Vitreo Retinal Diseases
Free Papers
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Sensitivity of Fundus Autofluorescence in Diagnosis of Disorders of Retinal Pigment Epithelium

Dr. Shroff Rahul Ashok

Abnormal accumulation of Lipofuscin occurs if there is a functional abnormality of the photoreceptor outer segment – RPE relationship which limits the ability of the RPE to phagocytose the photoreceptor outer segments. Fundus autofluorescence provides functional images of the fundus by stimulated emission of light from lipofuscin.

Purpose

To evaluate the sensitivity of various patterns of hyper and hypo fundus autofluorescence compared to fluorescein angiography (FFA) and Optical coherence tomography (OCT) in diagnosing disorders of the Retinal Pigment Epithelium.

MATERIALS AND METHODS

This is a retrospective analyses of 45 eyes of 33 patients. Fundus autofluorescence images were recorded using a fundus camera. The images were compared with by a single observer with either OCT or FFA images or both. Baye’s Theorem was used to evaluate the sensitivity, specificity, predictive value and likelihood ratio. To calculate the predictive value and likelihood ratio, the data was compared with 59 eyes with normal RPE (i.e. where autofluorescence was expected to be normal) on OCT or FFA or both.

RESULTS

The overall sensitivity was 38 of 45 eyes (84.5%). Of the disorders causing Hypo autofluorescence 14 of 14 eyes (100%) with geographic RPE atrophy at macula (7 eyes) and Stargardt’s disease (7 eyes) showed reduced autofluorescence. Of the disorders causing Hyper autofluorescence, 7 of 8 eyes (87.5%) with drusenoid PED showed a rim of increased autofluorescence, while 15 of 17 eyes (88%) with active choroidal neovascularization showed increased autofluorescence. However only 2 of 6 eyes (33.3%) with central serous chorioretinopathy showed increase autofluorescence of the PED. The overall specificity was 84.7%. In patients where the test was positive, with either a hypo or hyper autofluorescent lesion seen, the positive predictive value was 80.8% with a likelihood ratio
of 5.5. If the test was negative, *i.e.* there was no abnormal autofluorescence seen, the negative predictive value was 87.7% with a likelihood ratio of 5.4. Hyper autofluorescent lesions had a comparably higher sensitivity (100%) and specificity (92.5%) as compared to hyper autofluorescent lesions where the sensitivity was 77.4% and the specificity was 90.9%.

**Conclusion**

This study shows that fundus autofluorescence has a good sensitivity and a good positive predictive value in evaluating diseases where there is a functional abnormality of the photo-receptor relationship. The sensitivity and specificity was good in both hypo and hyper autofluorescence lesions making it a reliable test to detect active choroidal neovascularization at the margins of RPE atrophy. It also shows good specificity and negative predictive value in disorders where the RPE is normal. The only condition where autofluorescence is not a reliable test was central serous chorioretinopathy. The study also showed that whether the test was positive (*i.e.* showed hyper or hypo autofluorescence) or negative (*i.e.* showed normal autofluorescence), the odds of the test being accurate were 5.5:1.

**Management of Giant Retinal Tear and Retinal Detachment with or Without Scleral Buckling**

**Dr. Verma Gopal Lal**

Use of a scleral buckle for the repair of giant retinal tear (GRT) in modern era of vitrectomy is controversial. Several prospective randomized controlled trial in GRT without proliferative vitreoretinopathy (PVR), the success of primary surgery was higher in scleral buckle group as compared to no scleral buckle group. In other studies single surgery anatomic success rate with and without scleral buckle in GRT with retinal detachment has been found with similar outcome. It is not clear whether the absence of scleral buckle and encircling element is associated with higher rate of retinal redetachment in eyes with GRT and retinal detachment if located to inferior quadrants. The Interaction of Scleral buckle on GRT has not been studied enough.

This study is a retrospective analysis of thirty five eyes undergoing 20-G 3 port parsplana vitrectomy for management of giant retinal tear with retinal detachment and PVR with and without scleral buckle by a single surgeon between September 1997 till May 2012. Eyes with extreme hypotony (IOP less than 5mm), media haze due to corneo-lenticular opacities or pseudophakic bullous keratopathy or PVR grade D3 and eyes receiving intraocular gas tamponade were excluded from analysis.
Base line preoperative characteristics: 35 eyes undergoing PPV ± SB

<table>
<thead>
<tr>
<th></th>
<th>Group A (PPV, n=19)</th>
<th>Group B (PPV+SB, n=16)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average age (yrs.)</td>
<td>55.3</td>
<td>58.9</td>
</tr>
<tr>
<td>Sex</td>
<td>2M, 7F</td>
<td>11M, 5F</td>
</tr>
<tr>
<td>Phakic</td>
<td>11</td>
<td>9</td>
</tr>
<tr>
<td>Pseudophakic</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td>Macula on</td>
<td>6</td>
<td>5</td>
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<tr>
<td>PVR</td>
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<td></td>
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<tr>
<td>Grade 0-B</td>
<td>12</td>
<td>7</td>
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<tr>
<td>CA-CP</td>
<td>7</td>
<td>9</td>
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<tr>
<td>Extent of GRT</td>
<td></td>
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</tr>
<tr>
<td>90-120°</td>
<td>10</td>
<td>7</td>
</tr>
<tr>
<td>120-180°</td>
<td>4</td>
<td>5</td>
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<tr>
<td>&gt;180°</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Preop. Visual acuity (mean logMAR)</td>
<td>0.9</td>
<td>1.1</td>
</tr>
</tbody>
</table>

Operative Procedure

20 G pars plana vitrectomy under noncontact EIBOS wide angle viewing, endolaser, PFO-silicon oil exchange in nineteen eyes (group A) and combined with 240 band 360°±SB286/3014 tire in 16 eyes (group B). All eyes received intraocular cavity tamponade with 1000CS silicon oil. Follow up minimum 6 months post silicon oil removal.

Complications

Posterior slippage of retina occurred in 6 cases while injecting silicone oil through infusion canula. Highly mobile retinal flap inadvertently engaged in vitreous cutter in 2 cases. Subretinal PFO bubble observed in 3 cases.

RESULTS

<table>
<thead>
<tr>
<th>Anatomical outcome in primary surgery</th>
<th>Group A (PPV)</th>
<th>Group B (PPV+SB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post silicone oil removal retina attached</td>
<td>69.2%(9/13)</td>
<td>83.3%(10/12)</td>
</tr>
<tr>
<td>Post silicone oil redetachment</td>
<td>30.76%(4/13)</td>
<td>16.66%(2/12)</td>
</tr>
<tr>
<td>Retinal redetachment in eyes with GRT extending to inferior 180° quad.</td>
<td>23%(3/13)</td>
<td>8.3%(1/12)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Location of GRT and primary surgery failure</th>
<th>PPV</th>
<th>PPV+SB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meridian</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Above 3-9 O’clock</td>
<td>5.26%(1/19)</td>
<td>12.5%(2/16)</td>
</tr>
<tr>
<td>Below 3-9 O’clock</td>
<td>26.31%(5/19)</td>
<td>12.5%(2/16)</td>
</tr>
<tr>
<td>Calcx²=0&lt;3.845</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Post silicon oil removal recurrence of retinal detachment within 8 wks

<table>
<thead>
<tr>
<th>Meridian</th>
<th>PPV</th>
<th>PPV+SB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Above 3-9 O’clock</td>
<td>7.69%(1/13)</td>
<td>8.3%(1/12)</td>
</tr>
<tr>
<td>Below 3-9 O’clock</td>
<td>23% (3/13)</td>
<td>8.3%(1/12)</td>
</tr>
<tr>
<td>Calcx²=0&lt;3.845</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Post silicone oil removal redetachment rate was 30.76%(4/13) in group A and 16.66%(2/12) in group B. The retinal redetachment rate was 23%(3/13) in group A and 8.3%(1/12) in group B if giant retinal tear extending to inferior quadrants.

### Post operative visual outcome

<table>
<thead>
<tr>
<th></th>
<th>GroupA (PPV)</th>
<th>GroupB (PPV+SB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean visual acuity (logMAR)</td>
<td>0.87(0.2-2)</td>
<td>1.2 (0.6-1.8)</td>
</tr>
</tbody>
</table>

The difference in visual outcome in group A and group B is insignificant.

### Conclusion

The retrospective analysis favours placement of broad and low scleral buckle for GRT extending to inferior quadrants. Larger comparative studies needed to conclude benefit of scleral buckle and encircling element in GRT.

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### Choroidal thickness Measurements in Indian Subjects with Diabetes Mellitus

**Dr. Jay Kumar Chhablani, Dr. Rajeev Kumar Reddy Pappuru, Dr. Narayanan R, Dr. Annie Mathai**

To measure the subfoveal Choroidal Thickness (CT) in subjects with diabetes mellitus.

**MATERIALS AND METHODS**

This study was performed at L V Prasad eye institute, India from January 2010 to June 2012. Prior approval from the Institutional Review Board of the institute was taken and informed consent was obtained from each subject. This study was conducted in accordance with the tenets of the Declaration of Helsinki. Fifty-nine diabetic subjects were recruited for this study. Exclusion criteria included high myopia (greater than - 6 diopter), or hyperopia (greater than +4 diopter), any retinal or retinal pigment epithelium (RPE) abnormality detectable on optical coherence tomography scan, poor image quality because of unstable fixation, or any history of any intraocular surgery.
All participants underwent a comprehensive ophthalmic examination including visual acuity testing using, slit-lamp biomicroscopy, intraocular pressure (IOP) measurement using Goldmann applanation tonometer and dilated fundoscopic examination. Axial length (AXL) measurement was performed using ocular biometry (IOL Master; Carl Zeiss Meditec, Jena, Germany).

**Eyes were divided into four groups**

No evidence of diabetic retinopathy (DR) (group 1), non-proliferative DR (NPDR) with macular edema (ME) (group 2) and without ME (group 3); and proliferative DR (PDR) (group 4).

**Choroidal imaging**

The OCT scans were obtained by using Cirrus HD-OCT (Carl Zeiss Meditec, Inc., Dublin, CA. Software Version 5.0.0.326) with undilated pupil. The scan used for imaging in this study is HD 1 line raster. Scan 3 of the 5, which passes through the fovea and was used for all the measurements. Scans with a signal strength of more than or equal to 6 were used for analysis.

Using the Cirrus linear measurement tool, single observer measured choroidal thickness perpendicularly from the outer portion of the hyperreflective line corresponding to the RPE to the inner surface of the sclera at 500 microns intervals temporal and nasal from the fovea, up to 2500 Microns (Figure 1).

**Statistical Analysis**

Descriptive statistics included mean and standard deviation for continuous variables. As both eyes of most subjects were included for analysis, the correlation between the two eyes of the same subject was adjusted using generalized estimating equations (GEE) during the calculation of summary descriptive parameters. Multivariate models adjusted using GEE methods were fit to assess the effects of age, gender, axial length, and macular thickness on the CT measurements. Statistical analyses were performed using commercial software (Stata ver. 12.1; StataCorp, College Station, TX). The alpha level (type I error) was set at 0.05.

**RESULTS**

The mean age was 54.5 ± 8.8 years. SFCT was 283.45±49.32, 273.58±50.78, 256.16±75.15, 252.90±70.18 and 246.57±81.99 microns in groups 1, 2, 3 and 4 respectively. There was no significant difference between the SFCT among the groups 1, 2 and 3 (p>0.05, ANOVA) except group 4 in whom it was decreased compared to age-matched healthy subjects (p<0.05, ANOVA).

**Conclusion**

SFCT did not vary between subjects with NPDR. Choroidal thickness in PDR was significantly lower when compared to normals.
Foveal Scanning using Spectralis to Correlate Visual Outcome Post Surgery for Retinal Detachment

Dr. Kiran Shakya

Every rhegmatogenous retinal detachment causes anatomical distortion which leads to visual impairment even after successful surgical retinal attachment of fovea. Spectral domain Optical coherence tomography (SD-OCT) enables visualization of the foveal images at near-histologic resolution. Several studies have shown a relation between the preoperative or postoperative SD-OCT structural findings with postoperative visual outcome after RRD repair. This study was conducted to look at SD-OCT abnormalities of pre and postoperative period with fovea involving RRD and correlated these findings with visual outcome.

MATERIALS AND METHODS

Consecutive thirty eyes presenting with primary rhegmatogenous RD who were to undergo scleral buckling (SB) (6 eyes) and pars plana vitrectomy (PPV) (19 eyes) and combined SB and PPV (5 eyes) surgery were recruited to the study. Patients with preexisting macular pathology (e.g., age-related macular degeneration, macular scars) and history of ocular trauma and those unable to give informed consent were excluded. All patients underwent pre- and postoperative VA testing, slit-lamp biomicroscopy, and fundus examination and SD OCT (Spectralis HRA+OCT; Heidelberg Engineering, Inc, Heidelberg, Germany) of foveal scan preoperatively on the same day of surgery and post operatively on 30 days and 90 days. OCT characteristics were analyzed and correlated with final visual outcome. Snellen VA was converted to logMAR (log of the minimum angle of resolution) for statistical analysis. The statistical p value was deduced by using independent sample t-test.
RESULTS
Thirty eyes of 30 patients aged 31 to 76 years were included (mean age, 53.5 years). Preoperatively, patients had an average of 17.5 days of symptoms (range, 1 to 90 days) prior to presentation. The time to surgical repair from the day of presentation ranged from 0 to 10 days (mean, 2.2 days). Preoperative VA ranged from 20/30 to hand movement (with accurate recognition of light projection in all quadrant) with mean logMAR of 1.3.

Abbreviations
CME, cystoid macular edema; IS/OS, inner segment/outer segment junction; ELM, external limiting membrane; ORC, outer retinal corrugation; BCVA, best corrected visual acuity.

| Table 1: The patient preoperative OCT findings are displayed |
|---------------------------------|-------|------------------|
| OCT characteristics present     | No.   | Mean BCVA (logMAR) |
| IS/OS preserved                 | 11    | 1.14             |
| IS/OS disrupted                 | 19    | 1.36             |
| CME (present)                   | 21    | 1.23             |
| ELM (disrupted)                 | 3     | 1.43             |
| ORC present                     | 23    | 1.35             |
| ORC absent                      | 7     | 1.04             |

| P value: | 0.36 | 0.25 |

| Table 2 |
|---------------------------------|-------|------------------|------------------|
| OCT characteristics present     | Postoperative 30 days | Postoperative 90 days |
| No. | Mean BCVA | P value | No. | Mean BCVA | P value |
| IS/OS disrupted                 | 19    | 0.86 | 0.0002 | 19    | 0.82 | 0.0003 |
| IS/OS preserved                 | 11    | 0.37 | 0.36   | 11    | 0.36 |
| CME                             | 14    | 0.8  | 0.047  | 10    | 0.84 |
| ELM disrupted                   | 3     | 1.4  | 1.4    | 3     | 1.4  |
| ORC present                     | 21    | 0.82 | 0.001  | 20    | 0.8  | 0.001 |
| ORC absent                      | 9     | 0.34 | 0.35   | 10    | 0.35 |
| SRF                             | 9     | 0    | 0      | 0     | 0    |

IS/OS junction integrity was the indicator of better BCVA at postoperative 30 days and at 90 days (P=0.0002 and P=0.0003 respectively). Outer Retinal Corrugation (ORC) was related to worse BCVA at postoperative 30 days and at 90 days (P=0.001). External limiting membrane (ELM) did not show significant role in visual outcome but cystoid macular edema (CME) showed role at postoperative 90 days (P=0.047). All eyes of SB and 3 eyes of PPV had minimal subfoveal fluid at 30 days follow up that had no affect on visual acuity. All retinas were attached at 90 days postoperatively.
DISCUSSION

Several reports have analyzed the structural changes found on OCT of the fovea in patients with fovea-involving retinal detachments. In the present study, IS/OS junction integrity was the indicator of better postoperative visual acuity. Nakanishi et al. showed using their prototype SD-OCT, that a preoperative foveal loss of IS/OS junction at the detached macula was significantly correlated with postoperative visual acuity. A recent study has shown that damage to the IS/OS junction in postoperative SD-OCT image, may explain inadequate postoperative visual recovery. Outer retinal corrugation (ORC) may indicate more severe photoreceptor damage at the time of detachment. It is also possible that this sign is a manifestation of chronicity for patients with RD. Postoperatively, the corrugation manifested as ill defined line instead of clear demarked outer IS/OS junction line. In this study, ORC showed worse postoperative visual acuity at 30 days and at 90 days. Minhee Cho et al. concluded that ORC was the most predictive of worse preoperative and 1-month postoperative visual acuity. A recent study has shown that damage to the IS/OS junction, with or without disruption of the ELM in postoperative SD-OCT image, may explain inadequate postoperative visual recovery. External limiting membrane (disrupted, n=3) did not show any role in visual outcome as ELM disrupted cases were few in number. Hsuan Chieh Lin et al. show low significant different between ELM preserved group and ELM disrupted group for postoperative visual outcome.

Conclusion

IS/OS junction integrity and Outer retinal corrugation may be important predictors of visual outcome after anatomically successful RRD surgery.

REFERENCES

Structural and Functional Correlation in Eyes with X Linked Retinoschisis (XLRS)

Dr. Kumar Saurabh, Dr. Rupak Roy, Dr. Vishnu Suryaprakash

Juvenile X linked retinoschisis (XLRS) is the most common form of macular dystrophy in young males with a prevalence of 1 in 25000 to 1 in 5000.1-4 XLRS presents as strabismus and nystagmus in infancy or poor vision in school age.5 Vision remains stable until fourth decade of life; thereafter further deterioration is often noted due to retinal atrophic changes.6 Splitting in various layers of retina both at the macula and the periphery is the hallmark of XLRS. Earlier studies have shown that foveal thickness and area of schisis at macula do not correlate with the visual acuity.7 With the advent of newer optical coherence tomography (OCT) machines it has been known that inner nuclear layer (INL) is the most commonly involved layer in XLRS, however splitting can affect other layers as well.8,9

On full field electroretinogram (FFERG) eyes with XLRS usually show reduced amplitude of b wave with preservation of negative a wave.6 Though reduction in b wave indicates predominant inner retinal abnormality a wave abnormalities in the later part of life points towards progressive outer retinal (photoreceptor) involvement.10 Present study intends to find out the correlation between layers of retinal involvement, ERG characteristics and visual acuity in eyes with XLRS.

MATERIALS AND METHODS

It was a record based, retrospective case series of patients with XLRS attending our hospital from January 2006 to December 2012. Eyes with co-existant ocular pathology were excluded from the study. The age and gender of the patients were noted from the medical records. Log MAR best corrected visual acuity was obtained after conversion of Snellen’s chart reading at first visit. Fundus was examined with indirect ophthalmoscope using plus 20 Dioptre lens and slit lamp biomicroscopy to note the peripheral and posterior pole retinoschisis respectively. Cirrus HD-OCT (Carl Zeiss Meditec, Dublin CA, USA) was used to acquire OCT images.

Macular cube protocol was used to identify the inner and outer retinal boundaries while involved layers of retinoschisis were identified with five line raster scanning protocol. Full field electroretinogram (FFERG) was done using VerisTM Science 5.2.2X software (Electro-Diagnostic Imaging Inc. CA, USA) according to ISCEV standards. Mann Whitney U test was used for statistical analysis and p value of less than 0.05 was considered significant.
RESULTS

Thirty eight eyes of 19 patients were included in the study. The mean age of the patients was 15.36 ± 9.66 years. All the eyes had clear cornea and lens. None of them had undergone any ocular surgery in past. Retinoschisis involved fovea and peripheral retina in 26 (68.4%) eyes while it was limited to macular region in 12 (31.6%) eyes.

The eyes were divided into four groups based on the layer of involvement (Table 1). Inner nuclear layer (INL) was involved in retinoschisis in all the eyes. The mean logMAR BCVA was 0.7 ± 0.17 in group 1, 0.7 ± 0.36 in group 2 and 0.7 ± 0.4 in group 4 while it was 0.4 ± in group 3. The mean b wave amplitude was 158±32 microvolt in group 1, 157±29 microvolt in groups 2, 161 + 33 microvolt 4 and 172 + 18 microvolt in group 3. The mean b wave implicit time was 46.7 + 3 millisecond in group 1, it was 46 + 2.9 millisecond in groups 2, 49 + 1.5 millisecond in group 4 and 44 + 4 milliseconds in group 3. There was no statistically significant difference between four groups in BCVA (P= 0.86), b wave amplitude (P= 0.08) and implicit time (P=0.09).

DISCUSSION

Mutation in the RS1 gene which leads to formation of mutant retinoschisin protein has been associated with XLRS.11 Retinoschisin is responsible for cell to cell adhesion and interaction in inner nuclear layer and also allows synaptic connection between bipolar cells and photoreceptors.11-13 It is produced by photoreceptors and are taken up by Muller cells. Defective retinoschisin tends to accumulate in the Muller cell and later into the extracellular space.12 The initial intracellular accumulation of retinoschisin in Muller cells and later extracellular retention leads to schitic changes in various layers of retina. Anatomical location of schisis is coincident upon the extent of Muller cell dysfunction invoked upon by accumulation of mutant retinoschisin.14 Functional disability of Muller cells, defective cell to cell adhesion and interaction and defects in the synaptic connection between bipolar cells and photoreceptors ushered by the defective retinoschisin appear earlier than the structural schitic changes which appear after sufficient accumulation of defective retinoschisin within Muller cells and in extracellular space. Our study shows that though eyes with retinoschisis show schitic changes in different retinal layers, this differential involvement of retina has no bearing on the visual acuity and FFERG changes. It may mean that the functional changes (visual acuity and b wave amplitude and implicit times) precede the structural changes (layer of retinal involvement) in eyes with XLRS. It is in keeping with the initial effects of mutant retinoschisin and later by central role of Muller cells in dealing with the accumulated mutant retinoschisin leading to formation of schitic cavities in the retina.
We have found that majority of eyes had schitic changes in the macula as well as in the peripheral retina and most commonly involved INL. This is in keeping with the previous studies\(^8,15\). To the best of our knowledge, ours is the first report to have correlated the FFERG changes in XLRS with layer of retinal involvement. The fact that we did not find any correlation in the visual acuity and FFERG findings with OCT may mean that any future study or possible treatment intervention should not be guided by OCT parameters alone. In other words OCT findings in XLRS may have a limited prognostic role in the advent of any future treatment intervention.

Present study has limited sample size and is a retrospective cross sectional study which can be cited as the drawback. Since XLRS is an evolving process over the years of the patient; a prospective longitudinal study design would seem more appropriate to understand the course of events in the spectrum of disease. Being a rare entity such a study design may require multicenter approach to understand the disease better.

Present study adds to the existing knowledge about XLRS. It shows that layer of retinal involvement does not guided the FFERG and visual acuity changes. It also suggests that future studies should not be based on OCT alone and should take electrophysiological evaluation into account.

<table>
<thead>
<tr>
<th>Table 1: OCT characteristics of study eyes</th>
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<tr>
<td>Group</td>
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<tr>
<td>-------</td>
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INL: Inner nuclear layer, ONL: Outer nuclear layer, OPL: Outer plexiform layer, GCL: Ganglion cell layer, NFL: Nerve fibre layer

REFERENCES

Scleral Buckling for Rhegmatogenous Retinal Detachment using Vitrectomy based Visualization Systems

Dr. Sidharth Bhardwaj, Dr. Manish Nagpal, Dr. Navneet Mehrotra, Dr. Kartikey Kothari

The type of surgical procedure used for rhegmatogenous RD is influenced by the preoperative findings, patient characteristics, available tools for surgery and above all the experience and ability of the operating surgeon. In recent years, a definite trend towards pars plana vitrectomy (PPV) has been observed due to improvements in the instrumentation and safety of PPV along with modern microscopes and wide-angle viewing systems.\(^1\) On the
other hand, scleral buckling though technically easier requires an accurate decision making for appropriate case selection which may prove critical to the surgical success, hence takes experience with a multitude of cases and experienced mentors to feel comfortable with selection of the most effective elements. It also requires practice to visualize and localize the breaks, to place the SB elements in the correct location with the desired indentation to support the retinal breaks and to drain subretinal fluid without complications. It is very different from microscope-based ophthalmic surgery, and there is a significant learning curve to it.

The visualization systems and their optical zooming capability in vitrectomy surgery are far superior to that of indirect ophthalmoscopy, thereby making it easier to teach vitrectomy with real-time video transmission facilities which has resulted in primary vitrectomy being a more popular as a procedure of choice among the present generation of ophthalmologists. In addition, new generation chandelier systems have improved the field and quality of resolution thus allowing the surgeon an unrestricted view of the extreme periphery when used in conjunction with wide field viewing systems.

Hence we would like to introduce a concept which would allow us to do scleral buckling in non-complex fresh retinal detachments without using an indirect ophthalmoscope and instead using Volk HRX Vit SSV lens (VOLK® Mentor, Ohio USA) using a single 25 gauge chandelier (ALCON Fort Worth, TX) for illumination.

**MATERIALS AND METHODS**

We prospectively assessed 20 eyes undergoing scleral buckling for primary rhegmatogenous retinal detachment with Chandelier illumination system for retinal detachment at Retina foundation over a 6 month period. Ethical approval was obtained and informed consent to participate was gained from participants.

Patient with rhegmatogenous retinal detachment of recent onset having peripheral break/s were included in the study. Patients with media opacities such as vitreous hemorrhage or significant cataract and any co-existing ocular pathology such as glaucoma and uveitis were excluded.

Following enrolment, all patients underwent complete preoperative assessment including best-corrected visual acuity (Snellen), relative afferent pupillary defect in the affected eye and refraction of the fellow eye; slit-lamp examination, including assessment of the anterior segment, type, and position of IOL and integrity of the posterior capsule; and intraocular pressure (IOP) measurement. Fundus examination with slit lamp biomicroscopy and indirect ophthalmoscopy was performed to evaluate the extent of RD, the presence of
any predisposing pathologic features in the peripheral retina, PVR grading, signs of myopic degeneration and to find retinal breaks and to determine their location, type, and number. Detailed history of co- incidental and past systemic and ocular pathologies and procedures were elucidated.

All patients were operated under peribulbar anesthesia. After a 360° limbal peritomy, traction sutures were passed under the rectus muscles. Sclerotomy for Chandelier illumination was created with 25 gauge Edgeplus trocar (ALCON Fort Worth, Tx) at 3.5 and 4 mm posterior to the limbus for pseudophakic and phakic patients respectively in inferotemporal quadrant. The fibreoptic was connected to either a Constellation (Xenon) or Accurus (Halogen) Vitrectomy systems (Alcon Fort Worth, Tx).

The Trocar Fixation plate (Asico, Westmont, IL) was used so as to stabilize the globe while making the biplanar incision. Initially, the blade was inserted obliquely into the sclera at an angle of about 30° to 45° up to the cannula mark. Then, the direction of the blade was adjusted perpendicular to the sclera as it is inserted into the vitreous cavity. Once the chandelier was inserted the wide field viewing contact lens was placed on corneal surface with viscoelastic interface. Once visualization was achieved the image was reinverted using the invertor attached on the microscope. Detailed assessment of the fundus was done using indentation and the break/s was localized. Cryopexy of the breaks and all the suspicious areas was performed. Silicone sponge 5 mm, 506 (LABTICIAN Ophthalmics, Inc. Canada,) was passed beneath the rectus muscles and fixed with Mersilene 5.0 suture placed in the sclera such that the buckle indented the site of the break and 1 clock hour on either side, 3 mm posterior and 2 to 3 mm anterior to it.

The decision to use a segmental buckle was made according to the size and location of the retinal tear. Subretinal fluid (SRF) was externally drained through a sclerotomy with a 24 gauge needle after diathermy to the sclerotomy site. Full drainage was achieved in all cases and visual confirmation was done by checking under the microscope.

At this stage the fundus was checked to confirm retinal flattening along with the desired indentation effect. Externally the remaining sutures were taken. The Chandelier light cannula was plugged and eventually removed and the sclerotomy was sutured with 8-0 vicryl suture. A drop of povidone-iodine is then instilled followed conjunctival closure with 8-0 vicryl and subconjunctival antibiotic injection. All surgeries were transmitted real time to the viewing monitor within the theatre for visibility to fellows/assistants and the entire surgical procedure was recorded for teaching and training purposes.

Patients were examined postoperatively on day 1, 30, 90 and finally at 180 days.
RESULTS
A total of 20 patients were included in the study of which 14 were phakic, 4 pseudophakic and 2 aphakic eye. The retinal detachment involved > 2 quadrants in 10 (50%) eyes. There was total retinal detachment in 8 (40%) eyes. The macula had been spared in the retinal detachment at presentation in 2 (10%) eyes. An encirclage was done in 18 eyes and segmental buckle used in 2 eyes. Subretinal fluid was drained in all cases. All patients were followed up for a minimum duration of 6 months. 19 out of 20 patients had fully attached retina at all follow ups with visual improvement. 1 patient who had settled on table and stable on first postoperative day presented with redetachment on the first month follow up. Patient was a myope with tessellated fundus and staphylomatous changes and hence a small macular hole could have been missed. However after a vitrectomy the retina settled well. The mean preoperative BCVA of 1.3 logmar improved postoperatively to 0.48 at the end of 6 months.

DISCUSSION
Nawrocki et. al. have demonstrated the use of the Optic Fibre Free Intravitreal Surgical System (OFFISS) (Topcon Inc., Paramus, NJ) in scleral buckling performed as a complete microsurgical procedure in seven eyes with rhegmatogenous retinal detachment. It provides a visual field of approximately 50 degrees inside the eye which is smaller than a wide-angle viewing system. Even with the usage of an additionally equipped with a prismatic lens, the visual field may be increased up to a maximum of 70 degrees. The OFFISS 120 diopter lens when mounted under the microscope does allow wide-field viewing inside the eye but with the use of endoillumination. Moreover, the best quality images may be achieved in aphakic eyes. In comparison, Volk HRX Vit SSV lens provides a much wider view (150o) which provides a clear visualization of all the breaks. The contact lens works equally well in phakic, aphakic as well as pseudophakic eyes.

Aras C et. al. have described the outcomes of scleral buckling surgery using a non-contact wide-angle viewing system combined with a 25-gauge illumination fibre inserted into the sclera at the pars plana for fundus visualization in 16 patients with rhegmatogenous retinal detachment without proliferative vitreoretinopathy. We have used contact wide angle viewing system (Volk HRX Vit SSV lens) in our study. Although both types of WAVs can gain magnified fundus images by zooming of the surgical microscope, the image resolution (imaging clarity) is theoretically superior with the contact type system because the aberration and reflection from the corneal surface can be compensated by directly placing the lens on the corneal surface.
The procedure of buckling by this technique is the same except that the chandelier is inserted and viewing is done using wide field contact lenses instead of an indirect ophthalmoscope. But the ability to transmit the surgery to an OT monitor and see every step in a fine detail makes a major difference. This greatly helps in teaching purpose. It may also have ergonomic benefits for the surgeon in the long run to do buckling procedures with the comfort of sitting on a chair and visualizing using a microscope.

REFERENCES

Role of Standard Spectral Domain (SD) OCT in Early Detection of Macular Hole Closure after Surgery

Dr. Subhendu Kumar Boral, Dr. Arnab Das, Dr. Tushar Kanti Sinha, Dr. Somak Mazumdar

Standard surgery for full thickness macular holes is vitrectomy with induction of posterior vitreous detachment followed by peeling of internal limiting membrane and fluid air exchange and ending with short or long acting gas endotamponade. Few studies show results with air tamponade.1,2,3 We know vitrectomy with PVD induction relieves anterior-posterior as well as tangential traction and ILM peeling relieves residual centrifugal tangential traction. The logic behind maintaining postoperative prone position is not well understood, but gas may promote reattachment of hole margin the by
virtue of its surface tension, and/or facilitate re-apposition of the macular hole edges by providing a surface for glial migration. Buoyant force is greatest at the apex of a gas bubble. Face-down positioning enhance the effect of the gas tamponade by ensuring that the macula is consistently in contact with the surface of the gas bubble, or enhance any effect of its buoyancy. But maintaining prone position for long periods is very cumbersome for the patients as it increases psychophysical burden with delayed recovery. Studies showed postoperative prone poisoning can be decreased to 7 days or less. But post operatively hole status is most of times is difficult to assess with available OCTs to detect its closure, so to stop prone positioning. Opinion differs regarding when hole closure occurs after surgery because we cannot examine retina. Whether it closes right way or it takes several days? Again the question comes how long to be in prone position? Claus Eckardt showed the macular hole was successfully closed in 91.6% patients after 3 days of prone positioning with air tamponade using a modified Fourier-domain vertical OCT2. But how early the available standard spectral domain OCT can detect hole closure? Moreover the subjective assessment of gas bubble height postoperatively is also very complex scenario.

Aim of this study was to detect hole status by standard SD-OCT after macular hole surgery.

**MATERIALS AND METHODS**

A nonrandomised prospective comparative study performed taking 66 cases of idiopathic full thickness macular holes in Disha Eye Hospitals, Barrackpore, Kolkata, West Bengal from Nov 2011 to May 2013. Both large (>400µ, n=40) and small (<400µ, n=26) sized macular holes were included. Triamcinolone assisted 23G three port vitrectomy done in all with PVD induction and removal. Then Brilliant Blue G stained ILM peeling performed followed by fluid air exchange. All patients were divided into two groups-I (n=35), where 14% C₃F₈ gas used and Group II (n=31), where air used for tamponade. Two tools were used postoperatively in this study. First, ultra-wide field digital retinal image by Optos 200TX was used to measure height of gas bubble. When hole status and or optic disc was just/ barely visible, the gas bubble height was considered as 50%; thus it was measured as less than 50%, 50% and more than 50%. The second one was standard SD-OCTs (RTVue Fourier Domain OCT primary series, software version 6.3, Optovue), which was performed serially in all preoperatively and postoperatively at 24 hours, 48 hours, 72 hours, 7 days, 2 weeks and 1 month. Minimum follow up was 3 months period. If macular hole was closed on OCT in first OCT, then subsequent prone positioning was stopped. But if the hole closure was questionable or not confirmed or open, further prone positioning was continued till next OCT. Resurgery
was considered for an open macular hole when the tamponade volume was significantly less (<20% gas volume with arc of contact ≤ 1060).

**RESULTS**

Pre and postoperative BCVA was 0.93±0.37 and 0.63±0.26 Log MAR in Group I and 1.15±0.45 and 0.73±0.21 Log MAR in Group II respectively. Mean age was 66.71±7.69 years in Group I and 67.32±7.07 years in Group II. Combined phacoemulsification with intraocular lens implantation was performed along with macular hole surgery in 22 patients (10 in Group I and 12 in Group II). Cataract progression was noted in 10/13 (76.92%) patients in Group I and 5/10 (50%) patients in Group II. Overall closure rate were 91.43% (32/35 patients) in Group I and 93.55% (29/31 patients) in Group II.

Ultra-wide field digital retinal image by Optos 200TX was done to measure the height of gas bubble in both groups and its measurements were as follows:

<table>
<thead>
<tr>
<th>GROUP</th>
<th>Height of gas bubble</th>
<th>24 hours</th>
<th>48 hours</th>
<th>72 hours</th>
<th>7 days</th>
<th>14 days</th>
<th>30 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 50%</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>07</td>
<td>34</td>
</tr>
<tr>
<td>I</td>
<td>50%</td>
<td>0</td>
<td>0</td>
<td>04</td>
<td>10</td>
<td>13</td>
<td>01</td>
</tr>
<tr>
<td>&gt;50%</td>
<td>35</td>
<td>35</td>
<td>31</td>
<td>24</td>
<td>15</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>&lt;50%</td>
<td>1</td>
<td>04</td>
<td>05</td>
<td>11</td>
<td>31</td>
<td>31</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>50%</td>
<td>3</td>
<td>15</td>
<td>18</td>
<td>19</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>&gt;50%</td>
<td>27</td>
<td>12</td>
<td>08</td>
<td>01</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

Serial SD-OCT performed in all. At 24 hours, only 4 holes showed definitive closure in air group. At 48 hours, macular OCT was possible in 19(61.29%) eyes of Group II only. In Group I eyes, OCT was not possible because of presence of large sized (> 50%) gas (C3F8) bubble at 48 hours. At 72 hours, SD-OCT was possible in 4(11.43%) eyes in Group I but 23(74.19%) eyes in Group II [statistically significant, p <0.001]. On 7th day, SD-OCT was possible in 11(31.43%) eyes in Group I, but in 30(96.77%) eyes in Group II [statistically significant, p <0.001]. After 2 weeks, it was possible in 20(57.14%) eyes in Group I and all 31(100%) eyes in Group II. SD-OCT was possible in all 35 eyes Group I eyes at 1 month.

<table>
<thead>
<tr>
<th>GROUP</th>
<th>Hole Closure on SD-OCT</th>
<th>24 hours</th>
<th>48 hours</th>
<th>72 hours</th>
<th>7 days</th>
<th>14 days</th>
<th>30 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Closed</td>
<td>0</td>
<td>0</td>
<td>04</td>
<td>09</td>
<td>17</td>
<td>32</td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>Not Closed/ Open</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>02</td>
<td>03</td>
<td>-</td>
</tr>
<tr>
<td>Questionable/Not visible</td>
<td>35</td>
<td>35</td>
<td>31</td>
<td>24</td>
<td>15</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Closed</td>
<td>4</td>
<td>19</td>
<td>22</td>
<td>28</td>
<td>29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>Not Closed/ Open</td>
<td>0</td>
<td>0</td>
<td>01</td>
<td>02</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Questionable/Not visible</td>
<td>27</td>
<td>12</td>
<td>08</td>
<td>01</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>
Resurgery was considered for an open macular hole when the tamponade volume was significantly less (<20% gas volume). In Group I, we did repeat fluid air exchange with 14% $C_3F_8$ gas injection. And in Group II, repeat fluid air exchange only. Further prone position was maintained accordingly.

**DISCUSSION**

Early detection of hole closure postoperatively reduces postoperative prone positioning period and thereby decrease psychophysical burden for the patients. But detection of hole closure in early postoperative days depends on the visibility of macular status in a gas filled eye. However, Hasler PW et. al. showed, OCT demonstrated macular hole closure in 28 eyes (93%) on postoperative day 3 with air tamponade. Sato and Isomae showed 5 (91%) achieved hole closure after only 1 day prone positioning with air tamponade in macular holes with small diameter. Majority of our patients (40/66) had large sized (>400µ diameter) macular hole. Shah S P et.al. showed that confirming early closure of macular holes with spectral domain optical coherence tomography imaging can significantly shorten the duration of prone positioning, but their sample size was small and 6.2% cases were with $C_3F_8$ and rest with $SF_6$ gas tamponade. Claus Eckardt showed 91.6% hole closure with 3 days prone positioning through the air filled eye with the modified vertical OCT. But this vertical OCT is not so readily available and the procedure is little bit cumbersome. Moreover assessing height of intravitreal gaseous tamponade is many times difficult, very subjective due to parallax errors and needs complex measurement. Invent of ultra-wide field digital retinal imaging system (Optos) has another advantage of assessing the vertical meniscus height of gas tamponade postoperatively, avoiding parallax errors and complex equations. Height of gas bubble decrease with time and the rate of decrease vary with air and long acting gas. Air is the simplest of all tamponades. With air tamponade, we know, the vitreous cavity is 100% full of air on table in supine position. On the first postoperative day, in standing position, the vitreous cavity is 60% full of air and macula cannot be seen as light rays will be deflected inferiorly from the hitting the inferior surface of gas bubble. At 48 hours, in standing position with the cavity still 50% full of air and macula still cannot easily be seen. But with slight downward rotation of the globe, the disc/ macular status can be picked up by standard SD-OCT at 48 hours without any deflection of light rays. So, standard SD-OCT can detect hole closure earliest at or after 48 hours after surgery with air tamponade cases only with gas volume ≤ 50% in size. In our study, at 48 hours 61.29 % (19/31) holes (all closed), at 72 hours 74.19%(23/31) holes (70.97% closed) and after 7 days 96.77% (30/31) holes (90.32% closed) were visible in SD-OCT with air tamponade. On the other hand, with $C_3F_8$ gas tamponade, at 48 hours hole status was not visible, at 72 hours 11.43% (4/35) holes(all closed), on 7th day, 31.43% (11/35) holes (25.71% closed), on 14th
day 57.14% (20/35) holes (48.57% closed) and after 30 days 100% holes (91.43% closed) were visible in SD-OCT. Probability of picking up the hole status with standard SD-OCT postoperatively was significantly high at 72 hours and on 7th day (p <0.001) with air tamponade cases. In Group I, SD-OCT was possible in 4 eyes at 72 hours and 11 eyes after 7 days as gas bubble height was ≤ 50% in these eyes which may be due inadequate concentration of C$_3$F$_8$ gas, achieved intraoperatively. Overall delayed confirmation of hole closure with C$_3$F$_8$ gas tamponade cases means maintaining prone position for prolonged period, which may not be necessary, as hole closure happens in early postoperative days, within first 7 days and majority (70.97% in this study) can be detected in first 3 days with simplest gas air tamponade only. Although surface tension and buoyancy effect of air is definitely less than perfluoropropane (C$_3$F$_8$) gas, but this may be enough to close a macular hole, provided prone positioning maintained for ≤ 7 days, specifically first 3 days after surgery.

**Conclusion**

1) Standard SD-OCT can detect macular hole closure earliest at 48 hours after surgery with air tamponade in majority (61.29%) of cases and significantly more with air than C$_3$F$_8$ gas tamponade at 72 hours and 7 days, 2) Ultra-wide field digital retinal imaging can assess height of gas bubble in postoperative periods.

**REFERENCES**

Glueless Sutureless Scleral Fixated Intraocular Lenses: A Boon to Aphakics!

Dr. Tanwangee Joag, Dr. Aditi Patwardhan, Dr. Shailbala Patil, Dr. Kulkarni Anil Narayan

Artificial intraocular lens implantation in the absence of capsular support though a surgical challenge, is an extremely essential part of cataract surgery today. Currently, the two most widely used approaches include iris fixation or scleral fixation with sutures. Sutureless intrascleral fixation of a three-piece IOL is a recent technique which was first reported by Scharioth and colleagues in the Journal of Cataract and Refractive Surgery in 2007. This technique allows sutureless fixation of the haptics in scleral tunnels parallel to the limbus, while reducing surgical time and minimizing the risk of postoperative astigmatism due to lens tilt.

Aim of this study was to study the outcomes of glueless sutureless scleral fixated posterior chamber IOLs.

**Inclusion Criteria**
1. Aphakia of causes – traumatic or surgical
2. Subluxated or dislocated natural lens due to any cause – Traumatic, secondary to pseudoexfoliation or hypermature cataracts
3. Dislocated artificial lens – IOL drop, Secondary to Zonular dialysis or pseudoexfoliation

**Exclusion Criteria**
1. Retinal tears or breaks
2. Optic atrophy
3. Scleral ectasias or any other scleral disease
4. Central corneal or media opacities

**MATERIALS AND METHODS**

80 eyes undergoing glueless sutureless SFIOL between June 2012 to February 2013 were included in the study. All cases were operated at a tertiary eye hospital in Western Maharashtra by a single surgeon using the same technique.

**Surgical Technique**
- Limited conjunctival peritomy
- Making a superior Scleral tunnel or refashioning the old one if already present
• AC paracentesis and AC maintainer positioning in the infero-temporal quadrant 3 mm from limbus
• AC entry through superior scleral tunnel
• Anterior vitrectomy / Pars plana vitrectomy ± Lensectomy as per the need of the case. Dropped nuclei or Dislocated IOLs when present were removed
• On table Indirect Ophthalmoscopy to rule out peripheral retinal breaks
• Sclerotomies with 23G MVR blade at 3 and 9 o clock positions 2 mm away from limbus
• Introduction of 25G DORC forceps from any one sclerotomy and simultaneous insertion of a 3 piece PMMA IOL from the superior scleral tunnel
• Grasping the haptic tip to deliver it out of sclerotomy with the DORC forceps
• Repeating similar procedure through the opposite sclerotomy
• Making a scleral groove with a 23G MVR blade on both sides parallel to limbus
• Tucking both the haptics in the respective side grooves
• Suturing of scleral tunnel with 8-0 vicryl
• Conjunctival closure with 8-0 vicryl
• Removing AC maintainer and hydration of paracentesis

RESULTS

Age distribution
Patients were in age range of 40 to 90 years with a mean age on 63.4 ± 11.7 years.

Sex distribution
80 eyes were included in the study of which 51(63.75%) were males and 29 (36.25%) were females.

Indications for SFIOL
1. Aphakia - 42 (52.5%) eyes of which 31 (38.75%) were due to Surgical complications (PCR, ZD, nucleus drops), 4 (5%) were Traumatic and 7 (8.75%) had Dislocated IOLs.

2). Subluxated or dislocated natural lens 38 (47.5% ) eyes of which 14 (17.5%) were Traumatic and 24 (30%) were Secondary to Ocular (e.g. Psuedoexfoliation, hypermature cataracts etc.) or systemic conditions (e.g. Marfans syndrome)
Visual acuity

Best corrected Mean preoperative visual acuity of 0.017 ± 0.038 decimal eq. (2/60 Snellens) improved to a Mean acuity of 0.17 ± 0.14 decimal eq. (6/36 Snellens) on day 1 which further improved to 0.54 ± 0.28 decimal eq. (6/12 Snellens) at the end of 2 months follow up. The Improvement in visual acuity was statistically highly significant [t(-16.76) P(0.00)]. The mean astigmatism was noted to be 1.9 ± 0.93 D.

Complications

The complications noted were deposition of pigment clumps on IOL in 8 eyes (10%), IOL tilt or decentration in 5 eyes (6.25%), development of lamellar macular hole in 5 eyes (6.25%) and a retinal detachment in 2 eyes (2.5%). Out of the 5 cases, only 1 patient of decentered IOL was symptomatic enough to require a recentration surgery, whereas the remaining 4 being asymptomatic, no intervention was done in these cases. Retinal detachment in 1 case settled satisfactorily with placement of a scleral buckle while the 2nd patient refused surgery and was later lost to follow up.

DISCUSSION

Till date, this study which included 80 eyes, is the largest reported single centre retrospective case series of its kind all over the world. Similar studies by Scharioth et. al., Liu et. al. and Benayoun et. al. had sample sizes of 63, 30 and 9 respectively.

The mean visual acuity in this study showed a statistically significant improvement postoperatively [t(-16.76) P(0.00)] which was similar and comparable to similar studies published in literature.

A mean improvement in this study of 0.3 log MAR (0.52 decimal eq.) is comparable to 0.42 log MAR (0.4 decimal eq.) in study by Benayuon et. al. and 0.2 log MAR (0.6 decimal eq.) in the study by Liu et. al.

The mean follow up of 2 months in this study is lesser as compared to the mean follow up of 7 months in the Scharioth et. al. study and 3 months in the Banyuon et. al. study. This was due to the fact that glasses were prescribed at 2 months, and most of the patients after receiving spectacle prescription did not turn up for further visits and were lost to follow up.

The complication of IOL decentration in 6.25% eyes was slightly more than that in the study by Scharioth et. al. (3.6%) and less than that in the study by Banyoun et. al. (11.1%). The other complications encountered in this study i.e. deposition of pigment clumps over the IOL in 8 (10%) eyes, development of a lamellar macular hole in 5 (6.25%) eyes and retinal detachment in 2 (2.5%) eyes were not reported in any other similar studies. Complications like post
operative macular edema, haptic rupture, endophthalmitis, glaucoma etc. which were reported in similar studies were not encountered in this study.

**Sutureless SFIOLs Vs Other techniques of IOL fixation in capsule deficient eyes**

- Compatible in cases of iris trauma where iris claw lenses are ineffective.
- No restriction to pupillary dilation which may be a hindrance to posterior segment interventions at a later date.
- Less time consuming and not technically difficult like scleral suturing technique.
- Can be performed by an anterior segment surgeon with a basic anterior vitrectomy machine.
- Can be performed in cases with insufficient capsule, trauma, aniridia, pseudoexfoliation, lens subluxation or loss of zonular integrity where suturing may not be feasible.
- Pseudophakodonesis, lens tilt and suture breakage which are commonly encountered with sutured SFIOLs are minimal.

**Potential Pitfalls**

- Adequate planning as where to make the incisions and grooves is essential.
- The sclera needs to be healthy and having a reasonable thickness.
- If a thorough vitrectomy is not performed, there is a high risk of vitreous incarceration through the sclerotomies.
- There is a chance that a small part of the haptic may remain exposed directly underneath the conjunctiva and can present a nidus to infection as well as granuloma formation and chronic irritation.

**Limitation of our study**

A short follow up of 2 months, which was due to patients being lost to follow up after receiving spectacle prescription at this visit.

**Conclusion**

Glueless sutureless Scleral fixation of PCIOLs is a reasonably safe procedure, with relatively few serious complications. It is preferable to be attempted when prompt VR backup is available in order to efficiently manage possible intraoperative complications like IOL drop or retinal breaks. It should be advocated as the first line of management in any case with a deficient capsular support and the technique when mastered can indeed prove to be a Boon to Aphakics!
REFERENCES


Spontaneous Pediatric Vitreous Hemorrhage: Clinical Features and Outcomes

Dr. Aditya Sudhalkar, Dr. Jay Kumar Chhablani, Dr. Subhadra Jalali, Dr. Rajeev Kumar Reddy Pappuru

We aimed to determine the causes, clinical presentation, and anatomic and functional outcomes of “spontaneous” vitreous hemorrhage in the pediatric population as noted at a tertiary eye care center in India.

MATERIALS AND METHODS

A Retrospective Computer-Assisted Database Search and chart review of all patients aged less than 18 years with vitreous hemorrhage who presented to L.V. Prasad Eye Institute, Kallam Anji Reddy campus, Hyderabad between January 1, 2002 and May 31, 2012 was conducted. All procedures conformed to the Declaration of Helsinki for research involving human subjects. The Institutional Review Board of L.V. Prasad Eye Institute, Hyderabad, India approved this retrospective review of these patients’ records for the study. Written informed consent for all subjects was taken from their guardians/parents for the diagnostic and treatment procedures conducted. Cases of vitreous hemorrhage secondary to retinopathy of prematurity (ROP) or trauma (surgical or nonsurgical) and those with incomplete records or diagnosis and/or a follow-up of less than 1 month were excluded.

The chart review adhered to previously established guidelines, described in earlier publications. 11 Data collected included demographics; laterality; presenting symptoms and signs (if the child was old enough to cooperate for appropriate history taking; if not, information about the onset of symptoms, possible causes, and previously existing conditions, if any, was obtained from parents); the presenting corrected distance visual acuity; details of the examination procedure; additional investigations and systemic examination, if conducted; the cause, if evident; the treatment offered; the duration of follow-up; and the final anatomic and visual outcomes. Visual acuity was measured using the ETDRS (Early Treatment Diabetic Retinopathy Study) chart and the results subsequently converted to logarithm of minimal angle of resolution (logMAR) chart and noted in logMAR units. For children in the age range of 6 months to 4 years, Teller acuity charts were used and similarly
converted to logMAR units. A comprehensive ocular examination was performed in all cases, including under short general anesthesia if required, and further imaging (such as computerized tomography scans), blood and urine examinations such as complete blood count, erythrocyte sedimentation rate, C reactive protein, Quantiferon tuberculosis (TB) test, serum calcium, serum angiotensin converting enzyme level, rheumatoid arthritis factor, antinuclear antibody, and urine gross and microscopic examination; and systemic and laboratory tests for specific vasculitis were ordered as per the requirement. Treatment, both ocular and systemic, was planned on the basis of diagnosis and can be broadly classified as surgical or nonsurgical. Surgical intervention ranged from vitreous biopsy as a diagnostic aid to combined buckling and vitreoretinal procedures for associated vitreoretinal pathology.

Nonsurgical therapy consisted of observation, topical or systemic medical therapy, and/or laser photocoagulation. Frequent cycloplegic refractions and amblyopia therapy by part-time occlusion was part of the management protocol.

Statistical analysis was performed using SPSS (v. 16; SPSS, Inc, Chicago, Illinois, USA), with special emphasis on the aforementioned information. Statistical significance was set at P < .05.

RESULTS

A Total Of 619 Pediatric Patients With An Entered diagnosis of vitreous hemorrhage in our medical records department database were identified. Analysis after exclusion of acute ROP cases (n = 34 patients) and those with an incorrect diagnosis (n = 27 patients) or coding errors (n = 13) was performed on 545 patients.

A total of 656 eyes with any vitreous hemorrhage (as the diagnosis) were available for analysis. We identified and included 76 patients (124 eyes; 18.09% of the total number of pediatric patients (619) with vitreous hemorrhage who presented to our institute in the stated period) of nontraumatic and nonsurgical "spontaneous" vitreous hemorrhage and performed the analysis. Six patients had an identified cause of spontaneous vitreous hemorrhage; a follow-up of less than 1 month led to their exclusion. Their baseline characteristics did not differ significantly from those included in the study.

The median age of the patients was 12.78 6 4.68 (standard deviation) years (range 4 months to 17 years). There was no significant sex bias (39 female Vs 37 male patients). Forty-eight patients presented with bilateral vitreous hemorrhage; Table 1 shows the proportion of patients having a specific cause in different age groups. All patients with an identified cause for the vitreous hemorrhage had local and/or systemic comorbidities, which provided the underlying pathologic mechanism of hemorrhage.
The mean follow-up was 28.6 ± 18.38 months. The most common presenting complaint in children aged more than 3 years was diminished vision (96.4%). The most common presenting complaint in children aged more than 3 years was diminished vision (119 of 124 patients, 95.96%). The most common presenting complaint in children aged less than 3 years (as reported by the parents) was behavioral changes (110 of 124 patients, 88.7%), such as not being able to recognize the mother, or a recent-onset lack of interest in surroundings.

The mean baseline corrected distance visual acuity in logMAR was 2.25 ± 1.11. In addition to vitreous hemorrhage, 76 eyes (61.3%) had sufficient view of the fundus and showed typical features of the underlying disease on fundus examination. Patients were given medical therapy (topical and/or systemic) or underwent laser photocoagulation (36 eyes) and/or surgery (69 eyes). Overall, 69 eyes (55.6%) required some form of surgical intervention, such as scleral buckling, vitrectomy, lensectomy, plaque placement, enucleation, or diagnostic vitreous biopsy. The mean number of surgeries was 1.89 ± 1.45, with a range of 1-4 surgeries. None of the operated cases developed endophthalmitis or secondary glaucoma. A total of 19 eyes underwent surgery for tractional or rhegmatogenous retinal detachment, with 3 eyes having a recurrent retinal detachment at final follow-up. Two of these eyes had familial exudative vitreoretinopathy (FEVR) and 1 eye had retinoschisis.

To conclude, spontaneous vitreous hemorrhage in children is a condition with a diverse etiology that requires a comprehensive ocular and systemic examination, often aided by additional investigations, to be able to reach an appropriate diagnosis.

<table>
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Outcome and Predictive Factors in Macular Hole Surgery

Dr. Hari Narayan Prasad, Dr. Jay Shah

Idiopathic macular hole occurs primarily in the elderly, with female predominance after the sixth decade of life although macular holes due to secondary causes like trauma and high myopia are seen in young adults. Macular hole is usually diagnosed late as patients are unaware of this problem due to its characteristics feature of gradual painless diminution of vision. More than a century following the first description of macular hole by Henry Noyes in 1871, Kelly and Wendell first reported the successful closure of macular holes by pars plana vitrectomy and membrane peeling in 1991. Many series have been reported with higher anatomic and functional success using different surgical techniques in selected cases.

To the best of our knowledge, there are no published case series stating outcome and predictive factor of macular hole surgery together.

MATERIALS AND METHODS

This is a retrospective, interventional consecutive case series conducted at our hospital, from Jan; 2009 to Dec; 2012. Ethical approval was obtained from the Ethical Committee of the Institutional Review Board. Inclusion criteria included stage 3 and stage 4 idiopathic MH treated with pars plana vitrectomy, membrane peeling and perfluoropropane gas ($\text{C}_3\text{F}_8$) and followed by a follow-up duration of at least three months. Macular hole associated with trauma or other macular pathology like diabetic maculopathy, age related macular degeneration, high myopia, previous retinal detachment surgery or concomitant retinal detachment, cases wherein hole formed after chronic CME and those with a follow-up period of less than three months following surgery were excluded from the study.

The staging of MH was determined bio-microscopically with a slit-lamp examination according to Gass Classification and further quantified by spectral domain optical coherence tomography (SD-OCT). The pre-operative data included age, sex, laterality, BCVA, clinical and OCT based staging of the MH, Hole Formation Factor (HFF) calculated according to Puliafito and colleagues and Macular Hole Index (MHI= e/a).
All patients underwent 23G Pars plana vitrectomy with BBG assisted ILM peeling, fluid-air exchange followed by flushing with 50ml of C$_3$F$_8$ (14%) gas. Patients with concurrent visually significant cataract underwent phacoemulsification with intra-ocular lens implantation at the same setting. Usual Post operative medication were prescribed. The post-operative data included were BCVA, clinical and OCT evaluation of MH closure type and IOP at six weeks, three months and last visit. Postoperative anatomical success was defined as flattening of the macular hole with no sub-retinal fluid. Anatomical success determined by OCT was defined as restoration of full or partial thickness retinal reflection over the retinal pigment epithelium and choriocapillaries reflections. Accordingly MH closure classified into three types. Type 1 closure indicates that the macular hole is closed without foveal defect of the neurosensory retina as a U-type or V-type. Type 2 closure indicates non-closure of hole with W-type. Type 3 closure indicates incomplete closure of hole with residual outer lamellar hole. Data was tabulated and analyzed using SPSS 11 (SPSS Inc; Chicago, IL, USA).

RESULTS
A total of 32 patients (32 eyes) with the age ranging from 47-79 years and the mean age of 63.59 years were included in the study. Females outnumbered males, comprising of 20 cases (62.5%) and 12 cases (37.5%) respectively. 19 (59.38%) patients had right eye involvement. Preoperative visual acuity ranged from 1.8-0.48 log mar (2/60 - 6/18) with a mean of 1 log mar (6/60). Postoperative visual acuity ranged from 1.8-0.18 log mar (2/60 - 6/9) with a mean of 0.62 log mar (6/24). Mean gain in vision was from 1 to 0.62 log mar which corresponds to mean of two line improvement on snellens chart (P value<0.05). The visual acuity improved in 78.12% cases, with more than 2 lines in 62.5% and was stable in 21.88% of cases during the last follow-up.

All patients having HFF of >0.75 had good anatomical closure. 6/7 Patients having HFF of <0.75 had type 2 anatomical closure (Table 3).

All patients with MHI of <0.3 had type 2 closure and 1 patient with MHI of >0.3 had type 2 closure (Table 4).

No patients had post operative complication like raised IOP, Retinal detachment or re-opening of hole after macular hole surgery.

DISCUSSION
Surgical treatment of idiopathic macular holes had given vitreo-retinal surgeons and patients an option for visual recovery for this once untreatable condition. Although the surgical results have improved over the years, controversy still exists as regards to the exact surgical timing and also case selection. Timing of surgical intervention, depending on idiopathic macular hole staging, size and
duration has shown correlation in success rate and visual recovery. Moreover, conditions such as epiretinal membrane, lamellar macular hole, cystoid macular oedema and macular degeneration can be misdiagnosed as macular hole on biomicroscopy. OCT helps to differentiate these conditions and also allow better quantification of macular hole parameters like HFF and MHI.

The mean age of patients in our series was 63.59 years, which was comparable to that of the series by HirneiB et al. (67 years; age range 50-78 years), Schurmans et. al. (69 years; age range 51-82 years); Ullrich et. al. (68 years; age range 50 - 80 years). The female predominance for macular hole in our series was similar to those in other series. Visual acuity improved in 78.12% patient (80% patient had improvement of two line and 20% had improvement of 1 line). 21.88% patient remained stable at pre operative visual acuity. no patient worsen after surgery. The overall visual success (6/18 and better snellens acuity) in our series

| Table 1: Best corrected visual acuity before and after macular hole surgery |
|-----------------------------|------------------|------------------|
| BCVA            | BEFORE Sx | AFTER Sx |
| <3/60           | 4         | 1         |
| 3/60-6/60       | 6         | 2         |
| 6/60-6/18       | 22        | 20        |
| >6/18           | 0         | 9         |

| Table 2: OCT based anatomical closure obtained after macular hole surgery |
|-----------------------------|------------------|
| Type of closure            | Number of patients |
| Type 1                      | 24               |
| Type 2                      | 6                |
| Type 3                      | 2                |

| Table 3: Association of HFF with type of closure after macular hole surgery |
|-----------------------------|------------------|------------------|------------------|
| HFF            | No. of Patients | Type 1 | Type 2 | Type 3 |
| >0.75          | 25               | 23     | –      | 2      |
| <0.75          | 7                | 1      | 6      | –      |

| Table 4: Association of MHI with type of closure after macular hole surgery |
|-----------------------------|------------------|------------------|------------------|
| MHI            | No. of Patients | Type 1 | Type 2 | Type 3 |
| >0.30          | 27               | 24     | 1      | 2      |
| <0.30          | 5                | –      | 5      | –      |
was 43.75%, comparable to the series by Gupta et. al.\textsuperscript{10} (33%). The better results in our series could be due to the concurrent phacoemulsification with intraocular lens implantation in patients having cataract. Regarding the BCVA, among the cases who underwent combined cataract and macular hole surgery, it is difficult to explain that visual improvement was because of cataract surgery or because of macular hole surgery.

The overall anatomical closure rate in our series was 82%, which was similar to the series by Gupta et. al.\textsuperscript{10} (86%).

We calculated the hole formation factor originally created by Puliafito.\textsuperscript{7} He considered the ratio between the overlying dimension and the hole base diameter to be of greater influence on the anatomical success rate than the base diameter alone. Puliafito found an 80% anatomical success rate in eyes with HFF>0.9 and an anatomical success rate of less than 25% in eyes with HFF under 0.5. However in our study we found that with HFF>0.75, 92% patient had type 1 and 8% patient had type 3 closure with residual outer lamellar hole, no patient had type 2 closure. In patient with HFF<0.75, 85% patient had type 2 closure. In patients with MHI<0.3, all patient had type 2 closure post operatively. And only 1 patient with MHI>0.3 had type 2 closure. So HFF>0.75 and MHI>0.3 pre-operatively can be considered as good prognostic factor for anatomical and visual outcome post macular hole surgery.

Based on ophthalmoscopy or biomicroscopic examination, the anatomical status of the macula after macular hole surgery was classified by Tornambe et. al.\textsuperscript{11} into three types. They suggested that flat and closed outcomes have a better visual prognosis than flat and open outcomes. Imai et. al.\textsuperscript{12} categorized the successfully repaired macular hole into three patterns with OCT: U-type (normal foveal contour), V-type (steep foveal contour), and W-type (foveal defect of neurosensory retina). We reported that postoperative visual acuity was well correlated with these patterns (U>V>W). The visual results obtained from the two types in our study were also similar. Because the borderline between the U and V pattern in the aforementioned study was sometimes...
unclear, and the ophthalmoscopic appearance of postoperative macular hole status would be easily matched with one of the two types of closure. Thus in our study, classification system seems more clinically relevant and acceptable with classification in to type 1 as closed hole, type 2 as open hole and type 3 as incomplete closure of hole with residual outer lamellar hole on the basis of OCT finding.

Complications of vitreous surgery for idiopathic macular hole includes retinal breaks, visual field defects, cataract formation and late reopening of the macular hole. Late reopening of macular holes has been reported in 5% to 9.5% of eyes in the previous studies.\textsuperscript{12,13,14,15}

In our study we didn’t had any significant complication post macular hole surgery, although we have not done perimetry in post operative period. There was no case of reopening of macular hole in our series.

Limitations of this study is small sample size. We have not taken in to consideration the duration of symptoms \textit{i.e.} Chronocity of hole which can affect the outcome of surgery. Some patients got operated for cataract along with macular hole surgery which can affect the visual outcome after surgery.

**Conclusion**

Preoperative measurement HFF and MHI for idiopathic macular hole using OCT helps predict postoperative anatomical and visual results. Patients with type I closure have a better postoperative visual acuity as compared to patients with type II closure. Preoperative HFF of more than 0.75 and MHI more than 0.3 are good predictors for anatomical and functional success after macular hole surgery.

**REFERENCES**

Optical Coherence Tomography of Successfully Repaired Idiopathic Large Macular Holes with “Inverted ILM Flap Technique”

Dr. Rajesh Ramanjulu

Macular hole is a full thickness defect of the retinal tissue involving the anatomical fovea. Although much progress has been made towards an understanding of macular hole, significant controversy still exists regarding the pathogenesis, management and prognosis of this lesion.

The first clinical description of a macular hole was published by Henry Noyes in 1871. Kelly and Wendell in 1991 reported the first successful closure of a series of macular holes by pars plana vitrectomy and induction of posterior vitreous detachment.1

The postoperative success rate varies between 86% and 95% with improvement in visual acuity in a large percentage of cases.2,3

Grade 4 macular Hole have poor prognosis in both anatomical closure and Visual outcome as shown by Salter and et. al.4 had failure rate of 1.4% to 19.1% with base hole >500µ. Ip MS and et. al.5 had an anatomical closure 56% in >400 µ. Late macular hole reopening was also common in macular holes >400µ.

In 2010 Michalewska et. al. studied a novel technique of Inverted Internal Limiting Membrane Flap Technique for Large Macular Holes >400 µ. Hole closure was observed in 88% of patients in routine ILM Peeling Group and 98% of patients in Inverted Inter Limiting Membrane Flap Technique with better Visual improvement in the inverted group.6

The anatomical outcome of successfully repaired macular hole is described into three patterns on basis of OCT; U-type (normal foveal contour), V-type (steep foveal contour), and W-type (foveal defect of neurosensory retina). Imai M and et. al. reported that postoperative visual acuity was well correlated with these patterns (U > V > W).7

Our study involved OCT analysis of Macular hole with minimum size more than 500µ which underwent successful surgery and anatomical closure.

MATERIALS AND METHODS

A retrospective case control study of 31 eyes patients (28 {90.3%} Females, 3{9.7%} Males) with idiopathic stage IV macular hole >500µ who underwent 23G Pars Plana vitrectomy + Brilliant Blue G dye assisted Inverted ILM Flap + C3F8 Gas by single surgeon between May 2011 and January 2013, with at least 3 months postoperative follow-up were studied.

Patients with traumatic macular holes, high myopia and previous macular surgery were excluded from the study.
Preoperative and postoperative BCVA was measured using a standard Snellen acuity chart. OCT scanning was performed using the Topcon 3D OCT. Measurements of the hole were made using the following parameters: macular hole inner opening diameter, minimum diameter, base diameter and macular hole height.

Patients were examined at day 1, 1st week and 1,2,3 and 6 months. As mentioned at each follow up all essential imaging such as fundus bio-microscopy and OCT to assess closure and the configuration of the hole were done. Holes were considered closed if there was no foveal neurosensory retinal defect, indicating anatomical success as demonstrated on OCT. Additionally, changes in foveal contour, nerve fibre layer defects, and RPE defects were evaluated. Measurement of BCVA and its correlation with the hole closure and the configuration was noted.

**DISCUSSION**

Vitrectomy has been the gold standard of macular hole surgery since its introduction by Kelly Wendal. Although an initial success rate of 68% was reported,(1) most surgeons currently achieve a success rate of 90% to 98%.8,9 Despite good results reported by a number of authors, OCT and SD OCT data demonstrate that 19% to 39% of so-called closed macular holes actually have flat borders but bare retinal pigment epithelium (flat-open macular holes).7,10,11 Large macular holes frequently “close” this way. In these eyes, visual acuity is usually limited.

Different approaches for large macular Hole have been tried with variable success.

- Alpatov S et. al. in 2007 studied Mechanical joining and compression of the retinal edges during surgery for stage 3 or 4 idiopathic macular holes appears to yield a promising anatomic and functional result. Closure rate was 86±6.2%.12
- Al Sabti K, et. al. in 2009 studied Extended internal limiting membrane peeling in the management of unusually large macular holes measuring 1,147 and 773 microns in diameter, and the injection of long-acting gas. Postoperatively, the macular holes closed and there was improvement in visual acuity.13
- N. Avgoustinakis, et. al. in 2011 studied that Massage around the macular hole is a safe manipulation and facilitates anatomical closure in difficult macular hole cases. Hole Closure 100% (n=19).

Michalewska Z, Michalewski J, et. al. in 2010 studied Inverted internal limiting membrane flap technique for large macular holes. The inverted ILM flap
technique 98% Closure in holes with a diameter greater than 400 μm. (N-50) Spectral optical coherence tomography after vitrectomy with the inverted ILM flap technique suggests improved foveal anatomy compared with the standard surgery(6).

All the above surgeries they may induce glial cell proliferation, resulting in the macular hole filling with proliferating cells that enhance closure the peeled-off ILM itself contains Müller cell fragments; therefore, ILM peeling alone can induce gliosis. Flap of ILM is left attached, it may provoke gliosis.

Fig. 1: OCT images of a patient with a minimum macular hole size of 910μ. Subsequent OCT images showing “U” closure. V/A improved from 3/60 to 6/36 at the end of 3 months with progressive improvement.

Fig. 2: OCT images of a patient with a minimum macular hole size of 892μ. Subsequent OCT images showing “V” closure. V/A improved from 4/60 to 6/60 at the end of 3 months.
both inside the retina and on the surface of the ILM. The ILM also may be a scaffold for tissue proliferation. It acts as a pulling force to keep the edges of the hole together and closing it completely.6

Müller cells are important not only for maintaining anatomic structure of the foveola but also for assuming the role of optical fibers to reliably transfer light from the retinal surface to the photoreceptor cell layer.14 We hypothesize that glial cells proliferate, thereby producing an environment for the photoreceptors to assume new positions in direct proximity to the fovea. These findings explain why inducing Müller cell proliferation improves not only the macular hole closure rate but also postoperative visual acuity.

Conclusion
Macular holes close with a bridge-like glial proliferation. Photoreceptor defects get continuously smaller with time.

REFERENCES
Therapeutic Efficacy of Oral Valproic Acid in Patients with Retinitis Pigmentosa

Dr. Neha Midha, Dr. Atul Kumar, Dr. Varun Gogia, Dr. Shikha Gupta

Retinitis pigmentosa [RP] is a retinal degenerative disease involving photoreceptors which is associated with night blindness, progressive peripheral visual field loss followed by reduction in central vision and ERG abnormalities.¹ Conventionally, full-field ERG has been used in the diagnosis
and monitoring of RP, however it measures retinal mass response and does not assess specifically the central retinal function. Multifocal ERG [MfERG] has been widely utilized to evaluate the central and regional variations of retinal dysfunction in RP patients.\textsuperscript{2-5}

Recently, experimental studies have documented the use of Valproic acid [VPA] and other molecules as pharmacological chaperones to increase the amount of properly folded RP mutant rhodopsins in heterologous cell culture.\textsuperscript{5,6} Clemson \textit{et. al.}\textsuperscript{7} had also previously shown benefits of VPA in terms of improvement in visual acuity in RP patients. It acts as a potent inhibitor of histone deacetylase [HDAC] and inhibits inflammatory response pathway via apoptosis of microglial cells.\textsuperscript{9-11}

In addition, it down regulates complement proteins and upregulates the levels of various neurotropic factors,\textsuperscript{12,13} and thus shows unique biological profile suitable for treating retinal diseases including retinal dystrophies. However, there is controversial evidence about the benefit of VPA therapy in RP.\textsuperscript{14,15} In order to assess the effects of valproic acid in our population, we conducted this study wherein we used multifocal ERG and change in visual acuity as objective parameters.

**MATERIALS AND METHODS**

A prospective single cohort interventional study was conducted at our tertiary care ophthalmic centre (Dr. Rajendra Prasad centre for Ophthalmic Sciences). Patients with non-syndromic RP, without any systemic association, cooperative for MFERG and compliant for follow-up were included. Patients with atypical RP or any systemic or ocular disease that could affect vision or their capacity to perform the tests were excluded. Patients with suspected liver or renal dysfunction, metabolic hereditary diseases or other urea cycle disorders, history of neurological disorders like epilepsy requiring any anti-convulsants, those with allergy to valproic acid or peanuts [peanut oil is an inactive ingredient in valproic acid capsules], pregnant women and lactating mothers were excluded. Two patients who had deranged LFTs were also excluded from the study.

Sixty eyes of thirty RP which met these criteria were included in this study. These were randomised into two groups, 15 patients [group 1] received valproic acid and 15 control subjects [group II] did not receive any treatment. Patients in group 1 were administered 500 mg/day of VPA every day, which is lower than the anticonvulsant dose. Patient demographics, diagnosis, family history, best corrected visual acuity [BCVA], mfERG, VER, blood chemistry included alanine aminotransferase [ALT], aspartate aminotransferase [AST], serum urea and ammonia, and electrolyte and blood cell panels included sodium, potassium, chloride, bicarbonate, creatinine, white blood cell count
with differential, red blood cell count and platelet count and reported side effects were recorded at baseline, 3 months and at 6 months.

RESULTS

Demography
We recruited 30 patients [60 eyes] with bilateral RP. Group 1 comprised of 10 males [66.6%] and 5 females, whereas in group 2, 12 were males [80%] and 3 were females. Median age of patients in both groups was 30 years [group I-15 to 47, group II-15 to 57 years].

Visual acuity
The median logMAR BCVA improved from 1.8 [1-3] in group I at baseline to 1.3 [0.6-1.3] at 1 year follow-up. This change was statistically significant [p <0.001; Wilcoxon signed rank test]. On the other hand, in controls there was a slight decrease in median BCVA from 1.8 [0.8 to 3] logMAR at baseline to 1.83 at 1 year follow up [p=0.3] [Fig. 1a,1b].

MFERG results

A) Central ring
In the central 2 degrees in group 1, the median amplitude increased from 137.5nV [0-560] at baseline to 314.75 nV [0-753] at 1 year and the median latency decreased from 47.75ms [0 – 78.4] at baseline to 40.3ms [0 – 57.3] at 1 year; both these change were statistically significant [p<0.001 for both; Wilcoxon signed rank test]. In group 2, amplitude decreased from 232.1 nV [0-1065] at baseline to 74.3 nV [0-1200] at 1 year [p 0.46] and latency decreased from 46.75 ms [0 to 67.2] to 44.2 ms [0 to 77.1] at 1 year [p 0.009; Wilcoxon signed rank test] [Fig. 2a-b].

b) 2-5 degree ring
Median amplitude changed from 138 nV [0-567] at baseline to 272.5 nV [0-702] [p<0.001] at 1 year and latency decreased from 55.6ms [0 -90.1] at baseline to 44.2ms [0-77.3] at 1 year [p 0.009] in group 1. On the contrary, in group 2 the median amplitude changed from 8.55 nV [0-388.1] at baseline to132.1 nV [0-444.6] at 1 year follow up [p=0.259] and median latency changed from 55.6 [0-69.5] at baseline to 44.2 [0-77.1] at 1year [p 0.009; Wilcoxon signed rank test] [Fig. 2c-d]

C) 5-10 degrees ring
Group 1 showed increase in the median amplitude from 107.5 nV [0 – 312] at baseline to 184.5 nV [0 –423] at 1 year; median latency decreased from 52.95ms [0 – 76.8] at baseline to 41.4 ms [0 – 61.2] at 1year; these change were found to be statistically significant in both [p<0.001; Wilcoxon signed rank test]. In group 2 the median amplitude changed from 135 nV [0-987] at baseline to 85.65 nV
D) 10–15 degrees ring

In group 1 the median amplitude increased from 114 nV [0-424] at baseline to 257 nV [0 – 487] at 1 year and the median latency decreased from 51.85 ms [0 - 74.1] at baseline to 43.45 ms [0–52.7] at 1year [p<0.001 for both]. In group 2 change in median amplitude was from 56.6 nV [0-728.6] at baseline to 118 nV [0-393.6] at 1 year [p 0.9]. The change in median latency was from baseline value of 38.15ms [0-68.6] to 38.8ms [0-65.6] at 1 year follow up [p 0.2]. [Fig. 2g-h]

E) >15 degrees ring

In group 1 eyes, the median amplitude increased from 96.85 nV [0-783] at baseline to 199.5 nV [0–815] at 1 year and the median latency decreased from 52.2ms [0–73.1] at baseline to 44 ms [0-63.2] at 1 year [p<0.001 for both]. In group 2 the change in amplitude was from 42.75 nV [0-444.3] at baseline to 47.9 nV [0-412] at 1 year [p 0.3]. The median latency changed from 23.65ms [0-52.3] at baseline to 29.1ms [0-48.1] at 1 year [p 0.5]. [Fig. 2i-j]

VER results

In group 1 eyes median amplitude increased from 3.99µV [0-12] at baseline to 5.4 µV [0-13.1] at 1year follow up and median latency decreased from 129ms [0-167] at baseline to 96.5ms [0-136] at 1year follow up [p<0.001 for both]. In control group there was no change in median amplitude value at 1 year follow up which was 3µV [0-18] at baseline. Latency changed from 87.5ms [0-108] at baseline to 93.5 [0-170] at 1year follow up [p=0.5 and 0.39 respectively]. [Fig. 3a-b].
Fig. 2 [A-J]: Graphs showing change in amplitude and latency in group 1 and 2 over 1 year at different mfERG rings i.e. <2°, 2-5°, 5-10°, 10-15° and >15°.
None of the patients experienced any adverse side effects requiring termination of VPA therapy. However, three patients developed gastritis which was managed with anti-histamines.

**DISCUSSION**

In the absence of any standard protocol for restoration of visual functions in RP patients, and past evidence of failed attempts to delay the progression of photoreceptor loss in RP patients, this study was conducted to evaluate the efficacy of VPA on central visual functions in RP patients.

Recent evidence suggests that VPA may work at the cellular level for cell death protection or inflammatory mediation for its neuroprotective action. It can down regulate the photoreceptor-specific inflammatory response pathway via apoptosis of microglial cells. Furthermore, VPA is known to be a potent inhibitor of HDAC. A particularly exciting property of VPA has recently been documented that suggests that it has the unique ability to reverse photoreceptor damage as it can induce cells to differentiate in culture. Moreover, it has been shown to stimulate glial cells to differentiate into photoreceptor-like cells. Data by Noorwez showed that there was increase in yield of properly folded RP mutant rhodopsins after treatment with oral VPA in heterologous cell cultures. This adds to the hypothesis that VPA has a potential role as a retinal therapeutic agent.

In our study, a statistically significant improvement in visual acuity in patients on VPA was observed at 1 year in comparison to the control group which experienced no change in the visual acuity. Clemson et. al. had shown a logMAR change of 0.172 lines whereas we observed a fall in logMAR BCVA.
by 0.5 units which correlates to a positive change from approximately 6/379 to 6/120 Snellen equivalent.

MfERG provides an objective measurement of retinal function expression in RP and has been used for assessing central retinal function in these patients. Holopigian et. al had demonstrated that the extent of visual field loss correlates significantly with cone-mediated mfERG amplitude as well as the implicit time.19 Thus mfERG results were analysed over the follow up to assess the role of VPA in preservation of vision in RP patients. Nagy D et. al. in their long term follow up of RP patients with mfERG have demonstrated that these patients are expected to show 6-10% reduction in mfERG amplitudes annually.20 However, we recorded a statistically significant increase in the mfERG amplitude and a decrease in the latency in all fields consistently in patients on oral VPA therapy which also correlated well to the VER amplitude and latency thus demonstrating the positive protective effects of VPA on photoreceptors and therapeutic efficacy of the drug.

mfERG responses displayed pattern of no change in control group or deterioration at most tested locations, except for attenuated latency at hexagons within 5° of macula. We hypothesize that this may be due to certain inherent limitations of mfERG recording such as an average variability of test-retest ranges from 10% to 20% of amplitude response.21-23 Multifocal response variance has been found to be maximum in central two rings24 Furthermore, sometimes signal-to-noise ratio improves after the waveform responses are averaged. Other than these, some variants of RP are known to progress slowly[25]. The improvement in implicit time may also be related to seasonal variation of retinal sensitivity as demonstrated in ocular hypertensives[26]

We observed no significant side effects in our patients on therapy with VPA.

Though we could assess the impact of VPA on macular function tests through central vision and mfERG testing, mid-peripheral retinal function using kinetic perimetry could not be evaluated. Another limitation includes that the patients were not genetically characterised, and genetic variation in RP might account for variability in the therapeutic response to VPA.27 VPA might alter the progression of this relentlessly progressive retinal degeneration.

REFERENCES


Does Antecedent Trauma make A Difference in Sympathetic Ophthalmitis following Vitreoretinal Surgery

Dr. Ekta Rishi, Dr. Pukhraj Rishi, Dr. Bindu K. Appukuttan, Dr. Tarun Sharma

Gass has reported sympathetic ophthalmitis following vitrectomy and Lewis et al. have reported cases of sympathetic ophthalmitis after trauma and vitrectomy. However, there is lack of data on the role of antecedent penetrating ocular trauma impacting the disease manifestation in eyes developing SO following vitrectomy. In this study of 17 patients with SO following vitreoretinal surgery, we analyze the impact of antecedent penetrating ocular trauma in disease manifestation and treatment outcomes.

MATERIALS AND METHODS

Review of the medical records of 17 patients presenting with clinical features of sympathetic ophthalmitis (SO), between 1995 and 2011 was done. The patients were divided into two groups; those with prior penetrating injury constituting Group I and those without, constituting Group II.

Collected data included age, sex, presenting complaints, history of antecedent penetrating ocular trauma or any other ocular surgery, timing of the surgical procedures performed, the time interval between the vitreoretinal surgery and the onset of symptoms, the duration of follow-up and the final visual
outcome. The clinical parameters recorded included the best corrected visual acuity (BCVA) measured by Snellen’s chart, at each visit, anterior and posterior segment manifestations with fundus fluorescein angiographic and ultrasound B scan features. Therapeutic response to steroids (oral, intravenous and topical) and immunosuppressants (Azathioprine and Cyclosporine) and complications during the course of the treatment were also noted.

**RESULTS**

Seven patients were included in Group I whereas 10 patients were included in group II. Overall, the mean age at presentation was 37 ±14.96 years (range 18 – 65 years); the mean age at presentation in group I being 30.28 years (range 18-44 years) and that in group II being 39.4 years (range 20-65 years). Vitrectomy was performed using 20G instrumentation in all the patients in the study. In group I, 4 (57.1%) eyes underwent repeated surgeries within 2-4 weeks and all of them presented with SO within 1 to 1.5 months of the last surgery.

The group I eyes differed from group II eyes with respect to the presence of neurosensory detachments (100% versus 30%, p=0.01), disc and vessel involvement (42% versus 70%, p=0.28), Dalen-Fuchs nodules (localized versus diffuse) and the areas of RPE atrophy on resolution (macular versus peripapillary).

Patients in both groups presented with distinct fluorescein angiographic features. Sympathizing eyes in group I revealed RPE leakages (n= 7). The RPE leaks were larger, associated with late pooling of dye (n=5) and usually confined to the posterior pole (except in 3 patients where the leaks were present beyond the equator). In contrast, group 2 sympathizing eyes predominantly showed early hypofluorescence and late hyperfluorescence in the area corresponding to the peripapillary choroidal nodules (n=7) , disc leakage in eyes with disc edema/hyperemia (n=9), segmental staining of the retinal veins and arterioles (n=2) , retinal venous beading and tortuosity (n=6) and RPE leaks that were pin-point, multiple, scattered all over the post pole extending beyond arcades upto the equator.

Oral and topical corticosteroids were the mainstay of treatment. Treatment with oral steroids was initiated with a dose of 1.5-2 mg/kg, tapered and followed-up with a maintenance dose of 5-10 mg/day. Eyes with recurrent inflammation were managed with repeat cycles of immunosuppressive and systemic steroid therapy.

**DISCUSSION**

In patients with multiple surgeries, it was the subsequent (post primary repair) VR surgery that was seen as the inciting factor in 71.4% patients in group I and 50% patients in group II. This aspect has also been reported by Tamai et. al. We found
an earlier presentation (median 1.5 months) in group I in comparison to group II, though not statistically significant. Galor et al. also found that trauma-inflicted patients presented earlier than surgically induced SO patients. However patients in group II had varied presentation with a median of 8 months (range 20 days to 12 years) similar to the study by Pollack et al.

Both groups were similar with respect to the presenting visual acuity in the sympathizing eyes but differed in the presenting vision amongst inciting eyes (p=0.029), which was significantly better in group I. 40% patients presented with NLP in the inciting eyes in group II. The clinical features in eyes from group II involved mainly the optic disc, peripapillary area and the retinal vessels whereas neurosensory detachments at the macula were conspicuous in group I eyes. This is in contrast with the findings by Pollack et al. where anterior segment involvement was seen in 75% patients. Predominant involvement of the posterior segment has also been observed in a study on Asian-Indian population by Gupta et al.

All patients in group I (except 1) required additional immunesuppression with oral steroids whereas inciting eyes with ≤ PL vision (n= 8) in group II required additional immunesuppression. Our treatment regime was comparable to that used by Su et al. However despite different treatment regimens the visual outcomes were good in the sympathizing eyes in about 88% of the patients.

According to Galor et al., traumatic cause, exudative retinal detachment and active inflammation were associated with poor visual outcome. A more severe course with traumatic SO theoretically may be the result of high-doses of antigenic exposure. Patients treated promptly with prednisone and/or immunesuppression were more likely to achieve quiescence and seemed to do so more quickly.

Kilmartin argued that early enucleation did not affect the visual outcome. In our study, eyes which were advised enucleation did not have any recurrences throughout the follow-up. Recurrences and severe inflammations when present, were managed by stepping up the doses of steroids and use of additional immunesuppressive agents.

In conclusion, persistent, low grade uveitis or isolated posterior segment features following vitreo-retinal surgery should alert the Ophthalmologist to the possibility of sympathetic ophthalmitis. Sympathetic ophthalmitis patients with antecedent penetrating trauma, present early (with a CSR like picture) and have better visual outcome. Prior use of systemic steroids in might have a bearing on the clinical presentation and treatment outcome. Presence of superadded infection/further surgical insults to the inciting eye in active phase of inflammation is likely to be associated with multiple recurrences of sympathetic ophthalmitis and poor visual prognosis in the inciting eyes.
Retrospective Analysis of Combined Primary Surgery with Iris Retrofixation Lens 2 Year follow-up

Dr. Prathibha M. Chachadi, Dr. Chandra Kumar H.V., Dr. Sri Ganesh, Dr. Raju S., Dr. Mamatha Nagamalli

Dislocation and gross subluxation (>180 deg) of lens leaves back no capsular support for placement of primary Posterior chamber IOL. The surgical options to correct aphakia are keratorefractive surgery, and intraocular lens (IOL). The various IOLs available are 1) anterior chamber IOL (ACIOL), 2) scleral fixated IOL and 3) iris fixated IOL, both anterior and posterior. ACIOLs have high risk of corneal decompensation. In scleral fixated lenses, surgery is technically more difficult and suture related complications are common like suture degradation; inflammation and suture breakage. Between the iris fixated IOLs, we selected retro-pupillary fixation to keep the IOL in the posterior chamber, a very safe place, which gives maximum protection to the corneal endothelium and as well away from the trabecular meshwork. The possible complications with iris claw lenses include decentration, IOL tilting, iris chaffing, disenclavation, secondary glaucoma and endothelial decompensation. In this retrospective analysis, patients underwent posterior iris claw lens implantation. We carried out this study to understand the long-term efficacy and safety of placing posterior iris claw lens during primary combined surgery.

MATERIALS AND METHODS

This is a retrospective analysis of 42 eyes (35 patients) over 2 years from April 2010 to June 2012; 7 patients with bilateral congenital subluxation and 28 patients with traumatic posterior dislocation of lens who underwent posterior iris claw implantation during the primary surgery were included. Inclusion criteria were Aphakia which resulted due to posterior dislocated lens (traumatic or congenital); large zonular-dialysis (>180°); subluxated cataractous lens (>180°); subluxation with monocular diplopia; distance BCVA worse than 6/12 and variable refraction or variable BCVA measurements caused by progressive subluxation of the lens and bisection of the pupil. Exclusion criteria were patients with corneal pathology (tear, opacity, bullous keratopathy) or retinal pathologies (CNVM; subretinal bleed, traumatic choroidal rupture; traumatic optic neuropathy) that would affect the final visual outcome and aphakia with poor iris tissue.

Written informed consent was taken for the surgery. All the patients underwent baseline examination – UCVA, BCVA (snellen chart for distance; N charting for near); IOP (non contact tonometry in mmhg); dilated fundus examination and B scan if associated media opacity due to vitreous hemorrhage, cataract was
Biometry was done for both eyes by contact method A scan to record the axial length in mm and keratometry readings taken with IOL master and IOL power calculated using SRK-T formula (A- constant 117). IOL power was aimed at emmetropia. Specular microscopy was done to know the corneal endothelial cell density.

**Procedure**

All the patients underwent standard 20 gauge pars plana vitrectomy (3 port) for removal of dislocated lens and grossly subluxated lens where a CTR cannot be placed under peribulbar anaesthesia and 7 patients who had bilateral congenital gross subluxation were in the age group of 8 to 15 underwent surgery under general anaesthesia. The superior small incision limbal tunnel was made before starting the pars plana vitrectomy. During the pars plana vitrectomy the vitreous was removed surrounding the dislocated lens and any associated vitreous hemorrhage if present was cut and aspirated. Phaco fragmentome was used to clear nucleus with the grade 1, 2 traumatic cataract and clear lens with gross subluxation.

Peripheral indentation examination done and diode endolaser (11 eyes) applied for tears when present. Following this at the end of vitrectomy surgery superior 2 ports plugged. Two corneal side ports of 1mm made at 3 and 9 O’clock, the entry made through the limbal tunnel with keratome and extended, viscoelastic used to protect the endothelium, flow in the infusion port adjusted accordingly. Iris Retrofixation lens is held with lens holding forceps (Budo’s forceps) at its optic centered in the pupillary area and the haptics are placed below the iris tissue to enclavate the iris into the haptic cleft using enclavation forceps through the side ports at 3 and 9 O’clock. Superior peripheral iridectomy was made at 1 o’clock or 11 o’clock the vitrectomy ports are secured with cross suture using 6-0 vicryl.

The limbal tunnels were closed with 10-0 nylon in pediatric age group. Post operatively the antibiotic steroid combination with NSAID eye drops was used for 6 weeks. Follow up was next day 1 month, 3 month, 6 months, 1 year and 2 years. During the follow up status of the retro fixated IOL-enclavation, centration, BCVA, IOP, corneal endothelial cell density were noted.

**RESULTS**

The Statistical software namely SAS 9.2, SPSS 15.0, Stata 10.1, MedCalc 9.0.1, Systat 12.0 and R environment ver.2.11.1 were used for the analysis of the data. The mean age group was Mean ± SD: 47.12±26.88 years. 7 patients with bilateral congenital subluxation and 28 patients with traumatic posterior dislocation of lens. Male to female ratio was 3:1. 7 eyes were pseudophakic; 26 eyes had cataract; 16 eyes had clear lens. The Specular count for endothelial
cells was stable with pre Mean ± SD 2856.33±334.28 and at 2 years Mean ± SD 2818.52±348.63 cells/mm/sq(p value <0.001**). The central corneal thickness pre Mean ± SD 541.52±38.64 microns and at 2 years Mean ± SD 534.45±36.49 microns (p value <0.001**). The intraocular pressure pre Mean ± SD 15.81±3.09 mmhg and at 2 years 16.26±3.12 (p=0.152). 32 eyes had post operative vision of 6/12-6/6. The BCVA Improvement for distance of 61.9% at 6/9-6/12 is statistically significant with P=0.0412* using Paired Proportion test and 32 eyes had N6 vision. Improvement of Near Vision at N6 is statistically significant with p=0.046* (Paired Proportion test). The spherical error change in diopters pre 5.23±8.87D and at 2 years 0.01±1.35 D is statistically significant (p value <0.001**) and astigmatism pre 0.43±1.66 and at 2 years 1.41±2.65 is also statistically significant. (P value <0.047*). Disenclavation at 1 month was seen in 1 eye at 1 year in 2 eyes. Secondary steroid induced glaucoma was seen in 2 eyes.

**DISCUSSION**

ACIOL and scleral-fixated posterior chamber IOLs have been the type of IOLs used in implantation in the absence of adequate capsule support and they avoid the need for aphakic spectacles or contact lenses. Retropupillary fixation of an iris claw IOL during the primary surgery has the advantages of single surgery, posterior chamber implantation- which results in a deeper anterior chamber and greater distance to the corneal endothelium and has a lower intra-operative and postoperative risk profile than anterior fixation.

In our study we see the need for multiple surgery was reduced due to primary placement of iris Retrofixation, the Specular count for endothelial cells was stable with pre Mean ± SD 2856.33±334.28 and at 2 years Mean ± SD 2818.52±348.63 cells/mm/sq (p value <0.001**). The BCVA was between 6/12 and 6/6 in 32 eyes matching to the post operative WHO guidelines of better than 20/40. None of our patients developed any major complications like cystoid macular edema, bullous keratopathy or retinal detachment. The IOL was well centered in all patients. The Disenclavation seen in 2 eyes were reenclavated. The 2 patients with secondary steroid induced glaucoma had well controlled IOP after anti glaucoma medication.

The Retrofixation iris claw lens during primary surgery has the advantages of a true posterior chamber IOL with low intra- and postoperative complications. The implantation process with this technique is simple.

**Conclusion**

Primary iris Retrofixation lens is a best option for the early post operative recovery with best visual outcome better than 6/12 as set by WHO guidelines along with corneal endothelial protection by avoiding multiple surgeries in patients with traumatic or congenital dislocated lens and gross subluxation.
Retinal Detachment in Eyes with Retinitis Pigmentosa

Dr. Pukhraj Rishi, Dr. Ekta Rishi, Dr. Rekha S., Dr. Tarun Sharma

Serous detachment of the neurosensory retina is a rare event in the course of retinitis pigmentosa (RP). Intraretinal migration of RPE seen clinically in retinal dystrophies does not protect against retinal detachment (RD) and thus differs from the pigmentary changes seen in association with interventional retinopexy procedures. The pigment migration does not cause adhesion but it indicates the probability of adhesion. Reports suggest that adhesions caused by the migration of pigment epithelial cells presumably protects retina from detachment and concluded that retinal detachment tends to occur in younger age group as the adhesions are not yet developed. Few case reports exist on retinal detachment in retinitis pigmentosa. This series evaluates the outcome of surgery for retinal detachment associated with RP.

MATERIALS AND METHODS

Retrospective analysis of 30 eyes of 27 patients with retinal detachment associated with retinitis pigmentosa. Patients underwent complete ophthalmic examination and investigations including electrophysiological study from 2001 to 2010 at a tertiary ophthalmic center.

RESULTS

The mean age of presentation was 22.32 years (range: 4-63 years), most common age of presentation was in the second decade (64.29%). Males (93%)
were more commonly affected than females (7%). Isolated inheritance of retinitis pigmentosa was found in 75%, autosomal recessive in 18% and autosomal dominant in 7% of cases. History of trauma was noted in 28.57% patients. 82% eyes were phakic, 7% pseudophakic and 11% aphakic. 22(78.57%) patients presented with typical RP and 6 (21.42%) had atypical presentation. Three patients presented with Usher’s syndrome and one with Bardet-Biedl syndrome. 49% patients had associated myopia while 36% had hypermetropia.

Total retinal detachment was noted in 11 eyes while 17 eyes had sub-total RD. 3 eyes had subtotal RD group with macular hole. Lattice with hole were seen in 21.43%, horse shoe shaped tear in 37.51%, retinal holes in 25.00%, PVR changes noted in 7.14%, macular hole in 7.14% and finally one case was noted with vitreous hemorrhage with total retinal detachment. Posterior vitreous detachment noted in 53.57% and absent in 46.43%. 21 eyes had undergone vitreo-retinal intervention for retinal detachment in which 11(52.38%) were treated by sclera buckle and 8(38.09%) were treated with vitrectomy, and in 2 eyes pneumatic retinopexy was done.

On a follow up after 6 weeks, there was a marked improvement in visual acuity in 13(61.90%) eyes; more than 3 lines improvement in Snellens visual acuity in 9(42.85%), 2 line improvement in 2(9.52%) eyes and 1 line improvement in 2(9.52%) eyes. Vision remained same in 6(28.57%) eyes, in which one had recurrent RD with proliferative vitreoretinopathy (PVR) changes and undewent revision surgery, others had chronic RD. In one patient with full thickness macular hole, vision had reduced.

Postoperative visual improvement in sclera buckle group (P value 0.019) was significantly more than vitrectomy group (P value 0.052). No significant difference in visual acuity was seen in drainage and non-drainage scleral buckle procedure. 1(5.26%) eye had recurrent retinal detachment but settled with resurgery, 1(5.26%) developed secondary glaucoma, 2 eyes developed epiretinal membrane and 2(10.52%) underwent cataract surgery.

**DISCUSSION**

Eyes with RP do not show a tendency to develop spontaneous retinal breaks; when breaks occur, the propensity to retinal detachment is small. Vitreoretinal separation in early life and possibly a stronger than normal RPE-neurosensory retinal bond may afford further protection against detachment in eyes with RP. Gartner and Henkind have recently presented pathologic evidence of adhesions between neural retina and RPE or Bruch’s membrane.

Migration of RPE occurs also after chorioretinopathy and following trauma sufficient to cause a loss of photoreceptors. Our study noted 28.57% patients of retinitis pigmentosa who developed retinal detachment after a trivial trauma.
Myopia contributes to more than half of all nontraumatic retinal detachments compared with emmetropes, the risk of RD is four times greater in low myopes (1-3D) and 10 times greater in high myopes (>3D). Previous reports show that RD is common in retinitis pigmentosa with myopia. Myopia was defined as spherical equivalent more than -0.50DS, and hyperopia as spherical equivalent greater than +0.05DS. Our study also showed 42.86% of RP with myopia leading to retinal detachment.

In previous reported cases, RP associated RDs have been noted along with retinal hole, dialysis, horseshoe tears, giant retinal tears and no tears. Our study also noticed the same but three cases presented with macular hole. Macular hole (MH) formation leading to retinal detachment is unusual in retinitis pigmentosa (RP), and full-thickness MH formation has rarely been reported. The exact cause of MH development in RP patients is still unclear. There are several distinct hypotheses for MH formation in RP patients. A previous study showed that vitreous traction is uncommon in RP. In our study, 3 cases presented with macular hole.

Post-operative visual improvement in scleral buckle group (P value-0.019) treated cases was significantly more than vitrectomy group (P value -0.052). In scleral buckled cases, there was no significant difference in visual improvement whether subretinal fluid was drained or not.

**Conclusion**

Retinal detachment in retinitis pigmentosa is a very rare entity, noted most commonly in second decade of life with male preponderance. RD in RP cases, after surgical intervention has a better anatomical and visual outcome except in cases of macular holes associated RD. Patients with scleral buckling surgery showed better visual results compared to vitrectomy procedure.
Structural and Visual outcomes after Epimacular Membrane Surgery (EMMS) with Internal Limiting Membrane Peeling (ILMP)

Dr. Sonia Rani John, Dr. Meena Chakrabarti, Dr. Arup Chakrabarti

Epiretinal membranes (ERMs) were initially described by Iwanoff in 1865.

Epiretinal membranes have been described in 5.3% to 18.5% of the population and the incidence increases with age, with 2% incidence at the age of 50 and 20% incidence at the age of 75 by examination of autopsy eyes.

ERMs are bilateral in up to 20% of patients and can cause metamorphopsia and reduced visual acuity (VA) by several mechanisms including macular distortion, vascular leakage, shallow tractional retinal detachment and opacity from the ERM itself. Vitrectomy and ERM peel, first performed by Machemer in 1978, is now a well-established procedure with visual acuity (VA) improvement by two Snellen lines in up to 90% of patients. Visually significant recurrence of ERM is being reported at 3%.

Histologic evaluations of tissue removed during vitrectomy showing the internal limiting membrane (ILM) to be a common feature enhanced our understanding of the underlying pathology and helped to develop the surgical technique as applied today. Despite single reports on possible adverse effects of ILM peeling during macular pucker surgery, the surgical removal of ERMs and the ILM has become a standard procedure in ophthalmology. A previous prospective study evaluating the effect of ILM peeling in macular hole surgery showed no ERM formation after a follow-up of 32 months. This is applicable also in macular pucker surgery to prevent recurrences by eliminating a potential scaffold for cellular proliferation.

Application of dyes such as indocyanine green (ICG) and trypan blue during ERM surgery has become popular to assist the removal of ERM’s, the ILM or both. Whereas the use of ICG to assist ILM peeling is controversial, with some investigators describing possible adverse effect on functional outcome and others observing no dye-related complications, no such problems have been reported along with the application of Trypan Blue or Brilliant Blue G (BBG) in clinical practice. Intraoperative application of dye helps better visualization of the epiretinal tissues and ILM and facilitates their easy removal.
The choice of dye in macular surgery is governed by the ability to stain the posterior cortical vitreous, the ERM and the ILM. 0.5 ml of 0.06% trypan blue (TB) used in this procedure stains both the ERM and the ILM faintly.

Aim of this study was to evaluate the long term visual outcome and macular structural changes in 130 consecutive patients who underwent epimacular membrane surgery with internal limiting membrane peeling.

**MATERIALS AND METHODS**

This was a retrospective consecutive case series analysis which reviewed the visual outcome and OCT changes of 130 eyes of 130 consecutive patients who underwent vitrectomy for epiretinal membrane formation. Out of the 130 cases, 98 were females and 32 males. Only patients with idiopathic macular pucker were included in this study. Patients with ERM in association with other retinal diseases were excluded. Hence patients with ERM associated with diabetic retinopathy, age-related macular degeneration, uveitis, retinal detachment, macular hole and prior ocular surgery were excluded. Informed consent was obtained from all patients.

Preoperative and postoperative routine examination included determination of best corrected visual acuity, applanation tonometry, biomicroscopy with a 90-D lens, binocular indirect ophthalmoscopy and high resolution cross sectional imaging of the retina provided by optical coherence tomography. Digital fluorescein angiography and Humphery C30-2 field charting were done in selected cases.

Surgery was performed by a single surgeon using the following standard technique. A standard three port vitrectomy was performed in all patients using peribulbar anesthesia. The infusion cannula was placed in the infero temporal quadrant. All cataractous eyes underwent phacoemulsification with intraocular lens implantation before pars plana vitrectomy. After core vitrectomy, the posterior vitreous was separated from the retina, if still attached. Posterior hyaloid separation was achieved by active suction with the vitrectomy probe, around the optic nerve head. The epiretinal membrane was then dissected from the retinal surface using a blunt spatula to loosen the membrane, followed by peeling using intraocular 23G end gripping forceps. 0.5 ml of 0.06 % trypan blue solution was used to stain the membrane. The dye was completely washed out by irrigation after 10 seconds. The internal limiting membrane was removed by a technique of maculorhexis similar to the capsulorhexis in cataract surgery, by initiating a tear in the inferior quadrant using a spatula and extending the tear by using a blunt spatula.

All patients were reviewed on the first postoperative day followed by 1,3,6 and 12 months post operatively.
RESULTS

The age ranged from 48 to 72 years with a mean age of 60 years, 32 were males and 98 females. The preoperative best corrected visual acuity ranged from 6/18 to 5/60. The duration of follow up was 12 months. Post operatively BCVA improved to ≥ 6/12 in 80% and 6/18-6/60 in 20%. There was no improvement in VA in 12% from the baseline visual acuity.

The preoperative central retinal thickness as measured from the OCT scan ranged from 450 to 690 micrometers. The OCT scan also demonstrated total (global) epiretinal membrane adherence in 30% and localized adherence in 70%. Vitreomacular traction was observed in 30% (39 patients). The retinal nerve fiber layer thickness was normal in all patients preoperatively; 52 patients (40%) patients were pseudophakic. Post operatively the central retinal thickness reduced by ≥ 50% of the mean baseline value in 80% of cases.

Metamorphopsia decreased significantly in all the patients with reporting of no distortion postoperatively at 12 months follow up. Distortion is a marked visual symptom produced by ERM and its resolution is often associated with patient subjective satisfaction even if the snellen VA fails to improve.

No residual foveal ERM was noticed in any of the cases. Residual postoperative extra foveal membrane was noted in 5% cases which was not considered clinically significant to justify further surgical intervention.

Post operative improvement in distance and near VA failed to reach statistical significance. However, 80% patients experienced improvement of VA and a BCVA of > 6/9 at 6 months, but the BCVA dropped to 6/18 at the end of 12 months follow up.

This is in contrast to previously reported improvement in VA by 2 Snellen lines to up to 90%. Failure of VA improvement may be related to the development of cataract (75%) observed in this study where the end point was 6 months and cataract surgery has been performed in all these patients. Post operative cataract progression may also lead to reduction in contrast sensitivity in these patients. 3% patients developed macular hole postoperatively 5% of the patients developed recurrence of epiretinal membrane after 6 months.

Table 1: Mean RNFL Thickness

<table>
<thead>
<tr>
<th>Clock hours of involvement</th>
<th>Pre operative RNFL thickness</th>
<th>Post operative RNFL thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. 12°clock -3°clock (SN)</td>
<td>108.53 ± 21.63 µm</td>
<td>110.34 ± 18.93 µm</td>
</tr>
<tr>
<td>2. 3°clock - 6°clock (IN)</td>
<td>106.51 ± 22.76 µm</td>
<td>108.39 ± 20.98 µm</td>
</tr>
<tr>
<td>3. 6°clock - 9°clock (IT)</td>
<td>136.22 ± 7.2 µm</td>
<td>125.3 ± 24.8 µm</td>
</tr>
<tr>
<td>4. 9°clock - 12°clock (ST)</td>
<td>165.7 ± 23.4 µm</td>
<td>150.6 ± 19 µm</td>
</tr>
</tbody>
</table>
The pre operative and 6 months post operative RNFL thickness were compared. The mean RNFL thickness in the various clock hours with the fovea as centre is given in Table 1.

The statistically significant reduction in visual acuity observed at 12 months post operatively where the visual acuity dropped from the immediate postoperative level by 2 lines, could be attributed to the RNFL atrophy and consequent reduction in the RNFL thickness.

The subjective visual improvement in the form of reduced metamorphopsia was experienced by all in our series of patients despite presence of structural macular changes as evidenced by the statistically significant reduction in RNFL thickness at 12 month follow up. The following table II and Fig 3 demonstrates the slow and sequential decline in the RNFL thickness in the serial OCTs performed at 7th day, 3, 6 and 12 months after the surgical procedure.

Table 2: Comparison of RNFL thickness at various post operative periods

<table>
<thead>
<tr>
<th>Quadrant tested</th>
<th>7 days POP</th>
<th>3 months POP</th>
<th>6 months POP</th>
<th>12 months POP</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. 12&lt;sup&gt;th&lt;/sup&gt;-3&lt;sup&gt;rd&lt;/sup&gt; clock (SN)</td>
<td>116.50 ± 20.03</td>
<td>110.38 ± 14.53</td>
<td>110.0 ± 18.93</td>
<td>110.0 ± 18.93</td>
</tr>
<tr>
<td>2. 3&lt;sup&gt;rd&lt;/sup&gt;-6&lt;sup&gt;th&lt;/sup&gt; clock (IN)</td>
<td>116.13 ± 23.39</td>
<td>109.27 ± 21.83</td>
<td>106.29 ± 20.45</td>
<td>108.39 ± 20.98</td>
</tr>
<tr>
<td>3. 6&lt;sup&gt;th&lt;/sup&gt;-9&lt;sup&gt;th&lt;/sup&gt; clock (IT)</td>
<td>142.59 ± 25.87</td>
<td>139.65 ± 22.91</td>
<td>129.50 ± 23.11</td>
<td>125.30 ± 24.80</td>
</tr>
<tr>
<td>4. 9&lt;sup&gt;th&lt;/sup&gt;-12&lt;sup&gt;th&lt;/sup&gt; clock (ST)</td>
<td>169.63 ± 22.90</td>
<td>162.01 ± 19.43</td>
<td>159.45 ± 22.58</td>
<td>150.60 ± 19.67</td>
</tr>
</tbody>
</table>

Visual field defect due to peripapillary RNFL thinning following vitrectomy with internal limiting membrane has been reported. Haritoglou and associates 16 reported that 8 of 105 patients had anatomic macular changes (for example, macular edema and retinal pigment epithelium changes). Furthermore, 59 eyes had asymptomatic paracentral...
scotomata postoperatively, which the authors felt was due to trauma to the nerve fibers during ILM peeling. It has been shown that the removal of the ILM had no adverse effect on visual acuity in macular hole surgery, although the selective delay of recovery of the focal macular electroretinogram b-wave suggests and alteration of retinal physiology in the macular region. In a histopathologic study of idiopathic epiretinal membranes removed during vitrectomy, ILM was present in most of the specimens, which means ILM is often removed together with the epiretinal membrane even if intentional ILM peeling is not performed.

Tadayoni and associates reported numerous arcuate striae within the posterior pole in the direction of the optic nerve fibers that were slightly darker than the surrounding retina, called dissociated optic nerve fiber layer appearance, after removal of an epiretinal membrane. They started that this feature had no functional effect and did not preclude good visual recovery. Similar finding were reported by Sivalingam and associates. They stated that this feature had no functional effect and did not preclude good visual recovery. Sivalingam and associates reported, however, that the presence of long segments of ILM within the histopathologic specimen after removal of a macular ERM appeared to indicate a less favorable visual outcome. Most recently, Kim and associates described visual field defect after uneventful epiretinal membrane surgery.

The authors concluded that adhesion between the epiretinal membrane and retinal tissue in the area of the ILM defect might cause damage to the nerve fiber layer, producing the defect. It therefore cannot be excluded that the RNFL thinning in our series may be the result of a direct trauma to the nerve fibers during ILM peeling. It is unlikely that localized damage to the nerve fiber layer in the macula leads to these significant peripheral field defects, however, even if extensive ILM was removed. Furthermore, no visual field defect has been found in large series of eyes with ILM removal for macular hole.

Despite documented evidence of structural macular damage in the form of progressive decrease in RNFL thickness, all our patients reported symptomic relief from metamorphosia. The 2 line decrease in Snellen VA at 12 months was in fact not noticed by the majority of patients.

REFERENCES


Natural History of Retinochoroidal Coloboma
Dr. Devendra Venkatramani, Dr. Jay Kumar Chhablani, Dr. Subhadra Jalali, Dr. Annie Mathai

Ocular coloboma is a rare eye malformation caused by failure of the optic fissure to close.\textsuperscript{1,2} Frequently associated ocular anomalies are cataract, microphthalmia, and anophthalmia.\textsuperscript{3} Visual disability and its severity in eyes with colobomata depend on three factors. The involvement of the macula and/or optic nerve by the colobomatous process naturally interferes with vision.\textsuperscript{4} Eyes with colobomata commonly have other associated anomalies such as microphthalmos and nystagmus.\textsuperscript{5,6} There is a high risk of complications, chiefly rhegmatogenous retinal detachment, which has been estimated to occur in about 40% of these eyes.\textsuperscript{7,8,9}

The aim of this study was to evaluate the natural history and clinical profile of patients with choroidal coloboma, determine the prevalence of retinal detachment, and presence of associated ocular anomalies, in patients under the age of 15 years with chorioretinal coloboma.

MATERIALS AND METHODS
This is a retrospective analysis of medical records of children aged 0 to 15 years who presented to the L.V. Prasad Eye Institute, Hyderabad, India from January 2003 to December 2009 in which a diagnosis of choroidal coloboma was made. Approval for the study was obtained from the institutional review board. The review included data regarding age, gender, parental consanguinity, duration of follow-up, best corrected visual acuity measured with a Snellen chart or Teller acuity chart when possible and refractive error, presence of associated ocular anomalies, use of prophylactic delimiting laser photocoagulation, and presence and duration of retinal detachment. Colobomas were subgrouped according to the Ida Mann classification.\textsuperscript{10}

RESULTS
A total of 335 eyes of 198 patients were studied made up of 106 (53.5%) males and 92 (46.5%) females. The mean age at presentation was 7.8 ± 4.75 years (range 2 days to 15 years). Type 2 colobomas were most common (n=157, 46.9%). BCVA ranged from 20/20 to no perception of light, with 44.2% eyes having visual acuity of worse than 20/200 and better than light perception. 14.9% eyes had myopia in excess of -6.0 DS.

A total of 59(17.6%) eyes had retinal detachment, with a mean duration of visual loss prior to presentation was 0.61±0.95 years (range 4 days to 4 years). Spontaneous reattachment of the detached retina occurred in 1 (1.7%) patient with retinal detachment. A total of 30(50.8%) eyes had surgery for retinal detachment.
detachment. The mean age of occurrence of retinal detachment based on symptom duration was 10.03±3.93 years (range 1-15 years). In 26 patients (46.1%) this information could not be determined.

14 eyes (46.7%) had recurrent retinal detachment which required repeat surgeries. Post surgical complications occurred in 26 eyes (86.7%) after surgery, most frequently recurrent retinal detachment, followed by cataract progression, hypotony, and secondary glaucoma. Phthisis occurred in 1 eye. Associated ocular anomalies were seen in 292 (87.2%) eyes, with iris coloboma being the most common. Microcornea, nystagmus, strabismus and microphthalmos were also seen.

**DISCUSSION**

In our series, we found that 82.2% of eyes had visual acuity < 20/40 and 54.4% eyes had visual acuity < 20/200. In 6 eyes, light could not be perceived. Poor vision can be ascribed to various reasons described below.

In 64.8% of eyes the coloboma was of types 1 or 2, in which the coloboma extends up to or beyond the superior margin of the optic disc. This finding is associated with poor vision. Other ocular anomalies noted in 87.2% of eyes such as micro cornea and microphthalmos, and nystagmus and strabismus can also impair visual function.11

In our series retinal detachment was seen in 17.6% of all eyes. Most retinal detachments associated with chorioretinal coloboma require surgery and often have poor visual outcomes.8,12,13 In the paediatric age group management of pediatric retinal detachment is difficult and outcomes are usually suboptimal.14 Post operative problems which lead to poor outcomes include difficulty in proper positioning, difficult visual rehabilitation with contact lenses or glasses and development of amblyopia.14 There was a high incidence of complications after surgery (86.7%) which will further worsen the prognosis for useful vision.

**Conclusions**

Children with retinochoroidal coloboma have poor vision at presentation, with nearly half in this series having visual acuity poorer than 20/200. There was a high prevalence of associated ocular anomalies. The prevalence of retinal detachment was 17.6% (59 eyes), and retinal reattachment surgery had modest success but with a high rate of postoperative complications.

**REFERENCES**


**Correlation between the Clinical Stages and Micro Morphology in type 2A Macular Telangiectasia**

**Dr. Rameez Najamul Hussien, Dr. Giridhar A., Dr. Mahesh G., Dr. Jaitra P.G.**

Idiopathic juxtafoveal retinal telangiectasis (IJFT), also known as parafoveal telangiectasis or idiopathic macular telangiectasia, refers to a heterogeneous group of well-recognized clinical entities characterized by telangiectatic alterations of the juxtafoveal capillary network of one or both eyes, but which differ in appearance, presumed pathogenesis, and management strategies.

In 1993, Gass and Blodi subdivided IJFT into three distinct groups I, II, and III (also known as groups 1, 2, and 3), with two subgroups in each (A and B), based on demographic difference or clinical severity. Yannuzzi *et. al.* proposed a
simplified classification of IJFT, essentially a revision and simplification of the Gass–Blodi mode. They proposed the term “idiopathic macular telangiectasia” with two distinct types: Type 1 or “aneurysmal telangiectasia” equivalent to IJFT group I (A and B combined), which is the second most common form of IJFT; and type 2 or “perifoveal telangiectasia” equivalent to IJFT group IIA.

Type 2A macular telangiectasia is the most common type of IJFT, and differs completely from IJFT I. It is acquired, not congenital. Affected patients are middle-aged or older (mean 55 years). Males and females are affected equally. This disorder is bilateral, but may be asymmetric appearing as unilateral in its early stages. Similarly, patients may have visual loss in only one eye. The natural course of IJFT IIA has been subdivided by Gass and Blodi into five stages.

<table>
<thead>
<tr>
<th>Stage</th>
<th>Prominent feature</th>
<th>Biomicroscopy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Occult vascular abnormalities</td>
<td>Slight parafoveal graying</td>
</tr>
<tr>
<td>2</td>
<td>No clinically visible telangiectasis</td>
<td>Mild loss of parafoveal retinal transparency</td>
</tr>
<tr>
<td>3</td>
<td>Prominent dilated right angled retinal venules</td>
<td>Parafoveal right-angled venules draining telangiectasis/visible capillary dilation</td>
</tr>
<tr>
<td>4</td>
<td>Retinal pigment hyperplasia extending into the retina</td>
<td>Retinal pigment epithelial hyperplasia or clumps around right-angled venules</td>
</tr>
<tr>
<td>5</td>
<td>Subretinal neovascularization</td>
<td>Subretinal exudation and hemorrhage/retinochoroidal anastomosis</td>
</tr>
</tbody>
</table>

Structural changes demonstrated using spectral domain Optical coherence tomography (SD-OCT) are retinal cyst, ILM draping, photo receptor disruption, hyper-reflective lesion corresponding to pigment clumps and foveal atrophy. All of the changes mentioned above (foveal cyst, intraretinal RPE hyperplasia, foveal atrophy, and absence of edema) are consistent with the hypothesis of progressive retinal tissue loss, possibly due to Müller cells degeneration. The latter could lead to alterations in the parafoveolar retinal capillaries, to ILM separation, tissue loss, and cyst formation in the fovea. Parallel to these changes, or later in the course of the disease, reduction of foveal thickness from resolution of foveal cyst or photoreceptor atrophy occurs.

OCT features corresponding to the stages of macular telangiectasia are not studied yet. Our study aims to unveil the OCT features of IJFT IIA in each of its stage.

**Objective**

To study stage wise morphological changes of Type 2A macular telangiectasia using SD-OCT and to analyze the micro morphological changes in its natural course.
Materials and Methods

Prospective cross-sectional study of 105 eyes of 58 patients who were diagnosed clinically as IJFT IIA. The study adhered to the tenets of the Declaration of Helsinki; the study was approved by the local ethics committee, and informed consent was obtained from all subjects. Patients were grouped into 5 stages according to Gass and Blodi classification. Patient demography and baseline characteristics were recorded. Each patient underwent a complete ophthalmologic examination, including determination of best-corrected visual acuity (BCVA), slit-lamp examination, and indirect ophthalmoscopy. Exclusion criteria included any history or signs of retinal surgery (including laser treatment), diabetic retinopathy, retinal vascular occlusions, arterial macroaneurysm, intraocular inflammation, and hereditary retinal dystrophy.

All were subjected to SD-OCT analysis (Spectralis HRA+OCT; Heidelberg Engineering, Heidelberg, Germany). Spectral-domain OCT imaging is carried out with 870-nm illumination wavelength, an acquisition speed of 40,000 A-scans per second, and a scan depth of 1.8 mm. Live B-scans are acquired and observed simultaneously in real time with a cSLO reference image. Because of the 2 independent pairs of scanning mirrors, eye movements are registered and automatically corrected. This allows for exact topographic alignment of cSLO and OCT findings. Images were analyzed for all kinds of micro-morphological changes. Statistical analysis was performed using SPSS-19.

Results

105 eyes of 58 patients were studied. Male to female ratio was 1:3 which shows clear female preponderance to the disease in Indian population. Mean age was 57.55 ± 9.86 years. More than 54.8% had diabetes and 35% had hypertension. More than 91% showed hypermetropic refraction.

<table>
<thead>
<tr>
<th>Mac Tel Stage</th>
<th>No of Eyes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage - I</td>
<td>7</td>
</tr>
<tr>
<td>Stage - II</td>
<td>12</td>
</tr>
<tr>
<td>Stage - III</td>
<td>47</td>
</tr>
<tr>
<td>Stage - IV</td>
<td>33</td>
</tr>
<tr>
<td>Stage - V</td>
<td>6</td>
</tr>
</tbody>
</table>

In stage 1 (n=7) cases, OCT showed foveal cysts in all cases and Inner segment outer segment junction (ISOS) defects in 4 cases.

Foveal cysts appeared even before ISOS disruption (Fig. 1).
Stage 2 (n=12) showed multiple foveal cysts and ISOS disruption in all cases. ILM draping was more evident in stage 2 cases.

Stage 3 (n=47) showed foveal cysts, ISOS disruptions (Fig. 2) in all cases and 36.4% cases showed intra retinal split (Fig. 3).

Stage 4 (n=33) showed features of stage 3 with additional hyper reflective lesion corresponding to pigment clumps (Fig. 4) in all cases with foveal atrophy (Fig. 5). Stage 5 (n=6) showed sub retinal hyper reflective lesion corresponding to sub retinal neovascular membrane scar.

### Foveal cyst versus stages

<table>
<thead>
<tr>
<th>STAGE</th>
<th>Stage-1</th>
<th>Stage-2</th>
<th>Stage-3</th>
<th>Stage-4</th>
<th>Stage-5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foveal cyst</td>
<td>100%</td>
<td>83.3%</td>
<td>93.6%</td>
<td>52.2%</td>
<td>50%</td>
</tr>
</tbody>
</table>

Pearson Chi-square test – p=0.002

### Area of ISOS disruption versus stages

<table>
<thead>
<tr>
<th>STAGE</th>
<th>Stage-1</th>
<th>Stage-2</th>
<th>Stage-3</th>
<th>Stage-4</th>
<th>Stage-5</th>
</tr>
</thead>
<tbody>
<tr>
<td>IS/OS disruption</td>
<td>0</td>
<td>690µ</td>
<td>750µ</td>
<td>2108µ</td>
<td>2546µ</td>
</tr>
</tbody>
</table>

ANOVA TEST  p=.000

### Intra retinal split versus stages

<table>
<thead>
<tr>
<th>STAGE</th>
<th>Stage-1</th>
<th>Stage-2</th>
<th>Stage-3</th>
<th>Stage-4</th>
<th>Stage-5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intra retinal split</td>
<td>0</td>
<td>0</td>
<td>36.4%</td>
<td>51.5%</td>
<td>0</td>
</tr>
</tbody>
</table>
### Macular and foveal thickness versus stages

<table>
<thead>
<tr>
<th></th>
<th>Stage-1</th>
<th>Stage-2</th>
<th>Stage-3</th>
<th>Stage-4</th>
<th>Stage-5</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Macular thickness (μ)</td>
<td>223.5</td>
<td>235.5</td>
<td>230.48</td>
<td>182.35</td>
<td>218.50</td>
<td>0.000</td>
</tr>
<tr>
<td>Foveal thickness (μ)</td>
<td>204.0</td>
<td>197.30</td>
<td>176.78</td>
<td>137.07</td>
<td>173.0</td>
<td>0.001</td>
</tr>
</tbody>
</table>

### Pigment clumping versus staging

<table>
<thead>
<tr>
<th>Pigment clumps (Intra retinal Hyper reflective lesions)</th>
<th>Stage-1</th>
<th>Stage-2</th>
<th>Stage-3</th>
<th>Stage-4</th>
<th>Stage-5</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>2</td>
<td>35</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

### DISCUSSION

Cohan et. al.\(^5\) reported that ISOS disruption was the first morphological change observed; but in our study, foveal cysts were the first OCT change. In a study done by Sönke et. al.\(^6\) showed that eyes classified as stage 1 showed no further abnormal reflectivity in the outer retinal layers on the SD-OCT scans. In our study, foveal cysts and ISOS disruption were found in stage 1 (n=7) disease. Stage 2 showed multiple foveal cysts, ISOS disruptions in all cases. The area of disruption is seen increasing with the natural course. Intra retinal split was seen from stage 3 and it preceded foveal atrophy.

In stage 3 (n=47), SD OCT scans demonstrated atrophy of the outer retina mostly affecting the outer plexiform layer, outer nuclear layer, and receptor elements. In stage 4 eyes (n=33), SD OCT showed advancing disruption of the IS/OS junction and progressive loss of the normal retinal architecture. Intra retinal hyper reflective lesion corresponding to pigment clumps was characteristic of stage 4 and 5. Foveal atrophy develops in stage 4. Stage 5 eyes (n=6) showed diffuse, irregular reflectivity in the area of neovascularization. An increase in macular thickness is observed in stage 5 which is caused by sub retinal scar.

When we sequence the OCT changes in each stage, the micro-morphological progression of the disease may be seen. First change to occur is foveal cyst, followed by ISOS disruption and multiple cyst formation. Then Intra retinal split occurs. The cysts disappear as the adjacent retinal tissue collapse on to fill the tissue loss in the cyst. Foveal atrophy and pigment clumping occurs almost simultaneously.

### Conclusion

Interventional studies for IJFT IIA are complicated by an incomplete understanding of its pathogenesis.\(^7\) SD-OCT unveils the patho-physiological changes in IJFT IIA. This might help in developing new treatment modalities for the disease. This study revealed previously unknown distinct structural alterations by using combined high resolution SD OCT imaging in patients with MacTel type 2. There is a clear
female preponderance for this disease in Indian population. Our study shows associated hypermetropic refraction in more than 91% cases and this has never been never reported before. Diabetes also seems to be significantly associated with macular telangiectasia in Indian population. By sequencing the changes in each stage, we could demonstrate the micro morphological alterations occurring along the natural course of the disease.

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Does ILM Peel Size Determine Anatomical and Visual Outcome after Surgery for Macular Hole?

**Dr. Guruprasad Ayachit**, Dr. Apoorva A.G., Dr. Sourabh Shah, Dr. Shrinivas M. Joshi

Gass and Johnson were the first to classify idiopathic macular holes (IMH) into four stages using very keen biomicroscopic observations.1,2 Gass also proposed that it was the perifoveal vitreous detachment and consequent tangential and antero posterior traction on the fovea that led to idiopathic hole formation. New observations and images have added to our understanding of the pathogenesis of macular holes.3,7

In 1991, Kelly and Wendel reported that IMH could be closed by vitrectomy and gas tamponade.8
One of the important developments in the surgical approach during the last decade is peeling of the internal limiting membrane (ILM). This has been greatly facilitated by staining techniques for atraumatic peeling of the ILM. Recently, Brilliant Blue (BBG) has been found to be having high affinity to ILM, but with minimal toxicity. OCT imaging is a very useful tool to evaluate pre operatively and follow up post operatively. Pre-operative macular hole form factor is a reliable yard stick to prognosticate a case of MH. Several studies in the past have proven the superiority of ILM peeling technique over simple vitrectomy. However there are few studies which have analysed the rate and pattern of hole closure with respect to the size of ILM peeled. Air/Gas injection at the end of surgery is a standard step adopted by majority of surgeons.

To compare small - 1 disc diameter (DD) Vs large (3 DD) ILM peel and to evaluate the functional and anatomical result after surgery for Idiopathic Macular Hole.

**MATERIAL AND METHODS**

In a randomized prospective study 45 eyes of 45 consecutive patients of FTMH were operated. Preoperative assessment included Visual acuity, Slit lamp examination, lens status, and macular hole size. Duration of symptoms was noted but not taken for analysis. Pre operative hole form factor was determined on Spectral Domain OCTs per the work of Puliafito and colleagues. Eyes were divided into 3 groups. Group I (HFF > 0.9, n=10) Group II (HFF 0.6-0.9, n=18) Group III (HFF<0.6, n=17). All patients underwent standard 23 gauge vitrectomy with triamcinolone assisted removal of the posterior hyaloid face. Eyes in all 3 groups were randomized to either 3 DD or 1 DD radius of ILM peel. The size of the ILM peel was determined approximately by comparing with the disc size. In the 1DD subgroup the diameter of ILM peeled was approximately 3 mm and in the 3DD radius subgroup it spanned the perifoveal zone from arcade to arcade. This was assisted by Brilliant Blue G (BBG) staining of Internal Limiting Membranes and its removal with Greishaber ILM forceps for pinching the ILM and end gripping forceps for peeling it. Pure C₃F₈ gas 0.3 to 0.4 cc was injected into the vitreous cavity after complete fluid air exchange. Prone positioning was advised for 12 hours daily for a week after surgery. Outcome measures were hole closure, Type of closure by SD OCT and change in visual acuity. All patients were operated by a single surgeon, at the M.M. Joshi Eye Institute Hubli between Jan 2011 and Dec 2012.
Included cases were: Idiopathic full thickness macular holes (stage II, III and IV).

Excluded cases were cases of macular hole due to Post traumatic cause, Previous macular surgery, Rhegmatogenous retinal detachment with macular hole, Myopia higher than 6D, Macular hole of more than 2 years symptoms and Previous retinal vascular disease.

Post-operative visual acuity testing and SD-OCT were performed in all eyes either after 2 weeks or as soon as the gas bubble allowed, to note the type of closure i.e. Type I, Type II or non-closure.

**RESULTS**

The number of eyes in which the MH closed was 39/45 (86.67%).

In Group 1 the closure rate was 100% (10/10 eyes). Type 1 closure was seen in 8/10 eyes and Type 2 closure in 2 eyes. Taking ILM peel size into consideration 5/5 eyes undergoing large peel achieved Type 1 closure against 3/5 eyes in the small peel subgroup. Two eyes in the small peel subgroup had Type 2 closure. (p <0.05).

In group 2 closure rate was 95% (17/18 eyes). Type 1 closure was seen in 10/17 eyes and Type 2 closure in 7 eyes. Taking ILM peel size into consideration 8/9 eyes undergoing large peel achieved Type 1 closure against 2/8 eyes in the small peel subgroup. Correspondingly Type 2 closure was seen in 1 and 5 cases respectively in the large and small peel subgroups (p <0.05). There was one failure of closure in the small peel subgroup.

In group 3 closure rate was 70.59% (12/17 eyes). Type 1 closure was seen in 8/17 eyes and Type 2 closure in 4 eyes. 2/8 eyes undergoing large peel achieved Type 1 closure against 0/4 eyes in the small peel subgroup. Correspondingly Type 2 closure was seen in 6 and 4 eyes respectively in the large and small peel subgroups. Of the 5 eyes with non-closure 4 were in the small peel subgroup. (p<0.05).

In all groups, holes which closed did so by the 2nd week follow up visit. In one non-closure case in group 3, small peel subgroup, C$_3$F$_8$ gas was reinjected at 2 weeks and positioning advised. This however did not result in success.

Visual acuity was measured at 1 month and 3 months.

Preoperative Mean Best Corrected Visual Acuity was 0.54 + 0.17, 0.81+ 0.16 and 1.01±0.29 logMAR in Groups 1, 2 and 3 respectively. At one month in Group I, mean postoperative BCVA was 0.44 ± 0.13 logMAR and further improved
to 0.26 ± 0.17 logMAR at 3 months postoperatively. In Group 2BCVA at one month was 0.71 ± 0.20logMAR and further improved to 0.58 ± 0.19 logMAR at 3 months. In Group 3, BCVA at one month was 0.83 ± 0.16 logMAR and marginally improved to 0.72 ± 0.22 logMAR at 3 months.

Visual change in relation to Type of closure was analysed. At 3 months, In group 1 the mean visual change was -0.31 logMAR in eyes with Type 1 closure and -0.19 in eyes with Type 2 closure (P<0.05). In group 2 it was -0.28 and -0.17 logMAR respectively (P<0.05). In group 3 the visual change difference between the closure types was not statistically significant -0.29 and -0.25 logMAR respectively (p=0.09).

In the eyes in which there was failure to close there was no change in HFF in Group 2. In Group 3 however there was a marginal increase in basal hole diameter in 2 of the 5 failed eyes at 3 months. Visual acuity though was unchanged.

**DISCUSSION**

Vitrectomy with posterior hyaloid removal was started 2 decades ago for the treatment of macular hole. Thereafter ILM peeling has proven to enhance the results. Reports in the literature claim that ILM peeling was the single most important variable for success. Clearly, ILM peeling ensures removal of tangential traction due to residual vitreous on the retinal surface, which, although rare, can occur even with an apparent PVD as evidenced by a Weiss ring. In addition, ILM peeling guarantees successful removal of epiretinal membranes, which are occasionally present typically, in eyes with striae and elliptical holes without cuffs. ILM peeling increases retinal elasticity by over 50%, which enables lateral surface-tension forces to close the hole as soon as the bubble comes into contact with the hole. It is also likely that ILM peeling initiates mechanical signalling to the astrocytes to heal the hole margins days after it is closed by lateral surface tension. Overall, the increased mobilisation of the retina by ILM peeling, especially at the edge of the hole, seems to be the mechanism of hole closure. In a recent unpublished study the author Michel Gonvers, MD, has found that inducing perifoveal detachment to mobilise the retina in larger holes helps to facilitate approximation of the edges. Some workers have tried “extra-large re peeling of ILM” for failed macular hole surgery with encouraging results. The extent of the relief of traction achieved by a given area of ILM peeling may be variable, due to the individual variations in the retinal architecture from patient to patient. This probably explains why a larger hole can respond favourably with Type 1 closure even with a small peel, whereas a big peel sometimes fails to achieve closure of a smaller hole. In our study, in group 1, the two cases which showed type 2 closure were both
in the small peel subgroup. Our results in Group 2 and Group 3 also favour this explanation. In small holes where the HFF is >0.9 the size of the peel did not influence the outcome. The larger the hole the more the mobilisation of the perifoveal retina required to achieve approximation of the edges, for better chances of Type 1 closure. Hence larger peels may be required for holes with HFF of 0.6 and less.

The literature has several articles establishing the correlation of visual acuity outcome with macular hole closure pattern. Our study also showed a clinically significant difference in the visual acuity change between the eyes with Type 1 and eyes with type 2 closure in small and medium sized holes. In Group 3 (larger holes) the difference was not statistically significant.

Shortcomings of this study include, - the peel size was only compared with disc size and not exactly measured. The duration of symptoms, an established prognostic factor was not considered for visual outcome analysis. Other visual function parameters such as contrast sensitivity, microperimetry and multifocal ERG which are more sensitive than just acuity, could have been measured for better quantifying changes in visual function.

Conclusions
Vitrectomy with ILM peeling results in MH closure in majority of cases. The smaller holes will close with any size of peel. Larger holes need larger peels to achieve success and Type 1 closure. The hole form factor may be used for determining the surgical plan (Peel size) for patients with MH. In eyes with HFF of 0.6 and more visual outcome correlates with hole closure. In eyes with large holes anatomical results are encouraging but visual change is marginal. A larger sample study with longer follow up will be more conclusive.

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To Evaluate Efficacy of Oral Dextrose in Addition To Topical Anaesthesia in Providing Pain Relief During Laser Therapy of Retinopathy of Prematurity Under Topical Anaesthesia

Dr. Subina Narang, Dr. Manisha Kataria

The incidence of ROP in India is on rise and reported to vary between 38% -51.9%. Developing countries like India are facing the third epidemic of ROP at present. This is due to higher survival of premature babies. In a developing country like India, most of the laser for ROP babies are done under topical anaesthesia, as neonatal general anesthesia may not be readily available. During eye screening, babies clearly display well defined pain responses. Premature infant pain profile score (PIPP score) is the most comprehensive method to evaluate pain (including physiologic, behavioural, and contextual Indicators). Recent published guidelines from the american academy of Pediatrics AAP’s Section on Pain, recommended considering the use of sucrose in NICU patients undergoing a wide variety of procedures. As regard to the pain management in ROP babies undergoing laser treatment, there is hardly any study in the available literature using sucrose during the procedure. Sucrose is not available in India so glucose could be used instead which might decrease pain by release of opioids due to sweet taste.

MATERIAL AND METHODS

This study was prospective, randomised and double-blind case control study. Twenty four preterm infants, born before 32 weeks gestational age and/or weighing less than 2000 grams and therefore included in the screening programme for ROP, were enrolled in the study. Parents informed consent were taken before laser and neonatologist were also informed. Lasered with 532 nm YAG laser in neonatal intensive care unit done.
Babies were randomized into two groups

- Group 1 (12 babies given topical paracaine instilled twice at 10 minutes interval before laser treatment)
- Group 2 (12 babies administered oral 2 ml of 25% dextrose 30 minutes before procedure, with topical anaesthesia as in group 1).

Detailed history was recorded including the gestational age, the birth weight, significant post natal problems such as apnoeic spells, septicemia, need for blood transfusions, and intraventricular hemorrhages. The age at first presentation was noted. Laser treatment with 532nm laser indirect ophthalmoscope was done for Type 1 ROP. In Group 2 babies, Topical paracaine and oral 2 ml of 25% dextrose was administered 30 minutes before laser procedure. Group 1 babies served as controls and laser was done only under topical anaesthesia.

Eyes were opened using a sterile pediatric lid speculum introduced carefully into the conjunctival sac, without touching cornea. Eye rotation for purpose of laser was done using a wire vectis. Throughout the procedure, an infant pulse oxymeter was applied to infant’s foot and a digital camera was positioned approximately 1 meter from infants.

The infant’s face was videotaped and physiologic (heart rate and oxygen saturation) responses were continuously recorded. PIPP scores were used based on 30-second observations that compare baseline indicators to phases throughout a procedure. A score of 0 to 3 is given for each of the 7 PIPP indicators, including:

- 2 contextual indicators (gestational age, sleep/awake state),
- 2 physiologic indicators (heart rate, oxygen saturation),
- 3 behavioral indicators (brow bulge, eyes squeeze shut, and nasolabial furrow).

The individual item scores were added to form a composite pain score.

**RESULTS**

The two groups were comparable in sex distribution, birth weight, period of gestation, stage, extent of ROP. The composite PIPP score was comparable in the two groups (11.45 in group 1 and 11.27 in group 2; p=0.92).

<table>
<thead>
<tr>
<th></th>
<th>Group 1</th>
<th>Group 2</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase in Heart rate (&gt;24 beats)</td>
<td>4 (33.3%)</td>
<td>3 (25%)</td>
<td>0.88</td>
</tr>
<tr>
<td>Oxygen desaturation (SpO2)</td>
<td>3 (25%)</td>
<td>4 (33.3%)</td>
<td>0.52</td>
</tr>
<tr>
<td>Final PIPP score</td>
<td>11.45+_3.67</td>
<td>11.27+_4.19</td>
<td>0.92</td>
</tr>
</tbody>
</table>
DISCUSSION

In our study, both groups infant experienced mild to moderate pain during procedure (PIPP score 11.3–11.5). There was no significant difference in PIPP scores using 25% dextrose with topical anaesthesia or only topical anaesthesia. Rush and Grabska studied effect of administering 24% sucrose on cry behaviour during ROP exams and no significant differences in cry behaviour were found between treatment and control groups. They also assessed changes in heart rate during and after ROP exams, there were no significant differences between sucrose and control groups in either study.

Grabska in his series of 62 neonates found oxygen saturation was significantly reduced in infants given sucrose compared to the control group during ROP screening.

Contradictory to our study, Gal (2005) and Mitchell (2004) found that sucrose significantly reduced PIPP scores during ROP exams for short time (p = 0.001 and 0.0077, respectively), but in their study, the analgesic effects were not sustained after the examination. Laser of ROP is a longer and more painful procedure than screening and one time use of dextrose before laser seems to be ineffective. Multiple doses of dextrose and combination with pacifier could be tried to decrease pain in these babies.