Glaucoma
Free Papers
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Orbscan Changes in Congenital Glaucoma

Dr. Bharat Patil, Dr. (Mrs.) Radhika Tandon, Dr. Namrata Sharma, Dr. Ramanjit Sihota

Congenital glaucoma is associated with various corneal changes which include an increased corneal diameter, corneal oedema, Haab's striae and altered corneal thickness. Despite controlling IOP optimally, visual outcomes are sometimes suboptimal, and this may be due to glaucomatous optic neuropathy as well as topographic changes in the cornea. Corneal abnormalities and topography in congenital glaucoma have not been studied in detail, or reported in literature, to the best of our knowledge. This study was undertaken to study the corneal clinical features and topography in congenital glaucoma, and correlate these with refractive error and best corrected visual acuity.

MATERIALS AND METHODS

Consecutive patients of congenital glaucoma aged more than 5 years were screened at the Glaucoma service for a period of 1 year. Only cooperative children, with an intraocular pressure (IOP) of < 15 mm Hg after either medical therapy or a trabeculectomy cum trabeculotomy performed at least 1 year earlier, were included. Exclusion criteria were the presence of any congenital anomaly other than iridotrabecular, any other corneal pathology, congenital cataract, uveitis, any retinal disease or advanced optic disc cupping associated with a relative afferent pupillary defect or the absence of vision on examination.

Age matched controls were consecutive patients reviewed for strabismus, with no significant refractive error, no amblyopia or any ocular pathology.

Institutional ethics committee approval was obtained and the tenets of the Helsinki declaration were observed.

A detailed ocular examination including slit-lamp biomicroscopy, applanation tonometry, pachymetry and cycloplegic refraction was done. Orbscan topography was performed on Orbscan topography system II (Bausch and Lomb, Salt Lake City, Utah). The parameters evaluated by Orbscan topography system were anterior elevation, posterior elevation, simulated keratometry (Sim K), central corneal thickness (CCT), thinnest area, white to white diameter and astigmatism.
Differences between congenital glaucoma and control eyes, as well as different types of congenital glaucoma were assessed using appropriate tests on STATA 11.2 statistical software. A p-value of less than 0.05 was considered statistically significant.

**RESULTS**

Sixty three patients over the age of 5 years, having congenital glaucoma were examined, and 29 patients who met all criteria were studied.

Primary congenital glaucoma was seen in 18/29, 62.1% while and 11/29, 37.9% had congenital glaucoma with associated ocular anomalies, Axenfeld Reiger’s syndrome 8, Axenfeld Reiger’s syndrome 8, Sturge Weber syndrome 2 and neurofibromatosis 1. The mean age of patients was 159.2 ± 3.7 months (range 72-336 months) and of controls was a 175.2 ± 60.8 months (range 72 -330 months) [p = 0.48]. Fifty of 58 eyes, 86.2%, had undergone a combined trabeculectomy and trabeculotomy surgery for the control of IOP while 13.8%, 8 eyes were controlled on antiglaucoma medications alone. The IOP in medically controlled eyes was 12.25±1.15 mm of Hg, and 12.51 ± 2.46 mm of Hg in surgically managed eyes.

The mean best corrected visual acuity in congenital glaucoma eyes was 0.68 ±0.72, while all control eyes had an uncorrected visual acuity of 0 on Log MAR scale.

A completely clear cornea was seen in 18/58, 31.0%, of congenital glaucoma eyes, while 14/58, 24.1%, had some corneal opacification without Haab’s striae - nebulomacular opacity in 8 eyes, 13.8%, and a leucomatous corneal opacity in 6 eyes, 10.3%. All corneal opacities were mostly limited to the posterior stroma and were avascular.

Haab’s striae were present in 26/58, 44.8%, eyes and were multiple and circumferentially located in 22 eyes, and were exclusively horizontal in 4 eyes. Only 3/26, 11.5%, eyes had Haab’s striae located within the central optical zone of 3 mm, and these patients had a BCVA poorer than 0.30 on log MAR scale. Twelve eyes, 46.1%, had Haab’s striae located in the paracentral zone, between 3mm and 5mm from the optical axis and 11 eyes had Haab’s striae in the periphery with a mean BCVA of 0.632± 0.5381[0.4515, (0-1.778)] log MAR and 0.624±0.460 [ 0.477, (0-1.176)] log MAR respectively p= 0.9699. There was a significantly increased posterior elevation in eyes with Haab’s striae as compared to those without Haab’s striae, 0.047 ± 0.015 µm, [0.015,( 0.01-0.07)] vs. 0.037 ±0.021 µm [0.02, (0.01-0.06) µm], p= 0.0396. Haab’s striae were more common in eyes with Primary congenital glaucoma, p=0.135, while there was no significant difference in frequency of corneal opacification in both types of congenital glaucoma. Eyes without Haab’s striae had better vision, 0.60±0.46 log MAR, as compared to eyes with Haab’s striae, 0.23±0.25 log MAR, p= 0.0135.
Primary congenital glaucoma eyes were found to have a significantly increased posterior elevation as compared to congenital glaucoma eyes with other anomalies, $0.046 \pm 0.017 \mu m$ [0.045, (0.01-0.08)] vs. $0.035 \pm 0.020 \mu m$ [0.029, (0.01-0.08)], $p = 0.0526$. All other parameters were statistically similar in these two groups.

An assessment of all congenital glaucoma eyes together versus control eyes showed that the mean posterior elevation recorded in congenital glaucoma eyes overall, $0.042 \pm 0.019 \mu m$ [0.04, (0.01-0.08)], was significantly higher than in control eyes, $0.018 \pm 0.058 \mu m$ [0.018, (0.011-0.033)], $p < 0.0001$. The mean anterior elevation in glaucoma eyes ($0.022 \pm 0.015 \mu m$) and in controls ($0.015 \pm 0.078 \mu m$) was comparable [$p = 0.08$].

The simulated keratometry values also showed a significant difference between all congenital glaucoma and control eyes. Sim K max was $43.99 \pm 0.80$ vs. $42.47 \pm 2.76$, $p = 0.01$, and Sim K min was $43.18 \pm 0.83$ vs. $40.54 \pm 2.77$, $p < 0.0001$. The mean corneal astigmatism in glaucomatous eyes, $2.09 \pm 1.40 D$ cylinder [1.65, (0.1-5.5)], was significantly higher than that in control eyes, $0.93 \pm 0.60$ cylinder [0.85, (0.2-2.3)], $p = 0.0001$. The mean K at 3 mm was significantly lower in congenital glaucoma eyes, $42.07 \pm 2.50$, as compared to control eyes, $43.60 \pm 0.85$, $p = 0.013$. All congenital glaucoma eyes had an irregular astigmatism.

**DISCUSSION**

Congenital glaucoma is relatively difficult to treat and follow up. Even after controlling IOP, the final visual acuity can be low. This study evaluated corneal topography to study their role in the best corrected visual acuity achieved after control of intraocular pressure in congenital glaucoma.

In the present study, there was a statistically significant increase in posterior corneal elevation in eyes with congenital glaucoma, as compared to control eyes. There was no significant difference in anterior corneal elevation. This increase in posterior corneal elevation could be attributed to the mechanical effect of the raised intraocular pressure on the posterior corneal surface of the more pliant cornea in children. Above a threshold, the raised IOP can lead to Descemet’s membrane tears, Haab’s striae. The presence of Haab’s striae was significantly associated with an increase in posterior corneal elevation. The increased posterior elevation of the cornea would increase the negative power of the cornea irregularly, but escape detection by routine keratometry.

There was a significantly increased irregular astigmatism in all congenital glaucoma eyes. Irregular corneal astigmatism is a known cause of visual loss in congenital glaucoma.\(^5\)

In conclusion, congenital glaucoma causes a significant increase in posterior corneal elevation and irregular astigmatism. These, together with
Glaucomatous optic neuropathy may contribute significantly to the visual dysfunction and amblyopia, commonly seen in such patients. Performing an accurate refraction assisted by corneal topography, and prescribing appropriate cylindrical correction early, would improve visual outcomes.

REFERENCES


Outcome of Lensectomy, Vitrectomy and Scleral Fixated IOL Combined with Trabeculectomy with MMC

Dr. Rathini David, Dr. George Ronnie J.

Subluxated or dislocated lens may be associated with trauma, congenital disorders (Marfans syndrome, Weil Marchesani, Homocysteinuria\textsuperscript{1,2}) and microspherophakia. The various mechanisms postulated for the glaucoma in these conditions are pupillary block, angle anomalies, phacolytic mechanism, traumatic angle recession, presence of vitreous in the anterior chamber, chronic inflammation, secondary angle closure, secondary open angle and mixed mechanisms\textsuperscript{3}.

The management of subluxated lens with secondary glaucoma is complex and may involve different treatment modalities. Medical management to control intraocular pressure, laser iridotomy to relieve pupillary block and surgical interventions. With the recent advances in pars plana vitrectomy and scleral fixated intraocular lens\textsuperscript{4,5} it has become possible to combine the removal of the subluxated lens along with glaucoma surgery. The aim of this study was to evaluate the outcome of lensectomy, pars plana vitrectomy and scleral fixated IOL combined with Trabeculectomy with mitomycin C.
MATERIALS AND METHODS

In this retrospective study we reviewed the medical records of 56 eyes of 56 patients with subuxated or dislocated lens with poor capsular or zonular support with uncontrolled IOP with or without glaucomatous optic neuropathy operated between 2003 and 2012. The data recorded included age, sex, relevant history for the etiology, visual acuity with refraction at each visit using Standard Snellens chart, a complete anterior segment evaluation, Intraocular pressure measurement by Goldmann Appplanation Tonometry, gonioscopy by 4 mirror gonioprism, a complete posterior segment evaluation including optic disc evaluation, intra operative complications, post operative complications and interventions.

Surgical success was defined as: Complete success when IOP less than 21mmHg without glaucoma medication. Qualified success was IOP of less than 21mm Hg with glaucoma medication. Success was IOP less than 21mm Hg with or without glaucoma medication.

Surgical Technique

The surgical technique involved a 23 or 20 gauge pars plana vitrectomy, lensectomy followed by a 4 point Ab externo scleral fixated IOL implantation under peribulbar or general anesthesia. After a thorough anterior vitrectomy an ‘L’ shaped partial thickness scleral flap was created at 3 and 9’clock and a 7.0mm superior corneal incision was made. A 10-0 polypropelene suture with a straight needle was passed through a inferior scleral mark 1mm from the limbus under the tunnel thorough the ciliary sulcus retrieved with 27 gauge hollow needle through the corneal incision and threaded through eyelet of the haptic of a PMMA IOL. The prolene suture was again passed from inside the eye out through the superior point in the scleral bed with guidance of a 27 gauge hollow needle. The other haptic was treated in a similar fashion, the IOL was positioned in the posterior chamber and the scleral sutures were tied in the scleral bed and the knots buried into the eye.

For the trabeculectomy a superior fornix based conjunctival flap was made, 0.4mg /ml of mitomycin C was placed in the scleral bed for a minute and washed thoroughly with ringer lactate. A triangular scleral flap 4 x 4 mm was fashioned upto 1 mm into the clear cornea before vitrectomy. A block of trabeculoscleral tissue was excised with a Kelleys punch after vitrectomy and insertion of SFIOL. The scleral flap was closed with fixed and releasable sutures using 10-0 nlyon. The conjunctiva was closed with 10-0 nylon or vicryl suture and the infusion port was removed finally.
Analysis
Statistical analysis was performed using SPSS version 14. In bilateral cases only the eye operated first was included. Demographic characteristics were analyzed using descriptive statistics, student t test (paired T test) was used to compare preoperative and postoperative measurements p value<0.05 was considered statistically significant.

RESULTS
51 eyes of 51 patients operated between year 2003 and 2012 having a minimum follow up of 3 months were included. The clinical characteristics are summarized in (Table 1).

Outcomes Measured:
Table 2 provides the details of the significant outcomes measured at the last follow up.

Intraocular Pressure
At the last follow up IOP reduced by 13.3 mm Hg and 44 eyes (86.2 %) had an IOP of 21 mm Hg or less.

Visual Acuity
14 eyes (27.4%) had a best-corrected visual acuity of log MAR 0 (20/20) at the last visit. In 9 eyes (17.7%) the visual acuity did not improve beyond 20/200 because of severe glaucomatous optic neuropathy in 2(4.0%) eyes, corneal decompensation in 1(2%) eye and other co morbid retinal pathology in 6 eyes (11.7%).

Number of glaucoma medications
39 eyes (77%) of the operated patients did not require glaucoma medications at the last follow.

Success Rate at last follow up
Complete success was achieved in 35 eyes (68.6%), Qualified success in 9 eyes(17.6%) and success in 44 eyes (86.2%).

Seven eyes (13.7%) were considered to have failed at last follow up. The causes were as follows - hypotony (IOP of less than 6 mmHg) in 1 eye (2%), 3 eyes (5.8%) had IOP greater than 21 mm Hg, 1 eye (2%) developed corneal decompensation at 2 years, 1 eye (2%) had a retinal detachment at 3 months and 1 eye (2%) had SFIOL dislocation at 9 years.

Postoperative complications and interventions
6 eyes (11.7%) developed choroidal detachment in the early postoperative period which resolved with conservative treatment. 3 eyes (5.8%) had Injection
5Fu, 12 eyes (23.5%) required removal of the releasable suture and 3 eyes (5.8%) needed argon laser suture lysis of the nylon suture.

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<td>Age</td>
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<td>Mean±SD</td>
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<tr>
<td>Range</td>
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<tr>
<td>Sex No (%)</td>
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<tr>
<td>Men</td>
</tr>
<tr>
<td>Women</td>
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<tr>
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<tr>
<td>Blunt trauma</td>
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<tr>
<td>Spherophakia</td>
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<tr>
<td>Marfans syndrome</td>
</tr>
<tr>
<td>Unknown</td>
</tr>
<tr>
<td>Gonioscopy</td>
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<tr>
<td>Angle recession</td>
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<tr>
<td>Peripheral Anterior Synechiae</td>
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<td>Postoperative values at last follow up</td>
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<td>Pvalue</td>
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<td>IOP (mmHg) Mean±SD</td>
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<td>BCVA LogMAR Mean±SD</td>
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<td>Standard Snellen acuity</td>
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<td>No of anti glaucoma Mean±SD</td>
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IOP-intraocular pressure, SD- standard deviation, logMAR- logarithm of minimum angle of resolution, BCVA – best corrected visual acuity

**DISCUSSION**

The management of subluxated or dislocated lens with associated glaucoma is a difficult challenge. More than 80% of these cases require surgical intervention for IOP control. Hence it is logical to remove ‘the primary
culprit’ the lens through the anterior aspect or the pars plana route along with vitrectomy and to do a trabeculectomy in conjunction. The 4- point Ab externo scleral fixated intraocular lens technique used in our study has been described in detail elsewhere for cases with poor capsular or zonular support. We achieved a success rate of 87% in terms of intraocular pressure control which was comparable to the success rate of 84% in a similar study done by Shin et. al. They had chosen aphakes with inadequate capsular support with glaucoma as subjects, intraoperative mitomycin C was not used and reported that 34 % required a repeat surgery for control of IOP. However in our study lensectomy was performed as part of the primary procedure.

Intra operative mitomycin C was used as antimetabolite and none required resurgeries. In our study the complications related to SFIOL were negligible in comparison to a long term study done by Brenden et. al. where 49% required repeat surgeries for the per-operative and post-operative complications. The major limiting factors of our study was its retrospective nature, the lack of description of the bleb and the huge losses to follow up.

**Conclusion**

We conclude that this combined surgery is safe and effective in terms of IOP reduction and visual rehabilitation.

**REFERENCES**

A Genetic Study on Familial Primary open Angle Glaucoma in Patients of Eastern India

Dr. Avinaba Sen, Dr. Pranab Kumar Chatterjee, Dr. Dey Ashim Kumar, Dr. Nilay Kumar Majumdar

Glaucoma is a progressive optic neuropathy with characteristic appearance of the optic disc and specific pattern of visual field defect that is associated frequently but not invariably with raised intraocular pressure. It is one of the leading causes of blindness.

Out of the different types of glaucoma, Primary Open Angle Glaucoma (POAG) is the most prevalent form worldwide. It is now known that POAG is a multifactorial complex disorder, where both environmental and genetic factors precipitate the disease. POAG have both monogenic as well as complex mode of inheritance. A positive family history of glaucoma especially in a first degree relative is definitely a risk factor for POAG.

Four underlying candidate genes which are involved in POAG pathogenesis have been detected – Myocilin (MYOC), Optineurin (OPTN), WDR36 and NTF4. Out of the above four genes, Myocilin is most commonly involved.

Aim and objective

The objective of this study is to screen the myocilin (MYOC) gene of familial primary open angle glaucoma patients from eastern India and identify any genetic defect whether they be a disease causing mutation or a polymorphism.

MATERIALS AND METHODS

This is a prospective type of study and the patients were recruited from the glaucoma clinic of Susrut Eye Foundation and Research Centre, a tertiary eye hospital. The study was approved by the ethical committee of the institution.

49 Eastern Indian familial primary open angle glaucoma patients, were selected for the study. The patients were between ages of 35 years and 87 years, 33 of them being males and 16 were females. The male to female ratio was approximately 2:1. The patients were taken during the period between July 2011 and May 2012.

Personal interview was conducted to determine profile, presence of risk factors of glaucoma like family history of open angle glaucoma, ocular trauma, past eye surgery, duration of the disease and past treatment for glaucoma. History was also taken pertaining to systemic diseases such as hypertension, heart disease and asthma and also intake of systemic medication for the same such as beta blockers. Intake of steroids were also noted.

In every case the best corrected visual acuity, applanation tonometry to
measure the intraocular pressure (IOP), anterior segment examination, gonioscopy by the Sussman four mirror gonioprism to examine the anterior chamber angle and Fundus examination was performed.

In all patients visual field examination by Humphrey Visual Field Analyzer and central corneal thickness (CCT) measurement (pachymetry) by Sonomed Pac Scan was done. Pachymetry helped in obtaining the CCT corrected IOP.

Clinically glaucoma was diagnosed in those patients who had VCDR (vertical cup disc ratio) of 0.7 or greater or asymmetry between the right and left VCDR of 0.2 or more, and a visual field defect consistent with glaucoma.

The inclusion criteria were patients with a family history of primary open angle glaucoma with clinically proven primary glaucoma, the presence of open angle on gonioscopy and with central corneal thickness corrected intraocular pressure (IOP) above 21 mm Hg. However those individuals with IOP within the normal range after medication was also included in this study.

The exclusion criteria included any secondary glaucoma, angle closure in any quadrant as seen gonioscopically, history of steroid use and any history suggestive of congenital glaucoma.

Genomic DNA was prepared from 10ml fresh whole blood using the conventional phenol chloroform method followed by ethanol precipitation. Then, the DNA was dissolved in Tris-EDTA.

The coding sequence of myocilin gene (exons) were amplified by polymerase chain reaction (PCR) in a total volume of 25 microlitres using genomic DNA, Taq polymerase, primers, dNTPs (deoxynucleotide phosphates) and magnesium chloride in a thermocycler (MJ Research, PTC 700).

Five microlitres of the PCR products were analyzed by electrophoresis in 0.8% agarose gels in an electrophoresis machine prestained in ethidium bromide and only those PCR products that demonstrated no evidence of non-specific amplification was used for DNA sequencing. PCR was repeated for those samples which showed nonspecific amplification.

The PCR products were then purified. The purification methods utilized were column purification, Exonuclease I and Shrimp Alkaline phosphatase treatments.

This was followed by sequencing of the PCR products with the help of sequence primers. The sequencing reactions were carried out in a thermocycler.

After the sequencing reaction the products were cleaned by ethanol precipitation and incubated with 5 μl of EDTA and 60μl of ethanol for 30 mins in dark. The DNA was then pelleted in a microcentrifuge and was washed twice in 60 μl of 70% ethanol.
After purification, the sequence so obtained was read in a sequencing machine AB1 3100 Avant DNA sequencer. Nucleotide changes were detected by identifying double peaks in the chromatogram due to heterozygosity and DNA Star software analysis of the sequence output data against the normal copy of myocilin.

**RESULTS**

The myocilin gene contains three exons (coding regions).

Out of the 49 patient samples selected, 33 samples could be successfully analyzed for myocilin (MYOC) exon 1 and 37 samples for exon 3. Exon 2 was not analyzed because of previous reports from around the world and also from India (displayed in the Indian Genome Disease Database and Myocilin database) of absence of any genetic mutations in it.

Successful analysis of exon 1 of MYOC in 33 patients lead to the identification of a single nucleotide polymorphism (SNP) 227 G>A (Arg76Lys), that is guanine was changed to adenine at 227th position, in 18 patients either in heterozygous or homozygous condition. This SNP was found to be in complete Linkage Disequilibrium with a promoter polymorphism –83G>A (i.e. guanine was changed to adenine at 83rd position upstream in the promoter region). The alleles of two polymorphisms were observed to always move in a single phase.

Analysis of exon 3 of myocilin in 37 patients, lead to the identification of a single mutation, p. Gly399Val (c.1196 G>T) in a single patient in heterozygous condition. This myocilin mutation resulted in substitution of a highly conserved glycine residue within the olfactomedin domain for a valine.

**DISCUSSION**

In 1993, Shefield et. al., identified the first locus associated with POAG, denominated as GLC1A, in a family having JOAG, in the long arm of chromosome 1.

In 1997 Stone et. al. identified the gene to be Myocilin (MYOC), also known to be a Trabecular Meshwork-inducible glucocorticoid response gene (TIGR), located in the GLC1A locus on chromosome 1q23-q24, from families affected with autosomal dominant JOAG and POAG.

The myocilin gene spans about 17 kilobase region in the genomic DNA. Exon 1 contains the Leucine Zipper like domain while the Exon 3 contains the Olfactomedin like domain.

It has been observed that among three exons of MYOC, majority of the mutations (over 90%) are clustered in exon 3, rarely in exon 1 and none has been detected so far in exon 2.

Though the exact pathophysiology underlying MYOC mediated glaucoma...
pathogenesis is yet to be elucidated, it has been hypothesized that an increased level of myocilin as well as mutated form of the protein forms aggregates within the trabecular meshwork (TM) resulting in malfunction or death of TM cells. Overall there appears to be an increased resistance to the outflow of aqueous and this results in elevated IOP leading to glaucomatous change.

In this study all the samples could not be analyzed because of failures in the PCR amplification and or the sequencing reactions. Failure in PCR amplification can occur due to inappropriate enzyme concentration, non equivalent concentrations of dNTPs, incomplete denaturation of target template and non optimum concentrations of magnesium. Failure in sequencing reactions can occur due to poor quality of DNA, degraded synthesis primer, insufficient PCR products, the water used contains sequencing inhibitor and dye blockage while identifying sequence changes in a sequencer which uses chromatographic techniques.

Conclusion
To conclude, this study is one of the first such in India to work only with familial primary open angle glaucoma cases.

The percentage of mutation found in this study (2% of the total number of cases) is nearly the same as that found by similar other studies done in India and worldwide such as those by Banerjee et. al. and Alward et. al.

The mutation (Gly399Val) is for the first time being reported from India though it has been reported previously in a Guyanese family.

The patient with the myocilin gene mutation should be advised that the younger generation of his family and all his 1st degree relatives should undergo a molecular genetic test to find out whether they have any mutation and should also be screened for glaucoma at regular intervals by an ophthalmologist.

The study had the limitation of a small sample size and there is also a need of more studies like this.

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Ganglion Cell Complex Scan in the Early Prediction of Glaucoma

Dr. Sunil Ganekal, Dr. Krishna Prasad K., Dr. Hegde Sharat Shivaramaiah, Dr. Vikram Jain

Optical coherence tomography (OCT) has allowed in vivo quantitative analysis of the peripapillary retinal nerve fiber layer (RNFL), and measuring the RNFL has been useful for diagnosing glaucoma (Huang ML
and Chen HY, 2005: Parikh RS et al. 2007). However, the normal variation of the peripapillary RNFL and pathological peripapillary changes make that diagnosis of glaucoma difficult when interpreting OCT peripapillary RNFL measurements by comparing them with the normative database. Retinal ganglion cells encompass three layers in the retina, 1) the retinal nerve fiber layer (RNFL) is made up of the ganglion cell axons, 2) the ganglion cell layer (GCL) is made up of the ganglion cell bodies, and 3) the inner-plexiform layer (IPL) is made up of the ganglion cell dendrites. All three layers, collectively known as the ganglion cell complex (GCC) (Fig 1). Fourier Domain OCT can measure the thickness of the macular GCC, which extends from the internal limiting membrane to the inner nuclear layer including the ganglion cell layer and provides a unique analysis of the percent loss of these layers compared to an extensive normative database. Glaucoma is characterized by selective loss of retinal ganglion cells (RGC) (Garway-Heath DF et al. 2000: Harwerth RS et al. 1999; Zeimer R et al. 1998) Because the macular region contains more than 50% of all the RGCs, assessing ganglion cell changes in the macular region may be useful for diagnosing glaucoma instead of measuring peripapillary RNFL thickness (Ishikawa H et al. 2005: Tan O et al. 2008: Van Buren JM, 1963). RTVue-100 (Optovue, Fremont, California) is a commercially available OCT device with Fourier-domain (FD) technology. Although previous studies have shown the utility of peripapillary RNFL measurements in glaucoma patients, little is known about comparison between RNFL thickness and macular GCC or the diagnostic ability of GCC using FD-OCT. In this study, we used FD-OCT to compare measuring macular GCC and peripapillary RNFL thickness for early diagnosis of glaucoma.

MATERIALS AND METHODS
Forty Participants [n=20 glaucoma suspects (GS; normal SAP, C/D ratio > 0.5 or asymmetry > 0.2 and/or ocular hypertension) n=20 glaucoma patients (MD < -12 dB, glaucomatous optic neuropathy)] were enrolled. The study was approved by our institutional review board (IRB) and complied with the tenets of the Declaration of Helsinki. Informed consent was obtained from all participants. All eyes underwent applanation tonometry, dark room gonioscopy, stereoscopic optic disc photography, red-free RNFL photography and RTVue FD-OCT after pupillary dilation to a minimum diameter of 5 mm on the same day. Peripapillary RNFL and perifoveal GCC thickness measurements were obtained using RTVue-100 by the same operator in the same visit. Standard Automated Perimetry was performed with the Octopus 3.1.1 Dynamic 24-2 program.

OCT Measurements
The average thickness of the GCC and RNFL was measured using RTVue-100
Glaucoma Free Papers

(software version: 4.0.5.39), which acquires 26,000 A scans per second and has a 5 μm depth resolution in tissue. The RNFL thickness was determined by the nerve head map 4 mm diameter (NHM4) mode, which measures RNFL thickness by recalculating data along a 3.45 mm diameter circle around the optic disc using a map created from en face imaging utilizing six circular scans ranging from 2.5 to 4.0 mm in diameter (587 or 775 A scans each) and 12 linear data inputs (3.4 mm length, 452 A scans each). Disc area measurements were also obtained using the NHM4 mode. GCC parameters were obtained by the MM7 protocols, centered 1 mm temporal to the fovea. This protocol uses one horizontal line with a 7 mm scan length (934 A scans) followed by 15 vertical lines with a 7 mm scan length and 0.5 mm interval (800 A scans) (Fig 2A). The GCC thickness was measured from the internal limiting membrane to the inner plexiform layer boundary. The focal loss volume (FLV) as the integral of deviation in areas of significant focal GCC loss and global loss volume (GLV) as the sum of negative fractional deviation in the entire area were also computed. Images with a Signal Strength Index less than 35 with overt misalignment of the surface detection algorithm or with overt decentration of the measurement circle location were excluded. RNFL and GCC thicknesses in the normal range were represented by green backgrounds, those that were abnormal at the 5% level were represented by yellow backgrounds, and those that were abnormal at the 1% level were represented by red backgrounds. The statistical analysis was performed with the SPSS 10.1 (SPSS Inc. Chicago, IL, EUA). Results were expressed as mean ± standard deviation and a p value of 0.05 or less was considered significant.

RESULTS

Patients were categorized into two groups: the glaucoma suspects (n=20) and glaucoma groups (n=20). The mean age of the participants was 50.69±15.90 years (range 22–77 in the glaucoma suspect group; 22–78 in the glaucoma group). There was no difference in Optic Disc area (p=0.35) and vertical Cup/Disc ratio (p=0.234) comparing both groups (Table 1). But there was a statistical significant difference in average RNFL thickness (p=0.004), Superior RNFL thickness (p=0.006), Inferior RNFL thickness (p=0.005) and average GCC (p=0.03) between suspects and glaucoma patients (Table 2). The GCC thickness showed strong correlations with RNFL thickness (correlation coefficient=0.763, p<0.001). Fifteen of 40 (38%) eyes had an abnormal GCC and 5 of 40 eyes (13%) had an abnormal RNFL thickness in the glaucoma suspect group. 39 of 40 eyes (98%) had an abnormal GCC and 36 of 40 eyes (90%) had an abnormal RNFL thickness in the glaucoma group.

DISCUSSION

Although glaucoma is clinically defined as optic disc cupping with
corresponding visual field defects, the underlying disease process in glaucoma is the loss of RGC (Quigley HA et al. 1989; Quigley HA et al. 1980; Sommer A et al. 1977). Approximately one-third of the RGC population resides within the posterior pole. In the macula, the RGC layer is more than one cell layer thick with an RGC body diameter 10 to 20 times larger compared to their axons. In addition, the central retina has less variability in cell density compared with

Table 1: Shows the optic disc area and the vertical C/D ratio between two groups

<table>
<thead>
<tr>
<th></th>
<th>Optic Disc Area</th>
<th>Vertical C/D ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glaucoma Suspects</td>
<td>2.52±0.72</td>
<td>0.78±0.10</td>
</tr>
<tr>
<td>Glaucoma</td>
<td>2.33±0.46</td>
<td>0.83±0.09</td>
</tr>
</tbody>
</table>

Table 2: GCC Vs. RNFL thickness

<table>
<thead>
<tr>
<th>GCC</th>
<th>VS RNFL Thickness</th>
<th>RNFL Thickness</th>
<th>Superior</th>
<th>Inferior</th>
<th>GCC Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Superior</td>
<td>Inferior</td>
<td>GCC</td>
<td></td>
</tr>
<tr>
<td>Glaucoma</td>
<td>Suspects</td>
<td>112.41 ± 10.92</td>
<td>110.42 ± 9.91</td>
<td>114.38 ± 13.61</td>
<td>95.40 ± 8.11</td>
</tr>
<tr>
<td>Glaucoma</td>
<td></td>
<td>98.57 ± 13.68</td>
<td>100.45 ± 16.35</td>
<td>98.49 ± 15.79</td>
<td>86.06 ± 12.43</td>
</tr>
</tbody>
</table>
peripheral retina (Glovinsky Y et. al. 1993). Thus detecting RGC loss in the macula may allow earlier detection of glaucoma in some cases. The higher resolution RTVue system allows for more specific segmentation where only the retinal layers associated with the ganglion cells can be analyzed. This method of segmenting out the ganglion cell complex targets the layers directly associated with the ganglion cells, as opposed to the limited methods of the Stratus which can only analyze the entire retina thickness. In the past, most investigators have focused on the comparison of measurements at the macula and the optic disc. This was due in part to the fact that most commercial imaging instruments yielded one or the other. Now, many techniques are available for obtaining both measurements in one session. The perifoveal region yields information on the ganglion cells and their axons located at the centre of the macula, which are represented in perimetry only by a few points at the centre of the visual field, whereas the peripapillary region reflects the entire retina. The time course of the disease and for treatment decisions may differ between eyes with a well-preserved central macula and damaged peripheral retina, and one with damage in both areas. By including both regions, it may be possible to gain new knowledge on the process of glaucomatous damage through an additional role for measuring GCC in glaucoma assessment. Ishikawa H et. al. (2000) developed a software algorithm to perform automatic retinal layer segmentation in the macula for the commercially available Stratus TD-OCT and reported that macular inner retinal layer thickness measurements could indeed be used to discriminate normal from glaucomatous eyes. They found that the outer retinal layers were not affected in glaucoma. However, one of the limitations of the study was variable scan quality. Over one-third of their scans on glaucomatous eyes had to be excluded from segmentation analysis due to poor quality scans related to speckle noise and uneven tissue reflectivity. The authors suggested that higher resolution and improved signal quality (higher signal-to-noise ratio), as provided by FD-OCT, may be needed for better quality image acquisition to allow accurate retinal layer segmentation. Greenfield et. al. (2003) reported that OCT-derived macular thickness was well correlated with changes in visual function and RNFL structure in moderately advanced glaucoma. They reported a strong correlation between mean macular thickness and visual field mean deviation (R2=0.47, p<0.001), and suggested that reduced macular thickness could be a surrogate for loss of RGCs in glaucoma. Tan O et. al. (2009) showed that the GCC average measured by the RTVue FD-OCT were significantly better at diagnosing glaucoma in the perimetric group, compared to the macular retinal thickness(MR) average measured by either FD-OCT or TD-OCT. Thus, isolating GCC from the outer retina improved the diagnostic power of the macular measurement. This could be explained by the fact that the outer retina, which is not much affected by glaucoma, takes up 65% to 70% of total retinal thickness and, therefore,
could contribute variation in thickness that decreases discriminant power. The diagnostic power of GCC average was also higher than that of MR in the discrimination between pre-perimetric group (PPG) and normal eyes, but the advantage was not statistically significant. Macular GCC measurement by OCT may detect pre-perimetric glaucoma earlier in those cases where the ganglion cell loss is more predominantly macular rather than peripheral (Tan O et. al. 2009). The addition of GCC data to NFL increased glaucoma detection rate from 78% to 87% in the perimetric group and from 45% to 56% in the pre-perimetric group (Tan O et. al. 2009). Tan O et. al. (2009) in their study showed GCC detected an additional 9% of perimetric glaucoma cases and 11% of pre-perimetric glaucoma cases that were not detected by NFL. These results are consistent with our results, 38% eyes had an abnormal GCC and 13% had an abnormal RNFL thickness in the glaucoma suspect group, 98% had an abnormal GCC and 90% had an abnormal RNFL thickness in the glaucoma group. The reliability of the GCC increases in the glaucoma group than in the suspects or pre-perimetric group. Even though our results show that GCC imaging can detect glaucoma cases inspite of normal RNFL thickness (Fig 2B and 2C), further prospective studies are needed before such a definitive conclusion is made due to a small sample size and also we did not compare the two groups (Glaucoma and Glaucoma suspects) with the normal group. The ability to diagnose glaucoma with macular GCC thickness was comparable to peripapillary RNFL thickness. Macular GCC thickness measurements may be a good alternative or a complementary measurement to RNFL thickness and visual field test in the clinical evaluation and management of glaucoma.

Comparison of Quality of Life in Cases and Controls using Glaucoma Quality of Life–15 Questionnaire

Dr. Pallak Kusumgar, Dr. Sulatha V. Bhandary, Dr. (Mrs.) Lavanya G. Rao, Dr. Krishna Addoor Rao, Dr. Smita Kapoor

Glaucoma is the second-leading cause of blindness worldwide and is one of the leading causes of preventable blindness. For the year 2020, model calculations showed that the number of people affected by Glaucoma would increase by 20 million, and that India would become second overall in number, surpassing Europe.¹

Glaucoma is a chronic, slowly progressive irreversible blinding condition, requiring lifelong medication. The efficacy of treatment by convention is
evaluated by clinical indicators like, visual acuity, intra ocular pressure (IOP) and perimetric findings which are essentially objective measures. However this chronic disease leads to physical, psychological and social dysfunction and thus affects individual’s daily life.

Glaucoma affects daily life both through visual deterioration and by the glaucoma treatment itself. Glaucoma patients can lose quality of life (QoL) for several reasons: the diagnosis itself, the functional loss, the inconvenience of the treatment, the side effects of the treatment and the cost of the treatment.

Thus the main goal of glaucoma treatment is not only to maintain target IOP but also to maintain the patient’s quality of life (QoL), which includes preservation of visual function, at a sustainable cost.

Several QoL questionnaires like Short Form-36 (SF-36) or Short Form-12 (SF-12)4,9,10,11 the 25- item National Eye Institute Visual Function Questionnaire (NEI VFQ-25)2,10,12 the Visual Activities Questionnaire (VAQ)7,13 the Activities of Daily Vision Scale13 have been validated and correlate closely with clinical indices of glaucoma severity, one of them is the Glaucoma Quality of Life-15 (GQL-15). In our study we have used the GQL-15 as an indicator to assess the of quality of life in glaucoma patients.

Aim

The aim of this study was to evaluate the quality of life in patients with glaucoma and compare it with control group using Glaucoma Quality of Life-15 (GQL) questionnaire.

MATERIALS AND METHODS

This was a cross sectional study, carried out in the out-patient department of Ophthalmology, in tertiary care hospital, during the period of September 2012-May 2013, after obtaining ethical committee clearance.

Sample size- Anticipating SD of 8 and average GQL-15 score among cases double that of controls, for power of 80% and 95% confidence level 40 subjects in each group were needed.

Patients

A total of 50 patients (diagnosed to have POAG) and 50 healthy controls who had no family or personal history of glaucoma, were included. All eligible participants had to be at least 18 years old and be able to speak and read English or kanada fluently. Patients with any nonglaucomatous condition or disease affecting visual function, such as cataract, diabetic retinopathy, macular degeneration, or any other retinal pathology were excluded. Also patients suffering from any co-morbid physical illness which is severe enough to cause its own psychological morbidity, or those who were not fit mentally
to be subjected to the scale were excluded. Primary open angle glaucoma was diagnosed on the basis of an open angle, untreated IOP >21mm of Hg, characteristic glaucomatous optic disc changes, and glaucomatous visual field defects.

**Methodology**

After obtaining informed consent all the subjects (cases and controls) were interviewed for the demographic data such as age, sex, occupation and subjected to general and systemic examination. History regarding number, type, and duration of anti-glaucomatous medical therapy (where applicable), presence and duration of systemic illness like diabetes mellitus were also recorded.

All eyes underwent a full ophthalmologic examination, which included recording of visual acuity, detailed anterior segment and fundus examination (under mydriasis), calibrated Goldmann applanation tonometry and gonioscopy. Cases underwent Humphrey 30–2 static threshold perimetry examination (reliable fields).

All the cases and the controls were then subjected to GQL-15 questionnaire. For the purpose of analyses, cases were stratified by glaucoma severity using Hadopp-Parish-Anderson (H-P-A) criteria for visual field defect as early, moderate and severe.

GQL-15 questionnaire consists of 15 questions to be answered on a 5-point wherein 0 signified abstinence from activity owing to nonvisual reasons, 1 indicated no difficulty, and 5 represented severe difficulty. These 15 items, addresses 4 factors of visual disability: (1) central and near vision; (2) peripheral vision; (3) dark adaptation and glare; and (4) outdoor mobility. There are six questions relating to peripheral vision, six relating to glare and dark adaptation, two for central and near vision and one for outdoor mobility. For comparison the subscale scores were converted to percentage score. Higher subscale scores represented more difficulty with vision-related activities and poorer G-QoL.

**Statistical analysis**

Statistical analysis was performed using SPSS 20.0. Categorical data was expressed in terms of rates, ratios and percentages. Continuous variables were expressed as mean ± standard deviation (SD). Comparisons between variables were done using a Chi-square test. A probability value (‘p’ value) of < 0.05 was considered as statistically significant

**RESULTS**

50 patients with glaucoma and 50 subjects without glaucoma meeting the
eligibility criteria were enrolled. The mean age of the patients with glaucoma was 61 [standard deviation (SD)10; range, 43 to 86] with 58% being male versus 57.14 years (SD 8; range, 42 to 72) for controls, 50% being male. There were 19(38%) cases each in mild and moderate stage of glaucoma and 12(24%) patients in severe stage. The mean GQL-15 score of cases was 32.34±9.1 and that of control was 14.62±1 (P<0.001). Significant relationship was found between GQL scores and increasing severity of glaucoma. The mean GQL-15 scores of patients with early, moderate, and severe glaucoma were 22.7(±3.3), 34.2(±2.5), 44.6(±2.6) (respectively) (P<0.001). A statistically significant difference was also found in the GQL-15 score of controls and cases in early glaucoma stage (p<0.001). Subscale percentage scores showed glare and dark adaptation was most problematic to majority, followed by peripheral vision, central and near vision and outdoor mobility. Their mean percentage score were- 48%, 47%, 38% and 36% respectively.

**DISCUSSION**

Our study, on a South Indian glaucoma population, demonstrates a consistent pattern of worsening of functioning (higher GQL-15 scores) with increasing amounts of VF loss across the disease spectrum.

Several scales have been introduced for measuring QOL in glaucoma patients. One of them-GQL-15 is specific for glaucoma. This concept of a glaucoma-specific questionnaire was introduced by Nelson and colleagues in their pilot study, which was followed up with a validation of a shorter GQL-15. Both studies demonstrated that problems encountered by patients with glaucoma in everyday life were reflected in their performance on the GQL and GQL-15 respectively.

The subscale scores also afforded us the opportunity to examine loss of G-QoL in the context of daily activities that may be especially troublesome for patients with glaucoma. In particular, glare and dark adaptation were most disabling for patients with glaucoma in our study. This finding extends the observations of Nelson et. al and the Collaborative Initial Glaucoma Treatment Study (CIGTS) which also found these factors to be the most troublesome for patients with early glaucoma.

However, unlike Nelson et. al who observed a marked difference in GQL-15 summary performance measures between patients with mild and severe glaucoma only, in our study the differences among patients in all stages of glaucoma were statistically significant. We found a statistically significant difference between the controls and early stage glaucoma patients, suggesting that even early stages of disease affect the quality of life. This emphasises the importance of early diagnosis and intervention.
Our results are in accordance with those from developed countries that have demonstrated the deleterious effects of VF loss on vision-specific functioning in glaucoma.8-17 The population-based Los Angeles Latino Eye study (LALES) used the National Eye Institute-Visual Function Questionnaire (NEIVFQ) and reported that greater VF loss in patients with OAG impacts on the vision-related QOL.14

Using the same GQL-15 as in the present study, Goldberg et. al. reported that the GQL-15 scores differ significantly among patients with mild, moderate, and severe glaucoma, demonstrating a trend of poorer functioning with increasing severity in an Australian clinic-based sample.15 In a study of a Singapore hospital-based glaucoma sample that also used the GQL-15, Wang et. al. demonstrated a significant and independent association between the severity of bilateral glaucoma and functioning.16 Taken together, these findings suggest that glaucoma impacts functioning transcending all barriers such as ethnicity, race, and culture.

**Conclusion**

In conclusion, POAG reduces QOL even in the early stages of the disease, as there was a significant reduction in the QOL of patients with mild glaucoma compared with the controls. It showed a clear trend of worsening QOL scores with increasing severity of disease. The correlation observed between QOL scores and objective measures of visual function suggest that inclusion of QOL assessment in clinical practice could be highly informative to both patient and doctor and would also help in providing the patients with best possible treatment not only in terms of good vision but also maintaining or improving their overall quality of life.

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**Outcomes of Surgical Repair of Late Leaking Blebs**

**Dr. Arpita Basia**

Late leaking blebs are thin ischemic blebs which leaks months to years after (GFS) glaucoma filtering surgery.¹ Vision threatening complications of leaking bleb include shallow anterior chamber, hypotonic maculopathy, choroidal detachment, cataract and endophthalmitis.²³ Surgical procedures described for bleb repair are conjunctival patch graft, conjunctival advancement with or without scleral patch grafts.⁴⁵

**MATERIALS AND METHODS**

Single center, non comparative, retrospective case series including 56 eyes of 54 patients underwent either conjunctival autograft or conjunctival advancement for bleb leak or thin blebs with hypotony. Early bleb leaks < 3 months of GFS or leaks due to trauma were excluded from study.
Diagnosis of bleb leak

Positive Seidel’s Test. Hypotony defined as an intraocular pressure of less than 6 mmHg on two consecutive occasions

Conjunctival Advancement

A fornix based conjunctivo-tenon flap made behind the bleb and was undermined and pulled towards limbal region. Necrotic tissue around the fistulous track removed and the intensity of leakage assessed. Incision made at the anterior limbal region and debridement of the epithelial lining performed. Watertight closure achieved by suturing conjunctiva at the incision with 10-0 nylon suture.

Free Autologous Conjunctival Graft

Avascular bleb measured with calipers and 2 mm added to measure the donor conjunctiva to allow for postoperative shrinkage of the bleb. Globe rotated superiorly to expose inferior conjunctiva, was measured and harvested along with the tenon. Conjunctival graft sutured over the avascular bleb maintaining the limbal orientation. The limbal edge of the harvested conjunctiva anchored to the shallow corneal groove created with mattress sutures using 10–0 nylon. Antibiotic, steroid, and cycloplegic eye drops were administered postoperatively. All patients were reviewed at day 1, week 1 and week 6.

RESULTS

<table>
<thead>
<tr>
<th>Table 1: Demographic and baseline characteristics of subjects</th>
<th>Conjunctival advancement (n=23)</th>
<th>Conjunctival autograft (n=33)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>49 ± 18</td>
<td>47 ± 15</td>
<td>0.70</td>
</tr>
<tr>
<td>Gender (males:females)</td>
<td>15:8</td>
<td>27:6</td>
<td>0.16</td>
</tr>
<tr>
<td>Primary surgery</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Iridenclesis</td>
<td>1 (4.4%)</td>
<td>2 (6.1%)</td>
<td>0.98</td>
</tr>
<tr>
<td>- Trabeculectomy</td>
<td>15 (65.1%)</td>
<td>21 (63.6%)</td>
<td></td>
</tr>
<tr>
<td>- Trabeculectomy MMC</td>
<td>6 (26.1%)</td>
<td>8 (24.2%)</td>
<td></td>
</tr>
<tr>
<td>- Cataract + Trabeculectomy</td>
<td>1 (4.4%)</td>
<td>2 (6.1%)</td>
<td></td>
</tr>
<tr>
<td>Pre bleb repair</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Visual acuity*</td>
<td>0.4 (0.1, 1.8)</td>
<td>0.4 (0.2, 1.0)</td>
<td>0.98</td>
</tr>
<tr>
<td>IOP</td>
<td>8.8 ± 4.6</td>
<td>6.5 ± 4.1</td>
<td>0.06</td>
</tr>
<tr>
<td>Duration between primary surgery and bleb repair*</td>
<td>45 (33, 77)</td>
<td>115 (42, 177)</td>
<td>0.04</td>
</tr>
</tbody>
</table>
**MMC: Mitomycin C; IOP: Intraocular Pressure**

Mean interval between GFS and bleb revision in Conjunctival advancement group is 45 months and Conjunctival autograft group is 115 months. So Conjunctival autograft was performed in eyes where bleb leak appeared late.

Outcome of conjunctival advancement and conjunctival autograft procedures for bleb repair

<table>
<thead>
<tr>
<th></th>
<th>Conjunctival advancement</th>
<th>Conjunctival autograft</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post bleb repair</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Visual acuity</td>
<td>0.3 (0.1, 1.0) 15.1 ±</td>
<td>0.4 (0.1, 1.0) 12.2 ±</td>
<td>0.66</td>
</tr>
<tr>
<td>- IOP</td>
<td>8.9</td>
<td>4.2</td>
<td>0.11</td>
</tr>
<tr>
<td>Improvement in visual acuity</td>
<td>0.0 (-0.2, 0.5)</td>
<td>0.0 (-0.1, 0.2)</td>
<td>0.78</td>
</tr>
<tr>
<td>Increase in IOP</td>
<td>6 (2, 9)</td>
<td>5 (2, 8)</td>
<td>0.68</td>
</tr>
<tr>
<td>Number of eyes requiring antiglaucoma medications</td>
<td>5</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Complete success probability</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- At 6 months</td>
<td>70%(45-86)</td>
<td>80%</td>
<td>(60-90)</td>
</tr>
<tr>
<td>- At 1 year</td>
<td>56%(32-76)</td>
<td>71%</td>
<td>(50-85)</td>
</tr>
<tr>
<td>- At 2 years</td>
<td>51%(26-71)</td>
<td>71%</td>
<td>(50-85)</td>
</tr>
<tr>
<td>- At 3 years</td>
<td>51%(26-71)</td>
<td>46%</td>
<td>(20-68)</td>
</tr>
<tr>
<td>- At 4 years</td>
<td>43%(18-65)</td>
<td>71%</td>
<td>(50-85)</td>
</tr>
<tr>
<td>- At 5 years</td>
<td>43% (18-65)</td>
<td>34%</td>
<td>(10-60)</td>
</tr>
<tr>
<td>Qualified success probability</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- At 6 months</td>
<td>90% (66-97)</td>
<td>96%</td>
<td>(76-99)</td>
</tr>
<tr>
<td>- At 1 year</td>
<td>90% (66-97)</td>
<td>96%</td>
<td>(76-99)</td>
</tr>
<tr>
<td>- At 2 years</td>
<td>84% (58-95)</td>
<td>96%</td>
<td>(76-99)</td>
</tr>
<tr>
<td>- At 3 years</td>
<td>78% (50-91)</td>
<td>96%</td>
<td>(76-99)</td>
</tr>
<tr>
<td>- At 4 years</td>
<td>71% (42-87)</td>
<td>96%</td>
<td>(76-99)</td>
</tr>
<tr>
<td>- At 5 years</td>
<td>71% (42-87)</td>
<td>77%</td>
<td>(41-93)</td>
</tr>
<tr>
<td>Follow-up duration (months)</td>
<td>41 (4, 75)</td>
<td>23 (7, 59)</td>
<td>0.28</td>
</tr>
</tbody>
</table>

Success defined as resolution of bleb leak or hypotony with IOP between 6 and 21mm Hg as complete without any antiglaucoma medication and/or additional surgery. Qualified with or without medications. Failure as persistent bleb leak requiring repeat surgery or persistent hypotony (IOP<6 mm Hg) or IOP>21mm Hg despite medical treatment.

Qualified success rate was 82.14% (46/56). Complete success rate was 59% (33/56). Failure rate was 17.86% (10/56). In 3 patients IOP was not under control even with medication. 3 remained hypotonous. 4 patients developed complication i.e. 2 blebitis and 2 bullous keratopathy.
DISCUSSION

Success rates after bleb repair varies between 60-90% 6-8 . Our success rate of 82.14% is consistent with the published literature. Increase in IOP and visual acuity post bleb repair was similar in both conjunctival advancement and autograft group. Repeat intervention as well as early and late postoperative complications post bleb repair was also similar with the 2 procedures. So both commonly performed procedures are safe and effective in closure of leak and reversal of hypotony.

Conclusion

Bleb excision with conjunctival autograft and conjunctival advancement both are safe and successful procedures for bleb repair. Both are effective in closure of leak and reversal of hypotony with good IOP control and minimal postoperative complications. However, patients should be educated and informed of the postoperative possibility of requiring medical or surgical intervention for IOP control after bleb repair.

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Surgical Outcome of Adjunctive Anterior Lens Capsule Implantation in Phacotrabeculectomy

Dr. Sujata S., Dr. Vanila C.G., Dr. Nelson Jesudasen C.A.

Trabeculectomy remains the gold standard for external filtering surgery. Surgical failure is mainly due to scarring at the level of the scleral flap or conjunctiva-Tenon-episcleral interface. Many foreign materials designed to aid drainage in glaucoma surgery; horse hair, silk thread, nylon, gelatin film, silicon tubes, and amniotic membrane and anti-fibrotic agents primarily 5-fluorouracil and mitomycin-C (MMC) have been used to reduce scarring. They are too expensive for most patients in developing countries to use. Side effects observed with the use of antifibrotics are corneal and conjunctival toxicity, hypotonic maculopathy, endophthalmitis, and late onset bleb leak.1

The anterior lens capsule (ALC), one of the thickest basement membrane of our bodies, is a constitutive basement membrane of the lens. Moreover, it does not result in fibrosis or rejection reaction. The presence of ALC itself or some cytokine released may keep fibroblasts from forming adhesion. ALC for chronic corneal ulcers or as a support material in retinal pigment epithelium cell transplantation has been studied.1,2

Formation of a drainage bleb over an accidental inclusion of anterior capsular tag into the cataract wound has been observed. Hogan and Zimmerman reported that the lens capsule or its incarceration may result in “localized areas of non-union” of the wound.3

The fact that cataract and glaucoma frequently coexist, we studied our results of phacotrabeculectomy by using a readily available, autogenous seton, the anterior lens capsule, as an inclusion under the scleral flap in these eyes.

MATERIALS AND METHODS

In this prospective study from July 2012 to March 2013, patients with coexisting cataract and primary open angle glaucoma, uncontrolled on maximal medical therapy, were randomly assigned to single site phacotrabeculectomy alone (Group-1, 20 eyes) or phacotrabeculectomy and subscleral ALC implantation (Group-2, 20 eyes). The research followed the tenets of the Declaration of Helsinki. Informed consents were obtained from patients wherein all details of the procedure were explained with emphasis on the intended outcome. The research was approved by the institutional review board.
The inclusion criteria for this study were a visually significant cataract and an uncontrollable IOP despite maximum tolerable medical treatment. The cut-off value for the IOP was 21 mm Hg. Patients with PNAG, pseudoexfoliation, uveitis, poorly dilating pupils, previous ocular surgery were excluded from the study. All patients had a thorough ocular examination which involved assessment of best corrected visual acuity (BCVA), slit lamp biomicroscopy, measurement of IOP using a Goldmann applanation Tonometer, gonioscopy and dilated fundus examination and preoperative fields and optical coherence tomography wherever possible.

**Surgical Technique**

All surgeries were performed under peribulbar anesthesia by a single surgeon and followed up by an ophthalmologist who was masked to the type of surgery performed. A single site phacotrabeculectomy was performed in all cases. Anterior capsulorrhexis was performed after staining with trypan blue and the flap was removed and placed in ringer lactate solution. The nucleus was removed by phacoemulsification using the stop and chop technique by Infinity Machine (Alcon, TX). The cortex was removed with bimanual irrigation aspiration, followed by meticulous scraping of the anterior leaf of the capsule and polishing of the posterior capsule.

Sclerostomy was done using a Kelley’s punch and a wide basal iridectomy was then performed. In surgeries where the ALC was used, it was washed twice with saline before use. It was laid flat under the scleral flap and its edge was included in the 10-0 nylon suture. Conjunctiva was closed by interlocking continuous sutures using 10-0 monofilament nylon.

**Postoperative Care**

Postoperative medications included steroid antibiotic combination one hourly for a day followed by six times daily for a week and subsequently tapered over three weeks period in both the groups. The patients were seen on the first day, first week, first month and every month subsequently till the end of follow up. The follow up was also altered according to the clinical condition seen in each visit.

The presence of the ALC was ensured in the first visit, by the blue tinge that appeared beyond the edges of scleral flap. Monitoring of bleb status, thorough slit lamp examination of anterior segment, fundus examination, intraocular pressure (IOP) and visual acuity were done at 1, 2, 4 days, 2 weeks and every month postoperatively. Follow-up was done for a period of 9 months.

An IOP of 21 mm Hg or lower following surgery was considered “complete success” and if achieved after additional antiglaucoma medications, was considered qualified success. Patients with an IOP of > 21 mm Hg regardless of medications or had progressive glaucomatous atrophy with visual field loss were classified as surgical failures. The filtering bleb was graded as: 1)
polycystic functioning bleb, 2) diffuse functioning bleb, 3) flat nonfunctioning bleb and 4) encapsulated nonfunctioning bleb.

Statistical analysis

Data was subjected to statistical analysis using SPSS version 13.0 (SPSS Inc, Chicago, IL) and all tests were 2 tailed, a probability value of <0.05 was considered statistically significant.

RESULTS

The mean age of patients in group-1 was 65.13±7.3 yrs and group-2 was 64.75±6.45 yrs. The male female ratio was 2:3 in group-1 and 9:11 in group-2. In group-1, the mean post-operative IOP (13.30± 2.8 mmHg) was significantly lower (p=0.001) than the mean pre-operative IOP (25.8± 6.4 mmHg). Similarly, in group-2, the mean post-operative IOP (18.25± 2.6 mmHg) was significantly lower (p =0.031) than the mean pre-operative IOP (25.83± 9.8mmHg). All eyes in both group had improved visual acuity because of cataract removal. The mean preoperative BCVA was 0.35± 0.16 in group-1 and 1.18± 1.16 in group-2. The mean postoperative BCVA was 0.19± 0.11 in group-1 and 0.24±0.16 in group-2. The improvement in BCVA from pre-op values to final post-op value was statistically significant (p= 0.000) in group-1 and p=0.015 in group-2. The change in IOP before and after surgery was 12.46± 6.17 in group-1 and 7.58 ±10.63 in group-2 (p=0.127). A diffuse bleb was achieved in most cases in both groups however the blebs were more elevated and less vascularized in the ALC group. There were no cases with large cystic blebs in either group. In the ALC group the mean number of antiglaucoma medications reduced from 1.42 preoperatively to none at the last postoperative visit. In group-1 the mean number of antiglaucoma medications reduced from 1.6 preoperatively to 0.6 medications at the last postoperative visit. There were no intra-operative complications noted in either group.

Post-operative iridocyclitis was mild in both groups and resolved with topical steroid antibiotic combination therapy. Choroidal detachment and shallow anterior chamber occurred in two eyes in group-1 and none in group-2. The patients with choroidal detachment received systemic steroids with tapering dosage for 12 days. None of the patients needed choroidal tapping or a second intervention.

DISCUSSION

Treatment of glaucoma with significant cataract is not an infrequent condition, as both are prevalent in the elderly. Cataract procedure performed in eyes with a functioning bleb is associated with a bleb failure rate as high as 30%. Combined procedures are becoming more common whenever indicated. The success of surgical procedures designed to treat glaucoma depends on the prevention of excessive wound healing. The ALC may aid filtration by
capillary action and act as a splint providing maximal separation of the internal sclerostomy by facilitating aqueous humour flow through the surgical fistula without excessive egress of aqueous and sequele of a flat anterior chamber. Additionally as the anterior lens capsule is derived from ectoderm and the sclera from mesoderm and as tissues of different blastodermal origin do not adhere to each other, this could be an additional mechanism of action. The one-site combined surgery done in our study was faster and easy to perform and the ALC was placed in the sclero-corneal tunnel. The lack of serious complications, the good short-term success rate, the lack of additional costs, and the availability of the anterior lens capsule in combined procedures demonstrated by our study makes this an appealing alternative especially in developing countries, where the patient compliance with follow up is poor.

**Conclusion**

Shallow chamber and choroidal detachment occur less frequently in phacotrabeculectomy when adjunctive subscleral ALC implantation is done and the lack of any additional cost to obtain the lens capsule and lack of immune reaction to it, allows its use in glaucoma surgery especially in financially challenged countries. Long term follow up in a larger series may prove this beneficial effect noted in this study.

**REFERENCES**


**Amniotic Membrane as an Adjuvant in Mitomycin C (MMC) Modulated Trabeculectomy for Primary Glaucoma**

**Dr. Kirti Jaisingh**, Dr. Usha Yadava, Dr. Prolima Thacker, Dr. Sonal Dangda

A well healed trabeculectomy is a failed trabeculectomy. Success in trabeculectomy is linked to the interruption of the physiological wound healing process in order to maintain the patency of the newly created fistula. Fibroblast proliferation causing subconjunctival and episcleral fibrosis being the
major cause of failure, introduction of antifibrotics has revolutionized glaucoma surgery especially in cases at high risk of failure. 5-Flourouracil (5-FU), the 1st drug introduced, acts by interrupting the DNA synthesis and is still in vogue for needling for failing blebs. Mitomycin C (MMC) assisted trabeculectomy has been routinely adopted in similar cases. Widespread cellular toxicity of these drugs has worked like a double edged sword. Hypotony, shallow chambers, choroidal detachments and haemorrhage, bleb related infections, snuff out phenomenon were some of the serious sight threatening complications emerging out of use of these drugs. In the unabated quest for ways of achieving a better bleb health and consequent glaucoma control, role of Human Amniotic Membrane Transplantation (AMT) was explored as a physiological bleb modulator in trabeculectomy. Inhibition of fibrosis, downregulation of TGF-β, anti-inflammatory action, avascular stroma, increased hydraulic conductivity and ability to keep potentially adhesive surfaces apart favoured its use as a potential modulator in trabeculectomy. Acting at different levels in the wound healing pathway, theoretically, AMT can be additive to MMC in achieving a better IOP control and stable bleb vitality and efficacy. Mandate of this study was to study the effects of such a combined augmentation of trabeculectomy in primary glaucoma patients in INDIA.

MATERIALS AND METHODS
A prospective, randomized controlled clinical trial was conducted at the glaucoma services of Guru Nanak Eye Centre, Maulana Azad Medical College, Delhi. An informed consent was obtained from all subjects. The study was conducted in compliance with the tenets of Declaration of Helsinki and ethics committee approval was obtained before the start of the study. It was a single blind study with the investigator being blinded. 32 adult primary glaucoma eyes, aged 35-70 years, with uncontrolled glaucoma were randomly divided into 2 groups. Both groups had trabeculectomy with 0.02% MMC (study group A) and 2nd group (control group B) had AMT in addition. Any form of secondary glaucomas in the form of uveitic glaucoma, neovascular glaucoma, lenticular, pigmentary and pseudo-exfoliation glaucoma, history of prior surgical interventions in the form of past glaucoma surgery, cataract surgery, or any other surgery involving conjunctiva or any existing conjunctival disease were excluded. Patients were followed up for 6 months. Both the groups were age and sex matched. IOP and bleb morphology using Indiana Bleb Appearance Grading Scale (IBAGS)² were assessed weekly in 1st month and then monthly till 6 months. Based on the IOP control achieved, eyes were divided into complete success, qualified success and failure. Complete success was defined as an IOP 6-16 mm of Hg without any anti glaucoma medication at 6 month follow up. Qualified success was defined as an IOP ≤ 16 mm of Hg with one anti-glaucoma medication or after bleb needling with 5-Flourouracil. Whereas failure was defined as IOP > 16 mm of Hg, IOP < 6 mm of Hg, need for
additional surgical intervention, vision threatening events, chronic hypotony and the need for two or more medications. The data obtained was analyzed by SPSS software version 16. Qualitative data assessed by Fishers Exact test or Chi-square test, quantitative data by Mann-Whitney test or Wilcoxon Sign Rank test, and Correlation by Pearson’s correlation coefficient. p value of <0.05 was considered significant.

RESULTS

In the study group (A), the mean pre-operative IOP decreased from 43.14±11.22 mm Hg to mean postoperative IOP of 12.06±2.62 mm Hg on day 180. In the control group (B), the mean pre-operative IOP of 40.51±8.72 mm Hg reduced to mean postoperative IOP of 13.13±4.87 mm Hg. Both the groups were comparable in terms of post-operative IOP control on all follow up visits except day 7, with lower mean IOP in study group (p=0.03) and no statistically significant difference was noted in the mean IOP control achieved at 6 months between the 2 groups (p>0.05). At each visit, patients were categorized as complete success, qualified success or complete failure, as per the protocol described earlier. In study group, 12(75%) eyes had complete success with 3(25%) eyes showing qualified success and none having complete failure; while in control group, 8(50%) eyes had complete success, 7(43.75%) eyes qualified success and 1(6.25%) eye reported complete failure. AMT group had significantly greater complete success rate, p=0.03 but the difference became insignificant for qualified success, p=0.06 and failure, p=0.15.

Blebs of all eyes were photographed digitally on slit lamp imaging system and were scored at each visit according to IBAGS scoring system, taking the standard pictures for reference. On day 1, 93.75% (15/16) group A blebs fell into E3 category as against 75%(12/16) group B, difference not being statistically significant, p=0.07. Similarly both groups showed comparable results at 3 and 6 months also, p<0.05. On comparing the height, AMT blebs showed significantly better height (H2+H3) on both day 1 and at 3 months, p=0.03 and 0.02 respectively. The difference however became insignificant at 6 months, p=0.12. 1 eye in MMC group had a flat bleb postoperatively. Regarding vascularity, both the groups showed comparable results on all visits, p<0.05 with maximum blebs settling in avascular polycystic category (V1) by 3 months. MMC group had 1 pale ischemic scarred bleb showing very high IOP postoperatively. There was no case of bleb leak anytime in either group.

Bleb needling with 5-FU to achieve a qualified success was required in 3/16 eyes in study group as against 7/16 eyes in control group, p=0.06. Out of these, 2/16 group A and 5/16 group B eyes still required an additional antiglaucoma drug for qualified control. 1 eye in MMC only group developed a transient choroidal detachment which resolved with cycloplegics and oral steroids. 1 more eye in this group developed very high IOP in the 2nd week
postoperatively with very shallow anterior chamber (AC). Anterior segment OCT showed a blocked sclerostomy for which internal revision of sclerostomy was done. It was subjected argon laser suture lysis also but to no use. At 4 months, phacoemulsification with in the bag IOL was performed for very shallow AC and considered for trabeculectomy at 6 months.

**DISCUSSION**

The safety and efficacy of amniotic membrane transplantation is well established as an excellent ocular surface modulator in literature with widespread use in pterygium surgery, chemical burns, symblepheron, etc. Recently, there has been a keen interest in exploiting its physiological nature, antifibrotic and antiangiogenic properties in enhancing the success rates of trabeculectomy. Ricardo reported complete success in 81.25% eyes using AMT alone at the end of 12 months. In our study a complete success with cut off IOP taken as 16mm of Hg was observed in 75% in study group and in 50% in the control group. In both the groups, there was a significant fall in mean IOP post-operatively (p=0.00) which was maintained throughout the period of observation. On comparing the two groups, the difference was statistically significant for complete success, p=0.03 but not for qualified success and failure, p=0.06 and 0.15. In a similar study by Sheha et. al. in 37 eyes with refractory glaucoma, complete success (IOP<22 mm Hg) was seen in 93.7% of AMT with MMC and 60% MMC alone eyes at 6 months. The lower success rate in our study vis-a-vis the above can be attributed to the strict criteria of IOP<16 mm Hg in ours. Studies done by Cheung et. al. with MMC augmented trabeculectomy showed complete success rate (IOP<21 without medication) as 62.77% increasing to 83.17% with medication at the end of 1 year. In our study, the success rate increased to 100% from 75% and 93.75% from 50% in study and control group respectively with the use of 1 antiglaucoma medication, a much better result. A well filtering functional bleb indicates an adequate IOP control. IBAGS and all other previous classifications have described an ideal bleb as a diffuse, moderately high, avascular polycystic bleb corresponding to a score range of H2-3, E2-3, V1, S0. However the bleb is in a state of continuous remodelling and requires adequate time post-operatively for consolidation of its morphological characters. This study showed that adding amnion significantly increases the height of the bleb with a sustainable effect till at least 3 months. Though the difference regarding the extent was not statistically significant, AMT blebs definitely showed a better extent at all postoperative visits. A scarred bleb was only seen in control group. Moreover, the need for 5-FU needling for survival of the bleb was reduced to half with the addition of amnion. This, in a way, protected the already compromised conjunctiva from a second surgical and anti-metabolite insult. It seemed to provide a scaffold for the growth and repair of acutely injured conjunctiva over it preventing
it from thinning and becoming leaky due to MMC. Thus AMT seemed to preserve the integrity of the overlying conjunctiva keeping the bleb in a more physiological state which goes a long way in predicting better health of the bleb in long term, being our ultimate aim. A special note can be made of the more number of complications in control group, suggesting the favourable effects of this physiological modulator on the surrounding structures by virtue of its hydraulic conductivity property, absorbing any residual excess of MMC from the bleb area. This is the first study exploring the role of AMT as an adjunct to MMC modulated trabeculectomy, aiming not only to achieve a good IOP control but a better bleb morphology as well. In fact, bleb morphology as an integral part of trabeculectomy assessment has been used as a quantifying tool for the first time in AMT augmented trabeculectomy. The only limitation being the sample size and follow up duration. Hence, it is recommended that more longitudinal studies with larger sample size and longer observation period must be undertaken to accurately elucidate the effectiveness of Amniotic Membrane Transplantation as a cost effective bleb modulator demanding no extra learning curve as against modern patented surgical devices used in trabeculectomy.

REFERENCES


Favourable Effect of Amniotic Membrane on Corneal Endothelium in Trabeculectomy

**Dr. Kirti Jaisingh**, Dr. Usha Yadava, Dr. Sonal Dangda, Dr. Prolima Thacker

The advent of anti-fibrotics as wound modulators has enhanced the surgical success of trabeculectomy, MMC being the most widely used agent. By
virtue of its cytotoxic effects, the very same mechanisms which reduces bleb fibrosis also cause other ocular complications, like hypotony, choroidal detachments, bleb leaks, and late onset bleb infections. MMC has also been shown to have adverse effects on corneal endothelial cell counts both in animal studies and human subjects.

Of late there has been a lot of interest in the role of amniotic membrane as a physiological wound modulator and there are only few studies in literature where effect of combined MMC and Amniotic membrane in Trabeculectomy has been studied. To our knowledge none of them have studied the effect of AMT augmentation on the cytotoxic effects of MMC on corneal endothelial counts after trabeculectomy surgery.

MATERIALS AND METHODS

A prospective, randomized controlled clinical trial was conducted at the glaucoma services of Guru Nanak Eye Centre, Maulana Azad Medical College, Delhi. An informed consent was obtained from all subjects.

The study was conducted in compliance with the tenets of Declaration of Helsinki and ethics committee approval was obtained before the start of the study. It was a single blind study with the investigator being blinded. 30 adult primary glaucoma eyes, aged 35-75 years, were randomly divided into 2 equal groups. Both groups had trabeculectomy with 0.02% MMC (study group) and 2nd group (control group) had AMT in addition. Any form of secondary glaucomas in the form of uveitic glaucoma, neovascular glaucoma, lenticular, pigmentary and pseudo-exfoliation glaucoma, history of prior surgical interventions in the form of past glaucoma surgery, cataract surgery, or any other surgery involving conjunctiva or any existing conjunctival disease were excluded.

Patients were followed up for 6 months. Both the groups were age and sex matched. Endothelial cell count (ECC) was assessed pre and post-operatively on day 1 and at 6 months. The data obtained was analyzed by SPSS software version 16. Quantitative data was analyzed by Mann-Whitney test or Wilcoxon Sign Rank test. p value of <0.05 was considered significant.

RESULTS

Mean preoperative ECC (cells/mm3) was comparable, 2205.13±512.87 in MMC (control) and 2277.67±349.14 in AMT (study) group (p=0.33). Mean ECC on day 1 was 2098.93±426.56 in study group and 2161.67±619.97 in control group. The corresponding values at 6 months were 2096.33±294.84 and 1912.87±888.45 respectively. At 6 months, former had a statistically significant endothelial cell loss of 13.25% (p=0.01) compared with 7.96% loss in latter (p=0.09) although ECC loss was not significant on day 1 in both (p=0.35,0.14 respectively).
DISCUSSION

The endothelial toxic effects of MMC have been well documented in literature, ranging from its use in pterygium excision to photorefractive keratectomy and trabeculectomy. Although glaucoma filtration surgery itself cause endothelial cell count (ECC) loss, which is dependent mainly on postoperative shallow anterior chamber and corneo-irido-lenticular touch, the simultaneous use of MMC further adds to the insult. Literature review reports an endothelial cell count loss of 7-14%; Cohen et. al. noted 7.8% ECC loss with MMC as compared to 3.6% loss without use of MMC in trabeculectomy, the observation being substantiated by various other reports showing a similar ECC loss with MMC use which even persisted at 12 months follow up. Sihota et. al. have reported even higher loss of 13.9% and 14.5% with 0.02% and 0.04% MMC respectively. Human corneal endothelium is a non-regenerative tissue which shows age related cell loss and it has been suggested that MMC obstructs the periodic repair of DNA, a mechanism that could be particularly important in the long-living human corneal endothelial cells, by the formation of alkylating agents. A short-term cytotoxic effect of MMC on human corneal endothelial cells has also been suggested that could be caused by the formation of free radicals that interact with the unsaturated lipids in the cell membranes. This could be particularly important as mean aqueous concentration of upto 35.65 ± 39.17 ng/ml (range 5-120.8 ng/ml) with applications to the scleral bed and of 4.98 ± 9.11 ng/ml (range 0-33.3 ng/ml) with episcleral applications has been reported by Seah et. al., 2-7 minutes after application in humans and studies on rabbits have shown peak aqueous concentrations at 30-60 minutes after application. Among the measures to reduce this toxicity, application of lesser concentration (0.02%) for smaller period of time (ranging from 1-2 minutes) and a thorough saline wash have been proposed.

Adjunctive use of viscoelastic substance like Healon has also been reported to significantly decrease ECC loss after MMC trabeculectomy which authors have attributed to lesser chances of intra-operative and post-operative shallow anterior chamber, hypotony and subsequent endothelial touch. There are a few recent studies on the combined use of amniotic membrane and MMC for wound modulation in trabeculectomy which have shown favourable and encouraging results in terms of IOP control and bleb morphology but in our knowledge there has been no study looking into the effect of such a combination on corneal endothelium.

In our study, the endothelial count was comparable in both groups preoperatively but at the end of 6 months, the MMC alone group had a statistically significant endothelial cell loss of 13.25% (p=0.01) compared with
7.96% loss in MMC with AMT group (p=0.09) although ECC loss was not significant on day 1 in both (p=0.35,0.14 respectively).

The hydraulic conductivity property of Amnion as reported by Keith Barton et. al. in 2007 could explain the protection of the anterior chamber structures like endothelium and overlying bleb from cytotoxic damage of MMC over a prolonged period of time. By this property it can be suggested that it may absorb some of the residual MMC available at the limbal site and thus be protective to the corneal endothelium and the overlying conjunctiva.

A statistically significant reduction in endothelial cell count in the control group points towards a likely protective action of amnion as seen in the AMT+MMC group. This is a very encouraging observation and favours simultaneous use of AMT with MMC.

Conclusion

The drop in ECC due to MMC was reduced to almost half with addition of amnion, probably by virtue of its hydraulic conductivity property preventing continued seepage of MMC into anterior chamber leading to a protective effect, hence encouraging its simultaneous use with MMC.

REFERENCES

Outcome of Ahmed Glaucoma Valve Implantation in Vitrectomised Eyes

Dr. Simar Rajan Singh, Dr. Savleen, Dr. Sushmita Kaushik, Dr. Pandav Surinder Singh

Vitreoretinal surgery was revolutionised in the early 1970’s by the introduction of closed system vitrectomy by Machemer. With further advancements in this field like intraocular gas and silicon oil tamponade, suture less 23Ga and 25Ga systems, the indications of vitrectomy have considerably expanded. Transient or permanent elevation of intraocular pressure (IOP) is a common complication following pars plana vitrectomy (PPV) with incidences ranging from 5.9% to 56% and sometimes even reported to be next commonest only to cataract. Not surprisingly in such cases delayed detection or suboptimal monitoring of the optic nerve damage may occur due to the emphasis being placed upon the successful attainment of the primary objective of vitrectomy like re-attachment of retina.

Treatment of post vitrectomy glaucoma is generally medical, and can include topical or systemic aqueous humour suppressants. It has been previously reported that glaucoma was controlled with medicines alone in only 30% of patients; however, recent data showed that medical therapy by means of topical or oral anti-glaucomatous agents was effective in up to 78% of the eyes, which developed elevated IOP after PPV.

Even though in most eyes medical therapy is successful in controlling IOP; the cases which are refractory to medical treatment are a management challenge. Conventional filtration surgery is associated with poor prognosis due to alterations of the conjunctiva from prior vitreoretinal procedures. Glaucoma drainage devices have been reported as a useful treatment option for refractory glaucomas in vitrectomized eyes, although, the statistical power of these studies has been low owing to the limited number of cases.

The Ahmed Glaucoma Valve Implant (New World Medical, Inc., Rancho Cucamonga, California, USA) has a unidirectional flow restriction system that was designed to prevent postoperative hypotony while maintaining IOP greater than 8 mm Hg. The aim of our study was to evaluate the surgical outcome of this device at a tertiary eye care centre of northern India in a large series of eyes with refractory glaucoma post pars plana vitrectomy.

Design

Study design was a consecutive, interventionional case series.

MATERIALS AND METHODS

A retrospective chart review was conducted of all patients who underwent
Ahmed Glaucoma Valve implantation for refractory glaucoma secondary to pars plana vitrectomy under the Glaucoma Services of a tertiary eye care centre in northern India from January 2006 to July 2012. Only patients with minimum of 6 months follow up after surgery were included in the study. In all cases, the indication for surgery was glaucoma not sufficiently controlled by medications and/or previous surgery or there was a concern that medications or other forms of surgery were not appropriate. Each patient was reviewed within the week before surgery and daily for the first 2 postoperative days as a minimum. The subsequent visits were slowly spaced out depending on their individual performance. Intraocular pressure was recorded by Goldman Applanation Tonometry at each follow up visit. Data samples were taken from postoperative examinations done at 1 day, 1 week, 1 month, 3 months, 6 months and last follow up after surgery. Parameters analyzed were mean age at presentation, mean IOP, visual acuity, number of drugs, complication rates, additional procedures required and effects of use of scleral buckle and silicon oil during vitrectomy. Complete success was defined as intraocular pressures (IOP) of ≤21mm Hg and ≥5mm Hg, 6 months following AGV implantation without the need of anti-glaucoma medications or additional pressure lowering procedures. Qualified success was defined as IOP ≤21mmhg and ≥5mmhg at 6 months following AGV implantation with one / two topical anti-glaucoma medications. The procedure was described as a failure if the IOP remained >21mmHg despite medications or was controlled on 3 or more medication including systemic drugs.

RESULTS
There were 35 males and 8 females at a mean age of 33.42 ± 17.17 years. Reasons for vitrectomy were trauma related complications 51.16%; rhegmatogenous retinal detachments 16.28%; endophthalmitis 6.98%; vasculitic vitreous hemorrhage 6.98%; diabetic complications 4.6% and others 13.9%. Nine patients had previously undergone filtration surgery in the same eye (rest 79% were primary AGV’s).

The mean IOP at presentation was 31.32 ± 10.54 mm Hg, which came down to 17.5 ± 8.08 mm Hg at 3 months (p < 0.001) and to 15.46 ± 4.67 mm Hg at 6 months (p < 0.001) following AGV implantation. Overall IOP was controlled in 81.4% of the patients without or with topical medications only.

Post-operative complications were encountered in 11 eyes (25.6%), which included tube retraction 4 eyes (9.3%); ciliochoroidal detachment 3 eyes (7.0%); tube corneal touch and hyphaema in 2 eyes each (4.7%).

Use of scleral buckle or silicon oil during vitrectomy did not alter the outcome significantly.
DISCUSSION

Glaucoma is a common complication following Pars Plana Vitrectomy and tends to be refractory to medical management.\(^4\)\(^{-7}\) Outcome of glaucoma filtration surgery in such cases is also suboptimal.\(^4\) Glaucoma drainage devices have been shown to be effective in such cases with minimal vision threatening complications. Along with significant decrease in mean IOP and total no. of antiglaucoma medications required to maintain it, our study also shows a steady increase in mean visual acuity during the course of management with AGV implantation.

Conclusion

Ahmed Glaucoma Valve is effective in controlling IOP in post vitrectomy glaucoma, which tends to be refractory to medical treatment. Complications are mostly non-vision threatening and manageable.

REFERENCES

Pentacam Vs. IOL Master: Are they Interchangeable for Anterior Chamber Depth?

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Anterior chamber depth (ACD) measurement has become more important in ophthalmic practice. ACD is implicated as a risk factor for glaucoma.\(^1\) It is also important for IOL power calculation\(^2\), Phakic IOL implantation\(^3\), and in keratorefractive surgery.\(^4\)

Several methods for measuring the ACD are available. They can be contact or non contact technique. Non contact method is preferred over contact method for several reasons like relative ease of use, speed, avoidance of topical anesthesia and lack of corneal indentation\(^5\). Two non contact equipments used for ACD measurement are IOL master and Pentacam. Differences in the instrumentation scan speed, and scan resolution between IOL Master and Pentacam may lead to measurement disparity. ACD measurements with IOL master and Pentacam have been demonstrated to be reproducible\(^6\). However, it remains uncertain whether the measurements obtained by the two instruments are interchangeable. The purpose of this study was to assess the agreement and interchangeability of two non contact devices in measuring ACD in healthy and glaucoma subjects.

MATERIALS AND METHODS

This study was a prospective, cross sectional, observational study conducted in tertiary eye care center between December 2012 and April 2013. There were three groups of subjects. Group 1: primary open angle glaucoma patients, Group 2: primary angle closure patients (PACS, PAC and PACG), Group 3: healthy volunteer from staff or clinic patients. 20 participants (40 eyes) were enrolled in each group.

POAG patients were defined as (1) untreated IOP exceeding 21 mmHg at different times of the day, from 8 AM to 6 PM, 2) Open anterior chamber angles on gonioscopy, 3) Glaucomatous optic neuropathy with thinning or notching of the neuroretinal rim and/or 4) Reliable glaucomatous visual field defects with Glaucoma hemifield test result outside of the normal limits

Angle closure defined as per ISGEO classification\(^7\)

1. **Primary angle closure suspect (PACS)**
   
   An eye in which appositional contact between the peripheral iris and posterior trabecular meshwork is considered possible (>180\(^\circ\))

2. **Primary angle closure (PAC)**
   
   An eye with an occludable drainage angle and feature indicating that trabecular
obstruction by the peripheral iris has occurred such as blotchy pigmentation, PAS, glaucomafleken. Optic disc does not have glaucomatous damage.

3. Primary Angle closure glaucoma (PACG)

PAC together with glaucomatous disc changes

**Healthy volunteers**

All healthy subjects had a best corrected visual acuity of 6/9 or better, normal appearances of the optic nerve heads, No other pathologic ocular condition other than refractive error, IOP less than 21 mmHg and visual fields normal.

Normal appearing ONH was defined as intact neuroretinal rim without splinter hemorrhage, notching, localized pallor or asymmetry of the cupping > 0.2 between the eyes.

Participants having history of ocular trauma or surgery were excluded. Subjects having corneal opacity, Irregular corneal surface, irregular anterior chamber, Inability to obtain ACD by IOL master or pentacam were also excluded from study.

Each subject underwent a Complete slit-lamp examination along with IOP evaluation by Goldmann applanation tonometry, diurnal variation of IOP, gonioscopy (Four mirror gonioscope) and visual field testing 24-2 full threshold (Humphery visual field analyzer). Central corneal thickness was measured using a pentacam (Oculus). ACD Measurements were obtained using Pentacam and with the IOLMaster (Carl Zeiss ).

Measurements were taken in identical physical environments and in the same order in each patient (Pentacam followed by IOLMaster) with intervals of 15 minutes between measurements to allow for relaxation of the patients and restoration of ocular tear film.

ACD measures with pentacam and IOL master were compared with and without CCT correction in pentacam reading using pair t test using Microsoft excel 2007 and Analyse-It software. A value of p < 0.05 was considered significant.

**RESULTS**

Mean Age were 54.1±5.78, 52.4±4.98, and 40.97±3.34yrs in group 1, group 2, and group 3 respectively. 12 male and 8 female were in each group. The mean axial ACD by IOL Master in POAG group, PACG group, and in healthy control group were 3.44±0.30mm, 2.54±0.32mm, 3.43±0.35mm respectively. The mean axial ACD by Pentacam were 3.03±0.28mm, 2.15±0.20mm, 2.95±0.34mm respectively. Mean CCT were 540.97±22.24, 531.82±27.35, 541.97±21.62µ respectively. There is statistically significant difference in ACD measurement in IOL Master and pentacam reading (P ≤ 0.0001) in all groups. ACD measurements using IOL
master were significantly higher than the Pentacam values in all groups (mean difference and 95% confidence interval shown in table 3). This could be due to the fact that IOL Master quantifies the distance between the anterior corneal surface and the anterior crystalline lens while the Pentacam calculates the space between corneal endothelium and the anterior surface of the lens. So IOL master measurements were also compared with the sums of Pentacam-ACD and pachymetrical values. After CCT correction of pentacam ACD reading mean were 3.57±0.28mm, 2.68±0.21mm, and 3.49±0.34mm respectively. Even after CCT correction of pentacam reading, there is still statistically significant difference in all groups (P ≤ 0.001).

<table>
<thead>
<tr>
<th>Group</th>
<th>IOL Master ACD (mm)</th>
<th>Pentacam ACD (mm)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>OAG</td>
<td>3.44±0.30</td>
<td>3.03±0.28</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>ACG</td>
<td>2.54±0.32</td>
<td>2.15±0.20</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Healthy</td>
<td>3.43±0.35</td>
<td>2.95±0.34</td>
<td>&lt;.0001</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Group</th>
<th>IOL Master ACD (mm)</th>
<th>CCT corrected Pentacam ACD (mm)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>OAG</td>
<td>3.44±0.30</td>
<td>3.57±0.28</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>ACG</td>
<td>2.54±0.32</td>
<td>2.68±0.21</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Healthy</td>
<td>3.43±0.35</td>
<td>3.49±0.34</td>
<td>.001</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean Difference</th>
<th>Confidence interval (95%)</th>
<th>Mean Difference</th>
<th>Confidence interval (95%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.41 (p&lt;0.0001)</td>
<td>0.36 to 0.45</td>
<td>-0.13 (p&lt;0.0001)</td>
<td>-0.17 to -0.08</td>
</tr>
<tr>
<td>2</td>
<td>0.38 (p&lt;0.0001)</td>
<td>0.32 to 0.45</td>
<td>-0.14 (p&lt;0.0001)</td>
<td>-0.20 to -0.07</td>
</tr>
<tr>
<td>3</td>
<td>0.47 (p&lt;0.0001)</td>
<td>0.43 to 0.51</td>
<td>-0.064 (p=0.001)</td>
<td>-0.10 to -0.02</td>
</tr>
</tbody>
</table>

**DISCUSSION**

ACD measurement had many applications. ACD being shallower in patients at risk of angle closure glaucoma. It has been shown that errors in prediction of effective lens position (ELP) may account for 20–40% of total refractive prediction error and IOL explantation.8 In phakic IOL implantation, precise
ACD measurements are required to determine IOL power, ELP and to prevent endothelial cell damage. In keratorefractive surgery the ACD is important to set a correct optical zone ablation diameter because deeper anterior chambers require larger ablation areas.

Several methods are available for measuring the ACD. They can be classified as non contact and contact. Contact method (Ultrasound ACD measurement) has been considered as the gold standard. But now a day non contact method is preferred over contact method to determine ACD because of high variability of the results between observers, between measurements, and underestimation of ACD in comparison with non contact modalities.9

ACD measurements using IOL master were significantly higher than the Pentacam values in all groups. This could be due to the fact that IOL Master quantifies the distance between the anterior corneal surface and the anterior crystalline lens while Pentacam calculates the space between corneal endothelium and the anterior lens surface. So IOL Master measurements were also compared with the sums of Pentacam ACD and pachymetrical values. IOL Master and Pentacam ACD reading were statistically significant different in both condition (with and without CCT correction) in all group. Differences may be clinically negligible, although statistically significant.

Dinc et. al. found clinically as well as statistically significant difference while Elbaz et. al. found statistically significant difference within clinical tolerance limit.

**Conclusions**

For ACD measurements these device should not be used interchangeably in healthy as well as in glaucoma subjects

**REFERENCES**

Comparison of the Ability of Swept Source and Spectral Domain OCT to Evaluate Anterior Chamber Angle

Dr. Vandhana Suren, Prof. Rajesh S. Kumar, Dr. Sathi Devi A.V.

The anterior segment optical coherence tomography (ASOCT) is a rapid noncontact imaging device that allows measurement of the anterior chamber angle (ACA) parameters. The newer Fourier-domain, swept-source OCT (SSOCT) is designed specifically for imaging the anterior segment (30,000 A-scans per second); the ACA can be imaged in 128 cross-sections (each with 512 A-scans) allowing a 360° evaluation of the anterior segment in 2.4 seconds.

SDOCT provides real-time imaging with a higher axial resolution and a scan rate that is 50 to 60 times faster than time-domain OCT devices. Aim of the study is to compare the ability of the swept source (SSOCT) and RTVue spectral domain optical coherence tomography (SDOCT) to image the anterior chamber angle (ACA).

MATERIALS AND METHODS

Consecutive subjects recruited from the glaucoma clinic prospectively underwent ophthalmic evaluation including gonioscopy and anterior chamber imaging with both swept source anterior segment OCT (SSOCT, Tomey, Nagoya, Japan) and the RTVue spectral domain OCT (SDOCT, Optovue, Freemont, CA) equipped with a corneal lens adapter (CAM-L module); imaging was performed by a single technician. Two ophthalmologists, masked to gonioscopy findings, assessed visualization of the scleral spur (SS), Schwalbe’s line (SL) and trabecular meshwork (TM) by the two modalities. The ability to detect a closed angle was compared with gonioscopy. SL was defined as the point of termination of Descemet’s membrane, while the TM was identified as a triangular low signal area between SL and the SS. The SS was defined as a
point where a change in the curvature of the inner surface of the angle wall was noted, usually appearing as an inward protrusion of the sclera. A closed angle in a quadrant was diagnosed by the presence of contact between the iris and angle wall anterior to the SS. Where the SS was not visible, the TM, if visible, was used as a surrogate landmark; a closed angle in a quadrant was then diagnosed by any contact between the iris and the TM in that quadrant.

### Table 1: Comparison of Anterior Chamber Angle Landmark visibility in SDOCT Vs. SSOCT images

<table>
<thead>
<tr>
<th>Angle Parameter</th>
<th>SSOCT n(%)</th>
<th>SDOCT n(%)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>SS</td>
<td>137 (76.9%)</td>
<td>64 (35.4%)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>SL</td>
<td>32 (17.9%)</td>
<td>114 (62.9%)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>TM</td>
<td>146 (80.02%)</td>
<td>161 (88.95%)</td>
<td>0.6</td>
</tr>
</tbody>
</table>

### Table 2: Ability to grade angle status using SDOCT and SSOCT compared to gonioscopy

<table>
<thead>
<tr>
<th>Angle Status</th>
<th>SSOCT n (%)</th>
<th>SDOCT n (%)</th>
<th>Gonioscopy n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Closed</td>
<td>56 (31.46%)</td>
<td>26 (14.36%)</td>
<td>75 (39.89%)</td>
</tr>
</tbody>
</table>

### Table 3: No. of quadrants with detectable scleral spur in SDOCT and SSOCT images

<table>
<thead>
<tr>
<th>Angle Parameter</th>
<th>SSOCT (n)</th>
<th>SDOCT (n)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inferior</td>
<td>26</td>
<td>18</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Superior</td>
<td>31</td>
<td>15</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Nasal</td>
<td>39</td>
<td>16</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Temporal</td>
<td>41</td>
<td>15</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

### Table 4: No. of anterior chamber angle quadrants that appeared closed on gradable images using SDOCT and SSOCT compared to gonioscopy

<table>
<thead>
<tr>
<th>Angle Parameter</th>
<th>Closed on SSOCT (n)</th>
<th>Closed on SDOCT (n)</th>
<th>Closed on Gonioscopy (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inferior</td>
<td>11/46</td>
<td>21/47</td>
<td>20/47</td>
</tr>
<tr>
<td>Superior</td>
<td>13/41</td>
<td>23/45</td>
<td>21/47</td>
</tr>
<tr>
<td>Nasal</td>
<td>16/45</td>
<td>10/45</td>
<td>19/47</td>
</tr>
<tr>
<td>Temporal</td>
<td>16/45</td>
<td>17/44</td>
<td>20/47</td>
</tr>
</tbody>
</table>
RESULTS
Forty seven eyes (47 subjects) were enrolled; the average age was 55.1±11.6 years; majority were women (61.7%). Table 1 highlights the landmark visibility in the 2 devices; SS-OCT images revealed the SS in 76.9% (137/178) quadrants and the SL in 17.9% (32/178) quadrants; in SD-OCT images the SL could be visualized in 62.9% (114/181) quadrants (p<0.001), while the SS was seen only in 35.4% (64/181) quadrants (p<0.001).

The TM was detected in 80.02% (146/178) quadrants using the SS-OCT and in 88.95% (161/181) quadrants with the SD-OCT (p=0.6). The angle status was gradable in 79.8% (142/178) images with SS-OCT, compared to only 40.9% (74/181) of SD-OCT images (p<0.001) (Table 2). Table 3 demonstrates quadrant wise comparison of SS visibility.

ACA was classified as closed in 31.46% (56/178) quadrants with SS-OCT and 14.36% (26/181) quadrants with the SD-OCT, compared to 39.89% (75/188) on gonioscopy; Table 4 shows quadrant wise comparison of closed angles detected by the 2 devices. When analyzing the horizontal quadrants alone, both modalities agreed well with gonioscopy, 0.75 and 0.74, respectively (AC1 statistics).

DISCUSSION
The RTVue SD-OCT demonstrated poor to average detection of the SS, as judged against the AS-OCT. Its major advantage in this study over the AS-OCT was in its unique ability to detect the SL in 77.9% of subjects. The depth and width of view provided by SD-OCT does not allow imaging of the entire angle up to the iris root; hence the entire angle cannot be viewed in a single image as in the AS-OCT. Wylegala et. al. reported good correlation between anterior segment parameters in 54 eyes imaged using the RTVue and the Visante AS-OCT. Gonioscopy can be used to assess the entire circumference of the angle, whereas these imaging devices only deliver a cross-sectional view of the angle. SS-OCT is found to be have better agreement with gonioscopy.

Limitations
- The angle recess needs to be identified as the reference point for measurements; those with poor visibility of SS were excluded.
- Small sample size

Conclusion
While both devices allow visualization of all the ACA structures, the SS-OCT appears to be more robust in detecting the SS compared to the RTVue SD-OCT. The SS-OCT also appears to have better agreement with gonioscopy compared to the SD-OCT device in detecting closed angles.
REFERENCES

Trabeculectomy with Mitomycin C Vs Trabeculectomy with Collagen Implant, A Randomized Clinical Trial

Dr. Ashok Vardhan, Dr. Sharmila R, Dr. George Puthuran, Dr. Rengaraj Venkatesh

Glaucowma is the leading cause of irreversible blindness affecting more than 67 million persons worldwide, of whom 10% i.e., 6.6 million are estimated to be blind.1 The social and economic impact of glaucoma is enormous but difficult to quantify. Because of the higher rate of bleb failure and greater postoperative dependence on glaucoma medications associated with glaucoma filtering surgery (GFS), glaucoma surgeons have explored techniques for modulating wound healing after trabeculectomy. Adjunctive anti fibrotic agents such as 5-Fluorouracil or Mitomycin C are commonly used to enhance the success of trabeculectomy. However, the additional use of these antifibrotic agents are associated with side effects such as thinning of conjunctiva, bleb leakage, hypotony, avascular filtering blebs, blebitis and endophthalmitis.2,3

Tissue bioengineered collagen implants have recently been created as an alternative to augment success rate of trabeculectomy. Ologen is a drug-free, biodegradable scaffold collagen matrix implant. It induces a regenerative non-scarring wound healing process, preventing scar formation without the use of antifibrotic agents.
In our study, we conducted a prospective, randomized, clinical trial to compare and analyse the safety and efficacy of trabeculectomy with Mitomycin C versus trabeculectomy with Collagen implant in medically uncontrolled adult onset glaucoma. The goal of the study was to determine which agent was more appropriate in achieving a safe IOP with fewer complications.

**MATERIALS AND METHODS**

A prospective randomized clinical trial, single blinded study was conducted at the Glaucoma Speciality clinic at Aravind Eye Hospital, Madurai, a tertiary eye care institute in the state of Tamil Nadu, South India. The study was conducted from the period of November 2010 to October 2011. Each patient was followed up for a period of 6 months.

The study population included adults of rural and urban population predominantly from south India. 50 patients who fulfilled the inclusion criteria and signed the written informed consent were recruited in the study. Eligible subjects included persons with adult onset glaucoma with inadequate intraocular pressure control despite maximum tolerable medical therapy, but without previous intraocular surgery except laser iridotomy.

Preoperative baseline evaluation was carried out in which a detailed medical and ocular history was obtained. The subjects then underwent an ocular examination which included visual acuity assessment, slit-lamp evaluation of anterior segment, fundus examination using 90 D lens, intra-ocular pressure measurement using Goldmann Appplanation tonometer, gonioscopy with Goldman 2 mirror and Zeiss gonio lens. The visual field was assessed by Humphrey perimeter (SITA standard 24-2).

Fifty consecutive eligible patients were randomly assigned either to undergo trabeculectomy with Mitomycin C (group A) or trabeculectomy with Ologen collagen implant (group B). The sequence of random allocation was generated by an individual not involved in the study using STATA 8.1 software. Randomization was determined just before surgery by sealed-envelope technique based on their surgical chart number.

All surgeries were performed by a single experienced competent surgeon, under sub-tenon’s anaesthesia. In control group A, a sponge with 0.2 mg/ml of Mitomycin C was placed on the scleral surface before creating a scleral flap, for 3 minutes and then removed. A triangular 4 mm scleral flap was then created followed by a sclerotomy of 1.5 x 1.5 mm was performed with Kelley’s punch and followed by a peripheral iridectomy. The scleral flap was then repositioned and fixed with one single apical suture and two releasable sutures to the sides of the flap using 10’ 0 nylon suture in both the groups. In study group B, a cylindrical Ologen implant (6 mm diameter and 2 mm
height - Model No.830601) was positioned on top of the scleral flap before conjunctival closure.

A standard postoperative regimen of topical antibiotics with steroid tapered over 6 weeks was followed in both the groups. Postoperatively, patients of both the groups were reviewed on day 1, 2 weeks, 1 month, 3 months and at 6 months. The following outcomes were assessed - Best corrected Visual acuity, Intraocular pressure, Number of postoperative anti-glaucoma medications used, morphology of filtering bleb, complications and interventions.

In cases of poorly functioning bleb, adjunctive procedures such as digital globe massage, releasable suture removal, laser suture lysis or additional surgery such as bleb needling with 5 FU (5 mg in 0.1 ml) were employed. If postoperative IOP measurements were >18mmHg after topical steroid withdrawal, IOP-lowering medication was added.

Complete success was defined as a post-operative IOP of <18mmHg and a relative decrease of >20% as compared with the pre-operative IOP, without any additional glaucoma surgery or medication. Qualified success was defined as an IOP of <18mmHg and an additional reduction of >20% as compared with the pre-operative IOP, with topical medication allowed but without any additional glaucoma surgery.

Chi-square test or Fisher’s exact test was used to assess difference between MMC and ologen group in sex, eye laterality, bleb status, vision status, surgical outcome. Unpaired t-test was used to assess the IOP difference between the groups, and Paired t-test was used to assess the IOP difference between baseline and six months follow-up. Mann Whitney U test was used to assess difference between MMC and Ologen group for number of medication and logMAR vision respectively. P-value less than 0.05 considered as statistically significant. All statistical analysis were done using statistical software STATA 11.0.

RESULTS

Only 48 patients completed the study. One patient in each groups were lost to follow-up after the 1 month post-operative visit. The mean preoperative IOP (± SD) was 31.9(±7.71) in MMC eyes and 33.8(±11.26) in Ologen eyes without significant intergroup difference. One day postoperatively, the IOP dropped to 18.4 (±7.27) and 18.1(±6.77) mmHg, respectively. At one month follow up visit, IOP reduction in ologen group was better compared to MMC. The postoperative IOP reduction was significant at the endpoint in both groups (p<.001) with a mean IOP of 13.5 (±2.64) and 14.1 (±4.16) mmHg in MMC and Ologen eyes, respectively. Difference between pre-operative and 6 month postoperative IOP were statistically significant in both groups.
The mean number of anti-glaucoma medications used was significantly reduced at the end point in both groups ($P<0.001$) from 2.5 ($\pm 0.59$) to 0.71 ($\pm 0.75$) and from 2.2 ($\pm 0.62$) to 0.86 ($\pm 0.74$) in the MMC and Ologen groups respectively.

Six months after surgery, based on our surgical success criteria as defined earlier, 9 (37.5%) MMC eyes and 5 (20.8%) Ologen eyes attained complete success. 9 (37.5%) MMC eyes and 13 (54.2%) Ologen eyes were considered qualified success.

No significant intra-operative complications were observed in both groups. The frequency of postoperative complications did not significantly differ between the two groups. 6 (25%) eyes in MMC group and 4 (16.7%) eyes in Ologen group developed complications. Over filtering bleb was noted in one eye of both groups on the first post-operative day. Bleb failure was more frequent in the MMC than in Ologen group (5 Vs. 2 cases respectively). At 1 & 3 months, all the failing blebs were treated by bleb needling with 5FU. All the 5 cases in MMC group regained their filtering function, whereas the failing blebs in the ologen group did not improve. At 6 months, all blebs in the MMC group were filtering, but 2 eyes in the ologen group showed vascularised non-filtering blebs. This shows that bleb needling was more effective in the MMC eyes as compared to ologen eyes.

There was no significant difference in the postoperative behaviour between the two groups, with a highly significant and stable IOP reduction and very few anti glaucoma medications throughout the 6 months follow-up, indicating that the efficacy of the Ologen implant is analogous to MMC.

**DISCUSSION**

Reduction of IOP by means of conventional filtering surgery like trabeculectomy has become the standard technique for glaucoma management. Various studies have demonstrated significant enhancement of success rates through intraoperative use of MMC. However due to anti-metabolite related complications, the current focus is on the development of less toxic agents and implants. Chen et. al. initially tested a porous collagen–glycosaminoglycan matrix (ologen implant) in animal models. He reported that this implant could be used as an alternative method for controlling the wound healing process following filtration surgeries, offering the potential for maintaining long-term IOP control. It acts by preventing collapse of the sub conjunctival space by leading to a randomised collagen deposition and micro cyst formation and thereby decreasing early postoperative scarring.

In the pilot study, Dimitris Papaconstantinou et. al. showed that trabeculectomy with ologen does not seem to offer any significant advantages compared with trabeculectomy alone. Rosentreter et. al. compared trabeculectomy with
MMC (10 patients) and trabeculectomy with ologen (10 patients). Absolute success at the end of one year was 100% in the MMC group and 50% in ologen group. However, the bleb morphology caused more problems in the MMC group.8

In our study constituting of a south Indian population, we compared eyes that underwent trabeculectomy with MMC (25 patients) against those with trabeculectomy with ologen (25 patients) for a period of 6 months. The pre-operative characteristics were comparable in both groups. There were no intra-operative complications in both groups.

The postoperative IOP reduction was significant at the endpoint in both groups. At one month follow up visit, IOP reduction in ologen group was transiently better compared to MMC. No intergroup difference was present at the remaining scheduled postoperative observation time. The reduction of the number of anti-glaucoma medications post-operatively, was slightly better in MMC group. Though not statistically significant, overall surgical success rate was slightly better in the MMC group as more eyes (37.5%) in the MMC group attained complete success compared to ologen group (20.8%)

The postoperative complications did not significantly differ between the two groups. Totally 6 eyes in the MMC group and 4 eyes in the ologen group developed complications. In the MMC group failing bleb was the most common complication encountered, which responded very well to bleb needling procedure. The poor response in the ologen group to the needling procedure can be due to the physical presence of the un-dissolved implant.

One eye in the Ologen group had persistent hypotony which improved spontaneously. None of the eyes in either group developed endophthalmitis. The pilot study done by Dimitris et. al.8 is not in agreement with our complication results, since it showed Ologen to have a larger amount of complications than simple trabeculectomy probably because of the scleral closure technique with two relatively loose 10-0 nylon sutures.

Major limitations of our study are relatively small sample size, which limits the statistical comparison between the groups. Follow up of just 6 months is one other limitation of our study as only with long term follow-up can we know the long term success in both groups. We did not compare the morphologic features of the bleb based on the accepted recent international classifications. Larger number of patients with longer duration of follow-up is required to be certain about the role of this new bioengineered material on the success rate of trabeculectomy.

Conclusion
In conclusion, in this prospective randomized study it appears that there is no significant difference in the postoperative behaviour between the two groups
in this 6 months follow-up. Trabeculectomy with Ologen does not offer any significant advantage compared with trabeculectomy with MMC alone. The Ologen implant may thus for instance be preferred when anti metabolite-related risks need to be avoided and maximum safety are required in cases such as in high myopia, haemorrhagic risk, young individuals and scleral thinning.

REFERENCES

8. A Rosentreter1, AM Schild 1, JF Jordan 2, GK Kriegstein 1, TS Dietlein1, 3. A prospective randomised trial of trabeculectomy using mitomycin C vs an ologen implant in open angle glaucoma. Eye 2010;1–9 and 2010 Macmillan Publishers Limited All rights reserved 0950-222X/10.

Comparative Study of SICS Trab Versus two Site Phacotrab in Coexisting Cataract and Glaucoma

Dr. Sneha Sharma, Dr. Bairwa Ashok Kumar

Glaucoma and cataract often occur together, especially in the elderly, and each condition can influence management of the other. In the management of a patient with a visually significant cataract and coexisting glaucoma, decision for combined cataract-glaucoma surgery, sequential surgery, or
one of these procedures alone is dependent on the individual case present, on the experience of the surgeon, and on the preference of both patient and the surgeon. With advances in both cataract and glaucoma surgery, success rates with combined procedures have improved and relative indications have shifted.

**Aims and Objectives**

To compare the main outcomes of filtration surgery combined with either clear corneal phacoemulsification or manual SICS, with IOL implantation, without the use of antimetabolites, in terms of Intraocular pressure (IOP), Best Corrected Visual Acuity (BCVA), Number of antiglaucoma medications, Intra-operative and Postoperative complications.

**MATERIALS AND METHODS**

Prospective randomized study which included 25 cases with coexisting cataract and glaucoma in each group. Group A consisted of patients who underwent phacotrabeculectomy through separate sites *i.e.* superior trabeculectomy incision and clear corneal temporal incision for phacoemulsification. Group B consisted of patients who underwent trabeculectomy and small incision cataract surgery through single site done superiorly through a scleral incision. All patients underwent surgery over a span of two years at a tertiary eye care centre in north India from May 2007 to May 2009. Exclusion criteria included monocular patients, patients with secondary glaucoma, associated ocular pathology, and patients with history of previous surgery in affected eye, and patients on such systemic medicines which may cause difficulty during the operative procedure.

**RESULTS**

**IOP Reduction**

The mean preoperative IOP was 32.41±7.49 in group A and 36.54±10.53 in group B, which reduced significantly postoperatively to 11.15±0.3 and 11.19±1.19 mm of Hg respectively. The reduction was significant and comparable at all postoperative visits.

**Demographics**

<table>
<thead>
<tr>
<th></th>
<th>Group A</th>
<th>Group B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>12</td>
<td>15</td>
</tr>
<tr>
<td>Male</td>
<td>13</td>
<td>10</td>
</tr>
</tbody>
</table>

**Complications**

The number of intraoperative complications were nil in group A whereas Group B showed one case of Posterior capsule rent with vitreous loss, and one
case of zonular dialysis. The commonest complication seen postoperatively was AC reaction, seen in 2 and 6 patients in group A and B respectively. Other complication seen were corneal edema (1in group A, 3 in group B), and 2 cases of shallow AC, hypotony and hyphaema in group B only.

<table>
<thead>
<tr>
<th>Medicine requirement</th>
<th>Total</th>
<th>Group A</th>
<th>Group B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preoperative mean</td>
<td>1.68</td>
<td>1.52</td>
<td>1.84</td>
</tr>
<tr>
<td>Postoperative mean</td>
<td>0.08</td>
<td>0.08</td>
<td>0.08</td>
</tr>
</tbody>
</table>

The mean astigmatism post-operatively at 2 monthly follow up was found to be 0.45±0.61 for group A as compared to 1.05±0.91 for group B. The number of patients with no astigmatism were significantly higher in Group A.

**DISCUSSION**

There was statistically significant difference between two groups at 2 weeks, 4 weeks and 2 months, suggesting better visual outcome and early visual stabilization in Group A. Comparison of BCVA at 6 months did not reach statistical significance (p>0.5).

The phaco group may have a faster recovery because of a smaller incision involved with less inflammation and induced astigmatism. Both intra and postoperative complications were lesser in Group A.

**Conclusion**

Both groups show significant and comparable improvement in visual acuity, fall in IOP and decrease in medication requirement. Group A (phaco-trab) showed earlier visual stabilization and less postoperative astigmatism.
REFERENCES


