The Kerala Journal of Ophthalmology is the official scientific publication of the Kerala Society of Ophthalmic Surgeons and 4 issues are published every year.

It welcomes original articles, interesting case reports, update articles, book reviews, journal abstracts and research papers in Ophthalmology. Dates of the upcoming conferences and CME's are also published. Original articles are accepted on condition that they have not been published in any other journal.

**SUBSCRIPTION RATE**

Annual : Rs. 600 (4 issues)
Single Copy : Rs. 150

Subscription should be sent by demand draft in favour of Kerala Journal of Ophthalmology payable at Trivandrum addressed to the Editor, KJO
# KERALA SOCIETY OF OPHTHALMIC SURGEONS

(Registered under Societies Registration XXI of 1860. No.387/2003)

<table>
<thead>
<tr>
<th>Role</th>
<th>Name</th>
<th>Address</th>
<th>Phone</th>
<th>Mobile</th>
</tr>
</thead>
<tbody>
<tr>
<td>President</td>
<td>Dr. T.A. Alexander</td>
<td>Thottumughath, Kusumagiri, Kakkanad, Kochi - 682 030</td>
<td>0484-2721161</td>
<td></td>
</tr>
<tr>
<td>General Secretary</td>
<td>Dr. V Sahasranamam</td>
<td>No-30, Vinayaka Nagar, Trivandum 695 018</td>
<td>0471-2490421</td>
<td>9846020421</td>
</tr>
<tr>
<td>Treasurer</td>
<td>Dr. B V Bhat</td>
<td>Bhat's Eye Clinic, Asoka Hospital, South Bazar, Kannur</td>
<td>0497 2700715</td>
<td></td>
</tr>
<tr>
<td>President Elect</td>
<td>Dr. P. Rajagopalan Nair</td>
<td>Raj Bhavan, Palakkad - 676 013</td>
<td>0491-2535676</td>
<td></td>
</tr>
<tr>
<td>Vice President</td>
<td>Dr. R.R. Vama</td>
<td>Ambikalayam, Warriam Road, Ernakulam - 682 572</td>
<td>0484-2352010</td>
<td></td>
</tr>
<tr>
<td>Web Site Editor</td>
<td>Dr. Arup Chakrabarti</td>
<td>Chakrabarti Eye Care Centre, Kochulloor, Trivandum - 695 011</td>
<td>0471 2555530</td>
<td></td>
</tr>
<tr>
<td>Immediate Past President</td>
<td>Dr. George Thomas</td>
<td>T.C. 4/1040-1, Near Kowdiar Jn., Trivandum - 695 003</td>
<td>0471-2431143, 2433333</td>
<td>9847315150</td>
</tr>
<tr>
<td>Managing Committee Members</td>
<td>Dr. A Giridhar</td>
<td>Ambikalayam, Warriam Road, Ernakulam - 682 572</td>
<td>0484-2352010</td>
<td></td>
</tr>
<tr>
<td>Immediate Past Secretary</td>
<td>Dr. R R Varma</td>
<td>Ambikalayam, Warriam Road, Ernakulam - 682 572</td>
<td>0484-2352010</td>
<td></td>
</tr>
<tr>
<td>Executive Committee Members</td>
<td>Dr. Suresh</td>
<td>Kasargode</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dr. Raj Issac Oommen</td>
<td>Kannur</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dr. Leila Mohan</td>
<td>Kozhikode</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dr. Govinda Babu</td>
<td>Malappuram</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Web Site Editor</td>
<td>Dr. Meena Chakrabarti</td>
<td>Chakrabarti Eye Care Centre, Kochulloor, Trivandum - 695 011</td>
<td>0471-2555530</td>
<td></td>
</tr>
<tr>
<td>Journal Editor</td>
<td>Dr. A Rohan</td>
<td>Palakkad</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dr. C V Anthravose Barbar</td>
<td>Thrissur</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dr. S Sasi Kumar</td>
<td>Ernakulam</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dr. Mohammed Haneef</td>
<td>Alapuzha</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dr. S Sabitha</td>
<td>Pathanamthittu</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dr. S Sabitha</td>
<td>Pathanamthittu</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dr. Sarojiam</td>
<td>Kottayam</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dr. S Venugopal</td>
<td>Kollam</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dr. Thomas George</td>
<td>Trivandum</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Joint Secretary</td>
<td>Dr. Elizabeth Joseph</td>
<td>L F Hospital, Angamali - 683 572</td>
<td>0484-2452141</td>
<td></td>
</tr>
<tr>
<td>Immediate Past Secretary</td>
<td>Dr. E.J. Mani</td>
<td>Little Flower Hospital, Angamali - 683 572</td>
<td>0484-2608919</td>
<td></td>
</tr>
<tr>
<td>Dr. Alex Joseph</td>
<td></td>
<td>Leavea Villa, Gandhi Nagar, Peringavu, Thrissur -680 018</td>
<td>2331199</td>
<td></td>
</tr>
<tr>
<td>Dr. N Jayanth</td>
<td></td>
<td>Nethra, Fort Road, Kannur</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


ZEISS optics give you the detail you've been missing

Amazing details like these are captured with the ZEISS FF 450™ and VISI PAC™ Digital Image Management System. Legendary ZEISS optics with new, powerful archive and analysis software will significantly improve practice workflow and prove that better diagnosis is in the detail. More than 150 years of ophthalmic excellence result in superb images. Call 800-342-9871 today to schedule an in-office consultation with your ZEISS Imaging and Laser Specialist.

Carl Zeiss India Pvt. Ltd.
K E E, Kempegowda Road, Ulsoor, Bangalore - 560 008 INDIA
022-51 80 2506/7102; Tel: 51 80 2507/9999; Fax: 51 80 2506/9102
Email: medindia@zeiss.co.in  http://www.zeiss.co.in
Every eye is a world like no other.

One instrument lets you provide customized treatment.
EDITORIAL
The Spirit of Teamwork
Dr. Meena Chakrabarti

MAJOR REVIEW
Bacterial Endophthalmitis Prophylaxis for Cataract Surgery: An Evidence Based Update of Incidence, Risk factors and Common Prophylactic Techniques
Dr. Meena Chakrabarti, Dr. Arup Chakrabarti, Dr. Valsa T. Stephen, Dr. Sonia Rani John

MINOR REVIEW
Intraoperative Floppy Iris Syndrome (IFIS)
Dr. Arup Chakrabarti, Dr. Sonia Rani John, Dr. Valsa T Stephen, Dr. Meena Chakrabarti

ORIGINAL ARTICLES
OCT Assessment of the Vitreoretinal Relationship in CSME
Dr. Manoj S., Dr. Unnikrishnan Nair, Dr. Gargi Suresh

Comparability and Influence of Central Corneal Thickness (CCT) on Measurements of Intraocular Pressure (IOP) by Goldmann Applanation Tonometry (GAT) and Non Contact Tonometry (NCT) In Different IOP Ranges
Dr. Meena Nair, Dr. K.G.R.Nair, Dr. Sudhir Tambile, Dr. Soumya Nambiar

The Functional Results of Posterior Chamber Intraocular Lens with Scleral Fixation : A One year follow-up Analysis
Dr. K.S. Chandrakant, Dr. Nirupama Balaji

Retinal Detachment Due to Retinal Dialysis
Dr. Meena Chakrabarti, Dr. Valsa T Stephen, Dr. Sonia Rani John, Dr. Arup Chakrabarti

OCULAR PHARMACOLOGY
Evolving Concepts in Ocular Allergy
Dr. Reena A., Dr. Valsa T. Stephen, Dr. Arup Chakrabarti

OPHTHALMIC INSTRUMENTATION
Dr. Mathew Joseph

Autorefractometers
Dr. Sahasranamam

Retinoscopy
Dr. Pappa

OPHTHALMIC SURGERY
Role of CTR in Cataract Surgery
Dr. Anup Chirayath, Dr. Jyothi Anup, Dr. K. Sunderesh
Techniques to Manage Pupil during Phacoemulsification and IOL Implantation
Dr. Boris Malyugin

CURRENT CONCEPTS

Surface Ablation - Epilasik
Dr. D. Ramamurthy

Retinopathy of Prematurity: Screening and Management
Dr. Meena Chakrabarti, Dr. Valsa T. Stephen

CASE REPORTS

Heredity as a Risk Factor in Concomitant Strabismus
Dr. Vijaya Pai, Dr. Anju Ninan, Dr. Shiji Gangadharan

A Rare Case of Central Retinal Artery Occlusion
Dr. Ashok Natarajan, Dr. Manoj S., Dr. Unnikrishnan Nair,
Dr. Anu Anna Paul

Viral fever and Disorders of Eye Movement
Dr. Dona Susan John, Dr. Ashley Thomas Jacob, Dr. Liz Thomas,
Dr. Leema Rose Thomas, Dr. Elizabeth Jaya Koshy

Fish Hook Injury
Dr. Elizabeth Sonu John, Dr. Anjana Krishnan, Dr. Thomas George, Dr. Reena

Juvenile Xanthogranuloma: A Case with Rare Ocular Manifestations
Dr. Reena A, Dr. Nandakumar, Dr. Sony Siraj, Dr. Tinu Mary Thomas

CONSULTATION SECTION

Recalcitrant Diabetic Macular Oedema: Therapeutic Options
Dr. Cyrus M Shroff, Dr. N.S. Muralidhar, Dr. R. Narayanan, Dr. Biju Raju,
Dr. Gopal Pillai, Dr. Giridhar A.

PHOTO ESSAY

The Missing Links in Paediatric Diagnosis: What Can an Ophthalmologist Offer?
Dr. Gopal S. Pillai, Dr. Natasha Radhakrishnan

COMMUNITY OPHTHALMOLOGY

Setting Up An Anterior Segment Practice
Dr. Ashley Thomas Jacob

How to set up a Vitreoretinal Surgical Unit
Dr. A. Giridhar

Journal Review: Dr. Roopasree

Book Review: Dr. Anthrayose Kakkanat

CME Programmes

PG Tear Sheet: ROP Screening & Management
Dr. Meena Chakrabarti
The Spirit of Teamwork

No one is more aware than the Editor and the Editorial board that the Kerala Journal of Ophthalmology (KJO) has ample scope for drastic improvement. Looking back at the last two years of our tenure, our objective had been to streamline the entire editorial process and to become an efficiency – oriented journal, responsive to the needs of ophthalmic fraternity within the state.

Our second objective to showcase ophthalmic practice, surgery, research performed in our state and place it on a national platform, has helped increase our visibility in the national scene. It is very obvious to us that running and developing a journal calls for teamwork; a team devoted to a single cause – “ improvement’ of the journal.

“ Individually we are one drop …………
together we are an ocean !!!!!
is an oft repeated quote on teamwork.

Hence, the editorial board depends on the members of the KSOS to work together with us as contributors and reviewers with the aim to take our journal to international heights. We request all to be part of this movement! The most effective teamwork is produced when all the individuals involved harmonise their contributions and work towards a common goal.

The scientific standards achieved by a journal are dependent on the care and rigor with which the peer review process is undertaken. I am grateful to the editorial team, reviewers, and my colleagues at my parent institute who ensured that the scientific rigor of the review process is maintained throughout.

Our aim so far has been to reduce the submission to decision time, improve the transparency in the management of articles, include reviewers from outside the state, and provide opportunity to all to publish their work and I sincerely hope that we have been able to achieve at least part of our goal.

Linus Pauling the celebrated Nobel Laureate Chemist has quoted that “ The way to get good ideas is to get lots of ideas and throw the bad ones away.”

In keeping with this principle we have so far never rejected any article if the idea is good and the contents can be improved upon. We look forwards to your active participation in the activities of the journal.

We sincerely hope that the journal will continue to be responsive to the needs of the ophthalmic fraternity, and improve to a position at the forefront of ophthalmic literature.

Dr. Meena Chakrabarti MS DO DNB
Editor
Bacterial Endophthalmitis Prophylaxis for Cataract Surgery: An Evidence Based Update of Incidence, Risk Factors and Common Prophylactic Techniques

Dr. Meena Chakrabarti MS DO DNB, Dr. Arup Chakrabarti MS DO, Dr. Valsa Stephen MS DO DNB, Dr. Sonia Rani John DNB

Introduction

Cataract extraction with posterior chamber intraocular lens implant is the most commonly performed surgical procedure throughout the world. With the advancements in surgical technique such as phacoemulsification and micro incision cataract surgery, this surgical procedure has become efficacious and predictable. However the possibility of serious postoperative infection and loss of vision still remain a serious unsolved problem in this era.

Incidence

Endophthalmitis is the most devastating complication of intraocular surgery. A review of 30,002 cases at a major teaching institute showed an incidence of culture proven cases of endophthalmitis in 0.072 % following extra capsular cataract surgery, 0.051 % following parsplana vitrectomy, in 0.11 % cases following penetrating keratoplasty, and in 0.061 % of cases following a glaucoma filter.

At the beginning of the 20th century (1910) the incidence of endophthalmitis after cataract operations was 10 %. In the era of extracapsular cataract surgery via a limbal or scleral incision and wound closure with sutures with observation of proper sterilization techniques and improved hygienic conditions (1970-1990) the infection rate declined to 0.12 % in Europe and 0.072 % in the US.

TABLE 1. Incidence of Post Cataract Endophthalmitis

<table>
<thead>
<tr>
<th>% Incidence</th>
<th>Country</th>
<th>Year</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.22</td>
<td>USA</td>
<td>1991</td>
<td>Menikoff et al; Ophthalmology 98:1761-68; 1991</td>
</tr>
<tr>
<td>0.72</td>
<td>USA</td>
<td>1991</td>
<td>Kattan HM et al; Ophthalmol 1991</td>
</tr>
<tr>
<td>0.148</td>
<td>GERMANY</td>
<td>1999</td>
<td>Schmitz et al; Ophthalmology 1999</td>
</tr>
<tr>
<td>0.1</td>
<td>NETHERLANDS</td>
<td>2000</td>
<td>Versteegh MPL et al. Documents Ophthalmologica ; 2000</td>
</tr>
<tr>
<td>0.1</td>
<td>SWEDEN</td>
<td>2002</td>
<td>Montan PG et al. Acta Ophthalmo Scand.; 2002</td>
</tr>
<tr>
<td>0.198</td>
<td>AUSTRALIA</td>
<td>2003</td>
<td>Morley et al, Br.J.Ophthalmo ; 2003</td>
</tr>
<tr>
<td>0.1</td>
<td>NORWAY</td>
<td>2003</td>
<td>Sandviq KU et al, JCRS. ; 2003</td>
</tr>
</tbody>
</table>


Chakrabarti Eye Care Centre, No. 102, Kochuloor, Trivandrum
Email: tvm_meenarup@sancharnet.in
In a study of Medicare beneficiaries in the US greater than 65 years of age admitted for cataract surgery in 1984, the risk of hospitalization in the year after surgery for endophthalmitis was 0.12% following ECCE and phacoemulsification which was reduced to 0.08% in the year 1986 when cataract surgery was largely performed as an outpatient technique. However since the introduction of phacoemulsification and clear corneal incisions the incidence has increased between 0.3% to 0.5% (Table 2).

Table 2. Review of literature showing increased incidence in Endophthalmitis

<table>
<thead>
<tr>
<th>Country</th>
<th>Year</th>
<th>Reference</th>
<th>Incidence %</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>2005</td>
<td>Jensen et al; Am.J. Ophthalmol</td>
<td>0.29%</td>
</tr>
<tr>
<td>IRELAND</td>
<td>2005</td>
<td>Kahn et al; JCRS Vol 31</td>
<td>0.5%</td>
</tr>
<tr>
<td>UK</td>
<td>2007</td>
<td>Molan et al; JCRS Vol 33</td>
<td>0.099%</td>
</tr>
<tr>
<td>SWEDEN</td>
<td>2007</td>
<td>Lindstrom et al; Ophthalmology:114.</td>
<td>0.048%</td>
</tr>
<tr>
<td>EUROPE</td>
<td>2007</td>
<td>ESCRS Endophthalmitis Study Group, JCRS;33</td>
<td>0.05-0.35%</td>
</tr>
</tbody>
</table>

The trend of increased incidence of endophthalmitis seen in the past decade have coincided with the popularization of clear corneal incision. However the association between the clear corneal incision and increased incidence of endophthalmitis is not clear. One proposed mechanism is the ingress of ocular surface fluid into the anterior chamber in the immediate postoperative period from a physically unstable potentially leaking wound. The negative pressure gradient allows pericocular fluid with bacterial flora to enter the anterior chamber. The technique of clear corneal incision made cataract surgery possible under topical anaesthesia which replaced block anaesthesia. Ellis MF et al have reported an increased incidence of endophthalmitis with use of topical anaesthesia. Forced blinking and voluntary contraction of the extraocular muscles which are possible after surgery performed under topical anaesthesia, (due to lack of akinesia) can result in IOP variations, preceeded by wound leakage. This creates a negative pressure gradient, sucking in ocular surface fluid into the anterior chamber.

Risk Factors For Endophthalmitis Following Cataract Surgery.

The various preoperative, intraoperative and postoperative events that increase the risk for developing endophthalmitis have been studied and analysed in detail. Matts Lundstorm et al (2007) reported the results of a prospective study evaluating incidence of endophthalmitis in relation to incision type and location. They performed a multiple logistic regression analysis of independent predictors for development of postoperative endophthalmitis. The variables analysed included 1) intraoperative posterior capsular rent and communication with the vitreous (P <0.001); 2) no intracameral cefuroxime (P < 0.001); 3) Age = 85 years versus 0 to 84 years; 4) clear corneal incisions versus superior scleral tunnel incisions. (P = 0.14); 5) temporal versus superior incisions (P = 0.14); 6) IOL material acrylic (and others) versus silicone (P = 0.33); other surgical procedures versus phacoemulsification with IOL implantation (P = 0.41). Trevin Wallin et al performed a cohort study of 27 cases of endophthalmitis at a single institution. Multivariate regression analysis of risks showed that the following were associated with risk for developing endophthalmitis 1) wound leak on the first postoperative day, 2) posterior capsular rent or zonular dehiscence at the time of the surgery 3) antibiotics started on the first postoperative day rather than on the day of surgery, 4) eye was not patched after surgery, 5) collagen shield soaked in cefazolin and dexamethasone not used at end of surgery and, 6) and the use of silicone rather than acrylic 10Ls.

ESCRS Endophthalmitis study on the prophylaxis of postoperative endophthalmitis following cataract surgery tried to identify the risk factors and assessed the effect of preoperative antibiotic prophylaxis as well as intracameral cefuroxime on the incidence of endophthalmitis. The risk factors for endophthalmitis following phacoemulsification surgery assessed in this study and the significance of the evidence as indicated by the odds ratio is given below in Table 3.
Table 3. Risk factors for endophthalmitis following phacoemulsification surgery investigated in the ESCRS study 14,20.

<table>
<thead>
<tr>
<th>Risk Factors</th>
<th>Odds Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Intracameral injection of Cefuroxime – given or not given</td>
<td>4.92</td>
</tr>
<tr>
<td>2. Clear corneal (and position) versus scleral tunnel incision</td>
<td>5.88</td>
</tr>
<tr>
<td>3. Type of wound closure – Suture or Sutureless found</td>
<td>No evidence</td>
</tr>
<tr>
<td>4. Insertion of IOL – injector or forceps Not retained as a risk factor</td>
<td>3.13</td>
</tr>
<tr>
<td>5. Type of IOL material</td>
<td>No evidence</td>
</tr>
<tr>
<td>6. Diabetic or non-diabetic</td>
<td>No evidence</td>
</tr>
<tr>
<td>7. Immunosuppression or not</td>
<td>No evidence</td>
</tr>
<tr>
<td>8. Complications of surgery</td>
<td>4.95</td>
</tr>
</tbody>
</table>

There are only few data on the incidence of endophthalmitis between inpatient and outpatient surgery respectively. Various studies give no evidence of any difference in incidence 71,72.

The clear corneal incision is thought to have contributed to the increase in the number of endophthalmitis cases following phacoemulsification.

Unsutured clear corneal cataract wounds have been implicated in the rising rates of bacterial endophthalmitis after cataract extraction over the past several years. However, the relationship is not certain 10.

Many studies reveal an increased incidence of postoperative endophthalmitis after clear corneal cataract incisions. John and Moblith 21 reported incidences of acute endophthalmitis of 0.29 % and 0.02 % after cataract extraction with clear corneal and scleral tunnel incisions respectively representing an almost 15 fold increase in risk. Lertsumikal et al 22 reported a 3.5 fold increased risk of postoperative endophthalmitis with clear corneal temporal incisions compared with superior scleral incisions. Nagaki et al 23 noted a 5.6 fold increase in risk of endophthalmitis with clear corneal incisions compared with scleral tunnel incisions. Colleaux and Hamilton 24 reported a 2.6 fold increase in risk of endophthalmitis with clear corneal incisions, though not statistically significant. However, a large study from the Bascom Palmer Eye Institute reports no greater incidence of endophthalmitis with clear corneal incisions than with scleral incisions 25.

The suggestion of increased risk of acute endophthalmitis with self-sealing clear corneal incision raises the question whether it might be possible for surface bacteria to traverse the clear corneal incision during the postoperative period.

One proposed mechanism is the ingress of fluid into the anterior chamber secondary to hypotony in the immediate postoperative period from physically unstable, potentially leaking wounds. This negative pressure gradient then allows pericocular fluid with bacterial flora to enter the anterior chamber 26. Studies have shown that 20.5 % of eyes had markedly low intraocular pressure (IOP) (5 mm Hg or less) 30 minutes postoperatively in unsutured 3 mm clear corneal incision cataract extraction 27. Experimental models show an incompetence of clear corneal incision with intraocular contamination under conditions of low IOP 28. It has been found that blinking and eyelid squeezing produce a sudden increase in IOP by 10 mm and 90 mm Hg respectively followed by 8 mm Hg undershoot after lid opening. A well pressurized operated eye may be able to withstand deformation brought on by these physiological compressive forces, but a hypotonic eye gives way to deformation and compression. This leads to progressive gaping of external incision, with the corneal tunnel pulling surface fluid into the tunnel and finally the internal incision gapes causing a precipitous efflux of aqueous. The elastic recoil of the globe creates a momentary state of relative vacuum in the anterior chamber producing a suction effect which sucks in the escaped aqueous-surface fluid flooding the conjunctiva and corneal tunnel into the anterior chamber. Thus a blink rate of 6 to 12 per minute causes scleral microincision events per minute until the IOP rebuilds to a point at which the eye ball can resist deformation from physiologic forces 29. Ex-vivo wound gaping at 10 mm or less of intraocular pressure have been demonstrated by optical coherence tomography in rabbits and human cadaver eyes establishing the fact that the cataract incision is unstable at IOP 10 mm or less 35. Similarly an anterior chamber compression performed by the surgeon to treat post operative high IOP spikes can lead to ingress of fluid into the anterior chamber by a similar mechanism 39.

There has also been reports on an increased incidence of post cataract endophthalmitis associated with clear corneal temporal incisions in comparison to the superior
scleral tunnel incision \cite{33,36,37}. However, review of literature does not convincingly confirm this opinion. Results of studies performed by Colleaux et al \cite{24} and Miller JJ et al \cite{38} showed that there was no significant difference in incidence and no relation between wound construction, and its location with the incidence of postoperative endophthalmitis.

Appropriate wound construction will help to prevent deformation under hypotonic conditions. It has been demonstrated that cataract tunnel incisions that are square or nearly square in surface architecture are significantly more resistant to external deformation than those that are rectangular \cite{30}. In addition, Langerman-style, deeply grooved pre incision has been shown to resist deformation \cite{31}. Ernest et al \cite{34} also have shown that square cataract wounds are more stable than rectangular wounds. Square wounds in cadaver eyes 3.2 mm x 3.2 mm were stable up to an external pressure of 525 pounds / square inch (psi) compared to rectangular incision (3.2 mm x 2.0 mm ) which leaked at 14 psi.

Furthermore, it is essential that the cataract incision is not subject to inordinate stretching and distortion during the surgical procedures as this can lead to instability of incision closure; the cornea being less tolerant than the sclera. The unsleeved, rigid round tubes used for bimanual microphaco distort the small slit incisions, increasing chances of postoperative leak \cite{32}.

It is also necessary to monitor all incisions and determine at the end of the case whether the wound is marginal in any way. A marginal wound might leak after stromal hydration ends which occurs in 15 minutes to 20 minutes. Wounds which are more than 1.75 mm long at any point, wound in which the peripheral edges are torn during wound creation or during the procedure, cases with Descemets' detachment, wounds that require an inordinate amount of stromal hydration and appear stretched or otherwise not well constructed are all examples of “marginal wounds ” \cite{32}. In these cases the risk for contamination is potentially increased, and suturing the wound as well as use of appropriate topical antibiotics is necessary.

Any incision suspected of incompetence (including side-port paracentesis) should be considered for suturing, bandage lenses etc. To enhance wound sealing, the wound should be stromal hydrated. The roof as well as sides of the incision should be hydrated. After surgery the IOP should be established at a physiologic level by injection of fluid into the anterior chamber to ensure proper apposition of internal wound. Seidel's testing should be done on all incisions to establish proof of closure \cite{33}.

The patient's periocular bacterial flora is the source of microbes in endophthalmitis \cite{40}. Therefore careful draping of the eyelids margins and chemoprophylactic antisepsis is likely to reduce the chance of anterior chamber contamination during surgery.

For the future we might consider methods to standardize the clear corneal incision to create architecturally consistent and truly self sealing incision. Biologic tissue adhesives may play a future role.

In a case control study of postoperative endophthalmitis cases in Sweden between 1994 and 2000 by Wejde et al \cite{73}, it was observed that silicone intraocular lenses carried a higher risk than heparin surface modified PMMA implants. Likewise in the ESCRS study \cite{14,70}, the type of IOL material was found to be a risk factor which was significantly associated with endophthalmitis. Patients receiving a silicone intraocular lens were 3.13 times more likely to develop endophthalmitis than patients receiving an acrylic (or other materials) IOL. Several other studies provided a comprehensive summary of clinical and experimental data supporting an association between silicone IOLs and post cataract endophthalmitis \cite{74,75}.

Results from an Asian study population reported by Wong TY & Chee SP et al showed that silicone IOLs were associated with 4.3 fold higher risk, of developing post cataract endophthalmitis and a 8 fold risk for culture positive cases. However a randomised trial from Japan \cite{23} showing that silicone IOLs were not associated with an increased risk had a biased, unbalanced study design and hence a proper assessment of risk, would not have been possible. The use of injector system to introduce the intraocular lens into the capsular bag provides both surgical conveniences and offer protection by keeping the IOL from touching the ocular surface, which is the main source of the offending microorganisms \cite{77}. However this association has not been substantiated by other authors. The ESCRS Endophthalmitis study also assessed this risk factor and
proved that there is no difference in incidence of endophthalmitis whether injectors or forceps were used for IOL insertion.

Several studies \(^{68,73,76}\) and lately the results of the ESCRS endophthalmitis study \(^{14}\) have conclusively proved that patients experiencing surgical complications (posterior capsular rent, zonular dialysis etc) during phacoemulsification had a 4.95 times higher risk of infection. Other factors, such as duration of surgery, tissue trauma, choice of viscoelastic, and irrigating solutions, degree of surgical experience of the surgeon, sex of the patient, age, diabetic status, outpatient versus inpatient surgery were analysed in detail and was not found to be associated with a higher risk of developing post cataract endophthalmitis.

About 14 % to 21 % of patients who develop bacterial endophthalmitis are diabetics \(^{78,79}\). However preexisting diabetes with controlled metabolic status has not been identified as an independent risk factor. If a diabetic with poor control and preexisting diabetic retinopathy develops infection, the visual prognosis becomes very grave \(^{79}\). Endophthalmitis in diabetic patients is usually caused by gram negative organisms more often than in non diabetics\(^ {78}\). Imunosuppression in patients undergoing phacoemulsification carries a higher risk for infection and hence vigilant prophylactic measures have to be employed in this category of patients \(^{80}\).

**Prophylaxis For Post Cataract Endophthalmitis:**

Thomas Ciulla et al \(^ {41}\) published the results of a systematic literature review and evidence rating of the commonly used cataract surgery bacterial endophthalmitis prophylaxis measures published between 1966 – 2000. They tried to rate each practice depending on its relevance to the clinical outcome and on the basis of availability of evidences justifying its use. Outcomes were graded as shown in Table 4.

**Role of Normal Ocular flora**

A variety of potentially infective microorganisms confront the cataract surgeon preoperatively. The main sources of bacteria include the lids, conjunctiva, ocular adnexa, irrigating solutions and medications, surgical instruments including IOL, respiratory tract and skin flora of the surgeon and his assistants and operating room air \(^{41}\). The patients’ own skin and conjunctival flora are the most significant among them, being the most difficult organism to contain.

The bacterial flora of normal human conjunctiva has been extensively studied and reported. Various staphylococcal species and corynebacterium predominate this flora, while streptococcal species and gram-negative organisms are less frequently seen \(^ {42,43}\).

The bacterial isolation rates and species from conjunctiva and lids of patients undergoing cataract surgery was studied by Behrens-Bauman et al \(^ {44}\). The bacterial isolate from lids (84.6 %) was about twice that from the conjunctiva (36.7 %). Speaker et al \(^ {45}\) used gene material for performing genetic analysis of bacteria by restriction enzyme endonuclease. Their study revealed that bacterial isolates from vitreous in 82 % of cases of acute postoperative endophthalmitis were genetically similar to bacteria isolated from lids, conjunctiva and nares of the patient. These studies suggest that indigenous conjunctival microorganisms are the most likely bacteria to enter the eye at time of surgery resulting in postoperative endophthalmitis. Therefore minimizing normal ocular microorganisms in the lids and conjunctiva preoperatively is an important step in the prevention of endophthalmitis.

Ariyasu et al \(^ {46}\) showed that in 8 out of the 13 patients studied (62 %) for aqueous contamination of bacteria at the end of the surgery, the species and antibiotic sensitivities of the organisms were identical to those of bacteria cultured from the patient’s lids and conjunctiva preoperatively.

70 % of the bacterial isolates in the Endophthalmitis Vitrectomy Study (EVS) \(^ {46,47,48}\), a multicentered

<table>
<thead>
<tr>
<th>Table 4. Outcomes grading (Ciulla T et al; 2002)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Crucial to Clinical Outcome</strong></td>
</tr>
<tr>
<td>No Prophylactic Measure</td>
</tr>
<tr>
<td><strong>2 Moderately Important to Clinical Outcome</strong></td>
</tr>
<tr>
<td>Preoperative Povidone Iodine Preparation</td>
</tr>
<tr>
<td><strong>3. Possibly Relevant But Not Definitely Important to the Clinical Outcome</strong></td>
</tr>
<tr>
<td>a) Postoperative Subconjunctival Antibiotic Administration</td>
</tr>
<tr>
<td>b) Preoperative eyelash trimming</td>
</tr>
<tr>
<td>c) Preoperative saline irrigation</td>
</tr>
<tr>
<td>d) Preoperative topical antibiotics</td>
</tr>
<tr>
<td>e) Antibiotic containing irrigating solution</td>
</tr>
<tr>
<td>f) Use of intraoperative heparin</td>
</tr>
</tbody>
</table>
randomised prospective clinical treatment trial involving 420 endophthalmitis patients who were seen within 6 weeks of cataract surgery and secondary IOL implantation. Confirmed microbiological growth was demonstrated in 69.3% of cases. 70% were gram positive coagulase negative staphylococcus and 9.9% were Staph. aureus. Postoperatively cultured eyelid isolates were indistinguishable from intraocular isolates in 71 (67.7%) among 105 comparisons studied by pulsed – field gel electrophoresis, an established molecular strain typing technique.

It has been clearly demonstrated that viable organisms are introduced into the eye at the time of surgery, and bacteria may be isolated from the aqueous in a quarter or more eyes undergoing cataract surgery. Dickey JB et al S4 reported that anterior chamber aspirates obtained at the conclusion of cataract surgery were culture positive in 13 of the 30 eyes studied (43%) and the most commonly associated organism was coagulase negative staphylococcus in 44% of eyes. It has also been reported that viable organisms can be isolated from the aqueous even when there has been an attempt at ocular surface disinfection with povidone-iodine or preoperative prophylaxis with topical antibiotics.

Although several studies have clearly demonstrated viable organisms from ocular surface contaminating the aqueous during cataract surgery, not all cases reported with positive cultures developed endophthalmitis. This proves that a low dose of bacterial innoculum occurring after cataract surgery can be cleared by the eye without developing endophthalmitis. The risk of contamination of aqueous during cataract surgery remains the same whether extracapsular cataract surgery, SICS or phacoemulsification is performed.

Given the ability of surface flora to enter the eye, prophylactic measures should aim at decreasing the bacterial load on the ocular surface, and achieving bactericidal concentrations of antibiotics to provide adequate coverage against the bacterial innoculum during cataract surgery.

Role of Preoperative Cultures In Cataract Surgery

Evidence proving that the patient himself was the major source of most postoperative infections prompted the technique of routine preoperative cultures from the ocular surface and attempts to contain or alter this flora with topical antibiotics. The role of routine preoperative conjunctival culture and sensitivity in predicting the risk of postoperative endophthalmitis has been extensively studied. Its reliability in eyes without any ocular inflammation is doubtful. In 35% of cases the conjunctival culture and sensitivity results obtained at the time of surgery were different from the results obtained the previous day. The conjunctival culture and sensitivity at the time of surgery may be negative even though the cultures had been positive 24 hours preoperatively and the reverse is also true (negative conjunctival culture and sensitivity preoperatively with positive cultures at time of surgery).

95% of routinely cultured eyes are positive for organisms causing endophthalmitis. However, very few of these culture positive eyes really go on to develop endophthalmitis even when the bacteria are of a particularly virulent nature.

Hence routine preoperative cultures in eyes without any ocular inflammation are misleading and often inappropriately raise the suspicion for increased risk of infection. They also give the surgeon a false sense of security while operating on culture negative cases even when they do not give a true reflection of the patients’ own flora. Hence any decision to proceed with or cancel an intraocular procedure, or tailor antimicrobial prophylaxis based on culture results is unwarranted.

However, preoperative cultures from the conjunctiva and lid margins have a definite role in the presence of ocular surface inflammation such as blepharitis, canaliculitis, chronic conjunctivitis, dacryocystitis etc. These eyes carry an increased risk for developing postoperative endophthalmitis if taken up for intraocular surgery before eradicating the inflammation and obtaining a negative culture report after treatment.

The Microbial Spectrum of Postoperative Endophthalmitis:

The most important pathogens causing postoperative endophthalmitis from various studies on phacoemulsification is given in Table 5.

A study from India on the spectrum of aetiological agents in postoperative endophthalmitis and antibiotic susceptibility of bacterial isolates showed a higher...
frequency of gram-negative organisms in 41.7 % of cases. The authors analysed 170 cases of postoperative endophthalmitis and reported on the frequency of various aetiological agents in their series: gram-negative organism 71/170 cases (41.7 %); gram-positive organism 64/170 cases (37.6 %) and fungi 37/170 cases (21.8 %). Table 6. gives the species identification in this series.

Table 6. Species Identification (AR Anand et al:2000.IJO)

<table>
<thead>
<tr>
<th>Gram Negative Organisms</th>
<th>Gram Positive Organisms</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAeuroginosa 17.1 %</td>
<td>Staph epi 12.9 %</td>
</tr>
<tr>
<td>Other Pseudomonas Species 8.8 %</td>
<td>S.Aureus 7.6 %</td>
</tr>
<tr>
<td>Non-fermenters 10.6 %</td>
<td>PAcnes 5.9 %</td>
</tr>
<tr>
<td>Others 5.8 %</td>
<td>Enterococci 2.3 %</td>
</tr>
<tr>
<td>Polymicrobial Infection 3 (1.8 %)</td>
<td>Streptococcus 4.1 %</td>
</tr>
<tr>
<td>Others 4.8 %</td>
<td></td>
</tr>
</tbody>
</table>

This study emphasizes the importance of gram-negative bacilli and fungi in causing postoperative endophthalmitis which represents a failure to maintain absolute sterility during surgery. A proper perspective of the incidence and aetiology of postoperative endophthalmitis in India is not available at present and it points to a necessity of a reporting system nationwide.

Commonly Employed Prophylactic Measures:-

A variety of presurgical, intraoperative and postoperative prophylactic measures are employed in an attempt to decrease the incidence of endophthalmitis. Some of them do not have conclusive scientific proof to justify their use while others are backed by reliable supportive evidence. Prophylactic measures are broadly classified into 1) Preoperative 2) Intraoperative 3) Post operative.

(I) Preoperative preparation of the Eye

(a) Preoperative Eyelash Trimming: Review of studies published does not give conclusive evidence to support this age-old practice of 'trimming eyelashes' preoperatively. Available literature suggest that this procedure plays no role in reducing the ocular surface bacterial flora on the day of surgery 81,82.

(b)Saline Irrigation: of the conjunctival sac is used in an attempt to mechanically flush out bacteria from the ocular surface. David.A.Boes et al 83 have demonstrated that following saline irrigation of the conjunctival sac the surface contamination is actually increased because of two important factors (1) bacteria from lid and periocular tissues are carried on to the ocular surface (2) washing out of organisms hidden with in the conjunctival crypts to the ocular surface. Thus the bacterial colony count literally doubles after irrigation of conjunctival sac and hence this practice should be avoided.

(c) Irrigation Of Lachrimal Passages: Preoperative irrigation of the lacrimal passages has no significant effect on the contamination of the aqueous aspirates 81. However this procedure should not be performed on the day of surgery as organisms from the lacrimal passages will get flushed out on to the conjunctival sac increasing the ocular surface bacterial load.

(d) Preoperative Chemical Preparation of the Ocular surface with Povidone – Iodine

The main aim of preoperative antiseptic prophylaxis is to reduce the risk of wound infection by reducing the total bacterial count in the area of the wound and its immediate surrounding environment.

1. For Periorbital Skin Antisepsis:
5 to 10 % Povidone – iodine solution should be allowed to act for a minimum of 3 minutes as the skin contains sebaceous glands. Povidone-iodine is contraindicated is the presence of allergy and hyperthyroidism 84

2. For antisepsis of the conjunctiva and cornea: Povidone-iodine 5 % drop is instilled into the conjunctival sac and allowed to act for 3 minutes. 5 % Povidone-iodine decreases the colony forming units in the conjunctiva, kills bacteria, virus and fungi, and has
a synergistic effect with the topically administered antibiotic. Michael R. Keverline et al specifically assessed whether the commonly used combination of a fluoroquinolone with Povidone – iodine was complimentary or simply redundant. Their results show that this combination is a complimentary one for surgical prophylaxis. Fluoroquinolone resistant bacterial isolates were covered by Povidone-iodine, while fluoroquinolones were effective against S. Marcescens and Bacillus species that were less susceptible to Povidone – iodine. The results of this study are limited clinically by the inability to take into account the actual concentration of each agent that is present on ocular surface and anterior chamber with topical application. The disinfective effect of Povidone – iodine depends on the exposure time and appropriate concentration.

A marked reduction in its disinfective action has been observed in the presence of organic material such as serum. Thus Povidone iodine had a definite antiseptic effect against resident flora, although it does not achieve the effect of totally eradicating it. It was also observed that it had no toxic effect on the ocular surface.

Preoperative administration of Povidone – iodine was associated with a low incidence of intraoperative bacterial contamination of aqueous humor, and was observed to decrease the incidence of endophthalmitis. Application of Povidone – iodine solution had a greater bactericidal effect when used in conjunction with preoperative course of topical antibiotics.

Schmitz et al in their questionnaire survey of 469 ophthalmic surgical institutions in Germany came to the conclusion that preoperative use of povidone – iodine on the conjunctiva significantly reduced the risk of endophthalmitis. However the survey gave no indication of the method of application, concentration of Povidone – iodine or its contact time with the ocular surface. The evidence based analysis of available Medline literature ( 1966 – 2000 ) performed by Ciulla et al confirmed the beneficial effect of Povidone – iodine antisepsis.

Speaker MG et al performed an open labelled non-randomised parallel trial for 11 months where 5 % Povidone – iodine was used in one set of 5 operating theatres while silver protein solution was used in another set of 5 operation theatres. In all cases the surgeons continued to use their systemic antibiotics. The Povidone – iodine group showed a lower incidence of endophthalmitis in comparison with the silver protein group (0.06 % vs 0.24 %). There were no adverse reactions to the use of Povidone – iodine. A similar trend was noticed by Bohignan et al who demonstrated a reduction in the incidence of endophthalmitis from 0.08 % to 0.03 % following the introduction of antisepsis with 5 % Povidone – iodine. However considerable toxic effects have been reported if Povidone – iodine enters the anterior chamber.

Application of a cotton pad soaked with 10 ml of 5 % Povidone – iodine one hour prior to the surgery, clamped against the closed lids was associated with fewer positive conjunctival cultures just prior to surgery and at conclusion of the procedure.

Thus the available clinical studies show that only Povidone – iodine in 5 % concentration can be recommended as a effective preoperative antiseptic. The optimum concentration of Povidone – iodine for use as preoperative antiseptic is still not established. Although 5 % solution is effective, studies showing significant reduction in conjunctival colony count when 1.25 % was used may lead to its use for preoperative antisepsis.

**Preoperative Antibiotic Prophylaxis**

Given the ability of the surface flora to contaminate the anterior chamber during cataract surgery, preoperative prophylaxis aims at reducing the bacterial load on the ocular surface. This is achieved using preoperative topical antibiotics and achieving sufficient bacterial concentration of the antibiotic in the aqueous to provide adequate coverage against the bacterial inoculums during surgery.

Antibiotics have been used for years by ophthalmic surgeons before, during and after cataract surgery as a prophylaxis against infection. Estimates suggest that 30 % of antibiotic usage in ophthalmic practice is for prophylaxis in surgical patients. Economic factors, adverse reactions, emerging bacterial resistance to the drug, emergence of new strains of antibiotic resistant microorganisms have rekindled concerns about inappropriate antibiotic usage. The degree to which the ocular flora will be reduced depend on the choice of antibiotic, frequency and duration of its administration, and the bacterial species present.
An antibiotic with a broad spectrum of antibacterial activity, excellent penetration into the cornea and anterior chamber, low toxicity and resistance and that which is compatible with other drugs is the ideal antibiotic for prophylaxis. It should be able to address the potential pathogens effectively and must be available at the site prior to inoculation with organisms. Appropriate time schedule for applications and adequate dosages are absolutely essential for maximising efficacy.

Allan and Mangiacine compared the incidence of post cataract endophthalmitis with and without the use of prophylactic topical antibiotics and their results suggest that preoperative antibiotic prophylaxis reduces the incidence of endophthalmitis. The difference in effect of preoperative antibiotic administration of Ofloxacin and Tobramycin on bacterial isolates from the conjunctiva was studied by Hara and Yasuda et al. Aerobic species were cultured from 24 % Tobramycin treated eyes whereas only 3.6 % of bacteria were cultured from Ofloxacin treated eyes, thus showing a marked decrease in positive isolation rate after Ofloxacin treatment.

Changes in the bacterial isolation rates during preoperative preparation was again studied by Hara and Yasuda. Isolation of aerobic bacteria reduced from 17 % to 3 % and a lower incidence of P.acnes was observed in eyes after conjunctival irrigation with Povidone-iodine than when Benzetonium chloride solution was used (9 % Vs 30 %). It is interesting to note that isolation of P.acnes actually showed an increase from 10 % prior to conjunctival irrigation to 30 % after conjunctival irrigation.

Application of preoperative prophylactic antibiotics appear rational to reduce the bacterial load on the ocular surface. Various antibiotics like chloramphenicol, aminoglycosides, vancomycin, fusidic acid, polymyxin-bacitracin, neomycin and current use of topical fluoroquinolones have been tried. However there has been no consensus on the choice of antibiotic and its optimum dosing for preoperative prophylaxis.

AR Anand et al studied the antibiotic susceptibilities of the bacterial isolates in 170 cases of postoperative endophthalmitis referred to their centre to commonly used antibiotics. Analysing the antibiotic susceptibilities of the gram-negative isolates it was seen that 55.5 % were sensitive to gentamycin, 65.2 % to cefotaxime, 68.1 % to amikacin, 73.2 % of the gram positive isolation were sensitive to gentamycin, 88.6 % to cefotaxime, 88.4 % to ciprofloxacin, 92.6 % to ceftazidime and 100 % to vancomycin. In this large series of postoperative endophthalmitis gram-negative bacilli followed by fungi accounted for the largest number of cases. A high degree of resistance of gram-negative bacilli to gentamycin, cefotaxime, amikacin, and ceftazidime was recorded.

The ESCRS Study showed the use of preoperative levofloxacin, which reached significantly higher concentrations in the anterior chamber than ofloxacin and ciprofloxacin, can prevent postoperative endophthalmitis. Although there appeared to be some benefit, the effect was smaller than for intracameral cefuroxime, and did not reach statistical significance. To maintain adequate bactericidal concentrations in the anterior chamber, levofloxacin should be continued every two hours on the day of surgery postoperatively.

In a retrospective observational series by Moshirfar et al on the rate of endophthalmitis after uncomplicated cataract surgery in 20,013 patients the effect of two 4th generation fluoroquinolones (Gatifloxacin 0.3 % and Moxifloxacin 0.5 %) prophylactic agents was compared. Estimated endophthalmitis rates of 0.06 % for gatifloxacin and 0.1 % for moxifloxacin was reported. The conclusion drawn by the authors is that older fluoroquinolones (Ofloxacin, Levofloxacin) should be used as prophylactic antibiotics and newer agents reserved for frank infection.

Fluoroquinolones achieve superior intraocular penetration after parenteral or even oral administration. Studies have shown that 200 mg of oflox achieves an aqueous level of 0.38 mg/l, two hours after oral administration, and an aqueous level of 0.33 mg/l after intravenous administration. A 750 mg single oral dose of ciprofloxacin at 17.5 and 5.5 hours after administration orally in 40 patients achieved a mean aqueous level of 0.53 ± 0.25mg/l. Oral prophylaxis with ciprofloxacin had been seriously considered. However the cost benefit ratio might not be favourable for using an expensive antibiotic for the very infrequent complication of postoperative endophthalmitis. Studies have shown that combining prophylaxis for three days by oral route with short term prophylaxis by the topical
route (1 hour prior to surgery) provided higher antibiotic concentrations in the aqueous than either modality alone. Combining prophylactic measures has not demonstrated a reduction in intraocular bacterial contamination in subsequently published reports. Antibiotic resistance patterns of ocular bacterial flora were analysed in a prospective study of patients undergoing anterior segment surgery by Ta et al. 78% of the coagulase negative staphylococcus were isolated in their series and 90% of the coagulase negative staphylococcus were susceptible to cefotaxime, levofloxacin, imipenam, meropenam, vancomycin and aminoglycosides except neomycin. 70% to 90% of coagulase negative staphylococcus were susceptible to cefazolin, neomycin, ciprofloxacin, oflox, norflox and chloramphenicol whereas only < 70% were sensitive to penicillin analogues, ceftaxidime, erythromycin and tetracyclines. This study clearly proves the superiority of vancomycin, aminoglycosides and levofloxacin as preoperative bacterial prophylaxis. However vancomycin the drug most effective against coagulase negative staphylococcus is not used as a preoperative prophylactic drug and its use is only reserved for frank infection.

**Addition of Antibiotics to Irrigating Solution**

With shift in surgical technique from extracapsular to phacoemulsification, antibiotic addition to the irrigating fluids was considered, but no significant difference in anterior chamber contamination was noticed in the questionnaire reporting surveys from various countries. 60% of the responding surgeons in Germany, 35% in the US, 16% in Newzealand, 8.5% in England and 8 in Australia used antibiotics in the irrigating fluids namely vancomycin and gentamycin. The result of this survey does not give an accurate indication due to poor response ratio and hence the results can be considered as crude comparative rates. Beigi et al. and Montan et al. have studied the anterior chamber contamination rates and compared it with and without the addition of vancomycin to the irrigating solution. Although a dramatic reduction in the anterior chamber contamination rate was demonstrated by Beigi et al, contradictory conclusions were drawn from the similar study by Montan et al.

The risks for developing aminoglycoside retinal toxicity and the danger of developing resistance are particularly disturbing as vancomycin is considered as a reserve drug and should not to be used for preoperative prophylaxis.

**Intracameral Antibiotics at conclusion of Surgery**

Intracameral application of antibiotics (cefazolin, cefuroxime, vancomycin and aminoglycosides) is not licensed by the regulatory authorities and hence this method of use is off-label at the surgeons discretion. A 3 year retrospective study of the use of intracameral cefazolin to prevent endophthalmitis in cataract surgery by Magela Garat et al. showed a statistically significant reduction in the incidence of endophthalmitis (0.421% to 0.031%). Cefazoline was used in this study in view of its safety, effectiveness against gram positive organisms and cost factor. Similar results were published by Pedro Romero et al. in 2006. Montan PG et al. reported a lowered incidence of endophthalmitis from 0.26% to 0.06% when prophylactic intracameral cefuroxime 1 mg was used after cataract surgery. The use of 1 mg cefuroxime in 0.1ml at the conclusion of surgery is an accepted practice in Europe. Cefuroxime is a broad spectrum antibiotic effective against staphylococcal and streptococcal species (except Methicillin resistant staphylococcus aureus, Methicillin resistant staphylococcus epidermidis and enterococcus faecalis), gram-negative bacteria (except Pseudomonas aeruginosa and enterococcus faecalis), and P.acnes. There has been no reports of corneal toxicity. However, severe anaphylactic reaction following intracameral use has been reported and hence its use is contraindicated in patients with allergy to cephalosporins.

In the ESCRS endophthalmitis study results the risk for contracting endophthalmitis following phacoemulsification cataract surgery was significantly reduced (five fold) by an intracameral injection of cefuroxime at the end of the surgery (P = 0.001) for presumed endophthalmitis and P = 0.005 for proven endophthalmitis. The lowest observed incidence rates was in the 4th arm of the study which received both intracameral cefuroxime and perioperative topical levofloxacin. In the ESCRS study despite prophylaxis,
some patients developed postoperative endophthalmitis. Cefuroxime resistance was also noticed in 3 isolates of coagulase negative staphylococcus. On sub-analysis the evidence of benefit of cefuroxime was weaker against Coagulase negative staphylococcus endophthalmitis than against streptococcal endophthalmitis.

Cesar Ramon G Esperiter et al studied the safety of prophylactic intracameral moxifloxacin 0.5 % ophthalmic solution (Vigamox) in patients undergoing cataract surgery. They concluded that intracameral Vigamox 0.5 mg/ml appeared to be nontoxic in terms of visual rehabilitation, anterior chamber reaction, pachymetry and corneal endothelial cell density. This study effectively proved the safety of intracameral moxifloxacin. Further studies are required to test its efficacy in preventing endophthalmitis.

**Subconjunctival Antibiotic Injection**

Prophylaxis has been used over the last 30 years with no definite scientific evidence whether this prophylactic technique had any benefit.

Subconjunctival antibiotic injections may achieve bactericidal aqueous humor levels for short periods postoperatively and thereby decrease the incidence of endophthalmitis. Significant incidence of contamination of corneoscleral incisions and aqueous humor at the end of the surgery has been demonstrated and bactericidal levels of antibiotics can penetrate the aqueous. Higher incidence of macular infarction after cataract surgery has been attributed to seepage of drug through the unstable cataract incision into the posterior segment.

**FLOW CHART ON PROPHYLAXIS GUIDELINES**

There are no formal studies to establish the efficacy of this technique, but there are studies on endophthalmitis including EVS in which the subjects who received subconjunctival injection of antibiotic developed postoperative infection. Jenkins et al.\textsuperscript{112} who investigated the pharmacokinetics of cefuroxime when 125 mg was given by subconjunctival route demonstrated an aqueous concentration of 20 μg/ml which is much lower than the concentration achieved after intracameral injection (3000 μg/ml).

Thus this prophylactic technique, although widely used for the last 30 years has little scientific basis to justify its usage.

Postoperative prophylaxis: In order to minimise the risk of infection until wound healing is secure, the continued use of the preoperatively administered antibiotic is advocated for up to 2 weeks. The frequency of application is every 2 hourly on the day of surgery and on 1st postoperative day followed by four times daily applications.

**Conclusion**

Thus the overall strategy of prophylaxis against post cataract Endophthalmitis is to adopt measures to reduce the patients own bacterial load on the lid, conjunctiva and pericocular tissues, measures to reduce microbial contamination of the anterior chamber and strategies to ensure that bacteriadal concentration of the antibiotic is present in the anterior chamber to tackles the bacterial inoculum. The flow chart given below summarises the essential prophylactic measures to be adopted to ensure zero post cataract Endophthalmitis rate.

**References**


Intraoperative Floppy Iris Syndrome (IFIS)

Dr. Sonia Rani John DNB, Dr. Arup Chakrabarti MS DO, Dr. Valsa Stephen MS DO DNB, Dr. Meena Chakrabarti MS DO DNB

IFIS is a recently identified condition, initially reported by Chang and Campbell, in the year 2005 associated with phacoemulsification in patients using systemic $\alpha_1$ antagonist drugs. It is a relatively common difficulty that can complicate an otherwise routine cataract surgery.

IFIS is characterized by a triad of intraoperative features. (1) A flaccid iris stroma that undulates and billows in response to ordinary intraocular fluid currents, (2) a propensity for the floppy iris stroma to prolapse toward the phaco and side port incisions despite proper wound construction and (3) progressive intraoperative miosis despite standard preoperative pharmacologic measures designed to prevent this (topical cyclopentolate, phenyl ephrine and topical nonsteroidal antiinflammatory drugs).

IFIS can be categorized as (1) Mild (good dilatation, some iris billowing without prolapse or constriction) (2) Moderate (iris billowing without prolapse but with constriction of a moderately dilated pupil and (3) Severe (Classic triad and poor preoperative dilation) (Table 1).

One of the most critical elements of safe cataract surgery is adequate pupillary dilation. Poor dilation leads to compromised visualization of the surgical field which not only impedes the complete removal of the cataractous lens but also significantly increases the risk of complications such as rupture of the posterior capsule. Other complications include iris stromal atrophy secondary to momentary aspiration of iris with phaco tip and capsulorhexis tear. The striking tendency toward progressive intraoperative miosis could be explained by prostaglandin release as a result of excessive mechanical iris stimulation. (eg, iris prolapse or billowing due to irrigation currents). Deficient iris dilator muscle tone also contributes to this tendency. Three characteristics of IFIS increase the risk for operative complications relative to other small pupil cases. These are the marked tendency for iris prolapse, the progressive and unexpected intraoperative miosis and the typical failure of sphincterotomies and mechanical stretching to maintain an adequate pupillary opening. In spite of routine administration of mydriatic agents, IFIS has been described in patients undergoing cataract surgery, with a suggested prevalence of 2%. Although the prevalence is reported to be 2%, the actual number of patients using $\alpha_1$ AR antagonist drugs may be greater and prevalence of IFIS much higher.

Pharmacology

Understanding the role of adrenergic receptors (ARs) in iris biology is important in understanding IFIS. Adrenergic receptors bind the endogenous catecholamines, epinephrine and nor-epinephrine (NE) and are important targets in a wide range of diseases. Originally divided into $\alpha$ AR and $\beta$ AR categories, nine total AR subtypes have been described – $\alpha_{1a}$, $\alpha_{1b}$, $\alpha_{1d}$, $\alpha_{2a}$, $\alpha_{2b}$, $\alpha_{2c}$, $\beta_1$, $\beta_2$ and $\beta_3$. $\alpha_1$ receptors have been
identified in the lower urinary tract as well as in the heart, liver and vascular and ocular smooth muscle. The $\alpha_{1a}$ and $\alpha_{1d}$ subtypes are present in the prostate and detrusor respectively. $\alpha_{1a}$ receptor has been found to specifically mediate pupil dilation. Approximately 70% of $\alpha_1$ receptors in human prostate are the $\alpha_{1a}$ subtype. Thus blockade of $\alpha_{1a}$ AR results in relaxation of prostate smooth muscle as well as iris dilator smooth muscle. Stimulation of presynaptic $\alpha_{2a}$ ARs inhibits release of NE from the nerve terminal, indirectly dampening the sympathetic tone. Nor-epinephrine released from the nerve terminal produces constriction of arterioles in the iris by activating $\alpha_{1b}$ ARs.

**Signaling**

$\alpha_1$ ARs predominately couple to the pertussis toxin insensitive G protein, $G_q$, resulting in hydrolysis of membrane phospholipids; subsequent activation of phospholipase C $\beta$ generates the major second messengers inositol triphosphate and diacylglycerol. Inositol triphosphate binding to its receptor on intra cellular storage sites results in mobilization of calcium ultimately stimulating smooth muscle contraction.

**Role of $\alpha_1$ AR subtypes in BPH/LUTS**

Benign prostatic hyperplasia is a common enlargement of the prostate gland that may lead to bladder outlet obstruction, lower urinary tract symptoms (LUTS) and reduced quality of life. Approximately 50% of men >50 years of age and 90% of men beyond 85 years of age require treatment for LUTS. BPH consists of 2 components: Static (related to absolute size of the prostate gland) and dynamic (related to prostate smooth muscle contraction). $\alpha_{1a}$ AR predominates and mediates contraction in human prostate, urethra and bladder neck. Blockade of $\alpha_{1a}$ ARs results in relaxation of prostate smooth muscle and relief of bladder outflow obstruction. Hence $\alpha_1$ AR blockade is capable of modifying the dynamic component of BPH.

### $\alpha_1$ AR antagonist drugs

Four $\alpha_1$ AR antagonists are currently available in the United States 3. Tamsulosin ($\alpha_{1a}$ and $\alpha_{1d}$ AR subtype selective) (Flomax), and three non subtype selective $\alpha_1$ AR antagonists. Alfuzosin (Uroxatral), Doxazosin (Cardura) and Terazosin (Hytrin). They block $\alpha_{1b}$ ARs also. In treating lower urinary tract symptoms, $\alpha_{1a}$ and $\alpha_{1d}$ receptors are targeted because these receptors are prevalent in bladder neck smooth muscle. IFIS is associated with all these $\alpha_1$ AR antagonists, although it is much more common with tamsulosin which is highly specific for the $\alpha_{1a}$ receptor. The subtype $\alpha_{1b}$ is vasoconstrictive; thus nonspecific $\alpha_1$ antagonists such as prazosin and doxazosin may produce clinically significant hypotension in some patients. The $\alpha_{1a}$ and $\alpha_{1d}$ subtypes, present in prostate and detrusor are selectively antagonized by tamsulosin which was

<table>
<thead>
<tr>
<th>$\alpha_1$ AR Antagonist</th>
<th>$\alpha_1$ AR Subtype Binding</th>
<th>Decreases Incr BP?</th>
<th>Usual Dose (mg)</th>
<th>Regimen (doses/day)</th>
<th>Half-life (hours)</th>
<th>Side-Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terazosin (Hytrin)</td>
<td>$\alpha_{1a} = \alpha_{1b} = \alpha_{1d}$</td>
<td>Y</td>
<td>1-10</td>
<td>1</td>
<td>12</td>
<td>Asthenia, dizziness, somnolence, hypotension, nasal congestion/rhinitis, impotence</td>
</tr>
<tr>
<td>Doxazosin</td>
<td>$\alpha_{1a} = \alpha_{1b} = \alpha_{1d}$</td>
<td>Y</td>
<td>1-8</td>
<td>1</td>
<td>22</td>
<td>Dizziness, fatigue, edema, dyspnoea, hypotension</td>
</tr>
<tr>
<td>Alfuzosin (Uroxatral)</td>
<td>$\alpha_{1a} = \alpha_{1b} = \alpha_{1d}$</td>
<td>(Y)</td>
<td>7.5 - 10</td>
<td>1-3</td>
<td>10</td>
<td>Dizziness, headache, nausea, dry mouth, diarrhea, hypotension</td>
</tr>
<tr>
<td>Tamsulosin (Flomax)</td>
<td>$\alpha_{1a}$=prostate and UB $&gt;\alpha_{1b}$</td>
<td>N</td>
<td>0.4</td>
<td>1</td>
<td>14-15</td>
<td>Abnormal ejaculation, dizziness, infection, headache, flu-like symptoms</td>
</tr>
</tbody>
</table>

---

Table 1. Summary of Characteristics of $\alpha_1$AR Antagonists used to treat BPH/LUTS (Pharmacologic, Functional, Clinical Selectivity, and Convenience)
developed to overcome possible hypotensive side effects seen with nonspecific α1 antagonists. Contraction of iris dilator muscle is mediated via α1a receptors which explains why tamsulosin in particular is associated with IFIS. Summary of the characteristics of α1 AR antagonists used to treat BPH/LUTS is given in table 1. All the four currently available drugs are competitive antagonists, therefore, their binding and clinical effects can be competed off by administering agonists such as nor epinephrine, epinephrine and phenyl ephrine.

Alpha agonist drugs are used to decrease intraocular pressure in patients with glaucoma by increasing conventional and uveoscleral outflow. These topical drugs include dipivefrine (Propine), a prodrug as well as α2 agonists such as apraclonidine and brimonidine. They do not have significant effect on the iris. However the direct acting α1 AR selective agonist, phenyl ephrine is capable of constricting iris dilator smooth muscle and therefore mediates mydriasis.

**Conditions which Predispose to IFIS**

Drugs which cause iris dilator relaxation like α1 AR antagonists, Endothelin A antagonists, angiotension antagonists and nitric oxide donors (nitrates) can predispose to IFIS if not discontinued. Systemic diseases associated with endothelial dysregulation like congestive cardiac failure, diabetes and hypertension also predispose to IFIS.

**Management and Prevention of IFIS**

Pre operative recognition of patients at risk for IFIS is the key to reducing cataract surgery complications in these patients. It is most commonly linked to the use of tamsulosin which is the most common and effective drug prescribed for lower urinary tract symptoms in elderly males. Rather than being a rare, unexpected, unpredictable syndrome, due to one drug, possible IFIS predisposition should be able to be predicted via a careful medical history designed to elicit whether the patient has concurrent diseases known to be associated with endothelial dysfunction e.g, congestive cardiac failure, diabetes, hypertension or drugs that mediate expected iris dilator smooth muscle relaxation e.g, α1 AR antagonists, Endothelin A antagonists, angiotensin antagonists and nitric oxide donors such as nitrates.

Prudent preoperative discontinuation of α1 antagonist drugs in collaboration with the urologists definitely lessens the likelihood of IFIS, although it does not prevent it entirely. Half lives of the four α1 AR antagonist drugs are similar, ranging from 10 to 22 hours. Chronic use of these drugs lead to disuse atrophy of the dilator smooth muscle. Recent recommendations by urologists are to not change prescribing practices, encourage patients to inform their ophthalmologists that they are taking the drug and stop using it one week before surgery, to minimize its effects.

**Intracameral injection of phenyl ephrine:**

Phenyl ephrine hydrochloride, a direct acting sympathomimetic, acts predominantly on the α1 AR of the iris. It acts directly on the α1 receptors and provides maximum stimulation that causes the pupil to dilate or at least increases the tone of the dilator muscle and prevents iris billowing. Intracameral phenyl ephrine is prepared using 0.25 ml of unpreserved phenyl ephrine 2.5 % diluted with 2ml of BSS in a 2ml syringe. The pH of intracameral phenyl ephrine is 6.4. When used during surgery, atleast 30 seconds should be allowed to ensure maximum effect before the agent is washed out.

Preoperative use of atropine 1% when used twice daily for 10 days effectively decreases the incidence of IFIS. The pre operative use of atropine appears to be as effective as intracameral phenyl ephrine without the increased risk for toxic anterior segment syndrome that any intracameral drug possesses. However this strategy alone is often ineffective for moderate to severe IFIS. Combined preoperative topical atropine sulfate 1 % and intracameral non preserved epinephrine hydrochloride 1:2500 has also been studied and found to bring down significantly the incidence of IFIS. Atropine sulfate, as the strongest available pupiloplegic agent, helps dilate the pupil. Super stimulation of the dilator by intracameral epinephrine combined with atropine pupiloplegia provides powerful synergism. It is also important that patients suffering from benign prostatic hyperplasia do not stop using an α1a blocker, especially when preoperative atropine is used, as acute urinary retention may ensue.

In tamsulosin patients, particular attention should be paid to proper incision construction and to avoiding excessive hydrodissection. A viscoadaptive agent such
as sodium hyaluronate 2.3 % (Healon 5) when properly positioned over the iris, may mechanically expand the pupil and block the iris from prolapsing to the incisions (due to its maximally cohesive properties). Iris prolapse can be caused by poor incision construction or by excessive injection of Ophthalmic Viscosurgical Devices (OVDS) or hydrodissection fluid. Other conditions such as diabetes can be associated with progressive intraoperative miosis 3. However IFIS is distinguishable by the characteristic bellowing of iris stroma that accompanies the iris prolapse and pupil constriction.

Two additional characteristics often accompany IFIS-poor preoperative pupil dilation and elasticity of the pupil margin. Partial thickness sphincterotomies and mechanical stretching of the pupil which creates microscopic sphincter tears is usually ineffective in IFIS because the iris pupil margin remains elastic 8. Unlike with non elastic miotic pupils, IFIS pupil immediately snaps back to its original size following attempts at stretching it. Because mechanical pupil restraining devices are difficult to safely insert after the capsulorhexis is completed, the ability to anticipate and recognize IFIS is important for strategizing small pupil management. Iris hooks or iris expansion rings should be employed prior to capsulorhexis.

Disposable pupil expansion rings are costly but 100 % effective 8. Both the Morcher 5S Pupil Ring and the Milvella Perfect Pupil are grooved PMMA rings that are threaded alongside the pupillary margin using metal injectors. A disposable plastic injector is used to insert Vision’s Graether Silicone Eagle pupil expansion ring. All these rings are difficult to position if the pupil is less than 4 mm wide or if the anterior chamber is shallow 3.

Iris retractors are another 100 % reliable strategy for pupil expansion with IFIS 8. One mm limbal paracenteses are made in each quadrant, including a separate stab incision made just posterior to the temporal clear corneal incision. Placement of hooks in this diamond configuration has several significant advantages. The sub incisional hook retracts the iris downward and out of the path of the phaco tip. This maximizes exposure in front of the phaco tip while the nasal hook facilitates chopper placement.

Bimanual microincisional phacoemulsification may represent a useful strategy in IFIS patients. A maximally water tight seal minimizes the strong tendency for the iris to prolapse to the phaco or side port incision 8. This is the case with bimanual microincisional phaco instrumentation around which the incisions are deliberately sized for a maximally tight fluidic seal. A separate front irrigating chopper also provides a better opportunity to keep irrigation flow circulating anterior to the iris, which can minimize the billowing. Irrigation/aspiration should be accomplished with lower flow and vacuum setting.

Ophthalmic viscosurgical devices (OVD) can be designed and used to construct any physical environment in the anterior chamber that may be desired, simplifying and facilitating the surgery 6. The best known and most frequently used of these techniques are the Soft Shell Technique (SST) and the Ultimate Soft Shell Technique (USST), described by Steve Arshinoff 7. After the side port incision and the primary clear corneal phaco incision are fashioned, the anterior chamber is filled through the phaco incision with sodium hyaluronate 3 %-chondroitin sulfate 4 % (Viscoat) until the anterior chamber is 75 % to 81 % full. Healon 5 (Sodium hyaluronate 2.3 %) is then injected into the surface of the anterior capsule, in the centre of the anterior chamber and pushes the viscoat upward and outward until the pupil stops dilating. It is important that the boundary of the Healon 5 Viscoat be at the pupil margin. This will later serve as a fracture boundary and will help to keep the iris stable and the pupil dilated throughout the surgery. At this point the anterior chamber should be over 90 % full of OVD. Balanced salt solution (BSS) or nonpreserved lidocaine (enhances dilation of pupil) is then injected slowly under the Healon 5 layer on the surface of the lens capsule. This elevates the OVD soft shell off the lens surface and creates a water pocket on the lenticular surface, confined to the lenticular surface and not spilling over the iris surface. A routine capsulorhexis is then performed keeping the diameter of the rhexis smaller than the pupillary diameter. This will later act to confine fluid flow into an area smaller than the pupil, preventing turbulence from impacting the iris and the Viscoat layer, which would permit the pupil to constrict.

During hydrodissection, the BSS should be able to circulate around the lens and flow out of the eye, beneath the OVD shell, without disturbing the shell.
Table 1. IFIS GRADING

<table>
<thead>
<tr>
<th></th>
<th>Iris billowing</th>
<th>Pupillary dilation</th>
<th>Iris Prolapse</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild</td>
<td>+</td>
<td>Good</td>
<td>–</td>
</tr>
<tr>
<td>Moderate</td>
<td>+</td>
<td>Constriction</td>
<td>–</td>
</tr>
<tr>
<td>Severe</td>
<td>+</td>
<td>Poor</td>
<td>+</td>
</tr>
</tbody>
</table>

Table 2. MANAGEMENT

A. PROPHYLACTIC
- Preoperative Recognition and Prediction
- Careful Medical History
  - Systemic Diseases
  - Drugs
- Stopping Drugs Preoperatively (1Week)
  In Collaboration With Urologist

B. PHARMACOLOGIC
- Preop Atropine (1% Tid x 2 Days)
  - Maximise Cycloplegia
  - No Risk of TASS
- Intracameral Phenyl Ephrine / Adrenaline
  - Competitive Antagonist
  - Direct Action on α1 Receptors
  - Prepn - .25 ml Unpreserved
    Phe.eph 2.5% + 2 ml BSS (30 Sec)
- Combined Preop Atropine + Intracameral Phenyl ephrine

C. THERAPEUTIC
- Proper Incision Construction
- Gentle and Slow Hydrodissection
- Ophthalmic Visco Surgical Devices
  - Healon 5 - Ideal Viscomydriasis
  - Blocks Prolapse
- Low I/A Flow Parameters
- Bimanual MICS- Tighter Incision

D. MECHANICAL DILATATION
- Pupil Stretching - Not effective
  - Elastic Pupil
- Pupil Expansion Rings
- Iris Retractors

Phaco emulsification is performed keeping the phaco tip at or below the capsulorhexis and confining fluid flow into the capsular bag.

Because of the rigid inferior surface of the OVD soft shell, formed by Healon 5 and the tamponade of the iris, achieved by the Viscoat, iris is seen to be completely stable throughout the procedure. Irrigation / aspiration should be accomplished with lower flow and vacuum settings.

The main advantage of this OVD technique is that it can be instituted safely and effectively at any time during surgery, unlike mechanical pupil dilators. The peripheral OVD ring is made with Viscoat because it is the best lower viscosity dispersive OVD available which tends to make it highly retentive despite the presence of moderate fluid turbulence. The viscoadaptive central layer of Healon 5 adds rigidity to the OVD structure to keep the iris from moving and keeping Viscoat in place. The BSS layer provides working space while the phaco is being done. It is important to have a viscoadaptive central layer above the BSS layer to avoid excessive mixing that would occur with Viscoat use alone (Table 2).

In conclusion, progressive intraoperative miosis, significantly increases the risk for complications in cataract surgery. Common pupil stretching techniques are usually ineffective in these eyes and the use of iris hooks or expansion rings before initiating the capsulorhexis may be preferable. Therefore, knowledge, anticipation and recognition of this syndrome may lead to a lower incidence of surgical complications in these patients.

References
OCT Assessment of the Vitreoretinal Relationship in CSME

Dr. Manoj S. DNB FRCS, Dr. Unnikrishnan Nair MS DO FRCS, Dr. Gargi Sathish MS

Introduction

Macular oedema is a main cause of visual loss in patients with nonproliferative diabetic retinopathy (NPDR). It also commonly contributes to the visual loss in proliferative diabetic retinopathy (PDR). Diabetic macular oedema is mainly due to the breakdown of the inner blood retinal barrier. However, its pathogenesis is not clearly understood and several investigators have suggested that the vitreous might be involved in triggering macular oedema in diabetic retinopathy. In diabetic patients, histological and biochemical changes such as nonenzymatic glycation, cause an early aging of the vitreous. The role of the vitreo-macular junction in the development of CSME is still controversial although many clinical studies concluded that it probably had a causative effect. Consequently, vitrectomy has been proposed for management of CSME especially in cases with thickened, taut posterior hyaloid and vitreofoveal traction. Some studies have also suggested that vitrectomy may be beneficial for eyes with CSME even with normal looking posterior hyaloid and no posterior vitreous detachment.

Optical Coherence Tomography (OCT) is a relatively new diagnostic technique that enables a high resolution, cross sectional image of the retina to be obtained. It has become an important tool in the diagnosis of macular disorders. OCT has made it possible to better understand the vitreoretinal relationship at the macula.

It is however not established if there is a difference in the pathogenesis of diabetic macular edema in NPDR and PDR. Though logically the pathogenetic mechanisms (microaneurysm leakage, capillary segment leakage) may be the same, the role of vitreo-macular interface changes in these group of eyes may be different. It is a known observation that patients with high risk PDR have a higher incidence of incomplete PVD than patients with NPDR and that incomplete PVD is the cause for vitreous hemorrhage and tractional retinal detachment in PDR. Thus it is hypothetical that the occurrence of overt vitreomacular traction or subtle incomplete vitreomacular vitreous separation is more common in PDR than NPDR. This study aims to verify this hypothesis.

Aim

To assess the vitreo retinal relationship in patients with CSME and study the differences in this relationship in patients with PDR and NPDR.

Materials and Methods

This was a retrospective analytical study of patients who attended the retina clinic of Chaithanya Eye Hospital between July 2006 and December 2006. 100 eyes of 70 patients with CSME were evaluated. The study group included both insulin dependent and non insulin dependent PDR and NPDR patients between the age of 40 and 80 years. Few patients had associated systemic diseases like hypertension, nephropathy and...
hypercholestremia and were on medications. The duration of diabetes ranged from 7 years to 33 years. None of the patients in our study had undergone previous focal laser or panretinal photocoagulation. Such patients were excluded as these could interfere with anatomic changes at the macula and additional changes may not be solely due to disease manifestation. Patients with CSME and cataract and uncooperative patients in whom a clear OCT image was not recordable were also excluded from the study. In such patients study of the vitreous may be incomplete, with possibility of missing subtle vitreo-retinal interface changes. A clear OCT image was defined as a standard 5 mm line scan passing through the foveal region and having a good signal strength ( 5 and above).

All patients underwent the following tests- Visual acuity estimation by Snellens visual acuity chart, dilated slit lamp- 90D examination, fundus fluorescein angiography and optical coherence tomography (Zeiss, Stratus-4 OCT) by the same examiner. We considered macular edema to be clinically significant as defined by the Early Treatment Diabetic Retinopathy Study (ETDRS) protocol – that is, if there was retinal thickening or hard exudates associated with adjacent retinal thickening observed within 500 ± 50 microns of the centre of foveal avascular zone or a zone or zones of retinal thickening 1 disc area or larger, any part of which was within 1 disc diameter of the center of the macula. Fundus fluorescein angiography was done to classify the disease, to diagnose early PDR, to diagnose cystoid macular oedema and to rule out macular ischemia as per the routine protocol followed by the hospital. Optical coherence tomography was done in all eyes using the standard 5 mm scan protocol. The line scan programme was chosen and multiple line scans through the fovea was done and the images processed and analyzed. Horizontal line scans through the fovea and 2 steps above and below the central foveal region were studied. The vitreoretinal relation at the macula was assessed and graded as

1. No PVD at the macula (Fig: 1)
2. Incomplete PVD without traction (Fig: 2)
3. Incomplete PVD with vitreomacular traction (Fig: 3)
4. Incomplete PVD with vitreofoveal traction (Fig: 4)
5. Complete PVD at the macula

Presence or absence of vitreous separation from the disc was not analysed in this study.

Results

Of the total 70 patients, there were 17 patients in 40 to 49 years age group (24 %), 29 in 50 to 59 years
age group (42 %), 21 in 60 to 69 age group (30 %), 3 in 70 to 79 age group (4 %) and none above 80 years (Fig. 1). This included patients with both type 1 and type 2 diabetes. Males predominated in the study with 67 % (Fig 2). The male: female ratio was 2:1. Of the 70 patients, 45 had NPDR (64 %) and 25 had PDR (36 %).

Optical coherence tomographic evaluation of the vitreoretinal interface showed that of the 100 eyes with CSME, the majority (78 %) had no posterior vitreous detachment at the macula (grade 1) (Table 2). The posterior hyaloid could not be visualized in these cases as the vitreous was completely attached to the retina. In cases of incomplete Posterior vitreous detachment, the posterior hyaloid was visualised as a linear hyperreflective signal upon the retina separated from it by a clear space. 22 % of the study eyes had an incomplete posterior vitreous detachment. Incomplete Posterior vitreous detachment (IPVD) included three types - incomplete posterior vitreous detachment with only attachment at the macula but no traction (grade 2), incomplete posterior vitreous detachment with vitreomacular traction- VMT grade 3, incomplete posterior vitreous detachment with vitreofoveal traction- VFT grade 4. 12 % of the eyes had an incomplete posterior vitreous detachment with attachment at the macula but no traction. Vitreofoveal traction and vitreomacular traction respectively were seen as hyperreflective band in the vitreous, which was adherent to the fovea centrally or paracentrally, causing traction and pulling up the fovea or macula. Out of the 100 eyes, 6 % had vitreofoveal traction (VFT) and 4 % had vitreomacular traction in this study.

Table 2. Vitreo-retinal interface changes- Type of PVD

<table>
<thead>
<tr>
<th>TYPE OF PVD</th>
<th>NPDR</th>
<th>PDR</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO PVD</td>
<td>56</td>
<td>22</td>
<td>78</td>
</tr>
<tr>
<td>Incomplete PVD</td>
<td>10</td>
<td>12</td>
<td>22</td>
</tr>
<tr>
<td>TOTAL</td>
<td>66</td>
<td>34</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 3. Vitreo-retinal interface changes- Type of IPVD

<table>
<thead>
<tr>
<th>TYPE OF IPVD</th>
<th>NPDR</th>
<th>PDR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade 2 IPVD</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Grade 3 IPVD</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Grade 4 IPVD</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>TOTAL</td>
<td>10</td>
<td>12</td>
</tr>
<tr>
<td>% of total eyes</td>
<td>15.2%</td>
<td>35.3%</td>
</tr>
</tbody>
</table>

Out of the 66 eyes with NPDR and CSME, 56 eyes (84.9 %) had no PVD. Among the 34 eyes with PDR and CSME, 22 eyes (64.7 %) had no posterior vitreous detachment (Table 2). Only 10 eyes with NPDR (15.2 %) had incomplete posterior vitreous detachment as compared to 12 eyes with PDR (35.3 %) – Table 3 and this difference was statistically significant (p value-0.04) Thus PDR with CSME eyes had a higher incidence of incomplete posterior vitreous detachment at macula than the eyes with NPDR and CSME.

On analyzing patients with incomplete posterior vitreous detachment at the macula, 4 eyes with PDR and CSME (11.8 %) had grade 4 IPVD (VFT), 2 eyes (5.9 %) had grade 3 IPVD (VMT) and 6 eyes (17.6 %) had grade 2 IPVD (incomplete PVD with no traction). Of the NPDR with CSME eyes 2 eyes (3 %) had grade 4 IPVD (VFT), 2 eyes (3 %) had grade 3 IPVD (VMT) and 6 eyes (9.1 %) had grade 2 IPVD (incomplete posterior vitreous detachment with no traction). None of the patients had a complete separation of the vitreous from the macular region (grade 5 IPVD) in either group of patients.
The mean visual acuity in the PDR with CSME group was 0.82 log units and 0.52 log units in the NPDR with CSME group. Patients with some form of macular traction namely those with grade 3 vitreomacular traction and grade 4 vitreofoveal traction incomplete Posterior vitreous detachment had poorer vision than the other grades of IPVD in both NPDR (1.15 log units) and PDR (1.37 log units). Even in the other groups namely- grade 1, grade 2 eyes many patients had poor vision due to the presence of other morphological changes at the macula like cystoid macular edema subfoveal detachment, epiretinal membrane, presence of hard exudates on the fovea etc.

Discussion

The advent of OCT has revolutionized our understanding and management of diabetic macular edema. One of the many advantages of OCT is the ability to study the vitreoretinal interface changes that occur in retinal diseases. As newer concepts in the understanding of CSME are evolving, one very relevant mechanism is the presence of vitreomacular traction in diabetic macular edema. Johnson et al\(^1\) had reported that some eyes with macular edema have subtle, localized perifoveal vitreous detachment which may cause anterior traction on the foveola, resulting in multicystoid foveal thickening without macular hole formation or capillary leakage. Thomas et al\(^2\) had reported that patients with macular edema who have a taut thickened posterior hyaloid and partial vitreomacular separation have been associated with subretinal fluid and subfoveal detachment. Yamada et al\(^3\) had reported that patients with vitreomacular traction had associated subfoveal detachment and those with incomplete Posterior vitreous detachment temporal to fovea had an associated CME. Ghazi et al\(^4\) had reported that there was a higher prevalence of vitreoretinal interface changes in patients who have undergone laser for diabetic macular edema and had persistent CSME but the number of laser sessions were not associated with an increased prevalence. Various studies have also demonstrated the usefulness of vitrectomy in such situations again confirming the role of this factor in the pathogenesis of diabetic macular edema. Also instances of spontaneous separation of the incomplete Posterior vitreous detachment have been reported. Collet et al\(^5\) had reported that spontaneous resolution of vitreomacular traction associated with diabetic macular edema, facilitated by PRP, resulted in concurrent reduction of macular thickness and visual improvement. These observations confirm the role of vitreomacular traction in the pathogenesis of macular edema.

Though various studies have reported the prevalence of incomplete posterior vitreous detachment or vitreomacular traction in CSME, no study have been done to analyse if there is a difference in vitreoretinal interface in NPDR and PDR patients. To our knowledge this is the first study which endeavors to study this aspect.

In our study 78 % of the eyes with CSME had no posterior vitreous detachment at the macula, 22 % had an incomplete posterior vitreous detachment and none with complete posterior vitreous detachment. This is comparable to a study by Gaucher et al\(^6\) who had reported that perifoveolar posterior vitreous detachment with foveolar attachment was significantly higher in eyes with diabetic macular edema than those without. In his series 69 % of eyes had no posterior vitreous detachment and 22 % had perifoveolar posterior vitreous detachment with foveolar attachment. However contrary to our study 8 % had complete posterior vitreous detachment at the macula. Thomas et al\(^2\) had also reported that 4 % of his series had taut thickened posterior hyaloid and 10 % had partial vitreomacular separation and these features have been associated with subretinal fluid. These studies however did not study the incidence of these features in different types of DR as is done in our study.

85 % of eyes with NPDR and CSME had no posterior vitreous detachment compared to 65% of eyes with PDR and CSME. 35 % eyes with PDR had incomplete posterior vitreous detachment as compared to 15 % eyes with NPDR. PDR with CSME eyes had a higher incidence of incomplete Posterior vitreous detachment at macula than the eyes with NPDR and CSME. 18 % of PDR had macular traction in the form of either vitreofoveal traction or vitreomacular traction compared to 6 % in NPDR group. Macular traction is thus higher in PDR than NPDR. The importance of the latter group is that this is a potential group of patients who respond poorly to the conventional treatment for macular edema.
namely laser. Many of the newer modalities of medical treatment of macular edema will also fail in these eyes if not worsen. This is a group which responds best to surgical treatment. Yamada et al\(^3\) had reported that patients with vitreomacular traction had a better surgical prognosis than those with incomplete posterior vitreous detachment temporal to fovea who have poor surgical outcome often leading to macular hole and atrophy. Do DV et al\(^7\) had reported that OCT examination was an essential preoperative tool in the detection of ERM and vitreomacular traction when planning vitreoretinal surgery for macular edema.

The mean visual acuity in the PDR group (0.82 log units) was worse than the NPDR (0.52 log units) group. Patients with macular traction namely those with vitreomacular traction and vitreofoveal traction had poorer vision than those without traction and this was more pronounced in the PDR (1.37 log units) than in NPDR group (1.15 log units). Many studies have shown that the presence of vitreomacular traction or vitreofoveal is associated with poor vision. Eyes with vitreomacular traction or vitreofoveal traction also have increased central foveal thickness. The DRCR network had concluded that there was a positive correlation between central foveal thickness and vision. Patients with increased central foveal thickness associated with vitreomacular traction have been demonstrated to have poor vision.

**Conclusion**

OCT is an excellent noninvasive tool in the study of the vitreo-retinal interface changes. Twice the number of eyes in the PDR group had incomplete posterior vitreous detachment when compared to NPDR group. Macular traction in the form of vitreomacular traction/vitreofoveal traction was seen in three times the number of eyes in the PDR group than NPDR eyes. These observations suggest that eyes with PDR may have an additional factor involved in the pathology of CSME namely the occurrence of posterior vitreous detachment and vitreous separation from the macula with or without macular traction. These observations are more relevant today in this era where newer treatment of macular edema are available. Such groups of patients may not be ideal candidates for conventional laser treatment and may benefit from vitrectomy. However a large controlled trial is needed to answer this question.

**References**

Comparability and Influence of Central Corneal Thickness (CCT) on Measurements of Intraocular Pressure (IOP) by Goldmann Applanation Tonometry (GAT) and Non Contact Tonometry (NCT) in Different IOP Ranges

Dr. Meena Nair*, Dr. K.G.R Nair*, Dr. Sudhir Tambile*, Dr. Soumya Nambiar*

Abstract

Aim : To compare IOP measurements using GAT and NCT in different IOP ranges (<10, ≥10-25 mm Hg and > 25 mm Hg) and evaluate the effect of CCT on IOP measurements by these techniques.

Materials and Methods: IOP was measured by NCT followed by GAT in 188 eyes of 100 glaucoma patients attending glaucoma clinic at Chaithanya Eye Hospital, Trivandrum by a single observer. Mean of three consecutive readings were taken for analysis by both techniques. IOP values were compared in the three IOP ranges (<10, 10-25, >25 mm Hg) between the two techniques. Statistical analysis was done to know whether the two methods were interchangeable across the three IOP ranges.

Results: Though good agreement was seen between GAT and NCT, the latter showed a tendency to overestimate IOP in the lower IOP range and underestimate in the normal and high IOP range. Mean values of GAT and NCT showed a statistically significant difference in the normal IOP range (10-25 mm Hg, significance level <0.08). However in the lower and higher ranges, the difference did not reach the level of statistical significance. NCT is more influenced by CCT. To conclude, though NCT has good accuracy and predictability to be used as a screening tool, it is not suitable for situations where accurate assessment of IOP has paramount importance as in glaucoma clinics.

Introduction

Glaucoma is a ‘pressure – sensitive’ optic neuropathy. Intraocular pressure is the only risk factor that can be manipulated to alter the course of the disease. Direct manometric measurements of IOP is possible but not practical and hence we have to rely on indirect measurements which is bound to be fraught with errors. As our ability to measure IOP becomes more accurate, a much tighter dose – response relationship between glaucoma damage and IOP will be found.
GAT has been regarded for almost a half century as the "gold standard" of IOP measurement. Non contact tonometers are gaining popularity as they eliminate the risk of slow virus disease transmission, do not need corneal anaesthesia and are free from operator bias. Pachymetry (CCT) is thought to represent an independent glaucoma risk factor and has become a part of routine glaucoma evaluation today. We now know that CCT varies greatly among the general population to a degree that impacts the accuracy of GAT in daily practice. The technique of measurement and CCT predominantly influence IOP measurements.

Aim

We conducted this study to compare IOP measurement using GAT and NCT in different IOP ranges (< 10, 10-25 and > 25 mm Hg) and evaluated the effect of CCT on IOP measurements by these techniques.

Materials and Methods

This was a prospective study done on 100 patients (188 eyes) who attended the glaucoma clinic of Chaithanya Eye Hospital, Trivandrum during the period April – June 2007.

Inclusion criteria

Glaucoma patients (irrespective of the type of glaucoma) attending glaucoma clinic at Chaithanya Eye Hospital, Trivandrum (included both treated and untreated patients)

Exclusion criteria

High corneal astigmatism (> 3 Dioptrre cylinder), corneal scarring, corneal surgery including LASIK, microphthalmos, buphthalmos, keratoconus, blepharospasm and corneal or conjunctival infection.

All patients underwent routine refraction, slit lamp examination for anterior segment and fundus evaluation followed by IOP estimation. IOP was measured first by NCT (Keeler Pulsair 3000) followed 15 minutes later by instillation of topical anaesthetic (1 drop of 0.5% proparacaine) and GAT reading was taken by the same ophthalmologist. A mean of three readings was used for analysis in both GAT and NCT techniques. Both instruments were well calibrated at the beginning of each session. This was followed by CCT measurement (TOMEY SP 3000 ultrasonic pachymeter) after 1 hour. A mean of ten readings was noted for each study eye.

Statistical analysis was performed using SPSS software version 15.0 (SPSS for windows, SPSS Inc. Chicago. IL). As a first step, data of GAT and NCT was explored and categorized into the three study IOP ranges of < 10 mm Hg, 10-25 mm Hg and > 25 mm Hg. Then cross tabulation was done to compare the two techniques (NCT and GAT) so as to analyse the percentage of cases under-estimated and over estimated by the two methods. Likelihood Ratio Chi Square Test ($\chi^2$) was used to find the association between the two measures. The mean difference between GAT and NCT was examined using Wilcoxon Signed Rank Test (a non parametric test) across the three IOP ranges to assess the statistical significance of the mean difference between the two methods of measurement. Significance level < 0.10 was considered significant.

Correlation between CCT and NCT/GAT was assessed using Karl Pearson product moment correlation co-efficient. The influence of CCT on NCT or GAT was examined using regression analysis. Thereby the influence of change in CCT on IOP was evaluated. A 'P' value of <0.05 was considered significant.

Results

The study comprised 188 eyes (100 patients – i.e., 12 eyes were excluded). The highest IOP recorded was 53 mm Hg and the lowest IOP recorded was 7 mm Hg.

For analysis, three groups in the IOP ranges of < 10 mm Hg. (n = 30), = 10-25 mm Hg (n=139) and > 25 mm Hg (n = 19) were considered.

Mean CCT of our study group was 526.05 μm (highest recorded CCT in our study was 614 μm and lowest recorded CCT was 435 μm)

Cross tabulation of NCT and GAT data

NCT values have been compared against GAT values taken as baseline which show that in the IOP range < 10 mm Hg, NCT corresponds to GAT in 73.3 % cases
Table 1. GAT_Coded * NCT_Coded Crosstabulation

<table>
<thead>
<tr>
<th>GAT_Coded</th>
<th>Less than 10</th>
<th>10 to 25</th>
<th>Greater than 25</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 10</td>
<td>22</td>
<td>8</td>
<td>0</td>
<td>30</td>
</tr>
<tr>
<td>% within GAT_Coded</td>
<td>73.3%</td>
<td>26.7%</td>
<td>.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>10 to 25</td>
<td>14</td>
<td>123</td>
<td>2</td>
<td>139</td>
</tr>
<tr>
<td>% within GAT_Coded</td>
<td>10.1%</td>
<td>88.5%</td>
<td>1.4%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Greater than 25</td>
<td>0</td>
<td>1</td>
<td>18</td>
<td>19</td>
</tr>
<tr>
<td>% within GAT_Coded</td>
<td>.0%</td>
<td>5.3%</td>
<td>94.7%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Total</td>
<td>36</td>
<td>132</td>
<td>20</td>
<td>188</td>
</tr>
<tr>
<td>% within GAT_Coded</td>
<td>19.1%</td>
<td>70.2%</td>
<td>10.6%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

Table 2. Chi-Square Tests

<table>
<thead>
<tr>
<th></th>
<th>Value</th>
<th>df</th>
<th>Asymp. Sig. (2-sided)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Chi-Square</td>
<td>222.311(a)</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Likelihood Ratio</td>
<td>148.049</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>N of Valid Cases</td>
<td>188</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3. Wilcoxon Signed Ranks Test

<table>
<thead>
<tr>
<th>Ranks</th>
<th>N</th>
<th>Mean Rank</th>
<th>Sum of Ranks</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCT DATA - GAT DATA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative Ranks</td>
<td>91(a)</td>
<td>88.3</td>
<td>8035.5</td>
</tr>
<tr>
<td>Positive Ranks</td>
<td>79(b)</td>
<td>82.27</td>
<td>6499.5</td>
</tr>
<tr>
<td>Ties</td>
<td>18(c)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>188</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Test Statistics (b)

<table>
<thead>
<tr>
<th>NCT DATA - GAT DATA</th>
<th>Z</th>
<th>Asymp. Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-1.209(a)</td>
<td>0.227</td>
</tr>
</tbody>
</table>

Wilcoxon Signed Rank Test

- <10 mm Hg
  - Though NCT over-estimates in 26.7% patients, significance level is 0.127 which shows that there is no statistical significant difference between the mean values. (see Table 4)

- ≥ 10-25 mm Hg
  - NCT underestimates in 10.1% and overestimates in 1.4% but Wilcoxon test shows a statistically significant difference between the mean values of GAT and NCT at 0.080 significance level. (see Table 5)

- > 25 mm Hg
  - NCT underestimates in 5.3% but significance level is 0.587 there is no statistically significant difference in the mean values. (see Table 5)
difference between the mean values of GAT and NCT. (refer Table -3)
Regression Analysis was done to assess the effect of pachymetry on GAT and NCT. Results showed that CCT has a statistically significant influence on GAT and NCT. The regression coefficient in the model with GAT as a dependant variable shows that a 10 microns change in CCT results in 0.67 mm Hg change in GAT a 0.75 mm Hg change in NCT. Hence NCT is affected more by the change in pachymetry (see tables 7, 8 and 9)

**Discussion**

A clinician should be aware of the variability between different instruments to predict the accuracy of IOP recorded during the follow up of a glaucoma patient. NCT being automatic, the inter observer variability is expected to be low while in GAT measurements due to various parameters being involved, the inter observer variability is expected to be high. Several studies have been done earlier in this regard but our endeavour in this study is to know whether GAT and NCT could be interchangeable in various IOP ranges.

Most studies with NCT showed that it overestimates at low pressures and underestimates at high pressures.

**Table 4. GAT Coded = Less than 10**

<table>
<thead>
<tr>
<th>Ranks(d)</th>
<th>N</th>
<th>Mean Rank</th>
<th>Sum of Ranks</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCT DATA - GAT DATA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative Ranks</td>
<td>11(a)</td>
<td>13.5</td>
<td>148.5</td>
</tr>
<tr>
<td>Positive Ranks</td>
<td>18(b)</td>
<td>15.92</td>
<td>286.5</td>
</tr>
<tr>
<td>Ties</td>
<td>1(c)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>30</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Test Statistics(b,c)**

<table>
<thead>
<tr>
<th>NCT DATA - GAT DATA</th>
<th>Z</th>
<th>Asymp. Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-1.527(a)</td>
<td>.127 – not significant</td>
</tr>
</tbody>
</table>

a Based on negative ranks. b Wilcoxon Signed Ranks Test. c GAT_Coded = Less than 10

**Table 5. GAT_Coded = 10 to 25**

<table>
<thead>
<tr>
<th>Ranks(d)</th>
<th>N</th>
<th>Mean Rank</th>
<th>Sum of Ranks</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCT DATA - GAT DATA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative Ranks</td>
<td>69(a)</td>
<td>65.2</td>
<td>4498.5</td>
</tr>
<tr>
<td>Positive Ranks</td>
<td>54(b)</td>
<td>57.92</td>
<td>3127.5</td>
</tr>
<tr>
<td>Ties</td>
<td>16(c)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>139</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Test Statistics(b,c)**

<table>
<thead>
<tr>
<th>NCT DATA - GAT DATA</th>
<th>Z</th>
<th>Asymp. Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-1.751(a)</td>
<td>.080 - significant</td>
</tr>
</tbody>
</table>

a Based on positive ranks. b Wilcoxon Signed Ranks Test c GAT_Coded = 10 to 25
Table 6. GAT_Coded = Greater than 25

<table>
<thead>
<tr>
<th>Ranks(d)</th>
<th>N</th>
<th>Mean Rank</th>
<th>Sum of Ranks</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCT DATA - GAT DATA</td>
<td>Negative Ranks 11(a)</td>
<td>8.91</td>
<td>98</td>
</tr>
<tr>
<td></td>
<td>Positive Ranks 7(b)</td>
<td>10.43</td>
<td>73</td>
</tr>
<tr>
<td></td>
<td>Ties 1(c)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total 19</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Test Statistics(b,c)

<table>
<thead>
<tr>
<th>NCT DATA – GAT DATA</th>
<th>Z</th>
<th>Asymp. Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-.548(a)</td>
<td>.584 – not significant</td>
</tr>
</tbody>
</table>

a Based on positive ranks. b Wilcoxon Signed Ranks Test c GAT_Coded = Greater than 25

Table 7. Correlation of pachymetry with NCT / GAT

<table>
<thead>
<tr>
<th>Pachy</th>
<th>Pearson Correlation</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>.281(**</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>.315(***</td>
<td>0</td>
</tr>
<tr>
<td>N</td>
<td>188</td>
<td>188</td>
</tr>
</tbody>
</table>

** Correlation is significant at the 0.01 level (2-tailed).

Table 8. Regression Analysis

<table>
<thead>
<tr>
<th>Coefficients*</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>B</td>
<td>Std. Error</td>
</tr>
<tr>
<td>1</td>
<td>(Constant)</td>
<td>-18.760</td>
</tr>
<tr>
<td></td>
<td>Pachy</td>
<td>.067</td>
</tr>
</tbody>
</table>

a Dependent Variable: NCT DATA

Table 9. Regression Analysis

<table>
<thead>
<tr>
<th>Coefficients*</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>B</td>
<td>Std. Error</td>
</tr>
<tr>
<td>1</td>
<td>(Constant)</td>
<td>-22.991</td>
</tr>
<tr>
<td></td>
<td>Pachy</td>
<td>.075</td>
</tr>
</tbody>
</table>

a Dependent Variable: NCT DATA

when IOP readings are compared with GAT 8,9,10,13. The same was shown in our study too with a difference that the percentage of underestimation was higher in the midrange of IOP (10-25 mm Hg) compared to the higher IOP. A 0.080 significance level noted in the middle range implies that out of 100 cases checked NCT is likely to show an error in 8 cases. NCT is thus an accurate objective method of IOP measurement in general ophthalmic practice but in glaucoma referral clinics GAT is probably still the gold standard tool. Tonnu et al11 were the only authors to show that NCT underestimated in lower ranges and over estimated at higher IOP ranges (Cannon model NCT).

It is also essential to know the quantitative effect of CCT on different IOP measuring techniques. Our study showed a correction factor of 0.67 mm Hg on an average per 10μ change in CCT, very close to the accepted Ehlers et al2 study which showed 0.7 mm Hg change per 10μ change in CCT. Previous studies have shown a correction factor ranging from 0.18 to 0.63 mm Hg per 10μ change in CCT.
Some authors have noted NCT to be minimally influenced by CCT\textsuperscript{8,12} while others have shown as much as 3 mm Hg change in IOP with NCT for 10 microns change in CCT. We observed NCT is more influenced by CCT than GAT in glaucomatous eyes studied in our sample. This can be attributed to the fact that NCT applanates a wider area as compared to GAT.

**Conclusion**

IOP measurements using NCT (Pulsair 3000) closely agree with those of GAT even in high IOP ranges. In the lower IOP range, though NCT overestimates, mean values of GAT and NCT are not found to be statistically significant while in the middle range of IOP (10 to 25 mm of Hg) the difference is significant (significance level \(< 0.080\)). NCT readings are more affected by pachymetry than GAT. NCT is thus a good screening tool for identifying ocular hypertensives while GAT has higher accuracy in the normal IOP range (10 to 25 mm of Hg).

**Acknowledgement**

Valuable help of Mr. Benoy John K.V, Chief Executive Officer, Norma Social and Market Research, Kumarapuram, Thiruvananthapuram in the statistical analysis during preparation of this manuscript is greatly acknowledged.

**References**

The Functional Results of Posterior Chamber Intraocular Lens with Scleral-Fixation: A One-Year Follow Up Analysis

Dr. K.S Chandrakanth DO DNB, Dr. R. Nirupama Balaji DO

Planned extracapsular cataract extraction with posterior chamber intraocular lens implantation is the “gold standard” procedure for managing cataracts. Posterior chamber intraocular lenses have several distinct advantages which include a lower rate of retinal detachment, cystoid macular oedema, a proven track record especially when implanted in eyes with co-existing ocular diseases such as diabetic retinopathy, uveitis and glaucoma.\(^1,2,3\)

Long term follow-up of anterior chamber intraocular lens implants (ACIOLs) have been associated with complications like pseudophakic bullous keratopathy, uveitis, glaucoma, hyphaema and cystoid macular oedema.\(^4,5\). Although the newer designs of open loop flexible AC IOLS are associated with fewer complications, their use is limited in the presence of uveitis, glaucoma and in eyes with compromised anterior chamber angle anatomy.\(^6\)

The essential prerequisite for posterior chamber intraocular lens implantation (PCIOL) is the presence of adequate capsulozonular support. However in the absence of adequate support for a posterior chamber implant, intraocular lenses fixated to the sclera or iris has been described. Hu and Cowden,\(^7\) Agapitos and Lindstorm\(^8\) have described various techniques for suture fixation of PC IOL implants to the sclera in the absence of adequate capsulozonular support.

Transsclerally sutured lenses are stabilised by the fixation sutures and the presumed placement of haptics in the ciliary sulcus. Increased clinical experience with these IOLS have shown that they are well tolerated in the eye although a variety of associated complications have been described. These include (1) intraocular haemorrhage during needle passage through the ciliary body, (2) persistent suture track and higher risk of endophthalmitis, (3) suture erosion through scleral flap and gaint papillary conjunctivitis, (4) suture slippage from haptic causing subluxation, tilt or dislocation of IOL, (5) difficult IOL power calculation, (6) episcleritis, (7) secondary glaucoma etc.\(^9,10,11\)

This prospective non-randomized interventional study was undertaken to assess the functional results and complications in a consecutive series of 25 eyes with surgical aphakia who underwent scleral fixation of PC IOL implant by the ab-externo four point scleral fixation technique.

Materials and Methods

This trial enrolled 25 eyes of 25 patients with surgical aphakia due to various causes, in whom adequate capsulozonular support for a PC IOL implantation was absent. Out of the 25 eyes, 16 patients had undergone congenital cataract removal, 6 had been operated on for traumatic cataracts and 7 had undergone extracapsular cataract extraction for senile cataracts. The time interval between the primary cataract
procedure and the surgical implantation of the secondary PC IOL implant was also noted.

All patients underwent a thorough preoperative evaluation which included a best corrected visual acuity with aphakic correction, applanation tonometry, slit lamp evaluation, dilated evaluation of fundus periphery, and biomicroscopic evaluation of the macula with a 78 D / 90 D lens. During slit lamp evaluation special care was taken to evaluate corneal clarity, gonioscopy of angles, presence of vitreous in the anterior chamber and for evidence of epithelialisation etc. All preoperative findings were recorded and the patient counseled on the options for IOL implants and the pros and cons of each procedure. An informed consent to undergo scleral fixation and to participate in the follow-up evaluation was taken.

An ab - externo four point scleral fixation technique described below was performed on all 25 patients under local anesthesia. After adequate peritomy two partial thickness scleral flaps hinged at the limbus was fashioned at the 3 0'clock and 9 0' clock meridians. Doubled arm 10° prolene sutures with straight needle was used. The scleral entry point was 0.50 mm to 0.75mm from the surgical limbus in the bed of the scleral flap avoiding the major arterial circle, and the entire ciliary body and providing true ciliary sulcus placement of the IOL. The needles were rail-roaded out of the eye through the bed of the opposite scleral flap using a bent 25g needle introduced through the scleral bed (Fig:1a&b).

A limbal section was fashioned and the sutures were drawn out of the eye, and cut into two halves (Fig 1 c and d). Each half of the sutures were passed through the fixation eyelet on the superior and inferior haptic of the IOL at the point of maximum haptic spread. A single piece, all PMMA, large optic IOL (Aurolab equiconvex 6.5mm optic, 13mm overall length) was used for scleral fixation (Fig 2 a-c).

The IOL was introduced into the posterior chamber, and the sutures were tightened and tied (Fig 3).

Fig 1. (a-d) a & b showing the passage of 10° Prolene double armed suture through the bed of the scleral flap.(c) limbal section is performed (d) The sutures are grasped in the pupillary area with forceps and brought out through the limbal section.
Fig. 2. The cut ends of the 10º prolone suture is tied and anchored to the fixation eyelets on the haptics of the PC IOL at the point of maximum haptic spread.

Fig. 3. The IOL is introduced into the posterior chamber and the sutures tightened and tied.

Fig: 4 a & b Stable well centered PC IOL implant under air bubble in anterior chamber.

The suture knots were buried in the scleral bed and the scleral flap sutured. The section was closed with 10’ Nylon sutures (Fig 4a & b).

Subconjunctival garamycin and decadron was given at the conclusion of the procedure. All the surgeries were performed by a single surgeon and no major intraoperative complications were encountered.

Postoperatively the patient was evaluated on 1st and 7th postoperative day, every fortnightly for 2 months and monthly for a year. The total duration of follow up was 12 months. At each postoperative visit, a slit lamp evaluation and tonometry was performed. The best corrected visual acuity was checked on the 5th postoperative day and monthly thereafter. Corneoscleral sutures were removed after 45 days in 21 eyes and at 3 months postoperatively in 4 patients.
Indirect ophthalmoscopic evaluation and biomicroscopic assessment of macula was performed monthly during the follow-up period. A careful note of IOL stability and centration, suture related complications, postoperative reaction and cystoid macular oedema was made and the compiled pre and postoperative data analysed. The results were compared with previously published studies.

**Results**

This study enrolled 25 consecutive patients with surgical aphakia who underwent suture fixation of a secondary PC IOL implant by an ab-externo four point scleral fixation technique. The patients were of the age group ranging from 18 years - 57 years (Mean: 37.5 years). The study group had 16 males and 9 female patients. The cause for surgical aphakia was surgery for congenital cataract in 16 eyes (64%); following traumatic cataract surgery in 6 eyes (24%) and extra capsular extraction for senile cataract in 7 eyes (28%).

The time interval between the primary cataract procedure and 2° IOL procedure was between 5 – 10 years after the primary cataract surgery in 10 of the 25 eyes (40%). Nine eyes had undergone parsplana lensectomy, and in 16 eyes extra capsular cataract surgery had been performed.

The preoperative best corrected visual acuity ranged from 6/9 (21 eyes) to 6/18. Slit lamp evaluation showed aphakia with intact anterior hyaloid face and no vitreous herniation into anterior chamber in 9 eyes, ruptured anterior vitreous with strands in the anterior chamber, iris surface and section in 9 eyes, and preexisting corneal opacities in 7 eyes.

The immediate postoperative complications included iritis (2 eyes), inflammatory cocoon membranes (2 eyes), striate keratopathy (1); IOL tilt (1); and vitreous in anterior chamber (1 eye). Majority of patients achieved a best corrected vision of 6/9 on the 5th postoperative day (20 eyes) and this number decreased to 17 eyes by the 1st month after surgery. By the end of 12 months 18 eyes had a best corrected visual acuity of 6/9 and 6 eyes had a vision of 6/12 (TABLE 2).

**TABLE 2 Distribution of visual acuity (BCVA) during follow-up**

<table>
<thead>
<tr>
<th>VISION</th>
<th>5th POD</th>
<th>1 month</th>
<th>3 months</th>
<th>6 months</th>
<th>1 year</th>
</tr>
</thead>
<tbody>
<tr>
<td>6/9</td>
<td>20</td>
<td>17</td>
<td>14</td>
<td>15</td>
<td>18</td>
</tr>
<tr>
<td>6/12</td>
<td>2</td>
<td>3</td>
<td>6</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>6/18</td>
<td>2</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>6/24</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Analysis of the post operative refractive error showed that 14 eyes had a spherical correction ranging from –1 D to –2.00 D, spherical correction = –2.00 D in 14 eyes, and a correction of –2.00 D to 3.50 D Cylinder or Sphere in 9 eyes each.

Delayed postoperative complications included IOL tilt (1); and cystoid macular oedema (1 eye). There was no incidence of suture related complications, endophthalmitis, giant papillary conjunctivitis, retinal detachment etc at 12 months follow up.

**Discussion**

The current indications for scleral fixation of PC IOL include aphakic status after intracapsular cataract surgery with inability to tolerate contact lenses, partial or total absence of the posterior capsule after extracapsular cataract extraction, and subluxation or dislocation of crystalline lens 11. Also in those cases where iris atrophy, distorsion or absence render iris fixation impossible, a scleral fixation remains the only viable alternative 12.

Stability of the lens in scleral fixation is primarily the result of intact trans-scleral sutures and not fibrosis,
encapsulation or the presumed ciliary sulcus placement of haptics. Numerous techniques have been devised to increase the chances of correct positioning, although no surgical technique guarantees sulcus placement of the haptics.

Using eye bank eyes Duffey and co-authors defined the exact anatomic measurements and surgical techniques necessary for sulcus fixation of the IOL. A scleral entry point 0.50mm to 0.75mm from the surgical limbus avoids the major arterial circle and the entire ciliary body and may provide true ciliary sulcus placement of the IOL.

The use of a one piece all PMMA, large optic IOL with fixation eyelet in each haptic in the area of maximum haptic spread provides excellent centration and haptic stabilization when one trans-scleral suture pass per haptic is made.

Postmortem histological studies on the characteristics at the site of scleral suture fixation disclosed a thin fibrous capsule surrounding the haptic at their attachment and absence of inflammation around the trans-scleral portion of the suture. Intraocular tilt of the suture supported PCIOL has not been associated with significant astigmatism.

Analysis of the complications associated with sclerally sutured PC IOLS in our series of 25 cases showed minimal and acceptable rate of complications. IOL tilt in one patient resulted in a postoperative astigmatism of –1.5 D cylinder. Cystoid macular oedema in one patient, diagnosed in the second postoperative month resolved with medical treatment. Our series is notable for the absence of suture related complications, endophthalmitis and retinal detachment.

The main advantages of this technique are 1) easy placement of sutures 2) less chance of suture slippage 3) avoidance of difficult intraoperative maneuvers and possible injury to the ocular tissues.

This method is simple and provide predictable placement of the sutures within the ciliary sulcus, proper haptic stabilisation, optic centration and decreases the risks of intraoperative bleeding during needle pass through the ciliary body. It requires minimal manipulation is relatively atraumatic to the delicate ocular structures, and facilitates safe IOL placement in the absence of capsulozonular support.

References

Retinal Detachment Due to Retinal Dialysis

Dr. Meena Chakrabarti MS DO DNB, Dr. Valsa Stephen MS DO DNB, Dr. Sonia Rani John DNB, Dr. Arup Chakrabarti MS DO

Retinal dialysis or oral disinsertion is a circumferential retinal tear located at its marginal attachment to the ora serrata. It is a common cause for retinal detachment with an incidence of 8% - 33% of all retinal detachments. Ocular trauma, mainly contusion injury is the most important cause for retinal dialysis. Quite distinct from the traumatic variety, a syndrome of bilateral spontaneous, inferotemporal dialysis have been described in young males. Developmental and degenerative factors have been proposed as the pathogenic mechanism for this entity. A higher incidence in native Americans, Hispanics and Asians favour a genetic predisposition. Controversy still exists as to whether the syndrome of bilateral spontaneous inferotemporal dialysis in the young is a distinct entity. It is possibly traumatic in origin and the history of trauma not elicited because of recall bias, denial or the delayed onset following trauma may actually make the patient forget this history. In this study a consecutive series of patients with retinal detachment secondary to retinal dialysis, categorized as traumatic and nontraumatic were compared and assessed as to whether they could be distinguished on the basis of anatomic characteristics and patient demographics.

Materials and Methods

A retrospective case record analysis of all patients who had undergone retinal reattachment procedure at our centre was carried out. The period of study was from February 1999 to February 2006 (72 months). 18 out of the 519 patients who underwent reattachment procedure had retinal detachments due to retinal dialysis and this group formed the basis for retrospective analysis. General demographic data, anatomic characteristics, surgical management details as well as the anatomic and visual outcomes were analysed. The presence of a definite history of trauma, details of prior ophthalmic examination present either in the case record or reference letter were noted. Documented evidence of the status of retinal periphery, gonioscopic findings at the time of initial examination following trauma, and vitreous changes were analysed. A careful note of the interval between trauma and retinal detachment was also made.

Results

18 out of 519 patients who underwent reattachment procedures had retinal dialysis (3.3%). There were 14 males and 2 females. The mean age of these 18 patients was 29 years (14 years - 34 years) and the mean follow up period was 12 months.

8 of the 18 patients gave a definitive history of trauma and was hence categorized as traumatic (44.4%). 10 of the 18 patients did not give any history of trauma and were hence categorized as nontraumatic (55.5%). 2 of the 10 patients in the nontraumatic category had bilateral involvement (20%). The right and left eye were equally affected and the M:F ratio was 8:1.

The patients in the traumatic category were of the age groups 14 – 29 years, while patients who gave no history of trauma were older, and in the 20 – 34 years age group. A family history of a similar condition could not be obtained in any of the patients. There was no difference in the refractive status in both these groups.
Analysis of the presenting complaints showed that field loss was the commonest symptom for which the patient sought medical advice in both the groups. 80 % of the patients in both the groups presented with field loss, while a complaint of loss of central vision was present in only 10 % of patients. Patients with nontraumatic category of dialysis were asymptomatic and the condition was detected only on routine examination. Two patients in this group were referred as macular oedema due to central serous retinopathy. Floaters and flashes were seen in 10 % of patients in the traumatic category while this symptom was absent in the nontraumatic dialysis. (TABLE:1)

Table 1 Differentiating the presenting symptoms in both categories of inferotemporal retinal dialysis.

<table>
<thead>
<tr>
<th>Symptom Groups</th>
<th>Distribution in Both</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Field Loss</td>
<td>80 % of Both groups (T = NT)</td>
</tr>
<tr>
<td>2. Asymptomatic</td>
<td>Non Traumatic (NT &gt; T)</td>
</tr>
<tr>
<td>3. Floaters and Flashes</td>
<td>10 % of Traumatic (T &gt; NT)</td>
</tr>
<tr>
<td>4. Loss of Central Vision</td>
<td>10 % of both groups (T = NT)</td>
</tr>
<tr>
<td>5. Referred as Macular Oedema / CSR</td>
<td>Non Traumatic (NT &gt; T)</td>
</tr>
</tbody>
</table>

Location of the dialysis showed a definite predilection in both groups. Majority of the traumatic dialysis were superonasal (5) in location followed by superotemporal (2) and inferotemporal (1) quadrant.

All the 10 patients in the nontraumatic group had dialysis located in the inferotemporal quadrant showing that spontaneous inferotemporal dialysis characteristically affects this quadrant.

Traumatic dialysis tended to be larger involving an average 2.4 clock hours of the ora serrata in comparison to the nontraumatic variety which was smaller (≤ 1.5 clock hours).

Ocular findings associated with retinal dialysis are given in Table 2. Macula off retinal detachment, presence of demarcation line indicating the chronicity of detachment, chorioretinal scarring, peripheral retinal schisis, and yellow white vitreous opacities were the associated findings. Peripheral cystoid degeneration, peripheral retinal schisis and whitish or yellow vitreous opacities were associated with the nontraumatic category. Peripheral lattice degeneration, other peripheral retinal tears, and areas of pigmented chorioretinal scarring were more commonly seen in eyes following trauma.

Table 2. Conditions Associated with Retinal Dialysis

<table>
<thead>
<tr>
<th>Condition</th>
<th>Non Traumatic Category</th>
<th>Traumatic Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Retinal Detachment</td>
<td>80 %</td>
<td>100 %</td>
</tr>
<tr>
<td>2. Macula – Off</td>
<td>80 %</td>
<td>100 %</td>
</tr>
<tr>
<td>3. Inferotemporal Location of Dialysis</td>
<td>100 %</td>
<td></td>
</tr>
<tr>
<td>4. Demarcation line</td>
<td>60 %</td>
<td>50 %</td>
</tr>
<tr>
<td>5. Cystoid Degeneration</td>
<td>80 %</td>
<td>25 %</td>
</tr>
<tr>
<td>6. Lattice Degeneration</td>
<td>-</td>
<td>25 %</td>
</tr>
<tr>
<td>7. Retinal Tears</td>
<td>-</td>
<td>25 %</td>
</tr>
<tr>
<td>8. Chorio retinal scarring</td>
<td>-</td>
<td>50 %</td>
</tr>
<tr>
<td>9. Retino schisis</td>
<td>20 %</td>
<td>-</td>
</tr>
<tr>
<td>10. Whitish / Yellow vitreous opacities</td>
<td>60 %</td>
<td>-</td>
</tr>
<tr>
<td>11. Avulsion of Vitreous base</td>
<td>-</td>
<td>25 %</td>
</tr>
</tbody>
</table>

Follow up findings in the fellow eyes included prominent peripheral cystoid degeneration (7), prominent oral pigmentation (3), retinal white without pressure (1), vitreous opacities (1) and occurrence of posterior vitreous detachment in two eyes.

12 of the 18 patients underwent scleral buckling with encirclage. Intraoperatively the encircling band and buckle had to be tightened to achieve a sufficiently high buckle effect to close the dialysis. This resulted in a significant degree of anisometropia in all the eyes postoperatively. Six patients underwent buckle with vitrectomy and silicone oil tamponade. Silicone oil removal was performed in all patients with in twelve months and two eyes also underwent phacoemulsification with IOL implantation in the same sitting.

Thus nontraumatic inferotemporal retinal dialysis exists as a distinct clinical entity with definite anatomic characteristics and patient profile.

**Discussion**

This study includes a small group of 18 eyes with retinal detachment associated with retinal dialysis who were categorized into traumatic and nontraumatic variety on the basis of history given by the patient. Recall bias, denial or reporting inaccuracies make this categorization biased. However our study shows that the syndrome of inferotemporal dialysis in the young emmetropic male exists as a distinct entity. Our results...
differ from similar studies in the following aspects and is tabulated in TABLE:3

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Present Study</th>
<th>Other studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Age</td>
<td>Mean age 29 years</td>
<td>Mean age 27 years</td>
</tr>
<tr>
<td>2. Sex</td>
<td>Male</td>
<td>Male</td>
</tr>
<tr>
<td>3. Refraction</td>
<td>Emmetropia 60 %</td>
<td>60% emetopoea</td>
</tr>
<tr>
<td>4. Pigmented Demarcation line</td>
<td>60%</td>
<td>36.40%</td>
</tr>
<tr>
<td>5. Infero temporal location</td>
<td>100%</td>
<td>87%</td>
</tr>
<tr>
<td>6. Size</td>
<td>1.5 clock hours</td>
<td>2.4 clock hours</td>
</tr>
<tr>
<td>7. F/U findings in fellow eye</td>
<td>In significant</td>
<td>Retinal macrocysts</td>
</tr>
<tr>
<td>8. Bilaterality</td>
<td>25%</td>
<td>2.10%</td>
</tr>
<tr>
<td>9. Whitish/Yellow Vitreous opacities</td>
<td>20%</td>
<td>29.40%</td>
</tr>
</tbody>
</table>

Vitreous opacities

The age and sex distribution in our series is similar to published results with dialysis typically affecting young males. More than 60 % of patients were emmetropic demonstrating that myopia is not a likely factor in nontraumatic dialysis. A posterior vitreous detachment was absent and the presence of formed vitreous contributes to the chronicity of the detachment and a higher incidence of pigmented demarcation lines (60 %). The defining feature of the nontraumatic category was its inferotemporal location in 100 % of eyes. Hagler and North reported a 87 % incidence of inferotemporal location in nontraumatic dialysis. The susceptibility of the temporal retina to develop an inferotemporal dialysis stems from its weakened, stretched condition due to accentuated postnatal growth further aggravated by the delay in postnatal vascularisation of the temporal periphery.

Traumatic retinal dialysis in this series had a propensity to involve the superonasal quadrant. Weidenthal and Schepens postulated that the nasal periphery had a greater susceptibility to traumatic dialysis due to the presence of a relatively narrower vitreous base.

Previous studies have postulated that peripheral cystoid degeneration, retinal macrocysts and retinoschisis were causative factors for spontaneous retinal dialysis. However in our study, follow up of the involved or fellow eye did not reveal any significant findings.

Hagler has reported a 2.1 % incidence of bilaterality for traumatic dialysis. In our study bilaterality was seen in 20 % of nontraumatic inferotemporal dialysis. Hilton has reported 78 % incidence of dialysis in young adult American Indians in Arizona with 28 % bilaterality suggesting a genetic predisposition.

Spontaneous inferotemporal dialysis in the emmetropic young adult male remains a separate entity with distinct anatomic and clinical characteristics. Careful examination of the fundus periphery of the patient and his siblings is necessary in view of the high incidence of bilaterality and genetic predisposition. Early detection of an asymptomatic retinal dialysis can be treated by prophylactic laser barrage or cryoretinopexy before a retinal detachment develops.

References

Evolving Concepts In Ocular Allergy

Dr. Reena A. 1, Dr. Valsa T Stephen 2, Dr. Arup Chakrabarti 2

Allergy is an ancient defence system that was a protective mechanism against parasites. While no one is certain as to why there has been such a surge in its incidence, the fact remains that allergy, including ocular allergy, is on the rise. One theory explaining the increased incidence of allergy suggests that as the background presence of parasites in industrialized countries declined, the immune system developed in such a way that it mistakenly identified trees, grass, weeds, and food as enemies.

Immunologic features of cornea and ocular surface

The immune system of the ocular surface, (cornea and sclera) encompasses features of both the local mucosal microenvironment as well as systemic immunity. The normal uninflamed conjunctival epithelium contains a special subpopulation of dendritic antigen presenting cells known as Langerhans cells (LC). These cells function similar to tissue macrophages elsewhere in the body and serve as the sentinel cells of the immune system on the ocular surface. In addition to the presence of immune cells, conjunctiva has a plentiful supply of lymphatic vessels which facilitate the trafficking of immune cells and antigens to the draining lymph nodes where the adaptive immune response is largely generated.

The normal cornea is also endowed with dendritic cells called Langerhans cells. In the corneal periphery and limbus unlike the corneal centre, these antigen presenting cells are in an activated mature state. Unlike the conjunctiva, normal cornea is considered to be an immunologically privileged site as the generation of immune responsiveness to foreign antigens is relatively suppressed. The important factors responsible for this are the absence of blood vessels and lymphatics, expression of immunosuppressive factors (TGF-α) and Fas-ligand capable for fas mediated apoptosis or programmed cell death by the cornea.

Yoshida et al have found that Langerhan cells bearing IgE in the conjunctiva of atopic dermatitis patients exceed the number found in patients without allergic dermatitis. During an allergic response, Langerhan cells proliferate and migrate to the focus of inflammatory reaction.

Antigens leading to Ocular allergy

Most disorders belonging to the group of ocular allergy are mediated by IgE producing B cells and mast cells (immediate or early phase reactions) as well as T cells (late phase reactions). Antigens leading to rhinoconjunctivitis and allergic keratoconjunctivitis (AKC) are often identifiable by skin testing. Pollen and some microbial agents are important antigens. In Giant papillary conjunctivitis (GPC) the deposits on the surface of contact lenses or probably the contact lens itself may induce a mechanical trauma followed by allergic reaction. In contact allergy, the allergen (drug) binds to a carrier molecule forming the complete antigen being presented to T cells. If vernal keratoconjunctivitis is not associated with atopy, the disease inducing antigen is unknown.

1Regional Institute of Ophthalmology, 2Chakrabarti Eye Care Centre, H No. 102, Kochulloor, Trivandrum 695 011 E-mail: tvm_meenarup@sanchamnet.in
Local Factors

Conjunctiva has physiologically a more immunosuppressive environment in which CD8+ cells exceed CD4+ cells in the epithelium, exhibiting similar proportions in substantia propria. Mast cells are located in the tarsal and bulbar conjunctiva and in the lid.

Genetic and Environmental factors

In ocular allergy, genetic factors are only known for ocular atopy. The majority of patients with Atopic Keratoconjunctivitis have a family history of atopic dermatitis. For atopic dermatitis, genetic linkage analysis has demonstrated a strong association between IgE reactivity and chromosome 11q. Environmental factors like geographic, climatic, psychologic and occupational seem to be important but are still not well characterized.

B and T cell reaction

Vernal Kerato Conjunctivitis and Atopic Keratoconjunctivitis are mediated by IgE producing B cells and mast cells and by T Helper Cell Type 2 (Th2) subgroup of T cells which preferentially activates IgE producing B cells with Interleukin-4 inhibiting the maturation of other B cells. Additionally neutrophils and eosinophils participate in allergic reactions. Eosinophils are activated by mast cells and Th-2 cells and they release cationic proteins stimulating mast cells. Eosinophils also can activate T cells resulting in the perpetuation of the system. For contact allergy, T cell response seems so strong that an early phase reaction may be absent.

Important Immune Mediated Diseases of Ocular Surface

Ocular allergic conditions range from the acute, self limited, mild form of seasonal allergic conjunctivitis to the chronic, severe, sight threatening atopic keratoconjunctivitis. Two acute disorders, seasonal allergic conjunctivitis and perennial allergic conjunctivitis and three chronic diseases, vernal keratoconjunctivitis, atopic keratoconjunctivitis and giant papillary conjunctivitis are described.

Contact Dermatoblepharitis: This may occur acutely as an anaphylactic reaction or have a delayed onset. Anaphylactic reactions are Type 1 IgE mediated hypersensitivity reactions. Contact blepharoconjunctivitis is a Type 4 cell mediated or delayed hypersensitivity reaction that may occur 24-72 hrs following exposure to the sensitizing agent. Medications commonly associated with this entity are cycloplegics like atropine and homatropine, aminoglycosides like neomycin, tobramycin, gentamycin etc, antivirals such as idoxuridine, preservatives such as thiomersal and EDTA.

Atopic Dermatitis: Is a result of increased IgE hypersensitivity.

Hay fever conjunctivitis and Perennial allergic conjunctivitis:

These are largely IgE mediated immediate hypersensitivity reactions. Often these patients suffer from other atopic diseases like asthma, allergic rhinitis etc.

Vernal Keratoconjunctivitis (VKC): The immunopathogenesis appears to involve both type 1 and type 4 hypersensitivity reactions.

Atopic keratoconjunctivitis: These patients demonstrate signs of type 1 immediate hypersensitivity responses but also have depressed systemic cell mediated immunity.

Ligneous conjunctivitis: The cause of this condition is recently linked to severe deficiency in type 1 plasminogen, and medical therapy by administration of purified plasminogen concentrate is reported to be effective.

Contact lens induced conjunctivitis: Here the pathogenesis is often multi-factorial. Immune mediated response may result from a variety of insults like allergy, dry eyes, infection, mechanical trauma etc. A hypersensitivity reaction to the contact lens polymer itself or other foreign materials adhering to it has also been postulated. Clinical presentation may vary from mild papillary reaction to giant papillary conjunctivitis.

Pathophysiology

The human eye has approximately 50 million mast cells. Each contains several hundred granules that in turn contain pre-formed chemical mediators. Chronic exposure to antigen result in an antigen IgE antibody
bound to mast cell membrane. The release of a cascade of mediators such as histamine, prostaglandin, leukotrienes and chemotactic factors follows. These mediators cause the itching and hyperemia associated with various forms of allergic conjunctivitis.

The type I and Type IV are the most commonly involved types of allergic reaction involved in ocular allergy.

**Type I hypersensitivity**
This is the most explosive, immediate and obvious reaction mediated by IgE, mast cells and basophils. It is seen in seasonal allergic conjunctivitis.

**Type IV Hypersensitivity**
Sensitisation occurs when the immune system is first exposed to the antigen. Re-exposure to the same antigen results in delayed reaction (18-72 hours later). This reaction is seen in Vernal Keratoconjunctivitis, Atopic Keratoconjunctivitis, Giant Papillary conjunctivitis (also type I). It is a cell mediated reaction involving T lymphocytes.

The allergic reaction involves an early phase and a late phase reaction.

**Early Phase Response**
In the early phase reaction, an allergen binds to allergen-specific IgE on the mast cell. The mast cell Fc receptors are cross-linked by allergens, sending signals via the cell membrane into the cytoplasm activating the mast cells and resulting in release of allergic mediators. This early phase reaction is immediate.

There are two components of the allergic mediator release from the mast cells. The first is the degranulation of mast cells due to an influx of calcium and a change in membrane permeability of the cell resulting in release of pre-formed mediators including histamine, proteoglycans (tryptase). Eosinophil chemotactic factor is also released.

The released histamine binds to H1 and H2 receptors on the conjunctival cell surface. H1 receptor binding results in vasodilation and increased vascular permeability resulting in ocular itching. H2 receptor binding results in increased mucus production at ocular surface.

The second component of mast cell activation is the release of newly synthesized mediators formed via the arachidonic acid cascade.

This denovo synthesis of inflammatory mediators occurs when calcium influx into the cell activates phospholipase A2. This liberates arachidonic acid from membrane bound phospholipids leading to the formation of eicosanoids such as prostaglandin via the cyclo-oxygenase pathway and leukotrienes via lipoxygenase pathway.

**Late phase reaction**
More severe allergic reactions may demonstrate a late phase reaction. These may be either sustained early
phase reactions or more discrete second peaks of response. The second peak late phase conjunctival reaction occurs from 2 to 9 hours after antigen exposure. This occurs at a cellular level and does not correlate with a separate clinical late-phase response of allergic conjunctivitis.

Usually about 4-6 hours after allergen exposure, an influx occurs into conjunctival tissue of non-specific cells of the inflammatory response, including neutrophils, basophils, eosinophils and T-lymphocytes. The eosinophils and T helper type 2 (TH 2 ) lymphocytes and cytokines are primarily responsible for the later phase reaction.

The infiltration of eosinophils is paramount to the allergic response. Chemotactic factors released during mast-cell degranulation aid in eosinophilic attraction and activation. The eosinophils release toxic proteins such as eosinophil major basic protein (MBP) and eosinophil cationic protein (ECP). These proteins have profound cytotoxic effects and stimulate further degranulation of the mast cell initiating a cascade of allergic events.

The TH2 lymphocytes commonly release cytokines i.e. interleukin 4 (IL-4), IL-5, IL-6 and IL-13 during the late-phase allergic inflammatory reaction.

A recent study now indicates that mast cells may also be a source of TH-2 type cytokines.

The function of mast cells in seasonal allergy conjunctivitis and perennial allergic conjunctivitis is clearly an important one. TH₂ type cytokines, an increase in the ratio of TH₁/TH₂ cytokines and increased adhesion molecules all play a role.

Management

The drug treatment options for allergic conjunctivitis have markedly expanded over the last few years, providing opportunities for more focused therapy.

Non-Pharmacological Intervention

1. Identification and avoidance of allergen

This involves education of the patient and family on the nature of the causative allergies and their environmental control. This includes a) preventive measures against “pollen” like limiting outdoor activities, use of AC or air filter, driving in cars with window closed and with AC or air filter on, using protective eye gear when outdoors (b). measures against mites like effective barrier cover for mattresses and pillows, washing bedding regularly at 60° C (130°F), removing reservoirs of dust eg books, carpets, curtains, upholstery furniture, reducing humidity and vacuuming or damp dusting the entire house weekly; c) measures against animal allergens by eliminating animals from house.

2. Dilution of antigen

This can be very effective especially in an acute attack. Rinsing the eyes with luke warm water, previously boiled and cooled water to which one teaspoon of table salt and half teaspoon of bicarbonate of soda is added will help to wash away the allergen. Alternatively instillation of tear substitutes will dilute the antigen load.

3. Cryotherapy

Application of ice to the closed eyelids will help in acute cases to reduce chemosis and eyelid swelling, aid vasoconstriction and relieve itching.

Pharmacological Intervention:

1. Antihistamines

Abelson et al demonstrated that topical instillation of histamine produced, in a dose dependent fashion, the itching and redness associated with allergic conjunctivitis. Studies have shown that the stimulation of H₁ receptors elicits ocular itching and H₂ receptors produce vasodilatation of conjunctival vessels without itching. Histamine is released in the early phase allergic reaction by activation of mast cells and is released in the late phase allergic reaction by mast cells and basophils via activation of histamine releasing factors.

By competing with histamines for receptors on effector cells, both H₁ and H₂ antihistamines effectively prevent the immune response and the manifestation of clinical signs and symptoms of allergic disease. In addition to this, many of the available antihistamines also prevent histamine production, bind to adrenergic, cholinergic and muscarinic receptors and inhibit mediator release.
from mast cells while others inhibit different components of the allergic inflammatory cascade. Even “pure” antihistamines have some anti-inflammatory action. Inactivation of H₁ receptors results in decreased levels of nuclear factor, a transcription factor important in the regulation of cytokine and 1 CAM-1 expression which plays a critical role in the allergic cascade.

**Systemic Antihistamines**

These significantly dampen or block the early phase and some features in the late phase allergic response. They however have a late onset of action compared to topical antihistamines. They also lead to decreased tear secretion and drying of ocular surfaces and may thereby increase the allergen load. Attaining adequate concentration in ocular tissues is difficult. Hence it is generally avoided in ocular allergy unless there are systemic symptoms. Adverse effects include sedation and dryness of secretions. However this is less with the second generation anti-histamines which have selective H₁ receptor blockade and less anti-cholinergic effect e.g. cetirizine, fexofenadine, loratadine, desloratadine.

**Topical Antihistamines**

Topical ophthalmic preparations of H₁ antihistamines currently include an alkylamine (pheniramine maleate), two ethylenediamines (antazoline phosphate and pyrilamine maleate), two piperidines (levocabastine hydrochloride and ketotifen fumarate), a dibenzoxepin (olopatadine hydrochloride) and a benzimidazole (emedastine fumarate). Pheneramine maleate, antazoline phosphate and pyrilamine maleate are only available in combination with vascoconstrictors while the others are available without a vascoconstrictor.

**Pheniramine (0.3%), Pyrilamine (0.1%) and Antazoline (0.5%):** are classic antihistamines that have been used since the 1940s. The recommended dose is 1 to 2 drops up to four times daily.

The topical antihistamines can further be divided into “pure” antihistamines like levocabastine and “multiple-action” group with combined antihistamine activity, mast cell stabilization and pro-inflammatory mediator action e.g. olopatadine, emedastine, ketotifen, azelastine, epinastine.

**Levocabastine**

This is a pure antihistamine which is long acting and highly potent with a selective H₁ receptor antagonist action. It has been shown to down-regulate 1 CAM-1 expression. It is 15,000 times more potent than chlorpheniramine in the rat model. Levocabastine 0.05% has been shown to be effective in reducing itching, hyperemia and chemosis. It is used in a dosage of 4 times daily. It has been shown to be more effective than topical sodium cromoglycate for the treatment of allergic conjunctivitis and as efficacious, well tolerated and possessing a faster onset of action than lodoxamide, another mast cell stabilizer.

**Olopatadine 0.1%** is the first dual action allergy therapy to receive approval as both an antihistamine and a mast cell stabilizer potentially reducing the need for multi-agent therapy. It has been shown to be 1059 times more selective for H₁ receptors than for H₂ receptors. Its dosing regimen is one drop twice daily. Olopatadine has been shown to inhibit histamine, tryptase and prostaglandin D₂ release from human conjunctival mast cell preparations in vitro. It has been shown to be effective against ocular pruritis up to 8 hours. It is administered twice daily. It has been found to be more efficacious than 2 weeks of nedocromil and oral loratadine. It is well tolerated and can be used in children 2 years and older. The most frequently reported side effects are dry eye, pruritis, stickiness, taste perversion and abnormal dreams.

**Emedastine 0.05%** is a potent selective H₁ antagonist with rapid onset and acceptable duration of action. Its selectivity accounts for its low side effects. It has an inhibitory effect on eosinophil chemotaxis. It has been found to be superior to levocabastine and topical nedocromil. It can be used up to four times daily.
Ketotifen 0.05% is one of the more recently approved anti-allergic eye drops. It is a non competitive H$_1$ receptor and eosinophil inhibitor antagonist. It stabilizes mast cells, inhibits platelet activating action and acts as an eosinophil inhibitor. It has been shown to inhibit the release of leukotrienes, inhibit eosinophil chemotaxis and suppress eosinophil activation by cytokines. It may down-regulate mast cell degranulation to below baseline measurements. A single dose was found to be superior to 2 weeks of nedocromil $^{17}$.

Azelastine: is a relatively selective H$_1$ receptor antagonist and inhibitor of the release of histamine and other mediators from mast cells. It downregulates 1 CAM-1 expression on conjunctival epithelial cells.

Epinastine: The latest “multiple action” topical agent, epinastine, has an H$_1$ and H$_2$ receptor antagonist with mast cell stabilizing and anti-inflammatory properties. H$_2$ receptor antagonism may provide additional benefits in reducing hyperemia and eyelid swelling. Epinastine has a rapid onset of action (3 minutes) and long duration of action (> 8 hours). It has been found to be similar or superior to levocabastine $^{18}$ and superior to olopatadine in a small study.$^{19}$ Its safety and tolerability appears to be equal to other topical antihistamines. It has low systemic exposure and does not cross the blood brain barrier.

Side effects of topical antihistamines

Some topical antihistamines are contraindicated in patients with narrow angle glaucoma. The mydriatic effect of vasoconstrictors in combination products could precipitate an attack of angle closure. These combinations may also be responsible for the loss of accommodation and the difficulty in near work experienced by some. These combinations should be used with caution in patients with hypertension, cardiovascular disease and poorly controlled diabetes.

Systemic side effects with topical ocular antihistamines are rare. Local irritation, including burning or stinging may occur, which usually resolves within a few seconds after instillation. Keratitis medicamentosa and punctate keratitis may be found associated with the preservative benzalkonium chloride.

II. Ophthalmic Vasoconstrictors

These are used alone or in combination with other agents like antihistamines.

The release of vasoactive amines is responsible for the hyperaemia, tearing and itching that occur with allergic conjunctivitis. Vasodilation results in endothelial gaping, fluid transudation, chemosis and lid oedema. By constricting the blood vessels, vasoconstrictors are able to alleviate these effects.

<table>
<thead>
<tr>
<th>Generic Name</th>
<th>Trade Name</th>
<th>Manufacturer</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Naprazoline</td>
<td>Antistin, Privin</td>
<td>Restan</td>
<td>0.5%</td>
</tr>
<tr>
<td>Phenylephrine</td>
<td>Prefrin</td>
<td>Allergan</td>
<td>0.012%</td>
</tr>
<tr>
<td>Oxymetazoline</td>
<td>Oxylin</td>
<td>Allergan</td>
<td>0.025%</td>
</tr>
<tr>
<td>Tetrahydrozoline</td>
<td>Gemini</td>
<td>Restan</td>
<td>0.05%</td>
</tr>
</tbody>
</table>

1. Phenylephrine: This is the oldest of the currently available vasoconstrictor agents.
2. Naphazoline – 0.012 %-0.1 %.
3. Tetrahydrozoline 0.05 %. Use of this drug does not alter pupil size or raise intraocular pressure but rather lowers IOP 30 minutes after use.
4. Oxymetazoline 0.025 %

Side Effects

These drugs are readily available over the counter and are hence misused. Prolonged use can lead to rebound vasodilatation due to receptor desensitization. Acute and chronic forms of conjunctivitis by pharmacological, toxic and allergic mechanisms can occur. Hence these products should not be used for prolonged periods.

III. Mast Cell Stabilizers

Cromolyn sodium (Opticrom) became the first widely used mast cell stabilizer for the treatment of allergic conjunctivitis, atopic keratoconjunctivitis and vernal keratoconjunctivitis after it was developed in the 1960s from Khelin, an extract derived from the seed of Ammi Visnaga, an Eastern Mediterranean plant used by the ancient Egyptians as an antispasmodic. Subsequently, other mast cell stabilizers like lodoxamide, perilormast, nedocromil, olopatadine and ketotifen have come into the market.
Mechanism of action

Mast cell stabilizers repress type I hypersensitivity reaction by inhibiting the degranulation of mast cells and by preventing the release of histamine and other mediators of hypersensitivity reactions. They have no direct vasoconstrictor, antihistaminic, or anti-inflammatory actions. These actions are reportedly achieved through the prevention of calcium influx into mast cells following antigen stimulation. Hence, once the mediators of inflammation are released these cannot reverse the reaction but can only prevent further mediator release. Olopatadine and ketotifen has both mast cell stabilizing and antihistaminic properties.

Cromolyn Sodium

This is beneficial in the treatment of seasonal and perennial allergic conjunctivitis, vernal and atopic keratoconjunctivitis. It is extremely well tolerated in the eye and the risks of long-term use are negligible. Its long safety record (up to 10 years of continuous use) makes it the drug of choice of many clinicians for long term use. Recommended dosage is 4 to 6 times per day. It may take up to 7 days to obtain relief and a 10 to 14 day period is recommended to evaluate the efficacy of therapy. Side effects include transient ocular burning or stinging on instillation.

Lodoxamide

It has been in use since the mid 1990s and has a similar mode of action to cromolyn sodium. It has been shown to be 2500 times more powerful than cromolyn sodium in inhibiting the signs and symptoms of allergic eye disease and to powerfully prevent shield ulcers in Vernal Keratoconjunctivitis. This finding is of particular importance because these changes are typically resistant to treatment. It is a safe drug and can be used 4 times a day for up to 3 months. The onset of action is earlier, the clinical improvement significantly greater and incidence of adverse effects lower than cromolyn sodium. Transient burning, stinging and ocular discomfort were experienced by 15% of patients in clinical trials.

Olopatadine and Ketotifen - have been dealt with along with antihistamines

Pemirolast: is thought to be a mast cell stabilizer that inhibit release of phospholipid by products histamine and leukotriene. It may also prevent migration of eosinophils from the blood stream to the site of infection and subsequent release of mediators.

Nedocromil Sodium

Nedocromil Sodium appears to be more potent than cromolyn. It has a wider spectrum of potential as an anti-allergic and anti-inflammatory medication. It prevents not only the release of preformed mediators, but also the release of newly generated mast cells. Additionally, it stabilizes both mucosal and connective tissues whereas cromolyn acts only on the connective tissue mast cells. It may be acting on a pathway common to mast cells, eosinophils, epithelial cells and sensory nerves thereby qualifying it as first rate maintenance therapy in the treatment of ocular allergy. In comparison trials with 2% cromolyn, nedocromil was found to be statistically superior in the treatment of seasonal and perennial allergic conjunctivitis by relieving symptoms such as itching, burning, grittiness and tearing that persisted with cromolyn.

The significant benefit of nedocromil sodium over cromolyn and lodoxamide is its dosing requirement. It is administered twice daily, rather than 4 to 8 times daily as with other mast cell stabilizers. The onset of action is rapid and the dosage regimen in easily adhered to by patients.

Transient burning, stinging, unusual taste sensation are some of the reported side effects.

IV Non-Steroidal Anti-inflammatory Drugs (NSAIDS)

NSAIDS have shown promise in the management of allergic disorders of the eye. They act by blocking prostaglandin biosynthesis by inhibiting the activity of
cyclooxygenase. This enzyme is responsible for the conversion of arachidonic acid to endoperoxides (PGD₂) in ocular and non-ocular tissues. Most NSAIDs do not inhibit the formation of eicosanoids such as leukotrienes which also contribute to inflammation as they are formed through the lipoxygenase arm of the arachidonic acid pathway. However certain NSAIDS (Ketoprofen, diclofenac) may have an inhibitory effect on the lipoxygenase pathway. The only NSAID currently approved by the US FDA for relief of itch due to seasonal allergic conjunctivitis is ketorolac tromethamine 0.5%. The recommended dose is 1 drop 4 times a day. This has been found to be effective and well tolerated for alleviating signs and symptoms associated with seasonal allergic conjunctivitis.

Diclofenac sodium 0.1% has also been found to be effective in relieving ocular signs and symptoms of allergic conjunctivitis comparable to ketorolac. Flurbiprofen 0.03% has also been found to be effective in reducing hyperemia and ocular itching.

Aspirin, piroxicam and indomethacin 1% administered topically have all shown promise as well. Oral aspirin also appears to be useful both as primary and adjunctive therapy for recalcitrant cases of vernal keratoconjunctivitis. Because of the higher doses required (upto 1 gm daily for 6 weeks) the potential side effects of aspirin should be considered before initiating treatment. Suprofen 0.1% has also provided relief in vernal conjunctivitis and contact lens associated giant papillary conjunctivitis.

Side Effects

The most common adverse effect with topical ocular use of NSAIDS is a stinging sensation following application. Oral NSAIDS can result in a variety of complications like gastrointestinal irritation, increased bleeding time, renal failure, drug interaction with hypoglycemic agents, warfarin, methotrexates etc. Its use in pregnancy and lactation is to be avoided as there are no well-controlled studies in these groups to prove their safety.

V. Corticosteroids

The principles of therapeutic use of corticosteroids

1) For most allergic disease, topical administration is the logical choice, although in the hands of the ophthalmologist, supratarsal or subconjunctival depot steroids are often valuable in unresponsive cases.

2) The minimal effective dose for the shortest amount of time to achieve the desired response is the golden rule. In ocular disease, the therapeutic as well as potential side effects that is increased IOP and cataract formation must be monitored by an ophthalmologist at a slit lamp.

3) The choice of steroid and dosage depends on the severity of the allergic response present. “Weaker” steroids like fluorometholone (FML) and medrysone are less likely to result in IOP elevation.

4) Topical therapy should be tapered slowly over several days to weeks because abrupt discontinuation may flare up the allergic response.

Types of Ophthalmic Corticosteroids

1. Prednisolone acetate 1% - is a synthetic analogue of hydrocortisone and is probably the most effective agent in anterior segment inflammation. However, it is seldom used in ocular allergy.

2. Dexamethasone 0.1% - is 25 times as potent as hydrocortisone.

3. Flurometholone 0.1% – is a structural analogue of progesterone. It is very effective in reducing ocular surface inflammation with a low potential for IOP elevation.

4. Medrysone 1% - is another synthetic derivative of progesterone. It is the least potent and does not produce rise in IOP.

5. Loteprednol etabonate 0.2% - Represents “a soft drug” designed to maximize therapeutic effect while minimizing side-effects. It has proved to be very effective in the treatment of allergic conjunctivitis.

6. Rimexolone 1% - is a novel synthetic topical corticosteroid which possesses similar anti-inflammatory effect as prednisolone and no greater associated increase in the risk of elevating IOP than fluorometholone. It has limited systemic absorption contributing to the clinical safety of the product.
Side Effects

As steroid dosage and duration increases, the side effects also increase.

Both systemic and topical steroids result in increased lens opacities usually posterior sub capsular cataracts. This can result in photophobia, glare and decreased vision.

Topical steroids can also cause elevation of IOP especially in steroid responders which is usually reversible. Those with glaucoma, family history of glaucoma, myopia > 5 D, patient age, Krukenberg spindles and diabetes are more prone to raised IOP. Dexamethasone 0.1 % and betamethasone 0.1 % are more likely to induce pressure elevations than prednisolone, fluoromethalone and medrysone. Fluoromethalone has less tendency while medrysone has the least tendency to elevate IOP.

Resistance to infections is lowered with increased risk of developing viral, bacterial and fungal infections. Corneal healing is delayed. Anterior uveitis can occur. Dilation of pupil and ptosis can occur. Temporary ocular discomfort following topical ocular administration can occur. Additionally occasional refractive changes, blurred vision, increase in corneal thickness, dry eye and calcium deposits on cornea have been reported. Systemic side effects are infrequent.

Contraindications

Corticosteroids should always be used with caution because of its potential side effects. Caution is needed in patients with diabetes mellitus, infections, congestive heart failure, chronic renal failure or systemic hypertension. Topical steroids must be used only when necessary and with caution in patients with glaucoma. While treating with steroids the patient should be examined for the development of corneal, lens and IOP changes and keratitis.

The step-care management approach to allergic conjunctivitis is recommended.

Table 4: Types of ophthalmic corticosteroids

<table>
<thead>
<tr>
<th>Preparation</th>
<th>Trade Name</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Prednisolone</td>
<td>Minims Pred</td>
<td>0.5 %</td>
</tr>
<tr>
<td>Phosphate</td>
<td>Sodium Phosphate</td>
<td></td>
</tr>
<tr>
<td>2. Prednisolone</td>
<td>Pred Mild</td>
<td>0.12 %</td>
</tr>
<tr>
<td>acetate</td>
<td>Pred Forte</td>
<td>1 %</td>
</tr>
<tr>
<td>3. Dexamethasone</td>
<td>Maxidex/</td>
<td>0.1 %</td>
</tr>
<tr>
<td>Suspension</td>
<td>Spersadex</td>
<td></td>
</tr>
<tr>
<td>4. Dexamethasone</td>
<td>Decadron</td>
<td>0.05 %</td>
</tr>
<tr>
<td>Ointment</td>
<td>AK-Dex</td>
<td></td>
</tr>
<tr>
<td>5. Fluoromethalone</td>
<td>Flucon</td>
<td>0.1 %</td>
</tr>
<tr>
<td>Suspension</td>
<td>FML</td>
<td>0.1 %</td>
</tr>
<tr>
<td>FML forte</td>
<td>0.25 %</td>
<td></td>
</tr>
<tr>
<td>6. Fluoromethalone</td>
<td>FML SOP</td>
<td>0.1 %</td>
</tr>
<tr>
<td>ointment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Medrysone</td>
<td>HMS</td>
<td>1.9 %</td>
</tr>
<tr>
<td>Suspension</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Rimexolone</td>
<td>Vexol</td>
<td>1 %</td>
</tr>
<tr>
<td>9. Loteprednol</td>
<td>Lotepred</td>
<td>0.2 %</td>
</tr>
</tbody>
</table>

Educating the patients to understand the condition and supplying the patient with all the step care knowledge will aid him or her in controlling symptoms adequately and will therefore reduce depending on drug therapy.

Drugs currently in the Pipeline

Immunomodulatory strategies are being studied

1. These include cyclosporine and tacrolimus which block mast cell proliferation and also may block other cytokines from being released by T lymphocytes. In the future there might be a role for topical cyclosporine in the treatment of severe allergic conjunctivitis. In several small trials, it has been found to be well tolerated and effective in the therapy of allergic and vernal keratoconjunctivitis. Currently topical cyclosporine...
is approved by the US FDA for only increased tear production in dry eye patients. At present, the role of topical cyclosporine as a steroid sparing agent in treatment of ocular allergy has not been fully investigated.

2. Anti IgE class of treatments:
IgE plays a crucial role in triggering the allergic reaction, when it binds to the surface of mast cells and other immune cells. In this position it is a sitting duck to which allergens adhere, cross linking the IgE molecules and thereby triggering mast cell degradation and the release of numerous pro-allergy mediators. Thus blocking IgE presents an opportunity for drug intervention. One drug in this class is omalizumab, which acts by binding to free circulating IgE thereby inactivating it. Subcutaneous omalizumab is currently indicated for moderate to severe persistent asthma uncontrolled with corticosteroids. It may become applicable for rare, severe forms of intraocular allergy such as atopic keratoconjunctivitis.

3. Lipoxygenase inhibitors and chemokine inhibitors
These are approaches to controlling the ocular allergic response at specific points in the immune system reaction of allergic conjunctivitis.

Conclusion
The armamentarium against ocular allergy has continued to expand in recent years with introduction of newer agents which are highly potent. A better understanding of these drugs will help to offer an effective and safe treatment regimen for all ocular allergy patients.

References
17. Greiner JV, Michaelson C et al. Single dose of ketotifin
fumarate 0.025 % Vs 2 weeks of cromolyn sodium 4 % for allergic conjunctivitis. Adv Ther 2002 Jul-Aug 19(4):185-93.


A “Do It Yourself” Instrument For Squint Evaluation

Dr Mathew Joseph MS

Introduction

This instrument enables the examiner to actually see the subject's eye under cover, and can be easily made.

Materials and Methods

The cover test for near and distance is the most important part of any examination for strabismus and amblyopia. It conveys both sensory and motor information. It can be done with patients of all ages and requires only the minimum of cooperation from a patient, especially a child. This instrument allows the examiner to see the eye undercover directly, unlike an opaque paddle commonly used for the cover test, where the examiner has to peep behind from the side.

This instrument consists essentially of a two way mirror and a light bulb. A two way mirror acts depending on the relative amount of light on either side of it. If the observer is standing on the side with greater illumination he or she cannot see the other side which is darker. But if the darker side is lighted up, the observer can see through the mirror. When the mirror is placed in front of the eye to be examined, the patient can see through the mirror, but the examiner cannot. When the bulb is put on, there is relatively more illumination on the patient's side and the patient can no longer see through, thus dissociating binocular fixation. In effect the eye is ‘under cover’, but the examiner can still see the eye.

A circular piece of clear plastic was cut out from the box of the US IOL lens. Then silver sun control film was pasted on both sides. The reflector part of a pen-torch was removed to leave the bare bulb. The circular mirror was then attached to the torch as shown in the illustration.

This occluder is especially useful in the evaluation of phorias and intermittent exotropias, mainly the good and the fair control types. It is also useful in the examination of dissociated horizontal and vertical deviations, where the tortional component, or a latent nystagmus can be observed. It is very useful in evaluating the extent of deviation of the dominant eye under cover which would otherwise return to fixation rapidly as soon as an opaque cover is removed.
OPHTHALMIC HISTORY

ARGYLL ROBERTSON AND THE PUPIL

Towards the middle of the nineteenth century, Ophthalmology developed into a specialty in its own right, helped by the work of many people including Helmholtz who invented the ophthalmoscope. One of the first to devote himself exclusively to Ophthalmology was the man best remembered for the abnormal pupil he described………

Douglas Moray Cooper Lamb Argyll Robertson, to give him his full name, was born in Edinburgh in 1837. His father, John Argyll Robertson was a General Surgeon, practising in Edinburgh with a special interest in eye surgery.

After his schooling at Edinburgh, Argyll Robertson went to the University of St. Andrews in Fife, which was the oldest in Scotland and the third oldest in the entire English speaking world. He completed his Medical studies in 1857 which was the year his father died.

Graduating at the age of twenty, he first worked as House Surgeon at The Royal Infirmary in Edinburgh and then went to Berlin to pursue his interest in Ophthalmology. There he studied under Albrecht von Graefe, the leading Ophthalmologist of that time.

In 1862, he became a fellow of the Royal College of Surgeons. In the March 1863 edition of the Edinburgh Medical Journal, he published an article of great importance on the Calabar bean, the seed of a plant found in Calabar, eastern Nigeria. This seed contained lethal amounts of the tertiary amine physostigmine and was used by the natives to determine if an accused was guilty or innocent. Only those who vomited the poisonous solution would survive and they were then declared innocent.

Sir Robert Christison, one of Argyll Robertson’s teachers, experimented with the Calabar bean and recommended its use for the humane execution of criminals. However it was Argyll Robertson who by instilling a drop of the extract into his own eye first described the miotic effect of physostigmine. His prediction that it would become a valuable agent in the ophthalmic pharmacopoeia was soon realized when that very same year, his former teacher Von Graefe used it before iridectomy.

(Contd on pg 412)
Autorefractometers

Dr. V. Sahasranamam MS DO

Man has always tried to automate all manual tasks assigned to him. In a similar way the process of automation of manual refraction has also evolved over a period of two centuries. Early attempts in this field were not fruitful since the technology available then could not cope up with this sophisticated task. Since the last 4-5 decades, with the advent of modern electronics and computers, autorefractometers (ARM’s) have evolved in a big way.

Earlier instruments in this field were mainly subjective optometers, i.e. the patient himself had to adjust the instrument, to focus a target. This had led to a lot of problems starting from, improper alignment of target and the subjects pupil, to excessive accommodation by the subject. This can lead to gross irregular astigmatism values, if only portion of the pupil is used in refraction. Excessive accommodation can lead to ‘instrument myopia’. Instruments available today are objective refractometers. They are much faster and need very little, patient co-operation. These instruments mainly use two sources of light – a visible light which illuminates the target in the instrument and an infrared (IR) light which performs the refraction. Various types of fixation targets like a 3-D coloured balloon, a landscape, starry sky etc. helps to relieve the accommodation. The vertex distance can be adjusted according to whether we need a contact lens correction at zero vertex distance or a spectacle correction at 12mm or 13.5mm V.D. A retro illumination mode helps to observe any lens opacity present.

The speed of actual refraction done by most of the new instruments is close to 0.1 second. This speed helps to negate the effects of momentary changes of fixation, blinking or accommodation which may occur during the process of measurement.

Methods to overcome the effect of patient accommodation
- Speed of measurement.
- Infrared (IR) light performs the refraction and hence accommodation is not stimulated.
- The type of target set in the Autorefractometers tend to relax the accommodation.
- The instruments use a fogging lens, through which the fixation target is seen. So, the subject hopefully learns that accommodation tends to make the visible target even more blurred and therefore, relaxes accommodation.

Optics of Autorefractometers

Infrared or near infrared light performs the refraction. Various optical devices like a grating or rotary prism focuses targets on to the retina.

In all these, infrared light scans across the papillary area and the emerging light from the fundus in various meridians, is detected by ‘photodetectors’ or ‘sensors’. The nature of the emerging beam gives an indication of the nature of refraction. The value detected by the sensors in the various meridians is analysed by the instrument which gives the refractive status of the eye as a display/print out – SPH/CYL/AXIS.

Most of the instruments use the full pupil for refraction. Measurement can be made even in pupil miotic upto 2mm. Area of retina used for refraction is about 30-70 around the fovea.

Hazy media like lens opacity or corneal opacity may
hinder the Autorefractometer reading. These opacities producing visual acuity less than 6/18 or more may end up in ‘error’.

**Advantages**

- User friendly machine – can be handled by an average ophthalmic technician.
- Better patient compliance than in manual refraction since the procedure is fast and there is no inconvenience to the patient. Especially in children and un-cooperative patients, manual refraction needs immense patience.
- In case of oblique astigmia, determination of axes is very easy.
- Can over-refract spectacles, contact lenses and IOL’s.
- People of all strata of life are generally impressed by computers and machines than manual refraction.

**Disadvantages**

- High initial investment
- We should not be fully dependent on the instrument for our refraction needs. The machine may give all sorts of sphero cylindrical combinations, but we should be judicious in assessing the subjective refraction, before prescribing.
- Calibration errors are common. So keep your instrument well serviced and cross check once in a while with your manual refraction values.
- May optical shops now use autorefractometer for glass prescription and the public is generally attracted towards the same. Unless, an Ophthalmologist oversees the procedure and does a proper ocular examination along with it, other organic diseases like, glaucoma and posterior segment pathologies will be left undiagnosed.

**Recent Advances in ARM’s**

- Hand held, wireless, autorefractometer for convenience and portability.
- Super quick mode with measurement time as low as 0.07 seconds.
- Traditional rotary prism systems being replaced by Duplex Disc Technology.
- Due to the shorter reaching distance in the new hand held models, no assistance is needed to help small children take the correct position and focus on the target. One touch provides a melody that plays to distract patients and provide a relaxed environment for refraction.
- Patients with nystagmus can be measured with the ‘super quick’ measuring mode.
- The minimum pupil diameter (2 to 2.5 mm) and light intensity control for the fixation target permit easy measurement of patients with smaller pupils along with patients who are light sensitive.
- Auto-measuring and auto- finish capability. i.e. the instrument begins automatic readings as soon as the corneal dot passes through the alignment mark and stops by itself as soon as reliable data is obtained. No keys have to be pressed at any time, to take the readings. A mire ring is projected on to the corneal surface making it easier and faster to align the system and check for abnormality of the cornea.
- In place of conventional LED’s, newer versions use SLD’s (Super luminiscent diodes) and highly sensitive CCD device for improved image quality of ARM’s.

In refraction, there is no ‘real standard’ for comparison. Manual refraction values can also vary, within a narrow range of power and axes even in expert hands. Such differences can occur in ARMs also.

The message is, the autorefractometer is a valuable companion in our refraction practice but we should be judicious in prescribing a glass from our autorefractometer print out.
Retinoscopy

Dr. Pappa P MS DO

Retinoscopy is defined as the objective method of assessing the Refractive State of the eye. This still forms the bread and butter of the most of the practicing ophthalmologists. A good manual refraction is more accurate than the autorefraction techniques available in today’s technologically advanced world.

Types

Mainly divided into Static retinoscopy: which is done in eyes after putting cycloplegic drugs and Dynamic retinoscopy: where the test is done in accommodating eyes.

Optics of Retinoscopy

The refractive power of the given eye is assessed by locating the image of the far point of the patient’s eyes by moving the illumination across the fundus and noting the behaviour of the luminous reflex seen in the patient’s pupillary area. If the image is formed between the patient and the observer “opposite movement or against movement” is seen and if the image falls outside this region a “with movement” is seen. When the far point of the patient’s eye corresponds to observer’s nodal point, neutral point is reached.

The detailed optics can be divided into 3 stages

(a) Illumination Stage- Where one patch of patients retina gets illuminated.

(b) Reflex Stage – Image of illuminated area formed by the subject’s diopteric power apparatus at patients far point

(c) Projection stage – Projection of image by the observer.

Retinoscopy in emmetropia

In the illumination stage, light from the retinoscopy mirror illuminates the patch from the patient’s retina ie P.

In the reflex stage, the illuminated patch forms an image at the far point of the patient’s eye which in emmetropia is at infinity.

In the projection stage, the determining ray is R, which from infinity comes to the observer’s nodal point and reaches the observer’s reina at Po. So as the mirror rotates “a with movement” is observed.

Retinoscopy with hypermetropia

The illumination stage is same as that of emmetropia.

The reflex stage is different as the far point lies behind the patient’s retina and so a virtual image is formed.

The projection stage is same as that of emmetropia and therefore a “a with movement” of reflex is obtained.

Retinoscopy in myopia

In higher degrees of myopia where the image is formed between the patient and the observer “against movement” will be obtained and in weak myopia where the far point lies behind the observer “with movement” is obtained.

The object of reinoscopy is to place lenses in front of the subject’s eye so as to find the point of neutralization at which the direction of movement of the reflex is indeterminate. The greater the degree of ametropia,
Illumination stage in emmetropia

Reflex stage in emmetropia

Projection stage in emmetropia

Reflex and projection stage in hypermetropia

Reflex and Projection stage in myopia less than 1.5 D

Reflex and Projection stage in myopia greater than 1.5 D
the shorter the excursion and slower the speed of movement.

**Methods of retinoscopy**

(A) Retinoscopes are mainly 2 types

1) Reflecting Retinoscopes: Which can be plane mirror or concave mirror with a perforation of 4 mm size in the cornea. This needs a separate light source.
2) Luminous Retinoscope: In this both light source and mirror are incorporated.

Eg. Streak retinoscope which allows the axis of any astigmatism to be more readily identified.

(B) Trial frames

This helps to keep a standard distance of the lenses from the eye and also for accurate centration of the lens. The lenses should be carried closer to the eye i.e approximately 12 mm in front of the cornea, so they occupy the same position as spectacle lenses. This should also allow angulation of lens when checking for near vision.

(C) Test Lenses

A typical trial set will have spheres every quarter of a dioptre to 4D and every half to 6D and thereafter every dioptre to 14D and every 2 D for 20D and cylinders every quarter to 4D and every half to 6D. In all the cases when a strength of over 5D in any meridian is involved the back vertex power of the combination should be determined and the prescription modified accordingly. Before commencing the retinoscopy the trial frames must be accurately centered so that the optical centre of the lens inserted corresponds to the patient’s visual axis.

Practice of Retinoscopy

The room should be long and darkened.

In case of dynamic retinoscopy, patient is asked to fix at a spot of light which is at least 6 m away.

The examiner should use his right eye for patient’s right and his left eye for patients left.

The working distance is usually 2/3 m.

The movement of the reflex obtained is then noted in all meridians.

To start with, vertical and horizontal meridians are assessed and if the same lens neutralises both vertical and horizontal meridian, then no astigmatism is present. If this is not so then examiner has to assess in different meridians and neutralize each meridian to find out the amount of astigmatism.

“With movement” is obtained in any meridian which is hypermetropic, emmetropic or myopic less than -1.5 D. The convex lenses are used for neutralization. If an “against movement” is found, concave lenses are used for neutralisation. Spherocylinder combination can be used to assess the correct axis of astigmatism.

Final refraction is obtained by deducting a diopteric value corresponding to the working distance as well as the cycloplegic drug used. The recording of retinoscopic results is usually done in the form of a cross which indicates the neutralization point of the two main meridia and also their orientation.

**Streak retinoscopy**

Linear light source is used instead of a circular image which will give more idea about the axis of astigmatism. The first meridian is neutralized at the point at which the streak disappears and the pupil becomes completely filled with light or completely dark. If all meridia are similarly neutralized, there is no astigmatism and if a band shaped reflex appears in any meridian then astigmatism is present. If there is a break in the alignment between the reflex in the pupil and the band outside which means the axis of astigmatism is different and you have to rotate the streak until the reflex in the pupil and the band outside will align.

**Special situations in retinoscopy**

- The reflex may be too faint in case of media opacities and high refractive errors.
- In case of high ametropia repeat the retinoscopy with ± 7D lens.
- Spherical aberrations cause different parts of the image with varying brightness which can be negative or positive.
- Scissor shadows are seen when one part of the aperture is myopic and one part is hypermetropic.
Usually seen in irregular astigmatism associated with corneal scar and subluxaion of lens etc.

- Children under the age of 7 years cycloplegia is mandatory and in children with squinting eye, retinoscopy is done after occluding the fixing eye.
- In immature cataract very confusing reflexes are obtained.
- In conical cornea, a triangular or swirling reflex with its apex at the centre of the cone is seen.

**Conclusion**

Retinoscopy is an art which requires much paintaking practises and every ophthalmologist has to lean and make it a daily practice.

(Contd from pg. 406)

In 1867 he became Assistant Professor at the Royal Infirmary in Edinburgh. The peculiar pupils of tabes and general paralysis were first described by Argyll Robertson in two articles he published in 1869.

That the pupils of patients with lues (the older name for syphilis) were small, irregular and did not react to light was already known. However it was Argyll Robertson who described the fact that these same pupils did contract on accommodation.

Argyll Robertson taught ophthalmology at the University of Edinburgh until 1897, when he retired from active hospital service. He was chairman of the Ophthalmologic Society of England and of the Royal College of Surgeons in Edinburgh, besides being honorary eye physician to Queen Victoria and King Edward VII.

Argyll Robertson was a man of broad medical interests and emphasised the role of ophthalmology in a wider medical context. He published observations on the albuminuric retinopathy and at his invitation as president of the Ophthalmological Society, lectured on “The therapeutical contributions of ophthalmology to general medicine.”

Argyll Robertson left no large number of medical publications; according to his obituary he “preferred the tongue to the pen as a medium”. In 1863 he described the clinical effects on the eye from physostigmin - The calabar beam as a new ophthalmic agent, a major contribution to the treatment of glaucoma. He was also the first to describe a trephining method of operation for certain cases of glaucoma.

Besides his professional standing, Argyll Robertson seems to have impressed his contemporaries by his social appearance and party talents. This side of his personality was thus summarized in a biographical note: “His handsome features and his tall, athletic frame made him the cynosure of all female eyes in his youth and in his later years, clad in a grey frock-coat and top hat, his dignified manner combined with his genial old-world courtesy made him conspicuous in any assembly and a magnificent ambassador of Scotland, firmly establishing that country in the social world of ophthalmology. He attributed his good health to golf and considered it the finest recreation in the world. Even though it was recreation, however, he brought to it the same skill he had as a surgical operator, winning the gold medal of the Royal and Ancient Club of St. Andrews five times”.

In 1894 the Calabar connection recurred in that a patient who had lived in Old Calabar for the previous eight years consulted him. She complained of a tickling, irritating sensation under the skin of the eyelids, which she had noticed, was worse in warm surroundings. He observed a worm “moving in a tortuous wriggling manner under the conjunctiva, the surface of which became slightly elevated as it moved along”. He anaesthetized the conjunctiva, incised it and removed the worm intact. It was found to be a filarial loa, which he presumed had got there through bathing in contaminated water. We know now that the vectors are flies and that the adult worms migrate through the subcutaneous tissue causing fugitive “Calabar swellings” and sometimes beneath the conjunctiva — hence the popular name “eye worm”.

Argyll Robertson in 1883 began teaching ophthalmology at the University of Edinburgh, remaining in this office until 1897, when he retired from active hospital service. From 1893 to 1895 he was chairman of the ophthalmologic society of England, 1886 chairman of the Royal College of Surgeons in Edinburgh, honorary eye physician to Queen Victoria and King Edward VII. In 1904, for health reasons, he moved to the Island of Jersey, and in 1908 made a journey to India. He caught a cold in Gondal near Bombay, and died there.
Role of CTR in Cataract Surgery

Dr Anup Chirayath FRCS, Dr Jyothi Anup MS, Dr K Sunderesh MS

A CTR is a device used to stabilize the capsular bag and intraocular lens intraoperatively and postoperatively in cases of zonular weakness or dialysis. Its use was first described by Legler and Witschel in 1993 at the ASCRS meeting at Seattle.

Since then it has grown in popularity and has now become a compulsory accessory in a cataract surgical OT.

Product Description

A CTR is a PMMA filament shaped like an open horse shoe with eyelets at either ends. It comes in different sizes and is used as per the size of the eye. A CTR size is described by two figures. The first figure describes its diameter in the compressed state with the eyelets apposed to each other as it is supposed to lie in the capsular bag and the second figure describes its size in the relaxed state.

Mechanism of action

The CTR due to its inherent spring action exerts a centrifugal force through out the capsular fornices thereby keeping it in a stretched state. In cases of zonular dehiscence the force exerted by the zonular fibres becomes irregular in distribution which ultimately leads to displacement of the bag. This irregular distribution of forces is made uniform by the CTR. This centrifugal force of the CTR also helps to bolster the zonular traction on the capsular fornices which opposes the force of capsular contraction due to capsular fibrous metaplasia. Thereby it also places a role in the prevention of capsular phimosis.

Sizes of CTR

The size of CTR to be used is decided by the size of the eye. One either uses the axial length or the white to white diameter to estimate the size of the capsular bag. The choice of CTRs as per the size of the capsular bag is as tabulated below.

Table 1. Sizing as per corneal white to white diameter

<table>
<thead>
<tr>
<th>Type</th>
<th>Expanded</th>
<th>Compressed</th>
<th>White to White</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>12.3mm</td>
<td>To 10.0mm</td>
<td>&lt; 11mm</td>
</tr>
<tr>
<td>14A</td>
<td>14.5mm</td>
<td>To 12.0mm</td>
<td>&gt; 12.5mm</td>
</tr>
<tr>
<td>14C</td>
<td>13.0mm</td>
<td>To 11.0mm</td>
<td>11–12.5mm</td>
</tr>
</tbody>
</table>

Table 2. Sizing as per axial length of the eye

<table>
<thead>
<tr>
<th>Type</th>
<th>Expanded</th>
<th>Compressed</th>
<th>Axial length</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>12.3mm</td>
<td>To 10.0mm</td>
<td>&lt; 24mm</td>
</tr>
<tr>
<td>14A</td>
<td>14.5mm</td>
<td>To 12.0mm</td>
<td>&gt; 28mm</td>
</tr>
<tr>
<td>14C</td>
<td>13.0mm</td>
<td>To 11.0mm</td>
<td>24-28mm</td>
</tr>
</tbody>
</table>

Cionni’s Ring

This ring is a modification of the CTR. The modified version was described by Roberto Cionni. He had successfully used his version in the surgical
management of subluxated crystalline lenses. This ring in addition has fixation hooks which may be one or two in number. The plane of the fixation hook is such that it lies over the anterior capsular rim on insertion. This facilitates in anchoring it to the sclera in the ciliary sulcus region without compromising on the integrity of the capsular bag. This ring is effective even in very large subluxations upto 6 clock hours. This ring also comes in three types depending upon the location and number of fixation hooks.

**Uses of CTR**

1. It is most commonly used in the intraoperative management of subluxated cataracts which can be either traumatic or degenerative. It is hence useful in subluxated cataracts due to pseudoexfoliation or hypermaturity of the cataract.

2. It is also used in cases of suluxated crystalline lenses as seen in cases of Marfans syndrome, Homocysteinurea. In these cases surgery is indicated whenever the subluxated lens bisects the
pupil leading to large refractive errors, high anisometropia, monocular diplopia and ultimately amblyopia.

It is also useful prophylactically in cases where capsular phimosis is expected to occur post operatively, in cases of high myopia and in post operative intraocular lens displacement as seen whenever soft plate haptic intraocular lenses are used.

**Surgical Technique**

In the pre operative evaluation it is essential to assess the extent of subluxation after a full pupillary dilatation. One should also look for any vitreous prolapse as that may necessitate a modification in the technique. It is important to assess the presence and extent of phacodonesis as this not only gives an indication of the degree of luxation but also the integrity of the residual zonules.

In the surgical technique one should take the standard precautions as in a case of subluxated cataract. This would include making the section in an area about 90° away from the area of zonular dehiscence, keeping the section watertight, starting the capsulorhexis away from the area of zonular dehiscence, doing a good hydrodissection and using retentive viscoelastics in the area of luxation to avoid vitreous prolapse. It is desirable to use low flow and low vacuum settings during phacoemulsification.

The ring can be inserted either before nucleus removal if the cataract is very unstable or after nucleus removal which is the more preferred method. In cases of large luxations, the bag can be stabilised with capsular or iris fixation hooks. The ring can be inserted by the simple threading-in method where one uses two forceps to thread in the CTR into the bag in a clock wise direction and the distal end is finally dialed in with a Sinskey hook.

One can also use an injector called as the Guelder’s injector. In this method the ring is first loaded into the injector which is then simply injected into the bag.

The problems which can be faced while inserting the ring are an inadvertent escape of the ring into the angle sulcus or into the vitreous cavity. It is impossible to retrieve the ring from the sulcus. In such cases it is best to leave it and insert another ring into the bag. Aspirating the cortex also proves to be difficult after insertion of the ring due to entrapment.

**Technique of insertion of a Cionni’s ring**

When inserting this ring one sutures the fixation hook to the sclera in the area of dialysis. This anchoring can be at one site or two depending on the extent of dialysis. One can use a 9-0 prolene suture with a straight needle (STC 6 for example). The method is similar to the suturing of a scleral fixated intraocular lens.

**Conclusion**

The CTR and Cionni’s rings are very simple devices but they have revolutionised the surgery on subluxated cataracts. Earlier on the option was placing the IOL in the bag with the haptic in the area of dialysis in cases of small luxations and intracapsular cataract extraction with anterior chamber IOL placement or scleral fixation of IOL for large luxations. The rate of complications both corneal and retinal are higher in the above mentioned techniques and moreover the incidence of post operative IOL decentrations were higher.
Human beings alone communicate using words. At least I think so. And words, especially when they do not belong to one's mother tongue, can be confusing and erroneous. Oftentimes this happens when laity speaks 'Medicalese' (China - Chinese; Medical - Medicalese). Sometimes, when they confuse medical terms with other similar sounding words, the results can be hilarious. The late Dr. K.S. Subrahmaniam was a past master in spotting these sort of 'bricks' as they can be called. He never used to correct them. "Let other people too have the pleasure of hearing it", he used to say.

I was reminded of this when, yesterday, one medical representative asked: "Doctor, the conjunctivitis epidemic has started subsidising this week, hasn't it?" Well, it definitely had subsidised his company.

Last year a teacher (of mathematics; how apt!) had come to me for a trapezium growing in his eye. And there was one indeed. I did a pterygium excision for him. Another person with the same problem said he had an erection in his eye. At first, I thought he had entered my consultation room mistaking it for that of the Andrologist. He too had his 'erection' removed and a limbal graft put in.

A I R has a morning programme called "Prabhathabheri". Some time back I heard a Naturopath talk on some skin ailment. "Allopathic methods like x-ray and ultraviolation are harmful to skin", she clearly said.

We have all had diabetic patients. Have you ever had one who took Chloroform tablets for that? Well, I have. And then there was one who took Arrowroot tablets for Vit.A supplementation. Yet another has had Criminopharingioma as a child. Umpteen are patients who have had prostrate operations, got transported on structures and have had intravenous trips.

Do not think that we doctors are immune from this sort of thing. I was seeing a patient and wanted to refer her to the Neurologist. Since he was on leave for a week or so I prescribed some placebo for a week and asked him to come again. A week later I was aghast to see that I had prescribed him "Tab. Neurologist 1 -0 -1 X 1 week". I asked him to show the tablets. It was Neurobion.
Techniques to Manage Small Pupil During Phacoemulsification and IOL Implantation

Boris Malyugin MD PhD

In spite of several recent innovations in cataract surgery, patients with small pupils are always challenging. Poor pupil dilation can be observed in cases complicated by pseudoexfoliation syndrome, uveitis, posterior synechiae, trauma or previous intraocular surgery. A significant number of patients who present for phacoemulsification cataract surgery have pupils that do not respond adequately despite several pharmacological attempts with different mydriatic agents. Inadequate pupil dilation can decrease visualization during all stages of the phacoemulsification including capsulorhexis, hydrodissection, lens nucleus fragmentation and IOL insertion. This compromises the surgery and increases the risk for complications.

Pharmacological therapy with the use of nonsteroidal eyedrops or strong mydriatics such as phenylephrine 10% sometimes lead to unwanted ocular and systemic side effects. Intracameral mydriatics is an effective, and safe addition to topical mydriatics in phacoemulsification. In some cases their use can simplify preoperative patients preparation and in certain high-risk groups, may reduce the risk for cardiovascular side effects. Unfortunately, present pharmacological approaches of managing a small pupil during cataract surgery have limitations.

Most surgeons decide to dilate the pupil mechanically at the time of the surgery if pharmacological agents fail. There is no general recommendation or solution to the small pupil problem because the strategies for pupil enlargement greatly depend on surgeon skill and preferences, as well as on intraoperative situation. There are four main dilation methods: the first is the synechiolysis, the second is mechanical stretching, the third is the cutting method and the fourth is the iris retraction. In the first method the surgeon separates the adhesions between the iris, the lens capsule and/or the cornea. The technique of pupillary membranectomy with the forceps presented by R.Osher is also effective in some cases. The second method - mechanical stretching of the pupil was introduced by Miller and Keener. It is usually effective for small pupils with the rigid iris tissue which is usually caused by prior miotic use, pseudoexfoliation, or posterior synechiae. Stretching can be achieved with the spatula, Sinskey hook or special instrument - Beehler pupil dilator. Usually a pair of hooks is introduced through 2 stab incisions in the cornea engage the iris sphincter. After that the hooks are pulled in opposite directions.

This maneuver creates microscopic sphincter tears which enlarge the pupil aperture. The main advantage of this procedure is that it is relatively simple and requires no special instruments.

Mechanical stretching of the pupil usually provides sufficient access to the lens and maintains the pupil diameter intraoperatively. Sometimes iris stretching technique leads to instability of its papillary margin, which can compromise cataract surgery.

In some eyes the stretching technique fails to adequately expand the pupil. The drawback of this technique is that it is creating permanent damage of the iris...
sphincter. The micro tears of the sphincter muscle are usually clinically asymptomatic but sometimes result in bleeding and pigment dispersion postoperatively. In a study of stretch pupilloplasty by Dinsmore, 10% of 50 patients developed an enlarged atonic pupil postoperatively. All patients had a history of injury or inflammatory disease. Partial-thickness iris sphincter cuts made with micro scissors is a common pupil enlargement technique. The cutting method is more controlled but requires multiple maneuvers of the scissors inside the anterior chamber which can result in corneal endothelial damage. The disadvantages are the same as those with the stretching method.

Suboptimal pupil dilation in response to the preoperative mydriatic protocols and minimal efficacy of pupil stretching techniques is a usual indication to the intraoperative use of iris hooks or other mechanical pupil dilation devices. For the iris retraction several devices have been introduced in the clinical practice. The main disadvantages of these devices include the bulkiness and rigidity. They are difficult to insert, remove, and manipulate through a small incision.

Graether developed a pupil expander that according to his data is superior to other methods of pupil enlargement, causing less sphincter trauma and fewer cases of permanent pupil size alteration. Pupil dilation technique with the hydrogel ring reported by Siepser has potential benefits but very limited clinical use. The Perfect Pupil device (Milvella) is a disposable polyurethane ring with the 0.24 mm flanged groove throughout the length of the ring and an integrated arm that allows insertion and removal from the anterior chamber at the end of surgery.

Retracting the iris tissue rather than cutting it as in a classic sector iridectomy is much simpler and results in a much better postoperative pupil appearance. Mackool was the first one who described a 4-point iris retractor configuration for phacoemulsification. He developed metal iris retractors connected to small blocks of titanium. The latter allows for stabilization of the hooks during the retraction of the iris. This method was enhanced with the introduction of the flexible iris retractor by de Juan and Hickingbotham.

Traditionally, 4 evenly spaced retractors are placed through limbal paracentesis 90 degrees apart from one another. The corneal incision is centered on 1 of the 4 sides of the square. Some surgeons use iris retractors in a triangular pattern decreasing the number of additional corneal incisions. The use of the iris hooks may lead to the damage of the pupillary margin intraoperatively producing a semi-mydriatic non-reacting pupil postoperatively.

Modification of the original square retractor configuration is described by Oetting and Omphroy. The rotation of the square improves lens access in clear corneal phacoemulsification by orienting the phacoemulsification needle along the diagonal. This was called by Dupps and Oetting “diamond configuration” of retractors. Advantages of this technique include ease of conversion from phacoemulsification, optimal orientation of the maximum pupil diameter, nucleus expression or intracapsular lens removal, and conservation of iris tissue.

Birhall assessed the effect on pupil shape and circumference of various flexible iris hook positions. He confirmed that malpositioned iris hooks may increase pupil stretching with possible deleterious effects on postoperative pupil function. He recommends using additional fifth hook to create a pentagonal pupil that reduces pupil stretching by 17%.

Masket and Yuguchi and coauthors recommend the pupil not be stretched by the hooks to larger than a 5.0 mm square because overstretching produces irregular atonic pupils postoperatively. Novak suggests the use of hooks with rigid pupils smaller than 3.0 mm (4.0 mm with a hard nucleus) and smaller than 4.0 to 5.0 mm for an inexperienced surgeon. In extremely small and rigid pupils he prefers combining the use of hooks with a radial sphincterotomy.

During engagement of the pupillary edge with the iris hook, it may catch and damage the capsule, leading to an anterior capsule tear that may extend to the periphery. To avoid this problem, a drop of viscoelastic material should be injected between the iris and the capsule before the hook is inserted. The other useful technique is to keep the hook parallel to the iris plane during the insertion and to tilt it slightly posterior right near the pupillary edge to engage the iris plane. The iris hooks may become loosened during surgery. Their tips may become dislocated, no longer holding the pupillary edge. This can cause some problems including iris...
aspiration and chafing from contact with the phacoemulsification needle.

Small degrees of pupil dysfunction are common place after cataract surgery with and without iris manipulation but usually this causes no subjective symptoms. Halpern and coauthors\textsuperscript{22} found an incidence of postoperative atonic pupil of 1.1 \% after phacoemulsification, with pupil diameters ranging from 6.0 to 8.0 mm. Most of the surgical maneuvers for enlarging the pupil and preventing its intraoperative constriction are not safe enough. They can lead to an increased risk of iris sphincter tear, bleeding, iris damage, posterior capsule tears, and loss of the vitreous body.

The postoperative complications can include an atonic pupil of irregular shape with poor cosmetic result, and photophobia. The rate of occurrence of iris prolapse has been reported between 0.3 \% and 1 \% in complicated cataract cases\textsuperscript{23}. Allan\textsuperscript{24} described one of the critical factors of iris prolapse during phaco which relates to fluid velocity. Allan’s model considers the Bernoulli principle as the most important, because when the velocity of fluid passing through the anterior chamber increases, the force exerted on the iris increases by the square of the velocity. The pupil often dilates poorly in atrophic irises, with significantly decreased iris tone unable to withstand the fluidic currents in the anterior chamber and maintain the correct position of the iris. These calculations give us some conclusions. In small pupil, iris tissue is located closer to the zone of the high fluidic currents. Hence it is more likely to be aspirated into the US or I/A handpiece. Decreasing of flow parameters is an important factor in preventing iris damage during phacoemulsification. Central positioning and minimal movements of the handpiece are also important to prevent iris damage. Endocapsular lens nucleus fragmentation is much safer because the areas of the highest fluidics currents are located inside the capsular bag away from the corneal endothelium and iris. Chang and Campbell\textsuperscript{25} recently described the intraoperative floppy-iris syndrome (IFIS) associated with systemic administration of the $\alpha$-1A antagonist tamsulosin (Flomax). The intraoperative diagnostic triad of this symptom is fluttering and billowing of the iris stroma, a tendency for the iris to prolapse through the main and/or side-port incisions, and progressive constriction of the pupil during surgery. Stretching of the pupil is ineffective in IFIS because the iris pupil margin remain elastic and the pupil immediately snaps back to its original size following attempts at stretching it.

Viscomydriasis with high viscosity OVDs such as Healon5 are very useful in small pupil phaco cases. S. Arshinoff\textsuperscript{26} described a technique using ophthalmic viscosurgical devices to perform cataract surgery in patients taking tamsulosin. This method uses a combination of the two OVDs. The lower-viscosity dispersive OVD which is highly retentive despite the presence of moderate fluid turbulence, is injected in the periphery of the anterior chamber and covers the endothelial layer and the iris. The viscoadaptive central layer of Healon5, according to S. Arshinoff adds a relatively rigid OVD roof above the surgical space and adds rigidity to the OVD structure to keep the iris from moving and the Viscoat in place. The BSS layer just over the pupillary space and below the viscoadaptive central layer provides working space for the phaco tip. The surgeon is working in the endocapsular space and Healon 5 is not attracted into the phaco tip and the OVD shell structure remains intact throughout the case. This technique gives satisfactory iris stability and permits uneventful surgery.

Cataract surgery in cases of iridoschisis may result in aspiration of iris fibers flowing in the anterior chamber\textsuperscript{5,11}. In these cases, stretching the iris with various instruments or dilating the pupil with iris retractors may not prevent the danger of contact of the phacotip with the iris tissue and aspiration of fibers. Intraoperative iris manipulations may lead to severe postoperative fibrinoid reaction especially in eyes with pseudoexfoliation syndrome, chronic uveitis, glaucoma or diabetes. That is why cataract surgery in the presence of a small pupil remains one of the most difficult and challenging cases.

**Malyugin Ring for Small Pupil Phaco**

To enhance phaco surgery in complicated small-pupil cases we have designed a new device. It is used in cases of pupil miosis refractory to dilation protocols. The device is a square shaped, transitory implant with four circular loops which holds the iris at equidistant points.
It has one-piece design with the curls at each angle of the ring that provides balanced stretching and gentle holding of the iris tissue (Figures 1, 2).

The insertion of the Malyugin ring is carried out through the main incision with injector. The pupil expander is positioned centrally and gently pushed at each angle with the help of a Sinskey hook to trap the iris in the four curls. Once in place, the ring expands the pupillary opening to 6.0 mm. The ring provides stable mydriasis with no trauma to the iris tissue and no need for additional paracenteses. It retracts the iris away from the flow currents and thus helps to prevent its incarceration into the US and I/A hand pieces. As a result of the ring implantation, we obtain a square, 6 mm pupil dilation that allows for safe and comfortable manoeuvres during phacoemulsification.

The ring is usually inserted at the beginning of the phaco procedure through an unenlarged 2.2-2.8 mm clear corneal incision into the pupillary aperture. The surgeon can control the iris without significant changes of his accustomed technique.

Capsulorhexis, hydrodissection, phacoemulsiication, and injection of the intraocular lens are performed through the expanded pupil with the device in place. In case of necessity, the ring can be inserted at any stage of the operation.

Cadaver eye study using scanning electronic microscopy showed how much less damage to the pigmented iris tissue was caused by this new instrument than by conventional iris retractors (Figures 3).

**Surgical Technique**

Topical anesthesia is applied using 2% Xylocaine, and paracentesis is done at 12 o’clock. Temporal clear corneal incision is performed using the disposable metal blade. A dispersive ophthalmic viscosurgical device (OVD) is injected in the anterior chamber to stabilize it and protect the corneal endothelium. The ring is introduced into the anterior chamber through the clear corneal phaco incision using a special inserter (Figure 4). The device is placed in the anterior chamber and the
distal scroll engages the iris margin opposite to the incision. The rest of the scroll is then attached to the pupillary margin in a circular manner with a hook, resulting in a pupillary opening approximately 6.0 mm wide (Figure 5). Capsulorhexis is performed using forceps or a bent needle.

Hydrodissection and hydrodelineation are performed with Balanced salt solution until the nucleus can be rotated freely inside the capsular bag (Figure 6). Phacoemulsification is done with the phaco machine using a modified quick-chop technique (Microflow or Kelman US needle; dual linear foot pedal control, 30-35 % of linear US power; 80-100 pps, duty cycle 50 %; vacuum settings at 350 mm Hg; bottle height 95 cm). A deep but short central trench is made in hard nucleus cases. The step-by-step chop in situ and lateral separation technique allows nucleus division with minimal stress on the capsular bag (Figure 7).

Coaxial or bimanual irrigation/aspiration is used to clean residual cortical fibers from the capsular bag (Figure 8). The capsular bag is then filled with the cohesive OVD. In case of necessity posterior capsulorhexis is performed. Foldable intraocular lens (IOL) is inserted with the help of injector (Figure 9).

Then the ring is retracted from the anterior chamber through the clear corneal incision with the same injector device (Figure 10, 11). Aspiration is performed to remove the residual OVD. After viscoelastic removal, clear corneal incision is hydrated with balanced salt solution. At the completion of the case, the pupil constricts spontaneously (Figure 12).

On the first postoperative day, the operated eye usually present with few cells and mild flare in the anterior chamber. The pupillary margin was minimally disturbed or undamaged and the IOL well centered.

We usually treat patients with small pupils after the surgery more aggressively than uncomplicated patients with topical steroids, cycloplegics, and sometimes systemic steroids. Patients receive local antibiotic and steroid treatment for 4-6 weeks.

**Conclusion**

Adequate transpupillary access to the lens is essential for the success of phaco procedures especially in cases with zonular weakness and capsular inadequacy. We believe that our iris retraction technique with the Malyugin Ring has several advantages.

First, the ring is as effective as the other conventional iris hooks. However, compared to other long-in-use iris retractors, it has the advantage of being friendlier with the eye, due to the well-distributed stretching and gentle holding of the delicate iris tissue, and to the easier and less traumatic implantation. It has no sharp or pointed endings that can damage the eye.

Second, equidistant position of the loops that holds the iris tissue ensure correct position of the iris and prevents the effect of overstretching of the pupil observed in incorrect iris hooks position.

Third, the device applies pressure to the sphincter muscle over an area which is wider than in cases of iris hooks. It is particularly useful in patients in which cutting or tearing of the iris tissue should be avoided, especially in the presence of rubeosis, chronic anterior uveitis, or systemic coagulopathy. Iris rim is safely fixed in the loops of the ring and there is no risk of the iris aspiration during phacoemulsification.

Fourth, the ring does not require additional incisions. This instrument is inserted through the one main incision, thus reducing surgical trauma and minimizing the risk of contamination and postoperative inflammatory reaction. In the technique, when the square pupil is formed by the conventional iris retractors the iris can prolapse through the wound. This is particularly true in patients with relatively wide paracenteses and atonic and atrophic irises that seem particularly floppy.

Fifth, ring provides sufficient room for nucleus fragmentation and removal. The device configuration allows the surgeon to work in the deep lens layers below the iris plane and the square shaped pupil formed by the ring. This provides enough space for grooving and cutting the nucleus and increased peripheral visualization during the chopping phase of the procedure.

Sixth, the ring is inserted and removed from the eye with a help of injector thus reducing the risk of contamination and disturbance of the incision architecture and wound integrity.

In summary, different techniques of nucleus disassembly in small-incision cataract surgery require wide and unobstructed view of the anterior portion of the lens as well as the instruments inserted in the anterior
chamber. The other important factor is sufficient manipulability of the instruments which is critical for the successful completion the surgery. A pupil that fails to dilate makes cataract removal more difficult with added risk. The new ring adequately dilates the pupil and prevents iris sphincter damage. It is easy to insert and remove. The ring expands the pupil to 6.0 mm, protects the iris sphincter during surgery, and allows the pupil to return to its normal shape, size, and function after the operation.

Iris ring is an important tool in phacoemulsification surgery. Careful intraoperative manipulation and insertion of the ring with liberal use of OVD can help prevent complications. After the surgery most of our patients had pupils almost indistinguishable from the appearance before surgery with the preserved functional activity. We consider the new device among the most effective methods to increase the size of even very rigid small pupils during phacoemulsification surgery. The use of this method is highly recommended, as it is likely to reduce postoperative abnormalities in pupil size and function.

References
Surface Ablation - Epilasik

Dr. D. Ramamurthy

Corneal refractive surgery has evolved through the last couple of decades. The radial keratotomy introduced by Fyodorov in 1980’s followed by 1990’s era of photorefractive keratotomy had their period of glory. However inconsistency in the predicted outcome, the discomfort in PRK, the regression which followed were the limiting features.

The need of the hour was a constant, predictable visual outcome and Lasik emerged a winner in late 1990’s with safety and reproducibility. With improved understanding of the bugbears inherent in lasik over the ensuing years, the occurrence of microkeratome induced complications, the rare occurrence of DLK and the growing awareness of probable ectasia, a rejuvenation of surface ablations occurred. This was also the period of growing awareness of the wound remodeling and the corneal biomechanical response.

Resurfacing of surface ablations was initiated by the Lasek procedure with alcohol induced separation of the basement membrane of the cornea. This was followed upon by a more refined Epilasik procedure described by Pallikaris in 2003.

The reasons for resurgence of surface ablations are
1. Conservation of corneal tissue by creating thinner flaps of 45 to 60μ thickness depending on the thickness of the epithelium in that individual.
2. Feasability to plan larger optic zones corresponding to the mesopic pupil measurement.
3. The earlier broad beam lasers and central island formation which brought disrepute to PRK gave way to sophisticated laser ablation profiles with distinctively improved visual outcome for surface treatment.
4. Thinner corneas, steep K’s with expectant microkeratome complications were more ideal for surface ablations.
5. Post flap complications with lasik could undergo enhancements with surface treatments with improved safety profile.
6. Wavefront ablations were found to perform better with surface ablations through various studies conducted and the corneal biomechanical response was more predictable in surface procedures.
7. Contrast sensitivity recovered faster than in lasik. Recovery from dry eye status was again speedier. ¹

Histological Findings

Transmission electron microscopy of the harvested epithelial sheets showed minimal evidence of trauma in the basal epithelial cells. The intracellular organelles and intercellular desmosomal connections as well as the hemi desmosomal connections with the basement membrane appeared closer to normal with only focal disruptions. ²

Alcohol assisted epithelial separations take place within the basement membrane affecting its integrity. The intact basement membrane has been found to be important to control the fibrotic activation of keratocytes and faster epithelial wound healing. To this end, Epilasik with the clean cleavage at the level of basement membrane faired better over Lasek.
Principle of Epilasik

A blunt epikerotome moves on the eye providing a clean cleavage between the basement membrane and Bowman’s layer, lifting an epithelial sheet of 50 - 60μ followed by surface laser ablation requisite for the refractive error. (Fig: 1)

Procedure

Icepacks need to be placed on either eye for 15 minutes prior to the procedure. This preoperative step contributes significantly in lessening the pain component following the surgery. The operative eye is prepared with three drops of topical proparcaine hydrochloride (applied every 5 minutes before the procedure) and povidone iodine and is covered with a sterile drape.

The epikeratome unit needs to be checked for all its parameters including vacuum build up and a trial run prior to the procedure. The cornea could be marked with the usual markers as in all corneal refractive procedures for a proper flap alignment.

Different epikeratomes are presently available in the market. The popular epikeratomes are the Amadeus, Moria, Centurion and Nidek. (Fig: 2)

The Amadeus epikeratome allows a consistent flap diameter of 9.0mm, variable hinge width of 1.0, 1.1
The epikeratomes include a blunt plastic separator (Fig:3) instead of the blade in the lasik microkeratome which have different angles of entry and slide along a path of least resistance.

A speculum is placed on the eye and copiously irrigated with chilled BSS or saline. Anesthetic drops are reapplied. The epikeratome assembly is placed on the eye and the vacuum built up. Following adequate vacuum build up signal & cross check with applanation tonometer, the epikeratome is run on its track by...
pressing on the foot pedal. The assistant should continuously irrigate with chilled BSS throughout the forward and reverse run. (Fig:4) This crucial measure significantly alleviates pain in the post operative period. The microkeratome pushes the thin epithelial sheet creating a nasal hinged flap. The epikeratome is lifted off the eye and the thin flap gently nugged to the periphery. (Fig:5) The laser parameters fed in the laser machine for the requisite correction is activated, the usual precautions for centered treatment applied and the surface ablation is performed.

After laser ablation, mitomycin C at 0.02% concentration is applied with a merocoel sponge for a duration of 12 sec. (Fig: 6) The concentration of 0.02% is arrived by a simple dilution measure. 2 mg of mitomycin is mixed with 5 ml of sterile water. 2.5 ml of this reconstituted mixture is discarded. The remaining 2.5 ml is further diluted with 2.5 ml of sterile water. From this final reconstituted 5 ml solution, 1 ml is taken in a syringe to wet the merocoel which is placed on the stromal bed.

Different exposure times is suggested by different surgeons but a larger consensus favors 0.02% mitomycin concentration. Application of mitomycin has been accepted to significantly retard the cytokine induced inflammatory cascade in the tear film. The exposed surface is then copiously washed to remove any remnant of mitomycin. A blunt cannula is then used to gently reposit the thin rolled up epithelial flap opposed to the nasal hinge. The epithelium is found to extend beyond the epithelial gutter because of the mechanical stretch induced by the cut. The periphery of the flap should be stroked smoothly to remove all the folds. The epithelial flap should be given adequate time to settle on the underlying stroma. A bandage contact lens (preferably 8.6 – 8.7 mm diameter) is gently placed on the eye & again given sufficient time to settle on the flap gently nudging the air bubble away under the BCL. (Fig:7) The speculum is removed once the flap integrity is checked and BCL is left in place.

**Intraoperative course**

The sequence of events may not be smooth in all situations. The flap may get torn or a buttonhole may present. Attempts to salvage the flap, if failed, allows removal of the flap in toto and gently scraping any epithelial tags. (Fig:8) Removal of this thin flap is no quandary as in a Lasik flap. Surgeons at different centres have studied the results with and without the flap and the final visual outcome is comparable. Rarely, a stromal incursion could occur (as low as 1% incidence) because of high vacuum and the procedure needs to be aborted.

**Post Operative Treatment**

The presence of the epithelial flap itself is understood to act as a bandage contact lens preventing the marked inflammatory cascade of cytokine production. However the epithelium tends to die out with the new epithelium migrating in from the periphery replacing the separated epithelial sheet. (Fig:9) Significant epithelial haze is seen in the first 3 days till a newly synthesized transparent epithelial sheet is laid down. The time of epithelial healing ranges from 3 to 5 days.

The patient is started off on a postoperative regime of frequent topical steroids coupled with fourth generation floroquinolones for the first couple of weeks. The topical steroids are gradually tapered off over the 6 weeks. Presence of a mild sub epithelial haze may warrant continuation of steroid drops upto 3 months with complete clearing of the haze. Artificial tear substitutes are maintained for 6 weeks or longer. The bandage contact lens is removed after 5 days by which time the epithelial healing is complete. Mild analgesics are indicated for 3-5 days. Different studies favor the usage of vitamin c (500 mg – BD dosage) over the 6 weeks period.

**Clinical deductions**

The present generations of epikeratomes are very safe involving intact epithelial flaps. The 60μ thin flap expand the range of correction leaving significant residual stromal bed. However, as of, now, mild to moderate myopes do perform favourably with epi procedures. ³ The visual outcome is comparable to Lasik after the initial 5 days. The wow effect of Lasik, however, is missing. The superficial lamellar fibres show a more predictable biomechanical response then in the thicker flaps. Wavefront ablation performs better as the flap induced aberrations of a thick Lasik flap are obviated. The initial corneal thickness of 480 – 500 μ and the residual bed of 300 + μ is a safe limit as of today.
Conclusion

The armamentarium of refractive surgery, at the present day scenario, provides varying options for differing corneal parameters. The final onus falls on the surgeon to analyse the present criteria and adopt a rational approach providing the requisite customized treatment with optimal visual outcome. The future awaits for a customized biomechanical wound response to be tailored to our treatment strategy.¹

References

3. Epilasik: Preliminary Clinical results of an alternative surface ablation procedure. Pallikaris IG etal JCRS – 2005 May; 31(5) 879-85
Retinopathy of Prematurity: Screening and Management

Dr. Meena Chakrabarti MS DO DNB, Dr. Valsa Stephen MS DO DNB, Dr. Sonai Rani John DNB, Dr. Arup Chakrabarti MS

Retinopathy of Prematurity (ROP) is a disease affecting the retina of premature infants. It was first identified by Terry in 1942 who termed it Retrolental Fibroplasia. The term ROP was coined by Heath in 1951. The incrimination of oxygen as the principal factor in the aetiopathogenesis of ROP occurred in the '50s. In 1951 Campbell suggested that the toxic effects of uncontrolled oxygen administration was responsible for ROP and advocated that, the use of oxygen be restricted to only cyanosed new borns. Subsequent studies showed that high levels of oxygen obliterated the retinal blood vessels of the neonatal retina. Although controlled use of oxygen lowered the rate of blindness, it led to an increased rate of neonatal deaths due to complications of Hyaline membrane disease such as atelectasis and respiratory distress syndrome.

During the late 1970’s and 1980’s; resurgence of ROP (due to an increased survival of low birth weight premature infants) was noted and was termed the second epidemic of ROP. In 1983, International Classification of ROP was formulated under the leadership of John Flynn and several treatment modalities like cryotherapy and laser to the avascular retina were found to be effective.

In India due to a markedly lopsided distribution of health care and almost negligible availability of neonatal primary health care centres as well as the existence of the state-of-the-art tertiary referral neonatal nurseries, the incidence, severity and progression to threshold ROP is progressively increasing.

The global estimate of children with severe visual impairment and blindness in the world is 1.5 million of which 1 million live in the Asian Continent. 50% to 70% of the blindness in children are either preventable or definitely curable. Out of the estimated population in India (1.02 Billion in 2001 Census), nearly 300,000 children are blind or have severe visual impairment. Based on data from blind school studies conducted by the World Bank, the common causes of childhood blindness in a descending order of precedence includes corneal scars; congenital anomalies, retinal dystrophies, cataract and infantile glaucomas. 22% of all blind children have retinal causes and ROP ranks high in this group.

Aetiopathogenesis of ROP

Normal Retinal Vascular Development: The immature retina has two blood supplies: the outer choroidal and inner retinal vessels. Upto the 16th week of gestation, the inner retina remains avascular while the choroidal vessels nourish the outer retina. After 16 weeks of gestation, the first blood supply to the inner retina in the form of mesenchymal ‘spindle cells’ arise from the adventitia of the hyaloid artery and migrate from the optic disc to the ora serrata in the form of a circumferential apron at the rate of 0.1 mm/day. It leaves behind solid chords that canalize and form mature vessels. It reaches the nasal ora serrata by the 7th or 8th month and the temporal ora being farther away, by the 9th month or at birth.

The classical theory by Ashton and Patz on the
pathogenesis of ROP implicates supplemental oxygen administration as the main causative factor. Elevated arterial PO\(_2\) causes retinal vasoconstriction leading to vascular closure and if the vasoconstriction is sustained, subsequent permanent vascular occlusion occurs. Endothelial cell proliferation adjacent to closed capillaries occur when the neonate returns to room air leading to neovascularisation, vitreous haemorrhage, retinal traction and retinal detachment\(^2\)\(^-\)\(^4\)\(^1\).

Spindle Cell Theory of Kretzer: proposed the concept that neovascularisation occurs by spindle cell insult. The spindle cells of the peripheral avascular retina of the premature infant is exposed to the hyperoxic environment due to increased oxygen diffusion from choroidal vasculature. Free oxygen radicals attack compromised spindle cells which have deficient antioxidative mechanisms leading to an abrupt stoppage of spindle cell migration and subsequent canalization\(^1\)\(^1\).

**Role of Growth factor in ROP**

Vascular Endothelial Growth Factor plays a vital role in the normal development of retinal vasculature. Normally the VEGF produced in the avascular anterior retina is sufficient for vascularisation of peripheral retina. If the avascular zone is larger, and when exposed to hyperoxic environment, VEGF expression is decreased leading to vaso obliteration. The resultant hypoxia and ischaemia in the nonperfused areas stimulates VEGF production resulting in neovascularisation\(^2\)\(^3\).

**International ROP Classification**\(^8\)

The retina of the premature neonate is divided into 3 zones to assess the severity of the disease.

**Zone I**: (Posterior pole or Inner Zone) : The limits of zone I are defined as twice the disc fovea distance in all directions from the optic disc.

**Zone II**: Extends from the edge of zone I peripherally to a point longitudinal to the nasal ora serrata.

**Zone III**: Is the residual temporal crescent of retina anterior to zone II (Fig. 1a).

The extent of the disease is coded \(^1\)\(^2\) by the number of clock hours of the peripheral retina with ROP and is described as contiguous or noncontiguous clock hours of involvement (Fig. 1 b).

**ICROP STAGING:**

**ROP STAGE DESCRIPTION**

Stage 1 Demarcation Line

Stage 2 Ridge

Stage 3 (Mild, moderate, Severe) Ridge with extra retinal fibrovascular proliferation.

Stage 4 Subtotal retinal Detachment

4a Not involving macula

4b Involving Macula

Stage 5 Total Retinal Detachment

Other Terminologies Commonly Used in ROP:

- Rush Disease
- Threshold ROP
- Pre Plus Disease
- Plus Disease
- Pre Threshold ROP
- Aggressive Posterior ROP
IC ROP Classification

STAGE 1 (Demarcation Line)

Demarcation line is a thin definite line that separates the avascular retina from the vascular retina posteriorly. Abnormal branching arcades are usually seen leading up to the flat demarcation line which is white in colour and lies within the plane of the retina.

STAGE 2 (Ridge):

The demarcation line of Stage 1 acquires height, width and volume and projects from the plane of the retina as a white/pink coloured ridge (Fig. 2b)

Stage 3: Ridge with extraretinal fibrovascular proliferation.(Fig. 2c)

Stage 4: Is characterised by the presence of subtotal retinal detachment caused by an exudative effusion of fluid, tractional element or both. Stage 4 a: subtotal RD not involving macula and Stage 4 b when the subtotal RD involves the macula (Fig. 2d and 2e)

Stage 5: Total tractional funnel shaped RD of one of the 4 different configurations

a. Anterior Open, Posterior Open (Fig 2f:i)
b. Anterior Open, Posterior Narrow (Fig 2f:ii)
c. Anterior Narrow Posterior open (Fig 2f:iii)
d. Anterior Narrow posterior narrow (Fig 2f, iv)

Fig. 2. a. Stage I: Demarcation Line
Fig. 2. b. Stage II: Ridge
Fig. 2. c. Stage III: Ridge with extraretinal proliferation
Fig. 2. d & e: Demonstrates subtotal retinal detachment caused by exudative effusion of fluid tractional element or both.

Rush Disease

Is characterized by engorgement of the posterior pole vessels whose most anterior border of the apron is still with in the posterior zone and the zone of avascular anterior retina is very broad. This term refers to the tempo of progression of ROP from Stage I to V which occurs usually within 2 weeks time. This is a zone 1 disease with extensive plus disease.

Plus Disease:

Schaeffer, Quinn & Johnson recognized certain features that were related to the severity of the disease and used the terminology – ‘Plus Disease’.

The features of ‘PLUS DISEASE’ are (Fig. 3a)

1. Dilated Tortuous Vessels of Posterior Pole
2. Dilated Iris Vessels.
3. Vitreous Haze
4. Pupillary Rigidity
**ETROP study subclassification (Early Treatment ROP)**

Type I ROP:
a. Zone I, ROP Any stage ROP with Plus Disease.
b. Zone I, Stage 3 ROP without plus.
c. Zone 2, Stage 2 or 3 ROP with Plus Disease.
Type I ROP requires immediate retinal ablation.

Type II ROP:
a. Zone I Stage 1 or 2 ROP without Plus Disease.
b. Zone 2 Stage 3 ROP without Plus Disease.
These eyes are considered for treatment only if they progress to type I or Threshold ROP.

**Threshold ROP:** Is characterized by Zone I or II stage 3 plus disease with 5 contiguous or 8 noncontiguous clock hours of involvement.

This is the stage at which treatment is mandatory since the chances of progression to retinal detachment is 50% if left untreated.

The ICROP classification was modified by paediatric ophthalmologists and retinal specialists to include (1) a virulent form of retinopathy that afflicted the tiniest of babies (aggressive posterior ROP) (2) Description of an intermediate level of plus disease (Pre-plus) insufficient for diagnosis of ‘Plus’ but demonstrates more arterial tortuosity and venous dilatation than normal and may later progress to ‘Plus’ disease.

**Risk Factor for the Development of ROP:**

I. Definite and Well Accepted Risk factors:
1. Prematurity/ Gestational Age/Birth Weight
2. Oxygen Supplementation.

II. Associated Risk Factors:
1. Light
2. Vit E Deficiency
3. Apnea with gas mask ventilation.
4. Respiratory distress syndrome.
5. Shock
6. Sepsis
7. Acidosis/Alkalosis
8. Blood Transfusions
10. Chronic in utero Hypoxia.

Based on well established risk factors like low birth weight, and low gestational age, a cumulative factor score can be considered to estimate the risk of developing ROP.

<table>
<thead>
<tr>
<th>Low Birth Weight</th>
<th>Risk Factor Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥ 1600 Gms</td>
<td>0</td>
</tr>
<tr>
<td>&lt; 1600-1200gm</td>
<td>1</td>
</tr>
<tr>
<td>&lt; 1200-800gm</td>
<td>2</td>
</tr>
<tr>
<td>&lt; 800gm</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Low Gestational Age</th>
<th>Risk Factor Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥ 36 wks</td>
<td>0</td>
</tr>
<tr>
<td>&lt; 36-32wks</td>
<td>1</td>
</tr>
<tr>
<td>&lt; 32-28wks</td>
<td>2</td>
</tr>
<tr>
<td>&lt; 28 wks</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Bw+Ga</th>
<th>Cumulative Risk Factor Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>0+0</td>
<td>0</td>
</tr>
<tr>
<td>0+1</td>
<td>1</td>
</tr>
<tr>
<td>0+2</td>
<td>2</td>
</tr>
<tr>
<td>0+3</td>
<td>3</td>
</tr>
<tr>
<td>1+2</td>
<td>1 to 2</td>
</tr>
<tr>
<td>2+3</td>
<td>2 to 3</td>
</tr>
</tbody>
</table>

**Birth Weight & Gestational Age:**
- = 28 wks + = 800gm - High Risk (Zone I ROP) 90%
- = 32 wks + = 1000gm - Moderate Risk 60%
- = 32 wks + = 1200gm - Low Risk 30%
- = 32 wks + = 1500gm - Low Risk 10%

**Fig. 3.** a. Plus disease showing dilated tortuous vessels at the posterior pole
Incidence of ROP: A review of literature reveals that the incidence and severity of ROP increases with decreasing birth weight and gestational age. Reports from India quote an incidence as high as 38% for a weight ≤ 1500gm.

<table>
<thead>
<tr>
<th>Author</th>
<th>Year of Study</th>
<th>Rop Incidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Azad et al</td>
<td>1999</td>
<td>2.3% (&lt; 1600gm)</td>
</tr>
<tr>
<td>Bassi et al</td>
<td>1998</td>
<td>3.35% (Very Premature)</td>
</tr>
<tr>
<td>Phelp DL et al</td>
<td>1992</td>
<td>2.4% (&lt;1 Kg)</td>
</tr>
</tbody>
</table>

Screening: The aim of screening premature neonates is to detect and treat Threshold ROP.

When to Screen: General guidelines on when and whom to screen are as follows.
1. Screen all babies ≤ 1500gm birth weight.
2. All babies ≤ 34 weeks gestational age.
3. Premies with oxygen administration ≥ 30 days.
4. All sickly survivors with stormy perinatal period.

Time of Screening: Ideal time for screening is at 31 weeks post conceptional age or 4 weeks chronological age whichever is earlier. The follow up schedule depends on the intra ocular finding.

<table>
<thead>
<tr>
<th>F/U Schedule</th>
<th>Stage of ROP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Every 2 weeks</td>
<td>No ROP</td>
</tr>
<tr>
<td>Weekly</td>
<td>ROP</td>
</tr>
<tr>
<td>Daily</td>
<td>Pre threshold ROP</td>
</tr>
</tbody>
</table>

The end point of screening is the development of intraretinal vascularisation or when the postconceptional age is 45 weeks. Further focus is on the visual rehabilitation. If threshold ROP is detected, peripheral cryo or laser ablation of the avascular retina anterior to the ridge is performed.

Immature Peripheral Retina

Signifies that though there is no ROP, the retinal vasculature has not developed and are short of 1DD from the nasal or temporal ora serrata. Thus the immature vessels could terminate in zone I, II, III and are designated accordingly as immature I, II, III. Regular follow-up till complete vascularisation occurs by 40-45 weeks is necessary.

Mature: Signifies that the vessels have now reached at nasal and temporal ora serrata. The child with mature...
periphery does not require further follow-up.

**ROP:** Zone or Stage or presence or absence of Plus Disease is to be noted.

**Treatment of Prethreshold & Threshold ROP:**
Treatment of the avascular peripheral retina is done either by laser ablation or cryo. This causes reduced vascularity and hence poor visual and structural outcomes.

The following table compares laser\textsuperscript{15,16} and cryo ablation of peripheral avascular retina.

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Criteria</th>
<th>Cryo</th>
<th>Laser</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Efficacy of treating ROP</td>
<td>Well</td>
<td>Now well proven</td>
</tr>
<tr>
<td>2</td>
<td>Cost</td>
<td>Low</td>
<td>Higher</td>
</tr>
<tr>
<td>3</td>
<td>Availability &amp; Usage</td>
<td>Easy</td>
<td>Less Available</td>
</tr>
<tr>
<td>4</td>
<td>Bradycardia</td>
<td>++++</td>
<td>+</td>
</tr>
<tr>
<td>5</td>
<td>Pain</td>
<td>++++</td>
<td>=</td>
</tr>
<tr>
<td>6</td>
<td>Anaesthesia</td>
<td>GA</td>
<td>LA</td>
</tr>
<tr>
<td>7</td>
<td>Ease of reaching posteriorly</td>
<td>Difficult in zone 1 and post zone 4</td>
<td>Easy</td>
</tr>
<tr>
<td>8</td>
<td>Small pupil/ Tunic vasculosa Lentis</td>
<td>Possible</td>
<td>Difficult</td>
</tr>
<tr>
<td>9</td>
<td>Cataract/Iris damage during procedure</td>
<td>None</td>
<td>Possible</td>
</tr>
<tr>
<td>10</td>
<td>Post Operative swelling of lids and chemosis</td>
<td>++++</td>
<td>-</td>
</tr>
<tr>
<td>11</td>
<td>Exudative RD</td>
<td>Possible with heavy treatment</td>
<td>Rare</td>
</tr>
</tbody>
</table>

The Cryo-ROP Trial randomised infants with Threshold ROP to receive cryo ablation of peripheral retina or observation alone. In the final analysis performed after the study period of 10 years; a visual acuity of = 20/200 was observed in 44.4 % of the cryo treated eyes versus 62.6 % in patients who were randomised to observation. Analysis of structural outcomes showed that 27.2 % of cryo treated eyes had unfavorable structural outcomes in comparison to 47.9 % of eyes randomised to observation.

**Peripheral Retinal Laser Ablation:** Is performed either through Tranpupillary or as Transscleral delivery. The laser settings are 200mw, 100ms, 200 burns which are grey or grey white confluent lesions. Avoid ‘Skip areas’ which have to be identified and retreated. Laser ablation is associated with complications like iris burn or atrophy, posterior synechiae, transient or permanent cataract, acute focal choroidal haemorrhage, delayed exudative choroidal detachment and vitreous haemorrhage\textsuperscript{15,16,17,22}. (Fig. 5 a&b)

The retinal structural outcomes of peripheral retinal ablation are

1. **Favourable Outcomes**
   Essentially normal posterior pole.
   Macular Ectopia
   Stage 4 a: Partial RD, Schisis, Fold.

2. **Unfavourable Outcomes**
   Stage 4 b: Partial RD Foveal involvement.
   Stage 5 ROP
   Cataract/ Corneal Opacity.

Sequela of Regressed ROP\textsuperscript{21}:

1. **Refractive Errors:** The incidence of refractive errors especially myopia is seen to be higher in premature neonates with very low birth weight and severe ROP. Some studies have established a correlation between the use of cryotherapy for threshold ROP and the degree of myopia. Astigmatism and anisometropia are seen to be present in 17-20 % of premature infants.

2. **Strabismus & motility defects:**

3. **Changes in Ocular Dimensions**
   - Tendency for longer axial length
   - Increased Corneal Curvature.
   - Microcornea.
   - Increased lens thickness and predisposition to angle closure glaucoma.

4. **Cataract**
5. **Anterior Segment Changes**\textsuperscript{25}: Pupillary rigidity, Ectropion Uveae, Iris Neovascularisation.
6. **Posterior Segment changes:** Macular heterotopia, disc drag, traction bands, folds, schisis etc.

**Management of Advanced ROP:**

The surgical goals while planning surgical intervention must be clearly discussed with the parents. The goals that are aimed at following surgical intervention are

- Preservation of formed vision.
- Preservation of light projection in difficult fields and in difficult illumination.

It must also be explained clearly that maximum visual recovery may be delayed by several years.

**Timing of Surgery**

The ideal time to perform surgery is when the child exhibits features of progressive stage IV ROP and there is

1. > 6 clock Hours Ridge Extension.
2. > 2 Quadrants of Plus Disease.
3. Vitreous Haze
4. PCA 38-42 weeks

A thorough preoperative ablation improves the structural outcome after surgery.

**Scleral Buckling:** Is indicated in stage 4 a ROP and selected cases of stages 4b. A No 40 on 240 band is employed to support the ridge and if there is a lot of subretinal fluid or if the IOP is high subretinal fluid drainage or a paracentesis is performed. The active RPE pump helps in the resorption of SRF and helps in gradually reattaching the retina. This procedure is associated with development of anisometropic amblyopia as it hampers the growth of the eye and may even erode into the developing eye. Hence transection or removal of the encircling band is indicated 6 to 9 months after the procedure. An anatomic success rate of 59.0 % to 76 % has been reported in several small case series.

**Lens Sparing Pars Plana Vitrectomy:** Is indicated in progressive stage 4a and most cases of stage 4b ROP and when the lens and retrolenticular tissues are uninvolved in the disease process. A core vitrectomy is performed and all 4 planes of traction (Ridge to Ridge; Ridge to Periphery; Ridge to Lens, Central Stalk) are removed, followed by a fluid air exchange and positioning of an air bubble or injection of high viscosity viscoelastics. Preoperative USG Evaluation will help demonstrate degree of funnel closure.

**Lensectomy Vitrectomy:** Is indicated in selected cases of stage 4b and stage 5 ROP. It is performed as a
The results for anatomic success following vitrectomy for advanced ROP is limited. From India a success rate of 22.5% was reported by L.Gopal et al on 96 eyes\textsuperscript{16}. In this series 10.4% achieved total reattachment and 12.5% posterior pole reattachment alone. The results were found to be better in cases of open funnel as compared to closed funnel. They identified indications of poor postoperative visual prognosis as (1) late identification (2) lack of prior treatment in the form of cryo or laser (3) narrow – narrow configuration of RD. Thus in cases of advanced ROP, surgical treatment is essential although the results are disappointing.

**Visual Rehabilitation:** Children with ROP have a higher chance of being ‘near sighted’ or far sighted or of having strabismus and developing amblyopia. Visual rehabilitation in the form of corrective glasses or special low visual aids have to be planned. Visual stimulation techniques, proper toy selection, creating proper contrast, alternate learning methods, parental narration, and control of light and glare must be planned. The child should be followed up by trained low vision professional\textsuperscript{32}.

**Psychosocial factors:** Infants with ROP who are blind or severely visually impaired have unique developmental needs. Their development is often hampered by other medical problems. Development in areas of cognitive, motor, language and exploratory learning are usually adversely affected. Coping strategies must be developed often requiring professional help. Since the family plays the most crucial role in their recovery, support to the family is important.

Fig. 6. a & b : Preoperative B Scan USG demonstrating Closed Funnel Total Retinal Detachment

parsplicata closed globe or open sky procedure. After lensectomy, bimanual dissection of the retrolental tissue is carried out using scissors and forceps under the operating microscope using the microscope illumination.

Fig. 7. a & b : Favourable outcomes after surgical treatment.  
c & d : Favourable outcomes after surgical treatment

Fig. 8. RetCam
role in the development of the child, the parents must be trained to achieve effecting parenting and teaching strategies.

**Alternative Treatment Strategies:**

- **STOP-ROP STUDY:** (Supplemental Therapeutic Oxygen for Pre Threshold ROP). The results of this study concluded that use of supplemental oxygen at pulse oxymetric saturation of 96% did not cause additional progression of prethreshold ROP.

- **HOPE-ROP:** Light reduction showed no benefit in reducing the onset and progression of ROP.

- **PHOTO – ROP:** Evaluated the use of remote digital retinal photographs using Retcam in diagnosing clinically significant ROP in high risk infants.

- **Vitamin E Prophylaxis:** A Meta analysis of numerous trials show that Vit E supplementation has no role in reducing the overall incidence of ROP.

- **Antenatal Steroids:** Prenatal steroids reduces the incidence of Respiratory distress syndrome (RDS), other morbidities like Patent ductus arteriosus (PDA), Intraventricral haemorrhage, and recrotising enterocolitis and hence may play a role in reducing the incidence of ROP.

**Retcam (Retinal camera)** documentation using a realtime wide angle digital camera for diagnosis and followup has enabled efficient assessment and monitoring of ROP. Wide field photography of 130 degree field helps in imaging the entire retina with real time image display.

Future treatment Directions:

- Supplementary Insulin Growth factor -1
- Anti VEGF or Anti VEGF receptor therapies.
- Surgical Advances : 2 port PPV, Sutureless 23/25 gauge vitrectomy with enzymatic vitreolysis
- Molecular & Genetic Engineering.

**Conclusion**

The aim of treatment is early detection of prethreshold ROP by timely screening and treatment by either laser or cryo. With advances in screening technique availability of facilities for documentation and, improved surgical techniques the future for a child with advanced ROP looks brighter.

**References**


Heredity as a Risk Factor in Concomitant Strabismus

Vijaya Pai H. MS DOMS

Introduction

Risk factors for the development of concomitant strabismus include heredity\(^1\), prematurity, increased maternal age at delivery and neonatal hypoxia. The role of heredity as an important risk factor for concomitant strabismus has been based on studies of large pedigrees with accumulation of strabismic members, high incidence of family history in strabismic patients and the concordance of strabismus in twins\(^4\). The prevalence of family history among patients with squint varies from 25\(^3\) to 55\(^2\) % . But the exact factor that is inherited or the actual mode of inheritance is not known.

Purpose

To study the prevalence of family history in patients with concomitant strabismus and to compare its role as a risk factor in concomitant exotropia and esotropia.

Materials and Methods

Sixty two patients with concomitant strabismus who attended our institution during the period January 1998 to March 2006 were included in the study. The patients and their family members were interviewed regarding any family history of strabismus. All the patients underwent complete ophthalmological evaluation for strabismus . Family history was taken as positive when at least one member in the family within six degree relatives (siblings, parents, grandparents, uncles, aunts, first and second cousins) had strabismus. Strabismus associated with any organic eye diseases was excluded. A comparison of the heredity as a risk factor among patients with exotropia and esotropia was done using Fisher’s test.

Results

Of the 62 patients 20 patients had exotropia and the remaining 42 patients had esotropia. There were 29 males and 33 females. The overall prevalence of positive family history among patients with concomitant strabismus was 25.8 %. 11 out of the 20 patients with exotropia had a positive family history (55 %) as against 5 out of the 42 with esotropia (11.9 %). Average age at presentation was 13.8 years . The higher prevalence of family history in patients with exotropia when compared to those with esotropia was statistically significant (p = 0.001 by Fishers test).

Discussion

The risk of developing strabismus increases by four times if either of the parents has squint\(^1\). In this study the prevalence of family history in patients with squint was 25.8 % which is comparable to studies cited earlier\(^3\).Aurell et al\(^1\) has reported increased risk of squint with family history in patients with esotropia while Toshihiko et al\(^4\) reported family history as significant risk factor in development of both esotropia and exotropia with a clearly greater incidence in patients with intermittent and

---

OEU Institute of Ophthalmology, Kasturba Medical College, Manipal.
E-mail: paivijaya@yahoo.co.in
constant exotropias and accommodative esotropia than in patients with infantile esotropia. Our study however finds a higher incidence in patients with exotropia than in esotropia. However the number of patients in our study was too small to evaluate the significance of family history in each of the subtypes.

**Conclusion**

In our study heredity was an important risk factor in patients with concomitant exotropia.

**References**

A Rare case of Central Retinal Artery Occlusion

A 58 year old gentleman came with sudden painless loss of vision in right eye of one day duration. He had an episode of amaurosis fugax, few hours before the actual episode. About 12 years back he had a bout of palpitation for which he was evaluated and found to be apparently normal. He was a nonsmoker with no diabetes or hypertension.

On examination his best corrected visual acuity in the right eye was perception of light, with inaccurate projection and left eye was 6/6. Anterior segment examination was normal in both eyes. Pupillary examination showed a relative afferent pupillary defect in the right eye. Fundus examination of the right eye showed pale disc, boxcarring of vessels with cloudy swelling of the posterior pole with cherry red spot at the macula suggestive of Central Retinal Artery Occlusion. Left eye fundus examination was normal (Fig. 1). Red free photograph did not show any emboli (Fig. 2).

On general examination, patient was afebrile, pulse rate 96/min, blood pressure was 130/70 mm Hg. There was no clubbing or pedal edema. Cardiovascular examination revealed pansystolic murmur at the apex with normal S1 and S2. Abdomen was soft with no organomegaly. Central nervous system examination did not reveal any abnormality.

Investigations

Haemoglobin 13.20 gm/100ml, PCV 39 %, TC 17000 cells /cu mm, Polymorphs 86 %, Lymphocytes 13 %, Eosinophils 1 %, ESR 78 mm/hr, PT 14.6/12 (INR = 1.22) seconds; Random Glucose 101 mg%, Serum Urea Nitrogen 11 mg %, Serum Potassium 4.3 m Eq/L, Serum Sodium 130 m Eq/ L, Creatinine 1.0 mg dl, Albumin SGOT 47 U/L, SGPT 65U/L, Bilirubin Total 1.17 mg %, Bilirubin Direct 0.35 mg %, Total Proteins 6.8g %, Albumin 3.8 g % Globulin 3.0g %, Alkaline Phosphatase 92 IU/L. Creatine phosphokinase (CPK) 20, Platelet Count 2.19 L/cu mm. Carotid Doppler was normal. Optical coherence tomography showed retinal thickening and increased signals at macula.

Patient was referred for a cardiology evaluation. ECG was normal. Echocardiogram showed mitral regurgitation, flail and ruptured posterior mitral leaf with torn chordae. A linear structure attached to the tip of posterior mitral leaf on underlying torn chordae suggestive of vegetation was noted (Fig. 3). Blood culture showed growth of enterococcus.

Patient was then diagnosed to have enterococcus related infective endocarditis involving the mitral valve. He was started on injection IV crystalline pencillin 5 million units 4th hourly and injection gentamycin 60 mg I.V 8th hourly to be continued for 6 weeks. At 4 weeks follow up CRAO appeared resolving but vision remained the same. His general condition had also improved. Fundus fluorescein angiography was deferred as physician fitness for the procedure could not be obtained.

Discussion

In 1859 Von Graefe first described central retinal artery occlusion (CRAO) as an embolic event to the central retinal artery in a patient with endocarditis. In 1868, Mauthner suggested that spasmodic contractions could lead to retinal artery occlusion. There is a multitude of
causes of Central Retinal Artery Occlusion, but patients typically present with sudden, severe, and painless loss of vision. Central Retinal Artery Occlusion is found in 1 per 10,000 outpatient visits. Of the patients, 1-2 % present with bilateral involvement.

Patients with visualized retinal artery emboli, whether or not obstruction is present, have a 56 % mortality rate over 9 years, compared to 27 % for an age-matched population without retinal artery emboli. Life expectancy of patients with Central Retinal Artery Occlusion is 5.5 years compared to 15.4 years for an age-matched population without Central Retinal Artery Occlusion. Men are affected slightly more frequently than women. Mean age of presentation is in the sixth decade. Causes of Central Retinal Artery Occlusion vary depending on the age of the patient.

In many instances it is impossible to ascertain the exact pathophysiologic process responsible for a central retinal artery obstruction. The main causes are emboli, intraluminal thrombosis, vasculitis, spasm, hypertensive arterial necrosis, dissecting aneurysm. These causes are intimately related to associated systemic abnormalities like diabetes mellitus (25 %), hypertension (66 %), and cardiac valvular disease (25 %). The emboli are visible within the retinal arterial system in about 20 to 40 %
of eyes with Central Retinal Artery Occlusion. An emboli can originate from any part of the arterial system. The most common is cholesterol emboli from atherosclerotic deposits in carotid arteries. The other emboli are fibrin–platelet thrombus and calcific emboli which usually originate from cardiac valves and cause more severe obstruction. Abnormalities in the cardiac valves or circulation as seen in infective endocarditis should be ruled out in every case of central retinal artery occlusion. Embolus from the heart is the most common cause of central retinal artery occlusion in patients younger than 40 years.

Infective endocarditis occurs due to microbial infection of a heart valve, the lining of a cardiac chamber or blood vessel, or a congenital anomaly (example Septal defect). The most common organism is streptococci (Viridans -30-40 % and enterococci -10-15 %). Patients can develop persistent fever, stroke, central retinal artery occlusion, and cardiac failure. Clinically they present with Roth’s spots, subconjunctival haemorrhage, splenomegaly, digital clubbing, hematuria, petechial rash and loss of pulses. In the heart the affected valves develop vegetations composed of organisms, fibrin and platelets, and the vegetation may become large enough to cause obstruction or may break away as emboli. The diagnosis is confirmed by positive blood culture, high erythrocyte sedimentation rate, C-Reactive protein, Echocardiography and is treated with high doses of broad spectrum antibiotics for 4 to 6 weeks.

In this particular patient, central retinal artery occlusion was the only extra cardiac manifestation of infective endocarditis. To have such an isolated presentation is very rare and no such cases have been reported so far (Medline search, Google search 1980-2007). The incidence of such an association has not been reported. The importance of this particular case lies in the fact that the patient has first presented to an ophthalmologist with this life threatening condition. This further emphasizes the fact that every patient with central retinal artery occlusion should have a thorough systemic evaluation and follow up.

References
Key-words: Lateral rectus palsy, Inferior rectus palsy, Viral fever, Chikungunya.

The healthcare personnel in Pathanamthitta District were challenged in the past two to three months (April-July 2007) by different, dangerous and difficult to diagnose fevers. Among the thousands of people afflicted, only a few were lab- diagnosed as Chikungunya or Dengue fever. Remaining were only clinically diagnosed or labeled as fever of unknown origin.

The most common symptoms in these patients were abrupt onset fever, generalized myalgias, severe arthralgias (especially involving knee and ankle joints), malaise, headache accompanied by rash.

Our exposure to these patients was mainly during their convalescent period. Most common presentations were follicular conjunctivitis, keratitis and anterior uveitis, the rarer ones being retinal periphlebitis, optic neuritis and ocular motor nerve palsies.

In this case report we present four cases of ocular motor nerve palsies following viral fever.

Case 1:
A 35 year old lady presented with acute onset of diplopia of one day duration. She was being treated for viral fever at a local hospital and was referred to us when she developed diplopia. On examination in primary gaze, there was less than 15 degree left esotropia. Extraocular movements showed limitation of abduction in left eye. Rest of ocular examination was unremarkable. Worth's Four Dot Test (WFDT), diplopia charting and Hess screen charting confirmed left lateral rectus palsy. General examination and systemic investigations were within normal limits.

Case 2:
A 64 year old man presented with acute onset of diplopia since one day. He gave history of viral fever a week back. He was diabetic with normal blood sugar values in the past 6 months. Ocular examination revealed <15 degree left esotropia, mild limitation of abduction in left eye and mild nonproliferative diabetic retinopathy in his right eye. WFDTT, diplopia charting and Hess screen charting confirmed left lateral rectus palsy. His blood pressure was 130/84 mm Hg and random blood sugar 88 mg%. Neurological examination was within normal limits except left abducens nerve palsy.

Case 3:
A 52 year old man presented with acute onset diplopia of three days duration. He had viral fever which was treated two weeks before. He was a diabetic and hypertensive; both controlled with medication. Positive findings on ocular examination were left hypertropia in primary gaze (which increased in right gaze) limitation of depression in abduction in left eye and moderate nonproliferative diabetic retinopathy in both eyes. WFDT diplopia charting and Hess screen charting confirmed left inferior rectus palsy. His blood pressure was 130/80 mm Hg and fasting blood sugar 78 mg%. Neurological examination was unremarkable except for inferior rectus palsy.

Case 4:
A 53 years old man presented with acute onset diplopia 2 weeks after viral fever. He did not have any other
systemic illnesses. Positive findings on ocular examination were less than 15 degree right esotropia and limitation of abduction in his right eye. WFDT, diplopia charting and Hess screen charting confirmed right lateral rectus palsy. General examination and systemic investigations were within normal limits. All the above patients were clinically diagnosed as having chikungunya.

In all the four cases we suspected a viral etiology for the nerve palsy and started them on oral steroids. Upon review after one week, none of them had diplopia, their extraocular movements were full in both eyes and WFDT was normal. Hess screen charting showed normal fields. The oral steroid was tapered and stopped.

Table 1. Clinical features and follow up

<table>
<thead>
<tr>
<th>Sl</th>
<th>Age / Laterality</th>
<th>Muscle Risk factor</th>
<th>Other Response to fever</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.</td>
<td>Sex</td>
<td>affected</td>
<td>Viral DM</td>
</tr>
<tr>
<td>1</td>
<td>35/F</td>
<td>Left</td>
<td>LR</td>
</tr>
<tr>
<td>2</td>
<td>64/M</td>
<td>Left</td>
<td>LR</td>
</tr>
<tr>
<td>3</td>
<td>52/M</td>
<td>Left</td>
<td>IR</td>
</tr>
<tr>
<td>4</td>
<td>53/M</td>
<td>Right</td>
<td>LR</td>
</tr>
</tbody>
</table>

DM- Diabetes mellitus, HT-Hypertension, LR- Lateral rectus, IR- Inferior rectus.

Discussion

The Chikungunya virus was first isolated from human patients and Aedes aegypti mosquitoes from Tanzania in 1952. The name ‘chikungunya’is derived from the native word for the disease in which the patient lies ‘doubled up’ due to severe joint pains. Chikungunya outbreaks occurred at irregular intervals along the east coast of India.

The disease presents as a sudden onset of fever, crippling joint pains, lymphadenopathy and conjunctivitis. A maculopapular rash is common and some show hemorrhagic manifestations. The fever is typically biphasic with a period of remission after 1-6 days of fever. The vector is Aedes aegypti. No animal reservoir has been identified. Antibody to virus has been demonstrated in domestic animals but its significance is not known. No vaccine is available.

Out of the four reported cases, two did not have any systemic risk factors and the two cases with systemic risk factors also reported double vision following the fever. All of them had ankle and knee arthralgia at presentation. Diplopia developed during convalescent period.

References

Fish Hook Injury

Dr Elizabeth Sonu John DO, Dr Anjana Krishnan DO, Dr Thomas George MS DOMS

Fishing is one of the major occupations in coastal Kerala. There are many inevitable injuries associated with fishing. We report here a case of fish hook injury.

A 17-year-old male presented to our casualty with history of injury to his right eyelid with a fish hook. The injury occurred while he was fly fishing in the sea and had not attempted to remove the hook as it was in the eye.

On ocular examination, vision was 6/6 in the right eye. The fish hook had pierced the lateral part of the upper eyelid 3mm above the lid margin and the tip could be palpated just below the eyebrow subcutaneously [Fig 1a and b]. There was no eyeball injury. Left eye was within normal limits.

Xylocaine 2% was locally infiltrated. Under aseptic precaution the fish hook was held firmly and pushed superiorly towards the skin. A small incision was made with No.11 blade where the tip of the fish hook was felt (Fig. 2). The fish hook was pushed out through this incision with minimum trauma [Fig. 2]. The hook was very thick at least 14G [Fig. 3]. As the wound was small there was no need for suturing. Inj. TT and broad spectrum antibiotics were given.

Discussion

Ocular fish hook injury is a potentially blinding form of ocular trauma. It is common especially with fly fishing. Although fish hook injury to the eyelid is not sight threatening, it is important to remove the fish hook in the right way to prevent damage to the eyelid. Fish hooks are of different types as some may be single barbed or with multiple barbs hence it is important to...
know the type of fish hook that caused the injury before trying to remove it. Hence it is important to obtain the details from the patient or bystander regarding the shape and size and tip of the hook.

Four techniques have been described to remove fish hook from the non ocular tissue in medical literature. Any of these can be employed in removing the fish hook from the eye in accordance with each case. Their advantages and drawbacks as well as use in ophthalmic injuries are detailed below.

1. The Back out method – refers to backing the hook out through its entrance wound. Although technically simple, it is primarily useful for barbless hooks. If a barb is present and engaged in ocular tissue, the method can cause excessive damage.

2. Snatch technique – is a modification of the back out method, where downward pressure on the hook shank and rapid extraction are used to diminish pain during the removal procedure in non ocular tissue. This is a traumatic technique and not advised.

3. The Advance and cut method – is the most useful technique in anterior segment fish hook injuries. The hook shank is grasped firmly and a controlled surgical incision is placed to allow atraumatic delivery of the point and barb. Sterile wire cutters are used to transect the hook at a location between the barb and the bend after which the barbless hook is easily removed using the back out technique. Advantage includes surgically controlled second wound, no enlargement of the primary wound and minimal traumatic manipulation.

4. For hook penetration in the retina, the needle cover technique is used. This procedure entails passing a large bore needle into the eye through the entry wound. The fish hook (for small hooks) barb is then engaged within the lumen of the needle and both are withdrawn together. Since different types of baits are used and due to the marine flora or fauna the wound caused by fish hook is a contaminated wound and needs treatment with broad spectrum antibiotics.

**Conclusion**

It is important to get information about the type of fish hook (or any object) that caused the injury before any attempt is made to remove it. We need not be taken aback when faced with a situation like removing a fish hook from the eye. The fish hook can be removed successfully by using the correct technique.

**References**

Juvenile Xanthogranuloma A Case with Rare Ocular Manifestations

Dr. Reena A. DO MS, Dr. Nandakumar MD, Dr. Sony Siraj E., Dr. Tinu Mary Thomas

Introduction

Juvenile xanthogranuloma is a benign self-limiting dermatological disorder which is rarely associated with systemic manifestations. The eye, particularly the uveal tract is the most frequent site of extracutaneous involvement. There are a few case reports in the literature describing juvenile xanthogranuloma with some ocular features mainly hyphaema. Juvenile xanthogranuloma is the most frequent cause of spontaneous hyphaema in childhood. We report an interesting case with rare ocular manifestations, characterised by the absence of hyphaema.

Case Report

A four year old boy presented to our institute with generalized pruritic skin lesions of one month duration with photophobia and watering of both eyes for one week. There was no significant antenatal and postnatal history. His best corrected visual acuity could not be checked at the time of presentation due to intense photophobia and watering. General examination revealed multiple non-tender discrete mobile lymph nodes involving bilateral cervical, axillary and inguinal areas.

Systemic examination showed multiple papules and plaques varying in size between two mm and two cm involving the trunk, limbs, palms and face including the eyelids which were either skin coloured or erythematous. [Fig 1a, 1b &1c]

The child had severe photophobia and blepharospasm, preventing proper ocular examination. Examination under anaesthesia was done and this showed severe conjunctival and circumcorneal congestion with multiple conjunctival granulomas involving both palpebral and bulbar conjunctiva [Fig 2]. Corneal stroma was studded with greyish white infiltrative lesions with a hypopyon of three to four mm in the anterior chamber. Iris also showed numerous granulomatous lesions. There was limited view of the posterior segment due to severe anterior chamber reaction and vitreous haze. Red glow was present bilaterally. Clinical examination of other systems were within normal limits.

Investigations included complete blood count, peripheral blood smear, erythrocyte sedimentation rate, liver function lists, renal function tests. Erythrocyte Sedimentation Rate (ESR) was elevated at 100 mm/hour. Thrombocytosis was identified. Serology was negative for HIV and VDRL. A chest X-ray was also taken and was found to be normal. Immunohistochemistry was done. S-100 was found to be positive.

Histopathology of the conjunctival lesions showed mild hyperplasia of lining epithelium, the deeper areas showing collection of plasma cells, lymphocytes and foamy histiocytes.

Lymph node biopsy showed partial effacement of the architecture with infiltration of the subcapsular and paracortical region with sheets of cells with abundant eosinophilic cytoplasm and bland looking nucleus. [Fig 3a & 3b].
Skin biopsy from one of the eyelid lesions showed sheets of foamy macrophages with moderate to abundant eosinophilic cytoplasm and vesicular nucleus filling papillary and mid-dermis and scattered in the lower dermis. Lymphocytes, neutrophils and Touton giant cells are seen in between. Histological appearance were confirmatory of xanthogranulomatous process. [Fig 4a & 4b]

The child was treated with topical and systemic steroids, topical cycloplegics and antiglaucoma medications. He responded very well to steroids with marked reduction in inflammatory signs and infiltrative lesions. At six weeks follow up there was significant clearing of the corneal and iris lesions. Skin lesions showed a gradual improvement. The child had two episodes of exacerbation of skin lesions in the past one month for which he was put on systemic steroids and antibiotics. On systemic steroids he showed excellent improvement and the drug was gradually tapered. The child is still having recurrences and is on maintenance dose of steroids. He is on regular follow up.

Discussion

Juvenile xanthogranuloma is a benign proliferative disorder of the non-Langerhans type of histiocytosis. It is characterised by benign, usually asymptomatic self healing red to yellowish papules and nodules composed of histiocytic cells. It predominantly occurs in infancy and childhood presenting at less than one year of age in 70% of cases. There is a male predominance in all categories of clinical presentation but especially noticed in the group with multiple cutaneous lesions.

It's mainly a skin disorder characterised by a typically raised orange skin lesions occurring either singly or in crops which regress spontaneously. Most frequent site of occurrence is the head and neck region followed by trunk and upper extremities.

Extra cutaneous form is rare and the most commonly involved site is the eye and periorbital region. The commonest ocular site is anterior uvea but any part of the eye may be affected. Although the lesions are histologically benign they bleed easily and are the commonest cause of spontaneous hyphaema in children. It was characteristically absent in our case. Progressive deterioration of vision caused by secondary glaucoma is a serious potential complication of uveal involvement.

Occasionally, the lesions may present in other areas such as cornea, lids and orbit. Our case of interest had multiple corneal infiltrates with hypopyon. It may also
be seen on the surface of ciliary process and are rarely seen in the vitreous. Involvement of the optic disc is a rare complication of juvenile xanthogranuloma.

Histological diagnosis depends on the demonstration of xanthoma cells infiltrating beyond the dermis. Touton giant cells, lymphocytic infiltration and focal hyaline necrosis may also be present. Old lesions demonstrate fibrosis. Histiocytes contain pleomorphic nuclei with few or absent mitotic figures and irregular dense bodies. In juvenile xanthogranuloma, histiocytes are positive to antibodies against Factor XIIIa, HAM 56, HHF35,CD 68 and vimentin and are generally negative to CD 1a and S 100. S 100 was found to be positive in our case. Other tests could not be performed due to lack of facilities.

Therapy depends on the condition of the eye. Early treatment of iris involvement is mandatory because if untreated it can lead to uncontrolled glaucoma, corneal blood staining and amblyopia. Antiglaucoma therapy can be added whenever necessary. Conservative management is justified because spontaneous regression of ocular lesions might occur. Topical steroids may not prevent recurrent hyphaemas and glaucomas. Supplemental therapy with periocular steroids, systemic steroids or low dose radiotherapy or a combination might be necessary. The iris lesions like the skin lesions may be self-limiting and resolution may not be related to the therapy. Both cutaneous and extracutaneous lesions involute spontaneously with in three to six years. The relapse rate is found to be 7%. Correct diagnosis is especially important because of the possibility of successful eradication of the lesions and control of complications. Ocular, neurologic and hepatic diseases are rare but may have serious long term consequences.

References


Recalcitrant Diabetic Macular Oedema: Therapeutic Options

Dr. Cyrus M Shroff¹, Dr. N S Muralidhar², Dr. R Narayanan³, Dr. Biju Raju⁴, Dr. Gopal Pillai⁵, Dr. A Giridhar⁶

A 63 year old gentleman with history of diabetes mellitus of 10 years duration presented to us with defective vision in both eyes of 6 months duration on November 23rd 2004. There was no previous treatment history of diabetic retinopathy, no history of associated hypertension or ischaemic heart disease. Metabolic control of diabetes was adequate. No abnormal lipid parameters. On examination best corrected visual acuity was 6/18 N8 in the right eye and 6/36 N12 in the left eye. Intraocular pressure was normal with applanatometry. Biomicroscopic examination of macula in both the eyes showed bilateral clinically significant macular oedema. He underwent digital fundus fluorescein angiography (Figure 1). Based on FFA he received bilateral perifoveal laser photocoagulation on 1st December 2004. He was reviewed 3 months following laser photocoagulation when his visual acuity was stable at 6/12 N6 in right eye and 6/36 N12 in the left eye. Optical Coherence Tomography of the left eye showed persistent macular edema with cystoid changes.

Fig. 1. Dfa of LE: early & late phase

Fig. 1. Dfa of RE: early and late phase

¹Shroff Eye Centre, New Delhi ²Retina Institute of Karnataka, Bangalore, ³LVPEI, Hyderabad, ⁴Ranjini Eye Care, Cochin, ⁵AIMS, Cochin, ⁶Giridhar Eye Institute, Cochin.
He was therefore advised Intravitreal Triamcinolone injection in the left eye. This was performed on 21\textsuperscript{st} March 2005. He received one more injection of Intravitreal Triamcinolone to the left eye on 26\textsuperscript{th} September 2005 and was reviewed in December 2005. Visual acuity in the right eye was 6/18 N6 and the left eye had improved to 6/24 N6. OCT showed near normal central macular thickness in the left eye (figure 2). The right eye received Intravitreal Triamcinolone Injection. However he reported in May 2006 with further decrease in vision. Visual acuity was 6/36 N12 in the right eye and 3/60 in the left eye. He underwent digital fundus
fluorescein angiography and OCT (figure 3 & 4). OCT of the right eye showed central macular thickness of 659 microns with cystoid changes and left eye 604 microns with cystoid changes.

We would like your comments regarding what has been done till now and how you will proceed with further management of this case.

**Cyrus M Shroff**

After going through the complete case report these are my comments as far as the treatment that has been undertaken till now. Focal laser photocoagulation could have been combined with Intravitreal Triamcinolone Injection. After giving Intravitreal Triamcinolone once the macular oedema has reduced, focal treatment could have been given to the micro aneurysms or a grid laser. This might have helped in better resolution.

As far as the present management is concerned the patient has bilaterally significant macular oedema. I would

a. Reassess metabolic status
b. Repeat Intravitreal Triamcinolone if intraocular pressure continues to be stable and metabolic status is satisfactory.
c. Perform laser once macular thickness comes down to around 300 microns.
d. Consider Anti VEGF Therapy if there is no response to Triamcinolone.
e. In this case based on OCT pictures vitreous surgery does not appear to be an option as there is no tractional component.

**N S Muralidhar**

The management of the macular edema has been done on well-accepted clinical practice. Initially grid laser followed by IVTA has produced reduction in the edema. Recurrence of macular edema is common and continues to be a major challenge. It is interesting to see that the last FFA shows some leakage in the right eye but not much leakage in the left eye. OCT shows possible ERM in the right eye but no ERM in left eye. I suggest reevaluation of the systemic factors, especially control of diabetes and renal failure, as it is nearly 18 months from the first presentation. Management options are a. Repeat IVTA b. Intravitreal Avastin. c. Combined with grid laser.

In the left eye, prognosis is poor as there is not much leakage on FFA, and the patient may be going for Cystoid degeneration. Vitrectomy with peeling of ILM is an option, but the outcome is uncertain.

**R. Narayanan**

This illustrated case of chronic diabetic macular edema is probably encountered by all ophthalmologists in their
practice. Such cases also pose a challenge to the treating ophthalmologist as it is not uncommon for the patient to have multiple sessions of treatment, laser photocoagulation or Intravitreal injections, and still have recurrences.

The patient in this case had been investigated and treated as per the best practice procedure. Metabolic control of diabetes and altered serum lipid profile had been appropriately investigated as these can have significant impact on macular edema and presence of hard exudates. Also, the importance of near visual acuity cannot be over-emphasized and had been recorded in this particular case. Fundus fluorescein angiography guided focal laser treatment was performed, as it still remains the standard of care for diabetic CSME. In the Early Treatment Diabetic Retinopathy Study, immediate focal laser photocoagulation in cases of CSME showed a 50% reduction in severe visual loss compared to the control group of untreated patients. However, OCT was not available at the time when the ETDRS study was conducted. In a recent study published by the Diabetic Retinopathy Clinical Research Network (DRCR.net), which is a network of institutions (both private practice and university hospitals) for clinical research in retinal diseases, modified macular grid laser reduced the central retinal thickness by an average of 88 microns as measured by OCT. In our case, at the follow-up visit 3 months after laser, OCT showed persistent macular edema in the left eye. It is important to rule out vitreomacular interface abnormalities and OCT is an excellent diagnostic tool to detect subtle traction. As OCT ruled out VMT in our case, one has to again evaluate the systemic conditions. Renal function test to rule out azotemia and blood counts with hematocrit should be performed to rule out anemia. Impaired renal function and anemia are known to cause not just a worsening of the severity of the retinopathy, but also aggravation of macular edema. Treatment of anemia and azotemia can improve the macular edema in many cases without any further intervention.

In cases where the systemic condition is normal, Intravitreal injection of Triamcinolone has been shown to be beneficial and can cause dramatic reduction in the macular edema. Periocular steroids have been shown to be ineffective in large prospective studies. The effect of Intravitreal Triamcinolone can be seen for up to 3 to 6 months, and there is usually a tendency for the macular edema to recur once the effect of the steroid has waned off, as happened in this case. Hence, a second injection of Triamcinolone was appropriate. However, an additional sitting of laser photocoagulation 2 weeks after the steroid injection may stabilize the macular edema and may reduce the need for repeated injections although there is no evidence from large randomized studies. Intravitreal Triamcinolone has significant adverse effects, mainly glaucoma and cataract. Recently, with the introduction anti-VEGF agents in the market, ophthalmologists have especially found the off-label use of Intravitreal Bevacizumab (Avastin, Genentech, USA) helpful in reducing the macular edema. However, a recently published phase II trial of Avastin alone or combining with laser did not show any significant advantage over focal laser, both in terms of visual acuity and retinal thickness. However, this was only a phase II study with a small sample size and a short follow-up. At this point of time, when the patient was seen again in December 2005, 3 months after the second Intravitreal injection, the lens status should be known as steroids can cause cataract.

The patient was next seen after a year in May 2006 when the visual acuity deteriorated in both eyes. Was there any cataract at this time? Fundus fluorescein angiography was appropriately performed to rule out any macular ischemia, and OCT showed significant macular thickening. This is mainly due to the fact that the effect of Triamcinolone is no longer present, and there has been a recurrence of macular edema. At this time, our objective would be to first stabilize the vision and reduce the macular edema. The options include Intravitreal injection of anti-VEGF agent combined with modified grid laser photocoagulation. Although Bevacizumab is inexpensive, it is used as off-off-label, whereas Pegaptinib (Macugen, Pfizer, USA) and Ranibizumab (Lucentis, Genentech, USA) may be used as off-label. Anti-VEGF agents do not have the adverse effect profile of steroids, such as glaucoma and cataract, although the risk of endophthalmitis is similar. Currently, all three of the above drugs are being studied in phase III trials for CSME. Other steroids, such as dexamethasone (Posurdex, USA), fluocinolone acetonide (Alameira Sciences, USA) are under investigation in phase III trials, and these may be useful additions to our armamentarium against CSME. There are reports of improvement in macular edema in
intractable cases with triple therapy of vitrectomy with or without ILM peeling, Intravitreal Triamcinolone and focal laser. However, evidence for this approach is limited to small non-randomized prospective and retrospective studies. In conclusion, this case has shown that intractable diabetic macular edema can pose serious challenges to the ophthalmologist. A thorough systemic evaluation along with a combination approach may be the only available option in such cases. Laser photocoagulation still remains the standard of care and the first line of treatment.

**Biju Raju**

From the clinical picture, fluorescein angiography and OCT of this patient, it is obvious that the patient has ischemic diabetic maculopathy and cystoid changes. The ischemia becomes obvious in the angiograms taken after IVTA. From the description, it is presumed that the renal parameters were normal. With IVTA, the macular thickness did return to normal in the left eye, but the resolution was short lived due to the ischemic nature of the maculopathy. The right eye responded initially to laser photocoagulation but from the OCT it is obvious that the edema still persisted despite the marginal symptomatic improvement. The presence of macular ischemia makes this a challenging case to treat. Repeat intravitreal triamcinolone acetonide followed by additional photocoagulation under angiographic control to the leaking micro aneurysms and non-ischemic areas, avoiding the Perifoveal areas of ischemia, once the retinal thickness approaches normal may work in this case. If there is further recurrence then as a last resort, vitrectomy with induction of posterior vitreous detachment may be attempted. But it may not be successful in complete resolution of the edema as OCT does not give any strong evidence of vitreo macular traction. However, right eye shows a hyper reflective layer suggestive of a thickened posterior hyaloid. The role of ILM peeling over such ischemic and boggy macula is controversial as is the role of VEGF inhibitors.

**Gopal Pillai**

Recurrence of macular edema following treatment is a very common problem that all medical retina specialists face during their diabetic retinopathy practice. The basic reason for such an occurrence is not a treatment failure, but it is due to the fact that diabetes is a multifaceted disease with no cure, but only control. Apart from diabetic macular leakages on fluorescein angiography and patterns of macular edema on OCT, there are many unknown factors, which may decide the progression or regression of diabetic macular edema following treatment.

**Comment on previous treatment**

To start with, this gentleman had a fluorescein angiography suggestive of diffuse diabetic macular edema in the left eye with a probable CME pattern on OCT (The OCT picture is not available) When ever we encounter a CME pattern on OCT, we should rule out a systemic cause for it like an acute change in blood pressure, recent onset of renal failure or a recent change in anti diabetic medication. However systemic evaluation of this patient was normal in 2004.

Prior to the advent of anti VEGF treatment including triamcinolone, we were all doing grid laser therapy to these patients with diffuse diabetic macular edema. In many cases, I have personally felt that macular grid in such patients actually worsened the edema. So after triamcinolone was popular, I used to treat these patients with triamcinolone to reduce the edema and then, when the edema comes down, laser the focal microaneurysms. The advantage it offered was that with less fluid and edema in the macula, we could use lower laser power settings to achieve the same effect than in an edematous macula. We could also define the microaneurysms very well in a less edematous retina. I have always felt that in DDME, if we lasered first, we would kick off the vicious cycle leading to more edema formation.

**Comments on future treatment**

Triamcinolone is a drug, which we find it difficult to use multiple times in the same eye for fear of secondary glaucoma and cataract. In 2006, Bevacizumab and the newer anti VEGF, pegaptanib and ranibizumab made its entry. However the edema reduction with Bevacizumab was found to be lesser than with triamcinolone. The usefulness of these drugs lay in the
fact that they can be injected multiple times. Many reports of a combination of Bevacizumab and dexamethasone for the effective reduction of macular edema are now on.

Recurrence of CME in diabetic macular edema should be again evaluated medically to rule out any systemic pathology. Provided, all the systemic factors are under control, this gentleman with >600 microns of CME in both eyes can be offered Bevacizumab/ Pegaptanib/ Ranibizumab with dexamethasone and it can be repeated if necessary. If the macular thickness reduces to less than 300 microns, then I will repeat a fluorescein angiography and if possible laser the leaking microaneurysms. If at the end of 4-6 months/ 3 injections, the adequate reduction of edema is not achieved, it may be necessary to undertake a vitrectomy with PVD induction and ILM peeling for this patient. Many studies have found good results for vitrectomy and ILM peeling in recalcitrant diabetic macular edema.

Most importantly, a relapse of edema is not to be taken as a failure of treatment. It is part and parcel of diabetic retinopathy. It may be our mindset that requires a change. Just like one injection of insulin cannot take care of diabetes, and daily injections are the rule, one or two intravitreal injections may not take care of the diabetic macular edema. We may have to be mentally prepared to tell the patients that repeat injections may be necessary to keep the macular edema under control and control is what we strive to achieve. Cure of diabetic macular edema may be as elusive as the cure of diabetes mellitus.

A Giridhar

We have presented a case of chronic recalcitrant diabetic macular oedema resistant to all forms of intervention. Although, there are certain patients who respond very well to treatment with long-term stabilization of vision, there are few cases wherein the macular oedema is recalcitrant and resistant to treatment. The experts in this panel have highlighted some of the important points to consider in such cases. The most important aspect, which has been highlighted by all the experts, is to reassess metabolic control. In this patient we have reassessed the metabolic control on multiple occasions and found the control of diabetes to be satisfactory and also the lipid parameters. Another important point high

lighted by many of the experts is combination treatment that is combining the use of Intravitreal Agent along with laser photocoagulation. In this particular case one probable reason why we did not do this treatment was because there were not many leaking microaneurysms. It was more of diffuse oedema. Probably we could have combined Intravitreal Agent with grid laser photocoagulation in the second stage of management. Regarding the use of Anti VEGF Agent it had not entered our clinical armamentarium when we first saw the patient in the year 2004. I would like to high light as what happened to this patient after May 2006 when he had presented with significant macular oedema in both the eyes. He received one more Injection of Intravitreal Triamcinolone combined with focal laser photocoagulation to the macula of right eye and he underwent cataract surgery with IOL implantation with Vitrectomy and PVD induction and ILM peeling in the left eye. The reason why we undertook a Vitrectomy was since the cataract was dense and he required a surgical procedure, we thought that vitreous surgery would be worthwhile. Surprisingly following the surgical procedure his visual acuity improves to 6/60 N12 when he was examined here on 10.08.06. The right eye also showed a visual acuity improvement of 6/24 N10 following re-injection of Triamcinolone along with focal laser photocoagulation. He reported in February 2007 4 months later with recent drop in visual acuity. OCT at this time showed significant macular oedema and he also underwent fundus fluorescein angiography. At this moment he received further Perifoveal laser to the left macula along with Intravitreal Injection of Avastin. HbA1c done at this time was 7.4. Subsequent to this treatment he was lost for follow up as he gone abroad to spend some time with his son. He reported back to us on 29.09.07 with poor vision in both the eyes. During his stay in UK he underwent cataract surgery with IOL Implantation in the right eye. Unfortunately he had a PC rupture in UK during cataract surgery and AC IOL was implanted. This eye had very low intra ocular pressure and uveitis with visual acuity of counting fingers 2 mtrs. Visual acuity in the left eye was stable at 3/60 N8. Concluding, we have presented a classic case of recalcitrant diabetic macular oedema wherein all modalities of treatment have been attempted. It is very obvious that in certain case of diabetic macular oedema multiple factors operate.
The Missing Links In Paediatric Diagnosis—What Can An Ophthalmologist Offer?

Dr Gopal S Pillai MD DNB FRCS, Dr Natasha Radhakrishnan MS DNB MRCOphth

Retinal findings in pediatric cases are often the missing pieces of a jigsaw puzzle that when fitted together with systemic findings make the big picture complete and the diagnosis clear. Here are a few cases where the retinal pathologies spotted by us helped the physicians to reach a conclusive diagnosis.

Fig. 1a & b. Cherry red spot at macula in both eyes

Fig. 2. Central retinal vein occlusion

This 2-year-old baby was brought with hepatosplenomegaly and delayed developmental milestones. Cherry red spots in both eyes pointed towards a storage disease. It turned out to be Tay Sachs disease. A pediatric cherry red spot (Fig 1a & b) should always alert the ophthalmologist of a storage disease and a systemic evaluation should be done.

Fig. 3. a–c. (a) Fundus showing astrocytoma (b) optical coherence tomography showing thickened retina in the region of astrocytoma (c) Ash-leaf macules on trunk
suggest the possibility of a coagulation sequence disorder. On further evaluation a Protein C deficiency was diagnosed. Other causes of young vascular block include protein S deficiency, homocysteinemia, antiphospholipid antibody syndrome or vasculitis.

1-year-old child with recent history of left tonic clonic convulsions and history of cardiac rhabdomyoma diagnosed at 3 weeks after birth. On examination the child had some hypopigmented lesions on the face and back. Retinal examination revealed astrocytomias near the disc and the arcade. The child had multiple hypopigmented ash leaf macules in the face and in the trunk (Fig. 3a-c). MRI done showed bilateral subependymal nodules with early calcification changes (subependymal tubers). The diagnosis in this child with this constellation of finding was Tuberous Sclerosis.

Spontaneous preretinal and intraretinal hemorrhages (Fig 4) along with a macular star in this 3-year-old child helped us direct the pediatricians' attention towards a blood morphology that turned out as leukemia. Anemia and hematological malignancies in children can present as spontaneous retinal hemorrhages.
A 20-year-old girl and her 14-year-old brother were referred from Dept of Neurology for Ophthalmic evaluation. Both of them had intellectual deterioration, cerebellar ataxia, gum hypertrophy and generalized seizures. Bilateral peripheral retinal pigments and disc pallor was seen. An OCT revealed cysts in the ganglion cell layer suggesting a storage disease. A diagnosis of oligosaccharidoses was reached on investigation.

A 5-year-old girl with iris, lens and choroidal coloboma (Fig. 6 a & b) on further evaluation had retarded growth and development, cardiac disorder and deafness. Choroidal colobomas are commonly seen in CHARGE syndrome, which has these components and also choanal atresia, genital hypoplasia and ear anomalies. This 12-year-old girl with sudden loss of vision of 2 days duration had multiple soft exudates and a cherry red spot. She also had evidence of retinal vasculitis. Her fluorescein angiography showed arterial block of the macular circulation (Fig. 7 a & b). Further evaluation revealed a diagnosis of SLE. Vasculitis in the periphery is a marker of collagen vascular diseases. This 8 year old girl had a retinal angioma at the macula that was clearly picked up on FFA (Fig 8a & b). This prompted a systemic evaluation which revealed a cerebellar hemangioblastoma and a diagnosis of Von Hippel Lindau syndrome was made. Children with angiomas in the fundus should be evaluated for this life threatening condition, the other components of which are pheochromocytoma, polycythemia and renal cell carcinoma.

Fig. 7. (a) & (b) Fundus photo and fluorescein angiography showing vasculitis

Fig. 8. (a) Retinal angioma in macula (b) FFA showing leak from the angioma
Setting up An Anterior Segment Practice

Dr. Ashley Thomas Jacob MS DNB FRCOphth

It is a dream of every graduate in ophthalmology to start their own practice. This article is meant to offer guidance on that journey.

**Governmental Clearances & Pre-requisites**

Invariably the young ophthalmologist would be so lost in the negotiations for ophthalmic equipment that the legal and bureaucratic aspects of starting a new clinic escape attention.

When realization does dawn, it would be too late and opens the doors for harassment, bribes and numerous other hassles. It is better then to be ready with the necessary permissions, registrations and documents prior to purchase of equipment.

1. Local body license
2. Current account with bank
3. Partnership / Trust deed (if applicable)
4. Rent agreement (if applicable)
5. Sales Tax registration (if planning to open pharmacy, optical dispensary, request demonstration equipment, etc)
6. Import Export Code number (compulsory if importing equipment)
7. Food license under Food adulteration act (if opening canteen, pharmacy)
8. Labor registration
9. Registration with Professional Protection Scheme (PPS) scheme of IMA or Qualified Private Medical Practitioners Association (absolute necessity)
10. Pollution control board clearance (if having generator, Operating Rooms, Inpatients, Canteen, Laboratoty)
11. Registration with IMAGE of Indian Medical Association to avoid PCB interferences
12. Join all respective associations (IMA, QPMPA, Kerala Society of Ophthalmic Surgeons etc)
13. Fire department clearance (if applicable)
14. Permanent Account number (absolute necessity)

**Bank loan**

Negotiating a bank loan is probably the worst thing a ophthalmic graduate is prepared for as it entails a lot of fiscal planning, hard negotiations, searching questions on credit worthiness, and worst of all preparing to mortgage your property.

With proper advice, a good chartered financial analyst and loads of confidence, this challenge can indeed be won.

1. Prepare a detailed project report
2. Loan can be availed for 75% of total project cost
3. Suitable collateral must be arranged
4. EMI must be realistic. A loan of one crore will entail an EMI of two lakhs per month or Rs.8000 per day.
5. It is advisable that bank loan is availed for around 40-50% of the project value and not more.

**Negotiating for equipments**

The young ophthalmologist must decide whether he wants to start a pure anterior segment practice or combine it with a medical retinal practice. The latter entails a further escalation of capital expenditure of roughly 30 Lakhs.

He or she should ask heads of existing institutions for advice and try to get guidance on pricing and service commitments. But it is recommended that one apply their own mind after sufficient deliberations.

1. Include at least 3 competing organizations
2. Ask for installation base within state
3. Call the existing customers (to verify actual installation, service, etc)
4. Ask for the list of optional extras
5. Look for hidden costs (eg. Table for the slit lamp)
6. Clarify warranty clauses (ask for extended warranty)
7. Fix Annual Maintenance Contract rates for 5 years
8. Verify service personnel in your area
9. Ensure service within 24-48 hours for critical equipments
10. Avoid dealers with no operation within the state
11. Try to source all equipments from one or two companies (not more)
12. Check the international website of the parent company
13. Ensure written official contracts (will help in legal actions later)
14. Prefer companies that feature in most Conferences
15. Provide for additional 10% customs duties

**Automated refractometers**

1. Look for pupil size, range of estimation in diopters, and speed
2. Ease of use (remember that you will not be the end user)
3. Avoid touch screens (they malfunction in humid conditions)
4. Color monitors (consume more power, use?)
5. Opt for ARK (Autorefracto-keratometers) – will need one for IOL calculation
6. Options include Topography module

**Slit Lamps**

1. At least one 5 step magnification slit lamp
2. Must be possible to upgrade with laser attachments later
3. Select model with provision for beam splitter (for digital camera later)
4. Do not forget applanation tonometer attachment, lenses etc

**Operating Microscope**

1. Preferably with automated focus, zoom & XY
2. Provision for Closed Circuit Camera (to tape your surgeries)
3. Do not forget to buy spare bulbs (if the bulb fails mid-surgery)
4. Select good quality optics

**Other Support Systems**

1. UPS - Uninterrupted Power Supply
   - All ophthalmic equipment ought to be connected with uninterrupted and stabilized electricity
   - Separate UPS for OR equipments with at least one hour backup battery
2. PABX
   - At least 2 lines, 1 fax
   - Provision for SIM card insertion
3. Generator
   - Necessary in our state where 8am – 5pm blackout is normal
   - Must power the UPS, lights, fans and OR airconditioner
4. AC - Air Conditioner
   - Is now an essential part of the consultation, waiting, laser and ORs
5. Computers
   - Preferably the highest configuration for memory intensive digital fundus camera, counseling software, etc
   - LAN - Local Area Network
   - Web enabled (for online appointments)
6. Hospital Management Software
   - Patient registration
   - Billing
   - Tax reports
   - Salary records
   - Purchase / sales of medicines, frames, lenses, etc
   - Archiving

**Operating Rooms**

1. Seamless floor and walls
2. Must have UPS
3. Heppa filter AC
4. Laminar flow is desirable
5. CSSD

**Support staff**

1. Security personnel
   - They are the point of first and last contact. They must be good natured.
   - Eye hospitals do not need security. Instead these men direct the patients to the respective sections
2. Customer Relations officers
   - Must be friendly, pleasant and preferably good at computers
   - Knowledge of English would be an advantage
3. Nurses
   - Appoint at least one specialist ophthalmic nurse in the OR and the OPD
   - Remainder can be trained by them or by you
   - It is advisable to train them in refraction
4. Optometrists
5. Housekeeping
6. Pharmacist is not an absolute necessity
7. Opticians (sales personnel and optical fitter)

Support network
1. Experienced anterior segment surgeon
2. Vitreo-retinal Surgeon
3. Anesthetist
4. Physicians (they could refer)
5. Clubs (for camps)
6. Journalists

The ethics of advertising
How does one know that a hen has laid an egg? It crows!! Well, that’s advertisement.
We have a responsibility to let the public know of our location, specialized services and arrival of newer equipment. But advertisement of special offers and discount packages are to be discouraged.

Conclusion
This article would have served its purpose if it encourages the reader to consider the possibility of approaching their dream with confidence and professionalism.
The reader is encouraged to contact the author should he or she need any assistance.
## Comparison of AR/ARKs

<table>
<thead>
<tr>
<th>Manufacturer, Distributor</th>
<th>Model, type</th>
<th>Pupill size mm</th>
<th>LCD / Color</th>
<th>Spnl range</th>
<th>Cyl range</th>
<th>Virtual vision</th>
<th>Auto track / Auto shoot</th>
<th>Special features</th>
<th>Ease of use, features, etc</th>
<th>Comments</th>
<th>Price (list price)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Topcon, Japan / Sunny Hi tech, Kochi</td>
<td>KR 8800 (ARK)</td>
<td>2</td>
<td>Y / Y</td>
<td>-25 to +22</td>
<td>+/- 10</td>
<td>N</td>
<td>N</td>
<td>Fixation target brightness can be adjusted, Binocular readings displayed,</td>
<td>Good</td>
<td>Value for money</td>
<td>2.90 + taxes</td>
</tr>
<tr>
<td>Topcon, Japan / Sunny Hi tech, Kochi</td>
<td>RM 8800 (ARK)</td>
<td>2</td>
<td>Y / Y</td>
<td>-25 to +22</td>
<td>+/- 10</td>
<td>N</td>
<td>N</td>
<td>Fixation target brightness can be adjusted, Binocular readings displayed,</td>
<td>Good</td>
<td>Value for money</td>
<td>2.25 + taxes</td>
</tr>
<tr>
<td>Nidek, Japan / KLB, Chennai Bionex, Bangalore</td>
<td>AR 350A (ARK)</td>
<td>2</td>
<td>Y / Y</td>
<td>-30 to +25</td>
<td>+/- 12</td>
<td>N</td>
<td>Y</td>
<td>Wider measurement range, Super luminous diode (no better reading in media opacities), double mirrors, guidance marks for chin rest and main body movement, power chin rest, eye care card for wire less transfer, Auto paper cutter for printer</td>
<td>Excellent</td>
<td>Best technology</td>
<td>2.45 + taxes</td>
</tr>
<tr>
<td>Nidek, Japan / KLB, Chennai Bionex, Bangalore</td>
<td>AR 350A (ARK)</td>
<td>2</td>
<td>Y / Y</td>
<td>-30 to +25</td>
<td>+/- 12</td>
<td>Y</td>
<td>Y</td>
<td>Wider measurement range, Super luminous diode (no better reading in media opacities), double mirrors, guidance marks for chin rest and main body movement, power chin rest, eye care card for wire less transfer, Auto paper cutter for printer</td>
<td>Excellent</td>
<td>Best technology</td>
<td>3.5 + taxes</td>
</tr>
<tr>
<td>Nidek, Japan / KLB, Chennai Bionex, Bangalore</td>
<td>ARK 1000 (ARK)</td>
<td>2</td>
<td>Y / Y</td>
<td>-30 to +25</td>
<td>+/- 12</td>
<td>Y</td>
<td>Y</td>
<td>Wider measurement range, Super luminous diode (no better reading in media opacities), double mirrors, guidance marks for chin rest and main body movement, power chin rest, eye care card for wire less transfer, Auto paper cutter for printer</td>
<td>Excellent</td>
<td>Best technology</td>
<td>3.65 + taxes</td>
</tr>
<tr>
<td>Tomay, Japan</td>
<td>TR 4000 (ARK)</td>
<td>2.5</td>
<td>N / N</td>
<td>CRT display</td>
<td>-20 to +20</td>
<td>+/- 8</td>
<td>N</td>
<td>N</td>
<td>Dual CCD camera,</td>
<td>Average</td>
<td>Measurements at range poor</td>
</tr>
<tr>
<td>Tomay, Japan / My Healthkape, Mumbai</td>
<td>RC 5000 (ARK)</td>
<td>2.2</td>
<td>Touch screen for pupil alignment</td>
<td>-25 to +22</td>
<td>+/- 10</td>
<td>N</td>
<td>N</td>
<td>Dual CCD camera, IOL / Corneal mode, corneal and pupil diameter measuring, power chin rest,</td>
<td>Good</td>
<td>Good</td>
<td></td>
</tr>
<tr>
<td>Arix, Korea Bionex, Bangalore</td>
<td>TSRK 1000 (ARK)</td>
<td>2.5</td>
<td>Y / Y</td>
<td>-25 to +22</td>
<td>+/- 10</td>
<td>N</td>
<td>N</td>
<td>Compact</td>
<td>Good</td>
<td>Best value</td>
<td>2.35 + taxes</td>
</tr>
<tr>
<td>Shin Nippon, Japan / Ascon, Chennai</td>
<td>Accu ref 8001 (ARK)</td>
<td>2.3</td>
<td>Y / Y</td>
<td>-25 to +25</td>
<td>+/- 10</td>
<td>N</td>
<td>N</td>
<td>Auto paper cutter for printer</td>
<td>-</td>
<td>Good</td>
<td></td>
</tr>
<tr>
<td>Shin Nippon, Japan / Ascon, Chennai</td>
<td>Accu ref 8090 (ARK)</td>
<td>2.3</td>
<td>Y / Y</td>
<td>-25 to +25</td>
<td>+/- 10</td>
<td>N</td>
<td>N</td>
<td>Auto paper cutter for printer, far and near EFD measurement, Contact lens base curve measurement</td>
<td>-</td>
<td>Good</td>
<td></td>
</tr>
</tbody>
</table>
## Comparison of Slit Lamps

<table>
<thead>
<tr>
<th>Manufacturer, Distributor</th>
<th>Model</th>
<th>Magnification</th>
<th>Filters</th>
<th>Lamp</th>
<th>Options</th>
<th>Special features</th>
<th>Service availability in Kerala</th>
<th>Comments</th>
<th>Price in lacs (list price)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Haag-Streit Switzerland</td>
<td>BM 900</td>
<td>10x &amp; 16x</td>
<td>Red free, Blue, Heat absorption</td>
<td>Tungsten lamp, (Halogen optional)</td>
<td>Photo digital connector, Yellow filter, Beam splitter</td>
<td>NIL</td>
<td>Service personnel posted for Kerala</td>
<td>Quality build, Work horse</td>
<td>4.00</td>
</tr>
<tr>
<td>Biomedix Bangalore</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Haag-Streit Switzerland</td>
<td>BP 900</td>
<td>10x, 16x &amp; 25x</td>
<td>Red free, Blue, Heat absorption</td>
<td>Tungsten lamp, (Halogen optional)</td>
<td>Photo digital connector, Yellow filter, Beam splitter</td>
<td>NIL</td>
<td>Service personnel posted for Kerala</td>
<td>Quality build</td>
<td>4.55</td>
</tr>
<tr>
<td>Biomedix Bangalore</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Haag-Streit Switzerland</td>
<td>BQ 900</td>
<td>5-step magnification changer 5.3x, 10x, 16x, 25x, &amp; 40x</td>
<td>Red free, Blue, Heat absorption</td>
<td>Tungsten lamp, (Halogen optional)</td>
<td>Photo digital connector, Yellow filter, Integrated flash</td>
<td>Zoom objective, Inclined eye piece adapter, Stereo variator</td>
<td>Service personnel posted for Kerala</td>
<td>Quality build and superior optics. Much like the Mercedes of slit lamps</td>
<td>5.50</td>
</tr>
<tr>
<td>Biomedix Bangalore</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carl Zeiss Meditec AG, Germany</td>
<td>SL 115</td>
<td>8X, 12X, 20X</td>
<td>blue, green UV protection filter, heat-absorbing filter</td>
<td>10 W Halogen lamp</td>
<td>Video adapter</td>
<td>-</td>
<td>-</td>
<td>Excellent optics</td>
<td></td>
</tr>
<tr>
<td>Present in India</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carl Zeiss Meditec AG, Germany</td>
<td>SL 120</td>
<td>6x 10x 16x 25x 40x</td>
<td>blue, green UV protection filter, heat-absorbing filter</td>
<td>20W Halogen lamp</td>
<td>Video adapter</td>
<td>Quick action lock, Link with Viupuc</td>
<td>-</td>
<td>Excellent optics</td>
<td></td>
</tr>
<tr>
<td>Present in India</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carl Zeiss Meditec AG, Germany</td>
<td>SL 130</td>
<td>6x 10x 16x 25x 40x</td>
<td>blue, green UV protection filter, heat-absorbing filter</td>
<td>20W Halogen lamp</td>
<td>Video adapter</td>
<td>Quick action lock, Link with Viupuc, Laser link</td>
<td>-</td>
<td>Excellent optics</td>
<td></td>
</tr>
<tr>
<td>Present in India</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Topcon, Japan</td>
<td>SL 1E</td>
<td>Red free, Blue, Heat absorption</td>
<td>20W Halogen lamp</td>
<td>-</td>
<td>No photography possible</td>
<td>Service center of distributor in Kerala</td>
<td>Best Value for money</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surya Hi tech, Kochi</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Topcon, Japan</td>
<td>SL 3E</td>
<td>10x &amp; 16x</td>
<td>Red free, Blue, Heat absorption</td>
<td>20W Halogen lamp</td>
<td>-</td>
<td>Laser mount possible, No photography possible</td>
<td>Service center of distributor in Kerala</td>
<td>Good</td>
<td></td>
</tr>
<tr>
<td>Surya Hi tech, Kochi</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Topcon, Japan</td>
<td>SL D7 / D8 Z</td>
<td>6x 10x 16x 25x 40x</td>
<td>Red free, Blue, Heat absorption</td>
<td>30W Halogen lamp</td>
<td>Photography possible with excellent results</td>
<td>Link with Imagenet</td>
<td>Service center of distributor in Kerala</td>
<td>Excellent value in a photography mode</td>
<td></td>
</tr>
<tr>
<td>Surya Hi tech, Kochi</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Appasamy Associates India</td>
<td>AIA 11</td>
<td>10X, &amp; 16X</td>
<td>Red free, Blue, Heat absorption</td>
<td>50W Halogen Lamp</td>
<td>-</td>
<td>Ruby lens, spare bulb, focusing rod, breathing sheet are all standard accessories</td>
<td>Service within 24 hours is assured</td>
<td>Phenomenal value. Exceptional service, average</td>
<td></td>
</tr>
</tbody>
</table>
How to Set up a Vitreoretinal Surgical Unit

Dr. A. Giridhar, Dr. Ram Kumar, Dr. Mahesh G, Dr. Archis Shedbale

Introduction

Vitreoretinal surgical techniques have developed over the last two to three decades. Vitreoretinal surgeons practicing today rely on the foundation of knowledge provided by early workers in the field such as Gonin, Custodis, Meyer, Lincoff, Schepens and Machemer. The various historical landmarks in the development of vitreoretinal surgery are listed in Table 1.

Table 1. Development of Vitreoretinal Surgery

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1470</td>
<td>Leonardo da Vinci recognised the retina as the organ of sight.</td>
</tr>
<tr>
<td>1851</td>
<td>Hermann Helmholtz invented the direct ophthalmoscope</td>
</tr>
<tr>
<td>1886</td>
<td>Stereoscopic fundus photography was pioneered by Jackson &amp; Weber</td>
</tr>
<tr>
<td>1931</td>
<td>Jules Gonin laid down the principles of retinal detachment surgery</td>
</tr>
<tr>
<td>1945</td>
<td>Charles Schepens redesigned and popularized the modern binocular indirect ophthalmoscope</td>
</tr>
<tr>
<td>1960</td>
<td>Novotny and Alvis discovered fluorescein angiography</td>
</tr>
<tr>
<td>1965</td>
<td>Lincoff, Baras, and McLean are the first to report on the use of silicone sponge for treating large retinal tears.</td>
</tr>
<tr>
<td>1971</td>
<td>Robert Machemer demonstrated pars plana vitreous surgery.</td>
</tr>
<tr>
<td>1979</td>
<td>The Scanning Laser Ophthalmoscope (SLO) was invented by Webb, Pomeranzoff, and Hughes.</td>
</tr>
<tr>
<td>1994</td>
<td>Optical Coherence Tomography invented by Professor Fujimoto</td>
</tr>
</tbody>
</table>

Thanks to these developments many diseases for which there was no treatment at all, can now be treated effectively. Many patients with advanced proliferative diabetic retinopathy achieve ambulatory vision thanks to modern vitreo retinal surgical techniques. The results of retinal detachment surgery have improved vastly due to effective vitreous surgery. Surgical techniques for closure of macular holes are another important development. Management of certain anterior segment disorders like vitreous wick syndrome, dislocated lens/IOL employ vitreous surgical technique for proper management. Results of complicated ocular trauma has again improved with development of vitreoretinal surgery. Intravitreal pharmacotherapy is now established in management of many macular diseases.

Over the last 2 decades there has been a significant increase in interest in this speciality among ophthalmologists. More and more centers are training young ophthalmologists in vitreoretinal surgery and developing the necessary infrastructure despite high initial costs.

Basic Outpatient Requirement For a Vitreoretinal Surgical Unit

The outpatient department in a Vitreoretinal Unit should have:

(a) Facilities for a complete ocular examination
(b) Diagnostic Services
(c) Outpatient Therapeutic Services

a) Facilities for a complete ocular examination (specific for vitreoretinal unit):

Apart from the routine vision testing charts, trial sets, retinoscope and direct ophthalmoscope there are certain specific requirements in outpatient department, which are highlighted in Table-2.
Table 2 Facilities specific for a vitreo retinal OPD Clinic

- Binocular indirect ophthalmoscope with Scleral depressor and Condensing lens (20 D or 28 D)
- Slit lamp
- 78D and 90D lens
- Couch / reclining chair
- ETDRS Chart
- Amsler chart
- Retinal drawing charts

The ETDRS chart is the Gold Standard for measuring visual acuity in patients with vitreoretinal diseases. Most of the randomised clinical trials have the ETDRS chart for visual acuity assessment and statistical analysis. Amsler charts are necessary in macular diseases and it is helpful for follow up. A good binocular indirect ophthalmoscope with good illumination and stereopsis is probably the most important prerequisite in the outpatient department.

(b) Outpatient Diagnostic Services

Fundus Fluorescein Angiography (FFA) continues to be an important diagnostic tool in retinal vascular and macular diseases. The essential requirement in a FFA unit is highlighted in Table-3 &4. Allergic reactions to fluorescein are quite uncommon. However, it is necessary to have the facilities to tackle such situations. It is therefore ideal to have the FFA unit close to the operation theatre complex so that in case of any anaphylactic reaction the anesthetist can attend to it immediately. Modern FFA machines are digitalized and therefore there is no need for film processing.

Table 3. Fluorescein angiography unit

- Fundus camera for fluorescein angiography/ICG
- Sterile sodium fluorescein vials
- Scalp vein set and syringes
- Venflow
- Telephone for emergencies
- Emergency medicines tray
- Emesis basin

Table 4. Emergency drugs in fluorescein angiography unit

- Injection Adrenaline
- Injection Atropine
- Injection Hydrocortisone
- Injection Avil
- Injection Betnesol
- Injection Calcium Gluconate
- 20% dextrose
- Intravenous Saline/ Ringer lactate
- Oxygen
- Endotracheal tube
- Ambu bag

Vasovagal reactions are quite common and therefore it would be advisable to have a couch for patient to rest. We have the Venflow for the intravenous injections. It has a distinct advantage over the scalp vein sets in emergency situation.

Fundus Fluorescein Angiography equipment and ultrasonography equipment are the two most important and necessary prerequisites in the diagnosis of vitreoretinal diseases. Table-5 lists the basic requirements of an ultrasonography unit.

Table 5. Ultrasonography units

- Ultrasonography machine
- A and B scan probes
- Coupling agent
- Reclining chair/ couch
- Camera for documentation

Optical Coherence Tomography (fig 2) has now become an essential diagnostic tool in medical retina department especially with the recent development in the management of macular diseases. The need to procure an OCT machine depends on the volume of cases. In situation where the volume of cases cannot sustain an OCT machine the patient can be referred to the nearest center for this particular investigation.

Fig. 1. Digital fundus camera (Carl Zeiss)

Fig. 2. Optical Coherence Tomography machine (Stratus OCT, Carl Zeiss)
c) Outpatient therapeutic procedures

1) Laser photocoagulation unit: Laser photocoagulation continues to be an important therapeutic modality for many retinal diseases. 532nm green laser is the most common laser delivery system used today. Laser can be delivered using the slit lamp or the indirect ophthalmoscopic laser delivery system. Table 6 lists the essential requirements in a Laser Photocoagulation Unit. Ideally the laser and the FFA machine can be installed in the same room. This is very useful for peripheral laser photocoagulation as we can identify the micro aneurysms accurately in the digital screen of the FFA machine and treat simultaneously. In a busy vitreoretinal unit we can have separate laser machine in the outpatient department and operation theatre. The laser unit in the operation room can be used for the endolaser and indirect delivery per operatively while the outpatient laser can have the slit lamp delivery. However, in smaller units a single laser machine can be used for both purposes and when necessary the laser can be wheeled into the operating room. In such a situation it would be ideal to have the laser unit installed adjacent to the operation theater complex.

Table 6. Essential requirements in a Laser Photocoagulation Unit

| Laser machine with slit lamp delivery system |
| Couch/ trolley for indirect laser delivery system |
| Lenses: Goldman 3 mirror* |
| Mainster lens* |
| Panfundoscope* lens |
| Quadruphoretic lens* |
| Methyl cellulose/K Y jelly |
| Indirect ophthalmoscope laser delivery system with 20D lens |

* Any of these lenses should be sufficient

2) Cryotherapy Unit (Table 7): Outpatient transconjunctival cryo therapy is performed for peripheral retinal lesions. With the advent of Laser Photocoagulation the need for outpatient trans conjunctival cryo therapy (TCC) has reduced significantly. However situation like retinal dialysis and peripheral retinal lesions in the presence of media opacity will need TCC. This is normally performed under topical/ local anaesthesia. It would be advisable to have a small room adjacent to the operating room for all these procedures or this can be accommodated in the FFA room.

Table 7. Cryotherapy Unit

| Cryo machine |
| Cryo probe |
| Indirect ophthalmoscope with 20D lens |
| Speculum |
| Local anaesthetic agents: Xylocaine |
| Pad and bandage |
| Antibiotic eye ointment |

3) Intravitreal Injection (Table 8): Over the last few years intravitreal injection has formed an important part of vitreoretinal practices. This is an outpatient procedure and this is ideally performed in a sterile room. In a small vitreoretinal unit this can be performed in the main operating room. However in a busy vitreoretinal practice this can be done in a separate sterile room with an operating microscope and couch. It is necessary to follow certain strict guidelines for patients undergoing intravitreal injections and this should be highlighted to the operating room, outpatient and inpatient nursing staff.

Table 8. Intravitreal injection set

| Local anaesthetic agents: Xylocaine |
| Betadine for Cleaning |
| Septidine for instillation |
| Wire speculum |
| 2cc syringe for LA |
| Tuberculin syringe for intravitreal injection |
| 30G or 27G needles |
| Consumables like disposable drapes, gloves etc. |

Basics Theatre Set Up for Performing Vitreoretinal Surgery

The most significant advancement in the management of vitreoretinal disease has been the advent of closed system Vitrectomy by Machemer in 1971. This enabled vitreoretinal surgeons to remove opaque vitreous, intraocular foreign bodies and repair complicated retinal detachment. Developments of high-speed cutters, vitreoretinal surgical instruments and small gauge vitrectomy system have further improved the surgical outcome of vitreous surgery.

Initially vitrectomy was performed with a single multifunction Vitrector such as VISC or Vitreophage, which performed the function of cutting, suction and infusion. This was later replaced by the 20G instrument such as the OCUTOME and the MicroVit, which are lighter and more comfortable to hold for a longer period of time. Over the last five years 23G and 25G vitrectomy
systems have been developed to perform less invasive surgical procedures. These are now primarily used for simple vitrectomies, macular holes and epiretinal membrane surgeries. However, the high cost of instruments and consumables have still restricted its use.

**Operating Room (OR):** The operating room for performing vitreoretinal surgery should be slightly larger than what we use for anterior segment surgery. Vitreo Retinal surgery requires more equipment and therefore requires more space. The major equipment required for vitreoretinal surgery are given in Table 9. I am not going into the details of the equipment however I would like to highlight certain important situations in V R surgery.

1. Patients coming to have diabetic vitrectomy usually have multisystem disease and therefore need better monitoring during surgery using pulse oximeter and cardiac monitor.
2. Some surgical procedures take a couple of hours and so patient can be more comfortable with nasal oxygen.
3. Standby anaesthetist would be advisable even for surgeries under local anaesthesia as many of these patients have associated cardiac diseases.

**Table 9. Major equipment in Operation Theater**

<table>
<thead>
<tr>
<th>Equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vitrectomy/fragmatome console with air pump,</td>
</tr>
<tr>
<td>Endoilluminator source( fig 3)</td>
</tr>
<tr>
<td>Diathermy console</td>
</tr>
<tr>
<td>Cryomachine</td>
</tr>
<tr>
<td>Good operating microscope with XY coupling,</td>
</tr>
<tr>
<td>focus and zoom controllable by footswitch</td>
</tr>
<tr>
<td>Laser- preferably with both endo laser delivery</td>
</tr>
<tr>
<td>and indirect ophthalmoscope delivery system</td>
</tr>
<tr>
<td>Binocular indirect ophthalmoscope</td>
</tr>
<tr>
<td>Boyle’s apparatus</td>
</tr>
<tr>
<td>Suction apparatus</td>
</tr>
<tr>
<td>Pulse Oximeter</td>
</tr>
<tr>
<td>Cardiac Monitor</td>
</tr>
<tr>
<td>Defibrillator</td>
</tr>
<tr>
<td>Emergency Medicine</td>
</tr>
<tr>
<td>Autoclave, Ultrasound sterilizer, Ethylene oxide sterilizer</td>
</tr>
</tbody>
</table>

Local anaesthesia can be topped up with Subtenon anaesthesia perioperatively. However there are certain situations wherein there is need for general anaesthesia and therefore a VR theatre should ideally have a Boyles Apparatus and a good support anaesthetic system. Indications for general anaesthesia include Paediatric cases, retinal detachment, and ocular trauma. It is also advisable to have a standby anaesthetist to take care of any emergency situation.

Some of the other important prerequisites in the Operation Theatre

- Comfortable operating table, as the patient has to lie for a couple of hours.
- An ergonomic Surgeon’s chair is mandatory, as he may have to sit for hours.
- Centralized UPS is necessary for continuous power so that the Surgeons continue to work at time of power failure.
- The OR should ideally be in the top floor of your building so that trespassing etc. is reduced to maintain better sterility.

Surgical instruments for VR surgery (Table 10 & 11).

The specific instruments that we use for vitreoretinal surgery includes –

- Alabama Forceps, Schepens retractor, Vitreous scissors, Vitreous forceps, Membrane spatula, and Pick, silicon brush, flute needle, flute with diathermy, intra ocular forceps, silicon oil, C3F8 Injection and scleral buckling materials, light pipes, plug, infusion cannula, common suture material include 7'o vicryl to close sclerotomies and conjunctiva, 4'o Dacron for scleral buckling.
Sterilization of instruments

1. Some of the surgical instruments used in VR surgery are very expensive, delicate and need special care. Instruments such as Vitreous forceps, ILM forceps, vitreous scissors, and Membrane spatula require very special care. Tips of these instruments should be wiped immediately after surgery. Once cleaned they should be kept aside with the tips protected with safety guards.

2. Use of Ethylene oxide sterilization: Reusable vitreous cutters, fiberoptic cable, Millipore filters, tuberculin syringes, Endolaser probes, cryo probes are some of the instruments which are ideally Ethylene Oxide sterilized. The advantage of ethylene oxide sterilization is that it increases the life of the consumable and also it is the ideal and safe method. Strips can be used to identify the quality of EO sterilization.

Trained Nursing Personnel: In view of the expensive and delicate instruments it is advisable to have a team of trained nursing personnel.

OT Assistant: Trained OT assistants are useful to handle all the equipments during surgery. Monitoring the various parameters in the vitrectomy machine, laser delivery system, cryo therapy is ideally done by trained OT assistant. They will also be helpful in doing the maintenance of these equipments.

Operation theatre sterilization: Proper aseptic techniques should be employed in the OR. Vitreoretinal surgery may take a couple of hours and therefore it is very important to maintain proper asepsis within the OR complex. It is also necessary to maintain the methods employed. I am not going into the details, as it does not come under the purview of this article.

Conclusion

This article gives a broad format for setting up a Vitreo Retinal Unit. It is very obvious that this requires huge investment in equipments and instruments. It also requires a team of dedicated personnel. It is also important to have good supporting staff to maintain all these equipments. Proper annual maintenance contract, regular servicing and use of facilities like uninterrupted power supply will definitely increase the life of these equipments.
Influence on Posterior Capsule Opacification and Visual Function of Intraocular Lens Optic Material

Ken Hayashi and Hideyuki Hayashi et al.

It is well known that optic design of IOLs, specifically the optic edge, is related to prevention of posterior capsule opacification. In this study, the authors examined the influence of optic material on posterior capsule opacification (PCO) by comparing PCO and visual functions between eyes with an acrylic intraocular lens and those with a silicone IOL of same optic design and with same haptics.

In this randomized clinical trial 100 patients scheduled for phacoemulsification surgery underwent implantation of an acrylic IOL (AMO Sensar; AR40e) in one eye and implantation of a silicone IOL (ClariFlex) of the same optic design and loops in the fellow eye. Eighty nine patients remained for analysis. The PCO value was measured using the Scheimpflug videophotography system at 1st, 3rd, 6th, 12th, 18th, 24th, 30th, and 36th months postoperatively. The incidence of eyes that required a Nd:YAG laser capsulotomy was examined; visual acuity and contrast sensitivity with and without a glare source were also evaluated.

The results showed that the mean PCO value did not increase significantly during follow-up in either the acrylic or silicone IOL group. When comparing the groups, no statistically significant difference was found in the PCO or in the incidence of Nd:YAG capsulotomy, although both tended to be slightly better in the silicone group than in the acrylic group. There was also no significant difference between the groups in visual acuity or in photopic and mesopic contrast sensitivity with or without glare. This study concludes that when acrylic and silicone IOLs of same optic design and with same haptics were implanted, the optic material does not influence the development of PCO significantly to impair visual function.

The Role of Common Viral Ocular Pathogens in Thygesons Superficial Punctate Keratitis

Paul P Connell, James O'Reilly, Suzie Coughlan, Louis M T Collum, William J Power.

The aetiology of Thygeson’s superficial punctate keratitis (TSPK) remains elusive. A viral aetiology has been suggested by the absence of bacterial infection and clinical resemblance to other viral keratopathies. Here the authors report the results of polymerase chain reaction analysis for the detection of herpes simplex virus (HSV) 1 and 2, herpes zoster virus, varicella zoster virus (VZV) and adenovirus from corneal epithelial samples from patients with active signs and symptoms of Thygesons Superficial Punctate Keratitis.
Schirmer strip impressions were taken from the epithelium of eight patients with a known history of TSPK and symptoms and signs of active disease. Three patients were recruited as positive controls (two with herpes simplex keratitis and one with herpes zoster ophthalmicus). Samples from a further three patients acted as negative controls. All 14 samples underwent polymerase chain reaction testing for HSV 1, HSV 2, VZV and adenovirus. DNA corresponding to the expected viral DNA was amplified from all three positive control samples. The three negative control samples showed no evidence of viral DNA. Similarly, all samples from patients with TSPK showed no evidence of the presence of HSV 1, HSV 2, VZV or adenovirus.

In this study, the Schirmer impression strips were placed in 0.5 ml of phosphate-buffered saline. This volume was chosen in order to avoid excessive dilution of the sample material. As each PCR assay requires at least 0.1 ml of Phosphate-buffered Saline, authors were limited in the number of viruses that they could test for. Authors chose HSV 1, HSV 2 and VZV as the issue of antiviral treatment has never been fully resolved. Trifluorothymidine has been reported as efficacious and this condition is frequently treated with topical acyclovir. Authors explain that they chose adenovirus as there have been occasional reports in the literature of adenoviral keratoconjunctivitis that has persisted over years with multiple remissions and exacerbations.

Safety of Triamcinolone Acetonide (TA) Assisted Pars Plana Vitrectomy in Macular Hole Surgery

G.Kampougeris, R Cheema, R McPherson and C Gorman

Eye 2007: 21, 591-594

In this study the authors evaluate whether Triamcinolone acetonide (TA)-assisted pars plana vitrectomy for visualization of posterior hyaloid during macular hole surgery has any adverse effects on macular hole closure rate and intraocular pressure (IOP). This is a case series comparing outcomes and adverse effects in patients who had surgery for macular holes with ILM peel, with and without the use of TA-assisted vitrectomy.

During the study period, 29 patients had vitrectomy for macular holes. In 18 patients (group 1), Triamcinolone acetonide was used intra-operatively to facilitate visualization of the posterior hyaloid and in 11 patients (group 2) no Triamcinolone acetonide was used. There was no statistically significant difference in the macular hole closure rates and the improvement in visual acuity between the two groups. No long-term increase in IOP was recorded in any of the 29 patients. The total anatomical success rate in both groups was 85.6% and the average improvement in visual acuity in both groups was two Snellen lines.

So the authors conclude that, Triamcinolone acetonide is safe and there is no contraindication for its use as an intra-operative aid to facilitate vitreous visualization in macular hole surgery.

Reviewed by Dr. Roopasree DO, Little Flower Hospital and Research Centre, Angamaly.
Step by Step Optical Coherence Tomography

Editors: Dr. Parul Sony, Dr. Pradeep Venkatesh, Dr. Satpal Garg Dr. Hem K Tewari
Publishers: Jaypee Brothers, New Delhi.
First edition 2007, Price Rs/- 695

Optical Coherence Tomography has revolutionized the way we ‘look’ at the macula and optic nerve head. Within a decade it has established itself as an integral part in the management of diseases of the macula and optic nerve head. Retina specialists should feel indebted to the pioneers Huang, Puliafito, Schuman and Fujimoto for developing such a device. OCT is now probably the gold standard to detect the presence of a macular pathology but fundus examination (photography) and fluorescein angiography remain ‘gold’ standards to detect a cause for the lesion identified on OCT.

In ‘Step by Step OCT’ the authors have endeavored to create a ‘small’ book conveying only those things that would be important for the ‘non-academic’ day to day user of OCT. Most things have been summarized into tables or short text for easier assimilation and disease patterns have been described only with typical examples. The purpose of this approach, with this fascinating device, was to allow the reader to have a valuable ready reckoner that can be placed in his apron pocket, using which he or she can grow further.

Salient features of the book are
- A total of 25 chapters cover all aspects of the subject
- Interprets OCT procedures in a simple and user-friendly manner
- Describes various disease patterns with typical examples
- Emphasizes macular, retinal and optic nerve head diseases

Lasers in Ophthalmology A Practical Manual

Editors: Dr. Atul Kumar, Dr. Harsh Kumar, Dr. Tanuj Dada.
Publishers: Jaypee Brothers, New Delhi.
Second Edition 2007, Price Rs/- 975/-

Although large volumes of literature are available on the clinical utility of lasers for ocular conditions, it is difficult for the busy practitioner to decipher these texts and gain useful practical information for day-to-day use.

This manual has been conceived to serve as an office companion for clinical ophthalmologists and provide a well-illustrated account of the basic concepts of laser therapy for various ocular conditions related to the lids, cornea, lens and retina. The basic principles of lasers, the preoperative work-up, the exact technique of laser delivery, post laser therapy and complications associated with these therapies are covered in the text.

The text covers laser treatment of diabetic retinopathy, vascular disorders of the retina, age-related macular degeneration, primary open-angle glaucoma, primary angle-closure glaucoma, utility of lasers in cataract surgery and its complications, refractive lasers and
management of corneal disorders with laser treatment in addition to various other conditions.

Salient features of the book are

- Handbook of laser surgery covering all anterior and posterior segment lasers
- Covers argon, diode, excimer, carbon dioxide, erbium and Nd: YAG lasers
- Special emphasis on lasers for diabetes, vascular occlusions, ARMD, glaucoma, corneal disorders, cataract and refractive surgery.
- Includes laser basics, preoperative evaluation, techniques of laser delivery
- Provides practical tips for actual performance of laser therapy
- Management of complications after laser therapy
- Well illustrated with coloured photographs
- A must for practicing ophthalmologists, residents and teachers

Mastering the Techniques of Laser Applications in Ophthalmology

Editors: Dr. Ashok Garg, Dr. JT Lin, Dr. Jorge L Alio, Dr. Rajvardhan Azad, Dr. Jerome Jean Bovet, Dr. Bojan Pajic, Dr. Cyres K Mehta
Publishers: Jaypee Brothers, New Delhi.
1st Edition 2007, Price Rs. 3995/-

This mega international book, first of its kind in the world is a dedicated hard work to provide complete information on various laser treatment options in the ophthalmic conditions. This book contains 99 chapters written by International masters on laser therapy and cover all parameters from laser machine dynamics to Lasers in lens diseases; Glaucoma, Refractive Surgery, Vitreo-retinal diseases, Strabismus and oculoplastic reconstruction, Pediatric refractive surgery and Recent advances.

This book covers all the clinically important ophthalmic subjects. A number of chapters are dedicated to the application of specific ophthalmic lasers in treating various ophthalmic diseases by International authorities in this field.

An interactive video DVD ROM is an added feature of this book showing various Laser applications in ophthalmology by international masters.

Specifically the basic physics and translation into clinical application of laser technology is described at the first section and in multiple chapters of this elaborate textbook. The second section concentrates on the application of laser in lens diseases such as laser in cataract surgery.

In the third section, the applications of lasers in glaucoma is presented. The fourth section of the book concentrates on lasers in cornea and refractive surgery, probably the most “explosive” and worldwide development of laser application in all of medicine. The fifth section of the book concentrates on the use of laser in retinal diseases and again another area of multiple and vast applications represented by multiple chapters written by many international leaders in their fields.

Section six deals with the lasers in aesthetic and reconstructive surgery, which is an analysis of the multiple applications of laser and also offers clinical pearls on these modalities. Finally, section seven looks into the recent advances of laser applications and probably the future advancements that we will see over the next ten years.

“Mastering the Techniques of Laser Applications in Ophthalmology” is a contemporary, well written, beautifully illustrated and comprehensive review of what is now a vast area of technological advancements and clinical applications of many different types of lasers in Ophthalmology.

This very elegantly written “Mastering the Techniques of Laser Applications in Ophthalmology”, is a text book that could provide educative reference for clinicians in ophthalmic practice by covering all the different applications of laser in Ophthalmology in depth.
Step by Step Interpretation of Glaucoma Diagnostics

Editor: Dr. Barun K Nayak
Publishers: Jaypee Brothers, New Delhi.
First Edition: 2005, Price Rs/- 325/-

Through this book, the authors try to familiarize all ophthalmologists with this new data. An attempt has been made to simplify it in a step-wise and organized manner.

This is a complete book for interpretation of printout that aid glaucoma treatment and diagnosis. When a patient brings a printout it will be possible to interpret test result with relative ease. This book is compiled and edited by Dr. Barun Kumar Nayak, who has been conducting instruction courses for over 17 years in the field of interpretation of printouts.

The printouts included in the book are:
- Autoperimetry (Humphrey, Octopus, Medmont, Synmed and Appa Perimeter)
- HRT-II
- GDxVCC
- OCT
- FDT perimetry

Dr. Andrews Kakkanatt, Jubilee Mission Medical College Trichur
CME Programmes

NATIONAL

14th -16th December 2007
VII All India Uveitis Conference
Contact Person: Dr.Dipankar, Dr.Kalyan Das
Sri Sankara Nethralaya, Guwahati, Assam, Pin 781 028, India. Tel:91 0361 2228879/80
E-mail:Ussissn2007@sify.com
Website:http://www.ssnguwahati.org.

1-2nd December 2007
Pediatric Ophthalmology,
Strabismus and Neuro-Ophthalmology.
Contact Person: Dr. K. Ramesh
L.V.Prasad Eye Institute, L.V.Prasad marg,
Banjara Hills, Hyderabad 500 034, Andhra Pradesh
E-mail: rameshak@lvpei.org, drrk123@rediffmail.com;
Web: www.lvpei.org

7-9th December 2007
17th Annual Conference of the Glaucoma Society of India.
Cont.Person:Dr.Chandrima Paul
(Mob:00919830079189) B B Eye Foundation
2/5 Sarat Bose Road, Sukhsagar
1st & 2nd Floors, Kolkata 700 020
Ph:91 33 24746608/8816
Fax: 91 33 248662720
E-mail :b beyefoundation@yahoo.co.in

14th-16th December 2007
Bihar Ophthalmological Annual Conference
(EYECON-2007)
Contact Person : Dr.C.S.Shah
Masakchak, Bhagalpur-812001, Bihar
Ph: 0641-2401234, 09431295959

14th -16th December
Cutting Edge 2007
Meeting of the Oculoplastic Association of India and Asia pacific Society of Ophthalmic Plastic and Reconstructive Surgery.
Contact: LV Prasad Eye Institute
LV Prasad Marg, Hyderabad-500034
Ph: 91-99591-89957
E-mail: cuttingedge@lvpei.org.

31st January – 3rd February 2007
EyeINFO 2008
66th All India Ophthalmological Conference
Venue: Vydehi Institute of Medical Sciences and Research Centre, Bangalore
Contact :Dr.Santhan Gopal
e-mail:aioc@eyeinfo2008.org
Ph:9844110288, 9448043140

INTERNATIONAL

4th – 9th April 2008
ASCRS.ASOA 2008
Venue:Chicago
Web:www.ascrs.org or www.asoa.org
Mail: C/o Convention Data Services
107, Water House Road
Bourne, MA 02532
Welcome to KSOS

All new members to this community are welcome to use the KSOS website that is feature rich and informational. The website address is

www.ksos.in

How to register as in the website?

All members are requested to provide the webmaster of KSOS, their details such as
1. First Name    2. Last Name    3. email id

What the webmaster will do:

The webmaster will add these details into the member list. The system will generate the User Id and Password, which will then be emailed to you.

Once the members receive their user ids and passwords, they are requested to visit the website and log in using the Member Login area (top right of the website). Then use the “View My Account” link to see your account details. Please update your details in that section. You are also allowed to change your User Id and Password, to your liking. Please use names that you can always remember, for your user id. If you change your password, do memorise the new password.

Online facilities for the Members

KSOS members have access to very good online resources. All members can then take advantage of the advanced facilities provided such as

1. KSOS journals: Members alone can access the KSOS journals online. You have to login to access the journals.
2. Message Board Members alone can feed messages into the message board for the rest of the KSOS members.
3. Discussion Forum for members All members are also requested to take part in the discussion forum (a new feature) in the website. For this, you are requested to register separately. The instructions for this have been given in the “News Update” section of the website.
4. Video Streaming has been added to the website
   This feature has been added to the KSOS website, making the website even more vibrant. It features streaming video content of medical surgeries and procedures.
5. Useful links The KSOS Website provides links to useful and important websites across the world.
6. Member search KSOS members can access the contact details of any other member, using the website. All members are requested to visit the website and see the features in the website and get accustomed to the online system.
Retinopathy of Prematurity Screening and Management

Dr. Meena Chakrabarti MS, DO, DNB

**Screening to Detect Prethreshold and Threshold ROP**
- Identification of “At - Risk Infants”
- Adequate Dilated Evaluation
- Appropriate Timing

**“AT-RISK” Infants**
- All Infants Weigh < 1500 gms
- All Infants with GA < 28 Weeks
- BW > 1500 gms: Stormy Course

**Screening : Instrumentation**
- Ophthalmoscopy
- 20 D and 28 D Lens
- Pediatric Wire Speculum
- Pediatric Scleral Depressor
- ZONE . STAGE . PLUS DISEASE . RUSH DISEASE

**CRYO – ROP Trial Results**
- Infants with Threshold ROP
- Randomization: Cryo Vs Observation
- Final Analysis: 10 Years
- Visual Acuity < 20 / 200 (44.4 % Cryo Vs 62.6 % Observation)
- Unfavorable Structural Outcomes (27.2 % Cryo Vs 47.9 % Observations)

**CRYO-ROP Natural History Study**
Factors: - Dev of Threshold ROP / Unfavorable Outcomes
- Young GA
- Multiple Births
- Out of Nursery Birth
- LBW
- ZONE I ROP PLUS DISEASE, Stage-3
- > 6 Clock Hours Stage 3
- IRIS NVI

**Laser Vs Cryo for Ill Definition ROP**
Bilateral Threshold ROP
Randomization: LASER Vs CRYO
Analysis at 10 Years (19 B / L ROP’s)
- ETDRS VA
- Unfavorable Outcomes
- Macular Dragging
- Axial Length

**Peripheral Retinal Laser Ablation**
- Trans Pupillary / Trans Scleral Delivery
- 200 mw / 100 ms: Intensity Adjusted
- 200 -100 Burns
- Grey / Grey White Near Confluent
- Identify ‘SKIP’ Areas
- 200 -100 Burns
- Grey / Grey White Near Confluent
- Identify ‘SKIP’ Areas

**Laser Vs Cryo : Comparison Criteria**

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Laser</th>
<th>Cryo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anesthesia</td>
<td>LA</td>
<td>GA (topical)</td>
</tr>
<tr>
<td>2. Apneic Spells</td>
<td>Rare</td>
<td>Present</td>
</tr>
<tr>
<td>3. Extent of Upto Treatment</td>
<td>Ridge</td>
<td>Peritomy for post Rx</td>
</tr>
<tr>
<td>4. Vitreous Haze</td>
<td>— —</td>
<td>X</td>
</tr>
<tr>
<td>5. Skip Areas</td>
<td>Rare</td>
<td>Present</td>
</tr>
<tr>
<td>6. Post Treatment</td>
<td>Reaction Nil</td>
<td>Present</td>
</tr>
<tr>
<td>7. Disc Drag</td>
<td>Rarer</td>
<td>15.62</td>
</tr>
<tr>
<td>8. Macular Drag</td>
<td>Rarer</td>
<td>More</td>
</tr>
<tr>
<td>9. Myopia</td>
<td>Lower</td>
<td>Higher</td>
</tr>
</tbody>
</table>

**Retinal Outcomes**
- Favourable Outcomes
  - Essentially Normal Posterior Pole
  - Macular Ectopia
  - Stage 4 A: Partial RD, Schisis, Fold

**Unfavourable Outcomes**
- Stage 4 B: Partial RD Foveal Inv.
- Stage 5 ROP
- Cataract / CO

**Surgical Goals**
- Extra Macular Stage 4 A ROP
- Undistorted Posterior Pole
- Minimal Distorted Post Pole
- Total Retinal Reattachment
- Preservation of Lens
- Central Fixation

**Retinal Outcomes**
- Favourable Outcomes
  - Essentially Normal Posterior Pole
  - Macular Ectopia
  - Stage 4 A: Partial RD, Schisis, Fold

**Unfavourable Outcomes**
- Stage 4 B: Partial RD Foveal Inv.
- Stage 5 ROP
- Cataract / CO

**Timings of Surgery**
- Features of Progressive Stage 4 ROP
- > 6 Clock Hours Ridge Elevation
- > 2 Quadrants of Plus Disease
- Vitreous Haze

**Visual Goal**
- Ambulatory Vision
- Preserve Formed Vision
- PL in Different Fields
- PL in Different Illumination
- Maximum Visual Recovery
- > Several Years

**Tractional Rd Inv. Fovea : (Stage 4 B ROP)**
- Minimize Retinal Distortions
- Prevent Progression to Total Stage 5 ROP RD
- Reattach as Much Retina as Possible

**Features of Progressive Stage 4 ROP**
- > 6 Clock Hours Ridge Elevation
- > 2 Quadrants of Plus Disease
- Vitreous Haze
Early Intervention 38 - 42 Weeks PCA
- Pre-Op Thorough Peripheral Ablation

Scleral Buckle for ROP
- Stage 4 A ROP
- # 40 / # 240 Band
- Applied to Support Ridge
- Paracentesis or SRFD: To ↓ IOP
- Dramatic Anisometropic Myopia
- Band Transaction / Removal
- Stage 4A / 4B / Selected Cases of Stage 5
- Peripheral fibrosis not a contradiction
- Remolding of Fibrosis takes over a period of time

Mechanism
- Reduces Vitreous traction
- Reduces stimulus for re-proliferation
- RPE pump absorbs SRF ? Retinal Reattachment
- Pre-op evaluation by Pediatrician and Anesthesiologist
- Surgery within 3-7 days of diagnosis
- Shallow RD can lead to spontaneous reattachment
- Removal / Cutting of the band approx. after 6 - 9 months as it:
- Hampers growth of the eye
- Can erode into the developing eye

Closed Vitrectomy
- Technique
- Usually 2 Ports
- Sclerotomies through iris root / Sector inidectomy
- Silt incision in prolif. Memb
- Viscoelastics to fill vit. Cavity
- Bimanual dissection of memb with scissors and forceps under microscope illumination

Lens Sparing PPV
- Stage 4 A (Progressive) & Most Stage 4 B
- Lens & Retro Lenticular Tissue Uninvolved
- Core PPV: Address 4 Planes of Traction (Ridge-Ridge; Ridge-Periphery; Ridge Lens, Central Stalk)
- FAE
- Air Bubble Positioned

Lensectomy - Vitrectomy
- Pars Platica Closed Globe Procedure
- Open Sky Procedure
- Stage 4b & S ROP

Non-Ocular Treatment of ROP
- Oxygen
- Light
- Steroids
- Vit E
- Surfactant
- CO2

Effects of Environmental Factors
- OXYGEN
- STOP-ROP (Supplemental Oxygen Percentages to Stop ROP)
- Hope –Rope (High Oxygen Percentages ROP)
- LIGHT
- LIGHT –ROP TRIAL
- Oxidative Damage
- VIT E Prophylaxis – Meta Analysis
- Surfactants: Incidence in Premie
- Steroids: Prenatal administration
- Carbodioxide

Future Treatment
- Supplementing IGF – 1
- Anti VEGF or Anti VEGF- Receptor Therapies
- Low O2 Saturation from Birth
- Surgical Advances
- 2 Port PPV
- Sutureless Surgery 26 G / 23 G
- Enzymatic Vitreolysis
- Molecular Mech: Norrie Gene Defects

Conclusions
- Majority of Cases Can Be Prevented From Going Into Advanced ROP By -
- Timely Screening
- Proper Identification of Stages of the Disease
- Timely Treatment with Laser / Cryo
**GENERAL INSTRUCTIONS TO AUTHORS**

The Kerala Journal of Ophthalmology (KJO) is a quarterly, peer reviewed journal, devoted to dissemination of the latest in ophthalmology to the general ophthalmologists as well as to specialists in the various subspecialties of this discipline. It invites submission of original work dealing with clinical and laboratory materials.

Authors submitting materials to this journal are requested to adhere STRICTLY to the norms laid down below. The matter must be typed on one side of the paper. A margin of 1” must be left all around and the material must be double-spaced. A page should contain not more than 25 lines. Two copies of the text in paper and one copy in a CD must be submitted to the Editor and the corresponding author is advised to keep another copy with him. The corresponding author must give it in writing in his covering letter that the same matter will not be submitted elsewhere if accepted. He must also enclose the copyright transfer of his work to this journal. The papers sent will be subjected to peer review. The accepted manuscripts become the permanent property of this Journal. The author is informed that, if his work is returned to him for correction/clarification after peer review, he should effect the same and send the manuscript back to the Editor within one month. Each manuscript component mentioned here under must begin with a new page and the pages are to be numbered at the right tip corner starting from the Title page.

1. **TITLE:** The title of the work must be brief and precise. It should not exceed two lines and 40 characters (including comma, period) Author(s) full name(s) must be given along with his (their) degree and the affiliations. Corresponding author’s name, correct address (including e-mail and Fax, if available) and phone number must be mentioned at the bottom left hand corner of the first page.

2. **ABSTRACT:** The abstract is to be given in the beginning itself. It should not exceed 200 words. It must contain the aim, methodology, results and conclusion. For case report, summary/conclusion alone is to be given.

   **KEY WORDS** (maximum five) in capitals are to be included at the end of Abstract.

3. **INTRODUCTION:** Describe the aim of the study, along with the hypotheses that were tested. Only necessary references are to be given.

4. **METHOD:** Give in detail the materials used and the methods employed. Describe the type of study. Pharmacological names only must be mentioned for the drugs used and, if proprietary name is used, then the manufacturers name must be given in parentheses. Except for standard, well-accepted abbreviations (Including SI Units), all others must be introduced in parentheses when the full term is used for the first time in the article.

5. **RESULTS:** Give only the results obtained by the study under discussion. State the statistics in the correct scientific form (P value, mean etc). Results based on assumptions must not be given. Indicate in the text the place where the tables have to be inserted.

6. **DISCUSSION:** The discussion should be to the point and relevant to the subject under discussion. This section can be combined with the previous one if the author desires. Avoid speculations. Use only standard abbreviations or the abbreviations already introduced.

7. **ACKNOWLEDGEMENT:** This is to be made only to those who were directly and scientifically involved with the preparation of the paper. Permitting authorities, technicians, photographers who assisted in the work need not be mentioned.
8. REFERENCES: The references should be given in numerical order in which they first appear in text and not in alphabetical order (Citation Order System). It should be numbered consecutively in the text. The references will not be checked by the Editor or by the Peer reviewer and hence the author is solely responsible for its completeness and the accuracy. Period should not be employed anywhere in the references. Personal communication, unpublished data and poster references, if mentioned, should be in the text itself and the source mentioned in parentheses. References should be in the following form:

*Journal reference:* Author(s) full title, Journal name (as abbreviated in Index Medicus), volume number, pages and year. If there are more than three authors, then mention the first three authors and then ‘et al’.

*Book reference:* Authors(s) (& Editor, if any), title of book (and chapter), publisher, place of publication, page number(s) of the cited portion and year.

9. THE LEGEND: The legend for the illustrations (and tables, if necessary) must be given in a separate sheet of paper and should be typed double-spaced.

*Illustrations:* The photos and figures should be prepared in glossy prints with good contrast and of the size 6” x 4”. Only salient details should be included. On the back of the illustration, the figure number in text, title of the paper, the first author’s name and the top side (marked with an arrow) must be specified. Except for arrows, no text is to be on the photos. It is the duty of the author(s) to get the patient’s written permission when the subject is identifiable in the photo. Submit two sets of illustrations. Illustrations from other Journals and books are usually not accepted. If used, it rests with the author(s) to get the copy right permission from the original author / publisher and this permission letter must be sent to the Editor at the time of submitting the manuscript. For Histological figures the stain and magnification used should be noted e.g.: - H & E Stain x 70.

10. TABLE: It should be in double space. Each table must have an Arabic numeral (except for single table) and a title both in a single line. Each column in the table must have a short heading. If a table is large, then it must be continued in a second page, which also must have the table number and the title. Avoid vertical lines in the tables. Two sets must be submitted.

The manuscripts are to be sent to The Editor by Courier Mail or by Registered post. The corresponding author will receive communication from the Editor within two weeks of receiving the manuscript.

11. All manuscripts are subjected to editorial board review.

12. Other Categories of Manuscript

a) Original Articles should generally not exceed 3,000 words or 12 double – spaced pages.

b) Review Articles: can be on topics of relevance to clinical practice, research methodology, community ophthalmology or investigative work, of relevance to visual science. These articles should include up to date review of existing literature, and summarize the current status / preferred practice for that particular topic.

Brief reports are short communication of new instruments, new laboratory techniques or surgical techniques as well as interesting case reports with unique findings. These should not exceed 1000 words with a maximum of 2 illustrations. They should follow the format - introduction, case, and discussion. No more than 8 references should be cited. Each brief report must begin with a 75-100 word summary that highlights the significance of the articles.
Advanced Endothelial Cell Evaluation And Pachymetry

**TOPCON**

**SPECULAR MICROSCOPE**

**SP-3000P**

- Motorized Chinrest
- Five Fixation Targets
- Three modes of image capture
  - Auto, Semi-Auto and Manual
- 3-D Auto Alignment
- Colour LCD Screen
- CellCount Software

Comprehensive data management and image transfer are possible with the use of **IMAGEnet™ Cell Analysis Software**

**Mehra Eyetech Private Limited**

Corporate Office: 54, Kallandaz Udyog Bhavan, Near Century Bazar, Prabhadevi, Mumbai-400 025.
Phone: +91-22-24304228, Fax: 24378531, Email: contactus@mehraeyetech.in
http://www.mehraeyetech.in

We Share in Your Care
APPASAMY
OPHTHALMIC INSTRUMENTS
AND EQUIPMENT

Ultrasound
B-SCAN
with UBM
New Dimensions
in Ultrasound

High Technology
That’s Affordable

MICROSURGICAL
VITRECTOMY
2000 P

GALAXY COLD PHACO SYSTEM
GALAXY CV I PERISTALTIC

MARKETED BY
APPASAMY ASSOCIATES

253B Officers Colony, First Street, A. Mambakkam, Chennai - 600 106, INDIA.
Tel: (91-44) 28938855, 28938858, 28938854, 28938845, 28938896, 28938886, 28938896
Fax: 1800 4251949, 4251949, 4251949, 4251949
E-mail: appasamy@tata.com Website: www.appasamy.com
Branch: 45, 2nd Cross, Jayanagar 4th Stage, Bangalore - 560 011.
When beta-blockers are inadequate...

Regain Balance, Regain Control

GANFORT® delivers

1 POWER – As effective as non-fixed once daily LUMIGAN™ and twice daily timolol®.

2 TOLERABILITY – 40% less hyperemia and 65% less blepharal pigmentation than LUMIGAN™ alone.

3 CONVENIENCE – One drop, once a day, morning or evening, at the same time each day.

ALLERGAN INDIA PRIVATE LIMITED
Silver Jubilee Block, Indiranagur, 3rd Cross, Bangalore-180 037 Tel: 91-80-22391126/10 Fax: 91-80-22308130 Email: allergan@agindia.com
For the use of registered medical practitioners, holders or dispensers only.
A tertiary care superspecialty hospital in Trivandrum invites application for the post of **Consultant Ophthalmologist** with postgraduate qualification capable of independent work in a tertiary care centre.

Salary and other benefits commensurate with clinical and surgical experience. Excellent opportunities available for professional development. Fresh energetic postgraduates will also be considered.

Apply with Bio-data to
The AO
Chakrabarti Eye Care Centre, Thiruvananthapuram

---

**SPECIFICATION OF THE JOURNAL**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
<td>¼ Demy (210 x 280 mm)</td>
</tr>
<tr>
<td>Frequency</td>
<td>Quarterly (4 Issues in a year)</td>
</tr>
<tr>
<td>Model of Printing</td>
<td>Offset</td>
</tr>
<tr>
<td>Model of Binding</td>
<td>Perfect Binding</td>
</tr>
<tr>
<td>Advertisement Material</td>
<td>Screen 175 LPI</td>
</tr>
<tr>
<td>Double Spread Full Page</td>
<td>42 x 28 cm + 6 mm gutter space</td>
</tr>
<tr>
<td>Black &amp; White</td>
<td>Positive/ Bromide/CD</td>
</tr>
<tr>
<td>Colour</td>
<td>CD with colour proof</td>
</tr>
<tr>
<td>Payment</td>
<td>All payment to be made in advance by DD in favour of Kerala Journal of Ophthalmology payable at Trivandrum.</td>
</tr>
<tr>
<td>Mailing and Contact</td>
<td>Dr. Meena Chakrabarti, Editor, KJO</td>
</tr>
<tr>
<td></td>
<td>Chakrabarti Eye Care Centre</td>
</tr>
<tr>
<td></td>
<td>Kochulloor, Medical College P.O</td>
</tr>
<tr>
<td></td>
<td>Trivandrum 695 011</td>
</tr>
<tr>
<td></td>
<td>Ph: 0471-2555530, 2449599 Fax: 0471-2558530</td>
</tr>
<tr>
<td>E-mail</td>
<td><a href="mailto:tvm_meenarup@sancharnet.in">tvm_meenarup@sancharnet.in</a></td>
</tr>
<tr>
<td>Meeting Time</td>
<td>Please fix by calling on phone</td>
</tr>
</tbody>
</table>