3mm circle (SI – superior inner, TI – temporal inner, II – inferior inner, NI – nasal inner)

Conclusion

1. In the present study, overall incidence of CME is 3.2%, following phacoemulsification (2%) and small incision cataract surgery (4.4%).

2. Precise surgical technique, in the bag implantation of IOL and good postoperative care, has reduced the occurrence of CME in both the surgery groups in this study.
3. Spectralis OCT detected increase in mean macular thickness at 6 weeks postoperative follow up in phacoemulsification and small incision cataract surgery group and the increase was statistically significant in SICS group.
4. The increase in mean macular thickness postoperatively did not affect final visual outcome in both groups except in patients with clinical CME.

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